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electronic engineers master catalog

VOLUME A

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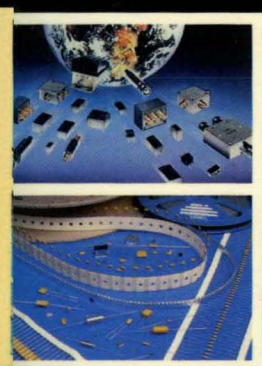
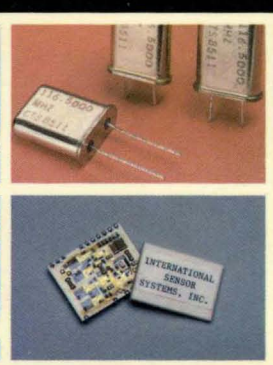
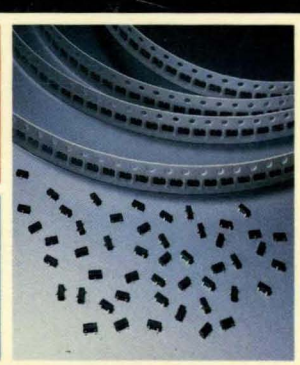
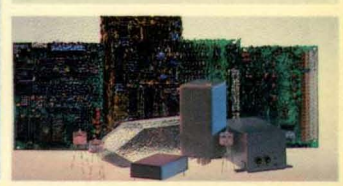
electronic engineers master catalog

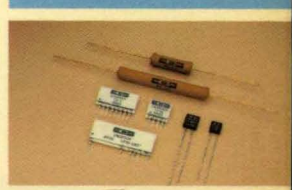
VOLUME A











components
electronic

electronic components

31st EDITION

1500 Capacitors
1800 Coils, Chokes, & Inductors
1850 Cores, Magnets, & Ferrites
2300 Crystals, Oscillators, Crystal & Piezoelectric Filters
2350 Delay Lines
2700 Filters (Excl. Crystal & Piezo Filters)
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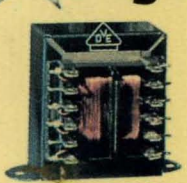
5600 Transformers

volume B Electromechanical, electro-optical, and military components
volume C Interconnections, packaging, and hardware
volume D Power sources, instrumentation, computer products, and equipment

signal
The American Original



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how to use eem

The 31st edition of EEM is arranged in four volumes each composed of related Product Sections. For user convenience, each volume contains its own Product in-dex and Directory (green pages) and its own Manufac-turers and Sales Offices Directory (yellow pages). Every Product Heading and every manufacturer of electronic products is listed in each volume. Where, however, the Product Section is assigned to a volume other than that in use, a cross reference is made to the appropriate volume for further information.

To locate a specific product. Start by choosing the volume whose title describes the class of electronic product you are seeking. If you are not sure which volume is appropriate, pick up the first one at hand and look up the product heading in the green pages. There you will find either a list of that product's manufacturers or you will be referred to the proper volume. All products are identified by their generic terms. Please read the instructions on the first page of each section. Manufacturers with catalog data pages in this edition of EEM appear in bold face type and page numbers are shown. Manufacturers appearing in light face type have submitted verifying evidence that they supply the products shown. When you have located a product of interest, turn to the page(s) shown for further information. You will find these pages in each volume in the appropriate sections.

product selection guides

There are 33 Product Selection Guides included in this edition of EEM. They are located on the first pages of the Product Section to which they apply. Use these guides for basic selection parameters and then go to the EEM pages shown in the guide for more detailed information.

product selection index

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*A Product Selection Guide precedes these Product Sections

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advertisers' index

To find a specific manufacturer's data pages, an alphabetical index of EEM participants appears in EEM starting on page **A**•4 of Volume A and on pages **B**•4, **C**•4 and **D**•4 of the other volumes.

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trademark and logofinder directories

A comprehensive trademark directory is included at the end of the EEM yellow pages in Volume **C**.The EEM logofinder shows the symbols and graphics used by manufacturers as identifiers on their products. Use these pages to locate manufacturers of specific trademarks and logos.

manufacturers' index

In the EEM yellow pages you will find pertinent details on all manufacturers listed in EEM including local sales offices and/or distributors. Please refer to the detailed instructions on the first page of the EEM yellow pages for additional information.

to order a product found in eem

When you have located the product that suits your needs, call the manufacturer or the local sales rep or distributor as shown in the EEM yellow pages. Give the EEM data page number and specs from that page. You and the supplier will be talking on the same wave length which should simplify your ordering and buying.

to file manufacturers' catalogs and data

The EEM File System is revised and updated to reflect changes in EEM itself. Each new EEM File System contains a complete Product Index. This index tells you where to file which catalog. It also contains a cross reference identifying what should be filed in each section.

In order to use the EEM File System all you need is a supply of standard letter size, third-cut manila file folders. You then use the pressure sensitive labels which are supplied with the system to go into as much detail as you want or need.

Each label fits the third-cut file folder exactly. There are over 300 of these labels in each system: 1 for the index, 1 each for the 61 EEM Product Sections, 24 for the alphabetical file of multiproduct catalogs, plus more than 200 additional labels for system expansion. The EEM File System also includes 61 Cross Reference Cards so you can quickly and easily find multiproduct catalogs. The EEM File System is complete and can save you countless hours of time and thousands of dollars. Send your check for $25.00 to: EEM File System, 645 Stewart Ave., Garden City, NY 11530 and we'll absorb postage and handling. Send a purchase order and add $2.00 for postage and handling. NY, CA and MA residents, please add sales tax.

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† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
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Amphenol Products, 4300 Commerce Ct., Lisle, IL 60532 312-983-3500
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
Deutsch Co., Deutsch Fiber Optics Div., 7001 W. Imperial Hwy., Los Angeles, CA 90045 213-649-1400
GTE Fiberoptic Products, 2401 Reach Rd., Williamsport, PA 17701 ..... 717-326-6591; 1-800-FBR-OPTICS
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
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† Maury Microwave Corp., 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
Micro-Coax Components, Inc., a UTI Company, Box E, Collegeville, PA 19426 215-489-3700
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Micro Mode Prods., 1870 John Towers Ave., El Cajon, CA 92020 619-449-3844
§ Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Electronics, 104 Gun Avenue, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† Narda Microwave Corp., Subsidiary of Loral Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
§ Prodelin Corporation, P.O. Box 368, Conover, NC 28613 704-464-4141
† Reeve Electronics, Mellish E. Murray, 1715 W. Carroll Ave., Chicago, IL 60612 312-670-0150
Sivers IMA, Div. of Philips, 5669 Selmaraine Drive, Culver City, CA 90230 213-390-7477
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
§† Telephonics Corporation/PRD Instruments, 770 Park Avenue, Huntington, NY 11743 ..... 516-549-6415/6102
Tucker Electronics, Box 461966, Garland, TX 75046 ..... 214-348-8800;800-527-4642
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100
§ Wiltron, 490 Jarvis Dr., Morgan Hill, CA 95037-2809 408-778-2000

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§ Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
† RHG Electronics Laboratory, Inc., Adams Russell, 161 E. Industry Ct., Deer Park, NY 11729 516-242-1100
Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
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Trontech, Inc., 63 Shark River Rd., Neptune, NJ 07753 201-922-8585

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Analog Systems, P.O. Box 17389, Tucson, AZ 85731-7389 602-290-1818
§† General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
§† NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241 .. 415-960-6000
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Andrew Corp., 10500 W. 153rd St, Orland Pk, IL 60462 800-255-1479
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† Dielectric Communications, General Signal, Tower Hill Rd., Raymond, ME 04071 ..... 207-655-4555;800-341-9678
† Eastern Microwave, 40 Ray Ave., Burlington, MA 01803 617-273-4700
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† Radio Research Instrument Co., Inc., 584 North Main Street, Waterbury, CT 06704-3506 203-753-5840
† Rantec, Emerson Electric, 9401 Oso Ave., Chatsworth, CA 91311 818-885-8223
† Sanders Associates, Inc., Microwave, 955 Perimeter Rd., Manchester, NH 03108 ..... 603-645-6000 Ext. 4299
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† TIW Systems, Inc., 1264 Geneva Drive, Sunnyvale, CA 94089 408-734-3900
† Transco Products, Inc., 1001 Flynn Rd., Camarillo, CA 93011-6003 805-987-8007

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Northwest Microcircuits, Inc., 5464SW Philomath Blvd., Corvallis, OR 97333 503-753-8242
§ Philmore Manufacturing, 40 Inip Dr., Inwood, NY 11696 516-239-6161
SGS Semiconductor Corporation, 1000 E. Bell Road, Phoenix, AZ 85022 602-867-6100
Trimm, Inc., Div. of Newton Instr. Co., 400 W. Lake St, Box 489, Libertyville, IL 60048 312-362-3700
§ VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743 813-347-2181

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† **Daico Industries, Inc., 2139 East Del Amo Blvd., Compton, CA 90224, 213-631-1143 ..... A•1766**
† **Elcom Systems, Inc., 932 Clint Moore Rd., Boca Raton, FL 33487, 305-994-1774 ..... A•1768**
† **General Microwave Corporation, 5500 New Horizons Blvd., Amityville, NY 11701, 516-226-8900 ..... A•1770**
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† **Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 350166, Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1775**
§ **Pomona Electronics, 1500 E. 9th St., P.O. Box 2767, Pomona, CA 91766, 714-623-3463 ..... C•1489,1708**
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Attenuators, IF-1900 — *See Vol. D*

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† Sanders Associates, Inc., Microwave, 955 Perimeter Rd., Manchester, NH 03108 ..... 603-645-6000 Ext. 4299
Telephonics Corporation/PRD Instruments, 770 Park Avenue, Huntington, NY 11743 ..... 516-549-6415/6102
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
† Telonic/Berkeley, Berkeley Inds. Inc., P.O. Box 277, Laguna Beach, CA 92652 714-494-9401
§ Texscan Instruments, Texscan Corporation, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
Tucker Electronics, Box 461966, Garland, TX 75046 ..... 214-348-8800;800-527-4642
U.S. Instr. Rentals, 2988 Campus Dr., San Mateo, CA 94403 800-824-2873
† Vectronics Microwave Corp., 113 Lincoln Blvd., Middlesex, NJ 08846 ... 201-356-2377
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33626 813-855-6611
Wavetek RF Products, Inc., (Formerly Wavetek Indiana, Inc.), 5808 Churchman By-Pass, Indianapolis, IN 46203 317-787-3332
† Weinschel Engineering, One Weinschel La., Gaithersburg, MD 20877 .... 301-948-3434; 800-638-2048
§ Wiltron, 490 Jarvis Dr., Morgan Hill, CA 95037-2809 408-778-2000

Attenuators, RF-1900 — *See Vol. D*

Attenuators, Step-3450

† **Daico Industries, Inc., 2139 East Del Amo Blvd., Compton, CA 90224, 213-631-1143 ..... A•1766**
IET Labs, Inc., 534 Main St., Westbury, NY 11590, 516-334-5959 .... D•1268-1272
VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181 ..... D•1061
† Alan Industries Inc., P.O. Box 1203, Columbus, IN 47201 812-372-8869
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St, Methuen, MA 01844 617-682-4661
† EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800
† General Microwave Corporation, 5500 New Horizons Blvd., Amityville, NY 11701 516-226-8900
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
† Kay Elemetrics Corp., 12 Maple Ave., Pine Brook, NJ 07058-9798 201-227-2000
Lectronic Research Labs., Inc., 1423 Ferry Ave., Camden, NJ 08104 609-541-4200
† Pasternack Enterprises, P.O. Box 16759, Irvine, CA 92713 714-261-1920
† Sanders Associates, Inc., Microwave, 955 Perimeter Rd., Manchester, NH 03108 ..... 603-645-6000 Ext. 4299
Telephonics Corporation/PRD Instruments, 770 Park Avenue, Huntington, NY 11743 ..... 516-549-6415/6102
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 .. 415-592-8832
§ Wiltron, 490 Jarvis Dr., Morgan Hill, CA 95037-2809 408-778-2000

Attenuators, Switch Operated-3450

CTS Corporation, Switch Div., Paso Robles, 500 Linne Rd., Paso Robles, CA 93446, 805-238-0350 ..... B•1686
VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181 ..... D•1061
† Alan Industries Inc., P.O. Box 1203, Columbus, IN 47201 812-372-8869
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St, Methuen, MA 01844 617-682-4661
† Kay Elemetrics Corp., 12 Maple Ave., Pine Brook, NJ 07058-9798 201-227-2000
Northwest Microcircuits, Inc., 5464SW Philomath Blvd., Corvallis, OR 97333 503-753-8242
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 .. 415-592-8832

Attenuators, Switchable-3450

CTS Corporation, Switch Div., Paso Robles, 500 Linne Rd., Paso Robles, CA 93446, 805-238-0350 ..... B•1686
VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181 ..... D•1061
† Alan Industries Inc., P.O. Box 1203, Columbus, IN 47201 812-372-8869
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St, Methuen, MA 01844 617-682-4661
§ Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
CTS Corp., Frequency Control Div., (Formerly Knights Div.), 400 Reimann Ave., Sandwich, IL 60548 815-786-8411
† EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800
† General Microwave Corporation, 5500 New Horizons Blvd., Amityville, NY 11701 516-226-8900
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
† Kay Elemetrics Corp., 12 Maple Ave., Pine Brook, NJ 07058-9798 201-227-2000
MarLee Switch Co., 933-D N. Central Ave., Upland, CA 91786 714-982-8988
Olektron Corp., Signal Technology Corp., 61 Sutton Road, Webster, MA 01570 617-943-7440
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
§ Test Probes, Inc., 9178 Brown Deer Rd., San Diego, CA 92121 619-459-4197
Wavetek RF Products, Inc., (Formerly Wavetek Indiana, Inc.), 5808 Churchman By-Pass, Indianapolis, IN 46203 317-787-3332
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 .. 415-592-8832

Attenuators, Turret-3450

Kay Elemetrics Corp., 12 Maple Ave., Pine Brook, NJ 07058-9798, 201-227-2000 ..... A•1771
Tech Labs., Inc., 500 10th St., Palisades Pk., NJ 07650, 201-944-2221 ... B•1805
† Alan Industries Inc., P.O. Box 1203, Columbus, IN 47201 812-372-8869
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St, Methuen, MA 01844 617-682-4661
Jefferson Elec., MagneTek, Inc., 1400 Center Circle Drive, Downers Grove, IL 60515-1021 312-691-2400
JFW Industries, Inc., 5134 Commerce Sq. Dr., Indianapolis, IN 46237 317-887-1340
Lectronic Research Labs., Inc., 1423 Ferry Ave., Camden, NJ 08104 609-541-4200
† Maury Microwave Corp., 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Norsal Industries, 85 D Hoffman Lane S., Central Islip, NY 11722 516-234-1200
† Telonic/Berkeley, Berkeley Inds. Inc., P.O. Box 277, Laguna Beach, CA 92652 714-494-9401
Wavetek RF Products, Inc., (Formerly Wavetek Indiana, Inc.), 5808 Churchman By-Pass, Indianapolis, IN 46203 317-787-3332
† Weinschel Engineering, One Weinschel La., Gaithersburg, MD 20877 .... 301-948-3434; 800-638-2048

Attenuators, Variable-3450

Elcom Systems, Inc., 932 Clint Moore Rd., Boca Raton, FL 33487, 305-994-1774 ..... A•1768
Kay Elemetrics Corp., 12 Maple Ave., Pine Brook, NJ 07058-9798, 201-227-2000 ..... A•1771
† **Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 350166, Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1775**
† **Tech Labs., Inc., 500 10th St., Palisades Pk., NJ 07650, 201-944-2221 ... B•1805**
§ **VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181 ..... D•1061**
† Alan Industries Inc., P.O. Box 1203, Columbus, IN 47201 812-372-8869
Allen Avionics, Inc., 224 E. 2nd St., Mineola, NY 11501 516-248-8080
§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St, Methuen, MA 01844 617-682-4661
§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 315-432-8909
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-727-0700
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
† Channel Microwave, TRAK Microwave Corp., 3/4 Lindsay Court, Dundee Technlg. Pk., Dundee, SCOTLAND DD2 1TY 44-382-561509
§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., 3 Washington St., Dover, NH 03820 603-742-1120
Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., Suite 845, New York, NY 10011 212-691-9050
§ Eaton Corp., Electronic Instrument Div., 5340 Alla Rd., Los Angeles, CA 90066 213-822-3061
† General Microwave Corporation, 5500 New Horizons Blvd., Amityville, NY 11701 516-226-8900
† Grim Corporation, Box 67, Triangle Industrial Center, Medford, NJ 08055 609-267-7950
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
Hyletronics, Newtown Rd., Littleton, MA 01460 617-486-8911
Jefferson Elec., MagneTek, Inc., 1400 Center Circle Drive, Downers Grove, IL 60515-1021 312-691-2400
† JFW Industries, Inc., 5134 Commerce Sq. Dr., Indianapolis, IN 46237 317-887-1340

KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
§ Leader Instruments Corp., 380 Oser Ave., Hauppauge, NY 11788-3694 516-231-6900
Lectronic Research Labs., Inc., 1423 Ferry Ave., Camden, NJ 08104 609-541-4200
† Lorch Electronics, Sub. of Vernitron Corp., 105 Cedar La., Englewood, NJ 07631 201-569-8282
M/A-COM Microwave Components, Inc., South Avenue, Burlington, MA 01803 617-272-3000
§ Marconi Instruments, 3 Pearl Court, Allendale, NJ 07401 201-934-9050
† Maury Microwave Corp., 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Merrimac Industries, 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§† Micronetics, 36 Oak St., Norwood, NJ 07648 201-767-1320
§ Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 ..... 315-437-3953; 800-448-1666
† Narda Microwave Corp., Subsidiary of Loral Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 312-364-6038
† Norsal Industries, 85 D Hoffman Lane S., Central Islip, NY 11722 516-234-1200
§ Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
Olektron Corp., Signal Technology Corp., 61 Sutton Road, Webster, MA 01570 617-943-7440
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
RLC Electronics, Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
† RMS Electronics Inc., 50 Antin Pl., Bronx, NY 10462 ..... 212-892-6700;800-223-8312
Sanders Associates, Inc., ECBD, A Lockheed Company, 955 Perimeter Rd., Manchester, NH 03108-8500 603-645-5548
† Sanders Associates, Inc., Microwave, 955 Perimeter Rd., Manchester, NH 03108 ..... 603-645-6000 Ext. 4299
§ Shallco, Inc., Box 1089, Smithfield, NC 27577 919-934-3135
§ Shure Bros., 222 Hartrey Ave., Evanston, IL 60202-3696 312-866-2200
§ Sinclair Radio Laboratories Ltd., 85 Mary St., Aurora, ONT., CANADA L4G 3G9 416-727-0165
Sivers IMA, Div. of Philips, 5669 Selmaraine Drive, Culver City, CA 90230 213-390-7477
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Tachonics Corporation, Grumman Corp., 107 Morgan Ln., Plainsboro, NJ 08536 609-275-2550
§† Telephonics Corporation/PRD Instruments, 770 Park Avenue, Huntington, NY 11743 ..... 516-549-6415/6102
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
† Telonic/Berkeley, Berkeley Inds. Inc., P.O. Box 277, Laguna Beach, CA 92652 714-494-9401
§ Texscan Instruments, Texscan Corporation, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
† TRAK Microwave Ltd., TRAK Microwave Corp., 3/4 Lindsay Court, Dundee Technlg. Pk., Dundee, SCOTLAND DD2 1TY 44-382-561509
Tucker Electronics, Box 461966, Garland, TX 75046 ..... 214-348-8800;800-527-4642
§† Vega Precision Labs., 800 Follin La., Vienna, VA 22180 703-938-6300
† Vermont Precision Resistor, Codeco Corp. of Vermont, West Hill Road, P.O. Box 1207, Stowe, VT 05672-1170 802-253-8567
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100
† Weinschel Engineering, One Weinschel La., Gaithersburg, MD 20877 ..... 301-948-3434; 800-638-2048
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 415-592-8832

Attenuators, Voltage Controlled-3450

† Daico Industries, Inc., 2139 East Del Amo Blvd., Compton, CA 90224, 213-631-1143 ..... A•1766
† General Microwave Corporation, 5500 New Horizons Blvd., Amityville, NY 11701, 516-226-8900 ..... A•1770
§† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St., Methuen, MA 01844 617-682-4661
† Amplifonix, Inc., 2010 Cabot Blvd. West, Langehorne, PA 19047 215-757-9600
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
Atlantic Research, 5390 Cherokee Ave., Alexandria, VA 22312 703-642-4000
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-727-0700
† Aydin Vector Div., Aydin Corp., Box 328, Newtown, PA 18940-0328 215-968-4271
Control Concepts Corp., P.O. Box 1380, Binghamton, NY 13902-1380 607-724-2484
Glassman High Voltage Inc., P.O. Box 551, Salem Indl. Pk., Whitehouse Sta., NJ 08889 201-534-9007
Hyletronics, Newtown Rd., Littleton, MA 01460 617-486-8911
† JFW Industries, Inc., 5134 Commerce Sq. Dr., Indianapolis, IN 46237 317-887-1340
† Kay Elemetrics Corp., 12 Maple Ave., Pine Brook, NJ 07058-9798 201-227-2000
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
MACOM, Inc., 43 Second Ave., Bldg. 8, Burlington, MA 01803 617-272-3000
† Merrimac Industries, 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
MITEQ Inc., 100 Davids Drive, Hauppauge, NY 11788 516-436-7400
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
Sanders Associates, Inc., ECBD, A Lockheed Company, 955 Perimeter Rd., Manchester, NH 03108-8500 603-645-5548
† Sanders Associates, Inc., Microwave, 955 Perimeter Rd., Manchester, NH 03108 ..... 603-645-6000 Ext. 4299
† Tachonics Corporation, Grumman Corp., 107 Morgan Ln., Plainsboro, NJ 08536 609-275-2550
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
† Vectronics Microwave Corp., 113 Lincoln Blvd., Middlesex, NJ 08846 201-356-2377

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† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St., Methuen, MA 01844 617-682-4661
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
† Eastern Microwave, 40 Ray Ave., Burlington, MA 01803 617-273-4700
† Maury Microwave Corp., 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§ Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Reeve Electronics, Mellish E. Murray, 1715 W. Carroll Ave., Chicago, IL 60612 312-670-0150
† Sivers IMA, Div. of Philips, 5669 Selmaraine Drive, Culver City, CA 90230 213-390-7477
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
Tucker Electronics, Box 461966, Garland, TX 75046 ..... 214-348-8800;800-527-4642
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

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American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ..... A•2115
§† **Electronic Devices, Inc., 21 Gray Oaks Ave., Yonkers, NY 10710, 914-965-4400 ..... A•2131**
§ **Fagor Elctrn. Comps., Inc., Natl. Mktg. Sls. Offs., Fagor Electrotecnica S. Coop., 8419 Canoga Ave., Canoga Pk., CA 91304, 818-718-2500;800-624-5367 ..... A•2133**
Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... A•2134
§ Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876 401-762-3800
§ Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-699-0918; 800-255-2666
Diodes Inc., 9957 Canoga Ave., Chatsworth, CA 91311 ... 818-882-4920;800-821-1178
§ International Components Corp., 105 Maxess Rd., Melville, NY 11747 ... 516-293-1500
§ International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
§ ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 ..... 516-753-0400; 800-862-2101
§ NTE Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
§ RMC Power Semiconductor, BBC, 2150 W. 6th Ave., Broomfield, CO 80020 ..... 303-469-1883;1-800-992-0312
§ Sanken Electric Co., Ltd., Overseas Operations, 1-22-8 Nishi-Ikebukuro, Toshima-ku, Tokyo, JAPAN 171 03-986-6164
§† Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 805-498-2111
Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830 201-321-3400
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
Stetron International, Inc., 90 Broadway, Buffalo, NY 14203 716-854-3443

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Bridges, Audio-1900 — *See Vol. D*

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A E G Corporation, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269 201-231-8300
§ Codi Semiconductor, Inc., 144 Market St, Kenilworth, NJ 07033 201-298-0400
§ Collmer Semiconductor, Inc., 14368 Proton Rd, Dallas, TX 75244 ..... 800-527-0251; 214-233-1589
§ International Rectifier Corp., Semiconductor Div., 233 Kansas St, El Segundo, CA 90245 213-772-2000
NAE, 69 Bennett St, Lynn, MA 01905 617-598-4800
§ Powerex, Westinghouse, GE, Mitsubishi, Hillis St, Youngwood, PA 15697 412-925-7272
Sanford-Miller Corp., 8 John St, Lynbrook, NY 11563 .... 516-593-2025;800-645-5900
§† Semtech, 652 Mitchell Rd, Newbury Park, CA 91320 805-498-2111
§ Shokai Far East, Ltd, 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Sussex Semiconductor, Inc., Rte. 206, Branchville, NJ 07826 201-948-3633
§ Varo Quality Semiconductor, 1000 N. Shiloh Rd, Garland, TX 75040 214-487-4300
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Amphenol Corporation, Corporate Headquarters, 358 Fall Avenue, Wallingford, CT 06492, 203-281-3200 ..... C•1274
Breeze-Illinois, Trans Technology Corp., 8823 North Industrial Rd., Peoria, IL 61615-1584, 309-693-3322 ..... C•1814
† Cable Systems, Inc., 210 Broadway, Everett, MA 02149, 617-389-7080 ... C•1826
Component Mfg. Svc., Inc., 1 Component Park, W. Bridgewater, MA 02379, 508-580-0111 ..... C•1304
§ Penstock Engineering Labs., Penstock, Inc., 520 Mercury Dr., Sunnyvale, CA 94086-4018, 408-730-0300 ..... A•1844
§ Pomona Electronics, 1500 E. 9th St., P.O. Box 2767, Pomona, CA 91766, 714-623-3463 ..... C•1489,1708
Advanced Techn. Research Labs., 5645 K General Washington Dr., Alexandria, VA 22312 703-750-2920
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
† Alpha Products, Inc., 5740 Corsa Ave. # 104, Westlake Village, CA 91362 818-889-9304
Amphenol Products, 4300 Commerce Ct., Lisle, IL 60532 312-983-3500
† Amphenol RF Operations, Amphenol Corporation, One Kennedy Avenue, Danbury, CT 06810 203-743-9272
Andrew Corp., 10500 W. 153rd St, Orland Pk., IL 60462 800-255-1479

† Applied Engineering Products, P.O. Box A-D, Amity Sta., New Haven, CT 06525 203-387-5282
Capulum Cable Technology, Ltd., 106-195 Stafford Road, Nepean, Ontario, CANADA K2H 9C1 613-726-1966
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
Coaxitube Corp., 245 Naylor Mill Rd., Salisbury, MD 21801 301-546-3911
§ Concord Electronics Corporation, 30 Great Jones St., New York, NY 10012 1-212-777-6571
§† Dyma Engineering, Box 1535, Los Lunas, NM 87031 505-865-6700
Eaton Corp., Microwave Products Division, 785 Palomar Ave., Sunnyvale, CA 94086 408-773-3700
† Fema Elctrns. Corp., 12-6 Edgeboro Rd., E. Brunswick, NJ 08816 201-238-1223
† Flexco Microwave, Inc., P.O. Box 174, Kamville Rd., Port Murray, NJ 07865 201-689-3020
† FM&T Industries,Inc., 145 S. Church St., P.O. Box 204, Shrewsbury, PA 17361 717-235-3000
W. L. Gore & Assocs., Inc., 1505 N. Fourth St., P.O. Box 1389, Flagstaff, AZ 86002 602-526-1290
† GSI Corp., 1917 Greenspring Dr., Timonium, MD 21093 301-252-1768
§ Johnson, E. F., Co., 11095 Viking Dr., Eden Prairie, MN 55344 612-942-1000
† Pasternack Enterprises, P.O. Box 16759, Irvine, CA 92713 714-261-1920
† Precision Tube, Church Rd. & Wissahickon, N. Wales, PA 19454 215-699-5801
Ritz Electronics/Relco, 196 Queen St. N., New Dundee, Ont., CANADA N0B 2E0 519-696-2616
RLC Electronics, Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
Solitron/Microwave, Solitron Devices, Inc., 1177 Blue Heron Blvd., Solitron Pk., Riviera Bch., FL 33404 305-848-4311
SPS Inc. (Muirhead Vactric), 51 Commerce St., Springfield, NJ 07081 201-376-1222
Storm Products Co., 116 Shore Drive, Hinsdale, IL 60521 312-323-9121
Tevelec, Ltd., 977 Pantera Drive, Mississauga, Ontario, CANADA L4W 2W6 416-624-5241
§† U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., 21517 Ocean, Torrance, CA 90503 213-316-9984
Weinschel Engineering, One Weinschel La., Gaithersburg, MD 20877 ..... 301-948-3434; 800-638-2048
§† Western Electronic Products Co., 915-G Calle Amanecer, San Clemente, CA 92672 714-492-4677
§ Wiltron, 490 Jarvis Dr., Morgan Hill, CA 95037-2809 408-778-2000

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Capacitor Wafers-1500

Johanson Dielectrics, 2220 Screenland Dr., Burbank, CA 91505, 818-848-4465 ..... A•1098
† Tusonix, Inc., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144, 602-744-0400 ..... A•1181
† Stanley Electronics, Inc., 10 Ocean Ave., Copiague, NY 11726 516-842-8866

Capacitors, Chip (For Microcircuits)-1500

§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, 818-765-8300;800-423-3186 ..... A•1007
† American Technical Ceramics Corporation, 1 Norden La., Huntington Sta., NY 11746, 516-271-9600 ..... A•1009-1013
† Armbar Industries, Inc., 139 White Oak Lane, Old Bridge, NJ 08857, 201-679-3377 ..... A•1014
§† AVX Corporation, Box 867, Myrtle Bch., SC 29577, 803-448-9411 ..... A•1023-1024,1026, B•1009
Delcap Div., American Precision Industries, Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600 ..... A•1073-1075
§ Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600 ..... A•1241
† Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150 ..... A•1933
§ International Components Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 ..... A•1088
§ ITT Components, ITT Corporation, 5 Jenner .st., Ste. 100, Irvine, CA 92718, 714-727-3001 ..... A•1093
ITW Paktron, Div. of Illinois Tool Works, P.O. Box 4539, 1205 McConville Rd., Lynchburg, VA 24502, 804-239-6941 ..... A•1095
† Johanson Dielectrics, 2220 Screenland Dr., Burbank, CA 91505, 818-848-4465 ..... A•1098
§† Kemet Electronics Corporation, Box 5928, Greenville, SC 29606, 803-963-6621 ..... A•1100-1101
§ KOA Speer Electronics, Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ..... A•1102
§ Maida Development Co., 20 Libby St., Hampton, VA 23663, 804-723-0785 ..... A•1104-1105
§ Mallory Capacitor Co., Emhart Elctrl./Elctrn. Grp., 3029 E. Washington St., Dept. EM, P.O. Box 1284, Indianapolis, IN 46201, 317-636-5353 ..... A•1111
§ Matsuo Electronics, 2134 Main Street, Suite 200, Huntington Beach, CA 92648, 714-969-2491 ..... A•1116,1118
Mepco/Centralab, North American Philips Corporation, 4561 Colorado Blvd., Los Angeles, CA 90039, 818-240-4880 ..... A•1123
Mepco/Centralab, North American Philips Corporation, 5900 Australian Avenue, W. Palm Bch., FL 33407, 305-842-3201 ..... A•1120
† Metuchen Capacitors, Inc., 139 White Oak Ln., P.O. Box 499, Old Bridge, NJ 08857, 201-679-3366 ..... A•1131-1133
Multi Products International, 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•1135
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•1136,1139
§ NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... A•1142-1143
NMB Technologies, 9730 Independence Avenue, Chatsworth, CA 91311, 818-341-3355 ..... A•1750-1751
§ Radio Materials Corp., P. O. Box 339, Attica, IN 47918, 317-762-2491;1-800-356-9956 ..... A•1168-1170
Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483, 619-575-9353 ..... A•2031
Sprague-Goodman Elctrns., Inc., 134 Fulton Ave., Garden City Pk., NY 11040, 516-746-1385 ..... A•1174
§ TDK Corporation, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku,, Tokyo, JAPAN 103, (03) 278-5111 ..... A•1179
§ United Chemi-Con Inc., 9801 W. Higgins Rd., Rosemont, IL 60018, 312-696-2000 ..... A•1182-1183
† U S Microtek Components Corp., Division of Unitrode Corp., 11144 Penrose St., Sun Valley, CA 91352, 818-767-6770 ..... A•1184
Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Alpha Industries, Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150

§† Arco Electronics, 9822 Independence Ave., Chatsworth, CA 91311 818-882-8707
§ Baknor Industries Limited, 2209 Dunwin Drive, Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§ Centre Engineering, 2820 E. College Ave., State College, PA 16801 814-237-0321
†Compex Corp., Taunton Professional Park, 238 Taunton Blvd., Medford, NJ 08055 609-596-9388
§ Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-699-0918; 800-255-2666
Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-8725
§† Delcap, Div. of American Precision Industries, Inc., 274 Sandusky Road, P. O. Box 38, Arcade, NY 14009 716-652-3600
§† Dielectric Labs., Rte. 20 E., Cazenovia, NY 13035 315-655-8710
† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
§ Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
§ Electronic Resources Inc., 568 Weddell Dr., No. 8, Sunnyvale, CA 94089 408-745-1420
§† Hilton Industries, Inc., Subsidiary of Core Industries, 1177 Cattlemen Road, Sarasota, FL 34232 813-371-2600
§† Hybrids International Ltd., Thick Film Division, 311 N. Lindenwood Dr., Olathe, KS 66062 913-764-6400
§ ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 ..... 516-753-0400; 800-862-2101
ITT Components, ITT Corporation, 5 Jenner .st, Ste. 100, Irvine, CA 92718 714-727-3001
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
† KD Components, Inc., 2710 S. Main St., Santa Ana, CA 92707 714-545-7108
§† Kyocera Northwest, Electronic Components Group, P.O. Box 85542, San Diego, CA 92138-5542 619-576-2600
§ Liberty Intl. Corp., FIRSTOHM, 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
3M Co., Tech Ceramic Resources, 3M Center 225-4W, St. Paul, MN. 55101 617-736-0601
Mepco/Centralab, North American Philips Corporation, 6071 St. Andrews Rd., Columbia, SC 29212-3198 803-772-2500
Mepco/Centralab, North American Philips Corporation, 7158 Merchant Ave., El Paso, TX 79915 915-779-3961
† Microcap, Inc., A MicroSemi Company, 501 South Andreasen Drive, Escondido, CA 92025 619-480-1906
§† Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
National Micronetics, Route 28, West Hurley, NY 12136 914-338-0333
NIC Components Corp., 6000 New Horizons Blvd., N. Amityville, NY 11701 516-226-7500
§ Paccom, 3928 148th NE, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
Philips Electronics Ltd., Elcoma Division, 601 Milner Avenue, Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
† Presidio Components, Inc., 7185 Construction Ct., San Diego, CA 92121 619-578-9390
§† Republic Elctrns. Corp., 176 E. 7th St., Paterson, NJ 07524 201-279-0300
Roederstein Elctrns., Inc., P.O. Box 5588, Statesville, NC 28677 704-872-8101
Rogers Corp., One Technology Dr., Rogers, CT 06263 203-774-9605
Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 805-498-2111
† SFE Technologies, 1501 1st St., San Fernando, CA 91340 818-365-9411
Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830 201-321-3400
§† Soshin Electric Co., Ltd., No. 18-18, 1-Chome Nakamagome, Ota-Ku, Tokyo, JAPAN ..... (03) 775-2111
§ Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 814-455-0966
§† Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
§† Sprague Electric Company, The Capacitor Group, 267 Lowell Rd., Hudson, NH 03051 603-881-7200
§ Stetco, Inc., 3344 Schierhorn Ct., Franklin Pk., IL 60131 312-671-4208
Taiyo Yuden (USA) Inc., 714 W. Algonquin Rd., Arlington Heights, IL 60005-4493 312-364-6104
§ Tansitor Electronics, West Rd., P.O. Box 230, Bennington, VT 05201 802-442-5473
Texas Instrs., Inc., Box 809066, Dallas, TX 75380 ..... 800-232-3200 (ext 700)
§ Thomas & Betts Corporation, 1001 Frontier Road, Bridgewater, NJ 08807 201-685-1600
Unitrode Corp., 580 Pleasant St., Watertown, MA 02172 617-926-0404
§† Vitramon N.A., P. O. Box 544, Bridgeport, CT 06601 203-268-6261

Capacitors, Energy Storage-1500

† American Technical Ceramics Corporation, 1 Norden La., Huntington Sta., NY 11746, 516-271-9600 ..... A•1009
§† Component Research Co. Inc., 1655-26 St., Santa Monica, CA 90404, 213-829-3615 ..... A•1031-1034,1036-1043,1046-1050,1052
§ Cornell-Dubilier Elctrns./Sangamo Weston Comps. Div., 1605 E. Rodney-French Blvd., New Bedford, MA 02741, 617-996-8561 ..... A•1070
CSI Capacitors, CSI Technologies, 810 Rancheros Dr., San Marcos, CA 92069, 619-747-4000 ..... A•1071
§ Elpac Components, Elpac Electronics, Inc., 3131 S. Standard Ave., Santa Ana, CA 92705, 714-979-4440 ..... A•1082-1083
NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... A•1141
PPD, Inc., 6001 Resco Ct., Raleigh, NC 27612, 919-781-3955 ..... A•1158,1160-1161,1166
Aselco, Inc., 429 E. Diamond Ave., Suite E, Gaithersburg, MD 20877 301-863-1937
Chicago Condenser Corp., 2900 West Chicago Ave., Chicago, IL 60622 312-227-7070
§ Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-699-0918; 800-255-2666
† Condenser Products, 2131 Broad St., Brooksville, FL 34609 904-796-3561
§ Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
§ Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
§† Electron Products, 2084 Central Ave., Duarte, CA 91010 818-359-8281
† Elmag Division, Lindgren RF Enclosures, 54 Clark St., Newark, NJ 07104 201-481-1600
High Energy, Inductotherm Industries, Lower Valley Rd., Parkesburg, PA 19365 215-593-2800
Hipotronics Inc., P.O. Drawer A, Brewster, NY 10509 914-279-8091
Industrial Midwec Capacitor Corp., 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
Marcon America Corp., 310 Era Drive, Northbrook, IL 60062 312-564-2820
Maxwell Laboratories, 8888 Balboa Avenue, San Diego, CA 92123-1506 619-279-5100
NWL Capacitors, NWL Transformers, 8050 Monetary Dr., Riviera Bch., FL 33404 305-848-9009
Paccom, 3928 148th NE, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
§ Plastic Capacitors, Inc., 2623 N. Pulaski Rd., Chicago, IL 60639 312-489-2229
RTE Aerovox Inc., 740 Belleville Ave., New Bedford, MA 02745 617-994-9661
§† Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
§† Sprague Electric Company, The Capacitor Group, 267 Lowell Rd., Hudson, NH 03051 603-881-7200
† Standard Oil Engineered Materials Co., Carborundum, P. O. Box 156, Niagara Falls, NY 14302 716-278-2000
† Stanley Electronics, Inc., 10 Ocean Ave., Copiague, NY 11726 516-842-8866
† Tobe Deutschmann Labs., Inc., 550 Turnpike St., Canton, MA 02021 617-828-3366
† Tran-Spectra, Inc., Rte. 1-Box 27A, Greenfield, TN 38230 901-235-2218
Unilator Technical Ceramics Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770 213-463-5618

Capacitors, Fixed, AC (Incl. Motor Start)-1500

§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, 818-765-8300;800-423-3186 ..... A•1007
American Shizuki Corporation, 21541 Blythe St., Canoga Pk., CA 91304, 818-710-8555 ..... A•1008
§† Component Research Co. Inc., 1655-26 St., Santa Monica, CA 90404, 213-829-3615 ..... A•1031-1034,1036-1043,1050,1060-1065,1067-1069
§ Cornell-Dubilier Elctrns./Sangamo Weston Comps. Div., 1605 E. Rodney-French Blvd., New Bedford, MA 02741, 617-996-8561 ..... A•1070
CSI Capacitors, CSI Technologies, 810 Rancheros Dr., San Marcos, CA 92069, 619-747-4000 ..... A•1071
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, 914-699-2000 ..... A•1072
§ Elpac Components, Elpac Electronics, Inc., 3131 S. Standard Ave., Santa Ana, CA 92705, 714-979-4440 ..... A•1082-1083
§ Illinois Capacitor, Inc., 3757 W. Touhy Ave., Lincolnwood, IL 60645, 312-675-1760 ..... A•1087
§ Inter-Technical Group Inc., WIMA Div., One Bridge Street, Irvington, NY 10533, 914-591-8822 ..... A•1089
Maida Development Co., 20 Libby St., Hampton, VA 23663, 804-723-0785 ..... A•1104,1106
§ Mallory Capacitor Co., Emhart Elctrl./Elctrn. Grp., 3029 E. Washington St., Dept. EM, P.O. Box 1284, Indianapolis, IN 46201, 317-636-5353 ..... A•1111
Mepco/Centralab, North American Philips Corporation, 5900 Australian Avenue, W. Palm Bch., FL 33407, 305-842-3201 ..... A•1120
Mepco/Centralab, North American Philips Corporation, 6071 St. Andrews Rd., Columbia, SC 29212-3198, 803-772-2500 ..... A•1121
PPD, Inc., 6001 Resco Ct., Raleigh, NC 27612, 919-781-3955 ..... A•1158-1161,1163-1166
Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675, 201-666-5600 ... A•1171
Wesco Electrical Co., 201 Munson St., Greenfield, MA 01301, 413-774-4358 ..... A•1186
§† American Capacitor, 2080 Central Ave, Duarte, CA 91010 818-357-8806
Aselco, Inc., 429 E. Diamond Ave., Suite E, Gaithersburg, MD 20877 301-863-1937
§ Baknor Industries Limited, 2209 Dunwin Drive, Mississauga, ONT., CANADA L5L 1X1 416-828-2400
Baldor Electric Company, P.O. Box 2400, Fort Smith, AR 72902 501-646-4711
Cera-Mite Corp., 1327 Sixth Ave., Grafton, WI 53024 414-377-3500
Chicago Condenser Corp., 2900 West Chicago Ave., Chicago, IL 60622 312-227-7070
§ Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
§ Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
§ Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§† Electron Products, 2084 Central Ave., Duarte, CA 91010 818-359-8281
† Elmag Division, Lindgren RF Enclosures, 54 Clark St., Newark, NJ 07104 201-481-1600
F-Dyne Elctrns., 449 Howard Ave., Bridgeport, CT 06605 203-367-6431
ICO-RALLY Corporation, 2575 E. Bayshore Rd., Palo Alto, CA 94303 415-856-9900
Industrial Midwec Capacitor Corp., 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
§ ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 ..... 516-753-0400; 800-862-2101
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
§† National Electronics Corp., 11731 Markon Dr., Garden Grove, CA 92641 ..... 714-892-7749;800-854-2451
§ Nichicon (America) Corp., 927 E. State Pkwy., Schaumburg, IL 60173 ... 312-843-7500
NWL Capacitors, NWL Transformers, 8050 Monetary Dr., Riviera Bch., FL 33404 305-848-9009
Plastic Capacitors, Inc., 2623 N. Pulaski Rd., Chicago, IL 60639 312-489-2229

Roederstein Elctrns., Inc., P.O. Box 5588, Statesville, NC 28677 704-872-8101
§ RTE Aerovox Inc., 740 Belleville Ave., New Bedford, MA 02745 617-994-9661
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
§† Sprague Electric Company, The Capacitor Group, 267 Lowell Rd., Hudson, NH 03051 603-881-7200
§ Thomson Passive Components Corp., 6203 Variel Ave., Unit A, Woodland Hills, CA 91367 818-887-1010
† Tran-Spectra, Inc., Rte. 1-Box 27A, Greenfield, TN 38230 901-235-2218
U.S. Instr. Rentals, 2988 Campus Dr., San Mateo, CA 94403 800-824-2873

Capacitors, Fixed, Air-1500

† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
High Energy, Inductotherm Industries, Lower Valley Rd., Parkesburg, PA 19365 215-593-2800
§ International Components Corp., 105 Maxess Rd., Melville, NY 11747 ... 516-293-1500
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Tettex Instruments, Inc., P.O. Box 281, Fairview Village, PA 19409-0281 215-539-6050

Capacitors, Fixed, Aluminum Electrolytic-1500

§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, 818-765-8300;800-423-3186 ..... A•1007
§† Cornell-Dubilier Elctrns./Sangamo Weston Comps. Div., 1605 E. Rodney-French Blvd., New Bedford, MA 02741, 617-996-8561 ..... A•1070
§ Illinois Capacitor, Inc., 3757 W. Touhy Ave., Lincolnwood, IL 60645, 312-675-1760 ..... A•1086-1087
§ International Components Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 ..... A•1088
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-937-3475 ..... A•1094
§ Maida Development Co., 20 Libby St., Hampton, VA 23663, 804-723-0785 ..... A•1106
§ Mallory Capacitor Co., Emhart Elctrl./Elctrn. Grp., 3029 E. Washington St., Dept. EM, P.O. Box 1284, Indianapolis, IN 46201, 317-636-5353 ..... A•1109-1110
Mallory Timers, Emhart Elec./Elctrn. Grp., 3029 E. Washington St., Indianapolis, IN 46201, 317-636-5353 ..... A•1113
Mepco/Centralab, North American Philips Corporation, 5900 Australian Avenue, W. Palm Bch., FL 33407, 305-842-3201 ..... A•1120
§† Mepco/Centralab, North American Philips Corporation, 6071 St. Andrews Rd., Columbia, SC 29212-3198, 803-772-2500 ..... A•1121
Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483, 619-575-9353 ..... A•2031
§ United Chemi-Con Inc., 9801 W. Higgins Rd., Rosemont, IL 60018, 312-696-2000 ..... A•1182-1183
§ Air Electro Supply, Inc., 7700 Gloria Ave., Van Nuys, CA 91406 ..... 213-873-6400; 818-988-4400
§† Arco Electronics, 9822 Independence Ave., Chatsworth, CA 91311 818-882-8707
Aselco, Inc., 429 E. Diamond Ave., Suite E, Gaithersburg, MD 20877 ... 301-863-1937
§ Baknor Industries Limited, 2209 Dunwin Drive, Mississauga, ONT., CANADA L5L 1X1 416-828-2400
Baldor Electric Company, P.O. Box 2400, Fort Smith, AR 72902 501-646-4711
§ Capacitor Technology, Inc., 5015 Speedway Dr., Ft. Wayne, IN 46825 ... 219-484-9054
§† Components Div., Sangamo Weston, Inc., Box 128, Pickens, SC 29671 .. 803-878-6311
§ Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-699-0918; 800-255-2666
§ Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
§ Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
Ei North America, 435 E. 79th St., New York, NY 10021 212-517-5622
§ Elna America, Inc., 153 E. Savarona Way, Carson, CA 90746 213-327-6090
ICO-RALLY Corporation, 2575 E. Bayshore Rd., Palo Alto, CA 94303 415-856-9900
Industrial Midwec Capacitor Corp., 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
§ Kahgan Electronics Corp., 605 Peninsula Blvd., Hempstead, NY 11550 .. 516-538-2300
Lawrence-Crow Elctrns. Inc., 2100 Stemmons, Dallas, TX 75207 214-749-5440
§ Liberty Intl. Corp., FIRSTOHM, 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
Mallory Components Division, Emhart Elec./Elctrn. Grp., 222 Dixon Rd., Weston, Ont., CANADA M9P 3S5 416-244-4239
§ Marcon America Corp., 310 Era Drive, Northbrook, IL 60062 312-564-2820
§ Multi Products International, 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009 201-239-8183
§ National Electronics Corp., 11731 Markon Dr., Garden Grove, CA 92641 ..... 714-892-7749;800-854-2451
§ NIC Components Corp., 6000 New Horizons Blvd., N. Amityville, NY 11701 516-226-7500
§ Nichicon (America) Corp., 927 E. State Pkwy., Schaumburg, IL 60173 ... 312-843-7500
§ NTE Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
Philips Electronics Ltd., Elcoma Division, 601 Milner Avenue, Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
§ Piher International Corp., 903 Feehanville Dr., Mt. Prospect, IL 60056 ..... 312-390-6680; 800-323-6693
Plasticorp, 24105 S. Frampton Ave., Harbor City, CA 90710 213-539-9530
Roederstein Elctrns., Inc., P.O. Box 5588, Statesville, NC 28677 704-872-8101
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830 201-321-3400
§ Speco Div., Components Specialties, Inc., P.O. Box 624, 1172 Rte. 109, Lindenhurst, NY 11757 ..... 516-957-8700;800-645-5516
§† Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
§† Sprague Electric Company, The Capacitor Group, 267 Lowell Rd., Hudson, NH 03051 603-881-7200
Stetron International, Inc., 90 Broadway, Buffalo, NY 14203 716-854-3443
§ Tansitor Electronics, West Rd., P.O. Box 230, Bennington, VT 05201 802-442-5473
† Tran-Spectra, Inc., Rte. 1-Box 27A, Greenfield, TN 38230 901-235-2218

Capacitors, Fixed, Ceramic, Disc & Tubular-1500

§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, 818-765-8300;800-423-3186 ..... A•1007
AVX Corporation, Box 867, Myrtle Bch., SC 29577, 803-448-9411 ... A•1023,1025
Bradford Electronics, Inc., 550 High Street, Bradford, PA 16701, 814-362-5700 ..... A•1028-1029
Delcap Div., American Precision Industries, Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600 ..... A•1073-1075
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, 914-699-2000 ..... A•1072
Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600 ..... A•1241
§ Illinois Capacitor, Inc., 3757 W. Touhy Ave., Lincolnwood, IL 60645, 312-675-1760 ..... A•1087
§ International Components Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 ..... A•1088
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-937-3475 ..... A•1094
§† Kemet Electronics Corporation, Box 5928, Greenville, SC 29606, 803-963-6621 ..... A•1100-1101
§ Maida Development Co., 20 Libby St., Hampton, VA 23663, 804-723-0785 ..... A•1103-1105,1954
§ Mallory Capacitor Co., Emhart Elctrl./Elctrn. Grp., 3029 E. Washington St., Dept. EM, P.O. Box 1284, Indianapolis, IN 46201, 317-636-5353 ..... A•1111
Mepco/Centralab, North American Philips Corporation, 7158 Merchant Ave., El Paso, TX 79915, 915-779-3961 ..... A•1124
† Metuchen Capacitors, Inc., 139 White Oak Ln., P.O. Box 499, Old Bridge, NJ 08857, 201-679-3366 ..... A•1126-1130
§ Multi Products International, 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•1135
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•1136-1140
Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483, 619-575-9353 ..... A•2031
§ TDK Corporation, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku,, Tokyo, JAPAN 103, (03) 278-5111 ..... A•1176-1179
§† Tusonix, Inc., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144, 602-744-0400 ..... A•1181
§ Air Electro Supply, Inc., 7700 Gloria Ave., Van Nuys, CA 91406 ..... 213-873-6400; 818-988-4400
§† Arco Electronics, 9822 Independence Ave., Chatsworth, CA 91311 818-882-8707
§ Baknor Industries Limited, 2209 Dunwin Drive, Mississauga, ONT., CANADA L5L 1X1 416-828-2400
Centre Engineering, 2820 E. College Ave., State College, PA 16801 814-237-0321
† Cera-Mite Corp., 1327 Sixth Ave., Grafton, WI 53024 414-377-3500
§ Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-699-0918; 800-255-2666
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-8725
§ Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
Ei North America, 435 E. 79th St., New York, NY 10021 212-517-5622
High Energy, Inductotherm Industries, Lower Valley Rd., Parkesburg, PA 19365 215-593-2800
ICO-RALLY Corporation, 2575 E. Bayshore Rd., Palo Alto, CA 94303 415-856-9900
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
K & M Electronics, 221 Interstate Dr., Dock No. 3, W. Springfield, MA 01089 413-781-1350
† KD Components, Inc., 2710 S. Main St., Santa Ana, CA 92707 714-545-7108
Lawrence-Crow Elctrns. Inc., 2100 Stemmons, Dallas, TX 75207 214-749-5440
§ Liberty Intl. Corp., FIRSTOHM, 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
Mepco/Centralab, North American Philips Corporation, 4561 Colorado Blvd., Los Angeles, CA 90039 818-240-4880
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
§ National Electronics Corp., 11731 Markon Dr., Garden Grove, CA 92641 ..... 714-892-7749;800-854-2451
§ NIC Components Corp., 6000 New Horizons Blvd., N. Amityville, NY 11701 516-226-7500
† Oxley, Inc., 25 Business Pk. Dr., P.O. Box 814, Branford, CT 06405 203-488-1033
§ Piher International Corp., 903 Feehanville Dr., Mt. Prospect, IL 60056 ..... 312-390-6680; 800-323-6693
§† Republic Elctrns. Corp., 176 E. 7th St., Paterson, NJ 07524 201-279-0300
Roederstein Elctrns., Inc., P.O. Box 5588, Statesville, NC 28677 704-872-8101
Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 805-498-2111
SFE Technologies, 1501 1st St., San Fernando, CA 91340 818-365-9411
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830 201-321-3400
Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 814-455-0966
Sprague Electric Company, The Capacitor Group, 267 Lowell Rd., Hudson, NH 03051 603-881-7200
§ Stetco, Inc., 3344 Schierhorn Ct., Franklin Pk., IL 60131 312-671-4208
Stetron International, Inc., 90 Broadway, Buffalo, NY 14203 716-854-3443

Taiyo Yuden (USA) Inc., 714 W. Algonquin Rd., Arlington Heights, IL 60005-4493 312-364-6104
§ Thomson Passive Components Corp., 6203 Variel Ave., Unit A, Woodland Hills, CA 91367 818-887-1010
§ TRW Capacitor Div., 301 West "O" St., Ogallala, NE 69153 308-284-3611
Unilator Technical Ceramics Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770 213-463-5618

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§ Alien Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, 818-765-8300;800-423-3186 ..... A•1007
† American Technical Ceramics Corporation, 1 Norden La., Huntington Sta., NY 11746, 516-271-9600 ..... A•1009,1011-1013
† Armbar Industries, Inc., 139 White Oak Lane, Old Bridge, NJ 08857, 201-679-3377 ..... A•1014
§† AVX Corporation, Box 867, Myrtle Bch., SC 29577, 803-448-9411 ... A•1023-1024
Bradford Electronics, Inc., 550 High Street, Bradford, PA 16701, 814-362-5700 ..... A•1028-1029
Delcap Div., American Precision Industries, Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600 ..... A•1074-1075
§ Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600 ..... A•1241
International Components Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 ..... A•1088
Johanson Dielectrics, 2220 Screenland Dr., Burbank, CA 91505, 818-848-4465 ..... A•1098
§† Kemet Electronics Corporation, Box 5928, Greenville, SC 29606, 803-963-6621 ..... A•1100-1101
§ Maida Development Co., 20 Libby St., Hampton, VA 23663, 804-723-0785 ..... A•1104
§ Mallory Capacitor Co., Emhart Elctrl./Elctrn. Grp., 3029 E. Washington St., Dept. EM, P.O. Box 1284, Indianapolis, IN 46201, 317-636-5353 ..... A•1111
Mepco/Centralab, North American Philips Corporation, 4561 Colorado Blvd., Los Angeles, CA 90039, 818-240-4880 ..... A•1123
Mepco/Centralab, North American Philips Corporation, 7158 Merchant Ave., El Paso, TX 79915, 915-779-3961 ..... A•1124
† Metuchen Capacitors, Inc., 139 White Oak Ln., P.O. Box 499, Old Bridge, NJ 08857, 201-679-3366 ..... A•1126-1133
§ Multi Products International, 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•1135
§† Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•1136,1138-1140
§ Radio Materials Corp., P. O. Box 339, Attica, IN 47918, 317-762-2491;1-800-356-9956 ..... A•1168,1170
Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483, 619-575-9353 ..... A•2031
§ TDK Corporation, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku,, Tokyo, JAPAN 103, (03) 278-5111 ..... A•1176-1179
† U S Microtek Components Corp., Division of Unitrode Corp., 11144 Penrose St., Sun Valley, CA 91352, 818-767-6770 ..... A•1184
§ Air Electro Supply, Inc., 7700 Gloria Ave., Van Nuys, CA 91406 ..... 213-873-6400; 818-988-4400
§† Arco Electronics, 9822 Independence Ave., Chatsworth, CA 91311 818-882-8707
† Assembly Specialists, 914 Main St., Box 965, Acton, MA 01720 617-263-9100
§ Baknor Industries Limited, 2209 Dunwin Drive, Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§ Centre Engineering, 2820 E. College Ave., State College, PA 16801 814-237-0321
§ Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-699-0918; 800-255-2666
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-8725
§ Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
ICO-RALLY Corporation, 2575 E. Bayshore Rd., Palo Alto, CA 94303 415-856-9900
§ ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 ..... 516-753-0400; 800-862-2101
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
K & M Electronics, 221 Interstate Dr., Dock No. 3, W. Springfield, MA 01089 413-781-1350
† KD Components, Inc., 2710 S. Main St., Santa Ana, CA 92707 714-545-7108
§† Kyocera Northwest, Electronic Components Group, P.O. Box 85542, San Diego, CA 92138-5542 619-576-2600
§ Liberty Intl. Corp., FIRSTOHM, 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
† Microcap, Inc., A MicroSemi Company, 501 South Andreasen Drive, Escondido, CA 92025 619-480-1906
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
§ National Electronics Corp., 11731 Markon Dr., Garden Grove, CA 92641 ..... 714-892-7749;800-854-2451
§ NIC Components Corp., 6000 New Horizons Blvd., N. Amityville, NY 11701 516-226-7500
§ Paccom, 3928 148th NE, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
§ Piher International Corp., 903 Feehanville Dr., Mt. Prospect, IL 60056 ..... 312-390-6680; 800-323-6693
† Presidio Components, Inc., 7185 Construction Ct., San Diego, CA 92121 619-578-9390
§† Republic Elctrns. Corp., 176 E. 7th St., Paterson, NJ 07524 201-279-0300
Rogers Corporation, Circuit Components Div., 2400 S. Roosevelt St., Tempe, AZ 85282 602-967-0624
§† Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 805-498-2111
§† SFE Technologies, 1501 1st St., San Fernando, CA 91340 818-365-9411
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830 201-321-3400
§† Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 814-455-0966
§† Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
§† Sprague Electric Company, The Capacitor Group, 267 Lowell Rd., Hudson, NH 03051 603-881-7200
§ Stetco, Inc., 3344 Schierhorn Ct., Franklin Pk., IL 60131 312-671-4208
§ Tansitor Electronics, West Rd., P.O. Box 230, Bennington, VT 05201 802-442-5473
§ Thomson Passive Components Corp., 6203 Variel Ave., Unit A, Woodland Hills, CA 91367 818-887-1010
Unilator Technical Ceramics Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770 213-463-5618
§† Vitramon N.A., P. O. Box 544, Bridgeport, CT 06601 203-268-6261

Capacitors, Fixed, Feedthru-1500

† American Technical Ceramics Corporation, 1 Norden La., Huntington Sta., NY 11746, 516-271-9600 ..... A•1009,1011
† Armbar Industries, Inc., 139 White Oak Lane, Old Bridge, NJ 08857, 201-679-3377 ..... A•1014
§† AVX Corporation, Box 867, Myrtle Bch., SC 29577, 803-448-9411 ..... A•1023
Bradford Electronics, Inc., 550 High Street, Bradford, PA 16701, 814-362-5700 ..... A•1028-1029
§† Component Research Co. Inc., 1655-26 St., Santa Monica, CA 90404, 213-829-3615 ..... A•1031-1034,1042-1044,1046,1048-1049,1058,1060-1061,1063,1066, 1068-1069
§ Cornell-Dubilier Elctrns./Sangamo Weston Comps. Div., 1605 E. Rodney-French Blvd., New Bedford, MA 02741, 617-996-8561 ..... A•1070
§ Elpac Components, Elpac Electronics, Inc., 3131 S. Standard Ave., Santa Ana, CA 92705, 714-979-4440 ..... A•1082-1083
§ International Components Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 ..... A•1088
§ ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-937-3475 ..... A•1094
Johanson Dielectrics, 2220 Screenland Dr., Burbank, CA 91505, 818-848-4465 ..... A•1098
§ Maida Development Co., 20 Libby St., Hampton, VA 23663, 804-723-0785 ..... A•1103-1105
† Metuchen Capacitors, Inc., 139 White Oak Ln., P.O. Box 499, Old Bridge, NJ 08857, 201-679-3366 ..... A•1129-1130,1672
† Oxley, Inc., 25 Business Pk. Dr., P.O. Box 814, Branford, CT 06405, 203-488-1033 ..... A•1677
Penstock Engineering Labs., Penstock, Inc., 520 Mercury Dr., Sunnyvale, CA 94086-4018, 408-730-0300 ..... A•1844
§ Pomona Electronics, 1500 E. 9th St., P.O. Box 2767, Pomona, CA 91766, 714-623-3463 ..... C•1489,1708
Radio Materials Corp., P. O. Box 339, Attica, IN 47918, 317-762-2491;1-800-356-9956 ..... A•1168
Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675, 201-666-5600 ... A•1171
Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483, 619-575-9353 ..... A•2031
§ TDK Corporation, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku,, Tokyo, JAPAN 103, (03) 278-5111 ..... A•1179
§† Tusonix, Inc., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144, 602-744-0400 ..... A•1181
† U S Microtek Components Corp., Division of Unitrode Corp., 11144 Penrose St., Sun Valley, CA 91352, 818-767-6770 ..... A•1184
Wesco Electrical Co., 201 Munson St., Greenfield, MA 01301, 413-774-4358 ..... A•1186
§† American Capacitor, 2080 Central Ave, Duarte, CA 91010 818-357-8806
§† Capcon, Inc., 147 West 25th Street, New York, NY 10001 212-243-6275
Captor Corp., 5040 S. County Rd. (25A), Tipp City, OH 45371 513-667-8484
† Chicago Condenser Corp., 2900 West Chicago Ave., Chicago, IL 60622 312-227-7070
† Circle Electronics, A Division of F-Dyne Elctrns., 3501 Electronics Way, W. Palm Beach, FL 33407 305-844-1310
Compac, 1320-13 Lincoln Ave., Holbrook, NY 11741 516-585-3400
§ Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
† Dynamic Air Engrg., Inc., 620 E. Dyer Rd., Santa Ana, CA 92705-5697 ... 714-540-1000
§ Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§ Electronic Resources Inc., 568 Weddell Dr., No. 8, Sunnyvale, CA 94089 408-745-1420
§† Electron Products, 2084 Central Ave., Duarte, CA 91010 818-359-8281
† Elmag Division, Lindgren RF Enclosures, 54 Clark St., Newark, NJ 07104 201-481-1600
† F-Dyne Elctrns., 449 Howard Ave., Bridgeport, CT 06605 203-367-6431
† Filtron Co., Inc., Sub. of ARX Inc., 148-E Sweet Hollow Rd., Old Bethpage, NY 11804 516-752-1144
† FL Jennings, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696 408-292-4025
† Genisco Technology Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
§ High Energy, Inductotherm Industries, Lower Valley Rd., Parkesburg, PA 19365 215-593-2800
ICO-RALLY Corporation, 2575 E. Bayshore Rd., Palo Alto, CA 94303 415-856-9900
Industrial Midwec Capacitor Corp., 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
§† Kyocera Northwest, Electronic Components Group, P.O. Box 85542, San Diego, CA 92138-5542 619-576-2600
§† Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080 404-436-1300
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111

Presidio Components, Inc., 7185 Construction Ct, San Diego, CA 92121 619-578-9390
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Rtron Corp., 7324 Lawndale, Skokie, IL 60076 312-679-7180
† S & El Manufacturing, Box 832, Northridge, CA 91324 818-349-4111
† SFE Technologies, 1501 1st St, San Fernando, CA 91340 818-365-9411
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Southern Electronics, F-Dyne, 726 So. Flower St., Burbank, CA 91502 ... 818-845-2458
§† Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 814-455-0966
§† Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
§† Sprague Electric Company, The Capacitor Group, 267 Lowell Rd., Hudson, NH 03051 603-881-7200
Standard Condenser Corp., 1065 W. Addison St., Chicago, IL 60613 312-327-5440
§ Stetco, Inc., 3344 Schierhorn Ct., Franklin Pk., IL 60131 312-671-4208
§ Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131 408-432-8020
Unilator Technical Ceramics Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770 213-463-5618
§† West-Cap Arizona, Sub. of SFE Technologies, 2201 East Elvira Road, Tucson, AZ 85706 602-294-2646

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§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, 818-765-8300;800-423-3186 ..... A•1007
American Shizuki Corporation, 21541 Blythe St., Canoga Pk., CA 91304, 818-710-8555 ..... A•1008
AT&T, 555 Union Blvd., Allentown, PA 18103, 1-800-372-2447;In Canada:1-800-553-2448 ..... A•1015-1022
§† Component Research Co. Inc., 1655-26 St., Santa Monica, CA 90404, 213-829-3615 ..... A•1031-1069
§† Cornell-Dubilier Elctrns./Sangamo Weston Comps. Div., 1605 E. Rodney-French Blvd., New Bedford, MA 02741, 617-996-8561 ..... A•1070
CSI Capacitors, CSI Technologies, 810 Rancheros Dr., San Marcos, CA 92069, 619-747-4000 ..... A•1071
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, 914-699-2000 ..... A•1072
Eichhoff Electronics, 205 Hallene Rd., Warwick, RI 02886, 401-738-1440 ..... A•1651
§† Electronic Concepts, Inc., Box 1278, Eatontown, NJ 07724, 201-542-7880 ..... A•1076-1081
§ Elpac Components, Elpac Electronics, Inc., 3131 S. Standard Ave., Santa Ana, CA 92705, 714-979-4440 ..... A•1082-1083
§ Evox, Inc., 100 Tri State International, Lincolnshire, IL 60015, 312-948-9511 ..... A•1084
§ Illinois Capacitor, Inc., 3757 W. Touhy Ave., Lincolnwood, IL 60645, 312-675-1760 ..... A•1087
§ International Components Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 ..... A•1088
§ Inter-Technical Group Inc., WIMA Div., One Bridge Street, Irvington, NY 10533, 914-591-8822 ..... A•1089
§ ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-937-3475 ..... A•1094
ITT Components, ITT Corporation, 5 Jenner .st., Ste. 100, Irvine, CA 92718, 714-727-3001 ..... A•1092
§ ITW Paktron, Div. of Illinois Tool Works, P.O. Box 4539, 1205 McConville Rd., Lynchburg, VA 24502, 804-239-6941 ..... A•1095-1097
§† Kemet Electronics Corporation, Box 5928, Greenville, SC 29606, 803-963-6621 ..... A•1100-1101
§ Maida Development Co., 20 Libby St., Hampton, VA 23663, 804-723-0785 ..... A•1106
§ Mallory Capacitor Co., Emhart Elctrl./Elctrn. Grp., 3029 E. Washington St., Dept. EM, P.O. Box 1284, Indianapolis, IN 46201, 317-636-5353 ..... A•1108,1111
Matsuo Electronics, 2134 Main Street, Suite 200, Huntington Beach, CA 92648, 714-969-2491 ..... A•1119
§ Mepco/Centralab, North American Philips Corporation, 6071 St. Andrews Rd., Columbia, SC 29212-3198, 803-772-2500 ..... A•1122
§† Nytronics Components Grp., Inc., 700 Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1144-1153
PPD, Inc., 6001 Resco Ct., Raleigh, NC 27612, 919-781-3955 ..... A•1158-1166
Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675, 201-666-5600 ... A•1171
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530, 914-681-0700 ..... D•1053
§ Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830, 201-321-3400 ..... A•1173
Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483, 619-575-9353 ..... A•2031
Tettex Instruments, Inc., P.O. Box 281, Fairview Village, PA 19409-0281, 215-539-6050 ..... D•1326
† Wesco Electrical Co., 201 Munson St., Greenfield, MA 01301, 413-774-4358 ..... A•1186-1191
§† American Capacitor, 2080 Central Ave, Duarte, CA 91010 818-357-8806
§ Arco Electronics, 9822 Independence Ave., Chatsworth, CA 91311 818-882-8707
Aselco, Inc., 429 E. Diamond Ave., Suite E, Gaithersburg, MD 20877 301-863-1937
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
§ Baknor Industries Limited, 2209 Dunwin Drive, Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§ Bishop Electronics Corp., 3729 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-695-0446;213-692-9391
† Capco, Box 1028, Grand Junction, CO 81502 303-243-8751
§† Capcon, Inc., 147 West 25th Street, New York, NY 10001 212-243-6275
Captor Corp., 5040 S. County Rd. (25A), Tipp City, OH 45371 513-667-8484
Chicago Condenser Corp., 2900 West Chicago Ave., Chicago, IL 60622 312-227-7070
§† Circle Electronics, A Division of F-Dyne Elctrns., 3501 Electronics Way, W. Palm Beach, FL 33407 305-844-1310
§ Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-699-0918; 800-255-2666
† Condenser Products, 2131 Broad St., Brooksville, FL 34609 904-796-3561
§ Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
§ Custom Electronics, Browne St., Oneonta, NY 13820 607-432-3880
Dow Switch, Screenprint/Dow, 271 Ballardvale St., P.O. Box 1332, Wilmington, MA 01887 617-935-6395
§ Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
§ Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
Electronic Film Capacitors, Inc., Reidville Industrial Pk., 41 Interstate Ln., Waterbury, CT 06705 203-755-5629
§† Electron Products, 2084 Central Ave., Duarte, CA 91010 818-359-8281
† Elmag Division, Lindgren RF Enclosures, 54 Clark St., Newark, NJ 07104 201-481-1600
† F-Dyne Elctrns., 449 Howard Ave., Bridgeport, CT 06605 203-367-6431
† Filtron Co., Inc., Sub. of ARX Inc., 148-E Sweet Hollow Rd., Old Bethpage, NY 11804 516-752-1144
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
ICO-RALLY Corporation, 2575 E. Bayshore Rd., Palo Alto, CA 94303 415-856-9900
Industrial Midwec Capacitor Corp., 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
Interelectronics Corp., Interelectronics Park, 550 U.S. Rte. 303, Congers, NY 10920 ..... 914-EL8-8000
§ ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 ..... 516-753-0400; 800-862-2101
ITT Components, ITT Corporation, 5 Jenner .st., Ste. 100, Irvine, CA 92718 714-727-3001
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
§ Kahgan Electronics Corp., 605 Peninsula Blvd., Hempstead, NY 11550 .. 516-538-2300
Lawrence-Crow Elctrns. Inc., 2100 Stemmons, Dallas, TX 75207 214-749-5440
Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
§ Liberty Intl. Corp., FIRSTOHM, 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
Marcon America Corp., 310 Era Drive, Northbrook, IL 60062 312-564-2820
Maxwell Laboratories, 8888 Balboa Avenue, San Diego, CA 92123-1506 619-279-5100
McGill Manufacturing Co., Inc., 909 North Lafayette Street, Valparaiso, IN 46383 219-465-2200
§ National Electronics Corp., 11731 Markon Dr., Garden Grove, CA 92641 ..... 714-892-7749;800-854-2451
§ Nedco Electronics, Inc., 6216 Oakton St., Morton Grove, IL 60053 312-966-6000
§ NIC Components Corp., 6000 New Horizons Blvd., N. Amityville, NY 11701 516-226-7500
§ Nichicon (America) Corp., 927 E. State Pkwy., Schaumburg, IL 60173 ... 312-843-7500
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
NWL Capacitors, NWL Transformers, 8050 Monetary Dr., Riviera Bch., FL 33404 305-848-9009
Philips Electronics Ltd., Elcoma Division, 601 Milner Avenue, Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
§† Plastic Capacitors, Inc., 2623 N. Pulaski Rd., Chicago, IL 60639 312-489-2229
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
Roederstein Elctrns., Inc., P.O. Box 5588, Statesville, NC 28677 704-872-8101
Rogers Corp., One Technology Dr., Rogers, CT 06263 203-774-9605
§ RTE Aerovox Inc., 740 Belleville Ave., New Bedford, MA 02745 617-994-9661
† S & El Manufacturing, Box 832, Northridge, CA 91324 818-349-4111
§† SFE Technologies, 1501 1st St, San Fernando, CA 91340 818-365-9411
† Southern Electronics, F-Dyne, 726 So. Flower St., Burbank, CA 91502 ... 818-845-2458
§† Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
§† Sprague Electric Company, The Capacitor Group, 267 Lowell Rd., Hudson, NH 03051 603-881-7200
Standard Condenser Corp., 1065 W. Addison St., Chicago, IL 60613 312-327-5440
† Stanley Electronics, Inc., 10 Ocean Ave., Copiague, NY 11726 516-842-8866
Stetron International, Inc., 90 Broadway, Buffalo, NY 14203 716-854-3443
§ Thomson Passive Components Corp., 6203 Variel Ave., Unit A, Woodland Hills, CA 91367 818-887-1010
§† TRW Capacitor Div., 301 West "O" St., Ogallala, NE 69153 308-284-3611
§† West-Cap Arizona, Sub. of SFE Technologies, 2201 East Elvira Road, Tucson, AZ 85706 602-294-2646

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§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, 818-765-8300;800-423-3186 ..... A•1007
† American Technical Ceramics Corporation, 1 Norden La., Huntington Sta., NY 11746, 516-271-9600 ..... A•1009
† FL Jennings, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696, 408-292-4025 ..... A•1085
Mepco/Centralab, North American Philips Corporation, 7158 Merchant Ave., El Paso, TX 79915, 915-779-3961 ..... A•1124
§ Air Electro Supply, Inc., 7700 Gloria Ave., Van Nuys, CA 91406 ..... 213-873-6400; 818-988-4400
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-8725
Presidio Components, Inc., 7185 Construction Ct, San Diego, CA 92121 619-578-9390
§ Tansitor Electronics, West Rd., P.O. Box 230, Bennington, VT 05201 802-442-5473
§† Vitramon N.A., P. O. Box 544, Bridgeport, CT 06601 203-268-6261

Capacitors, Fixed, Laboratory Standard-1500

† American Technical Ceramics Corporation, 1 Norden La., Huntington Sta., NY 11746, 516-271-9600 ..... A•1009-1010

AT&T, 555 Union Blvd., Allentown, PA 18103, 1-800-372-2447;In Canada:1-800-553-2448 ..... A•1016-1017
§† Component Research Co. Inc., 1655-26 St., Santa Monica, CA 90404, 213-829-3615 ..... A•1031-1034,1045,1047-1049,1053-1054,1057,1059,1062,1064-1065,1067
§ Illinois Capacitor, Inc., 3757 W. Touhy Ave., Lincolnwood, IL 60645, 312-675-1760 ..... A•1086-1087
§† Tusonix, Inc., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144, 602-744-0400 ..... A•1181
Wesco Electrical Co., 201 Munson St., Greenfield, MA 01301, 413-774-4358 ..... A•1186
American HV Test Systems Inc., Central Garrett Ind'l Pk, Accident, MD 21520 301-826-8651
Aselco, Inc., 429 E. Diamond Ave., Suite E, Gaithersburg, MD 20877 301-863-1937
† Circle Electronics, A Division of F-Dyne Elctrns., 3501 Electronics Way, W. Palm Beach, FL 33407 305-844-1310
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
† F-Dyne Elctrns., 449 Howard Ave., Bridgeport, CT 06605 203-367-6431
Industrial Midwec Capacitor Corp., 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
§ Nichicon (America) Corp., 927 E. State Pkwy., Schaumburg, IL 60173 ... 312-843-7500
Rutherford Research, Box 249, Rutherford, NJ 07070 201-933-2091
† Southern Electronics, F-Dyne, 726 So. Flower St., Burbank, CA 91502 ... 818-845-2458
Sprague Electric Company, The Capacitor Group, 267 Lowell Rd., Hudson, NH 03051 603-881-7200
Standard Condenser Corp., 1065 W. Addison St., Chicago, IL 60613 312-327-5440
Tettex Instruments, Inc., P.O. Box 281, Fairview Village, PA 19409-0281 215-539-6050
Tucker Electronics, Box 461966, Garland, TX 75046 ..... 214-348-8800;800-527-4642

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§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, 818-765-8300;800-423-3186 ..... A•1007
§† Cornell-Dubilier Elctrns./Sangamo Weston Comps. Div., 1605 E. Rodney-French Blvd., New Bedford, MA 02741, 617-996-8561 ..... A•1070
Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•1139
Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483, 619-575-9353 ..... A•2031
§ Air Electro Supply, Inc., 7700 Gloria Ave., Van Nuys, CA 91406 ..... 213-873-6400; 818-988-4400
§† Arco Electronics, 9822 Independence Ave., Chatsworth, CA 91311 818-882-8707
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
§ Baknor Industries Limited, 2209 Dunwin Drive, Mississauga, ONT., CANADA L5L 1X1 416-828-2400
† Cera-Mite Corp., 1327 Sixth Ave., Grafton, WI 53024 414-377-3500
§† Components Div., Sangamo Weston, Inc., Box 128, Pickens, SC 29671 .. 803-878-6311
§† Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
§† Custom Electronics, Browne St., Oneonta, NY 13820 607-432-3880
Ei North America, 435 E. 79th St., New York, NY 10021 212-517-5622
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
ICO-RALLY Corporation, 2575 E. Bayshore Rd., Palo Alto, CA 94303 415-856-9900
† Kahgan Electronics Corp., 605 Peninsula Blvd., Hempstead, NY 11550 .. 516-538-2300
Lawrence-Crow Elctrns. Inc., 2100 Stemmons, Dallas, TX 75207 214-749-5440
§† National Electronics Corp., 11731 Markon Dr., Garden Grove, CA 92641 ..... 714-892-7749;800-854-2451
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Soshin Electric Co., Ltd., No. 18-18, 1-Chome Nakamagome, Ota-Ku, Tokyo, JAPAN ..... (03) 775-2111
† Stanley Electronics, Inc., 10 Ocean Ave., Copiague, NY 11726 516-842-8866
† Tobe Deutschmann Labs., Inc., 550 Turnpike St., Canton, MA 02021 617-828-3366

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American Shizuki Corporation, 21541 Blythe St., Canoga Pk., CA 91304, 818-710-8555 ..... A•1008
§† Component Research Co. Inc., 1655-26 St., Santa Monica, CA 90404, 213-829-3615 ..... A•1031-1034,1052
§ Cornell-Dubilier Elctrns./Sangamo Weston Comps. Div., 1605 E. Rodney-French Blvd., New Bedford, MA 02741, 617-996-8561 ..... A•1070
† CSI Capacitors, CSI Technologies, 810 Rancheros Dr., San Marcos, CA 92069, 619-747-4000 ..... A•1071
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, 914-699-2000 ..... A•1072
§ Elpac Components, Elpac Electronics, Inc., 3131 S. Standard Ave., Santa Ana, CA 92705, 714-979-4440 ..... A•1082-1083
§ Mallory Capacitor Co., Emhart Elctrl./Elctrn. Grp., 3029 E. Washington St., Dept. EM, P.O. Box 1284, Indianapolis, IN 46201, 317-636-5353 ..... A•1111
§† Nytronics Components Grp., Inc., 700 Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1156-1157
Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483, 619-575-9353 ..... A•2031
§† American Capacitor, 2080 Central Ave, Duarte, CA 91010 818-357-8806
American HV Test Systems Inc., Central Garrett Ind'l Pk, Accident, MD 21520 301-826-8651
Aselco, Inc., 429 E. Diamond Ave., Suite E, Gaithersburg, MD 20877 301-863-1937
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
Baldor Electric Company, P.O. Box 2400, Fort Smith, AR 72902 501-646-4711
† Chicago Condenser Corp., 2900 West Chicago Ave., Chicago, IL 60622 312-227-7070
† Condenser Products, 2131 Broad St., Brooksville, FL 34609 904-796-3561
§ Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
§ Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
§† Electron Products, 2084 Central Ave., Duarte, CA 91010 818-359-8281
† Elmag Division, Lindgren RF Enclosures, 54 Clark St., Newark, NJ 07104 201-481-1600
§ High Energy, Inductotherm Industries, Lower Valley Rd., Parkesburg, PA 19365 215-593-2800
Hipotronics Inc., P.O. Drawer A, Brewster, NY 10509 914-279-8091
Industrial Midwec Capacitor Corp., 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
§ Inter-Technical Group Inc., WIMA Div., One Bridge Street, Irvington, NY 10533 914-591-8822
Maxwell Laboratories, 8888 Balboa Avenue, San Diego, CA 92123-1506 619-279-5100
§ Nichicon (America) Corp., 927 E. State Pkwy., Schaumburg, IL 60173 ... 312-843-7500
NWL Capacitors, NWL Transformers, 8050 Monetary Dr., Riviera Bch., FL 33404 305-848-9009
§† Plastic Capacitors, Inc., 2623 N. Pulaski Rd., Chicago, IL 60639 312-489-2229
Reeve Electronics, Mellish E. Murray, 1715 W. Carroll Ave., Chicago, IL 60612 312-670-0150
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
§ RTE Aerovox Inc., 740 Belleville Ave., New Bedford, MA 02745 617-994-9661
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§† Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
§† Sprague Electric Company, The Capacitor Group, 267 Lowell Rd., Hudson, NH 03051 603-881-7200
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† Tobe Deutschmann Labs., Inc., 550 Turnpike St., Canton, MA 02021 617-828-3366

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§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, 818-765-8300;800-423-3186 ..... A•1007
§† Component Research Co. Inc., 1655-26 St., Santa Monica, CA 90404, 213-829-3615 ..... A•1031-1034,1036-1041,1044-1045,1048-1050
§ Cornell-Dubilier Elctrns./Sangamo Weston Comps. Div., 1605 E. Rodney-French Blvd., New Bedford, MA 02741, 617-996-8561 ..... A•1070
CSI Capacitors, CSI Technologies, 810 Rancheros Dr., San Marcos, CA 92069, 619-747-4000 ..... A•1071
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, 914-699-2000 ..... A•1072
§ Elpac Components, Elpac Electronics, Inc., 3131 S. Standard Ave., Santa Ana, CA 92705, 714-979-4440 ..... A•1082-1083
§ Illinois Capacitor, Inc., 3757 W. Touhy Ave., Lincolnwood, IL 60645, 312-675-1760 ..... A•1087
§ Mallory Capacitor Co., Emhart Elctrl./Elctrn. Grp., 3029 E. Washington St., Dept. EM, P.O. Box 1284, Indianapolis, IN 46201, 317-636-5353 ..... A•1111
Mepco/Centralab, North American Philips Corporation, 6071 St. Andrews Rd., Columbia, SC 29212-3198, 803-772-2500 ..... A•1122
§† Nytronics Components Grp., Inc., 700 Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1154-1155,1157
Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483, 619-575-9353 ..... A•2031
§ Air Electro Supply, Inc., 7700 Gloria Ave., Van Nuys, CA 91406 ..... 213-873-6400; 818-988-4400
§† American Capacitor, 2080 Central Ave, Duarte, CA 91010 818-357-8806
American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
§ Arco Electronics, 9822 Independence Ave., Chatsworth, CA 91311 818-882-8707
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
§ Baknor Industries Limited, 2209 Dunwin Drive, Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§ Bishop Electronics Corp., 3729 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-695-0446;213-692-9391
§† Capcon, Inc., 147 West 25th Street, New York, NY 10001 212-243-6275
Chicago Condenser Corp., 2900 West Chicago Ave., Chicago, IL 60622 312-227-7070
† Condenser Products, 2131 Broad St., Brooksville, FL 34609 904-796-3561
§ Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
§ Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
Eichhoff Electronics, 205 Hallene Rd., Warwick, RI 02886 401-738-1440
§† Electron Products, 2084 Central Ave., Duarte, CA 91010 818-359-8281
† Elmag Division, Lindgren RF Enclosures, 54 Clark St., Newark, NJ 07104 201-481-1600
† Fil-Coil Company, Inc., 800 Axinn Ave., Garden City, NY 11530 516-228-9445
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
High Energy, Inductotherm Industries, Lower Valley Rd., Parkesburg, PA 19365 215-593-2800
ICO-RALLY Corporation, 2575 E. Bayshore Rd., Palo Alto, CA 94303 415-856-9900
Industrial Midwec Capacitor Corp., 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
§ International Components Corp., 105 Maxess Rd., Melville, NY 11747 ... 516-293-1500
§ Inter-Technical Group Inc., WIMA Div., One Bridge Street, Irvington, NY 10533 914-591-8822
§ ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 ..... 516-753-0400; 800-862-2101
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 .. 516-937-3475
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
Marcon America Corp., 310 Era Drive, Northbrook, IL 60062 312-564-2820

§ Martin Sound Prods., 28 Alpha Park, Cleveland, OH 44143-2297 216-442-2286
McGill Manufacturing Co., Inc., 909 North Lafayette Street, Valparaiso, IN 46383 219-465-2200
NWL Capacitors, NWL Transformers, 8050 Monetary Dr., Riviera Bch., FL 33404 305-848-9009
§† Plastic Capacitors, Inc., 2623 N. Pulaski Rd., Chicago, IL 60639 312-489-2229
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
§ RTE Aerovox Inc., 740 Belleville Ave., New Bedford, MA 02745 617-994-9661
§† SFE Technologies, 1501 1st St., San Fernando, CA 91340 818-365-9411
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Southern Electronics, F-Dyne, 726 So. Flower St., Burbank, CA 91502 ... 818-845-2458
§ Speco Div., Components Specialties, Inc., P.O. Box 624, 1172 Rte. 109, Lindenhurst, NY 11757 ..... 516-957-8700;800-645-5516
§† Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
§† Sprague Electric Company, The Capacitor Group, 267 Lowell Rd., Hudson, NH 03051 603-881-7200
Standard Condenser Corp., 1065 W. Addison St., Chicago, IL 60613 312-327-5440
† Stanley Electronics, Inc., 10 Ocean Ave., Copiague, NY 11726 516-842-8866
§† West-Cap Arizona, Sub. of SFE Technologies, 2201 East Elvira Road, Tucson, AZ 85706 602-294-2646

Capacitors, Fixed, Plastic — See Capacitors, Fixed, Film (Vol. A)

Capacitors, Fixed, Polycarbonate — See Capacitors, Fixed, Film (Vol. A)

Capacitors, Fixed, Polyester — See Capacitors, Fixed, Film (Vol. A)

Capacitors, Fixed, Polypropylene — See Capacitors, Fixed, Film (Vol. A)

Capacitors, Fixed, Polystyrene — See Capacitors, Fixed, Film (Vol. A)

Capacitors, Fixed, Polysulfone — See Capacitors, Fixed, Film (Vol. A)

Capacitors, Fixed, Porcelain-1500

† American Technical Ceramics Corporation, 1 Norden La., Huntington Sta., NY 11746, 516-271-9600 ..... A•1009-1012
† Johanson Dielectrics, 2220 Screenland Dr., Burbank, CA 91505, 818-848-4465 ..... A•1098
American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
§† Dielectric Labs., Rte. 20 E., Cazenovia, NY 13035 315-655-8710
High Energy, Inductotherm Industries, Lower Valley Rd., Parkesburg, PA 19365 215-593-2800
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080 404-436-1300
Presidio Components, Inc., 7185 Construction Ct., San Diego, CA 92121 619-578-9390
§† Republic Elctrns. Corp., 176 E. 7th St., Paterson, NJ 07524 201-279-0300
§ Tansitor Electronics, West Rd., P.O. Box 230, Bennington, VT 05201 802-442-5473
§† Vitramon N.A., P. O. Box 544, Bridgeport, CT 06601 203-268-6261

Capacitors, Fixed, Tantalum Electrolytic-1500

§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, 818-765-8300;800-423-3186 ..... A•1007
AVX Corporation, Box 867, Myrtle Bch., SC 29577, 803-448-9411 ... A•1023,1026
§† Cornell-Dubilier Elctrns./Sangamo Weston Comps. Div., 1605 E. Rodney-French Blvd., New Bedford, MA 02741, 617-996-8561 ..... A•1070
§ International Components Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 ..... A•1088
ITT Components, ITT Corporation, 5 Jenner .st., Ste. 100, Irvine, CA 92718, 714-727-3001 ..... A•1092-1093
§† Kemet Electronics Corporation, Box 5928, Greenville, SC 29606, 803-963-6621 ..... A•1100-1101
§ KOA Speer Electronics, Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ..... A•1102
§† Mallory Capacitor Co., Emhart Elctrl./Elctrn. Grp., 3029 E. Washington St., Dept. EM, P.O. Box 1284, Indianapolis, IN 46201, 317-636-5353 ..... A•1108-1110
§ Matsuo Electronics, 2134 Main Street, Suite 200, Huntington Beach, CA 92648, 714-969-2491 ..... A•1114-1118
Mepco/Centralab, North American Philips Corporation, 4561 Colorado Blvd., Los Angeles, CA 90039, 818-240-4880 ..... B•1015
§† Mepco/Centralab, North American Philips Corporation, 5900 Australian Avenue, W. Palm Bch., FL 33407, 305-842-3201 ..... A•1120
Mepco/Centralab, Inc., A North American Philips Co., 2566 Northwestern Ave., West Lafayette, IN 47906, 317-463-2536 ..... B•1015
Mepco/Centralab, North American Philips Corporation, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, 817-325-7871 ..... B•1015
§† NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... A•1143
Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483, 619-575-9353 ..... A•2031
§ Air Electro Supply, Inc., 7700 Gloria Ave., Van Nuys, CA 91406 ..... 213-873-6400; 818-988-4400
§† Arco Electronics, 9822 Independence Ave., Chatsworth, CA 91311 818-882-8707
§ Baknor Industries Limited, 2209 Dunwin Drive, Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§ Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-699-0918; 800-255-2666
§ Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-8725
§ Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
Ei North America, 435 E. 79th St., New York, NY 10021 212-517-5622
§ Elna America, Inc., 153 E. Savarona Way, Carson, CA 90746 213-327-6090
§ Hilton Industries, Inc., Subsidiary of Core Industries, 1177 Cattlemen Road, Sarasota, FL 34232 813-371-2600
Hunter Stanley Elec., 1813 Church St., Nashville, TN 37203 615-321-0500
ICO-RALLY Corporation, 2575 E. Bayshore Rd., Palo Alto, CA 94303 415-856-9900
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 .. 516-937-3475
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
Lawrence-Crow Elctrns. Inc., 2100 Stemmons, Dallas, TX 75207 214-749-5440
§ Liberty Intl. Corp., FIRSTOHM, 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
§ Marcon America Corp., 310 Era Drive, Northbrook, IL 60062 312-564-2820
§† Mepco/Centralab, North American Philips Corporation, 6071 St. Andrews Rd., Columbia, SC 29212-3198 803-772-2500
§ NIC Components Corp., 6000 New Horizons Blvd., N. Amityville, NY 11701 516-226-7500
§ Paccom, 3928 148th NE, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
Philips Circuit Assemblies, A Subdivision of North American Philips Corp., 2566 Northwestern Avenue, West Lafayette, IN 47906 317-463-2536
Philips Electronics Ltd., Elcoma Division, 601 Milner Avenue, Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
Roederstein Elctrns., Inc., P.O. Box 5588, Statesville, NC 28677 704-872-8101
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
§† Sprague Electric Company, The Capacitor Group, 267 Lowell Rd., Hudson, NH 03051 603-881-7200
Stetron International, Inc., 90 Broadway, Buffalo, NY 14203 716-854-3443
§† Tansitor Electronics, West Rd., P.O. Box 230, Bennington, VT 05201 802-442-5473
§ Thomson Passive Components Corp., 6203 Variel Ave., Unit A, Woodland Hills, CA 91367 818-887-1010

Capacitors, Fixed, Vacuum-1500

American Shizuki Corporation, 21541 Blythe St., Canoga Pk., CA 91304, 818-710-8555 ..... A•1008
† FL Jennings, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696, 408-292-4025 ..... A•1085
† EEV Inc., 4 Westchester Plaza, Elmsford, NY 10523 914-592-6050
§ Inmark Corp., 147 West Cedar St., Norwalk, CT 06854 203-866-8474
Lectronic Research Labs., Inc., 1423 Ferry Ave., Camden, NJ 08104 609-541-4200

Capacitors, Surface Mount-1500

§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, 818-765-8300;800-423-3186 ..... A•1007
American Shizuki Corporation, 21541 Blythe St., Canoga Pk., CA 91304, 818-710-8555 ..... A•1008
American Technical Ceramics Corporation, 1 Norden La., Huntington Sta., NY 11746, 516-271-9600 ..... A•1009-1013
Armbar Industries, Inc., 139 White Oak Lane, Old Bridge, NJ 08857, 201-679-3377 ..... A•1014
§ Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600 ..... A•1241
Electronic Concepts, Inc., Box 1278, Eatontown, NJ 07724, 201-542-7880 ..... A•1081
ITT Components, ITT Corporation, 5 Jenner .st., Ste. 100, Irvine, CA 92718, 714-727-3001 ..... A•1093
§ ITW Paktron, Div. of Illinois Tool Works, P.O. Box 4539, 1205 McConville Rd., Lynchburg, VA 24502, 804-239-6941 ..... A•1095
Johanson Dielectrics, 2220 Screenland Dr., Burbank, CA 91505, 818-848-4465 ..... A•1098
§ KOA Speer Electronics, Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ..... A•1102
Maida Development Co., 20 Libby St., Hampton, VA 23663, 804-723-0785 ..... A•1104
Mepco/Centralab, North American Philips Corporation, 4561 Colorado Blvd., Los Angeles, CA 90039, 818-240-4880 ..... A•1123
Mepco/Centralab, North American Philips Corporation, 5900 Australian Avenue, W. Palm Bch., FL 33407, 305-842-3201 ..... A•1120
Mepco/Centralab, North American Philips Corporation, 7158 Merchant Ave., El Paso, TX 79915, 915-779-3961 ..... A•1124
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•1138
NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... A•1142
§ Radio Materials Corp., P. O. Box 339, Attica, IN 47918, 317-762-2491;1-800-356-9956 ..... A•1168-1169
Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830, 201-321-3400 ..... A•1173
Sprague-Goodman Elctrns., Inc., 134 Fulton Ave., Garden City Pk., NY 11040, 516-746-1385 ..... A•1175
† Voltronics Corporation, West St.,, P.O. Box 476, E. Hanover, NJ 07936, 201-887-1517 ..... A•1185
Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
§ Baknor Industries Limited, 2209 Dunwin Drive, Mississauga, ONT., CANADA L5L 1X1 416-828-2400
Ei North America, 435 E. 79th St., New York, NY 10021 212-517-5622
Electronic Film Capacitors, Inc., Reidville Industrial Pk., 41 Interstate Ln., Waterbury, CT 06705 203-755-5629

§ Electronic Resources Inc., 568 Weddell Dr., No. 8, Sunnyvale, CA 94089 408-745-1420
§† Hilton Industries, Inc., Subsidiary of Core Industries, 1177 Cattlemen Road, Sarasota, FL 34232 813-371-2600
§ Inter-Technical Group Inc., WIMA Div., One Bridge Street, Irvington, NY 10533 914-591-8822
§ ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 ..... 516-753-0400; 800-862-2101
ITT Components, ITT Corporation, 5 Jenner .st, Ste. 100, Irvine, CA 92718 714-727-3001
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
§ Johnson, E. F., Co., 11095 Viking Dr., Eden Prairie, MN 55344 612-942-1000
† KD Components, Inc., 2710 S. Main St., Santa Ana, CA 92707 714-545-7108
§ Kyocera Northwest, Electronic Components Group, P.O. Box 85542, San Diego, CA 92138-5542 619-576-2600
§ Liberty Intl. Corp., FIRSTOHM, 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
§ Mallory Capacitor Co., Emhart Elctrl./Elctrn. Grp., 3029 E. Washington St., Dept. EM, P.O. Box 1284, Indianapolis, IN 46201 317-636-5353
Microcap, Inc., A MicroSemi Company, 501 South Andreasen Drive, Escondido, CA 92025 619-480-1906
† Miltope Corp., 1770 Walt Whitman Rd., Melville, NY 11747 516-420-0200
Mouser Electronics, 2401 Hwy. 287 North, Mansfield, TX 76063 817-483-4422
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
§ National Electronics Corp., 11731 Markon Dr., Garden Grove, CA 92641 ..... 714-892-7749;800-854-2451
NIC Components Corp., 6000 New Horizons Blvd., N. Amityville, NY 11701 516-226-7500
Nichicon (America) Corp., 927 E. State Pkwy., Schaumburg, IL 60173 312-843-7500
Philips Circuit Assemblies, A Subdivision of North American Philips Corporation, 5855 N. Glen Pk. Rd., Milwaukee, WI 53209 414-228-7632
§† Republic Elctrns. Corp., 176 E. 7th St., Paterson, NJ 07524 201-279-0300
§† SFE Technologies, 1501 1st St., San Fernando, CA 91340 818-365-9411
§ Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 814-455-0966
Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
Sprague Electric Company, The Capacitor Group, 267 Lowell Rd., Hudson, NH 03051 603-881-7200
§ Stetco, Inc., 3344 Schierhorn Ct., Franklin Pk., IL 60131 312-671-4208
§ Tansitor Electronics, West Rd., P.O. Box 230, Bennington, VT 05201 802-442-5473
§ Thomson Passive Components Corp., 6203 Variel Ave., Unit A, Woodland Hills, CA 91367 818-887-1010

Capacitors, Variable, Air-1500

§† Johanson Manufacturing Corporation, 400 Rockaway Valley Rd., Boonton, NJ 07005, 201-334-2676 ..... A•1099
† Oxley, Inc., 25 Business Pk. Dr., P.O. Box 814, Branford, CT 06405, 203-488-1033 ..... A•1677
§† Sprague-Goodman Elctrns., Inc., 134 Fulton Ave., Garden City Pk., NY 11040, 516-746-1385 ..... A•1175
Tettex Instruments, Inc., P.O. Box 281, Fairview Village, PA 19409-0281, 215-539-6050 ..... D•1326
† Voltronics Corporation, West St.,, P.O. Box 476, E. Hanover, NJ 07936, 201-887-1517 ..... A•1185
§ GC-Thorsen, 1801 Morgan St, P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
Hopt, Karl, Co., 118 First Ave., Atlantic Highlands, NJ 07716 201-291-0633
§ Johnson, E. F., Co., 11095 Viking Dr., Eden Prairie, MN 55344 612-942-1000
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080 404-436-1300
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
§ National Electronics Corp., 11731 Markon Dr., Garden Grove, CA 92641 ..... 714-892-7749;800-854-2451
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Tansitor Electronics, West Rd., P.O. Box 230, Bennington, VT 05201 802-442-5473
§ Trim-Tronics, Inc., Rt. 20 E., P.O. Box 315, Cazenovia, NY 13035 315-655-9528

Capacitors, Variable, Ceramic-1500

AVX Corporation, Box 867, Myrtle Bch., SC 29577, 803-448-9411 ..... A•1023
§† Johanson Manufacturing Corporation, 400 Rockaway Valley Rd., Boonton, NJ 07005, 201-334-2676 ..... A•1099
§ Maida Development Co., 20 Libby St., Hampton, VA 23663, 804-723-0785 ..... A•1103,1106,1954
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•1140
† Oxley, Inc., 25 Business Pk. Dr., P.O. Box 814, Branford, CT 06405, 203-488-1033 ..... A•1677
§ Sprague-Goodman Elctrns., Inc., 134 Fulton Ave., Garden City Pk., NY 11040, 516-746-1385 ..... A•1174
§† Tusonix, Inc., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144, 602-744-0400 ..... A•1181
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134 408-946-6000
† Compex Corp., Taunton Professional Park, 238 Taunton Blvd., Medford, NJ 08055 609-596-9388
§ Electronic Resources Inc., 568 Weddell Dr., No. 8, Sunnyvale, CA 94089 408-745-1420
† FL Jennings, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696 408-292-4025
§ GC-Thorsen, 1801 Morgan St, P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
§ ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 516-937-3475
§ Johnson, E. F., Co., 11095 Viking Dr., Eden Prairie, MN 55344 612-942-1000
§† Kyocera Northwest, Electronic Components Group, P.O. Box 85542, San Diego, CA 92138-5542 619-576-2600
§ Liberty Intl. Corp., FIRSTOHM, 2539 237th St, Suite F, Torrance, CA 90505 213-539-6452
Mepco/Centralab, North American Philips Corporation, 4561 Colorado Blvd., Los Angeles, CA 90039 818-240-4880
Mepco/Centralab, North American Philips Corporation, 7158 Merchant Ave., El Paso, TX 79915 915-779-3961
Mouser Electronics, 2401 Hwy. 287 North, Mansfield, TX 76063 817-483-4422
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303 415-856-6900
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Stetco, Inc., 3344 Schierhorn Ct., Franklin Pk., IL 60131 312-671-4208
§ Tansitor Electronics, West Rd., P.O. Box 230, Bennington, VT 05201 802-442-5473
§ Trim-Tronics, Inc., Rt. 20 E., P.O. Box 315, Cazenovia, NY 13035 315-655-9528

Capacitors, Variable, Film-1500

Mepco/Centralab, North American Philips Corporation, 6071 St. Andrews Rd., Columbia, SC 29212-3198, 803-772-2500 ..... A•1122
§ Sprague-Goodman Elctrns., Inc., 134 Fulton Ave., Garden City Pk., NY 11040, 516-746-1385 ..... A•1174
† Voltronics Corporation, West St.,, P.O. Box 476, E. Hanover, NJ 07936, 201-887-1517 ..... A•1185
† Circle Electronics, A Division of F-Dyne Elctrns., 3501 Electronics Way, W. Palm Beach, FL 33407 305-844-1310
† F-Dyne Elctrns., 449 Howard Ave., Bridgeport, CT 06605 203-367-6431
§ Johnson, E. F., Co., 11095 Viking Dr., Eden Prairie, MN 55344 612-942-1000
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056 312-297-0070

Capacitors, Variable, Gas Filled-1500

† FL Jennings, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696, 408-292-4025 ..... A•1085
Tettex Instruments, Inc., P.O. Box 281, Fairview Village, PA 19409-0281, 215-539-6050 ..... D•1326
Continental Electronics, Division of Varian Associates, Inc., P.O. Box 270879, Dallas, TX 75227 214-381-7161

Capacitors, Variable, Glass-1500

§† Johanson Manufacturing Corporation, 400 Rockaway Valley Rd., Boonton, NJ 07005, 201-334-2676 ..... A•1099
§† Sprague-Goodman Elctrns., Inc., 134 Fulton Ave., Garden City Pk., NY 11040, 516-746-1385 ..... A•1174
† Voltronics Corporation, West St.,, P.O. Box 476, E. Hanover, NJ 07936, 201-887-1517 ..... A•1185
§ Electronic Resources Inc., 568 Weddell Dr., No. 8, Sunnyvale, CA 94089 408-745-1420
† FL Jennings, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696 408-292-4025
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
§ National Electronics Corp., 11731 Markon Dr., Garden Grove, CA 92641 ..... 714-892-7749;800-854-2451
§ Stetco, Inc., 3344 Schierhorn Ct., Franklin Pk., IL 60131 312-671-4208
§† Tansitor Electronics, West Rd., P.O. Box 230, Bennington, VT 05201 802-442-5473

Capacitors, Variable, HV (Lab Type)-Also See Decade Boxes, Capacitance-1500

Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, 914-699-2000 ..... A•1072
IET Labs, Inc., 534 Main St., Westbury, NY 11590, 516-334-5959 ..... D•1268,1270-1272
§† Johanson Manufacturing Corporation, 400 Rockaway Valley Rd., Boonton, NJ 07005, 201-334-2676 ..... A•1099
Tettex Instruments, Inc., P.O. Box 281, Fairview Village, PA 19409-0281, 215-539-6050 ..... D•1326
American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
† Circle Electronics, A Division of F-Dyne Elctrns., 3501 Electronics Way, W. Palm Beach, FL 33407 305-844-1310
† F-Dyne Elctrns., 449 Howard Ave., Bridgeport, CT 06605 203-367-6431
† FL Jennings, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696 408-292-4025
Hipotronics Inc., P.O. Drawer A, Brewster, NY 10509 914-279-8091
§ Jensen Tools, Inc., Axia, Inc., 7815 S. 46th St, Phoenix, AZ 85044 602-968-6241
† Southern Electronics, F-Dyne, 726 So. Flower St., Burbank, CA 91502 818-845-2458
§† Sprague-Goodman Elctrns., Inc., 134 Fulton Ave., Garden City Pk., NY 11040 516-746-1385

Capacitors, Variable, Mica-1500

§ Sprague-Goodman Elctrns., Inc., 134 Fulton Ave., Garden City Pk., NY 11040, 516-746-1385 ..... A•1174
§ Arco Electronics, 9822 Independence Ave., Chatsworth, CA 91311 818-882-8707
Ei North America, 435 E. 79th St., New York, NY 10021 212-517-5622
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700

Capacitors, Variable, Padders & Trimmers-1500

§† Johanson Manufacturing Corporation, 400 Rockaway Valley Rd., Boonton, NJ 07005, 201-334-2676 ..... A•1099
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•1138
Nytronics Components Grp., Inc., 700 Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1156

† Oxley, Inc., 25 Business Pk. Dr., P.O. Box 814, Branford, CT 06405, 203-488-1033 ..... A•1677, B•1013
Penstock Engineering Labs., Penstock, Inc., 520 Mercury Dr., Sunnyvale, CA 94086-4018, 408-730-0300 ..... A•1844
Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483, 619-575-9353 ..... A•2031
§† Sprague-Goodman Elctrns., Inc., 134 Fulton Ave., Garden City Pk., NY 11040, 516-746-1385 ..... A•1174-1175
§† Tusonix, Inc., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144, 602-744-0400 ..... A•1181
† Voltronics Corporation, West St.,, P.O. Box 476, E. Hanover, NJ 07936, 201-887-1517 ..... A•1185
§ Alps Electric (USA), Inc., 3553 N. First St, San Jose, CA 95134 408-946-6000
§ Arco Electronics, 9822 Independence Ave., Chatsworth, CA 91311 818-882-8707
Ei North America, 435 E. 79th St, New York, NY 10021 212-517-5622
§ Johnson, E. F., Co., 11095 Viking Dr., Eden Prairie, MN 55344 612-942-1000
§ Maida Development Co., 20 Libby St, Hampton, VA 23663 804-723-0785
Philips Electronics Ltd, Elcoma Division, 601 Milner Avenue, Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
§† Plastic Capacitors, Inc., 2623 N. Pulaski Rd, Chicago, IL 60639 312-489-2229
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Stetco, Inc., 3344 Schierhorn Ct., Franklin Pk., IL 60131 312-671-4208
§ Tansitor Electronics, West Rd., P.O. Box 230, Bennington, VT 05201 802-442-5473

Capacitors, Variable, Vacuum-1500

Delcap Div., American Precision Industries, Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600 ..... A•1075
Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600 ..... A•1241
† FL Jennings, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696, 408-292-4025 ..... A•1085
Seiko Instruments U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505, 213-517-7770 ..... A•1753
† EEV Inc., 4 Westchester Plaza, Elmsford, NY 10523 914-592-6050
§ Inmark Corp., 147 West Cedar St, Norwalk, CT 06854 203-866-8474
Lectronic Research Labs., Inc., 1423 Ferry Ave., Camden, NJ 08104 609-541-4200

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Cavities, Microwave-3450

† MCL, Inc., 501 S. Woodcreek Rd., Bolingbrook, IL 60439-4999, 312-759-9500 ..... D•1425
§ Eaton Corp., Electronic Instrument Div., 5340 Alla Rd, Los Angeles, CA 90066 213-822-3061
EPSCO Microwave, EPSCO, Incorporated, 411 Providence Hwy., Westwood, MA 02090 617-329-1500
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Lorch Electronics, Sub. of Vernitron Corp., 105 Cedar La., Englewood, NJ 07631 201-569-8282
† M/A COM Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Premier Microwave, 35 New Broad St, Port Chester, NY 10573 914-939-8900
† Reeve Electronics, Mellish E. Murray, 1715 W. Carroll Ave., Chicago, IL 60612 312-670-0150
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E-8, Tampa, FL 33634 813-884-1411
† UTE Microwave, 3500 Sunset Ave., Asbury Park, NJ 07712 201-922-1009
Varian Associates, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
† Wavecom, Sub. of Loral Corp., 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
Zero Corp., 777 Front St., Burbank, CA 90503 818-846-4191

Cells, Electrolytic (Timing) — See Timers, Electrolytic Cell (Vol. D)

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† **Abbott Technologies, Inc., Burbank Division, Transformers, 639 So. Glenwood Pl., Burbank, CA 91506, 818-841-3630** ..... **A•2157**

† **Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147, 305-696-6660** ..... **A•1194,1197**

§ **Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224-5825, 213-537-5200** ..... **A•1199,1201-1204**

BH Electronics, Inc., 12219 Wood Lk. Dr., Burnsville, MN 55337, 612-894-9590 ..... **A•1206,2198**

Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... **A•1208-1216,1218-1222**

§ **Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301** ..... **A•1233,1235-1239**

§ **Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600** ..... **A•1241-1242**

Dynapower Corporation, Box 3180, Farmington Hills, MI 48333, 313-553-4300 ..... **D•1703,1706**

Eichhoff Electronics, 205 Hallene Rd., Warwick, RI 02886, 401-738-1440 ..... **A•1651**

† **Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950** ..... **A•2214**

§† **Gowanda Electronics Corp., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234** ..... **A•1245**

Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061, 913-782-0012 ..... **A•2239**

Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301, 201-782-5525 ..... **A•2240**

Jerome Industries Corp., 730 E. Division St., Elizabeth, NJ 07201, 201-353-5700 ..... **A•2242**

Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... **A•2248**

§† **Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050** ..... **A•1246,2280-2281,2288**

† **NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300** ..... **A•2303, D•1857**

† **Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... **A•1270-1272**

† **Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950** ..... **A•2351**

† **Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861, 201-826-4700** ..... **A•1281**

Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... **A•2365**

RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... **A•2011**

Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... **A•1282,2367**

Schaffner EMC, Inc., Components Division, 825 Lehigh Avenue, Union, NJ 07083, 201-851-0644;800-367-5566 ..... **A•1691**

† **Signal Transformer Co., Inc., Insilco Corporation, 500 Bayview Ave., Inwood, NY 11696, 516-239-5777** ..... **A•2372,2385,2389**

† **Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, 513-871-3777** ..... **A•1287**

Talema Electronic, Inc., 301 N. Highway 63, Rolla, MO 65401, 314-364-0882 ..... **A•2392**

Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518, 213-638-1790 ..... **A•2395, D•1983**

§ **Todd Systems, Inc., 50 Ash St., Yonkers, NY 10701, 914-963-3400** ..... **A•2410**

Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, 301-464-2100 ..... **A•1298,2412**

† **Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199, 816-761-6314** ..... **A•1300,2418-2419**

§† **United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600** ..... **A•2428**

§ **Vitec Electronic Corporation, 1525A East Acequia, Visalia, CA 93291, 209-739-1077** ..... **A•2438**

Wilco Corp., 6451 Saguaro Court, Indianapolis, IN 46268, 317-293-9300 ..... **A•1317-1318**

Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006

Amecon, Inc., 1900 S. Chris La., Anaheim, CA 92805 ..... 714-634-2220;800-392-2292

American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651

Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100

Atlas Engineering Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100

§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100

Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541

† Bicron Electronics, 100 Barlow Street, Canaan, CT 06018 203-824-5125

§† Capcon, Inc., 147 West 25th Street, New York, NY 10001 212-243-6275

Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640

† Cramer Coil & Transformer Co., Inc., 401 Progress Dr., Saukville, WI 53080 414-284-9425

† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000

Delta Products Corporation, 3823 Spinnaker Ct., Fremont, CA 94538 415-770-0660

§ Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360

Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520

Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222

§ Ferroxcube, Amperex Electronic Corp., 5083 Kings Hwy., Saugerties, NY 12477 914-246-2811

Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006

§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710

Hurricane Electronics Lab, P.O. Box 1280, Hurricane, UT 84737 801-635-2003

§ Jeffers Electronics, Grand Plaza, 945 Grand Ave., Nogales, AZ 85621 602-287-5851

Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 303-651-2011

§ Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500

† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054

§ Martin Sound Prods., 28 Alpha Park, Cleveland, OH 44143-2297 216-442-2286

North Hills Electronics, 1 Alexander Pl, Glen Cove, NY 11542 516-671-5700

NWL Capacitors, NWL Transformers, 8050 Monetary Dr., Riviera Bch., FL 33404 305-848-9009

OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600

† Perkin-Elmer Corp., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132 203-762-4786

† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200

§ Pulse Engineering, Inc., 7250 Convoy Ct., P.O. Box 12235, San Diego, CA 92112 619-268-2400

Rapid Power Technologies, Graysbridge Rd. , P.O.BOX 291, Brookfield, CT 06804 ..... 203-775-0411;800-332-1111

Sanford-Miller Corp., 8 John St, Lynbrook, NY 11563 ..... 516-593-2025;800-645-5900

† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma

§† Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342

South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866

Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900

Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483 619-575-9353

Staco Transpower, 610 W. 6th St., Mt. Carmel, IL 62863 618-262-5555

Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200

Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581

§ Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131 408-432-8020

§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056 312-297-0070

† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880

Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245 619-458-1471

† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443

† Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 602-861-1856

§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

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† **Abbott Technologies, Inc., Burbank Division, Transformers, 639 So. Glenwood Pl., Burbank, CA 91506, 818-841-3630** ..... **A•2157**

† **Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147, 305-696-6660** ..... **A•1194-1195,1197**

Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... **A•1208-1209,1212-1214**

§ **Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301** ..... **A•1239**

Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... **A•2214**

§ **EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048** ..... **A•1244,2225**

Gowanda Electronics Corp., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 ..... **A•1245**

Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301, 201-782-5525 ..... **A•2240**

§† **Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050** ..... **A•1246,2280-2281**

† **Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... **A•1271-1272**

† **Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861, 201-826-4700** ..... **A•1281**

Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... **A•2365**

Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... **A•1282,1284,2367**

† **Signal Transformer Co., Inc., Insilco Corporation, 500 Bayview Ave., Inwood, NY 11696, 516-239-5777** ..... **A•2372,2389**

Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518, 213-638-1790 ..... **A•2395, D•1983**

§ **Todd Systems, Inc., 50 Ash St., Yonkers, NY 10701, 914-963-3400** ..... **A•2410**

Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, 301-464-2100 ..... **A•1298,2412**

† **Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199, 816-761-6314 ..... A•1300**
Amecon, Inc., 1900 S. Chris La., Anaheim, CA 92805 ..... 714-634-2220;800-392-2292
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
† American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 612-788-9161
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§ Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360
Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
§ E-Tronics, 16774 Schoenborn, Sepulveda, CA 91343 818-892-7279
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hurricane Electronics Lab, P.O. Box 1280, Hurricane, UT 84737 801-635-2003
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 303-651-2011
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
† Northlake Engineering, Inc., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
† Perkin-Elmer Corp., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132 203-762-4786
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
§ Pulse Engineering, Inc., 7250 Convoy Ct., P.O. Box 12235, San Diego, CA 92112 619-268-2400
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
§† Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
† Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209 513-871-3777
§† Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600
† Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 602-861-1856

Chokes, Waveguide-3450

† **Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861, 201-826-4700 ..... A•2352-2353**
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Lectronic Research Labs., Inc., 1423 Ferry Ave., Camden, NJ 08104 609-541-4200
† Maury Microwave Corp., 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§ Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Reeve Electronics, Mellish E. Murray, 1715 W. Carroll Ave., Chicago, IL 60612 312-670-0150
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
§ Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Chokes (MIL)-2440 — *See Vol. B*

Choppers-Also See Light Choppers-4050 — *See Vol. D*

Choppers (MIL)-2440 — *See Vol. B*

Circuit Analyzers — See Testers, Signal Tracing (Vol. D)

Circuit Board Holders, Jig Type — See Holders, Circuit Board (Vol. D)

Circuit Breakers-4300 — *See Vol. B*

Circuit Breakers, Boxes, Panel Boards, Enclosures (MIL)-2440 — *See Vol. B*

Circuit Testers — See Testers, Signal Tracing (Vol. D)

Circuits, Hybrid, Custom-3130

† **Aeroflex Laboratories, Inc., Microelectronics Div., 35 S. Service Rd., Plainview, NY 11803, 516-694-6700 ..... A•1716**
CAC Microcircuits Inc., 2 Southgate Dr., Mt. Carmel, IL 62863, 618-263-4343 ..... A•1731
† **CTS Corporation, Microelectronics Div., 1201 Cumberland Ave., W. Lafayette, IN 47906, 317-463-2565 ..... A•1732-1733**
FDK America, Inc., Fuji Electromechanical Co., Ltd., 17326 Edwards Rd., Ste. A-130, Cerritos, CA 90701, 213-404-1770 ..... A•1734-1735
Gordos Corporation, A Flint Industries Company, 1000 N. Second St., P.O. Box 824, Rogers, AR 72757, 501-636-5000 ..... A•1736
HEI, Inc., Hybrid Electronics Div., 1495 Steiger Lake Ln., Victoria, MN 55386, 612-443-2500 ..... A•1737
Hybrids International Ltd., Thick Film Division, 311 N. Lindenwood Dr., Olathe, KS 66062, 913-764-6400 ..... A•1759
Hybridyne, Inc., 2155 N. Forbes Blvd., Tucson, AZ 85745, 602-629-0001 ..... A•1738
† **ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716, 516-567-5600 ..... D•1164**
† **Integrated Circuits, Inc., 10301 Willows Roads, P.O. Box 97005, Redmond, WA 98073-9705, 206-882-3100 ..... A•1740-1741**
§ **International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1739, B•1011**
§† **International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818, 402-694-6111 ..... A•1742-1743**
† **Leach Control Products Div., Leach Corporation, 6900 Orangethorpe Ave., Buena Pk., CA 90620, 714-739-0770 ..... A•1744-1745, B•1516-1519**
McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1416
Mepco/Centralab, Inc., A North American Philips Co., 2601 S. Moorland Rd., New Berlin, WI 53131, 414-785-6506 ..... A•1747
† **Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761, 617-695-0203 ..... A•1975**
M-Tron Industries, P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321 ..... A•1428
NMB Technologies, 9730 Independence Avenue, Chatsworth, CA 91311, 818-341-3355 ..... A•1750-1751
§ **Raltron Electronics, 2315 N.W. 107th Ave., Miami, FL 33172, 305-593-6033 ..... A•2009**
§† **RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2010-2011**
ACC Electronics Company, Echlin Inc., 1300 W. Oak, Independence, KS 67301 316-331-1000
§† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
† Addacon, Inc., 3702-C Alliance Dr., Greensboro, NC 27407 919-852-6200
† Advanced Analog, Intech, 2270 Martin Ave., Santa Clara, CA 95050 408-988-4930
† Aeroflex Laboratories Inc., Magnetic Products Div., 35 South Service Road, Plainview, NY 11803 516-694-6700
† Allied Corp. Aerospace Sector, Bendix Communications Div., East Joppa Rd., Towson, MD 21204 301-583-4000
† Alpha Inds., Inc., Microelectronic Div., 2800 Crystal Drive, Hatfield, PA 19440 215-822-1311
Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876 401-762-3800
Analogic Corp., 8 Centennial Dr., Peabody, MA 01961 617-246-0300
Applied Research Labs., Fisons, 24911 Stanford Ave., Valencia, CA 91355 805-295-0019
Aptek Technologies, Inc., Aptek Microsystems, 700 N. W. 12th Ave., Deerfield Beach, FL 33442 305-421-8450
Argo Transdata Corp., Box 554, Clinton, CT 06413 203-669-2233
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), 1699 Roosevelt Ave., Bohemia, NY 11716 516-589-5656
† Assembly Specialists, 914 Main St., Box 965, Acton, MA 01720 617-263-9100
Astec USA, Ltd., A BSR Intl. Co., 2880 San Tomas Expwy., # 200, Santa Clara, CA 95051 408-748-1200
Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147 305-696-6660
Aydin Corp., 700 Dresher Rd., Horsham, PA 19044 215-657-7510
† Aydin Vector Div., Aydin Corp., Box 328, Newtown, PA 18940-0328 215-968-4271
† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700
§† Boeing Electronics Co., P.O. Box 24969, M/S 9N-41, Seattle, WA 98124-6269 206-657-7474
Bosch, Robert, Corp., 2800 S. 25th Ave., Broadview, IL 60153 312-865-5200
§ Cermetek Microelectronics Inc., 1308 Borregas Ave., Sunnyvale, CA 94088-3565 408-752-5000
† Circuit Technology Inc., 160 Smith St., Farmingdale, NY 11735 516-293-8686
† CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
§† Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926 915-592-3253
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
† Datel, Inc., 11 Cabot Blvd., Mansfield, MA 02048 617-339-3000
Dover Electronics Manufacturing, Kirkwood Industrial Park, P.O. Box 5212, Binghamton, NY 13902-5212 ..... 607-772-7563;1-800-PWB-ASSY
Dow Switch, Screenprint/Dow, 271 Ballardvale St., P.O. Box 1332, Wilmington, MA 01887 617-935-6395
§† Dymec, Inc., 8 Lowell Ave., Winchester, MA 01890 ..... 617-729-7870;800-225-1151
Eltec Instruments Inc., P.O. Box 9610, Daytona Bch., FL 32020 904-253-5328
† EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800
Engelhard Corp., Menlo Pk., CN40, Edison, NJ 08818 ..... 201-632-6000;800-932-0444 (in NJ)
† Environmental Comm., 3150 Pullman St., Costa Mesa, CA 92627 714-557-7800
† Frequency Electronics, Inc., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
Fujitsu Components of America, 3320 Scott Blvd., Santa Clara, CA 95054 408-727-1700
General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
§† General Mircocircuits, 780 Boston Rd., Billerica, MA 01821 508-663-9101
† Gentex, Box 315, Carbondale, PA 18407 603-434-0311
Gentron Corp., 6667 N. Sidney Pl., Milwaukee, WI 53209 414-351-1660
GTI/Circuits Div., Box 217, Leesburg, IN 46538 219-453-3261

† Hi-G Company, A Subsidiary of Nytronics Inc., 101 Locust St., Hartford, CT 06114 203-522-8600
† Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Hybrid Electronics Corp., 6 DeAngelo Dr., Bedford, MA 01730 617-275-5350
† Hybrid Systems, Sipex Corporation, 22 Linnell Circle, Billerica, MA 01821 617-667-8700
† Hycomp, Inc., 165 Cedar Hill St., Marlborough, MA 01752 617-485-6300
† Hy-Tec Industries, Div. of Topo Industries, Inc., P.O. Box 91, Shoreham, NY 11786 516-924-8686
† Hytek Microsystems, 980 University Ave., Los Gatos, CA 95030 408-395-2300
§ International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
IXYS Corp., 2355 Zanker Rd., San Jose, CA 95131-1109 408-435-1900
† Kates Scientific Instruments, 142 Adam St., Newton, MA 02158 614-527-2711
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
† M.S. Kennedy Corp., Sub of Hybrilonics, Inc., 8170 Thompson Rd., Clay, NY 13041 315-699-9201
§† Kyocera Northwest, Electronic Components Group, P.O. Box 85542, San Diego, CA 92138-5542 619-576-2600
† Litton Applied Technology, 645 Almanor Ave., P.O. Box 3478, Sunnyvale, CA 94088-3478 408-773-0777
† Lockheed Electronics Co., Inc., Lockheed Corporation, 1501 U.S. Highway 22, CS No. 1, Plainfield, NJ 07061 201-757-1600
LTI, Inc., 6445 N. Hamlin Ave., Lincolnwood, IL 60645 312-679-7500
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 .. 617-329-1508
† MICRA Corp., 120 Ricefield Lane, Hauppauge, NY 11788 516-231-8600
Micro Hybrids, Inc., 2864 Route 112, Medford, NY 11763 516-732-3448
Micronel U.S., 2142F Industrial Ct., Sycamore Research Center, Vista, CA 92083 619-727-7400
† Micropac Inds., Inc., General Sensors Div., 905 E. Walnut St., Garland, TX 75040 214-272-3571
Microplex, Inc., 1977 State College Blvd., Anaheim, CA 92806 ..... 714-979-8833; 714-634-1535
† Micro Systems Engineering, Inc., 6024 S.W. Jean Rd., Lake Oswego, OR 97035 503-635-4016
§ Mitel Semiconductor, Mitel Corp., P. O. Box 13320, Kanata, ON, CANADA K2K 1X5 613-592-5630
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
† Modular Devices, Brookhaven R & D Plaza, 1 Roned Rd., Shirley, NY 11967 516-345-3100
Motorola Microelectronics Div., 8000 W. Sunrise, Ft. Lauderdale, FL 33322
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080 404-436-1300
† Natel Engineering Co., Inc., 4550 Runway St., Simi Valley, CA 93063 805-581-3950
† Northwest Microcircuits, Inc., 5464SW Philomath Blvd., Corvallis, OR 97333 503-753-8242
Optical Electronics, Inc., 2700 E. Bisby Rd., Tucson, AZ 85706 602-889-8811
§ Opto Technology, Inc., 562 Chaddick Dr., Wheeling, IL 60090 312-537-4277
† Paine Corporation, 2401 S. Bayview St., Seattle, WA 98144 ..... 206-329-8600; 800-426-0366
† Parlex Corp., 145 Milk St., Methuen, MA 01844 ..... 617-685-4341, Ext. 265
PCK Technology Div., Kollmorgen Corp., 322 South Service Rd., Melville, NY 11747 516-454-4400
Philips Circuit Assemblies, A Subdivision of North American Philips Corporation, 5855 N. Glen Pk. Rd., Milwaukee, WI 53209 414-228-7632
Philips Circuit Assemblies, A Subdivision of North American Philips Corp., 2601 S. Moorland Rd., New Berlin, WI 53151 414-785-6506
Philips Circuit Assemblies, 3602 W. Waters Avenue, Tampa, FL 33684 .. 813-933-5113
Philips Circuit Assemblies, 1515 Sixth St. South, Hopkins, MN 55343 ... 612-933-4600
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804 407-298-2000
Pulse Engineering, Inc., 7250 Convoy Ct., P.O. Box 12235, San Diego, CA 92112 619-268-2400
† Raytheon Co., Microwave & Power Tube Div., 190 Willow St., Waltham, MA 02154 617-899-8400
RCA Solid State Div., Linear Integrated Circuits, Rte. 202, Somerville, NJ 08876 201-685-6000
† Resistance Technology Inc., 1260 Red Fox Rd., St. Paul, MN 55112 612-636-9770
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
§ Rohm Corporation, 8 Whatney, Irvine, CA 92718 714-855-2131
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
SFE Technologies, 1501 1st St., San Fernando, CA 91340 818-365-9411
Signatron, A Unit of Sundstrand Corp., 110 Hartwell Ave., Lexington, MA 02173 617-861-1500
§† Soshin Electric Co., Ltd., No. 18-18, 1-Chome Nakamagome, Ota-Ku, Tokyo, JAPAN ..... (03) 775-2111
State of the Art, Inc., 2470 Fox Hill Rd., State College, PA 16803-1797 .. 814-355-8004
Tadiran Elec. Inds. Inc., 40 Seaview Blvd., Port Washington, NY 11050 .. 516-621-4980
Taiyo Yuden (USA) Inc., 714 W. Algonquin Rd., Arlington Heights, IL 60005-4493 312-364-6104
Tektronix, Inc., P.O. Box 500, 76/260, Beaverton, OR 97077 800-835-9433
Tektronix, Inc., Hybrid Components Operation, P.O. Box 500, Beaverton, OR 97077 503-627-4220
† Teledyne Crystalonics, Teledyne Industries, Inc., 147 Sherman St., Cambridge, MA 02140 617-491-1670
† Teledyne Microelectronics, 12964 Panama St., Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
§† Thickfilm International, Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-7400
Thomson Electron Tubes & Devices Corp., Special Products Div., 550 Mount Pleasant Ave., Dover, NJ 07801 201-328-1400
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., 565 West Golf Road, Arlington Heights, IL 60005 312-364-7277
† Trend Circuits, 44358 Old Warm Springs Blvd., Fremont, CA 94536 415-651-1150
† TRW LSI Products Division, PO Box 2472, La Jolla, CA 92038 619-457-1000
United Supertek, Inc., 118 Charcot Ave., San Jose, CA 95131-1101 408-922-0730
† Voltage Multipliers, Inc., 8711 W. Roosevelt Ave., Visalia, CA 93291 209-651-1402
WILMANCO, 19529 Business Center Drive, Northridge, CA 91324 ..... 818-993-1662/1663
§† Xenotronix Inc., 26074 Ave., Hall No. 10, Valencia, CA 91355 805-257-4793
† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733
† Zenith Components Group, Zenith Electronics Corp., 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

Circuits, Hybrid, Thick Film-3130

† Aeroflex Laboratories, Inc., Microelectronics Div., 35 S. Service Rd., Plainview, NY 11803, 516-694-6700 ..... A•1716
† AMITRON, American Micro-Tronix, Inc., 85 Flagship Drive, North Andover, MA 01845, 508-686-1882 ..... A•1763
CAC Microcircuits Inc., 2 Southgate Dr., Mt. Carmel, IL 62863, 618-263-4343 ..... A•1731
† CTS Corporation, Microelectronics Div., 1201 Cumberland Ave., W. Lafayette, IN 47906, 317-463-2565 ..... A•1732-1733
§† Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926, 915-592-3253 ..... A•1916
§ FDK America, Inc., Fuji Electromechanical Co., Ltd., 17326 Edwards Rd., Ste. A-130, Cerritos, CA 90701, 213-404-1770 ..... A•1734-1735
Gordos Corporation, A Flint Industries Company, 1000 N. Second St., P.O. Box 824, Rogers, AR 72757, 501-636-5000 ..... A•1736
HEI, Inc., Hybrid Electronics Div., 1495 Steiger Lake Ln., Victoria, MN 55386, 612-443-2500 ..... A•1737
§† Hybrids International Ltd., Thick Film Division, 311 N. Lindenwood Dr., Olathe, KS 66062, 913-764-6400 ..... A•1759
† Hybridyne, Inc., 2155 N. Forbes Blvd., Tucson, AZ 85745, 602-629-0001 ..... A•1738
† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716, 516-567-5600 ..... D•1164-1165
† Integrated Circuits, Inc., 10301 Willows Roads, P.O. Box 97005, Redmond, WA 98073-9705, 206-882-3100 ..... A•1740-1741
§ International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1739, B•1011
§† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818, 402-694-6111 ..... A•1742-1743
† Leach Control Products Div., Leach Corporation, 6900 Orangethorpe Ave., Buena Pk., CA 90620, 714-739-0770 ..... A•1744-1745, B•1516-1519
McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1416
Mepco/Centralab, Inc., A North American Philips Co., 2601 S. Moorland Rd., New Berlin, WI 53131, 414-785-6506 ..... A•1747
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§ Raltron Electronics, 2315 N.W. 107th Ave., Miami, FL 33172, 305-593-6033 ..... A•2009
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2010-2011
§ Silicon Power Cube Corp., 6015 Obispo Ave., Long Beach, CA 90805, 213-634-9390 ..... B•1586-1587
State of the Art, Inc., 2470 Fox Hill Rd., State College, PA 16803-1797, 814-355-8004 ..... A•2034-2035
ACC Electronics Company, Echlin Inc., 1300 W. Oak, Independence, KS 67301 316-331-1000
§† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
† Addacon, Inc., 3702-C Alliance Dr., Greensboro, NC 27407 919-852-6200
† Advanced Analog, Intech, 2270 Martin Ave., Santa Clara, CA 95050 408-988-4930
† Aeroflex Laboratories Inc., Magnetic Products Div., 35 South Service Road, Plainview, NY 11803 516-694-6700
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
† Allied Corp. Aerospace Sector, Bendix Communications Div., East Joppa Rd., Towson, MD 21204 301-583-4000
† Alpha Inds., Inc., Microelectronic Div., 2800 Crystal Drive, Hatfield, PA 19440 215-822-1311
Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Alpha Industries, Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St., Methuen, MA 01844 617-682-4661
Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876 401-762-3800
Applied Research Labs., Fisons, 24911 Stanford Ave., Valencia, CA 91355 805-295-0019
Aptek Technologies, Inc., Aptek Microsystems, 700 N. W. 12th Ave., Deerfield Beach, FL 33442 305-421-8450
Argo Transdata Corp., Box 554, Clinton, CT 06413 203-669-2233
Aselco, Inc., 429 E. Diamond Ave., Suite E, Gaithersburg, MD 20877 301-863-1937
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), 1699 Roosevelt Ave., Bohemia, NY 11716 516-589-5656
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AT&T, 555 Union Blvd., Allentown, PA 18103 ..... 1-800-372-2447;In Canada:1-800-553-2448
Aydin Corp., 700 Dresher Rd., Horsham, PA 19044 215-657-7510
† Aydin Vector Div., Aydin Corp., Box 328, Newtown, PA 18940-0328 215-968-4271
§† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700

§† Boeing Electronics Co., P.O. Box 24969, M/S 9N-41, Seattle, WA 98124-6269 206-657-7474
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§ Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 602-746-1111
California Eastern Labs. Inc., 3260 Jay St., Santa Clara, CA 95054 408-988-3500
Centerflex Techn. Corp., 221 Seventh Ave., P.O. Box 21, Hawthorne, NJ 07507 201-423-0505
Cermetek Microelectronics Inc., 1308 Borregas Ave., Sunnyvale, CA 94088-3565 408-752-5000
† Circuit Technology Inc., 160 Smith St., Farmingdale, NY 11735 516-293-8686
† Comatel USA, Inc., 22 Eagle Rd., Commerce Pk., Danbury, CT 06810 ... 203-797-9445
§ Crydom Company, 17215 Studebaker Rd., No. 328, Cerritos, CA 90701 213-865-3536
† CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
† Datel, Inc., 11 Cabot Blvd., Mansfield, MA 02048 617-339-3000
Dover Electronics Manufacturing, Kirkwood Industrial Park, P.O. Box 5212, Binghamton, NY 13902-5212 ..... 607-772-7563;1-800-PWB-ASSY
Dow Switch, Screenprint/Dow, 271 Ballardvale St., P.O. Box 1332, Wilmington, MA 01887 617-935-6395
§† Dymec, Inc., 8 Lowell Ave., Winchester, MA 01890 ..... 617-729-7870;800-225-1151
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§† Elantec, Inc., 1996 Tarob Ct., Milpitas, CA 95035 ..... 408-945-1323;800-821-7429
Eltec Instruments Inc., P.O. Box 9610, Daytona Bch., FL 32020 904-253-5328
† EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800
† Engelhard Corp., Menlo Pk., CN40, Edison, NJ 08818 ..... 201-632-6000;800-932-0444 (in NJ)
† Frequency Electronics, Inc., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
Fujitsu Components of America, 3320 Scott Blvd., Santa Clara, CA 95054 408-727-1700
General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
§† General Mircocircuits, 780 Boston Rd., Billerica, MA 01821 508-663-9101
§ Gentron Corp., 6667 N. Sidney Pl., Milwaukee, WI 53209 414-351-1660
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† Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Hybrid Electronics Corp., 6 DeAngelo Dr., Bedford, MA 01730 617-275-5350
† Hy-Tec Industries, Div. of Topo Industries, Inc., P.O. Box 91, Shoreham, NY 11786 516-924-8686
† Hytek Microsystems, 980 University Ave., Los Gatos, CA 95030 408-395-2300
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† Kates Scientific Instruments, 142 Adam St., Newton, MA 02158 614-527-2711
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
† M.S. Kennedy Corp., Sub of Hybrilonics, Inc., 8170 Thompson Rd., Clay, NY 13041 315-699-9201
§† Kyocera Northwest, Electronic Components Group, P.O. Box 85542, San Diego, CA 92138-5542 619-576-2600
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§† MICRA Corp., 120 Ricefield Lane, Hauppauge, NY 11788 516-231-8600
Micro Hybrids, Inc., 2864 Route 112, Medford, NY 11763 516-732-3448
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§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
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† Northwest Microcircuits, Inc., 5464SW Philomath Blvd., Corvallis, OR 97333 503-753-8242
† Omnitek, Inc., P.O. Box 102, 820 Pennsylvania Blvd., Feasterville, PA 19047 215-355-4443
† Optical Electronics, Inc., 2700 E. Bisby Rd., Tucson, AZ 85706 602-889-8811
Opto Technology, Inc., 562 Chaddick Dr., Wheeling, IL 60090 312-537-4277
† Paine Corporation, 2401 S. Bayview St., Seattle, WA 98144 ..... 206-329-8600; 800-426-0366
† Parlex Corp., 145 Milk St., Methuen, MA 01844 ..... 617-685-4341, Ext. 265
PCK Technology Div., Kollmorgen Corp., 322 South Service Rd., Melville, NY 11747 516-454-4400
Philips Circuit Assemblies, A Subdivision of North American Philips Corporation, 5855 N. Glen Pk. Rd., Milwaukee, WI 53209 414-228-7632
Philips Circuit Assemblies, A Subdivision of North American Philips Corp., 2601 S. Moorland Rd., New Berlin, WI 53151 414-785-6506
Philips Circuit Assemblies, 3602 W. Waters Avenue, Tampa, FL 33684 .. 813-933-5113
Philips Circuit Assemblies, 1515 Sixth St. South, Hopkins, MN 55343 ... 612-933-4600
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804 407-298-2000
Pulse Engineering, Inc., 7250 Convoy Ct., P.O. Box 12235, San Diego, CA 92112 619-268-2400
† Raytheon Co., Microwave & Power Tube Div., 190 Willow St., Waltham, MA 02154 617-899-8400
† Resistance Technology Inc., 1260 Red Fox Rd., St. Paul, MN 55112 612-636-9770
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
§ Rohm Corporation, 8 Whatney, Irvine, CA 92718 714-855-2131
Sanken Electric Co., Ltd., Overseas Operations, 1-22-8 Nishi-Ikebukuro, Toshima-ku, Tokyo, JAPAN 171 03-986-6164
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
Sensor Techn., 21012 Lassen St., Chatsworth, CA 91311 213-882-4100
SFE Technologies, 1501 1st St., San Fernando, CA 91340 818-365-9411
§† Silicon General, 11861 Western Ave., Garden Grove, CA 92641 714-898-8121
§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311
§† Soshin Electric Co., Ltd., No. 18-18, 1-Chome Nakamagome, Ota-Ku, Tokyo, JAPAN ..... (03) 775-2111
Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 814-455-0966
Taiyo Yuden (USA) Inc., 714 W. Algonquin Rd., Arlington Heights, IL 60005-4493 312-364-6104
§ TDK Corporation, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku, Tokyo, JAPAN 103 ..... (03) 278-5111
Tektronix, Inc., P.O. Box 500, 76/260, Beaverton, OR 97077 800-835-9433
Tektronix, Inc., Hybrid Components Operation, P.O. Box 500, Beaverton, OR 97077 503-627-4220
† Teledyne Crystalonics, Teledyne Industries, Inc., 147 Sherman St., Cambridge, MA 02140 617-491-1670
† Teledyne Microelectronics, 12964 Panama St., Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
§† Thickfilm International, Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-7400
Thomson Electron Tubes & Devices Corp., Special Products Div., 550 Mount Pleasant Ave., Dover, NJ 07801 201-328-1400
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., 565 West Golf Road, Arlington Heights, IL 60005 312-364-7277
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
§† TRW LSI Products Division, PO Box 2472, La Jolla, CA 92038 619-457-1000
United Supertek, Inc., 118 Charcot Ave., San Jose, CA 95131-1101 408-922-0730
WILMANCO, 19529 Business Center Drive, Northridge, CA 91324 ..... 818-993-1662/1663
† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733
† Zenith Components Group, Zenith Electronics Corp., 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

Circuits, Hybrid, Thick Film, Surface Mount-3130

† AMITRON, American Micro-Tronix, Inc., 85 Flagship Drive, North Andover, MA 01845, 508-686-1882 ..... A•1763
CAC Microcircuits Inc., 2 Southgate Dr., Mt. Carmel, IL 62863, 618-263-4343 ..... A•1731
§ FDK America, Inc., Fuji Electromechanical Co., Ltd., 17326 Edwards Rd., Ste. A-130, Cerritos, CA 90701, 213-404-1770 ..... A•1734-1735
Gordos Corporation, A Flint Industries Company, 1000 N. Second St., P.O. Box 824, Rogers, AR 72757, 501-636-5000 ..... A•1736, B•1461
HEI, Inc., Hybrid Electronics Div., 1495 Steiger Lake Ln., Victoria, MN 55386, 612-443-2500 ..... A•1737
§† Hybrids International Ltd., Thick Film Division, 311 N. Lindenwood Dr., Olathe, KS 66062, 913-764-6400 ..... A•1759
Hybridyne, Inc., 2155 N. Forbes Blvd., Tucson, AZ 85745, 602-629-0001 ..... A•1738
§ International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1739
§† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818, 402-694-6111 ..... A•1742-1743
Leach Control Products Div., Leach Corporation, 6900 Orangethorpe Ave., Buena Pk., CA 90620, 714-739-0770 ..... A•1744
M-Tron Industries, P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321 ..... A•1428
NMB Technologies, 9730 Independence Avenue, Chatsworth, CA 91311, 818-341-3355 ..... A•1750-1751
§ Raltron Electronics, 2315 N.W. 107th Ave., Miami, FL 33172, 305-593-6033 ..... A•2009
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2010-2011
ACC Electronics Company, Echlin Inc., 1300 W. Oak, Independence, KS 67301 316-331-1000
† Addacon, Inc., 3702-C Alliance Dr., Greensboro, NC 27407 919-852-6200
† Aeroflex Laboratories, Inc., Microelectronics Div., 35 S. Service Rd., Plainview, NY 11803 516-694-6700
Applied Research Labs., Fisons, 24911 Stanford Ave., Valencia, CA 91355 805-295-0019
Argo Transdata Corp., Box 554, Clinton, CT 06413 203-669-2233
AT&T, 555 Union Blvd., Allentown, PA 18103 ..... 1-800-372-2447;In Canada:1-800-553-2448
Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700
§ Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926 915-592-3253

† Densepac Microsystems, Inc., 7321 Lincoln Way, Garden Grove, CA 92641-1428 ..... 714-898-0007;800-64-CHIPS
Dover Electronics Manufacturing, Kirkwood Industrial Park, P.O. Box 5212, Binghamton, NY 13902-5212 ..... 607-772-7563;1-800-PWB-ASSY
Dow Switch, Screenprint/Dow, 271 Ballardvale St, P.O. Box 1332, Wilmington, MA 01887 617-935-6395
Dynacircuits Inc., 11230 W. Addison, Franklin Park, IL 60131 312-451-1700
† EMC Technology Inc, 1971 Old Cuthbert Rd, Cherry Hill, NJ 08034 609-429-7800
† Environmental Comm., 3150 Pullman St, Costa Mesa, CA 92627 714-557-7800
§ Fujitsu Components of America, 3320 Scott Blvd, Santa Clara, CA 95054 408-727-1700
Hy-Tec Industries, Div. of Topo Industries, Inc., P.O. Box 91, Shoreham, NY 11786 516-924-8686
Hytek Microsystems, 980 University Ave., Los Gatos, CA 95030 408-395-2300
† Kates Scientific Instruments, 142 Adam St, Newton, MA 02158 614-527-2711
LTI, Inc., 6445 N. Hamlin Ave., Lincolnwood, IL 60645 312-679-7500
Micro Hybrids, Inc., 2864 Route 112, Medford, NY 11763 516-732-3448
† Micro Systems Engineering, Inc., 6024 S.W. Jean Rd., Lake Oswego, OR 97035 503-635-4016
§ Mitel Semiconductor, Mitel Corp., P. O. Box 13320, Kanata, ON, CANADA K2K 1X5 613-592-5630
Northwest Microcircuits, Inc., 5464SW Philomath Blvd., Corvallis, OR 97333 503-753-8242
§ Opto Technology, Inc., 562 Chaddick Dr., Wheeling, IL 60090 312-537-4277
PCA Electronics, 16799 Schoenborn St, Sepulveda, CA 91343 818-892-0761
PCK Technology Div., Kollmorgen Corp., 322 South Service Rd., Melville, NY 11747 516-454-4400
Philips Circuit Assemblies, A Subdivision of North American Philips Corporation, 5855 N. Glen Pk. Rd., Milwaukee, WI 53209 414-228-7632
Philips Circuit Assemblies, 3602 W. Waters Avenue, Tampa, FL 33684 .. 813-933-5113
Philips Circuit Assemblies, 1515 Sixth St South, Hopkins, MN 55343 ... 612-933-4600
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804 407-298-2000
§ Piher International Corp., 903 Feehanville Dr., Mt. Prospect, IL 60056 ..... 312-390-6680; 800-323-6693
† Raytheon Co., Microwave & Power Tube Div., 190 Willow St, Waltham, MA 02154 617-899-8400
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
§ Sanyo Semiconductor Corp., 7 Pearl Ct, Allendale, NJ 07401 201-825-8080
§† Soshin Electric Co., Ltd., No. 18-18, 1-Chome Nakamagome, Ota-Ku, Tokyo, JAPAN ..... (03) 775-2111
State of the Art, Inc., 2470 Fox Hill Rd., State College, PA 16803-1797 .. 814-355-8004
Tektronix, Inc., P.O. Box 500, 76/260, Beaverton, OR 97077 800-835-9433
Tektronix, Inc., Hybrid Components Operation, P.O. Box 500, Beaverton, OR 97077 503-627-4220
† Teledyne Microelectronics, 12964 Panama St, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
§† Thickfilm International, Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-7400
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
† Trend Circuits, 44358 Old Warm Springs Blvd., Fremont, CA 94536 415-651-1150
WILMANCO, 19529 Business Center Drive, Northridge, CA 91324 ..... 818-993-1662/1663

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Aeroflex Laboratories, Inc., Microelectronics Div., 35 S. Service Rd., Plainview, NY 11803, 516-694-6700 ..... A•1716
§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•1865
CAC Microcircuits Inc., 2 Southgate Dr., Mt. Carmel, IL 62863, 618-263-4343 ..... A•1731
† CTS Corporation, Microelectronics Div., 1201 Cumberland Ave., W. Lafayette, IN 47906, 317-463-2565 ..... A•1732-1733
§† Hybrids International Ltd., Thick Film Division, 311 N. Lindenwood Dr., Olathe, KS 66062, 913-764-6400 ..... A•1759
† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716, 516-567-5600 ..... D•1164-1165
§ International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1739, B•1011
International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818, 402-694-6111 ..... A•1743
Leach Control Products Div., Leach Corporation, 6900 Orangethorpe Ave., Buena Pk., CA 90620, 714-739-0770 ..... A•1744
† Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761, 617-695-0203 ..... A•1975
§ Raltron Electronics, 2315 N.W. 107th Ave., Miami, FL 33172, 305-593-6033 ..... A•2009
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2010-2011
§† Adams-Russell, Anzac Div., 80 Cambridge St, Burlington, MA 01803 671-273-3333
† Advanced Analog, Intech, 2270 Martin Ave., Santa Clara, CA 95050 408-988-4930
Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St, Methuen, MA 01844 617-682-4661
Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876 401-762-3800
† Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106 617-329-4700
Applied Research Labs., Fisons, 24911 Stanford Ave., Valencia, CA 91355 805-295-0019
Argo Transdata Corp., Box 554, Clinton, CT 06413 203-669-2233
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), 1699 Roosevelt Ave., Bohemia, NY 11716 516-589-5656
AT&T, 555 Union Blvd., Allentown, PA 18103 ..... 1-800-372-2447;In Canada:1-800-553-2448
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-727-0700
Aydin Corp., 700 Dresher Rd., Horsham, PA 19044 215-657-7510
§† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700
Bosch, Robert, Corp., 2800 S. 25th Ave., Broadview, IL 60153 312-865-5200
§ Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 602-746-1111
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California Micro Devices, Inc., 215 Topaz Street, Milpitas, CA 95035 408-263-3214
† Circuit Technology Inc., 160 Smith St, Farmingdale, NY 11735 516-293-8686
† CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
§† Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
† Datel, Inc., 11 Cabot Blvd., Mansfield, MA 02048 617-339-3000
Dover Electronics Manufacturing, Kirkwood Industrial Park, P.O. Box 5212, Binghamton, NY 13902-5212 ..... 607-772-7563;1-800-PWB-ASSY
Dow Switch, Screenprint/Dow, 271 Ballardvale St, P.O. Box 1332, Wilmington, MA 01887 617-935-6395
Engelhard Corp., Menlo Pk., CN40, Edison, NJ 08818 ..... 201-632-6000;800-932-0444 (in NJ)
† Environmental Comm., 3150 Pullman St, Costa Mesa, CA 92627 714-557-7800
Epsilon-Lambda Elctrns. Corp., 427 Stevens St, Geneva, IL 60134 312-232-9611
Essex Group, 9933 13th St., Ft. Wayne, IN. 46809 219-478-1521
† Frequency Electronics, Inc., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
Fujitsu Components of America, 3320 Scott Blvd., Santa Clara, CA 95054 408-727-1700
§† General Mircocircuits, 780 Boston Rd., Billerica, MA 01821 508-663-9101
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Hybrid Electronics Corp., 6 DeAngelo Dr., Bedford, MA 01730 617-275-5350
† Hybrid Systems, Sipex Corporation, 22 Linnell Circle, Billerica, MA 01821 617-667-8700
† Hycomp, Inc., 165 Cedar Hill St., Marlborough, MA 01752 617-485-6300
ICO-RALLY Corporation, 2575 E. Bayshore Rd., Palo Alto, CA 94303 415-856-9900
† Kates Scientific Instruments, 142 Adam St., Newton, MA 02158 614-527-2711
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
§† Kyocera Northwest, Electronic Components Group, P.O. Box 85542, San Diego, CA 92138-5542 619-576-2600
† Lockheed Electronics Co., Inc., Lockheed Corporation, 1501 U.S. Highway 22, CS No. 1, Plainfield, NJ 07061 201-757-1600
Materials Research Corporation, Route 303, Orangeburg, NY 10962 914-359-4200
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 .. 617-329-1508
† MERET, Inc., 1815 24th St, Santa Monica, CA 90404-4998 213-828-7496
† MICRA Corp., 120 Ricefield Lane, Hauppauge, NY 11788 516-231-8600
Micro Hybrids, Inc., 2864 Route 112, Medford, NY 11763 516-732-3448
† Micro Networks, Unitrode Corporation, 324 Clark St., Worcester, MA 01606 617-852-5400
† Micropac Inds., Inc., General Sensors Div., 905 E. Walnut St, Garland, TX 75040 214-272-3571
† Micro Systems Engineering, Inc., 6024 S.W. Jean Rd., Lake Oswego, OR 97035 503-635-4016
Motorola Microelectronics Div., 8000 W. Sunrise, Ft. Lauderdale, FL 33322
Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080 404-436-1300
† Natel Engineering Co., Inc., 4550 Runway St, Simi Valley, CA 93063 805-581-3950
† Optical Electronics, Inc., 2700 E. Bisby Rd., Tucson, AZ 85706 602-889-8811
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§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311
Staffall Inc., 7 Woodland St, Providence, RI 02908 401-351-8282
Taiyo Yuden (USA) Inc., 714 W. Algonquin Rd., Arlington Heights, IL 60005-4493 312-364-6104
§ Tau-Tron, Inc., A Unit of General Signal, 10 Lyberty Way, Westford, MA 01886 617-692-5100
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Tektronix, Inc., Hybrid Components Operation, P.O. Box 500, Beaverton, OR 97077 503-627-4220
† Teledyne Microelectronics, 12964 Panama St, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
Thomson Electron Tubes & Devices Corp., Special Products Div., 550 Mount Pleasant Ave., Dover, NJ 07801 201-328-1400
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E-8, Tampa, FL 33634 813-884-1411
§† TRW LSI Products Division, PO Box 2472, La Jolla, CA 92038 619-457-1000
† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

Circuits, Hybrid, Thin Film, Surface Mount-3130

CAC Microcircuits Inc., 2 Southgate Dr., Mt. Carmel, IL 62863, 618-263-4343 ..... A•1731
§† Hybrids International Ltd., Thick Film Division, 311 N. Lindenwood Dr., Olathe, KS 66062, 913-764-6400 ..... A•1759
§ International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1739
Leach Control Products Div., Leach Corporation, 6900 Orangethorpe Ave., Buena Pk., CA 90620, 714-739-0770 ..... A•1744
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2011
AT&T, 555 Union Blvd., Allentown, PA 18103 ..... 1-800-372-2447;In Canada:1-800-553-2448
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-727-0700
Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700

California Micro Devices, Inc., 215 Topaz Street, Milpitas, CA 95035 408-263-3214
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Densepac Microsystems, Inc., 7321 Lincoln Way, Garden Grove, CA 92641-1428 ..... 714-898-0007;800-64-CHIPS
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Dow Switch, Screenprint/Dow, 271 Ballardvale St, P.O. Box 1332, Wilmington, MA 01887 617-935-6395
§ Fujitsu Components of America, 3320 Scott Blvd., Santa Clara, CA 95054 408-727-1700
† General Mircocircuits, 780 Boston Rd., Billerica, MA 01821 508-663-9101
Hybrid Electronics Corp., 6 DeAngelo Dr., Bedford, MA 01730 617-275-5350
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† Micro Systems Engineering, Inc., 6024 S.W. Jean Rd., Lake Oswego, OR 97035 503-635-4016
Philips Circuit Assemblies, 3602 W. Waters Avenue, Tampa, FL 33684 .. 813-933-5113
Philips Circuit Assemblies, 1515 Sixth St South, Hopkins, MN 55343 ... 612-933-4600
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Tektronix, Inc., Hybrid Components Operation, P.O. Box 500, Beaverton, OR 97077 503-627-4220
† Teledyne Microelectronics, 12964 Panama St., Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
† Trend Circuits, 44358 Old Warm Springs Blvd., Fremont, CA 94536 415-651-1150

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§ FDK America, Inc., Fuji Electromechanical Co., Ltd., 17326 Edwards Rd., Ste. A-130, Cerritos, CA 90701, 213-404-1770 ..... A•1769
§† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E-8, Tampa, FL 33634, 813-884-1411 ..... A•1839-1840
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Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Alpha Industries, Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
† Antenna Specialists, The Allen Group, 30500 Bruce Industrial Pkwy., Cleveland, OH 44139 216-349-8400
† Channel Microwave, TRAK Microwave Corp., 3/4 Lindsay Court, Dundee Technlg. Pk., Dundee, SCOTLAND DD2 1TY 44-382-561509
† Eaton Corporation, Microwave Products Division, 785 Palomar Ave., Sunnyvale, CA 94086 408-730-6410
† FEI Microwave, Inc., Frequency Electronics, Inc., 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Lectronic Research Labs., Inc., 1423 Ferry Ave., Camden, NJ 08104 609-541-4200
† M/A COM Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† Maury Microwave Corp., 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Merrimac Industries, 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Electronics, 104 Gun Avenue, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† Narda Microwave Corp., Subsidiary of Loral Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Raytheon Co., Microwave & Power Tube Div., 190 Willow St., Waltham, MA 02154 617-899-8400
§† Sinclair Radio Laboratories Ltd., 85 Mary St., Aurora, ONT., CANADA L4G 3G9 416-727-0165
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
Thomson Electron Tubes & Devices Corp., Special Products Div., 550 Mount Pleasant Ave., Dover, NJ 07801 201-328-1400
† TRAK Microwave Ltd., TRAK Microwave Corp., 3/4 Lindsay Court, Dundee Technlg. Pk., Dundee, SCOTLAND DD2 1TY 44-382-561509
† UTE Microwave, 3500 Sunset Ave., Asbury Park, NJ 07712 201-922-1009
Varian Associates, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

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Coil Assemblies & Forms-Also See Bobbins, Winding, Coil & Transformer-1800

Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224-5825, 213-537-5200 ..... A•1202,1204
Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1209
Caddell Coil Corp., 35M Main St., Poultney, VT 05764, 802-287-4055 .... A•1223
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379, 203-599-2075 ..... B•1402
† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2214
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•1244
§† Gowanda Electronics Corp., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 ..... A•1245
Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ..... A•2250
Multi Products International, 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•2298
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2365
RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2011
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1282
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1297
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199, 816-761-6314 ..... A•1300
Wilco Corp., 6451 Saguaro Court, Indianapolis, IN 46268, 317-293-9300 ..... A•1316
§† Able Power and Engineering Inc., 1222 N. Delta St, S. San Gabriel, CA 91770 818-571-6260
Anro Elctrn. Inds. Ltd., 300 Wildcat Rd., Downsview, ON, CANADA M3J 2N5 416-661-2600
Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Capco, Box 1028, Grand Junction, CO 81502 303-243-8751
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
Cortec, Inc., 15811 Chemical La., Huntington Bch., CA 92649 714-897-2529
Cosmo Corporation, 3239 W. 14th St., Cleveland, OH 44109 216-861-5594
† Cramer Coil & Transformer Co., Inc., 401 Progress Dr., Saukville, WI 53080 414-284-9425
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
† Delta Products Corporation, 3823 Spinnaker Ct., Fremont, CA 94538 415-770-0660
Diamond Magnetics, 235 Tank Farm Rd., Ste. G, San Luis Obispo, CA 93401 805-544-4019
† Dia-Netics, Inc., 18823 Napa St., Northridge, CA 91324 818-886-2616
Dynacast, Div. Coats & Clark Inc., 1401 Front Street, Yorktown Heights, NY 10598 914-245-0060
§ Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360
Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
§† Electronic Coil Corp., Farmington Industrial Park, Farmington, CT 06032 203-677-6731
Endicott Coil, 24 Charlotte St., Binghamton, NY 13905 607-797-1263
§ Frontier Electronics, 6311 DeSoto Ave., Ste. K, Woodland Hills, CA 91367 818-888-6242
Grand Transformers, 1500 Marion St., Grand Haven, MI 49417 616-842-5430
High Voltage Engrg. Corp., S. Bedford St., Burlington, MA 01803 617-272-1313
High Voltage Technology Inc., 127 Hillcrest Ave.:P.O. Box 437, Yonkers, NY 10705 914-423-6636
§ Inductive Prods., Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
Industrial Midwec Capacitor Corp., 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
§† Jaico Products, Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, IL 60622 312-421-1090
Kearney/Wabash Electrical Components, 1375 Swan Street, Huntington, IN 46750 219-356-8300
§† Krystinel Corp., 126 Pennsylvania Ave., Paterson, NJ 07509 201-345-8900
Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
† Magnetic Component Engineering, Inc., 11379 Playa Street, Culver City, CA 90230 213-398-4761
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetic Systems, 1021 Pecten Ct., Milpitas, CA 95035 408-263-6680
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704 516-587-0510
Micrometals, 1190 N. Hawk, Anaheim, CA 92807 714-630-7420
Millen Components, Electronic Instr. & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-6951
† Ogallala Elctrns., Div. Arnold Engrg. Co., Box 59, Ogallala, NE 69153 308-284-4093
† PCA Electronics, 16799 Schoenborn St., Sepulveda, CA 91343 818-892-0761
Permaluster, Inc., 1844 N. Keystone St., Burbank, CA 91504 ..... 213-849-4543; 213-849-6454
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861 201-826-4700
§† Powertron Corporation, Rte. 15, Box 932, Sparta, NJ 07871 201-579-5599
§† PTS Corporation, Box 272, Bloomington, IN 47401 812-824-9331
† Roanwell, 180 Varick St., New York, NY 10014 212-989-1090
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Staffall Inc., 7 Woodland St., Providence, RI 02908 401-351-8282
† Stevens Products, Inc., 128 N. Park St., E. Orange, NJ 07019 201-672-2140
Steward, D. M., Mfg. Co., P.O. Box 510, Chattanooga, TN 37401 615-867-4100
† Telectro Systems Corp., 96-18 43rd Ave., Corona, NY 11368 718-651-8900
Thermotech, Div. of FL Industries, Inc., 1203 S. 5th St., Hopkins, MN 55343 612-933-9400
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Trancor, 108 N. High St., P.O. Box 907, San Saba, TX 76877 915-372-6127
† Wayne Transformer Co., Inc., 666 Pacific St., Brooklyn, NY 11217 718-783-9007
† Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 ... 602-861-1856
Won Tronics, Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057 213-381-2500
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Coil/Lens Aligners, Micropositioner-1800

† CELCO, 70 Constantine Dr., Mahwah, NJ 07430 201-327-1123
† Syntronic Instruments, Inc., 100 Industrial Rd., Addison, IL 60101 312-543-6444

Coil Standards — See Standards, Inductance (Vol. D)

Coil-Winding Equipment — See Machines, Coil Winding (Vol. D)

Coils, AF-1800

Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057, 213-381-2500 ..... D•1076
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147, 305-696-6660 ..... A•1194
Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1209,1219
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•1239
† ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•1244
Foxboro/PCG, The Foxboro Company, 600 N. Bedford St., E. Bridgewater, MA 02333, 508-378-5260 ..... A•2235
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•1246,2295
North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•1247
† PCA Electronics, 16799 Schoenborn St., Sepulveda, CA 91343, 818-892-0761 ..... A•1610
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1271
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2351
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861, 201-826-4700 ..... A•2352-2353
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2365
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2011
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1282-1283
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530, 914-681-0700 ..... D•1053
Signal Transformer Co., Inc., Insilco Corporation, 500 Bayview Ave., Inwood, NY 11696, 516-239-5777 ..... A•2372
† Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, 513-871-3777 ..... A•1287
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1296
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199, 816-761-6314 ..... A•1300
Wilco Corp., 6451 Saguaro Court, Indianapolis, IN 46268, 317-293-9300 ..... A•1317
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
Anro Elctrn. Inds. Ltd., 300 Wildcat Rd., Downsview, ON, CANADA M3J 2N5 416-661-2600
Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
De Coursey Engineering Laboratory, 11828 W. Jefferson, Culver City, CA 90230 ..... 213-EX7-9668
† Delta Products Corporation, 3823 Spinnaker Ct., Fremont, CA 94538 415-770-0660
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§ Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360

Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
Electrocom Industries, 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
§† JB Electronic Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
KGS Electronics, Inc., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetic Component Engineering, Inc., 11379 Playa Street, Culver City, CA 90230 213-398-4761
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
§ Millen Components, Electronic Instr. & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-6951
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., 999 Anita Ave., Antioch, IL 60002 312-395-5710
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
† Roanwell, 180 Varick St., New York, NY 10014 212-989-1090
§† Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95054 408-988-0700
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518 213-638-1790
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600
Won Tronics, Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057 213-381-2500
Xylog Corp., 83 Hobart St., Hackensack, NJ 07601 201-489-4040

Coils, Antenna (Incl. Loading Type)-1800

Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1209,1219
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764, 802-287-4055 .... A•1223
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•1239
Multi Products International, 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•2298
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1296
Anro Elctrn. Inds. Ltd., 300 Wildcat Rd., Downsview, ON, CANADA M3J 2N5 416-661-2600
Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147 305-696-6660
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
† Cramer Coil & Transformer Co., Inc., 401 Progress Dr., Saukville, WI 53080 414-284-9425
Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
† Magnetic Component Engineering, Inc., 11379 Playa Street, Culver City, CA 90230 213-398-4761
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729 ..... 516-586-5566; 1-800-645-5828
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
§ Sparkomatic, Rte. 6 & 209, Milford, PA 18337 717-296-6444
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 ... 602-861-1856
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Coils, Broadcast-1800

Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1209,1212,1219
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764, 802-287-4055 .... A•1223
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•1239
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1271
† Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, 513-871-3777 ..... A•1287
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1296
Anro Elctrn. Inds. Ltd., 300 Wildcat Rd., Downsview, ON, CANADA M3J 2N5 416-661-2600
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147 305-696-6660
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224-5825 213-537-5200
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
§ Inductive Prods., Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
Millen Components, Electronic Instr. & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-6951
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
Permaluster, Inc., 1844 N. Keystone St., Burbank, CA 91504 ..... 213-849-4543; 213-849-6454
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729 ..... 516-586-5566; 1-800-645-5828
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880

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§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224-5825, 213-537-5200 ..... A•1199,1201,1203-1204
Coilcraft, 1102 Silver Lake Rd., Cary, IL 60013, 312-639-2361 ..... A•1225
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•1232,1235,1239
§† Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600 ..... A•1241,1243
† Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150 ..... A•1932
Gowanda Electronics Corp., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 ..... A•1245
NMB Technologies, 9730 Independence Avenue, Chatsworth, CA 91311, 818-341-3355 ..... A•1750-1751
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1271
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1277-1279
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2011
Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, 513-871-3777 ..... A•1287
TDK Corporation, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku,, Tokyo, JAPAN 103, (03) 278-5111 ..... A•1294
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1296
Anro Elctrn. Inds. Ltd., 300 Wildcat Rd., Downsview, ON, CANADA M3J 2N5 416-661-2600
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302 201-432-0463
§† Hybrids International Ltd., Thick Film Division, 311 N. Lindenwood Dr., Olathe, KS 66062 913-764-6400
§† Inductive Prods., Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
Jeffers Electronics, Grand Plaza, 945 Grand Ave., Nogales, AZ 85621 ... 602-287-5851
§† Krystinel Corp., 126 Pennsylvania Ave., Paterson, NJ 07509 201-345-8900
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080 404-436-1300
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
† SFE Technologies, 1501 1st St., San Fernando, CA 91340 818-365-9411
§ Sprague-Goodman Elctrns., Inc., 134 Fulton Ave., Garden City Pk., NY 11040 516-746-1385
§ Stetco, Inc., 3344 Schierhorn Ct., Franklin Pk., IL 60131 312-671-4208
† Thinco Div., Hull Corp., Davisville Rd., Hatboro, PA 19040 215-672-7800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
§† West-Cap Arizona, Sub. of SFE Technologies, 2201 East Elvira Road, Tucson, AZ 85706 602-294-2646

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§ Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•1246
Anro Elctrn. Inds. Ltd., 300 Wildcat Rd., Downsview, ON, CANADA M3J 2N5 416-661-2600
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Elma Engineering, 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† E M S Development Corp., 100 Sea La., Farmingdale, NY 11735 516-293-7900
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
LDJ Incorporated, 2200 Stephenson Hwy., P.O. Box 219, Troy, MI 48099-0219 313-528-2202
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
Magnetic Instrumentation, 8350 E. 48TH ST., Indianapolis, IN 46226 317-545-2102
† Penn-Tran Corp., Box 1321, Rte. 144N, Wingate, PA 16880 814-355-1521
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729 ..... 516-586-5566; 1-800-645-5828
Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209 513-871-3777
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Walker Scientific, Rockdale St., Worcester, MA 01606 .... 617-852-3674;617-853-3232

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Walker Scientific, Rockdale St., Worcester, MA 01606, 617-852-3674;617-853-3232 ..... D•1346
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006

Anro Elctrn. Inds. Ltd, 300 Wildcat Rd, Downsview, ON, CANADA M3J 2N5 416-661-2600
† A.P.W. Co., Inc., 72 W. Main, Rockaway, NJ 07866 201-627-0643
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
LDJ Incorporated, 2200 Stephenson Hwy., P.O. Box 219, Troy, MI 48099-0219 313-528-2202
Magnos, 6 Old School House Rd, Harvard, MA 01451 617-456-8880
Permaluster, Inc., 1844 N. Keystone St, Burbank, CA 91504 ..... 213-849-4543; 213-849-6454
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880

Coils, Focusing-1800

Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2365
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1297
Anro Elctrn. Inds. Ltd, 300 Wildcat Rd, Downsview, ON, CANADA M3J 2N5 416-661-2600
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
† CELCO, 70 Constantine Dr., Mahwah, NJ 07430 201-327-1123
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Elma Engineering, 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† Ogallala Elctrns., Div. Arnold Engrg. Co., Box 59, Ogallala, NE 69153 308-284-4093
† Penn-Tran Corp., Box 1321, Rte. 144N, Wingate, PA 16880 814-355-1521
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729 ..... 516-586-5566; 1-800-645-5828
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Stangenes Industries, Inc., 1052 East Meadow Circle, Palo Alto, CA 94303 415-493-0814
† Syntronic Instruments, Inc., 100 Industrial Rd., Addison, IL 60101 312-543-6444
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Coils, Foil Wound-1800

† Abbott Technologies, Inc., Burbank Division, Transformers, 639 So. Glenwood Pl., Burbank, CA 91506, 818-841-3630 ..... A•2157
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•1239
Delta Products Corporation, 3823 Spinnaker Ct., Fremont, CA 94538, 415-770-0660 ..... A•2211
Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2214
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•1244
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... A•2248
Signal Transformer Co., Inc., Insilco Corporation, 500 Bayview Ave., Inwood, NY 11696, 516-239-5777 ..... A•2372
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199, 816-761-6314 ..... A•1300
§† Able Power and Engineering Inc., 1222 N. Delta St, S. San Gabriel, CA 91770 818-571-6260
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ..... 818-765-8300;800-423-3186
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
Andover, Inc., 310 North Earl Avenue, Lafayette, IN 47904 317-447-1157
Anro Elctrn. Inds. Ltd, 300 Wildcat Rd, Downsview, ON, CANADA M3J 2N5 416-661-2600
Atlas Engineering Corp., 10 Cheney St, Dorchester, MA 02121 617-445-7100
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
§ Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360
Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
§ Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
Electro-Pacific, 5770 Thornwood Dr., Goleta, CA 93117 805-964-0751
Elma Engineering, 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
§ Inductive Prods., Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
§ ITT General Controls Div., Intl. Telephone & Telegraph Corp., 801 Allen Ave., Glendale, CA 91201 213-842-6131
LEPCO/Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 .. 512-546-1625
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
† Ogallala Elctrns., Div. Arnold Engrg. Co., Box 59, Ogallala, NE 69153 308-284-4093
OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
Permaluster, Inc., 1844 N. Keystone St, Burbank, CA 91504 ..... 213-849-4543; 213-849-6454
§† Powertron Corporation, Rte. 15, Box 932, Sparta, NJ 07871 201-579-5599
§ Pulse Engineering, Inc., 7250 Convoy Ct, P.O. Box 12235, San Diego, CA 92112 619-268-2400
† Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95054 408-988-0700
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
§ Tapecon, Inc., 10 Latta Rd., Rochester, NY 14612 716-621-8400
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600
Walker Power, Inc., Walker Magnetics Group, 10 B Mill St, Warner, NH 03278 603-456-3111
Walker Scientific, Rockdale St, Worcester, MA 01606 .... 617-852-3674;617-853-3232
† Wayne Transformer Co., Inc., 666 Pacific St, Brooklyn, NY 11217 718-783-9007
† Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 ... 602-861-1856

Coils, Helmholtz-1800

Walker Scientific, Rockdale St, Worcester, MA 01606 .... 617-852-3674;617-853-3232

Coils, High Q, Low Frequency-1800

Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1211,1214-1217,1221-1222
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764, 802-287-4055 .... A•1223
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•1236-1237,1239
Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2214
† ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•1244
Foxboro/PCG, The Foxboro Company, 600 N. Bedford St., E. Bridgewater, MA 02333, 508-378-5260 ..... A•2235
Gowanda Electronics Corp., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 ..... A•1245
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061, 913-782-0012 ..... A•2239
Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ..... A•2250
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•1246
Multi Products International, 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•2298
North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•1247
§† Nytronics Components Grp., Inc., 700 Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1248-1249,1254-1255,1257,1259-1267, B•1019
Oxley, Inc., 25 Business Pk. Dr., P.O. Box 814, Branford, CT 06405, 203-488-1033 ..... A•1677
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1271,1273-1275
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1277-1278
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861, 201-826-4700 ..... A•2352
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2365
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2011
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1284
† Signal Transformer Co., Inc., Insilco Corporation, 500 Bayview Ave., Inwood, NY 11696, 516-239-5777 ..... A•2372
† Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, 513-871-3777 ..... A•1287
Talema Electronic, Inc., 301 N. Highway 63, Rolla, MO 65401, 314-364-0882 ..... A•2390
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199, 816-761-6314 ..... A•1300,1303
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600 ..... A•2428
Wilco Corp., 6451 Saguaro Court, Indianapolis, IN 46268, 317-293-9300 ..... A•1318
§† Able Power and Engineering Inc., 1222 N. Delta St, S. San Gabriel, CA 91770 818-571-6260
AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
Anro Elctrn. Inds. Ltd, 300 Wildcat Rd, Downsview, ON, CANADA M3J 2N5 416-661-2600
Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057 213-381-2500
Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
† Associated Spring, Barnes Grp., 10 Main St, Bristol, CT 06010 203-583-1331
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St, Dept. E, Miami, FL 33147 305-696-6660
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224-5825 213-537-5200
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640

† Cramer Coil & Transformer Co., Inc., 401 Progress Dr., Saukville, WI 53080 414-284-9425
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§ Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
§ Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360
Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
Electrocom Industries, 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5770 Thornwood Dr., Goleta, CA 93117 805-964-0751
Elma Engineering, 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
§ Frontier Electronics, 6311 DeSoto Ave., Ste. K, Woodland Hills, CA 91367 818-888-6242
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
† Genisco Technology Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
§† Inductive Prods., Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
KGS Electronics, Inc., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
† Lenox-Fugle Electronics, 100 Sylvania Pl., S. Plainfield, NJ 07080 201-756-1164
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
§† Millen Components, Electronic Instr. & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-6951
† Northlake Engineering, Inc., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† PCA Electronics, 16799 Schoenborn St., Sepulveda, CA 91343 818-892-0761
† Permaluster, Inc., 1844 N. Keystone St., Burbank, CA 91504 ..... 213-849-4543; 213-849-6454
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034 ... 215-643-6950
† SFE Technologies, 1501 1st St., San Fernando, CA 91340 818-365-9411
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
† Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518 213-638-1790
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
Torelco, Inc., 14 Paine Ave., P.O. Box 560, Irvington, NJ 07111 201-374-8641
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
Trancor, 108 N. High St., P.O. Box 907, San Saba, TX 76877 915-372-6127
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
§ Vitec Electronic Corporation, 1525A East Acequia, Visalia, CA 93291 ... 209-739-1077
† Wayne Transformer Co., Inc., 666 Pacific St., Brooklyn, NY 11217 718-783-9007
Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 ... 602-861-1856
Won Tronics, Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057 213-381-2500
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Coils, Hum Eliminating — See Hum Eliminators (Vol. A)

Coils, Hybrid & Repeater-1800

§† Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600 ..... A•1241,1243
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•1244
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•1246,2280-2281
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1271
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2365
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518, 213-638-1790 ..... A•2395, D•1983
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199, 816-761-6314 ..... A•1300
AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
Anro Elctrn. Inds. Ltd., 300 Wildcat Rd., Downsview, ON, CANADA M3J 2N5 416-661-2600
Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147 305-696-6660
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Mini-Magnetics Co., Inc., 1100 Fulton Place, Fremont, CA 94539 415-490-7500
North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542 516-671-5700
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729 ..... 516-586-5566; 1-800-645-5828
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600
§† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Wayne Transformer Co., Inc., 666 Pacific St., Brooklyn, NY 11217 718-783-9007
Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 ... 602-861-1856

Coils, IF-1800

† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147, 305-696-6660 ..... A•1194
Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1209,1212-1216,1218-1219,1221-1222
Coilcraft, 1102 Silver Lake Rd., Cary, IL 60013, 312-639-2361 ..... A•1225-1230
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•1232,1235,1239
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•1244
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1277
† Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, 513-871-3777 ..... A•1287
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1296
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199, 816-761-6314 ..... A•1300
Wilco Corp., 6451 Saguaro Court, Indianapolis, IN 46268, 317-293-9300 ..... A•1316
Anro Elctrn. Inds. Ltd., 300 Wildcat Rd., Downsview, ON, CANADA M3J 2N5 416-661-2600
Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057 213-381-2500
Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224-5825 213-537-5200
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
† Cramer Coil & Transformer Co., Inc., 401 Progress Dr., Saukville, WI 53080 414-284-9425
† Delta Products Corporation, 3823 Spinnaker Ct., Fremont, CA 94538 415-770-0660
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
§ Frontier Electronics, 6311 DeSoto Ave., Ste. K, Woodland Hills, CA 91367 818-888-6242
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
Industrial Midwec Capacitor Corp., 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
† Magnetic Component Engineering, Inc., 11379 Playa Street, Culver City, CA 90230 213-398-4761
Millen Components, Electronic Instr. & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-6951
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034 ... 215-643-6950
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861 201-826-4700
§† PTS Corporation, Box 272, Bloomington, IN 47401 812-824-9331
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729 ..... 516-586-5566; 1-800-645-5828
§† SFE Technologies, 1501 1st St., San Fernando, CA 91340 818-365-9411
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95054 408-988-0700
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518 213-638-1790
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600
§† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 ... 602-861-1856
Won Tronics, Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057 213-381-2500
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Coils, Metallized Ceramic-1800

† Oxley, Inc., 25 Business Pk. Dr., P.O. Box 814, Branford, CT 06405, 203-488-1033 ..... A•1677
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1277,1279
Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199, 816-761-6314 ..... A•1300
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ..... 818-765-8300;800-423-3186
Stetco, Inc., 3344 Schierhorn Ct., Franklin Pk., IL 60131 312-671-4208

Coils, Metallized Glass-1800

Anro Elctrn. Inds. Ltd., 300 Wildcat Rd., Downsview, ON, CANADA M3J 2N5 416-661-2600
§† Sprague-Goodman Elctrns., Inc., 134 Fulton Ave., Garden City Pk, NY 11040 516-746-1385
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95054 408-988-0700
† Thinco Div., Hull Corp., Davisville Rd., Hatboro, PA 19040 215-672-7800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880

Coils, Molded-1800

Amecon, Inc., 1900 S. Chris La., Anaheim, CA 92805, 714-634-2220;800-392-2292 ..... A•2167-2169,2174
§† **Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224-5825, 213-537-5200 ..... A•1199**
Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1209
Coilcraft, 1102 Silver Lake Rd., Cary, IL 60013, 312-639-2361 ..... A•1225-1229
CSI Capacitors, CSI Technologies, 810 Rancheros Dr., San Marcos, CA 92069, 619-747-4000 ..... A•1071
§ **Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•1232-1234,1238**
§† **Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600 ..... A•1241-1243**
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379, 203-599-2075 ..... B•1402
† **ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558**
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•1244
§† **Gowanda Electronics Corp., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 ..... A•1245**
† **Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061, 913-782-0012 ..... A•2239**
§† **Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•1246,2280-2281**
§† **Nytronics Components Grp., Inc., 700 Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1251-1253,1256-1264,1266, B•1019**
† **PCA Electronics, 16799 Schoenborn St., Sepulveda, CA 91343, 818-892-0761 ..... A•1610**
† **Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1271**
† **Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1277-1278**
† **Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861, 201-826-4700 ..... A•1281,2352**
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1282,1285
Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, 513-871-3777 ..... A•1287
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518, 213-638-1790 ..... A•2398
§ **TDK Corporation, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku,, Tokyo, JAPAN 103, (03) 278-5111 ..... A•1294**
§ **Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1296**
† **Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199, 816-761-6314 ..... A•1300-1302,1306,1311,1314**
§ **Vitec Electronic Corporation, 1525A East Acequia, Visalia, CA 93291, 209-739-1077 ..... A•2435-2439**
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Andover, Inc., 310 North Earl Avenue, Lafayette, IN 47904 317-447-1157
Anro Elctrn. Inds. Ltd., 300 Wildcat Rd., Downsview, ON, CANADA M3J 2N5 416-661-2600
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147 305-696-6660
† Bicron Electronics, 100 Barlow Street, Canaan, CT 06018 203-824-5125
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
Cosmo Corporation, 3239 W. 14th St., Cleveland, OH 44109 216-861-5594
Coto Corporation, 55 DuPont Drive, Providence, RI 02907 401-943-2686
§ Deltrol Controls, 2745 S. 19th St., Milwaukee, WI 53215 414-671-6800
§† Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
Electro-Pacific, 5770 Thornwood Dr., Goleta, CA 93117 805-964-0751
Endicott Coil, 24 Charlotte St., Binghamton, NY 13905 607-797-1263
The Five Star Co., 120 W. Main St., Plantsville, CT 06479 203-628-5561
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
§ Frontier Electronics, 6311 DeSoto Ave., Ste. K, Woodland Hills, CA 91367 818-888-6242
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
§† Inductive Prods., Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
§ ITT General Controls Div., Intl. Telephone & Telegraph Corp., 801 Allen Ave., Glendale, CA 91201 213-842-6131
§† JB Electronic Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
§† Jeffers Electronics, Grand Plaza, 945 Grand Ave., Nogales, AZ 85621 ... 602-287-5851
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 ..... 201-396-9400; 1-800-223-0603
Kearney/Wabash Electrical Components, 1375 Swan Street, Huntington, IN 46750 219-356-8300
KGS Electronics, Inc., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
† Lenox-Fugle Electronics, 100 Sylvania Pl., S. Plainfield, NJ 07080 201-756-1164
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
§ Millen Components, Electronic Instr. & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-6951
§ Namco Controls, An Acme-Cleveland Co., 7567 Tyler Blvd., Mentor, OH 44060 216-946-9900
North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542 516-671-5700
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
§ Pulse Engineering, Inc., 7250 Convoy Ct., P.O. Box 12235, San Diego, CA 92112 619-268-2400
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
† Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
§† SFE Technologies, 1501 1st St., San Fernando, CA 91340 818-365-9411
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
Stetco, Inc., 3344 Schierhorn Ct., Franklin Pk., IL 60131 312-671-4208
Thermotech, Div. of FL Industries, Inc., 1203 S. 5th St., Hopkins, MN 55343 612-933-9400
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
Trancor, 108 N. High St., P.O. Box 907, San Saba, TX 76877 915-372-6127
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Trinetics Inc., 55807 Currant Rd., Mishawaka, IN 46545-4899 219-259-8535
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600
† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
§† West-Cap Arizona, Sub. of SFE Technologies, 2201 East Elvira Road, Tucson, AZ 85706 602-294-2646
Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 ... 602-861-1856

Coils, pi Winding-1800

§ **Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224-5825, 213-537-5200 ..... A•1199,1201**
Multi Products International, 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•2298
† **Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1271**
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1282,1284
Wilco Corp., 6451 Saguaro Court, Indianapolis, IN 46268, 317-293-9300 ..... A•1316,1318
† Associated Spring, Barnes Grp., 10 Main St., Bristol, CT 06010 203-583-1331
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147 305-696-6660
C W S, 17 Midland Dr., Norwich, NY 13815 607-334-5366
Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
High Voltage Technology Inc., 127 Hillcrest Ave.:P.O. Box 437, Yonkers, NY 10705 914-423-6636
North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542 516-671-5700
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
† Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342

Coils, Relay-1800

Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379, 203-599-2075 ..... B•1402
Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, 513-871-3777 ..... A•1287
Struthers-Dunn, Inc., Subsidiary of Nytronics, Inc., Lamb's Rd., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1592
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
Andover, Inc., 310 North Earl Avenue, Lafayette, IN 47904 317-447-1157
Anro Elctrn. Inds. Ltd., 300 Wildcat Rd., Downsview, ON, CANADA M3J 2N5 416-661-2600
Antex Electronics Corp., 16100 S. Figueroa St., Gardena, CA 90248 213-532-3092
Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057 213-381-2500
† A.P.W. Co., Inc., 72 W. Main, Rockaway, NJ 07866 201-627-0643
Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147 305-696-6660
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
† Computer Components, Inc., 629 Fifth Ave., Pelham, NY 10803 914-738-1611
Coto Corporation, 55 DuPont Drive, Providence, RI 02907 401-943-2686
Custom Bobbin Windings, A & K Corporation, P.O. Box 2369, Zanesville, OH 43702-2369 614-452-6973
§ Deltrol Controls, 2745 S. 19th St., Milwaukee, WI 53215 414-671-6800
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
† Dia-Netics, Inc., 18823 Napa St., Northridge, CA 91324 818-886-2616
§ Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360
§† Electronic Coil Corp., Farmington Industrial Park, Farmington, CT 06032 203-677-6731
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Endicott Coil, 24 Charlotte St., Binghamton, NY 13905 607-797-1263
† E-Tron Corporation, 30 Ethel Rd., Edison, NJ 08817 201-287-9039
The Five Star Co., 120 W. Main St., Plantsville, CT 06479 203-628-5561
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
Grand Transformers, 1500 Marion St., Grand Haven, MI 49417 616-842-5430

GTE SUPPLY, GTE Communications Systems, 5225 Wiley Post Way, Salt Lake City, UT 84116 800-433-4837
High Voltage Technology Inc., 127 Hillcrest Ave.:P.O. Box 437, Yonkers, NY 10705 914-423-6636
INRESCO, Inc., 654 Ocean Road, Pt. Pleasant, NJ 08742 201-892-5881
§† Jaico Products, Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, IL 60622 312-421-1090
Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 ..... 201-396-9400; 1-800-223-0603
Kearney/Wabash Electrical Components, 1375 Swan Street, Huntington, IN 46750 219-356-8300
Liberty Controls, 500 Brookforest Ave., Shorewood, IL 60435 815-725-2241
Line Electric Products, 122 Naubuc Ave., Glastonbury, CT 06033 ..... 203-659-3573; 1-800-331-1137
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704 516-587-0510
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861 201-826-4700
Reeve Electronics, Mellish E. Murray, 1715 W. Carroll Ave., Chicago, IL 60612 312-670-0150
Relay Service Co., 1300 N. Pulaski Rd., Chicago, IL 60651 312-252-2700
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729 ..... 516-586-5566; 1-800-645-5828
† SFE Technologies, 1501 1st St., San Fernando, CA 91340 818-365-9411
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Trinetics Inc., 55807 Currant Rd., Mishawaka, IN 46545-4899 219-259-8535
Vanguard Relay Corp., 333 Strawberry Field Rd., Warwick, RI 02886 401-732-0700
Won Tronics, Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057 213-381-2500

Coils, RF-1800

† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147, 305-696-6660 ..... A•1194
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224-5825, 213-537-5200 ..... A•1199-1203
BH Electronics, Inc., 12219 Wood Lk. Dr., Burnsville, MN 55337, 612-894-9590 ..... A•1206-1207,2198-2199
Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1216,1218-1219,1221-1222
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764, 802-287-4055 .... A•1223
Coilcraft, 1102 Silver Lake Rd., Cary, IL 60013, 312-639-2361 ..... A•1225-1230
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•1232-1233,1235,1238-1239
§† Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600 ..... A•1241-1242
† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•1244
§† Gowanda Electronics Corp., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 ..... A•1245
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061, 913-782-0012 ..... A•2239
Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•1246,2280-2281
Multi Products International, 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•2298
North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•1247
§† Nytronics Components Grp., Inc., 700 Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1248-1249,1251-1266, B•1019
Oxley, Inc., 25 Business Pk. Dr., P.O. Box 814, Branford, CT 06405, 203-488-1033 ..... A•1677
† PCA Electronics, 16799 Schoenborn St., Sepulveda, CA 91343, 818-892-0761 ..... A•1610
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1271
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1277,1279
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2365
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2011
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1282
§ Sprague-Goodman Elctrns., Inc., 134 Fulton Ave., Garden City Pk., NY 11040, 516-746-1385 ..... A•1175
Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, 513-871-3777 ..... A•1287
Talema Electronic, Inc., 301 N. Highway 63, Rolla, MO 65401, 314-364-0882 ..... A•2390
TDK Corporation, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku,, Tokyo, JAPAN 103, (03) 278-5111 ..... A•1294
Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131, 408-432-8020 ..... A•1295,1700
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1296
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199, 816-761-6314 ..... A•1300-1301,1303-1307
§ Vitec Electronic Corporation, 1525A East Acequia, Visalia, CA 93291, 209-739-1077 ..... A•2439
Wilco Corp., 6451 Saguaro Court, Indianapolis, IN 46268, 317-293-9300 ..... A•1317
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Anro Elctrn. Inds. Ltd., 300 Wildcat Rd., Downsview, ON, CANADA M3J 2N5 416-661-2600
Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057 213-381-2500
Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
§ Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33069 305-979-7920
Bey Electric, Inc., 362 Main St., Box 548, Lincoln Park, NJ 07035 201-694-5000
§ Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, NJ 07006 201-227-4222
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
† Cramer Coil & Transformer Co., Inc., 401 Progress Dr., Saukville, WI 53080 414-284-9425
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§ Dyma Engineering, Box 1535, Los Lunas, NM 87031 505-865-6700
† Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
Elma Engineering, 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
§ Ferroxcube, Amperex Electronic Corp., 5083 Kings Hwy., Saugerties, NY 12477 914-246-2811
† Fil-Coil Company, Inc., 800 Axinn Ave., Garden City, NY 11530 516-228-9445
Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
§ Frontier Electronics, 6311 DeSoto Ave., Ste. K, Woodland Hills, CA 91367 818-888-6242
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
§† Inductive Prods., Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
§† Jeffers Electronics, Grand Plaza, 945 Grand Ave., Nogales, AZ 85621 ... 602-287-5851
Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 ..... 201-396-9400; 1-800-223-0603
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
† Lenox-Fugle Electronics, 100 Sylvania Pl., S. Plainfield, NJ 07080 201-756-1164
† Lepel, 50 Heartland Blvd., Edgewood, NY 11717 516-586-3300
† Magnetic Component Engineering, Inc., 11379 Playa Street, Culver City, CA 90230 213-398-4761
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
§ Millen Components, Electronic Instr. & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-6951
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
Penn-Tran Corp., Box 1321, Rte. 144N, Wingate, PA 16880 814-355-1521
Philips Electronics Ltd., Elcoma Division, 601 Milner Avenue, Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
† Raytheon Co., Microwave & Power Tube Div., 190 Willow St., Waltham, MA 02154 617-899-8400
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
Rutherford Research, Box 249, Rutherford, NJ 07070 201-933-2091
§† SFE Technologies, 1501 1st St., San Fernando, CA 91340 818-365-9411
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95054 408-988-0700
§ Stetco, Inc., 3344 Schierhorn Ct., Franklin Pk., IL 60131 312-671-4208
Taiyo Yuden (USA) Inc., 714 W. Algonquin Rd., Arlington Heights, IL 60005-4493 312-364-6104
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518 213-638-1790
§ Tegal Scientific, Inc., Box 5905, Concord, CA 94524 415-827-1054
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
† Thinco Div., Hull Corp., Davisville Rd., Hatboro, PA 19040 215-672-7800
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600
§† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
§† West-Cap Arizona, Sub. of SFE Technologies, 2201 East Elvira Road, Tucson, AZ 85706 602-294-2646
† Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 ... 602-861-1856
Won Tronics, Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057 213-381-2500
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Coils, Saturable Reactor-1800

Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1209,1212-1213
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•1239
Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2214
† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•1244
Gowanda Electronics Corp., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 ..... A•1245
Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ..... A•2250

§† **Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050** ..... **A•1246**
Nytronics Components Grp., Inc., 700 Orange St., Darlington, SC 29532, 803-393-5421 ..... **B•1019**
† **Oram High Voltage, P.O. Box 1176, Dayton, TX 77535, 409-258-5553** .... **D•1859**
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... **A•2365**
Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, 513-871-3777 ..... **A•1287**
Talema Electronic, Inc., 301 N. Highway 63, Rolla, MO 65401, 314-364-0882 ..... **A•2390**
§ **Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131, 408-432-8020** ..... **A•1295,1700**
† **Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199, 816-761-6314** ..... **A•1300**
§† **United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600** ..... **A•2429**
§ Able Power and Engineering Inc., 1222 N. Delta St., S. San Gabriel, CA 91770 818-571-6260
AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
Anro Elctrn. Inds. Ltd., 300 Wildcat Rd., Downsview, ON, CANADA M3J 2N5 416-661-2600
† Atlas Engineering Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Bey Electric, Inc., 362 Main St., Box 548, Lincoln Park, NJ 07035 201-694-5000
† Bicron Electronics, 100 Barlow Street, Canaan, CT 06018 203-824-5125
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
Cross Electronics, 100 Commonwealth Dr., Warrendale, PA 15086 412-776-1591
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§ Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360
† Electrocom Industries, 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5770 Thornwood Dr., Goleta, CA 93117 805-964-0751
Elma Engineering, 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
Genisco Technology Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
Hipotronics Inc., P.O. Drawer A, Brewster, NY 10509 914-279-8091
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301 201-782-5525
† Industrial Control Co., 3100 Pineda Ave., Rockledge, FL 32955 305-259-7105
KGS Electronics, Inc., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
LEPCO/Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 .. 512-546-1625
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Northlake Engineering, Inc., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
Penn-Tran Corp., Box 1321, Rte. 144N, Wingate, PA 16880 814-355-1521
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861 201-826-4700
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729 ..... 516-586-5566; 1-800-645-5828
Rtron Corp., 7324 Lawndale, Skokie, IL 60076 312-679-7180
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
Torelco, Inc., 14 Paine Ave., P. O. Box 560, Irvington, NJ 07111 201-374-8641
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
Walker Power, Inc., Walker Magnetics Group, 10 B Mill St., Warner, NH 03278 603-456-3111
† Wayne Transformer Co., Inc., 666 Pacific St., Brooklyn, NY 11217 718-783-9007
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

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§† **Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224-5825, 213-537-5200** ..... **A•1202-1203,1205**
Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... **A•1208-1209,1217-1222**
§† **Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301** ..... **A•1233,1238**
§† **Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600** ..... **A•1241-1243**
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... **A•1244**
§† **Gowanda Electronics Corp., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234** ..... **A•1245**
† **Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061, 913-782-0012** ..... **A•2239**
North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... **A•1247**
§† **Nytronics Components Grp., Inc., 700 Orange St., Darlington, SC 29532, 803-393-5421** ..... **A•1248,1251-1257,1266, B•1019**
† **Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... **A•1271-1275**
† **Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501** ..... **A•1277**
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... **A•2365**
§† **RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054** ..... **A•2011**
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... **A•1282-1283**
† **Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, 513-871-3777** ..... **A•1287**
Talema Electronic, Inc., 301 N. Highway 63, Rolla, MO 65401, 314-364-0882 ..... **A•2390**
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518, 213-638-1790 ..... **A•1291,1293,1695,2395-2396, D•1983**
TDK Corporation, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku,, Tokyo, JAPAN 103, (03) 278-5111 ..... **A•1294**
§ **Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070** ..... **A•1296**
† **Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199, 816-761-6314** ..... **A•1300**
§† **United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600** ..... **A•2428-2429**
Wilco Corp., 6451 Saguaro Court, Indianapolis, IN 46268, 317-293-9300 ..... **A•1316**
Anro Elctrn. Inds. Ltd., 300 Wildcat Rd., Downsview, ON, CANADA M3J 2N5 416-661-2600
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147 305-696-6660
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
† Bicron Electronics, 100 Barlow Street, Canaan, CT 06018 203-824-5125
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
† Cramer Coil & Transformer Co., Inc., 401 Progress Dr., Saukville, WI 53080 414-284-9425
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
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Elma Engineering, 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
§ Frontier Electronics, 6311 DeSoto Ave., Ste. K, Woodland Hills, CA 91367 818-888-6242
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301 201-782-5525
§† Inductive Prods., Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
§† JB Electronic Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
§† Jeffers Electronics, Grand Plaza, 945 Grand Ave., Nogales, AZ 85621 ... 602-287-5851
Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 ..... 201-396-9400; 1-800-223-0603
† Lenox-Fugle Electronics, 100 Sylvania Pl., S. Plainfield, NJ 07080 201-756-1164
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861 201-826-4700
§† SFE Technologies, 1501 1st St., San Fernando, CA 91340 818-365-9411
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
§ Vitec Electronic Corporation, 1525A East Acequia, Visalia, CA 93291 ... 209-739-1077
§† West-Cap Arizona, Sub. of SFE Technologies, 2201 East Elvira Road, Tucson, AZ 85706 602-294-2646

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§ **Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301** ..... **A•1239**
§ **Deltrol Controls, 2745 S. 19th St., Milwaukee, WI 53215, 414-671-6800** ..... **B•1614,1617**
§† **Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., 3418 N. Milwaukee, Chicago, IL 60641, 312-283-4000** ..... **B•1619-1621**
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379, 203-599-2075 ..... **B•1402**
Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... **A•2214**
† **ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400** ..... **A•1558**
Gowanda Electronics Corp., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 ..... **A•1245**
Liberty Controls, 500 Brookforest Ave., Shorewood, IL 60435, 815-725-2241 ..... **B•1626**
Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ..... **A•2250**
† **Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501** ..... **A•1277**
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... **A•1282**
Ajax Magnethermic Corp., 1745 Overland Ave., N.E., Warren, OH 44482 216-372-8511
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ..... 818-765-8300;800-423-3186
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838

American Magnetics, P.O. Box 2509, Oak Ridge, TN 37831-2509 615-482-1056
Andover, Inc., 310 North Earl Avenue, Lafayette, IN 47904 317-447-1157
Anro Elctrn. Inds. Ltd., 300 Wildcat Rd., Downsview, ON, CANADA M3J 2N5 416-661-2600
Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057 213-381-2500
† A.P.W. Co., Inc., 72 W. Main, Rockaway, NJ 07866 201-627-0643
Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
§ Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33069 305-979-7920
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147 305-696-6660
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
† Bicron Electronics, 100 Barlow Street, Canaan, CT 06018 203-824-5125
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
† Computer Components, Inc., 629 Fifth Ave., Pelham, NY 10803 914-738-1611
Cryomagnetics, Inc., 739 Emory Valley Rd., Oak Ridge, TN 37830 615-482-9551
Custom Bobbin Windings, A & K Corporation, P.O. Box 2369, Zanesville, OH 43702-2369 614-452-6973
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
† Dia-Netics, Inc., 18823 Napa St., Northridge, CA 91324 818-886-2616
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§ Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360
Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
Electrocom Industries, 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
§† Electronic Coil Corp., Farmington Industrial Park, Farmington, CT 06032 203-677-6731
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Elma Engineering, 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
Endicott Coil, 24 Charlotte St., Binghamton, NY 13905 607-797-1263
The Five Star Co., 120 W. Main St., Plantsville, CT 06479 203-628-5561
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
† Genisco Technology Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
Grand Transformers, 1500 Marion St., Grand Haven, MI 49417 616-842-5430
§ ITT General Controls Div., Intl. Telephone & Telegraph Corp., 801 Allen Ave., Glendale, CA 91201 213-842-6131
§† Jaico Products, Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, IL 60622 312-421-1090
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 ..... 201-396-9400; 1-800-223-0603
Kearney/Wabash Electrical Components, 1375 Swan Street, Huntington, IN 46750 219-356-8300
LDJ Incorporated, 2200 Stephenson Hwy., P.O. Box 219, Troy, MI 48099-0219 313-528-2202
Line Electric Products, 122 Naubuc Ave., Glastonbury, CT 06033 ..... 203-659-3573; 1-800-331-1137
† Lisk, G. W., Co., 2 South St., Clifton Springs, NY 14432 315-462-2611
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnos, 6 Old School House Rd., Harvard, MA 01451 617-456-8880
Mini-Magnetics Co., Inc., 1100 Fulton Place, Fremont, CA 94539 415-490-7500
§ Namco Controls, An Acme-Cleveland Co., 7567 Tyler Blvd., Mentor, OH 44060 216-946-9900
† Northlake Engineering, Inc., 999 Anita Ave., Antioch, IL 60002 312-395-5710
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
† PCA Electronics, 16799 Schoenborn St., Sepulveda, CA 91343 818-892-0761
Permaluster, Inc., 1844 N. Keystone St., Burbank, CA 91504 ..... 213-849-4543; 213-849-6454
† SFE Technologies, 1501 1st St., San Fernando, CA 91340 818-365-9411
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† SR Engineering, BW/IP International, Inc., 13961 Nautilus Dr., Dept. E, Garden Grove, CA 92643 714-554-4200
Stangenes Industries, Inc., 1052 East Meadow Circle, Palo Alto, CA 94303 415-493-0814
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Trinetics Inc., 55807 Currant Rd., Mishawaka, IN 46545-4899 219-259-8535
Vanguard Relay Corp., 333 Strawberry Field Rd., Warwick, RI 02886 401-732-0700
§ Vitec Electronic Corporation, 1525A East Acequia, Visalia, CA 93291 209-739-1077
Walker Scientific, Rockdale St., Worcester, MA 01606 ..... 617-852-3674;617-853-3232
† Wayne Transformer Co., Inc., 666 Pacific St., Brooklyn, NY 11217 718-783-9007
Won Tronics, Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057 213-381-2500

Coils, Switching, Power-1800

Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•2280-2281

Coils, Telephone-1800

BH Electronics, Inc., 12219 Wood Lk. Dr., Burnsville, MN 55337, 612-894-9590 ..... A•1207,2198-2199
§† Daburn Electronics & Cable Corp., 70 Oak St., Norwood, NJ 07648, 201-768-5400 ..... C•1838
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•1239
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•1246,2292-2294
Para-Line Transformer Co., Inc., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2318
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1271
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2359,2361,2365
RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2011
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1282
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518, 213-638-1790 ..... A•1291,1695
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1296
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199, 816-761-6314 ..... A•1300
§ Vitec Electronic Corporation, 1525A East Acequia, Visalia, CA 93291, 209-739-1077 ..... A•2435-2437
§ Able Power and Engineering Inc., 1222 N. Delta St., S. San Gabriel, CA 91770 818-571-6260
AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Anro Elctrn. Inds. Ltd., 300 Wildcat Rd., Downsview, ON, CANADA M3J 2N5 416-661-2600
Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057 213-381-2500
† A.P.W. Co., Inc., 72 W. Main, Rockaway, NJ 07866 201-627-0643
Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
† Dia-Netics, Inc., 18823 Napa St., Northridge, CA 91324 818-886-2616
Electrocom Industries, 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
§ Electronic Coil Corp., Farmington Industrial Park, Farmington, CT 06032 203-677-6731
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Foxboro/PCG, The Foxboro Company, 600 N. Bedford St., E. Bridgewater, MA 02333 508-378-5260
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
GTE SUPPLY, GTE Communications Systems, 5225 Wiley Post Way, Salt Lake City, UT 84116 800-433-4837
Industrial Midwec Capacitor Corp., 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
§† JB Electronic Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 ..... 201-396-9400; 1-800-223-0603
LEPCO/Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Mini-Magnetics Co., Inc., 1100 Fulton Place, Fremont, CA 94539 415-490-7500
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861 201-826-4700
† Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 312-543-6400
† RMS Electronics Inc., 50 Antin Pl., Bronx, NY 10462 ..... 212-892-6700;800-223-8312
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600
Won Tronics, Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057 213-381-2500

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† Abbott Technologies, Inc., Burbank Division, Transformers, 639 So. Glenwood Pl., Burbank, CA 91506, 818-841-3630 ..... A•2157
Amecon, Inc., 1900 S. Chris La., Anaheim, CA 92805, 714-634-2220;800-392-2292 ..... A•2167-2169,2174
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147, 305-696-6660 ..... A•1194-1196
§† Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224-5825, 213-537-5200 ..... A•1199,1204
BH Electronics, Inc., 12219 Wood Lk. Dr., Burnsville, MN 55337, 612-894-9590 ..... A•1206-1207
Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1209
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764, 802-287-4055 ..... A•1223
§† Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•1235-1238
§† Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600 ..... A•1241-1242
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, 605-296-3462/3487 ..... A•2212
† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2214
† ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558
§† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•1244

§† **Gowanda Electronics Corp., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234** ..... **A•1245**

† **Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061, 913-782-0012** ..... **A•2239**

Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... **A•2248**

Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ..... **A•2250-2251**

§† **Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050** ..... **A•1246,2280-2281**

† **PCA Electronics, 16799 Schoenborn St., Sepulveda, CA 91343, 818-892-0761** ..... **A•1610**

† **Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... **A•1271**

† **Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501** ..... **A•1277**

† **Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950** ..... **A•2351**

† **Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861, 201-826-4700** ..... **A•1281,2352-2353**

Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... **A•2365**

§† **RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054** ..... **A•2011**

Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... **A•1284**

† **Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, 513-871-3777** ..... **A•1287**

Talema Electronic, Inc., 301 N. Highway 63, Rolla, MO 65401, 314-364-0882 ..... **A•2390-2391**

Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518, 213-638-1790 ..... **A•1291,1293,1695,2395, D•1983**

† **Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105** ..... **A•2407, B•1022-1025**

§ **Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131, 408-432-8020** ..... **A•1295,1700**

§ **Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070** ..... **A•1297**

Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, 301-464-2100 ..... **A•1298,2412**

† **Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199, 816-761-6314** ..... **A•1300,1304-1305,1308-1315**

§† **United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600** ..... **A•2428**

Wilco Corp., 6451 Saguaro Court, Indianapolis, IN 46268, 317-293-9300 ..... **A•1316,1318**

§† Able Power and Engineering Inc., 1222 N. Delta St., S. San Gabriel, CA 91770 818-571-6260

† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024

Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006

§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ..... 818-765-8300;800-423-3186

Andover, Inc., 310 North Earl Avenue, Lafayette, IN 47904 317-447-1157

Anro Elctrn. Inds. Ltd., 300 Wildcat Rd., Downsview, ON, CANADA M3J 2N5 416-661-2600

Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100

§ Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33069 305-979-7920

† Atlas Engineering Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100

§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100

Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302 201-432-0463

Bey Electric, Inc., 362 Main St., Box 548, Lincoln Park, NJ 07035 201-694-5000

† Bicron Electronics, 100 Barlow Street, Canaan, CT 06018 203-824-5125

† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148

Capco, Box 1028, Grand Junction, CO 81502 303-243-8751

§† Capcon, Inc., 147 West 25th Street, New York, NY 10001 212-243-6275

Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379

† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 915-592-9985

Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775

Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640

† Cramer Coil & Transformer Co., Inc., 401 Progress Dr., Saukville, WI 53080 414-284-9425

Cross Electronics, 100 Commonwealth Dr., Warrendale, PA 15086 412-776-1591

§ Current Ring Co. Inc., 252 Sunset Drive, P. O. 1525, Ballwin, MO 63011 800-325-8653

§ De Coursey Engineering Laboratory, 11828 W. Jefferson, Culver City, CA 90230 ..... 213-EX7-9668

† Delta Products Corporation, 3823 Spinnaker Ct., Fremont, CA 94538 415-770-0660

† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798

† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911

Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520

† Electrocom Industries, 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743

§ Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300

† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222

Electro-Pacific, 5770 Thornwood Dr., Goleta, CA 93117 805-964-0751

† El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300

Endicott Coil, 24 Charlotte St., Binghamton, NY 13905 607-797-1263

† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300

§ Frontier Electronics, 6311 DeSoto Ave., Ste. K, Woodland Hills, CA 91367 818-888-6242

Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006

† Genisco Technology Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750

Grand Transformers, 1500 Marion St., Grand Haven, MI 49417 616-842-5430

Hurricane Electronics Lab, P.O. Box 1280, Hurricane, UT 84737 801-635-2003

§ Inductive Prods., Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572

Industrial Midwec Capacitor Corp., 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120

§† JB Electronic Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080

† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 ..... 201-396-9400; 1-800-223-0603

KGS Electronics, Inc., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786

Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480

LEPCO/Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625

† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752

† Magnetic Component Engineering, Inc., 11379 Playa Street, Culver City, CA 90230 213-398-4761

† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054

† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166

§ Millen Components, Electronic Instr. & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-6951

Mini-Magnetics Co., Inc., 1100 Fulton Place, Fremont, CA 94539 415-490-7500

Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411

Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932

† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600

† Perkin-Elmer Corp., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132 203-762-4786

§† Powertron Corporation, Rte. 15, Box 932, Sparta, NJ 07871 201-579-5599

† Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 312-543-6400

§ Pulse Engineering, Inc., 7250 Convoy Ct., P.O. Box 12235, San Diego, CA 92112 619-268-2400

§ QPL Magnetics, Inc., P.O.BOX C, Lake Grove, NY 11755 516-589-3331

† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400

Ross Engineering Corp., 540 Westchester Dr., Campbell, CA 95008 408-377-4621

Rtron Corp., 7324 Lawndale, Skokie, IL 60076 312-679-7180

† Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173

† SFE Technologies, 1501 1st St., San Fernando, CA 91340 818-365-9411

§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700

† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700

† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma

§† Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342

South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866

Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900

Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483 619-575-9353

Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95054 408-988-0700

† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200

Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581

Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195

Torelco, Inc., 14 Paine Ave., P. O. Box 560, Irvington, NJ 07111 201-374-8641

† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050

† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800

Trancor, 108 N. High St., P.O. Box 907, San Saba, TX 76877 915-372-6127

† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880

† Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245 619-458-1471

§† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100

† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443

† Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 602-861-1856

Won Tronics, Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057 213-381-2500

§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Coils, Transducer-1800

Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ..... **A•2250-2251**

Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131, 408-432-8020 ..... **A•1295,1700**

† **Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199, 816-761-6314** ..... **A•1300**

† **United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600** ..... **A•2429**

Anro Elctrn. Inds. Ltd., 300 Wildcat Rd., Downsview, ON, CANADA M3J 2N5 416-661-2600

§ Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33069 305-979-7920

† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147 305-696-6660

Capco, Box 1028, Grand Junction, CO 81502 303-243-8751

Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379

Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640

† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798

† Dia-Netics, Inc., 18823 Napa St., Northridge, CA 91324 818-886-2616

Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520

§† Electronic Coil Corp., Farmington Industrial Park, Farmington, CT 06032 203-677-6731

† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222

Endicott Coil, 24 Charlotte St., Binghamton, NY 13905 607-797-1263

Kearney/Wabash Electrical Components, 1375 Swan Street, Huntington, IN 46750 219-356-8300

Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480

Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
† Perkin-Elmer Corp., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132 203-762-4786
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861 201-826-4700
§† Powertron Corporation, Rte. 15, Box 932, Sparta, NJ 07871 201-579-5599
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729 ..... 516-586-5566; 1-800-645-5828
Richard-Lee Co., Box 724, New Providence, NJ 07974 201-276-0710
† Roanwell, 180 Varick St., New York, NY 10014 212-989-1090
§ Rye Industries, Inc., 125 Spencer Pl., P.O. Box M, Mamaroneck, NY 10543 914-698-0080
Sensor Corp., Box 140, Scottdale, PA 15683 412-887-4080
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Transducer Systems, Inc., 1510 Delp Dr., Kulpsville, PA 19443 215-256-4611
† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Wayne Transformer Co., Inc., 666 Pacific St., Brooklyn, NY 11217 718-783-9007

Coils, Transformer-1800

† Abbott Technologies, Inc., Burbank Division, Transformers, 639 So. Glenwood Pl., Burbank, CA 91506, 818-841-3630 ..... A•2157
Amecon, Inc., 1900 S. Chris La., Anaheim, CA 92805, 714-634-2220;800-392-2292 ..... A•2176
Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1209
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•1238
§† Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., 3418 N. Milwaukee, Chicago, IL 60641, 312-283-4000 ..... B•1619
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379, 203-599-2075 ..... B•1402
† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2214
† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•1244
Foxboro/PCG, The Foxboro Company, 600 N. Bedford St., E. Bridgewater, MA 02333, 508-378-5260 ..... A•2235
† Gowanda Electronics Corp., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 ..... A•1245
Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ..... A•2250
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•1246
North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•1247
† Oram High Voltage, P.O. Box 1176, Dayton, TX 77535, 409-258-5553 .... D•1859
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1271
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1277
Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2350
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861, 201-826-4700 ..... A•1281
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2365
RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2011
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1282
† Signal Transformer Co., Inc., Insilco Corporation, 500 Bayview Ave., Inwood, NY 11696, 516-239-5777 ..... A•2372
Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, 513-871-3777 ..... A•1287
Superior Electric, 383 Middle St., Bristol, CT 06010, 203-582-9561 .. A•2370-2371
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025
§ Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131, 408-432-8020 ..... A•1295,1700
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1297
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199, 816-761-6314 ..... A•1300,1304-1305,2421
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763, 516-654-1880 ..... A•2426
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600 ..... A•2429
§ Vitec Electronic Corporation, 1525A East Acequia, Visalia, CA 93291, 209-739-1077 ..... A•2439
Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010
§† Able Power and Engineering Inc., 1222 N. Delta St., S. San Gabriel, CA 91770 818-571-6260
Acme Transformer, Acme Electric Corporation, Rte. 4, Box 54, Lumberton, NC 28358 919-738-1121
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
Andover, Inc., 310 North Earl Avenue, Lafayette, IN 47904 317-447-1157
Anro Elctrn. Inds. Ltd., 300 Wildcat Rd., Downsview, ON, CANADA M3J 2N5 416-661-2600
† A.P.W. Co., Inc., 72 W. Main, Rockaway, NJ 07866 201-627-0643
Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
§ Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33069 305-979-7920
† Atlas Engineering Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147 305-696-6660
† Avionic Instruments, 1414 Randolph Ave., Avenel, NJ 07001 201-388-3500
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224-5825 213-537-5200
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
Bey Electric, Inc., 362 Main St., Box 548, Lincoln Park, NJ 07035 201-694-5000
BH Electronics, Inc., 12219 Wood Lk. Dr., Burnsville, MN 55337 612-894-9590
† Bicron Electronics, 100 Barlow Street, Canaan, CT 06018 203-824-5125
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
Capco, Box 1028, Grand Junction, CO 81502 303-243-8751
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
† Computer Components, Inc., 629 Fifth Ave., Pelham, NY 10803 914-738-1611
Computer Power Inc., 124 W. Main St., High Bridge, NJ 08829 ..... 201-638-8000; 800-526-5088
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
† Cramer Coil & Transformer Co., Inc., 401 Progress Dr., Saukville, WI 53080 414-284-9425
Cross Electronics, 100 Commonwealth Dr., Warrendale, PA 15086 412-776-1591
Custom Bobbin Windings, A & K Corporation, P.O. Box 2369, Zanesville, OH 43702-2369 614-452-6973
C W S, 17 Midland Dr., Norwich, NY 13815 607-334-5366
De Coursey Engineering Laboratory, 11828 W. Jefferson, Culver City, CA 90230 ..... 213-EX7-9668
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Delta Products Corporation, 3823 Spinnaker Ct., Fremont, CA 94538 415-770-0660
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
Diamond Magnetics, 235 Tank Farm Rd., Ste. G, San Luis Obispo, CA 93401 805-544-4019
† Dia-Netics, Inc., 18823 Napa St., Northridge, CA 91324 818-886-2616
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360
Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
Electrocom Industries, 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
§ Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
§† Electronic Coil Corp., Farmington Industrial Park, Farmington, CT 06032 203-677-6731
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5770 Thornwood Dr., Goleta, CA 93117 805-964-0751
Elma Engineering, 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
Endicott Coil, 24 Charlotte St., Binghamton, NY 13905 607-797-1263
Engineering Design & Sls., One E.D.S. Way, Danville, VA 24540 804-685-7073
§† E-Tronics, 16774 Schoenborn, Sepulveda, CA 91343 818-892-7279
The Five Star Co., 120 W. Main St., Plantsville, CT 06479 203-628-5561
§ Frontier Electronics, 6311 DeSoto Ave., Ste. K, Woodland Hills, CA 91367 818-888-6242
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
General Magnetics, 211 Grove St., Bloomfield, NJ 07003 201-743-2700
† Genisco Technology Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
Gettysburg Transformer Corporation, 1380 Old Harrisburg Rd., P.O. Box 99, Gettysburg, PA 17325 717-334-2191
Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301 201-782-5525
Hurricane Electronics Lab, P.O. Box 1280, Hurricane, UT 84737 801-635-2003
§ Inductive Prods., Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
Industrial Midwec Capacitor Corp., 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
§† JB Electronic Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Kearney/Wabash Electrical Components, 1375 Swan Street, Huntington, IN 46750 219-356-8300
KGS Electronics, Inc., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
§† Krystinel Corp., 126 Pennsylvania Ave., Paterson, NJ 07509 201-345-8900
Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
LEPCO/Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 .. 512-546-1625
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetic Component Engineering, Inc., 11379 Playa Street, Culver City, CA 90230 213-398-4761
† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704 516-587-0510
Merrimack Magnetics Corp., 121 Hale St., Lowell, MA 01851 617-458-1487
Mini-Magnetics Co., Inc., 1100 Fulton Place, Fremont, CA 94539 415-490-7500
Multi Products International, 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009 201-239-8183
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., 999 Anita Ave., Antioch, IL 60002 312-395-5710

† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
† PCA Electronics, 16799 Schoenborn St., Sepulveda, CA 91343 818-892-0761
Permaluster, Inc., 1844 N. Keystone St., Burbank, CA 91504 ..... 213-849-4543; 213-849-6454
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 .. 312-543-6400
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
§ Pulse Engineering, Inc., 7250 Convoy Ct., P.O. Box 12235, San Diego, CA 92112 619-268-2400
§ QPL Magnetics, Inc., P.O.BOX C, Lake Grove, NY 11755 516-589-3331
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
† SFE Technologies, 1501 1st St., San Fernando, CA 91340 818-365-9411
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
§† Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95054 408-988-0700
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518 213-638-1790
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
Trancor, 108 N. High St., P.O. Box 907, San Saba, TX 76877 915-372-6127
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064 213-478-8224
† Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245 ... 619-458-1471
† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
Varo, Inc., Electron Devices Div., 2203 W. Walnut St., Garland, TX 75046 214-487-4129
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
Walker Power, Inc., Walker Magnetics Group, 10 B Mill St., Warner, NH 03278 603-456-3111
† Wayne Transformer Co., Inc., 666 Pacific St., Brooklyn, NY 11217 718-783-9007
Xylog Corp., 83 Hobart St., Hackensack, NJ 07601 201-489-4040

Coils, TV (All Types)-1800

Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1209,1219
Caddell Coil Corp., 35M Main St., Poultney, VT 05764, 802-287-4055 .... A•1223
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•1235,1239
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2365
Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, 513-871-3777 ..... A•1287
Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131, 408-432-8020 ..... A•1295,1700
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1296
Anro Elctrn. Inds. Ltd., 300 Wildcat Rd., Downsview, ON, CANADA M3J 2N5 416-661-2600
† Cramer Coil & Transformer Co., Inc., 401 Progress Dr., Saukville, WI 53080 414-284-9425
† Delta Products Corporation, 3823 Spinnaker Ct., Fremont, CA 94538 415-770-0660
§ Frontier Electronics, 6311 DeSoto Ave., Ste. K, Woodland Hills, CA 91367 818-888-6242
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
Penn-Tran Corp., Box 1321, Rte. 144N, Wingate, PA 16880 814-355-1521
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729 ..... 516-586-5566; 1-800-645-5828
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

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§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224-5825, 213-537-5200 ..... A•1202-1203,1205
Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1209,1217,1221-1222
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764, 802-287-4055 .... A•1223
Coilcraft, 1102 Silver Lake Rd., Cary, IL 60013, 312-639-2361 ..... A•1225, 1227-1229
§† Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600 ..... A•1241-1242
§† Gowanda Electronics Corp., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 ..... A•1245
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061, 913-782-0012 ..... A•2239
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... A•2248
North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•1247
§† Nytronics Components Grp., Inc., 700 Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1266-1268, B•1019
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1277
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2365
RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2011
§† Sprague-Goodman Elctrns., Inc., 134 Fulton Ave., Garden City Pk., NY 11040, 516-746-1385 ..... A•1175
Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, 513-871-3777 ..... A•1287
Superior Electric, 383 Middle St., Bristol, CT 06010, 203-582-9561 .. A•2370-2371
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1296
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600 ..... A•2428
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
Anro Elctrn. Inds. Ltd., 300 Wildcat Rd., Downsview, ON, CANADA M3J 2N5 416-661-2600
Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147 305-696-6660
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
† Coil-Q Corp., 340 Bronxville Rd, Bronxville, NY 10708 914-337-4775
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
† Cramer Coil & Transformer Co., Inc., 401 Progress Dr., Saukville, WI 53080 414-284-9425
† Delta Products Corporation, 3823 Spinnaker Ct., Fremont, CA 94538 415-770-0660
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
Electrocom Industries, 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Elma Engineering, 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
§ Frontier Electronics, 6311 DeSoto Ave., Ste. K, Woodland Hills, CA 91367 818-888-6242
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
† Magnetic Component Engineering, Inc., 11379 Playa Street, Culver City, CA 90230 213-398-4761
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
Permaluster, Inc., 1844 N. Keystone St., Burbank, CA 91504 ..... 213-849-4543; 213-849-6454
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861 201-826-4700
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729 ..... 516-586-5566; 1-800-645-5828
§ SFE Technologies, 1501 1st St., San Fernando, CA 91340 818-365-9411
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
§ Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95054 408-988-0700
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064 213-478-8224
† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100

Coils, Vidicon Alignment-1800

† CELCO, 70 Constantine Dr., Mahwah, NJ 07430 201-327-1123
Hamamatsu Photonics K.K., 325-6 Sunayama-Cho, Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
Hitachi America, Ltd., 2210 O'Toole Ave., San Jose, CA 95131 408-435-8300
† Penn-Tran Corp., Box 1321, Rte. 144N, Wingate, PA 16880 814-355-1521
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729 ..... 516-586-5566; 1-800-645-5828

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International Power Devices, 155 N. Beacon St., Brighton, MA 02135, 617-782-3331 ..... D•1774-1778

Power Products Div., Computer Products, Inc., 2981 Gateway Dr., Pompano Bch., FL 33069-4803, 305-975-7660 ..... D•1661

§ Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245, 619-458-1471 ..... D•2031,2035

† Computer Products Inc., Power Conversion, 2900 Gateway Drive, Pompano Bch., FL 33069-4803 305-974-5500

International Power Sources, Inc., 10 Cochituate St., Natick, MA 01760 .. 617-651-1818

Pulse Engineering, Inc., 7250 Convoy Ct., P.O. Box 12235, San Diego, CA 92112 619-268-2400

§ Stevens-Arnold Div., Computer Prods., Inc., 7 Elkins St., So. Boston, MA 02127 617-268-1170

Switching Power Inc., 3601 Veterans Hwy, Ronkonkoma, NY 11779 516-981-7231

Tectrol, Inc., 39 Kodiak Cres., Downsview, Ontario, CANADA M3J 3E5 .. 416-630-8108

† Telkoor Electronics Industries, Ltd., 510 Broadhollow Rd., Ste. 307, Melville, NY 11747 516-752-0982

Tower Electronics, Inc., 281 S. Commerce Circle, Fridley, MN 55432 612-571-3737

§ Valor Power Systems Div., Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245 619-458-1471

Converters, DC to DC, Less Than 30 VDC Output-4000 — ***See Vol. D***

Converters, DC to DC, 30 to 300 VDC Output-4000 — ***See Vol. D***

Converters, DC to DC, 300 to 1,000 VDC Output-4000 — ***See Vol. D***

Converters, DC to DC, Greater Than 1,000 VDC Output-4000 — ***See Vol. D***

Converters, DC to Sine/Cosine-2325 — ***See Vol. D***

Converters, DC to Synchro-2325 — ***See Vol. D***

Converters, Digital to Analog-2325 — ***See Vol. D***

Converters, Digital to Paper Tape-2000 — ***See Vol. D***

Converters, Digital to Resolver-2325 — ***See Vol. D***

Converters, Digital to Synchro-2325 — ***See Vol. D***

Converters, Frequency to Frequency-1900 — ***See Vol. D***

Converters, Frequency to Voltage-2325 — ***See Vol. D***

Converters, Frequency, Logarithmic-4050 — ***See Vol. D***

Converters, Frequency Shift Keying-1900 — ***See Vol. D***

Converters, Frequency to DC-Also See Power Supplies, AC Input, DC Output-4000 — ***See Vol. D***

Converters, Graphic to Digital-2000 — ***See Vol. D***

Converters, Multiplying, Analog to Digital & Digital to Analog-2325 — ***See Vol. D***

Converters, Paper Tape to Magnetic Tape-2000 — ***See Vol. D***

Converters, Phase-4050 — ***See Vol. D***

Converters, Polar to Rectangular Coordinates-2325 — ***See Vol. D***

Converters, Power Frequency, Electronic-4050 — ***See Vol. D***

Converters, Power Frequency, Rotary-4050 — ***See Vol. D***

Converters, Pressure to DC, Pressure to Frequency — See Transducers, Pressure (Vol. B)

Converters, Rectangular to Polar-2325 — ***See Vol. D***

Converters, Resolver to Digital-2325 — ***See Vol. D***

Converters, Rotary — See Motor Generator Sets (Vol. D)

Converters, Serial to Parallel/Parallel to Serial-2325 — ***See Vol. D***

Converters, Synchro to Digital-2325 — ***See Vol. D***

Converters, Synchro to Linear DC-2325 — ***See Vol. D***

Converters, Synchro to Sine/Cosine-2325 — ***See Vol. D***

Converters, Telemetry-1900 — ***See Vol. D***

Converters, Thermal-5300 — ***See Vol. B***

Converters, UHF to VHF-1900 — ***See Vol. D***

Converters, VLF to HF-1900 — ***See Vol. D***

Converters, Voltage to Frequency-2325 — ***See Vol. D***

Converters (MIL) DC to DC-3475 — ***See Vol. D***

Converters (MIL), Frequency-3475 — ***See Vol. D***

Coolants, Circuit & Component — See Refrigerants, Spray (Vol. C)

Cooling Equipment — See Air Conditioners (Vol. C), Blowers & Fans (Vol. C), Heat Exchangers & Systems (Vol. C)

Cooling/Heating Modules, Thermoelectric-2600 — *See Vol. C*

Cooling Sprays — See Refrigerants, Spray (Vol. C)

Cords & Tapes, Lacing-6000 — *See Vol. C*

Cords, Communication, Control, Microphone, etc. — See Cable, Specific Type (Vol. C)

Cords, Line & Set, Extension-6000 — *See Vol. C*

Cords, Line (Lamp) — See Cable, Multiconductor (Vol. C)

Cords, Line, Resistance-6000 — *See Vol. C*

Cords, Patch-2100 — *See Vol. C*

Cords, Power-6000 — *See Vol. C*

Cords, Retractile-6000 — *See Vol. C*

Cords, Speaker Extension — See Cable, Audio (Vol. C)

Cords, Telephone, Modular — See Cable, Telephone (Vol. C)

Cords, Twin Lead — See Cable, Multiconductor (Vol. C)

Cords & Cable, Dial Drive-2400 — *See Vol. C*

Cords & Cord Sets, Telephone-6000 — *See Vol. C*

Cords & Cord Sets, International-6000 — *See Vol. C*

Cores, Ceramic-1850

† Centerflex Techn. Corp., 221 Seventh Ave., P.O. Box 21, Hawthorne, NJ 07507 201-423-0505
§ Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, NJ 07006 201-227-4222
† Honeywell Inc., Aerospace & Defense Grp., Honeywell Plaza, Minneapolis, MN 55408 612-870-5186
3M Co., Tech Ceramic Resources, 3M Center 225-4W, St. Paul, MN. 55101 617-736-0601
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080 404-436-1300
Permag, 400 Karin La., Hicksville, NY 11801 516-822-3311
† Quartzite Processing, Inc., 6 Holyoke St., Malden, MA 02148 617-322-3611
Steward, D. M., Mfg. Co., P.O. Box 510, Chattanooga, TN 37401 615-867-4100

Cores, Magnetic, Ferrite, L, E, etc.-1850

Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057, 213-381-2500 ..... D•1076
Dynapower Corporation, Box 3180, Farmington Hills, MI 48333, 313-553-4300 ..... D•1703,1706
§ Fair-Rite Prods., PO Box J, Wallkill, NY 12589, 914-895-2055 ..... C•1750
§ FDK America, Inc., Fuji Electromechanical Co., Ltd., 17326 Edwards Rd., Ste. A-130, Cerritos, CA 90701, 213-404-1770 ..... A•1319
§ Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830, 201-321-3400 ..... A•1321
§ TDK Corporation, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku,, Tokyo, JAPAN 103, (03) 278-5111 ..... A•1322-1324
§ Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131, 408-432-8020 ..... A•1329
§ Allen-Bradley Co., Magnetics Division, Div. of Rockwell Corp., 5900 N. Harrison St, Shawnee, OK 74801 405-275-2100
§ Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, NJ 07006 201-227-4222
Cosmo Corporation, 3239 W. 14th St., Cleveland, OH 44109 216-861-5594
Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
Ferronics, 52 N. Main St., Fairport, NY 14450 716-388-1020
§ Ferroxcube, Amperex Electronic Corp., 5083 Kings Hwy., Saugerties, NY 12477 914-246-2811
§ ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 ..... 516-753-0400; 800-862-2101
§† Krystinel Corp., 126 Pennsylvania Ave., Paterson, NJ 07509 201-345-8900
§† Magnetics, Spang & Co., Box 391, Butler, PA 16003-0391 412-282-8282
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
Permag, 400 Karin La., Hicksville, NY 11801 516-822-3311
Steward, D. M., Mfg. Co., P.O. Box 510, Chattanooga, TN 37401 615-867-4100
TDJ Co., Inc., 1154 Morena Blvd., San Diego, CA 92110 619-276-5920
Thomson Passive Components Corp., 6203 Variel Ave., Unit A, Woodland Hills, CA 91367 818-887-1010

Cores, Magnetic, Ferrite, Pot/Cup-1850

Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1209
Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600 ..... A•1241
§ Fair-Rite Prods., PO Box J, Wallkill, NY 12589, 914-895-2055 ..... C•1750
§ FDK America, Inc., Fuji Electromechanical Co., Ltd., 17326 Edwards Rd., Ste. A-130, Cerritos, CA 90701, 213-404-1770 ..... A•1319
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1285
§ Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830, 201-321-3400 ..... A•1321
§ Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131, 408-432-8020 ..... A•1329
§ Allen-Bradley Co., Magnetics Division, Div. of Rockwell Corp., 5900 N. Harrison St, Shawnee, OK 74801 405-275-2100
§ Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, NJ 07006 201-227-4222
Dynapower Corporation, Box 3180, Farmington Hills, MI 48333 313-553-4300
§ Ferroxcube, Amperex Electronic Corp., 5083 Kings Hwy., Saugerties, NY 12477 914-246-2811
§ ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 ..... 516-753-0400; 800-862-2101
§† Krystinel Corp., 126 Pennsylvania Ave., Paterson, NJ 07509 201-345-8900
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
§† Magnetics, Spang & Co., Box 391, Butler, PA 16003-0391 412-282-8282
Permag, 400 Karin La., Hicksville, NY 11801 516-822-3311
Steward, D. M., Mfg. Co., P.O. Box 510, Chattanooga, TN 37401 615-867-4100
TDJ Co., Inc., 1154 Morena Blvd., San Diego, CA 92110 619-276-5920
Thomson Passive Components Corp., 6203 Variel Ave., Unit A, Woodland Hills, CA 91367 818-887-1010

Cores, Magnetic, Ferrite, Slug-1850

Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1209
Dynapower Corporation, Box 3180, Farmington Hills, MI 48333, 313-553-4300 ..... D•1703,1706
§ Fair-Rite Prods., PO Box J, Wallkill, NY 12589, 914-895-2055 ..... C•1750
Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131, 408-432-8020 ..... A•1329
§ Allen-Bradley Co., Magnetics Division, Div. of Rockwell Corp., 5900 N. Harrison St, Shawnee, OK 74801 405-275-2100
§ Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, NJ 07006 201-227-4222
Ferronics, 52 N. Main St., Fairport, NY 14450 716-388-1020
§ Ferroxcube, Amperex Electronic Corp., 5083 Kings Hwy., Saugerties, NY 12477 914-246-2811
§† Krystinel Corp., 126 Pennsylvania Ave., Paterson, NJ 07509 201-345-8900
§† Magnetics, Spang & Co., Box 391, Butler, PA 16003-0391 412-282-8282
Permag, 400 Karin La., Hicksville, NY 11801 516-822-3311
Steward, D. M., Mfg. Co., P.O. Box 510, Chattanooga, TN 37401 615-867-4100
TDJ Co., Inc., 1154 Morena Blvd., San Diego, CA 92110 619-276-5920
Thomson Passive Components Corp., 6203 Variel Ave., Unit A, Woodland Hills, CA 91367 818-887-1010

Cores, Magnetic, Ferrite, Toroid-1850

Dynapower Corporation, Box 3180, Farmington Hills, MI 48333, 313-553-4300 ..... D•1703,1706
§ Fair-Rite Prods., PO Box J, Wallkill, NY 12589, 914-895-2055 ..... C•1750
§ FDK America, Inc., Fuji Electromechanical Co., Ltd., 17326 Edwards Rd., Ste. A-130, Cerritos, CA 90701, 213-404-1770 ..... A•1319
§ Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830, 201-321-3400 ..... A•1321
§ Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131, 408-432-8020 ..... A•1329
§ Allen-Bradley Co., Magnetics Division, Div. of Rockwell Corp., 5900 N. Harrison St, Shawnee, OK 74801 405-275-2100
§ Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, NJ 07006 201-227-4222
† CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
† CTS Corporation, Systems & Datacomm Division, 6900 Shady Oak Rd., Eden Prairie, MN 55344 612-941-9100
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
Ferronics, 52 N. Main St., Fairport, NY 14450 716-388-1020
§ Ferroxcube, Amperex Electronic Corp., 5083 Kings Hwy., Saugerties, NY 12477 914-246-2811
§ ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 ..... 516-753-0400; 800-862-2101
§† Krystinel Corp., 126 Pennsylvania Ave., Paterson, NJ 07509 201-345-8900
§† Magnetics, Spang & Co., Box 391, Butler, PA 16003-0391 412-282-8282
Permag, 400 Karin La., Hicksville, NY 11801 516-822-3311
Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675 201-666-5600
Steward, D. M., Mfg. Co., P.O. Box 510, Chattanooga, TN 37401 615-867-4100
TDJ Co., Inc., 1154 Morena Blvd., San Diego, CA 92110 619-276-5920
Thomson Passive Components Corp., 6203 Variel Ave., Unit A, Woodland Hills, CA 91367 818-887-1010

Cores, Magnetic, Ferrite, Yoke Section-1850

Dynapower Corporation, Box 3180, Farmington Hills, MI 48333, 313-553-4300 ..... D•1703,1706
§ FDK America, Inc., Fuji Electromechanical Co., Ltd., 17326 Edwards Rd., Ste. A-130, Cerritos, CA 90701, 213-404-1770 ..... A•1319
Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830, 201-321-3400 ..... A•1321
TDK Corporation, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku,, Tokyo, JAPAN 103, (03) 278-5111 ..... A•1322
Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131, 408-432-8020 ..... A•1329
§ Allen-Bradley Co., Magnetics Division, Div. of Rockwell Corp., 5900 N. Harrison St, Shawnee, OK 74801 405-275-2100
§ Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, NJ 07006 201-227-4222
Ferronics, 52 N. Main St., Fairport, NY 14450 716-388-1020
Steward, D. M., Mfg. Co., P.O. Box 510, Chattanooga, TN 37401 615-867-4100
TDJ Co., Inc., 1154 Morena Blvd., San Diego, CA 92110 619-276-5920
Thomson Passive Components Corp., 6203 Variel Ave., Unit A, Woodland Hills, CA 91367 818-887-1010

Cores, Magnetic, Metal Alloy (Other Than Silicon & Nickel-Iron)-1850

Dynapower Corporation, Box 3180, Farmington Hills, MI 48333, 313-553-4300 ..... D•1703,1706
Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131, 408-432-8020 ..... A•1329
† Arnold Engineering Company, Sub. SPS Technologies, 300 West Street, Marengo, IL 60152 815-568-2000
† Magnetics, Spang & Co., Box 391, Butler, PA 16003-0391 412-282-8282
Permag, 400 Karin La., Hicksville, NY 11801 516-822-3311
† Pyroferric International, Inc., 200 Madison St, Toledo, IL 62468 217-849-3300
SL Electronics, 300 Harvard Ave., Westville, NJ 08093 609-456-7300

Cores, Magnetic, Nickel-Iron, L, EE, F, & Ring Laminations-1850

Dynapower Corporation, Box 3180, Farmington Hills, MI 48333, 313-553-4300 ..... D•1703,1706
Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131, 408-432-8020 ..... A•1329
Framar Metal Products Co., Inc., 345 Carnegie Avenue, Kenilworth, NJ 07033 201-241-0710
† Magnetics, Spang & Co., Box 391, Butler, PA 16003-0391 412-282-8282
Permag, 400 Karin La., Hicksville, NY 11801 516-822-3311
SL Electronics, 300 Harvard Ave., Westville, NJ 08093 609-456-7300

Cores, Magnetic, Nickel-Iron, Toroid-1850

Dynapower Corporation, Box 3180, Farmington Hills, MI 48333, 313-553-4300 ..... D•1703,1706
Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131, 408-432-8020 ..... A•1329
† Arnold Engineering Company, Sub. SPS Technologies, 300 West Street, Marengo, IL 60152 815-568-2000
† Infinetics Inc., Friskem Div., 201 Vandever Ave., Wilmington, DE 19802 .. 302-658-2471
§† Krystinel Corp., 126 Pennsylvania Ave., Paterson, NJ 07509 201-345-8900
† Magnetics, Spang & Co., Box 391, Butler, PA 16003-0391 412-282-8282
Permag, 400 Karin La., Hicksville, NY 11801 516-822-3311
SL Electronics, 300 Harvard Ave., Westville, NJ 08093 609-456-7300

Cores, Magnetic, Powdered Iron, Pot/Cup-1850

Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600 ..... A•1241
Dynapower Corporation, Box 3180, Farmington Hills, MI 48333, 313-553-4300 ..... D•1703,1706
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1285
Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131, 408-432-8020 ..... A•1329
† Arnold Engineering Company, Sub. SPS Technologies, 300 West Street, Marengo, IL 60152 815-568-2000
Cortec, Inc., 15811 Chemical La, Huntington Bch, CA 92649 714-897-2529
Micrometals, 1190 N. Hawk, Anaheim, CA 92807 714-630-7420
† Pyroferric International, Inc., 200 Madison St, Toledo, IL 62468 217-849-3300

Cores, Magnetic, Powdered Iron, Slug-1850

Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1209
Dynapower Corporation, Box 3180, Farmington Hills, MI 48333, 313-553-4300 ..... D•1703,1706
Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131, 408-432-8020 ..... A•1329
† Arnold Engineering Company, Sub. SPS Technologies, 300 West Street, Marengo, IL 60152 815-568-2000
Cortec, Inc., 15811 Chemical La, Huntington Bch, CA 92649 714-897-2529
Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052 716-652-3600
Micrometals, 1190 N. Hawk, Anaheim, CA 92807 714-630-7420
† Pyroferric International, Inc., 200 Madison St, Toledo, IL 62468 217-849-3300
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Cores, Magnetic, Powdered Iron, Toroid-1850

Dynapower Corporation, Box 3180, Farmington Hills, MI 48333, 313-553-4300 ..... D•1703,1706
Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131, 408-432-8020 ..... A•1329
† Arnold Engineering Company, Sub. SPS Technologies, 300 West Street, Marengo, IL 60152 815-568-2000
Cortec, Inc., 15811 Chemical La, Huntington Bch, CA 92649 714-897-2529
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
Micrometals, 1190 N. Hawk, Anaheim, CA 92807 714-630-7420
† Pyroferric International, Inc., 200 Madison St, Toledo, IL 62468 217-849-3300

Cores, Magnetic, Powdered Permalloy, Toroid-1850

Dynapower Corporation, Box 3180, Farmington Hills, MI 48333, 313-553-4300 ..... D•1703,1706
Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131, 408-432-8020 ..... A•1329
† Arnold Engineering Company, Sub. SPS Technologies, 300 West Street, Marengo, IL 60152 815-568-2000
† Magnetics, Spang & Co., Box 391, Butler, PA 16003-0391 412-282-8282

Cores, Magnetic, Silicon C-1850

Dynapower Corporation, Box 3180, Farmington Hills, MI 48333, 313-553-4300 ..... D•1703,1706
† Arnold Engineering Company, Sub. SPS Technologies, 300 West Street, Marengo, IL 60152 815-568-2000
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Framar Metal Products Co., Inc., 345 Carnegie Avenue, Kenilworth, NJ 07033 201-241-0710
SL Electronics, 300 Harvard Ave., Westville, NJ 08093 609-456-7300

Cores, Magnetic, Silicon El, EE, & F Laminations-1850

Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057, 213-381-2500 ..... D•1076
Dynapower Corporation, Box 3180, Farmington Hills, MI 48333, 313-553-4300 ..... D•1703,1706
Framar Metal Products Co., Inc., 345 Carnegie Avenue, Kenilworth, NJ 07033 201-241-0710
SL Electronics, 300 Harvard Ave., Westville, NJ 08093 609-456-7300

Cores, Magnetic, Silicon, Toroid-1850

Dynapower Corporation, Box 3180, Farmington Hills, MI 48333, 313-553-4300 ..... D•1703,1706
† Arnold Engineering Company, Sub. SPS Technologies, 300 West Street, Marengo, IL 60152 815-568-2000
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
† Magnetics, Spang & Co., Box 391, Butler, PA 16003-0391 412-282-8282
SL Electronics, 300 Harvard Ave., Westville, NJ 08093 609-456-7300

Cores, Magnets & Ferrites-1850

Dynapower Corporation, Box 3180, Farmington Hills, MI 48333, 313-553-4300 ..... D•1703,1706
§ TDK Corporation, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku,, Tokyo, JAPAN 103, (03) 278-5111 ..... A•1325
Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131, 408-432-8020 ..... A•1329
§ Allen-Bradley Co., Magnetics Division, Div. of Rockwell Corp., 5900 N. Harrison St., Shawnee, OK 74801 405-275-2100
† Arnold Engineering Company, Sub. SPS Technologies, 300 West Street, Marengo, IL 60152 815-568-2000
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Fair-Rite Prods., PO Box J, Wallkill, NY 12589 914-895-2055
§ ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 ..... 516-753-0400; 800-862-2101
Magnet Sales & Mfg. Co. Inc., 11250 Playa Court, Culver City, CA 90230-6127 ..... 213-391-7213;800-421-6692
Steward, D. M., Mfg. Co., P.O. Box 510, Chattanooga, TN 37401 615-867-4100
TDJ Co., Inc., 1154 Morena Blvd., San Diego, CA 92110 619-276-5920

Corners, Waveguide — See Bends & Twists, Microwave (Vol. A)

Coulometers — See Timers, Electrolytic Cell (Vol. D)

Countermeasures (CM) Sets (MIL), Airborne-3475 — *See Vol. D*

CM Sets (MIL), Internal-3475 — *See Vol. D*

CM Sets (MIL), Mobile-3475 — *See Vol. D*

Counter/Timers-2900 — *See Vol. D*

Counters, Bidirectional-2200 — *See Vol. D*

Counters, Coil Winding-2200 — *See Vol. D*

Counters, Decade-2200 — *See Vol. D*

Counters, Directional-2200 — *See Vol. D*

Counters, Electromagnetic-2200 — *See Vol. D*

Counters, Event-2200 — *See Vol. D*

Counters, Frequency-2900 — *See Vol. D*

Counters, Mechanical-2200 — *See Vol. D*

Counters, Particle-2900 — *See Vol. D*

Counters, Photoelectric-2200 — *See Vol. D*

Counters, Predetermining — See Counters, Preset (Vol. D)

Counters, Preset-2200 — *See Vol. D*

Counters, Printing-2200 — *See Vol. D*

Counters, Proportional — See Counters, Particle (Vol. D)

Counters, Pulse-2200 — *See Vol. D*

Counters, Reversible — See Counters, Bidirectional (Vol. D)

Counters, Revolution-2200 — *See Vol. D*

Counters, Universal-2900 — *See Vol. D*

Couplers, Acoustic-1900 — *See Vol. D*

Couplers, Antenna-1900 — *See Vol. D*

Couplers, Communications, Acoustic, Telephone-1900 — *See Vol. D*

Couplers, Directional-3450

Amplifier Research, 160 School House Rd., Souderton, PA 18964-9990, 215-723-8181 ..... D•1005
† Applied Research, Inc., 111 New South Rd., Hicksville, NY 11802, 516-938-9700 ..... A•1764
Elcom Systems, Inc., 932 Clint Moore Rd., Boca Raton, FL 33487, 305-994-1774 ..... A•1768
† Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 350166, Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1775
§ Penstock Engineering Labs., Penstock, Inc., 520 Mercury Dr., Sunnyvale, CA 94086-4018, 408-730-0300 ..... A•1844
TRM, Inc., 401 Kelly Ave., Grenier Field, Manchester, NH 03103, 603-627-6000 ..... A•1845,1847
§† Adams-Russell, Anzac Div., 80 Cambridge St, Burlington, MA 01803 671-273-3333
Aiken Advanced Systems, Inc., Amstar Electronics Group, 5901 Edsall Rd., Alexandria, VA 22304-4197 703-370-0900
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St, Methuen, MA 01844 617-682-4661
Amphenol Products, 4300 Commerce Ct., Lisle, IL 60532 312-983-3500
§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd, E. Syracuse, NY 13057 315-432-8909
† Arra Inc., 15 Harold Ct, Bay Shore, NY 11706 516-231-8400
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Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
† Connecticut Microwave Corp., 106 Powder Mill Rd., Box 389, Canton, CT 06019 203-693-4247
§ Dielectric Communications, General Signal, Tower Hill Rd., Raymond, ME 04071 ..... 207-655-4555;800-341-9678
† Electrospace Systems, Inc., P. O. Box 831359, Richardson, TX 75083-1359 ..... 214-470-2106/2107
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† Lorch Electronics, Sub. of Vernitron Corp., 105 Cedar La., Englewood, NJ 07631 201-569-8282
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† Pasternack Enterprises, P.O. Box 16759, Irvine, CA 92713 714-261-1920
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§† Systron-Donner Microwave Div., 14844 Oxnard St, Van Nuys, CA 91409 818-786-1760
§† Telephonics Corporation/PRD Instruments, 770 Park Avenue, Huntington, NY 11743 ..... 516-549-6415/6102
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† Vectronics Microwave Corp., 113 Lincoln Blvd, Middlesex, NJ 08846 ... 201-356-2377
† Wavecom, Sub. of Loral Corp., 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
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§ Wiltron, 490 Jarvis Dr., Morgan Hill, CA 95037-2809 408-778-2000

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† Applied Research, Inc., 111 New South Rd., Hicksville, NY 11802, 516-938-9700 ..... A•1764
† Elcom Systems, Inc., 932 Clint Moore Rd., Boca Raton, FL 33487, 305-994-1774 ..... A•1768
† Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 350166, Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1775
North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•2300-2302
§ Penstock Engineering Labs., Penstock, Inc., 520 Mercury Dr., Sunnyvale, CA 94086-4018, 408-730-0300 ..... A•1844
TRM, Inc., 401 Kelly Ave., Grenier Field, Manchester, NH 03103, 603-627-6000 ..... A•1845,1847
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Amplifier Research, 160 School House Rd., Souderton, PA 18964-9990 215-723-8181
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† Pasternack Enterprises, P.O. Box 16759, Irvine, CA 92713 714-261-1920
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† Reeve Electronics, Mellish E. Murray, 1715 W. Carroll Ave., Chicago, IL 60612 312-670-0150
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§† Pioneer Components, 2352 E. 66th St., Brooklyn, NY 11234 718-444-3880
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X-Tron Electronics, Inc., 1869 National Avenue, Hayward, CA 94545 415-783-2145

Crystals, Piezoelectric-2300

§† Anderson Electronics, P. O. Box 89, Hollidaysburg, PA 16648, 814-695-4428 ..... A•1337
† Colorado Crystal Corp., 2303 W. 8th St., Loveland, CO 80537, 303-667-9248 ..... A•1355-1357
§† Fox Electronics, 5842 Corporation Circle, Ft. Meyers, FL 33905, 813-693-0099 ..... A•1397
GTE Products Corp., 2401 Reach Rd., Williamsport, PA 17701, 717-326-6591 ..... A•1401
§† Hi-Q Crystals, Hybrids International Ltd., 311 N. Lindenwood Dr., Olathe, KS 66062, 913-764-4544 ..... A•1478
† McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1406
Micro Crystal Division, SMH, 35 E. 21st Street, New York, NY 10010, 212-505-5340 ..... A•1421
† Monitor Products Co., Inc., 502 Via Del Monte, Oceanside, CA 92054, 619-433-4510 ..... A•1426
§† M-Tron Industries, P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321 ..... A•1428-1429
Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... B•1899
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Inc., 99 Morris Ave., Springfield, NJ 07081, 201-376-6070 ..... A•1438, B•1901
† Q-Tech Corp., 10150 W. Jefferson Blvd., Culver City, CA 90232-3510, 213-836-7900 ..... A•1450-1451
§ SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303, 415-856-6900 ..... A•1458
§† Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810 ..... A•1470
§ Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131, 408-432-8020 ..... B•1926
AT&T, 555 Union Blvd., Allentown, PA 18103 ..... 1-800-372-2447;In Canada:1-800-553-2448
§† Atomergic Chemetals Corp., 91 Carolyn Blvd., Farmingdale, NY 11735-1527 516-694-9000
§ Baknor Industries Limited, 2209 Dunwin Drive, Mississauga, ONT., CANADA L5L 1X1 416-828-2400
† B-D Crystal Entprs., Inc., 1727 W. Galbraith Rd., Cincinnati, OH 45239 ... 513-522-3300
§ BEA electro-optics, inc., 690 First Ave., Des Plaines, IL 60016 312-298-1420
Blackhawk Networks Corp., 14 N. Parker Dr., P.O. Box 919, Janesville, WI 53545 608-752-8701
§ Bomar Crystal, 201 Blackford Ave., Middlesex, NJ 08846 .. 201-356-7787;800-526-3935
Burleigh Instruments, Burleigh Pk., Fishers, NY 14453 716-924-9355
Cal Crystal Lab., Inc., 1142 N. Gilbert, Anaheim, CA 92801 ..... 714-991-1580; 800-854-XTAL
§ Calmax Corp., 3410-C W. MacArthur Blvd., Santa Ana, CA 92704 714-957-1299
† Channel Industries, 839 Ward Dr., Santa Barbara, CA 93111 805-967-0171
† Croven Crystals, 500 Beech St., Whitby, ON, CANADA L1N 5S5 416-668-3324
§† Crystek Corp, P.O. Box 06135, Ft. Myers, FL 33906 813-936-2109
§† CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
§† CTS Corp., Frequency Control Div., (Formerly Knights Div.), 400 Reimann Ave., Sandwich, IL 60548 815-786-8411
† EDO Western Corp., EDO Corp., 2645 South 300 W., Salt Lake City, UT 84115 ..... 801-486-7481/3846
† Honeywell Inc., Aerospace & Defense Grp., Honeywell Plaza, Minneapolis, MN 55408 612-870-5186
International Crystal Mfg., 701 W. Sheridan, P.O. Box 26330, Oklahoma City, OK 73126 405-236-3741
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† K-W Manufacturing Co., Inc., P. O. Box 508, Prague, OK 74864 405-567-2285
† Leigh Instruments Ltd., Components Division, 141 Bond Ave., Don Mills, ON, CANADA M3B 1M2 416-447-8531
§ NEL Frequency Controls, Inc., 357 Beloit St., Burlington, WI 53105 414-763-3591
† Piezo Crystal, 100 K St., Box 619 , Carlisle, PA 17013 717-249-2151
† Piezo Kinetics Inc., Box 756, Pine and Mill Streets, Bellefonte, PA 16823 ..... 814-355-1593;814-355-1594
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804 407-298-2000
§† Pioneer Components, 2352 E. 66th St., Brooklyn, NY 11234 718-444-3880
§ Raltron Electronics, 2315 N.W. 107th Ave., Miami, FL 33172 305-593-6033
† Reeves-Hoffman Div., Dynamics Corporation of America, 400 W. North St., Carlisle, PA 17013 717-243-5929
† Savoy Electronics, P.O. Box 5727, Ft. Lauderdale, FL 33310 ..... 305-563-1333; 800-327-1282
Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675 201-666-5600
† Sentry Manufacturing, Crystal Park, Chickasha, OK 73018 405-224-6780
Sokol Crystal Products, Inc., 121 Water St., Mineral Point, WI 53565 608-987-3363
Star Micronics, Inc., OEM Division, 70-D Ethel Rd. W., Piscataway, NJ 08854 201-572-9512
Toyo Comm. Equip. Co., Ltd., 20-4, Nishi-Shimbashi, 3-Chome Minato-Ku, TOKYO, JAPAN 105 ..... 03-459-7320/03-459-7310
§† United States Crystal Corp., 3605 McCart St., Fort Worth, TX 76110 817-921-3014
§ Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831
† Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478 .. 216-232-8600

Crystals, Quartz-2300

§† Anderson Electronics, P. O. Box 89, Hollidaysburg, PA 16648, 814-695-4428 ..... A•1337
† Bliley Electric Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 ..... A•1350-1351,1353
† Colorado Crystal Corp., 2303 W. 8th St., Loveland, CO 80537, 303-667-9248 ..... A•1355-1357
† Croven Crystals, 500 Beech St., Whitby, ON, CANADA L1N 5S5, 416-668-3324 ..... A•1365
§† CTS Corp., Frequency Control Div., (Formerly Knights Div.), 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ..... A•1366-1369,1373-1381
Damon Electronics Div., 80 Wilson Way, Westwood, MA 02090, 617-329-2460 ..... A•1391
Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204, 913-631-6700 ..... A•1392
Epson America, Inc., 3415 Kashiwa St., Torrance, CA 90505, 213-534-4500 ..... A•1394
§† Fox Electronics, 5842 Corporation Circle, Ft. Meyers, FL 33905, 813-693-0099 ..... A•1397
GTE Products Corp., 2401 Reach Rd., Williamsport, PA 17701, 717-326-6591 ..... A•1401
§† Hi-Q Crystals, Hybrids International Ltd., 311 N. Lindenwood Dr., Olathe, KS 66062, 913-764-4544 ..... A•1478
ITT Components, ITT Corporation, 5 Jenner .st., Ste. 100, Irvine, CA 92718, 714-727-3001 ..... A•1405
† McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1406,1408-1411
† Monitor Products Co., Inc., 502 Via Del Monte, Oceanside, CA 92054, 619-433-4510 ..... A•1426-1427
§† M-Tron Industries, P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321 ..... A•1428-1429
Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•1430
NDK America, Inc., 20300 Stevens Creek Blvd., Ste. 400, Cupertino, CA 95014, 408-255-0831 ..... A•1330,1432
§ Pletronics, Inc., 9026 Roosevelt Way N.E., Seattle, WA 98115, 206-523-9395 ..... A•1447-1448
† Q-Tech Corp., 10150 W. Jefferson Blvd., Culver City, CA 90232-3510, 213-836-7900 ..... A•1450,1452
§ Raltron Electronics, 2315 N.W. 107th Ave., Miami, FL 33172, 305-593-6033 ..... A•1453
§ SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303, 415-856-6900 ..... A•1458-1459,1461
§ Seiko Instruments U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505, 213-517-7770 ..... A•1464
§ Standard Crystal Corporation, 9940 E. Baldwin Pl., El Monte, CA 91734, 818-443-2121 ..... A•1469
§† Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810 ..... A•1470,1473,1475
Advanced Filter Devices, Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92009 619-438-2074
§† Atomergic Chemetals Corp., 91 Carolyn Blvd., Farmingdale, NY 11735-1527 516-694-9000
§ Baknor Industries Limited, 2209 Dunwin Drive, Mississauga, ONT., CANADA L5L 1X1 416-828-2400
† B-D Crystal Entprs., Inc., 1727 W. Galbraith Rd., Cincinnati, OH 45239 ... 513-522-3300
Blackhawk Networks Corp., 14 N. Parker Dr., P.O. Box 919, Janesville, WI 53545 608-752-8701
§ Bomar Crystal, 201 Blackford Ave., Middlesex, NJ 08846 .. 201-356-7787;800-526-3935
Cal Crystal Lab., Inc., 1142 N. Gilbert, Anaheim, CA 92801 ..... 714-991-1580; 800-854-XTAL
§ Calmax Corp., 3410-C W. MacArthur Blvd., Santa Ana, CA 92704 714-957-1299

Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
§† Crystek Corp, P.O. Box 06135, Ft. Myers, FL 33906 ... 813-936-2109
§† CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 ... 219-293-7511
Electro Dynamics, Sub. of SFE Technologies, 9075 Cody, Overland Park, KS 66214 Elec. Dyna. ... 913-888-1750
Frequency Control Products, Inc., American Time Products Div., 430 Commack Rd., Deer Pk, NY 11729 ... 516-243-5730
† Hoffman, P. R., Co., Materials Processing Div., Spreckels Industries Inc., 321 Cherry St, Carlisle, PA 17013 ... 717-243-2011
† Hughes Microelectronics Circuits Division, 500 Superior Ave., P.O. Box H, Newport Beach, CA 92658-8903 ... 714-759-2952
§† Inductive Prods., Inc., 11733 Markon Dr., Garden Grove, CA 92641 ... 714-891-2572
International Crystal Mfg., 701 W. Sheridan, P.O. Box 26330, Oklahoma City, OK 73126 ... 405-236-3741
§ ITT Components, ITT Corporation, 5 Jenner .st., Ste. 100, Irvine, CA 92718 ... 714-727-3001
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 ... 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 ... 602-272-7944
† K-W Manufacturing Co., Inc., P. O. Box 508, Prague, OK 74864 ... 405-567-2285
§† Kyocera Northwest, Electronic Components Group, P.O. Box 85542, San Diego, CA 92138-5542 ... 619-576-2600
† Leigh Instruments Ltd., Components Division, 141 Bond Ave., Don Mills, ON, CANADA M3B 1M2 ... 416-447-8531
Micro Crystal Division, SMH, 35 E. 21st Street, New York, NY 10010 ... 212-505-5340
Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131 ... 312-451-1000
§ NEL Frequency Controls, Inc., 357 Beloit St., Burlington, WI 53105 ... 414-763-3591
§ NTE Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 ... 201-748-5089
§ Oscilloquartz, B & J Marketing, 17074 Dearborn St., Northridge, CA 91325 ... 818-993-0048
† Piezo Crystal, 100 K St., Box 619 , Carlisle, PA 17013 ... 717-249-2151
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804 ... 407-298-2000
† Reeves-Hoffman Div., Dynamics Corporation of America, 400 W. North St., Carlisle, PA 17013 ... 717-243-5929
† Savoy Electronics, P.O. Box 5727, Ft. Lauderdale, FL 33310 ... 305-563-1333; 800-327-1282
† Sentry Manufacturing, Crystal Park, Chickasha, OK 73018 ... 405-224-6780
§† SFE Technologies, 1501 1st St., San Fernando, CA 91340 ... 818-365-9411
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 ... 914-681-0700
§ Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830 ... 201-321-3400
§ Sloan Technology, Veeco Instruments Inc., 602 E. Montecito St., Santa Barbara, CA 93103 ... 805-963-4431
Sokol Crystal Products, Inc., 121 Water St., Mineral Point, WI 53565 ... 608-987-3363
Stetron International, Inc., 90 Broadway, Buffalo, NY 14203 ... 716-854-3443
Thermal Amer. Fused Quartz, Route 202, Montville, NJ 07045 ... 201-334-7770
Toyo Comm. Equip. Co., Ltd., 20-4, Nishi-Shimbashi, 3-Chome Minato-Ku, TOKYO, JAPAN 105 ... 03-459-7320/03-459-7310
§† United States Crystal Corp., 3605 McCart St., Fort Worth, TX 76110 ... 817-921-3014
§† Valpey-Fisher, 75 South St, Hopkinton, MA 01748 ... 617-435-6831
X-Tron Electronics, Inc., 1869 National Avenue, Hayward, CA 94545 ... 415-783-2145

Crystals, Quartz, for Watches-2300

Epson America, Inc., 3415 Kashiwa St., Torrance, CA 90505, 213-534-4500 ... A•1394
§† Fox Electronics, 5842 Corporation Circle, Ft. Meyers, FL 33905, 813-693-0099 ... A•1397
§† Hi-Q Crystals, Hybrids International Ltd., 311 N. Lindenwood Dr., Olathe, KS 66062, 913-764-4544 ... A•1478
Micro Crystal Division, SMH, 35 E. 21st Street, New York, NY 10010, 212-505-5340 ... A•1421
§ SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303, 415-856-6900 ... A•1458,1460
§ Seiko Instruments U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505, 213-517-7770 ... A•1464
§† Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810 ... A•1470
† B-D Crystal Entprs., Inc., 1727 W. Galbraith Rd., Cincinnati, OH 45239 ... 513-522-3300
Blackhawk Networks Corp., 14 N. Parker Dr., P.O. Box 919, Janesville, WI 53545 ... 608-752-8701
Cal Crystal Lab., Inc., 1142 N. Gilbert, Anaheim, CA 92801 ... 714-991-1580; 800-854-XTAL
§ Calmax Corp., 3410-C W. MacArthur Blvd., Santa Ana, CA 92704 ... 714-957-1299
§† Crystek Corp, P.O. Box 06135, Ft. Myers, FL 33906 ... 813-936-2109
Hoffman, P. R., Co., Materials Processing Div., Spreckels Industries Inc., 321 Cherry St, Carlisle, PA 17013 ... 717-243-2011
§† Kyocera Northwest, Electronic Components Group, P.O. Box 85542, San Diego, CA 92138-5542 ... 619-576-2600
§ NEL Frequency Controls, Inc., 357 Beloit St., Burlington, WI 53105 ... 414-763-3591
§ Raltron Electronics, 2315 N.W. 107th Ave., Miami, FL 33172 ... 305-593-6033
Stetron International, Inc., 90 Broadway, Buffalo, NY 14203 ... 716-854-3443
§ Valpey-Fisher, 75 South St, Hopkinton, MA 01748 ... 617-435-6831

Crystals, Semiconductor(Ingots & Wafers)-2300

† Aremco Products, Inc., Box 429, Ossining, NY 10562 ... 914-762-0685
§† Atomergic Chemetals Corp., 91 Carolyn Blvd., Farmingdale, NY 11735-1527 ... 516-694-9000
Capintec Instruments, 6 Arrow Rd., Ramsey, NJ 07446 ... 201-825-9500
Dow Corning Corp., Box 0994, Midland, MI 48686-0994 ... 517-496-4000
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 ... 301-749-2424
§ Laser Diode, Inc., Morgan Crucible, 1130 Somerset St., New Brunswick, NJ 08901 ... 201-249-7000
Materials Research Corporation, Route 303, Orangeburg, NY 10962 ... 914-359-4200
† Saphikon, Inc., 51 Powers St., Milford, NH 03055 ... 603-673-5831
† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 ... 305-848-4311
Sumitronics, Inc., Sumitomo Corporation, 580 N. Pastoria Ave., Sunnyvale, CA 94086 ... 408-737-7683
Swiss Jewel Company, 406 Lafayette Building, Philadelphia, PA 19106 ... 215-925-2867
§ Tennelec, 601 Oak Ridge Tpke., Oak Ridge, TN 37830 ... 615-483-8405
§ Texas Instrs., Inc., Box 809066, Dallas, TX 75380 ... 800-232-3200 (ext 700)
† Union Carbide Corporation, Industrial Chemicals Div., Crystal Products Dept., 9320 Chesapeake Dr., Ste. 216, San Diego, CA 92123 ... 619-279-4500

Crystals, Surface Mount-2300

Bliley Electric Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 ... A•1352
Epson America, Inc., 3415 Kashiwa St., Torrance, CA 90505, 213-534-4500 ... A•1395
§† Fox Electronics, 5842 Corporation Circle, Ft. Meyers, FL 33905, 813-693-0099 ... A•1397
§† Hi-Q Crystals, Hybrids International Ltd., 311 N. Lindenwood Dr., Olathe, KS 66062, 913-764-4544 ... A•1478
† McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ... A•1406-1407,1409
Micro Crystal Division, SMH, 35 E. 21st Street, New York, NY 10010, 212-505-5340 ... A•1421-1422
Monitor Products Co., Inc., 502 Via Del Monte, Oceanside, CA 92054, 619-433-4510 ... A•1426
M-Tron Industries, P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321 ... A•1429
§ Pletronics, Inc., 9026 Roosevelt Way N.E., Seattle, WA 98115, 206-523-9395 ... A•1447
§ Raltron Electronics, 2315 N.W. 107th Ave., Miami, FL 33172, 305-593-6033 ... A•1453
SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303, 415-856-6900 ... A•1459,1461
Seiko Instruments U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505, 213-517-7770 ... A•1464
Standard Crystal Corporation, 9940 E. Baldwin Pl., El Monte, CA 91734, 818-443-2121 ... A•1469
§† Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810 ... A•1470-1473
§ Baknor Industries Limited, 2209 Dunwin Drive, Mississauga, ONT., CANADA L5L 1X1 ... 416-828-2400
† B-D Crystal Entprs., Inc., 1727 W. Galbraith Rd., Cincinnati, OH 45239 ... 513-522-3300
Fujitsu Components of America, 3320 Scott Blvd., Santa Clara, CA 95054 ... 408-727-1700
† Hughes Microelectronics Circuits Division, 500 Superior Ave., P.O. Box H, Newport Beach, CA 92658-8903 ... 714-759-2952
Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131 ... 312-451-1000
§ NEL Frequency Controls, Inc., 357 Beloit St., Burlington, WI 53105 ... 414-763-3591
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804 ... 407-298-2000
† Reeves-Hoffman Div., Dynamics Corporation of America, 400 W. North St., Carlisle, PA 17013 ... 717-243-5929
Savoy Electronics, P.O. Box 5727, Ft. Lauderdale, FL 33310 ... 305-563-1333; 800-327-1282
§† SFE Technologies, 1501 1st St., San Fernando, CA 91340 ... 818-365-9411
Sokol Crystal Products, Inc., 121 Water St., Mineral Point, WI 53565 ... 608-987-3363
§ Valpey-Fisher, 75 South St, Hopkinton, MA 01748 ... 617-435-6831

Crystals, YIG-2300

† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 ... 201-539-5500
§† Atomergic Chemetals Corp., 91 Carolyn Blvd., Farmingdale, NY 11735-1527 ... 516-694-9000
† Crystek Corp, P.O. Box 06135, Ft. Myers, FL 33906 ... 813-936-2109
§ FDK America, Inc., Fuji Electromechanical Co., Ltd., 17326 Edwards Rd., Ste. A-130, Cerritos, CA 90701 ... 213-404-1770
§ Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131 ... 408-432-8020

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Curing Systems, Photo Magnetic-1600 — *See Vol. C*

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Decoders, Pulse-1900 — *See Vol. D*

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Decoders, Surface Mount-3130

§† Integrated Device Technology, Inc., 3236 Scott Blvd., Santa Clara, CA 95054-3090 408-727-6116

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Decoders, Video-1900 — *See Vol. D*

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Dehydrators-4100 — *See Vol. D*

Delay Generators — See Generators, Timing Digital (Vol. D)

Delay Lines, Active-2350

† **Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147, 305-696-6660** ..... **A•1498-1500**

§ **Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463** ..... **A•1503,1505,1508**

§† **Data Delay Devices, 3 Mount Prospect Ave., Clifton, NJ 07013-1915, 201-773-2299** ..... **A•1535-1540,1543-1547**

† **Delta Products Corporation, 3823 Spinnaker Ct., Fremont, CA 94538, 415-770-0660** ..... **A•1551**

† **ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400** ..... **A•1558-1559,1572-1573**

§† **Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065, 201-396-9400;1-800-223-0603** ..... **A•1575-1588**

† **KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900** ..... **A•1666**

§† **Nytronics Components Grp., Inc., 700 Orange St., Darlington, SC 29532, 803-393-5421** ..... **A•1600**

§ **PCA Electronics, 16799 Schoenborn St., Sepulveda, CA 91343, 818-892-0761** ..... **A•1602-1607**

RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... **A•2010**

§† **Rhombus Industries, 15801 Chemical Ln., Huntington Bch., CA 92649-1595, 714-898-0960** ..... **A•1616**

§ **TDK Corporation, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku,, Tokyo, JAPAN 103, (03) 278-5111** ..... **A•1619**

Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... **A•1620**

§ **Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070** ..... **A•1629**

Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245, 619-458-1471 ..... **A•1630**

Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100

§ CCD Imaging, Fairchild Weston Systems, Inc., 810 W. Maude Ave., Sunnyvale, CA 94086 408-720-7600

§ Datatronics, Ltd., P. O. Box 2839, Blue Jay, CA 92317 714-336-3561

El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300

Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761

Hytek Microsystems, 980 University Ave., Los Gatos, CA 95030 408-395-2300

JBM Electronics, Inc., 531 Front St., Manchester, NH 03102 603-623-0222

Matthey Electronics, Television Equipment Associates, Box 393, South Salem, NY 10590 914-763-8893

Nano Pulse Industries, 440 Nibus St., Brea, CA 92670 714-529-2600

† Polara Engineering Inc., 4115 W. Artesia Ave., Fullerton, CA 92633 714-521-0900

Pulse Engineering, Inc., 7250 Convoy Ct., P.O. Box 12235, San Diego, CA 92112 619-268-2400

Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900

Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483 619-575-9353

Delay Lines, Cable-2350

† **Allen Avionics, Inc., 224 E. 2nd St., Mineola, NY 11501, 516-248-8080** ..... **A•1496**

Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 ..... **A•1503**

Fischer-America, Inc., 28245 Avenue Crocker, Valencia, CA 91355, 818-362-9395 ..... **C•1327-1329**

§ **Penstock Engineering Labs., Penstock, Inc., 520 Mercury Dr., Sunnyvale, CA 94086-4018, 408-730-0300** ..... **A•1844**

Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St., Methuen, MA 01844 617-682-4661

Amphenol RF Operations, Amphenol Corporation, One Kennedy Avenue, Danbury, CT 06810 203-743-9272

Artronic Instrument Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444

† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147 305-696-6660

† Cablewave Systems, Celwave Systems, Inc., 60 Dodge Ave., North Haven, CT 06473 203-239-3311

C. E. Precision Assemblies, 1031 W. Fremont Dr., Tempe, AZ 85282 602-820-5596

Coaxitube Corp., 245 Naylor Mill Rd., Salisbury, MD 21801 301-546-3911

† Columbia Components, 9 Division St., Sidney, NY 13838 607-563-3520

† Control Electronics, Neurotech Corp., 139 Florida St., Farmingdale, NY 11735 516-694-0125

Eaton Corp., Microwave Products Division, 785 Palomar Ave., Sunnyvale, CA 94086 408-773-3700

§ Electronic Resources Inc., 568 Weddell Dr., No. 8, Sunnyvale, CA 94089 408-745-1420

† Flexco Microwave, Inc., P.O. Box 174, Karrville Rd., Port Murray, NJ 07865 201-689-3020

W. L. Gore & Assocs., 555 Paper Mill Rd., Newark, DE 19714 302-738-4880

Matthey Electronics, Television Equipment Associates, Box 393, South Salem, NY 10590 914-763-8893

§† Micro-Coax Components, Inc., a UTI Company, Box E, Collegeville, PA 19426 215-489-3700

Micro Mode Prods., 1870 John Towers Ave., El Cajon, CA 92020 619-449-3844

Precision Tube, Church Rd. & Wissahickon, N. Wales, PA 19454 215-699-5801

Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291

Universal Ad-Yu/D-F Corp., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100

Delay Lines, Digital-2350

† **Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147, 305-696-6660** ..... **A•1498-1501**

§ **Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463** ..... **A•1503-1512,1515-1520,1522-1532**

§† **Data Delay Devices, 3 Mount Prospect Ave., Clifton, NJ 07013-1915, 201-773-2299 ..... A•1535-1539,1541-1549**
† **ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558-1559,1563-1573**
§† **Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065, 201-396-9400;1-800-223-0603 ..... A•1575-1589,1592-1593**
§ **Nytronics Components Grp., Inc., 700 Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1594-1595,1599-1600**
§† **RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2011**
§† **Rhombus Industries, 15801 Chemical Ln., Huntington Bch., CA 92649-1595, 714-898-0960 ..... A•1613,1616-1617**
TDK Corporation, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku,, Tokyo, JAPAN 103, (03) 278-5111 ..... A•1619
† **Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•1620,1626, B•1022-1025**
§ **Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1629**
§† **Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245, 619-458-1471 ..... A•1630-1631**
§ AKG Acoustics, Inc., 77 Selleck St, Stamford, CT 06902 203-348-2121
§† Andersen Laboratories, 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-0761
Columbia Components, 9 Division St, Sidney, NY 13838 607-563-3520
Datatran Corp., 355 Yuma St, Denver, CO 80223 303-778-0870
§ Datatronics, Ltd., P. O. Box 2839, Blue Jay, CA 92317 714-336-3561
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
† Engineered Components Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
Eventide, Inc., One Alsan Way, Little Ferry, NJ 07643 ..... 201-641-1200;800-446-7878
§ FDK America, Inc., Fuji Electromechanical Co., Ltd., 17326 Edwards Rd., Ste. A-130, Cerritos, CA 90701 213-404-1770
† Hytek Microsystems, 980 University Ave., Los Gatos, CA 95030 408-395-2300
JBM Electronics, Inc., 531 Front St, Manchester, NH 03102 603-623-0222
LeCroy Corp., 700 S. Main St, Spring Vly, NY 10977 914-425-2000
Nano Pulse Industries, 440 Nibus St, Brea, CA 92670 714-529-2600
Olektron Corp., Signal Technology Corp., 61 Sutton Road, Webster, MA 01570 617-943-7440
§† PCA Electronics, 16799 Schoenborn St, Sepulveda, CA 91343 818-892-0761
† Polara Engineering Inc., 4115 W. Artesia Ave., Fullerton, CA 92633 714-521-0900
§ Pulse Engineering, Inc., 7250 Convoy Ct, P.O. Box 12235, San Diego, CA 92112 619-268-2400
Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd, San Diego, CA 92154-3483 619-575-9353
Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211

Delay Lines, Dispersive (Frequency Variable)-2350

§† **Andersen Laboratories, 1280 Blue Hills Ave., Bloomfield, CT 06002, 203-242-0761 ..... A•1497**
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 ..... A•1503
Control Electronics, Neurotech Corp., 139 Florida St., Farmingdale, NY 11735, 516-694-0125 ..... A•1534
† **Sawtek Inc., P.O. Box 609501, Orlando, FL 32860-9501, 407-886-8860 ... A•1463**
Matthey Electronics, Television Equipment Associates, Box 393, South Salem, NY 10590 914-763-8893
† Phonon Corporation, 7 Herman Drive, P.O. Box 549, Simsbury, CT 06070 203-651-0211

Delay Lines, Distributed Constant (Fixed)-2350

† **Allen Avionics, Inc., 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ... A•1496**
† **Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147, 305-696-6660 ..... A•1499-1501**
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 ..... A•1503
† **Control Electronics, Neurotech Corp., 139 Florida St., Farmingdale, NY 11735, 516-694-0125 ..... A•1534**
§† **Data Delay Devices, 3 Mount Prospect Ave., Clifton, NJ 07013-1915, 201-773-2299 ..... A•1541-1543,1546-1547,1549**
ELMEC Technology of America, 1225 Ridgecrest St., Monterey Pk., CA 91754, 213-265-1861 ..... A•1556-1557
† **ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558-1559,1561**
† **Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377, 718-424-7500 ..... A•1400**
† **Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065, 201-396-9400;1-800-223-0603 ..... A•1575-1576,1591-1593**
§† **Nytronics Components Grp., Inc., 700 Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1594-1595,1597,1599**
§† **PCA Electronics, 16799 Schoenborn St., Sepulveda, CA 91343, 818-892-0761 ..... A•1609**
§† **RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2010**
Rhombus Industries, 15801 Chemical Ln., Huntington Bch., CA 92649-1595, 714-898-0960 ..... A•1617
Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•1620, B•1022-1025
§ **Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1629**
Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245, 619-458-1471 ..... A•1630
† Artronic Instrument Co., Inc., 9 Division St, Sidney, NY 13838 607-563-8444
† Columbia Components, 9 Division St, Sidney, NY 13838 607-563-3520
† Daico Industries, Inc., 2139 East Del Amo Blvd., Compton, CA 90224 213-631-1143
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Engineered Components Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
Hytek Microsystems, 980 University Ave., Los Gatos, CA 95030 408-395-2300
JBM Electronics, Inc., 531 Front St, Manchester, NH 03102 603-623-0222
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
Nano Pulse Industries, 440 Nibus St, Brea, CA 92670 714-529-2600
† Polara Engineering Inc., 4115 W. Artesia Ave., Fullerton, CA 92633 714-521-0900
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd, Santa Clara, CA 95054 408-988-0700
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
§ Television Equipment Assocs., Box 393, So. Salem, NY 10590-0393 914-763-8893
Universal Ad-Yu/D-F Corp., 2517 E. Norwich St, Milwaukee, WI 53207 414-482-4100

Delay Lines, Distributed Constant (Variable)-2350

† **Allen Avionics, Inc., 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ... A•1496**
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 ..... A•1503
† **Control Electronics, Neurotech Corp., 139 Florida St., Farmingdale, NY 11735, 516-694-0125 ..... A•1534**
§† **Data Delay Devices, 3 Mount Prospect Ave., Clifton, NJ 07013-1915, 201-773-2299 ..... A•1549**
ELMEC Technology of America, 1225 Ridgecrest St., Monterey Pk., CA 91754, 213-265-1861 ..... A•1553,1555
† **ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558-1559**
† **Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065, 201-396-9400;1-800-223-0603 ..... A•1575-1576,1591**
PCA Electronics, 16799 Schoenborn St., Sepulveda, CA 91343, 818-892-0761 ..... A•1608
† Artronic Instrument Co., Inc., 9 Division St, Sidney, NY 13838 607-563-8444
† Columbia Components, 9 Division St, Sidney, NY 13838 607-563-3520
Matthey Electronics, Television Equipment Associates, Box 393, South Salem, NY 10590 914-763-8893
Nano Pulse Industries, 440 Nibus St, Brea, CA 92670 714-529-2600
§ Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd, Santa Clara, CA 95054 408-988-0700
§ Television Equipment Assocs., Box 393, So. Salem, NY 10590-0393 914-763-8893
Universal Ad-Yu/D-F Corp., 2517 E. Norwich St, Milwaukee, WI 53207 414-482-4100

Delay Lines, Glass & Quartz-2350

Damon Electronics Div., 80 Wilson Way, Westwood, MA 02090, 617-329-2460 ..... A•1391
GTE Products Corp., 2401 Reach Rd., Williamsport, PA 17701, 717-326-6591 ..... A•1401
† **Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... A•1425**
Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876 401-762-3800
† Anders, Inc., 77 Wolcott Rd., Simsbury, CT 06070 203-658-7666
§† Andersen Laboratories, 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-0761
Artronic Instrument Co., Inc., 9 Division St, Sidney, NY 13838 607-563-8444
† Control Electronics, Neurotech Corp., 139 Florida St, Farmingdale, NY 11735 516-694-0125
Corning Glass Works, Corning Elctrns., Houghton Pk, Bldg. A-2, Corning, NY 14830 607-974-8725
† Radio Research Instrument Co., Inc., 584 North Main Street, Waterbury, CT 06704-3506 203-753-5840
Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211

Delay Lines, Liquid-2350

Artronic Instrument Co., Inc., 9 Division St, Sidney, NY 13838 607-563-8444

Delay Lines, Lumped Constant (Electrically Variable)-2350

† **Allen Avionics, Inc., 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ... A•1496**
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 .. A•1503,1514
† **Control Electronics, Neurotech Corp., 139 Florida St., Farmingdale, NY 11735, 516-694-0125 ..... A•1534**
† **Data Delay Devices, 3 Mount Prospect Ave., Clifton, NJ 07013-1915, 201-773-2299 ..... A•1541-1542**
† **ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558-1559**
† **Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377, 718-424-7500 ..... A•1400**
† **Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065, 201-396-9400;1-800-223-0603 ..... A•1575-1576,1591**
§† **RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2011**
§† **Rhombus Industries, 15801 Chemical Ln., Huntington Bch., CA 92649-1595, 714-898-0960 ..... A•1617**
† **Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•1620,1628, B•1022-1025**
§† **Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245, 619-458-1471 ..... A•1630**
† Artronic Instrument Co., Inc., 9 Division St, Sidney, NY 13838 607-563-8444
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
† Columbia Components, 9 Division St, Sidney, NY 13838 607-563-3520
Engineered Components Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
Multi Products International, 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009 201-239-8183
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291

Delay Lines, Lumped Constant (Fixed)-2350

† **Allen Avionics, Inc., 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ... A•1496**
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 ... A•1503,1513-1516
Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ... A•1208-1209
† **Control Electronics, Neurotech Corp., 139 Florida St., Farmingdale, NY 11735, 516-694-0125 ... A•1534**
§† **Data Delay Devices, 3 Mount Prospect Ave., Clifton, NJ 07013-1915, 201-773-2299 ... A•1536,1544**
ELMEC Technology of America, 1225 Ridgecrest St., Monterey Pk., CA 91754, 213-265-1861 ... A•1556-1557
† **ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ... A•1558-1559**
† **Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377, 718-424-7500 ... A•1400**
† **Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061, 913-782-0012 ... A•2239**
† **Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065, 201-396-9400;1-800-223-0603 ... A•1575-1576,1591**
† **KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 .... A•1666**
§ **Nytronics Components Grp., Inc., 700 Orange St., Darlington, SC 29532, 803-393-5421 ... A•1596-1599**
§† **PCA Electronics, 16799 Schoenborn St., Sepulveda, CA 91343, 818-892-0761 ... A•1609**
§† **RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ... A•2011**
§† **Rhombus Industries, 15801 Chemical Ln., Huntington Bch., CA 92649-1595, 714-898-0960 ... A•1614,1617**
§ **TDK Corporation, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku,, Tokyo, JAPAN 103, (03) 278-5111 ... A•1619**
† **Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ... A•1620, B•1022-1025**
§ **Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ... A•1629**
§† **Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245, 619-458-1471 ... A•1630**
§† Andersen Laboratories, 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-0761
† Artronic Instrument Co., Inc., 9 Division St, Sidney, NY 13838 607-563-8444
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St, Dept. E, Miami, FL 33147 305-696-6660
† BG Electronics, 30 South St, Mt. Vernon, NY 10550 914-664-5591
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
† Columbia Components, 9 Division St, Sidney, NY 13838 607-563-3520
§ Datatronics, Ltd., P. O. Box 2839, Blue Jay, CA 92317 714-336-3561
† El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
† Engineered Components Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
§ FDK America, Inc., Fuji Electromechanical Co., Ltd., 17326 Edwards Rd., Ste. A-130, Cerritos, CA 90701 213-404-1770
† Hytek Microsystems, 980 University Ave., Los Gatos, CA 95030 408-395-2300
§† JBM Electronics, Inc., 531 Front St., Manchester, NH 03102 603-623-0222
Matthey Electronics, Television Equipment Associates, Box 393, South Salem, NY 10590 914-763-8893
Nano Pulse Industries, 440 Nibus St., Brea, CA 92670 714-529-2600
† Polara Engineering Inc., 4115 W. Artesia Ave., Fullerton, CA 92633 714-521-0900
§ Pulse Engineering, Inc., 7250 Convoy Ct., P.O. Box 12235, San Diego, CA 92112 619-268-2400
Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483 619-575-9353
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95054 408-988-0700
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
§ Television Equipment Assocs., Box 393, So. Salem, NY 10590-0393 914-763-8893
Universal Ad-Yu/D-F Corp., 2517 E. Norwich St, Milwaukee, WI 53207 414-482-4100

Delay Lines, Lumped Constant (Mechanically Variable)-2350

† **Allen Avionics, Inc., 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ... A•1496**
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 .. A•1503,1514
† **Control Electronics, Neurotech Corp., 139 Florida St., Farmingdale, NY 11735, 516-694-0125 ... A•1534**
§† **Data Delay Devices, 3 Mount Prospect Ave., Clifton, NJ 07013-1915, 201-773-2299 ... A•1538**
ELMEC Technology of America, 1225 Ridgecrest St., Monterey Pk., CA 91754, 213-265-1861 ... A•1553,1555
† **ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ... A•1558-1559**
† **Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065, 201-396-9400;1-800-223-0603 ... A•1575-1576,1591**
PCA Electronics, 16799 Schoenborn St., Sepulveda, CA 91343, 818-892-0761 ... A•1608
§† **Rhombus Industries, 15801 Chemical Ln., Huntington Bch., CA 92649-1595, 714-898-0960 ... A•1617**
† Artronic Instrument Co., Inc., 9 Division St, Sidney, NY 13838 607-563-8444
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
† Columbia Components, 9 Division St, Sidney, NY 13838 607-563-3520
Matthey Electronics, Television Equipment Associates, Box 393, South Salem, NY 10590 914-763-8893
§ Television Equipment Assocs., Box 393, So. Salem, NY 10590-0393 914-763-8893
Universal Ad-Yu/D-F Corp., 2517 E. Norwich St, Milwaukee, WI 53207 414-482-4100

Delay Lines, Magnetostrictive-2350

ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ... A•1558-1559
Rhombus Industries, 15801 Chemical Ln., Huntington Bch., CA 92649-1595, 714-898-0960 ... A•1613,1617
† Artronic Instrument Co., Inc., 9 Division St, Sidney, NY 13838 607-563-8444
† Columbia Components, 9 Division St, Sidney, NY 13838 607-563-3520
† Control Electronics, Neurotech Corp., 139 Florida St, Farmingdale, NY 11735 516-694-0125
JBM Electronics, Inc., 531 Front St, Manchester, NH 03102 603-623-0222

Delay Lines, Programmable-2350

Allen Avionics, Inc., 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ... A•1496
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 ... A•1503,1517-1519,1529-1530
Control Electronics, Neurotech Corp., 139 Florida St., Farmingdale, NY 11735, 516-694-0125 ... A•1534
§† **Data Delay Devices, 3 Mount Prospect Ave., Clifton, NJ 07013-1915, 201-773-2299 ... A•1539,1542,1545**
ELMEC Technology of America, 1225 Ridgecrest St., Monterey Pk., CA 91754, 213-265-1861 ... A•1552-1554
† **ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ... A•1558-1559,1571-1573**
† **Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065, 201-396-9400;1-800-223-0603 ... A•1575-1576,1588-1589**
§ **PCA Electronics, 16799 Schoenborn St., Sepulveda, CA 91343, 818-892-0761 ... A•1606**
† **Rhombus Industries, 15801 Chemical Ln., Huntington Bch., CA 92649-1595, 714-898-0960 ... A•1616**
† **Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ... A•1620,1622,1624-1625, B•1022-1025**
† **Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245, 619-458-1471 ... A•1630**
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St, Dept. E, Miami, FL 33147 305-696-6660
§ CCD Imaging, Fairchild Weston Systems, Inc., 810 W. Maude Ave., Sunnyvale, CA 94086 408-720-7600
Columbia Components, 9 Division St, Sidney, NY 13838 607-563-3520
§ Datatronics, Ltd., P. O. Box 2839, Blue Jay, CA 92317 714-336-3561
† Engineered Components Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
Eventide, Inc., One Alsan Way, Little Ferry, NJ 07643 .... 201-641-1200;800-446-7878
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761
Hytek Microsystems, 980 University Ave., Los Gatos, CA 95030 408-395-2300
§† JBM Electronics, Inc., 531 Front St, Manchester, NH 03102 603-623-0222
Matthey Electronics, Television Equipment Associates, Box 393, South Salem, NY 10590 914-763-8893
Nano Pulse Industries, 440 Nibus St., Brea, CA 92670 714-529-2600
† Polara Engineering Inc., 4115 W. Artesia Ave., Fullerton, CA 92633 714-521-0900
Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483 619-575-9353
Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211

Delay Lines, SAW — See Surface Acoustic Wave Devices (Vol. A)

Delay Lines, Strip-2350

Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 ..... A•1503
† **ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ... A•1558-1559**
Nytronics Components Grp., Inc., 700 Orange St., Darlington, SC 29532, 803-393-5421 ... A•1599
Artronic Instrument Co., Inc., 9 Division St, Sidney, NY 13838 607-563-8444
† Columbia Components, 9 Division St, Sidney, NY 13838 607-563-3520
† Control Electronics, Neurotech Corp., 139 Florida St, Farmingdale, NY 11735 516-694-0125
JBM Electronics, Inc., 531 Front St, Manchester, NH 03102 603-623-0222
Matthey Electronics, Television Equipment Associates, Box 393, South Salem, NY 10590 914-763-8893
PCA Electronics, 16799 Schoenborn St., Sepulveda, CA 91343 818-892-0761
RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
§† Solitron/Microwave, Solitron Devices, Inc., 1177 Blue Heron Blvd., Solitron Pk, Riviera Bch., FL 33404 305-848-4311
§ Television Equipment Assocs., Box 393, So. Salem, NY 10590-0393 914-763-8893

Delay Lines, Surface Mount-2350

† **Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 ... A•1503,1511-1512**
Data Delay Devices, 3 Mount Prospect Ave., Clifton, NJ 07013-1915, 201-773-2299 ... A•1535,1546
† **Delta Products Corporation, 3823 Spinnaker Ct., Fremont, CA 94538, 415-770-0660 ... A•1551**
ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ... A•1558-1562,1564-1565,1568-1569
† **Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065, 201-396-9400;1-800-223-0603 ... A•1575-1576,1582-1584**
§ **PCA Electronics, 16799 Schoenborn St., Sepulveda, CA 91343, 818-892-0761 ... A•1603**

RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2011
§† Rhombus Industries, 15801 Chemical Ln., Huntington Bch., CA 92649-1595, 714-898-0960 ..... A•1613-1615
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•1620,1623,1626-1628
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1629
Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245, 619-458-1471 ..... A•1630-1631
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St, Dept. E, Miami, FL 33147 305-696-6660
Datatronics, Ltd., P. O. Box 2839, Blue Jay, CA 92317 714-336-3561
JBM Electronics, Inc., 531 Front St, Manchester, NH 03102 603-623-0222
Matthey Electronics, Television Equipment Associates, Box 393, South Salem, NY 10590 914-763-8893
† Polara Engineering Inc., 4115 W. Artesia Ave., Fullerton, CA 92633 714-521-0900
Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483 619-575-9353

Delay Lines, Trimmer-2350

Allen Avionics, Inc., 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ... A•1496
Bel Fuse, 198 Van Voret St., Jersey City, NJ 07302, 201-432-0463 ..... A•1503
§† Data Delay Devices, 3 Mount Prospect Ave., Clifton, NJ 07013-1915, 201-773-2299 ..... A•1538
† ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558-1559,1561
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065, 201-396-9400;1-800-223-0603 ..... A•1575-1576,1591
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•1620, B•1022-1025
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1629
† Anders, Inc., 77 Wolcott Rd., Simsbury, CT 06070 203-658-7666
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St, Dept. E, Miami, FL 33147 305-696-6660
† Columbia Components, 9 Division St, Sidney, NY 13838 607-563-3520
† Control Electronics, Neurotech Corp., 139 Florida St., Farmingdale, NY 11735 516-694-0125
† Engineered Components Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
Matthey Electronics, Television Equipment Associates, Box 393, South Salem, NY 10590 914-763-8893
† Polara Engineering Inc., 4115 W. Artesia Ave., Fullerton, CA 92633 714-521-0900
§ Pulse Engineering, Inc., 7250 Convoy Ct., P.O. Box 12235, San Diego, CA 92112 619-268-2400
§ Television Equipment Assocs., Box 393, So. Salem, NY 10590-0393 914-763-8893
Universal Ad-Yu/D-F Corp., 2517 E. Norwich St, Milwaukee, WI 53207 414-482-4100

Delay Lines, Ultrasonic-2350

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† Damon Electronics Div., 80 Wilson Way, Westwood, MA 02090, 617-329-2460 ..... A•1391
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GTE Products Corp., 2401 Reach Rd., Williamsport, PA 17701, 717-326-6591 ..... A•1401
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065, 201-396-9400;1-800-223-0603 ..... A•1575-1576,1591
† Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... A•1425
† Sawtek Inc., P.O. Box 609501, Orlando, FL 32860-9501, 407-886-8860 ... A•1463
† Anders, Inc., 77 Wolcott Rd., Simsbury, CT 06070 203-658-7666
Artronic Instrument Co., Inc., 9 Division St, Sidney, NY 13838 607-563-8444
† Columbia Components, 9 Division St, Sidney, NY 13838 607-563-3520
† Control Electronics, Neurotech Corp., 139 Florida St., Farmingdale, NY 11735 516-694-0125
§ Datatronics, Ltd., P. O. Box 2839, Blue Jay, CA 92317 714-336-3561
JBM Electronics, Inc., 531 Front St, Manchester, NH 03102 603-623-0222
Matthey Electronics, Television Equipment Associates, Box 393, South Salem, NY 10590 914-763-8893
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
† Phonon Corporation, 7 Herman Drive, P.O. Box 549, Simsbury, CT 06070 203-651-0211

Delay Lines, Video — See Delay Lines, Ultrasonic (Vol. A)

Delay Lines, Waveguide-2350

Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 ..... A•1503
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St, Methuen, MA 01844 617-682-4661
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Micro-Coax Components, Inc., a UTI Company, Box E, Collegeville, PA 19426 215-489-3700
† Union Carbide Corporation, Industrial Chemicals Div., Crystal Products Dept., 9320 Chesapeake Dr., Ste. 216, San Diego, CA 92123 619-279-4500
Universal Ad-Yu/D-F Corp., 2517 E. Norwich St, Milwaukee, WI 53207 414-482-4100

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Demagnetizers-1850

Dowty RFL Inds. Inc./Instrumentation Div., The Dowty Grp. PLC, Powerville Rd., Boonton, NJ 07005-0239, 201-334-3100 ..... D•1238-1239
Magnos, 6 Old School House Rd., Harvard, MA 01451, 617-456-8880 .... D•1290
Walker Scientific, Rockdale St., Worcester, MA 01606, 617-852-3674;617-853-3232 ..... D•1346
§ Axial Magnetics, Tencal Inc., 450 W. Los Angeles Ave., Simi Valley, CA 93065 818-998-4850
§† Benjamin International, Inc., 1460 Old Country Rd., Plainview, NY 11803 516-753-0700
† E M S Development Corp., 100 Sea La., Farmingdale, NY 11735 516-293-7900
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
§ L & R Mfg. Co., 577 Elm St., Kearny, NJ 07032 201-991-5330
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
Magnetic Instrumentation, 8350 E. 48TH ST., Indianapolis, IN 46226 317-545-2102
§ Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582 516-561-6050
Permag, 400 Karin La., Hicksville, NY 11801 516-822-3311
§ Recoton Corp., 46-23 Crane St., Long Island City, NY 11101 718-392-6442
† Schonstedt Instrument Co., 1775 Wiehle Ave., Reston, VA 22090 703-471-1050
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Wide Range Elctrns. Corp., 140 Sun Valley Cir., St. Louis, MO 63026 314-343-9191

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Detection Systems (MIL), Passive-3475 — *See Vol. D*

Detection Systems (MIL), Submarine-3475 — *See Vol. D*

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Detectors, Air Flow-2900 — *See Vol. D*

Detectors, RF-2900 — *See Vol. D*

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Detectors, Coaxial-2900 — *See Vol. D*

Detectors, Corona — See Testers, Corona (Vol. D)

Detectors, Crystal-2300

Alford Manufacturing Co., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01801 617-935-8610
† FEI Microwave, Inc., Frequency Electronics, Inc., 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
† Frequency Electronics, Inc., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
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Lixi, Inc., 1438 Brook Dr., Downers Grove, IL 60515 312-620-4646
† M/A COM Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
M/A-COM Microwave Components, Inc., South Avenue, Burlington, MA 01803 617-272-3000
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† Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
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† Narda Microwave Corp., Subsidiary of Loral Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
RLC Electronics, Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334

† Sage Laboratories, Inc., 11 Huron Dr., Natick, MA 01760 617-653-0844
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
§† Telephonics Corporation/PRD Instruments, 770 Park Avenue, Huntington, NY 11743 ..... 516-549-6415/6102
§ Tennelec, 601 Oak Ridge Tpke., Oak Ridge, TN 37830 615-483-8405
Texscan Instruments, Texscan Corporation, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
U.S. Instr. Rentals, 2988 Campus Dr., San Mateo, CA 94403 800-824-2873
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100
§ Wiltron, 490 Jarvis Dr., Morgan Hill, CA 95037-2809 408-778-2000

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Detectors, GaAs-3450

Aborn Electronics Inc., 2108 D Bering Dr., San Jose, CA 95131 408-436-5444
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St., Methuen, MA 01844 617-682-4661
Camelco Assembly, 605136 Ontario Limited, 7400 Victoria Park Avenue, No. 1, Markham, Ontario, CANADA L3R 2V4 416-477-8269
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§ Photoswitch Div., Allen Bradley Co., 265 Winter St., Waltham, MA 02154 617-466-8000
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
§ Siemens Components, Inc., Optoelectronics Division, 19000 Homestead Rd., Cupertino, CA 95014 408-257-7910
Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830 201-321-3400
† Texas Optoelectronics, Inc., 714 Shepherd Dr., Garland, TX 75042 214-487-0085
Varo, Inc., Electron Devices Div., 2203 W. Walnut St., Garland, TX 75046 214-487-4129

Detectors, Ground Fault-4300 — *See Vol. B*

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American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ..... A•2115
Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... A•2135
Raytheon/TAG Semiconductors Ltd., 43 Third Ave., Burlington, MA. 01803, 617-272-3704 (3705) ..... A•2139-2141
Silicon Power Cube Corp., 6015 Obispo Ave., Long Beach, CA 90805, 213-634-9390 ..... B•1586
§ Teccor Electronics, Inc., 1801 Hurd Dr., Irving, TX 75038, 214-580-1515 ..... A•2146-2149
§ Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
§ NTE Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
Triac Electronic Systems, Inc., 87-27 Myrtle Ave., Glendale, NY 11385 .. 718-441-4759

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American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ..... A•2115
Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... A•2134
† Voltage Multipliers, Inc., 8711 W. Roosevelt Ave., Visalia, CA 93291, 209-651-1402 ..... A•2151
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§ Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876 401-762-3800
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§ Sanken Electric Co., Ltd., Overseas Operations, 1-22-8 Nishi-Ikebukuro, Toshima-ku, Tokyo, JAPAN 171 03-986-6164
§ Semicon Components, Inc., Div. of Semicon, Inc., 10 North Ave., Burlington, MA 01803 617-272-9015
§ Semikron, Inc., 11E Executive Dr., P.O. Box 66, Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
§† Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 805-498-2111
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
§† St-Semiconductors of Indiana, Inc., 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402-0609 812-332-1435
† Texas Optoelectronics, Inc., 714 Shepherd Dr., Garland, TX 75042 214-487-0085
§† Thor Electronics, 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§ Varo Quality Semiconductor, 1000 N. Shiloh Rd., Garland, TX 75040 214-487-4300

Diodes, Backward-4800

American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ..... A•2115
American Power Devices, 7 Andover St., Andover, MA 01810 617-475-4074
Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
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† Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660

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Diodes, Chip, Unpackaged-4800

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Alpha Industries, Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
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† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
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§† FEI Microwave, Inc., Frequency Electronics, Inc., 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
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§† ITT Electro-Optical Prods., ITT Corporation, 7635 Plantation Rd., Roanoke, VA 24019 703-563-0371
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§ Microsemi Corp. Colorado, Microsemi Corp., 800 Hoyt St., Broomfield, CO 80020 303-469-2161
§ Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
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§† Raytheon Semiconductor, 350 Ellis St., Mountain View, CA 94043 415-968-9211
§ RMC Power Semiconductor, BBC, 2150 W. 6th Ave., Broomfield, CO 80020 ..... 303-469-1883;1-800-992-0312
Semicon Components, Inc., Div. of Semicon, Inc., 10 North Ave., Burlington, MA 01803 617-272-9015
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† Shindengen America Inc., 2649 Townsgate Road, Ste. 200, Westlake Vl, CA 91361 805-373-1130
† Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 608-935-2707
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
Sprague Electric Company, The Semiconductor Group, 115 Northeast Cutoff, Box 2036, Worcester, MA 01613-2036 617-853-5000
Sussex Semiconductor, Inc., Rte. 206, Branchville, NJ 07826 201-948-3633
† Teledyne Crystalonics, Teledyne Industries, Inc., 147 Sherman St., Cambridge, MA 02140 617-491-1670
Texas Optoelectronics, Inc., 714 Shepherd Dr., Garland, TX 75042 214-487-0085
† Thor Electronics, 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
Varian Associates, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
§ Varo Quality Semiconductor, 1000 N. Shiloh Rd., Garland, TX 75040 214-487-4300

Diodes, Electroluminescent (Radiating)-4800

§ A E G Corporation, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269 201-231-8300
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§ General Optronics Corp., 2 Olsen Ave., Edison, NJ 08820 201-549-9000
§ Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
§† Leecraft Mfg., 21-02 44th Rd., Long Island City, NY 11101 718-392-8800
† MERET, Inc., 1815 24th St., Santa Monica, CA 90404-4998 213-828-7496
Sensor Techn., 21012 Lassen St., Chatsworth, CA 91311 213-882-4100
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700

Diodes, Frequency Multiplier-4800

§ A E G Telefunken, High Power Grp., Rte. 22, Orr Dr., Somerville, NJ 08876 201-722-9800
§ Alpha Industries, Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
§† FEI Microwave, Inc., Frequency Electronics, Inc., 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
† M/A COM Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
§† Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 805-498-2111
Thomson Electron Tubes & Devices Corp., Special Products Div., 550 Mount Pleasant Ave., Dover, NJ 07801 201-328-1400

Diodes, Germanium-4800

American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ..... A•2115
§ Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-699-0918; 800-255-2666
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
† EG & G Judson, 21 Commerce Dr., Montgomeryville, PA 18936 215-368-6900
§† FEI Microwave, Inc., Frequency Electronics, Inc., 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
Hitachi America, Ltd., 2210 O'Toole Ave., San Jose, CA 95131 408-435-8300
International Components Corp., 105 Maxess Rd., Melville, NY 11747 ... 516-293-1500
§ International Diode, 229 Cleveland Ave., Harrison, NJ 07029 201-482-6518
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 .. 516-937-3475
McGuirk Electronics Co. Inc., 212 So. Main St, P. O. Box 853, Middleton, MA 01949 617-933-3500
† Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Diode Corp., Washington St-Box 250, W. Stewartstown, NH 03597 ..... 603-246-3362/3363
§ NTE Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
§ Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
§ Semiconductor Technology, Inc., 3131 S.E. Jay St., Stuart, FL 34997 305-283-4500
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
§† Thor Electronics, 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300

Diodes, Gunn-4800

§ Alpha Industries, Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St., Methuen, MA 01844 617-682-4661
Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
† Central Microwave Co., Alpha Inds., Inc., 12180 Prichard Farm Rd., Maryland Heights, MO 63043 314-291-5270
MACOM, Inc., 43 Second Ave., Bldg. 8, Burlington, MA 01803 617-272-3000
† M/A COM Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
Marconi Instruments, 3 Pearl Court, Allendale, NJ 07401 201-934-9050
† Narda Microwave Corp., Subsidiary of Loral Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
§ RMC Power Semiconductor, BBC, 2150 W. 6th Ave., Broomfield, CO 80020 ..... 303-469-1883;1-800-992-0312
Thomson Electron Tubes & Devices Corp., Special Products Div., 550 Mount Pleasant Ave., Dover, NJ 07801 201-328-1400
† Thor Electronics, 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
Varian Associates, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141

Diodes, High Voltage (1,000 Volts & Over)-4800

American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ..... A•2115
§ Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876, 401-762-3800 ..... A•2124-2125
§ Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2127-2129
§ Electronic Devices, Inc., 21 Gray Oaks Ave., Yonkers, NY 10710, 914-965-4400 ..... A•2131
§† K & M Electronics, 221 Interstate Dr., Dock No. 3, W. Springfield, MA 01089, 413-781-1350 ..... A•1943
Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... A•2134
§ Silicon Power Cube Corp., 6015 Obispo Ave., Long Beach, CA 90805, 213-634-9390 ..... B•1586,1588
† Voltage Multipliers, Inc., 8711 W. Roosevelt Ave., Visalia, CA 93291, 209-651-1402 ..... A•2151
§ A E G Telefunken, High Power Grp., Rte. 22, Orr Dr., Somerville, NJ 08876 201-722-9800
§ Alpha Industries, Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
§† Codi Semiconductor, Inc., 144 Market St., Kenilworth, NJ 07033 201-298-0400
Diodes Inc., 9957 Canoga Ave., Chatsworth, CA 91311 ... 818-882-4920;800-821-1178
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§ Fagor Elctrn. Comps., Inc., Natl. Mktg. Sls. Offs., Fagor Electrotecnica S. Coop., 8419 Canoga Ave., Canoga Pk., CA 91304 ..... 818-718-2500;800-624-5367
Hitachi America, Ltd., 2210 O'Toole Ave., San Jose, CA 95131 408-435-8300
International Components Corp., 105 Maxess Rd., Melville, NY 11747 ... 516-293-1500
§ International Diode, 229 Cleveland Ave., Harrison, NJ 07029 201-482-6518
§ International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
§ ITT Semiconductors, ITT Corp., 55 Merrimack St., So. Lawrence, MA 01843 617-688-1881
§† Microsemi Corp., 2830 S. Fairview St., Santa Ana, CA 92704 714-979-8220
§ Microsemi Corp. Colorado, Microsemi Corp., 800 Hoyt St., Broomfield, CO 80020 303-469-2161
§† Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
§ NTE Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
† Oram High Voltage, P.O. Box 1176, Dayton, TX 77535 409-258-5553
§ Powerex, Westinghouse, GE, Mitsubishi, Hillis St., Youngwood, PA 15697 412-925-7272
§ RMC Power Semiconductor, BBC, 2150 W. 6th Ave., Broomfield, CO 80020 ..... 303-469-1883;1-800-992-0312
§ Sanken Electric Co., Ltd., Overseas Operations, 1-22-8 Nishi-Ikebukuro, Toshima-ku, Tokyo, JAPAN 171 03-986-6164
§ Semicon Components, Inc., Div. of Semicon, Inc., 10 North Ave., Burlington, MA 01803 617-272-9015
§ Semiconductor Technology, Inc., 3131 S.E. Jay St., Stuart, FL 34997 305-283-4500

§ Semikron, Inc., 11E Executive Dr., P.O. Box 66, Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
§† Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 805-498-2111
† Shindengen America Inc., 2649 Townsgate Road, Ste. 200, Westlake Vl, CA 91361 805-373-1130
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
§† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311
§† St-Semiconductors of Indiana, Inc., 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402-0609 812-332-1435
§† Thor Electronics, 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§ Varo Quality Semiconductor, 1000 N. Shiloh Rd., Garland, TX 75040 214-487-4300
Victoreen, Inc., A Sheller-Globe Corp. Subsidiary, 6000 Cochran Rd., Solon, OH 44139 216-248-9300
Westcode Semiconductors, Inc., 3270 Cherry Ave., Long Beach, CA 90807 213-595-6971

Diodes, Hot Carrier-4800

§ Alpha Industries, Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
§† FEI Microwave, Inc., Frequency Electronics, Inc., 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
§ Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
§ International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
§ ITT Semiconductors, ITT Corp., 55 Merrimack St., So. Lawrence, MA 01843 617-688-1881
§† Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
† Thor Electronics, 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§ Varo Quality Semiconductor, 1000 N. Shiloh Rd., Garland, TX 75040 214-487-4300

Diodes, Impatt-4800

Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
† California Eastern Labs. Inc., 3260 Jay St., Santa Clara, CA 95054 408-988-3500
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
† M/A COM Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
Thomson Electron Tubes & Devices Corp., Special Products Div., 550 Mount Pleasant Ave., Dover, NJ 07801 201-328-1400
§† Thor Electronics, 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
Varian Associates, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

Diodes, Infrared-4800

† Gilway Technical Lamp, 800 W. Cummings Pk., Woburn, MA 01801, 617-935-4442 ..... B•1126
§ Marktech International Corp., 120 Broadway, Menands, NY 12204, 518-436-5865 ..... B•1138-1139
§ Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... A•2142, B•1291
† Computer Optical Products, Inc., Sub. of Hathaway Corp., 9321 Eton Ave., Chatsworth, CA 91311-6910 818-882-0424
† EG & G Judson, 21 Commerce Dr., Montgomeryville, PA 18936 215-368-6900
† Ledtronics, Inc., 4009 Pacific Coast Hwy., Torrance, CA 90505 213-676-7996
† MERET, Inc., 1815 24th St., Santa Monica, CA 90404-4998 213-828-7496
Mitsubishi Elctrns. America, Inc., Semiconductor Div., 1050 East Arques Ave., Sunnyvale, CA 94086 408-730-5900
§ Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
§ Opto Technology, Inc., 562 Chaddick Dr., Wheeling, IL 60090 312-537-4277
Ortel Corp., 2015 W. Chestnut St., Alhambra, CA 91803 818-281-3636
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830 201-321-3400
Texas Optoelectronics, Inc., 714 Shepherd Dr., Garland, TX 75042 214-487-0085
§† TRW Optoelectronics Div., 1215 W. Crosby Rd., Carrollton, TX 75006 214-323-2200
Wamco, Inc., 11555-A Coley River Cir., Fountain Valley, CA 92708 714-545-5560
Zexco, 7661 Densmore, # 8, Van Nuys, CA 91406 818-997-7895

Diodes, Laser-4800

§ Marktech International Corp., 120 Broadway, Menands, NY 12204, 518-436-5865 ..... B•1138-1139,1276
NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... B•1174
§ Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... A•2144, B•1178-1179,1291
§ A E G Corporation, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269 201-231-8300
A E G Telefunken, High Power Grp., Rte. 22, Orr Dr., Somerville, NJ 08876 201-722-9800
Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876 401-762-3800
AT&T, 555 Union Blvd., Allentown, PA 18103 ..... 1-800-372-2447;In Canada:1-800-553-2448
§† Codenoll Technology Corp., 1086 N. Bwy., Yonkers, NY 10701 914-965-6300
§ D. O. Industries, 317 E. Chestnut St., E. Rochester, NY 14445 716-385-4920
§ EXFO E.O. Engineering, 352 St-Sacrement Ave., Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
§ General Optronics Corp., 2 Olsen Ave., Edison, NJ 08820 201-549-9000
Hitachi America, Ltd., 2210 O'Toole Ave., San Jose, CA 95131 408-435-8300
§† Laser Diode, Inc., Morgan Crucible, 1130 Somerset St., New Brunswick, NJ 08901 201-249-7000
§ Mitsubishi Elctrns. America, Inc., Semiconductor Div., 1050 East Arques Ave., Sunnyvale, CA 94086 408-730-5900
Ortel Corp., 2015 W. Chestnut St., Alhambra, CA 91803 818-281-3636
Tektronix, Inc., Hybrid Components Operation, P.O. Box 500, Beaverton, OR 97077 503-627-4220
Thomson Electron Tubes & Devices Corp., Special Products Div., 550 Mount Pleasant Ave., Dover, NJ 07801 201-328-1400
† Thor Electronics, 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300

Diodes, Light Emitting (LEDs)-3700 — *See Vol. B*

Diodes, Limiting-4800

§ Alpha Industries, Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
§† FEI Microwave, Inc., Frequency Electronics, Inc., 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
Hitachi America, Ltd., 2210 O'Toole Ave., San Jose, CA 95131 408-435-8300
† M/A COM Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Diode Corp., Washington St-Box 250, W. Stewartstown, NH 03597 ..... 603-246-3362/3363
§† Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
§ Schauer Manufacturing, 4500 Alpine Ave., Cincinnati, OH 45242 513-791-3030
§ Semiconductor Technology, Inc., 3131 S.E. Jay St., Stuart, FL 34997 305-283-4500
§† Teledyne Crystalonics, Teledyne Industries, Inc., 147 Sherman St., Cambridge, MA 02140 617-491-1670
§† Thor Electronics, 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300

Diodes, Liquid Crystal (LCDs)-3700 — *See Vol. B*

Diodes, Matched Pairs-4800

American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ..... A•2115
ELMA Electronic Inc., 41440 Christy Street, Fremont, CA 94538, 415-656-3400 ..... C•1605
Teccor Electronics, Inc., 1801 Hurd Dr., Irving, TX 75038, 214-580-1515 ..... A•2146-2149
† Voltage Multipliers, Inc., 8711 W. Roosevelt Ave., Visalia, CA 93291, 209-651-1402 ..... A•2151
§ A E G Corporation, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269 201-231-8300
§† Alpha Industries, Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
American Power Devices, 7 Andover St., Andover, MA 01810 617-475-4074
§ Codi Semiconductor, Inc., 144 Market St., Kenilworth, NJ 07033 201-298-0400
† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
† Eaton Corporation, Microwave Products Division, 785 Palomar Ave., Sunnyvale, CA 94086 408-730-6410
§† FEI Microwave, Inc., Frequency Electronics, Inc., 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
§ Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
Hitachi America, Ltd., 2210 O'Toole Ave., San Jose, CA 95131 408-435-8300
§† Honeywell Optoelectronics, 830 E. Arapaho Dr., Richardson, TX 75081 214-470-4271
§ International Diode, 229 Cleveland Ave., Harrison, NJ 07029 201-482-6518
MACOM, Inc., 43 Second Ave., Bldg. 8, Burlington, MA 01803 617-272-3000
† M/A COM Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
McGuirk Electronics Co. Inc., 212 So. Main St, P. O. Box 853, Middleton, MA 01949 617-933-3500
† Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§† Microsemi Corp., 2830 S. Fairview St., Santa Ana, CA 92704 714-979-8220
§† Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
MSI Electronics, Inc., 34-32 57th St., Woodside, NY 11377 718-672-6500
§ Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
Poulin Associates, Inc., 302 North Rd., Sudbury, MA 01776 617-443-7333
§ Powerex, Westinghouse, GE, Mitsubishi, Hillis St., Youngwood, PA 15697 412-925-7272
§ Semicoa, 333 McCormick Ave., Costa Mesa, CA 92626 714-979-1900
§ Semicon Components, Inc., Div. of Semicon, Inc., 10 North Ave., Burlington, MA 01803 617-272-9015
§ Semiconductor Technology, Inc., 3131 S.E. Jay St., Stuart, FL 34997 305-283-4500
§† Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 805-498-2111
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311
§ St-Semiconductors of Indiana, Inc., 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402-0609 812-332-1435
Summit Engineering Corp., Box 938, Bozeman, MT 59715 406-587-4511
§† Teledyne Crystalonics, Teledyne Industries, Inc., 147 Sherman St., Cambridge, MA 02140 617-491-1670
§† Thor Electronics, 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300

Diodes, Matched Quads-4800

ELMA Electronic Inc., 41440 Christy Street, Fremont, CA 94538, 415-656-3400 ..... C•1605
† Voltage Multipliers, Inc., 8711 W. Roosevelt Ave., Visalia, CA 93291, 209-651-1402 ..... A•2151

§ A E G Corporation, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269 201-231-8300
§ Alpha Industries, Inc., 20 Sylvan Rd, Woburn, MA 01801 617-935-5150
American Power Devices, 7 Andover St, Andover, MA 01810 617-475-4074
Codi Semiconductor, Inc., 144 Market St, Kenilworth, NJ 07033 201-298-0400
† Dionics, 65 Rushmore St, Westbury, NY 11590 516-997-7474
† Eaton Corporation, Microwave Products Division, 785 Palomar Ave., Sunnyvale, CA 94086 408-730-6410
§† FEI Microwave, Inc., Frequency Electronics, Inc., 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
§ Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
Hitachi America, Ltd., 2210 O'Toole Ave., San Jose, CA 95131 408-435-8300
§ International Diode, 229 Cleveland Ave., Harrison, NJ 07029 201-482-6518
MACOM, Inc., 43 Second Ave., Bldg. 8, Burlington, MA 01803 617-272-3000
† Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
MSI Electronics, Inc., 34-32 57th St, Woodside, NY 11377 718-672-6500
§ Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
Poulin Associates, Inc., 302 North Rd., Sudbury, MA 01776 617-443-7333
§ Semicon Components, Inc., Div. of Semicon, Inc., 10 North Ave., Burlington, MA 01803 617-272-9015
§ Semiconductor Technology, Inc., 3131 S.E. Jay St, Stuart, FL 34997 305-283-4500
† Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 805-498-2111
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311
St-Semiconductors of Indiana, Inc., 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402-0609 812-332-1435
Summit Engineering Corp., Box 938, Bozeman, MT 59715 406-587-4511
§† Teledyne Crystalonics, Teledyne Industries, Inc., 147 Sherman St, Cambridge, MA 02140 617-491-1670
§ Texas Instrs., Inc., Box 809066, Dallas, TX 75380 ..... 800-232-3200 (ext 700)
§† Thor Electronics, 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300

Diodes, Microwave Detector-4800

Elcom Systems, Inc., 932 Clint Moore Rd., Boca Raton, FL 33487, 305-994-1774 ..... A•1768
§ A E G Corporation, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269 201-231-8300
§† Alpha Industries, Inc., 20 Sylvan Rd, Woburn, MA 01801 617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St, Methuen, MA 01844 617-682-4661
Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
§† FEI Microwave, Inc., Frequency Electronics, Inc., 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
§ Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
Hitachi America, Ltd., 2210 O'Toole Ave., San Jose, CA 95131 408-435-8300
MACOM, Inc., 43 Second Ave., Bldg. 8, Burlington, MA 01803 617-272-3000
† M/A COM Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
† Shindengen America Inc., 2649 Townsgate Road, Ste. 200, Westlake Vl, CA 91361 805-373-1130
§† Thor Electronics, 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300

Diodes, Microwave Mixer-4800

§ A E G Corporation, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269 201-231-8300
§† Alpha Industries, Inc., 20 Sylvan Rd, Woburn, MA 01801 617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St, Methuen, MA 01844 617-682-4661
Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
† California Eastern Labs. Inc., 3260 Jay St, Santa Clara, CA 95054 408-988-3500
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§ **EG & G Vactec, 10900 Page Blvd., St. Louis, MO 63132, 314-423-4900 ... B•1271**
Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 350166, Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1775
NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... B•1174
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Diodes, Silicon-4800

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† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
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Sprague Electric Company, The Semiconductor Group, 115 Northeast Cutoff, Box 2036, Worcester, MA 01613-2036 617-853-5000
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§† Unitrode Corp., 580 Pleasant St., Watertown, MA 02172 617-926-0404
§ Varo Quality Semiconductor, 1000 N. Shiloh Rd., Garland, TX 75040 214-487-4300

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§† Electronic Devices, Inc., 21 Gray Oaks Ave., Yonkers, NY 10710, 914-965-4400 ..... A•2131
Micronetics, 36 Oak St., Norwood, NJ 07648, 201-767-1320 ..... D•1300
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§ Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876 401-762-3800
§ International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
§ ITT Semiconductors, ITT Corp., 55 Merrimack St., So. Lawrence, MA 01843 617-688-1881
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§ Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
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§ Rohm Corporation, 8 Whatney, Irvine, CA 92718 714-855-2131
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Sprague Electric Company, The Semiconductor Group, 115 Northeast Cutoff, Box 2036, Worcester, MA 01613-2036 617-853-5000
Sussex Semiconductor, Inc., Rte. 206, Branchville, NJ 07826 201-948-3633

Diodes, Temperature Compensating-4800

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Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876, 401-762-3800 ..... A•2119
Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... A•2134
§† Quality Thermistor, 2147 Centurion Pl., Boise, ID 83709, 208-377-3373 ..... B•1864-1865
Alpha Industries, Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
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International Components Corp., 105 Maxess Rd., Melville, NY 11747 ... 516-293-1500
§ International Diode, 229 Cleveland Ave., Harrison, NJ 07029 201-482-6518
§† Microsemi Corp., 2830 S. Fairview St., Santa Ana, CA 92704 714-979-8220
§† Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
Sprague Electric Company, The Semiconductor Group, 115 Northeast Cutoff, Box 2036, Worcester, MA 01613-2036 617-853-5000
§† Thor Electronics, 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300

Diodes, Trigger — See Diodes, Avalanche (Vol. A)

Diodes, Tuning, Surface Mount-4800

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Diodes, Tunnel-4800

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MACOM, Inc., 43 Second Ave., Bldg. 8, Burlington, MA 01803 617-272-3000
† Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
† Microsemi Corp., 2830 S. Fairview St., Santa Ana, CA 92704 714-979-8220
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
§† Thor Electronics, 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300

Diodes, Varactor-4800

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EPD Electronics, Inc., 16921 S. Western Ave., Ste. 110, Gardena, CA 90247, 213-323-7771 ..... D•1063
Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... A•2134
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Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
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† Eaton Corporation, Microwave Products Division, 785 Palomar Ave., Sunnyvale, CA 94086 408-730-6410

Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
§ Frequency Sources, Inc., Semiconductor Div., 16 Maple Rd., Chelmsford, MA 01824 ..... 617-256-4113/8101
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MACOM, Inc., 43 Second Ave., Bldg. 8, Burlington, MA 01803 617-272-3000
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§† Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
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§ NTE Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
§ Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830 201-321-3400
§† Teledyne Crystalonics, Teledyne Industries, Inc., 147 Sherman St., Cambridge, MA 02140 617-491-1670
Thomson Electron Tubes & Devices Corp., Special Products Div., 550 Mount Pleasant Ave., Dover, NJ 07801 201-328-1400
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§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
Varian Associates, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

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Diodes, Video Detector — See Diodes, Microwave Detector (Vol. A)

Diodes, Zener & Stabistors (Forward Reference Diodes)-4800

American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ..... A•2115
§ Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876, 401-762-3800 ..... A•2117,2119,2123
§ Fagor Elctrn. Comps., Inc., Natl. Mktg. Sls. Offs., Fagor Electrotecnica S. Coop., 8419 Canoga Ave., Canoga Pk., CA 91304, 818-718-2500;800-624-5367 ..... A•2132
Julie Research Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 ..... D•1280
§ Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... A•2134
§ A E G Corporation, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269 201-231-8300
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Ei North America, 435 E. 79th St., New York, NY 10021 212-517-5622
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§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
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ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 .. 516-937-3475
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§ Microwave Diode Corp., Washington St-Box 250, W. Stewartstown, NH 03597 ..... 603-246-3362/3363
§† Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
§† NAE, 69 Bennett St., Lynn, MA 01905 617-598-4800
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§ NTE Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
§ Rohm Corporation, 8 Whatney, Irvine, CA 92718 714-855-2131
§ Schauer Manufacturing, 4500 Alpine Ave., Cincinnati, OH 45242 513-791-3030
§ Semicon Components, Inc., Div. of Semicon, Inc., 10 North Ave., Burlington, MA 01803 617-272-9015
§ Semiconductor Technology, Inc., 3131 S.E. Jay St., Stuart, FL 34997 305-283-4500
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
Solitron Devices, 8808 Balboa Ave., San Diego, CA 92123 619-278-8780
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Diodes, Zener, Surface Mount-4800

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Dividers, Analog-3130

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Advanced Analog, Intech, 2270 Martin Ave., Santa Clara, CA 95050 408-988-4930
American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
† Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106 617-329-4700
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§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
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Dividers, Frequency-3450

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§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 315-432-8909
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† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
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† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-727-0700
Coaxial Dynamics, 15210 Industrial Parkway, Cleveland, OH 44135 .... 1-800-COAXIAL
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
† Dielectric Communications, General Signal, Tower Hill Rd., Raymond, ME 04071 ..... 207-655-4555;800-341-9678
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† Narda Microwave Corp., Subsidiary of Loral Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† Norsal Industries, 85 D Hoffman Lane S., Central Islip, NY 11722 516-234-1200
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† Sage Laboratories, Inc., 11 Huron Dr., Natick, MA 01760 617-653-0844
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† Werlatone, Inc., P. O. Box 47, Rte. 22, Brewster, NY 10509 914-279-6187
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 .. 415-592-8832
Wide Band Engineering Co., Inc., Box 21652, Phoenix, AZ 85036 602-254-1570
§ Wiltron, 490 Jarvis Dr., Morgan Hill, CA 95037-2809 408-778-2000

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Elcom Systems, Inc., 932 Clint Moore Rd., Boca Raton, FL 33487, 305-994-1774 ..... A•1768
† Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 350166, Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1775
North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•2302
§ Penstock Engineering Labs., Penstock, Inc., 520 Mercury Dr., Sunnyvale, CA 94086-4018, 408-730-0300 ..... A•1844
TRM, Inc., 401 Kelly Ave., Grenier Field, Manchester, NH 03103, 603-627-6000 ..... A•1845-1846
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500

Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St., Methuen, MA 01844 617-682-4661
Amplifier Research, 160 School House Rd., Souderton, PA 18964-9990 215-723-8181
§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 315-432-8909
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-727-0700
† Channel Microwave, TRAK Microwave Corp., 3/4 Lindsay Court, Dundee Technlg. Pk., Dundee, SCOTLAND DD2 1TY 44-382-561509
† Eastern Microwave, 40 Ray Ave., Burlington, MA 01803 617-273-4700
† EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
† Locus, Box 740, State College, PA 16804 814-466-6275
† Lorch Electronics, Sub. of Vernitron Corp., 105 Cedar La., Englewood, NJ 07631 201-569-8282
MACOM, Inc., 43 Second Ave., Bldg. 8, Burlington, MA 01803 617-272-3000
§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
† Merrimac Industries, 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Micronics Technology Inc., 7 Alexander Place, Glen Cove, NY 11542 ... 516-759-5600
† Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
§ Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 .... 315-437-3953; 800-448-1666
† Microwave Systems Inc., 6075 E. Molloy Rd., Syracuse, NY 13211-2100 315-437-9951
† Mitec Electronics, 104 Gun Avenue, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
Olektron Corp., Signal Technology Corp., 61 Sutton Road, Webster, MA 01570 617-943-7440
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Reeve Electronics, Mellish E. Murray, 1715 W. Carroll Ave., Chicago, IL 60612 312-670-0150
RLC Electronics, Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., 11 Huron Dr., Natick, MA 01760 617-653-0844
Sanders Associates, Inc., ECBD, A Lockheed Company, 955 Perimeter Rd., Manchester, NH 03108-8500 603-645-5548
† Sanders Associates, Inc., Microwave, 955 Perimeter Rd., Manchester, NH 03108 ..... 603-645-6000 Ext. 4299
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
† TRAK Microwave Ltd., TRAK Microwave Corp., 3/4 Lindsay Court, Dundee Technlg. Pk., Dundee, SCOTLAND DD2 1TY 44-382-561509
† Transco Products, Inc., 1001 Flynn Rd., Camarillo, CA 93011-6003 805-987-8007
† Vectronics Microwave Corp., 113 Lincoln Blvd., Middlesex, NJ 08846 ... 201-356-2377
§† Vega Precision Labs., 800 Follin La., Vienna, VA 22180 703-938-6300
† Wavecom, Sub. of Loral Corp., 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
§ Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100
Weinschel Engineering, One Weinschel La., Gaithersburg, MD 20877 .... 301-948-3434; 800-638-2048
§ Wiltron, 490 Jarvis Dr., Morgan Hill, CA 95037-2809 408-778-2000

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§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Megatran Electronic Power, Rising Sun Rd., Bordentown, NJ 08505 609-298-7300
§ NTE Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
Richard-Lee Co., Box 724, New Providence, NJ 07974 201-276-0710
§ Semikron, Inc., 11E Executive Dr., P.O. Box 66, Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
§† Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 805-498-2111
§ Staco Energy Products Co., 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191

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Drivers, Speaker-1300 — *See Vol. D*

Drivers, Surface Mount-1100 — *See Vol. D*

Drivers, Switch-3450

† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
† Circuit Technology Inc., 160 Smith St., Farmingdale, NY 11735 516-293-8686
Daico Industries, Inc., 2139 East Del Amo Blvd., Compton, CA 90224 213-631-1143
Sanders Associates, Inc., ECBD, A Lockheed Company, 955 Perimeter Rd., Manchester, NH 03108-8500 603-645-5548
† Sanders Associates, Inc., Microwave, 955 Perimeter Rd., Manchester, NH 03108 ..... 603-645-6000 Ext. 4299

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Electromagnets-1850

Walker Scientific, Rockdale St., Worcester, MA 01606, 617-852-3674;617-853-3232 ..... D•1346

† A.P.W. Co., Inc., 72 W. Main, Rockaway, NJ 07866 201-627-0643

§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100

Magnet Sales & Mfg. Co. Inc., 11250 Playa Court, Culver City, CA 90230-6127 ..... 213-391-7213;800-421-6692

§ Regdon Solenoid, Inc., 3713 Grand Blvd., Brookfield, IL 60513 312-485-5152

Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131 408-432-8020

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Sunrise Electronics, Inc., 524 S. Vermont Ave., Glendora, CA 91740, 818-914-1926 ..... A•1758

Ango Electronics Corp., 16 North Third St, Harrison, NJ 07029 201-484-1115

§† BYTEK Corp., Instrument Systems Div., 1021 S. Rogers Circle, Boca Raton, FL 33431 305-994-3520

International Instrumentation, Inc., 2282 Townsgate Rd., Westlake Vlg., CA 91361 805-495-7673
§ International Microsystems, 461 Valley Way, Milpitas, CA 95035 800-237-4734
Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
Oliver Advanced Engineering, 320 W. Arden St., Glendale, CA 91203 818-240-0080
§ Southern Computer Corp., 141 W. Wieuca Rd., Ste. 300-B, Atlanta, GA 30342 404-252-3340
§† Spectronics Corp., 956 Brush Hollow Rd., Westbury, NY 11590 516-333-4840
UVP, Inc., 5100 Walnut Grove Ave., P.O. Box 1501, San Gabriel, CA 91778 818-285-3123

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§ Fair-Rite Prods., PO Box J, Wallkill, NY 12589, 914-895-2055 ..... C•1750
§ FDK America, Inc., Fuji Electromechanical Co., Ltd., 17326 Edwards Rd., Ste. A-130, Cerritos, CA 90701, 213-404-1770 ..... A•1319
§ Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830, 201-321-3400 ..... A•1321
TDK Corporation, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku,, Tokyo, JAPAN 103, (03) 278-5111 ..... A•1322-1325
§ Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131, 408-432-8020 ..... A•1329
§ Allen-Bradley Co., Magnetics Division, Div. of Rockwell Corp., 5900 N. Harrison St., Shawnee, OK 74801 405-275-2100
Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057 213-381-2500
§† Atomergic Chemetals Corp., 91 Carolyn Blvd., Farmingdale, NY 11735-1527 516-694-9000
§† Capcon, Inc., 147 West 25th Street, New York, NY 10001 212-243-6275
† Centerflex Techn. Corp., 221 Seventh Ave., P.O. Box 21, Hawthorne, NJ 07507 201-423-0505
§ Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, NJ 07006 201-227-4222
§ Cosmo Corporation, 3239 W. 14th St., Cleveland, OH 44109 216-861-5594
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
Ferronics, 52 N. Main St., Fairport, NY 14450 716-388-1020
§ Ferroxcube, Amperex Electronic Corp., 5083 Kings Hwy., Saugerties, NY 12477 914-246-2811
Hoosier Magnetics, Inc., 110 N.E. 5th St., P.O. Box 753, Washington, IN 47501 812-254-1901
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
§† Krystinel Corp., 126 Pennsylvania Ave., Paterson, NJ 07509 201-345-8900
§† Magnetics, Spang & Co., Box 391, Butler, PA 16003-0391 412-282-8282
† Magnet Sales & Mfg. Co. Inc., 11250 Playa Court, Culver City, CA 90230-6127 ..... 213-391-7213;800-421-6692
Multi Products International, 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009 201-239-8183
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
National Micronetics, Route 28, West Hurley, NY 12136 914-338-0333
Permag, 400 Karin La., Hicksville, NY 11801 516-822-3311
† Quartzite Processing, Inc., 6 Holyoke St., Malden, MA 02148 617-322-3611
† Raytheon Co., Microwave & Power Tube Div., 190 Willow St., Waltham, MA 02154 617-899-8400
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Steward, D. M., Mfg. Co., P.O. Box 510, Chattanooga, TN 37401 615-867-4100
† Thomson Electron Tubes & Devices Corp., Special Products Div., 550 Mount Pleasant Ave., Dover, NJ 07801 201-328-1400
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E-8, Tampa, FL 33634 813-884-1411
Trans-Tech, Alpha Industries, 5520 Adamstown Rd., Adamstown, MD 21710 301-695-9400

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† Ohmtek Inc., Sfernice Group Company, 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ..... A•2023
Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483, 619-575-9353 ..... A•2031
† Acheson Colloids, Div. of Acheson Industries, Inc., P.O. Box 611747, Port Huron, MI 48061-1747 313-984-5581
† Assembly Specialists, 914 Main St., Box 965, Acton, MA 01720 617-263-9100
§† Datak Corp., 3117 Paterson Plank Rd., N. Bergen, NJ 07047 201-863-7667
† Engelhard Corp., Menlo Pk., CN40, Edison, NJ 08818 ..... 201-632-6000;800-932-0444 (in NJ)
† Environmental Comm., 3150 Pullman St., Costa Mesa, CA 92627 714-557-7800
† Hycomp, Inc., 165 Cedar Hill St., Marlborough, MA 01752 617-485-6300
Materials Research Corporation, Route 303, Orangeburg, NY 10962 914-359-4200
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 .. 617-329-1508

Filters, AC Power Line-2700

Comstron Corp., 10 Hub Dr., Melville, NY 11747, 516-756-1100 ..... A•1639
Corcom, Inc., 1600 Winchester Rd., Libertyville, IL 60048, 312-680-7400 ..... A•1640-1641
Curtis Industries, 7400 W. Douglas Ave., P.O. Box 18699, Milwaukee, WI 53218-0699, 414-535-1500 ..... A•1642-1643
Delta Products Corporation, 3823 Spinnaker Ct., Fremont, CA 94538, 415-770-0660 ..... A•1644-1645
Eichhoff Electronics, 205 Hallene Rd., Warwick, RI 02886, 401-738-1440 ..... A•1650
Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ..... A•1652
Elpac Components, Elpac Electronics, Inc., 3131 S. Standard Ave., Santa Ana, CA 92705, 714-979-4440 ..... A•1082-1083
Filter Concepts Inc., 2624 S. Rousselle, Santa Ana, CA 92707, 714-545-7003 ..... A•1656-1657
† Filtron Co., Inc., Sub. of ARX Inc., 148-E Sweet Hollow Rd., Old Bethpage, NY 11804, 516-752-1144 ..... A•1659
JMK, Inc., 15 Caldwell Dr., Amherst, NH 03031, ;;;603-886-4115 ... A•1663,1665
Marway Prods. Inc., 311 N. Clara St., Santa Ana, CA 92703, 714-973-1800 ..... D•2132
Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•1675
Power Dynamics Inc., 59 Lakeside Ave., P.O. Box 539, West Orange, NJ 07052, 201-736-5722 ..... A•1679
RTE Aerovox Inc., 740 Belleville Ave., New Bedford, MA 02745, 617-994-9661 ..... A•1688-1690
Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483, 619-575-9353 ..... A•1694
Tri-Mag, Inc., 8210 West Doe Ave., Visalia, CA 93291, 209-651-2222 ..... A•1703
§ Control Concepts Corp., P.O. Box 1380, Binghamton, NY 13902-1380 ... 607-724-2484

† Elmag Division, Lindgren RF Enclosures, 54 Clark St., Newark, NJ 07104 201-481-1600
MCG Elctrns., 12 Burt Dr., Deer Park, NY 11729 516-586-5125
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ..... 914-699-5514;800-431-1064
§ Pulizzi Engineering, Inc., 3260 S. Susan St., Santa Ana, CA 92704-6865 714-540-4229
Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000

Filters, AF-2700

A. P. Circuit, 256 Lincoln Ave., Brooklyn, NY 11208, 212-737-1348 ..... A•1637
Chesterfield Products, 37 Midland Ave., Elmwood Park, NJ 07407, 201-797-9655 ..... A•1638
† Comstron Corp., 10 Hub Dr., Melville, NY 11747, 516-756-1100 ..... A•1639
† Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ..... A•1652
† ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558,1653
JMK, Inc., 15 Caldwell Dr., Amherst, NH 03031, ;;;603-886-4115 ... A•1663,1665
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 ..... A•1666
Krohn-Hite Corp., Avon Indl. Pk., Bodwell St., Avon, MA 02322, 508-580-1660 ..... A•1669
McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1409
Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1678
Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 ... A•1680-1686
RTE Aerovox Inc., 740 Belleville Ave., New Bedford, MA 02745, 617-994-9661 ..... A•1688
Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483, 619-575-9353 ..... A•1694
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1701
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•1706-1710,1712
† Alpha Components, 1106 E. Simpson Rd., Mechanicsburg, PA 17055 ... 717-697-8595
Alpha-Tek, 7286 Murdy Circle, Huntington Beach, CA 92647 714-847-7515
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
§ Balston, 703 Massachusetts Ave., Lexington, MA 02173 617-861-7240
† BG Electronics, 30 South St., Mt. Vernon, NY 10550 914-664-5591
† Cirtech, EG & G, 15237 Cherry St., Shawnee Mission, KS 66223 913-681-2801
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
Data Delay Devices, 3 Mount Prospect Ave., Clifton, NJ 07013-1915 201-773-2299
Datel, Inc., 11 Cabot Blvd., Mansfield, MA 02048 617-339-3000
De Coursey Engineering Laboratory, 11828 W. Jefferson, Culver City, CA 90230 ..... 213-EX7-9668
Electrocom Industries, 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
§ Electronic Specialists, 171 South Main St., Natick, MA 01760 ..... 617-655-1532; 800-225-4876
§ Frazier, 1930 Valley View La., Dallas, TX 75234 214-241-3441
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761
Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
† Genisco Technology Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
Gennum Corporation, Linear Technology Inc., P.O. Box 489, Sta. A, Burlington, ON, CANADA L7R 3Y3 ..... 800-263-9353;416-632-2996
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
Hopkins Engrg., 12900 Foothill Blvd., San Fernando, CA 91342 818-361-8691
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
ITHACO, Inc., Meas. & Control Instrs. Div., 735 W. Clinton St., P.O. Box 6437, Ithaca, NY 14851-6437 607-272-7640
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 ..... 201-396-9400; 1-800-223-0603
§† Linear Technology Corp., 1630 McCarthy Blvd., Milpitas, CA 95035 408-432-1900
† Magnetic Component Engineering, Inc., 11379 Playa Street, Culver City, CA 90230 213-398-4761
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Modular Audio Products, Modular Devices, Inc., 50 Orville Dr., Bohemia, NY 11716 516-567-9620
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 312-564-5100
† Networks International Corporation, 13924 W. 108th St., Lenexa, KS 66215 913-469-6494
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ..... 914-699-5514;800-431-1064
Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034 ... 215-643-6950
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Rockwell Filter Products, 2990 Airway Ave., Costa Mesa, CA 92626 714-641-5311
§ Shure Bros., 222 Hartrey Ave., Evanston, IL 60202-3696 312-866-2200
Silicon Systems Inc., 14351 Myford Rd., Tustin, CA 92680 714-979-0941
Solar Electronics Co., A. T. Parker, Inc., 901 N. Highland, Hollywood, CA 90038 213-462-0806
§† Soshin Electric Co., Ltd., No. 18-18, 1-Chome Nakamagome, Ota-Ku, Tokyo, JAPAN ..... (03) 775-2111
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600
Universal Ad-Yu/D-F Corp., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33626 813-855-6611

Filters, Air — See Air Cleaners & Filters (Vol. C)

Filters, Air (for Clean Room)-2550 — *See Vol. D*

Filters, Air (for Disk Drives)-2700

§† Aluminum Filter, 1000 Cindy Lane, Carpinteria, CA 93013 805-684-7651
Cambridge Filter Corp., P.O. Box 4906, Syracuse, NY 13221-4906 315-457-1000
Micronel U.S., 2142F Industrial Ct., Sycamore Research Center, Vista, CA 92083 619-727-7400

Filters, Analog — See Filters, Continuously Variable (Vol. A)

Filters, Antenna-2700

† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 .... A•1666
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•1706
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
† Alpha Components, 1106 E. Simpson Rd., Mechanicsburg, PA 17055 ... 717-697-8595
Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Antenna Specialists, The Allen Group, 30500 Bruce Industrial Pkwy., Cleveland, OH 44139 216-349-8400
† Applied Research, Inc., 111 New South Rd., Hicksville, NY 11802 516-938-9700
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
† Bird Electronic Corp., 30303 Aurora Rd., Cleveland, OH 44139-2794 216-248-1200
Captor Corp., 5040 S. County Rd. (25A), Tipp City, OH 45371 513-667-8484
Chesterfield Products, 37 Midland Ave., Elmwood Park, NJ 07407 201-797-9655
† Cincinnati Elctrns., 2630 Glendale Milford Rd., Cincinnati, OH 45241 513-733-6100
Cir-Q-Tel, Inc., 6600-04 Virginia Manor Rd., Beltsville, MD 20805 301-946-1800
† Cirtech, EG & G, 15237 Cherry St., Shawnee Mission, KS 66223 913-681-2801
Coaxial Dynamics, 15210 Industrial Parkway, Cleveland, OH 44135 .... 1-800-COAXIAL
† Comstron Corp., 10 Hub Dr., Melville, NY 11747 516-756-1100
† Conolog Corp., 5 Columbia Rd., Somerville, NJ 08876 201-722-8081
Continental Electronics, Division of Varian Associates, Inc., P.O. Box 270879, Dallas, TX 75227 214-381-7161
Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
§ Electronic Specialists, 171 South Main St., Natick, MA 01760 ..... 617-655-1532; 800-225-4876
† Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
† Genisco Technology Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Hughes Microelectronics Circuits Division, 500 Superior Ave., P.O. Box H, Newport Beach, CA 92658-8903 714-759-2952
† Integrated Microwave, 3422 Tripp Ct., San Diego, CA 92121 619-259-2600
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 ..... 201-396-9400; 1-800-223-0603
† Lorch Electronics, Sub. of Vernitron Corp., 105 Cedar La., Englewood, NJ 07631 201-569-8282
McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065 717-486-3411
Micro-Coax Components, Inc., a UTI Company, Box E, Collegeville, PA 19426 215-489-3700
† Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
§ Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 .... 315-437-3953; 800-448-1666
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080 404-436-1300
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804 407-298-2000
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Sage Laboratories, Inc., 11 Huron Dr., Natick, MA 01760 617-653-0844
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Sinclair Radio Laboratories Ltd., 85 Mary St., Aurora, ONT., CANADA L4G 3G9 416-727-0165
§† Soshin Electric Co., Ltd., No. 18-18, 1-Chome Nakamagome, Ota-Ku, Tokyo, JAPAN ..... (03) 775-2111
Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
† Telonic/Berkeley, Berkeley Inds. Inc., P.O. Box 277, Laguna Beach, CA 92652 714-494-9401
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
† Transco Products, Inc., 1001 Flynn Rd., Camarillo, CA 93011-6003 805-987-8007
† Wavecom, Sub. of Loral Corp., 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010

Filters, Antialias-2700

A. P. Circuit, 256 Lincoln Ave., Brooklyn, NY 11208, 212-737-1348 ..... A•1637
Datel, Inc., 11 Cabot Blvd., Mansfield, MA 02048, 617-339-3000 ..... D•1159
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830, 617-374-0761 ..... A•1661
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 ..... A•1666-1667
Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 ... A•1682-1686

TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•1709
† BG Electronics, 30 South St, Mt. Vernon, NY 10550 914-664-5591
Chesterfield Products, 37 Midland Ave., Elmwood Park, NJ 07407 201-797-9655
Cir-Q-Tel, Inc., 6600-04 Virginia Manor Rd, Beltsville, MD 20805 301-946-1800
Hycomp, Inc., 165 Cedar Hill St, Marlborough, MA 01752 617-485-6300
† Integrated Microwave, 3422 Tripp Ct, San Diego, CA 92121 619-259-2600
§† Linear Technology Corp., 1630 McCarthy Blvd., Milpitas, CA 95035 408-432-1900
Matthey Electronics, Television Equipment Associates, Box 393, South Salem, NY 10590 914-763-8893
Preston Scientific, 805 E. Cerritos Ave., Anaheim, CA 92805 714-776-6400
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 .. 415-592-8832

Filters, Band Elimination-2700

Allen Avionics, Inc., 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ..... A•1496,1635
§† Andersen Laboratories, 1280 Blue Hills Ave., Bloomfield, CT 06002, 203-242-0761 ..... A•1636
A. P. Circuit, 256 Lincoln Ave., Brooklyn, NY 11208, 212-737-1348 ..... A•1637
Chesterfield Products, 37 Midland Ave., Elmwood Park, NJ 07407, 201-797-9655 ..... A•1638
† Comstron Corp., 10 Hub Dr., Melville, NY 11747, 516-756-1100 ..... A•1639
Datel, Inc., 11 Cabot Blvd., Mansfield, MA 02048, 617-339-3000 ..... D•1159
† Eagle, P.O. Box 911, Fallbrook, CA 92028, 619-728-6000 ..... A•1647
Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ..... A•1652
Elpac Components, Elpac Electronics, Inc., 3131 S. Standard Ave., Santa Ana, CA 92705, 714-979-4440 ..... A•1082-1083
† ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558,1653
† Frequency Electronics, Inc., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ..... A•1398
† Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377, 718-424-7500 ..... A•1400
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 ..... A•1666-1667
Matthey Electronics, Television Equipment Associates, Box 393, South Salem, NY 10590, 914-763-8893 ..... A•1670
† Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... A•1425
Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 350166, Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1775
PCA Electronics, 16799 Schoenborn St., Sepulveda, CA 91343, 818-892-0761 ..... A•1611
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1678
Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 ..... A•1680-1681,1684,1686
† Sawtek Inc., P.O. Box 609501, Orlando, FL 32860-9501, 407-886-8860 ... A•1463
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•1708,1713
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600 ..... A•1479
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070, 415-592-8832 ..... A•1715
Advanced Filter Devices, Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92009 619-438-2074
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
† Alpha Components, 1106 E. Simpson Rd., Mechanicsburg, PA 17055 ... 717-697-8595
Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Applied Research, Inc., 111 New South Rd., Hicksville, NY 11802 516-938-9700
† Arra Inc., 15 Harold Ct, Bay Shore, NY 11706 516-231-8400
ATV Research, Inc., 1301 Broadway, Dakota City, NE 68731 402-987-3771
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
† BG Electronics, 30 South St, Mt. Vernon, NY 10550 914-664-5591
† Bird Electronic Corp., 30303 Aurora Rd., Cleveland, OH 44139-2794 216-248-1200
† Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 602-746-1111
Captor Corp., 5040 S. County Rd. (25A), Tipp City, OH 45371 513-667-8484
Cir-Q-Tel, Inc., 6600-04 Virginia Manor Rd., Beltsville, MD 20805 301-946-1800
† Cirtech, EG & G, 15237 Cherry St, Shawnee Mission, KS 66223 913-681-2801
† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Conolog Corp., 5 Columbia Rd., Somerville, NJ 08876 201-722-8081
CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
† CTS Corporation, Microelectronics Div., 1201 Cumberland Ave., W. Lafayette, IN 47906 317-463-2565
† Daden Associates, 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653 714-770-1522
† Damon Electronics Div., 80 Wilson Way, Westwood, MA 02090 617-329-2460
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
§ De Coursey Engineering Laboratory, 11828 W. Jefferson, Culver City, CA 90230 ..... 213-EX7-9668
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Dontech, Inc., 700 Airport Blvd., Doylestown, PA 18901 215-348-5010
§ Dynamics, Div. of Waugh Controls Corp., 9001 Fullbright Ave., Chatsworth, CA 91311 818-998-8281
Ealing Electro-Optics, New Englander Industrial Park, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
Electrocom Industries, 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electro-Mechanics Co., Box 1546, Austin, TX 78767 512-835-4684
§ Electro-Metrics, Penril Corp., 100 Church St, Amsterdam, NY 12010 518-843-2600
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
† Ferretec Inc., 544 Gibralter Dr., Milpitas, CA 95035-6315 408-263-1216
† Filtron Co., Inc., Sub. of ARX Inc., 148-E Sweet Hollow Rd., Old Bethpage, NY 11804 516-752-1144
§† Fox Electronics, 5842 Corporation Circle, Ft. Meyers, FL 33905 813-693-0099
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761
† Genisco Technology Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Hughes Microelectronics Circuits Division, 500 Superior Ave., P.O. Box H, Newport Beach, CA 92658-8903 714-759-2952
† Integrated Microwave, 3422 Tripp Ct, San Diego, CA 92121 619-259-2600
† International Sensor Systems, Inc., Aurora Industrial Pk, Box 345, Aurora, NE 68818 402-694-6111
ITHACO, Inc., Meas. & Control Instrs. Div., 735 W. Clinton St., P.O. Box 6437, Ithaca, NY 14851-6437 607-272-7640
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 ..... 201-396-9400; 1-800-223-0603
Krohn-Hite Corp., Avon Indl. Pk., Bodwell St., Avon, MA 02322 508-580-1660
† Libbey-Owens-Ford Co., Liberty Mirror Products, 851 Third Ave., Brackenridge, PA 15014 412-224-1800
§† Linear Technology Corp., 1630 McCarthy Blvd., Milpitas, CA 95035 408-432-1900
† Lorch Electronics, Sub. of Vernitron Corp., 105 Cedar La., Englewood, NJ 07631 201-569-8282
M/A-COM Microwave Components, Inc., South Avenue, Burlington, MA 01803 617-272-3000
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Marconi Instruments, 3 Pearl Court, Allendale, NJ 07401 201-934-9050
† McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065 717-486-3411
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 .. 617-329-1508
† Metropole Products Inc., P. O. Box 309, Stafford, VA 22554 ..... 703-659-2132; 703-971-7082
† Micronics Technology Inc., 7 Alexander Place, Glen Cove, NY 11542 ... 516-759-5600
† Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 .... 315-437-3953; 800-448-1666
† Mitec Electronics, 104 Gun Avenue, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
§† Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080 404-436-1300
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 312-564-5100
† Networks International Corporation, 13924 W. 108th St., Lenexa, KS 66215 913-469-6494
† North Hills Electronics, 1 Alexander Pl, Glen Cove, NY 11542 516-671-5700
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804 407-298-2000
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034 ... 215-643-6950
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
† Reeves-Hoffman Div., Dynamics Corporation of America, 400 W. North St., Carlisle, PA 17013 717-243-5929
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† RF Monolithics, Inc., 4441 Sigma Rd., Dallas, TX 75244 214-233-2903
Sentry Manufacturing, Crystal Park, Chickasha, OK 73018 405-224-6780
§† Sinclair Radio Laboratories Ltd., 85 Mary St., Aurora, ONT., CANADA L4G 3G9 416-727-0165
Sokol Crystal Products, Inc., 121 Water St., Mineral Point, WI 53565 608-987-3363
§† Soshin Electric Co., Ltd., No. 18-18, 1-Chome Nakamagome, Ota-Ku, Tokyo, JAPAN ..... (03) 775-2111
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† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
Television Equipment Assocs., Box 393, So. Salem, NY 10590-0393 914-763-8893
† Telonic/Berkeley, Berkeley Inds. Inc., P.O. Box 277, Laguna Beach, CA 92652 714-494-9401
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
Varian Associates, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478 .. 216-232-8600
† Vibration Instruments Co., 1614 Orangethorpe Way, Anaheim, CA 92801 714-879-6085
† Wavecom, Sub. of Loral Corp., 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010

Filters, Bandpass-2700

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§† Andersen Laboratories, 1280 Blue Hills Ave., Bloomfield, CT 06002, 203-242-0761 ..... A•1636
A. P. Circuit, 256 Lincoln Ave., Brooklyn, NY 11208, 212-737-1348 ..... A•1637

Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1209
Chesterfield Products, 37 Midland Ave., Elmwood Park, NJ 07407, 201-797-9655 ..... A•1638
† Comstron Corp., 10 Hub Dr., Melville, NY 11747, 516-756-1100 ..... A•1639
Datel, Inc., 11 Cabot Blvd., Mansfield, MA 02048, 617-339-3000 ..... D•1159
† Eagle, P.O. Box 911, Fallbrook, CA 92028, 619-728-6000 ..... A•1647
† Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ..... A•1652
Elpac Components, Elpac Electronics, Inc., 3131 S. Standard Ave., Santa Ana, CA 92705, 714-979-4440 ..... A•1082-1083
† ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558,1653
† Filtron Co., Inc., Sub. of ARX Inc., 148-E Sweet Hollow Rd., Old Bethpage, NY 11804, 516-752-1144 ..... A•1659
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830, 617-374-0761 ..... A•1660-1661
† Frequency Electronics, Inc., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ..... A•1398
† Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377, 718-424-7500 ..... A•1400
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 ..... A•1666-1667
Matthey Electronics, Television Equipment Associates, Box 393, South Salem, NY 10590, 914-763-8893 ..... A•1670
† McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1409,1411
† Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... A•1425
Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 350166, Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1775
NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... B•1174
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1678
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2351
Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 ..... A•1680-1681,1684,1686
† Sawtek Inc., P.O. Box 609501, Orlando, FL 32860-9501, 407-886-8860 ... A•1463
Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131, 408-432-8020 ..... A•1700
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TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•1706-1707,1710
§† Tusonix, Inc., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144, 602-744-0400 ..... A•1714
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600 ..... A•1479
† Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478, 216-232-8600 ..... A•1487
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070, 415-592-8832 ..... A•1715
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† Antenna Specialists, The Allen Group, 30500 Bruce Industrial Pkwy., Cleveland, OH 44139 216-349-8400
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† BG Electronics, 30 South St., Mt. Vernon, NY 10550 914-664-5591
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† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 .. 617-329-1508
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§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 .... 315-437-3953; 800-448-1666
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† North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542 516-671-5700
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§† Sinclair Radio Laboratories Ltd., 85 Mary St., Aurora, ONT., CANADA L4G 3G9 416-727-0165
Sokol Crystal Products, Inc., 121 Water St., Mineral Point, WI 53565 608-987-3363
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† Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95054 408-988-0700
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
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† Telonic/Berkeley, Berkeley Inds. Inc., P.O. Box 277, Laguna Beach, CA 92652 714-494-9401
§ Texscan Instruments, Texscan Corporation, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
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† Wavecom, Sub. of Loral Corp., 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
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† Damon Electronics Div., 80 Wilson Way, Westwood, MA 02090, 617-329-2460 ..... A•1391
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§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 ..... 315-437-3953; 800-448-1666
† Mitec Electronics, 104 Gun Avenue, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
Motorola Ceramic Products, Components Division, 4800 Alameda Blvd. N.E., Albuquerque, NM 87113 505-822-8801
† Narda Microwave Corp., Subsidiary of Loral Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† North Hills Electronics, 1 Alexander Pl, Glen Cove, NY 11542 516-671-5700
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Sage Laboratories, Inc., 11 Huron Dr., Natick, MA 01760 617-653-0844
§ Sealectro-BICC Electronics, 40 Lindeman Dr., Trumbull, CT 06611 203-372-4118
SFE Technologies, 1501 1st St., San Fernando, CA 91340 818-365-9411
§† Sinclair Radio Laboratories Ltd., 85 Mary St., Aurora, ONT., CANADA L4G 3G9 416-727-0165
§ Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 814-455-0966
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
† Telonic/Berkeley, Berkeley Inds. Inc., P.O. Box 277, Laguna Beach, CA 92652 714-494-9401
Texscan Instruments, Texscan Corporation, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
† Transco Products, Inc., 1001 Flynn Rd., Camarillo, CA 93011-6003 805-987-8007
U.S. Instr. Rentals, 2988 Campus Dr., San Mateo, CA 94403 800-824-2873
† UTE Microwave, 3500 Sunset Ave., Asbury Park, NJ 07712 201-922-1009
† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
Varian Associates, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
Veeco Instruments Inc., Terminal Dr., Plainview, NY 11803 516-349-8300
† Wavecom, Sub. of Loral Corp., 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 .. 415-592-8832

Filters, Color, Panel Light - Also see Lenses, Readout & Display; Lenses, Filters, Windows, Infrared-2460 — *See Vol. B*

Filters, Comb-2700

† ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830, 617-374-0761 ..... A•1660-1661
† Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377, 718-424-7500 ..... A•1400
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 .... A•1666
† Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... A•1425
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•1706
Advanced Filter Devices, Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92009 619-438-2074
† Alpha Components, 1106 E. Simpson Rd., Mechanicsburg, PA 17055 ... 717-697-8595
† Applied Research, Inc., 111 New South Rd., Hicksville, NY 11802 516-938-9700
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
† Artronic Instrument Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
† BG Electronics, 30 South St., Mt. Vernon, NY 10550 914-664-5591
† Blackhawk Networks Corp., 14 N. Parker Dr., P.O. Box 919, Janesville, WI 53545 608-752-8701
Cir-Q-Tel, Inc., 6600-04 Virginia Manor Rd., Beltsville, MD 20805 301-946-1800
† Cirtech, EG & G, 15237 Cherry St., Shawnee Mission, KS 66223 913-681-2801
† Damon Electronics Div., 80 Wilson Way, Westwood, MA 02090 617-329-2460
De Coursey Engineering Laboratory, 11828 W. Jefferson, Culver City, CA 90230 ..... 213-EX7-9668
Electrocom Industries, 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
† Frequency Electronics, Inc., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
† Hughes Microelectronics Circuits Division, 500 Superior Ave., P.O. Box H, Newport Beach, CA 92658-8903 714-759-2952
† Integrated Microwave, 3422 Tripp Ct., San Diego, CA 92121 619-259-2600
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
† Lark Engineering Co., Baier & Baier Inc., 26401 Calle Rolando, San Juan Capistrano, CA 92675 714-240-1233
† Lorch Electronics, Sub. of Vernitron Corp., 105 Cedar La., Englewood, NJ 07631 201-569-8282
McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St, P.O. Box B, Mt. Holly Springs, PA 17065 717-486-3411
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
North Hills Electronics, 1 Alexander Pl, Glen Cove, NY 11542 516-671-5700
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
Precision Filters, 240 Cherry St., Ithaca, NY 14850 607-277-3550
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
† Reeves-Hoffman Div., Dynamics Corporation of America, 400 W. North St., Carlisle, PA 17013 717-243-5929
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Rockwell Filter Products, 2990 Airway Ave., Costa Mesa, CA 92626 714-641-5311
§ Sinclair Radio Laboratories Ltd., 85 Mary St., Aurora, ONT., CANADA L4G 3G9 416-727-0165
Sokol Crystal Products, Inc., 121 Water St., Mineral Point, WI 53565 608-987-3363
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
† Telonic/Berkeley, Berkeley Inds. Inc., P.O. Box 277, Laguna Beach, CA 92652 714-494-9401
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050

Filters, Continuously Variable-2700

A. P. Circuit, 256 Lincoln Ave., Brooklyn, NY 11208, 212-737-1348 ..... A•1637
Datel, Inc., 11 Cabot Blvd., Mansfield, MA 02048, 617-339-3000 ..... D•1159
† Eagle, P.O. Box 911, Fallbrook, CA 92028, 619-728-6000 ..... A•1647
ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830, 617-374-0761 ..... A•1660-1661
Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 ..... A•1680-1681,1684,1686
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•1706
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
Cir-Q-Tel, Inc., 6600-04 Virginia Manor Rd., Beltsville, MD 20805 301-946-1800
Coaxial Dynamics, 15210 Industrial Parkway, Cleveland, OH 44135 .... 1-800-COAXIAL
Comstron Corp., 10 Hub Dr., Melville, NY 11747 516-756-1100
† Conolog Corp., 5 Columbia Rd., Somerville, NJ 08876 201-722-8081
Control Concepts Corp., P.O. Box 1380, Binghamton, NY 13902-1380 ... 607-724-2484
† Daden Associates, 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653 714-770-1522
§ Dynamics, Div. of Waugh Controls Corp., 9001 Fullbright Ave., Chatsworth, CA 91311 818-998-8281
Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
† Integrated Microwave, 3422 Tripp Ct., San Diego, CA 92121 619-259-2600
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
Krohn-Hite Corp., Avon Indl. Pk., Bodwell St., Avon, MA 02322 508-580-1660
§† Linear Technology Corp., 1630 McCarthy Blvd., Milpitas, CA 95035 408-432-1900
† Lorch Electronics, Sub. of Vernitron Corp., 105 Cedar La., Englewood, NJ 07631 201-569-8282
† Metropole Products Inc., P. O. Box 309, Stafford, VA 22554 ..... 703-659-2132; 703-971-7082
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 .... 315-437-3953; 800-448-1666
† Narda Microwave Corp., Subsidiary of Loral Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
§ Palomar Engineers, Box 455, Escondido, CA 92025 619-747-3343
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
§ Pulizzi Engineering, Inc., 3260 S. Susan St., Santa Ana, CA 92704-6865 714-540-4229
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Telonic/Berkeley, Berkeley Inds. Inc., P.O. Box 277, Laguna Beach, CA 92652 714-494-9401
Texscan Instruments, Texscan Corporation, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E-8, Tampa, FL 33634 813-884-1411
Universal Ad-Yu/D-F Corp., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100
† Vibration Instruments Co., 1614 Orangethorpe Way, Anaheim, CA 92801 714-879-6085
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33626 813-855-6611
† Wavecom, Sub. of Loral Corp., 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010

Filters, Crystal (Incl. Monolithic Devices)-2300

† **Comstron Corp., 10 Hub Dr., Melville, NY 11747, 516-756-1100** ..... **A•1639**
† **Damon Electronics Div., 80 Wilson Way, Westwood, MA 02090, 617-329-2460** ..... **A•1391**
§† **Fox Electronics, 5842 Corporation Circle, Ft. Meyers, FL 33905, 813-693-0099** ..... **A•1397**
† **Frequency Electronics, Inc., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500** ..... **A•1398**
† **Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377, 718-424-7500** ..... **A•1400**
§† **Hi-Q Crystals, Hybrids International Ltd., 311 N. Lindenwood Dr., Olathe, KS 66062, 913-764-4544** ..... **A•1478**
† **McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411** ..... **A•1409-1411**
† **Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200** .... **A•1425**
§† **Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300** ..... **A•1430**
§ **NDK America, Inc., 20300 Stevens Creek Blvd., Ste. 400, Cupertino, CA 95014, 408-255-0831** ..... **A•1330,1432,1435**
United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600 ..... **A•1479**
† Advanced Filter Devices, Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92009 619-438-2074
† Alpha Components, 1106 E. Simpson Rd., Mechanicsburg, PA 17055 ... 717-697-8595
† B-D Crystal Entprs., Inc., 1727 W. Galbraith Rd., Cincinnati, OH 45239 ... 513-522-3300
† Blackhawk Networks Corp., 14 N. Parker Dr., P.O. Box 919, Janesville, WI 53545 608-752-8701
Cal Crystal Lab., Inc., 1142 N. Gilbert, Anaheim, CA 92801 ..... 714-991-1580; 800-854-XTAL
§ Calmax Corp., 3410-C W. MacArthur Blvd., Santa Ana, CA 92704 714-957-1299
† Cirtech, EG & G, 15237 Cherry St., Shawnee Mission, KS 66223 913-681-2801
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
† CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
† CTS Corp., Frequency Control Div., (Formerly Knights Div.), 400 Reimann Ave., Sandwich, IL 60548 815-786-8411
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Hughes Microelectronics Circuits Division, 500 Superior Ave., P.O. Box H, Newport Beach, CA 92658-8903 714-759-2952
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† Leigh Instruments Ltd., Components Division, 141 Bond Ave., Don Mills, ON, CANADA M3B 1M2 416-447-8531
§† Monitor Products Co., Inc., 502 Via Del Monte, Oceanside, CA 92054 ... 619-433-4510
Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131 312-451-1000
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 312-564-5100
† Networks International Corporation, 13924 W. 108th St., Lenexa, KS 66215 913-469-6494
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804 407-298-2000
§ Raltron Electronics, 2315 N.W. 107th Ave., Miami, FL 33172 305-593-6033
† Reeves-Hoffman Div., Dynamics Corporation of America, 400 W. North St., Carlisle, PA 17013 717-243-5929
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Savoy Electronics, P.O. Box 5727, Ft. Lauderdale, FL 33310 ..... 305-563-1333; 800-327-1282
Sentry Manufacturing, Crystal Park, Chickasha, OK 73018 405-224-6780
Sokol Crystal Products, Inc., 121 Water St., Mineral Point, WI 53565 608-987-3363

Filters, Delay-2700

Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ..... **A•1652**
ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... **A•1653**
† **KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900** ..... **A•1666-1667**
NTK Technical Ceramics, NGK Spark Plugs (USA), Inc., 99 Morris Ave., Springfield, NJ 07081, 201-376-6070 ..... **A•1438**
Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 ... **A•1680-1686**
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... **A•1709**
† Alpha Components, 1106 E. Simpson Rd., Mechanicsburg, PA 17055 ... 717-697-8595
† BG Electronics, 30 South St., Mt. Vernon, NY 10550 914-664-5591
Cir-Q-Tel, Inc., 6600-04 Virginia Manor Rd., Beltsville, MD 20805 301-946-1800
† Integrated Microwave, 3422 Tripp Ct., San Diego, CA 92121 619-259-2600
McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065 717-486-3411
† RF Monolithics, Inc., 4441 Sigma Rd., Dallas, TX 75244 214-233-2903
† Rockwell Filter Products, 2990 Airway Ave., Costa Mesa, CA 92626 714-641-5311
Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483 619-575-9353
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 .. 415-592-8832

Filters, Digital-2700

A. P. Circuit, 256 Lincoln Ave., Brooklyn, NY 11208, 212-737-1348 ..... **A•1637**
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830, 617-374-0761 ..... **A•1661**
Matthey Electronics, Television Equipment Associates, Box 393, South Salem, NY 10590, 914-763-8893 ..... **A•1670**
McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... **A•1411**
Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 ... **A•1680-1686**
§ **Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070** ..... **A•1701**
† Aeroflex Laboratories, Inc., Microelectronics Div., 35 S. Service Rd., Plainview, NY 11803 516-694-6700
† Alpha Components, 1106 E. Simpson Rd., Mechanicsburg, PA 17055 ... 717-697-8595
† Aydin Vector Div., Aydin Corp., Box 328, Newtown, PA 18940-0328 215-968-4271
† Bruel & Kjaer Instrs. Inc., 185 Forest St., Marlboro, MA 01752-3093 617-481-7000
Cir-Q-Tel, Inc., 6600-04 Virginia Manor Rd., Beltsville, MD 20805 301-946-1800
Curtis Industries, 7400 W. Douglas Ave., P.O. Box 18699, Milwaukee, WI 53218-0699 414-535-1500
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
† Digital Radio Corp., 601 S. Pacific Coast Hwy., Redondo Beach, CA 90277 213-316-9114
Engineered Components Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
Mathematical Systems Design, Inc., 11835 W. Olympic Blvd., Suite 745, Los Angeles, CA 90064 213-479-7180
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
Signatron, A Unit of Sundstrand Corp., 110 Hartwell Ave., Lexington, MA 02173 617-861-1500
Spectrum Signal Processing Inc., 240 H Street, Blaine, WA 98230 ..... 1-800-663-8986 (US);604-438-7266 (Can.)
Television Equipment Assocs., Box 393, So. Salem, NY 10590-0393 914-763-8893
† Telonic/Berkeley, Berkeley Inds. Inc., P.O. Box 277, Laguna Beach, CA 92652 714-494-9401
† Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245 ... 619-458-1471
Varian Associates, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

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Filters, EMI/RFI-2700

Amecon, Inc., 1900 S. Chris La., Anaheim, CA 92805, 714-634-2220;800-392-2292 ..... **A•2174**
BH Electronics, Inc., 12219 Wood Lk. Dr., Burnsville, MN 55337, 612-894-9590 ..... **A•1206**
Comstron Corp., 10 Hub Dr., Melville, NY 11747, 516-756-1100 ..... **A•1639**
§ **Corcom, Inc., 1600 Winchester Rd., Libertyville, IL 60048, 312-680-7400** ..... **A•1640-1641, C•1313**
§ **Curtis Industries, 7400 W. Douglas Ave., P.O. Box 18699, Milwaukee, WI 53218-0699, 414-535-1500** ..... **A•1642-1643**
§† **Delta Products Corporation, 3823 Spinnaker Ct., Fremont, CA 94538, 415-770-0660** ..... **A•1644-1645**
Eichhoff Electronics, 205 Hallene Rd., Warwick, RI 02886, 401-738-1440 ..... **A•1648-1650**
§† **Elpac Components, Elpac Electronics, Inc., 3131 S. Standard Ave., Santa Ana, CA 92705, 714-979-4440** ..... **A•1082-1083**
ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... **A•1558**
§ **FDK America, Inc., Fuji Electromechanical Co., Ltd., 17326 Edwards Rd., Ste. A-130, Cerritos, CA 90701, 213-404-1770** ..... **A•1654-1655**
Filter Concepts Inc., 2624 S. Rousselle, Santa Ana, CA 92707, 714-545-7003 ..... **A•1656-1657**
† **Filtron Co., Inc., Sub. of ARX Inc., 148-E Sweet Hollow Rd., Old Bethpage, NY 11804, 516-752-1144** ..... **A•1659**
† **Homalite, Inc., 11 Brookside Dr., Wilmington, DE 19804, 302-652-3686** .. **B•1072**
§† **JMK, Inc., 15 Caldwell Dr., Amherst, NH 03031, ;;;603-886-4115** ... **A•1663-1665**
Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ..... **A•2250-2251**
Marway Prods. Inc., 311 N. Clara St., Santa Ana, CA 92703, 714-973-1800 ..... **D•2132-2133**
† **Metuchen Capacitors, Inc., 139 White Oak Ln., P.O. Box 499, Old Bridge, NJ 08857, 201-679-3366** ..... **A•1130,1672-1673, C•1452-1455**
§† **Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300** ..... **A•1675-1676**
† **NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300** ..... **D•1857**
† **Oxley, Inc., 25 Business Pk. Dr., P.O. Box 814, Branford, CT 06405, 203-488-1033** ..... **A•1677**
§ **Penstock Engineering Labs., Penstock, Inc., 520 Mercury Dr., Sunnyvale, CA 94086-4018, 408-730-0300** ..... **A•1844**
† **Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... **A•1270**
§ **Power Dynamics Inc., 59 Lakeside Ave., P.O. Box 539, West Orange, NJ 07052, 201-736-5722** ..... **A•1679**
§ **Pulizzi Engineering, Inc., 3260 S. Susan St., Santa Ana, CA 92704-6865, 714-540-4229** ..... **D•2146-2149**
† **RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706, 516-231-6400** ..... **A•1687**
§ **RTE Aerovox Inc., 740 Belleville Ave., New Bedford, MA 02745, 617-994-9661** ..... **A•1688-1690**
Schaffner EMC, Inc., Components Division, 825 Lehigh Avenue, Union, NJ 07083, 201-851-0644;800-367-5566 ..... **A•1691**
§ **Schurter, Inc., 1016 Clegg Ct., Petaluma, CA 94952, 707-778-6311** .. **A•1692-1693**
Signal Transformer Co., Inc., Insilco Corporation, 500 Bayview Ave., Inwood, NY 11696, 516-239-5777 ..... **A•2372**
§† **Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483, 619-575-9353** ..... **A•1694**
§ **Stancor Products, Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947, 219-722-2244** ..... **A•2393**
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518, 213-638-1790 ..... **A•1291-1293,1695-1697**
§ **TDK Corporation, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku,, Tokyo, JAPAN 103, (03) 278-5111** ..... **A•1698-1699**
§ **Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131, 408-432-8020** ..... **A•1700**

Tri-Mag, Inc., 8210 West Doe Ave., Visalia, CA 93291, 209-651-2222 ..... A•1702-1704
§† **Tusonix, Inc., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144, 602-744-0400 ..... A•1714**
† **U S Microtek Components Corp., Division of Unitrode Corp., 11144 Penrose St., Sun Valley, CA 91352, 818-767-6770 ..... A•1184**
Wilco Corp., 6451 Saguaro Court, Indianapolis, IN 46268, 317-293-9300 ..... A•1317-1318
AMP, Box 3608, Harrisburg, PA 17105 800-362-5673
† Ark Elctrns. Corp., 1325 Industrial Hwy., Southampton, PA 18966 215-322-6510
† Armbar Industries, Inc., 139 White Oak Lane, Old Bridge, NJ 08857 201-679-3377
§ AVA Electronics Corporation, P.O. Box 184, 4000 Bridge St, Drexel Hill, PA 19026 215-284-2500
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
§ Beswick, Dubilier International Plc., Alert Works, Frome, UNITED KINGDOM BA11 1PP ..... (0373) 64311
† Brady Co., 63 Middlesex Ave., Iselin, NJ 07083 201-283-0400
§† Capcon, Inc., 147 West 25th Street, New York, NY 10001 212-243-6275
Captor Corp., 5040 S. County Rd. (25A), Tipp City, OH 45371 513-667-8484
† Centre Engineering, 2820 E. College Ave., State College, PA 16801 814-237-0321
† Chomerics, Inc., 77 Dragon Ct., Woburn, MA 01888 617-935-4850
† Circle Electronics, A Division of F-Dyne Elctrns., 3501 Electronics Way, W. Palm Beach, FL 33407 305-844-1310
§† Compac, 1320-13 Lincoln Ave., Holbrook, NY 11741 516-585-3400
Control Concepts Corp., P.O. Box 1380, Binghamton, NY 13902-1380 ... 607-724-2484
§† Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
§ Current Technology, Inc., 1400 S. Sherman, # 202, Richardson, TX 75081 214-238-5300
§ Displex, Inc., North Hills Electronics, Inc., Alexander Place, Glen Cove, NY 11542 516-671-4400
† Dontech, Inc., 700 Airport Blvd., Doylestown, PA 18901 215-348-5010
† Dynamic Air Engrg., Inc., 620 E. Dyer Rd., Santa Ana, CA 92705-5697 ... 714-540-1000
§ Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
Electro-Mechanics Co., Box 1546, Austin, TX 78767 512-835-4684
§ Electronic Resources Inc., 568 Weddell Dr., No. 8, Sunnyvale, CA 94089 408-745-1420
§ Electronic Specialists, 171 South Main St., Natick, MA 01760 ..... 617-655-1532; 800-225-4876
ELMA Electronic Inc., 41440 Christy Street, Fremont, CA 94538 415-656-3400
† Elmag Division, Lindgren RF Enclosures, 54 Clark St., Newark, NJ 07104 201-481-1600
Engineered Components Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
§ Ericson Manufacturing Co., 4215 Hamann Pkwy., Willoughby, OH 44094 216-951-8000
† Evaporated Coatings, Inc., 2365 Maryland Rd., Willow Grove, PA 19090 215-659-3080
§† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
† F-Dyne Elctrns., 449 Howard Ave., Bridgeport, CT 06605 203-367-6431
† Fil-Coil Company, Inc., 800 Axinn Ave., Garden City, NY 11530 516-228-9445
† Genisco Technology Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
§† Hopkins Engrg., 12900 Foothill Blvd., San Fernando, CA 91342 818-361-8691
ICO-RALLY Corporation, 2575 E. Bayshore Rd., Palo Alto, CA 94303 415-856-9900
§† Inductive Prods., Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
Industrial Midwec Capacitor Corp., 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
International Power Sources, Inc., 10 Cochituate St., Natick, MA 01760 .. 617-651-1818
§ ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 ..... 516-753-0400; 800-862-2101
ITC Systems, Inc., 813 Anapamu St. 2C, Santa Barbara, CA 93103 805-965-8900
§† ITT Cannon, 666 E. Dyer Road, Santa Ana, CA 92705-5684 714-557-4700
Kalglo Elctrns. Co., Inc., 6584 Ruch Rd., E. Allen Twp., Bethlehem, PA 18017-9359 ..... 215-837-0700;800-524-0400
§† Kyocera Northwest, Electronic Components Group, P.O. Box 85542, San Diego, CA 92138-5542 619-576-2600
Lambda Electronics, Veeco Instr., Inc., 515 Broad Hollow Rd., Melville, NY 11747 516-694-4200
§ L.E.A. Dynatech, Inc., Dynatech Corporation, 12516 Lakeland Rd., Santa Fe Springs, CA 90670-9990 213-944-0916
† Lectro Magnetics, Inc., 6056 W. Jefferson Blvd., Los Angeles, CA 90016 ..... 213-870-9383;(USA):800-325-9814;(CA):800-325-9815
† Libbey-Owens-Ford Co., Liberty Mirror Products, 851 Third Ave., Brackenridge, PA 15014 412-224-1800
† Lindgren RF Enclosures, Inc., 1228 Capitol Drive, Addison, IL 60101 312-628-9100
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
MCG Elctrns., 12 Burt Dr., Deer Park, NY 11729 516-586-5125
† Motor Technology, Inc., 2798 Culver Ave., Dayton, OH 45429 513-294-1041
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
NWL Capacitors, NWL Transformers, 8050 Monetary Dr., Riviera Bch., FL 33404 305-848-9009
† Optical & Conductive Coatings, Meridian Inds., Inc., 428 N. Buchanan Cir., # 8, Pacheco, CA 94553 415-798-6066
Panel Components Corp., P.O. Box 6626M, Santa Rosa, CA 95406 707-523-0600
† Polara Engineering Inc., 4115 W. Artesia Ave., Fullerton, CA 92633 714-521-0900
Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034 ... 215-643-6950
§ PolyPhaser Corporation, 1425 Industrial Way, P.O. Box 1237, Gardnerville, NV 89410-1237 ..... 702-782-2511;800-325-7170
§† Power Integrity Corp., 1840 Pembroke Rd., P.O. Box 9682, Greensboro, NC 27429-0682 ..... 919-379-9773;800-237-6260
† Preferred Electronics, Inc., Main Line Dr., P.O. Box 248, Westfield, MA 01086 413-568-2301
Pulse Engineering, Inc., 7250 Convoy Ct., P.O. Box 12235, San Diego, CA 92112 619-268-2400
§ Qualtek Electronics Corp., 7158 Industrial Pk. Blvd., Mentor, OH 44060 .. 216-951-3300
Ray Proof, Shielding Systems Corp., 50 Keeler Ave., P.O. Box 5060, Norwalk, CT 06856-5060 800-243-5704
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729 ..... 516-586-5566; 1-800-645-5828
Roederstein Elctrns., Inc., P.O. Box 5588, Statesville, NC 28677 704-872-8101
† Rtron Corp., 7324 Lawndale, Skokie, IL 60076 312-679-7180
§ SAFE Power Systems, 528 W. 21st St., Tempe, AZ 85023 602-894-6864
† Sanders Associates, Inc., A Lockheed Company, EMC Dept., 95 Canal St., Nashua, NH 03061-2004 603-885-3602
Schaffner EMC, Inc., Instr. Div., 825 Lehigh Avenue, Union, NJ 07083 ..... 201-851-0644; 800-367-5566
† SFE Technologies, 1501 1st St., San Fernando, CA 91340 818-365-9411
§ Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830 201-321-3400
§ SL Waber, Inc., 300 Harvard Ave., Westville, NJ 08093 ... 609-456-5400;800-257-8384
Solar Electronics Co., A. T. Parker, Inc., 901 N. Highland, Hollywood, CA 90038 213-462-0806
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
§ Speco Div., Components Specialties, Inc., P.O. Box 624, 1172 Rte. 109, Lindenhurst, NY 11757 ..... 516-957-8700;800-645-5516
§† Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 814-455-0966
§† Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
† Standard Condenser Corp., 1065 W. Addison St., Chicago, IL 60613 312-327-5440
§ Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95054 408-988-0700
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
§ Sun-Flex Co., Inc., 20 Pimentel Ct., Novato, CA 94947 415-883-1221
Switching Power Inc., 3601 Veterans Hwy, Ronkonkoma, NY 11779 516-981-7231
† Tecknit (Eastern Facility), 129 Dermody St., Cranford, NJ 07016 201-272-5500
§ Tripp-Lite, 500 No. Orleans, Chicago, IL 60610 312-329-1777
TWP, Inc., 2133 4th St., Berkeley, CA 94710 415-548-4434
§† Tycor Electronic Products Ltd., 6107-6 Street S.E., Calgary, Alberta, CANADA T2H 1L9 403-259-3200
† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600
§ Vidaire Electronics Mfg. Corp., 54 Nancy St., W. Babylon, NY 11704 516-491-1826
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141

Filters, Equalizer-2700

Allen Avionics, Inc., 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ... A•1496
Chesterfield Products, 37 Midland Ave., Elmwood Park, NJ 07407, 201-797-9655 ..... A•1638
† **Comstron Corp., 10 Hub Dr., Melville, NY 11747, 516-756-1100 ..... A•1639**
Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ..... A•1652
† **ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558**
† **Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377, 718-424-7500 ..... A•1400**
† **KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 .... A•1666**
Matthey Electronics, Television Equipment Associates, Box 393, South Salem, NY 10590, 914-763-8893 ..... A•1670
† **McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1411**
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•1709
† Alpha Components, 1106 E. Simpson Rd., Mechanicsburg, PA 17055 ... 717-697-8595
A. P. Circuit, 256 Lincoln Ave., Brooklyn, NY 11208 212-737-1348
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
† BG Electronics, 30 South St., Mt. Vernon, NY 10550 914-664-5591
§ Cermetek Microelectronics Inc., 1308 Borregas Ave., Sunnyvale, CA 94088-3565 408-752-5000
† Cirtech, EG & G, 15237 Cherry St., Shawnee Mission, KS 66223 913-681-2801
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
† Eagle, P.O. Box 911, Fallbrook, CA 92028 619-728-6000
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
§ Frazier, 1930 Valley View La., Dallas, TX 75234 214-241-3441
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761
† Frequency Electronics, Inc., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
† Genisco Technology Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
† Integrated Microwave, 3422 Tripp Ct., San Diego, CA 92121 619-259-2600
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 ..... 201-396-9400; 1-800-223-0603
§† Linear Technology Corp., 1630 McCarthy Blvd., Milpitas, CA 95035 408-432-1900
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 312-564-5100
† Networks International Corporation, 13924 W. 108th St., Lenexa, KS 66215 913-469-6494
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034 ... 215-643-6950
Precision Filters, 240 Cherry St., Ithaca, NY 14850 607-277-3550

† Reeves-Hoffman Div., Dynamics Corporation of America, 400 W. North St., Carlisle, PA 17013 717-243-5929
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Rockwell Filter Products, 2990 Airway Ave., Costa Mesa, CA 92626 714-641-5311
§ Spectra Sonics, 3750 Airport Rd., Ogden, UT 84405 801-392-7531
Television Equipment Assocs., Box 393, So. Salem, NY 10590-0393 914-763-8893
† Wavecom, Sub. of Loral Corp., 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 .. 415-592-8832

Filters, Harmonic-2700

Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ..... A•1652
† ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558
† Filtron Co., Inc., Sub. of ARX Inc., 148-E Sweet Hollow Rd., Old Bethpage, NY 11804, 516-752-1144 ..... A•1659
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 ..... A•1666
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•1713
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
† Alpha Components, 1106 E. Simpson Rd., Mechanicsburg, PA 17055 ... 717-697-8595
Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
A. P. Circuit, 256 Lincoln Ave., Brooklyn, NY 11208 212-737-1348
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
† BG Electronics, 30 South St., Mt. Vernon, NY 10550 914-664-5591
Chesterfield Products, 37 Midland Ave., Elmwood Park, NJ 07407 201-797-9655
Cir-Q-Tel, Inc., 6600-04 Virginia Manor Rd., Beltsville, MD 20805 301-946-1800
† Cirtech, EG & G, 15237 Cherry St., Shawnee Mission, KS 66223 913-681-2801
† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
Coaxial Dynamics, 15210 Industrial Parkway, Cleveland, OH 44135 .... 1-800-COAXIAL
† Comstron Corp., 10 Hub Dr., Melville, NY 11747 516-756-1100
Continental Electronics, Division of Varian Associates, Inc., P.O. Box 270879, Dallas, TX 75227 214-381-7161
Control Concepts Corp., P.O. Box 1380, Binghamton, NY 13902-1380 ... 607-724-2484
Curtis Industries, 7400 W. Douglas Ave., P.O. Box 18699, Milwaukee, WI 53218-0699 414-535-1500
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
† Eagle, P.O. Box 911, Fallbrook, CA 92028 619-728-6000
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
§ Fox Electronics, 5842 Corporation Circle, Ft. Meyers, FL 33905 813-693-0099
† Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
† Genisco Technology Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
† Integrated Microwave, 3422 Tripp Ct., San Diego, CA 92121 619-259-2600
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
§† Linear Technology Corp., 1630 McCarthy Blvd., Milpitas, CA 95035 408-432-1900
† Lorch Electronics, Sub. of Vernitron Corp., 105 Cedar La., Englewood, NJ 07631 201-569-8282
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Micro-Coax Components, Inc., a UTI Company, Box E, Collegeville, PA 19426 215-489-3700
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 .... 315-437-3953; 800-448-1666
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080 404-436-1300
† Networks International Corporation, 13924 W. 108th St., Lenexa, KS 66215 913-469-6494
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034 ... 215-643-6950
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
† Reeves-Hoffman Div., Dynamics Corporation of America, 400 W. North St., Carlisle, PA 17013 717-243-5929
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
RLC Electronics, Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
§† Sinclair Radio Laboratories Ltd., 85 Mary St., Aurora, ONT., CANADA L4G 3G9 416-727-0165
† Telonic/Berkeley, Berkeley Inds. Inc., P.O. Box 277, Laguna Beach, CA 92652 714-494-9401
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
§† Tycor Electronic Products Ltd., 6107-6 Street S.E., Calgary, Alberta, CANADA T2H 1L9 403-259-3200
† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600
† Vibration Instruments Co., 1614 Orangethorpe Way, Anaheim, CA 92801 714-879-6085
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
† Wavecom, Sub. of Loral Corp., 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 .. 415-592-8832

Filters, High Pass-2700

Allen Avionics, Inc., 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ..... A•1496,1635
A. P. Circuit, 256 Lincoln Ave., Brooklyn, NY 11208, 212-737-1348 ..... A•1637

Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1209
Chesterfield Products, 37 Midland Ave., Elmwood Park, NJ 07407, 201-797-9655 ..... A•1638
Datel, Inc., 11 Cabot Blvd., Mansfield, MA 02048, 617-339-3000 ..... D•1159
† Eagle, P.O. Box 911, Fallbrook, CA 92028, 619-728-6000 ..... A•1647
† Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ..... A•1652
Elpac Components, Elpac Electronics, Inc., 3131 S. Standard Ave., Santa Ana, CA 92705, 714-979-4440 ..... A•1082-1083
† ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558,1653
† Filtron Co., Inc., Sub. of ARX Inc., 148-E Sweet Hollow Rd., Old Bethpage, NY 11804, 516-752-1144 ..... A•1659
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830, 617-374-0761 ..... A•1660-1661
† Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377, 718-424-7500 ..... A•1400
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 ..... A•1666,1668
† Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... A•1425
Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 350166, Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1775
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1678
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2351
Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 ... A•1680-1684
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1701
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•1708,1712
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600 ..... A•1479
† U S Microtek Components Corp., Division of Unitrode Corp., 11144 Penrose St., Sun Valley, CA 91352, 818-767-6770 ..... A•1184
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070, 415-592-8832 ..... A•1715
Advanced Filter Devices, Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92009 619-438-2074
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
† Alpha Components, 1106 E. Simpson Rd., Mechanicsburg, PA 17055 ... 717-697-8595
Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Applied Research, Inc., 111 New South Rd., Hicksville, NY 11802 516-938-9700
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
† Balzers Optical Corporation, 170 Locke Dr., Marlboro, MA 01752 617-481-9860
† BG Electronics, 30 South St., Mt. Vernon, NY 10550 914-664-5591
† Bird Electronic Corp., 30303 Aurora Rd., Cleveland, OH 44139-2794 216-248-1200
† Bruel & Kjaer Instrs. Inc., 185 Forest St., Marlboro, MA 01752-3093 617-481-7000
§ Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 602-746-1111
Captor Corp., 5040 S. County Rd. (25A), Tipp City, OH 45371 513-667-8484
Cir-Q-Tel, Inc., 6600-04 Virginia Manor Rd., Beltsville, MD 20805 301-946-1800
† Cirtech, EG & G, 15237 Cherry St., Shawnee Mission, KS 66223 913-681-2801
† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
Coaxial Dynamics, 15210 Industrial Parkway, Cleveland, OH 44135 .... 1-800-COAXIAL
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
† Comstron Corp., 10 Hub Dr., Melville, NY 11747 516-756-1100
† Conolog Corp., 5 Columbia Rd., Somerville, NJ 08876 201-722-8081
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
Curtis Industries, 7400 W. Douglas Ave., P.O. Box 18699, Milwaukee, WI 53218-0699 414-535-1500
† Daden Associates, 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653 714-770-1522
† Damon Electronics Div., 80 Wilson Way, Westwood, MA 02090 617-329-2460
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
† Data Delay Devices, 3 Mount Prospect Ave., Clifton, NJ 07013-1915 201-773-2299
De Coursey Engineering Laboratory, 11828 W. Jefferson, Culver City, CA 90230 ..... 213-EX7-9668
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§ Dyma Engineering, Box 1535, Los Lunas, NM 87031 505-865-6700
§ Dynamics, Div. of Waugh Controls Corp., 9001 Fullbright Ave., Chatsworth, CA 91311 818-998-8281
† Eaton Corporation, Microwave Products Division, 785 Palomar Ave., Sunnyvale, CA 94086 408-730-6410
Electrocom Industries, 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
§ Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§ Electronic Specialists, 171 South Main St., Natick, MA 01760 ..... 617-655-1532; 800-225-4876
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elmag Division, Lindgren RF Enclosures, 54 Clark St., Newark, NJ 07104 201-481-1600
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Engineered Components Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
§† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
§† Fox Electronics, 5842 Corporation Circle, Ft. Meyers, FL 33905 813-693-0099
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
† Genisco Technology Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 516-822-4770
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012

† Hopkins Engrg., 12900 Foothill Blvd., San Fernando, CA 91342 818-361-8691
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Hughes Microelectronics Circuits Division, 500 Superior Ave., P.O. Box H, Newport Beach, CA 92658-8903 714-759-2952
Hycomp, Inc., 165 Cedar Hill St., Marlborough, MA 01752 617-485-6300
ICO-RALLY Corporation, 2575 E. Bayshore Rd., Palo Alto, CA 94303 415-856-9900
Industrial Midwec Capacitor Corp., 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
† Infrared Industries, Inc., 12151 Research Parkway, Orlando, FL 32826 ... 305-282-7700
† Integrated Microwave, 3422 Tripp Ct., San Diego, CA 92121 619-259-2600
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
ITHACO, Inc., Meas. & Control Instrs. Div., 735 W. Clinton St., P.O. Box 6437, Ithaca, NY 14851-6437 607-272-7640
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 ..... 201-396-9400; 1-800-223-0603
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
Krohn-Hite Corp., Avon Indl. Pk., Bodwell St., Avon, MA 02322 508-580-1660
† Lark Engineering Co., Baier & Baier Inc., 26401 Calle Rolando, San Juan Capistrano, CA 92675 714-240-1233
† Lectro Magnetics, Inc., 6056 W. Jefferson Blvd., Los Angeles, CA 90016 ..... 213-870-9383;(USA):800-325-9814;(CA):800-325-9815
§† Linear Technology Corp., 1630 McCarthy Blvd., Milpitas, CA 95035 408-432-1900
† Lorch Electronics, Sub. of Vernitron Corp., 105 Cedar La., Englewood, NJ 07631 201-569-8282
M/A-COM Microwave Components, Inc., South Avenue, Burlington, MA 01803 617-272-3000
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Matthey Electronics, Television Equipment Associates, Box 393, South Salem, NY 10590 914-763-8893
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 .. 617-329-1508
† Metropole Products Inc., P. O. Box 309, Stafford, VA 22554 ..... 703-659-2132; 703-971-7082
§† Micro-Coax Components, Inc., a UTI Company, Box E, Collegeville, PA 19426 215-489-3700
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Micronics Technology Inc., 7 Alexander Place, Glen Cove, NY 11542 ... 516-759-5600
† Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 .... 315-437-3953; 800-448-1666
† Monitor Products Co., Inc., 502 Via Del Monte, Oceanside, CA 92054 ... 619-433-4510
§† Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080 404-436-1300
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 312-564-5100
† Networks International Corporation, 13924 W. 108th St., Lenexa, KS 66215 913-469-6494
† North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542 516-671-5700
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
§ PCA Electronics, 16799 Schoenborn St., Sepulveda, CA 91343 818-892-0761
† Polara Engineering Inc., 4115 W. Artesia Ave., Fullerton, CA 92633 714-521-0900
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
† Reeves-Hoffman Div., Dynamics Corporation of America, 400 W. North St., Carlisle, PA 17013 717-243-5929
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
RLC Electronics, Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., 11 Huron Dr., Natick, MA 01760 617-653-0844
Sentry Manufacturing, Crystal Park, Chickasha, OK 73018 405-224-6780
§ Shure Bros., 222 Hartrey Ave., Evanston, IL 60202-3696 312-866-2200
§† Sinclair Radio Laboratories Ltd., 85 Mary St., Aurora, ONT., CANADA L4G 3G9 416-727-0165
Solar Electronics Co., A. T. Parker, Inc., 901 N. Highland, Hollywood, CA 90038 213-462-0806
§† Soshin Electric Co., Ltd., No. 18-18, 1-Chome Nakamagome, Ota-Ku, Tokyo, JAPAN ..... (03) 775-2111
§ Spectra Sonics, 3750 Airport Rd., Ogden, UT 84405 801-392-7531
Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483 619-575-9353
† Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95054 408-988-0700
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
† Telonic/Berkeley, Berkeley Inds. Inc., P.O. Box 277, Laguna Beach, CA 92652 714-494-9401
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
Tucker Electronics, Box 461966, Garland, TX 75046 ..... 214-348-8800;800-527-4642
U.S. Instr. Rentals, 2988 Campus Dr., San Mateo, CA 94403 800-824-2873
† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33626 813-855-6611
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
† Wavecom, Sub. of Loral Corp., 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
Wavetek San Diego, Inc., 9045 Balboa Avenue, San Diego, CA 92123 ... 619-279-2200
Wide Band Engineering Co., Inc., Box 21652, Phoenix, AZ 85036 602-254-1570
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Filters, Hybrid-2700

A. P. Circuit, 256 Lincoln Ave., Brooklyn, NY 11208, 212-737-1348 ..... A•1637
Comstron Corp., 10 Hub Dr., Melville, NY 11747, 516-756-1100 ..... A•1639
Datel, Inc., 11 Cabot Blvd., Mansfield, MA 02048, 617-339-3000 ..... D•1159
† Aydin Vector Div., Aydin Corp., Box 328, Newtown, PA 18940-0328 215-968-4271
Cir-Q-Tel, Inc., 6600-04 Virginia Manor Rd., Beltsville, MD 20805 301-946-1800
CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
CTS Corp., Frequency Control Div., (Formerly Knights Div.), 400 Reimann Ave., Sandwich, IL 60548 815-786-8411
Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
† Hughes Microelectronics Circuits Division, 500 Superior Ave., P.O. Box H, Newport Beach, CA 92658-8903 714-759-2952
§† Hybrids International Ltd., Thick Film Division, 311 N. Lindenwood Dr., Olathe, KS 66062 913-764-6400
† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716 516-567-5600
† Integrated Microwave, 3422 Tripp Ct., San Diego, CA 92121 619-259-2600
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
Matthey Electronics, Television Equipment Associates, Box 393, South Salem, NY 10590 914-763-8893
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 .. 617-329-1508
† Modular Devices, Brookhaven R & D Plaza, 1 Roned Rd., Shirley, NY 11967 516-345-3100
PCA Electronics, 16799 Schoenborn St., Sepulveda, CA 91343 818-892-0761
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804 407-298-2000
† Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95054 408-988-0700
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
§† Tycor Electronic Products Ltd., 6107-6 Street S.E., Calgary, Alberta, CANADA T2H 1L9 403-259-3200
Varian Associates, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 .. 415-592-8832

Filters, IF-2700

§† Andersen Laboratories, 1280 Blue Hills Ave., Bloomfield, CT 06002, 203-242-0761 ..... A•1636
Chesterfield Products, 37 Midland Ave., Elmwood Park, NJ 07407, 201-797-9655 ..... A•1638
† Comstron Corp., 10 Hub Dr., Melville, NY 11747, 516-756-1100 ..... A•1639
Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ..... A•1652
† ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558,1653
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830, 617-374-0761 ..... A•1660
JMK, Inc., 15 Caldwell Dr., Amherst, NH 03031, ;;;603-886-4115 ... A•1663,1665
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 .... A•1666
† McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1409,1411
† Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... A•1425
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•1430
† Sawtek Inc., P.O. Box 609501, Orlando, FL 32860-9501, 407-886-8860 ... A•1463
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•1706-1713
† Advanced Filter Devices, Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92009 619-438-2074
† Alpha Components, 1106 E. Simpson Rd., Mechanicsburg, PA 17055 ... 717-697-8595
§ AVA Electronics Corporation, P.O. Box 184, 4000 Bridge St., Drexel Hill, PA 19026 215-284-2500
† BG Electronics, 30 South St., Mt. Vernon, NY 10550 914-664-5591
† Blackhawk Networks Corp., 14 N. Parker Dr., P.O. Box 919, Janesville, WI 53545 608-752-8701
Cir-Q-Tel, Inc., 6600-04 Virginia Manor Rd., Beltsville, MD 20805 301-946-1800
† Cirtech, EG & G, 15237 Cherry St., Shawnee Mission, KS 66223 913-681-2801
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
† CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
† CTS Corp., Frequency Control Div., (Formerly Knights Div.), 400 Reimann Ave., Sandwich, IL 60548 815-786-8411
† Daden Associates, 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653 714-770-1522
† Damon Electronics Div., 80 Wilson Way, Westwood, MA 02090 617-329-2460
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
† Eagle, P.O. Box 911, Fallbrook, CA 92028 619-728-6000
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Fox Electronics, 5842 Corporation Circle, Ft. Meyers, FL 33905 813-693-0099
† Frequency Electronics, Inc., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
† Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
† Genisco Technology Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
GTE Products Corp., 2401 Reach Rd., Williamsport, PA 17701 717-326-6591
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
† Integrated Microwave, 3422 Tripp Ct., San Diego, CA 92121 619-259-2600
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944

† Lark Engineering Co., Baier & Baier Inc., 26401 Calle Rolando, San Juan Capistrano, CA 92675 714-240-1233
† LNR Communications, Inc., 180 Marcus Blvd., Hauppauge, NY 11788 ... 516-273-7111
† Lorch Electronics, Sub. of Vernitron Corp., 105 Cedar La., Englewood, NJ 07631 201-569-8282
† Magnetic Component Engineering, Inc., 11379 Playa Street, Culver City, CA 90230 213-398-4761
† Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Monitor Products Co., Inc., 502 Via Del Monte, Oceanside, CA 92054 ... 619-433-4510
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 312-564-5100
† Networks International Corporation, 13924 W. 108th St, Lenexa, KS 66215 913-469-6494
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804 407-298-2000
Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034 ... 215-643-6950
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† RF Monolithics, Inc., 4441 Sigma Rd., Dallas, TX 75244 214-233-2903
† Rockwell Filter Products, 2990 Airway Ave., Costa Mesa, CA 92626 714-641-5311
Sentry Manufacturing, Crystal Park, Chickasha, OK 73018 405-224-6780
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Sokol Crystal Products, Inc., 121 Water St., Mineral Point, WI 53565 608-987-3363
† Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95054 408-988-0700
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
† Telonic/Berkeley, Berkeley Inds. Inc., P.O. Box 277, Laguna Beach, CA 92652 714-494-9401
Texscan Instruments, Texscan Corporation, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056 312-297-0070
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
Toyo Comm. Equip. Co., Ltd., 20-4, Nishi-Shimbashi, 3-Chome Minato-Ku, TOKYO, JAPAN 105 ..... 03-459-7320/03-459-7310
† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478 .. 216-232-8600
† Wavecom, Sub. of Loral Corp., 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010

Filters, Ladder-2700

† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 .... A•1666
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•1431
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•1706
Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478, 216-232-8600 ..... A•1487
† Blackhawk Networks Corp., 14 N. Parker Dr., P.O. Box 919, Janesville, WI 53545 608-752-8701
Cir-Q-Tel, Inc., 6600-04 Virginia Manor Rd., Beltsville, MD 20805 301-946-1800
† Eagle, P.O. Box 911, Fallbrook, CA 92028 619-728-6000
† Integrated Microwave, 3422 Tripp Ct., San Diego, CA 92121 619-259-2600
† Networks International Corporation, 13924 W. 108th St, Lenexa, KS 66215 913-469-6494
† Rockwell Filter Products, 2990 Airway Ave., Costa Mesa, CA 92626 714-641-5311
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 .. 415-592-8832

Filters, LC-2700

Allen Avionics, Inc., 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ..... A•1496,1635
Chesterfield Products, 37 Midland Ave., Elmwood Park, NJ 07407, 201-797-9655 ..... A•1638
† Comstron Corp., 10 Hub Dr., Melville, NY 11747, 516-756-1100 ..... A•1639
† Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ..... A•1652
Elpac Components, Elpac Electronics, Inc., 3131 S. Standard Ave., Santa Ana, CA 92705, 714-979-4440 ..... A•1082-1083
† ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558,1653
† Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377, 718-424-7500 ..... A•1400
† Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... A•1425
† Oxley, Inc., 25 Business Pk. Dr., P.O. Box 814, Branford, CT 06405, 203-488-1033 ..... A•1677
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1678
Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131, 408-432-8020 ..... A•1700
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1701
Tri-Mag, Inc., 8210 West Doe Ave., Visalia, CA 93291, 209-651-2222 ..... A•1702-1704
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•1706
§† Tusonix, Inc., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144, 602-744-0400 ..... A•1714
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600 ..... A•1479
† U S Microtek Components Corp., Division of Unitrode Corp., 11144 Penrose St., Sun Valley, CA 91352, 818-767-6770 ..... A•1184
† Advanced Filter Devices, Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92009 619-438-2074
† Alpha Components, 1106 E. Simpson Rd., Mechanicsburg, PA 17055 ... 717-697-8595
Amecon, Inc., 1900 S. Chris La., Anaheim, CA 92805 ..... 714-634-2220;800-392-2292
§† Andersen Laboratories, 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-0761
† Applied Research, Inc., 111 New South Rd., Hicksville, NY 11802 516-938-9700
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
† BG Electronics, 30 South St., Mt. Vernon, NY 10550 914-664-5591
† Blackhawk Networks Corp., 14 N. Parker Dr., P.O. Box 919, Janesville, WI 53545 608-752-8701
Cir-Q-Tel, Inc., 6600-04 Virginia Manor Rd., Beltsville, MD 20805 301-946-1800
† Cirtech, EG & G, 15237 Cherry St., Shawnee Mission, KS 66223 913-681-2801
Control Concepts Corp., P.O. Box 1380, Binghamton, NY 13902-1380 ... 607-724-2484
† Daden Associates, 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653 714-770-1522
† Damon Electronics Div., 80 Wilson Way, Westwood, MA 02090 617-329-2460
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
De Coursey Engineering Laboratory, 11828 W. Jefferson, Culver City, CA 90230 ..... 213-EX7-9668
† Dynamic Air Engrg., Inc., 620 E. Dyer Rd., Santa Ana, CA 92705-5697 ... 714-540-1000
† Eagle, P.O. Box 911, Fallbrook, CA 92028 619-728-6000
Electrocom Industries, 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
§ Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elmag Division, Lindgren RF Enclosures, 54 Clark St., Newark, NJ 07104 201-481-1600
Engineered Components Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
Genisco Technology Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
† Hopkins Engrg., 12900 Foothill Blvd., San Fernando, CA 91342 818-361-8691
† Hughes Microelectronics Circuits Division, 500 Superior Ave., P.O. Box H, Newport Beach, CA 92658-8903 714-759-2952
Industrial Midwec Capacitor Corp., 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
† Integrated Microwave, 3422 Tripp Ct., San Diego, CA 92121 619-259-2600
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 ..... 201-396-9400; 1-800-223-0603
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001 201-636-1900
† Lark Engineering Co., Baier & Baier Inc., 26401 Calle Rolando, San Juan Capistrano, CA 92675 714-240-1233
† Lectro Magnetics, Inc., 6056 W. Jefferson Blvd., Los Angeles, CA 90016 ..... 213-870-9383;(USA):800-325-9814;(CA):800-325-9815
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Matthey Electronics, Television Equipment Associates, Box 393, South Salem, NY 10590 914-763-8893
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† Metropole Products Inc., P. O. Box 309, Stafford, VA 22554 ..... 703-659-2132; 703-971-7082
Monitor Products Co., Inc., 502 Via Del Monte, Oceanside, CA 92054 ... 619-433-4510
Mu-Del Electronics, Inc., 2426 Linden Lane, Silver Spring, MD 20910-1288 301-587-6087
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 312-564-5100
† Networks International Corporation, 13924 W. 108th St, Lenexa, KS 66215 913-469-6494
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Performance Controls, Inc., 433 Caredean Drive, Horsham, PA 19044 ... 215-675-6500
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804 407-298-2000
† Polara Engineering Inc., 4115 W. Artesia Ave., Fullerton, CA 92633 714-521-0900
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034 ... 215-643-6950
§† Power Integrity Corp., 1840 Pembroke Rd., P.O. Box 9682, Greensboro, NC 27429-0682 ..... 919-379-9773;800-237-6260
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
Rtron Corp., 7324 Lawndale, Skokie, IL 60076 312-679-7180
† Sanders Associates, Inc., A Lockheed Company, EMC Dept., 95 Canal St, Nashua, NH 03061-2004 603-885-3602
† SFE Technologies, 1501 1st St, San Fernando, CA 91340 818-365-9411
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
Sokol Crystal Products, Inc., 121 Water St., Mineral Point, WI 53565 608-987-3363
Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 814-455-0966
§† Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
§† Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483 619-575-9353
† Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95054 408-988-0700
Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
† Telonic/Berkeley, Berkeley Inds. Inc., P.O. Box 277, Laguna Beach, CA 92652 714-494-9401
† Thinco Div., Hull Corp., Davisville Rd., Hatboro, PA 19040 215-672-7800
Universal Ad-Yu/D-F Corp., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100
† Vanguard Electronics Co., 1480 W. 178th St, Gardena, CA 90248 213-323-4100
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 .. 415-592-8832
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

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Allen Avionics, Inc., 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ... A•1496
Chesterfield Products, 37 Midland Ave., Elmwood Park, NJ 07407, 201-797-9655 ... A•1638
† Comstron Corp., 10 Hub Dr., Melville, NY 11747, 516-756-1100 ... A•1639
Curtis Industries, 7400 W. Douglas Ave., P.O. Box 18699, Milwaukee, WI 53218-0699, 414-535-1500 ... A•1642-1643
† ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ... A•1558,1653
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830, 617-374-0761 ... A•1660-1661
† Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377, 718-424-7500 ... A•1400
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 ... A•1666
† McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ... A•1411
† Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 ... A•1425
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ... A•1678
Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 ... A•1680-1684
† Sawtek Inc., P.O. Box 609501, Orlando, FL 32860-9501, 407-886-8860 ... A•1463
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ... A•1706
† Advanced Filter Devices, Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92009 ... 619-438-2074
† Alpha Components, 1106 E. Simpson Rd., Mechanicsburg, PA 17055 ... 717-697-8595
§† Andersen Laboratories, 1280 Blue Hills Ave., Bloomfield, CT 06002 ... 203-242-0761
A. P. Circuit, 256 Lincoln Ave., Brooklyn, NY 11208 ... 212-737-1348
† Artronic Instrument Co., Inc., 9 Division St., Sidney, NY 13838 ... 607-563-8444
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 ... 718-291-3900
† BG Electronics, 30 South St., Mt. Vernon, NY 10550 ... 914-664-5591
Cir-Q-Tel, Inc., 6600-04 Virginia Manor Rd., Beltsville, MD 20805 ... 301-946-1800
† Cirtech, EG & G, 15237 Cherry St., Shawnee Mission, KS 66223 ... 913-681-2801
† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 ... 213-936-6188
† Damon Electronics Div., 80 Wilson Way, Westwood, MA 02090 ... 617-329-2460
Datel, Inc., 11 Cabot Blvd., Mansfield, MA 02048 ... 617-339-3000
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 ... 816-331-4911
§ Dynamics, Div. of Waugh Controls Corp., 9001 Fullbright Ave., Chatsworth, CA 91311 ... 818-998-8281
Electrocom Industries, 1105 N. Ironwood Dr., S. Bend, IN 46615 ... 219-232-2743
Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550 ... 914-664-2333
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 ... 201-942-2222
† Frequency Electronics, Inc., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 ... 516-794-4500
† Genisco Technology Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 ... 213-537-4750
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 ... 516-822-4770
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 ... 913-782-0012
† Hughes Microelectronics Circuits Division, 500 Superior Ave., P.O. Box H, Newport Beach, CA 92658-8903 ... 714-759-2952
† Integrated Microwave, 3422 Tripp Ct., San Diego, CA 92121 ... 619-259-2600
ITHACO, Inc., Meas. & Control Instrs. Div., 735 W. Clinton St., P.O. Box 6437, Ithaca, NY 14851-6437 ... 607-272-7640
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 ... 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 ... 602-272-7944
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 ... 201-396-9400; 1-800-223-0603
Krohn-Hite Corp., Avon Indl. Pk., Bodwell St., Avon, MA 02322 ... 508-580-1660
† Leigh Instruments Ltd., Components Division, 141 Bond Ave., Don Mills, ON, CANADA M3B 1M2 ... 416-447-8531
§† Linear Technology Corp., 1630 McCarthy Blvd., Milpitas, CA 95035 ... 408-432-1900
† Lorch Electronics, Sub. of Vernitron Corp., 105 Cedar La., Englewood, NJ 07631 ... 201-569-8282
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 ... 516-654-1166
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 ... 617-329-1508
† Metropole Products Inc., P. O. Box 309, Stafford, VA 22554 ... 703-659-2132; 703-971-7082
Micro-Coax Components, Inc., a UTI Company, Box E, Collegeville, PA 19426 ... 215-489-3700
† Microphase, 587 Connecticut Ave., Norwalk, CT 06856 ... 203-866-8000
Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 ... 617-655-0060
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 ... 312-564-5100
† North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542 ... 516-671-5700
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 ... 201-454-2600
Pacific Instruments Inc., 215 Mason Circle, Concord, CA 94520 ... 415-827-9010
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804 ... 407-298-2000
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034 ... 215-643-6950
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 ... 301-279-5535
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 ... 516-231-6400
† Rockwell Filter Products, 2990 Airway Ave., Costa Mesa, CA 92626 ... 714-641-5311
Sokol Crystal Products, Inc., 121 Water St., Mineral Point, WI 53565 ... 608-987-3363
† Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95054 ... 408-988-0700
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 ... 406-586-0291
† Telonic/Berkeley, Berkeley Inds. Inc., P.O. Box 277, Laguna Beach, CA 92652 ... 714-494-9401
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056 ... 312-297-0070
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 ... 914-664-2050
† UTE Microwave, 3500 Sunset Ave., Asbury Park, NJ 07712 ... 201-922-1009
† Wavecom, Sub. of Loral Corp., 9036 Winnetka Ave., Northridge, CA 91324 ... 818-882-3010
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 ... 415-592-8832

Filters, Low Pass-2700

Allen Avionics, Inc., 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ... A•1496,1635
A. P. Circuit, 256 Lincoln Ave., Brooklyn, NY 11208, 212-737-1348 ... A•1637
Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ... A•1208-1209
Chesterfield Products, 37 Midland Ave., Elmwood Park, NJ 07407, 201-797-9655 ... A•1638
† Comstron Corp., 10 Hub Dr., Melville, NY 11747, 516-756-1100 ... A•1639
Datel, Inc., 11 Cabot Blvd., Mansfield, MA 02048, 617-339-3000 ... D•1159
† Eagle, P.O. Box 911, Fallbrook, CA 92028, 619-728-6000 ... A•1647
† Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon; NY 10550, 914-664-2333 ... A•1652
Elpac Components, Elpac Electronics, Inc., 3131 S. Standard Ave., Santa Ana, CA 92705, 714-979-4440 ... A•1082-1083
† ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ... A•1558,1653
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830, 617-374-0761 ... A•1661
† Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377, 718-424-7500 ... A•1400
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 ... A•1666-1668
Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ... A•2250
Matthey Electronics, Television Equipment Associates, Box 393, South Salem, NY 10590, 914-763-8893 ... A•1670
Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 350166, Brooklyn, NY 11235-0003, 718-934-4500 ... A•1775
§ PCA Electronics, 16799 Schoenborn St., Sepulveda, CA 91343, 818-892-0761 ... A•1611
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ... A•1678
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ... A•2351
Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 ... A•1680-1684
Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131, 408-432-8020 ... A•1700
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ... A•1701
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ... A•1709,1711,1713
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600 ... A•1479
† U S Microtek Components Corp., Division of Unitrode Corp., 11144 Penrose St., Sun Valley, CA 91352, 818-767-6770 ... A•1184
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070, 415-592-8832 ... A•1715
Advanced Filter Devices, Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92009 ... 619-438-2074
† Aeroflex Laboratories, Inc., Microelectronics Div., 35 S. Service Rd., Plainview, NY 11803 ... 516-694-6700
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 ... 201-539-5500
† Alpha Components, 1106 E. Simpson Rd., Mechanicsburg, PA 17055 ... 717-697-8595
AMP, Box 3608, Harrisburg, PA 17105 ... 800-362-5673
† Applied Research, Inc., 111 New South Rd., Hicksville, NY 11802 ... 516-938-9700
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 ... 516-231-8400
† Artronic Instrument Co., Inc., 9 Division St., Sidney, NY 13838 ... 607-563-8444
§ AVA Electronics Corporation, P.O. Box 184, 4000 Bridge St., Drexel Hill, PA 19026 ... 215-284-2500
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 ... 718-291-3900
† Balzers Optical Corporation, 170 Locke Dr., Marlboro, MA 01752 ... 617-481-9860
† BG Electronics, 30 South St., Mt. Vernon, NY 10550 ... 914-664-5591
† Bird Electronic Corp., 30303 Aurora Rd., Cleveland, OH 44139-2794 ... 216-248-1200
† Blackhawk Networks Corp., 14 N. Parker Dr., P.O. Box 919, Janesville, WI 53545 ... 608-752-8701
§ Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 ... 602-746-1111
Captor Corp., 5040 S. County Rd. (25A), Tipp City, OH 45371 ... 513-667-8484
Centre Engineering, 2820 E. College Ave., State College, PA 16801 ... 814-237-0321
Cir-Q-Tel, Inc., 6600-04 Virginia Manor Rd., Beltsville, MD 20805 ... 301-946-1800
† Cirtech, EG & G, 15237 Cherry St., Shawnee Mission, KS 66223 ... 913-681-2801
† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 ... 213-936-6188
Coaxial Dynamics, 15210 Industrial Parkway, Cleveland, OH 44135 ... 1-800-COAXIAL
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 ... 914-337-4775
§ Compac, 1320-13 Lincoln Ave., Holbrook, NY 11741 ... 516-585-3400
† Conolog Corp., 5 Columbia Rd., Somerville, NJ 08876 ... 201-722-8081
§† Control Concepts Corp., P.O. Box 1380, Binghamton, NY 13902-1380 ... 607-724-2484
† Control Electronics, Neurotech Corp., 139 Florida St., Farmingdale, NY 11735 ... 516-694-0125
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 ... 219-293-7511
† CTS Corporation, Microelectronics Div., 1201 Cumberland Ave., W. Lafayette, IN 47906 ... 317-463-2565
† Daden Associates, 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653 ... 714-770-1522
† Damon Electronics Div., 80 Wilson Way, Westwood, MA 02090 ... 617-329-2460
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 ... 209-292-1111
† Data Delay Devices, 3 Mount Prospect Ave., Clifton, NJ 07013-1915 ... 201-773-2299
De Coursey Engineering Laboratory, 11828 W. Jefferson, Culver City, CA 90230 ... 213-EX7-9668
† Dielectric Communications, General Signal, Tower Hill Rd., Raymond, ME 04071 ... 207-655-4555;800-341-9678
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 ... 816-331-4911
§ Dyma Engineering, Box 1535, Los Lunas, NM 87031 ... 505-865-6700

† Dynamic Air Engrg., Inc., 620 E. Dyer Rd., Santa Ana, CA 92705-5697 ... 714-540-1000
§ Dynamics, Div. of Waugh Controls Corp., 9001 Fullbright Ave., Chatsworth, CA 91311 ... 818-998-8281
† Eaton Corporation, Microwave Products Division, 785 Palomar Ave., Sunnyvale, CA 94086 ... 408-730-6410
Electrocom Industries, 1105 N. Ironwood Dr., S. Bend, IN 46615 ... 219-232-2743
§ Electronic Specialists, 171 South Main St., Natick, MA 01760 ... 617-655-1532; 800-225-4876
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 ... 201-942-2222
† Elmag Division, Lindgren RF Enclosures, 54 Clark St., Newark, NJ 07104 ... 201-481-1600
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 ... 312-478-7300
Engineered Components Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 ... 805-544-3800
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ... 201-245-3200;800-526-4048
† Fil-Coil Company, Inc., 800 Axinn Ave., Garden City, NY 11530 ... 516-228-9445
† Filtron Co., Inc., Sub. of ARX Inc., 148-E Sweet Hollow Rd., Old Bethpage, NY 11804 ... 516-752-1144
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 ... 212-386-1300
† Genisco Technology Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 ... 213-537-4750
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 ... 516-822-4770
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ... Call Local Sls. Off.
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 ... 913-782-0012
† Hopkins Engrg., 12900 Foothill Blvd., San Fernando, CA 91342 ... 818-361-8691
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 ... 714-752-3800
† Hughes Microelectronics Circuits Division, 500 Superior Ave., P.O. Box H, Newport Beach, CA 92658-8903 ... 714-759-2952
Hycomp, Inc., 165 Cedar Hill St., Marlborough, MA 01752 ... 617-485-6300
Industrial Midwec Capacitor Corp., 4902 Tollview Dr., Rolling Meadows, IL 60008 ... 312-577-0120
† Infrared Industries, Inc., 12151 Research Parkway, Orlando, FL 32826 ... 305-282-7700
† Integrated Microwave, 3422 Tripp Ct., San Diego, CA 92121 ... 619-259-2600
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 ... 402-694-6111
ITHACO, Inc., Meas. & Control Instrs. Div., 735 W. Clinton St., P.O. Box 6437, Ithaca, NY 14851-6437 ... 607-272-7640
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 ... 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 ... 602-272-7944
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 ... 201-396-9400; 1-800-223-0603
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 ... 201-887-8100
Krohn-Hite Corp., Avon Indl. Pk., Bodwell St., Avon, MA 02322 ... 508-580-1660
§† Kyocera Northwest, Electronic Components Group, P.O. Box 85542, San Diego, CA 92138-5542 ... 619-576-2600
† Lark Engineering Co., Baier & Baier Inc., 26401 Calle Rolando, San Juan Capistrano, CA 92675 ... 714-240-1233
† Lectro Magnetics, Inc., 6056 W. Jefferson Blvd., Los Angeles, CA 90016 ... 213-870-9383;(USA):800-325-9814;(CA):800-325-9815
§† Linear Technology Corp., 1630 McCarthy Blvd., Milpitas, CA 95035 ... 408-432-1900
† Lorch Electronics, Sub. of Vernitron Corp., 105 Cedar La., Englewood, NJ 07631 ... 201-569-8282
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 ... 516-654-1166
† Marel Instr. Co., 907 South East 13th Pl., Cape Coral, FL 33990 ... 813-574-8788
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 ... 617-329-1508
† Metropole Products Inc., P. O. Box 309, Stafford, VA 22554 ... 703-659-2132; 703-971-7082
§† Micro-Coax Components, Inc., a UTI Company, Box E, Collegeville, PA 19426 ... 215-489-3700
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 ... 201-992-7700
† Micronics Technology Inc., 7 Alexander Place, Glen Cove, NY 11542 ... 516-759-5600
† Microphase, 587 Connecticut Ave., Norwalk, CT 06856 ... 203-866-8000
§ Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 ... 617-655-0060
§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 ... 315-437-3953; 800-448-1666
† Mitec Electronics, 104 Gun Avenue, Pointe Claire, QUEBEC, CANADA H9R 3X3 ... 514-694-6666
† Monitor Products Co., Inc., 502 Via Del Monte, Oceanside, CA 92054 ... 619-433-4510
Mu-Del Electronics, Inc., 2426 Linden Lane, Silver Spring, MD 20910-1288 ... 301-587-6087
§† Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080 ... 404-436-1300
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 ... 312-564-5100
† Networks International Corporation, 13924 W. 108th St., Lenexa, KS 66215 ... 913-469-6494
† North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542 ... 516-671-5700
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 ... 503-659-7932
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 ... 201-454-2600
Pacific Instruments Inc., 215 Mason Circle, Concord, CA 94520 ... 415-827-9010
† Performance Controls, Inc., 433 Caredean Drive, Horsham, PA 19044 ... 215-675-6500
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804 ... 407-298-2000
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 ... 914-939-8900
Preston Scientific, 805 E. Cerritos Ave., Anaheim, CA 92805 ... 714-776-6400
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 ... 301-279-5535
† Reeves-Hoffman Div., Dynamics Corporation of America, 400 W. North St., Carlisle, PA 17013 ... 717-243-5929
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 ... 516-231-6400
RLC Electronics, Inc., 83 Radio Cir., Mt. Kisco, NY 10549 ... 914-241-1334
Rtron Corp., 7324 Lawndale, Skokie, IL 60076 ... 312-679-7180
† Sage Laboratories, Inc., 11 Huron Dr., Natick, MA 01760 ... 617-653-0844
Sentry Manufacturing, Crystal Park, Chickasha, OK 73018 ... 405-224-6780
† SFE Technologies, 1501 1st St., San Fernando, CA 91340 ... 818-365-9411
§ Shure Bros., 222 Hartrey Ave., Evanston, IL 60202-3696 ... 312-866-2200
† Signal Processing Technologies, Business Unit of Honeywell, Inc., 1150 E. Cheyenne Mtn. Blvd., Colorado Springs, CO 80906 ... 719-540-3734
Solar Electronics Co., A. T. Parker, Inc., 901 N. Highland, Hollywood, CA 90038 ... 213-462-0806
§† Soshin Electric Co., Ltd., No. 18-18, 1-Chome Nakamagome, Ota-Ku, Tokyo, JAPAN ... (03) 775-2111
§ Spectra Sonics, 3750 Airport Rd., Ogden, UT 84405 ... 801-392-7531
§† Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 ... 814-455-0966
§† Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 ... 617-339-8900
§† Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483 ... 619-575-9353
§ Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95054 ... 408-988-0700
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 ... 718-782-4200
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 ... 818-786-1760
Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 ... 415-968-2211
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 ... 406-586-0291
† Telonic/Berkeley, Berkeley Inds. Inc., P.O. Box 277, Laguna Beach, CA 92652 ... 714-494-9401
§ Texscan Instruments, Texscan Corporation, 3169 N. Shadeland, Indianapolis, IN 46226 ... 317-545-4196
Tucker Electronics, Box 461966, Garland, TX 75046 ... 214-348-8800;800-527-4642
§† Tycor Electronic Products Ltd., 6107-6 Street S.E., Calgary, Alberta, CANADA T2H 1L9 ... 403-259-3200
† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 ... 213-323-4100
Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478 ... 216-232-8600
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33626 ... 813-855-6611
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 ... 415-493-4141
† Wavecom, Sub. of Loral Corp., 9036 Winnetka Ave., Northridge, CA 91324 ... 818-882-3010
Wavetek San Diego, Inc., 9045 Balboa Avenue, San Diego, CA 92123 ... 619-279-2200
Wide Band Engineering Co., Inc., Box 21652, Phoenix, AZ 85036 ... 602-254-1570

Filters, Mechanical-2700

Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131, 408-432-8020 ... A•1700
A E G Corporation, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269 ... 201-231-8300
Cir-Q-Tel, Inc., 6600-04 Virginia Manor Rd., Beltsville, MD 20805 ... 301-946-1800
§ CUNO, Inc., Process Filtration Products, 400 Research Pkwy., Meriden, CT 06450 ... 203-237-5541
† Fil-Coil Company, Inc., 800 Axinn Ave., Garden City, NY 11530 ... 516-228-9445
† Microphase, 587 Connecticut Ave., Norwalk, CT 06856 ... 203-866-8000
† Penfield, Inc., 8 West St., Plantsville, CT 06479 ... 203-621-9141
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 ... 516-231-6400
† Rockwell Filter Products, 2990 Airway Ave., Costa Mesa, CA 92626 ... 714-641-5311
§ Seiko Instruments U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505 ... 213-517-7770
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 ... 312-297-0070
TWP, Inc., 2133 4th St., Berkeley, CA 94710 ... 415-548-4434

Filters, Microwave-3450

† Applied Research, Inc., 111 New South Rd., Hicksville, NY 11802, 516-938-9700 ... A•1764
Comstron Corp., 10 Hub Dr., Melville, NY 11747, 516-756-1100 ... A•1639
† Eagle, P.O. Box 911, Fallbrook, CA 92028, 619-728-6000 ... A•1647
ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ... A•1558,1653
§ FDK America, Inc., Fuji Electromechanical Co., Ltd., 17326 Edwards Rd., Ste. A-130, Cerritos, CA 90701, 213-404-1770 ... A•1654-1655,1769
McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ... A•1411
Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 350166, Brooklyn, NY 11235-0003, 718-934-4500 ... A•1775
Oxley, Inc., 25 Business Pk. Dr., P.O. Box 814, Branford, CT 06405, 203-488-1033 ... A•1677
§ Penstock Engineering Labs., Penstock, Inc., 520 Mercury Dr., Sunnyvale, CA 94086-4018, 408-730-0300 ... A•1844
Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ... A•1678
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 ... 201-539-5500
Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 ... 617-935-5150
Alpha Industries, Inc., 20 Sylvan Rd., Woburn, MA 01801 ... 617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St., Methuen, MA 01844 ... 617-682-4661
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 ... 516-231-8400
† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 ... 408-727-0700
Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 ... 718-291-3900
§† Capcon, Inc., 147 West 25th Street, New York, NY 10001 ... 212-243-6275
† Cincinnati Elctrns., 2630 Glendale Milford Rd., Cincinnati, OH 45241 ... 513-733-6100
Cir-Q-Tel, Inc., 6600-04 Virginia Manor Rd., Beltsville, MD 20805 ... 301-946-1800
Coaxial Dynamics, 15210 Industrial Parkway, Cleveland, OH 44135 ... 1-800-COAXIAL
† Daden Associates, 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653 ... 714-770-1522
† Eaton Corporation, Microwave Products Division, 785 Palomar Ave., Sunnyvale, CA 94086 ... 408-730-6410
† Ferretec Inc., 544 Gibralter Dr., Milpitas, CA 95035-6315 ... 408-263-1216

Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
† General Microwave Corporation, 5500 New Horizons Blvd., Amityville, NY 11701 516-226-8900
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
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† Integrated Microwave, 3422 Tripp Ct., San Diego, CA 92121 619-259-2600
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§ Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 ..... 315-437-3953; 800-448-1666
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Sanders Associates, Inc., ECBD, A Lockheed Company, 955 Perimeter Rd., Manchester, NH 03108-8500 603-645-5548
† Sanders Associates, Inc., Microwave, 955 Perimeter Rd., Manchester, NH 03108 ..... 603-645-6000 Ext. 4299
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† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
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§ Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

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§† Andersen Laboratories, 1280 Blue Hills Ave., Bloomfield, CT 06002, 203-242-0761 ..... A•1497,1636
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Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1209
Chesterfield Products, 37 Midland Ave., Elmwood Park, NJ 07407, 201-797-9655 ..... A•1638
† Comstron Corp., 10 Hub Dr., Melville, NY 11747, 516-756-1100 ..... A•1639
§ Corcom, Inc., 1600 Winchester Rd., Libertyville, IL 60048, 312-680-7400 ..... A•1640-1641, C•1313
† Damon Electronics Div., 80 Wilson Way, Westwood, MA 02090, 617-329-2460 ..... A•1391
† Eagle, P.O. Box 911, Fallbrook, CA 92028, 619-728-6000 ..... A•1647
Elpac Components, Elpac Electronics, Inc., 3131 S. Standard Ave., Santa Ana, CA 92705, 714-979-4440 ..... A•1082-1083
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§ FDK America, Inc., Fuji Electromechanical Co., Ltd., 17326 Edwards Rd., Ste. A-130, Cerritos, CA 90701, 213-404-1770 ..... A•1654-1655
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† Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377, 718-424-7500 ..... A•1400
JMK, Inc., 15 Caldwell Dr., Amherst, NH 03031, ;;;603-886-4115 ... A•1663,1665
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† McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1409-1411
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NTK Technical Ceramics, NGK Spark Plugs (USA), Inc., 99 Morris Ave., Springfield, NJ 07081, 201-376-6070 ..... A•1438
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§ Penstock Engineering Labs., Penstock, Inc., 520 Mercury Dr., Sunnyvale, CA 94086-4018, 408-730-0300 ..... A•1844
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1678
RTE Aerovox Inc., 740 Belleville Ave., New Bedford, MA 02745, 617-994-9661 ..... A•1688
† Sawtek Inc., P.O. Box 609501, Orlando, FL 32860-9501, 407-886-8860 ... A•1463
§† Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483, 619-575-9353 ..... A•1694
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TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•1706-1713
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† Filtron Co., Inc., Sub. of ARX Inc., 148-E Sweet Hollow Rd., Old Bethpage, NY 11804, 516-752-1144 ..... A•1659
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•1706
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600 ..... A•1479
A. P. Circuit, 256 Lincoln Ave., Brooklyn, NY 11208 212-737-1348
Aptek Technologies, Inc., Aptek Microsystems, 700 N. W. 12th Ave., Deerfield Beach, FL 33442 305-421-8450
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
† BG Electronics, 30 South St., Mt. Vernon, NY 10550 914-664-5591
† Cirtech, EG & G, 15237 Cherry St., Shawnee Mission, KS 66223 913-681-2801
† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Comstron Corp., 10 Hub Dr., Melville, NY 11747 516-756-1100
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
§ De Coursey Engineering Laboratory, 11828 W. Jefferson, Culver City, CA 90230 ..... 213-EX7-9668
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electrocom Industries, 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Engineered Components Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761
† Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
† Genisco Technology Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001 201-636-1900
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065 717-486-3411
† Metropole Products Inc., P. O. Box 309, Stafford, VA 22554 ..... 703-659-2132; 703-971-7082
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034 ... 215-643-6950
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Rockwell Filter Products, 2990 Airway Ave., Costa Mesa, CA 92626 714-641-5311
Silicon Systems Inc., 14351 Myford Rd., Tustin, CA 92680 714-979-0941
† Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95054 408-988-0700
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478 .. 216-232-8600
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 .. 415-592-8832

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Filters, Tuning Fork-2300

CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
CTS Corp., Frequency Control Div., (Formerly Knights Div.), 400 Reimann Ave., Sandwich, IL 60548 815-786-8411
† Integrated Microwave, 3422 Tripp Ct., San Diego, CA 92121 619-259-2600
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111

Filters, UHF & VHF-2700

Allen Avionics, Inc., 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ..... A•1496,1635
§† Andersen Laboratories, 1280 Blue Hills Ave., Bloomfield, CT 06002, 203-242-0761 ..... A•1497,1636
† Comstron Corp., 10 Hub Dr., Melville, NY 11747, 516-756-1100 ..... A•1639
Damon Electronics Div., 80 Wilson Way, Westwood, MA 02090, 617-329-2460 ..... A•1391
† Eagle, P.O. Box 911, Fallbrook, CA 92028, 619-728-6000 ..... A•1647
Elpac Components, Elpac Electronics, Inc., 3131 S. Standard Ave., Santa Ana, CA 92705, 714-979-4440 ..... A•1082-1083
† ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558,1653
† Frequency Electronics, Inc., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ..... A•1398
† Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377, 718-424-7500 ..... A•1400
JMK, Inc., 15 Caldwell Dr., Amherst, NH 03031, ;;;603-886-4115 ... A•1663,1665
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 .... A•1666
McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1410-1411
Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 350166, Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1775
NTK Technical Ceramics, NGK Spark Plugs (USA), Inc., 99 Morris Ave., Springfield, NJ 07081, 201-376-6070 ..... A•1438
Oxley, Inc., 25 Business Pk. Dr., P.O. Box 814, Branford, CT 06405, 203-488-1033 ..... A•1677
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1678
Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 ... A•1680-1686
RTE Aerovox Inc., 740 Belleville Ave., New Bedford, MA 02745, 617-994-9661 ..... A•1688
† Sawtek Inc., P.O. Box 609501, Orlando, FL 32860-9501, 407-886-8860 ... A•1463
Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483, 619-575-9353 ..... A•1694
TDK Corporation, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku,, Tokyo, JAPAN 103, (03) 278-5111 ..... A•1698-1699
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1701
Tri-Mag, Inc., 8210 West Doe Ave., Visalia, CA 93291, 209-651-2222 ..... A•1703
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•1706-1710,1712
§† Tusonix, Inc., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144, 602-744-0400 ..... A•1714
Advanced Filter Devices, Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92009 619-438-2074
† Alpha Components, 1106 E. Simpson Rd., Mechanicsburg, PA 17055 ... 717-697-8595
† Antenna Specialists, The Allen Group, 30500 Bruce Industrial Pkwy., Cleveland, OH 44139 216-349-8400
A. P. Circuit, 256 Lincoln Ave., Brooklyn, NY 11208 212-737-1348
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
† Bird Electronic Corp., 30303 Aurora Rd., Cleveland, OH 44139-2794 216-248-1200
Chesterfield Products, 37 Midland Ave., Elmwood Park, NJ 07407 201-797-9655
Cir-Q-Tel, Inc., 6600-04 Virginia Manor Rd., Beltsville, MD 20805 301-946-1800
† Cirtech, EG & G, 15237 Cherry St., Shawnee Mission, KS 66223 913-681-2801
Coaxial Dynamics, 15210 Industrial Parkway, Cleveland, OH 44135 .... 1-800-COAXIAL
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
† Daden Associates, 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653 714-770-1522
† Dielectric Communications, General Signal, Tower Hill Rd., Raymond, ME 04071 ..... 207-655-4555;800-341-9678
§ Fox Electronics, 5842 Corporation Circle, Ft. Meyers, FL 33905 813-693-0099
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 516-822-4770
Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
† Hughes Microelectronics Circuits Division, 500 Superior Ave., P.O. Box H, Newport Beach, CA 92658-8903 714-759-2952
† Integrated Microwave, 3422 Tripp Ct., San Diego, CA 92121 619-259-2600
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 ..... 201-396-9400; 1-800-223-0603
§† Kyocera Northwest, Electronic Components Group, P.O. Box 85542, San Diego, CA 92138-5542 619-576-2600
† Lark Engineering Co., Baier & Baier Inc., 26401 Calle Rolando, San Juan Capistrano, CA 92675 714-240-1233
† Lorch Electronics, Sub. of Vernitron Corp., 105 Cedar La., Englewood, NJ 07631 201-569-8282
† Magnetic Component Engineering, Inc., 11379 Playa Street, Culver City, CA 90230 213-398-4761
Micro-Coax Components, Inc., a UTI Company, Box E, Collegeville, PA 19426 215-489-3700
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 .... 315-437-3953; 800-448-1666
Mu-Del Electronics, Inc., 2426 Linden Lane, Silver Spring, MD 20910-1288 301-587-6087
§† Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080 404-436-1300
North Hills Electronics, 1 Alexander Pl, Glen Cove, NY 11542 516-671-5700
OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804 407-298-2000
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
† Reeves-Hoffman Div., Dynamics Corporation of America, 400 W. North St., Carlisle, PA 17013 717-243-5929
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† RF Monolithics, Inc., 4441 Sigma Rd., Dallas, TX 75244 214-233-2903
RLC Electronics, Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
Sentry Manufacturing, Crystal Park, Chickasha, OK 73018 405-224-6780
§† Sinclair Radio Laboratories Ltd., 85 Mary St., Aurora, ONT., CANADA L4G 3G9 416-727-0165
Sokol Crystal Products, Inc., 121 Water St., Mineral Point, WI 53565 608-987-3363
§† Soshin Electric Co., Ltd., No. 18-18, 1-Chome Nakamagome, Ota-Ku, Tokyo, JAPAN ..... (03) 775-2111
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
† Telonic/Berkeley, Berkeley Inds. Inc., P.O. Box 277, Laguna Beach, CA 92652 714-494-9401
Texscan Instruments, Texscan Corporation, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
Toyo Comm. Equip. Co., Ltd., 20-4, Nishi-Shimbashi, 3-Chome Minato-Ku, TOKYO, JAPAN 105 ..... 03-459-7320/03-459-7310
† Transco Products, Inc., 1001 Flynn Rd., Camarillo, CA 93011-6003 805-987-8007
† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Wavecom, Sub. of Loral Corp., 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010

Wavetek San Diego, Inc., 9045 Balboa Avenue, San Diego, CA 92123 ... 619-279-2200
Wide Band Engineering Co., Inc., Box 21652, Phoenix, AZ 85036 602-254-1570

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A. P. Circuit, 256 Lincoln Ave., Brooklyn, NY 11208, 212-737-1348 ..... A•1637
McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1411-1412
Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 ... A•1680-1684
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1701
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•1706
Anasco Corporation, 42A Cherry Hill Dr., Commerce Ctr. Bldg, Danvers, MA 01923 ..... 617-777-8888;800-826-2726
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
† Balzers Optical Corporation, 170 Locke Dr., Marlboro, MA 01752 617-481-9860
Bently Nevada Corp., P.O. Box 157, Minden, NV 89423 702-782-3611
† Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 602-746-1111
Cir-Q-Tel, Inc., 6600-04 Virginia Manor Rd., Beltsville, MD 20805 301-946-1800
Coaxial Dynamics, 15210 Industrial Parkway, Cleveland, OH 44135 .... 1-800-COAXIAL
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Comstron Corp., 10 Hub Dr., Melville, NY 11747 516-756-1100
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
† Daden Associates, 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653 714-770-1522
§ Dynamics, Div. of Waugh Controls Corp., 9001 Fullbright Ave., Chatsworth, CA 91311 818-998-8281
† Eagle, P.O. Box 911, Fallbrook, CA 92028 619-728-6000
† Electrac, Inc., 1614 Orangethrope Way, Anaheim, CA 92801 714-879-6021
† Ferretec Inc., 544 Gibralter Dr., Milpitas, CA 95035-6315 408-263-1216
Frequeney Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761
† General Microwave Corporation, 5500 New Horizons Blvd., Amityville, NY 11701 516-226-8900
Hopkins Engrg., 12900 Foothill Blvd., San Fernando, CA 91342 818-361-8691
Hughes Microelectronics Circuits Division, 500 Superior Ave., P.O. Box H, Newport Beach, CA 92658-8903 714-759-2952
§ Integra, Inc., 2368 Walsh Ave., Santa Clara, CA 95051 408-727-9601
† Integrated Microwave, 3422 Tripp Ct., San Diego, CA 92121 619-259-2600
ITHACO, Inc., Meas. & Control Instrs. Div., 735 W. Clinton St., P.O. Box 6437, Ithaca, NY 14851-6437 607-272-7640
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
Krohn-Hite Corp., Avon Indl. Pk., Bodwell St., Avon, MA 02322 508-580-1660
Lectronic Research Labs., Inc., 1423 Ferry Ave., Camden, NJ 08104 609-541-4200
† Lorch Electronics, Sub. of Vernitron Corp., 105 Cedar La., Englewood, NJ 07631 201-569-8282
† Marel Instr. Co., 907 South East 13th Pl, Cape Coral, FL 33990 813-574-8788
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 .. 617-329-1508
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§ Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 .... 315-437-3953; 800-448-1666
Pacific Instruments Inc., 215 Mason Circle, Concord, CA 94520 415-827-9010
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804 407-298-2000
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
Sivers IMA, Div. of Philips, 5669 Selmaraine Drive, Culver City, CA 90230 213-390-7477
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Telonic/Berkeley, Berkeley Inds. Inc., P.O. Box 277, Laguna Beach, CA 92652 714-494-9401
† Transco Products, Inc., 1001 Flynn Rd., Camarillo, CA 93011-6003 805-987-8007
Tucker Electronics, Box 461966, Garland, TX 75046 ..... 214-348-8800;800-527-4642
† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33626 813-855-6611
§ Voltex, 3460 Great Neck Rd., Amityville, NY 11701 516-842-2772
† Wavecom, Sub. of Loral Corp., 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010

Filters, Vestigial Sideband-2700

§† Andersen Laboratories, 1280 Blue Hills Ave., Bloomfield, CT 06002, 203-242-0761 ..... A•1636
† Comstron Corp., 10 Hub Dr., Melville, NY 11747, 516-756-1100 ..... A•1639
† ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558
† Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377, 718-424-7500 ..... A•1400
Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1678
† Sawtek Inc., P.O. Box 609501, Orlando, FL 32860-9501, 407-886-8860 ... A•1463
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•1706
Alpha Components, 1106 E. Simpson Rd., Mechanicsburg, PA 17055 ... 717-697-8595
ATV Research, Inc., 1301 Broadway, Dakota City, NE 68731 402-987-3771
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
† BG Electronics, 30 South St., Mt. Vernon, NY 10550 914-664-5591
Cir-Q-Tel, Inc., 6600-04 Virginia Manor Rd., Beltsville, MD 20805 301-946-1800
† Cirtech, EG & G, 15237 Cherry St., Shawnee Mission, KS 66223 913-681-2801
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001 201-636-1900
Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034 ... 215-643-6950
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 .. 415-592-8832

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Allen Avionics, Inc., 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ..... A•1496,1635
Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ..... A•1652
ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1653
† Filtron Co., Inc., Sub. of ARX Inc., 148-E Sweet Hollow Rd., Old Bethpage, NY 11804, 516-752-1144 ..... A•1659
JMK, Inc., 15 Caldwell Dr., Amherst, NH 03031, ;;;603-886-4115 ... A•1663,1665
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 .... A•1667
Matthey Electronics, Television Equipment Associates, Box 393, South Salem, NY 10590, 914-763-8893 ..... A•1670
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•1431
Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483, 619-575-9353 ..... A•1694
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1701
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•1706,1708-1710
† Alpha Components, 1106 E. Simpson Rd., Mechanicsburg, PA 17055 ... 717-697-8595
Cir-Q-Tel, Inc., 6600-04 Virginia Manor Rd., Beltsville, MD 20805 301-946-1800
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 .. 415-592-8832

Filters, Waveguide-3450

† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Alpha Industries, Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
Cir-Q-Tel, Inc., 6600-04 Virginia Manor Rd., Beltsville, MD 20805 301-946-1800
Epsilon-Lambda Elctrns. Corp., 427 Stevens St., Geneva, IL 60134 312-232-9611
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
Hughes Aircraft Co., Microelctms. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
Lectronic Research Labs., Inc., 1423 Ferry Ave., Camden, NJ 08104 609-541-4200
† Lorch Electronics, Sub. of Vernitron Corp., 105 Cedar La., Englewood, NJ 07631 201-569-8282
MACOM, Inc., 43 Second Ave., Bldg. 8, Burlington, MA 01803 617-272-3000
† Metropole Products Inc., P. O. Box 309, Stafford, VA 22554 ..... 703-659-2132; 703-971-7082
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 .... 315-437-3953; 800-448-1666
† Mitec Electronics, 104 Gun Avenue, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† Narda Microwave Corp., Subsidiary of Loral Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Radio Research Instrument Co., Inc., 584 North Main Street, Waterbury, CT 06704-3506 203-753-5840
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Sage Laboratories, Inc., 11 Huron Dr., Natick, MA 01760 617-653-0844
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Tecknit (Eastern Facility), 129 Dermody St., Cranford, NJ 07016 201-272-5500
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
Texscan Instruments, Texscan Corporation, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
† UTE Microwave, 3500 Sunset Ave., Asbury Park, NJ 07712 201-922-1009
† Wavecom, Sub. of Loral Corp., 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
§ Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Filters, YIG-2700

Eaton Corp., Microwave Products Division, 785 Palomar Ave., Sunnyvale, CA 94086 408-773-3700
† Ferretec Inc., 544 Gibralter Dr., Milpitas, CA 95035-6315 408-263-1216
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E-8, Tampa, FL 33634 813-884-1411

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Flanges, Waveguide-3450

† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St., Methuen, MA 01844 617-682-4661
† Gabriel Electronics, Box 70, Scarborough Indl. Pk., Scarborough, ME 04074 207-883-5161
Lectronic Research Labs., Inc., 1423 Ferry Ave., Camden, NJ 08104 609-541-4200

MACOM, Inc., 43 Second Ave., Bldg. 8, Burlington, MA 01803 617-272-3000
† Maury Microwave Corp., 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§ Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Electronics, 104 Gun Avenue, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
§† Systron-Donner Microwave Div., 14844 Oxnard St, Van Nuys, CA 91409 818-786-1760
§ Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

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† Ad-Vance Magnetics, Inc., 625 Monroe St., Rochester, IN 46975, 219-223-3158 ..... C•1743
† Amuneal Manufacturing Corp., 4737 Darrah St., Philadelphia, PA 19124, 215-535-3000 ..... C•1744
† Arnold Engineering Company, Sub. SPS Technologies, 300 West Street, Marengo, IL 60152 815-568-2000
† Eagle Magnetic Company, Inc., P.O. Box 24283, Indianapolis, IN 46224 317-297-1030
§ Egis Corporation, P. O. Box 751, Barrington, IL 60011-0751 312-639-4448
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Permaluster, Inc., 1844 N. Keystone St., Burbank, CA 91504 ..... 213-849-4543; 213-849-6454
SL Electronics, 300 Harvard Ave., Westville, NJ 08093 609-456-7300
† Zippertubing Co., Box 61129, Los Angeles, CA 90061 213-321-3901

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† **Velonex, 560 Robert Ave., Santa Clara, CA 95050, 408-727-7370 ... D•1340-1341**
§ Advanced Micro Devices, P.O. Box 3453, 901 Thompson Pl, Sunnyvale, CA 94088 408-732-2400
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† Computer Conversions Corp., 6 Dunton Ct, E. Northport, NY 11731 516-261-3300
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Cybernetic Micro Sys., P.O. Box 3000, 3000 Hwy. 84, San Gregorio, CA 94074 415-726-3000
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§ Spanta, Inc., 795 Franklin Ave., P.O. Box 193, Franklin Lakes, NJ 07417 201-848-0033
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Vistar Corp., 13740 McCormick Dr., Tampa, FL 33626 813-855-6611
Wavetek San Diego, Inc., 9045 Balboa Avenue, San Diego, CA 92123 ... 619-279-2200

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† **Connector Corp., 6025 N. Keystone Ave., Chicago, IL 60646, 312-539-3108 ..... C•1310**
CTS Corp., Frequency Control Div., (Formerly Knights Div.), 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ..... A•1366-1367,1370-1371,1378
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† **M-Tron Industries, P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321 ..... A•1428**
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SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303, 415-856-6900 ..... A•1458
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Accurate Electronics, 169 S. Abbe Rd., P.O. Box 1287, Elyria, OH 44036 216-366-6330
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Frequency Control Products, Inc., American Time Products Div., 430 Commack Rd., Deer Pk, NY 11729 516-243-5730
† Jettron Products, P.O. Box 337, E. Hanover, NJ 07936 201-887-0571
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§ Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Milross Controls, Inc., 511 Second St Pike, Southampton, PA 18966 215-355-0200
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† Sage Laboratories, Inc., 11 Huron Dr., Natick, MA 01760 617-653-0844
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Telephonics Corporation/PRD Instruments, 770 Park Avenue, Huntington, NY 11743 ..... 516-549-6415/6102
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

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§† **Garry Electronics, Div. of Brintec Corp., 9 Queen Anne Ct., Laghorne, PA 19047, 215-949-2300 ..... C•1370-1373,1739, D•1112**
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Acme Model Engineering Co., 654 Bergen Blvd., Ridgefield, NJ 07657 .. 201-943-7650
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§ Assmann Components, Div. of ebm Industries, Inc., 525 New Britain Ave., Unionville, CT 06085 203-674-1515
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Milross Controls, Inc., 511 Second St Pike, Southampton, PA 18966 215-355-0200
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Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95054 408-988-0700
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§ Wells Electronics, 1701 S. Main St., South Bend, IN 46613 219-287-5941

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Allen Avionics, Inc., 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ... A•1496
Delta Products Corporation, 3823 Spinnaker Ct., Fremont, CA 94538, 415-770-0660 ..... A•2211
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Valhalla Scientific, 9955 Mesa Rim Rd., San Diego, CA 92121, 619-457-5576 ..... D•1336-1337
Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478, 216-232-8600 ..... A•1487

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† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147, 305-696-6660 ..... A•1194-1197
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BH Electronics, Inc., 12219 Wood Lk. Dr., Burnsville, MN 55337, 612-894-9590 ..... A•1206
Coilcraft, 1102 Silver Lake Rd., Cary, IL 60013, 312-639-2361 ..... A•1225,1230
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Gowanda Electronics Corp., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 ..... A•1245
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§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
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† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
§† Hybrids International Ltd., Thick Film Division, 311 N. Lindenwood Dr., Olathe, KS 66062 913-764-6400
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§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
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Stetco, Inc., 3344 Schierhorn Ct., Franklin Pk., IL 60131 312-671-4208
§† West-Cap Arizona, Sub. of SFE Technologies, 2201 East Elvira Road, Tucson, AZ 85706 602-294-2646

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Instruments, Test & Measuring, GPIB (IEEE 488) Compatible-2900 — ***See Vol. D***

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Insulation Parts, Fabricated-3100 — ***See Vol. C***

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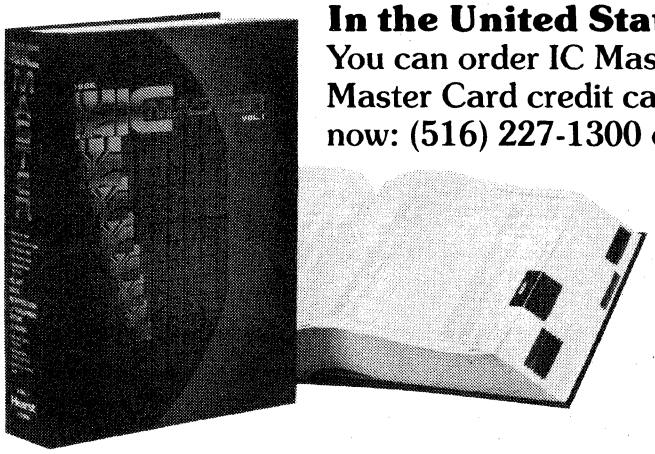

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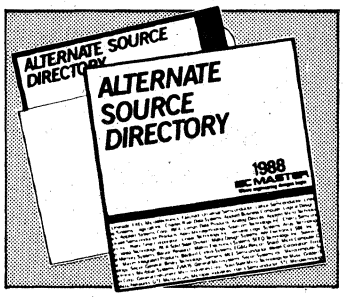

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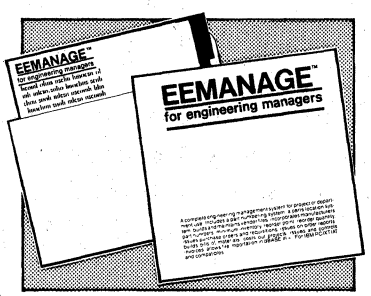

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§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-727-0700
† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700
Cherry Semiconductor Corp, 2000 S. County Trail, East Greenwich, RI 02818 401-885-3600
§† Elantec, Inc., 1996 Tarob Ct., Milpitas, CA 95035 ..... 408-945-1323;800-821-7429
Ferranti Interdesign, Inc., 1500 Green Hills Rd., Scotts Valley, CA 95066 408-438-2900
§† General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
Gennum Corporation, Linear Technology Inc., P.O. Box 489, Sta. A, Burlington, ON, CANADA L7R 3Y3 ..... 800-263-9353;416-632-2996
§† Integrated Device Technology, Inc., 3236 Scott Blvd., Santa Clara, CA 95054-3090 408-727-6116
§ Linear Technology Corp., 1630 McCarthy Blvd., Milpitas, CA 95035 408-432-1900
† MCE Semiconductor, Inc., 1111 Fairfield Dr., West Palm Beach, FL 33407 305-845-2837
§ Mitel Semiconductor, Mitel Corp., P. O. Box 13320, Kanata, ON, CANADA K2K 1X5 613-592-5630
Mitsubishi Elctrns. America, Inc., Semiconductor Div., 1050 East Arques Ave., Sunnyvale, CA 94086 408-730-5900
§ Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
§† NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241 415-960-6000
Philips Circuit Assemblies, A Subdivision of North American Philips Corporation, 5855 N. Glen Pk. Rd., Milwaukee, WI 53209 414-228-7632
§ Rohm Corporation, 8 Whatney, Irvine, CA 92718 714-855-2131
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311
§ Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
§† Sprague Electric Company, The Semiconductor Group, 115 Northeast Cutoff, Box 2036, Worcester, MA 01613-2036 617-853-5000
§† Teledyne Semiconductor, 1300 Terra Bella Ave., PO Box 7267, Mountain View, CA 94039-7267 415-968-9241
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
§† Xicor, Inc., 851 Buckeye Court, Milpitas, CA 95035 408-432-8888

Integrated Circuits, Logic, Surface Mount-3130

Sharp, Microelectronics Div., Integrated Circuits, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... A•1754

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AT&T, 555 Union Blvd., Allentown, PA 18103 ..... 1-800-372-2447;In Canada:1-800-553-2448
† Densepac Microsystems, Inc., 7321 Lincoln Way, Garden Grove, CA 92641-1428 ..... 714-898-0007;800-64-CHIPS
§† General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
Greenwich Instruments USA, 3401 Monroe Rd., Charlotte, NC 28205 ... 704-376-7805
§† Integrated Device Technology, Inc., 3236 Scott Blvd., Santa Clara, CA 95054-3090 408-727-6116
§† LSI Logic Corp., 1551 McCarthy Blvd., Milpitas, CA 95035 408-433-8000
§ Mitsubishi Elctrns. America, Inc., Semiconductor Div., 1050 East Arques Ave., Sunnyvale, CA 94086 408-730-5900
§ Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
† NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241 .. 415-960-6000
§ Panatech Semiconductor, 3375 Scott Blvd., Suite 314, Santa Clara, CA 95054 408-727-7700
Philips Circuit Assemblies, A Subdivision of North American Philips Corporation, 5855 N. Glen Pk. Rd., Milwaukee, WI 53209 414-228-7632
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
§† SEEQ Technology, 1849 Fortune Dr., San Jose, CA 95131 408-432-9550

Integrated Circuits, Memory-3130

American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ..... A•2115
Catalyst Research, Mine Safety Appliances Co., 1421 Clarkview Rd., Baltimore, MD 21209, 301-296-7000, Ext. 304 ..... D•1442
Epson America, Inc., 3415 Kashiwa St., Torrance, CA 90505, 213-534-4500 ..... A•1395
Memory X, 5205 Kearny Villa Way, No. 106, San Diego, CA 92123, 619-292-1151 ..... A•1746
Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... A•2135
Seiko Instruments U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505, 213-517-7770 ..... A•1753
Sharp, Microelectronics Div., Integrated Circuits, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... A•1754-1756
Advanced Electronic Packaging, 21562 Surveyor Circle, Huntington Beach, CA 92646 714-969-1150
§† Advanced Micro Devices, P.O. Box 3453, 901 Thompson Pl., Sunnyvale, CA 94088 408-732-2400
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), 1699 Roosevelt Ave., Bohemia, NY 11716 516-589-5656
AT&T, 555 Union Blvd., Allentown, PA 18103 ..... 1-800-372-2447;In Canada:1-800-553-2448
§ Data General, 4400 Computer Dr., Westboro, MA 01581 617-366-8911
† Densepac Microsystems, Inc., 7321 Lincoln Way, Garden Grove, CA 92641-1428 ..... 714-898-0007;800-64-CHIPS
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§† Exel Microelectronics, Inc., Sub. of Exar Corp., 2150 Commerce Dr., San Jose, CA 95131 408-432-0500
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§† Harris Semiconductor, Box 883, Melbourne, FL 32901 305-724-7400
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International Microelectronic Prods., 2830 North First Street, San Jose, CA 95134 408-432-9100
§† Intersil, 2450 Walsh Ave., Santa Clara, CA 95051 408-996-5000
§† LSI Logic Corp., 1551 McCarthy Blvd., Milpitas, CA 95035 408-433-8000
† Micrel, Inc., 1235 Midas Way, Sunnyvale, CA 94086 408-245-2500
§† Microchip Technology Inc., Sub. of General Instrument Corp., 2355 W. Chandler Blvd., Chandler, AZ 85224 602-963-7373
§ Mitsubishi Elctrns. America, Inc., Semiconductor Div., 1050 East Arques Ave., Sunnyvale, CA 94086 408-730-5900
† Modular Devices, Brookhaven R & D Plaza, 1 Roned Rd., Shirley, NY 11967 516-345-3100
§ Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
§† NCR Microelectronics, NCR Corporation, 1635 Aeroplaza Dr., Colorado Springs, CO 80916 ..... 303-596-5795;800-543-5618
§† NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241 .. 415-960-6000
§ NTE Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
§† Raytheon Semiconductor, 350 Ellis St., Mountain View, CA 94043 415-968-9211
§† RCA Solid State Div., Micro Processors/Memories/Peripherals, Route 202, Somerville, NJ 08876 201-685-6000
§† Rockwell Int'l, 4311 Jamboree Rd., Newport Beach, CA 92660 800-854-8099
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
§† SEEQ Technology, 1849 Fortune Dr., San Jose, CA 95131 408-432-9550
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SGS Semiconductor Corporation, 1000 E. Bell Road, Phoenix, AZ 85022 602-867-6100
Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830 201-321-3400
§† Sprague Solid State, 3900 Welsh Rd., Willow Grove, PA 19090 215-657-8400
§† Standard Microsystems, 35 Marcus Blvd., Hauppauge, NY 11788 516-273-3100
§† Texas Instrs., Inc., Box 809066, Dallas, TX 75380 ..... 800-232-3200 (ext 700)
Texas Instrs., Data Sys. Group, P. O. Box 809063, Dallas, TX 75380-9063 1-800-527-3500
† Third Domain, Inc., P.O. Box 17568, Tucson, AZ 85731-7568 602-290-1820
§ Thor Electronics, 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§† VLSI Technology, Inc., 1109 McKay Dr., San Jose, CA 95131 408-434-3000
§† Xicor, Inc., 851 Buckeye Court, Milpitas, CA 95035 408-432-8888

Integrated Circuits, Microprocessor-3130

American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ..... A•2115
Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... A•2134
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Aeroflex Laboratories, Inc., Microelectronics Div., 35 S. Service Rd., Plainview, NY 11803 516-694-6700
AT&T, 555 Union Blvd., Allentown, PA 18103 ..... 1-800-372-2447;In Canada:1-800-553-2448
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Gould Inc., Semiconductor Division, 2300 Buckskin Rd., Pocatello, ID 83201 208-233-4690
§ GTE Microcircuits, 2000 W. 14th. St., Tempe, AZ 85281 602-968-4431
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Hitachi America, Ltd., 2210 O'Toole Ave., San Jose, CA 95131 408-435-8300
§† Inmos Corp., P.O. Box 16000, Colorado Springs, CO 80935 ... 303-630-4000 Ext. 4454
§† Integrated Device Technology, Inc., 3236 Scott Blvd., Santa Clara, CA 95054-3090 408-727-6116
International Microelectronic Prods., 2830 North First Street, San Jose, CA 95134 408-432-9100
§† Intersil, 2450 Walsh Ave., Santa Clara, CA 95051 408-996-5000
§ LSI Computer Systems, Inc., 1235 Walt Whitman Rd., Melville, NY 11747 516-271-0400
§† LSI Logic Corp., 1551 McCarthy Blvd., Milpitas, CA 95035 408-433-8000
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§† NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241 .. 415-960-6000
§ NTE Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
§ Panatech Semiconductor, 3375 Scott Blvd., Suite 314, Santa Clara, CA 95054 408-727-7700
Photobell, 40 Vreeland Ave., Totowa, NJ 07512 201-785-0049
§ Pro-Log, 2411 Garden Rd., Monterey, CA 93940 408-372-4593
§† Raytheon Semiconductor, 350 Ellis St., Mountain View, CA 94043 415-968-9211
§† RCA Solid State Div., Micro Processors/Memories/Peripherals, Route 202, Somerville, NJ 08876 201-685-6000
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§ SEEQ Technology, 1849 Fortune Dr., San Jose, CA 95131 408-432-9550
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SGS Semiconductor Corporation, 1000 E. Bell Road, Phoenix, AZ 85022 602-867-6100
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§† Standard Microsystems, 35 Marcus Blvd., Hauppauge, NY 11788 516-273-3100
§† Texas Instrs., Inc., Box 809066, Dallas, TX 75380 ..... 800-232-3200 (ext 700)
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§ VLSI Technology, Inc., 1109 McKay Dr., San Jose, CA 95131 408-434-3000
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Integrated Circuits, Microprocessor, Surface Mount-3130

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§† Integrated Device Technology, Inc., 3236 Scott Blvd., Santa Clara, CA 95054-3090 408-727-6116
§† LSI Logic Corp., 1551 McCarthy Blvd., Milpitas, CA 95035 408-433-8000
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§ Mitsubishi Elctrns. America, Inc., Semiconductor Div., 1050 East Arques Ave., Sunnyvale, CA 94086 408-730-5900
§† NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241 .. 415-960-6000

Philips Circuit Assemblies, A Subdivision of North American Philips Corporation, 5855 N. Glen Pk. Rd., Milwaukee, WI 53209 414-228-7632
Rockwell Int'l, 4311 Jamboree Rd., Newport Beach, CA 92660 800-854-8099
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
§ VLSI Technology, Inc., 1109 McKay Dr., San Jose, CA 95131 408-434-3000

Integrated Circuits, MOS, Digital, Surface Mount-3130

§ NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... B•1081
Sharp, Microelectronics Div., Integrated Circuits, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... A•1755-1756
§† Advanced Micro Devices, P.O. Box 3453, 901 Thompson Pl., Sunnyvale, CA 94088 408-732-2400
† Applied Micro Circuits Corp., 6195 Lusk Blvd., San Diego, CA 92121 619-450-9333
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IXYS Corp., 2355 Zanker Rd., San Jose, CA 95131-1109 408-435-1900
§† LSI Logic Corp., 1551 McCarthy Blvd., Milpitas, CA 95035 408-433-8000
§† Microchip Technology Inc., Sub. of General Instrument Corp., 2355 W. Chandler Blvd., Chandler, AZ 85224 602-963-7373
§ Mitel Semiconductor, Mitel Corp., P. O. Box 13320, Kanata, ON, CANADA K2K 1X5 613-592-5630
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Integrated Circuits, MOS, Linear, Surface Mount-3130

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Integrated Circuits, MOS, Memory, Surface Mount-3130

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§ Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
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Philips Circuit Assemblies, A Subdivision of North American Philips Corporation, 5855 N. Glen Pk. Rd., Milwaukee, WI 53209 414-228-7632
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Integrated Circuits, Silicon Monolithic, Unpackaged Chips-3130

Clairex Electronics, Clairex Corporation, 560 S. 3rd Ave., Mt. Vernon, NY 10550, 914-664-6602 ..... B•1270
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§† LSI Logic Corp., 1551 McCarthy Blvd., Milpitas, CA 95035 408-433-8000
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Polycore Electronics, 1107 Tourmaline Dr., Newbury Pk., CA 91320 805-499-6777
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§† RCA Solid State Div., CMOS IC Mktg., Rte. 202, Somerville, NJ 08876 ... 201-685-6000
RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 201-685-6000
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
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SGS Semiconductor Corporation, 1000 E. Bell Road, Phoenix, AZ 85022 602-867-6100
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§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311
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Intercom Systems — See Switching Systems, Audio (Vol. D)

Interconnection Systems-3200 — *See Vol. C*

Interfaces, Computer/Peripheral-2000 — *See Vol. D*

Interfaces, Telex/Computer-1900 — *See Vol. D*

Interrupters, Ground Fault-4300 — *See Vol. B*

Interrupters, Optoelectronic-3700 — *See Vol. B*

Interrupters, Photo-3700 — *See Vol. B*

Interrupters, Power-4300 — *See Vol. B*

Interrupters, Vacuum-4300 — *See Vol. B*

Intervalometers — See Timers (Vol. D)

Inverters, DC to AC — See Power Supplies, AC Output (Vol. D)

Ion, implanter, medium current-4100 — *See Vol. D*

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Isolators, Ferrite-3450

§ FDK America, Inc., Fuji Electromechanical Co., Ltd., 17326 Edwards Rd., Ste. A-130, Cerritos, CA 90701, 213-404-1770 ..... A•1769
§† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E-8, Tampa, FL 33634, 813-884-1411 ..... A•1839-1840
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Alpha Industries, Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St., Methuen, MA 01844 617-682-4661
Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
† Antenna Specialists, The Allen Group, 30500 Bruce Industrial Pkwy., Cleveland, OH 44139 216-349-8400
† Channel Microwave, TRAK Microwave Corp., 3/4 Lindsay Court, Dundee Technlg. Pk., Dundee, SCOTLAND DD2 1TY 44-382-561509
† Eaton Corporation, Microwave Products Division, 785 Palomar Ave., Sunnyvale, CA 94086 408-730-6410
† Emerson & Cuming, W. R. Grace & Co., 59 Walpole St., Canton, MA 02021 617-828-3300
† FEI Microwave, Inc., Frequency Electronics, Inc., 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Lectronic Research Labs., Inc., 1423 Ferry Ave., Camden, NJ 08104 609-541-4200
MACOM, Inc., 43 Second Ave., Bldg. 8, Burlington, MA 01803 617-272-3000
M/A-COM Microwave Components, Inc., South Avenue, Burlington, MA 01803 617-272-3000
† Maury Microwave Corp., 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microwave Applications Group, 3030 Industrial Pkwy., Santa Maria, CA 93455 805-928-5711
Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Electronics, 104 Gun Avenue, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Raytheon Co., Microwave & Power Tube Div., 190 Willow St., Waltham, MA 02154 617-899-8400
§† Sinclair Radio Laboratories Ltd., 85 Mary St., Aurora, ONT., CANADA L4G 3G9 416-727-0165
Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
† TRAK Microwave Ltd., TRAK Microwave Corp., 3/4 Lindsay Court, Dundee Technlg. Pk., Dundee, SCOTLAND DD2 1TY 44-382-561509
† UTE Microwave, 3500 Sunset Ave., Asbury Park, NJ 07712 201-922-1009
Varian Associates, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

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§ FDK America, Inc., Fuji Electromechanical Co., Ltd., 17326 Edwards Rd., Ste. A-130, Cerritos, CA 90701, 213-404-1770 ..... A•1769
§† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E-8, Tampa, FL 33634, 813-884-1411 ..... A•1839-1840
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St., Methuen, MA 01844 617-682-4661
Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
† Channel Microwave, TRAK Microwave Corp., 3/4 Lindsay Court, Dundee Technlg. Pk., Dundee, SCOTLAND DD2 1TY 44-382-561509
† Eaton Corporation, Microwave Products Division, 785 Palomar Ave., Sunnyvale, CA 94086 408-730-6410
† Emerson & Cuming, W. R. Grace & Co., 59 Walpole St., Canton, MA 02021 617-828-3300
† FEI Microwave, Inc., Frequency Electronics, Inc., 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Lectronic Research Labs., Inc., 1423 Ferry Ave., Camden, NJ 08104 609-541-4200
MACOM, Inc., 43 Second Ave., Bldg. 8, Burlington, MA 01803 617-272-3000
† M/A COM Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
M/A-COM Microwave Components, Inc., South Avenue, Burlington, MA 01803 617-272-3000
† Maury Microwave Corp., 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Merrimac Industries, 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Microwave Applications Group, 3030 Industrial Pkwy., Santa Maria, CA 93455 805-928-5711
Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Electronics, 104 Gun Avenue, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
† Narda Microwave Corp., Subsidiary of Loral Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† Norsal Industries, 85 D Hoffman Lane S., Central Islip, NY 11722 516-234-1200
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
§ TDK Corporation, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku,, Tokyo, JAPAN 103 ..... (03) 278-5111
Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
§† Telephonics Corporation/PRD Instruments, 770 Park Avenue, Huntington, NY 11743 ..... 516-549-6415/6102
† TRAK Microwave Ltd., TRAK Microwave Corp., 3/4 Lindsay Court, Dundee Technlg. Pk., Dundee, SCOTLAND DD2 1TY 44-382-561509
† UTE Microwave, 3500 Sunset Ave., Asbury Park, NJ 07712 201-922-1009
Varian Associates, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

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† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St., Methuen, MA 01844 617-682-4661
† Eastern Microwave, 40 Ray Ave., Burlington, MA 01803 617-273-4700
† Graphite Metallizing Corp., 1036 Nepperhan Ave., P.O. Box 110, Yonkers, NY 10702 914-968-8400
† Kevlin Microwave Corp., 26 Conn St., Woburn, MA 01801 617-935-4800
† Maury Microwave Corp., 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§ Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Electronics, 104 Gun Avenue, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Sage Laboratories, Inc., 11 Huron Dr., Natick, MA 01760 617-653-0844
† Sivers IMA, Div. of Philips, 5669 Selmaraine Drive, Culver City, CA 90230 213-390-7477
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

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TRM, Inc., 401 Kelly Ave., Grenier Field, Manchester, NH 03103, 603-627-6000 ..... A•1845
§† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alford Manufacturing Co., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01801 617-935-8610
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St., Methuen, MA 01844 617-682-4661
§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 315-432-8909
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
§ CES Elctrns., 2968 Avenue Z, Brooklyn, NY 11235
† Eastern Microwave, 40 Ray Ave., Burlington, MA 01803 617-273-4700
† Electro-Magentic Processes, Inc., Subsidiary of ISC Group, Inc., 9616 Owensmouth Ave., Chatsworth, CA 91311-4858 818-882-6333
† General Microwave Corporation, 5500 New Horizons Blvd., Amityville, NY 11701 516-226-8900
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Lorch Electronics, Sub. of Vernitron Corp., 105 Cedar La., Englewood, NJ 07631 201-569-8282
§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
† Maury Microwave Corp., 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Merrimac Industries, 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Electronics, 104 Gun Avenue, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Reeve Electronics, Mellish E. Murray, 1715 W. Carroll Ave., Chicago, IL 60612 312-670-0150
Sanders Associates, Inc., ECBD, A Lockheed Company, 955 Perimeter Rd., Manchester, NH 03108-8500 603-645-5548
† Sanders Associates, Inc., Microwave, 955 Perimeter Rd., Manchester, NH 03108 ..... 603-645-6000 Ext. 4299
Sivers IMA, Div. of Philips, 5669 Selmaraine Drive, Culver City, CA 90230 213-390-7477
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Transco Products, Inc., 1001 Flynn Rd., Camarillo, CA 93011-6003 805-987-8007
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

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Memcor-Truohm, Inc., 1320 Flaxmill Rd., Huntington, IN 46750, 219-356-4300 ..... A•2086
Allen-Bradley Co., Industrial Control Div., 1201 S. Second St., Milwaukee, WI 53201 414-382-2000
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050

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† **Hybridyne, Inc., 2155 N. Forbes Blvd., Tucson, AZ 85745, 602-629-0001** ..... **A•1738**
† **International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818, 402-694-6111** ..... **A•1742**
K-Two Industries, 4331 Miranda Ave., Palo Alto, CA 94306 408-720-9316
§ Nepenthe, Inc., 2471 E. Bayshore Road, Palo Alto, CA 94303 ..... 415-856-9332; 800-NEPENTHE

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† **Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 350166, Brooklyn, NY 11235-0003, 718-934-4500** ..... **A•1775**
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
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Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St., Methuen, MA 01844 617-682-4661
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-727-0700
§† EFI Corporation, 350 West 2700 South, Salt Lake City, UT 84115 ..... 801-486-5871; 800-221-1174
† FEI Microwave, Inc., Frequency Electronics, Inc., 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
† General Microwave Corporation, 5500 New Horizons Blvd., Amityville, NY 11701 516-226-8900
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
† M/A COM Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
M/A-COM Microwave Components, Inc., South Avenue, Burlington, MA 01803 617-272-3000
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† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
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Sanders Associates, Inc., ECBD, A Lockheed Company, 955 Perimeter Rd., Manchester, NH 03108-8500 603-645-5548
† Sanders Associates, Inc., Microwave, 955 Perimeter Rd., Manchester, NH 03108 ..... 603-645-6000 Ext. 4299
U.S. Instr. Rentals, 2988 Campus Dr., San Mateo, CA 94403 800-824-2873
Varian Associates, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
§ Wiltron, 490 Jarvis Dr., Morgan Hill, CA 95037-2809 408-778-2000

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† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-4111

† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§ Penstock Engineering Labs., Penstock, Inc., 520 Mercury Dr., Sunnyvale, CA 94086-4018 408-730-0300
RLC Electronics, Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., 11 Huron Dr., Natick, MA 01760 617-653-0844
Tucker Electronics, Box 461966, Garland, TX 75046 ..... 214-348-8800;800-527-4642
§ Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

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Machines, Lead Cutting & Forming-4100 — *See Vol. D*

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Magnetometers-2900 — *See Vol. D*

Magnetoresistors, Hall-4800

Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, OH 43212, 614-486-9561 ..... B•1917
Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... A•2143, B•1925
† American Aerospace Controls, 570 Smith St., Farmingdale, NY 11735 .. 516-694-5100
§ Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830 201-321-3400

Magnetrons — See Tubes, Microwave (Vol. A)

Magnets, Focusing — See Magnets, Permanent (Vol. C)

Magnets (Lab. Type)-1850

Jobmaster Corp., 9008 Liberty Rd., Randallstown, MD 21133, 301-655-1400;800-642-1400 ..... A•1320
§ TDK Corporation, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku,, Tokyo, JAPAN 103, (03) 278-5111 ..... A•1326
Walker Scientific, Rockdale St., Worcester, MA 01606, 617-852-3674;617-853-3232 ..... D•1346
Allen-Bradley Co., Magnetics Division, Div. of Rockwell Corp., 5900 N. Harrison St, Shawnee, OK 74801 405-275-2100
† Arnold Engineering Company, Sub. SPS Technologies, 300 West Street, Marengo, IL 60152 815-568-2000
Elma Engineering, 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
§ General Hardware Mfg., 80 White St, New York, NY 10013 212-431-6100
High Voltage Engrg. Corp., S. Bedford St, Burlington, MA 01803 617-272-1313
LDJ Incorporated, 2200 Stephenson Hwy., P.O. Box 219, Troy, MI 48099-0219 313-528-2202
Magnetic Instrumentation, 8350 E. 48TH ST., Indianapolis, IN 46226 317-545-2102
† Magnet Sales & Mfg. Co. Inc., 11250 Playa Court, Culver City, CA 90230-6127 ..... 213-391-7213;800-421-6692
Magnos, 6 Old School House Rd., Harvard, MA 01451 617-456-8880
† Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Techni-Tool, 5 Apollo Rd., Box 368, Plymouth Meeting, PA 19462 215-825-4990

Magnets, Permanent-1850

Hamlin, Lake & Grove Sts., Lake Mills, WI 53551, 414-648-2361 ..... B•1721
§† Jobmaster Corp., 9008 Liberty Rd., Randallstown, MD 21133, 301-655-1400;800-642-1400 ..... A•1320
Allen-Bradley Co., Magnetics Division, Div. of Rockwell Corp., 5900 N. Harrison St, Shawnee, OK 74801 405-275-2100
Alpha-Tek, 7286 Murdy Circle, Huntington Beach, CA 92647 714-847-7515
† Arnold Engineering Company, Sub. SPS Technologies, 300 West Street, Marengo, IL 60152 815-568-2000
§ Bunting Magnetics Co., 500 So. Spencer Rd., Newton, KS 67114 ..... 316-284-2020; 800-835-2526
§ Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, NJ 07006 201-227-4222
† Engelhard Corp., Menlo Pk., CN40, Edison, NJ 08818 ..... 201-632-6000;800-932-0444 (in NJ)
Epson America, Inc., 3415 Kashiwa St, Torrance, CA 90505 213-534-4500
Ferronics, 52 N. Main St., Fairport, NY 14450 716-388-1020
§ General Hardware Mfg., 80 White St, New York, NY 10013 212-431-6100
§† Magnetic Systems, 770 Linden Avenue, Rochester, NY 14625 716-385-9010
† Magnet Sales & Mfg. Co. Inc., 11250 Playa Court, Culver City, CA 90230-6127 ..... 213-391-7213;800-421-6692
Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
Multi Products International, 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009 201-239-8183
Namiki Precision Jewel Co., Ltd., 15 Warren Street, Hackensack, NJ 07601 201-343-3080
† Ogallala Elctrns., Div. Arnold Engrg. Co., Box 59, Ogallala, NE 69153 308-284-4093
† The Permanent Magnet Co., Inc., 4437 Bragdon St., P. O. Box 26226, Indianapolis, IN 46226 317-547-1336
R-Columbia Prods. Co., Inc., 2008 St. Johns Ave., Highland Park, IL 60035 312-432-7915
§ Risk, George, Inds., 802 S. Elm St., Kimball, NE 69145 308-235-4645
† Shogyo International Corp., 287 Northern Blvd, Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Stackpole, Magnet Div., 201 Stackpole St., St. Marys, PA 15857 814-781-1234
Steward, D. M., Mfg. Co., P.O. Box 510, Chattanooga, TN 37401 615-867-4100
TDJ Co., Inc., 1154 Morena Blvd., San Diego, CA 92110 619-276-5920
§ Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131 408-432-8020
Varian Associates, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

Magnets, Superconducting-1850
Jobmaster Corp., 9008 Liberty Rd., Randallstown, MD 21133, 301-655-1400;800-642-1400 ..... A•1320
TDK Corporation, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku,, Tokyo, JAPAN 103, (03) 278-5111 ..... A•1326
American Magnetics, P.O. Box 2509, Oak Ridge, TN 37831-2509 615-482-1056
Cryomagnetics, Inc., 739 Emory Valley Rd., Oak Ridge, TN 37830 615-482-9551
Varian Assocs., Instr. Grp., 220 Humboldt Ct., Sunnyvale, CA 94089 408-734-5370
Varian Associates, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

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Markers, Wire, Tab & Sleeve — See Wire Markers (Vol. C)

Mark Recognition Equipment, Optical-2000 — *See Vol. D*

Masers & Accessories-3450
Ball Corp., Efratom Division, 3 Parker, Irvine, CA 92718-1605, 714-770-5000 ..... A•1344
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509-2999 213-517-6000

Mask Alignment & Exposure Systems — See Machines, Mask Alignment & Exposure (Vol. D)

Masks, Solder-4600 — *See Vol. C*

Material, Permanent Magnet-1850
Heraeus Cermalloy Division, Heraeus, Inc., Union Hill Industrial Park, W. Conshohocken, PA 19428 215-825-6050
† Magnet Sales & Mfg. Co. Inc., 11250 Playa Court, Culver City, CA 90230-6127 ..... 213-391-7213;800-421-6692
Steward, D. M., Mfg. Co., P.O. Box 510, Chattanooga, TN 37401 615-867-4100

Materials, Shock, Noise, & Vibration Control-2500 — *See Vol. C*

Materials, Thick Film-1600 — *See Vol. C*

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Media, Magnetic — See Disks, Magnetic (Vol. D), Tape, Magnetic (Vol. D)

Megaphones — See Amplifiers (Vol. D)

Memories, DRAM, Surface Mount-3130
AT&T, 555 Union Blvd., Allentown, PA 18103 ..... 1-800-372-2447;In Canada:1-800-553-2448
† Densepac Microsystems, Inc., 7321 Lincoln Way, Garden Grove, CA 92641-1428 ..... 714-898-0007;800-64-CHIPS
§ Fujitsu Microelectronics, Inc., Sub. of Fujitsu Limited, 3545 North First St., San Jose, CA 95134 408-922-9000
§† General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
§ Mitsubishi Elctrns. America, Inc., Semiconductor Div., 1050 East Arques Ave., Sunnyvale, CA 94086 408-730-5900
§† NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241 .. 415-960-6000
NMB Technologies, 9730 Independence Avenue, Chatsworth, CA 91311 818-341-3355
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080

Memories, RAM, Surface Mount-3130
AT&T, 555 Union Blvd., Allentown, PA 18103 ..... 1-800-372-2447;In Canada:1-800-553-2448
† Densepac Microsystems, Inc., 7321 Lincoln Way, Garden Grove, CA 92641-1428 ..... 714-898-0007;800-64-CHIPS
§ Fujitsu Microelectronics, Inc., Sub. of Fujitsu Limited, 3545 North First St., San Jose, CA 95134 408-922-9000
§† General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
Greenwich Instruments USA, 3401 Monroe Rd., Charlotte, NC 28205 ... 704-376-7805
§† Integrated Device Technology, Inc., 3236 Scott Blvd., Santa Clara, CA 95054-3090 408-727-6116
§ Mitsubishi Elctrns. America, Inc., Semiconductor Div., 1050 East Arques Ave., Sunnyvale, CA 94086 408-730-5900
§ Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
§† NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241 .. 415-960-6000
§† Xicor, Inc., 851 Buckeye Court, Milpitas, CA 95035 408-432-8888

Memory Devices/Controllers, Bipolar, Add-in-2000 — *See Vol. D*

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Microcomputer Boards-3130

Vector Electronic Co., Inc., 12460 Gladstone Ave., Box 4336, Sylmar, CA 91342, 818-365-9661 ..... **C•1742**
ADAC Corp., 70 Tower Office Pk., Woburn, MA 01801 617-935-6668
Aeroflex Laboratories, Inc., Microelectronics Div., 35 S. Service Rd., Plainview, NY 11803 516-694-6700
Applied Micro Technlg., A Burr Brown Co., 3669 E. 44th Street, Tucson, AZ 85713 602-622-8605
§ Central Data Corp., 1602 Newton Dr., Champaign, IL 61821 217-359-8010
Charles River Data Systems, Inc., 983 Concord St., Framingham, MA 01701 617-626-1000
Computer Dynamics Sales, 107 S. Main St., Greer, SC 29651 803-877-8700
Cubit, Div. of Proteus Industries. Inc., 190 S. Whisman Rd., Mountain View, CA 94041 415-962-8237
§ Data Translation, Inc., 100 Locke Dr., Marlboro, MA 01752 508-481-3700
§ Datel, Inc., 11 Cabot Blvd., Mansfield, MA 02048 617-339-3000
Davidge Corporation, 94 Commerce Dr., Buellton, CA 93427 805-688-9598
§ GENROCO, Inc., 205 Kettle Moraine Drive North, Slinger, WI 53086-9407 414-644-8700
G W Three Incorporated, 7623 Fullerton Rd., 2nd Floor, Springfield, VA 22153 703-451-2043
Hancock Electronics Corp., 135 King St., P.O. Box 557, Cohasset, MA 02025 617-383-6610
§ Industrial Computer Designs, Inc., 31264 La Baya Drive, Westlake Village, CA 91362 818-889-3179
Ironics Incorporated, 798 Cascadilla St., Ithaca, NY 14850 607-277-4060
JF Microsystems, 3641 Frontier Road, Pasco, WA 99301 ..... 509-297-4294; 800-JF-CARDS

Kinetic Systems, 11 Maryknoll Dr., Lockport, IL 60441 815-838-0005
Matrix Corp., 1203 New Hope Rd., Raleigh, NC 27610 919-833-2000
Microbar Systems, Inc., 785 Lucerne Drive, Sunnyvale, CA 94086 408-720-9300
Micro Industries, 691 Greenscrest Drive, Westerville, OH 43081..... 614-895-0404
Pacific Microcomputers, Signal Technology, 6730 Mesa Ridge Rd., San Diego, CA 92121 619-453-8649
QSI Corporation, 1740 North Research Park Way, Logan, UT 84321 801-753-3657
Sensoray, 44106 Old Warm Springs Blvd., Fremont, CA 94538 415-657-7290
† Stock Drive Products, Div. of Designatronics, Inc., 2101 Jericho Turnpike, New Hyde Pk., NY 11040 ..... 516-328-0200;328-3300
Sunrise Electronics, Inc., 524 S. Vermont Ave., Glendora, CA 91740 818-914-1926
Wintek Corp., 1801 South St., Lafayette, IN 47904-2993 ... 317-742-8428;800-742-6809
Zendex Corp., 6700 Sierra La., Dublin, CA 94568 415-828-3000
Ziatech, 3433 Roberto Ct., San Luis Obispo, CA 93401 805-541-0488

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Microwave Integrated Circuits (MICs)-3450

† General Microwave Corporation, 5500 New Horizons Blvd., Amityville, NY 11701, 516-226-8900 ..... A•1770
§† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
† Alpha Inds., Inc., Microelectronic Div., 2800 Crystal Drive, Hatfield, PA 19440 215-822-1311
Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St., Methuen, MA 01844 617-682-4661
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-727-0700
California Eastern Labs. Inc., 3260 Jay St., Santa Clara, CA 95054 408-988-3500
† Central Microwave Co., Alpha Inds., Inc., 12180 Prichard Farm Rd., Maryland Heights, MO 63043 314-291-5270
Compact Software, Inc., 483 McLean Boulevard, Paterson, NJ 07504 ... 201-881-1200
† Daico Industries, Inc., 2139 East Del Amo Blvd., Compton, CA 90224 213-631-1143
Electro Rent Corp., 4209 Van Owen Place, Burbank, CA 91505 818-843-1221
† EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800
† FEI Microwave, Inc., Frequency Electronics, Inc., 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
† Frequency Electronics, Inc., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
Glassman High Voltage Inc., P.O. Box 551, Salem Indl. Pk., Whitehouse Sta., NJ 08889 201-534-9007
† Harris Microwave Semiconductor, 1530 McCarthy Blvd., Milpitas, CA 95035 408-433-2222
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
† Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Hyletronics, Newtown Rd., Littleton, MA 01460 617-486-8911
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
† Litton Systems, Inc., Electron Dvcs. Div., 960 Industrial Rd., San Carlos, CA 94070 415-591-8411
† M/A COM Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
M/A-COM Microwave Components, Inc., South Avenue, Burlington, MA 01803 617-272-3000
† Magnum Microwave Corp., 4575 Cushing Pkwy., Fremont, CA 94538 ... 415-657-9898
† Micronics Technology Inc., 7 Alexander Place, Glen Cove, NY 11542 ... 516-759-5600
† Microwave Semiconductor Corp., 100 School House Rd., Somerset, NJ 08873 201-563-6300
† Microwave Solutions, Inc., 3200 Highland Ave., National City, CA 92050 619-234-7966
§ Mitsubishi Elctrns. America, Inc., Semiconductor Div., 1050 East Arques Ave., Sunnyvale, CA 94086 408-730-5900
† Narda Microwave Corp., Subsidiary of Loral Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
§ Penstock Engineering Labs., Penstock, Inc., 520 Mercury Dr., Sunnyvale, CA 94086-4018 408-730-0300
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
Sanders Associates, Inc., ECBD, A Lockheed Company, 955 Perimeter Rd., Manchester, NH 03108-8500 603-645-5548
† Sanders Associates, Inc., Microwave, 955 Perimeter Rd., Manchester, NH 03108 ..... 603-645-6000 Ext. 4299
Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830 201-321-3400
† Tachonics Corporation, Grumman Corp., 107 Morgan Ln., Plainsboro, NJ 08536 609-275-2550
Tektronix, Inc., P.O. Box 500, 76/260, Beaverton, OR 97077 800-835-9433
† Teledyne Microelectronics, 12964 Panama St., Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
§ Thor Electronics, 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E-8, Tampa, FL 33634 813-884-1411
Varian Associates, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Vectronics Microwave Corp., 113 Lincoln Blvd., Middlesex, NJ 08846 ... 201-356-2377

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Mirrors, Front Surface-3700 — *See Vol. B*

Mirrors, Rear Surface-3700 — *See Vol. B*

Mixers, Audio-1300 — *See Vol. D*

Mixers, Microwave-3450

† Elcom Systems, Inc., 932 Clint Moore Rd., Boca Raton, FL 33487, 305-994-1774 ..... A•1768
† Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 350166, Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1775
TRM, Inc., 401 Kelly Ave., Grenier Field, Manchester, NH 03103, 603-627-6000 ..... A•1845
§† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St., Methuen, MA 01844 617-682-4661
§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 315-432-8909
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-727-0700
† Eastern Microwave, 40 Ray Ave., Burlington, MA 01803 617-273-4700
§ Eaton Corp., Electronic Instrument Div., 5340 Alla Rd., Los Angeles, CA 90066 213-822-3061
† Eaton Corporation, Microwave Products Division, 785 Palomar Ave., Sunnyvale, CA 94086 408-730-6410
Eaton Corp., Microwave Products Division, 785 Palomar Ave., Sunnyvale, CA 94086 408-773-3700
† FEI Microwave, Inc., Frequency Electronics, Inc., 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
Lectronic Research Labs., Inc., 1423 Ferry Ave., Camden, NJ 08104 609-541-4200
† LNR Communications, Inc., 180 Marcus Blvd., Hauppauge, NY 11788 ... 516-273-7111
† Lorch Electronics, Sub. of Vernitron Corp., 105 Cedar La., Englewood, NJ 07631 201-569-8282
MACOM, Inc., 43 Second Ave., Bldg. 8, Burlington, MA 01803 617-272-3000
† M/A COM Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
M/A-COM Microwave Components, Inc., South Avenue, Burlington, MA 01803 617-272-3000
† Magnum Microwave Corp., 4575 Cushing Pkwy., Fremont, CA 94538 ... 415-657-9898
† Maury Microwave Corp., 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715

† Merrimac Industries, 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§ Micro-Now Instr. Co., Inc., 8260 N. Elmwood St., P. O. Box 1488, Skokie, IL 60077 312-677-4700
† Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Microwave Systems Inc., 6075 E. Molloy Rd., Syracuse, NY 13211-2100 315-437-9951
† Mitec Electronics, 104 Gun Avenue, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† MITEQ Inc., 100 Davids Drive, Hauppauge, NY 11788 516-436-7400
† Narda Microwave Corp., Subsidiary of Loral Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† Norsal Industries, 85 D Hoffman Lane S., Central Islip, NY 11722 516-234-1200
Olektron Corp., Signal Technology Corp., 61 Sutton Road, Webster, MA 01570 617-943-7440
§ Penstock Engineering Labs., Penstock, Inc., 520 Mercury Dr., Sunnyvale, CA 94086-4018 408-730-0300
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† RHG Electronics Laboratory, Inc., Adams Russell, 161 E. Industry Ct., Deer Park, NY 11729 516-242-1100
† Sage Laboratories, Inc., 11 Huron Dr., Natick, MA 01760 617-653-0844
† Sanders Associates, Inc., Microwave, 955 Perimeter Rd., Manchester, NH 03108 ..... 603-645-6000 Ext. 4299
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Tachonics Corporation, Grumman Corp., 107 Morgan Ln., Plainsboro, NJ 08536 609-275-2550
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§† Telephonics Corporation/PRD Instruments, 770 Park Avenue, Huntington, NY 11743 ..... 516-549-6415/6102
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
Varian Associates, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Vectronics Microwave Corp., 113 Lincoln Blvd., Middlesex, NJ 08846 ... 201-356-2377
§ Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Mixers, RF-3450

† Elcom Systems, Inc., 932 Clint Moore Rd., Boca Raton, FL 33487, 305-994-1774 ..... A•1768
† Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 350166, Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1775
§† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St., Methuen, MA 01844 617-682-4661
§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 315-432-8909
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-727-0700
§ Eaton Corp., Electronic Instrument Div., 5340 Alla Rd., Los Angeles, CA 90066 213-822-3061
† Eaton Corporation, Microwave Products Division, 785 Palomar Ave., Sunnyvale, CA 94086 408-730-6410
† FEI Microwave, Inc., Frequency Electronics, Inc., 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
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KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
† Lorch Electronics, Sub. of Vernitron Corp., 105 Cedar La., Englewood, NJ 07631 201-569-8282
MACOM, Inc., 43 Second Ave., Bldg. 8, Burlington, MA 01803 617-272-3000
† Magnum Microwave Corp., 4575 Cushing Pkwy., Fremont, CA 94538 ... 415-657-9898
† Merrimac Industries, 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
† Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
Microwave Systems Inc., 6075 E. Molloy Rd., Syracuse, NY 13211-2100 315-437-9951
† MITEQ Inc., 100 Davids Drive, Hauppauge, NY 11788 516-436-7400
Olektron Corp., Signal Technology Corp., 61 Sutton Road, Webster, MA 01570 617-943-7440
REPCO, 2421 N. Orange Blossom Trail, Box 7065, Orlando, FL 32854 .. 305-843-8484
† RHG Electronics Laboratory, Inc., Adams Russell, 161 E. Industry Ct., Deer Park, NY 11729 516-242-1100
Summit Engineering Corp., Box 938, Bozeman, MT 59715 406-587-4511
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Tachonics Corporation, Grumman Corp., 107 Morgan Ln., Plainsboro, NJ 08536 609-275-2550
Tektronix, Inc., P.O. Box 500, 76/260, Beaverton, OR 97077 800-835-9433
Telephonics Corporation/PRD Instruments, 770 Park Avenue, Huntington, NY 11743 ..... 516-549-6415/6102
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
Weinschel Engineering, One Weinschel La., Gaithersburg, MD 20877 .... 301-948-3434; 800-638-2048
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 .. 415-592-8832

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† Analog Modules, Inc., 126 Baywood Avenue, Longwood, FL 32750, 305-339-4356/4355 ..... D•1006
Instruments for Industry, Inc., 731 Union Parkway, Ronkonkoma, NY 11779, 516-467-8400 ..... D•1012
Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 350166, Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1775
† Advanced Analog, Intech, 2270 Martin Ave., Santa Clara, CA 95050 ... 408-988-4930
† Alpha Inds., Inc., Microelectronic Div., 2800 Crystal Drive, Hatfield, PA 19440 215-822-1311
† Alpha Inds., Inc., Microwave Comp. Div., 90 Glenn St., Lawrence, MA 01843 617-681-8520
† American Microwave Technology, Inc., 1127 S. Placentia Ave., Fullerton, CA 92631 714-680-4936
Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876 401-762-3800
Amplifier Research, 160 School House Rd., Souderton, PA 18964-9990 215-723-8181
† Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106 617-329-4700
Analogic Corp., Data Conversion Prods. Grp., Audubon Rd., Wakefield, MA 01880 617-246-0300
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-727-0700
Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 602-746-1111
Canberra Ind., One State St., Meriden, CT 06450 203-238-2351
† CELCO, 70 Constantine Dr., Mahwah, NJ 07430 201-327-1123
Compact Power Company, 17282 Orange Drive, Yorba Linda, CA 92686 714-996-5826
† Datel, Inc., 11 Cabot Blvd., Mansfield, MA 02048 617-339-3000
DEVAR, Inc., P.O. Box 589, Bridgeport, CT 06601 203-368-6751
† FEI Microwave, Inc., Frequency Electronics, Inc., 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
Infodex, Inc., 10 Venus Dr., Wolcott, CT 06716 203-757-9291
Information Control Corp., Abacus Div. Dept. EM7, 9610 Bellanca Ave., Los Angeles, CA 90045 213-641-8520
† Inland Motor, Kollmorgen Corp., 501 First St., Radford, VA 24141 703-639-9045
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
MERET, Inc., 1815 24th St., Santa Monica, CA 90404-4998 213-828-7496
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† Modular Devices, Brookhaven R & D Plaza, 1 Roned Rd., Shirley, NY 11967 516-345-3100
§ Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
§ MVP Elctrns., P. O. Box 5534, Orange, CA 92613-5534 714-788-8734
§ NTE Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
§ Pulse Instruments Co., 1234 Francisco, Torrance, CA 90502 213-515-5330
Skan-A-Matic, Electro Corporation, Route 5 West, Elbridge, NY 13060 .. 315-689-3961
§ Tennelec, 601 Oak Ridge Tpke., Oak Ridge, TN 37830 615-483-8405

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† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E-8, Tampa, FL 33634 813-884-1411
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735 516-293-3100
TRW, RF Devices Div., 14520 Aviation Blvd., Lawndale, CA 90260 213-536-0888
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Validyne Engineering Corporation, 8626 Wilbur Ave., Northridge, CA 91324 818-886-2057

Modules, Analog Multiplier-3130

† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735, 516-293-3100 ..... D•1184
Advanced Analog, Intech, 2270 Martin Ave., Santa Clara, CA 95050 408-988-4930
† Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106 617-329-4700
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§ DEVAR, Inc., P.O. Box 589, Bridgeport, CT 06601 203-368-6751
§† General Magnetics, 211 Grove St., Bloomfield, NJ 07003 201-743-2700
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Natel Engineering Co., Inc., 4550 Runway St., Simi Valley, CA 93063 805-581-3950

Modules, Analog-to-Digital Conversion-3130

† Datel, Inc., 11 Cabot Blvd., Mansfield, MA 02048, 617-339-3000 ..... D•1153
† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716, 516-567-5600 ..... D•1165
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818, 402-694-6111 ..... A•1742-1743
§† NES, Inc. (Nationwide Electronic Systems), 3003 Wakefield, Carpentersville, IL 60110, 312-426-5900 ..... D•1137
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735, 516-293-3100 ..... D•1184
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† Addacon, Inc., 3702-C Alliance Dr., Greensboro, NC 27407 919-852-6200
† Advanced Analog, Intech, 2270 Martin Ave., Santa Clara, CA 95050 408-988-4930
† Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106 617-329-4700
Analogic Corp., Data Conversion Prods. Grp., Audubon Rd., Wakefield, MA 01880 617-246-0300
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† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700
Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 602-746-1111
Canberra Ind., One State St., Meriden, CT 06450 203-238-2351
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731 516-261-3300
§ Data Translation, Inc., 100 Locke Dr., Marlboro, MA 01752 508-481-3700
Data World Products, Second N.H. Tpke., Francestown, NH 03043 603-588-3746
DGH Corporation, P. O. Box 5638, Manchester, NH 03108 603-622-0452
Digital Equip., One Iron Way, Marlborough, MA 01752
§† Dymec, Inc., 8 Lowell Ave., Winchester, MA 01890 ..... 617-729-7870;800-225-1151
Erbtec Engineering, Inc., 2760 29th St., Boulder, CO 80301 303-447-8750
§ Giddings & Lewis Electronics, A Unit of AMCA International, 666 S. Military Rd., P.O. Box 1658, Fond du Lac, WI 54935 414-921-7100
† Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
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§† Integrated Device Technology, Inc., 3236 Scott Blvd., Santa Clara, CA 95054-3090 408-727-6116
† Interface Engineering Inc., 275/300 Centre St., Unit 7, Holbrook, MA 02343 617-986-2600
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LeCroy Corp., 700 S. Main St., Spring Vly., NY 10977 914-425-2000
MERET, Inc., 1815 24th St., Santa Monica, CA 90404-4998 213-828-7496
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Micro Industries, 691 Greenscrest Drive, Westerville, OH 43081 614-895-0404
† Micro Networks, Unitrode Corporation, 324 Clark St., Worcester, MA 01606 617-852-5400
† Natel Engineering Co., Inc., 4550 Runway St., Simi Valley, CA 93063 805-581-3950
§ National Instruments, 12109 Technology Blvd., Austin, TX 78727-6204 512-250-9119
Northern Precision Labs., 11 Madison Rd., Fairfield, NJ 07006 201-227-4800
§ Opto 22, 15461 Springdale St., Huntington Bch., CA 92649 714-891-5861
§† Phoenix Data, Inc., 3384 W. Osborn Rd., Phoenix, AZ 85017 602-278-8528
Preferred Electronics, Inc., Main Line Dr., P.O. Box 248, Westfield, MA 01086 413-568-2301
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Serial Lab Prods., Inc., 162 Cook Lane, P.O. Box 766, Marlboro, MA 01752 617-481-1684
Taurus Computer Products, DY-4 Systems Inc., 110-1140 Morrison Dr., Ottawa, Ont., CANADA K2H 8S9 613-596-3910
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§ Veeder-Root, 70 Sargeant St., Hartford, CT 06102 203-527-7201
Xycom, 750 N. Maple Rd., Saline, MI 48176 313-429-4971

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Modules, Data Retention-2325 — *See Vol. D*

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Modules, Delay Line-2350

§† Andersen Laboratories, 1280 Blue Hills Ave., Bloomfield, CT 06002, 203-242-0761 ..... A•1497
§† Data Delay Devices, 3 Mount Prospect Ave., Clifton, NJ 07013-1915, 201-773-2299 ..... A•1541-1542
Rhombus Industries, 15801 Chemical Ln., Huntington Bch., CA 92649-1595, 714-898-0960 ..... A•1613-1615
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•1620-1621,1623-1624,1627-1628, B•1022-1025
Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245, 619-458-1471 ..... A•1630
† Anders, Inc., 77 Wolcott Rd., Simsbury, CT 06070 203-658-7666
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147 305-696-6660
Datatronics, Ltd., P. O. Box 2839, Blue Jay, CA 92317 714-336-3561
Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070

Modules, Digital-to-Analog Conversion-3130

† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731, 516-261-3300 ..... D•1144
† Datel, Inc., 11 Cabot Blvd., Mansfield, MA 02048, 617-339-3000 ..... D•1153
† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716, 516-567-5600 ..... D•1165
† Interface Engineering Inc., 275/300 Centre St., Unit 7, Holbrook, MA 02343, 617-986-2600 ..... D•1170
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† Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106 617-329-4700
Analogic Corp., Data Conversion Prods. Grp., Audubon Rd., Wakefield, MA 01880 617-246-0300
Anasco Corporation, 42A Cherry Hill Dr., Commerce Ctr. Bldg., Danvers, MA 01923 ..... 617-777-8888;800-826-2726
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† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700
Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 602-746-1111
C-Tek Inc., 4 Railroad Ave., Wakefield, MA 01880 617-246-1720
§ Data Translation, Inc., 100 Locke Dr., Marlboro, MA 01752 508-481-3700
Digital Equip., One Iron Way, Marlborough, MA 01752
§† Dymec, Inc., 8 Lowell Ave., Winchester, MA 01890 ..... 617-729-7870;800-225-1151
† Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
§ Industrial Computer Designs, Inc., 31264 La Baya Drive, Westlake Village, CA 91362 818-889-3179
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§† Integrated Device Technology, Inc., 3236 Scott Blvd., Santa Clara, CA 95054-3090 408-727-6116
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† Micro Networks, Unitrode Corporation, 324 Clark St., Worcester, MA 01606 617-852-5400
† Natel Engineering Co., Inc., 4550 Runway St., Simi Valley, CA 93063 805-581-3950
§ National Instruments, 12109 Technology Blvd., Austin, TX 78727-6204 512-250-9119
Northern Precision Labs., 11 Madison Rd., Fairfield, NJ 07006 201-227-4800
§ Opto 22, 15461 Springdale St., Huntington Bch., CA 92649 714-891-5861
§† Phoenix Data, Inc., 3384 W. Osborn Rd., Phoenix, AZ 85017 602-278-8528
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Preston Scientific, 805 E. Cerritos Ave., Anaheim, CA 92805 714-776-6400
§ PrimeLine, Soltec Corporation, P. O. Box 670, San Fernando, CA 91341-0670 818-365-0101
§ RCA Solid State Div., Micro Processors/Memories/Peripherals, Route 202, Somerville, NJ 08876 201-685-6000
R. C. Electronics Inc., 5386 Hollister Ave., Ste. D, Santa Barbara, CA 93111 805-964-6708
Serial Lab Prods., Inc., 162 Cook Lane, P.O. Box 766, Marlboro, MA 01752 617-481-1684
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735 516-293-3100
Tustin Electronics Co., 1580 N. Kellogg Drive, Anaheim, CA 92807 714-777-5800
Xycom, 750 N. Maple Rd., Saline, MI 48176 313-429-4971

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Modules, Encoding/Decoding-3130

§† Andersen Laboratories, 1280 Blue Hills Ave., Bloomfield, CT 06002, 203-242-0761 ..... A•1497

† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731, 516-261-3300 ..... D•1144
† Control Sciences, Inc., 9509 Vassar Ave., Chatsworth, CA 91311, 818-709-5510 ..... D•1148-1149,1151
Dio-Rey, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022, 201-941-4455 ..... B•1061-1062
Disc Instruments, Honeywell, 102 E. Baker St., Costa Mesa, CA 92626, 714-433-0343 ..... B•1885-1887
† Interface Engineering Inc., 275/300 Centre St., Unit 7, Holbrook, MA 02343, 617-986-2600 ..... D•1170
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ..... B•1030
§ Xico, Inc., 9737 Eton Ave., Chatsworth, CA 91311, 818-709-4403 ..... D•1109
Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106 617-329-4700
† Anders, Inc., 77 Wolcott Rd., Simsbury, CT 06070 203-658-7666
† Aydin Vector Div., Aydin Corp., Box 328, Newtown, PA 18940-0328 215-968-4271
Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 602-746-1111
Datel, Inc., 11 Cabot Blvd., Mansfield, MA 02048 617-339-3000
§ Giddings & Lewis Electronics, A Unit of AMCA International, 666 S. Military Rd., P.O. Box 1658, Fond du Lac, WI 54935 414-921-7100
† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716 516-567-5600
Information Control Corp., Abacus Div. Dept. EM7, 9610 Bellanca Ave., Los Angeles, CA 90045 213-641-8520
§ Interswitch, Wm. J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010 .. 415-347-8217
§† NES, Inc. (Nationwide Electronic Systems), 3003 Wakefield, Carpentersville, IL 60110 312-426-5900
Richard-Lee Co., Box 724, New Providence, NJ 07974 201-276-0710

Modules, Filter-3130

§† Andersen Laboratories, 1280 Blue Hills Ave., Bloomfield, CT 06002, 203-242-0761 ..... A•1497,1636
A. P. Circuit, 256 Lincoln Ave., Brooklyn, NY 11208, 212-737-1348 ..... A•1637
§ Corcom, Inc., 1600 Winchester Rd., Libertyville, IL 60048, 312-680-7400 ..... A•1640-1641, C•1313
Delta Products Corporation, 3823 Spinnaker Ct., Fremont, CA 94538, 415-770-0660 ..... A•1644-1645
† ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558,1653
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818, 402-694-6111 ..... A•1743
Marway Prods. Inc., 311 N. Clara St., Santa Ana, CA 92703, 714-973-1800 ..... D•2132
McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1411
Schaffner EMC, Inc., Components Division, 825 Lehigh Avenue, Union, NJ 07083, 201-851-0644;800-367-5566 ..... A•1691
† Anders, Inc., 77 Wolcott Rd., Simsbury, CT 06070 203-658-7666
Aptek Technologies, Inc., Aptek Microsystems, 700 N. W. 12th Ave., Deerfield Beach, FL 33442 305-421-8450
† Aydin Vector Div., Aydin Corp., Box 328, Newtown, PA 18940-0328 215-968-4271
† Boonton Electronics Corp., 791 Route 10, Randolph, NJ 07869 201-584-1077
Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 602-746-1111
Cambridge Filter Corp., P.O. Box 4906, Syracuse, NY 13221-4906 315-457-1000
† Circuit Technology Inc., 160 Smith St., Farmingdale, NY 11735 516-293-8686
ELMA Electronic Inc., 41440 Christy Street, Fremont, CA 94538 415-656-3400
Engineered Components Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
Hopkins Engrg., 12900 Foothill Blvd., San Fernando, CA 91342 818-361-8691
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 .. 617-329-1508
§ Power Dynamics Inc., 59 Lakeside Ave., P.O. Box 539, West Orange, NJ 07052 201-736-5722
Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33626 813-855-6611

Modules, I/O Relay-3130

Aromat Corp., 629 Central Avenue, New Providence, NJ 07974, 201-464-3550 ..... B•1381
§ Crydom Company, 17215 Studebaker Rd., No. 328, Cerritos, CA 90701, 213-865-3536 ..... B•1396-1399
Dixson, Inc., Box 1449, Grand Junction, CO 81502, 303-242-8863 (ext 223) ..... D•1367
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379, 203-599-2075 ..... B•1409
§ Elec-Trol, Inc., 26477 N. Golden Valley Rd., Saugus, CA 91350, 805-252-8330 ..... B•1415
FL Jennings, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696, 408-292-4025 ..... B•1423
Flotek Corporation, 1300 E. Floriza St., Ste. 101, Tucson, AZ 85714, 602-294-9222 ..... D•1370-1371
§ Gordos Corporation, A Flint Industries Company, 1000 N. Second St., P.O. Box 824, Rogers, AR 72757, 501-636-5000 ..... B•1460-1461
§ Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525, 312-354-1040 .... B•1465
International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245, 213-772-2000 ..... B•1501
§ Opto 22, 15461 Springdale St., Huntington Bch., CA 92649, 714-891-5861 ..... B•1556
§ Potter & Brumfield, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001, 812-386-1000 ..... B•1559,1572-1573
§ Silicon Power Cube Corp., 6015 Obispo Ave., Long Beach, CA 90805, 213-634-9390 ..... B•1586-1588
§ T-Bar Incorporated, Data Switch Corporation, 1 Enterprise Dr., Shelton, CT 06484, 203-926-1801 ..... B•1804
Teledyne Relays, Teledyne, Inc., 12525 Daphne Ave., Hawthorne, CA 90250, 213-777-0077 ..... B•1608
§ WECO Electrical Connectors, Inc., 16805 Hymus Blvd., Kirkland, Quebec, CANADA H9H 3L4, 514-694-9136 ..... C•1600
ADAC Corp., 70 Tower Office Pk., Woburn, MA 01801 617-935-6668
Applied Micro Technlg., A Burr Brown Co., 3669 E. 44th Street, Tucson, AZ 85713 602-622-8605
§ Bloxcom Corporation, A Siemens Company, 1130 Larkin Dr., Wheeling, IL 60090 312-520-8010
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Kinetic Systems, 11 Maryknoll Dr., Lockport, IL 60441 815-838-0005
KMC Systems, Inc., 140 Greenwood Ave. (Bldg. 3), Midland Pk., NJ 07432 201-447-0007
§† Teledyne Solid State, A Div. of Teledyne Relays, 12525 Daphne Ave., Hawthorne, CA 90250 213-777-0077
§† Theta-J Corporation, 8 Corporate Pl., 107 Audobon Rd., Wakefield, MA 01880 617-246-4000

Modules, Logic-Also See Cards; Circuits; Networks-3130

§ Catalyst Research, Mine Safety Appliances Co., 1421 Clarkview Rd., Baltimore, MD 21209, 301-296-7000, Ext. 304 ..... D•1442
§† Data Delay Devices, 3 Mount Prospect Ave., Clifton, NJ 07013-1915, 201-773-2299 ..... A•1541-1542
Elgenco, Inc., Box 460, Hurricane, UT 84737, 801-635-4954 .. D•1244-1245,1249
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818, 402-694-6111 ..... A•1743
§ Struthers-Dunn, Inc., Subsidiary of Nytronics, Inc., Lamb's Rd., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1592
Applied Micro Technlg., A Burr Brown Co., 3669 E. 44th Street, Tucson, AZ 85713 602-622-8605
† Assembly Specialists, 914 Main St., Box 965, Acton, MA 01720 617-263-9100
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
§ Circuit Assembly Corp., 18 Thomas St., Irvine, CA 92718-2703 714-855-7887
Datel, Inc., 11 Cabot Blvd., Mansfield, MA 02048 617-339-3000
Digital Equip., One Iron Way, Marlborough, MA 01752
Douglas Electronics, 718 Marina Blvd., San Leandro, CA 94577 415-483-8770
§ Dymec, Inc., 8 Lowell Ave., Winchester, MA 01890 ..... 617-729-7870;800-225-1151
Dynage/Controls, Inc., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012 605-296-3487
Engineered Components Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
Enterprise Sys. Corp., P.O. Box 698, Dover, NH 03820 603-742-7363
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716 516-567-5600
Information Control, Dept. EM7 9610 Bellanca Ave., Los Angeles, CA 90045 213-641-8520
Information Control Corp., Abacus Div. Dept. EM7, 9610 Bellanca Ave., Los Angeles, CA 90045 213-641-8520
§ Interswitch, Wm. J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010 .. 415-347-8217
LeCroy Corp., 700 S. Main St., Spring Vly., NY 10977 914-425-2000
† Logic Technology, Inc., 2452 Charleston Rd., Mtn. View, CA 94043 415-967-1007
Matrix Systems Corp., 5177 N. Douglas Fir Rd., Calabasas, CA 91302 .. 818-992-6776
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 .. 617-329-1508
Micro/sys, 1011 Grand Central Ave., Glendale, CA 91201-3010 818-244-4600
Monolithic Sys., 84 Inverness Circle E., Englewood, CO 80112 303-790-7400
Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
§ Namco Controls, An Acme-Cleveland Co., 7567 Tyler Blvd., Mentor, OH 44060 216-946-9900
§† NES, Inc. (Nationwide Electronic Systems), 3003 Wakefield, Carpentersville, IL 60110 312-426-5900
Penn Airborne Prods., 950 Industrial Hwy., Southampton, PA 18966 215-355-3400
† Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
Preferred Electronics, Inc., Main Line Dr., P.O. Box 248, Westfield, MA 01086 413-568-2301
Rhombus Industries, 15801 Chemical Ln., Huntington Bch., CA 92649-1595 714-898-0960
Richard-Lee Co., Box 724, New Providence, NJ 07974 201-276-0710
Rockwell Int'l, 4311 Jamboree Rd., Newport Beach, CA 92660 800-854-8099
Skan-A-Matic, Electro Corporation, Route 5 West, Elbridge, NY 13060 .. 315-689-3961
Sunrise Electronics, Inc., 524 S. Vermont Ave., Glendora, CA 91740 818-914-1926
§† Superior Electric, 383 Middle St., Bristol, CT 06010 203-582-9561
§ Tri-Tronics Co. Inc., 6902 Cypress Park Drive, Tampa, FL 33622 ..... 813-886-4000; 800-237-0946
Xycom, 750 N. Maple Rd., Saline, MI 48176 313-429-4971

Modules, MIC-3130

Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211

Modules, Logic, Surface Mount-3130

† Densepac Microsystems, Inc., 7321 Lincoln Way, Garden Grove, CA 92641-1428 ..... 714-898-0007;800-64-CHIPS
§ PTS Corporation, Box 272, Bloomington, IN 47401 812-824-9331
Rhombus Industries, 15801 Chemical Ln., Huntington Bch., CA 92649-1595 714-898-0960
§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311

Modules, NIM-2900 — *See Vol. D*

Modules, Oscillator-2300

§† Andersen Laboratories, 1280 Blue Hills Ave., Bloomfield, CT 06002, 203-242-0761 ..... A•1335,1497,1636

AT&T, 555 Union Blvd., Allentown, PA 18103, 1-800-372-2447;In Canada:1-800-553-2448 ..... A•1341
† Austron, Inc., P.O. Box 14766, Austin, TX 78761-4766, 512-251-2341 .... A•1342
California Instruments, Amstar Electronics Group, 5125 Convoy St., Ste. 201, San Diego, CA 92111, 619-279-8620;800-356-2244;800-821-1634 ..... D•2082
Connor-Winfield Corp., 1865 Selmarten Rd., Aurora, IL 60505, 312-851-4722 ..... A•1361
§ Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282, 602-967-7874 ..... A•1388-1390
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818, 402-694-6111 ..... A•1742
McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1414
† Techtrol Cyclonetics, Inc., 815 Market St., New Cumberland, PA 17070, 717-774-2746 ..... A•1476
† Vectron Laboratories, Inc., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433 ..... A•1481-1485
† Z Communications, Inc., 5450 N.W. 33rd Ave., Ste. 100, Ft. Lauderdale, FL 33309, 305-735-1000 ..... A•1491,1493
Alpha Inds., Inc., Microelectronic Div., 2800 Crystal Drive, Hatfield, PA 19440 215-822-1311
Analytic Instruments Corporation, P.O. Box 542845, Dallas, TX 75354 ... 214-357-3882
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St, Dept. E, Miami, FL 33147 305-696-6660
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-727-0700
† Aydin Vector Div., Aydin Corp., Box 328, Newtown, PA 18940-0328 215-968-4271
Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 602-746-1111
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731 516-261-3300
Engineered Components Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
† General Magnetics, 211 Grove St., Bloomfield, NJ 07003 201-743-2700
† Gorman-Redlich Mfg. Co., 257 W. Union St., Athens, OH 45701 614-593-3150
Information Control Corp., Abacus Div. Dept. EM7, 9610 Bellanca Ave., Los Angeles, CA 90045 213-641-8520
Modular Audio Products, Modular Devices, Inc., 50 Orville Dr., Bohemia, NY 11716 516-567-9620
† Modular Devices, Brookhaven R & D Plaza, 1 Roned Rd., Shirley, NY 11967 516-345-3100
§ Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131 312-451-1000
Potter & Brumfield, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001 812-386-1000
Richard-Lee Co., Box 724, New Providence, NJ 07974 201-276-0710
† Solid State Electronics Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E-8, Tampa, FL 33634 813-884-1411
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33626 813-855-6611

Modules, Power Entry, Filtered-2700

§ Corcom, Inc., 1600 Winchester Rd., Libertyville, IL 60048, 312-680-7400 ..... A•1640-1641, C•1313
Curtis Industries, 7400 W. Douglas Ave., P.O. Box 18699, Milwaukee, WI 53218-0699, 414-535-1500 ..... A•1642-1643
Delta Products Corporation, 3823 Spinnaker Ct., Fremont, CA 94538, 415-770-0660 ..... A•1644-1645
Eichhoff Electronics, 205 Hallene Rd., Warwick, RI 02886, 401-738-1440 ..... A•1648-1649
Filter Concepts Inc., 2624 S. Rousselle, Santa Ana, CA 92707, 714-545-7003 ..... A•1656
JMK, Inc., 15 Caldwell Dr., Amherst, NH 03031, ;;;603-886-4115 ... A•1663,1665
Krohn-Hite Corp., Avon Indl. Pk., Bodwell St., Avon, MA 02322, 508-580-1660 ..... A•1669
Marway Prods. Inc., 311 N. Clara St., Santa Ana, CA 92703, 714-973-1800 ..... D•2132-2133
§ Power Dynamics Inc., 59 Lakeside Ave., P.O. Box 539, West Orange, NJ 07052, 201-736-5722 ..... A•1679, C•1522
RTE Aerovox Inc., 740 Belleville Ave., New Bedford, MA 02745, 617-994-9661 ..... A•1688-1690
Schaffner EMC, Inc., Components Division, 825 Lehigh Avenue, Union, NJ 07083, 201-851-0644;800-367-5566 ..... A•1691
§ Schurter, Inc., 1016 Clegg Ct., Petaluma, CA 94952, 707-778-6311 .. A•1692-1693
Transducers and Systems, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, 203-481-5721 ..... B•1927
Tri-Mag, Inc., 8210 West Doe Ave., Visalia, CA 93291, 209-651-2222 ..... A•1703

Modules, RMS-to-DC Conversion-3130

Abbott Technologies, Inc., Sun Valley Division, Power Supplies, 8203 Vineland Ave., Sun Valley, CA 91352, 818-504-0644 ..... D•1521
§ WECO Electrical Connectors, Inc., 16805 Hymus Blvd., Kirkland, Quebec, CANADA H9H 3L4, 514-694-9136 ..... C•1600
Advanced Analog, Intech, 2270 Martin Ave., Santa Clara, CA 95050 408-988-4930
Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 602-746-1111
§ Semikron, Inc., 11E Executive Dr., P.O. Box 66, Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308

Modules, Sample & Hold-3130

Datel, Inc., 11 Cabot Blvd., Mansfield, MA 02048, 617-339-3000 .... D•1153,1156
† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716, 516-567-5600 ..... D•1165
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818, 402-694-6111 ..... A•1743
Advanced Analog, Intech, 2270 Martin Ave., Santa Clara, CA 95050 408-988-4930
† Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106 617-329-4700
Analogic Corp., Data Conversion Prods. Grp., Audubon Rd., Wakefield, MA 01880 617-246-0300
Anasco Corporation, 42A Cherry Hill Dr., Commerce Ctr. Bldg., Danvers, MA 01923 ..... 617-777-8888;800-826-2726
Applied Micro Technlg., A Burr Brown Co., 3669 E. 44th Street, Tucson, AZ 85713 602-622-8605
Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 602-746-1111
§ Dymec, Inc., 8 Lowell Ave., Winchester, MA 01890 ..... 617-729-7870;800-225-1151
Information Control Corp., Abacus Div. Dept. EM7, 9610 Bellanca Ave., Los Angeles, CA 90045 213-641-8520
Kinetic Systems, 11 Maryknoll Dr., Lockport, IL 60441 815-838-0005
LeCroy Corp., 700 S. Main St., Spring Vly., NY 10977 914-425-2000
§ WECO Electrical Connectors, Inc., 16805 Hymus Blvd., Kirkland, Quebec, CANADA H9H 3L4 514-694-9136

Modules, Switching-5100 — *See Vol. B*
Modules (MIL), Electronic-2440 — *See Vol. B*
Modules (MIL), Standard Electronic-2440 — *See Vol. B*
Molding Services — See Services, Molding (Vol. D)
Monitors, Current-2200 — *See Vol. D*
Monitors, Data Link-1900 — *See Vol. D*
Monitors, Error Rate-1900 — *See Vol. D*
Monitors, Frequency-2900 — *See Vol. D*
Monitors, Humidity-2200 — *See Vol. D*
Monitors, Laser Energy-2200 — *See Vol. D*
Monitors, Line & Program-1900 — *See Vol. D*
Monitors, Modulation-2900 — *See Vol. D*
Monitors, Phase & Phase Angle-2900 — *See Vol. D*
Monitors, Phase Sequence & Loss-2200 — *See Vol. D*
Monitors, Power, AC & DC-2200 — *See Vol. D*
Monitors, Power, AF-1300 — *See Vol. D*
Monitors, Power Failure-2200 — *See Vol. D*
Monitors, Power, Microwave-2900 — *See Vol. D*
Monitors, Power, RF-2900 — *See Vol. D*
Monitors, Response Time-2900 — *See Vol. D*
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Monitors, Temperature-Also See Controls, Temperature-5300 — *See Vol. B*
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Monitors, Vibration-2200 — *See Vol. D*
Monitors, Video-1900 — *See Vol. D*
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Monitors, Waveform — See Oscilloscopes (Vol. D)
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Motor Assemblies with Integral Tachometer/Encoder-3500 — *See Vol. B*
Motor Generator Sets-4000 — *See Vol. D*
Motorized Micropositioners-4900 — *See Vol. D*
Motorized Translation Stages-4900 — *See Vol. D*
Motor Speed Drives — See Controls, Motor Speed (Vol. D)
Motors, Brush, DC-3500 — *See Vol. B*
Motors, Brushless, DC-3500 — *See Vol. B*
Motors, Clock & Timing-3500 — *See Vol. B*
Motors, Control-3500 — *See Vol. B*
Motors, DC Timing-3500 — *See Vol. B*
Motors, Drag Cup-3500 — *See Vol. B*

Motors, Fractional Horsepower-3500 — *See Vol. B*

Motors, Gearhead-3500 — *See Vol. B*

Motors, Gyro-3500 — *See Vol. B*

Motors, Hysteresis-3500 — *See Vol. B*

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Motors, Induction-3500 — *See Vol. B*

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Motors, Servo-4900 — *See Vol. D*

Motors, Squirrel Cage-3500 — *See Vol. B*

Motors, Stepping-3500 — *See Vol. B*

Motors, Synchronous-3500 — *See Vol. B*

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Motors, Universal, AC or DC Operation-3500 — *See Vol. B*

Motors, (MIL)-2440 — *See Vol. B*

Mounts, Antenna-1900 — *See Vol. D*

Mounts, CRT & Accessories-2500 — *See Vol. C*

Mounts, Crystal-2300

Bivar, Inc., 4 Thomas, Irvine, CA 92718, 714-951-8808 ..... C•1017
McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1407-1408
Accurate Electronics, 169 S. Abbe Rd., P.O. Box 1287, Elyria, OH 44036 216-366-6330
§ Atlee Inc., 10 Bayfield Dr., North Andover, MA 01845 617-681-1003
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
Lectronic Research Labs., Inc., 1423 Ferry Ave., Camden, NJ 08104 609-541-4200
§ Methode Electronics, Inc., Interconnect Prods Div, 1700 Hicks Rd, Rolling Meadows, IL 60008 312-392-3500
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
† Milross Controls, Inc., 511 Second St. Pike, Southampton, PA 18966 215-355-0200
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
§† Telephonics Corporation/PRD Instruments, 770 Park Avenue, Huntington, NY 11743 ..... 516-549-6415/6102
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Mounts, Integrated Circuit — See Sockets, Integrated Circuit (Vol. C), Boards, Plug-In (Vol. C)

Mounts, Microwave-3450

Andrew Corp., 10500 W. 153rd St., Orland Pk., IL 60462 800-255-1479
§ CGTI, 2 Windward Ave., White Plains, NY 10605 914-949-3719
Gabriel Electronics, Box 70, Scarborough Indl. Pk., Scarborough, ME 04074 207-883-5161
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Maury Microwave Corp., 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Micro-Mounting Devices, 4092 Keith Dr., Campbell, CA 95008 408-866-4626
† Mitec Electronics, 104 Gun Avenue, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† Narda Microwave Corp., Subsidiary of Loral Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
§† Telephonics Corporation/PRD Instruments, 770 Park Avenue, Huntington, NY 11743 ..... 516-549-6415/6102
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Mounts, Mobile Antenna — See Mounts, Antenna (Vol. D)

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Multipliers, Frequency-3450

† Applied Research, Inc., 111 New South Rd., Hicksville, NY 11802, 516-938-9700 ..... A•1764
† Frequency Electronics, Inc., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ..... A•1399
† Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 350166, Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1775
† Techtrol Cyclonetics, Inc., 815 Market St., New Cumberland, PA 17070, 717-774-2746 ..... A•1476-1477
§† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
† Ajax Magnethermic Corp., 1745 Overland Ave., N.E., Warren, OH 44482 216-372-8511
Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St., Methuen, MA 01844 617-682-4661
† Anghel Laboratories, Inc., 3 Route 46 West, Fairfield, NJ 07006 201-575-1116
† Comstron Corp., 10 Hub Dr., Melville, NY 11747 516-756-1100
Dowty RFL Inds. Inc./Communications Div., The Dowty Grp. PLC, Powerville Rd., Boonton, NJ 07005-0239 201-334-3100
† Electrac, Inc., 1614 Orangethrope Way, Anaheim, CA 92801 714-879-6021
† Engineered Components Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
† FEI Microwave, Inc., Frequency Electronics, Inc., 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Hughes Microelectronics Circuits Division, 500 Superior Ave., P.O. Box H, Newport Beach, CA 92658-8903 714-759-2952
† Integrated Microwave, 3422 Tripp Ct., San Diego, CA 92121 619-259-2600
† Lorch Electronics, Sub. of Vernitron Corp., 105 Cedar La., Englewood, NJ 07631 201-569-8282
† M/A COM Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Micronics Technology Inc., 7 Alexander Place, Glen Cove, NY 11542 516-759-5600
§ Micro-Now Instr. Co., Inc., 8260 N. Elmwood St., P. O. Box 1488, Skokie, IL 60077 312-677-4700
† Microwave Systems Inc., 6075 E. Molloy Rd., Syracuse, NY 13211-2100 315-437-9951
† MITEQ Inc., 100 Davids Drive, Hauppauge, NY 11788 516-436-7400
§ Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
† North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542 516-671-5700
Olektron Corp., Signal Technology Corp., 61 Sutton Road, Webster, MA 01570 617-943-7440
§† RCA Solid State Div., CMOS IC Mktg., Rte. 202, Somerville, NJ 08876 201-685-6000
§ Reliance Comm/Tec, Reliance Electric, P. O. Box 99502, Cleveland, OH 44199 800-245-4501
Resdel Engrg. Corp, Resdel Inds., 300 E. Live Oak Ave., Arcadia, CA 91006 213-684-2600
Richard-Lee Co., Box 724, New Providence, NJ 07974 201-276-0710
Rockwell International Telecommunications, 1200 N. Alma Rd., Richardson, TX 75081 214-996-5000
Sanders Associates, Inc., ECBD, A Lockheed Company, 955 Perimeter Rd., Manchester, NH 03108-8500 603-645-5548
† Sanders Associates, Inc., Microwave, 955 Perimeter Rd., Manchester, NH 03108 ..... 603-645-6000 Ext. 4299
† Teledyne Microelectronics, 12964 Panama St., Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831

Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E-8, Tampa, FL 33634 813-884-1411
Tucker Electronics, Box 461966, Garland, TX 75046 ..... 214-348-8800;800-527-4642
Varian Associates, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Vibration Instruments Co., 1614 Orangethorpe Way, Anaheim, CA 92801 714-879-6085
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
WILMANCO, 19529 Business Center Drive, Northridge, CA 91324 ..... 818-993-1662/1663
† Zeta Labs., Sub. of CCT Corp., 2811 Orchard Parkway, San Jose, CA 95134 408-434-3600

Multipliers, Hall-4800

Bell, F. W., Inc., 6120 Hanging Moss Rd., Orlando, FL 32807, 407-678-6900 ..... D•1122
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, OH 43212, 614-486-9561 ..... B•1916
Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... A•2143
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800

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Networks, Directional Antenna Phasing-1900 — *See Vol. D*

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Networks, Hybrid Substrates-3130

† Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150 ..... A•1932
International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1739,1939
† Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761, 617-695-0203 ..... A•1975
Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•2001
§ Raltron Electronics, 2315 N.W. 107th Ave., Miami, FL 33172, 305-593-6033 ..... A•2009
ACC Electronics Company, Echlin Inc., 1300 W. Oak, Independence, KS 67301 316-331-1000
§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
§† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700
California Micro Devices, Inc., 215 Topaz Street, Milpitas, CA 95035 408-263-3214
Corning Glass Works, Materials Business, Main Plant, MP 21-3, Corning, NY 14831 607-974-9000
† Hybrid Systems, Sipex Corporation, 22 Linnell Circle, Billerica, MA 01821 617-667-8700
Hycomp, Inc., 165 Cedar Hill St., Marlborough, MA 01752 617-485-6300
† Hy-Tec Industries, Div. of Topo Industries, Inc., P.O. Box 91, Shoreham, NY 11786 516-924-8686
Hytek Microsystems, 980 University Ave., Los Gatos, CA 95030 408-395-2300
§ Kyocera Northwest, Electronic Components Group, P.O. Box 85542, San Diego, CA 92138-5542 619-576-2600
LTI, Inc., 6445 N. Hamlin Ave., Lincolnwood, IL 60645 312-679-7500
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 .. 617-329-1508
† Microplex, Inc., 1977 State College Blvd., Anaheim, CA 92806 ..... 714-979-8833; 714-634-1535
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
† Natel Engineering Co., Inc., 4550 Runway St., Simi Valley, CA 93063 805-581-3950
Northwest Microcircuits, Inc., 5464SW Philomath Blvd., Corvallis, OR 97333 503-753-8242
Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
State of the Art, Inc., 2470 Fox Hill Rd., State College, PA 16803-1797 .. 814-355-8004
Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502 .. 303-242-0810
United Supertek, Inc., 118 Charcot Ave., San Jose, CA 95131-1101 408-922-0730
† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

Networks, Ladder-4700

§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•1866
§ Bradford Electronics, Inc., 550 High Street, Bradford, PA 16701, 814-362-5700 ..... A•1876
Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1878-1879
§† Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926, 915-592-3253 ..... A•1916
† Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150 ..... A•1932
† ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558
† International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1739,1939
Kelvin Industries, Inc., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501, 818-990-1192 ..... A•1945
§ KOA Speer Electronics, Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ..... A•1947
† KRL/Bantry Components, Inc., 160 Bouchard St., Manchester, NH 03103, 603-668-3210 ..... A•1951
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1968
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•1976
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•2001
Precision Resistive Products, Inc., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, 319-394-9131 ..... A•2002
§ Raltron Electronics, 2315 N.W. 107th Ave., Miami, FL 33172, 305-593-6033 ..... A•2009
Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483, 619-575-9353 ..... A•2031
Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478, 216-232-8600 ..... A•1487
† Artronic Instrument Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), 1699 Roosevelt Ave., Bohemia, NY 11716 516-589-5656
† Assembly Specialists, 914 Main St., Box 965, Acton, MA 01720 617-263-9100
§† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700
† BG Electronics, 30 South St., Mt. Vernon, NY 10550 914-664-5591
Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 602-746-1111
† Circuit Technology Inc., 160 Smith St., Farmingdale, NY 11735 516-293-8686
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-8725
Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
† Environmental Comm., 3150 Pullman St., Costa Mesa, CA 92627 714-557-7800
† Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
General Resistance, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471 203-481-5721
† Genisco Technology Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
† Hybrid Systems, Sipex Corporation, 22 Linnell Circle, Billerica, MA 01821 617-667-8700
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
§ Kyocera Northwest, Electronic Components Group, P.O. Box 85542, San Diego, CA 92138-5542 619-576-2600
Meissner Industries, 551 Rte. 10, Dover, NJ 07801 201-366-1700
† Microplex, Inc., 1977 State College Blvd., Anaheim, CA 92806 ..... 714-979-8833; 714-634-1535
Ohmtek Inc., Sfernice Group Company, 2160 Liberty Dr., Niagara Falls, NY 14304 716-283-4025
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
Shallco, Inc., Box 1089, Smithfield, NC 27577 919-934-3135
Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311
§† Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
§† Sprague Electric Company, Advanced Ceramics Group, 267 Lowell Road, Hudson, NH 03051 603-881-7200
† Tech Labs., Inc., 500 10th St., Palisades Pk., NJ 07650 201-944-2221
Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405 818-781-1642
Tel Labs, Inc., Sfernice, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 603-625-8994
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064 213-478-8224
Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502 .. 303-242-0810
Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 .. 215-644-1300
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 .. 415-592-8832
† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

Networks, LC-2700

Allen Avionics, Inc., 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ... A•1635
§ Bradford Electronics, Inc., 550 High Street, Bradford, PA 16701, 814-362-5700 ..... A•1876
† ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558,1653
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1968

Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1678,2001
United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600 ..... A•1479
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070, 415-592-8832 ..... A•1715
† Alpha Components, 1106 E. Simpson Rd., Mechanicsburg, PA 17055 ... 717-697-8595
† Artronic Instrument Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
† BG Electronics, 30 South St., Mt. Vernon, NY 10550 914-664-5591
Chesterfield Products, 37 Midland Ave., Elmwood Park, NJ 07407 201-797-9655
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-8725
§† Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926 915-592-3253
Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Design Automation, Inc., 809 Massachusetts Ave., Lexington, MA 02173-3992 617-862-8998
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electrocom Industries, 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
† Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Engineered Components Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
† Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
† Genisco Technology Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001 201-636-1900
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Maxwell Laboratories, 8888 Balboa Avenue, San Diego, CA 92123-1506 619-279-5100
Ohmtek Inc., Sfernice Group Company, 2160 Liberty Dr., Niagara Falls, NY 14304 716-283-4025
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Plastic Capacitors, Inc., 2623 N. Pulaski Rd., Chicago, IL 60639 312-489-2229
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
Rtron Corp., 7324 Lawndale, Skokie, IL 60076 312-679-7180
Solitron/Microwave, Solitron Devices, Inc., 1177 Blue Heron Blvd., Solitron Pk., Riviera Bch., FL 33404 305-848-4311
† Thinco Div., Hull Corp., Davisville Rd., Hatboro, PA 19040 215-672-7800
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064 213-478-8224

Networks, Line Impedance Stabilization-1900 — *See Vol. D*

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Networks, Phase-2700

† ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558,1653
† Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377, 718-424-7500 ..... A•1400
† Velonex, 560 Robert Ave., Santa Clara, CA 95050, 408-727-7370 ... D•1340-1341
Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
† Alpha Components, 1106 E. Simpson Rd., Mechanicsburg, PA 17055 ... 717-697-8595
† Artronic Instrument Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
† BG Electronics, 30 South St., Mt. Vernon, NY 10550 914-664-5591
§ Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926 915-592-3253
§† Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Elcom Systems, Inc., 932 Clint Moore Rd., Boca Raton, FL 33487 305-994-1774
Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
Engineered Components Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
† Genisco Technology Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
M/A-COM Microwave Components, Inc., South Avenue, Burlington, MA 01803 617-272-3000
† Merrimac Industries, 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
† Microwave Applications Group, 3030 Industrial Pkwy., Santa Maria, CA 93455 805-928-5711
North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542 516-671-5700
Olektron Corp., Signal Technology Corp., 61 Sutton Road, Webster, MA 01570 617-943-7440
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† STI, Control Components Div., 9520 Black Mountain Rd., San Diego, CA 92126-4507 ..... 619-566-7680;800-826-5053
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064 213-478-8224
Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 .. 215-644-1300
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 .. 415-592-8832

Networks, Pulse Forming-2700

† ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558,1653
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818, 402-694-6111 ..... A•1743
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•1706
Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
† Artronic Instrument Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147 305-696-6660
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
§† Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926 915-592-3253
Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
† El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Engineered Components Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
† Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
Hipotronics Inc., P.O. Drawer A, Brewster, NY 10509 914-279-8091
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Kappa Scientific Corp., Box 30585, Santa Barbara, CA 93105 805-687-9648
† MAR-CHAR CORPORATION, ATR Electronics, Inc., 167 East Fifth Street, Montello, WI 53949 608-297-2106
Maxwell Laboratories, 8888 Balboa Avenue, San Diego, CA 92123-1506 619-279-5100
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
Phase Control Electronics, 87-27 Myrtle Ave., Glendale, NY 11385 718-441-4728
† Plastic Capacitors, Inc., 2623 N. Pulaski Rd., Chicago, IL 60639 312-489-2229
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034 ... 215-643-6950
† Radio Research Instrument Co., Inc., 584 North Main Street, Waterbury, CT 06704-3506 203-753-5840
Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
Sprague Electric Company, Advanced Ceramics Group, 267 Lowell Road, Hudson, NH 03051 603-881-7200
† Stanley Electronics, Inc., 10 Ocean Ave., Copiague, NY 11726 516-842-8866
† Tobe Deutschmann Labs., Inc., 550 Turnpike St., Canton, MA 02021 617-828-3366
Triac Electronic Systems, Inc., 87-27 Myrtle Ave., Glendale, NY 11385 .. 718-441-4759
Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 .. 215-644-1300

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Networks, RC-2000 — *See Vol. D*

Networks, Resistance-4700

§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•1862-1867
§† Ametek/Rodan Div., 2905 Blue Star St., Anaheim, CA 92806, 714-630-0081 ..... B•1838
§† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635, 714-447-2700 ..... A•2063
§ Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ..... A•1871
§ Bradford Electronics, Inc., 550 High Street, Bradford, PA 16701, 814-362-5700 ..... A•1875
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1878-1879,1883,1893-1899
CTS Corporation, Microelectronics Div., 1201 Cumberland Ave., W. Lafayette, IN 47906, 317-463-2565 ..... A•1732-1733
§ CTS Corp., Resistor Network Div., (Formerly CTS Corp., Berne Div.), 406 Parr Rd., Berne, IN 46711, 219-589-3111 ..... A•1913
Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... A•1928-1931
§† Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926, 915-592-3253 ..... A•1914-1917
§† Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701, 402-371-0080 ..... A•1918,1924
† Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150 ..... A•1932
Elliott/Jordan, A Sub. of Vishay Intertechnology, 63 Lincoln Highway, Malvern, PA 19355, 215-644-1300 ..... A•1935
† General Resistance, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, 203-481-5721 ..... A•1941
International Manufacturing Services, 50 Schoolhouse La., Portsmouth, RI 02871-2418, 401-683-9700 ..... A•1936
§† International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1739,1939
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818, 402-694-6111 ..... A•1742-1743
† Julie Research Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 ..... A•1961
§ K & M Electronics, 221 Interstate Dr., Dock No. 3, W. Springfield, MA 01089, 413-781-1350 ..... A•1943
Kelvin Industries, Inc., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501, 818-990-1192 ..... A•1944-1945
§ KOA Speer Electronics, Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ..... A•1949

† KRL/Bantry Components, Inc., 160 Bouchard St., Manchester, NH 03103, 603-668-3210 ..... A•1951
Mepco/Centralab, North American Philips Corporation, 4561 Colorado Blvd., Los Angeles, CA 90039, 818-240-4880 ..... A•1957, B•1014
Mepco/Centralab, Inc., A North American Philips Co., 2566 Northwestern Ave., West Lafayette, IN 47906, 317-463-2536 ..... A•1959, B•1014
Mepco/Centralab, North American Philips Corporation, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, 817-325-7871 ..... A•1957, B•1014
§ Micro-Ohm Corp., 1088 Hamilton Rd., Duarte, CA 91010, 818-3575377 ... A•1967
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1968
† Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761, 617-695-0203 ..... A•1975
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•1976
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•2001
Precision Resistive Products, Inc., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, 319-394-9131 ..... A•2002
§ Raltron Electronics, 2315 N.W. 107th Ave., Miami, FL 33172, 305-593-6033 ..... A•2009
RCL-Shallcross, 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... A•2017
Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483, 619-575-9353 ..... A•2031
State of the Art, Inc., 2470 Fox Hill Rd., State College, PA 16803-1797, 814-355-8004 ..... A•2036
Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405, 818-781-1642 ... A•2026
Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 ..... A•2027
Victoreen, Inc., A Sheller-Globe Corp. Subsidiary, 6000 Cochran Rd., Solon, OH 44139, 216-248-9300 ..... A•2044
§† Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ..... A•2050
ACC Electronics Company, Echlin Inc., 1300 W. Oak, Independence, KS 67301 316-331-1000
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134 408-946-6000
Applied Research Labs., Fisons, 24911 Stanford Ave., Valencia, CA 91355 805-295-0019
§ Augat Alcoswitch, 1551 Osgood St, N. Andover, MA 01845 617-685-4371
Betatherm Corp., 910 Turnpike Rd. (Rte. 9), Shrewsbury, MA 01545 617-842-0516
California Micro Devices, Inc., 215 Topaz Street, Milpitas, CA 95035 408-263-3214
† Circuit Technology Inc., 160 Smith St, Farmingdale, NY 11735 516-293-8686
Components Div., Sangamo Weston, Inc., Box 128, Pickens, SC 29671 .. 803-878-6311
§ Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-699-0918; 800-255-2666
§ Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-8725
§† CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
Dowty RFL Inds. Inc./Communications Div., The Dowty Grp. PLC, Powerville Rd., Boonton, NJ 07005-0239 201-334-3100
Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
† Environmental Comm., 3150 Pullman St, Costa Mesa, CA 92627 714-557-7800
Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
Hycomp, Inc., 165 Cedar Hill St, Marlborough, MA 01752 617-485-6300
† Hy-Tec Industries, Div. of Topo Industries, Inc., P.O. Box 91, Shoreham, NY 11786 516-924-8686
§ International Components Corp., 105 Maxess Rd., Melville, NY 11747 ... 516-293-1500
§ ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 ..... 516-753-0400; 800-862-2101
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 .. 516-937-3475
§ Kahgan Electronics Corp., 605 Peninsula Blvd., Hempstead, NY 11550 .. 516-538-2300
§ KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
Keystone Carbon, Thermistor Div., 1935 State Street, St. Marys, PA 15857 814-781-1591
§† Kyocera Northwest, Electronic Components Group, P.O. Box 85542, San Diego, CA 92138-5542 619-576-2600
LTI, Inc., 6445 N. Hamlin Ave., Lincolnwood, IL 60645 312-679-7500
Meissner Industries, 551 Rte. 10, Dover, NJ 07801 201-366-1700
Mepco/Centralab Corp. Hdqrtr., North American Philips Corporation, 2001 W. Blue Heron Blvd., Riviera Beach, FL 33404 407-881-3200
† Microplex, Inc., 1977 State College Blvd., Anaheim, CA 92806 ..... 714-979-8833; 714-634-1535
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
§ NIC Components Corp., 6000 New Horizons Blvd., N. Amityville, NY 11701 516-226-7500
† Northwest Microcircuits, Inc., 5464SW Philomath Blvd., Corvallis, OR 97333 503-753-8242
† Ohmtek Inc., Sfernice Group Company, 2160 Liberty Dr., Niagara Falls, NY 14304 716-283-4025
§ Paccom, 3928 148th NE, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
Peca, Inc., 592 Winks Lane, Bensalem, PA 19020 215-245-1550
Philips Circuit Assemblies, A Subdivision of North American Philips Corp., 2566 Northwestern Avenue, West Lafayette, IN 47906 317-463-2536
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
RCL-Shallcross, Inc., U.S. Hwy. 70 East, Smithfield, NC 27577 919-934-5181
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
§ Rohm Corporation, 8 Whatney, Irvine, CA 92718 714-855-2131
§† Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
† Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311
Sprague Electric Company, Passive Components Group, 41 Hampton Rd, P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
Sprague Electric Company, Advanced Ceramics Group, 267 Lowell Road, Hudson, NH 03051 603-881-7200
† Tech Labs., Inc., 500 10th St., Palisades Pk., NJ 07650 201-944-2221
Tel Labs, Inc., Sfernice, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 603-625-8994
† Thickfilm International, Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-7400
United Supertek, Inc., 118 Charcot Ave., San Jose, CA 95131-1101 408-922-0730
† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

Networks, Resistance, Trimmer-4700

§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•1861,1866
Precision Resistive Products, Inc., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, 319-394-9131 ..... A•2002
Raltron Electronics, 2315 N.W. 107th Ave., Miami, FL 33172, 305-593-6033 ..... A•2009
Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483, 619-575-9353 ..... A•2031
§ Nepenthe, Inc., 2471 E. Bayshore Road, Palo Alto, CA 94303 ..... 415-856-9332; 800-NEPENTHE
Paccom, 3928 148th NE, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
Sprague Electric Company, Advanced Ceramics Group, 267 Lowell Road, Hudson, NH 03051 603-881-7200

Networks, Resistance, Voltage Divider-4700

Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•1865
Bertan Assocs., 121 New South Rd., Hicksville, NY 11801, 516-433-3110 ..... D•1610,1621
§ Bradford Electronics, Inc., 550 High Street, Bradford, PA 16701, 814-362-5700 ..... A•1876
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1878-1879,1883-1884,1894-1895
Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... A•1928-1931
† Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150 ..... A•1932
Glassman High Voltage Inc., P.O. Box 551, Salem Indl. Pk., Whitehouse Sta., NJ 08889, 201-534-9007 ..... D•1732-1733
Kelvin Industries, Inc., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501, 818-990-1192 ..... A•1944
§ Raltron Electronics, 2315 N.W. 107th Ave., Miami, FL 33172, 305-593-6033 ..... A•2009
State of the Art, Inc., 2470 Fox Hill Rd., State College, PA 16803-1797, 814-355-8004 ..... A•2036
Victoreen, Inc., A Sheller-Globe Corp. Subsidiary, 6000 Cochran Rd., Solon, OH 44139, 216-248-9300 ..... A•2044-2045
§† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700
§† Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926 915-592-3253
§† Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
§ Dale Electronics, Inc., Specialty Div., P. O. Box 1179, Robbinsville, NC 28771 704-479-6451
Hipotronics Inc., P.O. Drawer A, Brewster, NY 10509 914-279-8091
§ Kyocera Northwest, Electronic Components Group, P.O. Box 85542, San Diego, CA 92138-5542 619-576-2600
Northwest Microcircuits, Inc., 5464SW Philomath Blvd., Corvallis, OR 97333 503-753-8242
RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
§† Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
Sprague Electric Company, Advanced Ceramics Group, 267 Lowell Road, Hudson, NH 03051 603-881-7200
Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405 818-781-1642
† Thickfilm International, Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-7400
Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502 .. 303-242-0810

Networks, (MIL), Resistance-2440 — *See Vol. B*

NIM Modules — See Modules, NIM (Vol. D)

Nuclear EMP (NEMP) Protectors-4300 — *See Vol. B*

Null Detectors — See Indicators, Null (Vol. D)

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Nuts, Plastic — See Fasteners, Nonmetallic (Vol. C)

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Opamps — See Amplifiers, Operational (Vol. D)

Optical Breadboards-4200 — *See Vol. C*

Optical Character Readers (OCR)-2000 — *See Vol. D*

Optical Component Mounts & Accessories-3700 — *See Vol. B*

Optical-Coupler Isolators — See Isolators, Opto (Vol. B)

Optical Design Service — See Services, Optical Design (Vol. D)

Optical Disk Drives-2000 — *See Vol. D*

Optical Radiation Measuring-2900 — *See Vol. D*

Optical Signal Sources — See Generators, Light Pulse (Vol. D)

Optocouplers-3700 — *See Vol. B*

Optocouplers, Surface Mount-3700 — *See Vol. B*

Oscillators, Audio (Module)-2300

† **Connor-Winfield Corp., 1865 Selmarten Rd., Aurora, IL 60505, 312-851-4722** ..... **A•1360-1362**
† **Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204, 913-631-6700** ..... **A•1392**
Genstar Rental Electronics, Inc., 6307 De Soto Ave., Suite J, Woodland Hills, CA 91367, 800-331-3440 (in CA);800-227-8409 ..... **D•1257**
§ **Industrial Test Equipment, 21 Yennicock Ave., Port Washington, NY 11050, 516-883-1700** ..... **D•2120**
† **McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411** ..... **A•1412-1414**
Monitor Products Co., Inc., 502 Via Del Monte, Oceanside, CA 92054, 619-433-4510 ..... **A•1427**
§ **Opamp Labs, Inc., 1033 N. Sycamore Ave., Los Angeles, CA 90038, 213-934-3566** ..... **D•1015**
Oscillatek, K & L Microwave, 620 North Lindenwood Dr., Olathe, KS 66062, 913-829-1777 ..... **A•1440-1441**
Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ..... **A•1443-1444**
† **Q-Tech Corp., 10150 W. Jefferson Blvd., Culver City, CA 90232-3510, 213-836-7900** ..... **A•1450**
† **Vectron Laboratories, Inc., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433** ..... **A•1480**
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St, Brooklyn, NY 11217 718-857-2400
Cybernetic Micro Sys., P.O. Box 3000, 3000 Hwy. 84, San Gregorio, CA 94074 415-726-3000
† Damon Electronics Div., 80 Wilson Way, Westwood, MA 02090 617-329-2460
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
Engineered Components Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761
† FSI/Fork Standards, Inc., 666 Western Ave., Lombard, IL 60148 ..... 312-231-3511; 312-932-9380
† General Magnetics, 211 Grove St., Bloomfield, NJ 07003 201-743-2700
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
Modular Audio Products, Modular Devices, Inc., 50 Orville Dr., Bohemia, NY 11716 516-567-9620
† Modular Devices, Brookhaven R & D Plaza, 1 Roned Rd., Shirley, NY 11967 516-345-3100
† Solid State Electronics Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
† Spectrum Technology, Inc., DATUM, Incorporated, 300 Lopez Rd., Goleta, CA 93116 805-964-7791
Star Micronics, Inc., OEM Division, 70-D Ethel Rd. W., Piscataway, NJ 08854 201-572-9512
§ Syntest Corp., 40 Locke Dr., Marlboro, MA 01752-9973 508-481-7827
† T-F Electronics, 4903 Commercial Park Dr., Austin, TX 78724-2638 512-928-8926
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33626 813-855-6611
§ Wilson, H. M., Co., 11501 Chimney Rock Rd., Houston, TX 77035 713-729-1183

Oscillators, Audio (Test) — See Generators, Audio (Vol. D)

Oscillators, Beat Frequency (BFO)-2300

† **Frequency Electronics, Inc., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500** ..... **A•1399**
† Bruel & Kjaer Instrs. Inc., 185 Forest St., Marlboro, MA 01752-3093 617-481-7000
† Crystek Corp, P.O. Box 06135, Ft. Myers, FL 33906 813-936-2109
Dowty RFL Inds. Inc./Communications Div., The Dowty Grp. PLC, Powerville Rd., Boonton, NJ 07005-0239 201-334-3100
† Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204 913-631-6700
† Microwave Systems Inc., 6075 E. Molloy Rd., Syracuse, NY 13211-2100 315-437-9951
United States Crystal Corp., 3605 McCart St., Fort Worth, TX 76110 817-921-3014

Oscillators, Bias-2300

† **Connor-Winfield Corp., 1865 Selmarten Rd., Aurora, IL 60505, 312-851-4722** ..... **A•1361**
§ **Opamp Labs, Inc., 1033 N. Sycamore Ave., Los Angeles, CA 90038, 213-934-3566** ..... **D•1015**
† Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204 913-631-6700
† Solid State Electronics Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070

Oscillators, Cavity-2300

§† Adams-Russell, Anzac Div., 80 Cambridge St, Burlington, MA 01803 671-273-3333
Alpha Inds., Inc., 20 Sylvan Rd, Woburn, MA 01801 617-935-5150
† Communication Techniques Inc., 36 Route 10, East Hanover, NJ 07936 201-884-2580
EPSCO Microwave, EPSCO, Incorporated, 411 Providence Hwy., Westwood, MA 02090 617-329-1500
Epsilon-Lambda Elctrns. Corp., 427 Stevens St, Geneva, IL 60134 312-232-9611
† Frequency West, Inc., Subsidiary of LORAL Corporation, 214 Devcon Dr., San Jose, CA 95112-4210 408-436-4500
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† M/A COM Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† MCL, Inc., 501 S. Woodcreek Rd., Bolingbrook, IL 60439-4999 312-759-9500
† MITEQ Inc., 100 Davids Drive, Hauppauge, NY 11788 516-436-7400
† Narda Microwave Corp., Subsidiary of Loral Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† RFD, Inc., 5024 Nassau St, Tampa, FL 33607 813-872-1502
† Techtrol Cyclonetics, Inc., 815 Market St., New Cumberland, PA 17070 .. 717-774-2746
Texscan Instruments, Texscan Corporation, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
† Zeta Labs., Sub. of CCT Corp., 2811 Orchard Parkway, San Jose, CA 95134 408-434-3600

Oscillators, Clock-2300

† **Anderson Electronics, P. O. Box 89, Hollidaysburg, PA 16648, 814-695-4428** ..... **A•1337**
† **Austron, Inc., P.O. Box 14766, Austin, TX 78761-4766, 512-251-2341** .... **A•1343**
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 ..... **A•1522**
† **Bliley Electric Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571** ..... **A•1348**
§ **Comclok, Inc., 1142 N. Gilbert St., Anaheim, CA 92801, 714-991-1580;800-333-9825** ..... **A•1358**
† **Connor-Winfield Corp., 1865 Selmarten Rd., Aurora, IL 60505, 312-851-4722** ..... **A•1361**
§† **CTS Corp., Frequency Control Div., (Formerly Knights Div.), 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411** ..... **A•1372-1380**
§ **Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282, 602-967-7874** ..... **A•1388-1390**
DCI Inc., 14812 W. 117th Street, P.O. Box 215, Olathe, KS 66061, 913-782-5672 ..... **B•1054**
§ **Epson America, Inc., 3415 Kashiwa St., Torrance, CA 90505, 213-534-4500** ..... **A•1394**
§† **Fox Electronics, 5842 Corporation Circle, Ft. Meyers, FL 33905, 813-693-0099** ..... **A•1397**
§ **ITT Components, ITT Corporation, 5 Jenner .st., Ste. 100, Irvine, CA 92718, 714-727-3001** ..... **A•1404-1405**
† **McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411** ..... **A•1412-1414**
§† **MF Elctrns. Corp., 10 Commerce Dr., New Rochelle, NY 10801, 914-576-6570** ..... **A•1418-1419**
Micro Crystal Division, SMH, 35 E. 21st Street, New York, NY 10010, 212-505-5340 ..... **A•1422**
Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... **A•1425**
§† **Monitor Products Co., Inc., 502 Via Del Monte, Oceanside, CA 92054, 619-433-4510** ..... **A•1426-1427**
M-Tron Industries, P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321 ..... **A•1429**
§ **Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300** ..... **A•1430**
§ **NDK America, Inc., 20300 Stevens Creek Blvd., Ste. 400, Cupertino, CA 95014, 408-255-0831** ..... **A•1330,1432-1433,1435-1437**
† **Oscillatek, K & L Microwave, 620 North Lindenwood Dr., Olathe, KS 66062, 913-829-1777** ..... **A•1440-1441**
§ **Pletronics, Inc., 9026 Roosevelt Way N.E., Seattle, WA 98115, 206-523-9395** ..... **A•1448-1449**
† **Q-Tech Corp., 10150 W. Jefferson Blvd., Culver City, CA 90232-3510, 213-836-7900** ..... **A•1450-1451**
† **Reeves-Hoffman Div., Dynamics Corporation of America, 400 W. North St., Carlisle, PA 17013, 717-243-5929** ..... **A•1454**
§ **SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303, 415-856-6900** ..... **A•1460-1462**
§ **Seiko Instruments U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505, 213-517-7770** ..... **A•1464**
Spectrum Technology, Inc., DATUM, Incorporated, 300 Lopez Rd., Goleta, CA 93116, 805-964-7791 ..... **A•1465-1468**
§ **Standard Crystal Corporation, 9940 E. Baldwin Pl., El Monte, CA 91734, 818-443-2121** ..... **A•1469**
§† **Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810** ..... **A•1470,1474-1475**
† **Vectron Laboratories, Inc., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433** ..... **A•1480-1481**
† **Xsis Electronics, Inc., 12620 W. 63rd St., Shawnee, KS 66216, 913-631-0448** ..... **A•1488**
Analytic Instruments Corporation, P.O. Box 542845, Dallas, TX 75354 ... 214-357-3882
† B-D Crystal Entprs., Inc., 1727 W. Galbraith Rd., Cincinnati, OH 45239 ... 513-522-3300
Blackhawk Networks Corp., 14 N. Parker Dr., P.O. Box 919, Janesville, WI 53545 608-752-8701
Cal Crystal Lab., Inc., 1142 N. Gilbert, Anaheim, CA 92801 ..... 714-991-1580; 800-854-XTAL
§† Crystek Corp, P.O. Box 06135, Ft. Myers, FL 33906 813-936-2109
CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
§† Data Delay Devices, 3 Mount Prospect Ave., Clifton, NJ 07013-1915 201-773-2299

Electro Dynamics, Sub. of SFE Technologies, 9075 Cody, Overland Park, KS 66214 Elec. Dyna. 913-888-1750
Engineered Components Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
Frequency Control Products, Inc., American Time Products Div., 430 Commack Rd., Deer Pk., NY 11729 516-243-5730
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
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† Hughes Microelectronics Circuits Division, 500 Superior Ave., P.O. Box H, Newport Beach, CA 92658-8903 714-759-2952
§† Inductive Prods., Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
§ Kahgan Electronics Corp., 605 Peninsula Blvd., Hempstead, NY 11550 .. 516-538-2300
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
§† Kyocera Northwest, Electronic Components Group, P.O. Box 85542, San Diego, CA 92138-5542 619-576-2600
§ Mallory Capacitor Co., Emhart Elctrl./Elctrn. Grp., 3029 E. Washington St, Dept. EM, P.O. Box 1284, Indianapolis, IN 46201 317-636-5353
§ Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131 312-451-1000
§ NEL Frequency Controls, Inc., 357 Beloit St., Burlington, WI 53105 414-763-3591
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804 407-298-2000
Potter & Brumfield, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001 812-386-1000
§ Pulse Instruments Co., 1234 Francisco, Torrance, CA 90502 213-515-5330
§ Raltron Electronics, 2315 N.W. 107th Ave., Miami, FL 33172 305-593-6033
† Savoy Electronics, P.O. Box 5727, Ft. Lauderdale, FL 33310 ..... 305-563-1333; 800-327-1282
SFE Technologies, 1501 1st St., San Fernando, CA 91340 818-365-9411
Sokol Crystal Products, Inc., 121 Water St., Mineral Point, WI 53565 608-987-3363
Stetron International, Inc., 90 Broadway, Buffalo, NY 14203 716-854-3443
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056 312-297-0070
Toyo Comm. Equip. Co., Ltd., 20-4, Nishi-Shimbashi, 3-Chome Minato-Ku, TOKYO, JAPAN 105 ..... 03-459-7320/03-459-7310
United States Crystal Corp., 3605 McCart St., Fort Worth, TX 76110 817-921-3014
§ Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831

Oscillators, Crystal Controlled (Module)-2300

§† Anderson Electronics, P. O. Box 89, Hollidaysburg, PA 16648, 814-695-4428 ..... A•1337
AT&T, 555 Union Blvd., Allentown, PA 18103, 1-800-372-2447;In Canada:1-800-553-2448 ..... A•1339-1341
Austron, Inc., P.O. Box 14766, Austin, TX 78761-4766, 512-251-2341 .... A•1342
† Bliley Electric Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 ..... A•1345,1348
† California Instruments, Amstar Electronics Group, 5125 Convoy St., Ste. 201, San Diego, CA 92111, 619-279-8620;800-356-2244;800-821-1634 ..... D•2082
§ Comclok, Inc., 1142 N. Gilbert St., Anaheim, CA 92801, 714-991-1580;800-333-9825 ..... A•1358
† Connor-Winfield Corp., 1865 Selmarten Rd., Aurora, IL 60505, 312-851-4722 ..... A•1361
† CTS Corp., Frequency Control Div., (Formerly Knights Div.), 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ..... A•1372-1373,1375,1378,1382-1387
§ Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282, 602-967-7874 ..... A•1388-1390
† Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204, 913-631-6700 ..... A•1392
Epson America, Inc., 3415 Kashiwa St., Torrance, CA 90505, 213-534-4500 ..... A•1393-1394
§† Fox Electronics, 5842 Corporation Circle, Ft. Meyers, FL 33905, 813-693-0099 ..... A•1397
† Frequency and Time Systems, Inc., DATUM, INC., 34 Tozer Rd., Beverly, MA 01915, 508-927-8220 ..... D•1254
† Frequency Electronics, Inc., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ..... A•1398-1399
† Isotemp Research, Inc., 1750 Broadway St., P.O. Box 3389, Charlottesville, VA 22901, 804-295-3101 ..... A•1402-1403
ITT Components, ITT Corporation, 5 Jenner .st., Ste. 100, Irvine, CA 92718, 714-727-3001 ..... A•1404-1405
† McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1412-1415
§† MF Elctrns. Corp., 10 Commerce Dr., New Rochelle, NY 10801, 914-576-6570 ..... A•1418-1419
Micro Crystal Division, SMH, 35 E. 21st Street, New York, NY 10010, 212-505-5340 ..... A•1421
† Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... A•1425
† Monitor Products Co., Inc., 502 Via Del Monte, Oceanside, CA 92054, 619-433-4510 ..... A•1426-1427
§ M-Tron Industries, P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321 ..... A•1429
§† Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•1430
NDK America, Inc., 20300 Stevens Creek Blvd., Ste. 400, Cupertino, CA 95014, 408-255-0831 ..... A•1330,1432,1434-1437
† Oscillatek, K & L Microwave, 620 North Lindenwood Dr., Olathe, KS 66062, 913-829-1777 ..... A•1440-1441
† Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ..... A•1442-1444
§ Pletronics, Inc., 9026 Roosevelt Way N.E., Seattle, WA 98115, 206-523-9395 ..... A•1449
† Q-Tech Corp., 10150 W. Jefferson Blvd., Culver City, CA 90232-3510, 213-836-7900 ..... A•1450
† Reeves-Hoffman Div., Dynamics Corporation of America, 400 W. North St., Carlisle, PA 17013, 717-243-5929 ..... A•1455
§ SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303, 415-856-6900 ..... A•1460-1462
† Sawtek Inc., P.O. Box 609501, Orlando, FL 32860-9501, 407-886-8860 ... A•1463
§ Seiko Instruments U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505, 213-517-7770 ..... A•1464
† Spectrum Technology, Inc., DATUM, Incorporated, 300 Lopez Rd., Goleta, CA 93116, 805-964-7791 ..... A•1465-1468
§† Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810 ..... A•1470,1472-1475
† Techtrol Cyclonetics, Inc., 815 Market St., New Cumberland, PA 17070, 717-774-2746 ..... A•1477
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E-8, Tampa, FL 33634, 813-884-1411 ..... A•1842
† Vectron Laboratories, Inc., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433 ..... A•1481,1483-1484
† Xsis Electronics, Inc., 12620 W. 63rd St., Shawnee, KS 66216, 913-631-0448 ..... A•1488
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Analytic Instruments Corporation, P.O. Box 542845, Dallas, TX 75354 ... 214-357-3882
† B-D Crystal Entprs., Inc., 1727 W. Galbraith Rd., Cincinnati, OH 45239 ... 513-522-3300
Berkeley Nucleonics Corp., 1121 Regatta Sq., Richmond, CA 94804 415-234-1100
Blackhawk Networks Corp., 14 N. Parker Dr., P.O. Box 919, Janesville, WI 53545 608-752-8701
Cal Crystal Lab., Inc., 1142 N. Gilbert, Anaheim, CA 92801 ..... 714-991-1580; 800-854-XTAL
§ Calmax Corp., 3410-C W. MacArthur Blvd., Santa Ana, CA 92704 714-957-1299
§ Chronomite Labs, 21011 S. Figueroa St., Carson, CA 90745 213-320-9452
† Comstron Corp., 10 Hub Dr., Melville, NY 11747 516-756-1100
§† Crystek Corp, P.O. Box 06135, Ft. Myers, FL 33906 813-936-2109
† CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
† Damon Electronics Div., 80 Wilson Way, Westwood, MA 02090 617-329-2460
Datum Inc., Timing/Aacom Divisions, 1363 S. State College Blvd., Anaheim, CA 92806-5790 714-533-6333
Elgar Corp., 9250 Brown Deer Rd., San Diego, CA 92121 ..... 619-450-0085; 800-854-2213
† Frequency Control Products, Inc., American Time Products Div., 430 Commack Rd., Deer Pk., NY 11729 516-243-5730
† FSI/Fork Standards, Inc., 666 Western Ave., Lombard, IL 60148 ..... 312-231-3511; 312-932-9380
§† Gorman-Redlich Mfg. Co., 257 W. Union St., Athens, OH 45701 614-593-3150
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Hughes Microelectronics Circuits Division, 500 Superior Ave., P.O. Box H, Newport Beach, CA 92658-8903 714-759-2952
§ Kahgan Electronics Corp., 605 Peninsula Blvd., Hempstead, NY 11550 .. 516-538-2300
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† Leigh Instruments Ltd., Components Division, 141 Bond Ave., Don Mills, ON, CANADA M3B 1M2 416-447-8531
† Microwave Systems Inc., 6075 E. Molloy Rd., Syracuse, NY 13211-2100 315-437-9951
† MITEQ Inc., 100 Davids Drive, Hauppauge, NY 11788 516-436-7400
§ Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131 312-451-1000
§ NEL Frequency Controls, Inc., 357 Beloit St., Burlington, WI 53105 414-763-3591
† Piezo Crystal, 100 K St., Box 619 , Carlisle, PA 17013 717-249-2151
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804 407-298-2000
§ Raltron Electronics, 2315 N.W. 107th Ave., Miami, FL 33172 305-593-6033
† RFD, Inc., 5024 Nassau St., Tampa, FL 33607 813-872-1502
† Savoy Electronics, P.O. Box 5727, Ft. Lauderdale, FL 33310 ..... 305-563-1333; 800-327-1282
Sensor Corp., Box 140, Scottdale, PA 15683 412-887-4080
SFE Technologies, 1501 1st St., San Fernando, CA 91340 818-365-9411
Sokol Crystal Products, Inc., 121 Water St., Mineral Point, WI 53565 608-987-3363
† Solid State Electronics Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
§ Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 814-455-0966
Stetron International, Inc., 90 Broadway, Buffalo, NY 14203 716-854-3443
§ Syntest Corp., 40 Locke Dr., Marlboro, MA 01752-9973 508-481-7827
Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
† T-F Electronics, 4903 Commercial Park Dr., Austin, TX 78724-2638 512-928-8926
Toyo Comm. Equip. Co., Ltd., 20-4, Nishi-Shimbashi, 3-Chome Minato-Ku, TOKYO, JAPAN 105 ..... 03-459-7320/03-459-7310
§ Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831
Varian Associates, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
WILMANCO, 19529 Business Center Drive, Northridge, CA 91324 ..... 818-993-1662/1663
† Zeta Labs., Sub. of CCT Corp., 2811 Orchard Parkway, San Jose, CA 95134 408-434-3600

Oscillators, Decade (Test)-2900 — *See Vol. D*

Oscillators, Digitally Compensated Crystal (DCXO)-2300

† Bliley Electric Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 ..... A•1346
† Connor-Winfield Corp., 1865 Selmarten Rd., Aurora, IL 60505, 312-851-4722 ..... A•1363
† Vectron Laboratories, Inc., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433 ..... A•1480
† Crystek Corp, P.O. Box 06135, Ft. Myers, FL 33906 813-936-2109
CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511

CTS Corp., Frequency Control Div., (Formerly Knights Div.), 400 Reimann Ave., Sandwich, IL 60548 815-786-8411
† Frequency Electronics, Inc., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
§ Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831
WILMANCO, 19529 Business Center Drive, Northridge, CA 91324 ..... 818-993-1662/1663

Oscillators, LC-2300

Coilcraft, 1102 Silver Lake Rd., Cary, IL 60013, 312-639-2361 ..... A•1225
† Connor-Winfield Corp., 1865 Selmarten Rd., Aurora, IL 60505, 312-851-4722 ..... A•1361
Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ..... A•1444
† Vectron Laboratories, Inc., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433 ..... A•1480
† Crystek Corp, P.O. Box 06135, Ft. Myers, FL 33906 813-936-2109
† Damon Electronics Div., 80 Wilson Way, Westwood, MA 02090 617-329-2460
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Isotemp Research, Inc., 1750 Broadway St, P.O. Box 3389, Charlottesville, VA 22901 804-295-3101
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† MITEQ Inc., 100 Davids Drive, Hauppauge, NY 11788 516-436-7400
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804 407-298-2000
† Solid State Electronics Corp., 18646 Parthenia St, Northridge, CA 91324 818-993-8257
Spectrum Technology, Inc., DATUM, Incorporated, 300 Lopez Rd., Goleta, CA 93116 805-964-7791
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
WILMANCO, 19529 Business Center Drive, Northridge, CA 91324 ..... 818-993-1662/1663

Oscillators, Low Frequency (Module)-2300

Anderson Electronics, P. O. Box 89, Hollidaysburg, PA 16648, 814-695-4428 ..... A•1337
AT&T, 555 Union Blvd., Allentown, PA 18103, 1-800-372-2447;In Canada:1-800-553-2448 ..... A•1341
† Bliley Electric Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 ..... A•1348
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217, 718-857-2400 ..... D•2084
† Connor-Winfield Corp., 1865 Selmarten Rd., Aurora, IL 60505, 312-851-4722 ..... A•1360-1361
CTS Corp., Frequency Control Div., (Formerly Knights Div.), 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ..... A•1375,1383
Elgar Corp., 9250 Brown Deer Rd., San Diego, CA 92121, 619-450-0085;800-854-2213 ..... D•2093
Fiskars Electronics Corp., (Formerly Behlman Engrg.), 1142 Mark Ave., Carpinteria, CA 93013, 805-684-8311 ..... D•2107
† Fox Electronics, 5842 Corporation Circle, Ft. Meyers, FL 33905, 813-693-0099 ..... A•1397
† Frequency Electronics, Inc., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ..... A•1398-1399
§ Industrial Test Equipment, 21 Yennicock Ave., Port Washington, NY 11050, 516-883-1700 ..... D•2120,2122
† McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1412-1414
§† MF Elctrns. Corp., 10 Commerce Dr., New Rochelle, NY 10801, 914-576-6570 ..... A•1418-1419
M-Tron Industries, P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321 ..... A•1429
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•1430, B•1899
Oscillatek, K & L Microwave, 620 North Lindenwood Dr., Olathe, KS 66062, 913-829-1777 ..... A•1440-1441
Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ..... A•1442-1444
† Pacific Power Source Corp., 15122 Bolsa Chica St., Huntington Bch., CA 92649, 714-898-2691;800-854-2433 ..... D•2134
† Q-Tech Corp., 10150 W. Jefferson Blvd., Culver City, CA 90232-3510, 213-836-7900 ..... A•1450
SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303, 415-856-6900 ..... A•1460,1462
Standard Crystal Corporation, 9940 E. Baldwin Pl., El Monte, CA 91734, 818-443-2121 ..... A•1469
§† Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810 ..... A•1472,1474-1475
† Vectron Laboratories, Inc., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433 ..... A•1480
§† Adams-Russell, Anzac Div., 80 Cambridge St, Burlington, MA 01803 671-273-3333
Analytic Instruments Corporation, P.O. Box 542845, Dallas, TX 75354 214-357-3882
† B-D Crystal Entprs., Inc., 1727 W. Galbraith Rd., Cincinnati, OH 45239 513-522-3300
Blackhawk Networks Corp., 14 N. Parker Dr., P.O. Box 919, Janesville, WI 53545 608-752-8701
† California Instruments, Amstar Electronics Group, 5125 Convoy St, Ste. 201, San Diego, CA 92111 ..... 619-279-8620;800-356-2244;800-821-1634
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† Crystek Corp, P.O. Box 06135, Ft. Myers, FL 33906 813-936-2109
CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
Cybernetic Micro Sys., P.O. Box 3000, 3000 Hwy. 84, San Gregorio, CA 94074 415-726-3000
Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., Suite 845, New York, NY 10011 212-691-9050
† Damon Electronics Div., 80 Wilson Way, Westwood, MA 02090 617-329-2460
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
† Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204 913-631-6700
Frequency Control Products, Inc., American Time Products Div., 430 Commack Rd., Deer Pk., NY 11729 516-243-5730
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761
† FSI/Fork Standards, Inc., 666 Western Ave., Lombard, IL 60148 ..... 312-231-3511; 312-932-9380
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† Isotemp Research, Inc., 1750 Broadway St, P.O. Box 3389, Charlottesville, VA 22901 804-295-3101
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† Microwave Systems Inc., 6075 E. Molloy Rd., Syracuse, NY 13211-2100 315-437-9951
† Monitor Products Co., Inc., 502 Via Del Monte, Oceanside, CA 92054 619-433-4510
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§ NEL Frequency Controls, Inc., 357 Beloit St, Burlington, WI 53105 414-763-3591
† NH Research, Incorporated, Instrumentation Products Division, 16601 Hale Ave., Irvine, CA 92714 714-474-3900
† Piezo Crystal, 100 K St., Box 619 , Carlisle, PA 17013 717-249-2151
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804 407-298-2000
§ Richard-Lee Co., Box 724, New Providence, NJ 07974 201-276-0710
† Solid State Electronics Corp., 18646 Parthenia St, Northridge, CA 91324 818-993-8257
† Spectrum Technology, Inc., DATUM, Incorporated, 300 Lopez Rd., Goleta, CA 93116 805-964-7791
§ Syntest Corp., 40 Locke Dr., Marlboro, MA 01752-9973 508-481-7827
Texscan Instruments, Texscan Corporation, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
† T-F Electronics, 4903 Commercial Park Dr., Austin, TX 78724-2638 512-928-8926
U.S. Instr. Rentals, 2988 Campus Dr., San Mateo, CA 94403 800-824-2873
§ Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33626 813-855-6611

Oscillators, Microwave-3450

§† Andersen Laboratories, 1280 Blue Hills Ave., Bloomfield, CT 06002, 203-242-0761 ..... A•1497
Comstron Corp., 10 Hub Dr., Melville, NY 11747, 516-756-1100 ..... D•1235
† Frequency Electronics, Inc., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ..... A•1398
Marconi Instruments, 3 Pearl Court, Allendale, NJ 07401, 201-934-9050 ..... D•1294
MF Elctrns. Corp., 10 Commerce Dr., New Rochelle, NY 10801, 914-576-6570 ..... A•1418-1419
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•1838
Q-Tech Corp., 10150 W. Jefferson Blvd., Culver City, CA 90232-3510, 213-836-7900 ..... A•1452
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† Techtrol Cyclonetics, Inc., 815 Market St., New Cumberland, PA 17070, 717-774-2746 ..... A•1477
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E-8, Tampa, FL 33634, 813-884-1411 ..... A•1841-1842
† Z Communications, Inc., 5450 N.W. 33rd Ave., Ste. 100, Ft. Lauderdale, FL 33309, 305-735-1000 ..... A•1491
§† Adams-Russell, Anzac Div., 80 Cambridge St, Burlington, MA 01803 671-273-3333
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Alpha Industries, Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St., Methuen, MA 01844 617-682-4661
† Anghel Laboratories, Inc., 3 Route 46 West, Fairfield, NJ 07006 201-575-1116
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-727-0700
† Aydin Corp., 700 Dresher Rd., Horsham, PA 19044 215-657-7510
† Central Microwave Co., Alpha Inds., Inc., 12180 Prichard Farm Rd., Maryland Heights, MO 63043 314-291-5270
† Communication Techniques Inc., 36 Route 10, East Hanover, NJ 07936 201-884-2580
§ Eaton Corp., Electronic Instrument Div., 5340 Alla Rd., Los Angeles, CA 90066 213-822-3061
† Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204 913-631-6700
EPSCO Microwave, EPSCO, Incorporated, 411 Providence Hwy., Westwood, MA 02090 617-329-1500
Epsilon-Lambda Elctrns. Corp., 427 Stevens St., Geneva, IL 60134 312-232-9611
EVI, Inc., 8300 Guilford Rd., Ste. A, Columbia, MD 21046 301-290-9550
† FEI Microwave, Inc., Frequency Electronics, Inc., 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
† Ferretec Inc., 544 Gibralter Dr., Milpitas, CA 95035-6315 408-263-1216
† Frequency West, Inc., Subsidiary of LORAL Corporation, 214 Devcon Dr., San Jose, CA 95112-4210 408-436-4500
General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
† HDS Inc., 12310 Pinecrest Rd., Reston, VA 22091 703-620-6200
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Hughes Microelectronics Circuits Division, 500 Superior Ave., P.O. Box H, Newport Beach, CA 92658-8903 714-759-2952

K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
Lectronic Research Labs., Inc., 1423 Ferry Ave., Camden, NJ 08104 609-541-4200
† Litton Systems, Inc., Electron Dvcs. Div., 960 Industrial Rd., San Carlos, CA 94070 415-591-8411
MACOM, Inc., 43 Second Ave., Bldg. 8, Burlington, MA 01803 617-272-3000
† M/A COM Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† M/A-COM OSW, Inc., 2626 S. Hardy Dr., Tempe, AZ 85282 602-966-1471
† Magnum Microwave Corp., 4575 Cushing Pkwy., Fremont, CA 94538 ... 415-657-9898
† Maury Microwave Corp., 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† MCL, Inc., 501 S. Woodcreek Rd., Bolingbrook, IL 60439-4999 312-759-9500
† Micronics Technology Inc., 7 Alexander Place, Glen Cove, NY 11542 ... 516-759-5600
† Microwave Systems Inc., 6075 E. Molloy Rd., Syracuse, NY 13211-2100 315-437-9951
† Mitec Electronics, 104 Gun Avenue, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† MITEQ Inc., 100 Davids Drive, Hauppauge, NY 11788 516-436-7400
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
† Narda Microwave Corp., Subsidiary of Loral Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
§† Omni Spectra, Inc., Microwave Subsystems Div., 2626 So. Hardy Dr., Tempe, AZ 85282 602-966-1471
Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901 804-977-8050
§ Penstock Engineering Labs., Penstock, Inc., 520 Mercury Dr., Sunnyvale, CA 94086-4018 408-730-0300
Philips Electronics Ltd., Elcoma Division, 601 Milner Avenue, Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804 407-298-2000
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Racal-Dana Instrs. Inc., 4 Goodyear St., Irvine, CA 92718 714-859-8999
† Reeve Electronics, Mellish E. Murray, 1715 W. Carroll Ave., Chicago, IL 60612 312-670-0150
† RFD, Inc., 5024 Nassau St., Tampa, FL 33607 813-872-1502
† Rodale Elctrns. Corp., 603 Chestnut St., Garden City, NY 11530 516-222-0050
Sanders Associates, Inc., ECBD, A Lockheed Company, 955 Perimeter Rd., Manchester, NH 03108-8500 603-645-5548
† Sanders Associates, Inc., Microwave, 955 Perimeter Rd., Manchester, NH 03108 ..... 603-645-6000 Ext. 4299
Sivers IMA, Div. of Philips, 5669 Selmaraine Drive, Culver City, CA 90230 213-390-7477
§ Syntest Corp., 40 Locke Dr., Marlboro, MA 01752-9973 508-481-7827
Tektronix, Inc., P.O. Box 500, 76/260, Beaverton, OR 97077 800-835-9433
Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
Tucker Electronics, Box 461966, Garland, TX 75046 ..... 214-348-8800;800-527-4642
Varian Associates, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
WILMANCO, 19529 Business Center Drive, Northridge, CA 91324 ..... 818-993-1662/1663
† Zeta Labs., Sub. of CCT Corp., 2811 Orchard Parkway, San Jose, CA 95134 408-434-3600

Oscillators, Oven-2300

Austron, Inc., P.O. Box 14766, Austin, TX 78761-4766, 512-251-2341 .... A•1342
† Bliley Electric Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 ..... A•1345
† Connor-Winfield Corp., 1865 Selmarten Rd., Aurora, IL 60505, 312-851-4722 ..... A•1363
† CTS Corp., Frequency Control Div., (Formerly Knights Div.), 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ..... A•1369,1373,1384-1386
Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204, 913-631-6700 ..... A•1392
Isotemp Research, Inc., 1750 Broadway St., P.O. Box 3389, Charlottesville, VA 22901, 804-295-3101 ..... A•1402-1403
† McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1412,1415
† Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... A•1425
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•1430
§ NDK America, Inc., 20300 Stevens Creek Blvd., Ste. 400, Cupertino, CA 95014, 408-255-0831 ..... A•1330,1432,1434-1435
Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ..... A•1442
† Reeves-Hoffman Div., Dynamics Corporation of America, 400 W. North St., Carlisle, PA 17013, 717-243-5929 ..... A•1456
Techtrol Cyclonetics, Inc., 815 Market St., New Cumberland, PA 17070, 717-774-2746 ..... A•1477
† Vectron Laboratories, Inc., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433 ..... A•1482-1485
Comstron Corp., 10 Hub Dr., Melville, NY 11747 516-756-1100
§† Crystek Corp, P.O. Box 06135, Ft. Myers, FL 33906 813-936-2109
CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
Datum Inc., Timing/Aacom Divisions, 1363 S. State College Blvd., Anaheim, CA 92806-5790 714-533-6333
† Frequency and Time Systems, Inc., DATUM, INC., 34 Tozer Rd., Beverly, MA 01915 508-927-8220
† Frequency Control Products, Inc., American Time Products Div., 430 Commack Rd., Deer Pk., NY 11729 516-243-5730
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
† Hughes Microelectronics Circuits Division, 500 Superior Ave., P.O. Box H, Newport Beach, CA 92658-8903 714-759-2952
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† MITEQ Inc., 100 Davids Drive, Hauppauge, NY 11788 516-436-7400
Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131 312-451-1000
§ Oscilloquartz, B & J Marketing, 17074 Dearborn St., Northridge, CA 91325 818-993-0048
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804 407-298-2000
WILMANCO, 19529 Business Center Drive, Northridge, CA 91324 ..... 818-993-1662/1663

Oscillators, Power (Module)-2300

CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217, 718-857-2400 ..... D•2084
Compact Power Company, 17282 Orange Drive, Yorba Linda, CA 92686, 714-996-5826 ..... D•2090
† Control Sciences, Inc., 9509 Vassar Ave., Chatsworth, CA 91311, 818-709-5510 ..... D•1147
Elgar Corp., 9250 Brown Deer Rd., San Diego, CA 92121, 619-450-0085;800-854-2213 ..... D•2092-2093
Fiskars Electronics Corp., (Formerly Behlman Engrg.), 1142 Mark Ave., Carpinteria, CA 93013, 805-684-8311 ..... D•2107
§ Industrial Test Equipment, 21 Yennicock Ave., Port Washington, NY 11050, 516-883-1700 ..... D•2120,2122
Julie Research Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 ..... D•1282
† Pacific Power Source Corp., 15122 Bolsa Chica St., Huntington Bch., CA 92649, 714-898-2691;800-854-2433 ..... D•2134
† Q-Tech Corp., 10150 W. Jefferson Blvd., Culver City, CA 90232-3510, 213-836-7900 ..... A•1450
SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303, 415-856-6900 ..... A•1460
† Vectron Laboratories, Inc., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433 ..... A•1480
† American Microwave Technology, Inc., 1127 S. Placentia Ave., Fullerton, CA 92631 714-680-4936
† Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204 913-631-6700
Energy Systems, 21550 Oxnard St., Woodland Hills, CA 91367 805-273-0547
EVI, Inc., 8300 Guilford Rd., Ste. A, Columbia, MD 21046 301-290-9550
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Isotemp Research, Inc., 1750 Broadway St., P.O. Box 3389, Charlottesville, VA 22901 804-295-3101
† Litton Systems, Inc., Electron Dvcs. Div., 960 Industrial Rd., San Carlos, CA 94070 415-591-8411
† MAR-CHAR CORPORATION, ATR Electronics, Inc., 167 East Fifth Street, Montello, WI 53949 608-297-2106
† MCL, Inc., 501 S. Woodcreek Rd., Bolingbrook, IL 60439-4999 312-759-9500
† MITEQ Inc., 100 Davids Drive, Hauppauge, NY 11788 516-436-7400
† Modular Devices, Brookhaven R & D Plaza, 1 Roned Rd., Shirley, NY 11967 516-345-3100
† Narda Microwave Corp., Subsidiary of Loral Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
§† Omni Spectra, Inc., Microwave Subsystems Div., 2626 So. Hardy Dr., Tempe, AZ 85282 602-966-1471
† Piezo Crystal, 100 K St., Box 619 , Carlisle, PA 17013 717-249-2151
Texscan Instruments, Texscan Corporation, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
Varian Associates, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
WILMANCO, 19529 Business Center Drive, Northridge, CA 91324 ..... 818-993-1662/1663
§ Wilson, H. M., Co., 11501 Chimney Rock Rd., Houston, TX 77035 713-729-1183

Oscillators, Programmable-2300

† Boonton Electronics Corp., 791 Route 10, Randolph, NJ 07869, 201-584-1077 ..... D•1226
Datel, Inc., 11 Cabot Blvd., Mansfield, MA 02048, 617-339-3000 ..... D•1159
Elgar Corp., 9250 Brown Deer Rd., San Diego, CA 92121, 619-450-0085;800-854-2213 ..... D•2092-2093
§ Epson America, Inc., 3415 Kashiwa St., Torrance, CA 90505, 213-534-4500 ..... A•1393
Krohn-Hite Corp., Avon Indl. Pk., Bodwell St., Avon, MA 02322, 508-580-1660 ..... D•1285
Q-Tech Corp., 10150 W. Jefferson Blvd., Culver City, CA 90232-3510, 213-836-7900 ..... A•1451
§† Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810 ..... A•1474
† Z Communications, Inc., 5450 N.W. 33rd Ave., Ste. 100, Ft. Lauderdale, FL 33309, 305-735-1000 ..... A•1491
Analytic Instruments Corporation, P.O. Box 542845, Dallas, TX 75354 ... 214-357-3882
† Frequency Electronics, Inc., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
† NH Research, Incorporated, Instrumentation Products Division, 16601 Hale Ave., Irvine, CA 92714 714-474-3900
Programmed Test Sources, Beaver Brook Rd., P.O. Box 517, Littleton, MA 01460 617-486-3008
Racal-Dana Instrs. Inc., 4 Goodyear St., Irvine, CA 92718 714-859-8999
Richard-Lee Co., Box 724, New Providence, NJ 07974 201-276-0710
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33626 813-855-6611

Oscillators, Pulse (Module)-2300

§ Anderson Electronics, P. O. Box 89, Hollidaysburg, PA 16648, 814-695-4428 ..... A•1337

Austron, Inc., P.O. Box 14766, Austin, TX 78761-4766, 512-251-2341 .... A•1342
† Connor-Winfield Corp., 1865 Selmarten Rd., Aurora, IL 60505, 312-851-4722 ..... A•1361
CTS Corp., Frequency Control Div., (Formerly Knights Div.), 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ..... A•1383
Damon Electronics Div., 80 Wilson Way, Westwood, MA 02090, 617-329-2460 ..... A•1391
Epson America, Inc., 3415 Kashiwa St., Torrance, CA 90505, 213-534-4500 ..... A•1393
Fox Electronics, 5842 Corporation Circle, Ft. Meyers, FL 33905, 813-693-0099 ..... A•1397
Isotemp Research, Inc., 1750 Broadway St., P.O. Box 3389, Charlottesville, VA 22901, 804-295-3101 ..... A•1402-1403
† McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1412
MF Elctrns. Corp., 10 Commerce Dr., New Rochelle, NY 10801, 914-576-6570 ..... A•1418-1419
Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... A•1425
Monitor Products Co., Inc., 502 Via Del Monte, Oceanside, CA 92054, 619-433-4510 ..... A•1426
Oscillatek, K & L Microwave, 620 North Lindenwood Dr., Olathe, KS 66062, 913-829-1777 ..... A•1440-1441
Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ..... A•1442-1443
† Q-Tech Corp., 10150 W. Jefferson Blvd., Culver City, CA 90232-3510, 213-836-7900 ..... A•1452
† Reeves-Hoffman Div., Dynamics Corporation of America, 400 W. North St., Carlisle, PA 17013, 717-243-5929 ..... A•1455
SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303, 415-856-6900 ..... A•1460
Seiko Instruments U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505, 213-517-7770 ..... A•1464
Spectrum Technology, Inc., DATUM, Incorporated, 300 Lopez Rd., Goleta, CA 93116, 805-964-7791 ..... A•1465-1468
§† Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810 ..... A•1470
† Vectron Laboratories, Inc., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433 ..... A•1482,1484-1485
Analytic Instruments Corporation, P.O. Box 542845, Dallas, TX 75354 ... 214-357-3882
Berkeley Nucleonics Corp., 1121 Regatta Sq., Richmond, CA 94804 415-234-1100
Blackhawk Networks Corp., 14 N. Parker Dr., P.O. Box 919, Janesville, WI 53545 608-752-8701
Comstron Corp., 10 Hub Dr., Melville, NY 11747 516-756-1100
† Crystek Corp, P.O. Box 06135, Ft. Myers, FL 33906 813-936-2109
CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
† Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204 913-631-6700
Elgar Corp., 9250 Brown Deer Rd., San Diego, CA 92121 ..... 619-450-0085; 800-854-2213
Engineered Components Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
EPSCO Microwave, EPSCO, Incorporated, 411 Providence Hwy., Westwood, MA 02090 617-329-1500
Frequency Control Products, Inc., American Time Products Div., 430 Commack Rd., Deer Pk., NY 11729 516-243-5730
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
† Hughes Microelectronics Circuits Division, 500 Superior Ave., P.O. Box H, Newport Beach, CA 92658-8903 714-759-2952
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† MCL, Inc., 501 S. Woodcreek Rd., Bolingbrook, IL 60439-4999 312-759-9500
Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131 312-451-1000
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080 404-436-1300
§ NEL Frequency Controls, Inc., 357 Beloit St., Burlington, WI 53105 414-763-3591
§† Omni Spectra, Inc., Microwave Subsystems Div., 2626 So. Hardy Dr., Tempe, AZ 85282 602-966-1471
† Piezo Crystal, 100 K St., Box 619 , Carlisle, PA 17013 717-249-2151
Power Functions Engineering, 3831 Cavalier Dr., Garland, TX 75042 214-278-0996
† Radio Research Instrument Co., Inc., 584 North Main Street, Waterbury, CT 06704-3506 203-753-5840
Rhombus Industries, 15801 Chemical Ln., Huntington Bch., CA 92649-1595 714-898-0960
§ Richard-Lee Co., Box 724, New Providence, NJ 07974 201-276-0710
Sokol Crystal Products, Inc., 121 Water St., Mineral Point, WI 53565 608-987-3363
† Solid State Electronics Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
§ Syntest Corp., 40 Locke Dr., Marlboro, MA 01752-9973 508-481-7827
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E-8, Tampa, FL 33634 813-884-1411
Varian Associates, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
WILMANCO, 19529 Business Center Drive, Northridge, CA 91324 ..... 818-993-1662/1663

Oscillators, Pulse (Test) — See Generators, Pulse (Vol. D)

Oscillators, RC (Module)-2300

Connor-Winfield Corp., 1865 Selmarten Rd., Aurora, IL 60505, 312-851-4722 ..... A•1360
Krohn-Hite Corp., Avon Indl. Pk., Bodwell St., Avon, MA 02322, 508-580-1660 ..... D•1285
Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ..... A•1444
Vectron Laboratories, Inc., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433 ..... A•1480
† Crystek Corp, P.O. Box 06135, Ft. Myers, FL 33906 813-936-2109
CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
CTS Corp., Frequency Control Div., (Formerly Knights Div.), 400 Reimann Ave., Sandwich, IL 60548 815-786-8411
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
Elgar Corp., 9250 Brown Deer Rd., San Diego, CA 92121 ..... 619-450-0085; 800-854-2213
Engineered Components Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761
† General Magnetics, 211 Grove St., Bloomfield, NJ 07003 201-743-2700
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Hughes Microelectronics Circuits Division, 500 Superior Ave., P.O. Box H, Newport Beach, CA 92658-8903 714-759-2952
Isotemp Research, Inc., 1750 Broadway St., P.O. Box 3389, Charlottesville, VA 22901 804-295-3101
† Modular Devices, Brookhaven R & D Plaza, 1 Roned Rd., Shirley, NY 11967 516-345-3100
§† Omni Spectra, Inc., Microwave Subsystems Div., 2626 So. Hardy Dr., Tempe, AZ 85282 602-966-1471
Solid State Electronics Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
Tektronix, Inc., P.O. Box 500, 76/260, Beaverton, OR 97077 800-835-9433
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33626 813-855-6611

Oscillators, Reed-2300

Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•1430
Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† MAR-CHAR CORPORATION, ATR Electronics, Inc., 167 East Fifth Street, Montello, WI 53949 608-297-2106

Oscillators, RF (Module)-2300

§† Andersen Laboratories, 1280 Blue Hills Ave., Bloomfield, CT 06002, 203-242-0761 ..... A•1497
Anderson Electronics, P. O. Box 89, Hollidaysburg, PA 16648, 814-695-4428 ..... A•1337
† Austron, Inc., P.O. Box 14766, Austin, TX 78761-4766, 512-251-2341 .... A•1342
† Bliley Electric Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 ..... A•1348
† Connor-Winfield Corp., 1865 Selmarten Rd., Aurora, IL 60505, 312-851-4722 ..... A•1360-1362
CTS Corp., Frequency Control Div., (Formerly Knights Div.), 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ..... A•1383-1385,1387
§ Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282, 602-967-7874 ..... A•1388-1389
Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204, 913-631-6700 ..... A•1392
Epson America, Inc., 3415 Kashiwa St., Torrance, CA 90505, 213-534-4500 ..... A•1393
§† Fox Electronics, 5842 Corporation Circle, Ft. Meyers, FL 33905, 813-693-0099 ..... A•1397
† Frequency Electronics, Inc., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ..... A•1398
† Isotemp Research, Inc., 1750 Broadway St., P.O. Box 3389, Charlottesville, VA 22901, 804-295-3101 ..... A•1402-1403
† McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1412-1415
MF Elctrns. Corp., 10 Commerce Dr., New Rochelle, NY 10801, 914-576-6570 ..... A•1418-1419
Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... A•1425
† Monitor Products Co., Inc., 502 Via Del Monte, Oceanside, CA 92054, 619-433-4510 ..... A•1427
§ M-Tron Industries, P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321 ..... A•1429
Oscillatek, K & L Microwave, 620 North Lindenwood Dr., Olathe, KS 66062, 913-829-1777 ..... A•1440-1441
Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ..... A•1442-1444
Pletronics, Inc., 9026 Roosevelt Way N.E., Seattle, WA 98115, 206-523-9395 ..... A•1449
† Q-Tech Corp., 10150 W. Jefferson Blvd., Culver City, CA 90232-3510, 213-836-7900 ..... A•1452
† Reeves-Hoffman Div., Dynamics Corporation of America, 400 W. North St., Carlisle, PA 17013, 717-243-5929 ..... A•1454,1456
SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303, 415-856-6900 ..... A•1459-1462
Spectrum Technology, Inc., DATUM, Incorporated, 300 Lopez Rd., Goleta, CA 93116, 805-964-7791 ..... A•1465-1467
Standard Crystal Corporation, 9940 E. Baldwin Pl., El Monte, CA 91734, 818-443-2121 ..... A•1469
† Techtrol Cyclonetics, Inc., 815 Market St., New Cumberland, PA 17070, 717-774-2746 ..... A•1477
† Vectron Laboratories, Inc., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433 ..... A•1481
Xsis Electronics, Inc., 12620 W. 63rd St., Shawnee, KS 66216, 913-631-0448 ..... A•1489
† Z Communications, Inc., 5450 N.W. 33rd Ave., Ste. 100, Ft. Lauderdale, FL 33309, 305-735-1000 ..... A•1491
§† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
† Alpha Inds., Inc., Microelectronic Div., 2800 Crystal Drive, Hatfield, PA 19440 215-822-1311
Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
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† Applied Research, Inc., 111 New South Rd., Hicksville, NY 11802 516-938-9700

§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-727-0700
Blackhawk Networks Corp., 14 N. Parker Dr., P.O. Box 919, Janesville, WI 53545 608-752-8701
† Communication Techniques Inc., 36 Route 10, East Hanover, NJ 07936 201-884-2580
Comstron Corp., 10 Hub Dr., Melville, NY 11747 516-756-1100
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
Crystek Corp, P.O. Box 06135, Ft. Myers, FL 33906 813-936-2109
CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
† Damon Electronics Div., 80 Wilson Way, Westwood, MA 02090 617-329-2460
Engineered Components Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
† FEI Microwave, Inc., Frequency Electronics, Inc., 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
Frequency Control Products, Inc., American Time Products Div., 430 Commack Rd., Deer Pk., NY 11729 516-243-5730
† Frequency West, Inc., Subsidiary of LORAL Corporation, 214 Devcon Dr., San Jose, CA 95112-4210 408-436-4500
§† Gorman-Redlich Mfg. Co., 257 W. Union St., Athens, OH 45701 614-593-3150
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† MCL, Inc., 501 S. Woodcreek Rd., Bolingbrook, IL 60439-4999 312-759-9500
† Microwave Systems Inc., 6075 E. Molloy Rd., Syracuse, NY 13211-2100 315-437-9951
† MITEQ Inc., 100 Davids Drive, Hauppauge, NY 11788 516-436-7400
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§ Penstock Engineering Labs., Penstock, Inc., 520 Mercury Dr., Sunnyvale, CA 94086-4018 408-730-0300
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† Sanders Associates, Inc., Microwave, 955 Perimeter Rd., Manchester, NH 03108 ..... 603-645-6000 Ext. 4299
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§ Industrial Test Equipment, 21 Yennicock Ave., Port Washington, NY 11050, 516-883-1700 ..... D•2120
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† McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1412-1414
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† **Fox Electronics, 5842 Corporation Circle, Ft. Meyers, FL 33905, 813-693-0099** ..... **A•1397**
Genstar Rental Electronics, Inc., 6307 De Soto Ave., Suite J, Woodland Hills, CA 91367, 800-331-3440 (in CA);800-227-8409 ..... **D•1257**
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§ **M-Tron Industries, P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321** ..... **A•1429**
§ **Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300** ..... **A•1430**
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† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147 305-696-6660
Berkeley Nucleonics Corp., 1121 Regatta Sq., Richmond, CA 94804 415-234-1100
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† **Z Communications, Inc., 5450 N.W. 33rd Ave., Ste. 100, Ft. Lauderdale, FL 33309, 305-735-1000** ..... **A•1492**
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† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
HDS Inc., 12310 Pinecrest Rd., Reston, VA 22091 703-620-6200
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Hughes Microelectronics Circuits Division, 500 Superior Ave., P.O. Box H, Newport Beach, CA 92658-8903 714-759-2952
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† Leigh Instruments Ltd., Components Division, 141 Bond Ave., Don Mills, ON, CANADA M3B 1M2 416-447-8531
† M/A-COM OSW, Inc., 2626 S. Hardy Dr., Tempe, AZ 85282 602-966-1471
† Magnum Microwave Corp., 4575 Cushing Pkwy., Fremont, CA 94538 ... 415-657-9898
Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131 312-451-1000
§† Omni Spectra, Inc., Microwave Subsystems Div., 2626 So. Hardy Dr., Tempe, AZ 85282 602-966-1471
§ Oscilloquartz, B & J Marketing, 17074 Dearborn St., Northridge, CA 91325 818-993-0048
† Piezo Crystal, 100 K St., Box 619 , Carlisle, PA 17013 717-249-2151
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804 407-298-2000
§ Raltron Electronics, 2315 N.W. 107th Ave., Miami, FL 33172 305-593-6033
† RF Monolithics, Inc., 4441 Sigma Rd., Dallas, TX 75244 214-233-2903
Savoy Electronics, P.O. Box 5727, Ft. Lauderdale, FL 33310 ..... 305-563-1333; 800-327-1282
† Solid State Electronics Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
† T-F Electronics, 4903 Commercial Park Dr., Austin, TX 78724-2638 512-928-8926
Toyo Comm. Equip. Co., Ltd., 20-4, Nishi-Shimbashi, 3-Chome Minato-Ku, TOKYO, JAPAN 105 ..... 03-459-7320/03-459-7310
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E-8, Tampa, FL 33634 813-884-1411
§ Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831
WILMANCO, 19529 Business Center Drive, Northridge, CA 91324 ..... 818-993-1662/1663
† Zeta Labs., Sub. of CCT Corp., 2811 Orchard Parkway, San Jose, CA 95134 408-434-3600

Oscillators, Test Equipment — See Generators (Specific Types) (Vol. D)

Oscillators, Timable-2300

Analytic Instruments Corporation, P.O. Box 542845, Dallas, TX 75354 ... 214-357-3882

Oscillators, Trigger Coherent-2300

Berkeley Nucleonics Corp., 1121 Regatta Sq., Richmond, CA 94804 415-234-1100

Oscillators, Tuning Fork Controlled - Also see Resonators-2300

Micro Crystal Division, SMH, 35 E. 21st Street, New York, NY 10010, 212-505-5340 ..... A•1423
§† Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810 ..... A•1470
† Z Communications, Inc., 5450 N.W. 33rd Ave., Ste. 100, Ft. Lauderdale, FL 33309, 305-735-1000 ..... A•1491
† Crystek Corp, P.O. Box 06135, Ft. Myers, FL 33906 813-936-2109
† Frequency Control Products, Inc., American Time Products Div., 430 Commack Rd., Deer Pk., NY 11729 516-243-5730
† Philamon, Inc., 33 Dubon Ct., Farmingdale, NY 11735 516-249-2700
§ Raltron Electronics, 2315 N.W. 107th Ave., Miami, FL 33172 305-593-6033
§ SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303 415-856-6900
† Spectrum Technology, Inc., DATUM, Incorporated, 300 Lopez Rd., Goleta, CA 93116 805-964-7791
† T-F Electronics, 4903 Commercial Park Dr., Austin, TX 78724-2638 512-928-8926

Oscillators, UHF/VHF (Module)-2300

§† Andersen Laboratories, 1280 Blue Hills Ave., Bloomfield, CT 06002, 203-242-0761 ..... A•1335
Anderson Electronics, P. O. Box 89, Hollidaysburg, PA 16648, 814-695-4428 ..... A•1337
Austron, Inc., P.O. Box 14766, Austin, TX 78761-4766, 512-251-2341 .... A•1342
† Bliley Electric Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 ..... A•1348
Connor-Winfield Corp., 1865 Selmarten Rd., Aurora, IL 60505, 312-851-4722 ..... A•1360-1363
CTS Corp., Frequency Control Div., (Formerly Knights Div.), 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ..... A•1384
† Damon Electronics Div., 80 Wilson Way, Westwood, MA 02090, 617-329-2460 ..... A•1391
Datum Inc., Timing/Aacom Divisions, 1363 S. State College Blvd., Anaheim, CA 92806-5790, 714-533-6333 ..... D•1062
Epson America, Inc., 3415 Kashiwa St., Torrance, CA 90505, 213-534-4500 ..... A•1393
† Fox Electronics, 5842 Corporation Circle, Ft. Meyers, FL 33905, 813-693-0099 ..... A•1397
† Frequency Electronics, Inc., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ..... A•1398
Isotemp Research, Inc., 1750 Broadway St., P.O. Box 3389, Charlottesville, VA 22901, 804-295-3101 ..... A•1402-1403
McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1412-1414
MF Elctrns. Corp., 10 Commerce Dr., New Rochelle, NY 10801, 914-576-6570 ..... A•1418-1419
Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... A•1425
Monitor Products Co., Inc., 502 Via Del Monte, Oceanside, CA 92054, 619-433-4510 ..... A•1426-1427
§† Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•1430
Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ..... A•1442-1444
Pletronics, Inc., 9026 Roosevelt Way N.E., Seattle, WA 98115, 206-523-9395 ..... A•1449
† Q-Tech Corp., 10150 W. Jefferson Blvd., Culver City, CA 90232-3510, 213-836-7900 ..... A•1452
† Reeves-Hoffman Div., Dynamics Corporation of America, 400 W. North St., Carlisle, PA 17013, 717-243-5929 ..... A•1454,1456
SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303, 415-856-6900 ..... A•1459-1462
Seiko Instruments U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505, 213-517-7770 ..... A•1464
Spectrum Technology, Inc., DATUM, Incorporated, 300 Lopez Rd., Goleta, CA 93116, 805-964-7791 ..... A•1465-1468
Standard Crystal Corporation, 9940 E. Baldwin Pl., El Monte, CA 91734, 818-443-2121 ..... A•1469
Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810 .... A•1474-1475
† Techtrol Cyclonetics, Inc., 815 Market St., New Cumberland, PA 17070, 717-774-2746 ..... A•1476-1477
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E-8, Tampa, FL 33634, 813-884-1411 ..... A•1842
† Vectron Laboratories, Inc., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433 ..... A•1480-1485
Xsis Electronics, Inc., 12620 W. 63rd St., Shawnee, KS 66216, 913-631-0448 ..... A•1489
† Z Communications, Inc., 5450 N.W. 33rd Ave., Ste. 100, Ft. Lauderdale, FL 33309, 305-735-1000 ..... A•1491
Alpha Inds., Inc., Microelectronic Div., 2800 Crystal Drive, Hatfield, PA 19440 215-822-1311
† Applied Research, Inc., 111 New South Rd., Hicksville, NY 11802 516-938-9700
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-727-0700
Blackhawk Networks Corp., 14 N. Parker Dr., P.O. Box 919, Janesville, WI 53545 608-752-8701
Comstron Corp., 10 Hub Dr., Melville, NY 11747 516-756-1100
Crystek Corp, P.O. Box 06135, Ft. Myers, FL 33906 813-936-2109
CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
† Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204 913-631-6700
Frequency Control Products, Inc., American Time Products Div., 430 Commack Rd., Deer Pk., NY 11729 516-243-5730
† Frequency West, Inc., Subsidiary of LORAL Corporation, 214 Devcon Dr., San Jose, CA 95112-4210 408-436-4500
† Gorman-Redlich Mfg. Co., 257 W. Union St., Athens, OH 45701 614-593-3150
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Hughes Microelectronics Circuits Division, 500 Superior Ave., P.O. Box H, Newport Beach, CA 92658-8903 714-759-2952
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† Magnum Microwave Corp., 4575 Cushing Pkwy., Fremont, CA 94538 ... 415-657-9898
† Microwave Systems Inc., 6075 E. Molloy Rd., Syracuse, NY 13211-2100 315-437-9951
MITEQ Inc., 100 Davids Drive, Hauppauge, NY 11788 516-436-7400
Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131 312-451-1000
† Piezo Crystal, 100 K St., Box 619 , Carlisle, PA 17013 717-249-2151
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804 407-298-2000
† RF Monolithics, Inc., 4441 Sigma Rd., Dallas, TX 75244 214-233-2903
Sokol Crystal Products, Inc., 121 Water St., Mineral Point, WI 53565 608-987-3363
§ Syntest Corp., 40 Locke Dr., Marlboro, MA 01752-9973 508-481-7827
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
Texscan Instruments, Texscan Corporation, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
§ Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831
† Zeta Labs., Sub. of CCT Corp., 2811 Orchard Parkway, San Jose, CA 95134 408-434-3600

Oscillators, UHF/VHF (Test) — See Generators, UHF/VHF (Vol. D)

Oscillators, Ultrasonic (Module)-2300

M-Tron Industries, P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321 ..... **A•1429**
Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810 ..... **A•1472,1474-1475**
† **Vectron Laboratories, Inc., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433** ..... **A•1481,1483-1485**
Compact Power Company, 17282 Orange Drive, Yorba Linda, CA 92686 714-996-5826
Energy Systems, 21550 Oxnard St, Woodland Hills, CA 91367 805-273-0547
Matec Instruments, Inc., 75 South St, Hopkinton, MA 01748 617-435-9039
† Phonon Corporation, 7 Herman Drive, P.O. Box 549, Simsbury, CT 06070 203-651-0211
† Piezo Crystal, 100 K St, Box 619 , Carlisle, PA 17013 717-249-2151
† Solid State Electronics Corp., 18646 Parthenia St, Northridge, CA 91324 818-993-8257
Tokin America, Inc., 155 Nicholson Ln, 95134, CA 95131 408-432-8020
Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831

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Oscillators, Voltage Controlled Crystal (VCXO)-2300

AT&T, 555 Union Blvd., Allentown, PA 18103, 1-800-372-2447;In Canada:1-800-553-2448 ..... **A•1339-1341**
§† **Ball Corp., Efratom Division, 3 Parker, Irvine, CA 92718-1605, 714-770-5000** ..... **A•1344**
† **Bliley Electric Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571** ..... **A•1347**
† **Connor-Winfield Corp., 1865 Selmarten Rd., Aurora, IL 60505, 312-851-4722** ..... **A•1362**
† **CTS Corp., Frequency Control Div., (Formerly Knights Div.), 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411** ..... **A•1374,1376-1377,1381-1383,1387**
† **Damon Electronics Div., 80 Wilson Way, Westwood, MA 02090, 617-329-2460** ..... **A•1391**
Fox Electronics, 5842 Corporation Circle, Ft. Meyers, FL 33905, 813-693-0099 ..... **A•1397**
Frequency and Time Systems, Inc., DATUM, INC., 34 Tozer Rd., Beverly, MA 01915, 508-927-8220 ..... **D•1254**
† **Frequency Electronics, Inc., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500** ..... **A•1398**
§ **Industrial Test Equipment, 21 Yennicock Ave., Port Washington, NY 11050, 516-883-1700** ..... **D•2120,2122**
† **McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411** ..... **A•1412,1414-1415**
MF Elctrns. Corp., 10 Commerce Dr., New Rochelle, NY 10801, 914-576-6570 ..... **A•1418-1419**
Micro Crystal Division, SMH, 35 E. 21st Street, New York, NY 10010, 212-505-5340 ..... **A•1423**
† **Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200** ..... **A•1425**
† **Monitor Products Co., Inc., 502 Via Del Monte, Oceanside, CA 92054, 619-433-4510** ..... **A•1426-1427**
M-Tron Industries, P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321 ..... **A•1429**
§ **Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300** ..... **A•1430**
§ **NDK America, Inc., 20300 Stevens Creek Blvd., Ste. 400, Cupertino, CA 95014, 408-255-0831** ..... **A•1330,1432,1434-1435**
Oscillatek, K & L Microwave, 620 North Lindenwood Dr., Olathe, KS 66062, 913-829-1777 ..... **A•1440-1441**
Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ..... **A•1444**
† **Q-Tech Corp., 10150 W. Jefferson Blvd., Culver City, CA 90232-3510, 213-836-7900** ..... **A•1452**
† **Reeves-Hoffman Div., Dynamics Corporation of America, 400 W. North St., Carlisle, PA 17013, 717-243-5929** ..... **A•1456**
† **Spectrum Technology, Inc., DATUM, Incorporated, 300 Lopez Rd., Goleta, CA 93116, 805-964-7791** ..... **A•1465-1468**
Standard Crystal Corporation, 9940 E. Baldwin Pl., El Monte, CA 91734, 818-443-2121 ..... **A•1469**
Struthers-Dunn, Inc., Subsidiary of Nytronics, Inc., Lamb's Rd., Pitman, NJ 08071-0901, 609-589-7500 ..... **B•1592**
† **Techtrol Cyclonetics, Inc., 815 Market St., New Cumberland, PA 17070, 717-774-2746** ..... **A•1477**
† **Vectron Laboratories, Inc., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433** ..... **A•1484-1485**
† Advanced Filter Devices, Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92009 619-438-2074
Alpha Inds., Inc., Microelectronic Div., 2800 Crystal Drive, Hatfield, PA 19440 215-822-1311
† Applied Research, Inc., 111 New South Rd., Hicksville, NY 11802 516-938-9700
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St, Brooklyn, NY 11217 718-857-2400
† Communication Techniques Inc., 36 Route 10, East Hanover, NJ 07936 201-884-2580
† Comstron Corp., 10 Hub Dr., Melville, NY 11747 516-756-1100
† Crystek Corp, P.O. Box 06135, Ft. Myers, FL 33906 813-936-2109
† CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
† Electronic Research Co., 7618 Wedd St, Overland Park, KS 66204 913-631-6700
§ EMR Data Systems, Div. Sangamo- Weston, Box 3041, Sarasota, FL 33578 813-371-0811
Erbtec Engineering, Inc., 2760 29th St, Boulder, CO 80301 303-447-8750
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
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† Hughes Microelectronics Circuits Division, 500 Superior Ave., P.O. Box H, Newport Beach, CA 92658-8903 714-759-2952
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† Leigh Instruments Ltd., Components Division, 141 Bond Ave., Don Mills, ON, CANADA M3B 1M2 416-447-8531
MACOM, Inc., 43 Second Ave., Bldg. 8, Burlington, MA 01803 617-272-3000
† M/A-COM OSW, Inc., 2626 S. Hardy Dr., Tempe, AZ 85282 602-966-1471
† Microwave Systems Inc., 6075 E. Molloy Rd., Syracuse, NY 13211-2100 315-437-9951
† MITEQ Inc., 100 Davids Drive, Hauppauge, NY 11788 516-436-7400
Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131 312-451-1000
§† Omni Spectra, Inc., Microwave Subsystems Div., 2626 So. Hardy Dr., Tempe, AZ 85282 602-966-1471
§ Oscilloquartz, B & J Marketing, 17074 Dearborn St, Northridge, CA 91325 818-993-0048
Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
† Piezo Crystal, 100 K St, Box 619 , Carlisle, PA 17013 717-249-2151
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804 407-298-2000
§ Raltron Electronics, 2315 N.W. 107th Ave., Miami, FL 33172 305-593-6033
† Solid State Electronics Corp., 18646 Parthenia St, Northridge, CA 91324 818-993-8257
Teledyne/Geotech, 3401 Shiloh Rd., Garland, TX 75041 214-271-2561
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
Texscan Instruments, Texscan Corporation, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
T-F Electronics, 4903 Commercial Park Dr., Austin, TX 78724-2638 512-928-8926
§ Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831
Varian Associates, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33626 813-855-6611
WILMANCO, 19529 Business Center Drive, Northridge, CA 91324 ..... 818-993-1662/1663
† Zeta Labs., Sub. of CCT Corp., 2811 Orchard Parkway, San Jose, CA 95134 408-434-3600

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Ovens, Crystal & Component-2300

† **CTS Corp., Frequency Control Div., (Formerly Knights Div.), 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411** ..... **A•1369,1384-1386**
McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... **A•1415**
† **Monitor Products Co., Inc., 502 Via Del Monte, Oceanside, CA 92054, 619-433-4510** ..... **A•1427**
† **Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901, 804-977-8050** ..... **A•1445**

Spectrum Technology, Inc., DATUM, Incorporated, 300 Lopez Rd., Goleta, CA 93116, 805-964-7791 ..... **A•1465**
Acme Elec. Heating Corp., 4685 E. 11th Ave., Hialeah, FL 33013 305-685-8326
† Blue M, A Unit of General Signal, 138th & Chatham Sts., Blue Island, IL 60406 312-385-9000
§† Casso-Solar, P.O. Box 163, U.S. Route 202, Pomona, NY 10970 914-354-2500
† CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
† Frequency Electronics, Inc., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
† FTS Systems, Inc., Rte. 209, P.O. Box 158, Stone Ridge, NY 12484 800-824-0400
International Instrumentation, Inc., 2282 Townsgate Rd., Westlake Vlg., CA 91361 805-495-7673
† Isotemp Research, Inc., 1750 Broadway St., P.O. Box 3389, Charlottesville, VA 22901 804-295-3101
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080 404-436-1300
† Oven Industries, 207 Hempt Rd., P.O. Box 290, Mechanicsburg, PA 17055 717-766-0721
† Trent, Inc., 201 Leverington Ave., Philadelphia, PA 19127 215-482-5000

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Airpax Corp., Woods Rd., Cambridge, MD 21613, 301-228-4600 ..... **A•1717**
AMP, Box 3608, Harrisburg, PA 17105, 800-362-5673 ..... **C•1165**
Aromat Corp., 629 Central Avenue, New Providence, NJ 07974, 201-464-3550 ..... **B•1381**
§ **Bivar, Inc., 4 Thomas, Irvine, CA 92718, 714-951-8808** ..... **C•1017**
FDK America, Inc., Fuji Electromechanical Co., Ltd., 17326 Edwards Rd., Ste. A-130, Cerritos, CA 90701, 213-404-1770 ..... **A•1735**
HEI, Inc., Hybrid Electronics Div., 1495 Steiger Lake Ln., Victoria, MN 55386, 612-443-2500 ..... **A•1737**
§† **Hybrids International Ltd., Thick Film Division, 311 N. Lindenwood Dr., Olathe, KS 66062, 913-764-6400** ..... **A•1759**
Hybridyne, Inc., 2155 N. Forbes Blvd., Tucson, AZ 85745, 602-629-0001 ..... **A•1738**
† **International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818, 402-694-6111** ..... **A•1742-1743**
Leach Control Products Div., Leach Corporation, 6900 Orangethorpe Ave., Buena Pk., CA 90620, 714-739-0770 ..... **A•1744**
Mepco/Centralab, Inc., A North American Philips Co., 2601 S. Moorland Rd., New Berlin, WI 53131, 414-785-6506 ..... **A•1747**
† **Mini-Systems, Inc., Electronic Package Div., 168 E. Bacon St., P.O. Box 1597, Plainville, MA 02762, 508-695-2000** ..... **A•1748**
NMB Technologies, 9730 Independence Avenue, Chatsworth, CA 91311, 818-341-3355 ..... **A•1750-1751**
† **Reeves-Hoffman Div., Dynamics Corporation of America, 400 W. North St., Carlisle, PA 17013, 717-243-5929** ..... **C•1638-1639**
§ Accessories for Elctrns., Inc., 800 Merrick Rd., Baldwin, NY 11510-3593 516-546-1751
Centerflex Techn. Corp., 221 Seventh Ave., P.O. Box 21, Hawthorne, NJ 07507 201-423-0505
† Detoronics Corporation, 10660 E. Rush St., S. El Monte, CA 91733 818-579-7130
Douglas Electronics, 718 Marina Blvd., San Leandro, CA 94577 415-483-8770
ELMA Electronic Inc., 41440 Christy Street, Fremont, CA 94538 415-656-3400
Gennum Corporation, Linear Technology Inc., P.O. Box 489, Sta. A, Burlington, ON, CANADA L7R 3Y3 ..... 800-263-9353;416-632-2996
Hudson Tool & Die Co., 18 Malvern St., Newark, NJ 07105 201-589-1800
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
International Instrumentation, Inc., 2282 Townsgate Rd., Westlake Vlg., CA 91361 805-495-7673
§ International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
† Isotronics, Augat, Industrial Park, New Bedford, MA 02745 617-998-2000
K-Two Industries, 4331 Miranda Ave., Palo Alto, CA 94306 408-720-9316
§† Kyocera Northwest, Electronic Components Group, P.O. Box 85542, San Diego, CA 92138-5542 619-576-2600
§† LSI Logic Corp., 1551 McCarthy Blvd., Milpitas, CA 95035 408-433-8000
Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
§ Nepenthe, Inc., 2471 E. Bayshore Road, Palo Alto, CA 94303 ..... 415-856-9332; 800-NEPENTHE
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Inc., 99 Morris Ave., Springfield, NJ 07081 201-376-6070
PCK Technology Div., Kollmorgen Corp., 322 South Service Rd., Melville, NY 11747 516-454-4400
Philips Circuit Assemblies, 3602 W. Waters Avenue, Tampa, FL 33684 813-933-5113
Philips Circuit Assemblies, 1515 Sixth St. South, Hopkins, MN 55343 612-933-4600
Sanders Associates, Inc., ECBD, A Lockheed Company, 955 Perimeter Rd., Manchester, NH 03108-8500 603-645-5548
† Sanders Associates, Inc., Microwave, 955 Perimeter Rd., Manchester, NH 03108 ..... 603-645-6000 Ext. 4299
SGS Semiconductor Corporation, 1000 E. Bell Road, Phoenix, AZ 85022 602-867-6100
† Stevens Products, Inc., 128 N. Park St., E. Orange, NJ 07019 201-672-2140
† Thomson Electron Tubes & Devices Corp., Special Products Div., 550 Mount Pleasant Ave., Dover, NJ 07801 201-328-1400

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Phototransistors, Surface Mount-4800

§ **Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757** ..... **B•1179,1282-1286,1291**
† Centronic, Inc., Morgan Crucible Co., Electronics Div., 1829 B DeHavilland Dr., Dept. E, Newbury Park, CA 91320-1702 805-499-5902
Philips Electronics Ltd., Elcoma Division, 601 Milner Avenue, Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161

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Bell, Floyd, Inc., 897 Higgs Ave., Columbus, OH 43212, 614-294-4000 ... **D•1024**
International Components Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 ..... **D•1031**
LZR Electronics, Inc., 8174 Beechcraft Ave., Gaithersburg, MD 20879, 301-921-9440 ..... **D•1033**
Mallory Capacitor Co., Emhart Elctrl./Elctrn. Grp., 3029 E. Washington St., Dept. EM, P.O. Box 1284, Indianapolis, IN 46201, 317-636-5353 ..... **D•1036-1037**
§ **Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300** ..... **A•1430, B•1899, D•1040-1042**
§ **NTK Technical Ceramics, NGK Spark Plugs (USA), Inc., 99 Morris Ave., Springfield, NJ 07081, 201-376-6070** ..... **A•1438, B•1901, D•1044-1045**
Radio Materials Corp., P. O. Box 339, Attica, IN 47918, 317-762-2491;1-800-356-9956 ..... **A•1168,1170**
§ **Star Micronics, Inc., OEM Division, 70-D Ethel Rd. W., Piscataway, NJ 08854, 201-572-9512** ..... **D•1054,1056,1058-1059**
§ **TDK Corporation, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku,, Tokyo, JAPAN 103, (03) 278-5111** ..... **D•1060**
§ **Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131, 408-432-8020** ..... **B•1926**
† **Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478, 216-232-8600** ..... **A•1487**
§ Atomergic Chemetals Corp., 91 Carolyn Blvd., Farmingdale, NY 11735-1527 516-694-9000
Burleigh Instruments, Burleigh Pk., Fishers, NY 14453 716-924-9355
† Channel Industries, 839 Ward Dr., Santa Barbara, CA 93111 805-967-0171
† EDO Western Corp., EDO Corp., 2645 South 300 W., Salt Lake City, UT 84115 ..... 801-486-7481/3846
§ Ferroxcube, Amperex Electronic Corp., 5083 Kings Hwy., Saugerties, NY 12477 914-246-2811
§† Kyocera Northwest, Electronic Components Group, P.O. Box 85542, San Diego, CA 92138-5542 619-576-2600
§ Martin Sound Prods., 28 Alpha Park, Cleveland, OH 44143-2297 216-442-2286
Motorola Ceramic Products, Components Division, 4800 Alameda Blvd. N.E., Albuquerque, NM 87113 505-822-8801
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
† Piezo Crystal, 100 K St, Box 619, Carlisle, PA 17013 717-249-2151
† Piezo Electric Products, Inc., 212 Durham Ave., Metuchen, NJ 08840 201-548-2800
Primo Company Limited, 25-1, 6-Chome, Mure, Mitakashi, Tokyo, JAPAN 181 0422-43-3121
† Pulsar Products Div., Physics International, 2700 Merced St., San Leandro, CA 94577 415-577-7236
§ Raltron Electronics, 2315 N.W. 107th Ave., Miami, FL 33172 305-593-6033
§ Stetco, Inc., 3344 Schierhorn Ct., Franklin Pk., IL 60131 312-671-4208
Unilator Technical Ceramics Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770 213-463-5618

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Potentiometer Elements-4750

Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... **A•2061**
§ **Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101, 718-361-0800** ..... **C•1607,1610**
† **JDK Controls, Inc., 2630 Lavery Ct., Suite F, Newbury Park, CA 91320-1593, 805-499-7779** ..... **A•2075**
† **Maurey Instrument Corp., 4555 W. 60th St., Chicago, IL 60629, 312-581-4555** ..... **A•2085**
Novotechnik U.S., Inc., Village Plaza, 488 Boston Post Rd., Rte. 20 E., Marlborough, MA 01752, 617-485-2244 ..... **B•1900**
Precision Control Manufacturing, Inc., 1509 B Queen Anne Ave. N., Seattle, WA 98109, 206-281-9380 ..... **A•2097**
† **Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100** ..... **A•2103**
† **Waters Manufacturing, Inc., Talley Industries, Longfellow Ctr., Wayland, MA 01778, 617-358-2777** ..... **A•2110**
† Assembly Specialists, 914 Main St, Box 965, Acton, MA 01720 617-263-9100
Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700
Carter Manufacturing Corporation, 237 Sugar Road, Bolton, MA 01740 .. 617-779-5501
† Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626 714-545-8261
† Electronic Controls, Inc., 431 Park Industrial Dr., La Habra, CA 90631 213-697-4189
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
§ Piher International Corp., 903 Feehanville Dr., Mt. Prospect, IL 60056 ..... 312-390-6680; 800-323-6693
† Robert Shaw Instrument Div., Kendall Lane, Natick, MA 01760 617-875-9711
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 .. 215-644-1300

Potentiometers, Air Operated-4750

† **Pres-Air-Trol Corp., 1009 Boston Post Rd., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY)** ..... **B•1787**
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733

Potentiometers, Carbon Ceramic-4750

§ **Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888** ..... **A•2059**
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590, 516-935-3640 ..... **A•2068**
Mepco/Centralab, North American Philips Corporation, Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501, 515-573-1300 ..... **A•2087**
§ **Piher International Corp., 903 Feehanville Dr., Mt. Prospect, IL 60056, 312-390-6680;800-323-6693** ..... **A•2096**
§ **Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., 565 West Golf Road, Arlington Heights, IL 60005, 312-364-7277** ..... **A•2100-2101**
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134 408-946-6000
§† Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
§ ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 ..... 516-753-0400; 800-862-2101
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 .. 516-937-3475
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100

Potentiometers, Carbon Film-4750

Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590, 516-935-3640 ..... **A•2068**
IET Labs, Inc., 534 Main St., Westbury, NY 11590, 516-334-5959 ..... **D•1272**
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-937-3475 ..... **A•1094**
Maurey Instrument Corp., 4555 W. 60th St., Chicago, IL 60629, 312-581-4555 ..... **A•2082**
Mepco/Centralab, North American Philips Corporation, Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501, 515-573-1300 ..... **A•2087**
§ **Riher International Corp., 903 Feehanville Dr., Mt. Prospect, IL 60056, 312-390-6680;800-323-6693** ..... **A•2096**
§ **Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., 565 West Golf Road, Arlington Heights, IL 60005, 312-364-7277** ..... **A•2100-2101**
† **Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100** ..... **A•2103**
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134 408-946-6000
§ Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
Carter Manufacturing Corporation, 237 Sugar Road, Bolton, MA 01740 .. 617-779-5501
Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., 3 Washington St., Dover, NH 03820 603-742-1120
§ ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 ..... 516-753-0400; 800-862-2101
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
Novotechnik U.S., Inc., Village Plaza, 488 Boston Post Rd., Rte. 20 E., Marlborough, MA 01752 617-485-2244
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
† Robert Shaw Instrument Div., Kendall Lane, Natick, MA 01760 617-875-9711
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700

Potentiometers, Ceramic Metal (CERMET)-4750

§ **Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888** ..... **A•2059-2061**
§† **Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050** ..... **A•2064,2066-2067**
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590, 516-935-3640 ..... **A•2068**
CTS Corporation, Switch Div., Paso Robles, 500 Linne Rd., Paso Robles, CA 93446, 805-238-0350 ..... **B•1686**
Mepco/Centralab, North American Philips Corporation, Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501, 515-573-1300 ..... **A•2087**
§† **Mepcopal Company, 11468 Sorrento Valley Rd., San Diego, CA 92121, 619-453-0332** ..... **A•2089**
§ **Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300** ..... **A•2090-2091**
§ **Piher International Corp., 903 Feehanville Dr., Mt. Prospect, IL 60056, 312-390-6680;800-323-6693** ..... **A•2096**
§ **Preh Electronic Industries, Inc., 470 E. Main St., Lake Zurich, IL 60047-2578, 312-438-4000** ..... **A•2098**
Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405, 818-781-1642 ... **A•2099**
§ **Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., 565 West Golf Road, Arlington Heights, IL 60005, 312-364-7277** ..... **A•2100**
§† **VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181** ..... **A•2107,2109, B•1031**
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134 408-946-6000
§† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700
§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., 3 Washington St., Dover, NH 03820 603-742-1120
Components Div., Sangamo Weston, Inc., Box 128, Pickens, SC 29671 .. 803-878-6311
§† CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
CTS Corporation, Microelectronics Div., 1201 Cumberland Ave., W. Lafayette, IN 47906 317-463-2565
CTS Corp., Resistor Network Div., (Formerly CTS Corp., Berne Div.), 406 Parr Rd., Berne, IN 46711 219-589-3111
International Resistive Company, P.O. Box 1860, Boone, NC 28607 704-264-8861
§ ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 ..... 516-753-0400; 800-862-2101
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 .. 516-937-3475
Mepco/Centralab Corp. Hdqrtr., North American Philips Corporation, 2001 W. Blue Heron Blvd., Riviera Beach, FL 33404 407-881-3200
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
Novotechnik U.S., Inc., Village Plaza, 488 Boston Post Rd., Rte. 20 E., Marlborough, MA 01752 617-485-2244
§ Raltron Electronics, 2315 N.W. 107th Ave., Miami, FL 33172 305-593-6033
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 608-935-2707
§† Spectrol Electronics, 17070 East Gale Ave., City of Industry, CA 91745 .. 818-964-6565
Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502 .. 303-242-0810

Potentiometers, Composition, Carbon-4750

§ **Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888** ..... **A•2059-2061**
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590, 516-935-3640 ..... **A•2068**
CTS Corp., Electromechanical Div., (Formerly Elkhart Div.), 1142 W. Beardsley Ave., Elkhart, IN 46514, 219-295-3575 ..... **A•1910**
Mepco/Centralab, North American Philips Corporation, Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501, 515-573-1300 ..... **A•2087**
§ **Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300** ..... **A•2091**
§† **Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600** ..... **A•2095**
§ **Preh Electronic Industries, Inc., 470 E. Main St., Lake Zurich, IL 60047-2578, 312-438-4000** ..... **A•2098**
§ **Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530, 914-681-0700** ..... **D•1053**
§ **Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., 565 West Golf Road, Arlington Heights, IL 60005, 312-364-7277** ..... **A•2100**
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134 408-946-6000
§† Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
§ CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
CTS Corp., Resistor Network Div., (Formerly CTS Corp., Berne Div.), 406 Parr Rd., Berne, IN 46711 219-589-3111
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 .. 516-937-3475
Mepco/Centralab Corp. Hdqrtr., North American Philips Corporation, 2001 W. Blue Heron Blvd., Riviera Beach, FL 33404 407-881-3200
Philips Electronics Ltd., Elcoma Division, 601 Milner Avenue, Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
§ Philmore Manufacturing, 40 Inip Dr., Inwood, NY 11696 516-239-6161
§ Piher International Corp., 903 Feehanville Dr., Mt. Prospect, IL 60056 ..... 312-390-6680; 800-323-6693
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§† Spectrol Electronics, 17070 East Gale Ave., City of Industry, CA 91745 .. 818-964-6565
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100
† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Potentiometers, Conductive Plastic-4750

§ **Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888** ..... **A•2060-2061**
§† **Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050** ..... **A•2065**
§ **ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, 619-757-7770** ..... **A•2070-2072, B•1205**
† **JDK Controls, Inc., 2630 Lavery Ct., Suite F, Newbury Park, CA 91320-1593, 805-499-7779** ..... **A•2075**
§† **Maurey Instrument Corp., 4555 W. 60th St., Chicago, IL 60629, 312-581-4555** ..... **A•2078-2085**
Mepco/Centralab, North American Philips Corporation, Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501, 515-573-1300 ..... **A•2087**
§ **Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300** ..... **A•2091**
Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405, 818-781-1642 ... **A•2099**
† **Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100** ..... **B•1030**
§ **VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181** ..... **A•2107**
† **Waters Manufacturing, Inc., Talley Industries, Longfellow Ctr., Wayland, MA 01778, 617-358-2777** ..... **A•2111**
§† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700
† Carter Manufacturing Corporation, 237 Sugar Road, Bolton, MA 01740 .. 617-779-5501

§† Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., 3 Washington St., Dover, NH 03820 603-742-1120
† Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626 714-545-8261
Electronic Controls, Inc., 431 Park Industrial Dr., La Habra, CA 90631 213-697-4189
Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101 718-361-0800
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
Novotechnik U.S., Inc., Village Plaza, 488 Boston Post Rd., Rte. 20 E., Marlborough, MA 01752 617-485-2244
† Penny & Giles, 1640 Fifth Street, Suite 224, Santa Monica, CA 90401 ... 213-393-1497
PIC Design, P.O. Box 1004, Middlebury, CT 06762 203-758-8272
† Resistance Technology Inc., 1260 Red Fox Rd., St. Paul, MN 55112 612-636-9770
† Robert Shaw Instrument Div., Kendall Lane, Natick, MA 01760 617-875-9711
† Samarius Precision Instruments, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418 203-735-7405
Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Spectrol Electronics, 17070 East Gale Ave., City of Industry, CA 91745 .. 818-964-6565
Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502 .. 303-242-0810
Wilbrecht Electronics, 346 Chester St., St. Paul, MN 55107 612-222-2791

Potentiometers, Hot Molded-4750

§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•2060-2061
§† Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..... A•2095
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100

Potentiometers, Hybrid-4750

§† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635, 714-447-2700 ..... A•2063
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ..... A•2064
ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, 619-757-7770 ..... A•2070,2072, B•1205
† Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626 714-545-8261
Dymec, Inc., 8 Lowell Ave., Winchester, MA 01890 ..... 617-729-7870;800-225-1151
Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
† Penny & Giles, 1640 Fifth Street, Suite 224, Santa Monica, CA 90401 ... 213-393-1497

Potentiometers, Lab Type-4750

ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, 619-757-7770 ..... A•2070, B•1205
IET Labs, Inc., 534 Main St., Westbury, NY 11590, 516-334-5959 ..... D•1272
Julie Research Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 ..... D•1280
Precision Control Manufacturing, Inc., 1509 B Queen Anne Ave. N., Seattle, WA 98109, 206-281-9380 ..... A•2097
§† VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181 ..... A•2109
Biddle Instruments, 510 Township Line Rd., Blue Bell, PA 19422 215-646-9200
§ Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
† Carter Manufacturing Corporation, 237 Sugar Road, Bolton, MA 01740 .. 617-779-5501
Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626 714-545-8261
Electro Scientific Inds., 13900 N.W. Science Pk. Dr., Portland, OR 97229 503-641-4141
§† Guideline Instruments, 4403 Vineland Rd, Suite B-10, Orlando, FL 32811-7335 305-423-8215
Leeds & Northrup, General Signal, Sumneytown Pike, North Wales, PA 19454 215-643-2000
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
Samarius Precision Instruments, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418 203-735-7405
† Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Spectrol Electronics, 17070 East Gale Ave., City of Industry, CA 91745 .. 818-964-6565
Tettex Instruments, Inc., P.O. Box 281, Fairview Village, PA 19409-0281 215-539-6050
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100
Yokogawa Corp. of America, 200 West Park Drive, Peachtree City, GA 30269 404-487-1471

Potentiometers, Linear-4750

§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•2061
Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635, 714-447-2700 ..... A•2063
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ..... A•2064-2065
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590, 516-935-3640 ..... A•2068
CTS Corp., Electromechanical Div., (Formerly Elkhart Div.), 1142 W. Beardsley Ave., Elkhart, IN 46514, 219-295-3575 ..... A•1910
§ ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, 619-757-7770 ..... A•2070, B•1205
IET Labs, Inc., 534 Main St., Westbury, NY 11590, 516-334-5959 ..... D•1272
† JDK Controls, Inc., 2630 Lavery Ct., Suite F, Newbury Park, CA 91320-1593, 805-499-7779 ..... A•2075
§† Maurey Instrument Corp., 4555 W. 60th St., Chicago, IL 60629, 312-581-4555 ..... A•2078-2080,2083,2085
Mepco/Centralab, North American Philips Corporation, Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501, 515-573-1300 ..... A•2087
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•2091
§† Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..... A•2095
Precision Control Manufacturing, Inc., 1509 B Queen Anne Ave. N., Seattle, WA 98109, 206-281-9380 ..... A•2097
§ Preh Electronic Industries, Inc., 470 E. Main St., Lake Zurich, IL 60047-2578, 312-438-4000 ..... A•2098
Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405, 818-781-1642 ... A•2099
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., 565 West Golf Road, Arlington Heights, IL 60005, 312-364-7277 ..... A•2100-2101
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ..... A•2103, B•1030
§ VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181 ..... A•2107
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134 408-946-6000
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
Barber-Colman Co., Indl. Instrs. Div., P.O. Box 2940, 1354 Clifford Ave., Loves Park, IL 61132 815-877-0241
† Carter Manufacturing Corporation, 237 Sugar Road, Bolton, MA 01740 .. 617-779-5501
§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., 3 Washington St., Dover, NH 03820 603-742-1120
Components Div., Sangamo Weston, Inc., Box 128, Pickens, SC 29671 .. 803-878-6311
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900
§† CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
† Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626 714-545-8261
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
† Humphrey, Inc., 9212 Balboa Ave., San Diego, CA 92123 619-565-6631
Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101 718-361-0800
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
Mepco/Centralab Corp. Hdqrtr., North American Philips Corporation, 2001 W. Blue Heron Blvd., Riviera Beach, FL 33404 407-881-3200
§† Mepcopal Company, 11468 Sorrento Valley Rd., San Diego, CA 92121 .. 619-453-0332
§ Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
Novotechnik U.S., Inc., Village Plaza, 488 Boston Post Rd., Rte. 20 E., Marlborough, MA 01752 617-485-2244
† Orbit Instrument Corp., 80 Cabot Ct., Hauppauge, NY 11788 516-435-8300
§† Penny & Giles, 1640 Fifth Street, Suite 224, Santa Monica, CA 90401 ... 213-393-1497
† Perkin-Elmer Corp., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132 203-762-4786
§ Piher International Corp., 903 Feehanville Dr., Mt. Prospect, IL 60056 ..... 312-390-6680; 800-323-6693
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
† Robert Shaw Instrument Div., Kendall Lane, Natick, MA 01760 617-875-9711
Samarius Precision Instruments, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418 203-735-7405
Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 608-935-2707
§† Spectrol Electronics, 17070 East Gale Ave., City of Industry, CA 91745 .. 818-964-6565
§ Temposonics, MTS Sys. Corp., 111 East Ames Ct., Plainview, NY 11803 516-349-1950
Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502 .. 303-242-0810
§ Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 .. 215-644-1300
† Waters Manufacturing, Inc., Talley Industries, Longfellow Ctr., Wayland, MA 01778 617-358-2777

Potentiometers, Metal Film-4750

§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•2059
Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1878-1879
IET Labs, Inc., 534 Main St., Westbury, NY 11590, 516-334-5959 ..... D•1272
Preh Electronic Industries, Inc., 470 E. Main St., Lake Zurich, IL 60047-2578, 312-438-4000 ..... A•2098
Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405, 818-781-1642 ... A•2099
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., 565 West Golf Road, Arlington Heights, IL 60005, 312-364-7277 ..... A•2101
Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ..... A•2103
§ Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ..... A•2105
§† VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181 ..... A•2109
International Resistive Company, P.O. Box 1860, Boone, NC 28607 704-264-8861
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
§† Mepcopal Company, 11468 Sorrento Valley Rd., San Diego, CA 92121 .. 619-453-0332
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 608-935-2707
Topflight, 160 East 9th Ave., York, PA 17404 ..... 717-843-9901;800-233-9386

Potentiometers, Metal, Glazed — See Potentiometers, Ceramic Metal (Vol. A)

Potentiometers, Motorized-4750

Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ..... A•2064

§ ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, 619-757-7770 ..... A•2071,2073, B•1205
† JDK Controls, Inc., 2630 Lavery Ct., Suite F, Newbury Park, CA 91320-1593, 805-499-7779 ..... A•2075
† Maurey Instrument Corp., 4555 W. 60th St., Chicago, IL 60629, 312-581-4555 ..... A•2082
§† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700
† Carter Manufacturing Corporation, 237 Sugar Road, Bolton, MA 01740 .. 617-779-5501
† Industrial Control Co., 3100 Pineda Ave., Rockledge, FL 32955 305-259-7105
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
Novotechnik U.S., Inc., Village Plaza, 488 Boston Post Rd., Rte. 20 E., Marlborough, MA 01752 617-485-2244
Robert Shaw Instrument Div., Kendall Lane, Natick, MA 01760 617-875-9711
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100

Potentiometers, Multiturn-4750

§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•2059-2060
§† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635, 714-447-2700 ..... A•2063
§† Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ..... A•2064,2066-2067
§ ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, 619-757-7770 ..... A•2070-2073, B•1205
IET Labs, Inc., 534 Main St., Westbury, NY 11590, 516-334-5959 ..... D•1272
† Maurey Instrument Corp., 4555 W. 60th St., Chicago, IL 60629, 312-581-4555 ..... A•2082
Mepcopal Company, 11468 Sorrento Valley Rd., San Diego, CA 92121, 619-453-0332 ..... A•2089
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•2092
Precision Control Manufacturing, Inc., 1509 B Queen Anne Ave. N., Seattle, WA 98109, 206-281-9380 ..... A•2097
§ Preh Electronic Industries, Inc., 470 E. Main St., Lake Zurich, IL 60047-2578, 312-438-4000 ..... A•2098
† Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405, 818-781-1642 ... A•2099
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., 565 West Golf Road, Arlington Heights, IL 60005, 312-364-7277 ..... A•2101
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ..... A•2103, B•1030
§† VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181 ..... A•2107-2108
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134 408-946-6000
§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., 3 Washington St., Dover, NH 03820 603-742-1120
Components Div., Sangamo Weston, Inc., Box 128, Pickens, SC 29671 .. 803-878-6311
§ CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
CTS Corp., Resistor Network Div., (Formerly CTS Corp., Berne Div.), 406 Parr Rd., Berne, IN 46711 219-589-3111
† Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626 714-545-8261
§ ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 ..... 516-753-0400; 800-862-2101
§ Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101 718-361-0800
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
Novotechnik U.S., Inc., Village Plaza, 488 Boston Post Rd., Rte. 20 E., Marlborough, MA 01752 617-485-2244
§† Penny & Giles, 1640 Fifth Street, Suite 224, Santa Monica, CA 90401 ... 213-393-1497
† Perkin-Elmer Corp., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132 203-762-4786
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
Samarius Precision Instruments, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418 203-735-7405
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Spectrol Electronics, 17070 East Gale Ave., City of Industry, CA 91745 .. 818-964-6565
† Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502 .. 303-242-0810

Potentiometers, Nonlinear-4750

§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•2059
§† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635, 714-447-2700 ..... A•2063
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ..... A•2065
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590, 516-935-3640 ..... A•2068
ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, 619-757-7770 ..... B•1205
† JDK Controls, Inc., 2630 Lavery Ct., Suite F, Newbury Park, CA 91320-1593, 805-499-7779 ..... A•2075
Mallory Timers, Emhart Elec./Elctrn. Grp., 3029 E. Washington St., Indianapolis, IN 46201, 317-636-5353 ..... A•2077
† Maurey Instrument Corp., 4555 W. 60th St., Chicago, IL 60629, 312-581-4555 ..... A•2082
Mepco/Centralab, North American Philips Corporation, Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501, 515-573-1300 ..... A•2087
§ Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..... A•2095
§ Preh Electronic Industries, Inc., 470 E. Main St., Lake Zurich, IL 60047-2578, 312-438-4000 ..... A•2098
Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405, 818-781-1642 ... A•2099
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ..... A•2103, B•1030
§ VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181 ..... A•2109
† Carter Manufacturing Corporation, 237 Sugar Road, Bolton, MA 01740 .. 617-779-5501
Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., 3 Washington St., Dover, NH 03820 603-742-1120
† CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
† Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626 714-545-8261
† Electronic Controls, Inc., 431 Park Industrial Dr., La Habra, CA 90631 213-697-4189
§ Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101 718-361-0800
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
§ Mallory Components Division, Emhart Elec./Elctrn. Grp., 222 Dixon Rd., Weston, Ont., CANADA M9P 3S5 416-244-4239
Mepco/Centralab Corp. Hdqrtr., North American Philips Corporation, 2001 W. Blue Heron Blvd., Riviera Beach, FL 33404 407-881-3200
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
§† Penny & Giles, 1640 Fifth Street, Suite 224, Santa Monica, CA 90401 ... 213-393-1497
† Perkin-Elmer Corp., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132 203-762-4786
§ Piher International Corp., 903 Feehanville Dr., Mt. Prospect, IL 60056 ..... 312-390-6680; 800-323-6693
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
† Robert Shaw Instrument Div., Kendall Lane, Natick, MA 01760 617-875-9711
Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Spectrol Electronics, 17070 East Gale Ave., City of Industry, CA 91745 .. 818-964-6565
Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502 .. 303-242-0810
Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 .. 215-644-1300
Waters Manufacturing, Inc., Talley Industries, Longfellow Ctr., Wayland, MA 01778 617-358-2777

Potentiometers, Power — See Rheostats (Vol. A)

Potentiometers, Pushbutton-4750

Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ..... A•2064
ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, 619-757-7770 ..... A•2073, B•1205
Maurey Instrument Corp., 4555 W. 60th St., Chicago, IL 60629, 312-581-4555 ..... A•2084
J. R. Merritt Controls, Inc., 8 Crimmins Rd., Darien, CT 06820 203-656-0143

Potentiometers, Rectilinear-4750

§† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635, 714-447-2700 ..... A•2063
§ Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ..... A•2066
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590, 516-935-3640 ..... A•2068
§ ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, 619-757-7770 ..... A•2070,2072, B•1205
† JDK Controls, Inc., 2630 Lavery Ct., Suite F, Newbury Park, CA 91320-1593, 805-499-7779 ..... A•2075
Novotechnik U.S., Inc., Village Plaza, 488 Boston Post Rd., Rte. 20 E., Marlborough, MA 01752, 617-485-2244 ..... B•1900
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., 565 West Golf Road, Arlington Heights, IL 60005, 312-364-7277 ..... A•2101
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ..... A•2103
§ VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181 ..... A•2108
§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
† Carter Manufacturing Corporation, 237 Sugar Road, Bolton, MA 01740 .. 617-779-5501
Components Div., Sangamo Weston, Inc., Box 128, Pickens, SC 29671 .. 803-878-6311
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900
CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
CTS Corp., Resistor Network Div., (Formerly CTS Corp., Berne Div.), 406 Parr Rd., Berne, IN 46711 219-589-3111
† Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626 714-545-8261
† Electronic Controls, Inc., 431 Park Industrial Dr., La Habra, CA 90631 213-697-4189
† Humphrey, Inc., 9212 Balboa Ave., San Diego, CA 92123 619-565-6631
§ ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 ..... 516-753-0400; 800-862-2101
§ Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101 718-361-0800
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
† Penny & Giles, 1640 Fifth Street, Suite 224, Santa Monica, CA 90401 ... 213-393-1497
† Robert Shaw Instrument Div., Kendall Lane, Natick, MA 01760 617-875-9711
† Samarius Precision Instruments, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418 203-735-7405
Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§† Spectrol Electronics, 17070 East Gale Ave., City of Industry, CA 91745 .. 818-964-6565
§ Temposonics, MTS Sys. Corp., 111 East Ames Ct., Plainview, NY 11803 516-349-1950
§ Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 .. 215-644-1300
Waters Manufacturing, Inc., Talley Industries, Longfellow Ctr., Wayland, MA 01778 617-358-2777

Potentiometers, Servo Mount-4750

§† Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ..... A•2064

§ ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, 619-757-7770 ..... A•2072,2074, B•1205
† JDK Controls, Inc., 2630 Lavery Ct., Suite F, Newbury Park, CA 91320-1593, 805-499-7779 ..... A•2075
§† Maurey Instrument Corp., 4555 W. 60th St., Chicago, IL 60629, 312-581-4555 ..... A•2078,2081
Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405, 818-781-1642 ... A•2099
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ..... A•2103
§ VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181 ..... A•2107
† Waters Manufacturing, Inc., Talley Industries, Longfellow Ctr., Wayland, MA 01778, 617-358-2777 ..... A•2111
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
§† Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
§† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700
† Carter Manufacturing Corporation, 237 Sugar Road, Bolton, MA 01740 .. 617-779-5501
† Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626 714-545-8261
† Electronic Controls, Inc., 431 Park Industrial Dr., La Habra, CA 90631 213-697-4189
§ Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101 718-361-0800
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
† Novotechnik U.S., Inc., Village Plaza, 488 Boston Post Rd., Rte. 20 E., Marlborough, MA 01752 617-485-2244
† Penny & Giles, 1640 Fifth Street, Suite 224, Santa Monica, CA 90401 ... 213-393-1497
† Robert Shaw Instrument Div., Kendall Lane, Natick, MA 01760 617-875-9711
† Samarius Precision Instruments, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418 203-735-7405
Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§† Spectrol Electronics, 17070 East Gale Ave., City of Industry, CA 91745 .. 818-964-6565
Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502 .. 303-242-0810

Potentiometers, Sliding-4750

Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ..... A•2065
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590, 516-935-3640 ..... A•2068
ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, 619-757-7770 ..... A•2070,2072, B•1205
§ Preh Electronic Industries, Inc., 470 E. Main St., Lake Zurich, IL 60047-2578, 312-438-4000 ..... A•2098
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., 565 West Golf Road, Arlington Heights, IL 60005, 312-364-7277 ..... A•2101
Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626 714-545-8261
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
Novotechnik U.S., Inc., Village Plaza, 488 Boston Post Rd., Rte. 20 E., Marlborough, MA 01752 617-485-2244

Potentiometers, Surface Mount-4750

§† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635, 714-447-2700 ..... A•2063
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ..... A•2066-2067
§ Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282, 602-967-7874 ..... A•2069
ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, 619-757-7770 ..... A•2072, B•1205
Micro-Ohm Corp., 1088 Hamilton Rd., Duarte, CA 91010, 818-3575377 ... A•1966
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•2090
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., 565 West Golf Road, Arlington Heights, IL 60005, 312-364-7277 ..... A•2100
§ ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 ..... 516-753-0400; 800-862-2101
§ Kyocera Northwest, Electronic Components Group, P.O. Box 85542, San Diego, CA 92138-5542 619-576-2600
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
§ Piher International Corp., 903 Feehanville Dr., Mt. Prospect, IL 60056 ..... 312-390-6680; 800-323-6693
Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
Wilbrecht Electronics, 346 Chester St., St. Paul, MN 55107 612-222-2791

Potentiometers, Trimmer-4750

§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•2059-2060
§† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635, 714-447-2700 ..... A•2063
§† Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ..... A•2065-2067
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590, 516-935-3640 ..... A•2068
CTS Corp., Electromechanical Div., (Formerly Elkhart Div.), 1142 W. Beardsley Ave., Elkhart, IN 46514, 219-295-3575 ..... A•1910
CTS Corporation, Switch Div., Paso Robles, 500 Linne Rd., Paso Robles, CA 93446, 805-238-0350 ..... B•1686
§ Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282, 602-967-7874 ..... A•2069
IET Labs, Inc., 534 Main St., Westbury, NY 11590, 516-334-5959 ..... D•1272
§† Maurey Instrument Corp., 4555 W. 60th St., Chicago, IL 60629, 312-581-4555 ..... A•2078
§† Mepcopal Company, 11468 Sorrento Valley Rd., San Diego, CA 92121, 619-453-0332 ..... A•2088-2089
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•2090-2092
† Novotechnik U.S., Inc., Village Plaza, 488 Boston Post Rd., Rte. 20 E., Marlborough, MA 01752, 617-485-2244 ..... B•1900
§ Piher International Corp., 903 Feehanville Dr., Mt. Prospect, IL 60056, 312-390-6680;800-323-6693 ..... A•2096
§ Preh Electronic Industries, Inc., 470 E. Main St., Lake Zurich, IL 60047-2578, 312-438-4000 ..... A•2098
† Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405, 818-781-1642 ... A•2099
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., 565 West Golf Road, Arlington Heights, IL 60005, 312-364-7277 ..... A•2100
§† Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ..... A•2105
§† VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181 ..... A•2108, B•1031
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134 408-946-6000
§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., 3 Washington St., Dover, NH 03820 603-742-1120
Components Div., Sangamo Weston, Inc., Box 128, Pickens, SC 29671 .. 803-878-6311
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900
§ CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
§ CTS Corp., Resistor Network Div., (Formerly CTS Corp., Berne Div.), 406 Parr Rd., Berne, IN 46711 219-589-3111
† EMCA, Sub. Rohm and Haas Advanced Matls. Co., 605 Center Ave., Mamaroneck, NY 10543 914-698-8434
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
§ ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 ..... 516-753-0400; 800-862-2101
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 .. 516-937-3475
Mel-Rain Controls, 42974 M-43 Hwy., Paw Paw, MI 49079 616-657-2527
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
§ Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
Philips Electronics Ltd., Elcoma Division, 601 Milner Avenue, Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
† Resistance Technology Inc., 1260 Red Fox Rd., St. Paul, MN 55112 612-636-9770
§† Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 608-935-2707
§† Spectrol Electronics, 17070 East Gale Ave., City of Industry, CA 91745 .. 818-964-6565
† Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502 .. 303-242-0810
† Wilbrecht Electronics, 346 Chester St., St. Paul, MN 55107 612-222-2791

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§† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635, 714-447-2700 ..... A•2063
§† Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ..... A•2064,2066-2067
§† ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, 619-757-7770 ..... A•2070-2073, B•1205
§ Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101, 718-361-0800 ..... C•1607,1610
Mallory Timers, Emhart Elec./Elctrn. Grp., 3029 E. Washington St., Indianapolis, IN 46201, 317-636-5353 ..... A•2077
§† Maurey Instrument Corp., 4555 W. 60th St., Chicago, IL 60629, 312-581-4555 ..... A•2078-2080,2082
Memcor-Truohm, Inc., 1320 Flaxmill Rd., Huntington, IN 46750, 219-356-4300 ..... A•2086
Mepco/Centralab, North American Philips Corporation, Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501, 515-573-1300 ..... A•2087
§ Mepcopal Company, 11468 Sorrento Valley Rd., San Diego, CA 92121, 619-453-0332 ..... A•2089
§† Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..... A•2094-2095

Precision Control Manufacturing, Inc., 1509 B Queen Anne Ave. N., Seattle, WA 98109, 206-281-9360 ..... A•2097
Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405, 818-781-1642 ... A•2099
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., 565 West Golf Road, Arlington Heights, IL 60005, 312-364-7277 ..... A•2100-2101
§† VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181 ..... A•2107-2108, B•1031
† Carter Manufacturing Corporation, 237 Sugar Road, Bolton, MA 01740 .. 617-779-5501
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Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900
CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
† Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626 714-545-8261
† Electronic Controls, Inc., 431 Park Industrial Dr., La Habra, CA 90631 213-697-4189
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† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
§ Mallory Components Division, Emhart Elec./Elctrn. Grp., 222 Dixon Rd., Weston, Ont., CANADA M9P 3S5 416-244-4239
† Mel-Rain Controls, 42974 M-43 Hwy., Paw Paw, MI 49079 616-657-2527
Mepco/Centralab Corp. Hdqrtr., North American Philips Corporation, 2001 W. Blue Heron Blvd., Riviera Beach, FL 33404 407-881-3200
J. R. Merritt Controls, Inc., 8 Crimmins Rd., Darien, CT 06820 203-656-0143
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
Novotechnik U.S., Inc., Village Plaza, 488 Boston Post Rd., Rte. 20 E., Marlborough, MA 01752 617-485-2244
† Penny & Giles, 1640 Fifth Street, Suite 224, Santa Monica, CA 90401 ... 213-393-1497
† Perkin-Elmer Corp., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132 203-762-4786
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
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§† Spectrol Electronics, 17070 East Gale Ave., City of Industry, CA 91745 .. 818-964-6565
† Tech Labs., Inc., 500 10th St., Palisades Pk., NJ 07650 201-944-2221
Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502 .. 303-242-0810
§† Varistor Corp., 115 Industrial Pk., Sevierville, TN 37862 615-453-0001
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100
† Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 .. 215-644-1300
† Waters Manufacturing, Inc., Talley Industries, Longfellow Ctr., Wayland, MA 01778 617-358-2777
Wilbrecht Electronics, 346 Chester St., St. Paul, MN 55107 612-222-2791
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

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† Anghel Laboratories, Inc., 3 Route 46 West, Fairfield, NJ 07006 201-575-1116
Eaton Corporation, Microwave Products Division, 785 Palomar Ave., Sunnyvale, CA 94086 408-730-6410
FG Engineering, Box 476, Fredonia, AZ 86022 602-643-7375
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
† Lorch Electronics, Sub. of Vernitron Corp., 105 Cedar La., Englewood, NJ 07631 201-569-8282
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 .... 315-437-3953; 800-448-1666
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
Varian Associates, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

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Bell, F. W., Inc., 6120 Hanging Moss Rd., Orlando, FL 32807, 407-678-6900 ..... D•1122,1222-1223
Magnetic Instrumentation, 8350 E. 48TH ST., Indianapolis, IN 46226, 317-545-2102 ..... D•1289
Magnos, 6 Old School House Rd., Harvard, MA 01451, 617-456-8880 .... D•1290
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, OH 43212, 614-486-9561 ..... B•1917
Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... A•2143
Active Control Instrumentation, P.O. Box 243-Wildwood Circle, Key Largo, FL 33037 305-451-1000
Cryomagnetics, Inc., 739 Emory Valley Rd., Oak Ridge, TN 37830 615-482-9551
Dowty RFL Inds. Inc./Instrumentation Div., The Dowty Grp. PLC, Powerville Rd., Boonton, NJ 07005-0239 201-334-3100
§ Fluke, John, Manufacturing Co., Box C9090, MS 250C, Everett, WA 98206 206-356-5400
LDJ Incorporated, 2200 Stephenson Hwy., P.O. Box 219, Troy, MI 48099-0219 313-528-2202
§ Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
§ C. G. Soar, Inc., 434 Windsor Pk. Dr., Dayton, OH 45459 513-434-7643
§ Sunshine Scientific Instruments, 1810 Grant Ave., Philadelphia, PA 19115 215-673-5600
Walker Scientific, Rockdale St., Worcester, MA 01606 .... 617-852-3674;617-853-3232

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Probes, Logic Test-2900 — *See Vol. D*

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† General Microwave Corporation, 5500 New Horizons Blvd., Amityville, NY 11701 516-226-8900
GGB Industries, Inc., Picoprobe Division, P.O. Box 125, Gillette, NJ 07933 201-464-1749
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
† Maury Microwave Corp., 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Narda Microwave Corp., Subsidiary of Loral Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
Picosend Pulse Labs, Inc., P.O. Box 44, Boulder, CO 80306 303-443-1249
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
Probe-Rite, Inc., P.O. Box 242, Santa Clara, CA 95052 408-727-0100
Tektronix, Inc., P.O. Box 500, 76/260, Beaverton, OR 97077 800-835-9433
§† Telephonics Corporation/PRD Instruments, 770 Park Avenue, Huntington, NY 11743 ..... 516-549-6415/6102

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Programmers, Power-2200 — *See Vol. D*

Programmers, Power Supply-4000 — *See Vol. D*

Programmers, PROM & Logic Array-3130

Epson America, Inc., 3415 Kashiwa St., Torrance, CA 90505, 213-534-4500 ..... A•1395
Genstar Rental Electronics, Inc., 6307 De Soto Ave., Suite J, Woodland Hills, CA 91367, 800-331-3440 (in CA);800-227-8409 ..... D•1257
Magnum Opus Custom Elctrn. Engrg., 284 Kennedy St., Iselin, NJ 08830, 201-283-4925 ..... D•1113
Nohau Corporation, 51 E. Campbell Ave., Ste. 107E, Campbell, CA 95008, 408-866-1820;408-866-4493 ..... D•1304
PPM, Inc., 5385 Harper Rd., Cleveland, OH 44139, 216-349-2300 ..... D•1313
† Sunrise Electronics, Inc., 524 S. Vermont Ave., Glendora, CA 91740, 818-914-1926 ..... A•1758
Wintek Corp., 1801 South St., Lafayette, IN 47904-2993, 317-742-8428;800-742-6809 ..... D•1116
Ango Electronics Corp., 16 North Third St., Harrison, NJ 07029 201-484-1115
Applied Micro Technlg., A Burr Brown Co., 3669 E. 44th Street, Tucson, AZ 85713 602-622-8605
Barber-Colman Co., Indl. Instrs. Div., P.O. Box 2940, 1354 Clifford Ave., Loves Park, IL 61132 815-877-0241
§† BYTEK Corp., Instrument Systems Div., 1021 S. Rogers Circle, Boca Raton, FL 33431 305-994-3520
§ Curtis Electro Devices, Inc., Box 4090, Mountain View, CA 94040 415-964-3846
Cybernetic Micro Sys., P.O. Box 3000, 3000 Hwy. 84, San Gregorio, CA 94074 415-726-3000
Data I/O Corp., 10525 Willows Rd. N.E., Redmond, WA 98073-9746 206-881-6444
† Datron Instrs., Inc., 3401 SW 42nd Ave., Stuart, FL 33497 305-283-0935
Digital Equip., One Iron Way, Marlborough, MA 01752
§ Digital Media, 11770 Warner Ave., Ste. 225, Fountain Valley, CA 92708 714-751-1373
Dynatec International, 3594 West 1820 South, Salt Lake City, UT 84104 ..... 801-973-9500;800-722-7425
Eventide, Inc., One Alsan Way, Little Ferry, NJ 07643 .... 201-641-1200;800-446-7878
§† Exel Microelectronics, Inc., Sub. of Exar Corp., 2150 Commerce Dr., San Jose, CA 95131 408-432-0500
Global Technology International, Inc., 917-134th Street S.W., Everett, WA 98204 206-742-9111
§ GMR Co., 8801 Sepulveda Blvd., Los Angeles, CA 90045 213-216-9516

§ International Instrumentation, Inc., 2282 Townsgate Rd., Westlake Vlg., CA 91361 805-495-7673
§† International Microsystems, 461 Valley Way, Milpitas, CA 95035 800-237-4734
The IVYnet Company, One Gale Rd., Brick, NJ 08723 201-920-6807
§ Klockner Moeller, 4 Strathmore Rd., Natick, MA 01760 617-655-1910
§ Kontron Elctrns., 630 Clyde Avenue, Mountain View, CA 94039-7230 ... 415-965-7020
§ Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
Oliver Advanced Engineering, 320 W. Arden St., Glendale, CA 91203 818-240-0080
Perx, 1730 S. Amphlett Blvd., Ste. 222, San Mateo, CA 94402 415-573-0801
Pro-Log, 2411 Garden Rd., Monterey, CA 93940 408-372-4593
§ Rockwell Int'l., 4311 Jamboree Rd., Newport Beach, CA 92660 800-854-8099
§ Southern Computer Corp., 141 W. Wieuca Rd., Ste. 300-B, Atlanta, GA 30342 404-252-3340
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
U.S. Instr. Rentals, 2988 Campus Dr., San Mateo, CA 94403 800-824-2873
Xycom, 750 N. Maple Rd., Saline, MI 48176 313-429-4971

Programmers, Punched Card-2000 — *See Vol. D*

Programmers, Tape-2000 — *See Vol. D*

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Quartz, Fused-2300

† Accumet Engineering, 518 Main St., Hudson, MA 01749 617-568-8311
§† Atomergic Chemetals Corp., 91 Carolyn Blvd., Farmingdale, NY 11735-1527 516-694-9000
† Centerflex Techn. Corp., 221 Seventh Ave., P.O. Box 21, Hawthorne, NJ 07507 201-423-0505
Materials Research Corporation, Route 303, Orangeburg, NY 10962 914-359-4200
† Quartzite Processing, Inc., 6 Holyoke St., Malden, MA 02148 617-322-3611
Thermal Amer. Fused Quartz, Route 202, Montville, NJ 07045 201-334-7770

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Racks, Desk & Console — See Enclosures, Equipment & Panel Mounting (Vol. C)

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Radar Homing & Warning (RHAW) Systems (MIL)-3475 — *See Vol. D*

Radar Intercept (MIL)-3475 — *See Vol. D*

Radar (MIL), Tail Warning-3475 — *See Vol. D*

Radar Systems (MIL), Elint-3475 — *See Vol. D*

Radar System Components-3450

† Applied Research, Inc., 111 New South Rd., Hicksville, NY 11802, 516-938-9700 ..... A•1764
Comstron Corp., 10 Hub Dr., Melville, NY 11747, 516-756-1100 ..... A•1359
GSI Corp., 1917 Greenspring Dr., Timonium, MD 21093, 301-252-1768 ... C•1851
† Interface Engineering Inc., 275/300 Centre St., Unit 7, Holbrook, MA 02343, 617-986-2600 ..... D•1170
† Aiken Advanced Systems, Inc., Amstar Electronics Group, 5901 Edsall Rd., Alexandria, VA 22304-4197 703-370-0900
† Alden Electronics, Inc., 40 Washington Street, Westboro, MA 01581 617-366-8851
† Alpha Industries, Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St., Methuen, MA 01844 617-682-4661
† Anghel Laboratories, Inc., 3 Route 46 West, Fairfield, NJ 07006 201-575-1116
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-727-0700
Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
Aydin Corp., 700 Dresher Rd., Horsham, PA 19044 215-657-7510
† Cincinnati Elctrns., 2630 Glendale Milford Rd., Cincinnati, OH 45241 513-733-6100
Cober Electronics, 102 Hamilton Ave., Stamford, CT 06902 203-327-0003
Continental Electronics, Division of Varian Associates, Inc., P.O. Box 270879, Dallas, TX 75227 214-381-7161
† Datron Systems, Inc., 200 West Los Angeles Ave., Simi Valley, CA 93065-1650 805-584-1717
† Eaton Corp., AIL, Commack Rd., Deer Park, NY 11729 516-595-3094
† Electro-Magentic Processes, Inc., Subsidiary of ISC Group, Inc., 9616 Owensmouth Ave., Chatsworth, CA 91311-4858 818-882-6333
Epsilon-Lambda Elctrns. Corp., 427 Stevens St., Geneva, IL 60134 312-232-9611
Erbtec Engineering, Inc., 2760 29th St., Boulder, CO 80301 303-447-8750
† FEI Microwave, Inc., Frequency Electronics, Inc., 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
† Honeywell Inc., Aerospace & Defense Grp., Honeywell Plaza, Minneapolis, MN 55408 612-870-5186
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509-2999 213-517-6000
† ISC Cardion Electronics, Inc., Long Island Expwy., Woodbury, NY 11797 516-921-7300
† ITT Gilfillan, ITT Corp., 7821 Orion Ave., P.O. Box 7713, Van Nuys, CA 91409 818-988-2600
Lectronic Research Labs., Inc., 1423 Ferry Ave., Camden, NJ 08104 609-541-4200
† Litton Systems, Inc., Electron Dvcs. Div., 960 Industrial Rd., San Carlos, CA 94070 415-591-8411
Mathematical Systems Design, Inc., 11835 W. Olympic Blvd., Suite 745, Los Angeles, CA 90064 213-479-7180
† Merrimac Industries, 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
† Metric Systems, 645 Anchors St., Ft. Walton Beach, FL 32548-9990 904-244-9600
† Microwave Systems Inc., 6075 E. Molloy Rd., Syracuse, NY 13211-2100 315-437-9951
† Milliflect, 37444 Sycamore St., Bldg. A, Newark, CA 94560 415-791-5188
† North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542 516-671-5700
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
Programmed Test Sources, Beaver Brook Rd., P.O. Box 517, Littleton, MA 01460 617-486-3008
† Radio Research Instrument Co., Inc., 584 North Main Street, Waterbury, CT 06704-3506 203-753-5840
† RHG Electronics Laboratory, Inc., Adams Russell, 161 E. Industry Ct., Deer Park, NY 11729 516-242-1100
† Sage Laboratories, Inc., 11 Huron Dr., Natick, MA 01760 617-653-0844
Sanders Associates, Inc., ECBD, A Lockheed Company, 955 Perimeter Rd., Manchester, NH 03108-8500 603-645-5548
† Sanders Associates, Inc., Microwave, 955 Perimeter Rd., Manchester, NH 03108 ..... 603-645-6000 Ext. 4299
† Signatron, A Unit of Sundstrand Corp., 110 Hartwell Ave., Lexington, MA 02173 617-861-1500
† Singer Co., Electronic Systems Div., 164 Totowa Rd., Wayne, NJ 07470 201-785-6000
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Teledyne Micronetics, 7155 Mission Gorge Rd., San Diego, CA 92120 .. 619-583-3525
Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
† Texas Instrs., Inc., Box 809066, Dallas, TX 75380 ..... 800-232-3200 (ext 700)
Texscan Instruments, Texscan Corporation, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
† Thermacore Inc., 780 Eden Road, Lancaster, PA 17601 717-569-6551
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E-8, Tampa, FL 33634 813-884-1411
§† Vega Precision Labs., 800 Follin La., Vienna, VA 22180 703-938-6300
† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100
† Whittaker Corp., 10880 Wilshire Blvd., Los Angeles, CA 90024 213-475-9411

Radio Communications Systems — See Communications Systems (Vol. D)

Radiographic Equip. — See X-ray Inspection Equip. (Vol. D)

Radiometers-2900 — *See Vol. D*

Radomes & Windows, Microwave-3450

† Alpha Industries, Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150

Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St, Methuen, MA 01844 617-682-4661
Corning Glass Works, Corning Elctrns., Houghton Pk, Bldg. A-2, Corning, NY 14830 607-974-8725
† Electronic Space Systems Corp., Old Powder Mill Rd., Concord, MA 01742 617-369-7200
† Gabriel Electronics, Box 70, Scarborough Indl. Pk., Scarborough, ME 04074 207-883-5161
† Milliflect, 37444 Sycamore St., Bldg. A, Newark, CA 94560 415-791-5188
† Mitec Electronics, 104 Gun Avenue, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
Sanders Associates, Inc., ECBD, A Lockheed Company, 955 Perimeter Rd., Manchester, NH 03108-8500 603-645-5548
† Teledyne Micronetics, 7155 Mission Gorge Rd., San Diego, CA 92120 .. 619-583-3525
† Transco Products, Inc., 1001 Flynn Rd., Camarillo, CA 93011-6003 805-987-8007

Reactors, Charging-5600

Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
Electrocom Industries, 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Hipotronics Inc., P.O. Drawer A, Brewster, NY 10509 914-279-8091
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301 201-782-5525
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Perkin-Elmer Corp., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132 203-762-4786
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034 ... 215-643-6950
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
† Radio Research Instrument Co., Inc., 584 North Main Street, Waterbury, CT 06704-3506 203-753-5840
§† Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
† Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torelco, Inc., 14 Paine Ave., P. O. Box 560, Irvington, NJ 07111 201-374-8641
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Reactors, Epitaxial — See Machines & Accessories, Semiconductor Manufacturing (Vol. D)

Reactors, Filter-5600

Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301, 201-782-5525 ..... A•2240
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 ..... A•2303, D•1857
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1270
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025
Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010
American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
Andover, Inc., 310 North Earl Avenue, Lafayette, IN 47904 317-447-1157
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
Electrocom Industries, 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
† Genisco Technology Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
§ Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582 516-561-6050
† Northlake Engineering, Inc., 999 Anita Ave., Antioch, IL 60002 312-395-5710
NWL Capacitors, NWL Transformers, 8050 Monetary Dr., Riviera Bch., FL 33404 305-848-9009
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
† Perkin-Elmer Corp., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132 203-762-4786
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034 ... 215-643-6950
PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
§ QPL Magnetics, Inc., P.O.BOX C, Lake Grove, NY 11755 516-589-3331
Rapid Power Technologies, Graysbridge Rd., P.O.BOX 291, Brookfield, CT 06804 ..... 203-775-0411;800-332-1111
† Raytheon Co., Microwave & Power Tube Div., 190 Willow St., Waltham, MA 02154 617-899-8400
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729 ..... 516-586-5566; 1-800-645-5828
† Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
§† Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
Staco Transpower, 610 W. 6th St., Mt. Carmel, IL 62863 618-262-5555
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
§† Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Todd Systems, Inc., 50 Ash St., Yonkers, NY 10701 914-963-3400
Torelco, Inc., 14 Paine Ave., P. O. Box 560, Irvington, NJ 07111 201-374-8641
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199 816-761-6314
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
Wilco Corp., 6451 Saguaro Court, Indianapolis, IN 46268 317-293-9300
† Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 ... 602-861-1856
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Reactors, Loading-5600

§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
Electrocom Industries, 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Genisco Technology Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301 201-782-5525
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582 516-561-6050
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034 ... 215-643-6950
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600
Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 ... 602-861-1856
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Reactors, Saturable-1800

Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208
Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301, 201-782-5525 ..... A•2240
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 ..... A•2303
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2351
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
† Bicron Electronics, 100 Barlow Street, Canaan, CT 06018 203-824-5125
† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
Cross Electronics, 100 Commonwealth Dr., Warrendale, PA 15086 412-776-1591
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electrocom Industries, 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5770 Thornwood Dr., Goleta, CA 93117 805-964-0751
Elma Engineering, 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hipotronics Inc., P.O. Drawer A, Brewster, NY 10509 914-279-8091
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
† Industrial Control Co., 3100 Pineda Ave., Rockledge, FL 32955 305-259-7105
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
§ Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582 516-561-6050
† Northlake Engineering, Inc., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† Oram High Voltage, P.O. Box 1176, Dayton, TX 77535 409-258-5553
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
† Perkin-Elmer Corp., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132 203-762-4786
Rapid Power Technologies, Graysbridge Rd., P.O.BOX 291, Brookfield, CT 06804 ..... 203-775-0411;800-332-1111
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729 ..... 516-586-5566; 1-800-645-5828
Sigma Instuments, Pacific Scientific, 170 Pearl St., Braintree, MA 02184 617-843-5000
§† Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torelco, Inc., 14 Paine Ave., P. O. Box 560, Irvington, NJ 07111 201-374-8641
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199 816-761-6314
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800

§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
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§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

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Rectifier Assemblies-4800

American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ..... A•2115
§ Crydom Company, 17215 Studebaker Rd., No. 328, Cerritos, CA 90701, 213-865-3536 ..... B•1397
§ Silicon Power Cube Corp., 6015 Obispo Ave., Long Beach, CA 90805, 213-634-9390 ..... B•1586-1588
§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
§† Electronic Devices, Inc., 21 Gray Oaks Ave., Yonkers, NY 10710 914-965-4400
§ Microsemi Corp. Colorado, Microsemi Corp., 800 Hoyt St., Broomfield, CO 80020 303-469-2161
Renard Manufacturing Company, Inc., 3131 N.W. 79th Avenue, Miami, FL 33122-1011 305-592-1500
§ RMC Power Semiconductor, BBC, 2150 W. 6th Ave., Broomfield, CO 80020 ..... 303-469-1883;1-800-992-0312
§ Semikron, Inc., 11E Executive Dr., P.O. Box 66, Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443

Rectifiers, Blocks-4800

Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
§† Electronic Devices, Inc., 21 Gray Oaks Ave., Yonkers, NY 10710 914-965-4400
RMC Power Semiconductor, BBC, 2150 W. 6th Ave., Broomfield, CO 80020 ..... 303-469-1883;1-800-992-0312
§ Semikron, Inc., 11E Executive Dr., P.O. Box 66, Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308

Rectifiers, Bridges & Assemblies-4800

American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ..... A•2115
Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876, 401-762-3800 ..... A•2117
§ Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2128-2129
§ Crydom Company, 17215 Studebaker Rd., No. 328, Cerritos, CA 90701, 213-865-3536 ..... B•1397
§† Electronic Devices, Inc., 21 Gray Oaks Ave., Yonkers, NY 10710, 914-965-4400 ..... A•2131
§ Fagor Elctrn. Comps., Inc., Natl. Mktg. Sls. Offs., Fagor Electrotecnica S. Coop., 8419 Canoga Ave., Canoga Pk., CA 91304, 818-718-2500;800-624-5367 ..... A•2133

† **NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300** ..... **D•1857**
Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... **A•2134**
§ **Powerex, Westinghouse, GE, Mitsubishi, Hillis St., Youngwood, PA 15697, 412-925-7272** ..... **A•2136**
§ **Silicon Power Cube Corp., 6015 Obispo Ave., Long Beach, CA 90805, 213-634-9390** ..... **B•1586-1588**
† **Voltage Multipliers, Inc., 8711 W. Roosevelt Ave., Visalia, CA 93291, 209-651-1402** ..... **A•2151**
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A E G Telefunken, High Power Grp., Rte. 22, Orr Dr., Somerville, NJ 08876 201-722-9800
Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
Allen Bradley Co., Electronics Group, Div. of Rockwell Corp., PTC Div., 23201 S. Normandie Ave., Torrance, CA 90501 213-534-3737
§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
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§ Codi Semiconductor, Inc., 144 Market St., Kenilworth, NJ 07033 201-298-0400
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§ Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-699-0918; 800-255-2666
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Hitachi America, Ltd., 2210 O'Toole Ave., San Jose, CA 95131 408-435-8300
Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301 201-782-5525
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§ International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
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Lambda Semiconductors, Veeco Instruments, 121 International Dr., Corpus Christi, TX 78410 ..... 512-289-0403;800-255-9606
Lark Electronics, Inc., Box 390, New York, NY 10040 212-569-0430
† Megatran Electronic Power, Rising Sun Rd., Bordentown, NJ 08505 609-298-7300
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NAE, 69 Bennett St., Lynn, MA 01905 617-598-4800
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NWL Capacitors, NWL Transformers, 8050 Monetary Dr., Riviera Bch., FL 33404 305-848-9009
Rapid Power Technologies, Graysbridge Rd., P.O.BOX 291, Brookfield, CT 06804 ..... 203-775-0411;800-332-1111
§ RMC Power Semiconductor, BBC, 2150 W. 6th Ave., Broomfield, CO 80020 ..... 303-469-1883;1-800-992-0312
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§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311
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§† **Electronic Devices, Inc., 21 Gray Oaks Ave., Yonkers, NY 10710, 914-965-4400** ..... **A•2131**

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Rectifiers, General Purpose, Surface Mount-4800

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§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
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Rectifiers, Germanium-4800

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§† Germanium Power Devices, Box 3065, Shawsheen Village Sta., Andover, MA 01810 617-475-5982
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§ NTE Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
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§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
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§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

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Rectifiers, Selenium-4800

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§ Thor Electronics, 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300

Rectifiers, Silicon-4800

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§† NAE, 69 Bennett St., Lynn, MA 01905 617-598-4800
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§ RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 201-685-6000
§ Reliance Electric Co., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199 800-245-4501
Renard Manufacturing Company, Inc., 3131 N.W. 79th Avenue, Miami, FL 33122-1011 305-592-1500
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Sanford-Miller Corp., 8 John St., Lynbrook, NY 11563 .... 516-593-2025;800-645-5900
§ Sanken Electric Co., Ltd., Overseas Operations, 1-22-8 Nishi-Ikebukuro, Toshima-ku, Tokyo, JAPAN 171 03-986-6164
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§ Semikron, Inc., 11E Executive Dr., P.O. Box 66, Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
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§† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311
Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
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Sussex Semiconductor, Inc., Rte. 206, Branchville, NJ 07826 201-948-3633
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§ Thor Electronics, 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
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§† Unitrode Corp., 580 Pleasant St., Watertown, MA 02172 617-926-0404
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§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

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Rectifiers, Surface Mount-4800

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† Voltage Multipliers, Inc., 8711 W. Roosevelt Ave., Visalia, CA 93291, 209-651-1402 ..... A•2151
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§ Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
Renard Manufacturing Company, Inc., 3131 N.W. 79th Avenue, Miami, FL 33122-1011 305-592-1500
§ Rohm Corporation, 8 Whatney, Irvine, CA 92718 714-855-2131
Sussex Semiconductor, Inc., Rte. 206, Branchville, NJ 07826 201-948-3633

Rectifiers, Ultrafast-4800

§ Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876, 401-762-3800 ..... A•2116-2117
§ Electronic Devices, Inc., 21 Gray Oaks Ave., Yonkers, NY 10710, 914-965-4400 ..... A•2131
† Voltage Multipliers, Inc., 8711 W. Roosevelt Ave., Visalia, CA 93291, 209-651-1402 ..... A•2151
Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
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§ International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
§ Microsemi Corp. Colorado, Microsemi Corp., 800 Hoyt St., Broomfield, CO 80020 303-469-2161
§ RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 201-685-6000
§ Sanken Electric Co., Ltd., Overseas Operations, 1-22-8 Nishi-Ikebukuro, Toshima-ku, Tokyo, JAPAN 171 03-986-6164
§† Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 805-498-2111
§† Silicon Transistor Corp., Katrina Rd., Chelmsford, MA 01824 617-256-3321

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Refrigerators, Environmental Test-2550 — *See Vol. D*

Regulators, Current-4000 — *See Vol. D*

Regulators, Frequency-4050 — *See Vol. D*

Regulators & References, Silicon-Also See Diodes, Zener & Stabistors-4800

Julie Research Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 ..... D•1280
ACD-Elcor Products, P.O. Box 244, Bethel, CT 06801 203-743-3510
§ A E G Corporation, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269 201-231-8300
§† Codi Semiconductor, Inc., 144 Market St., Kenilworth, NJ 07033 201-298-0400
Computer Power Inc., 124 W. Main St., High Bridge, NJ 08829 ..... 201-638-8000; 800-526-5088
Datel, Inc., 11 Cabot Blvd., Mansfield, MA 02048 617-339-3000
§† General Semiconductor Ind., Inc., Square D Company, 2001 W. 10 Pl., Tempe, AZ 85281 602-968-3101
Hitachi America, Ltd., 2210 O'Toole Ave., San Jose, CA 95131 408-435-8300
§ International Diode, 229 Cleveland Ave., Harrison, NJ 07029 201-482-6518
§ ITT Semiconductors, ITT Corp., 55 Merrimack St., So. Lawrence, MA 01843 617-688-1881
† Koep Precision Standards, Inc., IC Coan Place, Metuchen, NJ 08840 ..... 201-549-9280/9282
Lambda Semiconductors, Veeco Instruments, 121 International Dr., Corpus Christi, TX 78410 ..... 512-289-0403;800-255-9606
§† Linear Technology Corp., 1630 McCarthy Blvd., Milpitas, CA 95035 408-432-1900
† MICRA Corp., 120 Ricefield Lane, Hauppauge, NY 11788 516-231-8600
§† Microsemi Corp., 2830 S. Fairview St., Santa Ana, CA 92704 714-979-8220
§† Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
† Northwest Microcircuits, Inc., 5464SW Philomath Blvd., Corvallis, OR 97333 503-753-8242
§ NTE Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
§ Semicon Components, Inc., Div. of Semicon, Inc., 10 North Ave., Burlington, MA 01803 617-272-9015
Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 805-498-2111
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Silicon General, 11861 Western Ave., Garden Grove, CA 92641 714-898-8121
§† St-Semiconductors of Indiana, Inc., 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402-0609 812-332-1435
§ Sunshine Scientific Instruments, 1810 Grant Ave., Philadelphia, PA 19115 215-673-5600
Sussex Semiconductor, Inc., Rte. 206, Branchville, NJ 07826 201-948-3633
§† Teledyne Semiconductor, 1300 Terra Bella Ave., PO Box 7267, Mountain View, CA 94039-7267 415-968-9241
† Trio Laboratories, Inc., 80 Dupont St., Plainview, NY 11803 516-349-0400

Regulators & Stabilizers, Voltage-Also See Transformers, Voltage Regulating-4000 — *See Vol. D*

Regulators, Pulse-Width Modulating, Surface Mount-3130

† Arnold Magnetics, 4000 Via Pescador, Camarillo, CA 93010 805-484-4221
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Computer Power Inc., 124 W. Main St., High Bridge, NJ 08829 ..... 201-638-8000; 800-526-5088
§ Linear Technology Corp., 1630 McCarthy Blvd., Milpitas, CA 95035 408-432-1900

Regulators, Voltage, Surface Mount-4800

Seiko Instruments U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505, 213-517-7770 ..... A•1753
† Arnold Magnetics, 4000 Via Pescador, Camarillo, CA 93010 805-484-4221
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Computer Power Inc., 124 W. Main St., High Bridge, NJ 08829 ..... 201-638-8000; 800-526-5088
§ ITT Semiconductors, ITT Corp., 55 Merrimack St., So. Lawrence, MA 01843 617-688-1881
Sussex Semiconductor, Inc., Rte. 206, Branchville, NJ 07826 201-948-3633
U.S. Instr. Rentals, 2988 Campus Dr., San Mateo, CA 94403 800-824-2873

Relays, Antenna — See Relays, RF (Incl. Antenna & Coaxial) (Vol. B)

Relays, Audio Operated — See Relays, Frequency Selective (Vol. B)

Relays, Coaxial — See Relays, RF (Vol. B)

Relays, Contact — See Relays, Power (Vol. B)

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Relays, Crystal Can, 1/2 Crystal Can-4500 — *See Vol. B*
Relays, Current Sensing-4500 — *See Vol. B*
Relays, Differential-4500 — *See Vol. B*
Relays, Frequency Selective-4500 — *See Vol. B*
Relays, General Purpose-4500 — *See Vol. B*
Relays, High Voltage (500 Volts & Over)-4500 — *See Vol. B*
Relays, Hybrid-4500 — *See Vol. B*
Relays, Impulse — See Relays, Stepping (Vol. B)
Relays, I/O Modules — See Modules, I/O Relays (Vol. A)
Relays, Latching-4500 — *See Vol. B*
Relays, Mercury-Wetted Contacts-4500 — *See Vol. B*
Relays, Meter-4500 — *See Vol. B*
Relays, Motor Start-4500 — *See Vol. B*
Relays, Phase Sensing-4500 — *See Vol. B*
Relays, Plug-in-4500 — *See Vol. B*
Relays, Power-4500 — *See Vol. B*
Relays, Printed Circuit Mounting (Incl. Transistor & DIP Case Types)-4500 — *See Vol. B*
Relays, Programmable-4500 — *See Vol. B*
Relays, RF (Incl. Antenna & Coaxial)-4500 — *See Vol. B*
Relays, Reed-4500 — *See Vol. B*
Relays, Reed, Surface Mount-4500 — *See Vol. B*
Relays, Sealed-4500 — *See Vol. B*
Relays, Solid State-4500 — *See Vol. B*
Relays, Solid State, Surface Mount-4500 — *See Vol. B*
Relays, Stepping-4500 — *See Vol. B*
Relays, Telephone-4500 — *See Vol. B*
Relays, Thermal-4500 — *See Vol. B*
Relays, Time Delay-4500 — *See Vol. B*
Relays, Transistor & DIP Case Types — See Relays, Printed Circuit Mounting (Vol. B)
Relays, Vacuum-4500 — *See Vol. B*
Relays, Voltage Sensitive-4500 — *See Vol. B*
Relays (MIL)-2440 — *See Vol. B*
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Repair Equipment, Surface Mount-4100 — *See Vol. D*
Repair Services, Surface Mount Equipment-4100 — *See Vol. D*
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Repeaters, Servo-4900 — *See Vol. D*
Resins, Encapsulating — See Compounds, Encapsulating, Molding & Potting (Vol. C)
Resins, Synthetic — See Plastic Raw Materials (Vol. C)
Resistance Comparators — See Bridges, Resistance (Vol. D)
Resistor Hardware-2800 — *See Vol. C*

Resistor Networks, Surface Mount-4700

Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•1861,1866
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, 818-765-8300;800-423-3186 ..... A•1868
† AMITRON, American Micro-Tronix, Inc., 85 Flagship Drive, North Andover, MA 01845, 508-686-1882 ..... A•1763
§ Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ..... A•1871
CTS Corp., Electromechanical Div., (Formerly Elkhart Div.), 1142 W. Beardsley Ave., Elkhart, IN 46514, 219-295-3575 ..... A•1904
§ CTS Corp., Resistor Network Div., (Formerly CTS Corp., Berne Div.), 406 Parr Rd., Berne, IN 46711, 219-589-3111 ..... A•1912
Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... A•1925,1928-1931
§ Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926, 915-592-3253 ..... A•1915
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701, 402-371-0080 ..... A•1918
Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150 ..... A•1933
§† International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1940
§ KOA Speer Electronics, Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ..... A•1946-1947
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•1976
† Ohmtek Inc., Sfernice Group Company, 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ..... A•2021,2024-2025
Precision Resistive Products, Inc., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, 319-394-9131 ..... A•2002
RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2010-2011
State of the Art, Inc., 2470 Fox Hill Rd., State College, PA 16803-1797, 814-355-8004 ..... A•2036
† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700
CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
† Doran Manufacturing Co., 2834 Sidney Ave., Cincinnati, OH 45225 513-681-5424
† EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800
§† Hybrids International Ltd., Thick Film Division, 311 N. Lindenwood Dr., Olathe, KS 66062 913-764-6400
Hy-Tec Industries, Div. of Topo Industries, Inc., P.O. Box 91, Shoreham, NY 11786 516-924-8686
Hytek Microsystems, 980 University Ave., Los Gatos, CA 95030 408-395-2300
§ Kahgan Electronics Corp., 605 Peninsula Blvd., Hempstead, NY 11550 .. 516-538-2300
§ Liberty Intl. Corp., FIRSTOHM, 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
§ Mallory Capacitor Co., Emhart Elctrl./Elctrn. Grp., 3029 E. Washington St., Dept. EM, P.O. Box 1284, Indianapolis, IN 46201 317-636-5353
§ Nepenthe, Inc., 2471 E. Bayshore Road, Palo Alto, CA 94303 ..... 415-856-9332; 800-NEPENTHE
§ Rohm Corporation, 8 Whatney, Irvine, CA 92718 714-855-2131
Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311
Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405 818-781-1642
Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502 .. 303-242-0810

Resistors, Adjustable-Also See Potentiometers; Rheostats-4700

§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•1861,1866
Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, 818-765-8300;800-423-3186 ..... A•1868
† Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ..... A•1870
CTS Corp., Electromechanical Div., (Formerly Elkhart Div.), 1142 W. Beardsley Ave., Elkhart, IN 46514, 219-295-3575 ..... A•1904-1910
§ CTS Corp., Resistor Network Div., (Formerly CTS Corp., Berne Div.), 406 Parr Rd., Berne, IN 46711, 219-589-3111 ..... A•1913
Huntington Electric Inc., P.O. Box 366, Dept. EEM 87, Huntington, IN 46750, 219-356-0778 ..... A•1942
IET Labs, Inc., 534 Main St., Westbury, NY 11590, 516-334-5959 ..... D•1268-1269,1271-1272
§ International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1937
KRL/Bantry Components, Inc., 160 Bouchard St., Manchester, NH 03103, 603-668-3210 ..... A•1953
§† Memcor-Truohm, Inc., 1320 Flaxmill Rd., Huntington, IN 46750, 219-356-4300 ..... A•1956
† Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204, 414-271-9900 ..... A•1970-1973
NMB Technologies, 9730 Independence Avenue, Chatsworth, CA 91311, 818-341-3355 ..... A•1750-1751
§† Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..... A•1989
† Resistors, Inc., 5226 W. 26th St., Chicago, IL 60650, 312-652-7555 ..... A•2019
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ..... A•2103
§† VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181 ..... A•2109
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134 408-946-6000
Capco, Box 1028, Grand Junction, CO 81502 303-243-8751
Carter Manufacturing Corporation, 237 Sugar Road, Bolton, MA 01740 .. 617-779-5501
§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., 3 Washington St., Dover, NH 03820 603-742-1120
Components Div., Sangamo Weston, Inc., Box 128, Pickens, SC 29671 .. 803-878-6311
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
§† CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626 714-545-8261

§† Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
§ International Components Corp., 105 Maxess Rd., Melville, NY 11747 ... 516-293-1500
International Manufacturing Services, 50 Schoolhouse La., Portsmouth, RI 02871-2418 401-683-9700
Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101 718-361-0800
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
† Maurey Instrument Corp., 4555 W. 60th St., Chicago, IL 60629 312-581-4555
Mel-Rain Controls, 42974 M-43 Hwy., Paw Paw, MI 49079 616-657-2527
Mepco/Centralab, North American Philips Corporation, Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501 515-573-1300
Mepcopal Company, 11468 Sorrento Valley Rd., San Diego, CA 92121 .. 619-453-0332
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
† Resistance Technology Inc., 1260 Red Fox Rd., St. Paul, MN 55112 612-636-9770
† Robert Shaw Instrument Div., Kendall Lane, Natick, MA 01760 617-875-9711
† Samarius Precision Instruments, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418 203-735-7405
Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Spectrol Electronics, 17070 East Gale Ave., City of Industry, CA 91745 .. 818-964-6565
Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405 818-781-1642
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., 565 West Golf Road, Arlington Heights, IL 60005 312-364-7277
Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502 .. 303-242-0810
United Foam Plastics, 172-Q E. Main St., Georgetown, MA 01833 617-352-2200
§† Varnistor Corp., 115 Industrial Pk., Sevierville, TN 37862 615-453-0001
§ Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 .. 215-644-1300
§† Ward Leonard Electric Co., Inc., 31 South St., Mt. Vernon, NY 10550 914-664-1000

Resistors, Ballast (Incl. Tube & Solid State Devices)-4700

Huntington Electric Inc., P.O. Box 366, Dept. EEM 87, Huntington, IN 46750, 219-356-0778 ..... A•1942
International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1937
§† Memcor-Truohm, Inc., 1320 Flaxmill Rd., Huntington, IN 46750, 219-356-4300 ..... A•1956
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1968
Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204, 414-271-9900 ..... A•1970
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2011
RCL-Shallcross, 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... A•2013-2017
Vermont Precision Resistor, Codeco Corp. of Vermont, West Hill Road, P.O. Box 1207, Stowe, VT 05672-1170, 802-253-8567 ..... A•2039
§† Amperite Co., Inc., 600 Palisade Ave., Union City, NJ 07087 201-864-9503
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
§ Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-699-0918; 800-255-2666
§ Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601 402-564-3131
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300

Resistors, Beryllia Core — See Resistors, Integral Heat Dissipator (Vol. A)

Resistors, Bulk Ceramic-4700

§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, 818-765-8300;800-423-3186 ..... A•1869
RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2010-2011
† Standard Oil Engineered Materials Co., Carborundum, P. O. Box 156, Niagara Falls, NY 14302, 716-278-2000 ..... A•2033
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
§ Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-699-0918; 800-255-2666
International Manufacturing Services, 50 Schoolhouse La., Portsmouth, RI 02871-2418 401-683-9700
§ Martin Sound Prods., 28 Alpha Park, Cleveland, OH 44143-2297 216-442-2286
Microplex, Inc., 1977 State College Blvd., Anaheim, CA 92806 ..... 714-979-8833; 714-634-1535
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
Stackpole, Carbon Div., 201 Stackpole St., St. Marys, PA 15857 814-781-1234

Resistors, Carbon Film-4700

§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, 818-765-8300;800-423-3186 ..... A•1868
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111, 201-371-9500 .... A•1903
§ International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1937
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-937-3475 ..... A•1094
§ KOA Speer Electronics, Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ..... A•1946,1948,1950
Mepco/Centralab, North American Philips Corporation, 4561 Colorado Blvd., Los Angeles, CA 90039, 818-240-4880 ..... A•1957
§ Mepco/Centralab, North American Philips Corporation, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, 817-325-7871 ..... A•1957
§† Micro-Ohm Corp., 1088 Hamilton Rd., Duarte, CA 91010, 818-3575377 ... A•1967
§ Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..... A•1991,1994
Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ..... A•1996
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2010-2011
§ Baknor Industries Limited, 2209 Dunwin Drive, Mississauga, ONT., CANADA L5L 1X1 416-828-2400
Component General, Inc., 13620 Wright Cir., Tampa, FL 33626 813-855-6655
§ Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-699-0918; 800-255-2666
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Dale Electronics, Inc., Specialty Div., P. O. Box 1179, Robbinsville, NC 28771 704-479-6451
Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
Ei North America, 435 E. 79th St., New York, NY 10021 212-517-5622
† Frederick Components Intl., 20806 Plummer St., Chatsworth, CA 91311 ..... 818-882-0868;800-354-0660
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
§ International Components Corp., 105 Maxess Rd., Melville, NY 11747 ... 516-293-1500
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
§ Kahgan Electronics Corp., 605 Peninsula Blvd., Hempstead, NY 11550 .. 516-538-2300
§ KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
§ Liberty Intl. Corp., FIRSTOHM, 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
Mepco/Centralab Corp. Hdqrtr., North American Philips Corporation, 2001 W. Blue Heron Blvd., Riviera Beach, FL 33404 407-881-3200
Mepco/Centralab, Inc., A North American Philips Co., 2566 Northwestern Ave., West Lafayette, IN 47906 317-463-2536
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
Mouser Electronics, 2401 Hwy. 287 North, Mansfield, TX 76063 817-483-4422
§ NIC Components Corp., 6000 New Horizons Blvd., N. Amityville, NY 11701 516-226-7500
Philips Circuit Assemblies, A Subdivision of North American Philips Corp., 2566 Northwestern Avenue, West Lafayette, IN 47906 317-463-2536
Philips Electronics Ltd., Elcoma Division, 601 Milner Avenue, Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
§ Piher International Corp., 903 Feehanville Dr., Mt. Prospect, IL 60056 ..... 312-390-6680; 800-323-6693
Roederstein Elctrns., Inc., P.O. Box 5588, Statesville, NC 28677 704-872-8101
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
§ Rohm Corporation, 8 Whatney, Irvine, CA 92718 714-855-2131
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Varnistor Corp., 115 Industrial Pk., Sevierville, TN 37862 615-453-0001
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Ceramic Core-4700

§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•1858
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, 818-765-8300;800-423-3186 ..... A•1869
§† Bradford Electronics, Inc., 550 High Street, Bradford, PA 16701, 814-362-5700 ..... A•1872
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1878-1879,1886
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111, 201-371-9500 .... A•1902
Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... A•1927-1931
§† Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701, 402-371-0080 ..... A•1921
Huntington Electric Inc., P.O. Box 366, Dept. EEM 87, Huntington, IN 46750, 219-356-0778 ..... A•1942
§ International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1937
§† KRL/Bantry Components, Inc., 160 Bouchard St., Manchester, NH 03103, 603-668-3210 ..... A•1951
§† Memcor-Truohm, Inc., 1320 Flaxmill Rd., Huntington, IN 46750, 219-356-4300 ..... A•1956
§ Micro-Ohm Corp., 1088 Hamilton Rd., Duarte, CA 91010, 818-3575377 ... A•1964
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1968
† Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204, 414-271-9900 ..... A•1970-1971
Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761, 617-695-0203 ..... A•1975
§† Nytronics Components Grp., Inc., 700 Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1979
§† Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..... A•1980,1982-1986,1988,1992
Ohmtek Inc., Sfernice Group Company, 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ..... A•2021
Precision Resistive Products, Inc., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, 319-394-9131 ..... A•2003

† **Precision Resistor Co., Inc., 10601 75 St. N., Largo, FL 34647, 813-541-5771** ..... **A•2005**
§† **RCL-Shallcross, 195 McGregor St., Manchester, NH 03102, 603-627-3831** ..... **A•2014-2017**
§† **Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810** ..... **A•2029**
† **Vermont Precision Resistor, Codeco Corp. of Vermont, West Hill Road, P.O. Box 1207, Stowe, VT 05672-1170, 802-253-8567** ..... **A•2038**
Victoreen, Inc., A Sheller-Globe Corp. Subsidiary, 6000 Cochran Rd., Solon, OH 44139, 216-248-9300 ..... **A•2043**
Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., 3 Washington St., Dover, NH 03820 603-742-1120
Component General, Inc., 13620 Wright Cir., Tampa, FL 33626 813-855-6655
§ Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-699-0918; 800-255-2666
§ Dale Electronics, Inc., Specialty Div., P. O. Box 1179, Robbinsville, NC 28771 704-479-6451
Detoronics Corporation, 10660 E. Rush St., S. El Monte, CA 91733 818-579-7130
Electro Comp., Inc., 2415 Main St., Stratford, CT 06497 203-375-5811
† Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800
† Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
Meissner Industries, 551 Rte. 10, Dover, NJ 07801 201-366-1700
Mouser Electronics, 2401 Hwy. 287 North, Mansfield, TX 76063 817-483-4422
NIC Components Corp., 6000 New Horizons Blvd., N. Amityville, NY 11701 516-226-7500
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
Pyrohm, Inc., 24268 Indoplex Circle, Farmington Hills, MI 48018 313-478-5060
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
§† RCL-Shallcross, Inc., U.S. Hwy. 70 East, Smithfield, NC 27577 919-934-5181
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
§† Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Solitron/Microwave, Solitron Devices, Inc., 1177 Blue Heron Blvd., Solitron Pk., Riviera Bch., FL 33404 305-848-4311
Stackpole, Carbon Div., 201 Stackpole St., St. Marys, PA 15857 814-781-1234
† Star Porcelain, 71 Muirhead Ave., Trenton, NJ 08638 609-392-3154
§† Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405 818-781-1642
Tel Labs, Inc., Sfernice, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 603-625-8994
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
† Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 .. 215-644-1300
§† Ward Leonard Electric Co., Inc., 31 South St., Mt. Vernon, NY 10550 914-664-1000
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Ceramic Metal (Cermet)-4700

§ **Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888** ..... **A•1862-1864,1866**
§ **Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, 818-765-8300;800-423-3186** ..... **A•1869**
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ..... **A•1870**
§ **Colber Corp., 26E Buffington St., Irvington, NJ 07111, 201-371-9500** .... **A•1903**
CTS Corp., Electromechanical Div., (Formerly Elkhart Div.), 1142 W. Beardsley Ave., Elkhart, IN 46514, 219-295-3575 ..... **A•1904**
§ **CTS Corp., Resistor Network Div., (Formerly CTS Corp., Berne Div.), 406 Parr Rd., Berne, IN 46711, 219-589-3111** ..... **A•1913**
International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... **A•1937**
KOA Speer Electronics, Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ..... **A•1948**
Mepco/Centralab, North American Philips Corporation, 4561 Colorado Blvd., Los Angeles, CA 90039, 818-240-4880 ..... **A•1958, B•1014**
Mepco/Centralab, Inc., A North American Philips Co., 2566 Northwestern Ave., West Lafayette, IN 47906, 317-463-2536 ..... **B•1014**
Mepco/Centralab, North American Philips Corporation, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, 817-325-7871 ..... **B•1014**
Micro-Ohm Corp., 1088 Hamilton Rd., Duarte, CA 91010, 818-3575377 ... **A•1964**
Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..... **A•1990**
† **Ohmtek Inc., Sfernice Group Company, 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025** ..... **A•2020-2021,2024-2025**
RCL-Shallcross, 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... **A•2017**
State of the Art, Inc., 2470 Fox Hill Rd., State College, PA 16803-1797, 814-355-8004 ..... **A•2035**
Victoreen, Inc., A Sheller-Globe Corp. Subsidiary, 6000 Cochran Rd., Solon, OH 44139, 216-248-9300 ..... **A•2043**
† Assembly Specialists, 914 Main St., Box 965, Acton, MA 01720 617-263-9100
† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700
Component General, Inc., 13620 Wright Cir., Tampa, FL 33626 813-855-6655
§† CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Ferro Corporation, Electronic Materials Div., 27 Castilion Dr., Santa Barbara, CA 93117-3092 805-968-5000
Heraeus Cermalloy Division, Heraeus, Inc., Union Hill Industrial Park, W. Conshohocken, PA 19428 215-825-6050
International Manufacturing Services, 50 Schoolhouse La., Portsmouth, RI 02871-2418 401-683-9700
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
K & M Electronics, 221 Interstate Dr., Dock No. 3, W. Springfield, MA 01089 413-781-1350
Microplex, Inc., 1977 State College Blvd., Anaheim, CA 92806 ..... 714-979-8833; 714-634-1535
Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
Mouser Electronics, 2401 Hwy. 287 North, Mansfield, TX 76063 817-483-4422
NIC Components Corp., 6000 New Horizons Blvd., N. Amityville, NY 11701 516-226-7500
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
Philips Circuit Assemblies, A Subdivision of North American Philips Corp., 2566 Northwestern Avenue, West Lafayette, IN 47906 317-463-2536
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
§† Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311
† Thickfilm International, Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-7400

Resistors, Chip (For Microcircuits)-4700

Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... **A•1860**
§ **Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, 818-765-8300;800-423-3186** ..... **A•1868**
† **AMITRON, American Micro-Tronix, Inc., 85 Flagship Drive, North Andover, MA 01845, 508-686-1882** ..... **A•1763**
§ **Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050** ..... **A•1871,2066-2067**
§ **Bradford Electronics, Inc., 550 High Street, Bradford, PA 16701, 814-362-5700** ..... **A•1877**
§ **Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700** ..... **A•1878-1879,1888,1890**
CTS Corp., Electromechanical Div., (Formerly Elkhart Div.), 1142 W. Beardsley Ave., Elkhart, IN 46514, 219-295-3575 ..... **A•1904**
Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... **A•1928-1931**
§† **Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701, 402-371-0080** ..... **A•1919-1920**
† **Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150** ..... **A•1932-1933**
† **International Manufacturing Services, 50 Schoolhouse La., Portsmouth, RI 02871-2418, 401-683-9700** ..... **A•1936**
§ **International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861** ..... **A•1739,1939**
§ **KOA Speer Electronics, Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536** ..... **A•1946-1947,1950**
§† **KRL/Bantry Components, Inc., 160 Bouchard St., Manchester, NH 03103, 603-668-3210** ..... **A•1951**
Mepco/Centralab, North American Philips Corporation, 4561 Colorado Blvd., Los Angeles, CA 90039, 818-240-4880 ..... **A•1957-1958**
Mepco/Centralab, North American Philips Corporation, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, 817-325-7871 ..... **A•1957**
§ **Micro-Ohm Corp., 1088 Hamilton Rd., Duarte, CA 91010, 818-3575377** ... **A•1966**
† **Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761, 617-695-0203** ..... **A•1975**
NMB Technologies, 9730 Independence Avenue, Chatsworth, CA 91311, 818-341-3355 ..... **A•1750-1751**
† **Ohmtek Inc., Sfernice Group Company, 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025** ..... **A•2020-2025**
† **Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501** ..... **A•2001**
§† **RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054** ..... **A•2011**
State of the Art, Inc., 2470 Fox Hill Rd., State College, PA 16803-1797, 814-355-8004 ..... **A•2034-2035**
§† **Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300** ..... **A•2047-2048,2050**
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134 408-946-6000
† Assembly Specialists, 914 Main St., Box 965, Acton, MA 01720 617-263-9100
§ Baknor Industries Limited, 2209 Dunwin Drive, Mississauga, ONT., CANADA L5L 1X1 416-828-2400
† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700
California Micro Devices, Inc., 215 Topaz Street, Milpitas, CA 95035 408-263-3214
Component General, Inc., 13620 Wright Cir., Tampa, FL 33626 813-855-6655
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-8725
† CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926 915-592-3253
Eltec Instruments Inc., P.O. Box 9610, Daytona Bch., FL 32020 904-253-5328
† EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800
† Environmental Comm., 3150 Pullman St., Costa Mesa, CA 92627 714-557-7800
§† General Mircocuits, 780 Boston Rd., Billerica, MA 01821 508-663-9101
§† Hybrids International Ltd., Thick Film Division, 311 N. Lindenwood Dr., Olathe, KS 66062 913-764-6400
† Hybrid Systems, Sipex Corporation, 22 Linnell Circle, Billerica, MA 01821 617-667-8700
† Hycomp, Inc., 165 Cedar Hill St., Marlborough, MA 01752 617-485-6300
Hy-Tec Industries, Div. of Topo Industries, Inc., P.O. Box 91, Shoreham, NY 11786 516-924-8686
§ International Components Corp., 105 Maxess Rd., Melville, NY 11747 ... 516-293-1500
§ ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 ..... 516-753-0400; 800-862-2101

§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
§ KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
§† Kyocera Northwest, Electronic Components Group, P.O. Box 85542, San Diego, CA 92138-5542 619-576-2600
§ Liberty Intl. Corp., FIRSTOHM, 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
Mepco/Centralab Corp. Hdqrtr., North American Philips Corporation, 2001 W. Blue Heron Blvd., Riviera Beach, FL 33404 407-881-3200
Mepco/Centralab, Inc., A North American Philips Co., 2566 Northwestern Ave., West Lafayette, IN 47906 317-463-2536
† Microplex, Inc., 1977 State College Blvd., Anaheim, CA 92806 ..... 714-979-8833; 714-634-1535
§ Morris Enterprises, 16799 Schoenborn St, Sepulveda, CA 91343 818-894-9103
Mouser Electronics, 2401 Hwy. 287 North, Mansfield, TX 76063 817-483-4422
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
National Micronetics, Route 28, West Hurley, NY 12136 914-338-0333
§ NIC Components Corp., 6000 New Horizons Blvd., N. Amityville, NY 11701 516-226-7500
§ Paccom, 3928 148th NE, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
Philips Circuit Assemblies, A Subdivision of North American Philips Corp., 2566 Northwestern Avenue, West Lafayette, IN 47906 317-463-2536
Philips Electronics Ltd., Elcoma Division, 601 Milner Avenue, Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
§ Piher International Corp., 903 Feehanville Dr., Mt. Prospect, IL 60056 ..... 312-390-6680; 800-323-6693
Roederstein Elctrns., Inc., P.O. Box 5588, Statesville, NC 28677 704-872-8101
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
§ Rohm Corporation, 8 Whatney, Irvine, CA 92718 714-855-2131
§† Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311
Stetron International, Inc., 90 Broadway, Buffalo, NY 14203 716-854-3443
§ Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405 818-781-1642
† Thickfilm International, Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-7400
§ Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502 303-242-0810
United Supertek, Inc., 118 Charcot Ave., San Jose, CA 95131-1101 408-922-0730
Wilbrecht Electronics, 346 Chester St., St. Paul, MN 55107 612-222-2791

Resistors, Composition, Carbon-4700

§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•1855-1857
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, 818-765-8300;800-423-3186 ..... A•1868
CTS Corp., Electromechanical Div., (Formerly Elkhart Div.), 1142 W. Beardsley Ave., Elkhart, IN 46514, 219-295-3575 ..... A•1904,1907-1910
§ International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1937
§ KOA Speer Electronics, Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ..... A•1949
§† Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..... A•1993-1994
§ Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-699-0918; 800-255-2666
CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
Ei North America, 435 E. 79th St., New York, NY 10021 212-517-5622
§ GC-Thorsen, 1801 Morgan St, P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
§ International Components Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
Mouser Electronics, 2401 Hwy. 287 North, Mansfield, TX 76063 817-483-4422
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Decade-4700

§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•1855
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1878-1879,1894-1895
General Resistance, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, 203-481-5721 ..... D•1256
IET Labs, Inc., 534 Main St., Westbury, NY 11590, 516-334-5959 ..... D•1268-1269,1271-1272
Julie Research Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 ..... D•1281
Micro-Ohm Corp., 1088 Hamilton Rd., Duarte, CA 91010, 818-3575377 ... A•1967
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1968
§ Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..... A•1990
Ohmtek Inc., Sfernice Group Company, 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ..... A•2023
† Precision Control Manufacturing, Inc., 1509 B Queen Anne Ave. N., Seattle, WA 98109, 206-281-9380 ..... A•2097
Shalltronix Corp., Preston St., P.O. Box 235, Selma, NC 27576, 919-965-6346 ..... D•1322
† Standard Oil Engineered Materials Co., Carborundum, P. O. Box 156, Niagara Falls, NY 14302, 716-278-2000 ..... A•2033
† Tech Labs., Inc., 500 10th St., Palisades Pk., NJ 07650, 201-944-2221 ... B•1805
Tettex Instruments, Inc., P.O. Box 281, Fairview Village, PA 19409-0281, 215-539-6050 ..... D•1326
CDS - Colorado Data Sys., 3301 W. Hampden, Unit C, Englewood, CO 80110 ..... 303-762-1640;800-CDS-ATE1
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900
§† Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
Electro Scientific Inds., 13900 N.W. Science Pk. Dr., Portland, OR 97229 503-641-4141
§ Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
International Manufacturing Services, 50 Schoolhouse La., Portsmouth, RI 02871-2418 401-683-9700
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
Kelvin Industries, Inc., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501 818-990-1192
Meissner Industries, 551 Rte. 10, Dover, NJ 07801 201-366-1700
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405 818-781-1642
Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502 .. 303-242-0810
§ Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 .. 215-644-1300

Resistors, Deposited Carbon-4700

§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, 818-765-8300;800-423-3186 ..... A•1868
§ KOA Speer Electronics, Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ..... A•1949
§ Micro-Ohm Corp., 1088 Hamilton Rd., Duarte, CA 91010, 818-3575377 ... A•1967
Victoreen, Inc., A Sheller-Globe Corp. Subsidiary, 6000 Cochran Rd., Solon, OH 44139, 216-248-9300 ..... A•2041
Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
§ Dale Electronics, Inc., Specialty Div., P. O. Box 1179, Robbinsville, NC 28771 704-479-6451
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
Vamistor Corp., 115 Industrial Pk., Sevierville, TN 37862 615-453-0001

Resistors, Disk, Rod & Tube-4700

§† Ametek/Rodan Div., 2905 Blue Star St., Anaheim, CA 92806, 714-630-0081 ..... B•1836
Huntington Electric Inc., P.O. Box 366, Dept. EEM 87, Huntington, IN 46750, 219-356-0778 ..... A•1942
§ K & M Electronics, 221 Interstate Dr., Dock No. 3, W. Springfield, MA 01089, 413-781-1350 ..... A•1943
Memcor-Truohm, Inc., 1320 Flaxmill Rd., Huntington, IN 46750, 219-356-4300 ..... A•1956
Mepco/Centralab, North American Philips Corporation, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, 817-325-7871 ..... A•1960
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1968
Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204, 414-271-9900 ..... A•1970
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2010-2011
† Standard Oil Engineered Materials Co., Carborundum, P. O. Box 156, Niagara Falls, NY 14302, 716-278-2000 ..... A•2033
Component General, Inc., 13620 Wright Cir., Tampa, FL 33626 813-855-6655
Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601 402-564-3131
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
International Resistive Company, P.O. Box 1860, Boone, NC 28607 704-264-8861
§ KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
Mepco/Centralab Corp. Hdqrtr., North American Philips Corporation, 2001 W. Blue Heron Blvd., Riviera Beach, FL 33404 407-881-3200
§† Solitron/Microwave, Solitron Devices, Inc., 1177 Blue Heron Blvd., Solitron Pk., Riviera Bch., FL 33404 305-848-4311
Stackpole, Carbon Div., 201 Stackpole St., St. Marys, PA 15857 814-781-1234
§ Ward Leonard Electric Co., Inc., 31 South St., Mt. Vernon, NY 10550 914-664-1000

Resistors, Film, Metallized & Nonmetallized-4700

Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•1854,1856-1857,1861,1867
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, 818-765-8300;800-423-3186 ..... A•1868
Angstrohm Precision, Inc., A Sub of Vishay Intertechnology, 63 Lincoln Highway, Malvern, PA 19355, 215-644-1300 ..... A•1852-1853
Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635, 714-447-2700 ..... A•2063
§† Bradford Electronics, Inc., 550 High Street, Bradford, PA 16701, 814-362-5700 ..... A•1872-1873,1877
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1878-1881,1885-1892,1900-1901
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111, 201-371-9500 .... A•1903
Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... A•1928-1931
Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926, 915-592-3253 ..... A•1914-1915

§† Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701, 402-371-0080 ..... A•1918-1919,1921-1924
† Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150 ..... A•1932
§† International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1937
§† KOA Speer Electronics, Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ..... A•1946,1948,1950
KRL/Bantry Components, Inc., 160 Bouchard St., Manchester, NH 03103, 603-668-3210 ..... A•1951,1953
Mepco/Centralab, North American Philips Corporation, 4561 Colorado Blvd., Los Angeles, CA 90039, 818-240-4880 ..... A•1957, B•1014
Mepco/Centralab, Inc., A North American Philips Co., 2566 Northwestern Ave., West Lafayette, IN 47906, 317-463-2536 ..... B•1014
Mepco/Centralab, North American Philips Corporation, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, 817-325-7871 ..... A•1957, B•1014
§† Micro-Ohm Corp., 1088 Hamilton Rd., Duarte, CA 91010, 818-3575377 ..... A•1964-1965
§† Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..... A•1981,1992,1994
Ohmtek Inc., Sfernice Group Company, 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ..... A•2020-2025
Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•2001
§ Precision Resistive Products, Inc., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, 319-394-9131 ..... A•2002-2003
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2011
RCL-Shallcross, 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... A•2017
State of the Art, Inc., 2470 Fox Hill Rd., State College, PA 16803-1797, 814-355-8004 ..... A•2036
† Vermont Precision Resistor, Codeco Corp. of Vermont, West Hill Road, P.O. Box 1207, Stowe, VT 05672-1170, 802-253-8567 ..... A•2038
Victoreen, Inc., A Sheller-Globe Corp. Subsidiary, 6000 Cochran Rd., Solon, OH 44139, 216-248-9300 ..... A•2041
Applied Research Labs., Fisons, 24911 Stanford Ave., Valencia, CA 91355 805-295-0019
California Micro Devices, Inc., 215 Topaz Street, Milpitas, CA 95035 408-263-3214
§ Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-699-0918; 800-255-2666
§† Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-8725
Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., Suite 845, New York, NY 10011 212-691-9050
Dale Electronics, Inc., Specialty Div., P. O. Box 1179, Robbinsville, NC 28771 704-479-6451
Eltec Instruments Inc., P.O. Box 9610, Daytona Bch., FL 32020 904-253-5328
EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800
† Engelhard Corp., Menlo Pk., CN40, Edison, NJ 08818 ..... 201-632-6000;800-932-0444 (in NJ)
† Environmental Comm., 3150 Pullman St., Costa Mesa, CA 92627 714-557-7800
Ferro Corporation, Electronic Materials Div., 27 Castilion Dr., Santa Barbara, CA 93117-3092 805-968-5000
† Frederick Components Intl., 20806 Plummer St., Chatsworth, CA 91311 ..... 818-882-0868;800-354-0660
† Hycomp, Inc., 165 Cedar Hill St., Marlborough, MA 01752 617-485-6300
§ International Components Corp., 105 Maxess Rd., Melville, NY 11747 ... 516-293-1500
† International Manufacturing Services, 50 Schoolhouse La., Portsmouth, RI 02871-2418 401-683-9700
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 .. 516-937-3475
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
§ Kahgan Electronics Corp., 605 Peninsula Blvd., Hempstead, NY 11550 .. 516-538-2300
§ KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
§ Liberty Intl. Corp., FIRSTOHM, 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
Mepco/Centralab Corp. Hdqrtr., North American Philips Corporation, 2001 W. Blue Heron Blvd., Riviera Beach, FL 33404 407-881-3200
† Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
§ Nepenthe, Inc., 2471 E. Bayshore Road, Palo Alto, CA 94303 ..... 415-856-9332; 800-NEPENTHE
§ NIC Components Corp., 6000 New Horizons Blvd., N. Amityville, NY 11701 516-226-7500
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
Paccom, 3928 148th NE, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
Philips Electronics Ltd., Elcoma Division, 601 Milner Avenue, Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
§ Piher International Corp., 903 Feehanville Dr., Mt. Prospect, IL 60056 ..... 312-390-6680; 800-323-6693
Raltron Electronics, 2315 N.W. 107th Ave., Miami, FL 33172 305-593-6033
RCL-Shallcross, Inc., U.S. Hwy. 70 East, Smithfield, NC 27577 919-934-5181
Roederstein Elctrns., Inc., P.O. Box 5588, Statesville, NC 28677 704-872-8101
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
§† Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311
§† Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405 818-781-1642
Tel Labs, Inc., Sfernice, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 603-625-8994
† Thickfilm International, Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-7400
§† Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502 .. 303-242-0810
§† Vamistor Corp., 115 Industrial Pk., Sevierville, TN 37862 615-453-0001
§† Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 .. 215-644-1300

Resistors, Flame Retardant-4700

§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•1859
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, 818-765-8300;800-423-3186 ..... A•1868
§† Bradford Electronics, Inc., 550 High Street, Bradford, PA 16701, 814-362-5700 ..... A•1873-1874
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1878-1879
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111, 201-371-9500 ..... A•1902-1903
Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... A•1926,1928-1931
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701, 402-371-0080 ..... A•1922-1924
Huntington Electric Inc., P.O. Box 366, Dept. EEM 87, Huntington, IN 46750, 219-356-0778 ..... A•1942
§† International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1937-1938
§ KOA Speer Electronics, Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ..... A•1948,1950
§† KRL/Bantry Components, Inc., 160 Bouchard St., Manchester, NH 03103, 603-668-3210 ..... A•1951
Mepco/Centralab, North American Philips Corporation, 4561 Colorado Blvd., Los Angeles, CA 90039, 818-240-4880 ..... A•1957
§† Mepco/Centralab, North American Philips Corporation, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, 817-325-7871 ..... A•1957
§ Micro-Ohm Corp., 1088 Hamilton Rd., Duarte, CA 91010, 818-3575377 ..... A•1965-1966
§ Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1968
Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•1977
Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..... A•1985-1986,1992
Ohmtek Inc., Sfernice Group Company, 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ..... A•2023
Precision Resistive Products, Inc., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, 319-394-9131 ..... A•2002-2003
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2010
RCL-Shallcross, 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... A•2013-2015,2017
Vermont Precision Resistor, Codeco Corp. of Vermont, West Hill Road, P.O. Box 1207, Stowe, VT 05672-1170, 802-253-8567 ..... A•2039
§ Baknor Industries Limited, 2209 Dunwin Drive, Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700
§ Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-699-0918; 800-255-2666
§ Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-8725
§ Dale Electronics, Inc., Specialty Div., P. O. Box 1179, Robbinsville, NC 28771 704-479-6451
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
Electro Comp., Inc., 2415 Main St., Stratford, CT 06497 203-375-5811
Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
§† Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
General Resistance, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471 203-481-5721
ICO-RALLY Corporation, 2575 E. Bayshore Rd., Palo Alto, CA 94303 415-856-9900
§ International Components Corp., 105 Maxess Rd., Melville, NY 11747 ... 516-293-1500
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 .. 516-937-3475
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
Kelvin Industries, Inc., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501 818-990-1192
Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
§ Liberty Intl. Corp., FIRSTOHM, 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
§† Memcor-Truohm, Inc., 1320 Flaxmill Rd., Huntington, IN 46750 219-356-4300
Mepco/Centralab Corp. Hdqrtr., North American Philips Corporation, 2001 W. Blue Heron Blvd., Riviera Beach, FL 33404 407-881-3200
Mepco/Centralab, Inc., A North American Philips Co., 2566 Northwestern Ave., West Lafayette, IN 47906 317-463-2536
NIC Components Corp., 6000 New Horizons Blvd., N. Amityville, NY 11701 516-226-7500
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
§ NTE Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
Philips Circuit Assemblies, A Subdivision of North American Philips Corp., 2566 Northwestern Avenue, West Lafayette, IN 47906 317-463-2536
Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
Roederstein Elctrns., Inc., P.O. Box 5588, Statesville, NC 28677 704-872-8101
Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405 818-781-1642
Tel Labs, Inc., Sfernice, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 603-625-8994

† Thickfilm International, Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-7400
Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502 .. 303-242-0810
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
Vamistor Corp., 115 Industrial Pk., Sevierville, TN 37862 615-453-0001
Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 .. 215-644-1300
§ Ward Leonard Electric Co., Inc., 31 South St., Mt. Vernon, NY 10550 914-664-1000

Resistors, Flux Sensitive-4700

§ Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500

Resistors, Foil, Ultraprecision-4700

§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1878-1879
§† Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 ..... A•2027-2028
§† Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ..... A•2046,2050
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
§† Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
† Wilbrecht Electronics, 346 Chester St., St. Paul, MN 55107 612-222-2791

Resistos, Four Terminal-4700

Huntington Electric Inc., P.O. Box 366, Dept. EEM 87, Huntington, IN 46750, 219-356-0778 ..... A•1942
§ International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1938
Precision Resistor Co., Inc., 10601 75 St. N., Largo, FL 34647, 813-541-5771 ..... A•2004,2007
RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2010
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
§ Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601 402-564-3131
Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
Kelvin Industries, Inc., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501 818-990-1192
§† KRL/Bantry Components, Inc., 160 Bouchard St., Manchester, NH 03103 603-668-3210
Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
Tel Labs, Inc., Sfernice, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 603-625-8994
§ Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502 .. 303-242-0810

Resistors, Fuse-4300 — *See Vol. B*

Resistors, Glass-4700

Angstrohm Precision, Inc., A Sub of Vishay Intertechnology, 63 Lincoln Highway, Malvern, PA 19355, 215-644-1300 ..... A•1852-1853
§† Bradford Electronics, Inc., 550 High Street, Bradford, PA 16701, 814-362-5700 ..... A•1874
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111, 201-371-9500 .... A•1902
Mepco/Centralab, North American Philips Corporation, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, 817-325-7871 ..... A•1960
Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•2001
Victoreen, Inc., A Sheller-Globe Corp. Subsidiary, 6000 Cochran Rd., Solon, OH 44139, 216-248-9300 ..... A•2040
Component General, Inc., 13620 Wright Cir., Tampa, FL 33626 813-855-6655
Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601 402-564-3131
Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
§ Dale Electronics, Inc., Specialty Div., P. O. Box 1179, Robbinsville, NC 28771 704-479-6451
Eltec Instruments Inc., P.O. Box 9610, Daytona Bch., FL 32020 904-253-5328
Solitron/Microwave, Solitron Devices, Inc., 1177 Blue Heron Blvd., Solitron Pk., Riviera Bch., FL 33404 305-848-4311
§† Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 .. 215-644-1300
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Heat Sink Encased — See Resistors, Integral Heat Dissipator (Vol. A)

Resistors, High Frequency-4700

§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•1855
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1878-1879
Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... A•1928-1931
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701, 402-371-0080 ..... A•1923
International Manufacturing Services, 50 Schoolhouse La., Portsmouth, RI 02871-2418, 401-683-9700 ..... A•1936
§ International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1937
Kelvin Industries, Inc., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501, 818-990-1192 ..... A•1945
† KRL/Bantry Components, Inc., 160 Bouchard St., Manchester, NH 03103, 603-668-3210 ..... A•1951
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1968
Ohmtek Inc., Sfernice Group Company, 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ..... A•2023
Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ..... A•1997
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2010-2011
RCL-Shallcross, 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... A•2013-2015,2017
Resistors, Inc., 5226 W. 26th St., Chicago, IL 60650, 312-652-7555 ..... A•2019
† Standard Oil Engineered Materials Co., Carborundum, P. O. Box 156, Niagara Falls, NY 14302, 716-278-2000 ..... A•2032
Victoreen, Inc., A Sheller-Globe Corp. Subsidiary, 6000 Cochran Rd., Solon, OH 44139, 216-248-9300 ..... A•2042
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ..... 818-765-8300;800-423-3186
Component General, Inc., 13620 Wright Cir., Tampa, FL 33626 813-855-6655
§ Dale Electronics, Inc., Specialty Div., P. O. Box 1179, Robbinsville, NC 28771 704-479-6451
† EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800
Huntington Electric Inc., P.O. Box 366, Dept. EEM 87, Huntington, IN 46750 219-356-0778
† Hycomp, Inc., 165 Cedar Hill St., Marlborough, MA 01752 617-485-6300
§ KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
§† Memcor-Truohm, Inc., 1320 Flaxmill Rd., Huntington, IN 46750 219-356-4300
† Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
§ Nepenthe, Inc., 2471 E. Bayshore Road, Palo Alto, CA 94303 ..... 415-856-9332; 800-NEPENTHE
RCL-Shallcross, Inc., U.S. Hwy. 70 East, Smithfield, NC 27577 919-934-5181
§† Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311
§† Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405 818-781-1642
Tel Labs, Inc., Sfernice, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 603-625-8994
† Thickfilm International, Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-7400
§† Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502 .. 303-242-0810
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
§† Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 .. 215-644-1300

Resistors, High Megohm (Over 22 Megohms)-4700

§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•1855-1856
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1878-1881,1884-1885,1888-1889,1892
CTS Corp., Electromechanical Div., (Formerly Elkhart Div.), 1142 W. Beardsley Ave., Elkhart, IN 46514, 219-295-3575 ..... A•1904
Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... A•1928-1931
Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701, 402-371-0080 ..... A•1922
International Manufacturing Services, 50 Schoolhouse La., Portsmouth, RI 02871-2418, 401-683-9700 ..... A•1936
§† International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1937
§ K & M Electronics, 221 Interstate Dr., Dock No. 3, W. Springfield, MA 01089, 413-781-1350 ..... A•1943
Kelvin Industries, Inc., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501, 818-990-1192 ..... A•1945
† KRL/Bantry Components, Inc., 160 Bouchard St., Manchester, NH 03103, 603-668-3210 ..... A•1951
Mepco/Centralab, North American Philips Corporation, 4561 Colorado Blvd., Los Angeles, CA 90039, 818-240-4880 ..... A•1957
Mepco/Centralab, North American Philips Corporation, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, 817-325-7871 ..... A•1957
† Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761, 617-695-0203 ..... A•1975
Ohmtek Inc., Sfernice Group Company, 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ..... A•2023-2024
Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ..... A•1996-1997
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2010
RCL-Shallcross, 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... A•2012
State of the Art, Inc., 2470 Fox Hill Rd., State College, PA 16803-1797, 814-355-8004 ..... A•2035
Victoreen, Inc., A Sheller-Globe Corp. Subsidiary, 6000 Cochran Rd., Solon, OH 44139, 216-248-9300 ..... A•2040-2045
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ..... 818-765-8300;800-423-3186
California Micro Devices, Inc., 215 Topaz Street, Milpitas, CA 95035 408-263-3214
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
Component General, Inc., 13620 Wright Cir., Tampa, FL 33626 813-855-6655
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900
CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926 915-592-3253
Dale Electronics, Inc., Specialty Div., P. O. Box 1179, Robbinsville, NC 28771 704-479-6451
Eltec Instruments Inc., P.O. Box 9610, Daytona Bch., FL 32020 904-253-5328
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000

§ KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
Mepco/Centralab Corp. Hdqrtr., North American Philips Corporation, 2001 W. Blue Heron Blvd., Riviera Beach, FL 33404 407-881-3200
Mepco/Centralab, Inc., A North American Philips Co., 2566 Northwestern Ave., West Lafayette, IN 47906 317-463-2536
† Microplex, Inc., 1977 State College Blvd., Anaheim, CA 92806 ..... 714-979-8833; 714-634-1535
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
Penn Airborne Prods., 950 Industrial Hwy., Southampton, PA 18966 215-355-3400
Philips Circuit Assemblies, A Subdivision of North American Philips Corp., 2566 Northwestern Avenue, West Lafayette, IN 47906 317-463-2536
Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
Stackpole, Carbon Div., 201 Stackpole St, St Marys, PA 15857 814-781-1234
Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405 818-781-1642
† Thickfilm International, Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-7400
Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502 .. 303-242-0810
Varnistor Corp., 115 Industrial Pk., Sevierville, TN 37862 615-453-0001
† Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 .. 215-644-1300

Resistors, High Temperature (Over 125°C)-4700

§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•1854,1859
§† Bradford Electronics, Inc., 550 High Street, Bradford, PA 16701, 814-362-5700 ..... A•1872
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1878-1881,1884-1886,1888-1891
§† Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... A•1926-1931
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701, 402-371-0080 ..... A•1922
† Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150 ..... A•1932
§ International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1937
KOA Speer Electronics, Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ..... A•1949
† KRL/Bantry Components, Inc., 160 Bouchard St., Manchester, NH 03103, 603-668-3210 ..... A•1951
Mepco/Centralab, North American Philips Corporation, 4561 Colorado Blvd., Los Angeles, CA 90039, 818-240-4880 ..... A•1957
§† Mepco/Centralab, North American Philips Corporation, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, 817-325-7871 ..... A•1957,1960
§† Micro-Ohm Corp., 1088 Hamilton Rd., Duarte, CA 91010, 818-3575377 ..... A•1963-1964
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1968
† Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204, 414-271-9900 ..... A•1970-1971
Nytronics Components Grp., Inc., 700 Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1979
† Pacific Resistor Co., 18300 Oxnard St., Tarzana, CA 91356, 818-345-7811 ..... A•1998-1999
Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•2001
Precision Resistive Products, Inc., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, 319-394-9131 ..... A•2003
Precision Resistor Co., Inc., 10601 75 St. N., Largo, FL 34647, 813-541-5771 ..... A•2005
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2011
§† RCL-Shallcross, 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... A•2012,2014,2016-2017
Resistors, Inc., 5226 W. 26th St., Chicago, IL 60650, 312-652-7555 ..... A•2019
† Standard Oil Engineered Materials Co., Carborundum, P. O. Box 156, Niagara Falls, NY 14302, 716-278-2000 ..... A•2032
State of the Art, Inc., 2470 Fox Hill Rd., State College, PA 16803-1797, 814-355-8004 ..... A•2035
Vermont Precision Resistor, Codeco Corp. of Vermont, West Hill Road, P.O. Box 1207, Stowe, VT 05672-1170, 802-253-8567 ..... A•2039
Victoreen, Inc., A Sheller-Globe Corp. Subsidiary, 6000 Cochran Rd., Solon, OH 44139, 216-248-9300 ..... A•2041-2042
§† Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ..... A•2047
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ..... 818-765-8300;800-423-3186
Capco, Box 1028, Grand Junction, CO 81502 303-243-8751
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
Component General, Inc., 13620 Wright Cir., Tampa, FL 33626 813-855-6655
§ Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-699-0918; 800-255-2666
Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926 915-592-3253
§ Dale Electronics, Inc., Specialty Div., P. O. Box 1179, Robbinsville, NC 28771 704-479-6451
Electro Comp., Inc., 2415 Main St, Stratford, CT 06497 203-375-5811
Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
§† Fenwal Electronics/APD, Kidde, Inc., 450 Fortune Blvd., Milford, MA 01757 617-478-5255
Ferro Corporation, Electronic Materials Div., 27 Castilion Dr., Santa Barbara, CA 93117-3092 805-968-5000
§† Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
Huntington Electric Inc., P.O. Box 366, Dept. EEM 87, Huntington, IN 46750 219-356-0778
† Hycomp, Inc., 165 Cedar Hill St, Marlborough, MA 01752 617-485-6300
§ INRESCO, Inc., 654 Ocean Road, Pt. Pleasant, NJ 08742 201-892-5881
International Manufacturing Services, 50 Schoolhouse La., Portsmouth, RI 02871-2418 401-683-9700
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
§ KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
Kelvin Industries, Inc., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501 818-990-1192
Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
Meissner Industries, 551 Rte. 10, Dover, NJ 07801 201-366-1700
§† Memcor-Truohm, Inc., 1320 Flaxmill Rd., Huntington, IN 46750 219-356-4300
Mepco/Centralab Corp. Hdqrtr., North American Philips Corporation, 2001 W. Blue Heron Blvd., Riviera Beach, FL 33404 407-881-3200
Mepco/Centralab, Inc., A North American Philips Co., 2566 Northwestern Ave., West Lafayette, IN 47906 317-463-2536
† Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
§† Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
Philips Circuit Assemblies, A Subdivision of North American Philips Corp., 2566 Northwestern Avenue, West Lafayette, IN 47906 317-463-2536
§† RCL-Shallcross, Inc., U.S. Hwy. 70 East, Smithfield, NC 27577 919-934-5181
§ Rohm Corporation, 8 Whatney, Irvine, CA 92718 714-855-2131
§† Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311
Stackpole, Carbon Div., 201 Stackpole St, St Marys, PA 15857 814-781-1234
§† Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405 818-781-1642
Tel Labs, Inc., Sfernice, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 603-625-8994
† Thickfilm International, Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-7400
§† Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502 .. 303-242-0810
United Foam Plastics, 172-Q E. Main St., Georgetown, MA 01833 617-352-2200
Ward Leonard Electric Co., Inc., 31 South St, Mt. Vernon, NY 10550 914-664-1000

Resistors, High Voltage (1,000 Volts & Over)-4700

§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1878-1886,1892
CTS Corp., Electromechanical Div., (Formerly Elkhart Div.), 1142 W. Beardsley Ave., Elkhart, IN 46514, 219-295-3575 ..... A•1904
§† Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... A•1928-1931
Electro Impulse, Box 870, Red Bank, NJ 07701-0870, 201-741-0404 ..... D•1241
Elliott/Jordan, A Sub. of Vishay Intertechnology, 63 Lincoln Highway, Malvern, PA 19355, 215-644-1300 ..... A•1934
International Manufacturing Services, 50 Schoolhouse La., Portsmouth, RI 02871-2418, 401-683-9700 ..... A•1936
§† International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1937
Julie Research Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 ..... A•1961
§ K & M Electronics, 221 Interstate Dr., Dock No. 3, W. Springfield, MA 01089, 413-781-1350 ..... A•1943
KRL/Bantry Components, Inc., 160 Bouchard St., Manchester, NH 03103, 603-668-3210 ..... A•1952
Micro-Ohm Corp., 1088 Hamilton Rd., Duarte, CA 91010, 818-3575377 ..... A•1962-1963
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1968
Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..... A•1982,1986
Ohmtek Inc., Sfernice Group Company, 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ..... A•2021,2023
Ovensire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ..... A•1996-1997
† Pacific Resistor Co., 18300 Oxnard St., Tarzana, CA 91356, 818-345-7811 ..... A•1998-1999
Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•2001
† Precision Resistor Co., Inc., 10601 75 St. N., Largo, FL 34647, 813-541-5771 ..... A•2004-2006
§† RCL-Shallcross, 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... A•2013-2016
† Standard Oil Engineered Materials Co., Carborundum, P. O. Box 156, Niagara Falls, NY 14302, 716-278-2000 ..... A•2032-2033
State of the Art, Inc., 2470 Fox Hill Rd., State College, PA 16803-1797, 814-355-8004 ..... A•2036
Victoreen, Inc., A Sheller-Globe Corp. Subsidiary, 6000 Cochran Rd., Solon, OH 44139, 216-248-9300 ..... A•2040-2044
Alden Products Co., P.O. Box 860, 117 N. Main St, Brockton, MA 02403 617-583-0160
Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
† Atlas Engineering Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
Component General, Inc., 13620 Wright Cir., Tampa, FL 33626 813-855-6655
† CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926 915-592-3253
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
§ Dale Electronics, Inc., Specialty Div., P. O. Box 1179, Robbinsville, NC 28771 704-479-6451

Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
§ KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
Kelvin Industries, Inc., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501 818-990-1192
Maxwell Laboratories, 8888 Balboa Avenue, San Diego, CA 92123-1506 619-279-5100
Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
§† RCL-Shallcross, Inc., U.S. Hwy. 70 East, Smithfield, NC 27577 919-934-5181
Sensitive Research Instruments, 25 Dock St., Mt. Vernon, NY 10550 914-699-9717
Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
Tel Labs, Inc., Sfernice, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 603-625-8994
† Thickfilm International, Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-7400
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
Varnistor Corp., 115 Industrial Pk, Sevierville, TN 37862 615-453-0001
Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 .. 215-644-1300
§ Ward Leonard Electric Co., Inc., 31 South St., Mt. Vernon, NY 10550 914-664-1000
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Hot Molded-4700

§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•1855-1857
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ..... A•1870
Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... A•1925,1928-1931
§† Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926, 915-592-3253 ..... A•1914-1915,1917
§† Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701, 402-371-0080 ..... A•1918,1921
§† International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1937
§† KRL/Bantry Components, Inc., 160 Bouchard St., Manchester, NH 03103, 603-668-3210 ..... A•1951,1953
Memcor-Truohm, Inc., 1320 Flaxmill Rd., Huntington, IN 46750, 219-356-4300 ..... A•1956
§† Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..... A•1981-1982,1986
† Pacific Resistor Co., 18300 Oxnard St., Tarzana, CA 91356, 818-345-7811 ..... A•1998
RCL-Shallcross, 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... A•2012
Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 ..... A•2029
§† Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ..... A•2051
§ Dale Electronics, Inc., Specialty Div., P. O. Box 1179, Robbinsville, NC 28771 704-479-6451
§ International Components Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
† Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Tel Labs, Inc., Sfernice, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 603-625-8994

Resistors, Integral Heat Dissipator-4700

Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1878-1879,1900-1901
§† Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... A•1928-1931
Huntington Electric Inc., P.O. Box 366, Dept. EEM 87, Huntington, IN 46750, 219-356-0778 ..... A•1942
Kelvin Industries, Inc., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501, 818-990-1192 ..... A•1945
§† KRL/Bantry Components, Inc., 160 Bouchard St., Manchester, NH 03103, 603-668-3210 ..... A•1951,1953
§† Micro-Ohm Corp., 1088 Hamilton Rd., Duarte, CA 91010, 818-3575377 ..... A•1962-1963
Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204, 414-271-9900 ..... A•1970-1972
Nytronics Components Grp., Inc., 700 Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1979
Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..... A•1982,1986
Pacific Resistor Co., 18300 Oxnard St., Tarzana, CA 91356, 818-345-7811 ..... A•1998-1999
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2011
§† RCL-Shallcross, 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... A•2013-2014
Coaxial Dynamics, 15210 Industrial Parkway, Cleveland, OH 44135 .... 1-800-COAXIAL
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
Component General, Inc., 13620 Wright Cir., Tampa, FL 33626 813-855-6655
Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926 915-592-3253
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Electro Comp., Inc., 2415 Main St., Stratford, CT 06497 203-375-5811
Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
§† RCL-Shallcross, Inc., U.S. Hwy. 70 East, Smithfield, NC 27577 919-934-5181
§† Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
Solitron/Microwave, Solitron Devices, Inc., 1177 Blue Heron Blvd., Solitron Pk., Riviera Bch., FL 33404 305-848-4311
§ Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405 818-781-1642
Tel Labs, Inc., Sfernice, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 603-625-8994
§ Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502 .. 303-242-0810
Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 .. 215-644-1300

Resistors, Low Temperature Coefficient-4700

§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•1858,1866
§† Bradford Electronics, Inc., 550 High Street, Bradford, PA 16701, 814-362-5700 ..... A•1873-1874
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1878-1882,1884-1886,1888-1892,1900-1901
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111, 201-371-9500 .... A•1902
CTS Corp., Electromechanical Div., (Formerly Elkhart Div.), 1142 W. Beardsley Ave., Elkhart, IN 46514, 219-295-3575 ..... A•1904
§† Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... A•1928-1931
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701, 402-371-0080 ..... A•1918,1921
† Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150 ..... A•1932
General Resistance, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, 203-481-5721 ..... A•1941
Huntington Electric Inc., P.O. Box 366, Dept. EEM 87, Huntington, IN 46750, 219-356-0778 ..... A•1942
§ International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1937
Julie Research Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 ..... A•1961
§ K & M Electronics, 221 Interstate Dr., Dock No. 3, W. Springfield, MA 01089, 413-781-1350 ..... A•1943
Kelvin Industries, Inc., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501, 818-990-1192 ..... A•1945
§† KOA Speer Electronics, Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ..... A•1949
† KRL/Bantry Components, Inc., 160 Bouchard St., Manchester, NH 03103, 603-668-3210 ..... A•1952
Mepco/Centralab, North American Philips Corporation, 4561 Colorado Blvd., Los Angeles, CA 90039, 818-240-4880 ..... A•1957
Mepco/Centralab, North American Philips Corporation, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, 817-325-7871 ..... A•1957
§† Micro-Ohm Corp., 1088 Hamilton Rd., Duarte, CA 91010, 818-3575377 ... A•1962
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1968
Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204, 414-271-9900 ..... A•1970
Nytronics Components Grp., Inc., 700 Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1979
§ Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..... A•1980-1981,1983-1986
Ohmtek Inc., Sfernice Group Company, 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ..... A•2020,2022,2025
† Pacific Resistor Co., 18300 Oxnard St., Tarzana, CA 91356, 818-345-7811 ..... A•1998-1999
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•2001
§ Precision Resistive Products, Inc., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, 319-394-9131 ..... A•2003
† Precision Resistor Co., Inc., 10601 75 St. N., Largo, FL 34647, 813-541-5771 ..... A•2004,2006-2007
RCL-Shallcross, 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... A•2012-2017
† Resistors, Inc., 5226 W. 26th St., Chicago, IL 60650, 312-652-7555 ..... A•2019
† Standard Oil Engineered Materials Co., Carborundum, P. O. Box 156, Niagara Falls, NY 14302, 716-278-2000 ..... A•2032
† State of the Art, Inc., 2470 Fox Hill Rd., State College, PA 16803-1797, 814-355-8004 ..... A•2036
§† Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 ..... A•2027-2028
† Vermont Precision Resistor, Codeco Corp. of Vermont, West Hill Road, P.O. Box 1207, Stowe, VT 05672-1170, 802-253-8567 ..... A•2038
Victoreen, Inc., A Sheller-Globe Corp. Subsidiary, 6000 Cochran Rd., Solon, OH 44139, 216-248-9300 ..... A•2042
§† Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ..... A•2048
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ..... 818-765-8300;800-423-3186
Applied Research Labs., Fisons, 24911 Stanford Ave., Valencia, CA 91355 805-295-0019
§† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700
Capco, Box 1028, Grand Junction, CO 81502 303-243-8751
§ Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-699-0918; 800-255-2666

Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900
§† Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-8725
§† CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
§† Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926 915-592-3253
§ Dale Electronics, Inc., Specialty Div., P. O. Box 1179, Robbinsville, NC 28771 704-479-6451
† Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
† EMCA, Sub. Rohm and Haas Advanced Matls. Co., 605 Center Ave., Mamaroneck, NY 10543 914-698-8434
§† Fenwal Electronics/APD, Kidde, Inc., 450 Fortune Blvd., Milford, MA 01757 617-478-5255
Ferro Corporation, Electronic Materials Div., 27 Castilion Dr., Santa Barbara, CA 93117-3092 805-968-5000
§† Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
§† Guideline Instruments, 4403 Vineland Rd, Suite B-10, Orlando, FL 32811-7335 305-423-8215
† Hycomp, Inc., 165 Cedar Hill St., Marlborough, MA 01752 617-485-6300
§ INRESCO, Inc., 654 Ocean Road, Pt. Pleasant, NJ 08742 201-892-5881
International Manufacturing Services, 50 Schoolhouse La., Portsmouth, RI 02871-2418 401-683-9700
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 .. 516-937-3475
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
§† KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
Meissner Industries, 551 Rte. 10, Dover, NJ 07801 201-366-1700
§† Memcor-Truohm, Inc., 1320 Flaxmill Rd., Huntington, IN 46750 219-356-4300
Mepco/Centralab Corp. Hdqrtr., North American Philips Corporation, 2001 W. Blue Heron Blvd., Riviera Beach, FL 33404 407-881-3200
Mepco/Centralab, Inc., A North American Philips Co., 2566 Northwestern Ave., West Lafayette, IN 47906 317-463-2536
† Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
NIC Components Corp., 6000 New Horizons Blvd., N. Amityville, NY 11701 516-226-7500
Philips Circuit Assemblies, A Subdivision of North American Philips Corp., 2566 Northwestern Avenue, West Lafayette, IN 47906 317-463-2536
§ Piher International Corp., 903 Feehanville Dr., Mt. Prospect, IL 60056 ..... 312-390-6680; 800-323-6693
Raltron Electronics, 2315 N.W. 107th Ave., Miami, FL 33172 305-593-6033
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
RCL-Shallcross, Inc., U.S. Hwy. 70 East, Smithfield, NC 27577 919-934-5181
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
§ Rohm Corporation, 8 Whatney, Irvine, CA 92718 714-855-2131
§† Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311
§† Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405 818-781-1642
Tel Labs, Inc., Sfernice, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 603-625-8994
§ Tepro of Florida, 2608 Enterprise Rd., Clearwater, FL 33575 813-796-1044
† Thickfilm International, Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-7400
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
§† Vamistor Corp., 115 Industrial Pk., Sevierville, TN 37862 615-453-0001
§ Ward Leonard Electric Co., Inc., 31 South St., Mt. Vernon, NY 10550 914-664-1000
Wilbrecht Electronics, 346 Chester St., St. Paul, MN 55107 612-222-2791
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Metal Glazed-4700

§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, 818-765-8300;800-423-3186 ..... A•1868
§† International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1939, B•1011
§ Micro-Ohm Corp., 1088 Hamilton Rd., Duarte, CA 91010, 818-3575377 ..... A•1964-1965
Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..... A•1991
Ohmtek Inc., Sfernice Group Company, 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ..... A•2024
RCL-Shallcross, 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... A•2017
Victoreen, Inc., A Sheller-Globe Corp. Subsidiary, 6000 Cochran Rd., Solon, OH 44139, 216-248-9300 ..... A•2040
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
§ Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-699-0918; 800-255-2666
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
§ Dale Electronics, Inc., Specialty Div., P. O. Box 1179, Robbinsville, NC 28771 704-479-6451
† EMCA, Sub. Rohm and Haas Advanced Matls. Co., 605 Center Ave., Mamaroneck, NY 10543 914-698-8434
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
§ Rohm Corporation, 8 Whatney, Irvine, CA 92718 714-855-2131
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Thickfilm International, Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-7400

Resistors, Metal Oxide-4700

§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, 818-765-8300;800-423-3186 ..... A•1868
§† Ametek/Rodan Div., 2905 Blue Star St., Anaheim, CA 92806, 714-630-0081 ..... B•1836
§† Bradford Electronics, Inc., 550 High Street, Bradford, PA 16701, 814-362-5700 ..... A•1872
§ International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1937
§ KOA Speer Electronics, Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ..... A•1948
§ KRL/Bantry Components, Inc., 160 Bouchard St., Manchester, NH 03103, 603-668-3210 ..... A•1953
Maida Development Co., 20 Libby St., Hampton, VA 23663, 804-723-0785 ..... A•1954-1955
Mepco/Centralab, North American Philips Corporation, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, 817-325-7871 ..... A•1960
RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2011
Victoreen, Inc., A Sheller-Globe Corp. Subsidiary, 6000 Cochran Rd., Solon, OH 44139, 216-248-9300 ..... A•2040-2045
Canadian Thermostats & Control Devices Ltd., 8415 Mountian Sights, Montreal, PQ, CANADA H4P2B8 514-739-3274
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
§ Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-699-0918; 800-255-2666
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-8725
Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Dale Electronics, Inc., Specialty Div., P. O. Box 1179, Robbinsville, NC 28771 704-479-6451
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 .. 516-937-3475
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
§ Liberty Intl. Corp., FIRSTOHM, 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
§ NTE Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
§ Paccom, 3928 148th NE, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
§ Piher International Corp., 903 Feehanville Dr., Mt. Prospect, IL 60056 ..... 312-390-6680; 800-323-6693
Roederstein Elctrns., Inc., P.O. Box 5588, Statesville, NC 28677 704-872-8101
§ Rohm Corporation, 8 Whatney, Irvine, CA 92718 714-855-2131
† Thickfilm International, Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-7400

Resistors, Microwave-4700

† AMITRON, American Micro-Tronix, Inc., 85 Flagship Drive, North Andover, MA 01845, 508-686-1882 ..... A•1763
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1878-1879
† Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150 ..... A•1932-1933
Electro Impulse, Box 870, Red Bank, NJ 07701-0870, 201-741-0404 ..... D•1241
§ Precision Resistive Products, Inc., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, 319-394-9131 ..... A•2002
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2011
† Standard Oil Engineered Materials Co., Carborundum, P. O. Box 156, Niagara Falls, NY 14302, 716-278-2000 ..... A•2032
† Bird Electronic Corp., 30303 Aurora Rd., Cleveland, OH 44139-2794 216-248-1200
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
Component General, Inc., 13620 Wright Cir., Tampa, FL 33626 813-855-6655
Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
International Manufacturing Services, 50 Schoolhouse La., Portsmouth, RI 02871-2418 401-683-9700
§ KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
§ Liberty Intl. Corp., FIRSTOHM, 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
† Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
† Mitec Electronics, 104 Gun Avenue, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311
§† Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405 818-781-1642
† Thickfilm International, Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-7400
§† Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502 .. 303-242-0810
Vamistor Corp., 115 Industrial Pk., Sevierville, TN 37862 615-453-0001
§† Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 .. 215-644-1300

Resistors, Negative Temperature Coefficient-4700

§† Ametek/Rodan Div., 2905 Blue Star St., Anaheim, CA 92806, 714-630-0081 ..... B•1836
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1878-1879,1901
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111, 201-371-9500 .... A•1902
† Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150 ..... A•1932
§† Fenwal Electronics/APD, Kidde, Inc., 450 Fortune Blvd., Milford, MA 01757, 617-478-5255 ..... B•1846

Huntington Electric Inc., P.O. Box 366, Dept. EEM 87, Huntington, IN 46750, 219-356-0778 ..... A•1942
§† International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1937
§ Keystone Carbon, Thermistor Div., 1935 State Street, St. Marys, PA 15857, 814-781-1591 ..... B•1847-1848
Mepco/Centralab, North American Philips Corporation, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, 817-325-7871 ..... A•1960
§ Midwest Components, Inc., 1981 Port City Blvd., Muskegon, MI 49443, 616-777-2602 ..... B•1852-1853
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1968
§ Precision Resistive Products, Inc., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, 319-394-9131 ..... A•2003
§ Quality Thermistor, 2147 Centurion Pl., Boise, ID 83709, 208-377-3373 .. B•1864
RCL-Shallcross, 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... A•2013-2015
Sensor Scientific, Inc., 1275 Bloomfield Ave., Fairfield, NJ 07006, 201-227-7790;800-524-1610 ..... B•1868-1869
† Standard Oil Engineered Materials Co., Carborundum, P. O. Box 156, Niagara Falls, NY 14302, 716-278-2000 ..... A•2032-2033
† Vermont Precision Resistor, Codeco Corp. of Vermont, West Hill Road, P.O. Box 1207, Stowe, VT 05672-1170, 802-253-8567 ..... A•2038
† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700
Betatherm Corp., 910 Turnpike Rd. (Rte. 9), Shrewsbury, MA 01545 617-842-0516
Canadian Thermostats & Control Devices Ltd., 8415 Mountian Sights, Montreal, PQ, CANADA H4P2B8 514-739-3274
Component General, Inc., 13620 Wright Cir., Tampa, FL 33626 813-855-6655
§ Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-699-0918; 800-255-2666
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900
Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926 915-592-3253
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
Ferro Corporation, Electronic Materials Div., 27 Castilion Dr., Santa Barbara, CA 93117-3092 805-968-5000
§ Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
Hitachi America, Ltd., 2210 O'Toole Ave., San Jose, CA 95131 408-435-8300
§ Hi-Tech Components, Mitsubishi International Corp., 520 Madison Ave., New York, NY 10022 212-605-2607
† Hycomp, Inc., 165 Cedar Hill St., Marlborough, MA 01752 617-485-6300
International Components Corp., 105 Maxess Rd., Melville, NY 11747 ... 516-293-1500
International Manufacturing Services, 50 Schoolhouse La., Portsmouth, RI 02871-2418 401-683-9700
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 .. 516-937-3475
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
Julie Research Labs., 211 West 61st St., New York, NY 10023 212-245-2727
§† KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
Memcor-Truohm, Inc., 1320 Flaxmill Rd., Huntington, IN 46750 219-356-4300
Mepco/Centralab Corp. Hdqrtr., North American Philips Corporation, 2001 W. Blue Heron Blvd., Riviera Beach, FL 33404 407-881-3200
† Piezo Electric Products, Inc., 212 Durham Ave., Metuchen, NJ 08840 201-548-2800
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
RCL-Shallcross, Inc., U.S. Hwy. 70 East, Smithfield, NC 27577 919-934-5181
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
§† Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405 818-781-1642
† Thickfilm International, Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-7400
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
§† Vamistor Corp., 115 Industrial Pk., Sevierville, TN 37862 615-453-0001
§ Victory Engineering Corp., Victory Rd., Springfield, NJ 07081 201-379-5900
§† Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 .. 215-644-1300
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Noninductive-4700

§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•1858-1859
§† Bradford Electronics, Inc., 550 High Street, Bradford, PA 16701, 814-362-5700 ..... A•1872
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1878-1881,1884,1886-1887,1889-1890,1901
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111, 201-371-9500 .... A•1903
§† Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... A•1925,1928-1931
Elliott/Jordan, A Sub. of Vishay Intertechnology, 63 Lincoln Highway, Malvern, PA 19355, 215-644-1300 ..... A•1934-1935
Huntington Electric Inc., P.O. Box 366, Dept. EEM 87, Huntington, IN 46750, 219-356-0778 ..... A•1942
§† International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1938
§† Kelvin Industries, Inc., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501, 818-990-1192 ..... A•1945
† KRL/Bantry Components, Inc., 160 Bouchard St., Manchester, NH 03103, 603-668-3210 ..... A•1951
Mepco/Centralab, North American Philips Corporation, 4561 Colorado Blvd., Los Angeles, CA 90039, 818-240-4880 ..... A•1957
Mepco/Centralab, North American Philips Corporation, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, 817-325-7871 ..... A•1957
§† Micro-Ohm Corp., 1088 Hamilton Rd., Duarte, CA 91010, 818-3575377 ..... A•1962-1963
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1968
Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204, 414-271-9900 ..... A•1970
§† Nytronics Components Grp., Inc., 700 Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1979
§† Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..... A•1980,1984,1988-1989
Ohmtek Inc., Sfernice Group Company, 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ..... A•2022
† Pacific Resistor Co., 18300 Oxnard St., Tarzana, CA 91356, 818-345-7811 ..... A•1998-1999
§ Precision Resistive Products, Inc., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, 319-394-9131 ..... A•2002
† Precision Resistor Co., Inc., 10601 75 St. N., Largo, FL 34647, 813-541-5771 ..... A•2005-2006
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2010-2011
§ RCL-Shallcross, 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... A•2012-2017
† Resistors, Inc., 5226 W. 26th St., Chicago, IL 60650, 312-652-7555 ..... A•2019
† Standard Oil Engineered Materials Co., Carborundum, P. O. Box 156, Niagara Falls, NY 14302, 716-278-2000 ..... A•2032-2033
† Vermont Precision Resistor, Codeco Corp. of Vermont, West Hill Road, P.O. Box 1207, Stowe, VT 05672-1170, 802-253-8567 ..... A•2038-2039
Victoreen, Inc., A Sheller-Globe Corp. Subsidiary, 6000 Cochran Rd., Solon, OH 44139, 216-248-9300 ..... A•2043
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ..... 818-765-8300;800-423-3186
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
§ Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700
Capco, Box 1028, Grand Junction, CO 81502 303-243-8751
§ Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-699-0918; 800-255-2666
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-8725
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
† Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
Electro Scientific Inds., 13900 N.W. Science Pk. Dr., Portland, OR 97229 503-641-4141
§† Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
§ INRESCO, Inc., 654 Ocean Road, Pt. Pleasant, NJ 08742 201-892-5881
International Manufacturing Services, 50 Schoolhouse La., Portsmouth, RI 02871-2418 401-683-9700
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
Julie Research Labs., 211 West 61st St., New York, NY 10023 212-245-2727
K & M Electronics, 221 Interstate Dr., Dock No. 3, W. Springfield, MA 01089 413-781-1350
Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
Meissner Industries, 551 Rte. 10, Dover, NJ 07801 201-366-1700
§† Memcor-Truohm, Inc., 1320 Flaxmill Rd., Huntington, IN 46750 219-356-4300
Mepco/Centralab Corp. Hdqrtr., North American Philips Corporation, 2001 W. Blue Heron Blvd., Riviera Beach, FL 33404 407-881-3200
Mepco/Centralab, Inc., A North American Philips Co., 2566 Northwestern Ave., West Lafayette, IN 47906 317-463-2536
Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
NIC Components Corp., 6000 New Horizons Blvd., N. Amityville, NY 11701 516-226-7500
Philips Circuit Assemblies, A Subdivision of North American Philips Corp., 2566 Northwestern Avenue, West Lafayette, IN 47906 317-463-2536
§ RCL-Shallcross, Inc., U.S. Hwy. 70 East, Smithfield, NC 27577 919-934-5181
Samarius Precision Instruments, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418 203-735-7405
§† Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405 818-781-1642
† Tel Labs, Inc., Sfernice, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 603-625-8994
§† Tepro of Florida, 2608 Enterprise Rd., Clearwater, FL 33575 813-796-1044
† Thickfilm International, Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-7400
§† Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502 .. 303-242-0810
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
† Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 .. 215-644-1300
§ Ward Leonard Electric Co., Inc., 31 South St., Mt. Vernon, NY 10550 914-664-1000
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Oil Filled-4700

† Julie Research Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 ..... A•1961
† KRL/Bantry Components, Inc., 160 Bouchard St., Manchester, NH 03103, 603-668-3210 ..... A•1951
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1968
† Atlas Engineering Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100

Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900
† Electro Impulse, Box 870, Red Bank, NJ 07701-0870 201-741-0404
Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
Kelvin Industries, Inc., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501 818-990-1192
Meissner Industries, 551 Rte. 10, Dover, NJ 07801 201-366-1700
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502 .. 303-242-0810
§ Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 .. 215-644-1300

Resistors, Plug-in-4700

Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1878-1879,1883,1888-1889,1891-1892,1898-1899,1901
CTS Corp., Electromechanical Div., (Formerly Elkhart Div.), 1142 W. Beardsley Ave., Elkhart, IN 46514, 219-295-3575 ..... A•1904
† KRL/Bantry Components, Inc., 160 Bouchard St., Manchester, NH 03103, 603-668-3210 ..... A•1951
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1968
Ohmtek Inc., Sfernice Group Company, 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ..... A•2023
§ Pomona Electronics, 1500 E. 9th St., P.O. Box 2767, Pomona, CA 91766, 714-623-3463 ..... C•1489,1708
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2010-2011
RCL-Shallcross, 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... A•2015-2017
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900
§ CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
§ Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601 402-564-3131
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
† E-Tron Corporation, 30 Ethel Rd., Edison, NJ 08817 201-287-9039
Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
International Resistive Company, P.O. Box 1860, Boone, NC 28607 704-264-8861
Julie Research Labs., 211 West 61st St., New York, NY 10023 212-245-2727
K & M Electronics, 221 Interstate Dr., Dock No. 3, W. Springfield, MA 01089 413-781-1350
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
Tel Labs, Inc., Sfernice, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 603-625-8994
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 .. 215-644-1300

Resistors, Positive Temperature Coefficient-4700

Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•1861
§† Ametek/Rodan Div., 2905 Blue Star St., Anaheim, CA 92806, 714-630-0081 ..... B•1836
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1878-1879,1900-1901
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111, 201-371-9500 ..... A•1902
§ Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... A•1928-1931
§† Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926, 915-592-3253 ..... B•1840-1841
† Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150 ..... A•1932
§† Fenwal Electronics/APD, Kidde, Inc., 450 Fortune Blvd., Milford, MA 01757, 617-478-5255 ..... B•1846
Huntington Electric Inc., P.O. Box 366, Dept. EEM 87, Huntington, IN 46750, 219-356-0778 ..... A•1942
§† International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1937
Kelvin Industries, Inc., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501, 818-990-1192 ..... A•1945
§ Keystone Carbon, Thermistor Div., 1935 State Street, St. Marys, PA 15857, 814-781-1591 ..... B•1848-1849
KOA Speer Electronics, Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ..... A•1950
† KRL/Bantry Components, Inc., 160 Bouchard St., Manchester, NH 03103, 603-668-3210 ..... A•1952
§† Micro-Ohm Corp., 1088 Hamilton Rd., Duarte, CA 91010, 818-3575377 ..... A•1964, B•1850
§ Midwest Components, Inc., 1981 Port City Blvd., Muskegon, MI 49443, 616-777-2602 ..... B•1852-1853,1858
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1968
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•1977
Ohmtek Inc., Sfernice Group Company, 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ..... A•2023
§ Precision Resistive Products, Inc., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, 319-394-9131 ..... A•2003
† Precision Resistor Co., Inc., 10601 75 St. N., Largo, FL 34647, 813-541-5771 ..... A•2005
§† Quality Thermistor, 2147 Centurion Pl., Boise, ID 83709, 208-377-3373 .. B•1864
§ RCL-Shallcross, 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... A•2013-2017
Sensor Scientific, Inc., 1275 Bloomfield Ave., Fairfield, NJ 07006, 201-227-7790;800-524-1610 ..... B•1868-1869
† Vermont Precision Resistor, Codeco Corp. of Vermont, West Hill Road, P.O. Box 1207, Stowe, VT 05672-1170, 802-253-8567 ..... A•2039
† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700
Cera-Mite Corp., 1327 Sixth Ave., Grafton, WI 53024 414-377-3500
§ Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-699-0918; 800-255-2666
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Electro Comp., Inc., 2415 Main St., Stratford, CT 06497 203-375-5811
§ Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
Ferro Corporation, Electronic Materials Div., 27 Castilion Dr., Santa Barbara, CA 93117-3092 805-968-5000
§ Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
Hitachi America, Ltd., 2210 O'Toole Ave., San Jose, CA 95131 408-435-8300
§ INRESCO, Inc., 654 Ocean Road, Ft. Pleasant, NJ 08742 201-892-5881
International Manufacturing Services, 50 Schoolhouse La., Portsmouth, RI 02871-2418 401-683-9700
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
Julie Research Labs., 211 West 61st St., New York, NY 10023 212-245-2727
§ Jumo Process Control, Inc., 410 Garibaldi Ave., Lodi, NJ 07644 201-779-7744
K & M Electronics, 221 Interstate Dr., Dock No. 3, W. Springfield, MA 01089 413-781-1350
§† KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
Meissner Industries, 551 Rte. 10, Dover, NJ 07801 201-366-1700
§† Memcor-Truohm, Inc., 1320 Flaxmill Rd., Huntington, IN 46750 219-356-4300
Mepco/Centralab Corp. Hdqrtr., North American Philips Corporation, 2001 W. Blue Heron Blvd., Riviera Beach, FL 33404 407-881-3200
Mepco/Centralab, North American Philips Corporation, Airport Road, P.O. Box 760, Mineral Wells, TX 76067 817-325-7871
Microplex, Inc., 1977 State College Blvd., Anaheim, CA 92806 ..... 714-979-8833; 714-634-1535
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
Raychem Corp., Elctrns. Grp., 300 Constitution Dr., Menlo Park, CA 94025 415-361-3860
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
§ RCL-Shallcross, Inc., U.S. Hwy. 70 East, Smithfield, NC 27577 919-934-5181
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
Sylvania GTE Control Devices, Rte. 35, Standish, ME 04084 207-642-4535
§ TDK Corporation, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku, Tokyo, JAPAN 103 ..... (03) 278-5111
Tel Labs, Inc., Sfernice, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 603-625-8994
Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502 .. 303-242-0810
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
§† Varistor Corp., 115 Industrial Pk., Sevierville, TN 37862 615-453-0001
§† Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 .. 215-644-1300
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Power-4700

Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•1858
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, 818-765-8300;800-423-3186 ..... A•1868
§† Bradford Electronics, Inc., 550 High Street, Bradford, PA 16701, 814-362-5700 ..... A•1874
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1878-1879,1881,1884-1887,1889,1900
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111, 201-371-9500 ..... A•1903
§† Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... A•1925-1931
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701, 402-371-0080 ..... A•1923-1924
Huntington Electric Inc., P.O. Box 366, Dept. EEM 87, Huntington, IN 46750, 219-356-0778 ..... A•1942
International Manufacturing Services, 50 Schoolhouse La., Portsmouth, RI 02871-2418, 401-683-9700 ..... A•1936
§† International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1937-1940
Julie Research Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 ..... A•1961
K & M Electronics, 221 Interstate Dr., Dock No. 3, W. Springfield, MA 01089, 413-781-1350 ..... A•1943
§ Kelvin Industries, Inc., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501, 818-990-1192 ..... A•1944-1945
§ KOA Speer Electronics, Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ..... A•1948

§† KRL/Bantry Components, Inc., 160 Bouchard St., Manchester, NH 03103, 603-668-3210 ..... A•1951,1953
§† Memcor-Truohm, Inc., 1320 Flaxmill Rd., Huntington, IN 46750, 219-356-4300 ..... A•1956
§† Micro-Ohm Corp., 1088 Hamilton Rd., Duarte, CA 91010, 818-3575377 ..... A•1962-1965
§ Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1968
† Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204, 414-271-9900 ..... A•1970-1974
† Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761, 617-695-0203 ..... A•1975
§† Nytronics Components Grp., Inc., 700 Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1979
§† Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..... A•1980-1987,1990,1992,1994
† Pacific Resistor Co., 18300 Oxnard St., Tarzana, CA 91356, 818-345-7811 ..... A•1998-1999
† Precision Resistor Co., Inc., 10601 75 St. N., Largo, FL 34647, 813-541-5771 ..... A•2004,2007
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2010-2011
RCL-Shallcross, 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... A•2012-2017
† Resistors, Inc., 5226 W. 26th St., Chicago, IL 60650, 312-652-7555 ..... A•2019
† Standard Oil Engineered Materials Co., Carborundum, P. O. Box 156, Niagara Falls, NY 14302, 716-278-2000 ..... A•2032-2033
† Tel Labs, Inc., Sfernice, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053, 603-625-8994 ..... A•2030
§† Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 ..... A•2029
Vermont Precision Resistor, Codeco Corp. of Vermont, West Hill Road, P.O. Box 1207, Stowe, VT 05672-1170, 802-253-8567 ..... A•2039
Victoreen, Inc., A Sheller-Globe Corp. Subsidiary, 6000 Cochran Rd., Solon, OH 44139, 216-248-9300 ..... A•2041,2044-2045
§ Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ..... A•2051
Alden Products Co., P.O. Box 860, 117 N. Main St., Brockton, MA 02403 617-583-0160
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
† Bird Electronic Corp., 30303 Aurora Rd., Cleveland, OH 44139-2794 216-248-1200
Capco, Box 1028, Grand Junction, CO 81502 303-243-8751
Carbone-Ferraz, Inc., 14 Eastmans Rd., Parsippany, NJ 07054 ..... 201-428-8400; 800-526-9067
§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., 3 Washington St., Dover, NH 03820 603-742-1120
Component General, Inc., 13620 Wright Cir., Tampa, FL 33626 813-855-6655
§ Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-699-0918; 800-255-2666
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900
§ Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-8725
Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926 915-592-3253
§ Dale Electronics, Inc., Specialty Div., P. O. Box 1179, Robbinsville, NC 28771 704-479-6451
Electro Comp., Inc., 2415 Main St., Stratford, CT 06497 203-375-5811
§† Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800
† Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
§ INRESCO, Inc., 654 Ocean Road, Pt. Pleasant, NJ 08742 201-892-5881
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 516-937-3475
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
§ KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
§ Liberty Intl. Corp., FIRSTOHM, 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
Maxwell Laboratories, 8888 Balboa Avenue, San Diego, CA 92123-1506 619-279-5100
Meissner Industries, 551 Rte. 10, Dover, NJ 07801 201-366-1700
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 312-364-6038
§ NTE Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
Ohmtek Inc., Sfernice Group Company, 2160 Liberty Dr., Niagara Falls, NY 14304 716-283-4025
§† RCL-Shallcross, Inc., U.S. Hwy. 70 East, Smithfield, NC 27577 919-934-5181
Samarius Precision Instruments, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418 203-735-7405
§† Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Solitron/Microwave, Solitron Devices, Inc., 1177 Blue Heron Blvd., Solitron Pk., Riviera Bch., FL 33404 305-848-4311
Stackpole, Carbon Div., 201 Stackpole St., St. Marys, PA 15857 814-781-1234
Standard Condenser Corp., 1065 W. Addison St., Chicago, IL 60613 312-327-5440
§† Tepro of Florida, 2608 Enterprise Rd., Clearwater, FL 33575 813-796-1044
† Thickfilm International, Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-7400
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
Varnistor Corp., 115 Industrial Pk., Sevierville, TN 37862 615-453-0001
§† Ward Leonard Electric Co., Inc., 31 South St., Mt. Vernon, NY 10550 914-664-1000
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Precision-4700

§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•1854,1859-1860,1864,1866
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, 818-765-8300;800-423-3186 ..... A•1868
Angstrohm Precision, Inc., A Sub of Vishay Intertechnology, 63 Lincoln Highway, Malvern, PA 19355, 215-644-1300 ..... A•1852-1853
§† Bradford Electronics, Inc., 550 High Street, Bradford, PA 16701, 814-362-5700 ..... A•1872,1874
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1878-1886,1888-1893,1898-1900
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111, 201-371-9500 ..... A•1902
§† Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... A•1925,1928-1931
§† Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701, 402-371-0080 ..... A•1921
† Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150 ..... A•1933
Elliott/Jordan, A Sub. of Vishay Intertechnology, 63 Lincoln Highway, Malvern, PA 19355, 215-644-1300 ..... A•1934-1935
§ General Resistance, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, 203-481-5721 ..... A•1941
IET Labs, Inc., 534 Main St., Westbury, NY 11590, 516-334-5959 ..... D•1268-1269,1271-1272
International Manufacturing Services, 50 Schoolhouse La., Portsmouth, RI 02871-2418, 401-683-9700 ..... A•1936
§† International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1940
Julie Research Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 ..... A•1961
K & M Electronics, 221 Interstate Dr., Dock No. 3, W. Springfield, MA 01089, 413-781-1350 ..... A•1943
§† Kelvin Industries, Inc., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501, 818-990-1192 ..... A•1944-1945
§† KOA Speer Electronics, Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ..... A•1946,1948
§† KRL/Bantry Components, Inc., 160 Bouchard St., Manchester, NH 03103, 603-668-3210 ..... A•1951
Mepco/Centralab, North American Philips Corporation, 4561 Colorado Blvd., Los Angeles, CA 90039, 818-240-4880 ..... A•1957
Mepco/Centralab, North American Philips Corporation, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, 817-325-7871 ..... A•1957
§† Micro-Ohm Corp., 1088 Hamilton Rd., Duarte, CA 91010, 818-3575377 ..... A•1962-1965
§ Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1968
† Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761, 617-695-0203 ..... A•1975
Nytronics Components Grp., Inc., 700 Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1979
§† Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..... A•1983
† Ohmtek Inc., Sfernice Group Company, 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ..... A•2022
Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ..... A•1996-1997
† Pacific Resistor Co., 18300 Oxnard St., Tarzana, CA 91356, 818-345-7811 ..... A•1998-1999
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•2001
§ Precision Resistive Products, Inc., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, 319-394-9131 ..... A•2002-2003
† Precision Resistor Co., Inc., 10601 75 St. N., Largo, FL 34647, 813-541-5771 ..... A•2004-2007
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2010-2011
§† RCL-Shallcross, 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... A•2013-2017
Resistors, Inc., 5226 W. 26th St., Chicago, IL 60650, 312-652-7555 ..... A•2019
† Tel Labs, Inc., Sfernice, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053, 603-625-8994 ..... A•2030
Tettex Instruments, Inc., P.O. Box 281, Fairview Village, PA 19409-0281, 215-539-6050 ..... D•1326
§† Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 ..... A•2028
Vermont Precision Resistor, Codeco Corp. of Vermont, West Hill Road, P.O. Box 1207, Stowe, VT 05672-1170, 802-253-8567 ..... A•2038
Victoreen, Inc., A Sheller-Globe Corp. Subsidiary, 6000 Cochran Rd., Solon, OH 44139, 216-248-9300 ..... A•2040
§† Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ..... A•2047-2048,2050-2051
§ Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900
§† Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-8725
§† Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926 915-592-3253
Dale Electronics, Inc., Specialty Div., P. O. Box 1179, Robbinsville, NC 28771 704-479-6451
Electro Comp., Inc., 2415 Main St., Stratford, CT 06497 203-375-5811
† Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
Engelhard Corp., Menlo Pk., CN40, Edison, NJ 08818 ..... 201-632-6000;800-932-0444 (in NJ)

† Environmental Comm., 3150 Pullman St., Costa Mesa, CA 92627 714-557-7800
† Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
† Hycomp, Inc., 165 Cedar Hill St., Marlborough, MA 01752 617-485-6300
§ INRESCO, Inc., 654 Ocean Road, Pt. Pleasant, NJ 08742 201-892-5881
International Components Corp., 105 Maxess Rd., Melville, NY 11747 ... 516-293-1500
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 .. 516-937-3475
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
§ Kahgan Electronics Corp., 605 Peninsula Blvd., Hempstead, NY 11550 .. 516-538-2300
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
Koep Precision Standards, Inc., IC Coan Place, Metuchen, NJ 08840 ..... 201-549-9280/9282
§ Liberty Intl. Corp., FIRSTOHM, 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
Meissner Industries, 551 Rte. 10, Dover, NJ 07801 201-366-1700
Mepco/Centralab Corp. Hdqrtr., North American Philips Corporation, 2001 W. Blue Heron Blvd., Riviera Beach, FL 33404 407-881-3200
Mepco/Centralab, Inc., A North American Philips Co., 2566 Northwestern Ave., West Lafayette, IN 47906 317-463-2536
NIC Components Corp., 6000 New Horizons Blvd., N. Amityville, NY 11701 516-226-7500
Philips Circuit Assemblies, A Subdivision of North American Philips Corp., 2566 Northwestern Avenue, West Lafayette, IN 47906 317-463-2536
§† RCL-Shallcross, Inc., U.S. Hwy. 70 East, Smithfield, NC 27577 919-934-5181
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
§ Rohm Corporation, 8 Whatney, Irvine, CA 92718 714-855-2131
† Samarius Precision Instruments, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418 203-735-7405
§† Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311
§† Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405 818-781-1642
§† Tepro of Florida, 2608 Enterprise Rd., Clearwater, FL 33575 813-796-1044
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
§† Vamistor Corp., 115 Industrial Pk., Sevierville, TN 37862 615-453-0001
† Waters Manufacturing, Inc., Talley Industries, Longfellow Ctr., Wayland, MA 01778 617-358-2777

Resistors, Pressure Sensitive-4700

Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
Topflight, 160 East 9th Ave., York, PA 17404 ..... 717-843-9901;800-233-9386
Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 .. 215-644-1300

Resistors, Rectilinear-4700

§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•1859
CTS Corp., Electromechanical Div., (Formerly Elkhart Div.), 1142 W. Beardsley Ave., Elkhart, IN 46514, 219-295-3575 ..... A•1904
† KRL/Bantry Components, Inc., 160 Bouchard St., Manchester, NH 03103, 603-668-3210 ..... A•1951
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2010
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ..... A•2103
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900
CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
† Samarius Precision Instruments, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418 203-735-7405
§ Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
§ Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 .. 215-644-1300

Resistors, Standards — See Standards, Resistance (Vol. D)

Resistors, Strip-4700

International Manufacturing Services, 50 Schoolhouse La., Portsmouth, RI 02871-2418, 401-683-9700 ..... A•1936
International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1940
Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ..... A•2050
§ Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601 402-564-3131
§† Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800
Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
Huntington Electric Inc., P.O. Box 366, Dept. EEM 87, Huntington, IN 46750 219-356-0778
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
Tel Labs, Inc., Sfernice, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 603-625-8994
Topflight, 160 East 9th Ave., York, PA 17404 ..... 717-843-9901;800-233-9386
§ Ward Leonard Electric Co., Inc., 31 South St., Mt. Vernon, NY 10550 914-664-1000

Resistors, Suppressor-4700

International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1937
KRL/Bantry Components, Inc., 160 Bouchard St., Manchester, NH 03103, 603-668-3210 ..... A•1951
Maida Development Co., 20 Libby St., Hampton, VA 23663, 804-723-0785 ..... A•1954-1955
Mepco/Centralab, North American Philips Corporation, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, 817-325-7871 ..... A•1960
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1968
RCL-Shallcross, 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... A•2013-2015
† Standard Oil Engineered Materials Co., Carborundum, P. O. Box 156, Niagara Falls, NY 14302, 716-278-2000 ..... A•2032-2033
Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ..... A•2051
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
§† Control Concepts Corp., P.O. Box 1380, Binghamton, NY 13902-1380 ... 607-724-2484
Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
Stackpole, Carbon Div., 201 Stackpole St., St. Marys, PA 15857 814-781-1234
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Surge-4700

Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•1859
§† Ametek/Rodan Div., 2905 Blue Star St., Anaheim, CA 92806, 714-630-0081 ..... B•1836-1838
§ Bradford Electronics, Inc., 550 High Street, Bradford, PA 16701, 814-362-5700 ..... A•1874
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1878-1879
§ International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1937-1938
§ Keystone Carbon, Thermistor Div., 1935 State Street, St. Marys, PA 15857, 814-781-1591 ..... B•1847
KRL/Bantry Components, Inc., 160 Bouchard St., Manchester, NH 03103, 603-668-3210 ..... A•1951
Maida Development Co., 20 Libby St., Hampton, VA 23663, 804-723-0785 ..... A•1954-1955
Mepco/Centralab, North American Philips Corporation, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, 817-325-7871 ..... A•1960
Micro-Ohm Corp., 1088 Hamilton Rd., Duarte, CA 91010, 818-3575377 ... A•1962
Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204, 414-271-9900 ..... A•1970
§ Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..... A•1989
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2011
RCL-Shallcross, 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... A•2012-2017
† Standard Oil Engineered Materials Co., Carborundum, P. O. Box 156, Niagara Falls, NY 14302, 716-278-2000 ..... A•2032
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ..... 818-765-8300;800-423-3186
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
§ Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-699-0918; 800-255-2666
§† Control Concepts Corp., P.O. Box 1380, Binghamton, NY 13902-1380 ... 607-724-2484
§ Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-8725
§ Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601 402-564-3131
Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
§† Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
Huntington Electric Inc., P.O. Box 366, Dept. EEM 87, Huntington, IN 46750 219-356-0778
Kelvin Industries, Inc., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501 818-990-1192
Maxwell Laboratories, 8888 Balboa Avenue, San Diego, CA 92123-1506 619-279-5100
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 .. 215-644-1300
§ Ward Leonard Electric Co., Inc., 31 South St., Mt. Vernon, NY 10550 914-664-1000

Resistors, Surface Mount-4700

Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•1860-1861,1866
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, 818-765-8300;800-423-3186 ..... A•1868
† AMITRON, American Micro-Tronix, Inc., 85 Flagship Drive, North Andover, MA 01845, 508-686-1882 ..... A•1763
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ..... A•1871
§ Bradford Electronics, Inc., 550 High Street, Bradford, PA 16701, 814-362-5700 ..... A•1877
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111, 201-371-9500 .... A•1902
§ CTS Corp., Resistor Network Div., (Formerly CTS Corp., Berne Div.), 406 Parr Rd., Berne, IN 46711, 219-589-3111 ..... A•1912
§ Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... A•1925,1928-1931

§ Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926, 915-592-3253 ... A•1915
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701, 402-371-0080 ... A•1918
† Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150 ... A•1933
International Manufacturing Services, 50 Schoolhouse La., Portsmouth, RI 02871-2418, 401-683-9700 ... A•1936
§† International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ... A•1937,1939
Kelvin Industries, Inc., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501, 818-990-1192 ... A•1944
§ KOA Speer Electronics, Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ... A•1946,1950
§ KRL/Bantry Components, Inc., 160 Bouchard St., Manchester, NH 03103, 603-668-3210 ... A•1951
Mepco/Centralab, North American Philips Corporation, 4561 Colorado Blvd., Los Angeles, CA 90039, 818-240-4880 ... A•1957-1958
Mepco/Centralab, North American Philips Corporation, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, 817-325-7871 ... A•1957
Micro-Ohm Corp., 1088 Hamilton Rd., Duarte, CA 91010, 818-3575377 ... A•1966
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ... A•1976
NMB Technologies, 9730 Independence Avenue, Chatsworth, CA 91311, 818-341-3355 ... A•1750-1751
Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ... A•1981
† Ohmtek Inc., Sfernice Group Company, 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ... A•2020,2022,2024-2025
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ... A•2001
RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ... A•2010-2011
† State of the Art, Inc., 2470 Fox Hill Rd., State College, PA 16803-1797, 814-355-8004 ... A•2036
Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ... A•2047,2050
§† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 ... 714-447-2700
† EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 ... 609-429-7800
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 ... 402-694-6111
§ ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 ... 516-753-0400; 800-862-2101
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 ... 305-771-7000
§ Liberty Intl. Corp., FIRSTOHM, 2539 237th St., Suite F, Torrance, CA 90505 ... 213-539-6452
Mepco/Centralab Corp. Hdqrtr., North American Philips Corporation, 2001 W. Blue Heron Blvd., Riviera Beach, FL 33404 ... 407-881-3200
Mepco/Centralab, Inc., A North American Philips Co., 2566 Northwestern Ave., West Lafayette, IN 47906 ... 317-463-2536
§ Mepcopal Company, 11468 Sorrento Valley Rd., San Diego, CA 92121 ... 619-453-0332
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
NIC Components Corp., 6000 New Horizons Blvd., N. Amityville, NY 11701 ... 516-226-7500
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 ... 312-364-6038
§ Paccom, 3928 148th NE, Redmond, WA 98052 ... 206-883-9200;800-426-6254
Philips Circuit Assemblies, A Subdivision of North American Philips Corp., 2566 Northwestern Avenue, West Lafayette, IN 47906 ... 317-463-2536
Philips Circuit Assemblies, A Subdivision of North American Philips Corporation, 5855 N. Glen Pk. Rd., Milwaukee, WI 53209 ... 414-228-7632
§ Piher International Corp., 903 Feehanville Dr., Mt. Prospect, IL 60056 ... 312-390-6680; 800-323-6693
§ Rohm Corporation, 8 Whatney, Irvine, CA 92718 ... 714-855-2131
§† Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 ... 303-242-0810
§ Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405 ... 818-781-1642
Tel Labs, Inc., Sfernice, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 ... 603-625-8994
§ Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502 ... 303-242-0810
§† Vamistor Corp., 115 Industrial Pk., Sevierville, TN 37862 ... 615-453-0001

Resistors, Tapped-4700

CTS Corp., Electromechanical Div., (Formerly Elkhart Div.), 1142 W. Beardsley Ave., Elkhart, IN 46514, 219-295-3575 ... A•1904
Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150 ... A•1932
Huntington Electric Inc., P.O. Box 366, Dept. EEM 87, Huntington, IN 46750, 219-356-0778 ... A•1942
International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ... A•1937
Kelvin Industries, Inc., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501, 818-990-1192 ... A•1944
§† KRL/Bantry Components, Inc., 160 Bouchard St., Manchester, NH 03103, 603-668-3210 ... A•1951
§† Memcor-Truohm, Inc., 1320 Flaxmill Rd., Huntington, IN 46750, 219-356-4300 ... A•1956
§† Micro-Ohm Corp., 1088 Hamilton Rd., Duarte, CA 91010, 818-3575377 ... A•1967
† Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204, 414-271-9900 ... A•1970-1971,1973-1974
§ Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ... A•1989
RCL-Shallcross, 195 McGregor St., Manchester, NH 03102, 603-627-3831 ... A•2012,2014
† Resistors, Inc., 5226 W. 26th St., Chicago, IL 60650, 312-652-7555 ... A•2019
Victoreen, Inc., A Sheller-Globe Corp. Subsidiary, 6000 Cochran Rd., Solon, OH 44139, 216-248-9300 ... A•2045
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111 ... 201-371-9500
Component General, Inc., 13620 Wright Cir., Tampa, FL 33626 ... 813-855-6655
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ... 914-YO3-5900
CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 ... 219-293-7511
§† Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601 ... 402-564-3131
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 ... 402-371-0080
Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550 ... 914-664-2333
§† Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 ... 609-461-1900
Hitachi America, Ltd., 2210 O'Toole Ave., San Jose, CA 95131 ... 408-435-8300
§ International Components Corp., 105 Maxess Rd., Melville, NY 11747 ... 516-293-1500
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 ... 305-771-7000
K & M Electronics, 221 Interstate Dr., Dock No. 3, W. Springfield, MA 01089 ... 413-781-1350
§ Liberty Intl. Corp., FIRSTOHM, 2539 237th St., Suite F, Torrance, CA 90505 ... 213-539-6452
Ohmtek Inc., Sfernice Group Company, 2160 Liberty Dr., Niagara Falls, NY 14304 ... 716-283-4025
† Quality Thermistor, 2147 Centurion Pl., Boise, ID 83709 ... 208-377-3373
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 ... 603-669-0054
RCL-Shallcross, Inc., U.S. Hwy. 70 East, Smithfield, NC 27577 ... 919-934-5181
§ Rohm Corporation, 8 Whatney, Irvine, CA 92718 ... 714-855-2131
† Samarius Precision Instruments, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418 ... 203-735-7405
Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 ... 303-242-0810
† Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 ... 914-681-0700
Tel Labs, Inc., Sfernice, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 ... 603-625-8994
† Thickfilm International, Rt. 1-Box 85-0, Indian Head, MD 20640 ... 301-375-7400
Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 ... 215-644-1300
§ Ward Leonard Electric Co., Inc., 31 South St., Mt. Vernon, NY 10550 ... 914-664-1000

Resistors, Temperature Sensitive-5300 — *See Vol. B*

Resistors, Tin Oxide-4700

§† Bradford Electronics, Inc., 550 High Street, Bradford, PA 16701, 814-362-5700 ... A•1877
§ International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ... A•1937
§ KOA Speer Electronics, Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ... A•1949
§ Micro-Ohm Corp., 1088 Hamilton Rd., Duarte, CA 91010, 818-3575377 ... A•1967
§† Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 ... 607-974-8725
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 ... 402-371-0080
§ Dale Electronics, Inc., Specialty Div., P. O. Box 1179, Robbinsville, NC 28771 ... 704-479-6451
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 ... 603-669-0054

Resistors, Variable — See Potentiometers (Vol. A), Rheostats (Vol. A), Resistors, Adjustable (Vol. A)

Resistors, Voltage Sensitive-4700

§ Maida Development Co., 20 Libby St., Hampton, VA 23663, 804-723-0785 ... A•1103,1107,1954-1955
Mepco/Centralab, North American Philips Corporation, 4561 Colorado Blvd., Los Angeles, CA 90039, 818-240-4880 ... A•1957
Mepco/Centralab, North American Philips Corporation, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, 817-325-7871 ... A•1957,1960
§ Midwest Components, Inc., 1981 Port City Blvd., Muskegon, MI 49443, 616-777-2602 ... B•1853
Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ... A•1676,1976
RCL-Shallcross, 195 McGregor St., Manchester, NH 03102, 603-627-3831 ... A•2013-2014,2016-2017
Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830, 201-321-3400 ... B•1350-1351
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111 ... 201-371-9500
§ Dale Electronics, Inc., Specialty Div., P. O. Box 1179, Robbinsville, NC 28771 ... 704-479-6451
Diodes Inc., 9957 Canoga Ave., Chatsworth, CA 91311 ... 818-882-4920;800-821-1178
§† General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 ... 201-685-6530
GTE SUPPLY, GTE Communications Systems, 5225 Wiley Post Way, Salt Lake City, UT 84116 ... 800-433-4837
GTE Switching & Telephone Products, 400 N. Wolf Rd., Northlake, IL 60164 ... 312-681-7100
§ International Components Corp., 105 Maxess Rd., Melville, NY 11747 ... 516-293-1500
§ Inter-Technical Group Inc., WIMA Div., One Bridge Street, Irvington, NY 10533 ... 914-591-8822
§ ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 ... 516-753-0400; 800-862-2101
§ Marcon America Corp., 310 Era Drive, Northbrook, IL 60062 ... 312-564-2820
Mepco/Centralab Corp. Hdqrtr., North American Philips Corporation, 2001 W. Blue Heron Blvd., Riviera Beach, FL 33404 ... 407-881-3200
Mepco/Centralab, Inc., A North American Philips Co., 2566 Northwestern Ave., West Lafayette, IN 47906 ... 317-463-2536

Philips Circuit Assemblies, A Subdivision of North American Philips Corp., 2566 Northwestern Avenue, West Lafayette, IN 47906 317-463-2536
Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
§ Raltron Electronics, 2315 N.W. 107th Ave., Miami, FL 33172 305-593-6033
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054
§ Schauer Manufacturing, 4500 Alpine Ave., Cincinnati, OH 45242 513-791-3030
Standard Oil Engineered Materials Co., Carborundum, P. O. Box 156, Niagara Falls, NY 14302 716-278-2000
Stetron International, Inc., 90 Broadway, Buffalo, NY 14203 716-854-3443
Taiyo Yuden (USA) Inc., 714 W. Algonquin Rd., Arlington Heights, IL 60005-4493 312-364-6104
§ TDK Corporation, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku, Tokyo, JAPAN 103 ..... (03) 278-5111
§ Thomson Passive Components Corp., 6203 Variel Ave., Unit A, Woodland Hills, CA 91367 818-887-1010
§ Victory Engineering Corp., Victory Rd., Springfield, NJ 07081 201-379-5900
Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 .. 215-644-1300
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Wirewound-4700

Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•1858
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, 818-765-8300;800-423-3186 ..... A•1868
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111, 201-371-9500 ..... A•1902-1903
CTS Corp., Electromechanical Div., (Formerly Elkhart Div.), 1142 W. Beardsley Ave., Elkhart, IN 46514, 219-295-3575 ..... A•1904
§† Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... A•1925-1931
Elliott/Jordan, A Sub. of Vishay Intertechnology, 63 Lincoln Highway, Malvern, PA 19355, 215-644-1300 ..... A•1934-1935
§ General Resistance, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, 203-481-5721 ..... A•1941
Huntington Electric Inc., P.O. Box 366, Dept. EEM 87, Huntington, IN 46750, 219-356-0778 ..... A•1942
§† International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1937-1938,1940
Julie Research Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 ..... A•1961
† Kelvin Industries, Inc., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501, 818-990-1192 ..... A•1944-1945
§† KRL/Bantry Components, Inc., 160 Bouchard St., Manchester, NH 03103, 603-668-3210 ..... A•1952-1953
§† Memcor-Truohm, Inc., 1320 Flaxmill Rd., Huntington, IN 46750, 219-356-4300 ..... A•1956
§† Micro-Ohm Corp., 1088 Hamilton Rd., Duarte, CA 91010, 818-3575377 ..... A•1962-1963,1967, B•1850
§ Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1968
† Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204, 414-271-9900 ..... A•1970-1971
§† Nytronics Components Grp., Inc., 700 Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1979
§† Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..... A•1980-1988,1994
Ohmtek Inc., Sfernice Group Company, 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ..... A•2021
† Pacific Resistor Co., 18300 Oxnard St., Tarzana, CA 91356, 818-345-7811 ..... A•1998-1999
Precision Control Manufacturing, Inc., 1509 B Queen Anne Ave. N., Seattle, WA 98109, 206-281-9380 ..... A•2097
† Precision Resistor Co., Inc., 10601 75 St. N., Largo, FL 34647, 813-541-5771 ..... A•2004-2007
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2010
§† RCL-Shallcross, 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... A•2012-2017
† Resistors, Inc., 5226 W. 26th St., Chicago, IL 60650, 312-652-7555 ..... A•2019
† Tel Labs, Inc., Sfernice, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053, 603-625-8994 ..... A•2030
§† Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 ..... A•2028-2029
Vermont Precision Resistor, Codeco Corp. of Vermont, West Hill Road, P.O. Box 1207, Stowe, VT 05672-1170, 802-253-8567 ..... A•2038-2039
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Capco, Box 1028, Grand Junction, CO 81502 303-243-8751
§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., 3 Washington St., Dover, NH 03820 603-742-1120
§ Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-699-0918; 800-255-2666
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900
CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
Electro Comp., Inc., 2415 Main St., Stratford, CT 06497 203-375-5811
§† Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
§† Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
ICO-RALLY Corporation, 2575 E. Bayshore Rd., Palo Alto, CA 94303 415-856-9900
§ INRESCO, Inc., 654 Ocean Road, Pt. Pleasant, NJ 08742 201-892-5881
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 .. 516-937-3475
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
§ Liberty Intl. Corp., FIRSTOHM, 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
Meissner Industries, 551 Rte. 10, Dover, NJ 07801 201-366-1700
† Mel-Rain Controls, 42974 M-43 Hwy., Paw Paw, MI 49079 616-657-2527
§ Mepcopal Company, 11468 Sorrento Valley Rd., San Diego, CA 92121 .. 619-453-0332
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
§ NTE Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
Philips Electronics Ltd., Elcoma Division, 601 Milner Avenue, Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
Pyrohm, Inc., 24268 Indoplex Circle, Farmington Hills, MI 48018 313-478-5060
§† RCL-Shallcross, Inc., U.S. Hwy. 70 East, Smithfield, NC 27577 919-934-5181
† Samarius Precision Instruments, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418 203-735-7405
§† Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Standard Condenser Corp., 1065 W. Addison St., Chicago, IL 60613 312-327-5440
§† Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405 818-781-1642
§† Tepro of Florida, 2608 Enterprise Rd., Clearwater, FL 33575 813-796-1044
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
§† Vamistor Corp., 115 Industrial Pk., Sevierville, TN 37862 615-453-0001
§† Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 .. 215-644-1300
§† Ward Leonard Electric Co., Inc., 31 South St., Mt. Vernon, NY 10550 914-664-1000
† Waters Manufacturing, Inc., Talley Industries, Longfellow Ctr., Wayland, MA 01778 617-358-2777
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Zero-Ohm-4700

§ Bradford Electronics, Inc., 550 High Street, Bradford, PA 16701, 814-362-5700 ..... A•1873,1877
International Manufacturing Services, 50 Schoolhouse La., Portsmouth, RI 02871-2418, 401-683-9700 ..... A•1936
§† International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1937
Kelvin Industries, Inc., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501, 818-990-1192 ..... A•1945
§ KOA Speer Electronics, Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ..... A•1950
RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2010
State of the Art, Inc., 2470 Fox Hill Rd., State College, PA 16803-1797, 814-355-8004 ..... A•2036
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
§ International Components Corp., 105 Maxess Rd., Melville, NY 11747 ... 516-293-1500
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
§ Liberty Intl. Corp., FIRSTOHM, 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
§ Paccom, 3928 148th NE, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
§ Piher International Corp., 903 Feehanville Dr., Mt. Prospect, IL 60056 ..... 312-390-6680; 800-323-6693
Roederstein Elctrns., Inc., P.O. Box 5588, Statesville, NC 28677 704-872-8101
§ Rohm Corporation, 8 Whatney, Irvine, CA 92718 714-855-2131
Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810

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§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•1430,1838, B•1899
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Inc., 99 Morris Ave., Springfield, NJ 07081, 201-376-6070 ..... A•1438,1772, B•1901
Radio Materials Corp., P. O. Box 339, Attica, IN 47918, 317-762-2491;1-800-356-9956 ..... A•1168,1170
† Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478, 216-232-8600 ..... A•1487
§† Fox Electronics, 5842 Corporation Circle, Ft. Meyers, FL 33905 813-693-0099
Fujitsu Components of America, 3320 Scott Blvd., Santa Clara, CA 95054 408-727-1700
† Hughes Microelectronics Circuits Division, 500 Superior Ave., P.O. Box H, Newport Beach, CA 92658-8903 714-759-2952
§† Kyocera Northwest, Electronic Components Group, P.O. Box 85542, San Diego, CA 92138-5542 619-576-2600
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
§ Raltron Electronics, 2315 N.W. 107th Ave., Miami, FL 33172 305-593-6033
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
Trans-Tech, Alpha Industries, 5520 Adamstown Rd., Adamstown, MD 21710 301-695-9400

Resonators, Ceramic, Surface Mount-2700

§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•1430, B•1899
† Z Communications, Inc., 5450 N.W. 33rd Ave., Ste. 100, Ft. Lauderdale, FL 33309, 305-735-1000 ..... A•1492
Fujitsu Components of America, 3320 Scott Blvd., Santa Clara, CA 95054 408-727-1700
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070

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† Z Communications, Inc., 5450 N.W. 33rd Ave., Ste. 100, Ft. Lauderdale, FL 33309, 305-735-1000 ..... A•1492

Resonators, SAW-2300
† Sawtek Inc., P.O. Box 609501, Orlando, FL 32860-9501, 407-886-8860 ... A•1463
† RF Monolithics, Inc., 4441 Sigma Rd., Dallas, TX 75244 214-233-2903
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070

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§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•2059
Angstrohm Precision, Inc., A Sub of Vishay Intertechnology, 63 Lincoln Highway, Malvern, PA 19355, 215-644-1300 ..... A•2062
Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101, 718-361-0800 ..... C•1607
§† Memcor-Truohm, Inc., 1320 Flaxmill Rd., Huntington, IN 46750, 219-356-4300 ..... A•2086
§† Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..... A•2094-2095
† Precision Control Manufacturing, Inc., 1509 B Queen Anne Ave. N., Seattle, WA 98109, 206-281-9380 ..... A•2097
Biddle Instruments, 510 Township Line Rd., Blue Bell, PA 19422 215-646-9200
Carter Manufacturing Corporation, 237 Sugar Road, Bolton, MA 01740 .. 617-779-5501
§ Cole-Hersee Co., 20 Old Colony Ave., Boston, MA 02127-2467 617-268-2100
CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
§ Mallory Components Division, Emhart Elec./Elctrn. Grp., 222 Dixon Rd., Weston, Ont., CANADA M9P 3S5 416-244-4239
† Maurey Instrument Corp., 4555 W. 60th St., Chicago, IL 60629 312-581-4555
Mel-Rain Controls, 42974 M-43 Hwy., Paw Paw, MI 49079 616-657-2527
Mepco/Centralab, North American Philips Corporation, Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501 515-573-1300
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
§ Reliance Electric Co., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199 800-245-4501
† Robert Shaw Instrument Div., Kendall Lane, Natick, MA 01760 617-875-9711
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 .. 215-644-1300

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Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St., Methuen, MA 01844 617-682-4661
† Applied Plastics Technology, 45 Broadcommon Rd., Bristol, RI 02809 ... 401-253-0200
† Bacon Industries, 192 Pleasant St., Watertown, MA 02172-2399 617-926-2550
† Chomerics, Inc., 77 Dragon Ct., Woburn, MA 01888 617-935-4850
† Conductive System, Inc., R.D. No. 1, Box 1040, Rte. 5 South, Amsterdam, NY 12010 518-843-5740
† Detoronics Corporation, 10660 E. Rush St., S. El Monte, CA 91733 818-579-7130
Lectronic Research Labs., Inc., 1423 Ferry Ave., Camden, NJ 08104 609-541-4200
M/A-COM Microwave Components, Inc., South Avenue, Burlington, MA 01803 617-272-3000
† Maury Microwave Corp., 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
§† Parker Seal Grp., P.O. Box 11751, Lexington, KY 40512 606-269-2351
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Tecknit (Eastern Facility), 129 Dermody St., Cranford, NJ 07016 201-272-5500

§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

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TRM, Inc., 401 Kelly Ave., Grenier Field, Manchester, NH 03103, 603-627-6000 ..... A•1845

† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500

† Alpha Inds., Inc., Microwave Comp. Div., 90 Glenn St., Lawrence, MA 01843 617-681-8520

Amphenol RF Operations, Amphenol Corporation, One Kennedy Avenue, Danbury, CT 06810 203-743-9272

† Anghel Laboratories, Inc., 3 Route 46 West, Fairfield, NJ 07006 201-575-1116

† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400

† Daico Industries, Inc., 2139 East Del Amo Blvd., Compton, CA 90224 213-631-1143

† General Microwave Corporation, 5500 New Horizons Blvd., Amityville, NY 11701 516-226-8900

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† Microwave Applications Group, 3030 Industrial Pkwy., Santa Maria, CA 93455 805-928-5711

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† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900

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§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

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Shunts, Meter-2900 — *See Vol. D*

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Triac Electronic Systems, Inc., 87-27 Myrtle Ave., Glendale, NY 11385 .. 718-441-4759

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† Central Microwave Co., Alpha Inds., Inc., 12180 Prichard Farm Rd., Maryland Heights, MO 63043 314-291-5270

Coaxial Dynamics, 15210 Industrial Parkway, Cleveland, OH 44135 .... 1-800-COAXIAL

† Electro-Magentic Processes, Inc., Subsidiary of ISC Group, Inc., 9616 Owensmouth Ave., Chatsworth, CA 91311-4858 818-882-6333

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Telonic/Berkeley, Berkeley Inds. Inc., P.O. Box 277, Laguna Beach, CA 92652 714-494-9401

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Penstock Engineering Labs., Penstock, Inc., 520 Mercury Dr., Sunnyvale, CA 94086-4018, 408-730-0300 ..... **A•1844**

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Brooks Power Systems, 1810 Byberry Rd., Bensalem, PA 19020 ..... 215-244-0264; 1-800-523-1551
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§† Control Concepts Corp., P.O. Box 1380, Binghamton, NY 13902-1380 ... 607-724-2484
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† Hoffman, P. R., Co., Materials Processing Div., Spreckels Industries Inc., 321 Cherry St., Carlisle, PA 17013 717-243-2011
† Phonon Corporation, 7 Herman Drive, P.O. Box 549, Simsbury, CT 06070 203-651-0211
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† Sanders Associates, Inc., Microwave, 955 Perimeter Rd., Manchester, NH 03108 ..... 603-645-6000 Ext. 4299
† Shindengen America Inc., 2649 Townsgate Road, Ste. 200, Westlake Vl., CA 91361 805-373-1130
† Union Carbide Corporation, Industrial Chemicals Div., Crystal Products Dept., 9320 Chesapeake Dr., Ste. 216, San Diego, CA 92123 619-279-4500

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Damon Electronics Div., 80 Wilson Way, Westwood, MA 02090, 617-329-2460 ..... A•1391
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† Phonon Corporation, 7 Herman Drive, P.O. Box 549, Simsbury, CT 06070 203-651-0211
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Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831
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† Sawtek Inc., P.O. Box 609501, Orlando, FL 32860-9501, 407-886-8860 ... A•1463
§† Kyocera Northwest, Electronic Components Group, P.O. Box 85542, San Diego, CA 92138-5542 619-576-2600
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§† Andersen Laboratories, 1280 Blue Hills Ave., Bloomfield, CT 06002, 203-242-0761 ..... A•1497
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§ Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845, 617-685-4371 ..... B•1656-1657
Crosspoint, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022, 201-941-4455 ..... B•1678
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† Alpha Inds., Inc., Microwave Comp. Div., 90 Glenn St., Lawrence, MA 01843 617-681-8520
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Synthesizers, Delay Line-2350

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† Control Electronics, Neurotech Corp., 139 Florida St., Farmingdale, NY 11735 516-694-0125
† Data Delay Devices, 3 Mount Prospect Ave., Clifton, NJ 07013-1915 201-773-2299
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† Arra Inc., 15 Harold Ct, Bay Shore, NY 11706 516-231-8400

† Bird Electronic Corp., 30303 Aurora Rd., Cleveland, OH 44139-2794 216-248-1200

§ CES Elctrns., 2968 Avenue Z, Brooklyn, NY 11235

Coastcom, P.O. Box 27068, Concord, CA 94527 415-825-7500

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† Compac, 1320-13 Lincoln Ave., Holbrook, NY 11741 516-585-3400

† Connecticut Microwave Corp., 106 Powder Mill Rd., Box 389, Canton, CT 06019 203-693-4247

† Detoronics Corporation, 10660 E. Rush St., S. El Monte, CA 91733 818-579-7130

§ Dielectric Communications, General Signal, Tower Hill Rd., Raymond, ME 04071 ..... 207-655-4555;800-341-9678

† Eastern Microwave, 40 Ray Ave., Burlington, MA 01803 617-273-4700

† Electro Impulse, Box 870, Red Bank, NJ 07701-0870 201-741-0404

† EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800

Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.

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† JFW Industries, Inc., 5134 Commerce Sq. Dr., Indianapolis, IN 46237 317-887-1340

KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100

Lectronic Research Labs., Inc., 1423 Ferry Ave., Camden, NJ 08104 609-541-4200

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† Manger Electric Company, Inc., W. Henry St., Stamford, CT 06902 203-348-7761

† Maury Microwave Corp., 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715

† Merrimac Industries, 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300

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† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700

† Micro Mode Prods., 1870 John Towers Ave., El Cajon, CA 92020 619-449-3844

§† Micronetics, 36 Oak St., Norwood, NJ 07648 201-767-1320

† Microwave Applications Group, 3030 Industrial Pkwy., Santa Maria, CA 93455 805-928-5711

§ Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060

† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 .... 315-437-3953; 800-448-1666

† Mitec Electronics, 104 Gun Avenue, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666

† Narda Microwave Corp., Subsidiary of Loral Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700

North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542 516-671-5700

† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900

RLC Electronics, Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334

† Sage Laboratories, Inc., 11 Huron Dr., Natick, MA 01760 617-653-0844

Sivers IMA, Div. of Philips, 5669 Selmaraine Drive, Culver City, CA 90230 213-390-7477

§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311

§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760

† Telonic/Berkeley, Berkeley Inds. Inc., P.O. Box 277, Laguna Beach, CA 92652 714-494-9401

Tucker Electronics, Box 461966, Garland, TX 75046 ..... 214-348-8800;800-527-4642

Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300

U.S. Instr. Rentals, 2988 Campus Dr., San Mateo, CA 94403 800-824-2873

§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

† Weinschel Engineering, One Weinschel La., Gaithersburg, MD 20877 .... 301-948-3434; 800-638-2048

§ Wiltron, 490 Jarvis Dr., Morgan Hill, CA 95037-2809 408-778-2000

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Phase Control Electronics, 87-27 Myrtle Ave., Glendale, NY 11385, 718-441-4728 ..... D•1140
Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... A•2134
§ Powerex, Westinghouse, GE, Mitsubishi, Hillis St., Youngwood, PA 15697, 412-925-7272 ..... A•2136
§ Silicon Power Cube Corp., 6015 Obispo Ave., Long Beach, CA 90805, 213-634-9390 ..... B•1586
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§ A E G Corporation, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269 201-231-8300
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§ RMC Power Semiconductor, BBC, 2150 W. 6th Ave., Broomfield, CO 80020 ..... 303-469-1883;1-800-992-0312
§ Sanken Electric Co., Ltd., Overseas Operations, 1-22-8 Nishi-Ikebukuro, Toshima-ku, Tokyo, JAPAN 171 03-986-6164
§ Semikron, Inc., 11E Executive Dr., P.O. Box 66, Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
§† Silicon Transistor Corp., Katrina Rd., Chelmsford, MA 01824 617-256-3321
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
§ Texas Instrs., Inc., Box 809066, Dallas, TX 75380 ..... 800-232-3200 (ext 700)
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§† Unitrode Corp., 580 Pleasant St., Watertown, MA 02172 617-926-0404
† Westcode Semiconductors, Inc., 3270 Cherry Ave., Long Beach, CA 90807 213-595-6971

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Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2183

AT&T, 555 Union Blvd., Allentown, PA 18103, 1-800-372-2447;In Canada:1-800-553-2448 ..... A•2184,2187,2189

Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 ..... A•2195

† Bicron Electronics, 100 Barlow Street, Canaan, CT 06018, 203-824-5125 ..... A•2202-2203

Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1209

† C & C Jetronic, Inc., Research Pk. 318 Wall St., Princeton, NJ 08540, 609-921-8540 ..... A•2204

§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2205-2207

† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2214

§† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2216,2227

Foxboro/PCG, The Foxboro Company, 600 N. Bedford St., E. Bridgewater, MA 02333, 508-378-5260 ..... A•2233

§ Gowanda Electronics Corp., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 ..... A•1245

† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061, 913-782-0012 ..... A•2239

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Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... A•2248

Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ..... A•2250

Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... A•2252-2253,2260-2261

MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265

§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•2295-2296

§ Multi Products International, 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•2299

§ Opamp Labs, Inc., 1033 N. Sycamore Ave., Los Angeles, CA 90038, 213-934-3566 ..... D•1015

Para-Line Transformer Co., Inc., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2318

PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ..... A•2308-2309

† Perkin-Elmer Corp., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132, 203-762-4786 ..... A•2317

† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319,2332-2339,2347

† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2350-2351

† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861, 201-826-4700 ..... A•2352-2353

Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2355,2365

§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530, 914-681-0700 ..... D•1053

§ Stancor Products, Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947, 219-722-2244 ..... A•2393

† Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518, 213-638-1790 ..... A•1291,1695,2395,2399,2403, D•1983

† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025

Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, 301-464-2100 ..... A•1298,2412

† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199, 816-761-6314 ..... A•2418-2420

† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763, 516-654-1880 ..... A•2426

TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•2433

§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600 ..... A•2428

† Wayne Transformer Co., Inc., 666 Pacific St., Brooklyn, NY 11217, 718-783-9007 ..... A•2440

§† Able Power and Engineering Inc., 1222 N. Delta St, S. San Gabriel, CA 91770 818-571-6260

AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024

Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006

American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838

† Atlas Engineering Corp., 10 Cheney St, Dorchester, MA 02121 617-445-7100

§ Atlas/Soundolier, 1859 Intertech Dr., Fenton, MO 63026 800-362-5673

§† Audiosone, Inc., 617 Fan Hill Rd., Monroe, CT 06468 ..... 203-268-4372/6703

† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St, Dept. E, Miami, FL 33147 305-696-6660

§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100

Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541

† BG Electronics, 30 South St, Mt. Vernon, NY 10550 914-664-5591

† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376

§ Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050

† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148

§ C-COR Elctrns., 60 Decibel Rd., State College, PA 16801 814-238-2461

CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217 718-857-2400

† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188

† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775

† Coiltronics Inc., 984 S.W. 13th Court, Pompana Beach, FL 33069 305-781-8900

Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640

Custom Bobbin Windings, A & K Corporation, P.O. Box 2369, Zanesville, OH 43702-2369 614-452-6973

Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111

† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798

† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911

§ Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000

Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075

Dowty RFL Inds. Inc./Communications Div., The Dowty Grp. PLC, Powerville Rd, Boonton, NJ 07005-0239 201-334-3100

Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360

Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520

Electrocom Industries, 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743

Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855

Electronic Coil Corp., Farmington Industrial Park, Farmington, CT 06032 203-677-6731

† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222

† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 213-515-1546

El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300

Endicott Coil, 24 Charlotte St., Binghamton, NY 13905 607-797-1263

§ Frazier, 1930 Valley View La., Dallas, TX 75234 214-241-3441

† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300

§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661

Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006

Genisco Technology Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750

Gettysburg Transformer Corporation, 1380 Old Harrisburg Rd., P.O. Box 99, Gettysburg, PA 17325 717-334-2191

Grand Transformers, 1500 Marion St., Grand Haven, MI 49417 616-842-5430

† Hadley, Robert M. Co., Inc., 750 West 51st St, Los Angeles, CA 90037 213-234-9091

Hamilton Standard Controls, 9100 Airport Dr., P.O. Box 11648, Fort Wayne, IN 46859 219-747-6142

§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710

Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800

§ James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
§† JB Electronic Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
KGS Electronics, Inc., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
LEPCO/Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 .. 512-546-1625
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Merrimack Magnetics Corp., 121 Hale St., Lowell, MA 01851 617-458-1487
Midcom, Inc., 121 Airport Dr., Watertown, SD 57201 605-886-4385
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
Mini-Magnetics Co., Inc., 1100 Fulton Place, Fremont, CA 94539 415-490-7500
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223 414-358-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
Onan Power/Electronics, 4801 W. 81st St., Minneapolis, MN 55437 612-921-5600
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
† Parker McCrory Mfg. Co., 2000 Forest Ave., Kansas City, MO 64108 816-221-2000
† Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 .. 312-543-6400
§† Primo Company Limited, 25-1, 6-Chome, Mure, Mitakashi, Tokyo, JAPAN 181 0422-43-3121
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
§ QPL Magnetics, Inc., P.O.BOX C, Lake Grove, NY 11755 516-589-3331
§ Quam-Nichols Co., 234 E. Marquette Rd., Chicago, IL 60637 312-488-5800
Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
§ Rye Industries, Inc., 125 Spencer Pl., P.O. Box M, Mamaroneck, NY 10543 914-698-0080
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Shure Bros., 222 Hartrey Ave., Evanston, IL 60202-3696 312-866-2200
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
§† Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
§ Speco Div., Components Specialties, Inc., P.O. Box 624, 1172 Rte. 109, Lindenhurst, NY 11757 ..... 516-957-8700;800-645-5516
Staco Transpower, 610 W. 6th St., Mt. Carmel, IL 62863 618-262-5555
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95054 408-988-0700
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
Xentek, Inc., 760 Shadow Ridge Dr., Vista, CA 92083 619-727-0940
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Autotransformer-5600

† Abbott Technologies, Inc., Burbank Division, Transformers, 639 So. Glenwood Pl., Burbank, CA 91506, 818-841-3630 ..... A•2157
Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2182
† Bicron Electronics, 100 Barlow Street, Canaan, CT 06018, 203-824-5125 ..... A•2202-2203
† Controlled Power Co., 1955 Stephenson Hwy., Troy, MI 48083, 313-528-3700;1-800-521-4792 ..... D•2085
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2205
† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2214
§ EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2216,2225
Jerome Industries Corp., 730 E. Division St., Elizabeth, NJ 07201, 201-353-5700 ..... A•2242
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735, 516-293-0475 ..... A•2243
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... A•2249
Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... A•2252-2253,2259
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•2282,2288
Para-Line Transformer Co., Inc., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2318
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ..... A•2308-2309,2314-2315
Phase Control Electronics, 87-27 Myrtle Ave., Glendale, NY 11385, 718-441-4728 ..... D•1140
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2350
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2355
† Signal Transformer Co., Inc., Insilco Corporation, 500 Bayview Ave., Inwood, NY 11696, 516-239-5777 ..... A•2372,2385,2389
Talema Electronic, Inc., 301 N. Highway 63, Rolla, MO 65401, 314-364-0882 ..... A•2390
§† Technipower, A Penril Co., P.O. Box 222, Commerce Pk., Danbury, CT 06813, 203-748-7001 ..... A•2405, D•1993
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025
§ Todd Systems, Inc., 50 Ash St., Yonkers, NY 10701, 914-963-3400 ..... A•2411
Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, 301-464-2100 ..... A•1298,2412
Ulveco, Inc., 323 Vintage Park Drive, Foster City, CA 94404, 415-574-1100 ..... A•2432

Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010
§† Able Power and Engineering Inc., 1222 N. Delta St., S. San Gabriel, CA 91770 818-571-6260
Acme Electric Corporation, 20 Water Street, Cuba, NY 14727 716-968-2400
Acme Transformer, Acme Electric Corporation, Rte. 4, Box 54, Lumberton, NC 28358 919-738-1121
§ AC Transformer, 89 Madison St., Newark, NJ 07105 201-589-8574
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
§ Atlas/Soundolier, 1859 Intertech Dr., Fenton, MO 63026 800-362-5673
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
§† Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† C & C Jetronic, Inc., Research Pk. 318 Wall St., Princeton, NJ 08540 609-921-8540
Carson Manufacturing Co., Inc., 5453 N. Rural St., P.O. Box 20464, Indianapolis, IN 46220 317-257-3191
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217 718-857-2400
† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
Computer Power Inc., 124 W. Main St., High Bridge, NJ 08829 ..... 201-638-8000; 800-526-5088
Custom Bobbin Windings, A & K Corporation, P.O. Box 2369, Zanesville, OH 43702-2369 614-452-6973
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
Diamond Magnetics, 235 Tank Farm Rd., Ste. G, San Luis Obispo, CA 93401 805-544-4019
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§ Displex, Inc., North Hills Electronics, Inc., Alexander Place, Glen Cove, NY 11542 516-671-4400
Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
Dynapower Corporation, Box 3180, Farmington Hills, MI 48333 313-553-4300
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360
Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
§ Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5770 Thornwood Dr., Goleta, CA 93117 805-964-0751
Elma Engineering, 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 .. 213-515-1546
Endicott Coil, 24 Charlotte St., Binghamton, NY 13905 607-797-1263
Foxboro/PCG, The Foxboro Company, 600 N. Bedford St., E. Bridgewater, MA 02333 508-378-5260
§ Frazier, 1930 Valley View La., Dallas, TX 75234 214-241-3441
§† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
† General Magnetics, 211 Grove St., Bloomfield, NJ 07003 201-743-2700
Gettysburg Transformer Corporation, 1380 Old Harrisburg Rd., P.O. Box 99, Gettysburg, PA 17325 717-334-2191
Grand Transformers, 1500 Marion St., Grand Haven, MI 49417 616-842-5430
† Hadley, Robert M. Co., Inc., 750 West 51st St., Los Angeles, CA 90037 .. 213-234-9091
Hamilton Standard Controls, 9100 Airport Dr., P.O. Box 11648, Fort Wayne, IN 46859 219-747-6142
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hipotronics Inc., P.O. Drawer A, Brewster, NY 10509 914-279-8091
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301 201-782-5525
§ Hughey & Phillips, Inc., 2162 Union Pl., Simi Valley, CA 93065 805-581-5591
§† JB Electronic Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
§ Jefferson Elec., MagneTek, Inc., 1400 Center Circle Drive, Downers Grove, IL 60515-1021 312-691-2400
KGS Electronics, Inc., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 303-651-2011
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166

Merrimack Magnetics Corp., 121 Hale St, Lowell, MA 01851 617-458-1487
§ Micron Industries, 1830 N. 32nd Ave., Stone Park, IL 60165 312-345-0788
Midcom, Inc., 121 Airport Dr., Watertown, SD 57201 605-886-4385
Mini-Magnetics Co., Inc., 1100 Fulton Place, Fremont, CA 94539 415-490-7500
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
Northlake Engineering, Inc., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
§ Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
Olektron Corp., Signal Technology Corp., 61 Sutton Road, Webster, MA 01570 617-943-7440
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
† Parker McCrory Mfg. Co., 2000 Forest Ave., Kansas City, MO 64108 816-221-2000
† Perkin-Elmer Corp., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132 203-762-4786
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861 201-826-4700
§† Powertron Corporation, Rte. 15, Box 932, Sparta, NJ 07871 201-579-5599
† Preferred Electronics, Inc., Main Line Dr., P.O. Box 248, Westfield, MA 01086 413-568-2301
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
Rapid Power Technologies, Graysbridge Rd. , P.O.BOX 291, Brookfield, CT 06804 ..... 203-775-0411;800-332-1111
§ Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729 ..... 516-586-5566; 1-800-645-5828
Sanford-Miller Corp., 8 John St., Lynbrook, NY 11563 .... 516-593-2025;800-645-5900
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
† Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
§† Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
§† Staco Energy Products Co., 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
Staco Transpower, 610 W. 6th St., Mt. Carmel, IL 62863 618-262-5555
§ Stancor Products, Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
Stangenes Industries, Inc., 1052 East Meadow Circle, Palo Alto, CA 94303 415-493-0814
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Superior Electric, 383 Middle St., Bristol, CT 06010 203-582-9561
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518 213-638-1790
Teco Corp., Bay Rd., P. O. Box A, Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torema U.S.A., Inc., 6699 Portwest Dr., No. 130, Houston, TX 77024 713-861-6643
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199 816-761-6314
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064 213-478-8224
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
Walker Power, Inc., Walker Magnetics Group, 10 B Mill St., Warner, NH 03278 603-456-3111
† Wayne Transformer Co., Inc., 666 Pacific St., Brooklyn, NY 11217 718-783-9007
Xentek, Inc., 760 Shadow Ridge Dr., Vista, CA 92083 619-727-0940
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

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Coilcraft, 1102 Silver Lake Rd., Cary, IL 60013, 312-639-2361 ..... A•1225
Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2205,2208
Gowanda Electronics Corp., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 ..... A•1245
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735, 516-293-0475 ..... A•2243
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319, D•1863
TDK Corporation, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku,, Tokyo, JAPAN 103, (03) 278-5111 ..... A•1294
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
SFE Technologies, 1501 1st St., San Fernando, CA 91340 818-365-9411
Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209 513-871-3777
Thinco Div., Hull Corp., Davisville Rd., Hatboro, PA 19040 215-672-7800
Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131 408-432-8020
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070

Transformers, Chopper-5600

† Abbott Technologies, Inc., Burbank Division, Transformers, 639 So. Glenwood Pl., Burbank, CA 91506, 818-841-3630 ..... A•2157
Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2182
† C & C Jetronic, Inc., Research Pk. 318 Wall St., Princeton, NJ 08540, 609-921-8540 ..... A•2204
† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2214
† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2216
Gowanda Electronics Corp., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 ..... A•1245
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•2282
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025
Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, 301-464-2100 ..... A•2412
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 612-788-9161
§ Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33069 305-979-7920
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
† Hadley, Robert M. Co., Inc., 750 West 51st St., Los Angeles, CA 90037 .. 213-234-9091
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301 201-782-5525
§ James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., 999 Anita Ave., Antioch, IL 60002 312-395-5710
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
§† Powertron Corporation, Rte. 15, Box 932, Sparta, NJ 07871 201-579-5599
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
§ QPL Magnetics, Inc., P.O.BOX C, Lake Grove, NY 11755 516-589-3331
Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Torelco, Inc., 14 Paine Ave., P. O. Box 560, Irvington, NJ 07111 201-374-8641
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199 816-761-6314
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735 516-293-3100
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600
† Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 ... 602-861-1856

Transformers, Constant Voltage-5600

Acme Electric Corporation, 20 Water Street, Cuba, NY 14727, 716-968-2400 ..... D•1534
Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2180
Bey Electric, Inc., 362 Main St., Box 548, Lincoln Park, NJ 07035, 201-694-5000 ..... A•2197
Controlled Power Co., 1955 Stephenson Hwy., Troy, MI 48083, 313-528-3700;1-800-521-4792 ..... D•2085
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, 605-296-3462/3487 ..... A•2212
† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2214
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... A•2248-2249
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 ..... A•2303
Para-Line Transformer Co., Inc., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2318
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ..... A•2308-2310,2312
Signal Transformer Co., Inc., Insilco Corporation, 500 Bayview Ave., Inwood, NY 11696, 516-239-5777 ..... A•2372
§ Sola, A Unit of General Sign., 1717 Busse Rd., Elk Grove Village, IL 60007, 312-439-2800 ..... D•1970,1972
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025
Ulveco, Inc., 323 Vintage Park Drive, Foster City, CA 94404, 415-574-1100 ..... A•2432
† Wayne Transformer Co., Inc., 666 Pacific St., Brooklyn, NY 11217, 718-783-9007 ..... A•2440
§† Able Power and Engineering Inc., 1222 N. Delta St., S. San Gabriel, CA 91770 818-571-6260
Acme Transformer, Acme Electric Corporation, Rte. 4, Box 54, Lumberton, NC 28358 919-738-1121
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
† American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 612-788-9161

Andover, Inc., 310 North Earl Avenue, Lafayette, IN 47904 317-447-1157
† Atlas Engineering Corp., 10 Cheney St, Dorchester, MA 02121 617-445-7100
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† C & C Jetronic, Inc., Research Pk. 318 Wall St., Princeton, NJ 08540 609-921-8540
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St, Brooklyn, NY 11217 718-857-2400
Computer Power Inc., 124 W. Main St, High Bridge, NJ 08829 ..... 201-638-8000; 800-526-5088
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
§ Electronic Specialists, 171 South Main St., Natick, MA 01760 ..... 617-655-1532; 800-225-4876
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Elgar Corp., 9250 Brown Deer Rd., San Diego, CA 92121 ..... 619-450-0085; 800-854-2213
Elgin Electronics, Combustion Engineering, 5533 New Perry Hwy., Erie, PA 16509-3570 814-864-4921
Elma Engineering, 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 .. 213-515-1546
§† E-Tronics, 16774 Schoenborn, Sepulveda, CA 91343 818-892-7279
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Gettysburg Transformer Corporation, 1380 Old Harrisburg Rd., P.O. Box 99, Gettysburg, PA 17325 717-334-2191
Hamilton Standard Controls, 9100 Airport Dr., P.O. Box 11648, Fort Wayne, IN 46859 219-747-6142
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hipotronics Inc., P.O. Drawer A, Brewster, NY 10509 914-279-8091
Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301 201-782-5525
Industrial Midwec Capacitor Corp., 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
§ Jefferson Elec., MagneTek, Inc., 1400 Center Circle Drive, Downers Grove, IL 60515-1021 312-691-2400
Jerome Industries Corp., 730 E. Division St., Elizabeth, NJ 07201 201-353-5700
KGS Electronics, Inc., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 303-651-2011
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Merrimack Magnetics Corp., 121 Hale St., Lowell, MA 01851 617-458-1487
§ Micron Industries, 1830 N. 32nd Ave., Stone Park, IL 60165 312-345-0788
§ Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582 516-561-6050
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223 414-358-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., 999 Anita Ave., Antioch, IL 60002 312-395-5710
§† Oaktron Industries, Inc., 704 30th St., Monroe, WI 53566 608-328-5560
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
Parker McCrory Mfg. Co., 2000 Forest Ave., Kansas City, MO 64108 816-221-2000
§ Perma Power Elctrns., 5601 W. Howard Ave., Chicago, IL 60648 312-647-9414
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861 201-826-4700
Power-Science, 7667 Vickers St., San Diego, CA 92111 619-292-4322
Power Sources International Inc., Sources Electronics, 15014 Malachite Ct., Reno, NV 89506 702-972-1224
§† Powertron Corporation, Rte. 15, Box 932, Sparta, NJ 07871 201-579-5599
† Preferred Electronics, Inc., Main Line Dr., P.O. Box 248, Westfield, MA 01086 413-568-2301
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
Rapid Power Technologies, Graysbridge Rd., P.O.BOX 291, Brookfield, CT 06804 ..... 203-775-0411;800-332-1111
Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
§ Reliance Electric Co., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199 800-245-4501
§ Shape Magnetronics, Inc., 901 DuPage Ave., Lombard, IL 60148 312-620-8394
† Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
§ Staco Energy Products Co., 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
Staco Transpower, 610 W. 6th St., Mt. Carmel, IL 62863 618-262-5555
§ Stancor Products, Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
Stangenes Industries, Inc., 1052 East Meadow Circle, Palo Alto, CA 94303 415-493-0814
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
§ Sun Research, Inc., Box 210, Old Bay Rd., New Durham, NH 03855 603-859-7110
§ Superior Electric, 383 Middle St., Bristol, CT 06010 203-582-9561
Teco Corp., Bay Rd., P. O. Box A, Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
Trancor, 108 N. High St., P.O. Box 907, San Saba, TX 76877 915-372-6127
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Transformation Electronics Group, P.O. Box 2314, Flagler Bch., FL 32036 904-439-5888
† Transistor Devices, Inc., 274 S. Salem St., Randolph, NJ 07869 201-361-6622
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600
Xentek, Inc., 760 Shadow Ridge Dr., Vista, CA 92083 619-727-0940
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

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AT&T, 555 Union Blvd., Allentown, PA 18103, 1-800-372-2447;In Canada:1-800-553-2448 ..... A•2190
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 ..... A•2194
BH Electronics, Inc., 12219 Wood Lk. Dr., Burnsville, MN 55337, 612-894-9590 ..... A•2198-2199
† Bicron Electronics, 100 Barlow Street, Canaan, CT 06018, 203-824-5125 ..... A•2202-2203
Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1209
† C & C Jetronic, Inc., Research Pk. 318 Wall St., Princeton, NJ 08540, 609-921-8540 ..... A•2204
Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2205,2209
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, 605-296-3462/3487 ..... A•2212, D•1702
† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2214
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2216
Foxboro/PCG, The Foxboro Company, 600 N. Bedford St., E. Bridgewater, MA 02333, 508-378-5260 ..... A•2234-2235
§† Gowanda Electronics Corp., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 ..... A•1245
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061, 913-782-0012 ..... A•2239
Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ..... A•2250
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166 ..... A•2262
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265
Multi Products International, 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•2298
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319,2342-2345
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2350-2351
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025
Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, 301-464-2100 ..... A•2412
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763, 516-654-1880 ..... A•2426
Vitec Electronic Corporation, 1525A East Acequia, Visalia, CA 93291, 209-739-1077 ..... A•2435-2439
§† Able Power and Engineering Inc., 1222 N. Delta St., S. San Gabriel, CA 91770 818-571-6260
AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
† American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 612-788-9161
Andover, Inc., 310 North Earl Avenue, Lafayette, IN 47904 317-447-1157
Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
§ Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33069 305-979-7920
Atlas Engineering Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147 305-696-6660
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† BG Electronics, 30 South St., Mt. Vernon, NY 10550 914-664-5591
Bikor, Microsemi Corporation, 1504 W. 228th St., Torrance, CA 90501 ... 213-539-6320
§ Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coiltronics Inc., 984 S.W. 13th Court, Pompana Beach, FL 33069 305-781-8900
Computer Power Inc., 124 W. Main St, High Bridge, NJ 08829 ..... 201-638-8000; 800-526-5088
† Cramer Coil & Transformer Co., Inc., 401 Progress Dr., Saukville, WI 53080 414-284-9425
Datatronics, Ltd., P. O. Box 2839, Blue Jay, CA 92317 714-336-3561
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798

† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360
Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
Electrocom Industries, 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5770 Thornwood Dr., Goleta, CA 93117 805-964-0751
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Endicott Coil, 24 Charlotte St., Binghamton, NY 13905 607-797-1263
† Endicott Research Group, 2601 Wayne St., P.O. Box 269, Endicott, NY 13760 607-754-9187
§† E-Tronics, 16774 Schoenborn, Sepulveda, CA 91343 818-892-7279
† Frederick Components Intl., 20806 Plummer St., Chatsworth, CA 91311 ..... 818-882-0868;800-354-0660
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
† Hadley, Robert M. Co., Inc., 750 West 51st St., Los Angeles, CA 90037 .. 213-234-9091
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301 201-782-5525
Hurricane Electronics Lab, P.O. Box 1280, Hurricane, UT 84737 801-635-2003
§ International High Voltage Elctrns., Inc., Finance Drive, Danbury, CT 06810 ..... 203-792-7820;800-634-0740
KGS Electronics, Inc., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
LEPCO/Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 .. 512-546-1625
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 303-651-2011
§ Love Controls Corp., 1475 S. Wheeling Rd., Wheeling, IL 60090 312-541-3232
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
Merrimack Magnetics Corp., 121 Hale St., Lowell, MA 01851 617-458-1487
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582 516-561-6050
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
Mini-Magnetics Co., Inc., 1100 Fulton Place, Fremont, CA 94539 415-490-7500
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† Novatronics, Box 878, Pompano Beach, FL 33061 305-942-5200
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† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Pacific Electro Dynamics, Inc., 11465 Willows Rd. N.E., Redmond, WA 98073-9745 206-881-1700
† PCA Electronics, 16799 Schoenborn St., Sepulveda, CA 91343 818-892-0761
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861 201-826-4700
§† Powertron Corporation, Rte. 15, Box 932, Sparta, NJ 07871 201-579-5599
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 .. 312-543-6400
† Preferred Electronics, Inc., Main Line Dr., P.O. Box 248, Westfield, MA 01086 413-568-2301
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
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§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Sierra West Power Systems, 2615 Missouri St., Las Cruces, NM 88001 505-522-8828
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
Staco Transpower, 610 W. 6th St., Mt. Carmel, IL 62863 618-262-5555
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95054 408-988-0700
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
† STI, Control Components Div., 9520 Black Mountain Rd., San Diego, CA 92126-4507 ..... 619-566-7680;800-826-5053
Talema Electronic, Inc., 301 N. Highway 63, Rolla, MO 65401 314-364-0882
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518 213-638-1790
§ TDK Corporation, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku, Tokyo, JAPAN 103 ..... (03) 278-5111
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
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† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199 816-761-6314
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
Trancor, 108 N. High St., P.O. Box 907, San Saba, TX 76877 915-372-6127
Transformation Electronics Group, P.O. Box 2314, Flagler Bch., FL 32036 904-439-5888
† Transistor Devices, Inc., 274 S. Salem St., Randolph, NJ 07869 201-361-6622
† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600
† Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245 ... 619-458-1471
† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 ... 602-861-1856
Xylog Corp., 83 Hobart St., Hackensack, NJ 07601 201-489-4040
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

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† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2350
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
Bey Electric, Inc., 362 Main St., Box 548, Lincoln Park, NJ 07035 201-694-5000
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† C & C Jetronic, Inc., Research Pk. 318 Wall St., Princeton, NJ 08540 609-921-8540
† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro Scientific Inds., 13900 N.W. Science Pk. Dr., Portland, OR 97229 503-641-4141
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
† Perkin-Elmer Corp., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132 203-762-4786
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880

Transformers, Differential-5600

† Bicron Electronics, 100 Barlow Street, Canaan, CT 06018, 203-824-5125 ..... A•2202-2203
Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1209
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731, 516-261-3300 ..... D•1145
Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2214
† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716, 516-567-5600 ..... D•1164
Novatronics of Canada Ltd., 677 Erie St., P.O. Box 610, Stratford, Ontario, CANADA N5A 6V6, 519-271-3880 ..... B•1243
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025
AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
§ Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33069 305-979-7920
§ Automatic Timing & Controls Co., 201 So. Gulph Rd., King of Prussia, PA 19406 ..... 215-337-5500;800-441-8245
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
Bey Electric, Inc., 362 Main St., Box 548, Lincoln Park, NJ 07035 201-694-5000
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
† C & C Jetronic, Inc., Research Pk. 318 Wall St., Princeton, NJ 08540 609-921-8540
† Columbia Resch. Labs., Macdade Blvd. & Bullens La., Woodlyn, PA 19094 215-872-3882
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
† Edcliff Div., Systron Donner, 1711 So. Mountain Ave., Monrovia, CA 91016 818-358-4571
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Grand Transformers, 1500 Marion St., Grand Haven, MI 49417 616-842-5430
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Midcom, Inc., 121 Airport Dr., Watertown, SD 57201 605-886-4385
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
§† Robinson-Halpern, Teleflex, Inc., One Apollo Rd., P.O. Box 248, Plymouth Meeting, PA 19462-0248 215-825-9200
† Schaevitz Engineering, U.S. 130, Union Ave., Pennsauken, NJ 08110 609-662-8000
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518 213-638-1790
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199 816-761-6314
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Transducers and Systems, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471 203-481-5721
Transformation Electronics Group, P.O. Box 2314, Flagler Bch., FL 32036 904-439-5888
Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735 516-293-3100
Trans-Tek, P.O. Box 338, Rte. 83, Ellington, CT 06029 203-872-8351

§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600
† Wayne Transformer Co., Inc., 666 Pacific St, Brooklyn, NY 11217 718-783-9007

Transformers, Discriminator-5600

Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2182
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224-5825, 213-537-5200 ..... A•1205
Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1209
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2205
Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2214
† ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558,2215
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2350
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025
† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600 ..... A•2428
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St, Dept. E, Miami, FL 33147 305-696-6660
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† BG Electronics, 30 South St, Mt. Vernon, NY 10550 914-664-5591
† C & C Jetronic, Inc., Research Pk. 318 Wall St., Princeton, NJ 08540 609-921-8540
Datatronics, Ltd., P. O. Box 2839, Blue Jay, CA 92317 714-336-3561
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electronic Coil Corp., Farmington Industrial Park, Farmington, CT 06032 203-677-6731
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
† Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
Genisco Technology Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582 516-561-6050
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861 201-826-4700
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199 816-761-6314
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100

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† Abbott Technologies, Inc., Burbank Division, Transformers, 639 So. Glenwood Pl., Burbank, CA 91506, 818-841-3630 ..... A•2157
Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2182
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2205
Delta Products Corporation, 3823 Spinnaker Ct., Fremont, CA 94538, 415-770-0660 ..... A•2211
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, 605-296-3462/3487 ..... A•2212
† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2214
† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2216
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-937-3475 ..... A•2241
Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ..... A•2250
§ Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... A•2252-2253
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•2282
Para-Line Transformer Co., Inc., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2318
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2350-2351
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2355
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1282,1284,2367,2369
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199, 816-761-6314 ..... A•2418-2420
Vitec Electronic Corporation, 1525A East Acequia, Visalia, CA 93291, 209-739-1077 ..... A•2435-2436
§† Able Power and Engineering Inc., 1222 N. Delta St., S. San Gabriel, CA 91770 818-571-6260
AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St, Dept. E, Miami, FL 33147 305-696-6660
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
C & C Jetronic, Inc., Research Pk. 318 Wall St., Princeton, NJ 08540 609-921-8540
† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 213-515-1546
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Foxboro/PCG, The Foxboro Company, 600 N. Bedford St, E. Bridgewater, MA 02333 508-378-5260
† Freed Transformer, 1718 Weirfield St, Ridgewood, NY 11385 212-386-1300
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
Grand Transformers, 1500 Marion St, Grand Haven, MI 49417 616-842-5430
† Hadley, Robert M. Co., Inc., 750 West 51st St, Los Angeles, CA 90037 213-234-9091
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301 201-782-5525
§† JB Electronic Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., 730 E. Division St., Elizabeth, NJ 07201 201-353-5700
KGS Electronics, Inc., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
LEPCO/Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 303-651-2011
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Penn-Tran Corp., Box 1321, Rte. 144N, Wingate, PA 16880 814-355-1521
† Perkin-Elmer Corp., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132 203-762-4786
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
§ QPL Magnetics, Inc., P.O.BOX C, Lake Grove, NY 11755 516-589-3331
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
§† Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
Staco Transpower, 610 W. 6th St, Mt. Carmel, IL 62863 618-262-5555
§ Stancor Products, Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518 213-638-1790
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
§ Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torelco, Inc., 14 Paine Ave., P. O. Box 560, Irvington, NJ 07111 201-374-8641
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
Trancor, 108 N. High St, P.O. Box 907, San Saba, TX 76877 915-372-6127
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600
Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245 619-458-1471
† Wayne Transformer Co., Inc., 666 Pacific St, Brooklyn, NY 11217 718-783-9007
Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 602-861-1856
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, Ferroresonant-5600

AT&T, 555 Union Blvd., Allentown, PA 18103, 1-800-372-2447;In Canada:1-800-553-2448 ..... A•2185-2188,2190
Controlled Power Co., 1955 Stephenson Hwy., Troy, MI 48083, 313-528-3700;1-800-521-4792 ..... D•2085,2087

Dynage/Power & Magnetics, Division Of Oakleaf, Inc., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, 605-296-3462/3487 ..... A•2212
† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2214
Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301, 201-782-5525 ..... A•2240
Jerome Industries Corp., 730 E. Division St., Elizabeth, NJ 07201, 201-353-5700 ..... A•2242
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861, 201-826-4700 ..... A•2352
Signal Transformer Co., Inc., Insilco Corporation, 500 Bayview Ave., Inwood, NY 11696, 516-239-5777 ..... A•2372,2387
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025
Vitec Electronic Corporation, 1525A East Acequia, Visalia, CA 93291, 209-739-1077 ..... A•2439
§† Able Power and Engineering Inc., 1222 N. Delta St., S. San Gabriel, CA 91770 818-571-6260
† ACD-Elcor Products, P.O. Box 244, Bethel, CT 06801 203-743-3510
Acme Electric Corporation, 20 Water Street, Cuba, NY 14727 716-968-2400
Acme Transformer, Acme Electric Corporation, Rte. 4, Box 54, Lumberton, NC 28358 919-738-1121
Actown-Electrocoil, Inc., 2414 Highview, Spring Grove, IL 60081 815-675-6641
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
Andover, Inc., 310 North Earl Avenue, Lafayette, IN 47904 317-447-1157
Atlas Engineering Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
Bey Electric, Inc., 362 Main St., Box 548, Lincoln Park, NJ 07035 201-694-5000
§ C-COR Elctrns., 60 Decibel Rd., State College, PA 16801 814-238-2461
Computer Power Inc., 124 W. Main St., High Bridge, NJ 08829 ..... 201-638-8000; 800-526-5088
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360
Elgin Electronics, Combustion Engineering, 5533 New Perry Hwy., Erie, PA 16509-3570 814-864-4921
† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 .. 213-515-1546
Endicott Coil, 24 Charlotte St., Binghamton, NY 13905 607-797-1263
§† E-Tronics, 16774 Schoenborn, Sepulveda, CA 91343 818-892-7279
Framar Metal Products Co., Inc., 345 Carnegie Avenue, Kenilworth, NJ 07033 201-241-0710
Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Gettysburg Transformer Corporation, 1380 Old Harrisburg Rd., P.O. Box 99, Gettysburg, PA 17325 717-334-2191
Grand Transformers, 1500 Marion St., Grand Haven, MI 49417 616-842-5430
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hipotronics Inc., P.O. Drawer A, Brewster, NY 10509 914-279-8091
Industrial Midwec Capacitor Corp., 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 303-651-2011
Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
§ Micron Industries, 1830 N. 32nd Ave., Stone Park, IL 60165 312-345-0788
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223 414-358-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
Penn-Tran Corp., Box 1321, Rte. 144N, Wingate, PA 16880 814-355-1521
Power Sources International Inc., Sources Electronics, 15014 Malachite Ct., Reno, NV 89506 702-972-1224
Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
§ S & H Inds., 2257 North Penn Rd., Hatfield, PA 19440 215-822-7211
§ Shape Magnetronics, Inc., 901 DuPage Ave., Lombard, IL 60148 312-620-8394
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
Staco Transpower, 610 W. 6th St., Mt. Carmel, IL 62863 618-262-5555
Stangenes Industries, Inc., 1052 East Meadow Circle, Palo Alto, CA 94303 415-493-0814
Teco Corp., Bay Rd., P. O. Box A, Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
Trancor, 108 N. High St., P.O. Box 907, San Saba, TX 76877 915-372-6127
† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Filament-5600

† Abbott Technologies, Inc., Burbank Division, Transformers, 639 So. Glenwood Pl., Burbank, CA 91506, 818-841-3630 ..... A•2157,2159
Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2182
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2205
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, 914-699-2000 ..... A•2210
Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2214
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2216
Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301, 201-782-5525 ..... A•2240
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735, 516-293-0475 ..... A•2243
§ Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... A•2252-2253,2256-2257
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•2282,2289
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 ..... A•2303
† Oram High Voltage, P.O. Box 1176, Dayton, TX 77535, 409-258-5553 .... D•1859
Para-Line Transformer Co., Inc., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2318
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ..... A•2308-2310,2312-2313
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319
Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2350
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2355
† Signal Transformer Co., Inc., Insilco Corporation, 500 Bayview Ave., Inwood, NY 11696, 516-239-5777 ..... A•2372
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025
§ Todd Systems, Inc., 50 Ash St., Yonkers, NY 10701, 914-963-3400 ..... A•2408
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701, 201-364-1800 ..... A•2424
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763, 516-654-1880 ..... A•2426
Transformer Technologies, Inc., 52 Putnam St., Mt. Vernon, NY 10550, 914-668-1600 ..... A•2427
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600 ..... A•2428
† Wayne Transformer Co., Inc., 666 Pacific St., Brooklyn, NY 11217, 718-783-9007 ..... A•2440
§† Able Power and Engineering Inc., 1222 N. Delta St., S. San Gabriel, CA 91770 818-571-6260
Actown-Electrocoil, Inc., 2414 Highview, Spring Grove, IL 60081 815-675-6641
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 612-788-9161
Andover, Inc., 310 North Earl Avenue, Lafayette, IN 47904 317-447-1157
§ Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33069 305-979-7920
† Atlas Engineering Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
§ Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
Bey Electric, Inc., 362 Main St., Box 548, Lincoln Park, NJ 07035 201-694-5000
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217 718-857-2400
† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coiltronics Inc., 984 S.W. 13th Court, Pompana Beach, FL 33069 305-781-8900
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
Computer Power Inc., 124 W. Main St., High Bridge, NJ 08829 ..... 201-638-8000; 800-526-5088
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5770 Thornwood Dr., Goleta, CA 93117 805-964-0751
Elma Engineering, 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 .. 213-515-1546
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Endicott Coil, 24 Charlotte St., Binghamton, NY 13905 607-797-1263
§† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
Gettysburg Transformer Corporation, 1380 Old Harrisburg Rd., P.O. Box 99, Gettysburg, PA 17325 717-334-2191
Grand Transformers, 1500 Marion St., Grand Haven, MI 49417 616-842-5430
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hipotronics Inc., P.O. Drawer A, Brewster, NY 10509 914-279-8091
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
§† JB Electronic Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., 730 E. Division St., Elizabeth, NJ 07201 201-353-5700
KGS Electronics, Inc., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Merrimack Magnetics Corp., 121 Hale St., Lowell, MA 01851 617-458-1487
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300

Nedap N.V., P.O. Box 6, Groenlo, HOLLAND 7140 AA ..... + 31-5440-71111
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., 999 Anita Ave., Antioch, IL 60002 312-395-5710
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
† Parker McCrory Mfg. Co., 2000 Forest Ave., Kansas City, MO 64108 816-221-2000
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 .. 312-543-6400
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
§† Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
Staco Transpower, 610 W. 6th St., Mt. Carmel, IL 62863 618-262-5555
§ Stancor Products, Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95054 408-988-0700
Stangenes Industries, Inc., 1052 East Meadow Circle, Palo Alto, CA 94303 415-493-0814
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518 213-638-1790
Teco Corp., Bay Rd., P. O. Box A, Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199 816-761-6314
Trancor, 108 N. High St., P.O. Box 907, San Saba, TX 76877 915-372-6127
† Transistor Devices, Inc., 274 S. Salem St., Randolph, NJ 07869 201-361-6622
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

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Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2180
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 ..... A•2194
Delta Products Corporation, 3823 Spinnaker Ct., Fremont, CA 94538, 415-770-0660 ..... A•2211
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, 605-296-3462/3487 ..... A•2213
† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2214
Foxboro/PCG, The Foxboro Company, 600 N. Bedford St., E. Bridgewater, MA 02333, 508-378-5260 ..... A•2234-2235
Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ..... A•2250
§ Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... A•2252-2253
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166 ..... A•2262
Multi Products International, 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•2298
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763, 516-654-1880 ..... A•2426
AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876 401-762-3800
† Atlas Engineering Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147 305-696-6660
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Coiltronics Inc., 984 S.W. 13th Court, Pompana Beach, FL 33069 305-781-8900
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
LEPCO/Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 .. 512-546-1625
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 303-651-2011
Merrimack Magnetics Corp., 121 Hale St., Lowell, MA 01851 617-458-1487
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080 404-436-1300
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
Nedap N.V., P.O. Box 6, Groenlo, HOLLAND 7140 AA ..... + 31-5440-71111
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Penn-Tran Corp., Box 1321, Rte. 144N, Wingate, PA 16880 814-355-1521
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ..... 914-699-5514;800-431-1064
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034 ... 215-643-6950
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861 201-826-4700
Power Sources International Inc., Sources Electronics, 15014 Malachite Ct., Reno, NV 89506 702-972-1224
† Preferred Electronics, Inc., Main Line Dr., P.O. Box 248, Westfield, MA 01086 413-568-2301
§ Pulse Engineering, Inc., 7250 Convoy Ct., P.O. Box 12235, San Diego, CA 92112 619-268-2400
QPL Magnetics, Inc., P.O.BOX C, Lake Grove, NY 11755 516-589-3331
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
Talema Electronic, Inc., 301 N. Highway 63, Rolla, MO 65401 314-364-0882
§ Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Trancor, 108 N. High St., P.O. Box 907, San Saba, TX 76877 915-372-6127
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

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† Abbott Technologies, Inc., Burbank Division, Transformers, 639 So. Glenwood Pl., Burbank, CA 91506, 818-841-3630 ..... A•2157,2159,2162-2166
Amecon, Inc., 1900 S. Chris La., Anaheim, CA 92805, 714-634-2220;800-392-2292 ..... A•2171,2175
Bey Electric, Inc., 362 Main St., Box 548, Lincoln Park, NJ 07035, 201-694-5000 ..... A•2197
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2205-2207
† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2214
† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2216-2217,2224-2225,2227-2228
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061, 913-782-0012 ..... A•2239
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735, 516-293-0475 ..... A•2243
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... A•2248-2249
Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ..... A•2250
Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... A•2252-2253,2255
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166 ..... A•2262
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•2289-2290
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 ..... A•2303
Para-Line Transformer Co., Inc., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2318
† PCA Electronics, 16799 Schoenborn St., Sepulveda, CA 91343, 818-892-0761 ..... A•2307
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ..... A•2308-2309,2314
† Perkin-Elmer Corp., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132, 203-762-4786 ..... A•2317
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319-2322,2324-2333,2346
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2350
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861, 201-826-4700 ..... A•2352-2353
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2355,2358-2360
† Signal Transformer Co., Inc., Insilco Corporation, 500 Bayview Ave., Inwood, NY 11696, 516-239-5777 ..... A•2372,2386
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025
Todd Systems, Inc., 50 Ash St., Yonkers, NY 10701, 914-963-3400 ..... A•2408
Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, 301-464-2100 ..... A•2412
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199, 816-761-6314 ..... A•2421-2423
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701, 201-364-1800 ..... A•2424-2425
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763, 516-654-1880 ..... A•2426
Transformer Technologies, Inc., 52 Putnam St., Mt. Vernon, NY 10550, 914-668-1600 ..... A•2427
Ulveco, Inc., 323 Vintage Park Drive, Foster City, CA 94404, 415-574-1100 ..... A•2431
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600 ..... A•2428-2429
Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010
§† Able Power and Engineering Inc., 1222 N. Delta St., S. San Gabriel, CA 91770 818-571-6260
Acme Electric Corporation, 20 Water Street, Cuba, NY 14727 716-968-2400
Acme Transformer, Acme Electric Corporation, Rte. 4, Box 54, Lumberton, NC 28358 919-738-1121
Actown-Electrocoil, Inc., 2414 Highview, Spring Grove, IL 60081 815-675-6641
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
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Andover, Inc., 310 North Earl Avenue, Lafayette, IN 47904 317-447-1157
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
† Atlas Engineering Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
Avel-Lindberg, Inc., 5 Old Town Park Rd., Unit 47, New Milford, CT 06776 203-355-4711
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100

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† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
Crompton Instrs., Hawker Siddley, 2763 Old Higgins Rd., Elk Grove Village, IL 60007 312-593-1107
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
§ Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5770 Thornwood Dr., Goleta, CA 93117 805-964-0751
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Foxboro/PCG, The Foxboro Company, 600 N. Bedford St., E. Bridgewater, MA 02333 508-378-5260
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
† General Magnetics, 211 Grove St., Bloomfield, NJ 07003 201-743-2700
† Hadley, Robert M. Co., Inc., 750 West 51st St., Los Angeles, CA 90037 .. 213-234-9091
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301 201-782-5525
§† JB Electronic Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
§† Jefferson Elec., MagneTek, Inc., 1400 Center Circle Drive, Downers Grove, IL 60515-1021 312-691-2400
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Merrimack Magnetics Corp., 121 Hale St., Lowell, MA 01851 617-458-1487
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Mini-Magnetics Co., Inc., 1100 Fulton Place, Fremont, CA 94539 415-490-7500
Nedap N.V., P.O. Box 6, Groenlo, HOLLAND 7140 AA ..... +31-5440-71111
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
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† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
† Performance Controls, Inc., 433 Caredean Drive, Horsham, PA 19044 ... 215-675-6500
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
§ QPL Magnetics, Inc., P.O.BOX C, Lake Grove, NY 11755 516-589-3331
Rapid Power Technologies, Graysbridge Rd., P.O.BOX 291, Brookfield, CT 06804 ..... 203-775-0411;800-332-1111
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Sierra West Power Systems, 2615 Missouri St., Las Cruces, NM 88001 505-522-8828
Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
§† Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
§† Staco Energy Products Co., 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
Staco Transpower, 610 W. 6th St., Mt. Carmel, IL 62863 618-262-5555
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Talema Electronic, Inc., 301 N. Highway 63, Rolla, MO 65401 314-364-0882
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518 213-638-1790
§† Technipower, A Penril Co., P.O. Box 222, Commerce Pk., Danbury, CT 06813 203-748-7001
Teco Corp., Bay Rd., P. O. Box A, Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
Torelco, Inc., 14 Paine Ave., P. O. Box 560, Irvington, NJ 07111 201-374-8641
Torema U.S.A., Inc., 6699 Portwest Dr., No. 130, Houston, TX 77024 713-861-6643
Trancor, 108 N. High St., P.O. Box 907, San Saba, TX 76877 915-372-6127
† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
† Wayne Transformer Co., Inc., 666 Pacific St., Brooklyn, NY 11217 718-783-9007
† Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 ... 602-861-1856
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, High Voltage (1,000 Volts & Over)-5600

Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2180
† C & C Jetronic, Inc., Research Pk. 318 Wall St., Princeton, NJ 08540, 609-921-8540 ..... A•2204
Controlled Power Co., 1955 Stephenson Hwy., Troy, MI 48083, 313-528-3700;1-800-521-4792 ..... D•2085
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, 914-699-2000 ..... A•2210
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, 605-296-3462/3487 ..... A•2212
Glassman High Voltage Inc., P.O. Box 551, Salem Indl. Pk., Whitehouse Sta., NJ 08889, 201-534-9007 ..... D•1732-1733
Hipotronics Inc., P.O. Drawer A, Brewster, NY 10509, 914-279-8091 ..... A•2236-2238
§ Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301, 201-782-5525 ..... A•2240
Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ..... A•2250
Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... A•2252-2253
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265,2273,2275
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 ..... A•2303
† Oram High Voltage, P.O. Box 1176, Dayton, TX 77535, 409-258-5553 ..... D•1858-1859
Pearson Electronics, Inc., 1860 Embarcadero Rd., Palo Alto, CA 94303, 415-494-6444 ..... A•2316
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2350
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025
† Wayne Transformer Co., Inc., 666 Pacific St., Brooklyn, NY 11217, 718-783-9007 ..... A•2440
§† Able Power and Engineering Inc., 1222 N. Delta St., S. San Gabriel, CA 91770 818-571-6260
Actown-Electrocoil, Inc., 2414 Highview, Spring Grove, IL 60081 815-675-6641
American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
Andover, Inc., 310 North Earl Avenue, Lafayette, IN 47904 317-447-1157
† Atlas Engineering Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
† Aydin Corp., 700 Dresher Rd., Horsham, PA 19044 215-657-7510
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
† Cramer Coil & Transformer Co., Inc., 401 Progress Dr., Saukville, WI 53080 414-284-9425
Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5770 Thornwood Dr., Goleta, CA 93117 805-964-0751
Elma Engineering, 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 .. 213-515-1546
Ferrotran Elctrns. Co., Inc., 11 W. 25th St., New York, NY 10010 212-691-3610
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
† Hadley, Robert M. Co., Inc., 750 West 51st St., Los Angeles, CA 90037 .. 213-234-9091
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
§ International High Voltage Elctrns., Inc., Finance Drive, Danbury, CT 06810 ..... 203-792-7820;800-634-0740
§ Jefferson Elec., MagneTek, Inc., 1400 Center Circle Drive, Downers Grove, IL 60515-1021 312-691-2400
Jerome Industries Corp., 730 E. Division St., Elizabeth, NJ 07201 201-353-5700
KGS Electronics, Inc., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 303-651-2011
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
§ Micron Industries, 1830 N. 32nd Ave., Stone Park, IL 60165 312-345-0788
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582 516-561-6050
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223 414-358-5300
Nedap N.V., P.O. Box 6, Groenlo, HOLLAND 7140 AA ..... +31-5440-71111
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., 999 Anita Ave., Antioch, IL 60002 312-395-5710
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
† Parker McCrory Mfg. Co., 2000 Forest Ave., Kansas City, MO 64108 816-221-2000
† Penn-Tran Corp., Box 1321, Rte. 144N, Wingate, PA 16880 814-355-1521
† Plastic Capacitors, Inc., 2623 N. Pulaski Rd., Chicago, IL 60639 312-489-2229
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861 201-826-4700
§† Powertron Corporation, Rte. 15, Box 932, Sparta, NJ 07871 201-579-5599
† Preferred Electronics, Inc., Main Line Dr., P.O. Box 248, Westfield, MA 01086 413-568-2301
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
§ QPL Magnetics, Inc., P.O.BOX C, Lake Grove, NY 11755 516-589-3331
Rapid Power Technologies, Graysbridge Rd., P.O.BOX 291, Brookfield, CT 06804 ..... 203-775-0411;800-332-1111
§ Reliance Electric Co., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199 800-245-4501
Ross Engineering Corp., 540 Westchester Dr., Campbell, CA 95008 408-377-4621
Rutherford Research, Box 249, Rutherford, NJ 07070 201-933-2091
§ S & H Inds., 2257 North Penn Rd., Hatfield, PA 19440 215-822-7211
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
Simco Co., 2257 North Penn Rd., Hatfield, PA 19440 215-822-2171

§† Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
† Spellman High Voltage Elctrns. Corp., 7 Fairchild Ave., Plainview, NY 11803 516-349-8686
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
Stangenes Industries, Inc., 1052 East Meadow Circle, Palo Alto, CA 94303 415-493-0814
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
§ Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
Torelco, Inc., 14 Paine Ave., P. O. Box 560, Irvington, NJ 07111 201-374-8641
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245 ... 619-458-1471
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Horizontal Sweep-5600

MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265,2275-2276,2278-2279
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2355,2365
Actown-Electrocoil, Inc., 2414 Highview, Spring Grove, IL 60081 815-675-6641
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† Penn-Tran Corp., Box 1321, Rte. 144N, Wingate, PA 16880 814-355-1521
§ Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121

Transformers, Hybrid-5600

Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2182
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 ..... A•2194
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2205
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, 605-296-3462/3487 ..... A•2213
Foxboro/PCG, The Foxboro Company, 600 N. Bedford St., E. Bridgewater, MA 02333, 508-378-5260 ..... A•2235
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•2291-2294
† North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•2302
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 ..... A•2303
Para-Line Transformer Co., Inc., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2318
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ..... A•2312
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2355,2361
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518, 213-638-1790 ..... A•2395-2397, D•1983
United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600 ..... A•2428
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070, 415-592-8832 ..... A•1715
AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† BG Electronics, 30 South St., Mt. Vernon, NY 10550 914-664-5591
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Coiltronics Inc., 984 S.W. 13th Court, Pompana Beach, FL 33069 305-781-8900
Delta Products Corporation, 3823 Spinnaker Ct., Fremont, CA 94538 415-770-0660
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360
Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
Electronic Coil Corp., Farmington Industrial Park, Farmington, CT 06032 203-677-6731
§ James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
Midcom, Inc., 121 Airport Dr., Watertown, SD 57201 605-886-4385
Mini-Magnetics Co., Inc., 1100 Fulton Place, Fremont, CA 94539 415-490-7500
Olektron Corp., Signal Technology Corp., 61 Sutton Road, Webster, MA 01570 617-943-7440
§ QPL Magnetics, Inc., P.O.BOX C, Lake Grove, NY 11755 516-589-3331
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
† Werlatone, Inc., P. O. Box 47, Rte. 22, Brewster, NY 10509 914-279-6187

Transformers, IF-5600

Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2180
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224-5825, 213-537-5200 ..... A•1205
Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1209
Coilcraft, 1102 Silver Lake Rd., Cary, IL 60013, 312-639-2361 ..... A•1225
§ Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... A•2252-2253
† Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 350166, Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1775
Multi Products International, 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•2298
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ..... A•2308-2309
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2350
Todd Systems, Inc., 50 Ash St., Yonkers, NY 10701, 914-963-3400 ..... A•2411
§† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
† Alpha Inds., Inc., Microelectronic Div., 2800 Crystal Drive, Hatfield, PA 19440 215-822-1311
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147 305-696-6660
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
† C & C Jetronic, Inc., Research Pk. 318 Wall St., Princeton, NJ 08540 609-921-8540
Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
† Cramer Coil & Transformer Co., Inc., 401 Progress Dr., Saukville, WI 53080 414-284-9425
† Delta Products Corporation, 3823 Spinnaker Ct., Fremont, CA 94538 415-770-0660
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
† Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
† Magnetic Component Engineering, Inc., 11379 Playa Street, Culver City, CA 90230 213-398-4761
† Merrimac Industries, 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
Olektron Corp., Signal Technology Corp., 61 Sutton Road, Webster, MA 01570 617-943-7440
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861 201-826-4700
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 ... 602-861-1856
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Transformers, Input-5600

† Bicron Electronics, 100 Barlow Street, Canaan, CT 06018, 203-824-5125 ..... A•2202-2203
† C & C Jetronic, Inc., Research Pk. 318 Wall St., Princeton, NJ 08540, 609-921-8540 ..... A•2204
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2205
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, 605-296-3462/3487 ..... A•2213
† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2214
† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2216
Foxboro/PCG, The Foxboro Company, 600 N. Bedford St., E. Bridgewater, MA 02333, 508-378-5260 ..... A•2235
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735, 516-293-0475 ..... A•2243-2244,2246-2247
Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ..... A•2250
§ Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... A•2252-2253
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•2291,2296
Para-Line Transformer Co., Inc., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2318
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ..... A•2308-2309,2312,2315

† **Perkin-Elmer Corp., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132, 203-762-4786** ..... **A•2317**
† **Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... **A•2319,2347**
† **Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950** ..... **A•2350**
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... **A•2355**
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518, 213-638-1790 ..... **A•2398**
† **Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105** ..... **A•1628,2407, B•1022-1025**
† **Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199, 816-761-6314** ..... **A•2418-2420**
§ **Vitec Electronic Corporation, 1525A East Acequia, Visalia, CA 93291, 209-739-1077** ..... **A•2439**
§† Able Power and Engineering Inc., 1222 N. Delta St., S. San Gabriel, CA 91770 818-571-6260
Actown-Electrocoil, Inc., 2414 Highview, Spring Grove, IL 60081 815-675-6641
AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
§ Bogen Communications, Inc., 50 Spring St., P.O. Box 575, Ramsey, NJ 07446 201-934-8500
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
† Coiltronics Inc., 984 S.W. 13th Court, Pompana Beach, FL 33069 305-781-8900
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
Computer Power Inc., 124 W. Main St., High Bridge, NJ 08829 ..... 201-638-8000; 800-526-5088
Custom Bobbin Windings, A & K Corporation, P.O. Box 2369, Zanesville, OH 43702-2369 614-452-6973
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§ Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360
Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 .. 213-515-1546
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
Grand Transformers, 1500 Marion St., Grand Haven, MI 49417 616-842-5430
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301 201-782-5525
Industrial Midwec Capacitor Corp., 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
§ James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
§† JB Electronic Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., 730 E. Division St., Elizabeth, NJ 07201 201-353-5700
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 303-651-2011
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Midcom, Inc., 121 Airport Dr., Watertown, SD 57201 605-886-4385
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Parker McCrory Mfg. Co., 2000 Forest Ave., Kansas City, MO 64108 816-221-2000
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861 201-826-4700
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
§ QPL Magnetics, Inc., P.O.BOX C, Lake Grove, NY 11755 516-589-3331
Robinson-Halpern, Teleflex, Inc., One Apollo Rd., P.O. Box 248, Plymouth Meeting, PA 19462-0248 215-825-9200
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
Staco Transpower, 610 W. 6th St., Mt. Carmel, IL 62863 618-262-5555
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torema U.S.A., Inc., 6699 Portwest Dr., No. 130, Houston, TX 77024 713-861-6643
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
Trancor, 108 N. High St., P.O. Box 907, San Saba, TX 76877 915-372-6127
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735 516-293-3100
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064 213-478-8224
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600

Transformers, Instrument-5600

† **Abbott Technologies, Inc., Burbank Division, Transformers, 639 So. Glenwood Pl., Burbank, CA 91506, 818-841-3630** ..... **A•2157**
Amecon, Inc., 1900 S. Chris La., Anaheim, CA 92805, 714-634-2220;800-392-2292 ..... **A•2176-2179**
§† **Bicron Electronics, 100 Barlow Street, Canaan, CT 06018, 203-824-5125** ..... **A•2202-2203**
† **C & C Jetronic, Inc., Research Pk. 318 Wall St., Princeton, NJ 08540, 609-921-8540** ..... **A•2204**
§ **Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301** ..... **A•2205**
† **Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, 914-699-2000** ..... **A•2210**
† **Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950** ..... **A•2214**
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... **A•2216**
Flex-Core Div., Morlan & Assocs., Inc., 6625 McVey Blvd., Worthington, OH 43235, 614-889-6152 ..... **A•2229**
Foxboro/PCG, The Foxboro Company, 600 N. Bedford St., E. Bridgewater, MA 02333, 508-378-5260 ..... **A•2231,2234-2235**
Gowanda Electronics Corp., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 ..... **A•1245**
Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ..... **A•2250-2251**
§ **Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500** ..... **A•2252-2253**
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... **A•2265**
§† **Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050** ..... **A•2283-2286,2290-2291**
† **NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300** ..... **A•2303**
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, OH 43212, 614-486-9561 ..... **B•1902-1903,1912, D•1306-1307**
Para-Line Transformer Co., Inc., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... **A•2318**
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ..... **A•2308-2309,2312-2313**
Pearson Electronics, Inc., 1860 Embarcadero Rd., Palo Alto, CA 94303, 415-494-6444 ..... **A•2316**
† **Perkin-Elmer Corp., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132, 203-762-4786** ..... **A•2317**
† **Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... **A•2319,2347**
† **Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950** ..... **A•2350-2351**
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... **A•2355**
Rekco, Inc., N. 114 W. 19225 Clinton Dr., Germantown, WI 53022, 414-784-3430 ..... **D•1141**
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518, 213-638-1790 ..... **A•2395, D•1983**
† **Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105** ..... **A•2407, B•1023-1025**
Todd Systems, Inc., 50 Ash St., Yonkers, NY 10701, 914-963-3400 ..... **A•2411**
Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, 301-464-2100 ..... **A•2412,2414,2416**
Transformer Technologies, Inc., 52 Putnam St., Mt. Vernon, NY 10550, 914-668-1600 ..... **A•2427**
Ulveco, Inc., 323 Vintage Park Drive, Foster City, CA 94404, 415-574-1100 ..... **A•2432**
Vitec Electronic Corporation, 1525A East Acequia, Visalia, CA 93291, 209-739-1077 ..... **A•2439**
§† Able Power and Engineering Inc., 1222 N. Delta St., S. San Gabriel, CA 91770 818-571-6260
Actown-Electrocoil, Inc., 2414 Highview, Spring Grove, IL 60081 815-675-6641
Advanced Components Inds., Inc., Spitznagel GmbH, 120 Center Street, El Segundo, CA 90245 213-322-4249
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
Andover, Inc., 310 North Earl Avenue, Lafayette, IN 47904 317-447-1157
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
Bey Electric, Inc., 362 Main St., Box 548, Lincoln Park, NJ 07035 201-694-5000
† BG Electronics, 30 South St., Mt. Vernon, NY 10550 914-664-5591
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
† Computer Components, Inc., 629 Fifth Ave., Pelham, NY 10803 914-738-1611

† Cramer Coil & Transformer Co., Inc., 401 Progress Dr., Saukville, WI 53080 414-284-9425
Crompton Instruments, 2763 Higgins Road, Elk Grove Village, IL 60007 312-593-1107
Crompton Instrs., Hawker Siddley, 2763 Old Higgins Rd., Elk Grove Village, IL 60007 312-593-1107
§ Current Ring Co. Inc., 252 Sunset Drive, P. O. 1525, Ballwin, MO 63011 800-325-8653
Custom Bobbin Windings, A & K Corporation, P.O. Box 2369, Zanesville, OH 43702-2369 614-452-6973
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
Electrical Instrument Service, 25 Dock St., Mt. Vernon, NY 10550 914-699-9717
§ Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360
Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
§ Electromatic Controls Corp., 2495 Pembroke Road, Hoffman Estates, IL 60195-2010 312-882-5757
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
Electronic Coil Corp., Farmington Industrial Park, Farmington, CT 06032 203-677-6731
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 .. 213-515-1546
Endicott Coil, 24 Charlotte St., Binghamton, NY 13905 607-797-1263
Esterline Angus Instrument Corp., Box 24000, Indianapolis, IN 46224 ... 317-244-7611
† Ferrotran Elctrns. Co., Inc., 11 W. 25th St., New York, NY 10010 212-691-3610
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
Gettysburg Transformer Corporation, 1380 Old Harrisburg Rd., P.O. Box 99, Gettysburg, PA 17325 717-334-2191
Grand Transformers, 1500 Marion St., Grand Haven, MI 49417 616-842-5430
† Greenlee Tool Co., Textron, 4455 Boeing Drive, Rockford, IL 61109 815-397-7070
Halmar Electronics, Inc., 900 N. Hague Ave., Columbus, OH 43204 614-275-0530
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Hurricane Electronics Lab, P.O. Box 1280, Hurricane, UT 84737 801-635-2003
Ion Physics Co., 323 Andover St., Wilmington, MA 01887 617-658-6030
§ James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
Jerome Industries Corp., 730 E. Division St., Elizabeth, NJ 07201 201-353-5700
KGS Electronics, Inc., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
§ Larson Instrument, Greenbush Rd., Orangeburg, NY 10962 914-359-3800
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223 414-358-5300
Nano Pulse Industries, 440 Nibus St., Brea, CA 92670 714-529-2600
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861 201-826-4700
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
§ QPL Magnetics, Inc., P.O.BOX C, Lake Grove, NY 11755 516-589-3331
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
Sensitive Research Instruments, 25 Dock St., Mt. Vernon, NY 10550 914-699-9717
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
Staco Transpower, 610 W. 6th St., Mt. Carmel, IL 62863 618-262-5555
Stangenes Industries, Inc., 1052 East Meadow Circle, Palo Alto, CA 94303 415-493-0814
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
† Sunshine Scientific Instruments, 1810 Grant Ave., Philadelphia, PA 19115 215-673-5600
Talema Electronic, Inc., 301 N. Highway 63, Rolla, MO 65401 314-364-0882
Tettex Instruments, Inc., P.O. Box 281, Fairview Village, PA 19409-0281 215-539-6050
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
Torema U.S.A., Inc., 6699 Portwest Dr., No. 130, Houston, TX 77024 713-861-6643
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199 816-761-6314
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
Trancor, 108 N. High St., P.O. Box 907, San Saba, TX 76877 915-372-6127
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735 516-293-3100
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064 213-478-8224
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600
† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
§ Western Electro-Mechanical Co., Inc., 300 Broadway, Oakland, CA 94607 415-452-1936
Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 ... 602-861-1856
§ Yokogawa Corp. of America, 200 West Park Drive, Peachtree City, GA 30269 404-487-1471
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Interstage-5600

Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1209
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2205
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, 605-296-3462/3487 ..... A•2213
† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2214
† ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558,2215
† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2216
Foxboro/PCG, The Foxboro Company, 600 N. Bedford St., E. Bridgewater, MA 02333, 508-378-5260 ..... A•2235
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-937-3475 ..... A•2241
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... A•2248
Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ..... A•2250
§ Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... A•2252-2253
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•2296
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ..... A•2308-2309,2315
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2350-2351
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2355
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1282,1284,2367,2369
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518, 213-638-1790 ..... A•2398
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199, 816-761-6314 ..... A•2418-2420
§† Able Power and Engineering Inc., 1222 N. Delta St., S. San Gabriel, CA 91770 818-571-6260
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Custom Bobbin Windings, A & K Corporation, P.O. Box 2369, Zanesville, OH 43702-2369 614-452-6973
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
§ Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360
Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 .. 213-515-1546
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
† Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301 201-782-5525
§† JB Electronic Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., 730 E. Division St., Elizabeth, NJ 07201 201-353-5700
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Merrimack Magnetics Corp., 121 Hale St., Lowell, MA 01851 617-458-1487
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., 999 Anita Ave., Antioch, IL 60002 312-395-5710
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
† Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700

Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
Staco Transpower, 610 W. 6th St., Mt. Carmel, IL 62863 618-262-5555
§ Stancor Products, Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
§ Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
Trancor, 108 N. High St., P.O. Box 907, San Saba, TX 76877 915-372-6127
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064 213-478-8224
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600

Transformers, Inverter-5600

Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 ..... A•2195
† Bicron Electronics, 100 Barlow Street, Canaan, CT 06018, 203-824-5125 ..... A•2202-2203
Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1209
† C & C Jetronic, Inc., Research Pk. 318 Wall St., Princeton, NJ 08540, 609-921-8540 ..... A•2204
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2205
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, 605-296-3462/3487 ..... A•2212
† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2214
Gowanda Electronics Corp., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 ..... A•1245
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735, 516-293-0475 ..... A•2243
Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ..... A•2250
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•2282
Para-Line Transformer Co., Inc., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2318
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319,2344-2345
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861, 201-826-4700 ..... A•2352-2353
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1282,1284,2367,2369
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025
Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, 301-464-2100 ..... A•2412
Transformer Technologies, Inc., 52 Putnam St., Mt. Vernon, NY 10550, 914-668-1600 ..... A•2427
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600 ..... A•2428-2429
§ Vitec Electronic Corporation, 1525A East Acequia, Visalia, CA 93291, 209-739-1077 ..... A•2435-2436,2439
Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010
§† Able Power and Engineering Inc., 1222 N. Delta St., S. San Gabriel, CA 91770 818-571-6260
Actown-Electrocoil, Inc., 2414 Highview, Spring Grove, IL 60081 815-675-6641
AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
Amecon, Inc., 1900 S. Chris La., Anaheim, CA 92805 ..... 714-634-2220;800-392-2292
† American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 612-788-9161
Andover, Inc., 310 North Earl Avenue, Lafayette, IN 47904 317-447-1157
§ Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33069 305-979-7920
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147 305-696-6660
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
BH Electronics, Inc., 12219 Wood Lk. Dr., Burnsville, MN 55337 612-894-9590
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
† Coiltronics Inc., 984 S.W. 13th Court, Pompana Beach, FL 33069 305-781-8900
§ Computer Power Inc., 124 W. Main St., High Bridge, NJ 08829 ..... 201-638-8000; 800-526-5088
† Cramer Coil & Transformer Co., Inc., 401 Progress Dr., Saukville, WI 53080 414-284-9425
Datatronics, Ltd., P. O. Box 2839, Blue Jay, CA 92317 714-336-3561
§ Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360
Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
Electrocom Industries, 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
§ Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5770 Thornwood Dr., Goleta, CA 93117 805-964-0751
Elgar Corp., 9250 Brown Deer Rd., San Diego, CA 92121 ..... 619-450-0085; 800-854-2213
† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 .. 213-515-1546
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Endicott Coil, 24 Charlotte St., Binghamton, NY 13905 607-797-1263
† Endicott Research Group, 2601 Wayne St., P.O. Box 269, Endicott, NY 13760 607-754-9187
Energy, Ltd., 4714 Upshur Street, Bladensburg, MD 20710 301-699-1144
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301 201-782-5525
§† JB Electronic Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., 730 E. Division St., Elizabeth, NJ 07201 201-353-5700
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 303-651-2011
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
† Pacific Electro Dynamics, Inc., 11465 Willows Rd. N.E., Redmond, WA 98073-9745 206-881-1700
† Perkin-Elmer Corp., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132 203-762-4786
† Preferred Electronics, Inc., Main Line Dr., P.O. Box 248, Westfield, MA 01086 413-568-2301
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
§ Pulse Engineering, Inc., 7250 Convoy Ct., P.O. Box 12235, San Diego, CA 92112 619-268-2400
§ QPL Magnetics, Inc., P.O.BOX C, Lake Grove, NY 11755 516-589-3331
Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
Sierra West Power Systems, 2615 Missouri St., Las Cruces, NM 88001 505-522-8828
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
§† Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
Stangenes Industries, Inc., 1052 East Meadow Circle, Palo Alto, CA 94303 415-493-0814
§ Sun Research, Inc., Box 210, Old Bay Rd., New Durham, NH 03855 603-859-7110
Talema Electronic, Inc., 301 N. Highway 63, Rolla, MO 65401 314-364-0882
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518 213-638-1790
§† Terado, 1068 Raymond Ave., St. Paul, MN 55108 612-646-2868
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
§ Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131 408-432-8020
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
Torelco, Inc., 14 Paine Ave., P. O. Box 560, Irvington, NJ 07111 201-374-8641
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199 816-761-6314
Trancor, 108 N. High St., P.O. Box 907, San Saba, TX 76877 915-372-6127
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Transducer Systems, Inc., 1510 Delp Dr., Kulpsville, PA 19443 215-256-4611
Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245 619-458-1471
† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Wayne Transformer Co., Inc., 666 Pacific St., Brooklyn, NY 11217 718-783-9007
Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 .. 602-861-1856
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Isolation-5600

† Abbott Technologies, Inc., Burbank Division, Transformers, 639 So. Glenwood Pl., Burbank, CA 91506, 818-841-3630 ..... A•2157
Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2180
§ B & K Precision, Maxtec International Corp, 6470 W. Cortland, Chicago, IL 60635, 312-889-1448 ..... D•1607
BH Electronics, Inc., 12219 Wood Lk. Dr., Burnsville, MN 55337, 612-894-9590 ..... A•2198-2199
† Bicron Electronics, 100 Barlow Street, Canaan, CT 06018, 203-824-5125 ..... A•2202-2203
† C & C Jetronic, Inc., Research Pk. 318 Wall St., Princeton, NJ 08540, 609-921-8540 ..... A•2204
Controlled Power Co., 1955 Stephenson Hwy., Troy, MI 48083, 313-528-3700;1-800-521-4792 ..... D•2085-2086,2088
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2205-2208
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, 914-699-2000 ..... A•2210
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, 605-296-3462/3487 ..... A•2212, D•1702
Dynapower Corporation, Box 3180, Farmington Hills, MI 48333, 313-553-4300 ..... D•1703,1706
† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2214
Elgar Corp., 9250 Brown Deer Rd., San Diego, CA 92121, 619-450-0085;800-854-2213 ..... D•2095

§† **EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048** ..... **A•2216,2221-2223,2225**

Hipotronics Inc., P.O. Drawer A, Brewster, NY 10509, 914-279-8091 ..... **A•2237, D•1750-1751**

§ **Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301, 201-782-5525** ..... **A•2240**

JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735, 516-293-0475 ..... **A•2243-2247**

Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... **A•2249**

Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ..... **A•2250**

§ **Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500** ..... **A•2252-2253,2261**

MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... **A•2265,2273,2275**

§† **Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050** ..... **A•2288-2291,2296**

† **Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 350166, Brooklyn, NY 11235-0003, 718-934-4500** ..... **A•1775**

† **North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700** ..... **A•2300-2302**

† **NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300** ..... **A•2303**

§ **Opamp Labs, Inc., 1033 N. Sycamore Ave., Los Angeles, CA 90038, 213-934-3566** ..... **D•1015**

† **Oram High Voltage, P.O. Box 1176, Dayton, TX 77535, 409-258-5553** ..... **D•1859**

Para-Line Transformer Co., Inc., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... **A•2318**

PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ..... **A•2308-2309,2314-2315**

† **Perkin-Elmer Corp., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132, 203-762-4786** ..... **A•2317**

† **Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... **A•2319**

† **Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950** ..... **A•2350**

Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... **A•2355**

Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... **A•2369**

† **Signal Transformer Co., Inc., Insilco Corporation, 500 Bayview Ave., Inwood, NY 11696, 516-239-5777** ..... **A•2372-2377,2382,2386,2389**

Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518, 213-638-1790 ..... **A•1291,1695,2395,2398, D•1983**

† **Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105** ..... **A•1628,2407, B•1022-1025**

§ **Todd Systems, Inc., 50 Ash St., Yonkers, NY 10701, 914-963-3400** ..... **A•2410**

§† **Topaz, Inc., 9192 Topaz Way, San Diego, CA 92123-1165, 619-279-0831** ..... **D•2156**

Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, 301-464-2100 ..... **A•2412-2416**

† **Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199, 816-761-6314** ..... **A•2418-2420**

† **Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701, 201-364-1800** ..... **A•2424**

Transformer Technologies, Inc., 52 Putnam St., Mt. Vernon, NY 10550, 914-668-1600 ..... **A•2427**

TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... **A•2433**

Ulveco, Inc., 323 Vintage Park Drive, Foster City, CA 94404, 415-574-1100 ..... **A•2431**

§† **United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600** ..... **A•2428**

§ **Vitec Electronic Corporation, 1525A East Acequia, Visalia, CA 93291, 209-739-1077** ..... **A•2437,2439**

VIZ Test Equipment, Kappa Networks Inc., 175 Commerce Drive, Ft. Washington, PA 19034, 215-643-6950;1-800-523-3696 ..... **D•1345**

† **Wayne Transformer Co., Inc., 666 Pacific St., Brooklyn, NY 11217, 718-783-9007** ..... **A•2440**

Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070, 415-592-8832 ..... **A•1715**

§ **Xentek, Inc., 760 Shadow Ridge Dr., Vista, CA 92083, 619-727-0940** ..... **D•2055**

Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010

§† Able Power and Engineering Inc., 1222 N. Delta St., S. San Gabriel, CA 91770 818-571-6260

† ACD-Elcor Products, P.O. Box 244, Bethel, CT 06801 203-743-3510

Acme Electric Corporation, 20 Water Street, Cuba, NY 14727 716-968-2400

Acme Transformer, Acme Electric Corporation, Rte. 4, Box 54, Lumberton, NC 28358 919-738-1121

Actown-Electrocoil, Inc., 2414 Highview, Spring Grove, IL 60081 815-675-6641

Advanced Components Inds., Inc., Spitznagel GmbH, 120 Center Street, El Segundo, CA 90245 213-322-4249

AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024

Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006

American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651

American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838

† American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 612-788-9161

Andover, Inc., 310 North Earl Avenue, Lafayette, IN 47904 317-447-1157

Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600

§ Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33069 305-979-7920

Atlas Engineering Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100

§ Avel-Lindberg, Inc., 5 Old Town Park Rd., Unit 47, New Milford, CT 06776 203-355-4711

† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900

§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100

§† Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341

Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541

† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376

† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148

Caristrap International, Inc., 1760 Fortin Blvd., Chomedey, Lavac, QUEBEC, CANADA H7S1N8 514-667-4700

Carson Manufacturing Co., Inc., 5453 N. Rural St., P.O. Box 20464, Indianapolis, IN 46220 317-257-3191

† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 915-592-9985

† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188

† Coiltronics Inc., 984 S.W. 13th Court, Pompana Beach, FL 33069 305-781-8900

§ Computer Power Inc., 124 W. Main St., High Bridge, NJ 08829 ..... 201-638-8000; 800-526-5088

Custom Bobbin Windings, A & K Corporation, P.O. Box 2369, Zanesville, OH 43702-2369 614-452-6973

Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111

† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798

Diamond Magnetics, 235 Tank Farm Rd., Ste. G, San Luis Obispo, CA 93401 805-544-4019

† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911

§ Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000

Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075

Eichhoff Electronics, 205 Hallene Rd., Warwick, RI 02886 401-738-1440

§ Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360

Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520

§ Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300

Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855

† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222

Electro-Pacific, 5770 Thornwood Dr., Goleta, CA 93117 805-964-0751

Elma Engineering, 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303

† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 213-515-1546

El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300

Endicott Coil, 24 Charlotte St., Binghamton, NY 13905 607-797-1263

§ ENI, Inc., Emerson Electric Co., 100 Highpower Road, Rochester, NY 14623 716-427-8300

EPE Technologies, Inc., 1660 Scenic Avenue, Costa Mesa, CA 92626 714-557-1636

§† Ericson Manufacturing Co., 4215 Hamann Pkwy., Willoughby, OH 44094 216-951-8000

† Ferrotran Elctrns. Co., Inc., 11 W. 25th St., New York, NY 10010 212-691-3610

† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300

Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006

Gettysburg Transformer Corporation, 1380 Old Harrisburg Rd., P.O. Box 99, Gettysburg, PA 17325 717-334-2191

Grand Transformers, 1500 Marion St., Grand Haven, MI 49417 616-842-5430

Hamilton Standard Controls, 9100 Airport Dr., P.O. Box 11648, Fort Wayne, IN 46859 219-747-6142

§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710

† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012

Industrial Midwec Capacitor Corp., 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120

ISOREG Corp., 410 Great Rd., P.O. Box 486, Littleton, MA 01460 617-486-9483

§ James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500

§† JB Electronic Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080

§ Jefferson Elec., MagneTek, Inc., 1400 Center Circle Drive, Downers Grove, IL 60515-1021 312-691-2400

Jerome Industries Corp., 730 E. Division St., Elizabeth, NJ 07201 201-353-5700

† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 ..... 201-396-9400; 1-800-223-0603

KGS Electronics, Inc., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786

LEPCO/Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625

Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 303-651-2011

Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820

† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752

† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054

† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166

Merrimack Magnetics Corp., 121 Hale St., Lowell, MA 01851 617-458-1487

§ Micron Industries, 1830 N. 32nd Ave., Stone Park, IL 60165 312-345-0788

Midcom, Inc., 121 Airport Dr., Watertown, SD 57201 605-886-4385

† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300

MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223 414-358-5300

Nano Pulse Industries, 440 Nibus St., Brea, CA 92670 714-529-2600

Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411

† Northlake Engineering, Inc., 999 Anita Ave., Antioch, IL 60002 312-395-5710

Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932

† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600

† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136

† Parker McCrory Mfg. Co., 2000 Forest Ave., Kansas City, MO 64108 816-221-2000

† Plastic Capacitors, Inc., 2623 N. Pulaski Rd., Chicago, IL 60639 312-489-2229

Power Conversion Products, 42 East St., Box 380, Crystal Lake, IL 60014 815-459-9100

† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861 201-826-4700
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 .. 312-543-6400
† Preferred Electronics, Inc., Main Line Dr., P.O. Box 248, Westfield, MA 01086 413-568-2301
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
§ QPL Magnetics, Inc., P.O.BOX C, Lake Grove, NY 11755 516-589-3331
Rapid Power Technologies, Graysbridge Rd. , P.O.BOX 291, Brookfield, CT 06804 ..... 203-775-0411;800-332-1111
Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
† RTE Deltec Corp., 2727 Kurtz St., San Diego, CA 92110 .. 619-291-4211;800-854-2658
Rutherford Research, Box 249, Rutherford, NJ 07070 201-933-2091
Sanford-Miller Corp., 8 John St., Lynbrook, NY 11563 .... 516-593-2025;800-645-5900
Schauer Manufacturing, 4500 Alpine Ave., Cincinnati, OH 45242 513-791-3030
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
Sencore, 3200 Sencore Dr., Sioux Falls, SD 57107 ..... 605-339-0100;800-843-3338
Shape Magnetronics, Inc., 901 DuPage Ave., Lombard, IL 60148 312-620-8394
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
§† Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
§† Staco Energy Products Co., 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
Staco Transpower, 610 W. 6th St., Mt. Carmel, IL 62863 618-262-5555
§ Stancor Products, Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95054 408-988-0700
Stangenes Industries, Inc., 1052 East Meadow Circle, Palo Alto, CA 94303 415-493-0814
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
§ Sun Research, Inc., Box 210, Old Bay Rd., New Durham, NH 03855 603-859-7110
§† Superior Electric, 383 Middle St., Bristol, CT 06010 203-582-9561
Talema Electronic, Inc., 301 N. Highway 63, Rolla, MO 65401 314-364-0882
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Thinco Div., Hull Corp., Davisville Rd., Hatboro, PA 19040 215-672-7800
§† Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
Torema U.S.A., Inc., 6699 Portwest Dr., No. 130, Houston, TX 77024 713-861-6643
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
Trancor, 108 N. High St., P.O. Box 907, San Saba, TX 76877 915-372-6127
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735 516-293-3100
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245 ... 619-458-1471
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Isolation, for LANs-5600

Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 .. A•2194-2195
BH Electronics, Inc., 12219 Wood Lk. Dr., Burnsville, MN 55337, 612-894-9590 ..... A•2198-2199
† C & C Jetronic, Inc., Research Pk. 318 Wall St., Princeton, NJ 08540, 609-921-8540 ..... A•2204
Coilcraft, 1102 Silver Lake Rd., Cary, IL 60013, 312-639-2361 ..... A•1225
Foxboro/PCG, The Foxboro Company, 600 N. Bedford St., E. Bridgewater, MA 02333, 508-378-5260 ..... A•2235
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735, 516-293-0475 ..... A•2243
North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•2300-2301
PCA Electronics, 16799 Schoenborn St., Sepulveda, CA 91343, 818-892-0761 ..... A•2305-2306
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2355,2360,2362-2364
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518, 213-638-1790 ..... A•2395, D•1983
Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245, 619-458-1471 ..... D•2031
§ Vitec Electronic Corporation, 1525A East Acequia, Visalia, CA 93291, 209-739-1077 ..... A•2437,2439
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 ..... 201-396-9400; 1-800-223-0603
Nano Pulse Industries, 440 Nibus St., Brea, CA 92670 714-529-2600
Pulse Engineering, Inc., 7250 Convoy Ct., P.O. Box 12235, San Diego, CA 92112 619-268-2400
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 .. 415-592-8832
Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 ... 602-861-1856
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Line-5600

† Abbott Technologies, Inc., Burbank Division, Transformers, 639 So. Glenwood Pl., Burbank, CA 91506, 818-841-3630 ..... A•2157
Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2180
AT&T, 555 Union Blvd., Allentown, PA 18103, 1-800-372-2447;In Canada:1-800-553-2448 ..... A•2188
† Bicron Electronics, 100 Barlow Street, Canaan, CT 06018, 203-824-5125 ..... A•2202-2203
† C & C Jetronic, Inc., Research Pk. 318 Wall St., Princeton, NJ 08540, 609-921-8540 ..... A•2204
† Controlled Power Co., 1955 Stephenson Hwy., Troy, MI 48083, 313-528-3700;1-800-521-4792 ..... D•2085
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2205-2207
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, 914-699-2000 ..... A•2210
Dynapower Corporation, Box 3180, Farmington Hills, MI 48333, 313-553-4300 ..... D•1703,1706
† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2214
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2216
Foxboro/PCG, The Foxboro Company, 600 N. Bedford St., E. Bridgewater, MA 02333, 508-378-5260 ..... A•2235
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-937-3475 ..... A•2241
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735, 516-293-0475 ..... A•2243-2247
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... A•2248-2249
Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ..... A•2250
§ Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... A•2252-2253,2261
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166 ..... A•2262
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•2282
North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•2301
Para-Line Transformer Co., Inc., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2318
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ..... A•2308-2309,2312-2314
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2350
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2355
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... A•2366, D•1967
Signal Transformer Co., Inc., Insilco Corporation, 500 Bayview Ave., Inwood, NY 11696, 516-239-5777 ..... A•2372
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... B•1022-1025
§ Todd Systems, Inc., 50 Ash St., Yonkers, NY 10701, 914-963-3400 ..... A•2409
§† Topaz, Inc., 9192 Topaz Way, San Diego, CA 92123-1165, 619-279-0831 ..... D•2156
Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, 301-464-2100 ..... A•2412-2416
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701, 201-364-1800 ..... A•2424
Vitec Electronic Corporation, 1525A East Acequia, Visalia, CA 93291, 209-739-1077 ..... A•2435,2439
† Wayne Transformer Co., Inc., 666 Pacific St., Brooklyn, NY 11217, 718-783-9007 ..... A•2440
§† Able Power and Engineering Inc., 1222 N. Delta St., S. San Gabriel, CA 91770 818-571-6260
Acme Electric Corporation, 20 Water Street, Cuba, NY 14727 716-968-2400
Acme Transformer, Acme Electric Corporation, Rte. 4, Box 54, Lumberton, NC 28358 919-738-1121
Actown-Electrocoil, Inc., 2414 Highview, Spring Grove, IL 60081 815-675-6641
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
† American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 612-788-9161
§ Avel-Lindberg, Inc., 5 Old Town Park Rd., Unit 47, New Milford, CT 06776 203-355-4711
† Avionic Instruments, 1414 Randolph Ave., Avenel, NJ 07001 201-388-3500
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
§ Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
§ Bogen Communications, Inc., 50 Spring St., P.O. Box 575, Ramsey, NJ 07446 201-934-8500
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
† Coiltronics Inc., 984 S.W. 13th Court, Pompana Beach, FL 33069 305-781-8900
§ Computer Power Inc., 124 W. Main St., High Bridge, NJ 08829 ..... 201-638-8000; 800-526-5088
Custom Bobbin Windings, A & K Corporation, P.O. Box 2369, Zanesville, OH 43702-2369 614-452-6973
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§ Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
Electrocom Industries, 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222

Elgar Corp., 9250 Brown Deer Rd., San Diego, CA 92121 ..... 619-450-0085; 800-854-2213
Elma Engineering, 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 .. 213-515-1546
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
ERA/Transpac Power Supplies, West Hill Road, Winsted, CT 06098 203-379-2731
† Ferrotran Elctrns. Co., Inc., 11 W. 25th St., New York, NY 10010 212-691-3610
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301 201-782-5525
Industrial Midwec Capacitor Corp., 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
§ James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
§† JB Electronic Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., 730 E. Division St., Elizabeth, NJ 07201 201-353-5700
Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 ..... 201-396-9400; 1-800-223-0603
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 303-651-2011
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
§ Martin Sound Prods., 28 Alpha Park, Cleveland, OH 44143-2297 216-442-2286
§ Micron Industries, 1830 N. 32nd Ave., Stone Park, IL 60165 312-345-0788
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
Mini-Magnetics Co., Inc., 1100 Fulton Place, Fremont, CA 94539 415-490-7500
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223 414-358-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861 201-826-4700
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 .. 312-543-6400
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
Quam-Nichols Co., 234 E. Marquette Rd., Chicago, IL 60637 312-488-5800
Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
Shape Magnetronics, Inc., 901 DuPage Ave., Lombard, IL 60148 312-620-8394
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Shure Bros., 222 Hartrey Ave., Evanston, IL 60202-3696 312-866-2200
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
§† Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
§ Speco Div., Components Specialties, Inc., P.O. Box 624, 1172 Rte. 109, Lindenhurst, NY 11757 ..... 516-957-8700;800-645-5516
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
§ Staco Energy Products Co., 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
Staco Transpower, 610 W. 6th St., Mt. Carmel, IL 62863 618-262-5555
§ Stancor Products, Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Talema Electronic, Inc., 301 N. Highway 63, Rolla, MO 65401 314-364-0882
Teco Corp., Bay Rd., P. O. Box A, Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199 816-761-6314
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600
Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 ... 602-861-1856
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

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† Bicron Electronics, 100 Barlow Street, Canaan, CT 06018, 203-824-5125 ..... A•2202-2203
Coilcraft, 1102 Silver Lake Rd., Cary, IL 60013, 312-639-2361 ..... A•1225
Gowanda Electronics Corp., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 ..... A•1245
Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ..... A•2250
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861, 201-826-4700 ..... A•2352
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199, 816-761-6314 ..... A•2418-2420
Ulveco, Inc., 323 Vintage Park Drive, Foster City, CA 94404, 415-574-1100 ..... A•2432
Amecon, Inc., 1900 S. Chris La., Anaheim, CA 92805 ..... 714-634-2220;800-392-2292
† Atlas Engineering Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
† Aydin Corp., 700 Dresher Rd., Horsham, PA 19044 215-657-7510
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† C & C Jetronic, Inc., Research Pk. 318 Wall St., Princeton, NJ 08540 609-921-8540
Cross Electronics, 100 Commonwealth Dr., Warrendale, PA 15086 412-776-1591
Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
† Electrocom Industries, 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5770 Thornwood Dr., Goleta, CA 93117 805-964-0751
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
† General Magnetics, 211 Grove St., Bloomfield, NJ 07003 201-743-2700
Genisco Technology Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301 201-782-5525
§† JB Electronic Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., 730 E. Division St., Elizabeth, NJ 07201 201-353-5700
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 303-651-2011
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetic Specs., 10 Albemarle Ave., Trenton, NJ 08638 609-883-3150
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Preferred Electronics, Inc., Main Line Dr., P.O. Box 248, Westfield, MA 01086 413-568-2301
§ QPL Magnetics, Inc., P.O.BOX C, Lake Grove, NY 11755 516-589-3331
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
Talema Electronic, Inc., 301 N. Highway 63, Rolla, MO 65401 314-364-0882
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518 213-638-1790
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131 408-432-8020
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
Torelco, Inc., 14 Paine Ave., P. O. Box 560, Irvington, NJ 07111 201-374-8641
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600
† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Wayne Transformer Co., Inc., 666 Pacific St., Brooklyn, NY 11217 718-783-9007
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

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Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2182
AT&T, 555 Union Blvd., Allentown, PA 18103, 1-800-372-2447;In Canada:1-800-553-2448 ..... A•2189
Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1209
† C & C Jetronic, Inc., Research Pk. 318 Wall St., Princeton, NJ 08540, 609-921-8540 ..... A•2204
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2205
† ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558,2215
§† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2216
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061, 913-782-0012 ..... A•2239
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-937-3475 ..... A•2241
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735, 516-293-0475 ..... A•2243
Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ..... A•2250
§ Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... A•2252-2253
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•2291,2296
§ Multi Products International, 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•2299
† North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•2300-2301
Para-Line Transformer Co., Inc., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2318
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ..... A•2308-2309
Perkin-Elmer Corp., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132, 203-762-4786 ..... A•2317
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2355,2358,2365
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... A•2366, D•1967
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518, 213-638-1790 ..... A•1291,1695,2395,2398, D•1983

† **Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105** ..... **A•1628,2407, B•1022-1025**
† **Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701, 201-364-1800** ..... **A•2424**
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... **A•2433**
Vitec Electronic Corporation, 1525A East Acequia, Visalia, CA 93291, 209-739-1077 ..... **A•2439**
§† Able Power and Engineering Inc., 1222 N. Delta St, S. San Gabriel, CA 91770 818-571-6260
Actown-Electrocoil, Inc., 2414 Highview, Spring Grove, IL 60081 815-675-6641
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
§ Amphenol RF Operations, Amphenol Corporation, One Kennedy Avenue, Danbury, CT 06810 203-743-9272
Amplifier Research, 160 School House Rd., Souderton, PA 18964-9990 215-723-8181
Applied Research, Inc., 111 New South Rd., Hicksville, NY 11802 516-938-9700
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147 305-696-6660
§ AVA Electronics Corporation, P.O. Box 184, 4000 Bridge St., Drexel Hill, PA 19026 215-284-2500
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† BG Electronics, 30 South St, Mt. Vernon, NY 10550 914-664-5591
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
§ Bogen Communications, Inc., 50 Spring St, P.O. Box 575, Ramsey, NJ 07446 201-934-8500
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
† Coiltronics Inc., 984 S.W. 13th Court, Pompana Beach, FL 33069 305-781-8900
Computer System Products, 14305 21st Ave. N., Minneapolis, MN 55447 ..... 612-476-6866;800-422-2537
† Cramer Coil & Transformer Co., Inc., 401 Progress Dr., Saukville, WI 53080 414-284-9425
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
Dowty RFL Inds. Inc./Communications Div., The Dowty Grp. PLC, Powerville Rd., Boonton, NJ 07005-0239 201-334-3100
† Elcom Systems, Inc., 932 Clint Moore Rd., Boca Raton, FL 33487 305-994-1774
§ Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360
Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
Electrocom Industries, 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 .. 213-515-1546
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
§ ENI, Inc., Emerson Electric Co., 100 Highpower Road, Rochester, NY 14623 716-427-8300
Foxboro/PCG, The Foxboro Company, 600 N. Bedford St, E. Bridgewater, MA 02333 508-378-5260
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
† Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
Hamilton Standard Controls, 9100 Airport Dr., P.O. Box 11648, Fort Wayne, IN 46859 219-747-6142
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301 201-782-5525
Industrial Midwec Capacitor Corp., 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
§ James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
§† JB Electronic Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
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Kappa Networks, Inc., 1443 Pinewood St, Rahway, NJ 07065 ..... 201-396-9400; 1-800-223-0603
KGS Electronics, Inc., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
L-Com Inc., 1755 Osgood St, N. Andover, MA 01845 617-682-6936
Lenco Elctrns., Inc., 1330 Belden St, McHenry, IL 60050 815-344-2900
§ Leviton Telcom, Leviton Manufacturing, 2222 222nd St, S.E., Bothell, WA 98021-4416 206-485-4288
† Lorch Electronics, Sub. of Vernitron Corp., 105 Cedar La., Englewood, NJ 07631 201-569-8282
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetic Circuit Elements, 1540 Moffett St, Salinas, CA 93905 408-757-8752
† Magnetic Component Engineering, Inc., 11379 Playa Street, Culver City, CA 90230 213-398-4761
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
§ MG Electronics, 32 Ranick Rd., Hauppauge, NY 11788 516-582-3400
Micro-Coax Components, Inc., a UTI Company, Box E, Collegeville, PA 19426 215-489-3700
Midcom, Inc., 121 Airport Dr., Watertown, SD 57201 605-886-4385
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
Mini-Magnetics Co., Inc., 1100 Fulton Place, Fremont, CA 94539 415-490-7500
† Northlake Engineering, Inc., 999 Anita Ave., Antioch, IL 60002 312-395-5710
§† Oaktron Industries, Inc., 704 30th St, Monroe, WI 53566 608-328-5560
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
Olektron Corp., Signal Technology Corp., 61 Sutton Road, Webster, MA 01570 617-943-7440
Onan Power/Electronics, 4801 W. 81st St, Minneapolis, MN 55437 612-921-5600
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
§ Palomar Engineers, Box 455, Escondido, CA 92025 619-747-3343
§ Philmore Manufacturing, 40 Inip Dr., Inwood, NY 11696 516-239-6161
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034 ... 215-643-6950
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861 201-826-4700
† Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 .. 312-543-6400
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
QPL Magnetics, Inc., P.O.BOX C, Lake Grove, NY 11755 516-589-3331
† RMS Electronics Inc., 50 Antin Pl., Bronx, NY 10462 ..... 212-892-6700;800-223-8312
† Sabre Communications Corp., 3400 Hwy 75 N., P.O. Box 536, Sioux City, IA 51102 712-258-6690
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Shure Bros., 222 Hartrey Ave., Evanston, IL 60202-3696 312-866-2200
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
§ Sitco Antennas, Simplicity Tool Co., 10330 N.E. Marx St., Portland, OR 97220 503-253-2000
§† Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
§ Speco Div., Components Specialties, Inc., P.O. Box 624, 1172 Rte. 109, Lindenhurst, NY 11757 ..... 516-957-8700;800-645-5516
Staco Transpower, 610 W. 6th St, Mt. Carmel, IL 62863 618-262-5555
§ Stancor Products, Hamilton Standard Controls, 131 Godfrey St, Logansport, IN 46947 219-722-2244
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95054 408-988-0700
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
Torema U.S.A., Inc., 6699 Portwest Dr., No. 130, Houston, TX 77024 713-861-6643
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199 816-761-6314
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600
† Vanguard Electronics Co., 1480 W. 178th St, Gardena, CA 90248 213-323-4100
† Wayne Transformer Co., Inc., 666 Pacific St, Brooklyn, NY 11217 718-783-9007
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 .. 415-592-8832
Wide Band Engineering Co., Inc., Box 21652, Phoenix, AZ 85036 602-254-1570
Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 ... 602-861-1856
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Microminiature-5600

Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... **A•2182**
§ **Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224-5825, 213-537-5200** ..... **A•1205**
† **C & C Jetronic, Inc., Research Pk. 318 Wall St., Princeton, NJ 08540, 609-921-8540** ..... **A•2204**
§ **Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301** ..... **A•2205**
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, 605-296-3462/3487 ..... **A•2212**
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... **A•2216,2228**
§† **Gowanda Electronics Corp., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234** ..... **A•1245**
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... **A•2248**
Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ..... **A•2250-2251**
Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... **A•2252-2253,2261**
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... **A•2265**
§† **Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050** ..... **A•2290-2291,2295-2296**
† **Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 350166, Brooklyn, NY 11235-0003, 718-934-4500** ..... **A•1775**
§ **Multi Products International, 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183** ..... **A•2298**
North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... **A•2300**
† **PCA Electronics, 16799 Schoenborn St., Sepulveda, CA 91343, 818-892-0761** ..... **A•2307**

† **Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... **A•2319-2346, D•1863**
† **Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950** ..... **A•2350**
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... **A•2355,2364-2365**
† **Signal Transformer Co., Inc., Insilco Corporation, 500 Bayview Ave., Inwood, NY 11696, 516-239-5777** ..... **A•2372,2388**
† **Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518, 213-638-1790** ..... **A•2398**
† **Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105** ..... **A•2407, B•1022-1025**
† **Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199, 816-761-6314** ..... **A•2418-2420**
† **Trans American Transformer, 142 Peconic Ave., Medford, NY 11763, 516-654-1880** ..... **A•2426**
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... **A•2433**
§† **United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600** ..... **A•2428**
Vitec Electronic Corporation, 1525A East Acequia, Visalia, CA 93291, 209-739-1077 ..... **A•2439**
§† Able Power and Engineering Inc., 1222 N. Delta St., S. San Gabriel, CA 91770 818-571-6260
Advanced Components Inds., Inc., Spitznagel GmbH, 120 Center Street, El Segundo, CA 90245 213-322-4249
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St, Dept. E, Miami, FL 33147 305-696-6660
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052 716-652-3600
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 .. 213-515-1546
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
† General Magnetics, 211 Grove St., Bloomfield, NJ 07003 201-743-2700
† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716 516-567-5600
§ James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
§† JB Electronic Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 ..... 201-396-9400; 1-800-223-0603
† Magnetic Component Engineering, Inc., 11379 Playa Street, Culver City, CA 90230 213-398-4761
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
Olektron Corp., Signal Technology Corp., 61 Sutton Road, Webster, MA 01570 617-943-7440
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861 201-826-4700
QPL Magnetics, Inc., P.O.BOX C, Lake Grove, NY 11755 516-589-3331
† Rhombus Industries, 15801 Chemical Ln., Huntington Bch., CA 92649-1595 714-898-0960
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
SFE Technologies, 1501 1st St., San Fernando, CA 91340 818-365-9411
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
§ Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100

Transformers, Microphone-5600

Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... **A•2183**
§ **Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950** ..... **A•2214**
§ **Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500** ..... **A•2252-2253**
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... **A•2265**
Multi Products International, 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... **A•2299**
Para-Line Transformer Co., Inc., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... **A•2318**
† **Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... **A•2319,2347**
† **Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950** ..... **A•2350**
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... **A•2355**
† **Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105** ..... **A•2407, B•1022-1025**
Vitec Electronic Corporation, 1525A East Acequia, Visalia, CA 93291, 209-739-1077 ..... **A•2439**
§† Able Power and Engineering Inc., 1222 N. Delta St., S. San Gabriel, CA 91770 818-571-6260
Actown-Electrocoil, Inc., 2414 Highview, Spring Grove, IL 60081 815-675-6641
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St, Dept. E, Miami, FL 33147 305-696-6660
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
§ Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., Suite 845, New York, NY 10011 212-691-9050
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
§ Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360
Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 .. 213-515-1546
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
§ James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582 516-561-6050
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
§ Paso Sound Products, 14 First St, Pelham, NY 10803 914-738-4800
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861 201-826-4700
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Shure Bros., 222 Hartrey Ave., Evanston, IL 60202-3696 312-866-2200
§† Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
§ Stancor Products, Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518 213-638-1790
§ Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199 816-761-6314
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600

Transformers, Mixing-5600

§ **Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301** ..... **A•2205**
§ **Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500** ..... **A•2252-2253**
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... **A•2265**
§† **Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050** ..... **A•2282**
† **Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 350166, Brooklyn, NY 11235-0003, 718-934-4500** ..... **A•1775**
North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... **A•2300**
Para-Line Transformer Co., Inc., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... **A•2318**
† **Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... **A•2319,2347**
† **Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950** ..... **A•2350**
† **Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105** ..... **A•2407, B•1022-1025**
† **Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701, 201-364-1800** ..... **A•2424**
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... **A•2433**
§† **United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600** ..... **A•2428**
Vitec Electronic Corporation, 1525A East Acequia, Visalia, CA 93291, 209-739-1077 ..... **A•2439**
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
§ Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33069 305-979-7920
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 .. 213-515-1546
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300

† Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
§ James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518 213-638-1790
§ Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199 816-761-6314
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100

Transformers, Modulation-5600

Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301, 201-782-5525 ..... A•2240
§ Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... A•2252-2253
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265
Para-Line Transformer Co., Inc., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2318
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2350
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2355
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701, 201-364-1800 ..... A•2424
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600 ..... A•2428
Vitec Electronic Corporation, 1525A East Acequia, Visalia, CA 93291, 209-739-1077 ..... A•2439
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
§ Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33069 305-979-7920
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 .. 213-515-1546
† Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
† General Magnetics, 211 Grove St., Bloomfield, NJ 07003 201-743-2700
§ James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582 516-561-6050
† Northlake Engineering, Inc., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861 201-826-4700
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
§† Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
Staco Transpower, 610 W. 6th St., Mt. Carmel, IL 62863 618-262-5555
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
§ Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199 816-761-6314
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† Wayne Transformer Co., Inc., 666 Pacific St., Brooklyn, NY 11217 718-783-9007
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Output-5600

Amecon, Inc., 1900 S. Chris La., Anaheim, CA 92805, 714-634-2220;800-392-2292 ..... A•2176
Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2180
AT&T, 555 Union Blvd., Allentown, PA 18103, 1-800-372-2447;In Canada:1-800-553-2448 ..... A•2191
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2205
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, 605-296-3462/3487 ..... A•2212
† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2214
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2216,2220,2227
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-937-3475 ..... A•2241
Jerome Industries Corp., 730 E. Division St., Elizabeth, NJ 07201, 201-353-5700 ..... A•2242, D•1781
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735, 516-293-0475 ..... A•2243
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... A•2248
§ Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... A•2252-2253
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•2296
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 ..... A•2303
Para-Line Transformer Co., Inc., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2318
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ..... A•2308-2309,2315
† Perkin-Elmer Corp., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132, 203-762-4786 ..... A•2317
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2350-2351
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2355
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518, 213-638-1790 ..... A•2398
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025
Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, 301-464-2100 ..... A•2412
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199, 816-761-6314 ..... A•2418-2420
§ Vitec Electronic Corporation, 1525A East Acequia, Visalia, CA 93291, 209-739-1077 ..... A•2439
† Wayne Transformer Co., Inc., 666 Pacific St., Brooklyn, NY 11217, 718-783-9007 ..... A•2440
Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010
§† Able Power and Engineering Inc., 1222 N. Delta St., S. San Gabriel, CA 91770 818-571-6260
Actown-Electrocoil, Inc., 2414 Highview, Spring Grove, IL 60081 815-675-6641
AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
† American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 612-788-9161
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
Bey Electric, Inc., 362 Main St., Box 548, Lincoln Park, NJ 07035 201-694-5000
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217 718-857-2400
† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
† Coiltronics Inc., 984 S.W. 13th Court, Pompana Beach, FL 33069 305-781-8900
Computer Power Inc., 124 W. Main St., High Bridge, NJ 08829 ..... 201-638-8000; 800-526-5088
Custom Bobbin Windings, A & K Corporation, P.O. Box 2369, Zanesville, OH 43702-2369 614-452-6973
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
§ Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 .. 213-515-1546
† Frederick Components Intl., 20806 Plummer St., Chatsworth, CA 91311 ..... 818-882-0868;800-354-0660
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
Gettysburg Transformer Corporation, 1380 Old Harrisburg Rd., P.O. Box 99, Gettysburg, PA 17325 717-334-2191
Grand Transformers, 1500 Marion St., Grand Haven, MI 49417 616-842-5430
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301 201-782-5525
§ James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
§† JB Electronic Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
KGS Electronics, Inc., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786

Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 303-651-2011
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Midcom, Inc., 121 Airport Dr., Watertown, SD 57201 605-886-4385
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223 414-358-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., 999 Anita Ave., Antioch, IL 60002 312-395-5710
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
† Parker McCrory Mfg. Co., 2000 Forest Ave., Kansas City, MO 64108 816-221-2000
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861 201-826-4700
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 .. 312-543-6400
§ QPL Magnetics, Inc., P.O.BOX C, Lake Grove, NY 11755 516-589-3331
Robinson-Halpern, Teleflex, Inc., One Apollo Rd., P.O. Box 248, Plymouth Meeting, PA 19462-0248 215-825-9200
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
§† Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
§† Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torema U.S.A., Inc., 6699 Portwest Dr., No. 130, Houston, TX 77024 713-861-6643
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
Trancor, 108 N. High St., P.O. Box 907, San Saba, TX 76877 915-372-6127
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Plate-5600

† Abbott Technologies, Inc., Burbank Division, Transformers, 639 So. Glenwood Pl., Burbank, CA 91506, 818-841-3630 ..... A•2157
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2205
† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2214
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735, 516-293-0475 ..... A•2243
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... A•2248
§ Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... A•2252-2253
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 ..... A•2303
Para-Line Transformer Co., Inc., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2318
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2350
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025
† Wayne Transformer Co., Inc., 666 Pacific St., Brooklyn, NY 11217, 718-783-9007 ..... A•2440
Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010
Actown-Electrocoil, Inc., 2414 Highview, Spring Grove, IL 60081 815-675-6641
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
† Atlas Engineering Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
§ Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
Bey Electric, Inc., 362 Main St., Box 548, Lincoln Park, NJ 07035 201-694-5000
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217 718-857-2400
† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
Computer Power Inc., 124 W. Main St., High Bridge, NJ 08829 ..... 201-638-8000; 800-526-5088
Custom Bobbin Windings, A & K Corporation, P.O. Box 2369, Zanesville, OH 43702-2369 614-452-6973
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
§ Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Elma Engineering, 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 .. 213-515-1546
† Ferrotran Elctrns. Co., Inc., 11 W. 25th St., New York, NY 10010 212-691-3610
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Gettysburg Transformer Corporation, 1380 Old Harrisburg Rd., P.O. Box 99, Gettysburg, PA 17325 717-334-2191
Grand Transformers, 1500 Marion St., Grand Haven, MI 49417 616-842-5430
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301 201-782-5525
§† JB Electronic Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., 730 E. Division St., Elizabeth, NJ 07201 201-353-5700
KGS Electronics, Inc., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 303-651-2011
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
Merrimack Magnetics Corp., 121 Hale St., Lowell, MA 01851 617-458-1487
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582 516-561-6050
† Northlake Engineering, Inc., 999 Anita Ave., Antioch, IL 60002 312-395-5710
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
† Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
§† Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
Staco Transpower, 610 W. 6th St., Mt. Carmel, IL 62863 618-262-5555
§ Stancor Products, Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
Stangenes Industries, Inc., 1052 East Meadow Circle, Palo Alto, CA 94303 415-493-0814
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
Walker Power, Inc., Walker Magnetics Group, 10 B Mill St., Warner, NH 03278 603-456-3111
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Plug-in-5600

§ Ault, Incorporated, 1600 Freeway Blvd., Minneapolis, MN 55430, 612-560-9300 ..... D•1600-1601
§ Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., 3418 N. Milwaukee, Chicago, IL 60641, 312-283-4000 ..... B•1619
§ EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2216,2218,2221,2227
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-937-3475 ..... A•2241
Jerome Industries Corp., 730 E. Division St., Elizabeth, NJ 07201, 201-353-5700 ..... A•2242
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735, 516-293-0475 ..... A•2243
Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ..... A•2250-2251
Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... A•2260
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•2282,2286-2291
Multi Products International, 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•2298
Para-Line Transformer Co., Inc., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2318
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ..... A•2308-2309,2311-2312,2315
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319-2321,2324-2325,2328-2330,2332-2340,2347-2348
Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2350
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... A•2366, D•1967
Signal Transformer Co., Inc., Insilco Corporation, 500 Bayview Ave., Inwood, NY 11696, 516-239-5777 ..... A•2372,2376,2378-2379
§ Stancor Products, Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947, 219-722-2244 ..... A•2393
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518, 213-638-1790 ..... A•2395,2401-2402, D•1983
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•2433
United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600 ..... A•2428
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147 305-696-6660
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Coiltronics Inc., 984 S.W. 13th Court, Pompana Beach, FL 33069 305-781-8900
§ Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
† Hadley, Robert M. Co., Inc., 750 West 51st St., Los Angeles, CA 90037 .. 213-234-9091
Mini-Magnetics Co., Inc., 1100 Fulton Place, Fremont, CA 94539 415-490-7500
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223 414-358-5300

† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861 201-826-4700
Power Sources International Inc., Sources Electronics, 15014 Malachite Ct., Reno, NV 89506 702-972-1224
Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
§† Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
Trancor, 108 N. High St, P.O. Box 907, San Saba, TX 76877 915-372-6127
Transformation Electronics Group, P.O. Box 2314, Flagler Bch., FL 32036 904-439-5888

Transformers, Power-5600

† Abbott Technologies, Inc., Burbank Division, Transformers, 639 So. Glenwood Pl., Burbank, CA 91506, 818-841-3630 ..... A•2157,2159-2160,2165-2166
Amecon, Inc., 1900 S. Chris La., Anaheim, CA 92805, 714-634-2220;800-392-2292 ..... A•2170-2173,2175-2176
Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2180
AT&T, 555 Union Blvd., Allentown, PA 18103, 1-800-372-2447;In Canada:1-800-553-2448 ..... A•2190-2191, D•2073
§ Ault, Incorporated, 1600 Freeway Blvd., Minneapolis, MN 55430, 612-560-9300 ..... D•1601
§ Avel-Lindberg, Inc., 5 Old Town Park Rd., Unit 47, New Milford, CT 06776, 203-355-4711 ..... A•2192
Bey Electric, Inc., 362 Main St., Box 548, Lincoln Park, NJ 07035, 201-694-5000 ..... A•2197
§† Bicron Electronics, 100 Barlow Street, Canaan, CT 06018, 203-824-5125 ..... A•2202-2203
C & C Jetronic, Inc., Research Pk. 318 Wall St., Princeton, NJ 08540, 609-921-8540 ..... A•2204
Coilcraft, 1102 Silver Lake Rd., Cary, IL 60013, 312-639-2361 ..... A•1225
Controlled Power Co., 1955 Stephenson Hwy., Troy, MI 48083, 313-528-3700;1-800-521-4792 ..... D•2085
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2205,2208
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, 914-699-2000 ..... A•2210
† Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., 3418 N. Milwaukee, Chicago, IL 60641, 312-283-4000 ..... B•1619
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, 605-296-3462/3487 ..... A•2212
Dynapower Corporation, Box 3180, Farmington Hills, MI 48333, 313-553-4300 ..... D•1703
† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2214
§† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2216,2218-2224,2226,2228
Foxboro/PCG, The Foxboro Company, 600 N. Bedford St., E. Bridgewater, MA 02333, 508-378-5260 ..... A•2232-2235
§ Gowanda Electronics Corp., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 ..... A•1245
Hipotronics Inc., P.O. Drawer A, Brewster, NY 10509, 914-279-8091 ..... A•2236-2238
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061, 913-782-0012 ..... A•2239
Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301, 201-782-5525 ..... A•2240
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-937-3475 ..... A•2241
Jerome Industries Corp., 730 E. Division St., Elizabeth, NJ 07201, 201-353-5700 ..... D•1780
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735, 516-293-0475 ..... A•2243-2245,2247
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... A•2248-2249
Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ..... A•2250-2251
§ Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... A•2252-2261
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166 ..... A•2262
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265,2269,2272-2274,2277,2279
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•2282-2287,2290
§ Multi Products International, 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•2298
North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•2300
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 ..... A•2303, D•1857
Para-Line Transformer Co., Inc., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2318
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ..... A•2308-2314
† Perkin-Elmer Corp., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132, 203-762-4786 ..... A•2317
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319,2346
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2350-2351
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861, 201-826-4700 ..... A•2352-2353
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2355-2357,2365
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1282,1284,2368
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... A•2366, D•1967
† Signal Transformer Co., Inc., Insilco Corporation, 500 Bayview Ave., Inwood, NY 11696, 516-239-5777 ..... A•2372-2373,2376,2378-2386,2388-2389
§ Stancor Products, Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947, 219-722-2244 ..... A•2393
Superior Electric, 383 Middle St., Bristol, CT 06010, 203-582-9561 .. A•2370-2371
Talema Electronic, Inc., 301 N. Highway 63, Rolla, MO 65401, 314-364-0882 ..... A•2390
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518, 213-638-1790 ..... A•1291,1695,2395,2400-2401,2403, D•1983
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025
§ Todd Systems, Inc., 50 Ash St., Yonkers, NY 10701, 914-963-3400 ..... A•2408,2410-2411
§† Topaz, Inc., 9192 Topaz Way, San Diego, CA 92123-1165, 619-279-0831 ..... D•2156
Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, 301-464-2100 ..... A•2412-2416
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199, 816-761-6314 ..... A•2421-2423
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701, 201-364-1800 ..... A•2425
Transformer Technologies, Inc., 52 Putnam St., Mt. Vernon, NY 10550, 914-668-1600 ..... A•2427
Ulveco, Inc., 323 Vintage Park Drive, Foster City, CA 94404, 415-574-1100 ..... A•2430-2431
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600 ..... A•2428
§ Vitec Electronic Corporation, 1525A East Acequia, Visalia, CA 93291, 209-739-1077 ..... A•2438-2439
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563, 516-887-9443 ..... D•2038
† Wayne Transformer Co., Inc., 666 Pacific St., Brooklyn, NY 11217, 718-783-9007 ..... A•2440
Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010
§† Able Power and Engineering Inc., 1222 N. Delta St., S. San Gabriel, CA 91770 818-571-6260
Acme Electric Corporation, 20 Water Street, Cuba, NY 14727 716-968-2400
Acme Transformer, Acme Electric Corporation, Rte. 4, Box 54, Lumberton, NC 28358 919-738-1121
Actown-Electrocoil, Inc., 2414 Highview, Spring Grove, IL 60081 815-675-6641
Advanced Components Inds., Inc., Spitznagel GmbH, 120 Center Street, El Segundo, CA 90245 213-322-4249
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
† American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 612-788-9161
Andover, Inc., 310 North Earl Avenue, Lafayette, IN 47904 317-447-1157
§ Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33069 305-979-7920
† Atlas Engineering Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St, Dept. E, Miami, FL 33147 305-696-6660
† Avionic Instruments, 1414 Randolph Ave., Avenel, NJ 07001 201-388-3500
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
§† Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
BH Electronics, Inc., 12219 Wood Lk. Dr., Burnsville, MN 55337 612-894-9590
§ Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
Brown Boveri Elec., Norristown Rd., Spring House, PA 19477 215-628-7400
Carson Manufacturing Co., Inc., 5453 N. Rural St., P.O. Box 20464, Indianapolis, IN 46220 317-257-3191
§ C-COR Elctrns., 60 Decibel Rd., State College, PA 16801 814-238-2461
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217 718-857-2400
† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coiltronics Inc., 984 S.W. 13th Court, Pompana Beach, FL 33069 305-781-8900
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
§ Computer Power Inc., 124 W. Main St., High Bridge, NJ 08829 ..... 201-638-8000; 800-526-5088
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
† Cramer Coil & Transformer Co., Inc., 401 Progress Dr., Saukville, WI 53080 414-284-9425
Custom Bobbin Windings, A & K Corporation, P.O. Box 2369, Zanesville, OH 43702-2369 614-452-6973
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
Diamond Magnetics, 235 Tank Farm Rd., Ste. G, San Luis Obispo, CA 93401 805-544-4019
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
§ Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360
† Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
§ Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855

† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5770 Thornwood Dr., Goleta, CA 93117 805-964-0751
Elgar Corp., 9250 Brown Deer Rd., San Diego, CA 92121 ..... 619-450-0085; 800-854-2213
Elgin Electronics, Combustion Engineering, 5533 New Perry Hwy., Erie, PA 16509-3570 814-864-4921
Elma Engineering, 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 .. 213-515-1546
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Endicott Coil, 24 Charlotte St., Binghamton, NY 13905 607-797-1263
Engineering Design & Sls., One E.D.S. Way, Danville, VA 24540 804-685-7073
§† E-Tronics, 16774 Schoenborn, Sepulveda, CA 91343 818-892-7279
† Ferrotran Elctrns. Co., Inc., 11 W. 25th St., New York, NY 10010 212-691-3610
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
Gettysburg Transformer Corporation, 1380 Old Harrisburg Rd., P.O. Box 99, Gettysburg, PA 17325 717-334-2191
Golden Pacific Electronics, Inc, 560 S. Melrose St., Placentia, CA 92670 714-993-6970
Grand Transformers, 1500 Marion St., Grand Haven, MI 49417 616-842-5430
Hamilton Standard Controls, 9100 Airport Dr., P.O. Box 11648, Fort Wayne, IN 46859 219-747-6142
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Industrial Midwec Capacitor Corp., 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
ISOREG Corp., 410 Great Rd., P.O. Box 486, Littleton, MA 01460 617-486-9483
§ James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
§† JB Electronic Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
§ Jefferson Elec., MagneTek, Inc., 1400 Center Circle Drive, Downers Grove, IL 60515-1021 312-691-2400
Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 ..... 201-396-9400; 1-800-223-0603
KGS Electronics, Inc., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
LEPCO/Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 .. 512-546-1625
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 303-651-2011
MACROAMP Inc., P.O. Box 1512, Ukiah, CA 95482 707-462-2222
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
Merrimack Magnetics Corp., 121 Hale St., Lowell, MA 01851 617-458-1487
§ Micron Industries, 1830 N. 32nd Ave., Stone Park, IL 60165 312-345-0788
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
Mini-Magnetics Co., Inc., 1100 Fulton Place, Fremont, CA 94539 415-490-7500
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223 414-358-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., 999 Anita Ave., Antioch, IL 60002 312-395-5710
NWL Capacitors, NWL Transformers, 8050 Monetary Dr., Riviera Bch., FL 33404 305-848-9009
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
Olektron Corp., Signal Technology Corp., 61 Sutton Road, Webster, MA 01570 617-943-7440
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
† Parker McCrory Mfg. Co., 2000 Forest Ave., Kansas City, MO 64108 816-221-2000
Power Sources International Inc., Sources Electronics, 15014 Malachite Ct., Reno, NV 89506 702-972-1224
§† Powertron Corporation, Rte. 15, Box 932, Sparta, NJ 07871 201-579-5599
† Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 .. 312-543-6400
† Preferred Electronics, Inc., Main Line Dr., P.O. Box 248, Westfield, MA 01086 413-568-2301
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
§ QPL Magnetics, Inc., P.O.BOX C, Lake Grove, NY 11755 516-589-3331
Rapid Power Technologies, Graysbridge Rd. , P.O.BOX 291, Brookfield, CT 06804 ..... 203-775-0411;800-332-1111
Sanford-Miller Corp., 8 John St., Lynbrook, NY 11563 .... 516-593-2025;800-645-5900
Schauer Manufacturing, 4500 Alpine Ave., Cincinnati, OH 45242 513-791-3030
† Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
Shape Magnetronics, Inc., 901 DuPage Ave., Lombard, IL 60148 312-620-8394
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Sierra West Power Systems, 2615 Missouri St., Las Cruces, NM 88001 505-522-8828
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
§† Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
† Staco Energy Products Co., 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
Staco Transpower, 610 W. 6th St., Mt. Carmel, IL 62863 618-262-5555
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Teco Corp., Bay Rd., P. O. Box A, Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
§ Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131 408-432-8020
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
Torelco, Inc., 14 Paine Ave., P. O. Box 560, Irvington, NJ 07111 201-374-8641
Torema U.S.A., Inc., 6699 Portwest Dr., No. 130, Houston, TX 77024 713-861-6643
Trancor, 108 N. High St., P.O. Box 907, San Saba, TX 76877 915-372-6127
Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Transformation Electronics Group, P.O. Box 2314, Flagler Bch., FL 32036 904-439-5888
† Transistor Devices, Inc., 274 S. Salem St., Randolph, NJ 07869 201-361-6622
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245 ... 619-458-1471
† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
Walker Power, Inc., Walker Magnetics Group, 10 B Mill St., Warner, NH 03278 603-456-3111
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Power Distribution-5600

Controlled Power Co., 1955 Stephenson Hwy., Troy, MI 48083, 313-528-3700;1-800-521-4792 ..... D•2085
Dynapower Corporation, Box 3180, Farmington Hills, MI 48333, 313-553-4300 ..... D•1706
§ Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301, 201-782-5525 ..... A•2240
† Oram High Voltage, P.O. Box 1176, Dayton, TX 77535, 409-258-5553 .... D•1859
§† Topaz, Inc., 9192 Topaz Way, San Diego, CA 92123-1165, 619-279-0831 ..... D•2156
United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600 ..... A•2428
Acme Electric Corporation, 20 Water Street, Cuba, NY 14727 716-968-2400
Acme Transformer, Acme Electric Corporation, Rte. 4, Box 54, Lumberton, NC 28358 919-738-1121
Advanced Components Inds., Inc., Spitznagel GmbH, 120 Center Street, El Segundo, CA 90245 213-322-4249
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
§ Golden Pacific Electronics, Inc, 560 S. Melrose St., Placentia, CA 92670 714-993-6970
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
ISOREG Corp., 410 Great Rd., P.O. Box 486, Littleton, MA 01460 617-486-9483
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 303-651-2011
† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034 ... 215-643-6950
§ QPL Magnetics, Inc., P.O.BOX C, Lake Grove, NY 11755 516-589-3331
Rapid Power Technologies, Graysbridge Rd. , P.O.BOX 291, Brookfield, CT 06804 ..... 203-775-0411;800-332-1111
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
§ Staco Energy Products Co., 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
Staco Transpower, 610 W. 6th St., Mt. Carmel, IL 62863 618-262-5555
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
Walker Power, Inc., Walker Magnetics Group, 10 B Mill St., Warner, NH 03278 603-456-3111
Xebex Data Systems, 6610 Buckley Dr., Cambria, CA 93428 805-927-5008

Transformers, Printed Circuit Mounting-5600

† Abbott Technologies, Inc., Burbank Division, Transformers, 639 So. Glenwood Pl., Burbank, CA 91506, 818-841-3630 ..... A•2157
Amecon, Inc., 1900 S. Chris La., Anaheim, CA 92805, 714-634-2220;800-392-2292 ..... A•2175-2176
Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2182
AT&T, 555 Union Blvd., Allentown, PA 18103, 1-800-372-2447;In Canada:1-800-553-2448 ..... A•2184-2191
§ Avel-Lindberg, Inc., 5 Old Town Park Rd., Unit 47, New Milford, CT 06776, 203-355-4711 ..... A•2192
BH Electronics, Inc., 12219 Wood Lk. Dr., Burnsville, MN 55337, 612-894-9590 ..... A•2198-2201
† Bicron Electronics, 100 Barlow Street, Canaan, CT 06018, 203-824-5125 ..... A•2202-2203
Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1209
C & C Jetronic, Inc., Research Pk. 318 Wall St., Princeton, NJ 08540, 609-921-8540 ..... A•2204
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2205-2209
§† Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., 3418 N. Milwaukee, Chicago, IL 60641, 312-283-4000 ..... B•1619
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, 605-296-3462/3487 ..... A•2212
† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2214
§† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2216-2221,2223
Foxboro/PCG, The Foxboro Company, 600 N. Bedford St., E. Bridgewater, MA 02333, 508-378-5260 ..... A•2232-2235
§† Gowanda Electronics Corp., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 ..... A•1245
Jerome Industries Corp., 730 E. Division St., Elizabeth, NJ 07201, 201-353-5700 ..... A•2242
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735, 516-293-0475 ..... A•2243-2247

Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... A•2248
Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ..... A•2250-2251
§ Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... A•2252-2255,2260-2261
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166 ..... A•2262
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265-2272,2276-2279
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•2283-2296
† Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 350166, Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1775
§ Multi Products International, 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•2298-2299
† North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•2300
Para-Line Transformer Co., Inc., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2318
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ..... A•2308-2312,2315
† Perkin-Elmer Corp., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132, 203-762-4786 ..... A•2317
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319,2341-2343,2346,2348, D•1863-1882
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2350-2351
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2355-2357,2364-2365
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1284,2367,2369
Schaffner EMC, Inc., Components Division, 825 Lehigh Avenue, Union, NJ 07083, 201-851-0644;800-367-5566 ..... A•1691
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... A•2366, D•1967
† Signal Transformer Co., Inc., Insilco Corporation, 500 Bayview Ave., Inwood, NY 11696, 516-239-5777 ..... A•2372,2374-2379,2382,2384,2388
§ Stancor Products, Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947, 219-722-2244 ..... A•2393
† Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, 513-871-3777 ..... A•1287
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518, 213-638-1790 ..... A•1291,1695,2395,2401, D•1983
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199, 816-761-6314 ..... A•2418-2423
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701, 201-364-1800 ..... A•2424-2425
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763, 516-654-1880 ..... A•2426
Transformer Technologies, Inc., 52 Putnam St., Mt. Vernon, NY 10550, 914-668-1600 ..... A•2427
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•2433
Ulveco, Inc., 323 Vintage Park Drive, Foster City, CA 94404, 415-574-1100 ..... A•2431
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600 ..... A•2429
§ Vitec Electronic Corporation, 1525A East Acequia, Visalia, CA 93291, 209-739-1077 ..... A•2435-2439
§† Able Power and Engineering Inc., 1222 N. Delta St., S. San Gabriel, CA 91770 818-571-6260
Actown-Electrocoil, Inc., 2414 Highview, Spring Grove, IL 60081 815-675-6641
Advanced Components Inds., Inc., Spitznagel GmbH, 120 Center Street, El Segundo, CA 90245 213-322-4249
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
§ Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33069 305-979-7920
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147 305-696-6660
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224-5825 213-537-5200
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† BG Electronics, 30 South St., Mt. Vernon, NY 10550 914-664-5591
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Computer Components, Inc., 629 Fifth Ave., Pelham, NY 10803 914-738-1611
† Cramer Coil & Transformer Co., Inc., 401 Progress Dr., Saukville, WI 53080 414-284-9425
Custom Bobbin Windings, A & K Corporation, P.O. Box 2369, Zanesville, OH 43702-2369 614-452-6973
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
Electrocom Industries, 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
Electronic Coil Corp., Farmington Industrial Park, Farmington, CT 06032 203-677-6731
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 213-515-1546
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Endicott Coil, 24 Charlotte St., Binghamton, NY 13905 607-797-1263
Engineering Design & Sls., One E.D.S. Way, Danville, VA 24540 804-685-7073
† Ferrotran Elctrns. Co., Inc., 11 W. 25th St., New York, NY 10010 212-691-3610
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
Gettysburg Transformer Corporation, 1380 Old Harrisburg Rd., P.O. Box 99, Gettysburg, PA 17325 717-334-2191
§ Golden Pacific Electronics, Inc, 560 S. Melrose St., Placentia, CA 92670 714-993-6970
Grand Transformers, 1500 Marion St., Grand Haven, MI 49417 616-842-5430
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
§ James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
§† JB Electronic Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 ..... 201-396-9400; 1-800-223-0603
KGS Electronics, Inc., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
LEPCO/Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetic Component Engineering, Inc., 11379 Playa Street, Culver City, CA 90230 213-398-4761
Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
Merrimack Magnetics Corp., 121 Hale St., Lowell, MA 01851 617-458-1487
Midcom, Inc., 121 Airport Dr., Watertown, SD 57201 605-886-4385
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
Mini-Magnetics Co., Inc., 1100 Fulton Place, Fremont, CA 94539 415-490-7500
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223 414-358-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., 999 Anita Ave., Antioch, IL 60002 312-395-5710
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
Onan Power/Electronics, 4801 W. 81st St., Minneapolis, MN 55437 612-921-5600
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
Penn-Tran Corp., Box 1321, Rte. 144N, Wingate, PA 16880 814-355-1521
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861 201-826-4700
Power Sources International Inc., Sources Electronics, 15014 Malachite Ct., Reno, NV 89506 702-972-1224
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 312-543-6400
† Preferred Electronics, Inc., Main Line Dr., P.O. Box 248, Westfield, MA 01086 413-568-2301
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
§ Pulse Engineering, Inc., 7250 Convoy Ct., P.O. Box 12235, San Diego, CA 92112 619-268-2400
§ QPL Magnetics, Inc., P.O.BOX C, Lake Grove, NY 11755 516-589-3331
† Rhombus Industries, 15801 Chemical Ln., Huntington Bch., CA 92649-1595 714-898-0960
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
Staco Transpower, 610 W. 6th St., Mt. Carmel, IL 62863 618-262-5555
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95054 408-988-0700
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Teco Corp., Bay Rd., P. O. Box A, Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
§ Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
Trancor, 108 N. High St., P.O. Box 907, San Saba, TX 76877 915-372-6127
† Transistor Devices, Inc., 274 S. Salem St., Randolph, NJ 07869 201-361-6622
Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245 619-458-1471
† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Wayne Transformer Co., Inc., 666 Pacific St., Brooklyn, NY 11217 718-783-9007
Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 602-861-1856
Xylog Corp., 83 Hobart St., Hackensack, NJ 07601 201-489-4040
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, Programmable Ratio-5600

† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319
Ryan International Corp., 4800 Evanswood Dr., Columbus, OH 43229-6207, 614-885-3303 ..... D•1318
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541

Bey Electric, Inc., 362 Main St, Box 548, Lincoln Park, NJ 07035 201-694-5000
Staco Energy Products Co., 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191

Transformers, Pulse-5600

Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2182
AT&T, 555 Union Blvd., Allentown, PA 18103, 1-800-372-2447;In Canada:1-800-553-2448 ..... A•2185-2186,2188
Avtech Electrosystems Ltd., P.O. Box 5120, Stn. F, Ottawa, Ontario, CANADA K2C 3H4, 613-226-5772 ..... D•1211
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 ..... A•2194
BH Electronics, Inc., 12219 Wood Lk. Dr., Burnsville, MN 55337, 612-894-9590 ..... A•2198-2201
† Bicron Electronics, 100 Barlow Street, Canaan, CT 06018, 203-824-5125 ..... A•2202-2203
Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1209
C & C Jetronic, Inc., Research Pk. 318 Wall St., Princeton, NJ 08540, 609-921-8540 ..... A•2204
Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2205,2208
† Delta Products Corporation, 3823 Spinnaker Ct., Fremont, CA 94538, 415-770-0660 ..... A•1551
† ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558,2215
† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2216
Foxboro/PCG, The Foxboro Company, 600 N. Bedford St., E. Bridgewater, MA 02333, 508-378-5260 ..... A•2233-2235
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061, 913-782-0012 ..... A•2239
Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ..... A•2250
§ Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... A•2252-2253
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166 ..... A•2262
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•2282
Multi Products International, 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•2298
† North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•2301
§† PCA Electronics, 16799 Schoenborn St., Sepulveda, CA 91343, 818-892-0761 ..... A•2307
Pearson Electronics, Inc., 1860 Embarcadero Rd., Palo Alto, CA 94303, 415-494-6444 ..... A•2316
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319,2340-2341,2348
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2350-2351
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861, 201-826-4700 ..... A•2352-2353
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518, 213-638-1790 ..... A•1291,1695,2395,2397,2399, D•1983
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•1628,2407, B•1022-1025
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701, 201-364-1800 ..... A•2424
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763, 516-654-1880 ..... A•2426
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600 ..... A•2428
§† Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245, 619-458-1471 ..... D•2031
§† Vitec Electronic Corporation, 1525A East Acequia, Visalia, CA 93291, 209-739-1077 ..... A•2435-2437,2439
Actown-Electrocoil, Inc., 2414 Highview, Spring Grove, IL 60081 815-675-6641
Advanced Components Inds., Inc., Spitznagel GmbH, 120 Center Street, El Segundo, CA 90245 213-322-4249
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
Amplifier Research, 160 School House Rd., Souderton, PA 18964-9990 215-723-8181
Andover, Inc., 310 North Earl Avenue, Lafayette, IN 47904 317-447-1157
§ Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33069 305-979-7920
† Atlas Engineering Corp., 10 Cheney St, Dorchester, MA 02121 617-445-7100
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St, Dept. E, Miami, FL 33147 305-696-6660
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
§ Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coiltronics Inc., 984 S.W. 13th Court, Pompana Beach, FL 33069 305-781-8900

† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
† Cramer Coil & Transformer Co., Inc., 401 Progress Dr., Saukville, WI 53080 414-284-9425
Datatronics, Ltd., P. O. Box 2839, Blue Jay, CA 92317 714-336-3561
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052 716-652-3600
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
EG&G, Inc., Electro-Optics Div., 35 Congress St., Salem, MA 01970 617-745-3200
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360
Electrocom Industries, 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5770 Thornwood Dr., Goleta, CA 93117 805-964-0751
† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 .. 213-515-1546
† El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Endicott Coil, 24 Charlotte St., Binghamton, NY 13905 607-797-1263
† Engine Systems Division, Simmonds Precision, P.O. Box 310, Norwich, NY 13815 607-335-5000
§ ENI, Inc., Emerson Electric Co., 100 Highpower Road, Rochester, NY 14623 716-427-8300
† Frederick Components Intl., 20806 Plummer St., Chatsworth, CA 91311 ..... 818-882-0868;800-354-0660
§† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
Grand Transformers, 1500 Marion St., Grand Haven, MI 49417 616-842-5430
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hipotronics Inc., P.O. Drawer A, Brewster, NY 10509 914-279-8091
Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301 201-782-5525
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Hurricane Electronics Lab, P.O. Box 1280, Hurricane, UT 84737 801-635-2003
ICO-RALLY Corporation, 2575 E. Bayshore Rd., Palo Alto, CA 94303 415-856-9900
† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716 516-567-5600
Industrial Midwec Capacitor Corp., 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
§ James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
§† JB Electronic Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., 730 E. Division St., Elizabeth, NJ 07201 201-353-5700
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 ..... 201-396-9400; 1-800-223-0603
KGS Electronics, Inc., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
LEPCO/Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 .. 512-546-1625
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 303-651-2011
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetic Component Engineering, Inc., 11379 Playa Street, Culver City, CA 90230 213-398-4761
Maxwell Laboratories, 8888 Balboa Avenue, San Diego, CA 92123-1506 619-279-5100
Midcom, Inc., 121 Airport Dr., Watertown, SD 57201 605-886-4385
Nano Pulse Industries, 440 Nibus St., Brea, CA 92670 714-529-2600
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
Picosend Pulse Labs, Inc., P.O. Box 44, Boulder, CO 80306 303-443-1249
† Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 .. 312-543-6400
§ Pulse Engineering, Inc., 7250 Convoy Ct., P.O. Box 12235, San Diego, CA 92112 619-268-2400
§ QPL Magnetics, Inc., P.O.BOX C, Lake Grove, NY 11755 516-589-3331
† Radio Research Instrument Co., Inc., 584 North Main Street, Waterbury, CT 06704-3506 203-753-5840
† Raytheon Co., Microwave & Power Tube Div., 190 Willow St., Waltham, MA 02154 617-899-8400
Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729 ..... 516-586-5566; 1-800-645-5828
† Rhombus Industries, 15801 Chemical Ln., Huntington Bch., CA 92649-1595 714-898-0960
† Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
§ Semikron, Inc., 11E Executive Dr., P.O. Box 66, Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
§† Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95054 408-988-0700
Stangenes Industries, Inc., 1052 East Meadow Circle, Palo Alto, CA 94303 415-493-0814
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Talema Electronic, Inc., 301 N. Highway 63, Rolla, MO 65401 314-364-0882
§ TDK Corporation, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku,, Tokyo, JAPAN 103 ..... (03) 278-5111
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Tobe Deutschmann Labs., Inc., 550 Turnpike St., Canton, MA 02021 617-828-3366
§ Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131 408-432-8020
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056 312-297-0070

Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
† Wayne Transformer Co., Inc., 666 Pacific St., Brooklyn, NY 11217 718-783-9007
† Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 ... 602-861-1856
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Ratio-5600

Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224-5825, 213-537-5200 ..... A•1205
Foxboro/PCG, The Foxboro Company, 600 N. Bedford St., E. Bridgewater, MA 02333, 508-378-5260 ..... A•2235
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•2282
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•2367
Ryan International Corp., 4800 Evanswood Dr., Columbus, OH 43229-6207, 614-885-3303 ..... D•1318
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147 305-696-6660
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
§ QPL Magnetics, Inc., P.O.BOX C, Lake Grove, NY 11755 516-589-3331
Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
§† Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518 213-638-1790
Torema U.S.A., Inc., 6699 Portwest Dr., No. 130, Houston, TX 77024 713-861-6643
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064 213-478-8224

Transformers, RF-5600

Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2182
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 ..... A•2195
Bey Electric, Inc., 362 Main St., Box 548, Lincoln Park, NJ 07035, 201-694-5000 ..... A•2197
Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1209
Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2205,2209
Delta Products Corporation, 3823 Spinnaker Ct., Fremont, CA 94538, 415-770-0660 ..... A•1551
Elcom Systems, Inc., 932 Clint Moore Rd., Boca Raton, FL 33487, 305-994-1774 ..... A•1768
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2216
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061, 913-782-0012 ..... A•2239
† Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 350166, Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1775
Multi Products International, 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•2298
† North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•2301-2302
§ Penstock Engineering Labs., Penstock, Inc., 520 Mercury Dr., Sunnyvale, CA 94086-4018, 408-730-0300 ..... A•1844
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2350
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2355
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•2369
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... A•2366, D•1967
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•2433
United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600 ..... A•2428
§ Vitec Electronic Corporation, 1525A East Acequia, Visalia, CA 93291, 209-739-1077 ..... A•2438-2439
§† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Alpha Inds., Inc., Microelectronic Div., 2800 Crystal Drive, Hatfield, PA 19440 215-822-1311
Amplifier Research, 160 School House Rd., Souderton, PA 18964-9990 215-723-8181
§ Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33069 305-979-7920
† Atlas Engineering Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147 305-696-6660
Avtech Electrosystems Ltd., P.O. Box 5120, Stn. F, Ottawa, Ontario, CANADA K2C 3H4 613-226-5772
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224-5825 213-537-5200
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
§ Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, NJ 07006 201-227-4222
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
Datatronics, Ltd., P. O. Box 2839, Blue Jay, CA 92317 714-336-3561
Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052 716-652-3600
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
† Electro Impulse, Box 870, Red Bank, NJ 07701-0870 201-741-0404
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
§ ENI, Inc., Emerson Electric Co., 100 Highpower Road, Rochester, NY 14623 716-427-8300
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
Genisco Technology Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Industrial Midwec Capacitor Corp., 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 ..... 201-396-9400; 1-800-223-0603
§ KLM Electronics, 16890 Church St., P.O. Box 816, Morgan Hill, CA 95037 408-779-7363
† Lorch Electronics, Sub. of Vernitron Corp., 105 Cedar La., Englewood, NJ 07631 201-569-8282
M/A-COM Microwave Components, Inc., South Avenue, Burlington, MA 01803 617-272-3000
† Magnetic Component Engineering, Inc., 11379 Playa Street, Culver City, CA 90230 213-398-4761
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Micro-Coax Components, Inc., a UTI Company, Box E, Collegeville, PA 19426 215-489-3700
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
Olektron Corp., Signal Technology Corp., 61 Sutton Road, Webster, MA 01570 617-943-7440
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
§ Pulse Engineering, Inc., 7250 Convoy Ct., P.O. Box 12235, San Diego, CA 92112 619-268-2400
† Radio Research Instrument Co., Inc., 584 North Main Street, Waterbury, CT 06704-3506 203-753-5840
Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
† Rhombus Industries, 15801 Chemical Ln., Huntington Bch., CA 92649-1595 714-898-0960
§ Sinclair Radio Laboratories Ltd., 85 Mary St., Aurora, ONT., CANADA L4G 3G9 416-727-0165
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Summit Engineering Corp., Box 938, Bozeman, MT 59715 406-587-4511
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Thinco Div., Hull Corp., Davisville Rd., Hatboro, PA 19040 215-672-7800
Til-Tek Limited, 500 Van Buren St., P.O. Box 550, Kemptville, Ontario, CANADA K0G 1J0 613-258-5928
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245 ... 619-458-1471
† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
† Werlatone, Inc., P. O. Box 47, Rte. 22, Brewster, NY 10509 914-279-6187
† Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 ... 602-861-1856
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Reactor — See Reactors, Filter (Vol. A)

Transformers, Rectifier-5600

† Abbott Technologies, Inc., Burbank Division, Transformers, 639 So. Glenwood Pl., Burbank, CA 91506, 818-841-3630 ..... A•2157,2159
Controlled Power Co., 1955 Stephenson Hwy., Troy, MI 48083, 313-528-3700;1-800-521-4792 ..... D•2085
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2205,2208
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, 605-296-3462/3487 ..... A•2212
Dynapower Corporation, Box 3180, Farmington Hills, MI 48333, 313-553-4300 ..... D•1703,1706
† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2214
§† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2216,2226
Foxboro/PCG, The Foxboro Company, 600 N. Bedford St., E. Bridgewater, MA 02333, 508-378-5260 ..... A•2235
Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301, 201-782-5525 ..... A•2240

Jerome Industries Corp., 730 E. Division St., Elizabeth, NJ 07201, 201-353-5700 ..... A•2242
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735, 516-293-0475 ..... A•2243,2246-2247
Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ..... A•2250
§ Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... A•2252-2253,2258-2260
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•2282,2288-2289
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 ..... A•2303
Para-Line Transformer Co., Inc., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2318
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ..... A•2308-2309,2312-2314
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2350-2351
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2355
† Signal Transformer Co., Inc., Insilco Corporation, 500 Bayview Ave., Inwood, NY 11696, 516-239-5777 ..... A•2372,2379,2381,2384,2389
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025
Todd Systems, Inc., 50 Ash St., Yonkers, NY 10701, 914-963-3400 ..... A•2408
Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, 301-464-2100 ..... A•2412,2416
Transformer Technologies, Inc., 52 Putnam St., Mt. Vernon, NY 10550, 914-668-1600 ..... A•2427
Ulveco, Inc., 323 Vintage Park Drive, Foster City, CA 94404, 415-574-1100 ..... A•2432
† Wayne Transformer Co., Inc., 666 Pacific St., Brooklyn, NY 11217, 718-783-9007 ..... A•2440

Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010
ACD-Elcor Products, P.O. Box 244, Bethel, CT 06801 203-743-3510
Actown-Electrocoil, Inc., 2414 Highview, Spring Grove, IL 60081 815-675-6641
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
§† Allied Corporation, Bendix Electric Power, 118 Hwy. 35, Eatontown, NJ 07724 201-542-2000
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
† American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 612-788-9161
§ Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33069 305-979-7920
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147 305-696-6660
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St, Brooklyn, NY 11217 718-857-2400
† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coiltronics Inc., 984 S.W. 13th Court, Pompana Beach, FL 33069 305-781-8900
§ Computer Power Inc., 124 W. Main St., High Bridge, NJ 08829 ..... 201-638-8000; 800-526-5088
Custom Bobbin Windings, A & K Corporation, P.O. Box 2369, Zanesville, OH 43702-2369 614-452-6973
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5770 Thornwood Dr., Goleta, CA 93117 805-964-0751
Elgar Corp., 9250 Brown Deer Rd., San Diego, CA 92121 ..... 619-450-0085; 800-854-2213
† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 .. 213-515-1546
Endicott Coil, 24 Charlotte St., Binghamton, NY 13905 607-797-1263
Ferrotran Elctrns. Co., Inc., 11 W. 25th St., New York, NY 10010 212-691-3610
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
Grand Transformers, 1500 Marion St., Grand Haven, MI 49417 616-842-5430
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hipotronics Inc., P.O. Drawer A, Brewster, NY 10509 914-279-8091
§† JB Electronic Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
KGS Electronics, Inc., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
§ Liberty Intl. Corp., FIRSTOHM, 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
MACROAMP Inc., P.O. Box 1512, Ukiah, CA 95482 707-462-2222
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223 414-358-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., 999 Anita Ave., Antioch, IL 60002 312-395-5710
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
† Parker McCrory Mfg. Co., 2000 Forest Ave., Kansas City, MO 64108 816-221-2000
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861 201-826-4700
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 .. 312-543-6400
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
§ QPL Magnetics, Inc., P.O.BOX C, Lake Grove, NY 11755 516-589-3331
Rapid Power Technologies, Graysbridge Rd. , P.O.BOX 291, Brookfield, CT 06804 ..... 203-775-0411;800-332-1111
§ S & H Inds., 2257 North Penn Rd., Hatfield, PA 19440 215-822-7211
Sanford-Miller Corp., 8 John St., Lynbrook, NY 11563 .... 516-593-2025;800-645-5900
Schauer Manufacturing, 4500 Alpine Ave., Cincinnati, OH 45242 513-791-3030
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Sierra West Power Systems, 2615 Missouri St., Las Cruces, NM 88001 505-522-8828
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
§† Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
Staco Energy Products Co., 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
Staco Transpower, 610 W. 6th St., Mt. Carmel, IL 62863 618-262-5555
§ Stancor Products, Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
Stangenes Industries, Inc., 1052 East Meadow Circle, Palo Alto, CA 94303 415-493-0814
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518 213-638-1790
Teco Corp., Bay Rd., P. O. Box A, Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199 816-761-6314
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
Walker Power, Inc., Walker Magnetics Group, 10 B Mill St., Warner, NH 03278 603-456-3111
Xylog Corp., 83 Hobart St., Hackensack, NJ 07601 201-489-4040
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Reference-5600

Foxboro/PCG, The Foxboro Company, 600 N. Bedford St., E. Bridgewater, MA 02333, 508-378-5260 ..... A•2235
Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... A•2252-2253,2259
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•2282
† Perkin-Elmer Corp., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132, 203-762-4786 ..... A•2317
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025

American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757.. 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 .. 213-515-1546
† Frederick Components Intl., 20806 Plummer St., Chatsworth, CA 91311 ..... 818-882-0868;800-354-0660
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861 201-826-4700
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
§ QPL Magnetics, Inc., P.O.BOX C, Lake Grove, NY 11755 516-589-3331
† Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
Staco Energy Products Co., 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199 816-761-6314
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Rotary-5600

Novatronics of Canada Ltd., 677 Erie St., P.O. Box 610, Stratford, Ontario, CANADA N5A 6V6, 519-271-3880 ..... **B•1243**
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
§ Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, NJ 07006 201-227-4222
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† E-Tron Corporation, 30 Ethel Rd., Edison, NJ 08817 201-287-9039
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
† Schaevitz Engineering, U.S. 130, Union Ave., Pennsauken, NJ 08110 609-662-8000
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Transducers and Systems, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471 203-481-5721

Transformers, Scott T-5600

EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... **A•2216**
† **Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166** ..... **A•2262**
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... **A•2265**
§† **Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050** ..... **A•2282**
† **Perkin-Elmer Corp., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132, 203-762-4786** ..... **A•2317**
† **Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... **A•2319**
† **Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105** ..... **A•2407, B•1022-1025**
† **Trans American Transformer, 142 Peconic Ave., Medford, NY 11763, 516-654-1880** ..... **A•2426**
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
Atlas Engineering Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
Bey Electric, Inc., 362 Main St, Box 548, Lincoln Park, NJ 07035 201-694-5000
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731 516-261-3300
† Control Sciences, Inc., 9509 Vassar Ave., Chatsworth, CA 91311 818-709-5510
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
Dynapower Corporation, Box 3180, Farmington Hills, MI 48333 313-553-4300
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5770 Thornwood Dr., Goleta, CA 93117 805-964-0751
Elma Engineering, 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 .. 213-515-1546
† Hadley, Robert M. Co., Inc., 750 West 51st St., Los Angeles, CA 90037 .. 213-234-9091
Hipotronics Inc., P.O. Drawer A, Brewster, NY 10509 914-279-8091
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301 201-782-5525
† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716 516-567-5600
§† JB Electronic Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
§ Jefferson Elec., MagneTek, Inc., 1400 Center Circle Drive, Downers Grove, IL 60515-1021 312-691-2400
KGS Electronics, Inc., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
QPL Magnetics, Inc., P.O.BOX C, Lake Grove, NY 11755 516-589-3331
Rapid Power Technologies, Graysbridge Rd. , P.O.BOX 291, Brookfield, CT 06804 ..... 203-775-0411;800-332-1111
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
§† Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735 516-293-3100
Walker Power, Inc., Walker Magnetics Group, 10 B Mill St., Warner, NH 03278 603-456-3111
† Wayne Transformer Co., Inc., 666 Pacific St., Brooklyn, NY 11217 718-783-9007
† Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 ... 602-861-1856
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Servo-5600

MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... **A•2265**
§† **Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050** ..... **A•2282**
† **Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... **A•2319**
† **Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105** ..... **A•2407, B•1022-1025**
† **Trans American Transformer, 142 Peconic Ave., Medford, NY 11763, 516-654-1880** ..... **A•2426**
† **Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735, 516-293-3100** ..... **D•1184**
† **Wayne Transformer Co., Inc., 666 Pacific St., Brooklyn, NY 11217, 718-783-9007** ..... **A•2440**
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 .. 213-515-1546
† Ferrotran Elctrns. Co., Inc., 11 W. 25th St., New York, NY 10010 212-691-3610
Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
† Industrial Control Co., 3100 Pineda Ave., Rockledge, FL 32955 305-259-7105
§† JB Electronic Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
† Perkin-Elmer Corp., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132 203-762-4786
§ QPL Magnetics, Inc., P.O.BOX C, Lake Grove, NY 11755 516-589-3331
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199 816-761-6314
† Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245 ... 619-458-1471
Xylog Corp., 83 Hobart St., Hackensack, NJ 07601 201-489-4040
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Split Bobbin-5600

Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... **A•2180**
C & C Jetronic, Inc., Research Pk. 318 Wall St., Princeton, NJ 08540, 609-921-8540 ..... **A•2204**
§ **Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301** ..... **A•2205**
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379, 203-599-2075 ..... **B•1402**
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, 605-296-3462/3487 ..... **A•2212**
† **Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950** ..... **A•2214**
§ **EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048** ..... **A•2216-2217,2221-2222,2224,2226**
Flex-Core Div., Morlan & Assocs., Inc., 6625 McVey Blvd., Worthington, OH 43235, 614-889-6152 ..... **A•2229**
Foxboro/PCG, The Foxboro Company, 600 N. Bedford St., E. Bridgewater, MA 02333, 508-378-5260 ..... **A•2234-2235**
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-937-3475 ..... **A•2241**
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735, 516-293-0475 ..... **A•2243-2247**
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... **A•2248**
Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ..... **A•2250**
§ **Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500** ..... **A•2252-2255**
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... **A•2265-2266,2269-2271,2273,2275**
§† **Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050** ..... **A•2283,2286**
§ **Multi Products International, 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183** ..... **A•2298**
Para-Line Transformer Co., Inc., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... **A•2318**
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ..... **A•2308-2310,2312**
† **Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... **A•2319**
Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... **A•2350**
† **Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861, 201-826-4700** ..... **A•2352**
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... **A•2355**
† **Signal Transformer Co., Inc., Insilco Corporation, 500 Bayview Ave., Inwood, NY 11696, 516-239-5777** ..... **A•2372,2374-2377,2380,2383,2387-2388**
§ **Stancor Products, Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947, 219-722-2244** ..... **A•2393**
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518, 213-638-1790 ..... **A•1291,1695**
Transformer Technologies, Inc., 52 Putnam St., Mt. Vernon, NY 10550, 914-668-1600 ..... **A•2427**
§ **Vitec Electronic Corporation, 1525A East Acequia, Visalia, CA 93291, 209-739-1077** ..... **A•2439**
Acme Electric Corporation, 20 Water Street, Cuba, NY 14727 716-968-2400
Acme Transformer, Acme Electric Corporation, Rte. 4, Box 54, Lumberton, NC 28358 919-738-1121
Actown-Electrocoil, Inc., 2414 Highview, Spring Grove, IL 60081 815-675-6641
Advanced Components Inds., Inc., Spitznagel GmbH, 120 Center Street, El Segundo, CA 90245 213-322-4249
AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147 305-696-6660
§ Avel-Lindberg, Inc., 5 Old Town Park Rd., Unit 47, New Milford, CT 06776 203-355-4711

Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
Bey Electric, Inc., 362 Main St, Box 548, Lincoln Park, NJ 07035 201-694-5000
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
BH Electronics, Inc., 12219 Wood Lk. Dr., Burnsville, MN 55337 612-894-9590
† Coiltronics Inc., 984 S.W. 13th Court, Pompana Beach, FL 33069 305-781-8900
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
§ Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
Electronic Coil Corp., Farmington Industrial Park, Farmington, CT 06032 203-677-6731
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Endicott Coil, 24 Charlotte St., Binghamton, NY 13905 607-797-1263
Engineering Design & Sls., One E.D.S. Way, Danville, VA 24540 804-685-7073
Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
Gettysburg Transformer Corporation, 1380 Old Harrisburg Rd., P.O. Box 99, Gettysburg, PA 17325 717-334-2191
§ Golden Pacific Electronics, Inc, 560 S. Melrose St., Placentia, CA 92670 714-993-6970
Grand Transformers, 1500 Marion St., Grand Haven, MI 49417 616-842-5430
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
§ James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
Jerome Industries Corp., 730 E. Division St., Elizabeth, NJ 07201 201-353-5700
LEPCO/Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 303-651-2011
Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
Merrimack Magnetics Corp., 121 Hale St., Lowell, MA 01851 617-458-1487
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
Mini-Magnetics Co., Inc., 1100 Fulton Place, Fremont, CA 94539 415-490-7500
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
Power Sources International Inc., Sources Electronics, 15014 Malachite Ct., Reno, NV 89506 702-972-1224
§ QPL Magnetics, Inc., P.O.BOX C, Lake Grove, NY 11755 516-589-3331
Schauer Manufacturing, 4500 Alpine Ave., Cincinnati, OH 45242 513-791-3030
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
Staco Transpower, 610 W. 6th St., Mt. Carmel, IL 62863 618-262-5555
Teco Corp., Bay Rd., P. O. Box A, Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199 816-761-6314
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 602-861-1856
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

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Transformers, Surface Mount-5600

† Abbott Technologies, Inc., Burbank Division, Transformers, 639 So. Glenwood Pl., Burbank, CA 91506, 818-841-3630 ..... A•2157
AT&T, 555 Union Blvd., Allentown, PA 18103, 1-800-372-2447;In Canada:1-800-553-2448 ..... A•2188
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 ..... A•2194
BH Electronics, Inc., 12219 Wood Lk. Dr., Burnsville, MN 55337, 612-894-9590 ..... A•2198-2200
† C & C Jetronic, Inc., Research Pk. 318 Wall St., Princeton, NJ 08540, 609-921-8540 ..... A•2204
Coilcraft, 1102 Silver Lake Rd., Cary, IL 60013, 312-639-2361 ..... A•1225
Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2205,2209
Delta Products Corporation, 3823 Spinnaker Ct., Fremont, CA 94538, 415-770-0660 ..... A•1551
Foxboro/PCG, The Foxboro Company, 600 N. Bedford St., E. Bridgewater, MA 02333, 508-378-5260 ..... A•2234-2235
Gowanda Electronics Corp., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 ..... A•1245
North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•2300
§ PCA Electronics, 16799 Schoenborn St., Sepulveda, CA 91343, 818-892-0761 ..... A•2307
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319,2322-2323,2326-2327, D•1863
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861, 201-826-4700 ..... A•2352
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•1628,2407, B•1022-1025
Transformer Technologies, Inc., 52 Putnam St., Mt. Vernon, NY 10550, 914-668-1600 ..... A•2427
United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600 ..... A•2428
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147 305-696-6660
Avel-Lindberg, Inc., 5 Old Town Park Rd., Unit 47, New Milford, CT 06776 203-355-4711
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
Computer Power Inc., 124 W. Main St., High Bridge, NJ 08829 ..... 201-638-8000; 800-526-5088
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
LEPCO/Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209 513-871-3777
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518 213-638-1790
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Thinco Div., Hull Corp., Davisville Rd., Hatboro, PA 19040 215-672-7800
Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131 408-432-8020
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245 619-458-1471

Transformers, Switching, Power-5600

MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265
Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•2286,2288

Transformers, Synchro Control-5600

† C & C Jetronic, Inc., Research Pk. 318 Wall St., Princeton, NJ 08540, 609-921-8540 ..... A•2204
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731, 516-261-3300 ..... D•1145
† Control Sciences, Inc., 9509 Vassar Ave., Chatsworth, CA 91311, 818-709-5510 ..... D•1147,1149
Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., 3418 N. Milwaukee, Chicago, IL 60641, 312-283-4000 ..... B•1619
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2216
Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061, 913-782-0012 ..... A•2239
† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716, 516-567-5600 ..... D•1164
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166 ..... A•2262
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•2282
Natel Engineering Co., Inc., 4550 Runway St., Simi Valley, CA 93063, 805-581-3950 ..... D•1175
† Perkin-Elmer Corp., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132, 203-762-4786 ..... A•2317
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763, 516-654-1880 ..... A•2426
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735, 516-293-3100 ..... D•1184
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Clifton Precision, Litton Systems, Inc., Marple at Broadway, Clifton Hgts., PA 19018 215-622-1000
† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 213-515-1546
† E-Tron Corporation, 30 Ethel Rd., Edison, NJ 08817 201-287-9039
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Industrial Control Co., 3100 Pineda Ave., Rockledge, FL 32955 305-259-7105
§† JB Electronic Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
J. R. Merritt Controls, Inc., 8 Crimmins Rd., Darien, CT 06820 203-656-0143
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
† Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
† SPS Inc. (Muirhead Vactric), 51 Commerce St., Springfield, NJ 07081 201-376-1222
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Transicoil, Inc., Trooper Rd., P.O. Box 99, Worcester, PA 19490-9990 215-277-1300
Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245 619-458-1471
† Vernitron Controls, Vernitron Corporation, 1601 Precision Park La., San Diego, CA 92073 619-428-5581
Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 602-861-1856

Transformers, Telephone Coupling-5600

Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2183
† C & C Jetronic, Inc., Research Pk. 318 Wall St., Princeton, NJ 08540, 609-921-8540 ..... A•2204
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2205-2207
† Delta Products Corporation, 3823 Spinnaker Ct., Fremont, CA 94538, 415-770-0660 ..... A•1551,2211

Dynage/Power & Magnetics, Division Of Oakleaf, Inc., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, 605-296-3462/3487 ..... A•2213
§ **Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950** ..... A•2214
† **ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400** ..... A•1558,2215
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2216,2227
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-937-3475 ..... A•2241
§ **Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500** ..... A•2252-2253,2261
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265
§† **Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050** ..... A•2291-2295
§ **Multi Products International, 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183** ..... A•2299
Para-Line Transformer Co., Inc., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2318
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ..... A•2308-2309,2315
† **Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... A•2319,2332-2339
† **Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950** ..... A•2350
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2355,2358-2360,2362-2365
Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... A•2366, D•1967
§ **Stancor Products, Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947, 219-722-2244** ..... A•2393
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518, 213-638-1790 ..... A•1291,1695,2395-2397, D•1983
† **Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105** ..... A•2407, B•1022-1023
United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600 ..... A•2428
Actown-Electrocoil, Inc., 2414 Highview, Spring Grove, IL 60081 815-675-6641
AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
† Coiltronics Inc., 984 S.W. 13th Court, Pompana Beach, FL 33069 305-781-8900
† Cramer Coil & Transformer Co., Inc., 401 Progress Dr., Saukville, WI 53080 414-284-9425
Datatronics, Ltd., P. O. Box 2839, Blue Jay, CA 92317 714-336-3561
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360
Electrocom Industries, 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 .. 213-515-1546
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Foxboro/PCG, The Foxboro Company, 600 N. Bedford St., E. Bridgewater, MA 02333 508-378-5260
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Industrial Midwec Capacitor Corp., 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
§ James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
§† JB Electronic Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 ..... 201-396-9400; 1-800-223-0603
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
LEPCO/Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 .. 512-546-1625
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Midcom, Inc., 121 Airport Dr., Watertown, SD 57201 605-886-4385
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
Mini-Magnetics Co., Inc., 1100 Fulton Place, Fremont, CA 94539 415-490-7500
Nedap N.V., P.O. Box 6, Groenlo, HOLLAND 7140 AA ..... +31-5440-71111
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
Onan Power/Electronics, 4801 W. 81st St., Minneapolis, MN 55437 612-921-5600
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861 201-826-4700
† Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 .. 312-543-6400
† Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
Staco Transpower, 610 W. 6th St., Mt. Carmel, IL 62863 618-262-5555
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
§ Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064 213-478-8224
Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245 ... 619-458-1471
Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 ... 602-861-1856
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Toroidal-5600

† **Abbott Technologies, Inc., Burbank Division, Transformers, 639 So. Glenwood Pl., Burbank, CA 91506, 818-841-3630** ..... A•2157,2166
Amecon, Inc., 1900 S. Chris La., Anaheim, CA 92805, 714-634-2220;800-392-2292 ..... A•2170-2173,2175-2176
Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2180
§ **Avel-Lindberg, Inc., 5 Old Town Park Rd., Unit 47, New Milford, CT 06776, 203-355-4711** ..... A•2192
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 ..... A•2194
Bey Electric, Inc., 362 Main St., Box 548, Lincoln Park, NJ 07035, 201-694-5000 ..... A•2197
BH Electronics, Inc., 12219 Wood Lk. Dr., Burnsville, MN 55337, 612-894-9590 ..... A•2198
Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1209
Coilcraft, 1102 Silver Lake Rd., Cary, IL 60013, 312-639-2361 ..... A•1225
§ **Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301** ..... A•2205,2209
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, 605-296-3462/3487 ..... A•2212
§ **Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950** ..... A•2214
† **ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400** ..... A•1558,2215
§† **EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048** ..... A•1244,2216,2219
§† **Gowanda Electronics Corp., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234** ..... A•1245
† **Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061, 913-782-0012** ..... A•2239
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... A•2248
Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ..... A•2250-2251
§ **Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500** ..... A•2252-2254
† **Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166** ..... A•2262
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265
§† **Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050** ..... A•2286,2289-2290,2292-2294
† **Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 350166, Brooklyn, NY 11235-0003, 718-934-4500** ..... A•1775
MPC, Div. of Consulting Systems, RFD No. 1, Box 441, Fremont, NH 03044, 603-642-5913 ..... D•1848
North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•2301
§† **PCA Electronics, 16799 Schoenborn St., Sepulveda, CA 91343, 818-892-0761** ..... A•2307
† **Perkin-Elmer Corp., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132, 203-762-4786** ..... A•2317
† **Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... A•2319
† **Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950** ..... A•2350-2351
† **Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861, 201-826-4700** ..... A•1281,2352-2353
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2355,2365
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1282,2369
Signal Transformer Co., Inc., Insilco Corporation, 500 Bayview Ave., Inwood, NY 11696, 516-239-5777 ..... A•2372,2376,2387
† **Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, 513-871-3777** ..... A•1287
Talema Electronic, Inc., 301 N. Highway 63, Rolla, MO 65401, 314-364-0882 ..... A•2390-2391
† **Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105** ..... A•2407, B•1022-1025
Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, 301-464-2100 ..... A•2412-2416
† **Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701, 201-364-1800** ..... A•2424-2425
† **Trans American Transformer, 142 Peconic Ave., Medford, NY 11763, 516-654-1880** ..... A•2426
Transformer Technologies, Inc., 52 Putnam St., Mt. Vernon, NY 10550, 914-668-1600 ..... A•2427
Ulveco, Inc., 323 Vintage Park Drive, Foster City, CA 94404, 415-574-1100 ..... A•2430-2431
§† **Vitec Electronic Corporation, 1525A East Acequia, Visalia, CA 93291, 209-739-1077** ..... A•2439
§† Able Power and Engineering Inc., 1222 N. Delta St., S. San Gabriel, CA 91770 818-571-6260
§† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Airpax Co., Sensor Div., A Division of North American Philips Corp., Cheshire Industrial Park, Cheshire, CT 06410 203-272-0301
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
Andover, Inc., 310 North Earl Avenue, Lafayette, IN 47904 317-447-1157
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
§ Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33069 305-979-7920
† Atlas Engineering Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100

† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147 305-696-6660
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224-5825 213-537-5200
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Bicron Electronics, 100 Barlow Street, Canaan, CT 06018 203-824-5125
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
† Coiltronics Inc., 984 S.W. 13th Court, Pompana Beach, FL 33069 305-781-8900
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
Cross Electronics, 100 Commonwealth Dr., Warrendale, PA 15086 412-776-1591
§ Current Ring Co. Inc., 252 Sunset Drive, P. O. 1525, Ballwin, MO 63011 800-325-8653
Datatronics, Ltd., P. O. Box 2839, Blue Jay, CA 92317 714-336-3561
† Delta Products Corporation, 3823 Spinnaker Ct., Fremont, CA 94538 415-770-0660
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
† Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
† Electrocom Industries, 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
§ Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5770 Thornwood Dr., Goleta, CA 93117 805-964-0751
† El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Endicott Coil, 24 Charlotte St., Binghamton, NY 13905 607-797-1263
§† E-Tronics, 16774 Schoenborn, Sepulveda, CA 91343 818-892-7279
† Frederick Components Intl., 20806 Plummer St., Chatsworth, CA 91311 ..... 818-882-0868;800-354-0660
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
† Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
Genisco Technology Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
Grand Transformers, 1500 Marion St., Grand Haven, MI 49417 616-842-5430
† Hadley, Robert M. Co., Inc., 750 West 51st St., Los Angeles, CA 90037 .. 213-234-9091
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hurricane Electronics Lab, P.O. Box 1280, Hurricane, UT 84737 801-635-2003
Industrial Midwec Capacitor Corp., 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
§ James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
§† JB Electronic Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 ..... 201-396-9400; 1-800-223-0603
KGS Electronics, Inc., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
LEPCO/Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 .. 512-546-1625
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetic Component Engineering, Inc., 11379 Playa Street, Culver City, CA 90230 213-398-4761
† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
Magnetic Specs., 10 Albemarle Ave., Trenton, NJ 08638 609-883-3150
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
Mini-Magnetics Co., Inc., 1100 Fulton Place, Fremont, CA 94539 415-490-7500
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223 414-358-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Novatronics, Box 878, Pompano Beach, FL 33061 305-942-5200
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
† Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 .. 312-543-6400
† Preferred Electronics, Inc., Main Line Dr., P.O. Box 248, Westfield, MA 01086 413-568-2301
PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
§ Pulse Engineering, Inc., 7250 Convoy Ct., P.O. Box 12235, San Diego, CA 92112 619-268-2400
§ QPL Magnetics, Inc., P.O.BOX C, Lake Grove, NY 11755 516-589-3331
Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
† Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
Shape Magnetronics, Inc., 901 DuPage Ave., Lombard, IL 60148 312-620-8394
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
§† Staco Energy Products Co., 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95054 408-988-0700
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518 213-638-1790
Teco Corp., Bay Rd., P. O. Box A, Winnisquam, NH 03289 603-524-1998
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
Torelco, Inc., 14 Paine Ave., P. O. Box 560, Irvington, NJ 07111 201-374-8641
Torema U.S.A., Inc., 6699 Portwest Dr., No. 130, Houston, TX 77024 713-861-6643
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199 816-761-6314
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
Trancor, 108 N. High St., P.O. Box 907, San Saba, TX 76877 915-372-6127
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064 213-478-8224
United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600
§ Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245 ... 619-458-1471
† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
Wilco Corp., 6451 Saguaro Court, Indianapolis, IN 46268 317-293-9300
† Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 ... 602-861-1856
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

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Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2182
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2205
§ Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2214
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2216
§ Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... A•2252-2253,2259
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166 ..... A•2262
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•2288,2290-2291,2295-2296
Para-Line Transformer Co., Inc., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2318
† PCA Electronics, 16799 Schoenborn St., Sepulveda, CA 91343, 818-892-0761 ..... A•2307
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319, D•1863
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2350
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2355
§ Stancor Products, Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947, 219-722-2244 ..... A•2393
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025
Actown-Electrocoil, Inc., 2414 Highview, Spring Grove, IL 60081 815-675-6641
AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
§ Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33069 305-979-7920
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147 305-696-6660
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BH Electronics, Inc., 12219 Wood Lk. Dr., Burnsville, MN 55337 612-894-9590
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Custom Bobbin Windings, A & K Corporation, P.O. Box 2369, Zanesville, OH 43702-2369 614-452-6973
Datatronics, Ltd., P. O. Box 2839, Blue Jay, CA 92317 714-336-3561
Delta Products Corporation, 3823 Spinnaker Ct., Fremont, CA 94538 415-770-0660
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360
Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
Electrocom Industries, 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 .. 213-515-1546
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
§† JB Electronic Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
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KGS Electronics, Inc., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
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Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223 414-358-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200

Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
Staco Transpower, 610 W. 6th St., Mt. Carmel, IL 62863 618-262-5555
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518 213-638-1790
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
§ Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torelco, Inc., 14 Paine Ave., P. O. Box 560, Irvington, NJ 07111 201-374-8641
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199 816-761-6314
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865 201-454-2600
† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Wayne Transformer Co., Inc., 666 Pacific St., Brooklyn, NY 11217 718-783-9007
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† C & C Jetronic, Inc., Research Pk. 318 Wall St., Princeton, NJ 08540, 609-921-8540 ..... A•2204
Gowanda Electronics Corp., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 ..... A•1245
Hipotronics Inc., P.O. Drawer A, Brewster, NY 10509, 914-279-8091 ..... A•2236-2238
Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... A•2252-2253
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ..... A•2314-2315
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861, 201-826-4700 ..... A•2352
§† Superior Electric, 383 Middle St., Bristol, CT 06010, 203-582-9561 .. A•2370-2371
§† Technipower, A Penril Co., P.O. Box 222, Commerce Pk., Danbury, CT 06813, 203-748-7001 ..... A•2405
Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407
Todd Systems, Inc., 50 Ash St., Yonkers, NY 10701, 914-963-3400 ..... A•2409
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
† Columbia Resch. Labs., Macdade Blvd. & Bullens La., Woodlyn, PA 19094 215-872-3882
Contact East, 335 Willow St. S., P.O. Box 786, N. Andover, MA 01845 ... 617-682-2000
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
Diamond Magnetics, 235 Tank Farm Rd., Ste. G, San Luis Obispo, CA 93401 805-544-4019
† E-Tron Corporation, 30 Ethel Rd., Edison, NJ 08817 201-287-9039
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 303-651-2011
J. R. Merritt Controls, Inc., 8 Crimmins Rd., Darien, CT 06820 203-656-0143
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
§ Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
Rapid Power Technologies, Graysbridge Rd. , P.O.BOX 291, Brookfield, CT 06804 ..... 203-775-0411;800-332-1111
§† Staco Energy Products Co., 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209 513-871-3777
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
§ Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100

Transformers, Variable, Motorized-5600

ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, 619-757-7770 ..... A•2071,2073-2074, B•1205
Superior Electric, 383 Middle St., Bristol, CT 06010, 203-582-9561 .. A•2370-2371

Transformers, Voltage Dividing-5600

† Abbott Technologies, Inc., Burbank Division, Transformers, 639 So. Glenwood Pl., Burbank, CA 91506, 818-841-3630 ..... A•2157
† C & C Jetronic, Inc., Research Pk. 318 Wall St., Princeton, NJ 08540, 609-921-8540 ..... A•2204
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2205
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379, 203-599-2075 ..... B•1402
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735, 516-293-0475 ..... A•2243
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... A•2248
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•2282
North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•2301
† Oram High Voltage, P.O. Box 1176, Dayton, TX 77535, 409-258-5553 .... D•1859
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2350
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2355
† Signal Transformer Co., Inc., Insilco Corporation, 500 Bayview Ave., Inwood, NY 11696, 516-239-5777 ..... A•2372
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025
Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010
American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
Crompton Instrs., Hawker Siddley, 2763 Old Higgins Rd., Elk Grove Village, IL 60007 312-593-1107
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
§ Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro Scientific Inds., 13900 N.W. Science Pk. Dr., Portland, OR 97229 503-641-4141
† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 .. 213-515-1546
† Frederick Components Intl., 20806 Plummer St., Chatsworth, CA 91311 ..... 818-882-0868;800-354-0660
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
Hipotronics Inc., P.O. Drawer A, Brewster, NY 10509 914-279-8091
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
Industrial Midwec Capacitor Corp., 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 303-651-2011
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
Para-Line Transformer Co., Inc., 511 South Palm Ave., Alhambra, CA 91803 818-281-0222
† Perkin-Elmer Corp., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132 203-762-4786
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
Staco Energy Products Co., 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
Staco Transpower, 610 W. 6th St., Mt. Carmel, IL 62863 618-262-5555
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518 213-638-1790
Teco Corp., Bay Rd., P. O. Box A, Winnisquam, NH 03289 603-524-1998
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
Tettex Instruments, Inc., P.O. Box 281, Fairview Village, PA 19409-0281 215-539-6050
§ Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torema U.S.A., Inc., 6699 Portwest Dr., No. 130, Houston, TX 77024 713-861-6643
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199 816-761-6314
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Venable Industries, Inc., 3555 Lomita Blvd., Torrance, CA 90505 213-539-2522
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Voltage Regulating-Also See Regulators & Stabilizers, Voltage-5600

Acme Electric Corporation, 20 Water Street, Cuba, NY 14727, 716-968-2400 ..... D•1534
† C & C Jetronic, Inc., Research Pk. 318 Wall St., Princeton, NJ 08540, 609-921-8540 ..... A•2204
† Controlled Power Co., 1955 Stephenson Hwy., Troy, MI 48083, 313-528-3700;1-800-521-4792 ..... D•2085,2088
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2205
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, 605-296-3462/3487 ..... A•2212

Hipotronics Inc., P.O. Drawer A, Brewster, NY 10509, 914-279-8091 ..... A•2236
§ Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301, 201-782-5525 ..... A•2240
Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... A•2252-2253,2260
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265
§ Perma Power Elctrns., 5601 W. Howard Ave., Chicago, IL 60648, 312-647-9414 ..... B•1346
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2355
Signal Transformer Co., Inc., Insilco Corporation, 500 Bayview Ave., Inwood, NY 11696, 516-239-5777 ..... A•2372
§ Sola, A Unit of General Sign., 1717 Busse Rd., Elk Grove Village, IL 60007, 312-439-2800 ..... D•1972
§† Superior Electric, 383 Middle St., Bristol, CT 06010, 203-582-9561 .. A•2370-2371
§† Technipower, A Penril Co., P.O. Box 222, Commerce Pk., Danbury, CT 06813, 203-748-7001 ..... A•2405
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025
Todd Systems, Inc., 50 Ash St., Yonkers, NY 10701, 914-963-3400 ..... A•2411
§† Topaz, Inc., 9192 Topaz Way, San Diego, CA 92123-1165, 619-279-0831 ..... D•2156
† Wayne Transformer Co., Inc., 666 Pacific St., Brooklyn, NY 11217, 718-783-9007 ..... A•2440
Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010
§† Able Power and Engineering Inc., 1222 N. Delta St., S. San Gabriel, CA 91770 818-571-6260
Acme Transformer, Acme Electric Corporation, Rte. 4, Box 54, Lumberton, NC 28358 919-738-1121
Adtech Power Inc., 1620 S. Sunkist St., Anaheim, CA 92806 714-634-9211
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
† American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 612-788-9161
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217 718-857-2400
§ Computer Power Inc., 124 W. Main St., High Bridge, NJ 08829 ..... 201-638-8000; 800-526-5088
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
§ Displex, Inc., North Hills Electronics, Inc., Alexander Place, Glen Cove, NY 11542 516-671-4400
Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360
§ Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5770 Thornwood Dr., Goleta, CA 93117 805-964-0751
Elgar Corp., 9250 Brown Deer Rd., San Diego, CA 92121 ..... 619-450-0085; 800-854-2213
§ E.P.D., 1045 So. East Street, Anaheim, CA 92805-8508 .. 714-520-0881;1-800-343-1813
ERA/Transpac Power Supplies, West Hill Road, Winsted, CT 06098 203-379-2731
§† E-Tronics, 16774 Schoenborn, Sepulveda, CA 91343 818-892-7279
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
§ HDR Power Systems, Inc., 600 Oakland Park Ave., Columbus, OH 43214 614-262-6832
Industrial Midwec Capacitor Corp., 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
§ ISOREG Corp., 410 Great Rd., P.O. Box 486, Littleton, MA 01460 617-486-9483
§ Jefferson Elec., MagneTek, Inc., 1400 Center Circle Drive, Downers Grove, IL 60515-1021 312-691-2400
Jerome Industries Corp., 730 E. Division St., Elizabeth, NJ 07201 201-353-5700
KGS Electronics, Inc., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 303-651-2011
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
§ Micron Industries, 1830 N. 32nd Ave., Stone Park, IL 60165 312-345-0788
§ Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582 516-561-6050
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223 414-358-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
§ Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
Parker McCrory Mfg. Co., 2000 Forest Ave., Kansas City, MO 64108 816-221-2000
Power Conversion Products, 42 East St., Box 380, Crystal Lake, IL 60014 815-459-9100
† Preferred Electronics, Inc., Main Line Dr., P.O. Box 248, Westfield, MA 01086 413-568-2301
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
Rapid Power Technologies, Graysbridge Rd. , P.O.BOX 291, Brookfield, CT 06804 ..... 203-775-0411;800-332-1111
† RTE Deltec Corp., 2727 Kurtz St., San Diego, CA 92110 .. 619-291-4211;800-854-2658
§ S & H Inds., 2257 North Penn Rd., Hatfield, PA 19440 215-822-7211
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
§ Shape Magnetronics, Inc., 901 DuPage Ave., Lombard, IL 60148 312-620-8394
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
§ Staco Energy Products Co., 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
Staco Transpower, 610 W. 6th St., Mt. Carmel, IL 62863 618-262-5555
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
† STI, Control Components Div., 9520 Black Mountain Rd., San Diego, CA 92126-4507 ..... 619-566-7680;800-826-5053
§ Sunshine Scientific Instruments, 1810 Grant Ave., Philadelphia, PA 19115 215-673-5600
§ Techni-Tool, 5 Apollo Rd., Box 368, Plymouth Meeting, PA 19462 215-825-4990
Teco Corp., Bay Rd., P. O. Box A, Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Ulveco, Inc., 323 Vintage Park Drive, Foster City, CA 94404 415-574-1100
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
Xebex Data Systems, 6610 Buckley Dr., Cambria, CA 93428 805-927-5008
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Wall Plug-in — See Power Supplies, Plug-in (Vol. D)

Transformers, Wideband-5600

AT&T, 555 Union Blvd., Allentown, PA 18103, 1-800-372-2447;In Canada:1-800-553-2448 ..... A•2187
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 ..... A•2194
Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1209
† C & C Jetronic, Inc., Research Pk. 318 Wall St., Princeton, NJ 08540, 609-921-8540 ..... A•2204
Coilcraft, 1102 Silver Lake Rd., Cary, IL 60013, 312-639-2361 ..... A•1225
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2205
† ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558,2215
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2216
Foxboro/PCG, The Foxboro Company, 600 N. Bedford St., E. Bridgewater, MA 02333, 508-378-5260 ..... A•2235
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061, 913-782-0012 ..... A•2239
Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... A•2252-2253
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•2291,2295
† Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 350166, Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1775
† North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•2300-2302
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319,2347, D•1863
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2350
Prem Magnetics, Inc., 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2355
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518, 213-638-1790 ..... A•1291,1695,2395,2397, D•1983
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763, 516-654-1880 ..... A•2426
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•2433
United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600 ..... A•2428
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070, 415-592-8832 ..... A•1715
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
American Magnetics, P.O. Box 49, Carterville, IL 62918 618-985-4838
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147 305-696-6660
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
§ C-COR Elctrns., 60 Decibel Rd., State College, PA 16801 814-238-2461
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217 718-857-2400
† Coast Coil Co., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775

Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
Datatronics, Ltd., P. O. Box 2839, Blue Jay, CA 92317 714-336-3561
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electrical Windings, Inc., 2015 N. Kolmar Ave., Chicago, IL 60639 312-235-3360
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
§ ENI, Inc., Emerson Electric Co., 100 Highpower Road, Rochester, NY 14623 716-427-8300
† Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
Hughes Aircraft Co., Microelctms. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
§† JB Electronic Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 ..... 201-396-9400; 1-800-223-0603
KGS Electronics, Inc., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
† Lorch Electronics, Sub. of Vernitron Corp., 105 Cedar La., Englewood, NJ 07631 201-569-8282
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Mini-Magnetics Co., Inc., 1100 Fulton Place, Fremont, CA 94539 415-490-7500
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223 414-358-5300
Oeco Corp., 4607 S.E. International Way, Milwaukie, OR 97222 503-659-7932
Onan Power/Electronics, 4801 W. 81st St., Minneapolis, MN 55437 612-921-5600
Picosend Pulse Labs, Inc., P.O. Box 44, Boulder, CO 80306 303-443-1249
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
§ Pulse Engineering, Inc., 7250 Convoy Ct., P.O. Box 12235, San Diego, CA 92112 619-268-2400
§ QPL Magnetics, Inc., P.O.BOX C, Lake Grove, NY 11755 516-589-3331
§ Sinclair Radio Laboratories Ltd., 85 Mary St., Aurora, ONT., CANADA L4G 3G9 416-727-0165
South American Development Corp., Rte. 9G, R.D. 413, Hyde Park, NY 12538 914-229-8866
Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209 513-871-3777
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95054 408-988-0700
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Summit Engineering Corp., Box 938, Bozeman, MT 59715 406-587-4511
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245 ... 619-458-1471
† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
† Wayne Transformer Co., Inc., 666 Pacific St., Brooklyn, NY 11217 718-783-9007
Wide Band Engineering Co., Inc., Box 21652, Phoenix, AZ 85036 602-254-1570
† Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 ... 602-861-1856
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers (MIL), Audio, Power, RF-2440 — *See Vol. B*

Transformers (MIL), Pulse & Variable-2440 — *See Vol. B*

Transistor Arrays-4800

† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818, 402-694-6111 ..... A•1742
§ Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... A•2134
§ A E G Corporation, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269 201-231-8300
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), 1699 Roosevelt Ave., Bohemia, NY 11716 516-589-5656
† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
§† Exar Corp., 2222 Qume Dr., P.O.Box 49007, San Jose, CA 95161-9007 408-732-7970
§ Fairchild Camera & Instr. Corp., Linear Div., 313 Fairchild Dr., Mountain View, CA 94139 415-962-4011
Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
§† General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
§ General Transistor Corp., 216 W. Florence Av., Inglewood, CA 90301 ... 213-673-8422
Hitachi America, Ltd., 2210 O'Toole Ave., San Jose, CA 95131 408-435-8300
ICO-RALLY Corporation, 2575 E. Bayshore Rd., Palo Alto, CA 94303 415-856-9900
§† Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
RCA Solid State Div., Linear Integrated Circuits, Rte. 202, Somerville, NJ 08876 201-685-6000
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
§ Rohm Corporation, 8 Whatney, Irvine, CA 92718 714-855-2131
§ Sanken Electric Co., Ltd., Overseas Operations, 1-22-8 Nishi-Ikebukuro, Toshima-ku, Tokyo, JAPAN 171 03-986-6164
§ Semicoa, 333 McCormick Ave., Costa Mesa, CA 92626 714-979-1900
SGS Semiconductor Corporation, 1000 E. Bell Road, Phoenix, AZ 85022 602-867-6100
§† Silicon General, 11861 Western Ave., Garden Grove, CA 92641 714-898-8121
§† Siliconix, Inc., 2201 Laurelwood Rd., Santa Clara, CA 95054 408-988-8000
§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311
§† Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
§† Sprague Electric Company, The Semiconductor Group, 115 Northeast Cutoff, Box 2036, Worcester, MA 01613-2036 617-853-5000
§† Supertex, Inc., 1225 Bordeaux Dr., P.O. Box 3607, Sunnyvale, CA 94088-3607 408-744-0100
§ Thor Electronics, 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300

Transistor Arrays, Surface Mount-4800

† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
§† General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
Philips Circuit Assemblies, A Subdivision of North American Philips Corporation, 5855 N. Glen Pk. Rd., Milwaukee, WI 53209 414-228-7632
§ Rohm Corporation, 8 Whatney, Irvine, CA 92718 714-855-2131
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
Siliconix, Inc., 2201 Laurelwood Rd., Santa Clara, CA 95054 408-988-8000
§† Supertex, Inc., 1225 Bordeaux Dr., P.O. Box 3607, Sunnyvale, CA 94088-3607 408-744-0100

Transistor, Diode, Thyristor Heat Dissipators — See Heat Sinks, Transistor (Vol. C)

Transistors, Bipolar-Also See Transistors, Silicon-4800

American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ..... A•2115
Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... A•2134
§ Allen Bradley Co., Electronics Group, Div. of Rockwell Corp., PTC Div., 23201 S. Normandie Ave., Torrance, CA 90501 213-534-3737
§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
§ Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876 401-762-3800
† California Eastern Labs. Inc., 3260 Jay St., Santa Clara, CA 95054 408-988-3500
§ Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75244 ..... 800-527-0251; 214-233-1589
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§ Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
§† General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
Hitachi America, Ltd., 2210 O'Toole Ave., San Jose, CA 95131 408-435-8300
† Microwave Semiconductor Corp., 100 School House Rd., Somerset, NJ 08873 201-563-6300
§† Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
§ NTE Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
Philips Electronics Ltd., Elcoma Division, 601 Milner Avenue, Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
† Powertech, Inc., 0-02 Fairlawn Ave., Fairlawn, NJ 07410 201-791-5050
§ PPC Products Corporation, 7516 Central Industrial Dr., Riviera Beach, FL 33404 305-848-9606
§† Raytheon Semiconductor, 350 Ellis St., Mountain View, CA 94043 415-968-9211
§† RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 201-685-6000
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
§ Sanken Electric Co., Ltd., Overseas Operations, 1-22-8 Nishi-Ikebukuro, Toshima-ku, Tokyo, JAPAN 171 03-986-6164
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
SGS Semiconductor Corporation, 1000 E. Bell Road, Phoenix, AZ 85022 602-867-6100
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§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311
§ Texet Semiconductors, 301 Texet Dr., Allen, TX 75002 214-727-1111
§† TRW, RF Devices Div., 14520 Aviation Blvd., Lawndale, CA 90260 213-536-0888

Transistors, Bipolar, Surface Mount-4800

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§† Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
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§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311
Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
Sprague Electric Company, The Semiconductor Group, 115 Northeast Cutoff, Box 2036, Worcester, MA 01613-2036 617-853-5000

Transistors, Chip, Unpackaged-4800

American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ..... A•2115
EG & G Vactec, 10900 Page Blvd., St. Louis, MO 63132, 314-423-4900 ... B•1271
NMB Technologies, 9730 Independence Avenue, Chatsworth, CA 91311, 818-341-3355 ..... A•1750-1751
§† Advanced Linear Devices, Inc., 1030 West Maude Ave., Bldg. 501, Sunnyvale, CA 94086-2810 408-720-8737
§ A E G Corporation, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269 201-231-8300

Allen Bradley Co., Electronics Group, Div. of Rockwell Corp., PTC Div., 23201 S. Normandie Ave., Torrance, CA 90501 213-534-3737
Alpha Industries, Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-727-0700
† California Eastern Labs. Inc., 3260 Jay St., Santa Clara, CA 95054 408-988-3500
§ Clairex Electronics, Clairex Corporation, 560 S. 3rd Ave., Mt. Vernon, NY 10550 914-664-6602
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EG&G Rotron, Industrial Division, Saugerties, NY 12477 914-246-3401
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§† General Semiconductor Ind., Inc., Square D Company, 2001 W. 10 Pl., Tempe, AZ 85281 602-968-3101
§ General Transistor Corp., 216 W. Florence Av., Inglewood, CA 90301 ... 213-673-8422
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† Hy-Tec Industries, Div. of Topo Industries, Inc., P.O. Box 91, Shoreham, NY 11786 516-924-8686
International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
† Intersil, 2450 Walsh Ave., Santa Clara, CA 95051 408-996-5000
IXYS Corp., 2355 Zanker Rd., San Jose, CA 95131-1109 408-435-1900
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§† RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 201-685-6000
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§† Semiconductor Technology, Inc., 3131 S.E. Jay St., Stuart, FL 34997 305-283-4500
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† Silicon Transistor Corp., Katrina Rd., Chelmsford, MA 01824 617-256-3321
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
§ Solitron Devices, 8808 Balboa Ave., San Diego, CA 92123 619-278-8780
§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311
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§† Sprague Electric Company, The Semiconductor Group, 115 Northeast Cutoff, Box 2036, Worcester, MA 01613-2036 617-853-5000
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† Teledyne Crystalonics, Teledyne Industries, Inc., 147 Sherman St., Cambridge, MA 02140 617-491-1670
Texas Instrs., Inc., Box 809066, Dallas, TX 75380 ..... 800-232-3200 (ext 700)
Unitrode Corp., 580 Pleasant St., Watertown, MA 02172 617-926-0404

Transistors, Darlington-4800

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§ Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876, 401-762-3800 ... A•2118-2123, B•1269
§ Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2127-2128
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§ Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... A•2134
§ Powerex, Westinghouse, GE, Mitsubishi, Hillis St., Youngwood, PA 15697, 412-925-7272 ..... A•2136
§ A E G Corporation, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269 201-231-8300
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Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
§ Fujitsu Microelectronics, Inc., Sub. of Fujitsu Limited, 3545 North First St., San Jose, CA 95134 408-922-9000
§† General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
§ General Transistor Corp., 216 W. Florence Av., Inglewood, CA 90301 ... 213-673-8422
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Lambda Semiconductors, Veeco Instruments, 121 International Dr., Corpus Christi, TX 78410 ..... 512-289-0403;800-255-9606
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§ NTE Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
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§† Raytheon Semiconductor, 350 Ellis St., Mountain View, CA 94043 415-968-9211
§† RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 201-685-6000
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§ Rohm Corporation, 8 Whatney, Irvine, CA 92718 714-855-2131
§ Sanken Electric Co., Ltd., Overseas Operations, 1-22-8 Nishi-Ikebukuro, Toshima-ku, Tokyo, JAPAN 171 03-986-6164
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§ Semicoa, 333 McCormick Ave., Costa Mesa, CA 92626 714-979-1900
§† Semiconductor Technology, Inc., 3131 S.E. Jay St., Stuart, FL 34997 305-283-4500
§ Semikron, Inc., 11E Executive Dr., P.O. Box 66, Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
SGS-ATES Semiconductor Corp., 240 Bear Hill Rd, Waltham, MA 02154 617-890-6688
SGS Semiconductor Corporation, 1000 E. Bell Road, Phoenix, AZ 85022 602-867-6100
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§† Silicon General, 11861 Western Ave., Garden Grove, CA 92641 714-898-8121
† Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 608-935-2707
§† Silicon Transistor Corp., Katrina Rd., Chelmsford, MA 01824 617-256-3321
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311
§† Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
§† Sprague Electric Company, The Semiconductor Group, 115 Northeast Cutoff, Box 2036, Worcester, MA 01613-2036 617-853-5000
§† Teledyne Crystalonics, Teledyne Industries, Inc., 147 Sherman St., Cambridge, MA 02140 617-491-1670
§ Texet Semiconductors, 301 Texet Dr., Allen, TX 75002 214-727-1111
§† TRW Optoelectronics Div., 1215 W. Crosby Rd., Carrollton, TX 75006 ... 214-323-2200
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Transistors, Darlington, Surface Mount-4800

Powertech, Inc., 0-02 Fairlawn Ave., Fairlawn, NJ 07410, 201-791-5050 .. A•2137
§† General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
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Sprague Electric Company, The Semiconductor Group, 115 Northeast Cutoff, Box 2036, Worcester, MA 01613-2036 617-853-5000

Transistors, Dual-4800

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§ General Transistor Corp., 216 W. Florence Av., Inglewood, CA 90301 ... 213-673-8422
Hitachi America, Ltd., 2210 O'Toole Ave., San Jose, CA 95131 408-435-8300
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
§† Intersil, 2450 Walsh Ave., Santa Clara, CA 95051 408-996-5000
§† Micro Power Sys. Inc., 3100 Alfred St., Santa Clara, CA 95050 408-727-5350
§† Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
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§ Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
§† Precision Monolithics, Inc., 1500 Space Park Dr., Santa Clara, CA 95054-3499 408-727-9222
§† Raytheon Semiconductor, 350 Ellis St., Mountain View, CA 94043 415-968-9211
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† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
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Transistors, Field Effect-4800

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Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St, Methuen, MA 01844 617-682-4661
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Transistors, Field Effect, Surface Mount-4800

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§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-727-0700
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Transistors, Germanium-4800

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§ Semiconductor Technology, Inc., 3131 S.E. Jay St., Stuart, FL 34997 305-283-4500
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
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† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Transistors, Low Noise, GaAs, FETs - Also See Transistors, Microwave-4800

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† California Eastern Labs. Inc., 3260 Jay St., Santa Clara, CA 95054 408-988-3500
† Harris Microwave Semiconductor, 1530 McCarthy Blvd., Milpitas, CA 95035 408-433-2222
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§ Rohm Corporation, 8 Whatney, Irvine, CA 92718 714-855-2131
§† TRW, RF Devices Div., 14520 Aviation Blvd., Lawndale, CA 90260 213-536-0888
Varian Associates, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

Transistors, Microwave-4800

Penstock Engineering Labs., Penstock, Inc., 520 Mercury Dr., Sunnyvale, CA 94086-4018, 408-730-0300 ..... A•1844
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§† TRW, RF Devices Div., 14520 Aviation Blvd., Lawndale, CA 90260 213-536-0888
Varian Associates, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

Transistors, NPN, Surface Mount-4800

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§† General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
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Philips Circuit Assemblies, A Subdivision of North American Philips Corporation, 5855 N. Glen Pk. Rd., Milwaukee, WI 53209 414-228-7632
§ Rohm Corporation, 8 Whatney, Irvine, CA 92718 714-855-2131
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
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§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311
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Transistors, Photo (Incl. Arrays)-3700 — *See Vol. B*

Transistors, PNP, Surface Mount-4800

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Transistors, Power-4800

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§ Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876, 401-762-3800 ..... A•2117-2118,2120,2122,2124-2125, B•1269
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§† Powerex, Westinghouse, GE, Mitsubishi, Hillis St., Youngwood, PA 15697, 412-925-7272 ..... A•2136
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Transistors, Power, Bipolar, Surface Mount-4800

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Transistors, Power, FET-4800

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Transistors, Power, Field Effect, Surface Mount-4800

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Transistors, Pressure Sensitive-4800

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Stow Labs., Inc., Kane Ind'l. Dr., Hudson, MA 01749 617-562-9347

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Transistors, RF, Surface Mount-4800

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§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
§ Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876 401-762-3800
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-727-0700
† California Eastern Labs. Inc., 3260 Jay St., Santa Clara, CA 95054 408-988-3500
§ Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75244 ..... 800-527-0251; 214-233-1589
† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
Ei North America, 435 E. 79th St., New York, NY 10021 212-517-5622
Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
§† General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
§† General Semiconductor Ind., Inc., Square D Company, 2001 W. 10 Pl., Tempe, AZ 85281 602-968-3101
§ General Transistor Corp., 216 W. Florence Av., Inglewood, CA 90301 ... 213-673-8422
Hitachi America, Ltd., 2210 O'Toole Ave., San Jose, CA 95131 408-435-8300
§ International Components Corp., 105 Maxess Rd., Melville, NY 11747 ... 516-293-1500
§ ITT Semiconductors, ITT Corp., 55 Merrimack St., So. Lawrence, MA 01843 617-688-1881
† Microwave Semiconductor Corp., 100 School House Rd., Somerset, NJ 08873 201-563-6300
§† Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
§ NTE Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
† Powertech, Inc., 0-02 Fairlawn Ave., Fairlawn, NJ 07410 201-791-5050
§ PPC Products Corporation, 7516 Central Industrial Dr., Riviera Beach, FL 33404 305-848-9606
§† RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 201-685-6000
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
§ Sanken Electric Co., Ltd., Overseas Operations, 1-22-8 Nishi-Ikebukuro, Toshima-ku, Tokyo, JAPAN 171 03-986-6164
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
§ Semiconductor Technology, Inc., 3131 S.E. Jay St., Stuart, FL 34997 305-283-4500
SGS-ATES Semiconductor Corp., 240 Bear Hill Rd, Waltham, MA 02154 617-890-6688
SGS Semiconductor Corporation, 1000 E. Bell Road, Phoenix, AZ 85022 602-867-6100
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Siliconix, Inc., 2201 Laurelwood Rd., Santa Clara, CA 95054 408-988-8000
§† Silicon Transistor Corp., Katrina Rd., Chelmsford, MA 01824 617-256-3321
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
§ Solid State Electronics Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
§ Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311
§† Teledyne Crystalonics, Teledyne Industries, Inc., 147 Sherman St., Cambridge, MA 02140 617-491-1670
§† TRW, RF Devices Div., 14520 Aviation Blvd., Lawndale, CA 90260 213-536-0888
§† Unitrode Corp., 580 Pleasant St., Watertown, MA 02172 617-926-0404
† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Transistors, Switching-4800

American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ..... A•2115
§ Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876, 401-762-3800 ..... A•2119-2122
§ Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2127-2128
Delta Products Corporation, 3823 Spinnaker Ct., Fremont, CA 94538, 415-770-0660 ..... A•2211
§ Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... A•2134-2135
† Powertech, Inc., 0-02 Fairlawn Ave., Fairlawn, NJ 07410, 201-791-5050 .. A•2137
§ A E G Corporation, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269 201-231-8300
§ Allen Bradley Co., Electronics Group, Div. of Rockwell Corp., PTC Div., 23201 S. Normandie Ave., Torrance, CA 90501 213-534-3737
† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
§† General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
§† General Semiconductor Ind., Inc., Square D Company, 2001 W. 10 Pl., Tempe, AZ 85281 602-968-3101
§ General Transistor Corp., 216 W. Florence Av., Inglewood, CA 90301 ... 213-673-8422
§† Germanium Power Devices, Box 3065, Shawsheen Village Sta., Andover, MA 01810 617-475-5982
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
Hitachi America, Ltd., 2210 O'Toole Ave., San Jose, CA 95131 408-435-8300
§ International Diode, 229 Cleveland Ave., Harrison, NJ 07029 201-482-6518
§† International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
§† Intersil, 2450 Walsh Ave., Santa Clara, CA 95051 408-996-5000
§ ITT Semiconductors, ITT Corp., 55 Merrimack St., So. Lawrence, MA 01843 617-688-1881
IXYS Corp., 2355 Zanker Rd., San Jose, CA 95131-1109 408-435-1900
Lambda Electronics, Veeco Instr., Inc., 515 Broad Hollow Rd., Melville, NY 11747 516-694-4200
Lambda Semiconductors, Veeco Instruments, 121 International Dr., Corpus Christi, TX 78410 ..... 512-289-0403;800-255-9606
§† Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241 .. 415-960-6000
§ NTE Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089

Philips Electronics Ltd., Elcoma Division, 601 Milner Avenue, Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
§† Powerex, Westinghouse, GE, Mitsubishi, Hillis St., Youngwood, PA 15697 412-925-7272
§ PPC Products Corporation, 7516 Central Industrial Dr., Riviera Beach, FL 33404 305-848-9606
§† Raytheon Semiconductor, 350 Ellis St., Mountain View, CA 94043 415-968-9211
§† RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 201-685-6000
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
§ Rohm Corporation, 8 Whatney, Irvine, CA 92718 714-855-2131
§ Sanken Electric Co., Ltd., Overseas Operations, 1-22-8 Nishi-Ikebukuro, Toshima-ku, Tokyo, JAPAN 171 03-986-6164
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
§ Semicoa, 333 McCormick Ave., Costa Mesa, CA 92626 714-979-1900
§† Semiconductor Technology, Inc., 3131 S.E. Jay St., Stuart, FL 34997 305-283-4500
§ SGS-ATES Semiconductor Corp., 240 Bear Hill Rd, Waltham, MA 02154 617-890-6688
SGS Semiconductor Corporation, 1000 E. Bell Road, Phoenix, AZ 85022 602-867-6100
† Shindengen America Inc., 2649 Townsgate Road, Ste. 200, Westlake Vl., CA 91361 805-373-1130
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Silicon Transistor Corp., Katrina Rd., Chelmsford, MA 01824 617-256-3321
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
§ Solitron Devices, 8808 Balboa Ave., San Diego, CA 92123 619-278-8780
§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311
§† Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
§† Teledyne Crystalonics, Teledyne Industries, Inc., 147 Sherman St., Cambridge, MA 02140 617-491-1670
§† Texas Instrs., Inc., Box 809066, Dallas, TX 75380 ..... 800-232-3200 (ext 700)
§† TRW Optoelectronics Div., 1215 W. Crosby Rd., Carrollton, TX 75006 ... 214-323-2200
† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Transistors, Switching, Surface Mount-4800

§ Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876 401-762-3800
§† General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
§† International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
§ ITT Semiconductors, ITT Corp., 55 Merrimack St., So. Lawrence, MA 01843 617-688-1881
§ Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
Philips Circuit Assemblies, A Subdivision of North American Philips Corporation, 5855 N. Glen Pk. Rd., Milwaukee, WI 53209 414-228-7632
§ Rohm Corporation, 8 Whatney, Irvine, CA 92718 714-855-2131
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311
Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900

Transistors, Unijunction-4800

American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ..... A•2115
§ Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... A•2135
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§† General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
§ General Transistor Corp., 216 W. Florence Av., Inglewood, CA 90301 ... 213-673-8422
§† Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
§ NTE Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
Philips Electronics Ltd., Elcoma Division, 601 Milner Avenue, Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
Triac Electronic Systems, Inc., 87-27 Myrtle Ave., Glendale, NY 11385 .. 718-441-4759
§ Unitrode Corp., 580 Pleasant St., Watertown, MA 02172 617-926-0404
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Transistors, Unijunction, Surface Mount-4800

NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300

Transistors (MIL)-2440 — *See Vol. B*

Translators, Data-2325 — *See Vol. D*

Translators, Frequency Band-2700

Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 ..... A•1686
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070, 415-592-8832 ..... A•1715
§ Beckman Industrial Corp., Emerson Electric Co., 3883 Ruffin Road, San Diego, CA 92123 619-495-3200
§ C-COR Elctrns., 60 Decibel Rd., State College, PA 16801 814-238-2461
General Microwave Corporation, 5500 New Horizons Blvd., Amityville, NY 11701 516-226-8900
ISC Datacom, ISC Defense & Space, 1288 Reamwood Ave., Sunnyvale, CA 94089 408-747-0300

Translators, Time Code-2000 — *See Vol. D*

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TRIACs-4800

American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ..... A•2115
§ Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876, 401-762-3800 ..... A•2117
§ Crydom Company, 17215 Studebaker Rd., No. 328, Cerritos, CA 90701, 213-865-3536 ..... B•1397
Phase Control Electronics, 87-27 Myrtle Ave., Glendale, NY 11385, 718-441-4728 ..... D•1140
Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... A•2134
§ Powerex, Westinghouse, GE, Mitsubishi, Hillis St., Youngwood, PA 15697, 412-925-7272 ..... A•2136
Raytheon/TAG Semiconductors Ltd., 43 Third Ave., Burlington, MA. 01803, 617-272-3704 (3705) ..... A•2139-2141
§ Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... B•1291
§ Silicon Power Cube Corp., 6015 Obispo Ave., Long Beach, CA 90805, 213-634-9390 ..... B•1586
§ Teccor Electronics, Inc., 1801 Hurd Dr., Irving, TX 75038, 214-580-1515 ..... A•2146-2149
§ Gentron Corp., 6667 N. Sidney Pl., Milwaukee, WI 53209 414-351-1660
Hutson Industries, 1000 Hutson Cir., Frisco, TX 75034 214-377-3557
§ Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
§ RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 201-685-6000
Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830 201-321-3400
Triac Electronic Systems, Inc., 87-27 Myrtle Ave., Glendale, NY 11385 .. 718-441-4759

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§ Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282, 602-967-7874 ..... A•2069
§ Mepcopal Company, 11468 Sorrento Valley Rd., San Diego, CA 92121, 619-453-0332 ..... A•2088-2089
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•1138
Voltronics Corporation, West St.,, P.O. Box 476, E. Hanover, NJ 07936, 201-887-1517 ..... A•1185
VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181 ..... A•2109, D•1061
§† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700
§ Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050

Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
§ Piher International Corp., 903 Feehanville Dr., Mt. Prospect, IL 60056 ..... 312-390-6680; 800-323-6693
Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
Stetco, Inc., 3344 Schierhorn Ct., Franklin Pk, IL 60131 312-671-4208
† U. S. Laser Corp., 825 Windham Court North, Wyckoff, NJ 07481 201-848-9200

Tube Heat Dissipators-2600 — *See Vol. C*

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Tubing, Metal-2500 — *See Vol. C*

Tubing, Paper-2800 — *See Vol. C*

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Tubing, Spaghetti-2800 — *See Vol. C*

Tubing, Spiral Wrap-2800 — *See Vol. C*

Tubing, Waveguide-3450

† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
§ Applied Plastics Technology, 45 Broadcommon Rd., Bristol, RI 02809 ... 401-253-0200
† Gabriel Electronics, Box 70, Scarborough Indl. Pk., Scarborough, ME 04074 207-883-5161
† Micro-Coax Components, Inc., a UTI Company, Box E, Collegeville, PA 19426 215-489-3700
§ Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Electronics, 104 Gun Avenue, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† Radio Research Instrument Co., Inc., 584 North Main Street, Waterbury, CT 06704-3506 203-753-5840
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Wall, A. T., Co., 55 Service Ave., Warwick, RI 02886 401-739-0740
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Tubing, Zipper-2800 — *See Vol. C*

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Tuners, Microwave-3450

EPD Electronics, Inc., 16921 S. Western Ave., Ste. 110, Gardena, CA 90247, 213-323-7771 ..... D•1063
§† Johanson Manufacturing Corporation, 400 Rockaway Valley Rd., Boonton, NJ 07005, 201-334-2676 ..... A•1099
Penstock Engineering Labs., Penstock, Inc., 520 Mercury Dr., Sunnyvale, CA 94086-4018, 408-730-0300 ..... A•1844
Alford Manufacturing Co., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01801 617-935-8610
Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Eastern Microwave, 40 Ray Ave., Burlington, MA 01803 617-273-4700
† FEI Microwave, Inc., Frequency Electronics, Inc., 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
† Ferretec Inc., 544 Gibralter Dr., Milpitas, CA 95035-6315 408-263-1216
HDS Inc., 12310 Pinecrest Rd., Reston, VA 22091 703-620-6200
§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
† Mallory Components Division, Emhart Elec./Elctrn. Grp., 222 Dixon Rd., Weston, Ont., CANADA M9P 3S5 416-244-4239
† Maury Microwave Corp., 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Micronics Technology Inc., 7 Alexander Place, Glen Cove, NY 11542 ... 516-759-5600
† Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
† Mitec Electronics, 104 Gun Avenue, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
Rockwell International Telecommunications, 1200 N. Alma Rd., Richardson, TX 75081 214-996-5000
Sivers IMA, Div. of Philips, 5669 Selmaraine Drive, Culver City, CA 90230 213-390-7477
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Tuning Forks-2300

ITT Components, ITT Corporation, 5 Jenner .st., Ste. 100, Irvine, CA 92718, 714-727-3001 ..... A•1405
§† Fox Electronics, 5842 Corporation Circle, Ft. Meyers, FL 33905 813-693-0099
† Frequency Control Products, Inc., American Time Products Div., 430 Commack Rd., Deer Pk., NY 11729 516-243-5730
ITT Components, ITT Corporation, 5 Jenner .st., Ste. 100, Irvine, CA 92718 714-727-3001
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
† Philamon, Inc., 33 Dubon Ct., Farmingdale, NY 11735 516-249-2700
SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303 415-856-6900
Savoy Electronics, P.O. Box 5727, Ft. Lauderdale, FL 33310 ..... 305-563-1333; 800-327-1282
T-F Electronics, 4903 Commercial Park Dr., Austin, TX 78724-2638 512-928-8926

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Valve Position Indicators/Transmitters-5500 — *See Vol. B*

Valve Positioners & Actuators-4750

ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, 619-757-7770 ..... A•2074

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Warning Systems (MIL), Laser-3475 — ***See Vol. D***

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Washers, Lock-2825 — ***See Vol. C***

Washers, Plain-2825 — ***See Vol. C***

Washers, Shoulder-2825 — ***See Vol. C***

Waveguide-Coax Adapters-3450

§ Penstock Engineering Labs., Penstock, Inc., 520 Mercury Dr., Sunnyvale, CA 94086-4018, 408-730-0300 ..... A•1844
† Adams-Russell Electronics Co., Inc., Haverhill Rd., Amesbury, MA 01913 617-388-5210
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alford Manufacturing Co., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01801 617-935-8610
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St., Methuen, MA 01844 617-682-4661
Amphenol Products, 4300 Commerce Ct., Lisle, IL 60532 312-983-3500
Andrew Corp., 10500 W. 153rd St., Orland Pk., IL 60462 800-255-1479
† Applied Plastics Technology, 45 Broadcommon Rd., Bristol, RI 02809 ... 401-253-0200
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
† Cablewave Systems, Celwave Systems, Inc., 60 Dodge Ave., North Haven, CT 06473 203-239-3311
§† Dielectric Communications, General Signal, Tower Hill Rd., Raymond, ME 04071 ..... 207-655-4555;800-341-9678
† Eastern Microwave, 40 Ray Ave., Burlington, MA 01803 617-273-4700
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
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§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
† Maury Microwave Corp., 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Micro Mode Prods., 1870 John Towers Ave., El Cajon, CA 92020 619-449-3844
† Microwave Applications Group, 3030 Industrial Pkwy., Santa Maria, CA 93455 805-928-5711
§ Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Electronics, 104 Gun Avenue, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Radio Research Instrument Co., Inc., 584 North Main Street, Waterbury, CT 06704-3506 203-753-5840
Reeve Electronics, Mellish E. Murray, 1715 W. Carroll Ave., Chicago, IL 60612 312-670-0150
Sivers IMA, Div. of Philips, 5669 Selmaraine Drive, Culver City, CA 90230 213-390-7477
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
§† Telephonics Corporation/PRD Instruments, 770 Park Avenue, Huntington, NY 11743 ..... 516-549-6415/6102
U.S. Instr. Rentals, 2988 Campus Dr., San Mateo, CA 94403 800-824-2873
† UTE Microwave, 3500 Sunset Ave., Asbury Park, NJ 07712 201-922-1009
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100
Weinschel Engineering, One Weinschel La., Gaithersburg, MD 20877 .... 301-948-3434; 800-638-2048

Waveguides-3450

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† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
† Cablewave Systems, Celwave Systems, Inc., 60 Dodge Ave., North Haven, CT 06473 203-239-3311
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-8725
† Dielectric Communications, General Signal, Tower Hill Rd., Raymond, ME 04071 ..... 207-655-4555;800-341-9678
† Eastern Microwave, 40 Ray Ave., Burlington, MA 01803 617-273-4700
Flann Microwave, Inc., 6290 Sunset Blvd, Ste. 1126, Los Angeles, CA 90028 213-463-5120
† Gabriel Electronics, Box 70, Scarborough Indl. Pk., Scarborough, ME 04074 207-883-5161
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† Lectro Magnetics, Inc., 6056 W. Jefferson Blvd., Los Angeles, CA 90016 ..... 213-870-9383;(USA):800-325-9814;(CA):800-325-9815
Lectronic Research Labs., Inc., 1423 Ferry Ave., Camden, NJ 08104 609-541-4200
M/A-COM Microwave Components, Inc., South Avenue, Burlington, MA 01803 617-272-3000
† Maury Microwave Corp., 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Micro-Coax Components, Inc., a UTI Company, Box E, Collegeville, PA 19426 215-489-3700
§ Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Electronics, 104 Gun Avenue, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Radio Research Instrument Co., Inc., 584 North Main Street, Waterbury, CT 06704-3506 203-753-5840
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§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
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Tucker Electronics, Box 461966, Garland, TX 75046 ..... 214-348-8800;800-527-4642
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

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Yokes, Deflection, CRT-1800

Multi Products International, 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•2298

† Penn-Tran Corp., Box 1321, Rte. 144N, Wingate, PA 16880, 814-355-1521 ..... A•1280, D•1862

Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876 401-762-3800

Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100

† CELCO, 70 Constantine Dr., Mahwah, NJ 07430 201-327-1123

§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111

Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107

† Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700

Sumitronics, Inc., Sumitomo Corporation, 580 N. Pastoria Ave., Sunnyvale, CA 94086 408-737-7683

† Syntronic Instruments, Inc., 100 Industrial Rd., Addison, IL 60101 312-543-6444

§ Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121

† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

Yokes, Deflection, Oscilloscope-1800

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Zone Boxes, Thermocouple – See Thermocouples, Elements & Accessories (Vol. B)

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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
ABS acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CAMAC computer automated measurement and control
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3
KSR keyboard send /receive

L
LC inductance capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIB microcomputer interface board
MIC microwave IC
MIPS million instructions per second
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

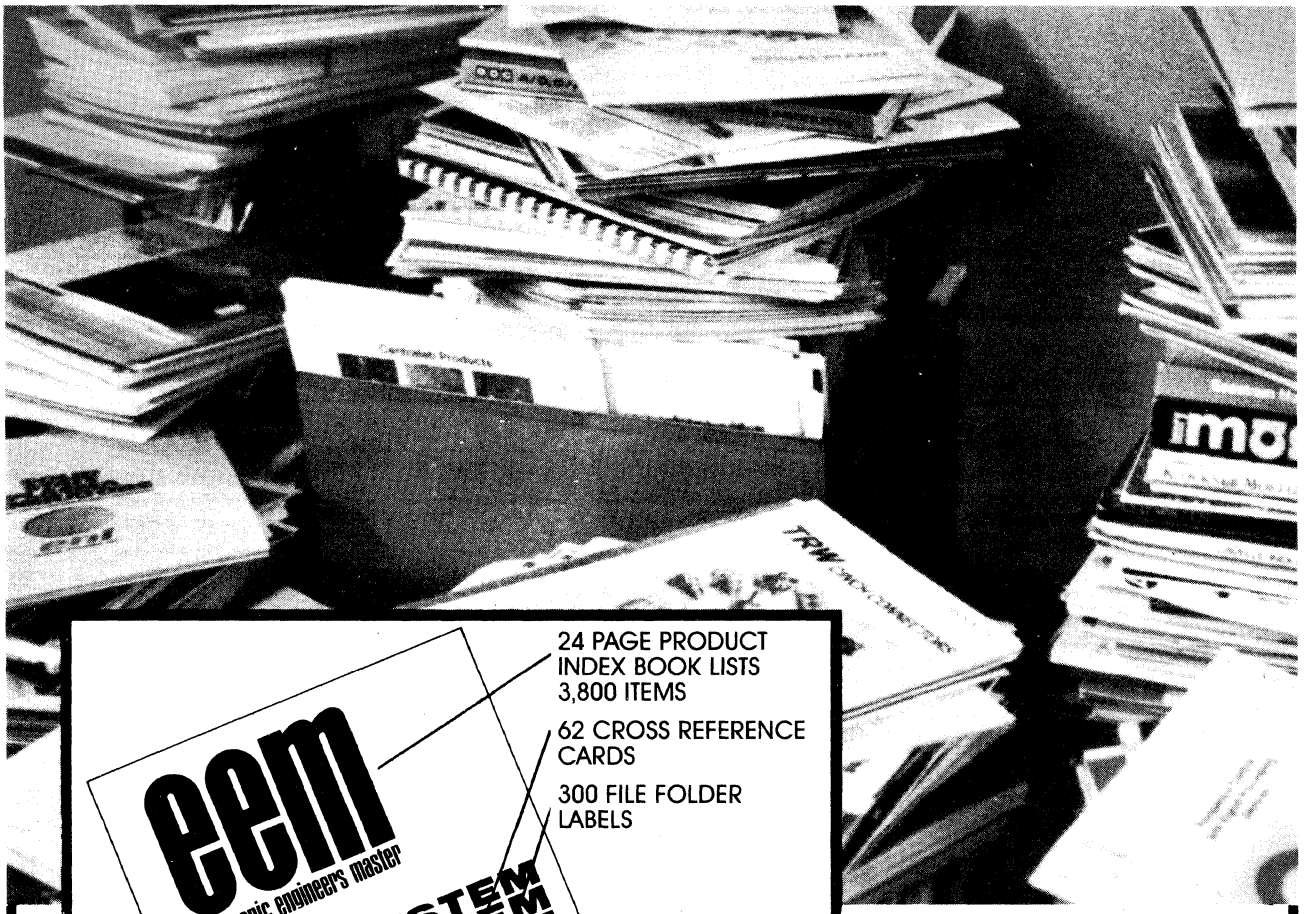
U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

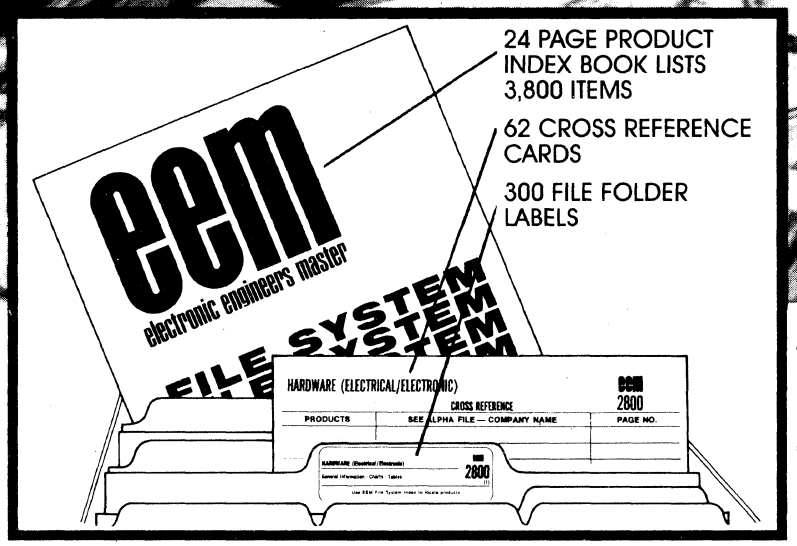
V
VAC volts (of) alternating current
VAN value added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force





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				b5	0	1	0	1	0	1	0	1
b4	b3	b2	b1		0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF	SUB	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF	FS	,	<	L	\	l	|
1	1	0	1	13	CR	GS	-	=	M	]	m	}
1	1	1	0	14	SO	RS	.	>	N	^	n	~
1	1	1	1	15	SI	US	/	?	O	_	o	DEL

Control Character Representations

NUL	Null
SOH	Start of Heading (CC)
STX	Start of Text (CC)
ETX	End of Text (CC)
EOT	End of Transmission (CC)
ENQ	Enquiry (CC)
ACK	Acknowledge (CC)
BEL	Bell
BS	Backspace (FE)
HT	Horizontal Tabulation (FE)
LF	Line Feed (FE)
VT	Vertical Tabulation (FE)
FF	Form Feed (FE)
CR	Carriage Return (FE)
SO	Shift Out
SI	Shift In
DLE	Data Link Escape (CC)
DC1	Device Control 1
DC2	Device Control 2
DC3	Device Control 3
DC4	Device Control 4
NAK	Negative Acknowledge (CC)
SYN	Synchronous Idle (CC)
ETB	End of Transmission Block (CC)
CAN	Cancel
EM	End of Medium
SUB	Substitute
ESC	Escape
FS	File Separator (IS)
GS	Group Separator (IS)
RS	Record Separator (IS)
US	Unit Separator (IS)
DEL	Delete

(CC) Communication Control
(FE) Format Effector
(IS) Information Separator

Special Graphic Characters

SP	Space
!	Exclamation Point
|	Logical OR
"	Quotation Marks
#	Number Sign
$	Dollar Sign
%	Percent
&	Ampersand
'	Apostrophe
(	Opening Parenthesis
)	Closing Parenthesis
*	Asterisk
+	Plus
,	Comma
-	Hyphen (Minus)
.	Period (Decimal Point)
/	Slant
:	Colon
;	Semicolon
<	Less Than
=	Equals
>	Greater Than
?	Question Mark
@	Commercial At
[	Opening Bracket
\	Reverse Slant
]	Closing Bracket
^	Circumflex
¬	Logical NOT
_	Underline
`	Grave Accent
{	Opening Brace
¦	Vertical Line (This graphic is stylized to distinguish it from Logical OR)
}	Closing Brace
~	Tilde

CHARACTERISTICS OF BATTERIES AND FUEL CELLS

System	Anode	Cathode	Theoretical battery		Practical battery		
			Voltage, V	Capacity, Ah/kg	Typical voltage, V	Capacity[a]	
						Wh/kg	Wh/dm³
Primary:							
Leclanche	Zn	MnO_2	1.6	230	1.2	65	175
Magnesium	Mg	MnO_2	2.0	270	1.5	100	195
Organic cathode	Mg	*m*-DNB	1.8	1,400	1.15	130	180
Alkaline MnO_2	Zn	MnO_2	1.5	230	1.15	65	200
Mercury	Zn	HgO	1.34	185	1.2	80	370
Mercad	Cd	HgO	0.9	165	0.85	45	175
Silver oxide	Zn	AgO	1.85	285	1.5	130	310
Zinc-air	Zn	Air (O_2)	1.6	815	1.1	200	190
Li-organic electrolyte	Li	[b]	2.1-5.4	130-660	1.8-3.2	250	400
Secondary:							
Lead-acid	Pb	PbO_2	2.1	55	2.0	37	70
Edison	Fe	Ni oxides	1.5	195	1.2	29	65
Nickel-cadmium	Cd	Ni oxides	1.35	165	1.2	33	60
Silver-zinc	Zn	AgO	1.85	285	1.5	100	170
Silver-cadmium	Cd	AgO	1.4	230	1.05	55	120
Zinc-nickel oxide	Zn	Ni oxides	1.75	185	1.6	55	110
Zinc-air[c]	Zn	Air (O_2)	1.6	815	1.1	150	155
Cadmium-air[c]	Cd	Air (O_2)	1.2	475	0.8	90	90
Zinc-O_2	Zn	O_2	1.6	610	1.1	130	120
H_2-O_2	H_2	O_2	1.23	3,000	0.8	45	65
Reserve:							
Cuprous chloride	Mg	CuCl	1.5	240	1.4	45	65[d]
Silver-chloride	Mg	AgCl	1.6	170	1.5	60	95[d]
Zinc-silver oxide	Zn	AgO	1.85	285	1.5	30	75[e]
Thermal	Ca	[b]	2.8	240	2.6	10	20[f]
Ammonia-activated	Mg	*m*-DNB	2.2	1,400	1.7	22	60[g]
High-temperature	NA	S	2.1	685	1.8	200	[h]
	Li	S	2.2	1,150	1.8	200	[i]
Solid electrolyte	Ag	Polyiodide	0.66	. . .	0.6	180	75[j]
Fuel cell:							
Hydrogen[c]	H_2	Air	1.23	26,000	0.7		[k]
Hydrazine[c]	N_2H_4	Air	1.5	2,100	0.7	800[b]	[l]
Methanol[c]	CH_2OH	Air	1.3	1,400	0.9	175[b]	185[m]

a Delivered capacity when discharged at normal temperatures (20°C) at normal discharge rates.
b Based on fuel consumption only.
c Weight of air not considered in computation of watt hours.
d Water-activated
e Automatically activated; high rate discharge; 2- to 10-min rate.
f Fused salt; heat-activated; high rate discharge; 2- to 10-min rate.
g Four-minute discharge rate.
h β-alumina electrolyte, 300°C operation.
i Fused salt; 350°C operation.
j Solid $RbAg_4I_5$ electrolyte.
k Several different cathode materials used.
l Fuel consumption is based on source of H_2.
m Based on methanol battery-fuel supply in situ.

eem MINIGLOSSARY CAPACITORS

Anode: One of two plates or conductors. In polarized capacitors, the anode should be connected to the positive conductor in the circuit.

Capacitive Reactance: The measure of the opposition of a capacitor to accepting a charge and expressed in ohms. When direct current is applied under stated conditions capacitive reactance becomes a constant but, when alternating current is applied the capacitive reactance varies until an equilibrium is achieved and the capacitor appears to have only direct current present. This condition is commonly used in filter applications or in coupling circuits.

Cathode: One of two plates or conductors. In electrostatic capacitors the cathode is metallic. In electrolytic capacitors the cathode is a liquid, gel or other conductive material which is in intimate contact with a metallic cathodic connection.

Dielectric Constant: The measure of quality of the insulating materials in a capacitor. Dry air has a dielectric constant of one (1). Aluminum oxide used in aluminum electrolytic capacitors has a nominal dielectric constant of ten (10).

Electrolytic: A capacitor with one metallic conductor (generally the anode) and with a liquid or semiconductor cathode. Nonpolarized electrolytic capacitors generally have two equal anodes as well as the liquid cathode. These anodes operate alternately as anode and cathodic connection as alternating current is applied.

Electrostatic: One of two general classes of capacitors in which two or more discrete metallic conductors are present and separated by an insulating dielectric material. Examples include: mica, ceramic, film, and paper types.

Farad: The basic unit of measure in capacitors. A capacitor charged to one volt with a charge of one coulomb (one ampere flowing for one second) has a capacitance of one farad. Capacitors are generally rated at portions of a farad (microfarads or picofarads).

1 farad (F) = 1,000,000 microfarads (μF) 1 microfarad (μF) = 1,000,000 picofarads (pF)

Impedance: All capacitors exhibit impedance. It is a function of capacitor type and internal construction. This can be particularly important in certain applications such as filters for switching power supplies. Capacitors used in these applications often have special multiple tab construction to shorten current paths and to reduce internal resistance.

Leakage Current: Expressed as dcl for electrolytic capacitors, a measure of the intrinsic losses in a charged capacitor. Generally speaking, the lower the dcl, the higher quality the capacitor.

Power Factor: A measure of the overall efficiency of a capacitor. Power factor ratings take all internal losses into consideration in a complex formula. This parameter of certain capacitors is often very important in AC applications such as motor-start and/or motor-run capacitors.

Rated Voltage: The rated working voltage of a capacitor. Generally expressed in DC Volts (Vdcw). This is the voltage at which a capacitor may be safely operated at 25°C continuously within its overall parameters.

Ripple Current: The total amount of alternating and direct current that may be applied to an electrolytic capacitor under stated conditions. In general, the higher the ripple current applied, the shorter the operating life of the capacitor will be. Application of significantly higher than rated ripple currents can shorten the capacitor life dramatically and may even cause catastrophic failure (explosion).

Surge Voltage: The momentary surge voltage which may be applied for a stated length of time without doing permanent damage to the unit.

Temperature: Capacitors are generally rated at 25°C at sea level under specific humidity conditions. Operating temperature ranges are also given, along with derating (reliability) curves for operation at temperatures other than 25°C.

Temperature Coefficient: Expressed as TC in ppm (parts per million) or in percent (%) from the norm of 25°C. This is seldom a straight line and may vary widely for certain types. Most capacitors have positive TC in that the capacitance increases as temperature increases. Some types, however, have negative TC in that the capacitance decreases as temperature increases.

Ceramic Capacitor Codes
(Capacitance Given In pF)

Color	Digit	Multiplier	Tolerance			Temperature Coefficient ppm°C	Significant Figure	Multiplier
			Class 1		Class 2			
			10pF or less	Over 10pF				
Black	0	1	±2.0pF	±20%	±20%	0	0.0	−1
Brown	1	10	±0.1pF	±1%		−33		−10
Red	2	100		±2%		−75	1.0	−100
Orange	3	1000		±3%		−150	1.5	−1000
Yellow	4	10000			+100% −0%	−220	2.0	−10000
Green	5		±0.5pF	±5%	±5%	−330	3.3	+1
Blue	6					−470	4.7	+10
Violet	7					−750	7.5	+100
Gray	8	0.01	±0.25pF		+80% −20%	+150 to −1500		+1000
White	9	0.1	±1.0pF	±10%	±10%	+100 to −750		+10000
Silver								
Gold								

MINIGLOSSARY BASIC CAPACITOR FORMULAS

I. Capacitance (farads)

English: $C = \frac{.224\ K\ A}{t_D}$

Metric: $C = \frac{.0884\ K\ A}{t_D}$

II. Energy stored in capacitors (Joules, watt-sec)

$$E = \tfrac{1}{2}\ CV^2$$

III. Linear charge of a capacitor (Amperes)

$$I = C\frac{dV}{dt}$$

IV. Total Impedance of a capacitor (ohms)

$$Z = \sqrt{R_s^2 + (X_C - X_L)^2}$$

Where Rs = ESR

V. Capacitive Reactance (ohms)

$$X_C = \frac{1}{2\pi fC}$$

VI. Inductive Reactance (ohms)

$$X_L = 2\pi fL$$

VII. Phase Angles:

Ideal Capacitors: Current leads voltage 90°
Ideal Inductors: Current lags voltage 90°
Ideal Resistors: Current in phase with voltage

VIII. Dissipation Factor

$$DF = \tan\delta \text{ (loss angle)} = \frac{ESR}{X_c} = (2\pi fC)\ (ESR)$$

IX. Power Factor

PF = Sine δ (loss angle) = Cos φ (phase angle)
PF = DF (when less than 10%)

X. Quality Factor (dimensionless)

$$Q = \text{Cotan } \delta \text{ (loss angle)} = \frac{1}{DF}$$

XI. Equivalent Series Resistance (ohms)

$$ESR = (DF)\ (Xc) = (DF)\ (\tfrac{1}{2}\pi fC)$$

XII. Power Loss (watts)

Power loss = $(2\pi fCV^2)$ (DF)

XIII. KVA (Kilowatts)

$$KVA = 2\pi fCV^2 \times 10^{-3}$$

XIV. Temperature Characteristic (ppm/°C)

$$TC = \frac{Ct - C_{25}}{C_{25}\ (T_t - 25)} \times 10^6$$

XV. Cap Drift (%)

$$C.D. = \frac{C_1 - C_2}{C_1} \times 100$$

XVI. Reliability of Ceramic Capacitors

$$\frac{L_o}{L_t} = \left[\frac{V_t}{V_o}\right]^x \left[\frac{T_t}{T_o}\right]^\tau$$

XVII. Capacitors in Series (current the same)

Any number: $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} \text{---} + \frac{1}{C_N}$

Two: $C_T = \frac{C_1 C_2}{C_1 + C_2}$

XVIII. Capacitors in Parallel (voltage the same)

$$C_T = C_1 + C_2 \text{---} + C_N$$

XIX. Aging Rate

A.R. = % Δ C/decade of time

XX. Decibels

$$db = 20 \log \frac{V_1}{V_2}$$

Metric prefixes:

Pico	X 10^{-12}
Nano	X 10^{-9}
Micro	X 10^{-6}
Milli	X 10^{-3}
Deci	X 10^{-1}
Deca	X 10
Kilo	X 10^{3}
Mega	X 10^{6}
Giga	X 10^{9}
Tera	X 10^{12}

Symbols:

K = Dielectric Constant
A = Area
t_D = Dielectric thickness
V = Voltage
t = time
R_S = Series Resistance
f = frequency
L = Inductance
δ = Loss angle
φ = Phase angle
x + y = Exponent effect of voltage and temp
L_o = Operating life
L_t = Test life
V_t = Test voltage
V_o = Operating voltage
T_t = Test temperature
T_o = Operating temperature

EEM MINIGLOSSARY CONNECTORS

Connector terminology is often quite confusing. This confusion starts with the very names of connectors. The name of a connector may derive from its shape, application, type of conductor or even method of termination.

Shape—Circular, cylindrical, and rectangular.

Electrical application—High voltage, RF, microwave, input/output, etc.

Mechanical application—Printed circuit, rack & panel, cable, etc.

Conductor type—Coaxial, flat cable, ribbon cable, flex circuit, etc.

Termination method—Wirewrap, soldercup, solderless, etc.

Hardware such as clamps, hoods, and adapters are frequently used to convert cable connectors to rack and panel types. This adds to the name confusion. A very common telephone connector, for example (the "C" type) got its name from the model number of the original maker.

Contact: The part(s) of the connector that actually provides circuit continuity between its two sections—the parts which are normally mated. The back end of the connector should properly be called the *termination.* This is the point where the wires or PC board is attached to the connector.

Contact alignments: Often called *contact float.* Describes the amount of allowable contact movement within the connector body. Permits self-alignment.

Male vs. female: In the U.S. this describes the contact construction. In Europe this term is more often used to describe the outer shell mating action which may be the reverse of the contacts.

Closed entry: A female contact which prevents entry of a male contact larger than a specific size.

Open entry: A female contact designed for a specific size of male contact but which will allow entry of larger male contacts by spring action.

Hermaphrodite: Contacts or connector bodies which are the same configuration. Male/female designations do not apply. Bodies usually have some mechanical means for maintaining polarity.

Hermetic seal: Glass-to-metal seals at terminations. Often used improperly to describe vacuum-tight seals.

Waterproof seal: May or may not be truly *waterproof.* May prevent easy entrance of casual water by means of a rubber or other boot.

Printed circuit connector: Connectors which are used in conjunction with printed circuit boards. There are two distinctly different styles.

Edgeboard. May be called *edge* or *card.* The printed circuit (PC) board edge enters the connector.

Two-piece: One part of the connecting pair is physically attached to the PC board itself. The other part is attached to something else such as a cable or a motherboard.

Readout: Describes the arrangement at the terminating edge of a PC board. May be single or double. A double readout PC board has termination strips on each side not usually interconnected.

Ribbon connectors: A type of connector which allows flat "ribbon" cable to be attached to a round or rectangular connector but also used interchangeably for flat connectors to flat cable.

Ribbon contact connector: Describes the contacts in a rectangular connector which have a self-wiping mating action. Not the same as ribbon connector.

Solderless terminal: Any style of termination which does not require solder for a permanent connection. See *crimp* and *insulation displacement.*

Crimp termination: A stripped wire is inserted into a barrel or trough which is then crimped to the conductor with a suitable tool.

Insulation displacement: Unstripped insulated wire is fitted into a channel containing metal teeth which are forced through the insulation to make contact with the conductor.

Service rating: The maximum rated voltage and/or current which may be applied continuously. May be called *working voltage.* Can be confused with the term used to describe how many times a connector may be mated and separated.

Withstanding voltage: Also called *test voltage.* The voltage a connector must withstand for one minute without breakdown. Applied between connectors and between connectors and shell and any grounding devices of the connector.

MAXIMUM CURRENT CAPACITY—CONDUCTORS

Size, AWG	MIL-W-5088				National Electrical Code	Underwriters Laboratory		American Insurance Association	500 c mils/A
	Copper		Aluminum			60°C	80°C		
	Single-wire	Wire-bundled	Single-wire	Wire-bundled					
30	...	...	...	...	...	0.2	0.4	...	0.20
28	...	...	...	...	...	0.4	0.6	...	0.32
26	...	...	...	...	...	0.6	1.0	...	0.51
24	...	...	...	...	...	1.0	1.6	...	0.81
22	9	5	...	...	...	1.6	2.5	...	1.28
20	11	7.5	...	...	...	2.5	4.0	3	2.04
18	16	10	...	...	6	4.0	6.0	5	3.24
16	22	13	...	...	10	6.0	10.0	7	5.16
14	32	17	...	...	20	10.0	16.0	15	8.22
12	41	23	...	...	30	16.0	26.0	20	13.05
10	55	33	...	...	35	...	...	25	20.8
8	73	46	58	36	50	...	...	35	33.0
6	101	60	86	51	70	...	...	50	52.6
4	135	80	108	64	90	...	...	70	83.4
2	181	100	149	82	125	...	...	90	132.8
1	211	125	177	105	150	...	...	100	167.5
0	245	150	204	125	200	...	...	125	212.0
00	283	175	237	146	225	...	...	150	266.0
000	328	200	...	...	275	...	...	175	336.0
0000	380	225	...	...	325	...	...	225	424.0

MINIGLOSSARY BASIC EBCDIC CODE

Bit Positions 4, 5, 6, 7	Second Hexadecimal Digit	Digit Punches	00				01				10				11				
			00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	Bit Positions 0, 1
			00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	Bit Positions 2, 3
			0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	First Hexadecimal Digit
			12				12	12		12	12	12		12	12				Zone Punches
				11				11	11	11		11	11	11		11			
					0		0		0	0	0		0	0			0		
			9	9	9	9	9	9	9	9									Digit Punches
			①	②	③	④	⑤	⑥	⑦	⑧					⑨	⑩	⑪	⑫	
0000	0	8-1	NUL	DLE	DS		SP	&	-									0	8-1
0001	1	1	SOH	DC1	SOS				⑬		a	j			A	J	⑭	1	1
0010	2	2	STX	DC2	FS	SYN					b	k	s		B	K	S	2	2
0011	3	3	ETX	TM							c	l	t		C	L	T	3	3
0100	4	4	PF	RES	BYP	PN					d	m	u		D	M	U	4	4
0101	5	5	HT	NL	LF	RS					e	n	v		E	N	V	5	5
0110	6	6	LC	BS	ETB	UC					f	o	w		F	O	W	6	6
0111	7	7	DEL	IL	ESC	EOT					g	p	x		G	P	X	7	7
1000	8	8		CAN							h	q	y		H	Q	Y	8	8
1001	9	8-1		EM							;	r	z	`	I	R	Z	9	9
1010	A	8-2	SMM	CC	SM		¢	!	⑮	:									8-2
1011	B	8-3	VT	CU1	CU2	CU3	.	$	,	#									8-3
1100	C	8-4	FF	IFS		DC4	<	*	%	@									8-4
1101	D	8-5	CR	IGS	ENQ	NAK	(	)	_	'									8-5
1110	E	8-6	SO	IRS	ACK		+	;	>	=									8-6
1111	F	8-7	SI	IUS	BEL	SUB	I	¬	?	"									8-7
			12				12				12	12		12	12	12		12	Zone Punches
				11				11				11	11	11		11	11	11	
					0				0		0		0	0	0		0	0	
			9	9	9	9									9	9	9	9	

Card Hole Patterns

①	12-0-9-8-1	⑤	No-Punches	⑨	12-0	⑬	0-1
②	12-11-9-8-1	⑥	12	⑩	11-0	⑭	11-0-9-1
③	11-0-9-8-1	⑦	11	⑪	0-8-2	⑮	12-11
④	12-11-0-9-8-1	⑧	12-11-0	⑫	0		

Control Character Representations

ACK	Acknowledge	EOT	End of Transmission	PF	Punch Off
BEL	Bell	ESC	Escape	PN	Punch On
BS	Backspace	ETB	End of Transmission Block	RES	Restore
BYP	Bypass	ETX	End of Text	RS	Reader Stop
CAN	Cancel	FF	Form Feed	SI	Shift In
CC	Cursar Control	FS	Field Separator	SM	Set Mode
CR	Carriage Return	HT	Horizontal Tab	SMM	Start of Manual Message
CU1	Customer Use 1	IFS	Interchange File Separator	SO	Shift Out
CU2	Customer Use 2	IGS	Interchange Group Separator	SOH	Start of Heading
CU3	Customer Use 3	IL	Idle	SOS	Start of Significance
DC1	Device Control 1	IRS	Interchange Record Separator	SP	Space
DC2	Device Control 2	IUS	Interchange Unit Separator	STX	Start of Text
DC4	Device Control 4	LC	Lower Case	SUB	Substitute
DEL	Delete	LF	Line Feed	SYN	Synchronous Idle
DLE	Data Link Escape	NAK	Negative Acknowledge	TM	Tape Mark
DS	Digit Select	NL	New Line	UC	Upper Case
EM	End of Medium	NUL	Null	VT	Vertical Tab
ENQ	Enquiry				

Special Graphic Characters

¢	Cent Sign
.	Period, Decimal Point
<	Less-than Sign
(	Left Parenthesis
+	Plus Sign
|	Logical OR
&	Ampersand
!	Exclamation Point
$	Dollar Sign
*	Asterisk
)	Right Parenthesis
;	Semicolon
¬	Logical NOT
-	Minus Sign, Hyphen
/	Slash
,	Comma
%	Percent
_	Underscore
>	Greater-than Sign
?	Question Mark
:	Colon
#	Number Sign
@	At Sign
'	Prime, Apostrophe
=	Equal Sign
"	Quotation Mark

MINIGLOSSARY ENCAPSULATION

MATERIALS/HANDLING

Catalyst: A substance which changes the *rate* of chemical reaction. Very small quantities can cause fast change.

Conformal coating Sprayed or dipped. A thin conformal jacket which protects an assembly from moisture or other degrading environments.

Curing agent: See catalyst.

Hardener: See catalyst.

Hermetic: A permanent gas-tight seal.

RTV: Room Temperature Vulcanizing. Associated with silicone rubber sealants which vulcanize at room temperature.

Thermoplastic: Plastic materials which can be made to flow *repeatedly* with the application of heat.

Thermosetting: Plastics which once cured cannot be made to flow again.

Thixotropy: The property of a coating compound which has low viscosity when agitated, but which thickens when the agitation ceases.

Viscosity: Measured in units of *poise* or *centipoise*. The property of a liquid which resists internal flow. Low viscosity equates with thin and vice-versa.

PROCESSING

Casting: Parts or assemblies are placed in a mold. Encapsulating material is added and cured. Part is then removed from the mold.

Dip coating: Part or assembly is dipped into the encapsulating material. Final thickness is determined by number of dips, viscosity, rate of withdrawal, and temperature.

Embedding: Wherein an encapsulant substantially fills all voids in and about an assembly.

Impregnation: A process of encapsulation involving evacuating all air and then allowing the encapsulating material to flow in and fill all voids.

Molding: Similar to casting except this process usually implies multicavity molds and costly machines.

Potting: Wherein the part or assembly is immersed in an encapsulating material contained in a shell which becomes a permanent outer surface after curing.

DIELECTRIC

Arc resistance: An encapsulant's resistance to the formation of a conductive path or track. Measured in time.

Breakdown voltage: The voltage at which an encapsulant fails electrically.

Capacitance: The property of conductors and dielectrics which allows the storage of an electrical charge when the voltage is applied.

Corona: A luminous discharge of electricity due to air ionization when a certain voltage is reached. Can be internal or external. The formation of ozone can cause rapid deterioration of certain materials.

Dielectric: Insulator (Nonconductor.)

Dielectric constant: The property of a material that determines its ability to store electrostatic energy.

Dielectric strength: The ratio of dielectric breakdown to the thickness of insulating material.

Dissipation factor: The ratio of a dielectric material's energy losses.

Flashover: Point at which an electric discharge occurs around an edge or across a surface. Can result in a carbon track and permanent degradation.

Insulation resistance: (IR) An insulating material's total DC leakage.

Surface resistivity: The resistance of the surface of an insulating material to the flow of direct current.

Voltage endurance: Sometimes called corona resistance. The ability of a material to withstand the application of sustained high voltage.

Volume resistivity: The resistance of a material to direct current flow as a measure of volume. Expressed as ohm-centimeters.

MINIGLOSSARY OPTO SEMICONDUCTORS

Avalanche Photodiode: A photodiode that takes advantage of avalanche multiplication of photocurrent. It is particularly suited to low noise and/or high speed applications.

Contrast: A noticeable difference in color, brightness, or other characteristics in a side-by-side comparison.

Chrominance Contrast: The color contrast between two adjacent surfaces of identical area, shape, texture, and luminance. The human eye is more sensitive to differences in color than it is to differences in brightness.

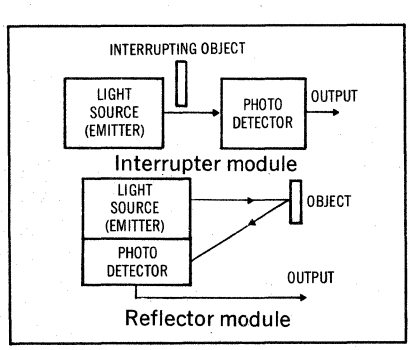
Current Transfer Ratio: The ratio of an optocoupler's output current to input current at a specified bias.

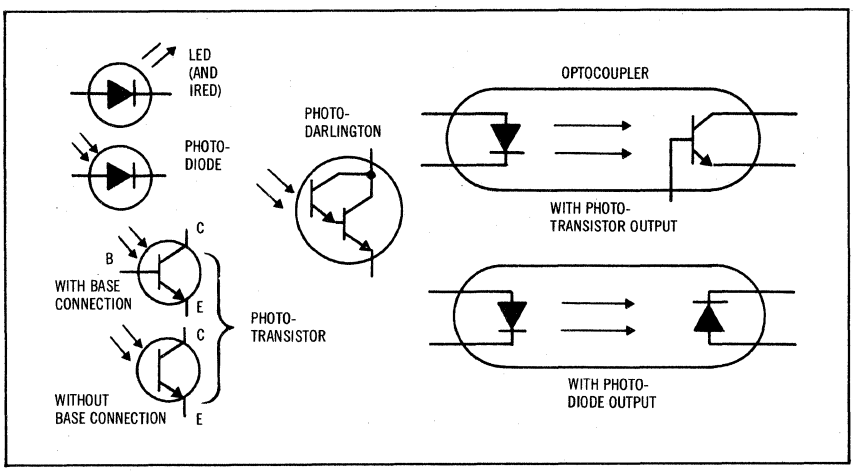
Dark Current: The leakage current of a photodetector with no incident light.

Dominant Wavelength: The wavelength that is a quantitative measure of apparent color of light as perceived by the human eye.

Infrared Radiation: The electromagnetic wavelength region between approximately 0.75 and 100 micrometers longer than the wavelength of visible light.

Interrupter (module): A device that produces an electrical output signal when an object breaks the light (visible or invisible) between a light source and a photodetector.





IRED: An infrared-emitting diode. See light-emitting diode.

Light Current: The current that flows through a photodetector when it is exposed to radiant energy.

Light-Emitting Diode (LED): A semiconductor diode that emits incoherent light at its PN junction when forward biased. The light can be in the visible or invisible (infrared) wavelength region.

Luminance Contrast: The observed brightness of a light-emitting element compared to the brightness of the "surround," an integral part of the device and inseparable from it.

Optocoupler: A device that transmits electrical signals, without electrical connection, between a light source (input) and the receiver (output). The input is generally an LED; the output might be a photodiode, phototransistor, a photo–Darlington, etc. Sometimes referred to as optoisolator.

Peak Wavelength: The wavelength at the peak of the radiated spectrum of an emitter.

Photo–Darlington: A light-sensitive Darlington-connected transistor pair. The photo–Darlington has a very high sensitivity to illumination or radiation.

Photodetector: A device that provides an electrical output signal when subjected to radiation in the visible, infrared, or ultraviolet regions of the electromagnetic spectrum. Photodiodes, phototransistors, and photo–Darlingtons are the most common type of photodetectors.

Photodiode: A junction diode that is responsive to radiant energy. Photodiodes have a high degree of linearity between the input radiation and the output current, and faster switching speeds than phototransistors.

Photothyristor: A thyristor whose switching action is controlled by light applied to the thyristor gate.

Phototransistor: A light-sensitive transister that delivers an electrical output proportional to the light intensity at its input. The low-level photocurrent that is generated is amplified by the current gain of the transistor. The base region (or gate in a FET) may or may not be brought out as an external terminal.

Point Source: A source with a maximum dimension less than one-tenth the distance between sources and detector.

Reflector (module): A device containing a light source and a photodetector that detects any object that reflects light produced by the source back to the detector.

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
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TECHNICAL INFORMATION

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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
ABS acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CAMAC computer automated measurement and control
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3)
KSR keyboard send /receive

L
LC inductance capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIB microcomputer interface board
MIC microwave IC
MIPS million instructions per second
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

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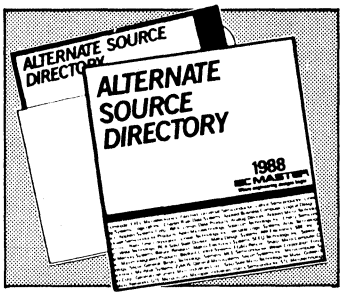

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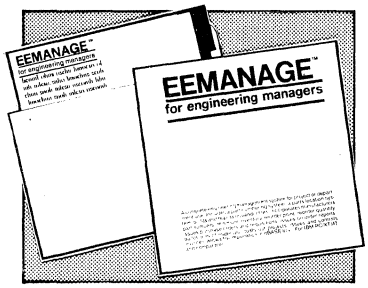

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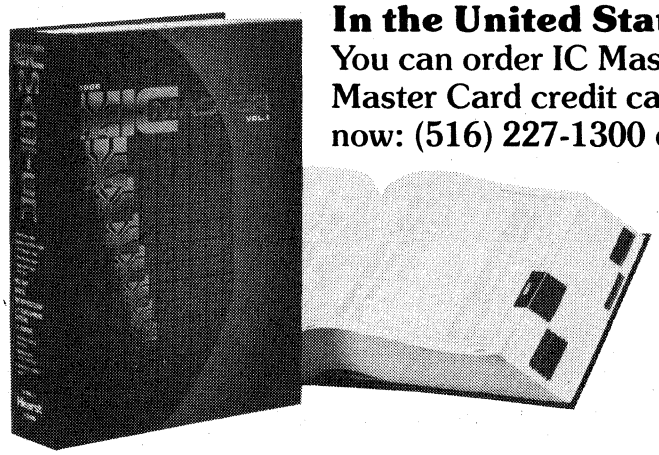

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88
89 Manufacturers and Sales Offices Directory

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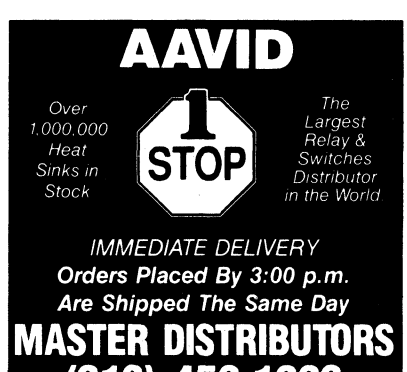

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MA Wilmington, Allied Elctrns. 617-942-0150
MA Woburn, Macbearing Co. 617-933-2110
MI Farmington Hills, Advent Elctrns. Inc. .. 313-477-1650
MN Bloomington, Bergquist Co. 612-835-2322
MN Minneapolis, Aero-Space Computer Supp. 612-884-4725
MN St. Paul, Chris Elctrns. 612-631-2647
MO St. Charles, Finnigan Elctrns. 314-946-6201
MO St. Louis, Ric-Tronics 314-576-9816
NH Hampstead, A E I 603-329-5656
NH Salem, Cronin Elctrns., Inc. 603-898-4440
NJ Frenchtown, Sintec Co. 201-996-4093
NJ Mt. Laurel, Future Elctrns. Inc. 609-778-7600
NJ Springfield, Route Elctrns. 201-379-7710
NY Bohemia, Car-Lac Elctrns. 516-567-4200
NY Buffalo, Summit Distrs. inc. 716-887-2800
NY Elmhurst, Century Fasteners Corp. 718-446-5000
NY Holtsville, Tower Fasteners 516-289-8800
NY Liverpool, Future Elctrns. Inc. 315-451-2371
NY Mineola, Allied Elctrns. 516-248-2360
NY Mt. Vernon, Q A R Indl. Elec. 914-699-2224
NY Rochester, Masline Elctrns. Inc. 716-546-5373
NY Rochester, Summit Elctrns. Inc. 716-334-8110
NC Charlotte, Century Fasteners Corp. ... 704-554-0444
NC Greensboro, Golden Elctrns. 919-294-4653
NC Greensboro, Hammond Elctrns. Inc. ... 919-275-6391
NC Raleigh, Century Elctrn. Comps. 919-782-2116
NC Raleigh, Century Fasteners Corp. 919-787-1800
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Cincinnati, Schuster Elctrns. 513-489-1400
OH Twinsburg, Schuster Elctrns. 216-425-8134
OH Warren, REM Elctrns. 216-373-1300
OK Tulsa, Carlton-Bates Co. Inc. 918-250-1626
OR Beaverton, Acacia/VWR Elctrns. 503-646-3377
OR Beaverton, Comp. Resources 503-641-8488
OR Beaverton, Future Elctrns. Inc. 503-626-2977
OR Beaverton, Murphy Elctrns. 503-642-2001
OR Portland, Dunn Elctrns. 503-285-0214
PA Carisle, Cumberland Elctrns. 717-243-8006
PA Erie, REM Elctrns. 814-453-5626
PA Harrisburg, Cumberland Elctrns. 717-232-5999
PA Lancaster, Cumberland Elctrns. 717-393-8304
PA Lewistown, Cumberland Elctrns. 717-249-9631
PA Norristown, Century Elctrn. Comp. 215-631-5400
PA Philadelphia, P E I-Genesis 800-523-0727
PA Philadelphia, Shap Elctrns. 215-969-3300
PA York, Cumberland Elctrns. 717-845-8791
SC Greenville, Hammond Elctrns. Inc. 803-233-4121
SC W. Columbia, Century Fasteners Corp. 803-791-1800
TN Memphis, Carlton-Bates Co. Inc. 901-365-3539
TN Nashville, Carlton-Bates Co. Inc. 615-244-3562
TX Austin, Wofford Elctrns., Inc. 512-339-1131
TX Ft. Worth, Allied Elctrns. 817-336-5401
TX Houston, Wofford Elctrns., Inc. 713-847-3583
TX Richardson, Comps. Cen. Inc. 214-664-3444
TX Texarkana, Carlton-Bates Co. Inc. 214-792-6923
UT Salt Lake City, Future Elctrns. Inc. 801-972-8489
VA Richmond, Century Fasteners Corp. .. 804-262-8671
WA Bellevue, Future Elctrns. Inc. 206-881-8199
WA Kent, Pyramid Elctrns. 206-872-5800
WA Redmond, Comp. Resources 800-547-6523
WA Redmond, Energy Sls. Inc. 206-883-2342
WA Redmond, Murphy Elctrns. 206-881-1234
WA Seattle, Allied Elctrns. 206-547-2827
WI New Berlin, N E P Elctrns. Inc. 414-785-9100
Can Calgary, Alberta, Future Elctrns. Inc. ... 403-259-6408
Can Downview, Ont., Future Elctrns. Inc. ... 416-638-4771
Can Edmonton, Alberta, Future Elctrns. Inc. 403-438-2858
Can Mississauga, Ont., Prelco 416-678-0401
Can Mississauga, Ont., Rush Elctrns. 416-677-7280
Can Montreal, Que., Prelco 514-389-8051
Can Nepean, Ont., Carsten Elctrns. Ltd. 613-726-9250
Can Ottawa, Ont., Future Elctrns. 613-820-8313
Can Pointe Claire, Que., Future Elctrns. Inc. 514-694-7710
Can Scarborough, Ont., Carsten Elctrns. Ltd. 416-495-9999
Can St. Laurent, Que., Carsten Elctrns. 514-334-8321
Can Vancouver, BC, Future Elctrns. Inc. ... 604-294-1166
Can Victoria, BC, Queale Elctrns. Ltd. 604-388-6111
Can Winnipeg, Manitoba, Future Elctrns. Inc. 204-339-0554

FAX: 201-526-6866

ABACUS CONTROLS INC., 89 Readington Rd., Somerville, NJ 08876, Tel: 201-526-6010, TELEX: 888186 ABACUS CONT UD; FSC No.: 54241; Empl.: 45; *Sls. Mgr.:* L. Albrecht ..... **D•2063-2065**

Local Sales Offices & Reps

AL Huntsville, Scientific Dvcs. 205-536-1969
CA Los Angeles, Power Partners 800-468-5400
CA San Diego, Power Partners 800-468-5400
CA Santa Clara, Source Tronics 408-988-8801,
CT New London, Elctrn. Sls. of New England 203-443-2646
FL Ft. Walton Beach, Scientific Dvcs. 904-651-4407
FL Orlando, Scientific Dvcs. 305-841-8180
GA Atlanta, Scientific Dvcs. 205-536-1969
GA Savannah, Scientific Dvcs. 904-651-4407
MA Wareham, Elctrn. Sls. of New England 617-295-7634
MO St. Louis, AME Sls. 314-962-9771,
NC Winston-Salem, Scientific Dvcs. 919-765-5776
TX Dallas, True Techn. 214-691-7870
EXP New York, NY, XPort Trading Co. 212-466-4204,

ABALON PRECISION MFG., 1040 Home Street, Bronx, NY 10459, Tel: 212-589-5682, FAX: 212-589-0300; Empl.: 25; *Sls. Mgr.:* Norman C. Orent

Abbott TECHNOLOGIES, INC.

FAX: 818-954-9305

ABBOTT TECHNOLOGIES, INC., Burbank Division, Transformers, 639 So. Glenwood Pl, Burbank, CA 91506, Tel: 818-841-3630, TELEX: 69-6282; FSC No.: 58910; Empl.: 50; *Sls. Mgr.:* P. Ferrari ..... **A•2157-2166**

Local Sales Offices & Reps

AZ Scottsdale, SMS & Assocs. 602-998-0831
FL Altamonte Springs, Gugel Assocs. Inc. 305-788-0845
IL Hinsdale, Palatine Engrg. & Sls. (CKC) 312-655-0668
IN Indianapolis, JFCO, Inc. 317-576-9363
IA Cedar Rapids, Palatine Engrg. & Sls., Inc. 319-365-8071
KS Wichita, Palatine Engrg. & Sls., Inc. 316-262-1020
MI Grand Rapids, JFCO, Inc. 616-949-1020
MN Minneapolis, Holmgren Assocs., Inc. .. 612-786-7641
MO Hazelwood, Palatine Engrg. & Sls., Inc. 314-839-0800
NJ Ft. Lee, Abbott Transistor Labs. 201-461-4411
OH Vandalia, JFCO, Inc. 513-890-8322
PA Pittsburgh, JFCO, Inc. 412-823-5400
TN Nashville, Mil-Spec Sls. Co. 615-367-2427
TX Richardson, Abbott Transistor Labs. .. 214-437-0697
Can Rexdale, Ontario, Source Elctrns., Ltd. 416-676-0830

abbott

FAX: 213-939-1995

ABBOTT TRANSISTOR LABS, Power Supplies, 2727 S. La Cienega Blvd., Los Angeles, CA 90034, Tel: 213-936-8185, TELEX: 69-1398; FSC No.: 15755; Empl.: 500; *Sls. Mgr.:* Mike Brown ..... **D•1505-1520**

Local Sales Offices & Reps

AZ Scottsdale, SMS & Assocs. 602-998-0831
CA Mtn. View, Martinez & Assocs. 415-966-1012
FL Altamonte Springs, Gugel-Tuttle Assocs. Inc. 305-788-0845
NJ Ft. Lee, Abbott Transistor Labs. 201-461-4411
NY Liverpool, R&D Assocs., Inc. 305-688-0845
OK Tulsa, General Sls. & Assocs. 918-622-7744
TX Richardson, Abbott Transistor Labs. .. 214-437-0697
UT Bountiful, Anderson & Assocs. 801-292-8991
WA Bellevue, Comtec 206-453-1188
Can Ottawa, Subtec Ltd. 613-738-1470

ABBOTT TECHNOLOGIES, INC., Sun Valley Division, Power Supplies, 8203 Vineland Ave., Sun Valley, CA 91352, Tel: 818-504-0644, TELEX: 75-2972, FAX: 818-768-0395; Empl.: 30; *Sls. Mgr.:* Frank Goitz ..... **D•1521-1529, 2066-2067**

Local Sales Offices & Reps

IN Indianapolis, John Sukup Inc. 317-253-5501
MN Minneapolis, Holmgren Assocs. 612-786-7641
MO Kansas City, Abrams & Assocs. 314-569-0447

ABL ELECTRONICS SUPPLY, INC., 1736 Front St., Yorktown Hgts., NY 10598, Tel: 914-962-2253, FAX: 914-962-2296; Empl.: 18; *Sls. Mgr.:* George Wiesel ..... **C•1768-1769**

ABLE POWER AND ENGINEERING INC., 1222 N. Delta St., S. San Gabriel, CA 91770, Tel: 818-571-6260, TELEX: 287020 SCS UR; Empl.: 25; *Sls. Mgr.:* Joe Chou; *Dist. Mgr.:* Bob Thomas

ABLESTIK LABORATORIES, 833 W. 182nd St., Gardena, CA 90248, Tel: 213-532-9341, TWX: 910-346-7606, FAX: 213-516-9417; FSC No.: 21109; Empl.: 150; *Sls. Mgr.:* D. W. Lefever

ABORN ELECTRONICS INC., 2108 D Bering Dr., San Jose, CA 95131, Tel: 408-436-5444, TELEX: 184817 MSGSNDR, FAX: 408-287-4535; FSC No.: 8Z441; Empl.: K. Bomin; *Sls. Mgr.:* V. Lumba

ABRAMS INSTRUMENT CORP., 2859 W. Jolly Rd., Okemos, MI 48864, Tel: 517-332-6405, TWX: 810-251-0785; FSC No.: 00048; *Sls. Mgr.:* Merlyn Gates

A B TOOL & MFG., INC., Engineered Automation Div., 152 Cregar Road, High Bridge, NJ 08829, Tel: 201-638-8555, TELEX: 847-340; Empl.: 25; *Sls. Mgr.:* David F. Mowen

ACC ELECTRONICS COMPANY, Echlin Inc., 1300 W. Oak, Independence, KS 67301, Tel: 316-331-1000, TELEX: 436483, FAX: 316-331-1000 (ext. 440); Empl.: 1000; *Sls. Mgr.:* Leon Allen

ACCESSORIES FOR ELCTRNS., INC., 800 Merrick Rd., Baldwin, NY 11510-3593, Tel: 516-546-1751, FAX: 516 867-1922; FSC No.: 54355; Empl.: 20; *Sls. Mgr.:* Bill Harris

ACCUDYNE CORP., P.O. Box 1429, Janesville, WI 53547, Tel: 608-752-9081; FSC No.: 18356; Empl.: 540; *Sls. Mgr.:* R. E. Mowris; *Dist. Mgr.:* R. E. Mowris

ACCUGRAPH CORP., 50 Gervais Drive, Suite 204, Don Mills, ONT, Canada M3C 1Z3, Tel: 416-441-2211, TELEX: 06-986973, FAX: 416 441-2228; Empl.: 155; *Sls. Mgr.:* Dennis Kukulsky; *Dist. Mgr.:* Dennis Kukulsky

ACCULEX CORPORATION, MetraByte, 440 Myles Standish Blvd., Taunton, MA 02780, Tel: 617-880-3660, TELEX: 240713; *Sls. Mgr.:* Ben Bailey ..... **D•1352**

ACCUMET ENGINEERING, 518 Main St., Hudson, MA 01749, Tel: 617-568-8311, FAX: 617-562-4384; *Sls. Mgr.:* C. T. Haering

Local Sales Offices & Reps

MD	Pasadena, Spectro-Lambda	301-437-7633
NJ	Clarksburg, Micro-Lambda	609-259-0400
NY	Huntington, Compar New York	516-423-5660
TX	Dallas, C & J Assocs.	214-450-5872

ACCUPROBE, INC., 1 Harrison Ave, Box 1044, Salem, MA 01970, Tel: 617-745-7878, TELEX: 882194 Accuprobe UD, FAX: 617-745-7922; Empl.: 26; *Sls. Mgr.:* Thomas H. Murphy; *Dist. Mgr.:* T. H. Murphy

ACCURATE ELECTRONICS, 169 S. Abbe Rd., P.O. Box 1287, Elyria, OH 44036, Tel: 216-366-6330, TELEX: 469705; FSC No.: 11375; Empl.: 35; *Sls. Mgr.:* J. F. Seybold

Accuride

FAX: 213-903-0208

ACCURIDE, 12311 Shoemaker, Santa Fe Springs, CA 90670, Tel: 213-944-0921, TWX: 910-586-1632; *Sls. Mgr.:* Jackie Pinto; *Dist. Mgr.:* Bill Kniegge ..... **C•1006-1009**

Local Sales Offices & Reps

CA	Belmont, Accuride	415-594-2830
CA	Diamond Bar, Accuride	213-944-0921
CA	Santa Fe Springs, Accuride	213-944-0921
GA	Dunwoody, Accuride	404-449-3350
IL	Wood Dale, Accuride	312-843-2585
MA	Holliston, Accuride	617-429-2474
MA	Leominster, Accuride	617-537-8985
NY	Rochester, Accuride	717-227-5835
TX	Dallas, Accuride	214-492-4633

ACCUSONIC DIVISION, Ferranti O.R.E. Inc., Box 709, Falmouth, MA 02541, Tel: 617-548-5800, TELEX: 6817399 OREFAL UW; Empl.: 125; *Sls. Mgr.:* Robert Beede

ACCUSONIC SYSTEMS CORP., Designatronics, Inc., 2101 Jericho Turnpike, New Hyde Park, NY 11040, Tel: 516-328-3300; Empl.: 15 (This Subsidiary); *Sls. Mgr.:* Dennis Goodman

ACCUTRONICS/CONNOR-WINFIELD, See Connor-Winfield

acdc electronics

FAX: 619-439-4243

ACDC ELECTRONICS, Div. of Emerson, 401 Jones Rd., Oceanside, CA 92054, Tel: 619-757-1880, TWX: 910-322-1470; Empl.: 750; *Sls. Mgr.:* Mike Kirkowski; *Dist. Mgr.:* Ray Brown ..... **D•1195, 1530-1533**

Local Sales Offices & Reps

CA	Burbank, ACDC	818-848-9252
CA	Orange City, ACDC	619-439-4200
CA	San Diego, ACDC	619-942-7230
CA	Santa Clara, ACDC Elctrns.	408-727-1626
CO	Englewood, Omega Ltd.	203-265-2972
CT	Wallingford, ACDC	203-265-2972
FL	Sanford, ACDC Elctrns.	305-321-8121
IL	Elk Grove Vl, Tri Star Grp.	312-593-0200
IL	Naperville, ACDC Elctrns.	312-355-8444
IN	Indianapolis, EMCI	317-253-1668
KS	Kansas City, Rush & West	913-764-2700
MA	Sudbury, ACDC Elctrns.	617-443-9903
MN	Minneapolis, Components	612-374-1250
MO	Ballwin, Rush & West	314-965-3322
NY	Binghamton, Tri-Tech	510-252-0891
NY	Hudson Valley, Tri-Tech	914-897-5611
NY	Islip, ACDC	516-348-7710
NY	Rochester, Tri-Tech	716-385-6500
NY	Syracuse, Tri-Tech	315-446-2881
OH	Cleveland, Lyons Corp.	216-659-9224
OH	Columbus, Lyons Corp.	614-890-2743
OH	Dayton, Lyons Corp.	513-278-0714
OK	Bixby, MGR Elctrns.	918-369-5186
OR	Beaverton, Earl & Brown	503-644-9230
PA	Philadelphia, Tech. Sls.	215-675-8600
TX	Austin, ACDC Elctrns.	512-250-1011
TX	Austin, MGR Elctrns.	512-250-0926
TX	Dallas, MGR ELctrns.	214-238-5246
TX	Houston, MGR Elctrns.	713-497-8306
WA	Redmond, Earl & Brown	206-875-5064
Can	Burnaby, BC, Webster Instrs.	604-434-2611
Can	Montreal, Que., Webster Instrs.	514-744-5829
Can	Toronto, Webster	416-625-0600

Local Distributors

CA	Chatsworth, Time Elctrns.	714-937-0911
CA	San Carlos, Lo-Dan	415-592-4600
CA	Torrance, Time Elctrns.	818-998-7200
CO	Englewood, Displays Elctrns.	303-779-8053
CT	Wallingford, Cronin Elctrns.	203-265-3134
FL	Largo, Lo-Dan	813-586-2851
GA	Norcross, Applied Power Inc.	404-263-0421
ID	Mt. Prospect, Magnuson Elctrns.	800-323-9773
IL	Arlington Hgts., Lo-Dan	312-398-5311
IL	Chicago, Newark Elctrns.	312-784-5100
IN	Indianapolis, Mar Elctrns.	317-633-6699
MD	Baltimore, PEI Genesis	301-296-9333
MD	Columbia, Time Elctrns.	301-964-3090
MD	Edina, Time Elctrns.	612-835-1250
MA	Boston, Time Elctrns.	617-935-8080
MA	Needham, Cronin Elctrns.	617-449-5000
MI	Madison Hgts., McNaughton-McKay	313-399-7500
MO	St. Louis, Time Elctrns.	314-391-6444
NJ	Pinebrook, Time Elctrns.	201-882-4611
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Syracuse, Time Elctrns.	315-432-0355
OH	Cincinnati, Hughes Peters, Inc.	513-351-2000
OH	Columbus, Hughes Peters, Inc.	614-294-5351
OR	Portland, Time Elctrns.	503-684-3780
PA	Philadelphia, Philadelphia Elctrns.	607-365-6704
TX	Dallas, Norvell Elctrns.	214-233-0020
WA	Redmond, Priebe Elctrns.	206-881-2363
WA	Redmond, Time Elctrns.	206-641-3640

ACD-ELCOR PRODUCTS, P.O. Box 244, Bethel, CT 06801, Tel: 203-743-3510; Empl.: 3

ACHESON COLLOIDS, Div. of Acheson Industries, Inc., P.O. Box 611747, Port Huron, MI 48061-1747, Tel: 313-984-5581, TWX: 810-231-5265; Empl.: 200

ACI DATA PRODUCTS, 17921 Sampson Ln., Huntington Beach, CA 92647, Tel: 714-842-2945, TELEX: 655328; Empl.: 10; *Sls. Mgr.:* J. Rogers

A.C. INTERFACE INC., 15560 Rockfield, Unit 1E, Irvine, CA 92718, Tel: 714-472-9524, TELEX: 655-328; FSC No.: OAP 78; Empl.: 23; *Sls. Mgr.:* Bill Roth; *Dist. Mgr.:* Ray Ponkey

ACL INC., 1960 E. Devon Ave., Elk Grove, IL 60007, Tel: 312-981-9212, 800-STATIC-0, TELEX: 4330251; Empl.: 8; *Sls. Mgr.:* Ralph D. Considine

ACME DIVISION, Allied Products Corporation, P.O. Box 1404, New Haven, CT 06505, Tel: 203-562-2171, TELEX: 295503 Acme UR; Empl.: 75; *Sls. Mgr.:* Marvin Leonard

Acme Electric Electronic Distribution

FAX: 716-968-3948

ACME ELECTRIC CORPORATION, 20 Water Street, Cuba, NY 14727, Tel: 716-968-2400; *Sls. Mgr.:* Dale Guilford; *Dist. Mgr.:* Donald Chesner ..... **D•1534-1536**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean	205-830-1540
AZ	Phoenix, O'Donnell Assocs. S.W.	602-944-9542
CA	San Jose, O'Donnell Assocs., North	408-432-1940
CO	Englewood, Harthun Assocs.	303-792-5050
FL	Deerfield Bch., Cartwright & Bean	305-429-3400
FL	Orlando, Cartwright & Bean	305-422-4531
GA	Norcross, Cartwright & Bean	404-368-0160
IL	Des Plaines, Electron Mktg.	312-298-2330
IN	Ft. Wayne, Needler Sls. Co., Inc.	219-447-2123
IN	Indianapolis, Luebbe Sls.	317-845-7389
IN	Indianapolis, Needler Sls. Co., Inc.	317-255-8056
KS	Shawnee Mission, Lowell Kangas & Assocs.	913-631-3515
LA	Covington, Cartwright & Bean	504-892-1780
MD	Gaithersburg, Naudain Assocs.	301-258-5040
MA	Framingham, Marathon Sls.	617-875-3566
MI	Jackson, Cartwright & Bean	601-981-1170
MI	Livonia, Luebbe Sls.	313-477-3131
MN	Minneapolis, Boerger & Assocs.	612-560-3435
MO	St. Louis, Lowell Kangas & Assocs.	314-821-4050
NJ	Matawan, Shepard & Assocs.	201-566-0095
NM	Albuquerque, O'Donnell Assocs. S.W.	505-883-1030
NY	E. Syracuse, Ossmann & Assocs.	315-437-7052
NY	Henrietta, Ossmann & Assocs.	716-359-1200
NC	Charlotte, Cartwright & Bean	704-536-0303
NC	Lumberton, Acme Elec. Corp.	919-738-9202
NC	Raleigh, Cartwright & Bean	919-876-4130
OH	Cincinnati, Luebbe Sls.	513-530-0600
OH	Cleveland, Luebbe Sls.	216-333-0425
OH	Cleveland, Marlow Assocs.	216-991-6500
OH	Columbus, Luebbe Sls.	614-431-0474
OH	Dayton, Luebbe Sls.	513-294-0426
OH	Dayton, Marlow Assocs.	513-274-9666
OK	Tulsa, Milco Mktg.	918-664-2277
OR	Beaverton, Pacific Specialists	503-641-9373
PA	Pittsburgh, Luebbe Sls.	412-364-0490
PA	Pittsburgh, Marlow Assocs.	412-343-5050
PA	Prospect Pk., Elf Sls. Co.	215-534-3340
TN	Memphis, Cartwright & Bean	901-362-8345
TX	Austin, Milco Mktg.	512-251-9918
TX	Houston, Milco Mktg.	713-723-5037
TX	Richardson, Milco Mktg.	214-783-2716
UT	Salt Lake City, Acme Elec. Corp.	801-539-0227
WA	Redmond, Pacific Mktg. Specialists	206-882-3144
WI	Waukesha, Electron Mktg.	414-547-1505

Local Distributors

AL	Decatur, Forbes Distbg.	205-353-4762
AL	Huntsville, Allied Elctrns.	205-721-3500
AL	Huntsville, Arrow Elctrns.	205-837-6955
AL	Huntsville, Forbes Distbg.	205-837-1579
AL	Mobile, Forbes Distbg.	205-479-4535
AZ	Phoenix, Arrow Elctrns.	602-437-0750
AZ	Phoenix, Cetec/Future	602-272-7951
CA	Chatsworth, Allied Elctrns.	818-701-7500
CA	Chatsworth, Cetec/Future	818-700-0914
CA	Fremont, Allied Elctrns.	415-770-0590
CA	Irvine, Cetec/Future	714-250-4141
CA	Menlo Pk., Casey Johnston	415-328-6892
CA	San Diego, Allied Elctrns.	619-565-4800
CA	San Diego, Cetec/Future	619-278-5020
CA	San Jose, Cetec/Future	408-434-1114
CA	San Jose, ITT Multicomp.	408-279-0685
CA	San Jose, Rose Elctrns.	408-263-9700
CA	Santa Ana, ITT Multicomp.	714-835-9019
CA	Santa Monica, Transworld Trade	213-476-8406
CA	Sunnyvale, Allied Elctrns.	408-745-6600
CA	Tustin, Allied Elctrns.	714-669-4190
CO	Denver, Allied Elctrns.	303-790-1664
CO	Englewood, Arrow Elctrns.	303-790-4444
CO	Englewood, NEP Elctrns.	303-799-9898
CT	Wallingford, Arrow Elctrns.	203-265-7741
FL	Altamonte Springs, Arrow Elctrns.	305-682-6923
FL	Clearwater, Allied Elctrns.	813-539-0369
FL	Deerfield Bch., Arrow Elctrns.	305-429-8200
FL	Ft. Lauderdale, American Battery	305-583-2470
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Jacksonville, Hammond/EMSCO	904-356-4851
FL	Lantana, Sylvia Prods.	305-482-5295
FL	Orlando, EMSCO	305-849-6362
FL	Orlando, Hammond Elctrns.	305-849-6060
FL	Palm Bay, Arrow Elctrns.	305-725-1480
FL	Pompano Bch., Allied Elctrns.	305-978-3008
FL	Tampa, Hammond/EMSCO	813-253-2684
GA	Doraville, Voltex Batteries	404-448-6021
GA	Marietta, Americom	404-428-8400
GA	Norcross, Allied Elctrns.	404-446-8585
GA	Norcross, Arrow Elctrns.	404-449-8252
GA	Norcross, Hammond Elctrns.	404-449-1996
IL	Addison, LComp Elctrns.	312-628-1400
IL	Chicago, NEP Elctrns.	312-625-8400
IL	Elgin, Allied Elctrns.	312-697-8200
IL	Itasca, Arrow Elctrns.	312-250-0500
IN	Ft. Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Advent Elctrns.	317-872-4910
IN	Indianapolis, Arrow Elctrns.	317-243-9353
IN	Indianapolis, Bell Inds.	317-875-8200
IA	Cedar Rapids, Arrow Elctrns.	319-395-7230
IA	Cedar Rapids, Iowa Radio Supp.	319-393-4510
KS	Lenexa, Arrow Elctrns.	913-541-9542
KS	Wichita, Radio, Inc.	316-264-2798
KY	Florence, URI Elctrns.	606-371-4423
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ADTRON CORPORATION, 745 N. Gilbert Rd., Ste. 124-361, Gilbert, AZ 85234, Tel: 602-926-1461, TWX: 910-240-3012; Empl.: 3; *Sls. Mgr.:* Douglas Lonngren

ADVANCE, A Unit of Zero Corporation, 6900 Beck Avenue, N. Hollywood, CA 91605, Tel: 818-983-0333 ..... **C•1101**

ADVANCE CONVERSION DEVICES CO., 274 S. Salem St., Randolph, NJ 07869, Tel: 201-989-0095; FSC No.: 52298; Empl.: 24; *Sls. Mgr.:* D. J. Fedderly ..... **D•2068-2069**

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ADVANCED DETECTOR CORP., Applied Solar Energy Corp., 15251 E. Don Julian Rd., Industry, CA 91746, Tel: 818-369-6886, TWX: 910-584-4890, FAX: 818-336-8694; Empl.: 297

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ADVANCED HIGH VOLTAGE CO., P.O. Box 2136, Lancaster, CA 93539, Tel: 818-997-7222; *Sls. Mgr.:* John Richardson ..... **D•1577**

ADVANCED INPUT DEVICES, W. 250 A.I.D. Dr., Coeur d'Alene, ID 83814, Tel: 208-765-8000, TWX: 510-776-0584; FSC No.: 95666; Empl.: 550; *Sls. Mgr.:* John Overby

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AEMC, 99 Chauncy, Boston, MA 02111, Tel: 617-451-0227, 800-343-1391, TELEX: 95-1073, FAX: 617-423-2952; *Sls. Mgr.:* Jon Henderson

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NY Pittsford, Alby Currant Sls. 716-586-1110
NC Burlington, Murphy & Cota, Inc. 919-584-6450
OH North Olmsted, Avcom, Inc. 216-777-2060
OR Portland, Earl & Brown Co., Inc. 503-245-2283
PA Hazelton, Forti Assocs., Inc. 717-455-2003
TX Houston, Graham/Davis Inc. 713-558-8662
TX Irving, Graham/Davis Inc. 214-554-6535
UT Sandy, Silver Peak Mktg. Ltd. 801-942-6694
WA Redmond, Earl & Brown Co., Inc. 206-885-5064

AirBorn

FAX: 214-931-9305

AIRBORN, INC., 4321 AirBorn Dr., Addison, TX 75001-0519, Tel: 214-931-3200, TELEX: 79-4200, TWX: 910-860-5230; FSC No.: 10400;Multiple; Empl.: 548; *Sls. Mgr.:* T. V. Lee, Sls. Mgr. ..... **C•1132-1157**

Local Sales Offices & Reps

AZ Tempe, Piper Sls. Co. 602-949-0048
CA Downey, Buffa Co., Inc. 213-923-4618
CA Mountain View, Serra Assocs. 415-964-4300
CO Boulder, Front Range 303-443-4780
CT Roxbury, Kimble Assocs. 203-354-1954
FL Ft. Lauderdale, Southland Comps. 305-491-6110
IL Des Plaines, ESCO Assoc. 312-298-5310
IA Cedar Rapids, Dytronix 319-377-8275
KS Wichita, Dytronix 316-838-0884
MD Hunt Valley, Eagle Sls. Corp. 301-666-3930
MN Bloomington, PWC 612-831-5999
MO Bridgeton, Dytronics, Inc. 314-291-4777
MO Raytown, Dytronix 816-356-6340
NH Nashua, Solla - Tronics 603-882-7146
NJ Manville, Dynorep 201-685-0135
NM Albuquerque, Piper Sls. Co. 505-883-9090
NY Penfield, Upstate Comps. 716-381-6070
OH Dayton, Electro-Com 513-898-5140
TX Austin, Pro-Mark 214-644-0467
TX Richardson, Pro-Mark 214-644-0467
WA Seattle, Eltech Inc. 206-643-4330
Can Mississauga, Ont., Source Elctrns. Ltd. 416-676-0830
Can Ottawa, Ont., Source Elctrns. Ltd. 613-737-7580

Local Distributors

TX Addison, AirBorn Distribution Service 214-931-3200

AIR ELECTRO SUPPLY, INC., 7700 Gloria Ave., Van Nuys, CA 91406, Tel: 213-873-6400, 818-988-4400, TELEX: 66-2459, TWX: 910-495-1794 ..... **C•1384**

AIR/FLEX INDS. INC., 2422 Merced Ave., S. El Monte, CA 91733, Tel: 818-579-7060; FSC No.: 22782; *Sls. Mgr.:* Karl Thorp

Airflyte ELECTRONICS CO.

FAX: 201-436-6024

AIRFLYTE ELCTRNS. CO., 56 New Hook Rd., P. O. Box 231, Bayonne, NJ 07002, Tel: 201-436-2230; Empl.: 75; *Sls. Mgr.:* John Piret ..... **B•1186-1191**

Local Sales Offices & Reps

CA Los Altos, Poltronics 415-941-3020
CA Signal Hill, Thorson Co. 213-595-0361
CT No. Haven, Kitchen & Kutchin 203-239-0212
IL Park Ridge, Probe Elctrns. 312-698-2044
MA Lexington, Kitchen & Kutchin 617-862-8230
NJ Kinnelon, Avionics Equip. 201-838-8105
NY Rochester, R. P. Kennedy Co. 716-271-6322
PA Dowing, Budd Elctrns. Corp. 215-458-8258
TX Austin, Electra Reps., Inc. 512-339-1163
TX Dallas, Electra Reps., Inc. 214-248-3852

AIR LAND SYSTEMS CORPORATION, 2710 Prosperity Ave., Fairfax, VA 22031, Tel: 703-573-1100, TELEX: 710-833-1174, TWX: Airland Frax; Empl.: 50

AIRMATIC-ALLIED, 185 Park Dr., Wilmington, OH 45177, Tel: 513-382-1691; Empl.: 150

AIR MAZE CORP., 25000 Miles Rd., Cleveland, OH 44128, Tel: 216-292-6800, TELEX: 98-5413; Empl.: 300; *Sls. Mgr.:* Jim Ernster; *Dist. Mgr.:* Gary Yoho

AIR-O-TRONICS, Trush Group, Route 20 E., Cazenovia, NY 13035, Tel: 315-655-2387, TWX: 710-541-1530, FAX: 315-655-3862; FSC No.: 16663; Empl.: 15

AIRPAX CORP., Woods Rd., Cambridge, MD 21613, Tel: 301-228-4600, TELEX: 8-7715, TWX: 710-865-9655; FSC No.: 81541; Empl.: 550; *Sls. Mgr.:* Bob Phillips ..... **A•1717; B•1298**

Local Sales Offices & Reps

AL Huntsville, BCI 205-539-4411
AZ Phoenix, Westrep 602-997-8899
CA Anaheim, Westrep 213-404-3881
CA San Diego, Westrep 714-566-6580
CA Santa Ana, Airpax Co. 408-980-0470
CO Littleton, Lange Sls. 303-795-3600
CT Clinton, Selmark Assocs. 203-573-9088
FL Pompano Bch., Airpax Co. 305-978-9019
GA Chamblee, BCI 404-455-0405
IL Palatine, Somers-Stanton, Inc. 312-991-1108
IN Indianapolis, Leslie M. Devoe 317-842-3245
IA Marion, Rep Assocs. 319-373-0152
MD Frederick, Airpax Co. 301-243-3133
MA Millis, Selmark 617-376-2914
MI Farmington Hills, Airpax Co. 313-553-6030
MN Minnetonka, Airpax Corp. 612-933-0170
MO Florissant, Delltron 314-839-0033
MO Kansas City, Delltron 816-436-6445
NH Hopkinton, Selmark Assocs. 603-746-3299
NY Hyde Pk., Airpax Co. 914-229-0016
NY Jericho, Airpax Co. 516-822-2410
NY Rochester, Airpax Co. 716-654-7470
NC Winston-Salem, L.G. White 919-725-3612
OH Dayton, Baehr, Greenleaf 513-439-0724
OH Westlake, Baehr, Greenleaf 216-892-1770
OH Worthington, Baehr, Greenleaf 614-847-0220
OR Beaverton, Airpax Co. 503-641-6130
PA Harleysville, T. Jackson 215-643-5560
PA Pittsburgh, Russell F. Clark 412-242-9500
SC Greenville, L.G. White 803-271-0630
TX Dallas, Airpax Co. 214-851-7433
UT Salt Lake City, Lange Sls. 801-487-0843
WI Wauwatosa, Larson Assocs. 414-258-0529

AIRPAX CORP., Cheshire Div., Cheshire Indl. Pk., Box E, Cheshire, CT 06410, Tel: 203-272-0301, TELEX: 962421, TWX: 710-455-4048; Empl.: 800; *Sls. Mgr.:* John Ricardi ..... **B•1194, 1877; D•1121**

Local Sales Offices & Reps

AL Huntsville, B.C.I. 205-539-4411
AZ Phoenix, Westrep 602-997-8899
CA Anaheim, Westrep 213-404-3881
CA San Diego, Westrep 619-566-6580
CA Santa Clara, Airpax Co. 408-980-0410
CO Littleton, Lange Sls. 303-795-3600
CT Clinton, Selmark Assocs. 203-573-9088
FL Pompano Bch., Airpax Co. 305-978-9019
GA Chamblee, B.C.I. 404-455-0405
IL Palatine, Somers-Stanton, Inc. 312-991-1108
IN Indianapolis, Leslie M. Devoe 317-842-3245
IA Marion, Rep Assocs. 319-373-0152
MD Frederick, Airpax Co. 301-243-3133
MA Millis, Selmark Assocs. 617-376-2914
MI Farmington Hills, Airpax Co. 313-553-6030
MN Minnetonka, Airpax Co. 612-933-0170
MO Florissant, Delltron 314-839-0033
MO Kansas City, Delltron Co., Inc. 816-436-6445
NH Hopkinton, Selmark Assocs. 603-746-3299
NY Hyde Park, Airpax Co. 914-229-0016
NY Jericho, Airpax Co. 516-822-2410
NY Rochester, Airpax Co. 716-654-7470
NC Winston-Salem, L. G. White 919-725-3612
OH Dayton, Baehr, Greenleaf & Assocs. .. 513-439-0724
OH Westlake, Baehr, Greenleaf & Assocs. 216-892-1770

OH Worthington, Baehr, Greenleaf & Assocs. 614-847-0220
OR Beaverton, Airpax Co. 503-641-6130
PA Harleysville, Thomas Jackson Assocs. 215-256-8877
PA Pittsburgh, Russell F. Clark Co. 412-242-9500
SC Greenville, L.G. White Southern, Inc. .. 803-271-0630
TX Dallas, Airpax Co. 214-851-7433
UT Salt Lake City, Lange Sls. 801-487-0843
WI Wauwatosa, Larson Assocs. 414-258-0529

AIRPAX COMPANY, A Division of North American Philips Corp., Husky Park P.O. Box 500, Frederick, MD 21701, Tel: 301-663-5141, TWX: 710-862-0901; Empl.: 600; *Sls. Mgr.:* Joe Ruth, Mktg. Mgr.; *Dist. Mgr.:* B. L. Reeder ..... **B•1357, 1835**

Local Sales Offices & Reps

AL Huntsville, B.C.I. 205-539-4411
AZ Phoenix, Westrep 602-997-8899
CA Anaheim, Westrep 213-404-3881
CA San Diego, Westrep 619-566-6580
CA Santa Clara, Airpax Co. 408-980-0410
CO Littleton, Lange Sls. 303-795-3600
CT Clinton, Selmark Assocs. 203-573-9088
FL Pompano Bch., Airpax Co. 305-978-9019
GA Chamblee, B.C.I. 404-455-0405
IL Palatine, Somers-Stanton Inc. 312-991-1108
IN Indianapolis, Leslie M. De Voe Co. 317-842-3245
IA Marion, Rep Assocs., Inc. 319-373-0152
MD Frederick, Airpax Co. 301-243-3133
MA Millis, Selmark Assocs. 617-376-2914
MI Farmington Hills, Airpax Co. 313-553-6030
MN Minnetonka, Airpax Co. 612-933-0170
MO Florissant, Delltron Co. 314-839-0033
MO Kansas City, Delltron Co., Inc 816-436-6445
NH Hopkinton, Selmark Assocs. 603-746-3299
NY Jericho, Airpax Co. 516-822-2410
NY Hyde Pk., Airpax Co. 914-229-0016
NY Rochester, Airpax Co. 716-654-7470
NC Winston-Salem, L. G. White Southern 919-725-3612
OH Dayton, Baehr, Greenleaf & Assocs. .. 513-439-0724
OH Westlake, Baehr, Greenleaf & Assocs. 216-892-1770
OH Worthington, Baehr, Greenleaf & Assocs. 614-847-0220
OR Beaverton, Airpax Co. 503-641-6130
PA Harleysville, Thomas Jackson Assocs. 215-256-8877
PA Pittsburgh, Russell F. Clark Co. 412-242-9500
SC Greenville, L. G. White Southern, Inc. .. 803-271-0630
TX Dallas, Airpax Co. 214-851-7433
UT Salt Lake City, Lange Sls. 801-487-0843
WI Wauwatosa, Larson Assocs. 414-258-0529

Local Distributors

CA Santa Ana, Norstan Elctrns. 714-540-4165
OK Tulsa, Altair 918-665-0524
TX Houston, Altair 713-462-3029
TX Richardson, Altair 214-231-5166

AIRPAX CORPORATION, International Div., West Johnson Ave., Cheshire, CT 06410, Tel: 203-272-0301, TELEX: 643967; Empl.: 350; *Sls. Mgr.:* Walter Kalwara ..... **B•1192-1193**

Local Sales Offices & Reps

AL Huntsville, B.C.I. 205-539-4411
AZ Phoenix, Westrep 609-997-8899
CA Anaheim, Westrep 213-404-3881
CA San Diego, Westerep 619-566-6580
CA Santa Clara, Airpax Co. 408-980-0410
CO Littleton, Lange Sls. 303-795-3600
CT Clinton, Selmark Assocs. 203-573-9088

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GA Chamblee, B.C.I. 404-455-0405
IL Palatine, Somers-Stanton, Inc. 312-991-1108
IN Indianapolis, Leslie M. Devoe 317-842-3245
IA Marion, Rep Assocs. 319-373-0152
MD Frederick, Airpax Co. 301-243-3133
MA Millis, Selmark Assocs. 617-376-2914
MI Farmington Hills, Airpax Co. 313-553-6030
MN Minnetonka, Airpax Co. 612-933-0170
MO Florissant, Delltron Co., Inc. 314-839-0033
MO Kansas City, Delltron Co., Inc. 816-436-6440
NH Hopkinton, Selmark Assocs. 603-746-3299
NY Hyde Pk., Airpax Co. 914-229-0016
NY Jericho, Airpax Co. 516-822-2410
NY Rochester, Airpax Co. 716-654-7470
NC Winston-Salem, L. G. White 919-725-3612
OH Dayton, Behr, Greenleaf & Assocs. 513-439-0724
OH Westlake, Behr, Greenleaf & Assocs. .. 216-892-1770
OH Worthington, Behr, Greenleaf & Assocs. 614-847-0220
OR Beaverton, Airpax Co. 503-641-6130
PA Harleysville, Thomas Jackson Assocs. 215-256-8877
PA Pittsburgh, Russell F. Clark Co. 412-242-9500
SC Greenville, L. G. White 803-271-0630
TX Dallas, Airpax Co. 214-851-7433
UT Salt Lake City, Lange Sls. 801-487-0843
WI Wauwatosa, Larson Assocs. 414-258-0529

AIRPAX CO., SENSOR DIV., A Division of North American Philips Corp., Cheshire Industrial Park, Cheshire, CT 06410, Tel: 203-272-0301, TELEX: 962421, TWX: 710-455-4048, FAX: 203-271-1395; Empl.: 200; *Sls. Mgr.:* Jim Rochford

AIRTRON, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950, Tel: 201-539-5500, TWX: 710-986-7473, FAX: 201-539-0357; FSC No.: 80006; Empl.: 500; *Sls. Mgr.:* M. R. Grosso, Natl. Sls. Mgr.

AIR-VAC ENGRG., 100 Gulf St., Milford, CT 06460, Tel: 203-874-2541, FAX: 203-783-1383; Empl.: 40

AJAX MAGNETHERMIC CORP., 1745 Overland Ave., N.E., Warren, OH 44482, Tel: 216-372-8511, TELEX: 098-2482, FAX: 216-372-8644; Empl.: 500

AKG ACOUSTICS, INC., 77 Selleck St., Stamford, CT 06902, Tel: 203-348-2121, TELEX: 285481, FAX: 203-324-1942; Empl.: 25; *Sls. Mgr.:* Rowland Powers

AKRO-MILS, 1293 S. Main St., Akron, OH 44301, Tel: 216-253-5593, TELEX: 98-6321; Empl.: 200; *Sls. Mgr.:* W. J. Tonachio; *Dist. Mgr.:* D. Martin

ALADDIN ELCTRNS., See AIE Div. of Vernitron

ALAN GORDON ENTPRS., INC., P.O. Box 3914, 5362 Cahuenga Blvd., N. Hollywood, CA 91601, Tel: 818-985-5500, TELEX: AGE-FOTO LSA 662532, TWX: 910-321-4526 GO, FAX: 213-871-2193; FSC No.: 94972; Empl.: 81; *Sls. Mgr.:* D. Sahlein

ALAN INDUSTRIES INC., P.O. Box 1203, Columbus, IN 47201, Tel: 812-372-8869, FAX: 812-372-5909; FSC No.: 52750; Empl.: 36; *Sls. Mgr.:* Blayde A. Kennedy

Local Sales Offices & Reps

AL Huntsville, Saber Assocs. 800-327-0853
CA Los Angeles, RF Assocs. 213-478-1586
CA Palo Alto, RF Assocs. 415-494-3331
CO Wheat Ridge, Trembly Assocs. 303-421-8900
CT Plainville, Addelco Corp. 203-747-9464
FL Apopka, Saber Assocs. 800-432-6288
FL Bradenton, Saber Assocs. 800-432-6288
FL Melbourne, Saber Assoc. 800-432-6288
GA Norcross, Saber Assocs. 800-327-0853
MD Randallstown, C. L. Malinow & Co. 301-922-2092
MA Needham, Addelco Corp. 617-444-4754
NV Las Vegas, Trembly Assocs. 702-739-9770
NM Albuquerque, Trembly Assocs. 505-266-8616
NY Liverpool, R. & D. Assocs. 315-457-0100
NY New Rochelle, Ascor Elctrns. 914-235-8838
NC Clayton, Saber Assocs. 800-327-0853
OH Dayton, Frederic L. Ohmer 513-434-1454
OK Tulsa, Beacon Elctrns. 918-622-1494,
TX Austin, Beacon Elctrns. 512-345-3543,
TX Dallas, Beacon Elctrns. 214-437-1505,
UT Salt Lake City, Trembly Assocs. 801-486-5292
EXP CT, Stamford, Dage Corp. 203-324-3123
Can Ottawa, Ont., Giga-Tron 613-225-4090,

Local Distributors

AL Huntsville, Component Distrs. 205-883-7501,
AR Little Rock, Component Distrs. 501-227-6278,
CA Sunnyvale, Elctrn. Resources, Inc. 408-745-1420,
CO Englewood, Component Distrs. 303-799-4916,
FL Melbourne, Component Distrs. 305-724-9910,
GA Norcross, Component Distrs. 404-441-3320,
IL Des Plains, Compucon Distrs. 312-827-9444,
IN Fort Wayne, Compucon Distrs. 219-432-8919,
MD Randallstown, CLM Sls. 301-922-7717,
MA Reading, Compucon Distrs. 617-944-6875,
NY Ronkonkoma, Compucon Distrs. 516-981-8810,
NC Raleigh, Component Distrs. 919-834-9465,
TX Dallas, Component Distrs. 214-644-0373,
VA Sterling, Ice Components 703-478-2677,

ALARM CONTROLS CORPORATION, P.O. Box 280, Deer Park, NY 11729, Tel: 516-586-4220, FAX: 516-586-6500; FSC No.: 55042; Empl.: 50; *Sls. Mgr.:* John Benedetto

ALASCO RUBBER & PLASTICS CORP., 617 Mountain View Ave.67, Belmont, CA 94002, Tel: 415-595-4100; FSC No.: 13862; Empl.: 25; *Sls. Mgr.:* Philip K. Nordberg

ALBAR, INC., 19013 36th Ave. W., Lynnwood, WA 98036, Tel: 206-771-4006, FAX: 206-771-2163; Empl.: 30; *Sls. Mgr.:* Merv Eaton

ALBEROX CORPORATION, New Bedford Ind'l. Pk., New Bedford, MA 02745, Tel: 617-995-1725, FAX: 617-995-6954; Empl.: 180

ALBION INDUSTRIES, 800 N. Clark St., Albion, MI 49224, Tel: 517-629-9441

ALDEN COMPUTER SYSTEMS, One Salem Green, Ste. 420, Salem, MA 01970, Tel: 617–744-1314; *Sls. Mgr.:* Donald O'Brien

ALDEN ELECTRONICS, INC., 40 Washington Street, Westboro, MA 01581, Tel: 617-366-8851, TELEX: 94-8404, FAX: 617-898-2427; Empl.: 140; *Sls. Mgr.:* L. A. Farrington

ALDEN

FAX: 617-583-0164

ALDEN PRODUCTS CO., P.O. Box 860, 117 N. Main St., Brockton, MA 02403, Tel: 617-583-0160, TELEX: 28-7793 ALDN UR; FSC No.: 01009; Empl.: 150; *Sls. Mgr.:* Donald J. Paul ..... **C•1161**

Local Sales Offices & Reps

OR Portland, Elctrn. Comp. Sls. 503-245-2342
WA Mercer Island, Elctrn. Comp. Sls. 206-232-9301
WA Mercer Island, Electronic Comp. Sls. .. 206-232-9301

ALDES SYSTEMS, Alden Products Co., 262 N. Main St., P.O. Box 860, Brockton, MA 02403-0860, Tel: 617-583-0160, TELEX: 287 793 ALDN UR, FAX: 617-583-0164; Empl.: 150; *Sls. Mgr.:* Norbert A. Duhamel

A. L. DESIGN, INC., 4232 Ridge Lea Rd., Amherst, NY 14226, Tel: 716-833-6272, FAX: 716-833-8856; Empl.: 20

ALEPH INTERNATIONAL, 1026 Griswold, San Fernando 91340, Tel: 818-365-9856

ALEXANDER BATTERIES, New Product/OEM Divison, P.O. Box 28880, San Diego, CA 92128, Tel: 619-480-4445, TELEX: 371-9855, FAX: 619-480-1351; Empl.: 175; *Sls. Mgr.:* Dave Zeman ..... **D•1435**

Local Sales Offices & Reps

CO Denver, Aurora Mktg. 303-758-3051
GA Atlanta, Alexander Battery S.E. 404-968-4087
IL McHenry, Alexander Battery Co. 815-344-0666
IA Mason City, Jon Alexandres 515-423-8955
MN Minneapolis, Paul Ohlin 612-941-7697
NJ Middlesex, Jim Sapp 201-271-5880
OH Dublin, Alexander Battery, Mideast 614-764-8771
TX Arlington, Alexander Battery South 800-323-3813

Alexander Batteries
By Alexander Manufacturing

FAX: 515-423-1644

ALEXANDER MANUFACTURING COMPANY, P.O. Box 1508, Mason City, IA 50401, Tel: 800-247-1821, 515-423-8955, TELEX: 3719855; Empl.: 225 ..... **D•1435**

Local Distributors

CA San Diego, Alexander Batteries-West 619-480-4806
CO Denver, Aurora Mktg. Co. 303-758-3051
GA Atlanta (Morrow), Alexander Batteries-S.W. 404-968-4087
IL McHenry, Alexander Batteries-Midwest 815-344-0666
MN St. Paul, Alexander Batteries-North ... 612-941-7697
NJ Middlesex, Alexander Batteries-East .. 201-271-5880
OH Dublin, Alexander Batteries-Midwest .. 614-764-8771
TX Arlington, Alexander Batteries-South .. 800-323-3812
WA Bellevue, Arpac Ltd. 206-453-2132
Can Delta, B.C., Traeger Dists., Ltd. 604-946-0818
Can Edmonton, Alberta, Allcan Elctrns. 403-451-2355

ALFORD MANUFACTURING CO., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01801, Tel: 617-935-8610, TWX: 710-348-1063, FAX: 617-933-4512; FSC No.: 07177; Empl.: 20; *Sls. Mgr.:* Fred Abel

ALGO, INC., 9198-C Red Branch Rd., Columbia, MD 21045, Tel: 301-730-7442, TELEX: 333405; Empl.: 12; *Sls. Mgr.:* G. J. O'Mara

ALINABAL, 28 Woodmont Rd., Milford, CT 06460, Tel: 203-877-3241, TWX: 710-462-1178, FAX: 203-877-3241 (ext. 360); Empl.: 255

ALLACO PRODUCTS DIV., Bacon Industries, Inc., 192 Pleasant St., Watertown, MA 02172-2399, Tel: 617-926-2550, TWX: 710-327-6518; FSC No.: 99098; Empl.: 24; *Sls. Mgr.:* R.S. Cass

ALLEN AVIONICS, INC., 224 E. 2nd St., Mineola, NY 11501, Tel: 516-248-8080, FAX: 516-747-5481; Empl.: 300; *Sls. Mgr.:* Richard Mintz ..... **A•1496, 1635**

Local Sales Offices & Reps

AZ Phoenix, J. F. Hurlbut Co. 602-952-2079
CA Arcadia, Van Gott & Assocs. 818-445-9728
CA Palo Alto, Adtek Assocs. 415-323-5414
CA San Diego, Van Gott & Assocs. 619-308-0667
CO Golden, J. F. Hurlbut Co. 303-279-7796
NY Plainview, Eastern Metro Assocs. 516-931-1414
OR Beaverton, Evergreen Mktg. Grp. 503-643-8020
PA Huntingdon Valley, Rabal Assocs. 215-947-4825
TX Dallas, Bradenco Corp. 214-352-3554
VA Alexandria, Vanguard Engrg. Sls. 703-768-1660
WA Seattle, Evergreen Mktg. Grp. 206-633-3160
EXP CT, Stamford, Dage Corp. 203-324-3123

AB ALLEN-BRADLEY
A ROCKWELL INTERNATIONAL COMPANY

FAX: 915-594-8922

ALLEN BRADLEY CO., ELECTRONIC COMPONENTS DIV., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, Tel: 915-592-4888, 800-592-4888, TELEX: 749-400; Empl.: 6500; *Sls. Mgr.:* Hugh Tyler; *Dist. Mgr.:* Chestley Grimsley ..... **A•1854-1867, 2059-2061**

Local Distributors

AZ Phoenix, Wyle Labs. 602-249-2888
CA Calabasas, Wyle Laboratories 818-880-9000
CA Chatsworth, Marshall Elctrns. Grp. 818-407-4100
CA Chatsworth, TTI, Inc. 818-709-1010
CA El Monte, Marshall Inds. Elctrns. Grp. 818-459-5500
CA El Segundo, Wyle Labs. 213-322-8100
CA Irvine, Marshall Inds. Elctrns. Grp. 714-859-5050
CA Irvine, Wyle Labs. 714-863-9953
CA Milpitas, Marshall Elctrns. Grp. 408-943-4600
CA Milpitas, TTI, Inc. 408-946-5577,
CA Rancho Cordova, Wyle Labs. 916-638-5282
CA San Diego, Wyle Labs. 619-565-9171
CA Santa Clara, Wyle Labs. 408-727-2500
CO Thornton, Wyle Distbn. Grp. 303-457-9953
CT Stratford, TTI, Inc. 203-375-1400
CT Wallingford, Marshall Elctrns. Grp. 203-265-3822
FL Orlando, Hammond Elctrns., Inc. 305-849-6060
FL Orlando, TTI, Inc. 305-859-1000
GA Atlanta, Marshall Elctrns. Grp. 404-923-5750
GA Atlanta, TTI, Inc. 404-662-0911
IL Chicago, Newark Elctrns. 312-784-5100
IL Palatine, Ohm Elctrns., Inc. 312-359-5500
IN Ft. Wayne, Graham Elctrns. Supp., Inc. 219-423-3422
IN Indianapolis, Graham Elctrns. Div. 317-875-8200,
MD Gaithersburg, Almo Elctrns. Inc. 301-670-0090
MD Gaithersburg, Marshall Elctrns. Inc. ... 301-840-9450
MA Canton, Almo Elctrns. 617-821-1450
MA Wilmington, Marshall Elctrns. Grp. 617-658-0810
MA Wilmington, TTI, Inc. 617-658-4700,
MI Livonia, Marshall Elctrns. Grp. 313-525-5850
MN St. Paul, Ragon Elctrns. 612-642-2828
MO Independence, Shelly-Ragon 816-254-3410
MO St. Louis, Chelsea Inds. 314-997-7709,
NJ Fairfield, Marshall Inds. Elctrns. Grp. .. 201-882-0320
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NY Hauppauge, Marshall Elctrns. Grp. 516-273-2424
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NY Rochester, Marshall Elctrns. Grp. 716-235-7620
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UT Salt Lake City, Wyle Labs. 801-974-9953
WA Bellevue, Wyle Labs. 206-453-8300
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ALLEN-BRADLEY CO., MAGNETICS DIVISION, Div. of Rockwell Corp., 5900 N. Harrison St., Shawnee, OK 74801, Tel: 405-275-2100, TELEX: 4311016; *Sls. Mgr.:* Carl Tufts, Dir. Mktg./Sls.; *Dist. Mgr.:* Jerry White, Natl. Sls. Mgr.

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NY Ronkonkoma, All American Semiconductor Inc. 516-981-3935

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FAX: 603-893-9042

ALLEN DATAGRAPH, INC., 2 Industrial Way, Salem, NH 03079, Tel: 603-893-1983, TWX: 710-366-0504; *Sls. Mgr.:* Tom Allen ..... **D•1416**

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CA Tarzana, Component Mktg. Assocs., Inc. 818-708-8058
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CT Clinton, Selmark Assocs., Inc. 203-573-9088
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IN Indianapolis, M & L Elctrn. Sls. 317-359-4742
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PA Pittsburgh, Process Engrg. Co. 412-561-5050
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TX Richardson, Comp. Technlg. 214-690-8537
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Can North York, R. D. Assocs. 416-444-0959

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FL	St. Petersburg, Electrocomp Assoc.	813-327-9677
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CA	Orange County, Knight Co.	714-833-8250
CA	Santa Clara, Interconnect Sls. Grp.	408-980-1166
CO	Englewood, FG Mktg. Co.	303-795-9176
CT	Bethel, Instr. Dynamics	203-743-5045
FL	Tampa, Temco Sls. Inc.	813-855-7566, 800-282-6815
GA	Atlanta, Kemp Instrs.	404-452-8050
IL	Bensenville, R. L. Lang & Assocs.	312-766-3667
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LA	Lafayette, Kemp Engrg.	318-269-9452
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MA	Wakefield, Instr. Dynamics	617-245-5100
MI	Livonia, Electro Sls. Assocs.	313-421-7500
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VA Ruther Glen, L. G. White & Co. 804-448-4476
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AMERICAN ETCHING & MFG., 13730 Desmond St., Pacoima, CA 91331-2796, Tel: 818-896-1187; Empl.: 90

AMERICAN HV TEST SYSTEMS INC., Central Garrett Ind'l. Pk., Accident, MD 21520, Tel: 301-826-8651, TELEX: 86223; Empl.: 45; *Sls. Mgr.:* Steve Sanders

AMERICAN INSULATED WIRE CORP.

FAX: 401-723-1420

AMERICAN INSULATED WIRE CORP., Leviton Mfg. Co., 36 Freeman St., Pawtucket, RI 02862, Tel: 401-726-0700, TWX: 710-384-0150; Empl.: 1300; *Sls. Mgr.:* John Pimental; *Dist. Mgr.:* Dennis Andrews .... **C•1770**

Local Sales Offices & Reps
AZ Scottsdale, Bill Earl Assocs., Inc. 602-994-3813
CA Pico Rivera, Leviton-American 213-949-6575
CT Hartford, Spec-Tech 617-795-7250,
FL Margate, EPM Corp. 305-977-0331
GA Atlanta, Cavendish & Winchester 404-449-5104
GA Atlanta, Leviton/American 404-691-9303
IL Chicago, Leviton/American 312-766-4100
KS Overland Park, Thomas L. Dowell & Assocs. 913-648-7373
LA New Orleans, Leviton/American 504-834-9415
MI Detroit, Leviton/American 313-933-3100
MN Lakeville, Peter Galdikas 612-435-7549
MO St. Louis, Thomas Dowell & Assocs. .. 314-849-4234
NY New York, Leviton Corp. Headquarters 212-229-4040
NY W. Hempstead, Schmitt Indl. Mktg. 516-486-3510
NC Kings Mountain, Cavendish & Winchester 704-739-9297
OH Cleveland, Leviton/American 216-831-1673
PA Philadelphia, Linton Assocs. 215-277-8600
TN Manchester, Cavendish & Winchester 615-728-7291
TX Dallas, Leviton/American 214-241-4556
TX Grapevine, Dan Cheetham 817-481-6238
TX Houston, Leviton/American 713-956-2816
WA Seattle, Dussault & Assocs. 206-527-5454
WA Seattle, Leviton/American 206-576-0242

AMERICAN LASER SYSTEMS, INC., 106 Fowler Rd., Goleta, CA 93117, Tel: 805-967-0423, TELEX: 4941760ALS; Empl.: 7; *Sls. Mgr.:* L. Shallenberger

AMERICAN MAGNETICS, 740 Watson Center Rd., Carson, CA 90745, Tel: 213-775-8651, FAX: 213-834-0685; Empl.: 300; *Sls. Mgr.:* Stuart Katcher

AMERICAN MAGNETICS, P.O. Box 49, Carterville, IL 62918, Tel: 618-985-4838; Empl.: 120

AMERICAN MAGNETICS, P.O. Box 2509, Oak Ridge, TN 37831-2509, Tel: 615-482-1056, TELEX: 557-592, FAX: 615-482-5472; Empl.: 25; *Sls. Mgr.:* E. T. Henson

AMERICAN MICROSEMICONDUCTOR, INC., 133 Kings Rd., Madison, NJ 07940, Tel: 201-377-9566, TWX: 710-986-8500, FAX: 201-377-3078; Empl.: 15; *Sls. Mgr.:* W. M. Foley; *Dist. Mgr.:* D. B. Wilson ..... **A•2115**

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AMERICAN MICROWAVE TECHNOLOGY INC.

FAX: 714-871-2453

AMERICAN MICROWAVE TECHNOLOGY, INC., 1127 S. Placentia Ave., Fullerton, CA 92631, Tel: 714-680-4936; Empl.: 25; *Sls. Mgr.:* Lowell A. Beezley ..... **D•1002-1003**

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CA Mission Hills, Detomasi & Grupp, Inc. 818-365-8285
CA San Diego, Detomasi & Grupp, Inc. ... 619-277-0178
CA Sunnyvale, Fuchs Tech. Sls., Inc. 408-245-3500
CA Torrance, Detomasi & Grupp, Inc. 213-618-8898
FL Indian Harbor Bch., Southeastern Comp. Sls., Inc. 305-773-3767
GA Atlanta, Southeastern Comp. Sls., Inc. 404-451-5353
GA Warner Robbins, King Consit. Svcs. ... 912-953-2835
IL Park Ridge, Probe Elctrns. 312-696-2828
IN Ft. Wayne, J & B Engrg. Sls. 219-483-2813
IA Cedar Rapids, Barnes-West Tech. Assocs. 319-393-9790
KS Overland Pk., Barnes-Midwest Sls. 913-469-9688
MD Linthicum, Advanced Technlg. Sls. 301-789-9360
MA Burlington, Tritek, Inc. 617-272-4550
NM Albuquerque, T.D.S.I. 505-293-8555
NY Deer Pk., MMD-East 516-667-7200,516-242-5900
NY New Rochelle, RDI 914-632-2828
NY Skaneateles, Robtron, Inc. 315-685-5731
OH Cleveland, J & B Engrg. Sls. Co., Inc. .. 216-642-9312
OR Beaverton, Thorson Co. N.W. 503-644-5900
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TX Dallas, The Thorson Co. 214-233-5744
TX Houston, The Thorson Co. 713-558-8205
WA Bellevue, Thorson Co. N.W. 206-455-9180

AMERICAN MONARCH, 2801-37th Ave., N.E., Minneapolis, MN 55421, Tel: 612-788-9161; FSC No.: 11146; Empl.: 120; *Sls. Mgr.:* B. Sutherland; *Dist. Mgr.:* Ron Anderson

AMERICAN PHOTONICS INC., 71 Commerce Dr., Brookfield Center, CT 06805, Tel: 203-775-8950, TELEX: 821353; *Sls. Mgr.:* James A. Walyus

AMERICAN POWER DEVICES, 7 Andover St., Andover, MA 01810, Tel: 617-475-4074, TELEX: 951206; Empl.: 140; *Sls. Mgr.:* R. Bryant

American Relays, Inc.

FAX: 213-944-0590

AMERICAN RELAYS, INC., 10306 Norwalk Blvd., Santa Fe Springs, CA 90670, Tel: 213-944-0447, TELEX: 3710614; FSC No.: 1H941; Empl.: 45; *Sls. Mgr.:* Richard Lenning ..... **B•1366-1370**

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FL	Pompano Bch., Bolton Assocs.	305-975-7245
IA	Cedar Rapids, Elctrn. Sls., Inc.	319-362-6413
MD	Baltimore, Eltron Sls. Ltd.	703-635-7201
MN	Burnsville, Elctrn. Sls., Inc.	612-894-8200
NJ	Turnersville, Pacesetters	609-589-1948
NY	Jericho, J-Square Mktg., Inc.	516-935-3200
OH	Cleveland, Components, Inc.	216-243-9200
OH	Dayton, Components, Inc.	513-436-0255
SC	Greenville, Eltron Sls., Ltd.	803-234-6931
VA	Front Royal, Eltron Sls., Ltd.	703-635-7201

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Local Distributors

AL	Huntsville, Comp. Dists.	205-883-7501
CA	San Diego, Deco Elctrns.	619-693-1595
CA	San Jose, Erie Elctrns.	408-432-1111
CA	San Jose, Passive Technlg.	408-435-5566
CA	Santa Clara, Pyramid Elctrns.	408-727-9810
CO	Englewood, Comp. Dists.	303-799-4916
FL	Melbourne, Comp. Dists.	305-724-9910
MA	Burlington, TLC Elctrns.	617-273-0140
NJ	Parsippany, Fabe Electro Sls., Inc.	201-299-1123
NC	Raleigh, Comp. Dists.	919-787-7311
OR	Beaverton, Murphy Elctrns.	503-642-2001
WA	Redmond, Murphy Elctrns.	206-881-1234

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FAX: 818-710-0694

AMERICAN SHIZUKI CORPORATION, 21541 Blythe St., Canoga Pk., CA 91304, Tel: 818-710-8555, TELEX: 66-2633 SHIZAM; Empl.: 1000; *Sls. Mgr.:* Jeff Cohen ..... **A•1008**

Local Sales Offices & Reps

AL	Huntsville, R. O. Whitesell & Assocs.	205-883-5110
AZ	Phoenix, Compass Mktg. & Sls., Inc.	602-293-1220
CA	Chatsworth, WCV-Raltech, Inc.	818-700-0933
CA	Redwood City, James S. Heaton Co., Inc.	415-367-9000
CA	San Francisco, Wrathall & Krusi, Inc.	415-777-0226
CO	Wheatridge, Waugaman Assocs.	303-423-1020
GA	Norcross, R. O. Whitesell & Assocs.	404-449-9190
IL	Itasca, Circuit Sls., Inc.	312-773-0200
IN	Ft. Wayne, R. O. Whitesell & Assocs.	219-432-5591
IN	Indianapolis, Insul-Reps., Inc.	317-251-1994
IN	Indianapolis, R. O. Whitesell & Assocs.	317-359-9283
IN	Kokomo, R. O. Whitesell & Assocs.	317-457-9127
IA	Cedar Rapids, C. H. Horn & Assocs.	319-393-8703
KS	Lenexa, Midtec Assocs., Inc.	913-541-0505
KS	Overland Pk., Spectrum Sls.	913-648-6811
KY	Pewee Valley, R. O. Whitesell & Assocs.	502-241-1441
LA	Hammond, Design Mktg. & Assocs.	504-294-3076
MD	Gaithersburg, Naudain Assocs. So. Inc.	301-258-5040
MI	Grand Blanc, R. O. Whitesell & Assocs.	313-695-0770
MI	Grand Rapids, R. O. Whitesell & Assocs.	616-942-5420
MI	Southfield, R. O. Whitesell & Assocs.	313-559-5454
MI	St. Joseph, R. O. Whitesell & Assocs.	616-983-7337
MN	Eden Prarie, Com-Tek Sls.	612-941-7181
MO	Creve Coeur, Hill & Co.	314-432-1136
MO	St. Louis, John G. Macke Co.	314-432-2830
NH	Salem, Sls. Engrg. Co.	603-893-5521
NY	Buffalo, Quality Comps.	716-837-5430
NY	Great Neck, F & F Metro	516-482-4080
NY	Manlius, Quality Comps.	315-682-8885
NJ	Marlton, BGR Assocs.	609-983-1020
NC	Raleigh, Micro Sls., Inc.	919-872-7922
OH	Cincinnati, R. O. Whitesell & Assocs.	513-521-2290
OH	Cleveland, R. O. Whitesell & Assocs.	216-447-9020
OH	Columbus, R. O. Whitesell & Assocs.	614-888-9396
OH	Dayton, R. O. Whitesell & Assocs.	513-298-9546
PA	Pittsburgh, R. O. Whitesell & Assocs.	412-936-6161
TN	Knoxville, R. O. Whitesell & Assocs.	615-694-9476
TX	Austin, Design Mktg. & Assocs.	512-263-9151
TX	Dallas, Design Mktg. & Assocs.	214-480-8151
TX	El Paso, Compass Mktg. & Sls.	505-888-0800
TX	Ft. Worth, Design Mktg. & Assocs.	817-232-3155
TX	Houston, Design Mktg. & Assocs.	713-550-3318
UT	Salt Lake City, Waugaman Assocs.	801-261-0802
WA	Bellevue, N. R. Schultz Co.	206-454-0300
WI	Brookfield, Circuit Sls. Inc.	414-784-7773

Local Distributors

AL	Huntsville, Bell	205-837-1074
AL	Huntsville, Hall-Mark	205-837-8700
AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Phoenix, Hall-Mark	602-437-1200
AZ	Tempe, Bell	602-966-7800
AZ	Tempe, TTI	602-431-1191
CA	Chatsworth, Passive Comps.	818-341-1745
CA	Chatsworth, Passive Technlg.	818-882-2277
CA	Chatsworth, TTI	818-709-1010
CA	Garden Grove, Bell	714-895-7801
CA	Gardena, Bell	213-515-1800
CA	Hall-Mark, Canoga Pk.	818-716-7300
CA	Milpitas, Cal Cap	408-262-6000
CA	Milpitas, TTI	408-946-5577
CA	Sacramento, Bell	916-969-3100
CA	Sacramento, Hall-Mark	916-722-8600
CA	San Diego, Bell	619-268-1277
CA	San Diego, Hall-Mark	619-268-1201
CA	San Diego, Projections Unltd.	619-453-7900
CA	San Diego, TTI	619-587-4888
CA	San Jose, Hall-Mark	408-946-0900
CA	San Jose, Passive Technlg.	408-435-5566
CA	Sunnyvale, Bell	408-734-8570
CA	Thousand Oaks, Bell	205-499-6821
CA	Torrance, Hall-Mark	213-217-8400
CA	Tustin, Hall-Mark	714-669-4700
CA	Tustin, Projections Unltd.	714-544-2700
CO	Denver, Hall-Mark	303-790-1662
CO	Denver, TTI	303-429-6806
CO	Wheat Ridge, Bell	303-424-1985
CT	Wallingford, Hall-Mark	203-269-0100
FL	Deerfield Bch., Bell	305-421-1997
FL	Ft. Lauderdale, Hall-Mark	305-971-9280
FL	Largo, Bell	813-541-4434
FL	Orlando, Hall-Mark	305-855-4020
FL	Orlando, TTI	305-859-1000
FL	Pompano Bch., Peerless	305-973-4141
FL	St. Petersburg, Hall-Mark	813-530-4543
GA	Atlanta, Hall-Mark	404-447-8000
GA	Norcross, Bell	404-662-0923
GA	Norcross, TTI	404-662-0911
IL	Chicago, Hall-Mark	312-860-3800
IL	Chicago, PEI/Genesis	312-530-2272
IL	Elk Grove Vl., Bell	312-640-1910
IL	Urbana, Bell	217-328-1077
IN	Ft. Wayne, Bell	219-423-3422
IN	Indianapolis, Bell	317-875-0200
IN	Indianapolis, Hall-Mark	317-872-8875
IN	South Bend, PEI/Genesis	219-287-2911
IA	Cedar Rapids, Bell	319-395-0730
KS	Kansas City, Hall-Mark	913-888-4747
MD	Baltimore, Hall-Mark	301-988-9800
MD	Baltimore, PEI/Genesis	301-561-5325
MD	Columbia, TTI	301-995-1331
MA	Boston, Hall-Mark	617-935-9777
MA	Wilmington, TTI	617-658-4700
MA	Winchester, Bell	617-729-5800
MI	Ann Arbor, Bell	313-971-9093
MN	Eden Prairie, TTI	612-944-5080
MN	Minneapolis, Hall-Mark	612-941-2600
MO	St. Louis, Hall-Mark	314-291-5350
NH	Hudson, Bell	603-882-1133
NJ	Edison, Peerless	201-906-1181
NJ	Fairfield, Hall-Mark	201-575-4415
NM	Albuquerque, Bell	505-292-2700
NY	Farmingdale, Bell	516-752-9303
NY	Lynbrook, Peerless	516-593-2121
NY	Ronkonkoma, Hall-Mark	516-737-0600
NY	Ronkonkoma, TTI	516-737-2000
NC	Raleigh, Hall-Mark	919-872-0712
OH	Cleveland, Hall-Mark	216-349-4632
OH	Columbus, EMC	614-299-4161
OH	Columbus, Hall-Mark	614-888-3313
OH	Columbus, TTI	614-848-5770
OH	Dayton, Bell	513-435-8660
OK	Tulsa, Hall-Mark	800-231-0253
OR	Portland, Bell	503-241-4115
PA	Philadelphia, Hall-Mark	215-355-7300
PA	Philadelphia, PEI-Genesis	215-673-0400
TX	Austin, Hall-Mark	512-258-8848
TX	Dallas, Hall-Mark	214-553-4300
TX	Ft. Worth, TTI	817-595-3100
TX	Houston, Hall-Mark	713-781-6100
TX	Richardson, Bell	214-690-0466
UT	Salt Lake City, Bell	801-972-6969
UT	Salt Lake City, Hall-Mark	801-972-1008
WA	Redmond, TTI	206-882-0291
WA	Seattle, Bell	206-747-1515
WI	Milwaukee, Hall-Mark	414-797-7844
WI	Waukesha, Bell	414-547-8879
Can	Calgary, Alberta, Future	403-235-5325
Can	Downsview, Ont., Future	416-638-4771
Can	Edmonton, Alberta, Future	403-438-2858
Can	Ottawa, Ont., Future	613-820-8313
Can	Pointe Claire, Que., Future	514-694-7710
Can	St. Foy, Que., Future	418-682-8092
Can	Vancouver, B.C., Future	604-294-1166
Can	Winnipeg, Manitoba, Future	204-786-7711

AMERICAN STEAM TIMER, INC., Div. of JMR Electronics, Inc., 1525 Blondell Ave., Bronx, NY 11050, Tel: 212-597-6050; Empl.: 6; *Sls. Mgr.:* Jack Gaon

ASC

FAX: 617-245-4531

AMERICAN SWITCH CORP., 134 Water St., Wakefield, MA 01880, Tel: 617-246-1007, TWX: 710-348-6756; FSC No.: 54659; Empl.: 40; *Sls. Mgr.:* Mike Palmerino; *Dist. Mgr.:* Mike Palmerino ..... **B•1643**

Local Sales Offices & Reps

AL	Decatur, Tenn Tech	205-350-0630
AZ	Scottsdale, BSE, Inc.	602-483-0373
CA	Arcadia, HMC, Inc.	818-447-0958
CA	Mtn. View, Serra Assocs.	415-964-4300
CO	Boulder, Stratford Grp.	303-530-3194
FL	Deerfield Bch., Newell-Hynes	305-429-3207
GA	Marietta, Tenn Tech	404-428-9594
IL	Wheaton, Chadra-Schilke	312-653-8126
IN	Acton, Nationwide Comps.	317-872-7207
IA	Marion, MSB Assocs.	319-377-6261
KS	Shawnee Mission, MSB Assocs.	913-432-2131
MA	Andover, Crawford Assocs.	617-470-2122
MI	Grand Blanc, Inter-Comm	313-695-0665
MN	Golden Valley, Highland Sls.	612-546-2123
MO	St. Charles, MSB Assocs.	314-946-5577
NJ	W. Caldwell, M T S	201-228-4418
NY	Marcellus, Mullahy Sls.	315-685-6280
OH	Willoughby, Nationwide Comps.	216-946-3226
OR	Forest Grove, Doran Sls.	503-357-3333
PA	Elkins Pk., Arnold Assocs.	215-742-0600
TX	Dallas, Allied Comps.	214-238-0408
UT	Salt Lake City, Sage Sls.	801-467-5451
WA	Redmond, Doran Sls.	206-885-1885
EXP	CT/Litchfield, Intrade	203-567-5901

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AL	Birmington, Forbes Distbg.	205-251-4104
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AZ	Phoenix, Electro Comps.	602-258-2665
AZ	Tempe, RCD Inds.	602-838-0979
CA	Buena Pk., Cypress Elctrns.	213-744-0355
CA	Hawthorne, Electrosonic Comps.	213-970-0997
CA	Los Angeles, Elec. Switches	213-660-1310
CA	San Diego, Deco Elctrns.	619-693-1595
CA	San Jose, Rose Elctrns.	408-263-9700
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CA	Santa Monica, Master Dists.	213-452-1229
CA	Sunnyvale, Power Supp. Comps.	408-737-1333
CA	Tustin, Western Switch & Controls	714-731-4333
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CT	Bridgeport, Park Dists.	203-366-7200
CT	Greenwich, Wise Comps.	203-531-4880
CT	Wallingford, Mid-State Elctrns.	203-265-9900
DE	New Castle, Elctrns. Exchange	302-322-5401
FL	Ft. Lauderdale, Brothers Elctrns.	305-561-6700
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FL	Longwood, Intertec Comps.	305-834-7777
FL	Oakland Pk., Zelcon	305-565-2555
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ID	Spirit Lake, A-I Elctrns.	208-623-3111
IL	Chicago, Leeds Elctrns.	312-625-3800
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IL	Wheeling, Hawk Elctrns.	312-459-4030
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IN	Lafayette, CWY Elctrns.	317-448-1611
IN	Terre Haute, Midwest Supp.	812-232-0187
IA	Cedar Rapids, Iowa Radio Supp.	319-393-4510
IA	W. Des Moines, Ramco Co.	515-225-6933
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NH Hudson, Interconnect of N.E. 603-883-1515
NJ E. Brunswick, Brothers Elctrns. 201-238-2200
NJ Mt. Laurel, PAC Elctrns. 609-387-3549
NJ Oakland, Relay Specialties 201-337-1000
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NY Amherst, Std. Elctrns. 716-691-3801
NY Bohemia, Key Comps. 516-567-7500
NY E. Syracuse, Add Elctrns. 315-437-0300
NY Hempstead, Davis Elctrns. 516-483-9200
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NY Woodside, Switches Unltd. 718-478-5000
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NC Winston-Salem, Kirkman Elctrns. 919-722-9131
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OH Wickliffe, Gateway Megatech 216-944-5801
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TN Chattanooga, Specialty Distbg. 615-267-9531
TN Knoxville, Curle Elctrns. 615-266-4727
TX Arlington, Bell Comp. Sls. 817-461-5303
TX Austin, Galtronics 512-837-7470
TX Dallas, Force Elctrns. 214-438-5700
TX Dallas, Wholesale Elctrns. 214-824-3001
TX El Paso, Intl. Elctrns. 915-598-3406
TX Ft. Worth, Indl. Elctrns. 817-731-7321
TX Garland, J & S Elctrns. 214-487-8808
TX Houston, Angie Elctrns. 713-659-8386
UT Salt Lake City, Std. Supp. Co. 801-486-3371
WA Kent, Pyramid Elctrns. 206-872-5800
WA Seattle, Pacific Elctrns. 206-575-1050
WV Huntington, Elctrn. Supp. 304-523-6443
WI Mequon, Lake-View Elctrns. 414-377-8250
WI Milwaukee, Progressive Image 414-321-4722
WI New Berlin, Nep Elctrns. 414-785-9100
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Can Montreal, Que., Prelco Elctrns. 514-389-8051
Can Montreal, Que., Versatech Elctrns. 514-481-0196

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FAX: 516-271-9615

AMERICAN TECHNICAL CERAMICS CORPORATION, 1 Norden La., Huntington Sta., NY 11746, Tel: 516-271-9600, TELEX: 221201; FSC No.: 29990;11272-868-73; Empl.: 497; *Sls. Mgr.:* R. Blumkin ..... **A•1009-1013**

Local Sales Offices & Reps

AZ Phoenix, Odyssey 1 602-246-8846
CA El Segundo, Fetty/Schoenduve, Inc. .. 213-322-4991
CA Mtn. View, Fetty/Schoenduve, Inc. 415-962-8330
CA San Diego, Fetty/Schoenduve, Inc. 619-292-5136
CO Englewood, FG Mktg. Co. 303-795-9176
FL Lighthouse Pt., R. C. Simon & Co., Inc. 305-941-2757
IL Chicago, Tech. Sls., Inc. 312-237-7210
KS Goddard, Midwest Tech. Sls., Inc. 316-794-8565
KS Lenexa, Midwest Tech. Sls., Inc. 913-888-5100
MA Topsfield, R.F. Assocs. 617-887-9762
MN New Brighton, TWC Sls. 612-636-1770
MO St. Charles, Midwest Tech. Sls., Inc. ... 314-441-1012
NJ Freehold, RF Elctrn. Sls. Co., Inc. 201-431-3374
NM Albuquerque, Odyssey 1 505-265-6645
NY Huntington Sta., American Tech. Ceramics Corp. 516-271-9600
NY Melville, RF Elctrn. Sls. Co., Inc. 516-420-8890
NY Rochester, Upstate Engrg. Sls. 716-225-2383
NY Utica, Upstate Engrg. Sls. 315-797-6721
OH Kettering, J. May Assocs., Inc. 513-299-8424
OR Beaverton, Quest Mktg. Inc. 503-641-7377
PA Lafayette Hill, M. Lader Co. 215-825-3177
TX Richardson, Vector Sls. Co. 214-234-4291
WA Bellevue, Quest Mktg. Inc. 206-747-9424

AMERICAN TIME PRODS. DIV., See Frequency Control Prods., Inc.

AMERICAN ULTRAVIOLET, 562 Central Avenue, Murray Hill, NJ 07974, Tel: 201-665-2211, TELEX: 13-9266, FAX: 201-665-9523; Empl.: 14; *Sls. Mgr.:* George Baer, Sls. Mgr.; *Dist. Mgr.:* George Baer

AMERICAN VOLPI CORP., 26 Aurelius Ave., Auburn, NY 13021, Tel: 315-253-9707, FAX: 315-255-1202; Empl.: 25; *Dist. Mgr.:* Stephanie Chesanek

AMERICAN WIRE & ELECTRONICS, 3198K Airport Loop Drive, Costa Mesa, CA 92626, Tel: 714-957-6905, FAX: 714-722-6183; Empl.: 5; *Sls. Mgr.:* Greg Corzine; *Dist. Mgr.:* Ray Forbes ..... **C•1771**

FAX: 714-660-0293

AMERICAN ZETTLER, 16881 Hale Ave., Irvine, CA 92714, Tel: 714-660-1670, TELEX: 67-8472; Empl.: 200; *Sls. Mgr.:* D. O. Barkhurst ..... **B•1372-1373**

Local Sales Offices & Reps

AL Madison, Benchmark Tech. Sls. 205-464-0033
AZ Tempe, Allegro Assocs., Inc. 602-967-1337
CA Irvine, Groh Assocs. 714-837-9871
CA Mountain View, G.C. Woempner 415-964-5454
CA San Diego, Groh Assocs. 619-696-0054
CO Longmont, Luscombe Engrg. Co. 303-772-3342
CT Madison, Focus Elctrn. Sls., Inc. 203-245-4314
FL Casselberry, Southern Elctrn. Sls. Inc. 305-332-4718
FL Melbourne, Southern Elctrns. Sls. Inc. 305-242-9661
GA Norcross, Benchmark Tech. Sls. 404-446-1711
IL Arlington Hgts., KMA Sls. Co. 312-398-5300
IN Carmel, Berndt Assocs. 317-844-0114
KS Overland Pk., AME Sls. 913-262-3971
MD Gaithersburg, Naudain Assocs. So. Inc. 301-258-5040
MA Taunton, Focus Elctrn. Sls., Inc. 617-824-3840
MI Ypsilanti, Techrep, Inc. 313-572-1950
MN Minneapolis, R.W. Marshall Co. 612-929-0457
MO St. Charles, AME Sls. 314-947-0333
NJ Marlton, Naudain Assocs., Inc. 609-983-5300
NJ Rahway, R. E. Breuer Co., Inc. 201-388-5045
NM Albuquerque, Thorson Desert States, Inc. 505-293-8555
NY Alexander, Union Mktg. Grp. 716-591-1219
NY Auburn, Union Mktg. Grp. 315-253-4109
NY E. Norwich, R. E. Breuer Co. Inc. 516-922-2838
NY Port Chester, R. E. Breuer Co. Inc. 914-939-3887
NY Rochester, Union Mktg. Grp. 716-546-7820
NY S. Farmingdale, R. E. Breuer Co., Inc. .. 516-694-6597
NC Wake Forest, Mountain Electro, Inc. ... 919-556-7103
OH Cincinnati, Makin & Assocs. 513-871-2424
OH Columbus, Makin & Assocs. 614-848-5424
OH Solon, Makin & Assocs. 216-248-7370
OR Beaverton, Thorson Co. N.W. 503-644-5900
TX Irving, AID Elctrns. 214-790-4761
UT Salt Lake City, Luscombe Engrg. Co. .. 801-532-4118
WA Bellevue, Thorson Co. N.W. 206-455-9180
WI Milwaukee, KMA Sls. Co. 414-259-1771
Can Richmond, B.C., Macom Agy. Ltd. 604-271-2661

Local Distributors

AL Huntsville, Hammond Elctrns. 205-830-4764
AZ Tempe, Acacia Elctrns. 602-894-2874
CA Buena Pk., Cypress Elctrns. 714-521-5230
CA Fountain Valley, Comps. Ctr. 714-979-0433
CA San Diego, Cypress Elctrns. 619-535-0011
CA Santa Clara, Components Ctr. 408-988-3751
CA Santa Clara, Cypress Elctrns. 408-980-2500
CA Santa Monica, Master Distrs. 213-452-1229
CO Lakewood, Acacia Elctrns. 303-232-2882
CO Wheatridge, Cypress Elctrns. 303-431-2622
CT E. Haven, J V Elctrns. 203-469-2321
CT Wallingford, The Green-Shaw Co. 203-265-3333
FL Ft. Lauderdale, Time Elctrns. 305-974-4800
FL Orlando, Time Elctrns. 305-841-6565
IL Lisle, Comps., Inc. 312-852-7707
IN Carmel, Altex Elctrns. 317-848-1323
MD Jessup, Treeko Sls., Inc. 301-470-3300
MD Savage, Pyttronic Inds. 301-953-9650
MA Norwood, Emtel Elctrns. 617-769-9500
MA Peabody, Time Elctrns./New Eng. 617-532-6200
MN New Brighton, Chris Elctrns. Distrs. ... 612-631-2647
MO St. Louis, Time Elctrns. 314-391-6444
NJ Oakland, Relay Spec. 201-337-1000
NJ W. Berlin, General Comps., Inc. 609-768-6767
NY Buffalo, Genesee Indl. Elctrns. 716-873-9661
NY Farmingdale, Pride Elctrns. 516-293-4020
NC Raleigh, Resco/Raleigh 919-781-5700
OH Dublin, Time Elctrns. 614-761-1100
OR Beaverton, Acacia Sls. 503-646-3377
PA Montgomeryville, Pyttronics Inds. 215-643-2850
TX Dallas, Cypress Elctrns. 214-869-1435
TX Dallas, Wallace Elctrns. 214-340-0400
TX Richardson, Comps. Ctr., Inc. 214-644-3444
WA Redmond, Time Elctrns. 206-882-1600
WI Milwaukee, Progressive Image 414-321-4722

AMETEK CONTROLS DIV., Orionics Products, 820 Pennsylvania Blvd., Feasterville, PA 19047, Tel: 215-355-6900, TELEX: 29-1769, FAX: 215-355-2937; Empl.: 100; *Sls. Mgr.:* Ken Ditto, Prod. Mgr.

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NJ Raritan, Eastcom Assocs. 201-722-7774
TX Richardson, Moore Assocs. 214-690-4929
WA Everett, C.S.I. 206-348-4800

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AMETEK, INC., Mansfield & Green Div., 8600 Sunset Dr., Largo, FL 34643, Tel: 813-536-7831, TELEX: 808-741, FAX: 813-539-6882; Empl.: 120; *Sls. Mgr.:* Gary Queensberry

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FAX: 714-630-4131

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AL Huntsville, Alpha Mktg. 205-533-0766
AZ Phoenix, TC Elctrn. Sls., Inc. 602-994-5153
AZ Scottsdale, TC Elctrn. Sls., Inc. 602-994-5153
CA Los Angeles, Landa & Assocs., Inc. 213-879-0770
CA Mountain View, Woempner-Arnold Assocs. 415-964-5454
CO Westminster, Straube Assocs. 303-426-0890
FL Coral Springs, H.A., Inc. 305-752-7520
IL Downers Grove, Richmar Elctrns. 312-968-0118
IN Ft. Wayne, Menze Sls. Co. 219-747-5616
KS Parker, S. W. Assocs., Inc. 913-898-6552
MA Framingham, Marathon Sls. Ltd. 617-875-3566
MI Lathrup Village, R. C. Nordstrom Co. 313-559-7373
MN Mendota Hgts., G-II Sls. 612-454-3086
MO St. Louis, Abrams & Assocs. 314-569-0447
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CA Los Alamitos, Permag Pacific Corp. 213-594-6515
CA Riverside, Elctrn. Supp. 714-543-9214
CA San Diego, Elctrn. Supp. 619-693-8222
CA Sunnyvale, Permag Sierra 408-738-1080
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GA Norcross, Permag S.E. Div. 404-448-4998
IL Elk Grove Vl, Permag Cen. Div. 312-956-1140
MA Billerica, Permag N.E. Div. 617-663-7500
MN Eden Prairie, Permag Minnesota Div. 612-934-4635
NY Hauppauge, Fairmont Elctrns. 516-231-3313
NY Hicksville, Permag Atlantic Div. 516-822-3311
OH Toledo, Permag Magnetics Div. 419-385-4621
TX Richardson, Permag S.W. Div. 214-699-1121
WA Bellevue, Permag N.W. Div. 206-882-2507
Can Mississauga, Ont., R-Theta, Inc. 416-890-0221

AMF POTTER & BRUMFIELD, See Potter & Brumfield

AMGLO, 5265 Michigan Ave., Rosemont, IL 60018, Tel: 312-671-4321; Empl.: 37

AMHERST INTERNATIONAL CORP., Cover Craft Div., 540 Commercial St., Manchester, NH 03101, Tel: 603-644-3555; *Sls. Mgr.:* Terry M. Pratt; *Dist. Mgr.:* Terry M. Pratt

AMICON CORP., 25 Hartwell Ave., Lexington, MA 02173, Tel: 617-861-9600; Empl.: 300; *Sls. Mgr.:* James Gilliland

AMILON CORP., 49-12 30th Ave., Woodside, NY 11377, Tel: 718-274-1794, TELEX: 4972608-LUSA; Empl.: 50; *Sls. Mgr.:* L. Rosenblatt

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FAX: 508-686-0622

AMITRON, American Micro-Tronix, Inc., 85 Flagship Drive, North Andover, MA 01845, Tel: 508-686-1882; *Sls. Mgr.:* Raymond C. Simione ..... **A•1763**

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AZ Tempe, Cain Technlg. 602-966-4322
CA Orange, Cain Technlg. 714-997-7311
CA Van Nuys, Cain Technlg. 818-904-9392
CO Englewood, Cain Technlg. 303-220-8118
CT Wethersfield, Compak, Inc. 203-563-4784
FL Melbourne Bch., Millett Assocs. 305-725-5055
IL Addison, Baldwin Sls. Assocs. 312-279-0352
MA Hudson, Compak, Inc. 617-568-0331
NH Nashua, Winn Microwave Sls. 603-883-9757
NJ Moorestown, Stern Assocs., Inc. 609-234-0661
NY Melville, RF Elctrn. Sls. Co. 516-420-8890

AMKEY, 55 Chase St., Methuen, MA 01844, Tel: 617-975-5445, FAX: 617-975-0357; Empl.: 35; *Sls. Mgr.:* Robert K. Foster; *Dist. Mgr.:* Robert K. Foster ..... **B•1810-1811**

AMLAN, INC., 97 Thornwood Rd., Stamford, CT 06903, Tel: 203-322-1913, TELEX: 643647, FAX: 203-322-7648; *Sls. Mgr.:* Mark Landeweer; *Dist. Mgr.:* Mark Landeweer

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CA Cupertino, AMP 408-255-3830
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CT Windsor, AMP 203-683-2715
FL Boca Raton, AMP 305-997-7005
GA Atlanta, AMP 404-934-7733
IL Schaumburg, AMP 312-351-5020
IN Carmel, AMP 317-848-1250
MA Framingham, AMP 617-879-3257
MI Southfield, AMP 313-645-5590
MN Minneapolis, AMP 612-831-8242
NJ Parsippany, AMP 201-334-6664
NY Holbrook, AMP 516-588-4430
NY Pittsford, AMP 716-385-2862
OH Dublin, AMP 614-764-9415
PA Malvern, AMP 215-647-6060
TN Knoxville, AMP 615-691-5710
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VA Alexandria, AMP 703-354-2419
WA Renton, AMP 206-255-0064

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AZ Chandler, Hamilton/Avnet Elctrns. 602-231-5100
NJ Cherry Hill, Hamilton/Avnet Elctrns. 609-424-0100
MD Columbia, Hamilton/Avnet Elctrns. 301-995-3500
NC Greenboro, Hammond Elctrns. 919-275-6391
PA Horsham, Schweber Elctrns. 215-441-0600
MA Peabody, Hamilton/Avnet Elctrns. 617-531-7430
CA Sacramento, Hamilton/Avnet Elctrns. 916-925-2216
CA Santa Clara, Cypress Elctrns. 408-945-8400
CA Sunnyvale, Hamilton/Avnet Elctrns. 408-743-3355
CT Wallingford, Marshall Inds. 203-265-3822
AL Huntsville, Hamilton/Avnet 205-837-7210
AL Huntsville, Marshall 205-881-9235
AL Huntsville, Powell Elctrns. 205-539-2731
AZ Phoenix, Dalis Elctrn. Supp. 602-275-2626
AZ Phoenix, Marshall 602-496-0290
AZ Phoenix, Sterling Elctrns. Corp. 602-268-2121
CA Buena Pk., Cypress 213-744-0355
CA Chatsworth, Hamilton Avent Elctrns. 818-700-1222
CA Chatsworth, Marshall Inds. 213-640-7188
CA Costa Mesa, Avnet Inc. 714-754-6111
CA Costa Mesa, Hamilton Electro Sls. 714-641-4100
CA Fullerton, Pyramid Elctrns. 714-773-0781
CA Gardena, Hamilton/Avnet 213-615-3900
CA Hawthorne, Electro-Sonic Comps. 213-970-0997
CA Irvine, Marshall Elctrns. Grp. 714-556-6400
CA Irvine, Schweber Elctrns. 714-863-0200
CA Milpitas, Marshall Inds. 408-943-4600
CA Ontario, Hamilton Avnet Elctrns. 714-989-4602
CA Rancho Cordova, Marshall 916-635-9700
CA San Diego, Cypress 619-292-5611
CA San Diego, Hamilton Avnet Elctrns. 714-541-7525
CA San Diego, Marshall Elctrns. Grp. 619-578-9600
CA San Jose, Powell Elctrns. 408-943-9020
CA Santa Clara, Pyramid Elctrns. 408-727-9810
CO Denver, CSID, Inc. 303-292-9594
CO Englewood, Hamilton Avnet Elctrns. 303-790-1000
CO Thornton, Marshall Inds. 303-451-8383
CT Danbury, Hamilton/Avnet 203-797-2800
CT Wallingford, ALMO Elctrns., Inc. 203-269-6801
CT Wallingford, Cronin Elctrns. 203-265-3134
FL Altamonte Springs, Schweber Elctrns. 305-331-7555
FL Ft. Lauderdale, Hamilton/Avnet 305-979-2900
FL Ft. Lauderdale, Hammond Elctrns., Inc. 305-973-7103
FL Ft. Lauderdale, Marshall 305-977-4880
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FL Winter Pk., Hamilton/Avnet 305-628-3888
GA Norcross, Hamilton/Avnet 404-447-7507
GA Norcross, Hammond 404-449-1996
GA Norcross, Marshall 404-923-5750
GA Norcross, Schweber Elctrns. Corp. 404-449-5842
IL Bensenville, Hamilton Avnet Elctrns. 312-860-8564
IL Elk Grove, Schweber Elctrns. Corp. 312-364-3750
IL Elmhurst, Semiconductor Spec. 312-279-1000
IL Schaumberg, Marshall 312-490-0155
IL Urbana, Bell Inds., Inc. 217-328-1077
IN Carmel, Hamilton/Avnet 317-844-9333
IN Indianapolis, Bell Inds. Inc. 317-634-8202
IN Indianapolis, Marshall 317-297-0483
IA Cedar Rapids, Hamilton/Avnet 319-362-4757
KS Edwardsville, Tennant Elctrns. 913-441-1801
KS Lenexa, Marshall 913-492-3621
KS Overland Pk., Hamilton Avnet Elctrns. 913-888-8900
MD Columbia, Powell Elctrns. 301-621-8080
MD Gaithersburg, Marshall 301-840-9450
MD Gaithersburg, MS Elctrns. 301-921-0200
MA Needham, Cronin Elctrns. 617-449-5000
MA Wilmington, Marshall Inds. 617-658-0810
MA Winchester, Bell Industries, Inc. 617-729-5800
MI Grand Rapids, Hamilton/Avnet 616-243-8805
MI Livonia, Hamilton Avnet Elctrns. 313-522-4700
MI Livonia, Marshall 313-525-5850
MI Livonia, RS Elctrns. 313-525-1155
MN Minnesota, Hamilton/Avnet 612-932-0600
MN Plymouth, Marshall 612-559-2211
MN St. Paul, Gopher Elctrns. Co., Inc. 612-483-3322

MO Earth City, Hamilton Avnet Elctrns. 314-344-1200
MO St. Charles, Lectronix 314-946-6424
NH Hudson, C & H Elctrns. 603-882-1133
NH Manchester, Hamilton Avnet Elctrns. .. 603-624-9400
NY Buffalo, Summit Distrs. 716-887-2800
NJ Fairfield, Hamilton Avnet Elctrns. 201-575-3390
NJ Fairfield, Marshall Elctrns. 201-882-0320
NJ Kenilworth, Federated Purchaser 201-272-0505
NJ Mt. Laurel, Marshall Inds. 609-234-9100
NM Albuquerque, Hamilton Avnet Elctrns. 505-765-1500
NY Hauppage, Marshall Inds. 516-273-2424
NY Hauppauge, Hamilton/Avnet 516-434-7421
NY Johnson City, Help Elctrns. 607-729-3528
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NY Lynbrook, Peerless Elctrns. 516-593-2121
NY Rochester, Hamilton/Avnet 716-475-9130
NY Rochester, Marshall Inds. 301-235-7620
NY Syracuse, Hamilton Avnet Elctrns. 315-437-2641
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NC Raleigh, Hamilton Avnet Elctrns. 919-828-0819
NC Raleigh, Marshall 919-878-9882
NC Raleigh, Southeastern Elctrns. 919-828-2311
OH Akron, AESCO Elctrns. 216-762-8818
OH Columbus, Elctrn. Mktg. Corp. 614-299-4161
OH Dayton, Graham/Bell Inds. 513-435-8660
OH Dayton, Hamilton/Avnet 513-439-6700
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OH Solon, Hamilton/Avnet 216-349-5100
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OH Westerville, Hamilton/Avnet 614-882-7389
OK Tulsa, Hamilton/Avnet 918-252-7297
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OR Lake Oswego, Hamilton-Avnet Elctrns. 503-635-8157
PA Mars, ALMO Elctrns., Inc. 412-776-9090
PA Philadelphia, Almo Elctrns. Corp. 215-698-4000
PA Philadelphia, Powell Elctrns. 215-365-1900
PA Pittsburgh, Hamilton/Avnet 412-281-4150
TN Nashville, Graham Elctrns. 615-367-4400
TX Austin, Kent Elctrns. Corp. 512-834-1900
TX Austin, Marshall 512-837-1991
TX Carrollton, Marshall Inds. 214-233-5200
TX Houston, Kent Elctrns. 713-780-7770
TX Houston, Marshall 713-895-9200
TX Irving, Hamilton/Avnet Elctrns. 214-550-7755
TX Richardson, Kent Elctrns. Corp. 214-669-2600
TX Stafford, Hamilton-Avnet Elctrns. 713-240-7898
UT Salt Lake City, Hamilton Avnet Elctrns. 801-972-2800
UT Salt Lake City, Kimball Elctrns. 801-328-2075
UT Salt Lake City, Marshall 801-485-1551
WA Bellevue, Hamilton Avnet Elctrns. 206-643-3950
WA Bellevue, Marshall Inds. 206-747-9100
WA Kent, Pyramid Elctrns. Supp., Inc. 206-872-5800
WI New Haven, Hamilton/Avnet 414-784-4510

AMPEREX ELECTRONIC CORP., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802, Tel: 516-931-6200, TWX: 510-221-1839, FAX: 516-931-6223; Empl.: 200; *Sls. Mgr.:* Robert Carlin; *Dist. Mgr.:* Robert Carlin

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CA Santa Clara, Amperex Sls. Corp. 408-727-6132
CO Denver, Amperex Sls. Corp. 303-989-7310
FL Clearwater, HHP Assocs., Inc. 813-797-4447
FL Pompano Beach, HHP Assocs., Inc. 305-971-5750
FL Winter Pk, HHP Assocs., Inc. 305-740-0320
GA Atlanta, CSR Elctrns., Inc. 404-396-3720
IL Wood Dale, Amperex Sls. Corp. 312-860-7373
IN Indianapolis, Leslie M. DeVoe Co. 317-842-3245
KS Shawnee Mission, Lowell-Kangas & Assoc. 913-631-3515
PA W. Conshohocken, Eastern Comps. Sls. Corp. 800-223-3851
MA Norwood, Amperex Sls. Corp. 617-769-6940
MI Farmington Hills, R. C. Merchant & Co., Inc. 313-476-4600
MI St. Joseph, R. C. Merchant & Co., Inc. 616-983-7378
MN Eden Prairie, Comprehensive Tech. Sls. 612-941-7181
MO St. Louis, Lowell-Kangas & Assocs. ... 314-821-4050
NY Hicksville, Amperex Sls. Corp. 516-931-6200
NY Mendon, Tech-Mark, Inc. 716-624-3840
NY Utica, Tech-Mark, Inc. 315-733-0575
NC Raleigh, Amperex Sls. Corp. 919-834-6829
OH Dayton, Amperex Sls. Corp. 513-898-9577
OR Beaverton, Western Tech. Sls. 503-644-8860
PA Willow Grove, Amperex Sls. Corp. 215-659-6096
TN Knoxville, CSR Elctrns. 615-577-1317
TX Dallas, Amperex Sls. Corp. 214-231-3481
WA Bellevue, Western Tech. Sls. 206-641-3900
WA Spokane, Western Tech. Sls., Inc. 509-922-7600

Local Distributors

CA Anaheim, Pacesetter Elctrns. 714-779-5855
CA Santa Clara, Cypress Elctrns., Inc. 408-980-2500
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MA Hingham, Sager 617-749-6700
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CA Los Altos 415-969-1445
FL Winter Pk. 305-657-5400
GA Atlanta 404-426-5070
IL St. Charles 312-377-3050
IN Ft. Wayne 219-486-7412
MD Severna Pk. 301-647-3879
MA Boston 603-893-5033
MN Minneapolis 612-824-2651
MO St. Charles 314-724-6460
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OH Dayton 513-294-0461
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PA Philadelphia, Power Elctrns. 215-365-1900
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FL Orlando, Sunland Assocs. 407-365-9533
GA Norcross, Electramark 404-446-7915
IL Arlington Hgts., Brainard-Wilson 312-437-2700
IN Ft. Wayne, Outman Sls. 219-483-7879
MD Columbia, Components & Assemblies 301-381-1800
MA Tewksbury, Sequel Assocs. 617-851-4010
NM Albuquerque, Reptronix Ltd. 505-292-1718
NY Manlius, Lamtec 315-637-3738
NY Port Washington, Ashtec 516-767-0336
NC Raleigh, Prime Comps. 919-850-9866
OR Portland, QR/Crown 503-620-8320
TX Dallas, Ammon & Rizos 214-644-5591

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AZ Phoenix, O'Donnell Assocs. S.W., Inc. 602-994-9542
CA Calabasas, Quadrep Southern, Inc. 818-887-3711
CA Santa Clara, Amphenol Corp. 408-986-0870
CO Colorado Springs, Amphenol Corp. 717-599-8951
FL Maitland, Hutto-Hawkins Assocs. 305-831-2474
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MD Columbia, Comps. & Assemblies 301-381-1800
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CA San Jose, QuadRep Inc. 408-432-3300
CA Thousand Oaks, Amphenol RF Opers. (Reg. Sls. Off.) 805-379-3379
CA Truckee, Quad Rep Inc. 916-587-5252
CO Boulder, Comp. Prod. Sls. 303-530-2800
CT Danbury, Amphenol RF Ops. 203-743-9272
FL Maitland, Hutto Hawkins Assocs. 305-831-2474
GA Norcross, Electramark Inc. 404-446-7915
ID Boise, Crown/Quad Rep 208-344-9588
IL Lisle, Connect Plus 312-355-6363
IN Indianapolis, Leslie M. Devoe Co. 317-842-3245
MD Columbia, Comps. & Assemblies 301-381-1800
MI Farmington Hills, R. C. Merchant & Co. 313-476-4600
MI St. Joseph, R. C. Merchant & Co. 616-983-7378
MO Kansas City, Connect Plus 816-756-0082
NH Amherst, D. A. Crowley Assocs. 603-673-7050
NJ Wayne, Astrorep Inc. 201-696-8200
NM Albuquerque, Reptronix Ltd. 505-292-1718
NY Babylon, Astrorep Inc. 516-422-2500
NC Greensboro, Amphenol RF Sls. 919-855-9033
OH Columbus, KT/DEPCO 614-447-0106
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FL Tampa, Hutto Hawkins Assocs., Inc. 813-251-2970
GA Norcross, Elctrn. Sls., Inc. 404-448-6554
IL Lisle, Connect-Plus, Inc. 312-355-6363
IN Indianapolis, Leslie M. DeVoe Co. 317-842-3245
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MI Farmington Hills, R. C. Merchant & Co., Inc. 313-476-4600
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CA N. Hollywood, O'Halloran Assoc. 213-877-0173
CA Palo Alto, O'Halloran Assoc. 415-969-1600
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CT Hamden, J.B.L. Assoc. 203-281-3161
FL Ft. Lauderdale, W. A. Brown Instrs., Inc. 305-776-6661
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FL Orlando, W. A. Brown Instrs., Inc. 305-648-9660
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IN Indianapolis, Elctrn. Instr. Assocs. 317-257-7231
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MD Severna Park, Delmarva Eng. Assoc. Ltd. 301-647-8388
MA Lexington, R.J. Sickles 617-862-5100
MN Minneapolis, Elctrn. Instr. Assocs. 612-374-5628
MO St. Louis, Midtec Assocs., Inc. 314-275-8666
NJ Westfield, Metro Mics 201-233-6116
NM Albuquerque, Hewitt & Assocs. 505-299-7746
NY Amsterdam, Electro-Tech Sls., Inc. 518-864-5524
NY Melville, Metro Mics 516-271-6677
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NC Cary, W. A. Brown Instrs., Inc. 919-460-1120
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CA Fremont, William Parks Assoc., Inc. 415-796-0875
CA San Diego, C.E.M., Inc. 619-692-3551
CA Santa Ana, C.E.M., Inc. 714-835-2702
CO Wheatridge, Waugaman Assocs., Inc. 303-423-1020
CT Meriden, MPS Elctrns. 203-235-1414
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MA	Norwood, MPS Elctrns.	617-769-8700
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TX	Richardson, Barry Sls.	214-234-0255
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CA	Hayward, FLW, Inc.	415-786-9070
CT	Wallingford, Pat Jenks Assocs.	203-265-9936
FL	Orlando, Currie, Peak & Frazier	305-855-0843
GA	Norcross, Currie, Peak & Frazier	404-449-7662
IL	Arlington Hgts., Comtel Midwest	312-392-4040
IN	Independance, WKM Assocs.	216-524-5930
IN	Indianapolis, Comtel Midwest	317-253-1681
KS	Shawnee Mission, Comtel Midwest	913-268-0762
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MA	Danvers, Pat Jenks Assocs.	617-777-5600
MI	Madison hgts., WKM Assocs.	313-588-2300
MN	Wayzata, Comtel Midwest	612-476-1551
MO	St. Louis, Comtel Midwest	314-991-5363
NC	Greensboro, Currie, Peak & Frazier	919-373-0380
OH	Dayton, WKM Assocs.	513-434-7500
OK	Tulsa, Abcor, Inc.	918-743-3249
PA	Frazier, FLW Inc.	215-251-9700
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CO	Denver, William J. Purdy	303-753-6800
CT	Meriden, Advance Comp. Sls.	203-238-6891
FL	Orlando, Currie, Peak, Frazier	305-855-0843
IL	Elmhurst, F.F./Hill Gray, Inc.	312-832-4101
IN	Indianapolis, Sukup	317-253-5501
MN	Minneapolis, Hei-Lite Sls.	612-861-6051
MO	Grandview, Harris-Hanson	816-763-6200
MO	St. Louis, Harris-Hanson	314-432-3611
NM	Albuquerque, William J. Purdy	505-266-7959
NY	Fairport, NET	716-223-1030
NC	Greensboro, Currie, Peak & Frazier, Inc.	919-373-0380
OH	Cleveland, Marlow	216-991-6500
OR	Beaverton, William J. Purdy Co.	503-641-9373
PA	Philadelphia, S. K. MacDonald, Inc.	215-545-1205
TX	Dallas, Elcom	214-241-2166
UT	Salt Lake City, William J. Purdy Co.	801-486-8557

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AZ	Tempe, Newark Elctrns.	602-968-7441
CA	Anaheim, A to Z Elctrns.	714-632-1620
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CA	Foster City, Newark Elctrns.	415-572-8300
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CA	Inglewood, Newark Elctrns.	213-671-7066
CA	Sacramento, Integrated Elctrns.	916-424-5297
CA	San Jose, Rose Elctrn.	408-263-9700
CA	Santa Clara, Waltronic Sls.	408-727-1200
CA	Sunnyvale, Sierra West Elctrns.	408-747-1188
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CO	Denver, Integrated Elctrns.	303-534-6121
CO	Denver, Newark Elctrns.	303-757-3351
CT	Stratford, Utronics	203-378-4201
CT	Wallingford, Sager Electrical Supp.	203-265-4600
FL	Melbourne, Rome Elctrns. South	305-242-8151
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IL	Schaumburg, Newark Elctrns.	312-843-0700
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MI	Oak Pk., Newark Elctrns.	313-967-0600
MN	Minneapolis, Newark Elctrns.	612-331-6350
MO	St. Louis, Newark Elctrns.	314-421-5066
NH	Nashua, Newark Elctrns.	603-883-9110
NJ	Bordentown, Newark Elctrns.	609-298-4450
NJ	Cranford, Garden State Elect.	201-272-6400
NY	Buffalo, Genessee Radio & Parts Co., Inc.	716-873-9661
NY	East Syracuse, ADD Elctrns.	315-437-0300
NY	Farmingdale, Midway Indl. Elctrns.	516-293-6800
NY	Mt. Vernon, QAR	914-699-2224
NY	Rochester, Simcona	716-328-3230
NY	Rome, Rome Elctrns.	315-337-5400
NY	Syracuse, Newark Elctrns.	315-437-6611
NC	Greensboro, Newark Elctrns.	919-292-7240
OH	Dayton, Stotts-Friedman	513-298-5555
OH	Warren, REM Elect.	216-373-1300
OR	Beaverton, Almac Elctrns. Grp.	503-629-8090
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PA	Philadelphia, Almo Elctrns.	215-698-4000
PA	Pittsburgh, Newark Elctrns.	412-367-2790

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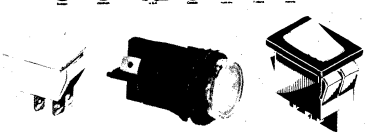

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NC	Cary, Powell Elctrns.	919-467-1212
OH	Akron, Stotts-Friedman	216-253-7000
OH	Warren, REM Elctrns.	216-373-1300
OK	Tulsa, The Altair Co.	918-252-5791
PA	Bristol, AIM Elect.	215-785-3500
TX	Richardson, Altair Co.	214-231-5166
Can	Montreal, Que., Tech-Rep	514-337-6046
Can	Richmond, Deskin Sls.	604-273-4983

ARISTO GRID LAMP PRODS., 65 Harbor Rd., Port Washington, NY 11050, Tel: 516-944-3030; Empl.: 21

ARIUM CORPORATION

ARIUM CORPORATION, 1931 Wright Circle, Anaheim, CA 92806-6052, Tel: 714-978-9531, TWX: 75493; Empl.: 40; *Sls. Mgr.:* Dave Blakemore ..... **D•1208-1209**

Local Sales Offices & Reps

CA	Garden Grove, Advanced Digital Grp.	714-897-0319
CA	San Jose, Ya-Man, Ltd.	408-559-9100
CA	Santa Clara, MANCO	408-496-6611
HI	Honolulu, Hawaiian Inds., Instr. Sls.	808-523-3676
IL	Chicago, Comtel Midwest	312-539-4838
MD	Baltimore, Rep-tron	301-799-7490
MA	North Reading, Tri-Logic Assocs.	617-664-4629
NJ	Pennsauken, Scientific Reps.	609-662-5222
NJ	Ridgefield, Rical Assocs.	201-945-5250
NY	Syracuse, Martindale-Paul, Inc.	315-487-0515
OH	Highland Heights, Comtel Instrs.	216-442-8080
OR	Lake Oswego, Syntech	503-636-6793
TX	Richardson, Testech	214-644-5010
UT	Ogden, AZTEC Entprs.	801-621-1655
WA	Kirkland, Syntech	206-488-0394
Can	No. Vancouver, B.C., Jerome & Francis Co. Ltd.	604-986-1286
Can	Ottawa, Ont., A.I.M. Elctrns.	613-722-8286

ARKAY ENGRAVERS, INC., 10-3 Drew Court, Ronkonkoma, NY 11779, Tel: 516-467-7795, FAX: 516-221-0290; FSC No.: 6Z099; *Sls. Mgr.:* Kenneth Kaplan

ARK ELCTRNS. CORP., 1325 Industrial Hwy., Southampton, PA 18966, Tel: 215-322-6510, FAX: 215-322-4231; Empl.: 20

Local Sales Offices & Reps

AL	Huntsville, E. G. Holmes & Assocs., Inc.	205-859-4199
CA	Fullerton, GRU Assocs.	714-738-0903
FL	Orlando, E. G. Holmes & Assocs., Inc.	305-894-8901
GA	Chamblee, E. G. Holmes & Assocs., Inc.	404-451-6161
NM	Albuquerque, MAYCO, Inc.	505-299-4002
NC	Cary, E. G. Holmes & Assocs., Inc.	719-469-8850
WA	Monroe, Envirotest, Inc.	206-794-6640
Can	Ottawa, Giga-Tron Assocs., LTD	613-225-4090

ARK-LES, 51 Water St., Watertown, MA 02172, Tel: 617-924-2330, TELEX: 24-4659; Empl.: 700; *Sls. Mgr.:* Bruce MacNeil

ARK-LES SPECIAL PRODUCTS CORP., Stackpole Switches, P.O.BOX 14466, Raliegh, NC 27620, Tel: 919-828-6201; Empl.: 350

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ARMBAR INDUSTRIES, INC., 139 White Oak Lane, Old Bridge, NJ 08857, Tel: 201-679-3377; Empl.: 11; *Sls. Mgr.:* Marie Gerbino ..... **A•1014**

Local Sales Offices & Reps

MD	Potomac, C.E. Tech. Elctrns.	301-235-1942
MA	Lowell, Underwood Sls.	617-256-8191
MO	Grandview, R. R. Burton Assocs.	816-763-5385
NJ	Brielle, EMC Technlgsts.	201-223-6699
NY	Medford, EMC Technlgsts.	516-286-5522

ARMEL ELECTRONICS, 1601 75th St., N. Bergen, NJ 07047, Tel: 201-869-4201, TWX: 710-992-8842, FAX: 201-869-4304; FSC No.: 91663; Empl.: 55; *Sls. Mgr.:* V. A. Pasqualino

ARMIGER CO., Woodhead Industries Inc., 2508 N. East Loop 820, P.O. Box 163709, Fort Worth, TX 76161, Tel: 817-626-3700; Empl.: 70; *Sls. Mgr.:* Ron Kahill; *Dist. Mgr.:* Larry Bucknell

ARMSTRONG WORLD INDS., W. Liberty St., Lancaster, PA 17604, Tel: 717-397-0611, TWX: 717-560-4405; Empl.: 24,000

ARNOLD ENGINEERING COMPANY, Sub. SPS Technologies, 300 West Street, Marengo, IL 60152, Tel: 815-568-2000, TELEX: 25-7448, TWX: 910-642-2790; Empl.: 650; *Sls. Mgr.:* E. F. Migely, V.P. Mktg./Sls.

ARNOLD MAGNETICS

FAX: 805-484-4113

ARNOLD MAGNETICS, 4000 Via Pescador, Camarillo, CA 93010, Tel: 805-484-4221, TWX: 910-343-6468; FSC No.: 04879; Empl.: 130; *Sls. Mgr.:* Jerry Satuloff ..... **D•1588-1592**

Local Sales Offices & Reps

AL	Huntsville, Teqspec	205-721-1701
AZ	Phoenix, Arnold Magnetics Corp.	800-421-8181
CA	Los Angeles, Arnold Magnetics	805-484-4221
CA	San Jose, Stout Inds.	408-746-0470
CO	Denver, Arnold Magnetics Corp.	800-421-8181
CT	Danbury, Power Assocs.	617-251-7756
FL	Melbourne, Kennedy Assocs.	305-676-6875
GA	Atlanta, Teqspec	404-972-7955
IL	Chicago, T-Squared	312-991-2144
MD	Silver Springs, Youth Assocs.	301-598-5740
MA	Chelmsford, Power Assocs.	617-251-7756
MN	Minneapolis, Arnold Magnetics Corp.	800-421-8181
MN	Minneapolis, Sector Engrg. & Sls.	612-593-1809
MO	St. Louis, Palatine Engrg. & Sls.	314-839-0800
NY	Buffalo, Hi-Tec Sls. Assocs.	716-223-5922
NY	New Rochelle, Ascor Elctrns.	914-235-8838
OH	Cleveland, Electro Sls. Assocs.	216-729-0190
OH	Dayton, Electro Sls. Assocs.	513-426-5551
OK	Tulsa, Spectra Sls. Corp.	218-663-7188
OR	Portland, Arnold Magnetics Corp.	800-421-8181
PA	Philadelphia, Youth Assocs.	301-598-5740
TX	Houston, Spectra Sls.	713-270-8212
TX	Richardson, Spectra Sls.	214-234-3600
WA	Seattle, Arnold Magnetics Corp.	800-421-8181
WI	Milwaukee, Sector Engrg. & Sls.	414-352-8280
Can	Montreal, Que., Arnold Magnetics Corp.	800-421-8181

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AROMAT CORP., 629 Central Avenue, New Providence, NJ 07974, Tel: 201-464-3550, TWX: 710-997-9536; Empl.: 150 ..... **B•1375-1381**

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns. Assoc.	205-881-5031
AZ	Tempe, Sys. Sls. of Arizona, Inc.	602-829-9338
AR	Little Rock, Beacon Elctrns. Assoc.	501-224-5449
CA	Cupertino, Aromat Corp.	408-446-5000
CA	Garden Grove, Aromat Corp.	714-895-7707
CA	Garden Grove, Elsco	213-533-1255
CA	Santa Clara, Fahrner-Miller	408-727-9800
CO	Englewood, Omega Ltd.	303-762-1921
CT	Madison, United Comps.	203-245-4810
FL	Maitland, EIR, Inc.	305-660-9600
FL	Orlando, Aromat Corp.	305-855-1075
GA	Atlanta, Beacon Elctrns. Assoc.	404-256-9640
IL	Elk Grove Village, Aromat Corp.	312-593-8535
IL	Elk Grove Village, Carlson Elctrn. Sls.	312-956-8240
IN	Indianapolis, J & W Sls. Co.	317-842-3740
IA	Cedar Rapids, Carlson Elctrn. Sls.	319-377-6341
IA	Davenport, Rush & West Assocs.	319-388-9494
KS	Olathe, Rush & West Assocs.	913-764-2700
MD	Upperco, Imagitron Sls.	301-374-5600
MA	Bourne, United Comps.	617-226-0556
MA	Gilman, United Comps.	203-889-4050
MI	Grand Rapids, R. P. Urban & Assocs.	616-245-0511
MI	Redford, R. P. Urban & Assocs.	313-535-2355
MN	S. St. Paul, Northport Engrg.	612-457-8000
MO	St. Louis, Rush & West Assocs.	314-965-3322
NJ	New Providence, Aromat Corp.	201-464-3550
NJ	W. Caldwell, Mariniello Tech. Sls. Co.	201-228-4418
NM	Albuquerque, SSA Inc. of New Mexico	505-889-2901
NY	Rochester, Ontec	716-464-8636
NC	Raleigh, Beacon Elctrns. Assoc.	919-787-0330
OH	Kettering, J. R. Thornberry Co.	513-258-1863
OH	Solon, J. R. Thornberry Co.	216-248-4995
PA	Pittsburgh, Covert & Newman Co.	412-531-2002
TX	Austin, Ultra Rep	512-474-8698
TX	Dallas, Ultra Rep	214-783-8831
TX	Houston, Ultra Rep	713-961-1262
TX	Richardson, Aromat Corp.	214-235-0415
UT	Salt Lake City, Omega, Ltd.	801-277-8061
WA	Redmond, Sls. & Engrg.	206-883-4999
WA	Vancouver, Sls. & Engrg.	206-573-5161
WI	Milwaukee, Carlson Elctrn. Sls.	414-476-2790
Can	Mississauga, Ont., Aromat Canada, Inc.	416-624-3777
Can	Mississauga, Ont., Tech-Trek Ltd.	416-238-0366
Can	St. Laurent, Que., Tech-Trek Ltd.	519-337-7540
Can	Vancouver, B.C., Deskin Sls. Corp.	604-324-8343

Local Distributors

AL	Huntsville, Pioneer Technlgs.	205-837-9300
AZ	Tempe, Bell Inds.	602-966-7800
AZ	Tempe, J. C. Intl.	602-968-0893
AR	Little Rock, Newark Elctrns.	501-225-8130
CA	Chatsworth, Mil-Com Dist.	213-998-3111
CA	Garden Grove, Bell Inds.	714-220-0681
CA	Gardena, Bell Inds.	213-515-1800
CA	Inglewood, Newark Elctrns.	213-671-7066
CA	Mtn. View, Bell Inds.	415-960-1440
CA	Rancho Cordova, Acacia Sls., Inc.	916-638-1861
CA	San Diego, Acacia Sls., Inc.	619-565-4365
CA	San Diego, Bell Inds.	619-268-1277
CA	Santa Ana, Norstan	213-924-7651
CA	Santa Clara, Master Dists.	408-496-6151
CA	Santa Monica, Master Distrs.	213-452-1229
CA	Sunnyvale, Acacia Sls., Inc.	408-745-7200
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Thousand Oaks, Bell Inds.	850-499-6821
CO	Denver, Newark Elctrns.	303-757-3351
CO	Englewood, Industrial Elctrns.	303-694-9444
CO	Lakewood, Acacia Sls., Inc.	303-232-2882
CO	Wheat Ridge, Bell Inds.	303-424-1985
CT	Naugatuck, SCR Elec. Co.	203-729-8274
CT	Wallingford, Cronin Elctrns.	203-265-3134
FL	Altamonte Springs, Pioneer Technlgs.	305-921-0660
FL	Deerfield Bch., Pioneer Technlgs.	305-428-8877
FL	Ft. Lauderdale, Dielco	304-973-8700
FL	Largo, Bell Inds.	813-541-4434
FL	Longwood, Dielco	305-831-3224
GA	Norcross, Bell Inds.	404-662-0923
GA	Norcross, Pioneer Technlgs.	404-448-1711
IL	Elk Grove Vl, Bell Inds.	312-640-1910
IL	Mt. Prospect, Magnuson Elctrns.	312-956-0700
IL	Mt. Prospect, Magnuson Elctrns., Inc.	312-956-0700
IL	Rolling Meadows, R.M. Elctrns.	312-358-0300
IL	Urbana, Bell Inds.	217-328-1077
IN	Ft. Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Bell Inds.	317-875-8200
IN	Indianapolis, Magnuson Elctrns.	317-247-5108
IN	Indianapolis, R. M. Elctrns.	317-291-7110
IA	Cedar Rapids, Bell Inds.	319-395-0730
LA	Metarie, Newark Elctrns.	504-838-9771
MD	Colombia, Aztech Elect.	301-995-6800
MA	Canton, Impact Sls. Co.	617-821-1500

MA Middleboro, Glynn Elctrns. 617-947-4262
MA Needham, Cronin Elctrns. 617-449-5000
MA Woburn, Bell Inds. 617-932-0577
MI Ann Arbor, Bell Inds. 313-971-9093
MI Grand Rapids, R. M. Elctrns. 616-531-9300
MI Livonia, LWC Distrs., Inc. 313-464-7700
MI Oak Pk, Newark Elctrns. 313-967-0600
MN Eden Prairie, Magnuson Elctrns. 612-829-0583
MN Hopkins, Joel Co. 612-935-6202
MN Minneapolis, Control Design Supp. Inc. 612-721-6555
MN Minneapolis, Newark Elctrns. 612-331-6350
NJ Oakland, Relay Specialties 201-337-1000
NJ Plainfield, Mars Elctrns. 201-757-4332
NM Albuquerque, Bell Inds. 505-292-2700
NY Buffalo, Summit Distrs. 716-884-3450
NY Hauppauge, Jaco Elctrns. 516-273-5500
NY Lynbrook, Peerless Radio Corp. 516-593-2121, 212-523-3456
NY Mt. Vernon, QAR Indl. Elctrn. Sls. 914-699-2224
NY Rochester, Masline Elctrns. 716-546-5373
NC Charlotte, Dixie Elctrns. 704-377-5413
NC Charlotte, Dixie Elctrns., Inc. 704-377-5413
NC Charlotte, Elctrns. Mktg. Corp. 704-394-6195
NC Charlotte, Pioneer Technlgs. 704-527-8188
NC Winston-Salem, Dixie Elctrns. 919-724-5961
OH Columbus, Elctrns. Mktg. Corp. (EMC) 614-299-4161
OH Dayton, Bell Inds. 513-434-8231
OH Dayton, Bell Inds. 513-435-8660
OH Highland Heights, Elctrns. Mktg. Corp. (EMC) 216-442-3441
OH Kettering, Elctrns. Mktg. Corp. (EMC) .. 513-439-4711
OH Valley View, Newark Elctrns. 216-447-8860
OK Oklahoma City, Newark Elctrns. 405-495-5000
OK Tulsa, Newark Elctrns. 918-832-7004
OK Tulsa, Norvell Elctrns. 918-254-8606
OR Beaverton, Acacia Sls., Inc. 503-646-3377
OR Lake Oswego, Bell Inds. 503-241-4115
OR Portland, P&R Inds. 503-641-9525
PA Horsham, Pioneer/Del. Vall. 215-674-4000
PA McKean, Advacom 814-476-7774
PA Wayne, Peak Elctrns. 215-293-9000
RI Pawtucket, Major/Edwards 401-725-7400
SC Charleston, Dixie Elctrns. 803-554-7515
SC Columbia, Dixie Elctrns. 803-779-5332
SC Greenville, Dixie Elctrns. 803-297-1437
TN Gray, Dixie Elctrns. 615-477-3838
TN Knoxville, Dixie Elctrns. 615-938-4131
TN Nashville, Bell Inds. 615-242-2682
TN Nashville, Pioneer Technlgs. 615-367-4400
TX Austin, Newark Elctrns. 512-338-0287
TX Austin, Norvell Elctrns. 512-837-5555
TX Austin, Southwest Elctrns. 512-343-7694
TX Dallas, Computer Comps. Corp. 214-239-0271
TX Dallas, Newark Elctrns. 214-340-3585
TX Dallas, Norvell Elctrns. 214-233-0020
TX Dallas, Southwest Elctrns. 214-234-2050
TX Garland, Newark Elctrns. 214-494-5911
TX Houston, Newark Elctrns. 713-782-4800
TX Houston, Newark Elctrns. 713-827-7040
TX Houston, Newark Elctrns. 713-827-0630
TX Houston, Norvell Elctrns. 713-777-1666
TX Irving, Newark Elctrns. 214-256-6585
TX Richardson, Bell Inds. 214-690-0466
TX Richardson, Southwest Elctrns. 214-234-3050
TX San Antonio, Newark Elctrns. 512-349-2641
TX Stafford, Southwest Elctrns. 713-491-4900
UT Salt Lake City, Bell Inds. 801-972-6969
VA Roanoke, Mexitronics Corp. 703-342-4444
WA Bellevue, Bell Inds. 206-747-1515
WA Seattle, Pacific Elctrns. 206-575-1050
WI Mequon, Taylor Elec. 414-241-4321
WI Waukesha, Bell Inds. 414-547-8879
Can Brampton, Ont., Zentronics 416-451-8445
Can Calgary, Alberta, Zentronics 403-272-1021
Can Montreal, Que., Ferro Technique Ltd. .. 514-341-3450
Can Nepean, Ont., Carsten Elctrns. 613-726-9250
Can Nepean, Ont., Zentronics 613-226-8840
Can Richmond, BC, Zentronics 604-273-5575
Can Scarborough, Ont., Carsten Elctrns. ... 416-495-7705
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Can St. Laurent, Que., Zentronics 514-737-9700
Can Winnipeg, Manitoba, Zentronics 204-694-1957

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ARROW HART COMPONENTS, Cooper Industries, P.O. Box 9050, Charlottesville, VA 22906-9050, Tel: 804-973-4411 ..... **B•1661**

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AZ Phoenix, M.E.S. Inc. 602-274-0898
CA Anaheim, Southwest Controls 714-758-1100
CA Novato, Control Design Comps. 415-457-9943
CA San Rafael, Arrow Hart Comps. 415-457-9940
CA Westminster, West Elctrn. Sls. 714-898-0120
CT Hartford, Arrow Hart Comps. 203-249-8471
FL Ft. Lauderdale, Motion Prods. 305-486-3440
ID Boise, Temco, Northwest 208-345-2051
IL Addison, Hedge Assocs. 312-543-0888
IN Indianapolis, E.S.I. 317-638-4439
IA Cedar Rapids, Lorenz Sls. 319-377-4666
KS Merriam, Lorenz Sls. 913-384-6556
MN St. Paul, Vikeland Sls. 612-645-4647
MO University City, Lorenz Sls. 314-997-4558
NE Lincoln, Lorenz Sls. 402-475-4660
NJ Paramus, Prime Indl. Comps. 201-262-9090
NY Rochester, Electra Sls. Corp. 716-427-7860
NY Syracuse, Electra Sls. 315-463-1248
OR Hillsboro, Temco Northwest 503-649-8375
PA Pittsburgh, Riggs Elctrl. Sls. Co. 412-244-0895
PA Willow Grove, O'Driscoll Sls. 215-659-3728
TX Richardson, Arrow Hart Comps. 214-669-2496
WA Bothell, Temco Northwest 206-821-5434
WA Spokane, Temco Northwest 509-534-8635

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AR Little Rock, Carlton-Bates Co. 501-562-9100
CA Commerce, Electro Comps. 213-727-0200
CA Covina, Selecta Switch 213-967-4123
CA Gardena, California Switch & Signal .. 213-770-2330
CA Hayward, Electro Comps. 415-783-5800
CA Los Angeles, Electric Switches 213-660-1310
CA San Jose, Consolidated Parts 408-263-9521
CA Santa Clara, Cypress Elctrns. 408-980-2500
CA Santa Fe Springs, Eurton Elec. 213-946-4477
CA Santa Monica, Master Distr. 213-452-1229
CA Tustin, Western Switches & Control ... 714-731-4333
CO Denver, Star for Parts 303-623-4224
IL Addison, LComp-Chicago 312-628-1400
IL Chicago, Newark Elctrns. 312-784-5100
IL Chicago, Revere Elec. Supp. 312-738-3636
IL Palatine, OHM Elctrns. 312-359-5500
IL Rockford, G. C. Elctrns. 815-968-9661
IL Wood Dale, Electro Kinetics 312-595-6700
IN Indianapolis, Graham Elctrns. 317-634-8202
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MA Hingham, Sager Elctrl. 617-749-6700
MI Livonia, RS Elctrns. 313-525-1155
MI St. Clair Shores, SPEMCO 313-771-2700
MN St. Paul, Gopher Elctrns. Co. 612-483-4450
MO Maryland Heights, LComp 314-291-6200
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NH Nashua, Brevan Elec. Inc. 603-889-7230
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NY Buffalo, Summit Distrs. 716-884-3450
NY Hauppauge, Sager Elec. 516-348-1300
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NY Lynbrook, Peerless Radio Corp. 516-593-2121
NY Woodside, Switches Unltd. 212-478-5000
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Cincinnati, Hughes-Peters 513-351-2000
OH Cleveland, Midland Elec. 216-248-3800
OH Cleveland, Pioneer/Cleveland 216-587-3600
OH Columbus, Hughes-Peters 614-294-5351
OR Portland, Johnstone Corp. 503-231-4833
PA Philadelphia, Philadelphia Elctrns. 215-568-7444
TX Dallas, Associated Aircraft 214-331-4381
TX Dallas, Harrison Equip. 214-239-2750
TX Ft. Worth, Allied Elctrns. 817-336-5401
TX Garland, Newark Elctrns. 214-494-5911
WA Seattle, Campbell H. D. 206-433-1900
WA Seattle, Radar Elec. 206-282-2511
WI Mequon, Taylor Elec. Co. 414-241-4321

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CA San Diego, S & A Tech. Sls. 619-295-0738
CA Santa Ana, S & A Tech. Sls. 714-250-0121
CA Santa Clara, RC Elctrns. 408-988-0701
GA Atlanta, Electro Sls. Inc. 404-394-1122
MA Framingham, Bob Mirabella 617-877-0884
NY No. Syracuse, R. F. Roux 315-458-9169
NC Raleigh, KZJ Comps. Sls. Co. 919-782-8100
OH Dayton, KW Elctrn. Sls. Inc. 513-890-2150
OH Shaker Hgts., KW Elctrn. Sls. Inc. 216-491-9177
PA Allison Pk., KW Elctrn. Sls. Inc. 412-487-4300
TX Dallas, Rem-Air Comps. Corp. 214-234-1069
TX Houston, John Dunkel 713-729-1670
WA Redmond, Elctrn. Mktg. Grp. 206-882-0962
WA Vancouver, Elctrn. Mktg. Grp. 503-684-5935

Local Distributors

NC Raleigh, Century Elctrns. 919-872-2203
PA Norristown, Century Elctrns. 215-631-5400

ARTEL COMMUNICATIONS CORP., 22 Kane Industrial Dr., Hudson, MA 01749, Tel: 617-562-2100, FAX: 617-562-6942; Empl.: 80; *Sls. Mgr.:* Frank Baker, Dir. of Sls.

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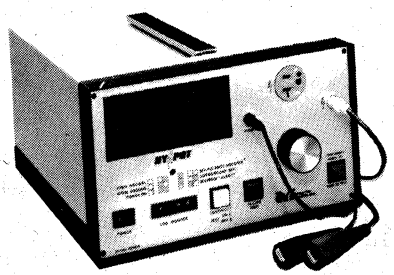

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MN	Minneapolis, Minnkota Elec. Sls.	612-871-7838
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CA	Signal Hill, Thorson Co. of So. Calif.	213-595-0361,
FL	Pompano Bch., J.P. Elctrn. Sls. Co.	305-782-6830,
IL	Lombard, Genesis One Sls.	312-953-8716,
MA	Hopkinton, Mantec, Inc.	617-435-3434,
MN	Minneapolis, Deerland Distrs., Inc.	612-331-6433,
NY	Cutchogue, L. M. J. Martin Assocs., Inc.	516-734-5337,
TX	Richardson, Barger Engrg., Inc.	214-349-6171,

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CO	Aurora, Electro Tech Sls.	303-343-8937
CO	Denver, CW Elctrns.	303-832-1111
GA	Marrietta, NBC Mktg.	404-424-9097
IL	Joliet, Communications Assoc.	815-744-6444
IL	Joliet, Primus Elctrns.	815-436-8945
MD	Cockleysville, Tessco.	301-785-5300
MA	N. Scituate, Two Comm Inc.	800-343-5519
MA	Reading, Graham Radio	617-944-4000
MA	Westport, Com Mar Inc.	617-636-6961
MN	St. Paul, Capital Sls.	612-642-1120
NJ	Clifton, Meridian Comms.	201-473-1623
OH	Cincinnati, Cartwright Comms.	513-489-1755
TX	Dallas, M. Hutton Co.	214-484-0580
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MO	Bridgeton, Di-Tronix, Inc.	314-291-4777
MO	Raytown, Di-Tronix, Inc.	816-365-6340
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TX	Dallas, Data Mktg. Assocs., Inc.	214-661-0330
WA	Bellevue, Fry Controls, Inc.	206-282-9270
WA	Seattle, Datacom & Assocs., Inc.	206-285-2525
WI	Appleton, Bu-Nell Eng. Co.	414-733-4242
WI	Waukesha, Bu-Nell Eng. Co.	414-784-0994
Can	Willowdale, Ont., Arthur Rosenblum Sls.	416-224-1177

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CA	Cypress	714-220-6100
CA	Los Angeles	213-726-5184
CA	Sunnyvale	408-522-5555
CA	VanNuys	818-785-4911
FL	Orlando	305-345-7296
GA	Norcross	404-446-4710
IL	Itasca	312-250-9777
MA	Framingham	617-626-2161
MN	Minneapolis	612-724-2019
NJ	Berkeley Hgt.	201-771-2601
NC	Raleigh	919-790-9004
OR	Portland	503-244-3883
PA	King of Prussia	215-768-2626
TX	Bedford	817-354-9798

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CA	Irvine, Schweber	714-863-0200
CA	Sacramento, Schweber	916-929-9732
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GA	Norcross, Schweber	404-449-9170
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IA	Cedar Rapids, Schweber	319-373-1417
KS	Kansas City, Schweber	913-492-2922
MD	Baltiomore, Schweber	301-792-4025
MA	Bedsford, Schweber	617-275-5100
MO	St. Louis, Schweber	314-739-0526
NH	Manchester, Schweber	603-625-2250
NJ	Fairfield, Schweber	201-227-7880
NY	Rochester, Schweber	716-424-2222
NY	Westbury, Schweber	516-334-7474
OH	Dayton, Schweber	513-439-1800
OK	Tulsa, Schweber	918-622-8000
PA	Pittsburgh, Schweber	412-782-1600
TX	Houston, Schweber	713-784-3600

ATC POWER SYSTEMS, INC., 472 Amherst Street, Nashua, NH 03063, Tel: 603-882-1366, TELEX: 756779; FSC No.: 61814; Empl.: 35; *Sls. Mgr.:* Thomas J. Mealey

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ATLAS ENGINEERING CORP., 10 Cheney St, Dorchester, MA 02121, Tel: 617-445-7100; FSC No.: 07001; Empl.: 75; *Sls. Mgr.:* Norman Scotch

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FL	Deerfield Bch., Cartwright & Bean	305-429-3400
LA	Covington, Cartwright & Bean	504-892-1780
MA	Sharon, Cummings Assocs.	617-784-5600
MS	Jackson, Cartwright & Bean	601-981-1170
NY	Binghamton, Empire Tech. Sls.	607-772-0651
NY	Skaneateles, Empire Tech. Assocs.	315-685-5703
NC	Charlotte, Cartwright & Bean	704-536-0303
NC	Raleigh, Cartwright & Bean	919-876-4130
PA	Paoli, Stitzer Assocs.	215-644-5500
TN	Knoxville, Cartwright & Bean	615-693-7450
TN	Memphis, Cartwright & Bean	901-362-8345

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CA	Granada Hills, Acort Inds., Inc.	818-368-4474
CA	San Jose, Bisco Inds.	408-946-8980
IL	Franklin Pk, Bisco Inds.	312-451-1230
IN	Ft. Wayne, Graham Elec. Supp.	219-423-3422
IN	Indianapolis, Graham Elec. Supp.	317-634-8202
IA	Cedar Rapids, Deeco	319-365-7551
MA	Marlboro, Hardware Specialties	617-481-8622
MA	Winchester, Rush Inds.	617-729-5800
MA	Woburn, Bisco Inds.	617-938-8590
MN	Minneapolis, Aerospace Computer	612-884-4725
NJ	Nutley, Essex Electric	201-661-2600
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NY	Bayshore, Merrit Fastener	516-242-1800
NY	Buffalo, Summit Dist.	716-887-2800
NY	Long Island City, Hardware Specialty	212-361-9393
NY	Plainview, Elctrn. Precepts	516-293-7441
NY	Plainview, G & B Fasteners	516-694-0990
NY	Rochester, Summitt Elec.	716-334-8110
TX	Dallas, National Precision	214-357-3921
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TX	Richardson, Altair Co.	214-231-5166
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AUDRE, INC., 10915 Technology Place, San Diego, CA 92127, Tel: 619-451-2260, FAX: 619-451-0267; Empl.: 25; *Sls. Mgr.:* Randall Peterson; *Dist. Mgr.:* Randall Peterson

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CA	Montrose, Signal Entprs.	818-957-0640
CA	San Jose, Augat Inc.	408-249-8801
CA	Solano Bch., Signal Entprs.	619-994-9944
CO	Denver, Augat Inc.	303-757-2100
CO	Denver, Spectrum Mktg.	303-480-9991
FL	Coral Springs, Augat Inc.	305-755-4364
FL	Orlando, Augat Inc.	305-352-2020
GA	Marietta, Augat/Alco	404-256-0452
IL	Downer's Grove, Rockford Controls	312-960-2046
IL	Naperville, Augat Inc.	312-357-9083
IN	Indianapolis, Luebbe Sls. Co.	317-845-7389
IA	Marion, Ensco-Rep, Inc.	319-377-8551
KS	Wichita, Ensco-Rep, Inc.	316-683-1070
MA	Canton, Augat Inc.	617-762-3164
MI	Livonia, Luebbe Sls. Co.	313-477-3131
MN	Edina, Augat Inc.	612-925-0255
MN	St. Paul, Countryman Assocs.	612-645-9151
MS	Jackson, Glen White Assocs.	601-856-5411
MO	Maryland Hgts., Ensco-Rep, Inc.	314-423-3935
NJ	Bedminster, Augat, Inc.	201-781-1775
NY	Clarence Ctr., Leonard D. Allen Inc.	716-835-1955
NY	Selden, Augat, Inc.	516-331-1097
NY	Setauket, Augat, Inc.	516-331-1097
NY	Syracuse, L. D. Allen Inc.	315-437-8387
NC	Charlotte, Quantum Mfg.	704-523-8822
NC	Raleigh, Quantum Mfg.	919-846-5728
OH	Cincinnati, Luebbe Sls. Co.	513-891-5770
OH	Cleveland, Luebbe Sls. Co.	216-333-0425
OH	Columbus, Luebbe Sls. Co.	614-431-0474
OH	Dayton, Augat, Inc.	513-256-6118
OH	Dayton, Luebbe Sls. Co.	513-294-0426
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PA	Trevose, P.S.A., Inc.	215-245-0513
PA	West Chester, Augat Inc.	215-431-0231
TX	Dallas, Augat Inc.	214-788-4211
TX	Houston, Augat Inc.	713-781-9343
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VA	Lynchburg, P.S.A., Inc.	800-233-4242
VA	Oakton, P.S.A. Inc.	800-233-4242
WA	Bellevue, Augat Sls.	206-451-9777
WI	W. Bend, Rockford Controls Co.	800-323-1042
PR	Rio Piedras, D K Mktg.	809-765-5380

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AL	Huntsville, Hall-Mark Elexs.	205-837-8700
AL	Huntsville, Time Elctrns.	205-721-1133
AZ	Phoenix, Arrow/Kierulff Elex Grp.	602-437-0750
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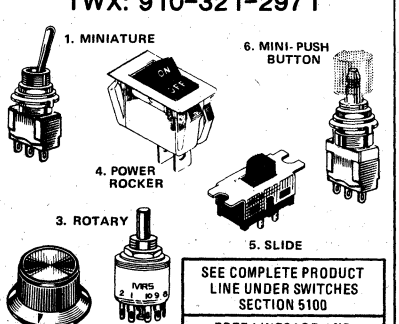

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WA Kent, Arrow/Kierulff 206-575-4420
WA Kent, Kierulff Elctrns. 206-575-4420
WA Redmond, Future Elctrns. 206-881-8199
WA Redmond, Integrated Elctrns. 206-455-2727
WI Brookfield, Arrow Elctrns. 414-792-0150
WI New Berlin, Hall-Mark Elctrns. 414-797-7844
WI New Berlin, NEP Elctrns. 414-785-9100
WI Waukesha, Marshall Inds. 414-797-8400
PR Hato Rey, Arrow/Kierulff 809-764-4384
Can Downsview, Ont., Future Elctrns. 416-638-4771
Can Mississauga, Ont., Arrow/Kierulff Elctrns. 416-672-7769
Can Montreal, Que., Arrow/Kierulff Elctrns. 514-735-5511
Can Montreal, Que., Arrow, Ltd. 514-735-5511
Can Nepean, Ont., Arrow/Kierulff Elctrns. 613-226-6903
Can Ottowa, Ont., Future Elctrns. 613-820-8313
Can Pointe Claire, Que., Future Elctrns. 514-694-7710
Can Quebec, Que., Arrow/Kierulff Elctrns. 418-687-2431
Can Willowdale, Ont., Milgray Elctrns. 416-756-4481

AXEL ELCTRNS., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418, Tel: 718-291-3900, TWX: 710-582-2618; FSC No.: 13058; Empl.: 250; *Sls. Mgr.:* J. Alaimo, VP Sls.

NORMAN N. AXELROD ASSOCS., Electro-Optical, Laser & Machine Vision Sys., 445 East 86th Street, New York, NY 10028, Tel: 212-228-0900

AXIAL MAGNETICS, Tencal Inc., 450 W. Los Angeles Ave., Simi Valley, CA 93065, Tel: 818-998-4850, TELEX: 551891; *Sls. Mgr.:* K. G. Kroll **B•1195**

AXIS CORPORATION, 7825 Engineer Rd., Ste. 208, San Diego, CA 92111, Tel: 619-560-7737, TELEX: 325144; FSC No.: 9S849; Empl.: 12; *Sls. Mgr.:* Mark J. Prager

AYDIN CORP., 700 Dresher Rd., Horsham, PA 19044, Tel: 215-657-7510, TELEX: 685-1211, FAX: 215-657-3830; Empl.: 2,000; *Sls. Mgr.:* B. Jack Miller

AYDIN CONTROLS, 414 Commerce Dr., Ft. Washington, PA 19034, Tel: 215-542-7800, TELEX: 6851057, TWX: 510-661-0518; Empl.: 533; *Sls. Mgr.:* Joseph J. Taylor

AYDIN MICROWAVE, 75 East Trimble Rd., San Jose, CA 95131, Tel: 408-946-5600, TELEX: 4990756, TWX: 910-338-0216; Empl.: 200; *Sls. Mgr.:* Dan Davis

AYDIN RADAR & EW DIVISION, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371, Tel: 408-629-1100, TWX: 910-373-1238; FSC No.: ZV23-1686808; *Sls. Mgr.:* D. Rutledge

AYDIN VECTOR DIV., Aydin Corp., Box 328, Newtown, PA 18940-0328, Tel: 215-968-4271, TWX: 510-667-2320, FAX: 215-968-3214; FSC No.: 13923; Empl.: 600

AZIMUTH ELECTRONICS, INC., 2605 So. El Camino Real, San Clemente, CA 92672, Tel: 714-492-6481, FAX: 714-492-0744; *Sls. Mgr.:* Kenneth C. Johnsen

BABCOCK, INC., 1717 West Collins Ave., Orange, CA 92667, Tel: 714-633-3700, TWX: 910-595-1517, FAX: 714-538-9740; FSC No.: 56623; Empl.: 270; *Sls. Mgr.:* Albin Gudis; *Dist. Mgr.:* Albin Gudis

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Local Sales Offices & Reps

AL Huntsville, Elctrn. Sls., Inc. 205-533-1735
AZ Scottsdale, Elctrn. Tech. Sls. Assocs., Inc.-(ETS) 602-941-9137
CA San Jose, Richards Assocs. 408-297-3010
CO Denver, Lindberg Co. 303-758-9033
FL Miramar, Dan-Tech Sls. 305-963-6142
GA Norcross, ESI 404-448-6554
IL Elk Grove Village, Carlson Elctrn. Sls. 312-956-8240
KS Overland Pk., Spectrum Sls. 913-648-6811
MD Columbia, Robert Elctrn. Sls. 301-995-1900
MN Eden Prairie, Com-Tek Sls. 612-941-7067/7181
MO Hazelwood, Spectrum Sls. 314-731-5151
CT Fairfield, Babcock Display Prods. 203-335-3433
NY Elmont, Crane & Egert Corp. 516-872-0800
NY Rochester, Apex Assocs. 716-254-6050
NC Cary, ESI 919-467-8486
NC Charlotte, ESI 704-522-8428
OH Centerville, SAI Mktg. Corp. 513-435-3181
OH Columbus, SAI Mktg. Corp. 614-876-8650
OH Shaker Heights, SAI Mktg. Corp. 216-751-3633
PA West Conshohocken, Eastern Comps. Sls. Corp. 800-223-3850,215-825-8610
TX Dallas, Pro-Comp Sls. Corp. 214-276-1948
TX Hurst, Pro-Comp Sls. Corp. 817-589-0336
UT Salt Lake City, Lindberg Co. 801-277-2643
WA Kirkland, N.W. Comps. Sls. 206-828-4838
WI Milwaukee, Carlson Elctrn. Sls. Assocs. 414-476-2790
Can Anjou, Que., Bestec Elctrns. Ltd. 514-643-1702
Can Rexdale, Ont., Bestec Elctrns. Ltd. 416-674-1330

Local Distributors

Can Mississauga, Ont., Ferro Technique, Ltd. 416-624-2770
Can Montreal, Que., Ferro Technique, Ltd. 514-341-3450

BACON INDUSTRIES, 192 Pleasant St., Watertown, MA 02172-2399, Tel: 617-926-2550, TWX: 710-327-6518; FSC No.: 99098; Empl.: 23; *Sls. Mgr.:* R. S. Cass

BAHR TECHNOLOGIES, INC., 1842 Hoffman St., Madison, WI 53704, Tel: 608-244-0500, FAX: 608-244-0528; Empl.: 18

BAILEY CONTROLS CO., Div. of Babcox & Wilcox, 29801 Euclid Ave., Wickliffe, OH 44092, Tel: 216-585-8500, TELEX: 980621, FAX: 216-944-4160; Empl.: 2300; *Sls. Mgr.:* D. Stamford; *Dist. Mgr.:* Robert Dubey

BAKER CO., INC., Drawer E - Sanford Airport, Sanford, ME 04073, Tel: 1-800-992-2537; Empl.: 150

BAKNOR INDUSTRIES LIMITED, 2209 Dunwin Drive, Mississauga, Ont., Canada L5L 1X1, Tel: 416-828-2400, FAX: 416-820-5733; Empl.: 25; *Sls. Mgr.:* M. E. Sawicki

BALDOR ELECTRIC COMPANY, P.O. Box 2400, Fort Smith, AR 72902, Tel: 501-646-4711, TELEX: 53-7425, FAX: 501-648-5792

BALLANTINE LABORATORIES, INC., P. O. Box 97, Boonton, NJ 07005, Tel: 201-335-0900, TWX: 710-987-8380; FSC No.: 50423; Empl.: 95; *Sls. Mgr.:* Robert Kerzman; *Dist. Mgr.:* Robert Kerzman ..... **D•1212**

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CA	Laguna Hills, Elotek Sys., Inc.	714-830-4856
CA	Rancho Cordova, Rohrer Instr. Sls.	916-635-2066
CO	Commerce City, MC2 Consultants & Controls	303-286-1414
CT	Plantsville, Scheinfein Assocs., Inc.	203-621-3492
FL	Orlando, Micro Spec, Inc.	305-898-3504
GA	Lilburn, Micro Spec, Inc.	404-921-3840
IL	Schaumburg, Kenneth W. Meyers Co.	312-882-4808
IN	Indianapolis, Kenneth W. Meyers Co.	317-783-1030
MA	Reading, Scheinfein Assocs.	617-944-2304
MI	Madison Hgts., WKM Assocs.	313-588-2300
MN	Minneapolis, Kenneth W. Meyers	612-920-7080
MO	St. Louis, JNM	314-991-1399
NJ	Elmwood Park, L & M Assocs.	201-797-0441
NM	Albuquerque, Fry-Gates, Inc.	505-262-1525
NY	Canandaigua, Mamula Sls.	716-394-5560
NY	New York, L & M Assocs.	212-243-6155
NC	Rock Hill, Microspec, Inc.	803-366-3015
OH	Dayton, Mann & Assocs.	513-434-2557
OH	Dayton, WKM Assoc.	513-434-7500
OH	Independence, WKM Assocs.	216-524-5930
OR	Portland, Westcon	503-283-0132
PA	Andalusia, L & M Assocs.	215-245-6658
PA	Pittsburgh, WKM Assoc.	412-292-2953
PA	Reading, L & M Assocs.	215-775-9559
SC	Rock Hill, Microspec, Inc.	803-366-3015
TN	Nashville, Micro Spec. Inc.	615-383-4064
TX	Houston, Lear Assocs.	713-488-7893
TX	Richardson, Lear Assocs.	214-231-5388
UT	Centerville, MC2 Consultants & Controls	801-298-3388
VA	Alexandria, Dyna Rep Co.	703-354-1222
WA	Federal Way, Weston, Inc.	206-859-8812
WI	Brookfield, Kenneth W. Meyers	414-784-3790
Can	Laval, Que., Techmatron	514-689-5889

Local Distributors

NJ	Belmar, Accutest	201-681-6560

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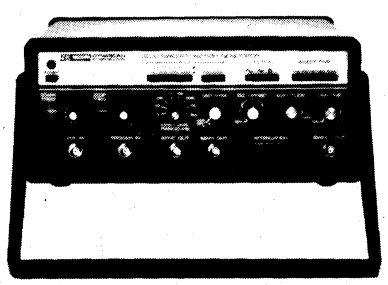

Model 3030

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs., Inc.	205-533-9108
CA	Los Altos, Kolm Mktg. Assoc.	415-948-2635
FL	Sarasota, Bass Assocs.	813-922-9538
GA	Norcross, Hughes Assocs., Inc.	404-662-1587
IL	Bannockburn, GMR Sls., Inc.	312-295-8440
IN	Fort Wayne, TX Sls. Indiana	219-489-4447
MA	Natick, Wayland Engrg. Sls.	617-655-6080
NY	Huntington, CDB Entprs.	516-692-5200
TN	Nashville, Hughes Assocs., Inc.	615-871-0908
TX	Richardson, Sci. Devices	214-231-8106
TX	Spring, Sci. Devices	713-376-8666
VA	Fairfax, Sci-Reps.-South	703-385-0600

BALL ELCTRN. SYS. DIV., Ball Corp., P. O. Box 589, Bloomfield, CO 80020, Tel: 303-460-5260, TWX: 910-563-3552; FSC No.: 612-786-4577; Empl.: 150; *Sls. Mgr.:* Bud Urling

BALL ELECTRONIC, Systems Div., P. O. Box 589, Broomfield, CO 80020, Tel: 303-460-5260, TELEX: 244826; Empl.: 500; *Sls. Mgr.:* Bud Urling

BALLY ELECTRONICS, Bally Mfg., 10750 W. Grand Ave., Franklin Park, IL 60131, Tel: 312-451-7223, TELEX: 190282; Empl.: 300; *Sls. Mgr.:* Lam McGannon

BALSTON, 703 Massachusetts Ave., Lexington, MA 02173, Tel: 617-861-7240, TELEX: 92-3481; Empl.: 50; *Sls. Mgr.:* J. Alpert

BALZERS OPTICAL CORPORATION, 170 Locke Dr., Marlboro, MA 01752, Tel: 617-481-9860, TELEX: 556-480, FAX: 617-485-0526; Empl.: 136; *Sls. Mgr.:* M. F. Wenzler

B & B MOTOR & CONTROL CORP., B & B Long Island City, Apple Hill Commons, Burlington, CT 06013, Tel: 203-673-7151, 800-638-7807, TELEX: 14-1484, FAX: 203-675-9745; Empl.: 90; *Sls. Mgr.:* John T. Wallace ..... **B•1204**

Local Sales Offices & Reps

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GA	Atlanta, B & B Motor & Control Corp.	800-845-1020
IL	Chicago, B & B Motor & Control Corp.	312-681-0089
IN	Indianapolis, B & B Motor & Control Corp.	317-248-0396
KY	Louisville, B & B Motor & Control Corp.	502-589-7753
MA	Boston, B & B Motor & Control Corp.	617-890-4944
MI	Detroit, B & B Motor & Control Corp.	313-737-3933,
NH	Nashua, B & B Motor & Control Corp.	603-883-1062
NJ	Piscataway, B & B Motor & Contol Corp.	201-572-0500
NY	Elmira, B & B Motor & Control Corp.	607-732-6599
NY	Long Island City, B & B Motor & Control Corp.	718-784-1313
NY	Rochester, B & B Motor & Control Corp.	716-424-7040
NC	Charlotte, B & B Motor & Control Corp.	704-375-0577
OH	Cincinnati, B & B Motor & Control Corp.	513-381-1885
PA	Allentown, B & B Motor & Control Corp.	215-439-8353
SC	Greenville, B & B Motor & Control Corp.	803-268-5702
TX	Dallas, B & B Motor & Control Corp.	214-641-0857
TX	Houston, B & B Motor & Control Corp.	713-820-7931

Local Distributors

CA	Los Angeles, B & B Motor & Control Corp.	213-222-7233,
CT	Berlin, B & B Automation Sys.	203-828-8766,

B & K PRECISION, Maxtec International Corp, 6470 W. Cortland, Chicago, IL 60635, Tel: 312-889-1448, TELEX: 253475; FSC No.: 08098, 18110, 48560, 30678; Empl.: 250; *Sls. Mgr.:* Dennis Hoy ..... **D•1213-1217, 1410-1412, 1607**

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AL	Birmingham, Maitland K. Smith, Inc.	205-595-9410
AR	Little Rock, Erickson Sls., Inc.	501-455-0618
CA	Santa Ana, Mike Roth Sls.	714-647-0606
CO	Denver, The Lindberg Co.	303-758-9033
FL	Altamonte Springs, Dynamic Mktg.	305-831-4584
GA	Tucker, Maitland K. Smith	404-939-3322
HI	Honolulu, Omega Hawaii, Inc.	808-732-7107
IL	Arlington Hgts., Brainard-Wilson Mktg.	312-437-2700
IN	Indianapolis, Elctrn. Reps. Inc.	317-894-1414
IN	Mishawaka, Elctrn. Reps. Inc.	219-259-9365
KS	Shawnee Mission, Lowell-Kangas & Assocs.	913-631-3515
LA	Chalmette, Erickson Sls.	504-271-1976
MD	Joppa, Electra-Tech	301-877-0344
MA	Woburn, W & D Mktg.	617-935-5610
MI	Southfield, Robert Milsk Co., Inc.	313-354-3310
MN	Minneapolis, HMR, Inc.	612-888-2122
MO	St. Louis, Lowell-Kangas Assocs.	314-821-4050
NJ	Medford, Champion Elctrn. Sls. Co.	609-983-0932
NY	Bellmore, Selectra Sls.	516-221-7865
NY	East Greenbush, Warren Kaufman & Assocs.	518-477-9864
NY	Rochester, Warren Kaufman & Assocs.	716-266-2728
NC	Charlotte, Maitland K. Smith, Inc.	704-372-2681
OH	Cleveland, Marlow Assocs.	216-991-6500
OH	Dayton, Marlow Assocs.	513-274-9666
OR	Portland, Westmark Elctrns	503-641-8780
PA	Pittsburgh, Marlow Assocs.	412-343-5050
TX	Dallas, Erickson Sls.	214-739-5833
TX	Houston, Erickson Sls., Inc.	713-266-1604
TX	Round Rock, Erickson Sls, Inc.	512-244-3068
VA	Dumfries, Electra-Tech	703-670-6962
WA	Seattle, Westmark Elctrns Inc.	206-281-4025
WI	Waukesha, Brainard-Wilson Mktg.	414-797-7940
EXP	NY, Plainview, Empire Exporters	516-293-5582
Can	Toronto, Ont., Atlas Elctrns.	416-789-7761

B & L COAXIAL CONNECTIONS LTD., 3251 Kennedy Rd., Unit No. 20, Scarborough, Canada M1V 2J9, Tel: 416-292-3906, TELEX: 065-25165, FAX: 416-298-1637; *Sls. Mgr.:* J. L. (Jim) Haskell; *Dist. Mgr.:* J. L. (Jim) Haskell

BANNER ENGINEERING CORP., 9714 - 10th Ave. N., Minneapolis, MN 55441, Tel: 612-544-3164, FAX: 612-544-3573; *Sls. Mgr.:* Floyd Schneider

BARBER-COLMAN CO., Indl. Instrs. Div., P.O. Box 2940, 1354 Clifford Ave., Loves Park, IL 61132, Tel: 815-877-0241, FAX: 815-877-0299; Empl.: 5000; *Sls. Mgr.:* John Parry

BARBER COLMAN CO. (A SIEBE CO.), Motor Division, P.O. Box 2940, Loves Pk, IL 61132-2940, Tel: 815-968-0660, TELEX: 4330367, FAX: 815-962-0070; Empl.: 300; *Sls. Mgr.:* B. B. Stout ..... **B•1196**

BARCEL WIRE & CABLE CORP., Electronics Div., 2851 Aton Ave., Irvine, CA 92714, Tel: 714-863-0300, TWX: 910-595-1957; FSC No.: 28427; Empl.: 100; *Sls. Mgr.:* Ryan Stoneburner

BARKSDALE CONTROLS DIV., Imo Delaval Inc., 3211 Fruitland Ave., P.O. Box 58843, Los Angeles, CA 90058, Tel: 213-589-6181; Empl.: 220; *Sls. Mgr.:* W. J. Kosmowski

BARNES & REINECKE, INC., 2375 Estes Ave., Elk Grove Village, IL 60007, Tel: 312-640-7200; FSC No.: 85336; Empl.: 345

BARNES ENGINEERING, 1645 So. Claudina Way, Anaheim, CA 92805, Tel: 714-533-7530; FSC No.: 53823, SIC 3400; Empl.: 47; *Sls. Mgr.:* Gordon Mackenzie

BARNES ENGINEERING DIV., EDO Corporation, 88 Long Hill Cross Rds., Shelton, CT 06484, Tel: 203-926-1777, TELEX: 6819115, FAX: 203-926-9285; Empl.: 250; *Sls. Mgr.:* M. L. Marusic

BARON WIRE & CABLE, 8111 N. St. Louis Ave., Skokie, IL 60076, Tel: 312-677-5000, TELEX: 72-4322, FAX: 312-677-7639; Empl.: 80; *Sls. Mgr.:* Al Desaluo

BARRINGTON PLASTICS, 3838 Church Road, Mt. Laurel, NJ 08054, Tel: 609-235-5151, FAX: 609-778-9032; Empl.: 120; *Sls. Mgr.:* Gary Brown

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BARTLETT INSTRUMENT CO., 14th & Ave. 'M', P.O. Box 445, Ft. Madison, IA 52627, Tel: 319-372-8366; Empl.: 25; *Sls. Mgr.:* P. R. Bartlett

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BASIC SYSTEMS, See J. L. Moon & Co.

BASLER ELEC., Rte. 143, Highland, IL 62249, Tel: 618-654-2341, TWX: 510-100-3841, FAX: 618-654-2351; Empl.: 1299

BATTERY ENGINEERING, INC., 1636 Hyde Park Ave., Hyde Park, MA 02136, Tel: 617-361-7555, FAX: 617-361-1835; FSC No.: 60289; Empl.: 30; *Sls. Mgr.:* P. Kane ..... **D•1441**

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TX Houston, Space Elctrns. 713-266-9245,

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BAY COMPONENTS, INC., 418 3rd St., Annapolis, MD 21403, Tel: 301-268-0122, TWX: 510-600-7370; Empl.: 55; *Sls. Mgr.:* Lois Levit

BAYLEY INSTRUMENT COMPANY, Box 357, Kenwood, CA 95452, Tel: 707-833-6014

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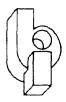
BBC-METRAWATT/GOERZ, 2150 W. 6th Ave., Broomfield, CO 80020, Tel: 303-469-5231, 800-821-6327, TELEX: 4970869; Empl.: 20; *Sls. Mgr.:* Erik Pfanku; *Dist. Mgr.:* Erik Pfanku

BBK, INC., 75 Travis Ave., Binghamton, NY 13904, Tel: 607-772-8119; *Sls. Mgr.:* Jerome Kunze

B C SYSTEMS, INC., 220 Terminal Road, Setauket, NY 11790, Tel: 516-751-9370, FAX: 516-751-9378; Empl.: 30; *Sls. Mgr.:* A. Morell

B-D CRYSTAL ENTPRS., INC., 1727 W. Galbraith Rd., Cincinnati, OH 45239, Tel: 513-522-3300; Empl.: 20; *Sls. Mgr.:* Pam Deshler



FAX: 203-367-9957

BEAD ELECTRONICS, Div. Bead Industries, Inc., 110 Mountain Grove St., P.O. Box K, Dept. 100, Bridgeport, CT 06605-0571, Tel: 203-334-4124; Empl.: 175; *Sls. Mgr.:* Mrs. B. M. Krafcik ..... **C•1702**

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IN Indianapolis, Hoster & Sieloff Assocs. 317-842-3700
MI Union Lake, Fox Inds. 313-363-7183
VA Williamsburg, Dyneers 804-229-3612
EXP NJ Rochelle Park, Richmen Metals & Comps. 201-796-6271

BEA ELECTRO-OPTICS, INC., 690 First Ave., Des Plaines, IL 60016, Tel: 312-298-1420, FAX: 312-298-1423; *Sls. Mgr.:* George E. Magerl; *Dist. Mgr.:* Vic Halkyn

BEARING INSPECTION, 10041 Shoemaker Ave., Santa Fe Springs, CA 90670, Tel: 213-944-6251; Empl.: 31

BEAU PRODUCTS DIV., Vernitron Corp., Box 10, Laconia, NH 03247, Tel: 603-524-5101, FAX: 603-524-1627; FSC No.: 13150; Empl.: 230; *Dist. Mgr.:* Larry Murphy ..... **C•1286-1289**

Local Sales Offices & Reps

AL Huntsville, DHR Mktg., Inc. 205-533-5165
AZ Phoenix, The Knight Co. 602-582-8506
AR Little Rock, Erickson Sls., Inc. 501-455-0618
CA Burlingame, Wm. J. Purdy 415-347-7701
CA Los Angeles, The Knight Co. 213-670-2833
CO Denver, W.J. Purdy Co. 303-753-6800
FL Orlando, Cartwright & Bean 305-422-4531
GA Atlanta, DHR Mktg., Inc. 404-451-9848
IL Lisle, W-G Controls 312-963-5954
LA Chalmette, Erickson Sls., Inc. 504-271-1976
MA Needham, R. Perron & Co. 617-449-6162
MN Minneapolis, Hei-Lite Sls. 612-861-6051
MO St. Louis, KKB & Co. 314-647-2400
NH Merrimack, R. Perron & Co. 603-424-4394
NJ Cherry Hill, Trinkle Sls., Inc. 609-795-4200
NJ West Caldwell, Grimm, Siegel Assoc. 201-575-9300
NM Albuquerque, C.T. Carlberg & Assoc. 505-883-3883
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OR Beaverton, Wm. J. Purdy Co. 503-641-9373
SC Greenville, DHR Mktg., Inc. 803-235-3594
TX Dallas, Erickson Sls. 214-739-5833
WA Redmond, Wm. J. Purdy Co. 206-8982-3144

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AL Huntsville, Century Fasteners 205-883-5844
AZ Tempe, Control Design Supp. 602-829-7481
AZ Tempe, Harper SID 602-967-1464
AR Little Rock, Carlton Bates 501-562-9100
CA Alhambra, Harper SID 818-289-0255
CA Anaheim, Control Design Supp. 714-821-1516
CA Fremont, Terminal Sls. 415-656-7722
CA San Carlos, Control Design Supp. 415-592-4808
CA Santa Clara, Pyramid 408-727-9810
CA Santa Monica, Master Distrs. 213-452-1229
CA Sunnyvale, Abacus 408-732-2000
CA Sunnyvale, Sierra West 408-747-1188
CA Van Nuys, Pacific Switch 818-873-4802
CO Denver, Intergrated Elex 303-292-5537
CO Englewood, Ragon Elctrns. 303-762-0670
CT Hartford, Atlantic Switch 203-527-7705
CT Wallingford, Mid State Elex 203-265-9900
CT Wallingford, Sager Elex 203-265-4600
FL Altamonte Springs, Control Design Supp. 305-788-3220
FL Lakeland, Switch Controls 813-644-7564
FL Miami, Elctrn. Equip. 305-871-3500
FL Tampa, Sunex Elex 813-885-4074
GA Doraville, Specialty Distr. 404-448-4004
GA Stone Mtn., Control Design Supp. 404-979-3500
IL Arlington Hgts., Ludan Elctrns. 312-398-5311
IL Bensonville, Voyager 312-860-1300
IL Carol Stream, Lectro Comps. 312-543-1680
IL Chicago, Newark Elctrns. 312-638-4411
IL Peoria, Klaus Radio 309-691-4840
IN Ft. Wayne, Graham Elec. 219-423-3422
IN Indianapolis, Control Design Supp. 317-788-4559
IA Cedar Rapids, Dee Elctrns. 319-365-7551
IA Marion, Control Design Supp. 319-373-2923
KS Wichita, RSC 316-267-5213
KY Louisville, P I Burks 502-589-3960
LA Baton Rouge, Indl. Elex 504-357-4244
LA Baton Rouge, Ralph's 504-344-3761
ME W. Buxton, Nelson & Wright 207-883-4388
MD Gaithersburg, M S Elctrns. 301-340-6400
MA Hingham, Sager Elctrns. 617-749-6700
MA Middleboro, Glynn Elctrns. 617-947-4262
MA Newton Upper Falls, In-Stock Prods. 617-964-6200
MI Farmington Hills, Advent Elctrns. 313-477-1650
MI Grand Rapids, S-F Elec. Supp. Inc. 616-459-0216
MI St. Clair Shores, SPEMCO 313-771-2700
MN Minneapolis, Control Design Supp. 612-721-1628
MO Kansas City, Elctrn. Supp. 816-931-0250
MO Kansas City, Walters Radio 816-531-7015
MO St. Louis, Control Design Supp. 314-426-3150
MO St. Louis, Van Sickle 314-621-5000
NV Reno, Walker Distrbn. 702-323-2766
NH Hudson, C & H Elex. 603-882-1133
NJ Camden, General Radio 609-964-8560
NJ Hanover, State Elctrns. 201-887-2550
NJ Oakland, Relay Specialty 201-337-1000
NM Albuquerque, Elctrn. Parts 505-243-6161
NM Albuquerque, Walker Elctrns. 505-883-2992
NY Albany, E. E. Taylor 518-438-7813
NY Bohemia, Key Comps. 516-567-7500
NY Buffalo, Summit 716-884-3450
NY Hauppauge, Sager Elctrns. 516-348-1300
NY Mt. Vernon, QAR 914-699-2224
NY Rochester, Simcona 716-328-3230
NC Pineville, Control Design Supp. 704-588-4410
NC Raleigh, Southeastern Elex 919-828-2311
OH Akron, Akron Elctrn. 216-762-8818
OH Cleveland, Roberts Elec. 216-238-1711
OH Columbus, EMC 614-299-4161
OK Tulsa, Carlton Bates 918-850-1626
OK Tulsa, Radio Inc. 918-587-9123
OR Beaverton, Comp. Resources 503-641-8488
PA Allentown, P. A. Peters 215-434-5237
PA Malvern, Control Design Supp. 215-296-0150
PA McKean, Advacom 814-476-7774
PA McKeesport, Barno Radio 412-751-5966
PA Philadelphia, PEI 215-568-7400
PA Philadelphia, Shap 215-969-3300
PA Wayne, PEAK 215-293-9000
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RI Providence, Wm. Dandretta 401-861-2800
SC Charleston, Wholesale Ind. Elec. 803-722-2634
SC Greenville, Hamond 803-233-4121
TN Chattanooga, Curle Elctrns. 615-266-4727
TN Knoxville, Bondurant Bros. 615-573-9151
TN Memphis, Bluff City 901-345-9500
TX Addison, Connec/Tek 214-733-4411
TX Corpus Christi, Douglas Elec. 512-883-5103
TX Dallas, Control Design Supp. 214-358-1441
TX El Paso, Ideal/Ind Elec. 915-779-6647
TX Houston, Wofford Elex 713-847-3583
TX San Antonio, Sherman Elec. 512-224-1004
UT Salt Lake City, Kimball 801-328-2075
UT Salt Lake City, Standard 801-486-3371
VA Charlottesville, VEC 804-296-4184
WA Bellevue, Intergrated Elex 206-455-2727
WA Seattle, Radar 206-282-2511
WV Huntington, State Elec. Supp. 304-523-7491
WI Berlin, Control Design Supp. 414-784-1015

BEAU TECH, 98 Elm Street, Portland, ME 04101, Tel: 207-775-6139, TELEX: 950-027 Attn Beau; Empl.: 7; *Sls. Mgr.:* Diane Sanborn; *Dist. Mgr.:* Barbara Pike

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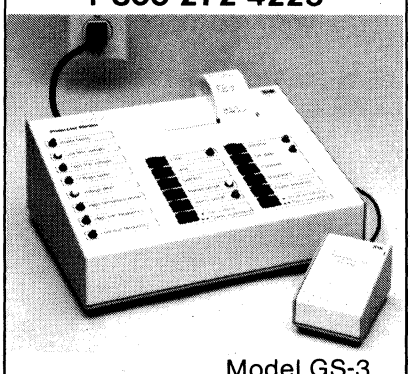
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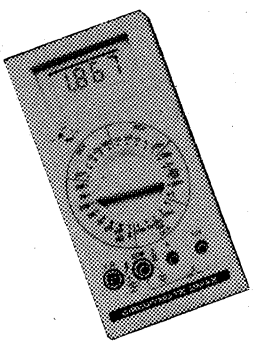

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FL	Deerfield Bch., Micro-Elctrns. Comps.	305-784-8944
FL	Palm Harbor, Micro-Elctrns. Comps.	813-784-8561
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IN	Indianapolis, J & W Sls.	317-842-3740
IA	Cedar Rapids, Carlson Elctrns.	319-377-6341
KS	Overland Park, Electri-Rep, Inc.	913-649-2168
MD	Columbia, Robert Elctrn. Sls.	301-995-1900
MA	Taunton, Focus/Forsberg Sls., Inc.	617-824-3840
MI	Fenton, SAI Mktg. Corp.	313-750-1922
MN	Minneapolis, Comstrand, Inc.	612-788-9234
MO	St. Louis, Electri-Rep	314-993-4421
NJ	Fairfield, Tech. Applications & Mktg., Inc.	201-575-4130
NM	Albuquerque, Reptronix, Ltd.	505-292-1718
NY	E. Syracuse, Ossmann Comp. Sls. Corp.	315-437-7052
NY	Henrietta, Ossmann Comp. Sls. Corp.	716-359-1200
NC	Raleigh, Tingen Tech. Sls.	919-878-4440
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OH	Dayton, SAI Mktg. Corp.	513-435-3181
OH	Shaker Heights, SAI Mktg. Corp.	216-751-3633
OR	Beaverton, Micro Sls., Inc.	503-645-2841
PA	Huntington Valley, Omega Sls.	215-947-4135
TX	Austin, Norcom, Inc.	512-451-2757
TX	Dallas, Norcom, Inc.	214-386-4888
TX	Houston, Norcom, Inc.	713-778-0392
UT	Midvale, Simpson Assoc.	801-566-3691
WA	Bellevue, Micro Sls.	206-451-0568
WI	Milwaukee, Carlson Elctrn. Sls. Co.	414-476-2790
Can	Downsview, Ont., Designtronics	416-747-1171
Can	Pointe Claire, Que., Designtronics	514-695-3124
Can	W. Vancouver, B. C., Blakewood Elctrn. Sys., Inc.	604-261-8099

BECKMAN INDUSTRIAL CORP., Emerson Electric Co., 3883 Ruffin Road, San Diego, CA 92123, Tel: 619-495-3200, TELEX: 249031 ..... **A•2063**

Local Sales Offices & Reps

CA	San Diego, Jim McGrath	619-495-3334
CA	San Diego, Michael Latham	619-495-3348
IL	Schaumburg, Tom Abrahamson	312-397-9390
NJ	Bridgeport, Stewart Hopkins	609-467-4220

BECKMAN INSTRS., HELIPOT DIV., See Beckman Instrs., Electro-Prods. Grp.

BEEDE ELECTRICAL INSTRUMENT CO., INC., S. Main St., Penacook, NH 03303, Tel: 603-753-6362, TWX: 710-364-6977, FAX: 603-753-6201; FSC No.: 06555; Empl.: 520; *Sls. Mgr.:* Dan Russell; *Dist. Mgr.:* Gail Lyman Gould ..... **D•1357-1359**

Local Sales Offices & Reps

AL	Huntsville, 20th Century Mktg.	205-533-9281
CA	Costa Mesa, F L W, Inc.	714-751-7512
FL	Apopka, Floritronics	305-886-4818
IL	Lincolnwood, Saffro & Assocs.	312-677-9720
MD	Mt. Airy, Strayton Assocs., Inc.	301-831-7007
MA	Billerica, Eastronix, Inc.	617-670-2400
MI	Madison Hgts., Michigan Romax Sls.	313-979-2450
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TX	Dallas, Southwest Elctrn. Industries	214-690-9881
WA	Kirkland, Temco NorthWest	206-821-5434
WI	Lake Mills, Saffro & Assocs.	414-648-2605
Can	Brampton, Ont., Mod-Tronics, Ltd.	416-457-6322

Local Distributors

CA	Santa Ana, Meter Craft, Inc.	714-973-8378
IL	Chicago, ALCA, Inc.	312-254-6293
MD	Sparks, E.I.L. Instrs., Inc.	301-771-4800
MI	Ferndale, Ram Meter, Inc.	313-398-6767
NJ	Pompton Lakes, REE Instr. Co.	201-839-2876

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FAX: 619-931-1212

BEI MOTION SYSTEMS CO., Corporate Off., 2111 Palomar Airport Rd., Ste. 250, Carlsbad, CA 92009, Tel: 619-931-1500, TWX: 910-380-5402; Empl.: 11 ..... **B•1880**

Local Sales Offices & Reps

CA	Newark, BEI Motion Sys. Co.	415-656-6686
CA	Santa Ana, BEI Motion Sys. Co.	714-973-8510
CO	Westminster, BEI Motion Sys. Co.	303-426-1566
FL	Clearwater, BEI Motion Sys. Co.	813-791-6043
IL	Rockford, BEI Motion Sys. Co.	815-968-9528
MA	Wakefield, BEI Motion Sys. Co.	617-245-3851
MI	Plymouth, BEI Motion Sys. Co.	313-451-0359
NJ	Parsippany, BEI Motion Sys. Co.	201-984-5600
OH	Cincinnati, BEI Motion Sys. Co.	513-232-4545
OR	Beaverton, Thorson Co. NW	503-644-5900
PA	Exton, BEI Motion Sys. Co.	215-363-5444
TX	Hurst, BEI Motion Sys. Co.	817-284-4313
WA	Bellevue, Thorson Co. Northwest	206-455-9180
Can	Quebec, Willer Engrg., Ltd.	514-333-8555
Can	Willowdale, Willer Engrg., Ltd.	416-499-4421

BEI MOTION SYSTEMS CO., Computer Products Div., 1755 B La Costa Meadows Dr., San Marcos, CA 92069, Tel: 619-471-2600, TWX: 910-333-4534, FAX: 619-471-2675; *Sls. Mgr.:* Hank Robinson ..... **B•1880**

BEI MOTION SYSTEMS CO., Digital Products Div., P.O. Box 3838, Little Rock, AR 72203, Tel: 501-851-4000, TWX: 910-722-7384, FAX: 501-851-5476; Empl.: 103; *Sls. Mgr.:* H. O. Tyler ..... **B•1880**

Refer to BEI Motion Sys. Co., Corporate Off., Carlsbad, CA for sales office information.

BEI MOTION SYSTEMS COMPANY, Drive Components Engineering Center, 160 Vallecitos de Oro, San Marcos, CA 92069, Tel: 619-744-5696, TWX: 910-322-1168

BEI MOTION SYSTEMS CO., Industrial Encoder Div., 7230 Hollister Ave., Goleta, CA 93117, Tel: 805-968-0782, TELEX: 888069, FAX: 805-968-3154; *Sls. Mgr.:* Glenn Avolio ..... **B•1880**

Refer to BEI Motion Sys. Co., Corporate Off., Carlsbad, CA for sales office information.

BEI MOTION SYSTEMS COMPANY, Kimco Division, 150 Vallecitos de Oro, San Marcos, CA 92069, Tel: 619-744-5671, TWX: 910-322-1168, FAX: 619-744-8815; Empl.: 43; *Sls. Mgr.:* George Beauchemin ..... **B•1880**

BEI MOTION SYSTEMS CO., Position Controls Div., 2280 Faraday Avenue, Carlsbad, CA 92008, Tel: 619-931-0200, TWX: 910-334-4903, FAX: 619-931-0772; *Sls. Mgr.:* John Buchanan ..... **B•1880**

Refer to BEI Motion Sys. Co., Corporate Off.,Carlsbad, CA for sales office information.

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FAX: 317-983-5294

BELDEN WIRE AND CABLE, Cooper Industries, P.O. Box 1980, Richmond, IN 47375, Tel: 317-983-5200, 800-BELDEN-1, TWX: 810-345-1393; Empl.: 2180; *Sls. Mgr.:* Ed Stull; *Dist. Mgr.:* Bill Donahue ..... **C•1762, 1772-1813**

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CA	Irvine, Belden W. & C.	714-474-1200
GA	Atlanta, Belden W. & C.	404-934-6767
IL	Geneva, Belden W. & C.	312-232-8900
IN	Richmond, Belden W. & C.	317-983-5200
MA	Shrewsbury, Belden W. & C.	617-845-5000
TX	Dallas, Belden W. & C.	214-788-4300

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FAX: 201-432-9542

BEL FUSE, 198 Van Vorst St., Jersey City, NJ 07302, Tel: 201-432-0463; Empl.: 225; *Sls. Mgr.:* A. Sutta; *Dist. Mgr.:* S. Rader ..... **A•1503-1532, 2194-2195; B•1302-1305**

Local Sales Offices & Reps

CA	Irvine, Groh Assoc.	714-837-9871

Fuses

AL	Huntsville, Beacon Elect.	205-881-5031
CA	Redwood City, James S. Heaton Co.	415-367-9000
FL	Maitland, Beacon Elect.	305-647-3498
FL	Boca Raton, Beacon Elect.	305-392-3500
IL	Chicago, MGA	312-775-1151
FL	Clearwater, Beacon Elect.	813-769-2378
FL	Melbourne, Beacon Elect.	305-724-8010
GA	Atlanta, Beacon Elect.	404-256-9640
ID	Boise, N.R. Schultz Co.	208-377-8686
MN	St. Paul, Northport Engrg.	612-457-8000
IN	Indianapolis, Insul. Reps., Inc.	317-842-5203
MD	Randallstown, Beacon North, Inc.	703-478-2480
MI	Brighton, A.P. Associates	313-229-6550
NH	Amherst, David A. Cowley Assoc.	603-673-7050
NY	Fayetteville, TR-Tech Elect.	315-446-2881
NC	Raleigh, Beacon Elect.	919-787-0330
OR	Beaverton, N.R. Schultz Co.	503-643-1644
PA	Hatboro, J.S. Wurts Co.	215-674-3562
TN	Knoxville, Insul-Reps., Inc.	615-691-7586
VA	Sterling, Beacon North, Inc.	703-478-2480
WA	Bellevue, J.R. Schultz Co.	206-454-0300
PR	Hato Rey, Max Anderson Co., Inc.	809-751-2026
Can	Scarboro, Ont., Cantronics, Ltd.	416-297-8668

Delay Lines

AL	Hunstville, Beacon Elect.	205-881-5031
AZ	Scottsdale, SMS & Assoc.	602-998-0831
CA	Irvine, Groh Assoc.	714-837-9871
CO	Boulder, Front Range Mktg.	303-443-4780
FL	Clearwater, Semtronics Assocs.	813-461-4675
FL	Ft. Lauderdale, Semtronics Assoc.	305-731-2484
FL	Houston, Oeler & Menelaides	713-682-1083
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NJ	E. Brunswick, Winch Sls. Assoc	201-828-4615
MO	St. Louis, Lowell-Kangas Assoc.	314-821-4050
NY	E. Rochester, Tri-Tech Elect.	716-385-6600
OR	Beaverton, N.R. Schultz	503-643-1644
PA	Hatboro, J.S. Wurts	215-674-3562
PA	Hatsboro, J. S. Wurts Co.	215-674-3562
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TX	Austin, Oeler & Menelaides	512-453-0275
TX	Dallas, Oeler & Menelaides	214-361-8876
UT	Salt Lake City, Front Range Mktg.	801-364-6481
VA	Sterling, Beacon North, Inc.	703-478-2480
TN	Knoxville, Insul. Reps.	615-691-7586
PR	Hato Rey, M. Anderson Co., Inc.	809-751-2020
Can	Scarboro, Ont., Cantronics, Ltd.	416-297-8668

Local Distributors

FL	Boca Raton, D & R	305-395-2341
NJ	N. Bergen, Cefco	201-869-7777
AL	Huntsville, CDI	205-883-7501
AZ	Phoenix, Lion Elctrns.	602-869-9611
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CA	Fullerton, Pyramid	213-691-0561
CA	Hayward, Kea Elctrns.	415-887-2900
CA	San Diego, Deco	619-693-1695
CA	San Diego, Sigma Elctrns.	619-565-2000
CA	San Jose, Force Elctrns.	408-943-1324
CA	Santa Clara, Pyramid	408-727-9810
CT	Norwalk, Cobra Comps.	203-847-5442
FL	Ft. Lauderdale, CDI	305-971-4950
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MD	Columbia, DK Elctrns.	301-995-1950
MD	St. Charles, Finnigan Elctrns.	314-946-6201
MA	Canton, EPC Labs.	617-821-2111
MA	Marlboro, Hardware Specialty	617-481-8622
MN	New Brighton, Chris Elctrns.	612-631-2647
NH	Hudson, C & H Elctrns.	603-882-1133
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NY	Buffalo, Summit Distrs.	716-887-2800
NC	Raleigh, CDI	919-834-9465
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PA	Cornwall Hgts., Reliance Merchandising	215-638-8200
PA	Harrisburg, Cumberland Elctrns.	717-232-9715
PA	Lyndora, Seneca Elctrns.	614-895-2631
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VA	Falls Church, CDI	703-241-8227
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IL	Mt. Prospect, Robert Adams Sls. Co.	312-297-8733
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PA	Paoli, Tyler Griffin Co.	215-647-1550

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CA	Milpitas, Maxim Elctrn. Sls.	408-946-6001
CO	Denver, Moss Mktg.	303-455-7205
IL	Palatine, Golbec Milota	312-705-0602
MA	Needham Hgts., Shain Assoc.	617-633-6651
MO	Grandview, Harris-Hanson Co.	816-763-6200
NM	Albuquerque, Moss Mktg.	505-292-7505
NY	Port Chester, Channel	914-939-8700
TX	Carrollton, Seaton Corp.	214-380-0414

Local Distributors

AZ	Phoenix, Jensen Tools & Alloys	602-968-6231
CA	Milpitas, Maxim Elctrn. Sls.	408-946-6001
CA	Pasadena, Pasadena Elctrns.	818-796-7481
CA	San Marcos, Mitchell Instrs.	619-744-2690
CA	Santa Ana, W.H.T.	714-754-6822
CO	Denver, Moss Mktg.	303-455-7205
FL	Indian Rocks Bch., P & R Instr. Supp.	813-596-8841
GA	Atlanta, P.R. Instr. Supp.	404-391-9117
IL	Palatine, Golbeck Milota Assocs.	312-705-0602
MA	Hingham, Shain Assocs.	617-740-2334
MO	St. Louis, Harris Hanson Co.	314-432-3611
NY	Rochester, Transcat	716-458-4801
OH	Dayton, Electro Entprs.	513-426-5551
PA	Horsham, BEC	215-672-2900
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TX	Houston, American Analog	713-524-0528

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BELL INDUSTRIES

FAX: 213-631-4217

BELL INDS., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224-5825, Tel: 213-537-5200, TWX: 910-346-6740; FSC No.: 76493; Empl.: 55 ..... **A•1199-1205**

Local Sales Offices & Reps

AZ	Mesa, Bidwell Sls. Assocs. of AZ	602-265-2029
CA	Campbell, Shur Sls.	408-374-5577
CA	Gardena, Bidwell Sls. Assocs.	213-770-0300
CO	Denver, West, Inc.	303-477-8180
FL	Clearwater, HHP Assocs., Inc.	813-797-4447
FL	Pompano Bch., HHP Assocs., Inc.	305-971-5750
FL	Winter Pk., HHP Assocs., Inc.	305-740-0320
GA	Atlanta, Millar Elctrns., Inc.	404-634-3350
IN	Indianapolis, Elctrn. Reps.	317-894-1414
IN	Mishawaka, Elctrn. Reps., Inc.	219-259-9365
KS	Overland Pk., Thomas L. Dowell & Assocs., Inc.	913-648-7373
MA	Burlington, Conti-Younger Assocs., Inc.	617-273-1582
MD	Woodbine, DJC Elctrn. Sls.	301-795-7020
MI	E. Detroit, Jack M. Thorpe Co.	313-779-6363
MN	Eden Prairie, Electro Mark, Inc.	612-944-5850
MO	St. Louis, Thomas L. Dowell & Assocs., Inc.	314-849-4234
NJ	Englewood, Epstein & Siebel Assoc.	201-569-7600
NC	Raleigh, Millar Elctrns., Inc.	919-828-8840
OH	St. Mary's, Thomas Shelby & Co., Inc.	419-394-3377
OR	Beaverton, Earl & Brown Co., Inc.	503-643-5500
TX	Ft. Worth, Chet Wells & Co.	817-284-0261
WA	Redmond, Earl & Brown Co., Inc.	206-885-5064
WI	Waukesha, Janus, Inc.	414-542-7575
EXP	NY, New York, Robum Agencies	212-989-5939
Can	Montreal, Que., Bestec Elctrns., Ltd.	514-643-1702
Can	Rexdale, Ont., Bestec Elctrns., Ltd.	416-674-1330

Local Distributors

AZ	Phoenix, Arizona Comps. Co., Inc.	602-269-5655
AZ	Tempe, Bell Industries/EDD	602-966-7800
AZ	Tempe, Circuit Specialists	602-966-0764
CA	Buena Park, Cypress/RPS Elctrns.	714-521-5230
CA	Garden Grove, Bell Industries/EDD	714-220-0681
CA	Gardena, Bell Industries/EDD	213-515-1800
CA	Milpitas, Zack Elctrns.	408-942-5432
CA	Riverside, Elctrn. Supp.	714-683-7300
CA	Roseville, Bell Inds./EDD	916-969-3100
CA	San Diego, Bell Industries/EDD	619-268-1277
CA	San Jose, Quement Elctrns.	408-998-5900
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Sunnyvale, Abacus Elctrns.	408-732-2000
CA	Sunnyvale, Bell Industries/EDD	408-734-8570
CA	Thousand Oaks, Bell Inds./Ventura/EDD	805-499-6821
CO	Arvada, Denver Beta Wintronic	303-431-7161
CO	Denver, Bell Industries/EDD	303-424-1985
CO	Englewood, Shelley-Ragon, Inc.	303-762-0670
CT	Danbury, Pilgrim Elctrns.	203-792-7274
CT	Wallingford, Greene-Shaw Co.	203-265-3333
CT	Wallingford, Sager Elctrcl. Supp.	203-265-4600
FL	Deerfield Bch., Bell Inds./EDD	305-421-1997
FL	Largo, Bell Inds./EDD	813-541-4434
FL	West Palm Beach, Nurmi Elctrns.	305-686-8553
GA	Norcross, Bell Inds./EDD	404-662-0923
IL	Chicago, Bell Industries/EDD	312-640-1910
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Palatine, Ohm/Elctrns, Inc.	312-359-5500
IL	Urbana, Bell Inds./EDD	217-328-1077
IN	Fort Wayne, Bell Inds./EDD	219-423-3422
IN	Indianapolis, Bell Inds./EDD	317-875-8200
IN	Indianapolis, Meunier Elctrn. Supp.	317-635-3511
IA	Cedar Rapids, Bell Industries/EDD	319-395-0730
MD	Gaithersburg, MS Elctrns.	301-921-0200
MA	Hingham, Sager Elctrcl. Supp.	617-749-6700
MA	Newton, Greene-Shaw Co.	617-969-8900
MA	Winchester, Bell Inds./EDD	617-729-5800
MI	Ann Arbor, Bell Inds./EDD	313-971-9093
MN	Minneapolis, Ind. Comps., Inc.	612-831-2666
MN	Thief River Falls, Digi-Key Corp.	218-681-6674
MO	Kansas City, Walters Radio Supp.	816-531-7015
MO	Maryland Hgts., Chelsea Inds., Inc.	314-997-7709
NH	Hudson, Bell Inds./EDD	603-882-1133
NJ	Camden, G.R.S. Elctrns.	609-964-8560
NJ	East Hanover, State Elctrn. Parts	201-887-2550
NM	Albuquerque, Bell Industries/EDD	505-292-2700
NY	Bohemia, Key Comps.	516-567-7500
NY	Buffalo, Summit Elctrns.	716-887-2800
NY	Farmingdale, Bell Inds./EDD	516-752-9303
NY	Melville, Arrow Elctrns./EDD	516-694-6800
NY	Rochester, Summit Elctrns.	716-334-8110
NY	Rome, Rome Elctrns.	315-337-5400
NC	Raleigh, Southeastern Elctrns.	919-828-2311
OH	Columbus, Hughes-Peters, Inc.	614-294-5351
OH	Dayton, Bell Inds./EDD	513-435-8660
OH	Dayton, Bell Inds./EDD-Military	513-434-8231
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Portland, Bell Industries/EDD	503-635-6500
PA	Allentown, P. A. Peters, Inc.	215-434-5237
PA	Braddock, Leff Elctrns.	412-351-5000
PA	Drexel Hill, Kass Elctrns.	215-528-6120
PA	Philadelphia, PEI Genesis	215-673-0400
TN	Hixson, Techni-Tronics, Inc.	615-842-0514
TN	Nashville, Bell Inds./EDD	615-367-4400
TX	Dallas, Wholesale Elctrns./Ind. Div.	214-824-3001
TX	Houston, Lenert Co.	713-225-1465
TX	Richardson, Bell Inds./EDD	214-690-0466
UT	Salt Lake City, Bell Industries/EDD	801-972-6969
VA	Charlottesville, Virginia Elctrn. Comps. Inc.	804-296-4184
WA	Bellevue, Bell Industries/EDD	206-747-1515
WI	Milwaukee, Bell Industries/EDD	414-547-8879
WI	Milwaukee, Marsh Elctrns.	414-475-6000
Can	Huntsville, Bell Inds./EDD	205-837-1074
Can	Scarborough, Ont., Carsten Elctrns. Ltd.	416-495-7705
Can	Willowdale, Ont., Electro Sonic, Inc.	416-494-1666

BELLOFRAM CORPORATION, Pulpit Rock Rd., Pelham, NH 03076, Tel: 603-635-2103, 800-343-0039, TELEX: 94-9457; Empl.: 300; *Sls. Mgr.:* Donald Rudolph; *Dist. Mgr.:* Donald Rudolph

BELTING INDUSTRIES CO., INC., 20 Boright Ave., Kenilworth, NJ 07033, Tel: 201-272-8591, TELEX: 229854; Empl.: 125

BEMCO, 9908 San Fernando Rd., Pacoima, CA 91331, Tel: 818-899-5296, FAX: 818-897-6525; Empl.: 70; *Sls. Mgr.:* Drew Dias

BENCHMARK TECHNOLOGY, 200 S. Turnbull Canyon Rd., City of Industry, CA 91745, Tel: 818-333-1201, TWX: 910-584-1861; Empl.: 185; *Sls. Mgr.:* S. Dorren

BENDIX CONNECTOR OPERATIONS, See Amphenol, Bendix Connector Ops.

BENDIX CORP., Electrodynamics Div., 11600 Sherman Way, N. Hollywood, CA 91605, Tel: 818-765-1010, TWX: 910-499-2151; Empl.: 1200

BENDIX CORP., MOTOR COMPS. DIV., See Facet Entprs.

BENJAMIN INTERNATIONAL, INC., 1460 Old Country Rd., Plainview, NY 11803, Tel: 516-753-0700, TELEX: 204945-BENCO, FAX: 516-753-0839

BENTLY NEVADA CORP., P.O. Box 157, Minden, NV 89423, Tel: 702-782-3611, TELEX: 354437; FSC No.: 1561105

BERG, W. M., INC., 499 Ocean Ave., East Rockaway, NY 11518, Tel: 516-599-5010, TELEX: 9103506176, FAX: 516-599-3274; Empl.: 150; *Sls. Mgr.:* Marie Raitz

BERGER-LAHR CORP., Fitzgerald Dr., Jaffrey, NH 03452, Tel: 603-532-7701, FAX: 603-532-6077; Empl.: 20; *Sls. Mgr.:* Steven R. Seabaugh

BERGQUIST

FAX: 612-835-4156

BERGQUIST, 5300 Edina Ind'l, Minneapolis, MN 55435, Tel: 800-328-3882, TWX: 910-576-2423; FSC No.: 55285; Empl.: 125; *Sls. Mgr.:* Bob Savage; *Dist. Mgr.:* Duane Dungey ..... **B•1809; C•1714**

Local Sales Offices & Reps

CA	Palo Alto, Shaw-Tech	415-961-4775
CA	San Diego, OMNI, Inc.	619-268-9606
CA	Santa Ana, Bergquist Co.	714-542-3383
CO	Broomfield, Connors Co.	303-466-9628
DE	Wilmington, Electro Tech. Sls.	302-764-2189
DC	Macrotech Assocs., Ltd.	301-766-1111
FL	Clearwater, Tech-Rep	813-530-1619
IA	Atkins, Bergquist	319-446-7456
IA	Cedar Rapids, Bergquist	319-366-8733
MA	Brookline, Harman Assocs.	617-232-6687
MO	St. Charles, Bergquist	314-946-8004
NY	Lynbrook, P. Saftler Assocs.	516-593-7880
NY	No. Syracuse, Leonard D. Allen	315-458-7470
OH	Cleveland, Staff Co.	216-331-5100
OR	Tigard, Elctrn. Comp. Sls.	503-245-2342
WA	Mercer Island, Elctrn. Comp. Sls.	206-232-9301

Local Distributors

AL	Huntsville, Component Dist., Inc.	205-883-7501
CA	Fountain Valley, Components Center	213-582-0667
CA	Hawthorne, Electrosonic	213-970-0997
CA	Mtn. View, Energy Sls.	415-969-0800
CA	San Diego, Southland Fasteners	619-578-6630
CO	Aurora, JET Elctrns.	303-364-1000
FL	Ft. Lauderdale, Components Dist. Inc.	305-973-6915
GA	Norcross, Components Dist. Inc.	404-441-3320
IL	Chicago, NEP Elctrns.	312-625-8400
MA	Brookline, Harman Sls.	617-232-6687
NY	Farmingdale, Addem Dist.	516-752-9303
NC	Raleigh, Components Dist. Inc.	919-834-9465
TX	Dallas, Components Dist. Inc.	214-694-0373
WA	Redwood, Murphy Elctrns.	206-881-1234

BERKELEY NUCLEONICS CORP., 1121 Regatta Sq., Richmond, CA 94804, Tel: 415-234-1100, TELEX: 677-1167; Empl.: 30; *Sls. Mgr.:* E. J. Buchs ..... **D•1219**

All sales engineering services in the U.S. and Canada are provided by our factory-direct sales and applications staff. For immediate assistance please contact: Telesales Department (415) 527-1121 For immediate assistance please contact: Tele-sales Department (415) 527-1121

BERKELEY PROCESS CONTROL, INC., 5327-K Jacuzzi St., Richmond, CA 94804, Tel: 415-526-3333, FAX: 415-525-1894; Empl.: 14; *Sls. Mgr.:* Theodore Arbuckle; *Dist. Mgr.:* Theodore Arbuckle

BERKSHIRE TRANSFORMER CORP., Route 341, P.O. Box 129, Kent, CT 06757, Tel: 203-927-3541; FSC No.: 89870; Empl.: 105; *Sls. Mgr.:* Janis R. Donovan

BERK TEK, INC., Box 888, RD 1, New Holland, PA 17557, Tel: 717-354-6200, FAX: 717-354-7944; FSC No.: 19449; Empl.: 350; *Sls. Mgr.:* Arnold Harris, Ntl. Sls. Mgr.; *Dist. Mgr.:* Sarah Stech

Local Sales Offices & Reps

AZ	Scottsdale, Bill Earl Assocs.	602-994-3813
CA	Milpitas, Maxim Elctrn. Sls.	408-946-6001
CA	Santa Ana, Caltronics	714-751-9162
GA	Norcross, Hollingsworth & Still	404-447-1700
MD	Wheaton, Electronic Data Assocs.	301-933-6660
MA	Clinton, B&N Assoc.	617-365-6364
MO	St. Louis, Thomas Dowell & Assoc.	314-849-4234
NJ	Sicklerville, Brown Associates	609-629-2240
NY	Fayetteville, C.W. Floring & Assoc.	315-637-4552
NY	Scottsdale, C.W. Floring & Assoc.	716-889-4614
NC	Charlotte, Pace Sls.	704-365-3216
OR	Tualatin, NICOR	415-490-5975
PA	Pittsburgh, Cody Assoc.	412-322-3121
TX	Houston, Yeager, Sumners & Assocs.	713-271-8104
UT	Salt Lake City, Aspen Sls.	801-467-2401
Can	Mississauga, RFM Electro Sls.	416-677-0027

BERMAR CORP., P.O. Box 12844, Research Triangle Park, NC 27709, Tel: 919-489-4316, TWX: 510 601-7697; *Sls. Mgr.:* M. Conland

BA BERTAN ASSOCIATES, INC.

FAX: 516-935-1766

BERTAN ASSOCS., 121 New South Rd., Hicksville, NY 11801, Tel: 516-433-3110, TWX: 510-221-2144; FSC No.: 6130; Empl.: 140; *Sls. Mgr.:* Jim Donley ... **D•1608-1621**

Local Sales Offices & Reps

AL	Huntsville, Currie, Peak, Frazier	205-536-1506
AZ	Phoenix, Thor Engrg.	602-437-1463
CA	Encino, King-Way Assoc.	818-788-4124
CA	Los Altos, Cain-White & Co.	415-948-6533
CO	Boulder, H. Bass Assocs.	303-530-7509
CT	Farmington, Ray Perron & Co., Inc.	203-673-4825
GA	Norcross, Currie, Peak, Frazier	404-449-7662
IL	Arlington Hgts., Coombs Assocs.	312-439-9810
MD	Randallstown, Beacon North	703-591-1300
MA	Needham, Ray Perron & Co., Inc.	617-449-6162
MI	Detroit, Geotronix, Inc.	313-559-2440
MN	Minneapolis, Electronic Instrs.	612-374-5628
MO	St. Louis, Acorn Elctrns., Inc.	314-644-2510
NH	Dover, Ray Perron & Co., Inc.	603-742-2321
NM	Albuquerque, Thorson/Desert States Co.	505-293-8555
NY	Elmont, Crane & Egert Corp.	516-872-0800
NY	Hicksville, Bertan Assocs., Inc.	516-433-3110
NY	Liverpool, Northern Tech. Sls. Co.	315-451-1091
OH	Cleveland, Geotronix	216-659-6100
PA	Audubon, Holmes Assocs.	215-666-0636
TX	Dallas, Automated Motion Control	214-340-4192
UT	Bountiful, H. Bass Assoc.	801-295-7100
VA	Fairfax, Beacon North	703-591-1300
WA	Bellevue, Cain-White & Co., Inc.	206-462-2118
WI	Milwaukee, Coombs Assocs.	414-351-6123
Can	Downsview, Ont., Rayonics Sci., Inc.	416-736-1600

BERTSCH U.S., SYCAMORE RESCH. CTR., 2142F Industrial Ct., Vista, CA 92083, Tel: 619-727-7420; FSC No.: 619-727-4436; Empl.: 25; *Sls. Mgr.:* B. Linko

BEST POWER TECHNOLOGY, INC., P.O. Box 280, Necedah, WI 54646, Tel: 608-565-7200, 800-356-5794, TELEX: 701934; Empl.: 205; *Sls. Mgr.:* Donald Soe

BEST TECHNOLOGY INC., 400 Boren Ave. North, Seattle, WA 98109, Tel: 206-382-1300, TWX: 910-444-2154, FAX: 206-382-0186; Empl.: 8 ..... **B•1839**

Local Sales Offices & Reps

CA	Mountain View, Straube Assocs.	415-969-6060
CO	Westminster, Straube Assocs.	303-426-0890

BESWICK, Dubilier International Plc., Alert Works, Frome, United Kingdom BA11 1PP, Tel: (0373) 64311, TELEX: 449196 G, FAX: (0373) 73175; *Sls. Mgr.:* Matthew Farrington

BETA AUTOMATION, INC., 3541 Old Conejo Rd., Newbury Park, CA 91320, Tel: 805-499-5785; Empl.: 8; *Sls. Mgr.:* James Valentino

BETATHERM CORP., 910 Turnpike Rd. (Rte. 9), Shrewsbury, MA 01545, Tel: 617-842-0516, TELEX: 374-8389, FAX: 617-842-0748; Empl.: 80

BEY ELECTRIC, INC., 362 Main St., Box 548, Lincoln Park, NJ 07035, Tel: 201-694-5000; *Sls. Mgr.:* Fred DeMauro, Gen. Mgr. ..... **A•2197**

BG ELECTRONICS, 30 South St., Mt. Vernon, NY 10550, Tel: 914-664-5591, TELEX: 6818048; FSC No.: 33791; Empl.: 26

B-G INSTRUMENTS, INC., P.O. Box 67, Alta Loma, CA 91701, Tel: 714-989-4802, 980-2826, TELEX: 517174, FAX: 714-989-0699; *Sls. Mgr.:* John Baum .... **D•1077**

Local Sales Offices & Reps

WA	Spokane, B-G Instrs., Inc.	509-238-4757

B. G. LABORATORIES, INC., 75 Travis Ave., Binghamton, NY 13904, Tel: 607-722-2376, FAX: 607-722-4204; FSC No.: 26522; Empl.: 150; *Sls. Mgr.:* Marj Jayne

BH Electronics

FAX: 612-894-9380

BH ELECTRONICS, INC., 12219 Wood Lk. Dr., Burnsville, MN 55337, Tel: 612-894-9590; FSC No.: 3677; Empl.: 300; *Sls. Mgr.:* Fred LaMarche ..... **A•1206-1207, 2198-2201**

Local Sales Offices & Reps

AZ	Fountain Hills, Halbar Assocs.	602-837-2464
CA	Glendale, Halbar Assocs.	818-246-8263
CA	San Mateo, Halbar Assocs.	415-349-4700
CO	Denver, Electro Comp. Sys.	303-797-0894
IL	Chicago, I. E. Hampton & Assocs.	312-634-8890
IN	Indianapolis, Shamrock Sls.	317-253-2563
MA	Norwood, Tom Maguire Assocs.	617-551-0500
MI	Detroit, I. E. Hampton & Assocs.	313-348-7714
MI	St. Joseph, I. E. Hampton & Assocs.	616-983-0862
MN	Osseo, Gaffney Sls. Co.	612-425-5484
OH	Dayton, Shamrock Sls.	513-258-1227
OH	Worthington, Shamrock Sls.	614-888-7638
OR	Portland, Halbar & Assocs.	206-696-0170
PA	Broomall, TCA Assocs.	215-692-6853
PA	Pittsburgh, Shamrock Sls.	412-343-5877
TX	Austin, Swearingen Sls.	512-339-8663
TX	Dallas, Swearingen Sls.	214-418-1817
TX	Houston, Swearingen Sls.	713-933-3517
WA	Redmond, Halbar Assocs.	206-882-0990
WI	Theinsville, TFL Assoc.	414-242-6800

B.H. INDS., INC., 5784 Venice Blvd., Los Angeles, CA 90019, Tel: 213-937-4763; Empl.: 6

BICC-VERO ELECTRONICS, INC., 1000 Sherman Ave, Hamden, CT 06514, Tel: 203-288-8001, TWX: 510-227-8890, FAX: 203-287-0062; Empl.: 50; *Sls. Mgr.:* David Sargent; *Dist. Mgr.:* Christine A. Martin

BICRON™

FAX: 203-824-1137

BICRON ELECTRONICS, 100 Barlow Street, Canaan, CT 06018, Tel: 203-824-5125; FSC No.: 10617; Empl.: 110; *Sls. Mgr.:* Peter B. Kent ..... **A•2202-2203**

Local Sales Offices & Reps

CA	San Clemente, ATA Assocs.	714-498-7180
CO	Denver, Omega, Ltd.	303-762-1921
IN	Indianapolis, J & W Sls.	317-842-3740
MN	Minneapolis, PSI	612-944-8545
NY	Hollis Hills, SAM Assocs.	718-464-1595
PA	Media, Homer Smith Co.	215-543-2434
PA	Pittsburg, Gormley Elec.	412-795-8010
UT	Salt Lake City, Omega, Ltd.	303-762-1921
VA	Salem, Homersmith, Inc.	703-387-1600
WI	Milwaukee, KMA Sls. Co.	414-259-1771
Can	Ottawa, Ellam & Assocs.	613-727-3892

BIDDLE INSTRUMENTS, 510 Township Line Rd., Blue Bell, PA 19422, Tel: 215-646-9200, TELEX: 685 1045 JGBCO, FAX: 215-643-2670; Empl.: 285

BIKOR, Microsemi Corporation, 1504 W. 228th St., Torrance, CA 90501, Tel: 213-539-6320, FAX: 213-539-0296; FSC No.: 58996; Empl.: 50; *Sls. Mgr.:* James Rorke

BINDICATOR, P.O. Box 0009, 1915 Dove St., Port Huron, MI 48061-0009, Tel: 313-987-2700, TWX: 810-231-5261 BINDICATOR P THY, FAX: 313-987-4476; Empl.: 50; *Sls. Mgr.:* Rick Secord; *Dist. Mgr.:* Rick Secord

BIRD ELECTRONIC CORP., 30303 Aurora Rd., Cleveland, OH 44139-2794, Tel: 216-248-1200, TELEX: 706898 Bird Elec. UD; FSC No.: 70998; Empl.: 267; *Sls. Mgr.:* W. F. Kail; *Dist. Mgr.:* Greg Johns

BIRTCHER CORP., See EG & G Birtcher

BISHOP ELECTRONICS CORP., 3729 San Gabriel River Pkwy., Pico Rivera, CA 90660, Tel: 213-695-0446, 213-692-9391, FAX: 213-692-4008

Local Sales Offices & Reps

AZ Scottsdale, BSE 602-483-0383
CA Garden Grove, Elsco Elctrns. 213-533-1255
CA Mtn. View, West Mark Assocs. 415-969-1700
CA San Diego, Elsco Elctrns. 619-292-1771
CO Denver, West High 303-477-8180
IL Oakbrook, Winner Co. 312-990-3545
KS Overland Pk, A.M.E. Sls. 913-262-3971
MD Middletown, S. T. Woolard 301-371-4500
MA Chelmsford, I.S.A. Interstate 617-256-2287
MN Minneapolis, Intl. Elctrns. 612-571-0000
NJ Leonia, Peter E. Schmitt Co. 201-944-1096
NY N. Syracuse, R. F. Roux 315-458-9169
NC Greensboro, United Sls. 919-674-9849
OH Dayton, J.D.S. 513-274-3224
OH Mansfield, J.D.S. 419-756-6933
PA Erie, Ecco Elctrns. 814-838-9804
SC Pickens, S. T. Woolard 803-878-3830
WA Bellevue, Olsen Tech. Sls. 206-883-7792
Can Oakville, Ont., Haltronics 416-844-2121

Local Distributors

AZ Phoenix, Arizona Comps. 602-269-5655
CA Chatsworth, MIL Comm. 818-998-3111
CA Orange, Western Micro/Ryno Elec. ... 714-637-0200
CA San Diego, Projection Unltd. 619-268-2929
CA San Diego, Western Micro/Ryno Elec. 619-453-8430
CA San Jose, Compass Comps. 408-946-7676
CA San Jose, Projection Unltd. 408-748-9280
CA Santa Ana, Projection Unltd. 714-261-2323
FL Largo, Elctrns. Precepts 813-544-3636
PA McKean, Advacom Inc. 814-476-7774
WI Oconomowoc, G.W. Elctrns. 414-567-9445

BISHOP GRAPHICS, INC., 5388 Sterling Center Drive, Westlake Village, CA 91359, Tel: 818-991-2600, TELEX: 66-2400 BISHOP WKVG, FAX: 818-889-3744; Empl.: 140; *Sls. Mgr.:* Fred Kern

BIT 3 COMPUTER CORPORATION, 8120 Penn Avenue S., Minneapolis, MN 55431-1393, Tel: 612-881-6955, TELEX: 4997016; FSC No.: 7Y590; *Sls. Mgr.:* Gordon Mitchell

Bivar

FAX: 714-951-3974

BIVAR, INC., 4 Thomas, Irvine, CA 92718, Tel: 714-951-8808, TELEX: 852348; FSC No.: 32559; Empl.: 22; *Sls. Mgr.:* Martin Lambert; *Dist. Mgr.:* Martin Lambert ..... **C•1017**

Local Sales Offices & Reps

CA San Jose, Veer Mktg. 408-432-1818
CO Englewood, B.C. & Assocs. 303-694-3999
IL Downers Grove, Richmar Elec. Corp. 312-968-0118
IN Indianapolis, Richmar Elec. Corp. 317-577-9950
MN Minneapolis, D. A. Case Assocs. Inc. .. 612-869-3700
NJ Berkeley Heights, Cambridge-Allen ... 201-464-0203
NY Syracuse, T-Squared Elctrns. 315-463-8592
NC Cary, 20th Century Mktg. Inc. 919-481-3370
OH Dayton, JFCO, Inc. 513-890-8322
OR Beaverton, Eclipse Mktg. Grp. 503-642-1661
PA Elkins Park, K. B. Erdman Co. 215-224-1833
TX Plano, Richmar Elec. Corp. 214-424-8388
WA Redmond, Eclipse Mktg. Grp. 206-885-6991
WI Butler, Richmar Elec. Corp. 414-781-1730
Can Mississauga, Ont., Wilson Sls. 416-677-8200
Can Scarborough, Ont., Carsten Elec. Ltd. 416-495-9999

Local Distributors

AZ Phoenix, EKO Sales 602-437-4646
CA Fountain Valley, Components Ctr. 714-979-0433
CA Fremont, Alatec 415-657-7701
CA Manhattan Beach, Prime Electro Prods. 213-379-3642
CA San Diego, Sigma Elctrns. 619-565-2000
CA San Diego, Southland Fasteners 619-578-6630
CA Santa Fe Springs, F T R Fasteners 714-957-0202, 213-946-6464
CA Sunnyvale, R. C. Dudek 408-734-3830
CA Sunnyvale, Vic/Tal Sls. 408-738-3450
CA Westlake Village, R. C. Dudek 818-707-1310
CO Englewood, Indus. Elctrns. 303-694-9444
CT Milford, Plastic & Metal Comps. Co. ... 203-877-2723
GA Norcross, Atlanta Hardware Specialty 404-449-3000
GA Peachtree City, Spyraflo, Inc. 404-487-7600
IL Chicago, EMF 800-621-0080,312-889-8323
IL Elmhurst, Miltex Sls. 312-941-7100
IN Carmel, Altex Elctrns. 317-848-1323
MD Beltsville, Petricko Sls. 301-937-4960
MD Gaithersburg, Capitol Fasteners 301-948-9310
MA Ashland, Quality Comps. 617-881-6504
MA Waltham, Electronic Fasteners 617-890-7780
MA Winchester, RUSH 617-729-5800
MI Detroit, Tri-West Prods. 313-273-0400
MN Eden Prairie, S. W. Anderson Co. 612-941-4198
NH Londonderry, E.P.E. Corp. 603-669-9181
NJ So. Hackensack, Fastbolt Corp. 201-440-9100
NY Bohemia, Key Comps. 516-567-7500
NY Long Island City, Hardware Specialty Co. 718-361-9393
NY Mt. Vernon, QAR Elctrns. 914-699-2224
NY Plainview, Tower Fastener Co. 516-289-8800
NY Rochester, Masline Elctrns. 716-546-5373
NC Raleigh, Century Elctrn. Comps. 919-872-2203
NC Raleigh, Century Fasteners 919-787-1800
OH Cincinnati, Hughes-Peters 513-351-2000
OH Columbus, Hughes-Peters 614-294-5351
OH Englewood, Argent Inds. 513-836-8633
OH Solon, Repco 216-248-8900
OR Beaverton, Component Resources 503-641-8488
OR Beaverton, Murphy Elctrns. 503-642-2001
PA Huntingdon Valley, Plastic & Metal Prods. 215-322-2000
PA Norristown, Century Elctrns. 215-631-5400
TX Dallas, Global Fasteners 214-340-6068
TX Grand Prairie, Tech Supp. 214-660-4888
WA Redmond, Murphy Elctrns. 206-881-1234
WA Seattle, Component Resources 206-454-8666
EXP CA/Bakersfield, Gray-Weatherhead Equip. 805-397-4281
Can Mississauga, Ont., Rush/Ontario 416-677-7280

BIW CABLE SYSTEMS, INC., 22 Joseph E. Warner Blvd., N. Dighton, MA 02764, Tel: 617-822-6600, TELEX: 94-0604, FAX: 617-822-1944; Empl.: 600; *Sls. Mgr.:* L. Latino, Mktg. Mgr./Elctrns.

BLACK & WEBSTER, 219 Bear Hill Rd., Waltham, MA 02254, Tel: 617-890-9100, TELEX: 951102; Empl.: 50; *Sls. Mgr.:* Andy Anderson

BLACKBURN, Division of FL Industries, 1525 Woodson Rd., St. Louis, MO 63144, Tel: 314-993-9430, TELEX: 4312046; Empl.: 500; *Sls. Mgr.:* T. T. Latanision

BLACKHAWK NETWORKS CORP., 14 N. Parker Dr., P.O. Box 919, Janesville, WI 53545, Tel: 608-752-8701, FAX: 608-752-8701; FSC No.: 12724; Empl.: 10; *Sls. Mgr.:* D. Adee

Local Sales Offices & Reps

CA Livermore, United Tech. Mktg. 415-449-7644
CA N. Hollywood, Crown Elctrns. 213-877-3550
FL Longwood, Mathias Assocs., Inc. 305-682-1700
GA Atlanta, Grady Duckett Sls. Co. 404-451-3529
IA Cedar Rapids, Snider Sls. Co. 319-362-4410
MA Burlington, Dynamic Sls. 617-272-5676
MN Brooklyn Center, Willman Assocs. 612-566-5010
MO Ellisville, Gateway Tech. Sls. 314-391-6543
NY Syracuse, Murcan Sls. Corp. 315-437-0734
TX Richardson, Precision Technlg. Assocs. 214-234-8071
Can Quebec, Militron Inc. 514-331-9992

BLATEK, INC., Box 574, Bellefonte, PA 16823, Tel: 814-355-4910; Empl.: 20; *Sls. Mgr.:* Linda C. Feltman ..... **B•1882**

Local Sales Offices & Reps

CA Anaheim, Universal NDT, Inc. 714-526-1638
PA Paoli, Stitzer Assoc. 215-644-5500

BLH ELCTRNS., 75 Shawmut Road, Canton, MA 02021, Tel: 617-821-2000, TELEX: 92-3413, TWX: 710-324-0683; FSC No.: 03089; Empl.: 170; *Sls. Mgr.:* C. Wesley

Local Sales Offices & Reps

AL Huntsville, Currie, Peak & Frazier 205-536-1506
CA Oakland, Frost Engrg. 415-568-7000,
MD Baltimore, Automation Indl. Controls .. 301-944-8400
FL Orlando, Currie, Peak & Frazier 305-855-0843
GA Norcross, Currie, Peak & Frazier 404-449-7662
IL Chicago, Comtel Midwest 312-539-4838
IN Indianapolis, Comtel Midwest 317-253-1681
IA Cedar Rapids, Comtel Midwest 319-377-9434
KS Shawnee Mission, Comtel Midwest ... 913-268-0762,
MI Farmington Hills, Great Lakes Processing Control, Inc. 313-478-8892
MN Wayzata, Comtel Midwest 612-476-1551
MO St. Louis, Comtel Midwest 314-991-5363
NY E. Syracuse, Ossmann Instrs. 315-437-7052
NY Rochester, Ossmann Instrs. 716-424-4460
NC Greensboro, Currie, Peak & Frazier ... 919-373-0380
OH Cincinnati, Alpha Controls 513-874-2000
OH Westlake, Advanced Technlg. Assocs. 216-835-5050
OK Tulsa, Bauman Instrument Co. 918-492-8086
TX Corpus Christi, Collier Equip. Corp. 512-289-6181
TX Houston, American Analogue 713-941-7265
TX Plano, Summit Controls, Inc. 214-867-6056
WA Woodinville, Frost Engrg. Svc. Corp. .. 206-485-8500
WI New Berlin, Comtel Midwest 414-544-6042

BLILEY ELECTRIC CO., 2545 W. Grandview Blvd., Erie, PA 16506, Tel: 814-838-3571, TWX: 510-696-6886, FAX: 814-833-2712; FSC No.: 71034;3098; Empl.: 170 ..... **A•1345-1353**

Local Sales Offices & Reps

AL Huntsville, R. W. Mitscher Co., Inc. 205-882-6050
AZ Tempe, Cain Technlg. Inc. 602-966-4322
CA Mountain View, Woempner-Arnold Assocs. 415-964-5454
CA Orange, Cain Technology, Inc. 714-997-7311
CA Van Nuys, Cain Technology, Inc. 818-904-9392
CO Englewood, Cain Technlog., Inc. 303-220-8118,
CT Plainfield, R. W. Mitscher Co., Inc. 203-564-1691,
FL Boca Raton, R. W. Mitscher Co., Inc. .. 305-368-3841
FL Largo, R. W. Mitscher Co., Inc. 813-581-1588,
FL Sanford, R. W. Mitscher Co., Inc. 305-322-7141,
GA Lawrenceville, R. W. Mitscher Co., Inc. 404-923-3239
MD Laurel, R. W. Mitscher Co., Inc. 301-498-6090
MA Needham, Sturgeon Co. 617-444-6603
NJ Princeton, R. W. Mitscher Co., Inc. 609-924-7026,
NM Albuquerque, C. T. Carlberg & Assocs., Inc. 505-888-3883
NY Clarence, R. W. Mitscher Co., Inc. 716-759-2350
NY Islandia, Schmitt Indl. Mktg. Corp. 516-582-5888,
NY Pittsford, R. W. Mitscher Co., Inc. 716-586-4012
NY Rochester, R. W. Mitscher Co., Inc. 716-227-0839
NY Utica, R. W. Mitscher Co., Inc. 315-738-0383
NC Charlotte, R. W. Mitscher Co., Inc. 704-366-9131,

BLILEY REPRESENTATIVES COVER THESE STATES:

Southern California, Arizona
Colorado, Utah
CAIN TECHNOLOGY, INC.

Northern California, Northwestern Nevada
WOEMPNER-ARNOLD ASSOCIATES

Massachusetts, Maine
New Hampshire, Vermont
STURGEON COMPANY

New York (Metropolitan NYC), Northern New Jersey
SCHMITT INDUSTRIAL MARKETING CORP.

New York State (excluding Metropolitan NYC), Connecticut, Rhode Island, Virginia, North & South Carolina, Georgia, Mississippi, Alabama, Tennessee, Maryland, Delaware, Florida, Eastern Pennsylvania, Southern New Jersey, Canadian Provinces of Ontario & Quebec
R.W. MITSCHER CO., INC.

Washington, Oregon
WESTMARK ELECTRONICS, INC.

Texas, Louisiana, Arkansas, Oklahoma
VECTOR SALES CO., INC.

DESC/Dayton, Ohio
THOMAS HERMAN & ASSOCIATES, INC.

New Mexico, El Paso County Texas
C. T. CARLBERG & ASSOCS. INC.

See adjacent listing for the address and telephone number of your Bliley representative.

Bliley
ELECTRIC COMPANY

NC Raleigh, R. W. Mitscher Co., Inc. 919-848-0941
OH Bellbrook, Thomas Herman & Assocs., Inc. 513-848-8332,
OR Portland, Westmark Elctrns. Inc. 503-641-8780
PA Huntingdon Valley, R. W. Mitscher Co., Inc. 215-355-4452
TN Johnson City, R. W. Mitscher Co., Inc. 615-929-7258
TX Richardson, Vector Sales Co. 214-234-4291
VA Richmond, R. W. Mitscher Co., Inc. 804-264-6883,
WA Seattle, Westmark Elctrns. Inc. 206-281-4025
EXP CT, Stamford, Dage Corp. 203-324-3123

BLOXCOM CORPORATION, A Siemens Company, 1130 Larkin Dr., Wheeling, IL 60090, Tel: 312-520-8010, FAX: 312-520-8049; *Sls. Mgr.:* Joe Smiesko

BLUE M

FAX: 312-331-2515

BLUE M, A UNIT OF GENERAL SIGNAL, 138th & Chatham Sts., Blue Island, IL 60406, Tel: 312-385-9000, TWX: 910-689-3398; Empl.: 275; *Sls. Mgr.:* H. G. Mathews; *Dist. Mgr.:* George Dixey ..... **D•1186**

Local Sales Offices & Reps

AZ Tempe, Blue M 602-894-2305
CA El Monte, Blue M 818-442-6672
CA Sunnyvale, Blue M 408-734-8734
DE Wilmington, Blue M 302-478-6983
FL Casselberry, Blue M 305-332-9322,
GA Atlanta, Blue M 404-455-3452
KS Overland Park, Blue M 913-888-6483
MA Millis, Blue M 617-376-4727
MI Livonia, Blue M 313-474-4312
NY Spring Valley, Blue M 914-426-1880,
NY Syracuse, Blue M 315-437-0192
NC Charlotte, Blue M 704-527-2492
OH Cincinnati, Blue M 513-821-6278
OH Hudson, Blue M 216-656-1177
TX Garland, Blue M 214-272-2509
WA Seattle, Blue M 206-763-1030

BMW INC., 17 Willow St., Lynn, MA 01903, Tel: 617-581-9241, 800-458-4020, FAX: 617-592-0964; Empl.: 25; *Sls. Mgr.:* William J. Valles; *Dist. Mgr.:* Richard Pelletier

BODINE ELECTRIC COMPANY

FAX: 312-410-5202

BODINE ELECTRIC COMPANY, 2500 W. Bradley Pl., Chicago, IL 60618, Tel: 312-478-3515, TELEX: 25-3646; Empl.: 800; *Sls. Mgr.:* R. J. Stuchly; *Dist. Mgr.:* R. J. Stuchly ..... **B•1197**

Local Sales Offices & Reps

CA Saratoga, E. W. Duemmlein 408-253-1201
KS Shawnee Mission, J. F. Gleeson & Assocs. 913-362-4422
MA Woburn, J. A. Cascino 617-938-1446,
MI Southfield, Bodine Elec. Co. (c/o Steve Cavender) 313-350-3610
MN Mound, John F. Rynkar 612-472-4252
NY Massapequa, D. V. Mayorga 516-541-1611
NY Rochester, Application Specialists 716-586-6226
NY Syracuse, Application Specialists 315-437-2814
OH Hudson, J. H. Basten 216-656-4226
TX Richardson, Control Dynamics 214-644-6945
VA McLean, J. S. Hsia 703-734-1739
WA Seattle, Drive Motor Control Sys. Co. 206-575-4172
EXP IL, Chicago, Export Dept., Bodine Elec. 312-478-3515
Can Vancouver, BC, Madison Indl. Equip. Ltd. 604-872-8155

Local Distributors

AL Mobile, Brownell Instrs. & Conts. Co. .. 205-479-5405
AZ Phoenix, Minarik Elec. Co. 602-233-3000
CA Carson, Power Trans. Specialties 213-631-7502
CA Fremont, Elec. Motor Svc. 415-651-2706
CA Glendale, Minarik Elec. Co. 213-624-3161
CA Los Angeles, Minarik Elec. Co. 213-624-3161
CA Newark, Republic Supp. Co. 415-794-9019,
CA San Diego, Minarik Elec. Co. 619-560-6632
CA Santa Clara, Minarik Elec. Co. 408-727-0575
CO Denver, Wazee Elec. Co. 303-623-8658
CT Berlin, B & B Motor & Control 203-828-8550
CT Hartford, Machine Drives & Controls .. 203-728-0403
CT Norwalk, Machine Drives & Controls .. 203-846-2007
FL Hialeah, Condo Elec. & Ind. Supp., Inc. 305-691-5400
FL Jacksonville, Electrical-Mech. Dr., Inc. 904-783-2730
FL Orlando, Brownell Instrs. & Conts. Co. 305-843-6770
FL Tampa, Electrical-Mech. Dr., Inc. 813-621-8675
GA Hapeville, Brownell Instrs. & Conts. Co. 404-762-5181
GA Tucker, Research Designs, Inc. 404-491-0745
IL Chicago, Excel Elec. Svc. Co. 312-421-7220
IL Franklin Pk., Flolo Elec. Co. 312-595-1010
IL Loves Park, Tek-Matic, Inc. 815-282-1775
IN Indianapolis, B & B Motor & Control ... 317-248-0396
IA Cedar Rapids, Precision Bearing Co. .. 319-365-5276
IA Des Moines, Precision Bearing Co. ... 515-265-9811
KS Kansas City, Kornfeld Thorp Elec. 913-321-7070
MD Baltimore, Advent Electric Inc. 301-532-8149,
MA Medford, Empire Elctrl. Co. 617-395-5000
MA Somerville, Electro Sls. Co., Inc. 617-666-0500
MI Detroit, Howard Elec. Co. 313-923-0430
MI Grand Rapids, MacKay Ind. Sls. 616-241-1671
MI Novi, Reserve Motion Control Sys. 313-473-1370
MN Minneapolis, Boustead Elec. & Mfg. 612-544-9131
MO St. Louis, State Elec. Co. 314-569-2140
MO St. Louis, Zeller Elec., Inc. 314-638-9641
NE Omaha, Precision Bearing Co. 402-593-7050
NH Manchester, Empire Elctrl. 603-627-6630
NJ Cherry Hill, Jos. T. Fewkes & Co. 609-424-5810
NY Binghamton, K. J. Elec. Corp. 607-772-1760
NY East Syracuse, K. J. Elec. Corp. 315-437-2826
NY Long Island City, B & B Motor & Control 718-784-1313
NY Rochester, B & B Motor & Control 716-424-7040
NC Charlotte, Brownell Instrs. & Conts. Co. 704-597-1270
NC Charlotte, Piedmont Motor &Control Ltd. 704-523-7121,
OH Dayton, Thal Mor Assoc., Inc. 513-298-9939
OH Middleburg Hgts., Reserve Motion Control Sys. 216-826-0290
OK Oklahoma City, Evans Elec. Mtr. Ctrs., Inc. 405-631-1344
OK Tulsa, Southwest Drives, Inc. 918-665-1455
PA Altoona, Miller Elec. Svc. & Supp. 814-942-9943
PA Bridgeport, Advent Elec., Inc. 215-277-6610
PA Pittsburgh, Braunlich-Roessle 412-471-6995
SC Taylors, B & B Motor & Control 803-268-5702
TN Memphis, Brownell Instrs. & Conts. Co. 901-795-8487
TN Nashville, Electric Motor Rewind, Inc. 615-256-2522,
TN Nashville, Tennessee Machinery Co. .. 615-244-8150
TX Dallas, Motion Inds. 214-351-2211
TX Dallas, Power Dynamics, Inc. 214-358-5500
TX Fort Worth, Motion Inds. 817-335-8131
TX Ft. Worth, Power Dynamics, Inc. 817-831-4581
TX Houston, B & B Motor & Control 713-820-7931
TX Houston, Research Des., Inc. 713-995-8591
TX San Antonio, Minarik Elec. Co. 512-822-7097
VA Richmond, Ind. Supp. Corp. 804-355-8041
WA Seattle, Indl. Elec. Mtr. & Mach., Inc. ... 206-329-3900
WI Milwaukee, Trester Svc. Elec. 414-264-8170
WI New Berlin, Elec. Sls. & Engrg. 414-782-2400
Can Brantford, Ont., Renold Canada 800-265-9970
Can Edmonton, Alberta, Soper's Supp. Ltd. 403-423-4066
Can Montreal, Que., Lalonde Elec., Inc. 514-524-7507
Can Mt. Royal, Que., Renold Canada 514-731-3591
Can Scarborough, Ont., Toronto Elec. 416-755-7716
Can Toronto, Renold Canada Ltd. 416-453-2190,
Can Vancouver, B.C., Armature Elec. 604-879-6141
Can Vancouver, BC, Renold Canada Ltd. .. 604-255-8455

BOEING ELECTRONICS CO., P.O. Box 24969, M/S 9N-41, Seattle, WA 98124-6269, Tel: 206-657-7474, TELEX: 329430, FAX: 206-657-8883; Empl.: 5800; *Sls. Mgr.:* J. B. Ewell

BOGEN COMMUNICATIONS, INC.

FAX: 201-934-9832

BOGEN COMMUNICATIONS, INC., MPD Products, 50 Spring St., Ramsey, NJ 07446, Tel: 201-934-8500, TWX: 710-990-5047; *Sls. Mgr.:* Lou Asighiere; *Dist. Mgr.:* David Chambers, Natl. Sls. Mgr. ..... **C•1290**

Local Sales Offices & Reps

AZ Scottsdale, Dar-C Inc. 602-948-2240
CA Pleasonton, Moulthrop Sls. 415-463-0450
CA San Diego, Tauber Assocs. 619-274-7242
CO Englewood, Comp. Sls. 303-779-8060
FL Tampa, SRT Mktg. 813-884-4805
IL Palatine, Technlg. Sls. 312-991-6600
IN Indianapolis, Marketing Engrg. 317-872-5665
IA Davenport, Rush West Assocs. 319-388-9494
KS Olathe, Rush West 913-764-2700
MA Burlington, Conti Younger 617-273-1582
MI Brighton, A. P. Assocs. 313-229-6550
MN Eden Prarie, Electro Mark 612-944-5850
MO St. Louis, Rush West 314-965-3322
NJ Berkeley Hgts., Cambridge Allen & Assocs. 201-464-0203
NC Greensboro, Hile Sls., Inc. 919-288-1500
OR Beaverton, Advanced Power Prods. ... 503-646-0994
PA Philadelphia, Samuel K. Macdonald, Inc. 215-659-4414
TX Dallas, Dunbar 214-239-7151
UT Salt Lake City, Comp. Sls. 801-268-8440
WI Waukesha, Technlg. Sls. 414-786-5015
Can Ontario, White Radio Ltd. 416-632-6894

Local Distributors

AL Huntsville, Resistacap, Inc. 205-883-4270
AZ Scottsdale, Electro Mark 602-991-0110
CA San Diego, Tauber Elec. 619-272-7242
CA San Jose, Rose Elctrns. 408-263-2934
CA Santa Clara, Cypress Elctrns., Inc. 408-980-2500
CA Van Nuys, Nesco 213-781-0505
CO Arvada, Denver Beta Wintronics 303-431-7161
FL Boca Raton, Plainview Elctrns. 305-997-7705
IL Morton Grove, Power Pak 312-966-6000
IN Indianapolis, Bell Elctrns. 317-875-8200
IN Indianapolis, Elctrn. Prod. Concepts ... 317-872-5665
MA Canton, Impact Sls. 617-821-1500
MA Danvers, Generation Elctrns. 617-777-4866
MA Sharon, Adcour 617-784-8123
MI Brighton, A. P. Sls. 313-227-3604
MN Minneapolis, Stark Elctrns. 612-332-1325
MN Thief River Falls, Digi Key 218-681-6674
NJ Camden, Gen. Radio Supp. 609-964-8560
NJ Clifton, Engrd. Assemblies Corp. 800-4-Battery
NJ Plainfield, Mars Elec. 201-757-4332
NY Buffalo, Summit Dist. 716-887-2800
OR Beaverton, Micro Power Elctrns. 503-626-7086
PA Philadelphia, Powell Elctrns. 215-365-1900
TX Dallas, Computer Comps. 214-239-0271
WI Milwaukee, Taylor Elctrns. 414-241-4321
Can Ontario, White Radio Ltd. 416-632-6894

BOGEN COMMUNICATIONS, INC., 50 Spring St., P.O. Box 575, Ramsey, NJ 07446, Tel: 201-934-8500, TWX: 710-990-5047, FAX: 201-934-9832; *Sls. Mgr.:* David Chambers; *Dist. Mgr.:* Len Charyak ..... **C•1290**

Local Sales Offices & Reps

AZ Phoenix, WesTech Mktg. 602-438-9763
CA Antioch, Lichtenauer & Assocs. 415-757-1200
CA Culver City, WesTech Mktg. 213-870-9286
FL Tampa, SRT Mktg. 813-884-4805
FL Winter Springs, SRT Mktg. 305-699-0505
GA Roswell, Henry W. Phillips Co., Inc. 404-992-3070
HI Honolulu, J.C. Elctrns. 808-943-8514
IL Deerfield, William M. Linz Assocs., Inc. 312-945-9600
IN Indianapolis, Kingston Sls. Corp. 317-876-2545
IA Cedar Rapids, R. W. Kunz & Assocs., Inc. 319-396-5386
KS Prairie Vl., R. W. Kunz & Assocs., Inc. 913-648-3535
MD Mt. Airy, Lowery Assocs. 800-345-1058
MA Northboro, W. B. Pray Sls., Inc. 617-393-3434
MI Farmington Hills, CM Sls. 313-553-8070
MN White Bear Lk., Yore Co. 612-770-9760
MO St. Louis, R. W. Kunz & Assocs., Inc. .. 314-966-4977
NJ Hopatcong, Bi-State Marketers 201-770-2262
NJ Ridgefield, Bi-State Marketers 201-943-5888
NY Lynbrook, Bi-State Marketers 516-593-8025
NY Syracuse, Paston-Hunter Co., Inc. 315-437-2992
OH Dayton, Shamrock Elctrns. Sls., Inc. ... 513-258-1227
OH Worthington, Shamrock Elctrns. Sls., Inc. 614-888-7638
PA Broomall, Lowery Assocs. 800-345-1058
PA Pittsburgh, Shamrock Elctrn. Sls., Inc. 412-343-5877
TX Dallas, Dimension/Pt. IX Mktg. Corp. .. 214-348-9657
TX Houston, Dimension/Pt. IX Mktg. Corp. 713-879-4010
UT Salt Lake City, Pro Tech Mktg. 801-943-8331
VA McLean, Lowery Assocs. 703-356-4654
WA Lynwood, Pacnor Mktg., Inc. 206-771-6016
WI Brookfield, William M. Linz Assocs., Inc. 414-782-0630
EXP New York/New York, Roburn Agencies, Inc. 212-989-5939
Can Burlington, Ont., White Radio Ltd. 416-632-6894

BOKER'S, INC., 3104 Snelling Ave., Minneapolis, MN 55406-1937, Tel: 612-729-9365, FAX: 612-729-8910; FSC No.: 85446; Empl.: 110; *Sls. Mgr.:* Andy Tscholl

BOMAR CRYSTAL, 201 Blackford Ave., Middlesex, NJ 08846, Tel: 201-356-7787, 800-526-3935, TWX: 710-480-4560, FAX: 1-201-356 7362; Empl.: 75; *Sls. Mgr.:* Phil Casciano

BOMCO, See MuShield Co.

BONAR SCI INC., A Bonar Power Supply Co., 49 Range Rd., Windham, NH 03087, Tel: 603-893-2330, FAX: 603-893-6280; Empl.: 100; *Sls. Mgr.:* Dale Raveney, VP Mktg. & Sls.

BOONTON

FAX: 201-584-3037

BOONTON ELECTRONICS CORP., 791 Route 10, Randolph, NJ 07869, Tel: 201-584-1077, TWX: 710-986-8215 BOONTRONICS; FSC No.: 04901; Empl.: 180; *Sls. Mgr.:* R. Morrell ..... **D•1226**

Local Sales Offices & Reps

AL	Huntsville, Sci. Devices	205-536-1969
AZ	Phoenix, Aztec Entprs.	602-944-9185
CA	North Hollywood, O'Halloran Assocs.	213-877-0173
CA	Palo Alto, O'Halloran Assocs.	415-969-1600
CO	Denver, Aztec Entprs.	303-779-5285
CT	Mt. Carmel, Sci. Devices	203-248-9361
FL	Orlando, Sci. Devices	305-841-8180
IL	Elmhurst, Sector Engrg. Sls., Inc.	312-530-7850
IN	Indianapolis, Sector Engrg. Sls., Inc.	317-842-1120
KS	Lenexa, Ramsey Assoc.	913-541-1007
MD	Lanhan, Sel-Tronics	301-731-8080
MA	Lexington, R. J. Sickles	617-862-5100
MN	Minneapolis, Sector Engrg. Sls., Inc.	612-593-1809
MO	Maryland Hgts., Ramsey Assoc.	314-878-5042
NJ	Teaneck, Sci. Devices	201-837-1004
NM	Albuquerque, Aztec Entprs.	505-262-1688
NY	Rochester, Sci. Devices	716-334-2445
NC	Winston-Salem, Sci. Devices	919-765-5776
OH	Centerville, Micro Sls.	513-433-8171
PA	Melrose Park, R. Meyers	215-224-1663
TX	Austin, Testech	512-327-7033
TX	Richardson, Testech	214-644-5010
UT	Ogden, Aztec Entprs.	801-621-1655
WA	Bellevue, Sci. Devices	206-747-5169
WI	Milwaukee, Sector Engrg. Sls., Inc.	414-352-8280

BOPLA ENCLOSURES, 12140 Parklawn Dr., Rockville, MD 20852, Tel: 301-770-2225, FAX: 301-984-8670; FSC No.: 4Y520; Empl.: 35; *Sls. Mgr.:* Andy Kassman ..... **C•1018**

Local Sales Offices & Reps

CA	Irvine, Comp. Mktg. Assocs.	714-951-5950
FL	Tampa, FL Comp. Sls.	813-960-7044
IL	Chicago, Paddock Mktg./Sls.	312-452-7852
IN	Nobelsville, R & D Elctrns.	317-849-2026
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PA	Lancaster, Indl. Comps. Inc.	215-889-0650
VA	Reston, Colrud Corp.	703-620-6621
WA	Federal Way, K. R. Jensen Sls.	206-874-2772

Local Distributors

MA	Framingham, Now Elctrns.	617-872-5876
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PA	Lancaster, Peak Elctrns.	215-293-9000
WA	Seattle, Radar Elec.	206-282-2511

BORG-WARNER THERMOELECTRICS, BORG-WARNER CORP., See TECA, ThermoElectric Cooling America Corp.

BOSCH, ROBERT, CORP., 2800 S. 25th Ave., Broadview, IL 60153, Tel: 312-865-5200, TELEX: 23-5563; *Sls. Mgr.:* Dieter Bloecks; *Dist. Mgr.:* Dave Robson

BOSCHERT, INC., Computer Products/Boschert, 3797 Spinnaker Ct., Fremont, CA 94538, Tel: 418-657-6700, FAX: 415-683-6400 ... **D•1644-1648, 1673-1674**

Refer to Computer Products, Inc., Pompano Beach, FL, for sales offfices, Reps. and Distributors.

BOSCHERT, INC., See Computer Products, Inc.

BOURNS, INC., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, Tel: 714-781-5050, TWX: 910-332-1252; Empl.: 6000; *Sls. Mgr.:* Dennis Lause; *Dist. Mgr.:* Vince Ingrao ..... **A•1870-1871, 2064-2067**

Local Sales Offices & Reps

AL	Huntsville, CSR Elctrns.	205-533-2444
AZ	Phoenix, Shefler-Kahn	602-257-9015
CA	Calabasas, Quad Rep. Inc.	818-887-4219
CA	Irvine, Quad Rep. Inc.	714-261-6706
CA	San Diego, SR Elctrns.	619-560-8330
CA	San Jose, QuadRep, Inc.	408-946-4000
CO	Parker, Parker Webster	303-841-4888
FL	Altamonte Springs, Dyne-A-Mark	305-831-2097
FL	Clearwater, Dyne-A-Mark	813-441-4702
FL	Ft. Lauderdale, Dyne-A-Mark	305-771-6501
FL	Palm Bay, Dyne-A-Mark	305-727-0192
GA	Atlanta, CSR Elctrns.	404-396-3720
ID	Boise, Intermountain Technlg.	208-322-5022
IN	Carmel, Technlg. Mktg. Corp.	317-844-8462
IN	Ft. Wayne, Technlg. Mktg. Corp.	219-432-5553
IA	Cedar Rapids, REP Assocs. Corp.	319-373-0152
KY	Louisville, Technlg. Mktg. Corp.	502-499-7808
MD	Baltimore, Micro-Comp.	301-247-0400
MA	Lexington, John E. Boeing Co.	617-862-2500
MI	Detroit, Rathburg Assocs.	313-882-1717
MN	Edina, Mel Foster	612-941-9790
MO	Bridgeton, Centech	314-291-4230
MO	Raytown, Centech	816-358-8100
NJ	Bellmawr, Thomas Assocs.	609-933-2600
NY	Ithaca, B. Dean	607-257-1111
NY	Melville, Comtronic Assocs.	516-249-0505
NC	Raleigh, CSR Elctrns.	919-878-9200
OH	Richfield, Bear Mktg.	216-659-3131
OK	Oklahoma City, Ammon & Rizos	405-942-2552
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OR	Salem, J. J. Backer	503-362-0717
TX	Austin, Ammon & Rizos	512-454-5131
TX	Dallas, Ammon & Rizos	214-644-5591
TX	Houston, Ammon & Rizos	713-781-6240
UT	Salt Lake City, Parker Webster	801-266-9939
VA	Huddleston, Micro-Comp	301-247-0400
WA	Seattle, J. J. Backer	206-285-1300

Local Distributors

AL	Huntsville, Hall-Mark Elctrns.	205-837-8700
AL	Huntsville, Hamilton/Avnet Elctrns.	205-837-7210
AL	Huntsville, Pioneer/Washington	205-837-9300
AL	Huntsville, Schweber	205-882-2200
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AZ	Phoenix, Schweber Elctrns.	602-997-4874
AZ	Phoenix, TTI	602-861-0222
AZ	Tempe, Bell Inds.	602-966-7800
AZ	Tempe, Elctrn. Supp.	602-258-4769
AZ	Tempe, Hamilton/Avnet	602-231-5100
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CA	Chatsworth, Avnet Elctrns.	213-700-2600
CA	Chatsworth, TTI	818-709-1010
CA	Citrus Hts, Hall-Mark Elctrns.	916-443-7282
CA	Compton, Harper S.I.D.	213-979-5090
CA	Costa Mesa, Avnet Elctrns.	714-754-6111
CA	Costa Mesa, Avnet Elctrns.	213-558-2313
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CA	Culver City, Hamilton Electro Sls.	213-558-2121
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CA	Gardena, Bell Inds.	213-515-1800
CA	Irvine, Schweber Elctrns.	714-556-3880
CA	Irvine, Schweber Elctrns.	714-863-0261
CA	Oakland, Brill Elctrns.	415-834-5888
CA	Riverside, Elctrn. Supp. Corp.	714-787-9220
CA	Roseville, Bell Inds.	916-969-3100
CA	Sacramento, Hamilton/Avnet	916-920-3150
CA	Sacramento, Schweber Elctrns.	916-929-9732
CA	San Diego, Bell Inds.	619-268-1277
CA	San Diego, Elctrn. Supp.	619-278-5020
CA	San Diego, Hall-Mark Elctrns.	619-268-1201
CA	San Diego, Hamilton/Avnet	619-571-7500
CA	San Jose, TTI	408-943-9155
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CA	Santa Clara, Schweber Elctrns.	408-748-4700
CA	Santa Clara, Schweber Elctrns.	408-496-0200
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Sunnyvale, Hall-Mark Elctrns.	408-773-9990
CA	Sunnyvale, Hamilton/Avnet	408-743-3300
CA	Tustin, Hall-Mark Elctrns.	714-669-0681
CA	Woodland Hills, Avnet Elctrns.	213-884-3322
CO	Denver, Newark Elctrns.	303-757-3351
CO	Englewood, Hall-Mark Elctrns.	303-790-1662
CO	Englewood, Hamilton/Avnet	303-779-9998
CO	Wheat Ridge, Bell Inds.	303-424-1985
CT	Danbury, Hamilton/Avnet	203-797-2856
CT	Danbury, Schweber Elctrns.	203-792-3500
CT	Hamden, Almo Elctrns. Corp.	203-288-6556
CT	Norwalk, Pioneer Std.	203-853-1515
CT	Statford, TTI	203-375-1400
CT	Wallingford, Midan Elctrns.	203-265-2077
FL	Altamonte Springs, Pioneer Std.	305-834-9090
FL	Altamonte Springs, Schweber Elctrns.	305-331-7555
FL	Clearwater, Hall-Mark Elctrns.	813-530-4543
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FL	Orlando, Hammond Elctrns.	305-849-6060
FL	Orlando, Pioneer/Orlando	305-834-9090
FL	Orlando, TTI	305-859-1000
FL	St. Petersburg, Hall-Mark Elctrns.	813-576-8691
FL	St. Petersburg, Hamilton/Avnet	813-576-3930
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GA	Norcross, Hall-Mark Elctrns.	404-447-8000
GA	Norcross, Hamilton/Avnet	404-447-7500
GA	Norcross, Hammond Elctrns.	404-449-1996
GA	Norcross, Pioneer/Washington	404-448-1711
GA	Norcross, Schweber Elctrns.	404-449-9170
GA	Norcross, TTI	404-662-0911
IL	Bensenville, Hall-Mark Elctrns.	312-860-3800
IL	Bensenville, Hamilton/Avnet	312-860-8523
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IN	Indianapolis, Graham Elctrns.	317-634-8202
IN	Indianapolis, Pioneer Std. Elctrns.	317-849-7300
IN	Lafayette, Graham Elctrns.	317-423-5564
IA	Cedar Rapids, Bell Inds.	319-395-0730
IA	Cedar Rapids, Hamilton/Avnet	319-362-4757
IA	Cedar Rapids, Schweber Elctrns.	319-373-1417
KS	Lenexa, Hall-Mark Elctrns.	913-888-4747
KS	Overland Park, Schweber Elctrns.	913-492-2921
KS	Overland Pk., Hamilton/Avnet Elctrns.	913-888-8900
MD	Baltimore, Radio Elec. Svc. Co.	301-529-0500
MD	Beltsville, Radio Elec. Svc. Co.	202-937-9100
MD	Columbia, Hall-Mark Elctrns.	301-796-9300
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MD	Gaithersburg, Almo Elctrns. Corp.	301-670-0090
MD	Gaithersburg, Pioneer/Washington	301-921-0660
MD	Gaithersburg, Schweber Elctrns.	301-840-5900
MA	Bedford, Schweber Elctrns.	617-275-5100
MA	Canton, Almo Elctrns. Corp.	617-821-1450
MA	Lexington, Pioneer Std.	617-863-1200
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	Woburn, Hall-Mark Elctrns.	617-935-9777
MA	Woburn, Hamilton/Avnet	617-273-7500
MI	Flint, RS Elctrns.	313-762-5800
MI	Grand Rapids, Hamilton/Avnet	616-243-8805
MI	Grand Rapids, RS Elctrns.	616-241-3483
MI	Kalamazoo, RS Elctrns.	616-381-5470
MI	Livonia, Hamilton/Avnet	313-522-4700
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MI	Livonia, RS Elctrns.	313-525-1155
MI	Livonia, Schweber Elctrns.	313-525-8100
MI	Roseville, RS Elctrns.	313-779-2450
MI	Wyandotte, RS Elctrns.	313-AV2-5880
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MN	Minneapolis, Newark Elctrns.	612-331-6350
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NM Albuquerque, Hamilton/Avnet Elctrns. 505-765-1500
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NY Rochester, Hamilton/Avnet Elctrns. 716-475-9130
NY Rochester, Schweber Elctrns. 716-424-2222
NY Rochester, Summit Distrs. 716-334-8110
NY Ronkonkoma, Hall-Mark Elctrns. 516-737-0600
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NY Westbury, Schweber Elctrns. 516-334-7474
NC Charlotte, Pioneer/Washington 704-527-8188
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NC Raleigh, Hall-Mark Elctrns. 919-872-0712
NC Raleigh, Hall-Mark Elctrns. 919-872-6286
NC Raleigh, Hamilton/Avnet 919-878-0819
NC Raleigh, Schweber Elctrns. 919-876-0000
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OH Cleveland, Hamilton/Avnet 216-831-3500
OH Cleveland, Pioneer Std. 216-587-3600
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OH Maumee, RS Elctrns. 419-893-0721
OH Solon, Hall-Mark Elctrns. 216-349-4632
OH Westerville, Hall-Mark Elctrns. 614-891-4555
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OK Tulsa, Schweber Elctrns. 918-622-8000
OR Beaverton, Almac Elctrns. 503-641-9070
OR Lake Oswego, Bell Inds. 503-241-4115
OR Lake Oswego, Hamilton/Avnet Elctrns. 503-635-8831
PA Horsham, Pioneer/Washington 215-674-4000
PA Horsham, Schweber Elctrns. 215-441-0600
PA Philadelphia, Almo Elctrns. Corp. 215-698-4000
PA Pittsburgh, Almo Elctrns. Corp. 412-931-5990
PA Pittsburgh, Pioneer Std. Elctrns. 412-782-2300
PA Pittsburgh, Schweber Elctrns. 412-782-1600
SC Greenville, Hammond Elctrns. 803-233-4121
TN Nashville, Graham Elctrns. 615-242-2682
TX Austin, Hall-Mark Elctrns. 512-258-8848
TX Austin, Hamilton/Avnet 512-837-8911
TX Austin, Harrison Equip. Co. 512-458-3555
TX Austin, Pioneer Std. Elctrns. 512-835-4000
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TX Dallas, Harrison Equip. Co. 214-239-2750
TX Dallas, Pioneer Std. Elctrns. 214-386-7300
TX Dallas, Schweber Elctrns. 214-661-5010
TX El Paso, Ideal Indl. Elctrn. Supp. 915-779-6647
TX Fort Worth, TTI 214-429-1440
TX Houston, Hall-Mark Elctrns. 713-781-6100
TX Houston, Hamilton/Avnet 713-975-3501
TX Houston, Harrison Equip. Co. 713-879-2600
TX Houston, Pioneer Std. 713-988-5555
TX Houston, Pioneer Std. Elctrns. 214-386-7300
TX Houston, Schweber Elctrns. 713-784-3600
TX Irving, Hamilton/Avnet 214-659-4100
TX Stafford, Harrison Equip. 713-879-2600
UT Salt Lake City, Bell Inds. 801-972-6969
UT Salt Lake City, Hamilton/Avnet 801-972-2800
WA Bellevue, Almac Elctrns. 206-643-9992
WA Bellevue, Bell Inds. 206-747-1515
WA Bellevue, Hamilton/Avnet 206-643-3950
WI Brookfield, Schweber Elctrns. 414-784-9020
WI Mequon, Taylor Elec. 414-241-4321
WI Milwaukee, Electronic Expd. 414-228-8100
WI New Berlin, Hamilton/Avnet 414-784-4510
WI Oak Creek, Hall-Mark Elctrns. 414-761-3000
WI Waukesha, Bell Inds. 414-547-8879

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Bowmar

FAX: 617-263-3358

BOWMAR/ALI, Bowmar Instr. Corp., 531 Main St., Acton, MA 01720, Tel: 508-263-8365, TWX: 710-347-1441; Empl.: 250; *Sls. Mgr.:* Andy Roeper ..... **D•1353-1355**

Local Sales Offices & Reps

CA Lacanada, Brooks, Moore & Assocs. .. 818-790-8358
CA Orange, Brooks-Moore & Assocs. 714-771-1220
CA Palo Alto, Mollard Mktg. 415-961-0456
CA Santa Ana, Brooks-Moore & Assocs. .. 714-544-8900
CO Commerce City, Meas. Consits. 303-286-1414
FL Tampa, Lewis & Assocs., Inc. 813-988-2104
GA Atlanta, Horton Instr. Co. 404-231-3131
IL Des Plaines, Lincoln, Hodges & Assocs. 312-297-3810
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MD Columbia, Tyler Griffin Co. 301-995-1215
MA Billerica, Eastronix, Inc 617-670-2400
MI Livonia, Amtech Reps. 313-474-8300
MN Minneapolis, Waltam Sls. Co. 612-781-2778
MO St. Louis, Barry Sls. 314-821-2525
NJ Perth Amboy, Cosine, Inc. 201-442-3600
NM Albuquerque, Meas. Consits. 303-286-1414
NY Clarence, EIL/Trott Elctrns. 716-634-8500
NY Pittsford, EIL/Trott Elctrns. 716-586-8251
NC Charlotte, EIL/Trott Elctrns. 704-376-2237
OH Cuyanoga Falls, J. C. Hofstetter Co. ... 216-928-5313
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UT Centerville, Measurement Consits. 801-298-3388
WA Redmond, Frank Jackson Assocs. 206-881-7277
WI Janesville, Lincoln, Hodges & Assocs. 608-754-4214,414-542-3087

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CA Redwood City, J. S. Heaton Co. 415-367-9000
CA San Diego, Vishay District Off. 619-690-5112
CO Colorado Springs, Dale Elctrns. Inc. Sls. 303-593-7529
CO Loveland, Dale Elctrns. Sls. 303-667-7500
CT Guilford, Kaelber & Mack 203-389-8643
FL Coral Springs, Graham Assocs. Inc. ... 305-775-6733
FL Melbourne, Graham Assocs. 305-773-6631
FL Palm Bch Gdns., Graham Assocs. 305-622-4049
FL W. Palm Bch., Bradford Elctrns. Inc. ... 305-641-4077
FL Winter Garden, Graham Assocs. 305-656-9369
GA Atlanta, JWL Assocs. 404-320-7643
IL Libertyville, Bradford Elctrns. Inc. 312-816-7900
IL Skokie, IRI 312-967-8430
IN Ft. Wayne, Scott Elctrns. 219-489-5690
IN Indianapolis, Scott Elctrns. 317-841-0010
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OH Dayton, Scott Elctrns. 513-294-0539
OH Reynoldsburg, Scott Elctrns. 614-863-1281
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TX Dallas, E. F. Aymond Co. 214-826-7620
TX San Antonio, E. F. Aymond Co. 512-675-8339
WA Snohomish, LD Elctrns. 206-568-0511
WA Spokane, LD Elctrns. 509-922-4883
WI Milwaukee, IRI 414-259-0965
Can Scarborough, Ont., Bradford Elctrns., Inc. 514-483-3812

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AL Huntsville, Schweber Elctrns. 205-895-0480
AZ Phoenix, Schweber Elctrns. 602-997-4874
AZ Phoenix, Wyle Distbn. 602-249-2232
AZ Tempe, Bell Inds. 602-966-7800
AZ Tempe, Shelley-Ragon, Inc. 602-894-2058
CA Calabasas, Wyle Distbn. Grp. 213-322-9953
CA Canoga Pk., Schweber Elctrns. 818-999-4702
CA Chatsworth, Shelley-Ragon, Inc. 818-998-3333
CA Garden Grove, Bell Inds. 714-220-0681
CA Gardena, Bell Inds. 213-515-1800
CA Irvine, Schweber Elctrns. 714-863-0254
CA Irvine, Wyle Distbn. Grp. 714-863-9953
CA Los Angeles, Bell Inds. 213-826-6778
CA Roseville, Bell Inds. 916-969-3100
CA Sacramento, Schweber Elctrns. 916-929-9732
CA San Diego, Neumann Elctrns. 619-695-3005
CA San Diego, Shelley-Ragon, Inc. 619-453-7133
CA San Diego, Wyle Distbn. Grp. 619-565-9171
CA San Jose, Schweber Elctrns. 408-946-7171
CA San Jose, Shelley-Ragon, Inc. 408-432-0600
CA Santa Clara, Wyle Distbn. Grp. 408-727-2500
CA Sunnyvale, Bell Inds. 408-734-8570
CA Thousand Oaks, Bell Inds. 805-499-6821
CO Denver, IEC 303-292-6121
CO Englewood, Shelley-Ragon, Inc. 303-762-0670
CT Danbury, Schweber Elctrns. 203-748-7080
CT Wallingford, Almo Elctrns. Corp. 203-269-6801
CT Wallingford, Cronin Elctrns., Inc. 203-265-3134
CT Wallingford, Sterling Elctrns. 203-265-9535
FL Altamonte Springs, Schweber Elctrns. 305-331-7555
FL Ft. Lauderdale, Hammond Elctrns. 305-973-7103
FL Orlando, Hammond Elctrns. 305-849-6060
FL Pompano Bch., Schweber Elctrns. 305-977-7511
FL Tampa, Shelley-Ragon, Inc. 813-623-6560
GA Norcross, Schweber Elctrns. 404-393-9669
IL Elk Grove Vl., Bell Inds., Inc. 312-640-1910
IL Elk Grove Vl., Schweber Elctrns. 312-364-3750
IN Ft. Wayne, Bell Inds., Inc. 219-423-3422
IN Indianapolis, Bell Inds., Inc. 317-875-8200
IA Cedar Rapids, Schweber Elctrns. 319-373-1417
KS Overland Pk., Schweber Elctrns. 913-492-2921
MD Gaithersburg, MB Elctrns. 301-921-0200
MD Gaithersburg, Schweber Elctrns. 301-840-5900
MD Jessup, Almo Elctrns. Corp. 301-670-0090
MD White Marsh, Resco/Baltimore, Inc. ... 301-529-0500
MA Bedford, Schweber Elctrns. 617-275-5100
MA Needham, Cronin Elctrns., Inc. 617-449-5000
MA Woburn, Sterling Elctrns. 617-938-6200
MI Ann Arbor, Bell Inds., Inc. 313-971-9093
MI Livonia, Schweber Elctrns. 313-525-8100
MN Edina, Schweber Elctrns. 612-941-5280
MN St. Paul, Shelley-Ragon, Inc. 612-642-2828
MO Earth City, Schweber Elctrns. 314-739-0526
MO Independence, Shelley-Ragon, Inc. 816-254-3410
NJ Fairfield, Schweber Elctrns. 201-227-7880
NJ S. Plainfield, Sterling Elctrns. 201-769-7000
NM Albuquerque, Bell Inds., Inc. 505-292-2700

NY Bohemia, Justin Elctrns., Inc. 516-589-4000
NY Rochester, Schweber Elctrns. 715-424-2222
NY Westbury, Schweber Elctrns. 516-334-7474
NC Greensboro, Hammond Elctrns. 919-275-6391
NC Raleigh, Resco/Raleigh 919-781-5700
NC Raleigh, Schweber Elctrns. 919-876-0000
OH Beachwood, Schweber Elctrns. 216-464-2970
OH Columbus, Hughes-Peters, Inc. 614-294-5351
OH Dayton, Bell Inds., Inc. 513-435-8660
OH Dayton, Bell Inds., Inc. 513-434-8231
OH Dayton, Schweber Elctrns. 513-439-1800
OK Tulsa, Schweber Elctrns. 918-622-8000
OK Tulsa, Sterling Elctrns. 918-663-2410
OR Beaverton, Shelley-Ragon, Inc. 503-641-1691
OR Lake Osego, Bell Inds., Inc. 503-241-4115
PA Horsham, Schweber Elctrns. 215-441-0600
PA Mars, Almo Elctrns. Corp. 412-931-5990
PA McKean, Advacom, Inc. 814-476-7774
PA Philadelphia, Almo Elctrns. Corp. 215-698-4009
PA Pittsburgh, Schweber Elctrns. 412-782-1600
TX Austin, Schweber Elctrns. 512-458-8253
TX Austin, Sterling Elctrns. 512-836-1341
TX Dallas, Schweber Elctrns. 214-661-5010
TX Dallas, Sterling Elctrns. 214-243-1600
TX Houston, Schweber Elctrns. 713-784-3600
TX Houston, Sterling Elctrns. 713-627-9800
UT Salt Lake City, Bell Inds., Inc. 801-972-6969
VA Charlottesville, Viginia Elec. Comps., Inc. 804-296-4184
WA Bellevue, Bell Inds., Inc. 206-747-1515
WA Redmond, Shelley-Ragon, Inc. 206-241-1980
WI New Berlin, Schweber Elctrns. 414-784-9020
WI Waukesha, Bell Inds., Inc. 414-547-8879
Can Alberta, Future Elctrns. 403-235-5325
Can British Columbia, Future Elctrns. 604-438-5545
Can Ontario, Future Elctrns. 416-638-4771
Can Ontario, Future Elctrns. 613-820-8313
Can Quebec, Future Elctrns. 514-694-7710

BRADY CO., 63 Middlesex Ave., Iselin, NJ 07083, Tel: 201-283-0400; *Sls. Mgr.:* Ed Brady; *Dist. Mgr.:* John Blaze

BRADY, W. H., CO., Indl. Prods. Div., 2221 W. Camden Rd., Milwaukee, WI 53201, Tel: 414-351-6630, TELEX: 26-677, TWX: 910-262-3151, FAX: 1-800-292-2229; *Sls. Mgr.:* M. O. Williamson; *Dist. Mgr.:* M. O. Williamson

BRADY, W.H., CO. NAMEPLATE DIV., See Brady, W.H., Co., Elctrn. Prods. Div

BRADY, W. H., CO., Xymox Div., 8225 W. Parkland Ct., P.O. Box 571, Milwaukee, WI 53201, Tel: 414-355-8300, TELEX: 26-677, TWX: 910-262-3151, FAX: 414-354-0453; FSC No.: 85480; *Sls. Mgr.:* F. P. Yorio

BRAEMAR CORP., 11400 Rupp Drive, Burnsville, MN 55337, Tel: 612-890-5135; Empl.: 130; *Sls. Mgr.:* A. J. Chan

BRAILSFORD & CO., 670 Milton Rd., Rye, NY 10580, Tel: 914-967-1820, FAX: 914-967-1836; Empl.: 25

BRAND DIELECTRICS, INC., Route 203, N. Windham, CT 06256, Tel: 203-423-6321; Empl.: 5; *Sls. Mgr.:* Philip Harvey

BRANDEN, T. G., CORP., 15822 S.W. Upper Bns. Fry. Rd., Lake Oswego, OR 97035, Tel: 503-620-7571; Empl.: 8; *Sls. Mgr.:* Curt Norby

BRANDT ELECTRONICS, INC., 815 E. Middlefield, Mountain View, CA 94043, Tel: 415-967-4944, FAX: 415-967-4105; FSC No.: 57837; Empl.: 52; *Sls. Mgr.:* Frank D. Brandt

BRAXTON MFG., Echo Lake Rd. N., P.O. Box 429, Watertown, CT 06795, Tel: 203-274-6781, TWX: 710-477-0621, FAX: 203-274-9195; Empl.: 115; *Sls. Mgr.:* Richard Rosa

BREEZE ILLINOIS INC

FAX: 303-693-3308

BREEZE-ILLINOIS, Trans Technology Corp., 8823 North Industrial Rd., Peoria, IL 61615-1584, Tel: 309-693-3322, TWX: 510-390-3691; Empl.: 180; *Sls. Mgr.:* Stanley Profiri ..... **C•1814-1815**

Local Sales Offices & Reps

CA Newport Beach, Camda 714-642-7281
CA San Diego, Camda 619-571-4818
CA San Jose, Camda 408-978-6718
CA Woodland Hills, Cal Ward Sls. 818-883-2202
CO Longmont, Todd & Fry Assocs. 303-776-7331
GA Atlanta, Pro Mark Prof. Mktg. Svcs. 404-393-2923
IL Hillside, Cadre Tech. Rep., Inc. 312-449-3900
MD Glen Burnie, Macrotech Assoc. 301-766-1111
MA Tewksbury, Sequel Assoc., Inc. 617-851-4010
MI Madison Heights, Pine Sls., Inc. 313-589-0350
MO St. Louis, Roth Kopf & Assoc., Inc. 314-961-4485
NJ Roebling, J. A. Kais Assoc. 609-499-9488
OH Bandalia, Cleary Sls. Co. 513-890-8642
OH Chagrin Falls, Pine Sls., Inc. 216-247-6198
PA Pittsburgh, Pine Sls., Inc. 412-456-7471
TX Collinsville, DeArmond Entprs. 817-267-2048
WA Bellevue, Lehr Assocs. 206-453-9993

BREN-TRONICS, INC., 10 Brayton Ct., Commack, NY 11725, Tel: 516-499-5155, TELEX: 22-1213 TTCUR, FAX: 516-266-2964; FSC No.: 51828; Empl.: 75; *Sls. Mgr.:* Don Fagon

BREVEL MOTORS, INC., Sub. Vernitron Corp., Broad & 16th Sts., Carlstadt, NJ 07072, Tel: 201-933-0220, TELEX: 642-606; Empl.: 300; *Sls. Mgr.:* Jack Dominice ..... **B•1198**

Local Sales Offices & Reps

AR El Dorado, Industrial Control Assocs. 501-862-2051
CA Los Angeles, Electric Motor Engrg. 213-469-7393
CO Denver, Tech Rep Sls. Co. 303-758-7031
CT Old Saybrook, M. L. Assocs. 203-388-9718
FL Altamonte Springs, Machine Controls 305-788-6607
IL Chicago, Jerry Golten Co. 312-792-1991
KS Prairie Village, Darco Sls. 913-381-7913
MA Ashland, M. L. Assocs. 617-485-6190
MN St. Paul, Vikeland Sls. 612-645-4647
NJ Teaneck, Herbert Rude & Assocs. 201-836-6778
NY Penfield, Upstate Comps. 716-381-6070
NC Raleigh, Leigh Sls. 919-872-1484
OH Bucyrus, Sissler & Assocs. 419-562-9311
OH Columbus, Sissler & Assocs. 614-488-4455
PA Exton, Kiley Elec. Co. 215-363-8550
TN Cleveland, Hicks Sls. 615-472-7398

Local Distributors

AZ Phoenix, Johnstone 602-269-9354
CA Baldwin Park, Johnstone 213-962-7138
CA Los Angeles, Minarik 213-624-3161
CO Denver, Johnstone 303-573-5626
CT Hartford, Brownell Electro 203-278-9000
FL Ft. Lauderdale, Johnstone 305-971-9350
GA Norcross, Johnstone 404-446-0400
ID Boise, Johnstone 208-377-1600
IL Chicago, Johnstone Supply 312-226-3033
KS Wichita, Johnstone 316-267-3629
LA New Orleans, Johnstone Supply 504-733-1495
MD Rockville, Johnstone 301-251-0281
MA Medford, Empire 617-395-5000
MI Farmington Hills, Universal Elec. Prod. 313-476-9500
MO Kansas City, Johnstone Corp. 816-842-3250
MT Billings, Johnstone Corp. 406-252-1207
NE Omaha, Johnstone Corp. 402-339-2342
NV Sparks, Johnstone Corp. 702-356-6668
NJ Cherry Hill, Motor and Control Sys. 609-424-5810
NY Woodside, Johnstone Supply 718-545-4896
OH Cleveland, Reserve Elec. 216-771-5764
OK Oklahoma City, Johnstone Corp. 405-232-8576
OR Portland, Johnstone Corp. 503-233-1151
TN Memphis, Johnstone Supply 901-324-1111
TX Dallas, Johnstone Supply 214-357-0835

BRIGGS, C. A., CO., P.O. Box 151, Glenside, PA 19038, Tel: 215-885-2244, TELEX: 83-4753; Empl.: 10; *Sls. Mgr.:* C. A. Briggs, Jr.

BRIM ELECTRONICS, P.O. Box 336 E, Fair Lawn, NJ 07410, Tel: 201-796-2886, FAX: 201-778-2792; FSC No.: 57834 ..... **C•1816-1825**

Local Sales Offices & Reps

MA Stow, R G Assocs. 617-897-7146
EXP NY, N.Y.C., Roburn Agencies 212-989-5939

Local Distributors

AL Dothan, Carmichael Whls. Supp. 205-793-7066
CA Canoga Park, Tim-Co. Sls. 213-992-5040
CA San Diego, Shanks & Wright 619-239-0176
CT Manchester, IMS 203-649-4415
CT Waterbury, Century Elec. 203-755-0405
FL Lake Mary, Electronic Fasteners 305-321-4000
KS Topeka, Acme Radio Supp. Co. 913-235-1363
LA New Orleans, Radio Parts 504-581-5959
MA Billerica, Eastern Video Sys. 617-667-0009
MA Lexington, Wholesale Elect. Supp. 617-862-3590
MA Springfield, Electro-Term 413-734-6469
MA Waltham, Linear Elect. 617-894-7300
NH Dover, American Radio Corp. 603-742-6800
NJ Hackensack, Milcor 201-489-1313
NY LIC, H.L. Dalis 212-361-1100
NY N.Y.C., Center Indl. 212-YU9-6363
OK Tulsa, Radio, Inc. 918-587-9123
RI Newport, J & S Elctrn. Distb. 401-847-2977
TN Knoxville, Bondurant Bros. Co. 615-573-9151
TX Texarkana, Lavender Elec. 501-773-4631
TX Texarkana, McCulloch Elctrns. 214-792-6923
VT Cavendish, C S Svc. & Supp. Co. 802-226-7582
VA Norfolk, Todd Elec. 804-855-3111
WA Seattle, Amateur Radio Supp. 206-767-3222

BRINTEC CORP., Brand-Rex Cable Systems Division, 1600 W. Main St., Willimantic, CT 06226-1128, Tel: 203-456-8000, TELEX: 99-4444, TWX: 710-440-2247; FSC No.: 71124; Empl.: 1000; *Sls. Mgr.:* J. F. Cichy

Local Sales Offices & Reps

CA El Toro, Par Mktg. 714-768-6021,
CA Laguna Hills, Brand-Rex 714-830-4278
CA Palo Alto, Baribeault Assocs. 415-493-4441
CO Boulder, Component Prod. Sls., Inc. 303-530-2800
CT Manchester, Manu-Rep, Inc. 203-646-6064
GA Dunwoody, Brand-Rex Cable Sys. 404-578-0156,
IN Indianapolis, Insulation Reps. 317-251-1994
MD Hanover, J. A. Maguire & Co. 301-796-0970
MA Clinton, CWS, Inc. 617-368-8753
MI Farmington Hills, Joseph H. Clark Sls. Co. 313-553-0610
MN Edina, Grayden & Flemmer 612-941-1120
MO Chesterfield, Durnin & Assocs. 314-532-9774
NH Amherst, Modern Technlg. 603-482-5443,
NJ Dunellen, J. A. Maguire & Co. 201-752-8480
NJ Pennsauken, J. A. Maguire & Co. 609-665-5136
NY Syracuse, Brand-Rex Cable Sys. 315-469-3599,
OH Chagrin Falls, Joseph H. Clark Sls. 216-247-7848
OR Beaverton, Eclipse Mktg. Grp. 503-642-1661
SC Greenwood, Bamco 803-229-6801
TN Knoxville, Insul-Reps 615-691-7586
TX Plano, C. J. Tellier Co. 214-231-6348
VA Portsmouth, J. A. Maguire & Co. 804-398-0202
WA Redmond, Eclipse Mktg. Grp. 206-885-6991

BRISTOL BABCOCK INC., 1100 Buckingham St., Watertown, CT 06795, Tel: 203-575-3000, 800-243-3576, TELEX: 962417, FAX: 203-754-1477; Empl.: 600; *Sls. Mgr.:* Carlos Batista

BROOKS INSTRUMENT DIV., Emerson Elec. Co., 407 W. Vine St., Hatfield, PA 19440, Tel: 215-362-3500, TELEX: 4975082, FAX: 215-362-3745; Empl.: 1500; *Sls. Mgr.:* H. T. Lund, Jr.

BROOKS MANUFACTURING CORP., 4001 N. American St., Philadelphia, PA 19140, Tel: 215-228-4433; Empl.: 70; *Sls. Mgr.:* G. Brooks; *Dist. Mgr.:* G. Brooks

BROOKS POWER SYSTEMS, 1810 Byberry Rd., Bensalem, PA 19020, Tel: 215-244-0264, 1-800-523-1551; Empl.: 90; *Sls. Mgr.:* Joan LaRocca

BROWN BOVERI ELEC., Norristown Rd., Spring House, PA 19477, Tel: 215-628-7400, TWX: 510-661-0168; Empl.: 3,500

BRUEL & KJAER INSTRS. INC., 185 Forest St., Marlboro, MA 01752-3093, Tel: 617-481-7000, TWX: 710-347-1187, FAX: 617-485-0519; Empl.: 200

BRUNING COMPUTER GRAPHICS, P.O. Box 3020, 777 Arnold Dr., Martinez, CA 94553, Tel: 415-372-7568, TWX: 910-481-5951 ZETAPLOTS MART; FSC No.: 52893; Empl.: 200; *Sls. Mgr.:* Gary Hasenfus

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BTU ENGINEERING CORP., 23 Esquire Rd., N. Billerica, MA 01862, Tel: 617-667-4111, TELEX: 94-7489, FAX: 617-667-9068; Empl.: 600; *Sls. Mgr.:* D. Barry/T. Campbell

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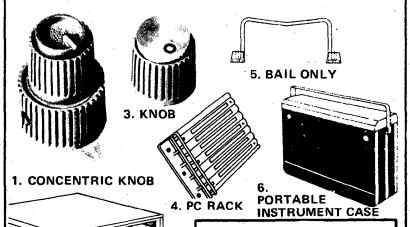

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CA	Irvine, Vale Elctrns. Assocs.	714-551-4821
CA	Pasadena, P. Nurches Co.	213-681-8957
CA	Santa Clara, Engrg. Assocs.	408-988-5001
CO	Denver, Moss Mktg.	303-455-7205
FL	Indian Rock Bch., PAR Assocs., Inc.	813-596-8841
GA	Atlanta, Par Assoc.	404-391-9117
IL	Mt. Prospect, Robert Adams Sls.	312-297-8733
KS	De Soto, Midtec Assoc.	913-441-6565
MD	Columbia, Tyler Griffin Co.	301-995-1215
MA	Belmont, Elctrn. Comps. & Svc.	617-484-8680
MN	Minneapolis, A. J. Warner Co.	612-729-7371
MO	Florissant, Midtec Assocs., Inc.	314-837-5200
NJ	Ocean, P. Saftler Assocs.	201-922-3014
NM	Albuquerque, Moss Mktg.	505-292-7505
NY	Fulton, P. Saftler Assocs.	315-592-7184
NY	Lynbrook, P. Saftler Assoc.	516-593-7880
OH	Beechwood, Elctrn. Sls. Masters, Inc.	800-321-1848
OH	Columbus, McFadden Sls.	614-761-3177
OK	Tulsa, Advance Tech. Sls.	918-664-0482
OR	Forest Grove, Doran Sls. Assocs., Inc.	503-357-3333
PA	Paoli, T. Griffin Co.	215-647-1550
TX	Austin, Advance Tech. Sls.	512-440-7677
TX	Dallas, Advance Tech. Sls.	214-340-1300
TX	Houston, Advance Tech. Sls.	713-440-3888
WA	Redmond, Doran Sls. Assocs., Inc.	206-885-1885

Local Distributors

CA	Los Angeles, Elect. Switches	213-664-1141
CA	Redwood City, Hi-Cor	415-368-3849
GA	Atlanta, Lakeland Engrg. Equip.	404-696-7334
MI	Ann Arbor, Wedemeyer Elctrns.	313-665-8611
MN	Albuquerque, Ideal Elctrn. Supp.	505-345-7887
NY	Hauppauge, Broadline Elctrn. Dist.	516-231-4100
OR	Portland, Radar Elec.	503-232-3404
TX	El Paso, Ideal Indl. Elctrn.	915-779-6647
WA	Seattle, Radar Elec.	206-282-2511
WA	Spokane, Radar Elec.	509-747-3053

BUD INDUSTRIES, INC., 4605 E. 355th St., Willoughby, OH 44094-0431, Tel: 216-946-3200, TWX: 810-427-2604; FSC No.: 71218; Empl.: 200; *Sls. Mgr.:* Bill DeRoche; *Dist. Mgr.:* B. K. Haas

BUDWIG MFG., P.O. Box 829, Ramona, CA 92065-0829, Tel: 619-789-0900; Empl.: 7

BUEHLER PRODUCTS, INC., P. O. Box 33400, Raleigh, NC 27606, Tel: 919-469-8522, TWX: 510-924-2474; Empl.: 400; *Sls. Mgr.:* D. Frank Slightom ..... **C•1653**

BUGGIE H. H., See Caton Connector Corp.

BULBTRONICS, INC., 45 Banfi Plaza, Farmingdale, NY 11735, Tel: 516-249-2272, 1-800-654-8542; Empl.: 45; *Sls. Mgr.:* Elaine Gray; *Dist. Mgr.:* Diana Jacobson

BULOVA WATCH CO., See Frequency Control Prods., Inc., American Time Prods. Div.

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BURGESS SWITCH CO., American Electronic Components, 1010 N. Main St., Elkhart, IN 46515, Tel: 219-262-8608, FAX: 219-262-8819; FSC No.: 6U850; *Sls. Mgr.:* Robin Dick; *Dist. Mgr.:* Robin Dick ..... **B•1658-1660**

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CA	Mountain View, Westech Sls.	415-961-1422
CA	Tustin, Sierra Pacific Engrg.	714-731-3411
FL	Casselberry, Southern Elec. Sls. Corp.	305-332-4718
FL	Melbourne, Southern Elec. Sls. Corp.	305-242-9661
GA	Atlanta, Murphy and Cota	404-875-2525
IL	Des Plaines, Lincoln, Hodges and Assocs.	312-297-3810
KS	Mission, Mertens Co.	913-432-9323
MA	Cambridge, R.J.C. Assocs.	617-492-5858
MI	Royal Oak, Hilltronics	313-398-5556
MN	St. Paul, Kencotronics	612-645-7717
MO	St. Louis, Mertens Co.	314-993-6600
NJ	Palisades Park, A. P. Technical Sls.	201-461-8875
NY	Albany, Niagara Elec. Sls.	518-869-0130
NY	Buffalo, Niagara Elec. Sls.	716-825-3100
NY	East Syracuse, Niagara Elec. Sls.	315-437-1656
NY	Rochester, Niagara Elec. Sls.	716-271-1223
NC	Burlington, Murphy & Cota	919-584-6450
OH	Cincinnati, Anderson-Bolds, Inc.	513-528-5680
OH	Cleveland, Anderson-Bolds, Inc.	216-229-4700
OH	Worthington, Anderson-Bolds Inc.	614-885-3933
OR	Forest Grove, Doran Sls. Assocs.	503-357-3333
PA	Philadelphia, Kenneth B. Erdman, Co.	215-224-1833
TX	Houston, William Reese Assocs.	713-463-1453
WA	Redmond, Doran Sls. Assocs.	206-885-1885
WI	Janesville, Antek Mktg. Corp.	608-734-7745
WI	Waukesha, Lincoln, Hodges and Assocs.	414-542-3087

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AL	Muscle Shoals, Jones Elctrns., Inc.	205-383-1241
CA	Anaheim, Control Design Supp.	714-821-1516
CA	Fresno, Control Elec.	209-268-4411
CA	Long Beach, Elctrl. Power & Controls	213-498-6699
FL	Miami, B & R Elctrns. Supp. Inc.	305-255-4510
FL	Miami, Electro-Standards Labs	305-593-6060
FL	Oakland Pk., Zelcon Inc.	305-565-2555
IL	Chicago Heights, Helsel-Jepperson	312-756-5600
IL	Harvey, George Elctrns.	312-331-1983
MA	Fall River, Broadway Elec. Sls.	617-673-3339
MA	Holyoke, Falcetti & Clark Elec.	413-532-9402
MA	Medford, Empire Elec.	617-395-5000
MA	Springfield, Yankee Elec.	413-739-2101
MI	Grand Rapids, S & F Elctrns. Supp.	616-459-0216
MI	St. Clair Shores, Spemco	313-771-2700
MN	Minneapolis, Elctrn. Center Inc.	612-371-5200
NE	Lincoln, Scott Elec. Supp.	402-446-8221
NH	Manchester, Cohen Machinery Co. Inc.	603-624-4324
NJ	Oakland, Relay Specialties	201-337-1000
NY	Gloversville, Montano Elctrl. Supp.	518-725-3139
NY	Roosevelt, Automated Equip. Co.	516-538-7417
NY	Woodside, Switches Unlimited	718-478-5000
NC	Durham, Triangle Elec. Motor	919-596-1333
NC	Gastonia, JMT Elctrns. & Control	704-867-4401
OH	Cincinnati, Richards Elec. Supp.	513-242-8800
PA	Harrisburg, Cumberland Elctrns.	717-232-9715
PA	Philadelphia, Esco Elctrl. Supp.	215-923-6050
RI	Providence, J & H Elec. Co., Inc.	401-421-7840
SC	Greenville, Sawyer Elctrns. Corp.	803-235-0438
TX	San Antonio, Sherman Elec. Supp. Inc.	512-224-1004
VA	Roanoke, Peoples Elctrn. Supp.	703-342-8933
WI	Milwaukee, Midwestern Elec. Co.	414-449-1500

BURLEIGH INSTRUMENTS, Burleigh Pk., Fishers, NY 14453, Tel: 716-924-9355, TELEX: 978379; Empl.: 57; *Sls. Mgr.:* Timothy Van Slambrouck; *Dist. Mgr.:* Timothy Van Slambrouck

BURLING INSTRUMENTS, P.O. Box 298, Chatham, NJ 07928, Tel: 201-635-9481, FAX: 201-635-9530; Empl.: 29; *Sls. Mgr.:* Roger Nation

BURNDY CORPORATION, Richards Ave., Norwalk, CT 06852, Tel: 203-838-4444, TWX: 710-468-2546; Empl.: 3500; *Sls. Mgr.:* Stan Suszek

BURR-BROWN CORP., P.O. Box 11400, Tucson, AZ 85734, Tel: 602-746-1111, TELEX: 66-6491, TWX: 910-952-1111; Empl.: 1500; *Sls. Mgr.:* L. Davis/B. McGrath/J. Stoupa

BURTON ELECTRICAL ENGINEERING, Wyle Laboratories, 111 Maryland Street, P.O. Box 217, El Segundo, CA 90245-0217, Tel: 213-772-1406, TELEX: 858485, TWX: 910-348-6699, FAX: 213-322-3603; FSC No.: 81861; Empl.: 55; *Sls. Mgr.:* Nasir Shah

BUSINESS TIMEKEEPING SYSTEMS, INC., 170 Navajo St, San Marcos, CA 92069-2593, Tel: 619-744-3044; Empl.: 12; *Sls. Mgr.:* William W. Stephenson; *Dist. Mgr.:* William W. Stephenson

BUSSCO INC., 119 Standard St., El Segundo, CA 90245, Tel: 213-322-6580, TWX: 910-348-6295, FAX: 213-322-8130; FSC No.: 29593; Empl.: 55

Local Sales Offices & Reps

AZ	Tempe, Jarko	602-243-4387
CA	Los Angeles, Electm. Tech. Assoc.	714-998-9241
FL	Ft. Lauderdale, IMR Inc.	305-942-2449,
MD	Rockville, Mechtronics Sls.	301-340-2130
MA	Brookline, Reliable Sls.	617-738-8305
MI	Jackson, Norwood Scroggs Co.	517-750-1170
NY	Great Neck, Trionics	516-466-2300
NY	Liverpool, Syronics Inc.	315-451-0968,
NC	Raleigh, L & D Inc.	919-876-5301,
PA	Hatboro, Jacobsen Assoc.	215-674-2937

BUSSMANN:COOPER INDUSTRIES, P.O. Box 14460, St. Louis, MO 63178, Tel: 314-394-2877, TELEX: 44 841; FSC No.: ;Multiple; Empl.: 3000; *Sls. Mgr.:* John Monter; *Dist. Mgr.:* John Monter ..... **C•1291**

BYTEK CORP., Instrument Systems Div., 1021 S. Rogers Circle, Boca Raton, FL 33431, Tel: 305-994-3520, FAX: 305-994-3615; Empl.: 45; *Sls. Mgr.:* Madeline Selwitz

BYTEX CORP., 120 Turnpike Rd., Southborough, MA 01772, Tel: 617-480-0840, TELEX: 951151; Empl.: 240; *Sls. Mgr.:* John Shoemaker

CABLESCAN, INC., Subsidiary of Eubanks Engrg. Co., 145 E. Emerson Ave., Orange, CA 92665, Tel: 714-998-1961, TELEX: 291693; *Sls. Mgr.:* Jerry Stephens

CABLE SYSTEMS, INC., 210 Broadway, Everett, MA 02149, Tel: 617-389-7080, TWX: 710-348-1760; FSC No.: 33426; Empl.: 175; *Sls. Mgr.:* Darrell Fernald ... **C•1826**

Local Sales Offices & Reps

CA	Santa Ana, Interconnect Engrg. Assoc.	714-852-1947
CA	Santa Clara, Caltronic Sls.	408-727-7552
CT	Tolland, TMR Corp.	203-872-3624
MD	Ellicott City, Marketing Technlg.	301-465-5944
MA	Holden, G. T. Joyce	617-829-6521
NY	Commack, MTR Technlg.	516-543-1200
NY	Islip, ABS Assocs.	516-277-7101

CABLETEST PRODUCTS CO., 81 W. Wyoming Ave., Melrose, MA 02176, Tel: 617-665-2932; Empl.: 28; *Sls. Mgr.:* H. E. Holley; *Dist. Mgr.:* H. E. Holley

CABLEWAVE SYSTEMS, Celwave Systems, Inc., 60 Dodge Ave., North Haven, CT 06473, Tel: 203-239-3311, TWX: 710-465-0244; Empl.: 250; *Sls. Mgr.:* William Meola

CABLEX, INC., 96 Inverness Dr. E., Ste. J, Englewood, CO 80112, Tel: 303-792-5760, FAX: 303-792-3006; Empl.: 50; *Sls. Mgr.:* Reed C. Mulder; *Dist. Mgr.:* Reed C. Mulder

CABOT BERYLCO, DIV. OF CABOT CORP., See NGK Berylco, Div. of NGK Metals Corp.

CABTRON SYSTEMS INC.

FAX: 312-272-1095

CABTRON SYSTEMS, INC., 200 N. Anets Dr., Northbrook, IL 60062, Tel: 312-498-6090; Empl.: 45; *Sls. Mgr.:* Terry Pullega ..... **C•1020**

Local Sales Offices & Reps

CA	Northridge, XBX Sls., Inc.	800-874-3821
CA	Orange, XBX Sls., Inc.	714-998-8200
CA	San Diego, XBX Sls., Inc.	619-586-1577
CA	Santa Clara, Warren Assocs.	408-988-7762
CT	Cheshire, Meco, Inc.	800-225-3409
FL	Maitland, E.I.R.	305-660-9600
GA	Atlanta, REMCO	404-447-6937
GA	Lilburn, Phillip Matthews Corp.	404-381-1662,
KS	Wichita, Buckman & Assocs.	316-267-2052
MD	Silver Spring, Ansell Engrg.	301-949-1655
MA	Reading, Meco, Inc.	617-944-6660,800-225-3409
MI	Livonia, Lowell-Wendt	313-464-2722
MN	St. Paul, Countryman Assocs.	612-645-9151
MO	St. Charles, Buckman & Assocs.	314-947-4727
NV	Reno, Warren Assocs.	408-988-7762
NJ	Mt. Lakes, N.J. Comps. for Elctrns.	201-334-2921
NY	Johnson City, Tech-Mark	607-729-6340
NY	Mendon, Tech-Mark	716-624-3840
NY	Utica, Tech-Mark	315-733-0575
NC	Kings, Phillip Matthews Corp.	919-983-9790,
OH	Cleveland, Geotronix	216-659-6100
OH	Dayton, Geotronix	513-854-5939
OR	Portland, McLaren, Inc.	503-297-2248
PA	Albrightville, Geotronix	412-487-1770
TX	Dallas, Dunbar Assocs.	214-239-7151
WA	Bellevue, McLaren	206-454-3400

CAC

FAX: 618-263-4295

CAC MICROCIRCUITS INC., 2 Southgate Dr., Mt. Carmel, IL 62863, Tel: 618-263-4343; Empl.: 95; *Sls. Mgr.:* Lloyd E.Dustmann ..... **A•1731**

Local Sales Offices & Reps

AZ	Scottsdale, Arcom Sls.	602-947-5745
CO	Boulder, Front Range Mktg.	303-443-4780
IA	Cedar Rapids, Dy-Tronix	319-377-8275
KS	Wichita, Dy-Tronix Inc.	316-838-0884
MN	Minnetonka, Gibb Elctrn. Sls.	612-935-4600
MO	Raytown, Dy-Tronix	913-229-6333
MO	St. Louis, Dy-Tronix	314-291-4777
NH	Amherst, D. A. Crowley & Assocs., Inc.	603-673-7050
UT	Salt Lake City, Front Range Mktg.	801-566-2500

CADDELL-BURNS MFG., 258 E. 2nd St., Mineola, NY 11501-3508, Tel: 516-746-2310; Empl.: 30 ..... **A•1208-1222**

CADDELL COIL CORP., 35M Main St., Poultney, VT 05764, Tel: 802-287-4055; Empl.: 6; *Sls. Mgr.:* James Caddell ..... **A•1223**

Local Sales Offices & Reps

FL	Vero Bch., R.B. Caddell	305-562-4496

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CADDOCK ELECTRONICS, INC., 1717 Chicago Ave., Riverside, CA 92507, Tel: 714-788-1700, TWX: 910-332-6108; FSC No.: 19647; Empl.: 300 ..... **A•1878-1901**

Local Sales Offices & Reps

OH	Cleveland, Arthur H. Baier Co.	216-461-6161
OH	Dayton, Arthur H. Baier Co.	513-276-4128
OR	Beaverton, Elctrn. Sources	503-627-0838
WA	Bellevue, Elctrn. Sources	206-451-3500

Local Distributors

TX	Houston, Lenert Co.	713-225-1465

CADILLAC PLASTIC & CHEM. CO., Day International, 530 Stephenson Hwy., Troy, MI 48083, Tel: 313-583-1200, TWX: 810-232-1886, FAX: 313-583-4715; Empl.: 1000

CAIG LABS., 1175-0 Industrial Ave., Escondido, CA 92025, Tel: 619-743-7143, FAX: 619-743-2460; Empl.: 15

Local Distributors

CA	Hollywood, Yale Elctrns.	213-465-3186
DE	Wilmington, Wholesale Elctrn.	302-656-9988
FL	Miami, ESL Elctrn. Dist.	305-593-6060
IL	Champaign, Klaus Radio	217-356-1896
LA	Lafayette, Ralphs Elctrns. Supp.	318-233-0105
MO	Kansas City, Walters Indl. Elctrns.	816-531-7015
NY	New York, Argil Elctrns.	212-691-8111
VA	Norfolk, Priest Elctrns.	703-855-0105
VA	Norfolk, Radio Parts Distr. Co.	703-461-8095

CALABRO INDS., INC., See UNITRACK Div., Calabro Inds., Inc.

CAL-AV, INC., 515B Westchester Drive, Campbell, CA 95008, Tel: 408-371-0666; Empl.: 8

CALAY SYSTEMS, INC., 2698 White Road, Irvine, CA 92714, Tel: 714-863-1700, TELEX: 6711321, FAX: 714-863-0310; Empl.: 80

CAL COUNT, 101 H Executive Dr., Sterling, VA 22170, Tel: 703-471-0450, TELEX: 440732, TWX: 440733; Empl.: 35

CAL CRYSTAL LAB., INC., 1142 N. Gilbert, Anaheim, CA 92801, Tel: 714-991-1580, 800-854-XTAL, TWX: 910-591-1892; Empl.: 25; *Sls. Mgr.:* Herb Plumhoff

CALEX

FAX: 415-932-6017

CALEX MFG. CO., INC., 3355 Vincent Rd., Pleasant Hill, CA 94523, Tel: 415-932-3911, TELEX: 269888; FSC No.: 29988; Empl.: 75; *Sls. Mgr.:* Steve Corbett ..... **D•1008-1009, 1622-1626**

Local Sales Offices & Reps

AZ	Glendale, Aspen	602-931-9289
CA	Carson, AMASCO	213-516-8561
CA	Sunnyvale, AMASCO	408-733-8690
CT	Tolland, R.G. Assocs.	203-875-4201
MA	Lowell, R.G. Assocs.	617-458-9802
MA	Marshfield, R.G. Assocs.	617-837-3290
NJ	Marlton, Analectro Tech. Rep., Inc.	609-424-2883
NC	Raleigh, Geotronix	216-659-6100
OH	Trottwood, Geotronix	513-253-6700
OK	Tulsa, Spectra Sls. Corp.	918-665-8899
OR	Portland, Topp Engrg.	503-244-7265
PA	Allison Pk., Geotronix	412-487-1770
TX	Houston, Spectra Sls. Corp.	713-270-8212
TX	Richardson, Spectra Sls. Corp.	214-234-3600
VA	Alexandria, Analectro Tech. Rep., Inc.	703-823-1703
WA	Bellevue, Topp Engrg. Sls. Co.	206-747-5400

Local Distributors

OH	Richfield, Alpha Distr.	216-659-7100

CALIBRON INSTRUMENTS, Burton-Rogers Co., 220 Grove St., Waltham, MA 02154, Tel: 617-894-6440, FAX: 617-893-8393; Empl.: 14; *Dist. Mgr.:* W. Burton

CALIFORNIA AUTOMATION INC., 11815 Sorrento Valley Rd., San Diego, CA 92121, Tel: 619-452-1341

CALIFORNIA AVIONICS LABS., See Cal-Av, Inc.

CA DC CALIFORNIA DC

FAX: 805-498-8381

CALIFORNIA DC, 2150 Anchor Ct., Newbury Park, CA 91320, Tel: 805-499-3621; Empl.: 100; *Sls. Mgr.:* C. Paton; *Dist. Mgr.:* C. Paton ..... **D•1628-1630**

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MA	Wellesley Hills, Sturdy Corp.	617-235-2330
NY	Hicksville, L-Tronix	516-935-0220
TX	Houston, Prime Tech. Sls.	713-894-4161

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IL	Arlington, Coombs & Assocs.	312-439-9810
MA	Wellesley Hills, Target Elctrns.	617-235-2545
NY	Hicksville, L-Tronix	516-935-0220
OR	Wilsonville, Micro Power	503-694-5353
Can	Montreal, Que., Future Elctrns.	514-694-7710
Can	Ontario, RD Assocs.	416-444-0959

CALIFORNIA EASTERN LABS. INC., 3260 Jay St, Santa Clara, CA 95054, Tel: 408-988-3500, TELEX: 346393, TWX: 171197; Empl.: 100; *Sls. Mgr.:* Len Lea, Sls. Mgr.; *Dist. Mgr.:* Jim McAuley

California INSTRUMENTS

FAX: 619-279-8139

CALIFORNIA INSTRUMENTS, Amstar Electronics Group, 5125 Convoy St, Ste. 201, San Diego, CA 92111, Tel: 619-279-8620, 800-356-2244, 800-821-1634, TELEX: 695047 CALICO SDG; FSC No.: 16067; Empl.: 95; *Sls. Mgr.:* Don Chilcoat (Int'l) ... **D•2081-2083**

Local Sales Offices & Reps

AZ	Phoenix, Aztec Ent., Inc.	602-944-9185
CA	Huntington Beach, Sci. Dvcs. West	714-840-3501
CA	San Jose, Scientific Dvcs.	408-554-0455
CO	Denver, Aztec Entprs.	303-779-5285
FL	Melbourne, Saber Assocs.	305-724-0924
IL	Chicago, EIA, Inc.	312-298-2290
IN	Indianapolis, EIA, Inc.	317-257-7231
KS	Lenexa, Ramsey Assocs.	913-541-1007
LA	Metairie, Data Mktg. Assocs.	504-833-3655
MD	Rockville, Creative Mktg. Assocs.	301-251-4100
MA	Waltham, McBar Assocs.	617-890-0233
MN	Minneapolis, E.I.A., Inc.	612-374-5628
MO	St. Louis, Ramsey Assocs.	314-532-9386
NJ	Teaneck, Sci. Dvcs. East, Inc.	201-837-1004
NM	Albuquerque, Aztec Entprs.	505-262-1688
NY	Albany, The Robert F. Lamb Co., Inc.	518-869-3355
NY	Buffalo, The Robert F. Lamb Co., Inc.	716-827-1111
NY	Rochester, The Robert F. Lamb Co., Inc.	716-323-1305
NY	Syracuse, The Robert F. Lamb Co., Inc.	315-455-2469
OH	Dayton, Hocker Assocs.	513-253-3642
OK	Tulsa, Data Mktg. Assocs.	918-494-2711
OR	Beaverton, Northwest T&M	503-645-9000
PA	Springhouse, Sci. Dvcs. East.	215-643-3335
TX	Austin, Data Mktg. Assocs.	512-443-7722
TX	Dallas, Data Mktg. Assocs.	214-661-0300
TX	Houston, Data Mktg. Assocs.	713-780-2511
TX	San Antonio, Data Mktg. Assocs.	512-342-3031
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CALIFORNIA MICROWAVE, 990 Almanor Ave., Sunnyvale, CA 94086, Tel: 408-732-4000, TELEX: 35 2016, TWX: 910-339-9231, FAX: 408-732-4244; Empl.: 780

CALMARK CORPORATION

FAX: 818-287-7350

CALMARK CORP., 4915 Walnut Grove Ave., San Gabriel, CA 91776, Tel: 818-287-0451, TWX: 910-589-1540; FSC No.: 52094; Empl.: 80; *Sls. Mgr.:* Bruce Rockwell; *Dist. Mgr.:* Bruce Rockwell ... **C•1021**

Local Sales Offices & Reps

AL	Huntsville, Par Mktg.	205-859-5702
AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Oceanside, Noo Rep. Tech. Sls.	619-941-0558
CA	San Gabriel, Calmark Corp.	818-287-0451
CA	San Jose, Calmark Corp.	408-998-2808
CO	Lakewood, Cristee-Meade	803-232-0287
CT	Bethel, Livera-Polk Assocs. Inc.	203-748-4639
FL	Goldenrod, Sunland Assocs.	305-365-9533
GA	Alpharetta, Par Mktg.	404-442-8858
IL	Elk Grove, Parcom Inc.	312-228-9046
KS	Lenexa, Midtec Assocs.	913-541-0505
MA	Needham, Component Technlgy.	617-449-8490
MI	Farmington Hills, W.R.Hummon	313-474-0661
MN	Minneapolis, Comps. Grp.	612-374-1250
MO	St. Louis, Midtec Assocs.	314-275-8666
NJ	Madison, Livera-Polk Assocs.	201-377-3220
NY	Cooperstown, Fitzelle Assocs.	607-547-9333
NY	Glen Head, Livera-Polk Assocs.	516-759-9300
OH	Cleveland, Electronic Comps.	216-582-4440
OH	Miamisburg, Electronics, Inc.	513-866-3340
OR	Beaverton, LD Elctrns. Inc.	503-684-8221
PA	Telford, Dalbrook Corp.	215-723-3300
TX	Houston, Zonk & Assocs.	713-895-9131
TX	Richardson, Zonk Assocs.	214-238-7651
WA	Snohomish, LD Elctrns. Inc.	206-568-0511
EXP	Ireland/Cappoquin, Calmark Ireland, Ltd.	TLX 80066
EXP	San Gabriel, CA, Calmark Corp.	818-287-0451
PR	Santruce, SISCO	809-726-3137
Can	Islington, Ont., Pipe-Thompson Ltd.	416-236-2355

Local Distributors

AZ	Phoenix, Aero-Space Computer Supps.	602-582-2779
CA	Buena Park, Cypress Elctrns.	714-521-5230
CA	Fremont, Terminal Sls. Corp.	415-656-7722
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CO	Denver, Solder Tec.	303-922-6214
FL	Largo, Lo-Dan	813-586-2851
FL	Longwood, Intertec Comps.	305-834-7777
IL	Elk Grove, Martec Assocs.	312-956-8090
MD	Beltsville, Petricko, Inc.	301-937-4960
MA	Haverhill, Cord	617-374-0100
MN	Minneapolis, Aero-Space Computer Supp.	612-884-4725
NJ	Sicklerville, Index	609-629-3158
NM	Albuquerque, Betatron	505-344-2381
NY	Elmsford, Multimetrics Co.	914-347-3667
NY	Endwell, Pryme-Line Distrs.	607-748-5200
TX	Dallas, Cypress Elctrns.	214-869-1435
TX	El Paso, International Elex.	915-598-3406
TX	Richardson, Zec Sls.	214-669-0895
WA	Bothell, Cypress Elctrns.	206-483-1144
Can	Mississauga, Ont., Rush Elex. Ltd.	416-677-7280

CALMAX CORP., 3410-C W. MacArthur Blvd., Santa Ana, CA 92704, Tel: 714-957-1299, TELEX: 67-8389, FAX: 714-957-3349; Empl.: 5; *Sls. Mgr.:* Yoshi Fukuda

CALMOS SYSTEMS INC., 20 Edgewater Street, Kanata, Ontario, Canada K2L 1V8, Tel: 613-836-1014, 800-267-7231, TELEX: 053-4501, FAX: 613-831-1742; Empl.: 39; *Sls. Mgr.:* Greg Gravelle; *Dist. Mgr.:* Greg Gravelle

CAL-POWER CORP., 140 Kansas St., El Segundo, CA 90245, Tel: 213-772-2171, TWX: 910-348-6678; Empl.: 30; *Sls. Mgr.:* James L. Dragomir

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CAL-TEK ENGINEERING, 36 Riverside Drive, Kingston, MA 02364, Tel: 617-585-5666; Empl.: 5

CAMBRIDGE AEROFLO INSTRUMENTS, INC., 900 Mount Laurel Circle, Shirley, MA 01464, Tel: 617-425-2346, TELEX: 948503, FAX: 617-425-2338; Empl.: 25 ... **C•1654**

Local Sales Offices & Reps

CO	Denver, Comp. Technlg., Inc.	303-758-5750
CT	Canton, Motoreps of New England	203-693-6366
MA	Needham, Motoreps of New England	617-449-3252
NJ	Springfield, F. F. Sylvester Assocs.	201-376-3324
NY	Rochester, Talty Assocs.	716-323-1210
WI	Racine, KMG Assocs.	414-639-9005

CAMBRIDGE ELECTRONICS LABORATORIES, 1b20 Chester St., Somerville, MA 02144, Tel: 617-629-2805, TELEX: 948580 RACE

CAMBRIDGE FILTER CORP., P.O. Box 4906, Syracuse, NY 13221-4906, Tel: 315-457-1000, TELEX: 322096; Empl.: 400-500

CAMBRIDGE INSTRUMENTS, INC., Optical Systems Division, P.O. Box 123, Buffalo, NY 14240, Tel: 716-891-3000, TELEX: 91-285 REICHERT BUF UW; Empl.: 650; *Sls. Mgr.:* Ronald Armstrong, VP Sls. & Mktg.

CAMBRIDGE PRODUCTS, 244 Woodland Ave., Bloomfield, CT 06002, Tel: 203-243-1761, 800-243-8814, FAX: 203-242-7006; Empl.: 32; *Sls. Mgr.:* Bill Pitcher; *Dist. Mgr.:* Bill Pitcher

CAMBRIDGE TECHNOLOGY, INC., 23 Elm Street, Watertown, MA 02172, Tel: 617-923-1181, TWX: 910-250-7539 CAMTECH BSN; Empl.: 25; *Sls. Mgr.:* E. Grenda

CAMELCO ASSEMBLY, 605136 Ontario Limited, 7400 Victoria Park Avenue, No. 1, Markham, Ontario, Canada L3R 2V4, Tel: 416-477-8269; Empl.: 39

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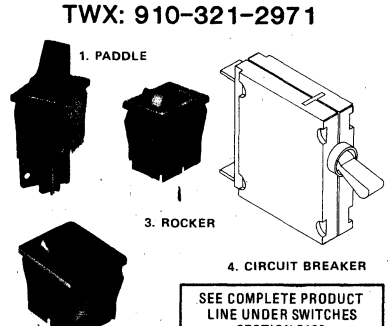

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WI Milwaukee, Key Entprs., Inc. 414-453-9462

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MD Savage, Pyttronic 301-792-0780

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WA Redmond, SPS ELctrns. 206-323-4140
Can Thornhill, Ont., RFQ, Ltd. 416-881-1976

CATRONIX CORP., 2298 Lower Roswell Rd. SE, Marietta, GA 30067, Tel: 404-977-8220; Empl.: 11; *Sls. Mgr.:* Dr. Charls Pearson

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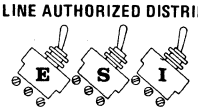

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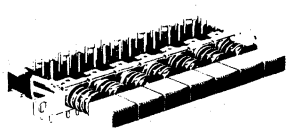

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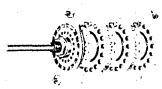

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CHICAGO LASER SYSTEMS, INC., 4034 N. Nashville Ave., Chicago, IL 60634, Tel: 312-282-2710, TELEX: 671-1269, FAX: 312-282-8455; *Sls. Mgr.:* Bernard Alpiner, V.P.

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CHROMALOX INSTRS. & CONTROLS, 1382 Heil-Quaker Blvd., La Vergne, TN 37086-3536, Tel: 615-793-3900, TELEX: 55-5129; Empl.: 110; *Sls. Mgr.:* John Cox ..... **D•1124**

CHROMATICS, 2558 Mountain Ind. Blvd, Tucker, GA 30084, Tel: 404-493-7000, TWX: 810-766-8099

CHRONO-LOG CORP., 2 W. Park Rd., Havertown, PA 19083, Tel: 215-853-1130, TELEX: 831579; Empl.: 20; *Sls. Mgr.:* Frank Sherlock ..... **D•1078**

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TX Houston, Electra Reps 512-339-1163
UT Salt Lake City, Western Region Mktg. 801-486-1646
VA Sterling, Beacon North, Inc. 703-478-2480
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MI Grand Rapids, Midwest Meridian 616-698-7391
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COAST COIL CO., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016, Tel: 213-936-6188, TELEX: 686103 AMI SPACE ASA; FSC No.: 05254; Empl.: 50

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COILCRAFT, 1102 Silver Lake Rd., Cary, IL 60013, Tel: 312-639-2361, TELEX: 216378, TWX: 910-651-2251, FAX: 312-639-2366; Empl.: 1200; *Sls. Mgr.:* Larry Thompson ..... **A•1225-1230**

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WA Seattle, Westmark Elctrns. 206-281-4025,
Can Toronto, Ont., Wilson Entprs. 416-766-0510,

COLLINS AVIONICS DIVISIONS, Rockwell Intl., 400 Collins Rd. NE, Cedar Rapids, IA 52498, Tel: 319-395-1000, TELEX: 464-421, TWX: 910-525-1321; Empl.: 4,325; *Sls. Mgr.:* R.N. Thorpe

Collmer Semiconductor, Inc.

FAX: 214-233-0481

COLLMER SEMICONDUCTOR, INC., 14368 Proton Rd., Dallas, TX 75244, Tel: 800-527-0251, 214-233-1589, TWX: 910-860-5462; Empl.: 50; *Sls. Mgr.:* Gene Uecker ..... **A•2127-2129**

Local Sales Offices & Reps

TX Dallas, Collmer Semiconductor Inc. 800-527-0251
IL Des Plaines, Electron Mktg. Corp. 312-298-2330
IN Ft. Wayne, Arete Sls. Inc. 219-423-1478
IN Greenwood, Arete Sls. Inc. 317-882-4407
KS Lenexa, Midtec Assocs., Inc. 913-541-0505
CA S. Mission Viejo, Collmer Semiconductor Inc. 714-582-2188
MA N. Burlington, Omni-Rep 617-245-4511
MN Minneapolis, Loren Green Assocs. 612-571-6666
CA San Jose, Comtech Mktg. 408-294-5445
MO St. Louis, Midtec Assocs., Inc. 314-275-8666
NJ Nutley, Falk-Baker Assocs. 201-661-2430
NY Clark Mills, KLM Garner 315-853-6126
NC Cary, Tec Rep Svcs., Inc. 919-467-6444
NC Charlotte, Tec Rep Svcs. Inc. 704-342-3900
OH Beachwood, Elctrn. Salesmasters 216-831-9555
OR Portland, Elctrn. Engrg. Sls. 503-639-3978
PA Hatboro, Electro Rep 215-674-4421
RI Cumberland, Omni-Rep 401-333-2353
CO Golden, J. F. Hurlbut Co. 303-279-7796
TN Nashville, Tec Rep Svcs. Inc. 615-832-0449
TX Austin, Barry Sls., Inc. 512-837-3616
TX Houston, Barry Sls., Inc. 713-784-5860
CT Madison, Omni-Rep 203-421-4561
FL Oldsmar, Boggs & Assocs. 813-855-1812
TX Richardson, Barry Sls., Inc. 214-234-0255
VA Richmond, Glasscock Assocs. 804-740-0063
FL W. Palm Bch., Boggs & Assocs. 305-478-8062
WA Redmond, Elctrn. Engrg. Sls. 206-883-3374
WI Waukesha, Electron Mktg. Corp. 414-547-1505
GA Alphretta, Tec Rep Svcs., Inc. 404-594-8973
Can Mississauga, Ont., R-Theta Inc. 416-890-0221

Local Distributors

IN Carmel, Altex Elctrns., Inc. 317-848-1323
IL Chicago, NEP Elctrns., Inc. 312-625-8400

COLORADO CRYSTAL CORP.

FAX: 303-667-3500

COLORADO CRYSTAL CORP., 2303 W. 8th St., Loveland, CO 80537, Tel: 303-667-9248; FSC No.: 33096; Empl.: 105; *Sls. Mgr.:* David Lind ..... **A•1355-1357**

Local Sales Offices & Reps

CA Calabasas, Shel Schreiber Assocs. ... 818-703-8083
CA Los Altos, Kolm Mktg. Assoc. ... 415-948-2635
IA Cedar Rapids, Barnes Midwest Sls. ... 319-393-9790
KS Overland Park, Barnes Midwest Sls. .. 913-469-9688
MA Randolph, Bengal ... 617-961-4120
OR Beaverton, L. D. Elctrns. ... 503-649-6177
TX Austin, Oeler & Menelaides ... 512-453-0275
TX Dallas, Oeler & Menelaides ... 214-361-8876
TX Houston, Oeler & Menelaides ... 713-682-7001
WA Spokane, L. D. Elctrns. ... 509-922-4883

COLORADO DATA SYSTEMS, INC., 3301 W. Hampden Ave., Unit C, Englewood, CO 80110, Tel: 303-762-1640, TWX: 910-933-0193; Empl.: 70; *Sls. Mgr.:* Louis J. Klahn, Jr.

COLORADO VIDEO, INC., Box 928, Boulder, CO 80306, Tel: 303-530-9580, TWX: 910-940-3248, FAX: 303-530-9569; Empl.: 28; *Sls. Mgr.:* N. H. Bennett

COLORGRAPHIC COMMUNICATIONS CORP., New Peachtree Rd., P.O. Box 80448, Atlanta, GA 30366, Tel: 404-455-3921, FAX: 404-458-0616; Empl.: 50; *Sls. Mgr.:* Michael Parrish

COLUMBIA CHASE CORP., HUMISEAL DIV., See HumiSeal Div.

COLUMBIA COMPONENTS, 9 Division St., Sidney, NY 13838, Tel: 607-563-3520; FSC No.: 59178; Empl.: 12; *Sls. Mgr.:* Helen Montren

COLUMBIA ELEC. MFG., 4519 Hamilton Ave. N.W., Cleveland, OH 44114, Tel: 216-361-8060; Empl.: 60; *Sls. Mgr.:* H. W. Sussman

COLUMBIA ELCTRN. CABLES DIV., See Carol Cable Co., Inc., Columbia Elctrn. Cables Div.

COLUMBIA RESCH. LABS., Macdade Blvd. & Bullens La., Woodlyn, PA 19094, Tel: 215-872-3882, TWX: 510-669-3625, FAX: 215-872-3882; FSC No.: 07571; Empl.: 95; *Sls. Mgr.:* Jack Sarty

COLUMBUS ELECTRIC MFG. CO., Switch Division, Route 3, Box 90, Piney Flats, TN 37686, Tel: 1-800-251-7828, TELEX: 533090 CEMCO USA; Empl.: 160; *Sls. Mgr.:* John P. Lipscomb

COLUMBUS INSTRUMENTS, 950 N. Hague Ave., Columbus, OH 43204, Tel: 614-488-6176, TELEX: 246514; *Sls. Mgr.:* Jan Czekajewski

COMAIR ROTRON, A KLI Company, 12 North Street, Saugerties, NY 12477, Tel: 914-246-3615, TELEX: 551496, TWX: 510-247-1941, FAX: 914-246-1176; FSC No.: 5Y921; Empl.: 800; *Dist. Mgr.:* Richard T. Bagg

Local Sales Offices & Reps

AL Huntsville, Montgomery Mktg., Inc. 205-830-0498
AZ Phoenix, Westrep ... 602-997-8899
CA Anaheim, Westrep ... 213-404-3881
CA San Diego, Hadden Assocs. ... 619-565-9444
CA Santa Clara, Westrep ... 408-988-8833
CO Littleton, Lange Sls., Inc. ... 303-795-3600
FL Altamonte Springs, Semtronics ... 305-831-3233
FL Clearwater, Semtronics ... 813-461-4675
GA Norcross, Montgomery Mktg., Inc. ... 404-447-6124
IL (Northern), Sumer, Inc. ... 312-991-8500
IN Ft. Wayne, Frank J. Campisano Co. ... 219-486-6443
IN Indianapolis, Frank J. Campisano ... 317-253-7651
IA Cedar Rapids, S & O Sls. ... 319-363-7331
MD Columbia, L. D. Lowery, Inc. ... 301-381-0225
MA Chelmsford, J. E. Boeing Co. ... 617-256-5800
MI Southfield, Rathsburg Assocs., Inc. ... 313-559-9700
MN Mendota Hgts., G-II Sls., Inc. ... 612-454-3086
MO Bridgetown, Cen Tech, Inc. ... 314-291-4230
MO Raytown, Cen Tech, Inc. ... 816-358-8100
NJ Springfield, F. F. Sylvester Assocs. ... 201-376-3324
NY Saugerties, Comair Rotron, Inc. ... 914-246-3615
NC Cary, Montgomery Mktg., Inc. ... 919-467-6319
OH Cincinnati, Frank J. Campisano Co. ... 513-574-7111
OH Cleveland, Components, Inc. ... 216-243-9200
OK Tulsa, Ammon & Rizos Co. ... 918-663-8788
OR Beaverton, Evergreen Mktg. Grp. ... 503-643-8020
PA Broomall, L. D. Lowery, Inc. ... 215-356-5300
TX Austin, Ammon & Rizos Co. ... 512-454-5314
TX Houston, Ammon & Rizos Co. ... 713-781-6240
TX Richardson, Ammon & Rizos Co. ... 214-644-5591
UT Salt Lake City, Lange Sls., Inc. ... 801-487-0843
WA Seattle, Evergreen Mktg. Grp. ... 206-633-3160
WI Brookfield, Sumer, Inc. ... 414-784-6641
PR Hato Rey, Semtronics ... 809-766-0700
Can Hamilton, Ont., Cartwright/Southall Assocs., Inc. ... 416-528-0294
Can Montreal, PQ, McIntyre Agencies Ltd. ... 514-731-9617

Local Distributors

CA Garden Grove, Richey/Western Elctrns. ... 714-895-0060
IL Chicago, Newark Elctrns. ... 312-784-5100
MI Livonia, RS Elctrns. ... 313-525-1155
MN Minneapolis, Indl. Comps., Inc. ... 612-831-2666
NY Buffalo, Summit Distrs., Inc. ... 716-887-2800
NY Melville, Arrow/Kierulff Elec. Grp. ... 516-391-1510
NY Westbury, Schweber Elctrns. ... 516-334-7474
PA Philadelphia, Almo Elctrns., Inc. ... 215-698-4000
TX Dallas, Hall-Mark Elctrns. ... 214-553-4300
TX Ft. Worth, Allied Elctrns. ... 817-336-5401
WA Bellevue, Almac Elctrns. Corp. ... 206-643-9992
Can Montreal, Que., Preico Elctrns., Ltd. ... 613-726-1800
Can Scarborough, Ont., Carsten Elctrns. ... 416-495-7705
Can Willowdale, Ont., Electrosonic ... 416-494-1666

COMARK CORP., 93 W St., P. O. Box 474, Medfield, MA 02052, Tel: 617-359-8161, FAX: 617-359-2267; Empl.: 35

COMATEL USA, INC., 22 Eagle Rd., Commerce Pk., Danbury, CT 06810, Tel: 203-797-9445, TELEX: 643-011, FAX: 203-790-9298; *Sls. Mgr.:* Tim Papp

COMCLOK, INC., 1142 N. Gilbert St., Anaheim, CA 92801, Tel: 714-991-1580, 800-333-9825, FAX: 714-491-9825; Empl.: 27; *Sls. Mgr.:* Herb Plumhoff ... **A•1358**

Local Sales Offices & Reps

CA Arcadia, HMC ... 818-447-0958
CO Denver, Electrophase ... 303-296-0443
MA Malden, J-K Assocs. ... 617-321-2922
OR Portland, SPS Elctrns. ... 503-297-6919
TN McMinnville, B & D Mktg. ... 615-473-7155
TX Dallas, Bradenco ... 214-352-3554

Local Distributors

CA Sunnyvale, Target Elctrns. ... 408-734-5611

COMDATA CORP., 7900 N. Nagle Ave., Morton Grove, IL 60053, Tel: 312-470-9600, TELEX: 4931765

COMLINEAR CORP., 4800 Wheaton Drive, Fort Collins, CO 80525, Tel: 303-226-0500, TELEX: 45-0881; FSC No.: 62839; Empl.: 100; *Sls. Mgr.:* John Perzow

COMMUNICATION CABLES & CONNECTORS, The Dutton Co., 8255 Black Run Rd., Nashport, OH 43830, Tel: 614-828-2468; Empl.: 30; *Sls. Mgr.:* Don Ritterbusch; *Dist. Mgr.:* Don Ritterbusch

COMMUNICATIONS INSTRUMENTS, INC., P.O. Box 520, Hwy. 74 East, Fairview, NC 28730, Tel: 704-628-1711, TELEX: 577436; FSC No.: 58614; Empl.: 450; *Sls. Mgr.:* R. McClinton ... **B•1386-1393**

Local Sales Offices & Reps

AL Huntsville, Macro Mktg. Assoc. ... 205-883-9630
AL Huntsville, Time Elctrns. ... 205-721-1133
AZ Phoenix, CPS Assocs. ... 602-246-1097
AZ Tempe, Time Elctrns. ... 602-967-2000
CA Anaheim, Time Elctrns. ... 714-937-0911
CA Chatsworth, Time Elctrns. ... 818-998-7200
CA Long Beach, R D & D Sls. Engrg. ... 213-988-1116
CA San Diego, Time Elctrns. ... 619-586-1331
CA Santa Clara, Ross Mktg. ... 408-988-8111
CA Sunnyvale, Time Elctrns. ... 408-734-9888
CA Torrance, Time Elctrns. ... 213-320-0880
CO Denver, AKI Entprs. ... 303-388-4488
CO Englewood, Time Elctrns. ... 303-799-8851
CT Cheshire, Time Elctrns. ... 203-271-3200
CT Torrington, Phoenix Sls. ... 203-496-7709
FL Ft. Lauderdale, Time Elctrns. ... 305-974-4800
FL Orlando, Time Elctrns. ... 305-841-6565
FL Oviedo, Conley & Assocs. ... 305-365-3283
GA Atlanta, ElectroAir ... 404-351-3545
GA Norcross, Time Elctrns. ... 404-448-4448
IL Arlington Hts., MB Sls. ... 312-392-9499
IL Wood Dale, Time Elctrns. ... 312-350-0610
IN Ft. Wayne, Denton Mktg. ... 219-486-0665/1264
IA Cedar Rapids, C. H. Horn & Assocs. .. 319-393-8703
KS Lenexa, Midwest Tech. Sls. ... 913-888-5100
MD Columbia, Time Elctrns. ... 301-964-3090
MD Ellicott City, Doss Elctrns. ... 301-465-1336
MA Needham, Component Technlg., Inc. .. 617-449-8490
MA Peabody, Time Elctrns. ... 617-532-6200
MI Grosse Pointe Park, Greiner Assocs., Inc. ... 313-499-0188
MN Bloomington, Time Elctrns. ... 612-532-1250
MN North Mankato, El Sls. ... 507-345-5786
MO St. Louis, Time Elctrns. ... 314-391-6444
NJ Pine Brook, Time Elctrns. ... 201-582-4611
NY E. Syracuse, Time Elctrns. ... 315-432-0355
NY East Rockaway, HLJ Comp. Tech. 516-599-2999
NY Hauppauge, Time Elctrns. ... 516-273-0100
NY Syracuse, M. M. Hare Co. ... 315-457-6859
NC Charlotte, Time Elctrns. ... 704-522-7600
NC Raleigh, Godwin Assocs. ... 919-878-8000
OH Cleveland, Arthur H. Baier Co. ... 216-461-6161
OH Dayton, Arthur H. Baier Co. ... 513-276-4128
OH Dublin, Time Elctrns. ... 614-761-1100
OR Beaverton, Quest Mktg., Inc. ... 503-641-7377
OR Portland, Time Elctrns. ... 503-684-3780
PA King of Prussia, Time Elctrns. ... 215-337-0900
TX Austin, Time Elctrns. ... 512-339-3051
TX Carrolton, Time Elctrns. ... 214-241-7441
TX Georgetown, Semco ... 512-863-2620
TX Houston, Time Elctrns. ... 713-530-0800
UT Salt Lake City, Time Elctrns. ... 801-973-8181
WA Bellevue, Quest Mktg. ... 206-747-9424
WA Redmond, Time Elctrns. ... 206-882-1600
Can Montreal, Que., Empro Sls. Co. ... 514-341-6420
Can Richmond Hill, Ont., Renmark Elctrns., Ltd. (Off. No. 1) ... 416-881-8844

Local Distributors

AL Huntsville, Time Elctrns. ... 205-721-1133
AZ Tempe, Time Elctrns. ... 602-967-2000
CA Anaheim, Time Elctrns. ... 714-937-0911
CA Chatsworth, Time Elctrns. ... 818-998-7200
FL Orlando, T & T Prods., Inc. ... 305-857-2282
MD Baltimore, Electronic Component Sls., Inc. ... 301-358-1900

COMMUNICATION TECHNIQUES INC., 36 Route 10, East Hanover, NJ 07936, Tel: 201-884-2580, TWX: 710-986-8265; FSC No.: 53213; *Sls. Mgr.:* Louis R. Trummel

COMPAC™

FAX: 516-585-3534

COMPAC, 1320-13 Lincoln Ave., Holbrook, NY 11741, Tel: 516-585-3400; FSC No.: 62099; Empl.: 35; *Sls. Mgr.:* Peter C. Rao ... **B•1677; C•1022-1025**

Local Sales Offices & Reps

GA Atlanta, EMA Inc. ... 404-448-1215
TX Dallas, Talo Products ... 214-644-6010
SC Greenville, EMA Inc. ... 803-233-4637
CA Westlake Village, CAL-Rep. ... 818-991-1940
AL Huntsville, EMA Inc. ... 205-837-7363
AZ Scottsdale, Territorial Mktg. ... 602-994-8665
CA Sunnyvale, ERI ... 408-996-8858,
IL Palatine, R-Tek ... 312-459-6170
IL Prospect Heights, R-Tek, Inc. ... 312-459-6170
IN Ft. Wayne, R-Tek, Inc. ... 219-432-8783
MA Haverill, L-K Assoc. ... 617-373-1313
MO St. Louis, Abrams & Assocs. ... 314-569-0447
NJ Sicklerville, Brown & Assocs. ... 609-629-2254
NC Raliegh, EMA Inc. ... 919-847-8800
VA Fairfax, Schibley Assocs. ... 703-591-3008

Local Distributors

CA Cupertino, Elctrn. Resources ... 408-996-8858

COMPACT POWER COMPANY, 17282 Orange Drive, Yorba Linda, CA 92686, Tel: 714-996-5826; *Sls. Mgr.:* Charles Lindberg ... **D•2090**

COMPACT SOFTWARE, INC., 483 McLean Boulevard, Paterson, NJ 07504, Tel: 201-881-1200, TELEX: 130073, FAX: 201-881-8361; FSC No.: 43304; *Sls. Mgr.:* Jerry Brocklehurst

COMPAR, D.G.W. Electronics Corporation, 85 Spy Ct., Markham, Ontario, Canada L3R 4Z4, Tel: 416-475-8500, TELEX: 06-966600, FAX: 416-475-4158

COMPEX CORP., Taunton Professional Park, 238 Taunton Blvd., Medford, NJ 08055, Tel: 609-596-9388, FAX: 609-596-3482; Empl.: 24

Local Sales Offices & Reps

CA North Hollywood, Crown Elctrns., Inc. ... 213-877-3550
CA Saratoga, E. Reid Miller, Corp. ... 408-257-6927
NH Amherst, Callahan Assocs. ... 603-883-9000
NJ Englewood, Cooper Assocs. ... 201-871-4985
NJ Morrestown, Stern Assocs. ... 609-234-0661
OH Lancaster, Cain-Forlaw Co., Inc. ... 614-654-4800
TX Dallas, Texas Avionics ... 214-363-6324
Can Neapean, Ont., Intrade Canada, Inc. ... 613-727-1272

COMPLEXX SYSTEMS, INC., Astrocom Corp., 4930 Research Dr., Huntsville, AL 35805, Tel: 205-830-4310; Empl.: 30; *Sls. Mgr.:* Kent Johnson; *Dist. Mgr.:* Bob Clacys

COMPLIANCE DESIGN INC., 593 Massachusetts Ave., Boxboro, MA 01719, Tel: 617-264-4668, TWX: 317-632-DASH, FAX: 617-263-7086; *Sls. Mgr.:* Harry Davis

COMPONENT GENERAL, INC., 13620 Wright Cir., Tampa, FL 33626, Tel: 813-855-6655, FAX: 813-855-2761; Empl.: 30; *Sls. Mgr.:* James A. Cook

Local Sales Offices & Reps

CA	Palo Alto, Mollard Mktg.	415-961-0456
DC	Washington, M. Lader Co.	202-296-2497
MA	Andover, Bee Assoc.	617-475-2124
MN	Minneapolis, Comstrand	612-788-9234
MO	Grandview, R. R. Burton	816-763-5385
NY	Buffalo, Ed Westgren Assoc.	716-632-0011
NY	New Rochelle, Robert Diamond Inc.	914-632-2828
PA	Lafayette Hill, M. Lader Co.	215-825-3177
PA	Murrysville, Pittsburgh Sls. Assoc.	412-327-3268
EXP	CT, New Canaan, Control Devices	203-966-7311

COMPONENT MFG. SVC., INC., 1 Component Park, W. Bridgewater, MA 02379, Tel: 508-580-0111, FAX: 508-559-9893; Empl.: 600; *Sls. Mgr.:* Scott Allen; *Dist. Mgr.:* Wayne Douglas **C•1304**

COMPONENT RESEARCH CO. INC., 1655-26 St., Santa Monica, CA 90404, Tel: 213-829-3615, TWX: 910-343-6864; FSC No.: 12517;Multiple; Empl.: 230; *Sls. Mgr.:* Sylvia Kellerman **A•1031-1069**

COMPONENTS CORP., 6 Kinsey Pl., Denville, NJ 07834, Tel: 201-627-0290, FAX: 201-361-5801; FSC No.: 26364; Empl.: 20; *Sls. Mgr.:* W. H. Gordon **C•1306-1307, 1703**

Local Sales Offices & Reps

CA	Laguna Niguel, SMC Sls.	714-240-8309
CA	Santa Cruz, LeRep	408-458-0667
FL	Orlando, EAB, Inc.	305-898-7444
IL	Rolling Meadows, Heartland Tech. Mktg.	312-577-9222
MN	Hopkins, S. J. Collins & Assocs.	612-933-7661
NJ	New Brunswick, Synergy Sls.	201-828-5090
OH	Worthington, The Dynel Co.	614-436-9452
OR	Beaverton, LeRep	503-626-7978
TX	Dallas, deForest Sls. Co.	214-349-3290
EXP	France, Charles Thayer	33-50.73.69.13
Can	Mississauga, Ont., T. W. Wilson Sls.	416-677-8200

Local Distributors

AZ	Tempe, Control Design Supp.	602-829-7981
CA	Anaheim, Bisco Inds.	714-635-0380
CA	Anaheim, Control Design Supp.	213-802-2429
CA	Los Angeles, Strassner Sls. Co.	213-242-8823
CA	Manhattan Bch., Prime Electro Prods.	213-379-3642
CA	San Carlos, Control Design Supp.	415-592-4808
CA	San Jose, Bisco Inds.	408-435-8980
FL	Altamonte Springs, Control Design Supp.	305-788-3220
GA	Stone Mtn., Control Design Supp.	404-979-3502
IL	Franklin Pk., Bisco Inds.	312-451-1230
IL	Genoa, Control Design Supp.	815-784-6519
IN	Indianapolis, Control Design Supp.	317-788-0551
IA	Marion, Control Design Supp.	319-373-2923
MA	Northboro, Papi Supp. Co.	617-393-3127
MA	Woburn, Bisco Inds.	617-938-8590
MN	Minneapolis, Control Design Supp.	612-721-1628
MO	St. Louis, Control Design Supp.	314-426-3150
NJ	Englewood, QC Elctrns.	201-569-0975
NY	Mt. Vernon, QAR Indl. Elctrns.	914-699-2224
NC	Charlotte, Control Design Supp.	704-588-4410
OH	Centerville, Industrial Prods. Distbg.	513-435-2086
PA	Malvern, Control Design Supp.	215-296-0150
TX	Arlington, Bisco Inds.	817-640-7046
TX	Dallas, Control Design Supp.	214-358-0489
WI	New Berlin, Control Design Supp.	414-784-1016

COMPONENTS DIV., Sangamo Weston, Inc., Box 128, Pickens, SC 29671, Tel: 803-878-6311, TELEX: 57-0441, TWX: 810-397-2496; FSC No.: 00853; *Sls. Mgr.:* Bob Hand

COMPONENT SPECIALTIES CORP., 9143 E. La Rosa Dr., Temple City, CA 91780, Tel: 213-283-0015, FAX: 818-287-7189; FSC No.: 28984; Empl.: 45; *Sls. Mgr.:* D.R. Heins

COMPUCART, Versa Tec Corp., 107 N. Rome Ave., Tampa, FL 33606, Tel: 800-237-9024, 813-251-2431; Empl.: 25

COMPU-MECH INC., 5242 Angola Rd., Toledo, OH 43615, Tel: 419-535-6702, TWX: 510-601-7362, FAX: 419-535-0805; *Sls. Mgr.:* John Stanley III

COMPUMOTOR CORPORATION, 1179 N. McDowell Blvd., Petaluma, CA 94952, Tel: 707-778-1244

COMPUTALKER, Compuvoice, Inc., 1119 Colorado Ave., Ste. 115, Santa Monica, CA 90401, Tel: 213-393-7781; Empl.: 1; *Sls. Mgr.:* Lloyd Rice; *Dist. Mgr.:* Lloyd Rice

COMPUTER AVIONICS, See CAC Microcircuits, Inc.

COMPUTER CABLE & PRODS., INC., Vertex Computer Cable & Products

COMPUTER COMPONENTS INC.

FAX: 914-738-6706

COMPUTER COMPONENTS, INC., 629 Fifth Ave., Pelham, NY 10803, Tel: 914-738-1611; FSC No.: 12965; Empl.: 25; *Sls. Mgr.:* John Hunsicker; *Dist. Mgr.:* John Hunsicker **B•1394**

COMPUTER CONVERSIONS CORP., 6 Dunton Ct., E. Northport, NY 11731, Tel: 516-261-3300, TWX: 510-226-0448, FAX: 516-261-3308; FSC No.: 51086; Empl.: 100; *Sls. Mgr.:* S. J. Renard **D•1144-1145**

Local Sales Offices & Reps

CA	N. Hollywood, Crown Elctrns.	213-877-3550
CA	San Carlos, Cymatix	415-592-8076
IL	Hoffman Estates, Bu-Nell Engrg. Co.	312-843-8600
IL	Westmont, GnH Sls.	312-654-2535
IN	Mishawaka, Engrd. Sls.	219-255-5111
IA	Hoffman Estates, Bu-Nell Engrg.	312-843-8600
MA	Brookline, Technology Prod. Grp.	617-731-0858
MI	Newport, Industrial Sensors, Inc.	313-289-3374
NM	Albuquerque, Fry-Gates	505-262-1525
NY	Moravia, Electrotech Sys.	315-497-1598
NC	Kanapolis, Bass & Assocs.	704-933-1762
OH	Cincinnati, Rilco	513-271-0630
PA	Ingoma, Greye Glass	412-366-6664
TX	Humble, Automated Dynamics	713-852-9500

COMPUTER DESIGN & APPLICATIONS INC., 411 Waverly Oaks Rd., Waltham, MA 02154, Tel: 617-647-1900, TELEX: 232-2240; *Sls. Mgr.:* Thomas Goliash

COMPUTER DEVICES, 749 Middlesex Turnpike, Nutting Lake, MA 01865, Tel: 617-663-4980, TELEX: 949398; Empl.: 60; *Sls. Mgr.:* Sandra R. Clark; *Dist. Mgr.:* Dick Leeman

COMPUTER DYNAMICS SALES, 107 S. Main St., Greer, SC 29651, Tel: 803-877-8700; *Sls. Mgr.:* Bruce Alexander

COMPUTER INSTRUMENTS, 100 Madison Ave., Hempstead, NY 11550, Tel: 516-483-8200, TWX: 510-222-4189, FAX: 516-483-8327; Empl.: 50; *Sls. Mgr.:* B. Peskin

COMPUTER MAINTENANCE CORP., 405 Murray Hill Pkwy, East Rutherford, NJ 07073, Tel: 201-896-0707, TELEX: 132-158; Empl.: 105; *Sls. Mgr.:* Arthur Young

FAX: 818-882-0492

COMPUTER OPTICAL PRODUCTS, INC., Sub. of Hathaway Corp., 9321 Eton Ave., Chatsworth, CA 91311-6910, Tel: 818-882-0424, TELEX: 18-33-73-UD; Empl.: 50; *Sls. Mgr.:* Neal Hinkle **B•1883**

Local Sales Offices & Reps

AL	Huntsville, DHR Mktg.	205-533-5165
CA	Santa Clara, Fahrner-Miller Assocs.	408-727-9800
CO	Englewood, Dynatech, Inc.	303-773-2830
CT	Wethersfield, Underwood Sls., Corp.	203-563-3046
FL	Maitland, EIR, Inc.	305-660-9600
IL	Addison, Vikeland Sls.	312-832-8425
IN	Fort Wayne, Denton Mktg.	219-486-0665
MA	Lowell, Underwood Sls. Corp.	617-256-8191
MN	St. Paul, Vikeland Sls.	612-645-4647
NC	Research Triangle Park, DHR Mktg.	919-781-1961
OH	Cincinnati, Stegman-Blaine Mktg., Inc.	513-729-1969
OH	Cleveland, Stegman-Blaine Mktg., Inc.	216-475-1515
OH	Vandalia, Stegman-Blaine Mktg., Inc.	513-890-7975
OR	Beaverton, General Elctrns.	503-641-5288
TX	Austin, R.F. Kimball Co., Inc.	512-443-5284
TX	Houston, R.F. Kimball Co., Inc.	713-840-0590
TX	Richardson, R.F. Kimball Co., Inc.	214-231-3447
UT	Layton, Dynatech, Inc.	801-546-4837
VA	Vinton, DHR Mktg.	804-359-8803
WA	Renton, General Elctrns.	206-228-9505

COMPUTER PERIPHERALS INC., 2635 Lavery Ct., Ste. 5, Newbury Pk., CA 91320, Tel: 805-499-5751, 800-854-7600, TELEX: 759299CPI, FAX: 805-498-8848; Empl.: 50; *Dist. Mgr.:* Mike Krunic

COMPUTER POWER INC., 124 W. Main St., High Bridge, NJ 08829, Tel: 201-638-8000, 800-526-5088, TELEX: 847481; FSC No.: 3643; Empl.: 185; *Sls. Mgr.:* J. Robert Hoeffler; *Dist. Mgr.:* J. Robert Hoeffler

COMPUTER PRODUCTS POWER CONVERSION

FAX: 305-971-7526

COMPUTER PRODUCTS INC., Power Conversion, 2900 Gateway Drive, Pompano Bch., FL 33069-4803, Tel: 305-974-5500; FSC No.: 62125; Empl.: 1900; *Sls. Mgr.:* Norm S. Berkowitz; *Dist. Mgr.:* Edward N. Bennett **D•1096-1098, 1496, 1639-1674**

Local Sales Offices & Reps

AL	Huntsville, Electro-Mech Sls. Engrg.	205-880-0592
AZ	Scottsdale, Summit Sls.	602-998-4850
CA	Los Angeles, Wiley Co.	213-666-1611
CA	Ontario, Bytewide Mktg., Inc.	416-675-1868
CA	San Diego, Wiley Co.	619-453-9018
CA	Santa Clara, Criterion Mfrs. Reps.	408-988-6300
CO	Aurora, Electrodyne	303-695-8903
NC	Raleigh, Electromech Sls. Engrg. Co.	919-790-0104
FL	Oviedo, Conley & Assocs.	305-365-3283
GA	Atlanta, Electro-Mech Sls. Engrg.	404-447-6478
IL	Itasca, Janus, Inc.	312-250-9650
IN	Indianapolis, SAI Mktg. Corp.	317-545-1010
IA	Boise, Cascade Comps.	208-343-9886
KS	Leawood, Dy-tronix, Inc.	913-339-6333
KS	Wichita, Dy-tronix, Inc.	316-838-0884
MD	Columbia, Professional Reps.	301-381-7460
MA	Norwood, MPS Elctrns.	617-769-8700
MA	Woburn, Alpha Omega Sls.	617-933-0237
MI	Fenton, SAI Mktg. Corp.	313-750-1922
MN	Minneapolis, Stan Clothier Co.	612-944-3456
MO	Bridgeton, Dy-tronix, Inc.	314-291-4777
NJ	Hasbrouch Hgts., Comp-Tech. Sls.	201-228-7400
NM	Albuquerque, Summit Sls.	505-343-9886
NY	Binghamton, Empire Tech. Assocs.	607-772-0651
NY	Great Neck, F & F Metro, Inc.	516-482-4080
NY	Rochester, Empire Tech	716-425-3775
NY	Skaneateles, Empire Tech	315-685-5703
NC	Raleigh, Zucker Assocs., Inc.	919-782-8433
OH	Columbus, SAI Mktg. Corp.	614-451-0778
OH	Dayton, SAI Mktg. Corp.	513-435-3181
OH	Shaker Hgts., SAI Mktg. Corp.	216-751-3633
OK	Tulsa, Ammon & Rizos	918-663-8788
OR	Beaverton, Micro Sls.	503-645-3754
PA	Erdenheim, Omni Sls., Inc.	215-233-4600
TN	Jonesville, Electromech Sls. Engrg. Co.	615-753-2964
TX	Austin, Ammon & Rizos	512-454-5131
TX	Houston, Ammon & Rizos	713-781-6240
TX	Richardson, Ammon & Rizos	214-644-5591
UT	Salt Lake City, Electrodyne, Inc.	801-264-8050
WA	Bellevue, Micro Sls., Inc.	206-451-0568
WI	Milwaukee, Janus, Inc.	414-542-7575
Can	Lachine,Quebec, Bytewide Mktg., Inc.	514-636-4121
Can	Ottawa, Ont., Bytewide Mktg.	613-728-0031
Can	West Vancouver B.C., Blakewood Elctrns. Sys., Inc.	604-261-8099

Local Distributors

AL	Huntsville, Bell Inds.	205-837-1074
AL	Huntsville, Marshall Inds.	205-881-9235
AL	Huntsville, Schweber Elctrns.	205-895-0480
AZ	Phoenix, Marshall Inds.	602-496-0290
AZ	Phoenix, Schweber Elctrns.	602-997-4874
AZ	Tempe, Anthem/Lionex	602-966-6600
AZ	Tempe, Bell Inds.	602-996-7800
AZ	Tempe, Marshall Inds.	602-968-6181
CA	Canoga Park, Schweber Elctrns.	818-999-4702
CA	Chatsworth, Anthem/Lionex	818-700-1000
CA	Chatsworth, Marshall Inds.	818-407-4100
CA	El Monte, Marshall Inds.	818-459-5500
CA	Garden Grove, Bell Inds.	714-895-7801
CA	Gardena, Bell Inds.	213-515-1800
CA	Gardena, Schweber Elctrns.	213-327-8409
CA	Irvine, Anthem/Lionex	714-768-4444
CA	Irvine, Marshall Inds.	714-458-5395
CA	Irvine, Schweber Elctrns.	714-863-0200/213-537-4321

CA Los Angeles, Bell Inds. 213-826-6778
CA Milpitas, Marshall Inds. 408-943-4600
CA Milpitas, Power Systems Distrs. 408-263-1063
CA Mtn. View, Bell Inds. 415-960-1440
CA N. Hollywood, B. J. Wolfe Entprs. 213-877-5518
CA Rancho Cordova, Marshall Inds. 916-635-9700
CA Roseville, Bell Inds. 916-969-3100
CA Sacramento, Anthem/Lionex 916-922-6800
CA Sacramento, Schweber Elctrns. 916-929-9732
CA San Diego, Anthem/Lionex 619-546-7893
CA San Diego, Bell Inds. 619-268-1277
CA San Diego, Marshall Inds. 619-578-9600
CA San Diego, Schweber Elctrns. 619-450-0454
CA San Jose, Anthem/Lionex 408-295-4200
CA San Jose, B. J. Wolfe Entprs. 408-731-3433
CA San Jose, Schweber Elctrns. 408-432-7171
CA Sunnyvale, Bell Inds. 408-734-8570,408-773-1100
CA Thousand Oaks, Bell Inds. 805-499-6821
CO Englewood, Anthem/Lionex 303-790-4500
CO Englewood, Schweber Elctrns. 303-799-0258
CO Thornton, Marshall Inds. 303-451-8383
CO Wheat Ridge, Bell Inds. 303-424-1985
CT Danbury, Schweber Elctrns. 203-748-7080
CT Meriden, Anthem/Lionex 203-237-2282
CT Wallingford, Marshall Inds. 203-265-3822
FL Altamonte Springs, Schweber Elctrns. 305-331-7555
FL Deerfield Bch., Bell Inds. 305-421-1997
FL El Monte Springs, Marshall Inds. 305-841-1878
FL Ft. Lauderdale, Marshall Inds. 305-977-4880
FL Largo, Bell Inds. 813-541-4434
FL Ovieda, Aztech Elctrns. 305-365-2241
FL Pompano Bch., Schweber Elctrns. 305-977-7511
FL St. Petersburg, Marshall Inds. 813-576-1399
GA Norcross, Bell Inds. 404-662-0923
GA Norcross, Marshall Inds. 404-923-5750
GA Norcross, Schweber Elctrns. 404-449-9170
IL Elk Grove, Bell Inds. 312-640-0474
IL Elk Grove, Schweber Elctrns. 312-364-3750
IL Elk Grove Vl., Anthem/Lionex 312-640-6066
IL Schaumburg, Marshall Inds. 312-490-0155
IL Urbana, Bell Inds. 217-328-1077
IN Fort Wayne, Bell Inds. 219-424-2433
IN Indianapolis, Bell Inds. .. 317-845-0737,317-299-5487
IN Indianapolis, Marshall Inds. 317-297-0483
IA Cedar Rapids, Bell Inds. 319-395-0730
IA Cedar Rapids, Schweber Elctrns. 319-373-1417
KS Lexena, Marshall Inds. 913-492-3121
KS Overland Park, Schweber Elctrns. 913-492-2922
MD Columbia, Anthem/Lionex 301-381-0040
MD Columbia, Aztech Elctrs. 301-995-6800
MD Gaithersburg, Marshall Inds. 301-840-9450
MD Gaithersburg, Schweber Elctrns. 301-840-5900
MA Bedford, Schweber Elctrns. 617-275-5100
MA Wilmington, Anthem/Lionex 617-657-5170
MA Wilmington, Jaco Elctrns. 617-273-1860
MA Wilmington, Marshall Inds. 617-658-0810
MA Winchester, Bell Inds. 617-729-5800
MI Ann Arbor, Bell Inds. 313-971-9093
MI Livonia, LWC Distrs. 313-464-7700
MI Livonia, Marshall Inds. 313-525-5850
MI Livonia, Schweber Elctrns. 313-525-8100
MN Edina, Schweber Elctrns. 612-941-5280
MN Plymouth, Marshall Inds. 612-559-2211
MO Bridgeton, Marshall Inds. 314-291-4650
MO Earth City, Schweber Elctrns. 314-739-0526
NH Hudson, Bell Inds. 603-882-1133
NH Manchester, Schweber Elctrns. 603-625-2250
NJ Fairfield, Anthem/Lionex 201-227-7960
NJ Fairfield, Marshall Inds. 201-882-0320
NJ Fairfield, Schweber Elctrns. 201-227-7880
NJ Mt. Laurel, Marshall Inds. 609-234-9100
NM Albuquerque, Bell Inds. 505-292-2700
NY Farmingdale, Bell Inds. 516-752-9303
NY Hauppauge, Anthem/Lionex 516-273-1660
NY Hauppauge, Jaco Elctrns. 516-273-5528
NY Hauppauge, Marshall Inds. 516-273-2424
NY Johnson City, Marshall Inds. 607-798-1611
NY Rochester, Marshall Inds. 716-235-7620
NY Rochester, Schweber Elctrns. 716-424-2222
NY Westbury, Schweber Elctrns. 516-334-7474
NC Raleigh, Century Elctrns. 919-782-2116
NC Raleigh, Marshall Inds. 919-878-9882
NC Raleigh, Resco/Raleigh 919-781-5700
NC Raleigh, Schweber Elctrns. 919-876-0000
OH Beechwood, Schweber Elctrns. 216-464-2970
OH Dayton, Bell Inds. 513-435-6765
OH Dayton, Marshall Inds. 513-236-8088
OH Dayton, Schweber Elctrns. 513-439-1800
OH Solon, Marshall Inds. 216-248-1788
OH Westerville, Marshall Inds. 614-891-7580
OK Tulsa, Norvell Elctrns. 918-254-8606
OK Tulsa, Schweber Elctrns. 918-622-8000
OR Beaverton, Almac Elctrns. 503-629-8090
OR Beaverton, Anthem/Lionex 503-643-1114
OR Beaverton, Marshall Inds. 503-644-5050
OR Lake Oswego, Bell Inds. 503-241-4115
PA Horsham, Anthem/Lionex 215-443-5150
PA Horsham, Schweber Elctrns. 215-441-0600
PA Norristown, Century Elctrn. Comps. 215-631-5400
PA Pittsburg, Schweber Elctrns. 412-963-6804
PA Pittsburgh, Marshall Inds. 412-963-0441
TN Nashville, Bell Inds. 615-367-4400
TX Austin, Marshall Inds. 512-837-1991
TX Austin, Norvell Elctrns. 512-837-5555
TX Austin, Schweber Elctrns. 512-339-0088
TX Carrollton, Marshall Inds. 214-233-5200
TX Dallas, Norvell Elctrns. 214-233-0020
TX Dallas, Schweber Elctrns. 214-661-5010
TX Houston, Marshall Inds. 713-895-9200
TX Houston, Norvell Elctrns. 713-777-1666
TX Houston, Schweber Elctrns. 713-784-3600
TX Richardson, Bell Inds. 214-690-0466
UT Salt Lake City, Anthem/Lionex 801-973-8555
UT Salt Lake City, Bell Inds. 801-972-6969
UT Salt Lake City, Marshall Inds. 801-485-1551
WA Bellevue, Almac Elctrns. 206-643-9992
WA Bellevue, Bell Inds. 206-747-1515
WA Bellevue, Marshall Inds. 206-747-9100
WA Redmond, Anthem/Lionex 206-881-0850
WA Spokane, Almac Elctrns. 509-924-9500
WI Brookfield, Marshall Inds. 414-797-8400
WI New Berlin, Schweber Elctrns. 414-784-9020
WI Waukesha, Bell Inds. 414-547-8879
Can Brampton, Ont., Zentronics 416-451-9600
Can Calgary, Alta., Future Elctrns. 403-235-5325
Can Calgary, Alta., Zentronics 403-272-1021
Can Downsview, Ont., Future Elctrns. 416-638-4771
Can Edmonton, Alta., Future Elctrns. 403-438-2858
Can Montreal, Que., Zentronics 514-737-9700
Can Ottawa, Ont., Future Elctrns. 613-820-8313
Can Ottawa, Ont., Zentronics 613-226-8840
Can Pointe Claire, Que., Future Elctrns. 514-694-7710
Can Richmond, B.C., Zentronics 604-273-5575
Can Saskatoon, Saskatchewan, Zentronics 306-955-2202
Can Ste. Foy, Que., Future Elctrns. 418-682-5775
Can Vancouver, B.C., Future Elctrns. 604-294-1166
Can Winnipeg, Mani., Future Elctrns. 204-786-7711
Can Winnipeg, Mani., Zentronics 204-694-1957

COMPUTER SYSTEM ASSOCS., 7564 Trade St., San Diego, CA 92121, Tel: 619-566-3911, TELEX: 333693, FAX: 619-566-0581; Empl.: 15; *Sls. Mgr.:* Bill Reed; *Dist. Mgr.:* Bill Reed

COMPUTER SYSTEM PRODUCTS, 14305 21st Ave. N., Minneapolis, MN 55447, Tel: 612-476-6866, 800-422-2537, FAX: 612-476-6966; Empl.: 50; *Sls. Mgr.:* Tom Quanbeck; *Dist. Mgr.:* Tom Quanbeck

COMPUTER TERMINAL SYSTEMS, INC., 75 Mall Drive, Commack, NY 11725-5703, Tel: 516-864-5260, TELEX: 291411, FAX: 516-864-5878; Empl.: 50; *Sls. Mgr.:* Paul Onish

COMPUTERWARE, INC., 8480-I Tyco Rd., Vienna, VA 22180, Tel: 703-821-8200; Empl.: 18; *Sls. Mgr.:* Betsy Henderson

COMPUTERWISE, 302 N. Winchester, Olathe, KS 66062, Tel: 913-829-0600, TELEX: 705337; Empl.: 20; *Sls. Mgr.:* William W. Brown; *Dist. Mgr.:* William W. Brown

COMPUTROL, MODCOMP, an AEG Co., 15 Ethan Allen Hwy., Ridgefield, CT 06877, Tel: 203-544-9871, TELEX: 643358, FAX: 203-544-8833; Empl.: 85; *Sls. Mgr.:* C. R. Wolfe

COMPUTRON DISPLAY SYSTEMS, Xcel Corporation, 3100 New York Drive, Pasadena, CA 91107, Tel: 818-791-5600, TELEX: 67-5485, TWX: 910-588-3794; FSC No.: 07126; Empl.: 300; *Sls. Mgr.:* R. Van Horn; *Dist. Mgr.:* Kathy Privett ..... **B•1055**

COMSPEC INC., 10700 Hammerly, Suite 120, Houston, TX 77043, Tel: 713-461-4487, FAX: 713-461-8846; Empl.: 15; *Sls. Mgr.:* T. A. Paine; *Dist. Mgr.:* T. A. Paine

comstron corporation

FAX: 516-756-1167

COMSTRON CORP., 10 Hub Dr., Melville, NY 11747, Tel: 516-756-1100, TWX: 310-497-3525; Empl.: 120 ..... **A•1359, 1639; D•1234-1235**

Local Sales Offices & Reps

AL Huntsville, Southern Mktg. Assocs. 305-682-7317
AZ Phoenix, Tech. Mktg. Specialists 602-582-4800
CA Anaheim, Blair Assocs. 714-220-1201
CA Santa Clara, Ward Davis Assocs. 408-245-3700
CA Woodland Hills, Southern CA Tech. Sls. 818-704-9087
CO Denver, Tech. Mktg. Specialists 303-691-5620
FL Longwood, Southern Mktg. Assocs. 305-682-7317
FL Satellite Bch., Southern Mktg. Assocs. 305-777-8629
GA Marietta, Southern Mktg. Assocs. 404-565-0603
IL Arlington Hgts., Dytec Central 312-394-3380
IN Indianapolis, Dytec Central 317-297-5988
KS Lenexa, Dytec South 913-888-0215
MD Rockville, Creative Mktg. 301-251-4100
MD Rockville, Creative Mktg. Assocs. 301-251-4100
MA Lexington, R. J. Sickles 617-862-5100
MA Lexington, R.J. Sickles Assocs. 617-862-5100
MN New Hope, Baltz Assocs. 612-546-8520
MO Maryland Hgts., Dytec South 314-739-0665
NJ Teaneck, Sci. Dvcs. East 201-837-1004
NM Albuquerque, Tech. Mktg. Specialists 602-582-4800
NY Melville, Carnes Assocs. 516-694-1600
NY Whitney Pt., TAE-Rep 607-692-3705
NC Greensboro, Southern Mktg. Assocs. 919-282-6001
PA Horsham, Pennsylvania Sci. Dvcs. 215-956-0700
PA Springhouse, Pennsylvania Sci. Dvcs., Inc. 215-643-3335
WI Brookfield, Dytec Cen. 414-792-0320
WI Brookfield, Dytec Central, Inc. 414-792-0320
Can Ottawa, Ont., AIM Elctrns. 613-722-8286

COMTECH MICROWAVE CORP., Comtech Corp., 63 Oser Ave., Hauppauge, NY 11788, Tel: 516-435-4646, TELEX: 221-234 CMTCH; FSC No.: 31196; *Sls. Mgr.:* J. Tardi

COM/TECH SYSTEMS, INC., 10 Halyard Rd., Valley Stream, NY 11581-2813, Tel: 516-791-1175; Empl.: 10

COMTEC INFORMATION SYSTEMS, INC., 53 John St., Cumberland, RI 02864, Tel: 401-724-8500, TWX: 710-387-1171; Empl.: 60; *Sls. Mgr.:* R. A. Hamilton

CONAP, INC., 1405 Buffalo St., Olean, NY 14760, Tel: 716-372-9650, TWX: 510-245-2769; Empl.: 120

CONCEPT INDUSTRIES, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660, Tel: 213-699-0918, 800-255-2666, FAX: 213-692-8947; Empl.: 25; *Sls. Mgr.:* Rosemary Martinez; *Dist. Mgr.:* Kathy Sawyer

CONCORD ELECTRONICS CORPORATION, 30 Great Jones St., New York, NY 10012, Tel: 1-212-777-6571, TWX: 710-581-4930, FAX: 1-212-995-0161; FSC No.: 18310; Empl.: 225; *Sls. Mgr.:* Josie Wheaton ..... **C•1308-1309, 1704**

CONDENSER PRODUCTS, 2131 Broad St., Brooksville, FL 34609, Tel: 904-796-3561, FAX: 904-799-0221; Empl.: 30; *Sls. Mgr.:* Bill Mason

CONDOR INC.
D.C. POWER SUPPLIES

FAX: 805-487-8911

CONDOR D.C. POWER SUPPLIES, INC., 2311 Statham Pkwy., Oxnard, CA 93033, Tel: 805-486-4565, TWX: 910-333-0681; Empl.: 250; *Sls. Mgr.:* Dan Horan, VP Mktg.; *Dist. Mgr.:* Deborah Perez ..... **D•1676-1677**

Local Sales Offices & Reps

AZ Phoenix, CPS Assocs. Inc. 602-246-1097
CA Brea, Masco Elctrns. 714-529-0866
CA San Jose, QCI Assocs. 408-432-1070
CO Denver, AKI Entprs. 303-388-4488
GA Marietta, FLW Southeast, Inc. 404-424-1731
IL Schaumberg, Engrg. Prods. 312-882-7640
IN Greenfield, Engrg. Prods. 317-894-7156
IA Cedar Rapids, Palatine 319-365-8071
MA Taunton, Focus Elctrns. Sls., Inc. 617-824-3840
MI Southfield, L. H. Dickelman 312-353-8210
MN Edina, Engrg. Prods. 612-835-9022
MO Blue Springs, Palatine 816-229-4007
NJ Medford, Comp. Consits. 609-654-5300
NY Pittsford, C. W. Beach 716-586-3200
NY Yonkers, Sonkin Assocs. 914-968-8282
OH Cincinnati, Stegman Blaine 513-729-1969
SC Greenville, RF Sls. 803-234-6931
TX Dallas, M Rep 214-349-5523

Can N. Vancouver, BC, Jerome & Francis 604-986-1286

Local Distributors

AL Huntsville, T.E. Southeast 205-830-0808
AZ Phoenix, Aerospace S.W. 602-582-2779
CA Anaheim, Pacesetter Elctrns. 714-779-5855
CA Bakersfield, Kern Elec. 805-327-5151
CA Costa Mesa, FLW 714-751-7512
CA Hayward, FLW 415-786-9070
CA Orange, Milgray 203-795-0711
CA Sunnyvale, Pacesetter Elctrns. 408-734-5470
CA Sunnyvale, Sierra West 408-747-1188
CO Westminster, Future Elctrns. 303-650-0123
FL Ft. Lauderdale, Allied 305-486-0500
FL Winter Pk., Milgray 305-647-5747
GA Decator, Allied 404-377-3555
IL Elgin, Allied 312-697-8200
IL Schaumberg, Engrg. Prods. 312-882-7640
KS Overland Pk., Milgray 913-236-8800
MD Columbia, Milgray 301-621-8169
MD Columbia, Vantage 301-621-8555
MD Marlow Hgts., Allied 301-423-0161
MD Wheaton, Brimberg Sls. 301-946-2760
MA Westborough, Future Elctrns. 617-366-2400
MA Wilmington, Allied 617-942-0150
MI Ann Arbor, McNaughton-McKay 313-995-9515
MI Madison Heights, McNaughton-McKay 313-399-7500
MN Eden Prarie, Cassidy 612-944-0100
MN Edina, Engrg. Prods. 612-835-9022
MN Minneapolis, Aerospace Comp. Prod. 612-884-4725
NJ Marlton, Milgray 609-983-5010
NJ Mt. Laurel, Future Elctrns. 609-778-7600
NY Buffalo, Summit Distr. 716-887-2800
NY Commack, Vantage 516-543-2000
NY Mineola, Allied 516-248-2360
NY Yonkers, Kintronics 914-968-7736
NC Raleigh, Allied 919-876-5845
OH Cleveland, Milgray 216-447-1520
OR Portland, Eoff 503-222-9411
TX Dallas, Cypress Elctrns. 214-869-1435
TX Fort Worth, Allied Elctrns. 817-336-5401
TX Richardson, Future Elctrns. 214-436-2437
UT Salt Lake City, Future Elctrns. 801-972-8489
WA Seattle, Allied 206-547-2827
WA Vancouver, Eoff 206-694-7504
Can Toronto, Ont., Duncan Inst. Ltd. 416-742-4448

CONDOR PACIFIC INDS., INC., 8053 Deering Ave., Canoga Park, CA 91304, Tel: 818-347-8331, TELEX: 65-1442, FAX: 818-713-0162; FSC No.: 24321; Empl.: 70

CONDOR SYSTEMS, INC., 2133 Branham Lane, San Jose, CA 95124, Tel: 408-371-9580, TELEX: 184819 Systems SANTA, FAX: 408-371-9589; FSC No.: 62065; Empl.: 150; *Sls. Mgr.:* Don Strandberg; *Dist. Mgr.:* Ed Brown

CONDUCTIVE RUBBER TECHNLG., 121 Gray Avenue, Santa Barbara, CA 93101, Tel: 805-965-6511, TELEX: 658-305, FAX: 805-963-2652

CONDUCTIVE SYSTEM, INC., R.D. No. 1, Box 1040, Rte. 5 South, Amsterdam, NY 12010, Tel: 518-843-5740, ESYLNK: 7105410104, FAX: 518-843-5829; *Sls. Mgr.:* John Severinsen

Local Sales Offices & Reps

CA Los Altos, Frauman Assocs. 415-941-0660
CT Danbury, D. Setter 203-792-9446
GA Atlanta, Hi-Tech Sls. 404-641-8977
MD Baltimore, Bernie White & Co. 301-484-5400
MO St. Charles, Hayes Elec. 314-922-6607
NJ E. Windsor, Warren Engrg. Co. 609-443-3894
NY Amsterdam, Conductive Sys., Inc. 518-843-5740
NY Rochester, Canavan-Scanlon 716-424-1830
NY Syracuse, Canavan-Scanlon 716-424-1830
TX Dallas, Scanlon, Hughes & Assocs. ... 214-739-2888
Can Downsview, Ont., HAR-TECH 416-665-7290

CONEXCO INTERNATIONAL, 175-20 Hillside Avenue, Jamaica, NY 11432, Tel: 718-523-4100, TELEX: 230629 CONEX, TWX: 668657 CONEX, FAX: 718-291-1803; *Sls. Mgr.:* Mike Costello

CONFORMING MATRIX, Box 5126, Pt. Pl. Sta., Toledo, OH 43611, Tel: 419-729-3777; Empl.: 35

CONKLIN INSTRUMENT CORP., West Rd., Pleasant Valley, NY 12569, Tel: 914-635-2136, FAX: 914-635-2510; Empl.: 75; *Sls. Mgr.:* Steven Muise, VP Mktg.; *Dist. Mgr.:* Steven Muise, VP Mktg.

CONNECT-AIR INTERNATIONAL, INC., 50 37th St. N.E., Auburn, WA 98002, Tel: 206-939-4880, FAX: 206-939-4882; Empl.: 50; *Sls. Mgr.:* Ron Jones

CONNECTICUT HARD RUBBER CO., See CHR Inds.

CONNECTICUT MICROWAVE CORP., 106 Powder Mill Rd., Box 389, Canton, CT 06019, Tel: 203-693-4247; FSC No.: 50974; Empl.: 10; *Sls. Mgr.:* Michael DePalo

FAX: 312-539-3825

CONNECTOR CORP., 6025 N. Keystone Ave., Chicago, IL 60646, Tel: 312-539-3108, TWX: 910-221-6059; *Sls. Mgr.:* Diane Racana ..... **C•1310-1311**

CONNECTOR INDUSTRIES OF AMERICA DIV., Microdot Mfg., 639 N. Wayne, Cincinnati, OH 45215, Tel: 513-733-3680; FSC No.: 32076; Empl.: 35; *Sls. Mgr.:* K. C. Neal

FAX: 312-851-5040

CONNOR-WINFIELD CORP., 1865 Selmarten Rd., Aurora, IL 60505, Tel: 312-851-4722, TELEX: 270244; FSC No.: 21022; Empl.: 35; *Sls. Mgr.:* John Hoag ..... **A•1360-1363**

Local Sales Offices & Reps

AL Huntsville, Reynolds & Assocs. 205-881-9362
CA Agoura Hills, C.D.H. Assocs. 818-707-1970
CA Los Altos, Frauman Assocs. 415-941-0660
FL Melbourne, Reynolds & Assocs. 305-259-7000

CONOLOG CORP., 5 Columbia Rd., Somerville, NJ 08876, Tel: 201-722-8081, TELEX: 833281, TWX: 710-480-9340

CONRAC DISPLAY PRODUCTS GROUP, A Mark IV Industries Co., 1724 S. Mountain Ave., Duarte, CA 91010, Tel: 818-303-0095, TWX: 910-584-5913, FAX: 818-303-5484; Empl.: 450; *Sls. Mgr.:* William Erns, Dir. of Broadcast Sls.; *Dist. Mgr.:* Scott Newton, Dir. of Var. Sls.

Local Sales Offices & Reps

CA Berkeley, General Elctrns. Sys. 415-527-7700
CA Lawndale, Omega Video 213-679-9021
CO Bailey, Scientific Sys. 303-838-4615
GA Atlanta, Elctrn. Equip. 404-873-5842
IL Elk Grove Vlg., Swiderski Elctrns. 312-364-1900
KY Edgewood, Midwest Corporation 606-331-8990
MA Woburn, QSI Sys. 617-938-1403
MN Burnsville, Emmons Assocs. 612-890-8920
NY New York, L. Matthew Miller Assocs. .. 212-741-8011
PA Philadelphia, Lerro Elec. 215-223-8200
TX Dallas, MZB & Assoc. 214-233-5535
VA Arlington, Robert Slye Elctrns. 703-525-7272
WA Seattle, North-West Inds. 206-722-7400

CONSOLIDATED CONTROLS, 15 Durant Ave., Bethel, CT 06801, Tel: 203-743-6721, TELEX: 969615, TWX: 710-456-0446; FSC No.: 02750; Empl.: 926; *Sls. Mgr.:* A.F. Jakubauskas

Consolidated electronic wire & cable

FAX: 312-455-8837

CONSOLIDATED ELECTRONIC WIRE & CABLE, 11044 King St., Franklin Park, IL 60131-1412, Tel: 312-455-8830, TWX: 910-227-1705; FSC No.: 73612; Empl.: 85; *Sls. Mgr.:* Karl Rankin; *Dist. Mgr.:* Steve Boynton ..... **C•1828-1835**

Local Sales Offices & Reps

AL Huntsville, Elctrn. Sls., Inc. 205-533-1735,
CA Downey, Mgt. Mktg. & Sls. 213-560-5584,
CA Los Gatos, Featherstone Sls. Co. 408-356-3243,
CA Pacifica, Featherstone Sls. Co. 415-355-3172,
CA San Diego, Mgt. Mktg. & Sls. 619-569-8611,
CT Hartford, Tulimieri Assocs. 203-525-3077,
FL Melbourne, Phoenix Comps. 305-723-4414,
GA Norcross, Elctrn. Sls., Inc. 404-448-6554,
IL Franklin Pk., Con. Elec. Wire & Cable 312-455-8830,
IL Highland Pk., Bransky Sls. 312-433-2375
IN Bloomington, Repptronics 812-334-0383
IA Cedar Rapids, R. W. Kunz & Assocs. .. 319-396-5386
KS Prairie Village, R. W. Kunz & Assocs. .. 913-648-3535
MI Warren, Burcaw Co. 313-573-4605
MN Minneapolis, Microelectronic Sls. 612-829-0948
MO St. Louis, R. W. Kunz & Assocs. 314-966-4977
NM Albuquerque, C.T. Carlberg & Assocs. 505-888-3883
NY Buffalo, NRM Mktg. Group 716-634-4300
NY Skaneateles, NRM Mktg. Group 315-685-8991
NY Whitestone, Jack Brown Elctrns. 718-767-1917,
NC Cary, Elctrn. Sls., Inc. 919-467-8486,
OH Beachwood, Elctrn. Salesmasters, Inc. 216-831-9555
OR Milwaukie, Comtec Intl. 503-654-6626
PA Birchrunville, Jadelectronic Assocs. ... 215-296-3800,
TX Dallas, SW Mktg. Inc. 214-341-8631,
TX Houston, SW Mktg. Inc. 713-537-8166,
UT Salt Lake City, Advanced Control Equip. 801-972-9377,
WA Bellevue, Comtec Intl. 206-453-1188,

CONSOLIDATED RESISTANCE CO. AMERICA, 222 Lake Ave., Yonkers, NY 10701, Tel: 914-YO3-5900; Empl.: 20

CONSOLINK CORP., 1275 S. Sherman Dr., Longmont, CO 80501, Tel: 303-651-2014, TWX: 910-320-0786; Empl.: 40; *Sls. Mgr.:* Dan Zec; *Dist. Mgr.:* Gary Peck

Local Sales Offices & Reps

AZ Scottsdale, Digital Bus. Sys., Inc. 602-991-9831
CA Irvine, Western Gralex 800-854-8385
CO Englewood, B.C. Assocs. 303-694-3999
IL Rolling Meadows, Commodore 1, Inc. 312-394-5441
IA Des Moines, Beams 515-255-1148
MI Southfield, Robert Milsk Co., Inc. 313-354-3310
NY Saugerties, Beckrep 914-246-3031
Can British Columbia, CTron 604-432-9990

Local Distributors

CO Longmont, P.C. Peripherals 303-772-5370, 800-272-7355
CO Rolling Meadows, Commodore I, Inc. 312-394-5441
FL Deerfield, Richard Young Computers 305-426-8100,800-325-0136
FL Melbourne, Data Link Ready, Inc. 305-676-0500
MD Baltimore, Control Cable, Inc. 301-298-4411
MI Troy, Lyben Computer Sys. 313-589-3442
MT Great Falls, Inner City Dists. 406-727-6366
NY Hauppauge, Manchester Equip. Co. ... 516-435-1199
OH Painesville, Xponet, Inc. 216-354-6617
PA Exton, Bell Atlantic Bus. Supp. 215-265-6601
PA Pittsburgh, South Hill Elctrns. 412-921-9000

CONTACT, INC., 5 Elm Ave., Hudson, NH 03051, Tel: 603-883-7708; FSC No.: M07015; Empl.: 11; *Sls. Mgr.:* R. Reid; *Dist. Mgr.:* R. Reid

CONTACT EAST, 335 Willow St. S., P.O. Box 786, N. Andover, MA 01845, Tel: 617-682-2000, TELEX: 383088, FAX: 617-688-7829; *Sls. Mgr.:* Richard Sullivan

CONTACT ELECTRONICS, INC., 30 Plymouth St, Fairfield, NJ 07006, Tel: 201-575-7660, 800-221-1451, TELEX: 130-216; Empl.: 50; *Sls. Mgr.:* Thomas E. Bodnar; *Dist. Mgr.:* Jaime N. Korosler

CONTINENTAL ELECTRONICS, Division of Varian Associates, Inc., P.O. Box 270879, Dallas, TX 75227, Tel: 214-381-7161, TELEX: 73-398; FSC No.: 52151; Empl.: 480; *Sls. Mgr.:* R. L. Floyd, Domestic Broadcast

CONTINENTAL SPECIALTIES CORP., See Global Specialties Corp.

CONTINENTAL WIRE & CABLE, Gulton Rd., P. O. Box 1863, York, PA 17405, Tel: 717-792-2644, TELEX: 84-0437; Empl.: 250; *Sls. Mgr.:* Edward W. Holland III; *Dist. Mgr.:* Shirley A. Eisenhart

CONTOURS INC., 290 Pratt St., Meriden, CT 06450, Tel: 203-237-8331; FSC No.: 033501; *Sls. Mgr.:* Richard Nokes

CONTRAVES GOERZ CORP., 610 Epsilon Dr., Pittsburgh, PA 15238, Tel: 412-967-7700, TELEX: 86-6237, TWX: 710-664-2082; FSC No.: 51261; *Sls. Mgr.:* Henry M. Voss; *Dist. Mgr.:* Ronald L. Ekas

CONTROL CABLE, INC., 7261 Ambassador Rd., Baltimore, MD 21207, Tel: 301-298-4411, FAX: 301-265-1646; FSC No.: 510124759; Empl.: 90; *Sls. Mgr.:* Greg Jones; *Dist. Mgr.:* Greg Jones

CONTROL CONCEPTS CORP., P.O. Box 1380, Binghamton, NY 13902-1380, Tel: 607-724-2484, TELEX: 62224380, FAX: 607-722-8713; Empl.: 41; *Sls. Mgr.:* Pat Gillette, VP Sls.; *Dist. Mgr.:* Fred Zack

CONTROL DATA CORP., P.O. Box O, Minneapolis, MN 55440, Tel: 1-800-828-8001 Operator 82, In MN 612-921-4400, FAX: 612-853-6748; Empl.: 6623; *Sls. Mgr.:* J. Repp; *Dist. Mgr.:* R. L. Kamps

CONTROL DISPLAYS, INC., 3075 Advance Lane, P.O. Box 227, Colmar, PA 18915, Tel: 215-822-3383, FAX: 215-997-1232; FSC No.: 27878; Empl.: 65; *Sls. Mgr.:* L. Rodrigue ..... **B•1010, 1046, 1813**

CONTROL ELECTRONICS, Neurotech Corp., 139 Florida St., Farmingdale, NY 11735, Tel: 516-694-0125, FAX: 516-694-0133; FSC No.: 95924; Empl.: 60; *Sls. Mgr.:* Harold Goldstein; *Dist. Mgr.:* Barbara Kilroy .... **A•1534**

Local Sales Offices & Reps

CA	Sherman Oaks, R.T. Assocs.	213-788-7588
FL	Melbourne, VPI	305-768-9349
FL	Tampa, VPI	813-832-2041
IL	Chicago, Electro-Tech Mktg. Assoc.	312-676-3151
MD	Ellicott City, VPI	301-461-2525
MA	Malden, JK Assocs.	617-321-2922
PA	Montgomeryville, Rufo Sys. Comp.	215-368-8495
TX	Dallas, Texas Avionics Co.	214-363-6324
WI	Brookfield, Electro-Tech Mktg. Assocs.	414-785-9554
EXP	FL, Hallandale, Emec	305-925-6366

CONTROL ENGRG., INC., 1686 Riverdale St., West Springfield, MA 01089, Tel: 413-781-1330; Empl.: 7; *Sls. Mgr.:* Mark Kimball

CONTROLEX, INC., Francestown Turnpike, New Boston, NH 03070, Tel: 603-487-5512, TELEX: 174094 FNB PETERBORO on TRT; Empl.: 7

CONTROLEX/EANCO, See Fincor

CONTROL INDS. INC., 530 Burnside Ave., Inwood, NY 11696, Tel: 212-471-9800; Empl.: 40

CONTROL LASER CORP., 7503 Chancellor Dr., Orlando, FL 32809, Tel: 305-438-2500, TELEX: 514215; Empl.: 130; *Sls. Mgr.:* Bob Sigman, VP Sls./Mktg.

CONTROLLED ENVIRONMENTAL EQUIPMENT CORP., 3 Delta Drive, Westbrook, ME 04092, Tel: 207-854-9126, TELEX: 62903721; Empl.: 10; *Sls. Mgr.:* M. F. Peck

FAX: 313-528-0411

CONTROLLED POWER CO., 1955 Stephenson Hwy., Troy, MI 48083, Tel: 313-528-3700, 1-800-521-4792, TWX: 810-2323401; Empl.: 160; *Sls. Mgr.:* Reggie Peck ..... **D•2085-2089**

CONTROL LOGIC, See Hancock Electronics Corp.

CONTROL MODULE, 380 Enfield St., Enfield, CT 06082, Tel: 203-745-2433, TELEX: 643167; Empl.: 160; *Sls. Mgr.:* D. Penn

CONTROL-O-MATION, INC, 7300 W. Huron River Dr., Dexter, MI 48130, Tel: 313-426-3935, FAX: 313-426-4335; Empl.: 65; *Sls. Mgr.:* Dennis Salamin

CONTROL PRODUCTS, INC., 280 Ridgedale Ave., E. Hanover, NJ 07936, Tel: 201-887-9400, FAX: 201-887-5083; FSC No.: 81901; Empl.: 62; *Sls. Mgr.:* J. R. Nile

CSI

FAX: 818-709-8546

CONTROL SCIENCES, INC., 9509 Vassar Ave., Chatsworth, CA 91311, Tel: 818-709-5510, TELEX: 4970496(CSI); FSC No.: 53317; Empl.: 20; *Sls. Mgr.:* Rhod Zimmerman ..... **D•1147-1151**

Local Sales Offices & Reps

AZ	Tempe, Hannah-Hill	602-431-1771
CA	San Ramon, Tech. Consits.	415-830-0829
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CT	Asonia, Pace Assocs.	203-732-8756
IN	Ft. Wayne, J & B Engrg.	219-483-2813
MN	St. Paul, Northstar Motion & Control	612-770-5311
MO	Peculiar, PEM Sales	816-884-4784
MO	St. Louis, PEM Sales	314-427-7200
NY	Victor, A & D Devices	716-924-9171
PA	Media, Horner Smith Sls.	215-543-2434
NY	Albertson, DOL Engrg.	516-294-9071
TX	Dallas, McDonald Assocs.	214-238-1858
UT	Salt Lake City, Hannah-Hill	801-364-0606

CONTROLS DIVISION, Ametek, Inc., 820 Pennsylvania Blvd., Feasterville, PA 19047, Tel: 215-355-6900, TELEX: 29-1769, FAX: 215-355-2937; Empl.: 100; *Sls. Mgr.:* R. Thomas Guinn

CONTROLS UNLIMITED, INC., 4823 North Ridge Rd., Perry, OH 44081, Tel: 216-259-2500, FAX: 216-259-5015; Empl.: 35

CONTROL TECHNOLOGY CO., INC., 41-16 29th St., Long Island City, NY 11101, Tel: 718-361-2133, FAX: 718-361-2253; FSC No.: 14545; Empl.: 35; *Sls. Mgr.:* H. Cooper ..... **D•2172-2173**

Local Sales Offices & Reps

CA	Claremont, W. Roth & Assocs.	714-621-1019
Can	Montreal, Que., Control Tech. Elctrns. CTC Canada, Ltd.	514-733-3279

CONTROL TECHNOLOGY, INC., 8200 N. Classen Blvd., Ste. 101, Oklahoma City, OK 73114, Tel: 405-840-3163; *Sls. Mgr.:* Charles Weddington; *Dist. Mgr.:* Charles Weddington

CONVER CORP., 916 W. Maude Ave., Sunnyvale, CA 94086, Tel: 408-739-9111, TWX: 910-338-2036, ESYLNK: 62024309, FAX: 408-739-9116; Empl.: 40; *Sls. Mgr.:* Robert Lloyd; *Dist. Mgr.:* Karen Clendening

CONVERSION EQUIP. CORP., 330 W. Taft Avenue, Orange, CA 92665, Tel: 714-637-2970; Empl.: 50; *Sls. Mgr.:* Patrick M. D'Acre

CONVERTER CONCEPTS INC

FAX: 608-429-9241

CONVERTER CONCEPTS, INC., Industrial Pkwy., Pardeeville, WI 53954, Tel: 608-429-2144, TWX: 910-280-2630; Empl.: 125; *Sls. Mgr.:* William A. Pearson ..... **D•1678-1685**

Local Sales Offices & Reps

AZ	Tempe, Cantec Sls.	602-345-1276
CA	Hayward, Pacific Mktg.	415-887-1620
CA	Irvine, Groh Assocs.	714-837-9871
CA	San Diego, Groh Assocs.	619-453-7572
FL	Boca Raton, Perrott Assocs.	305-792-2211
FL	Clearwater, Perrott Assocs.	813-443-5214
FL	Orlando, Perrott Assoc.	305-298-7748
MA	Chelmsford, Interstate Sls. Assocs.	617-256-2287
MI	Grand Rapids, JFCO	616-949-1020
MI	Lake Orion, JFCO	313-693-2053
MN	Minneapolis, Microelectronic Sls.	612-829-0948
MO	Kansas City, Abrams & Assocs.	816-561-9234
MO	St. Louis, Abrams & Assocs.	314-569-0447
NY	Syracuse, Pi-Tronics	315-455-7346
OH	Cleveland, JFCO	216-238-5905
OH	Vandalia, JFCO	513-890-8322
PA	Glenside, Koebert Assoc.	215-887-2310
PA	Pittsburgh, JFCO	412-823-5400
TX	Austin, Tesco	512-834-8374
TX	Dallas, Tesco	214-553-1200
WA	Kirkland, Northwest Comp. Sls.	206-828-4838
WV	Inwood, Koebert Assocs.	304-229-8401
Can	Nepean, Ont., Electro-Source, Inc.	613-726-1452
Can	Rexdale, Ont., Electro-Source, Inc.	416-675-4490
Can	Vancouver, BC, Davetek Mktg.	604-430-3680

CONVEX CORP., P.O. Box 17225, Dulles Intl. Airport, Washington, DC 20041, Tel: 703-661-8900; Empl.: 24

THE COOL-AMP CONDUCTO-LUBE CO., 8603 S.W. 17th Avenue, Portland, OR 97219, Tel: 503-244-2230; Empl.: 7; *Sls. Mgr.:* Marian Bomber

COONER WIRE CO., 9186 Independence Ave., Chatsworth, CA 91311, Tel: 818-882-8311, TELEX: 353734 Cooner Wire UD, TWX: 818-709-8281; *Sls. Mgr.:* Steven W. Smith

COOPER TOOLS, PO Box 30100, Raleigh, NC 27622, Tel: 919-781-7200, TELEX: 579497

CO-ORD SWITCH DIV., See LVC Inds., Inc.

COORS CERAMICS CO., 600 Ninth St., Golden, CO 80401, Tel: 303-278-4000, TELEX: 4322017; Empl.: 1700

COOSOL, INC., 3013 Harbor Blvd., Costa Mesa, CA 92626, Tel: 714-545-2216; Empl.: 20; *Sls. Mgr.:* A. Solomonian; *Dist. Mgr.:* Jim Cook

CORBY INDUSTRIES, INC., 1501 E. Pennsylvania St., Allentown, PA 18103, Tel: 215-433-1412, TELEX: 847318 CORBYUHL; Empl.: 15

CORCOM, INC., 1600 Winchester Rd., Libertyville, IL 60048, Tel: 312-680-7400, TWX: 910-687-1058; FSC No.: 05245; Empl.: 1000; *Sls. Mgr.:* Dale Van Scoyk, Dir. OEM Sls.; *Dist. Mgr.:* Greg Dec ..... **A•1640-1641; C•1313**

Local Sales Offices & Reps

AL	Huntsville, R. O. Whitesell Assocs.	205-883-5110
AZ	Phoenix, I.S.D.S.	602-971-6250
CA	Anaheim, Westrep	714-527-2822
CA	Mountain View, Straube Assocs.	415-969-6060
CA	San Diego, Westrep	619-566-6580
CO	Westminster, Straube Assocs.	303-426-0890
CT	Madison, Conti-Younger Assocs.	203-245-1136
CT	Norwalk, Wincor Sls.	203-348-7444
FL	Maitland, E.I.R. Inc.	305-660-9600
FL	Oldsmar, E.I.R. Inc.	813-786-2156
FL	Plantation, E.I.R. Inc.	305-791-8243
FL	Plantation, E.I.R. Inc.	305-581-6905
GA	Norcross, Robert O. Whitesell Assocs.	404-449-9190
ID	Boise, Cascade Comps.	208-343-9886
IL	Glendale Hgts., Beta Technlg. Sls. Inc.	312-790-9886
IN	Ft. Wayne, Robert O. Whitesell	219-432-5591
IN	Indianapolis, Robert O. Whitesell	317-359-9283
IN	Kokomo, Robert O. Whitesell	317-457-9127
KS	Overland Pk., Spectrum Sls.	913-648-6811
KY	Peewee Valley, Robert O. Whitesell	502-241-1441
MD	Ellicott City, Marketing Technlg.	301-465-5944
MA	Burlington, Conti-Younger Assocs.	617-273-1582
MI	Grand Rapids, Robert O. Whitesell	616-942-5420
MI	Southfield, Robert O. Whitesell	313-559-5454
MI	St. Joseph, Robert O. Whitesell	616-983-7337
MN	Edina, Mel Foster Co.	612-941-9790
MO	Hazelwood, Spectrum Sls.	314-731-5151
NJ	Paramus, Win-Cor Sls.	201-967-0242
NY	Manhasset, Win-Cor Elctrn. Sls.	516-627-9474
NY	Pittsford, Noeth-Honsinger Assocs.	716-586-9002
NC	Raleigh, Zucker Assoc.	919-782-8433
OH	Cincinnati, Robert O. Whitesell	513-521-2290
OH	Cleveland, Robert O. Whitesell	216-447-9020
OH	Columbus, Robert O. Whitesell	614-888-9396
OH	Dayton, Robert O. Whitesell	513-298-9546
OR	Beaverton, Jas. J. Backer Co.	503-627-0775
PA	Pittsburgh, Robert O. Whitesell	412-963-6161
PA	Trevose, Professional Svc. Assoc.	215-245-0513
TN	Knoxville, Robert O. Whitesell	615-694-9476
TN	Nashville, R. O. Whitesell Assocs.	615-352-4760
TX	Austin, K & H Sls.	512-339-7950
TX	Plano, K & H Sls.	214-423-6520
UT	Salt Lake City, Straube Assocs.	801-263-2640
WA	Seattle, Jas. J. Backer Co.	206-285-1300
WI	Milwaukee, Beta Technlg. Sls. Inc.	414-543-9288

Local Distributors

AL	Huntsville, Pioneer	205-837-9300
AZ	Phoenix, Cetec/Future Elec.	602-968-7140
AZ	Phoenix, Marshall Inds.	602-968-6181
CA	Chatsworth, Cetec/Future Elec.	818-700-0914
CA	Irvine, Cetec/Future Elec.	714-250-4141
CA	Irvine, Marshall Ind.	714-458-5395
CA	Irvine, Schweber	714-863-0200

CA	Milpitas, Marshall Ind.	408-942-4600
CA	San Diego, Cetec/Future Elec.	619-278-5020
CA	San Diego, Marshall Ind.	619-578-9600
CA	San Diego, Schweber	619-450-0454
CA	San Jose, Schweber	408-432-7171
CO	Thornton, Marshall Ind.	303-451-8444
CT	E. Haven, J.V. Elctrns.	203-499-2457
FL	Altamonte Springs, Pioneer	305-834-9090
FL	Deerfield Beach, Pioneer	305-771-7520
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Orlando, Hammond Elctrns.	305-849-6060
GA	Atlanta, Marshall Ind.	404-923-5750
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Elk Grove Village, Pioneer/Chicago	312-437-9680
IL	Palatine, OHM Elctrns.	312-359-5500
IN	Indianapolis, Marshall	317-297-0483
IN	Indianapolis, Pioneer	317-849-7300
KS	Lenexa, Marshall	913-492-3121
MD	Baltimore, Resco/Baltimore	301-529-0500
MD	Beltsville, Resco/Washington	301-937-9100
MD	Gaithersburg, Pioneer	301-921-0660
MA	Newton, Greene Shaw	617-969-8900
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	Wilmington, Marshall Ind.	617-658-0810
MI	Livonia, Pioneer	313-525-1800
MN	Eden Prairie, Pioneer/Twin Cities	612-944-3355
MN	St. Paul, Gopher Elctrns.	612-483-3322
NJ	Bellmawr, Mid Atlantic Elctrns. Corp.	609-931-5303
NJ	Fairfield, Marshall Inds.	201-882-0320
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NY	Mt. Vernon, QAR Indl. Elctrn. Sls.	914-699-2224
NY	Rochester, Simcona	716-328-3230
NY	Rochester, Summit Distrs.	716-334-8110
NC	Charlotte, Pioneer	704-527-8188
NC	Raleigh, Resco	919-781-5700
OH	Cleveland, Pioneer	216-587-3600
OH	Columbus, Elctrns. Mktg. Corp.	614-299-4161
OH	Dayton, Pioneer	513-236-9900
OR	Beaverton, Almac Elctrns.	503-629-8090
OR	Beaverton, Marshall Inds.	503-644-5050
PA	Horsham, Pioneer	215-674-4000
PA	Philadelphia, Almo Elctrns. Corp.	215-698-4000
PA	Pittsburgh, Pioneer	412-782-2300
TX	Austin, Marshall Inds.	512-837-1991
TX	Austin, Pioneer	512-835-4000
TX	Carrollton, Marshall Inds.	214-233-5200
TX	Dallas, Pioneer	214-386-7300
TX	Houston, Marshall Inds.	713-895-9200
TX	Houston, Pioneer	713-988-5555
UT	Salt Lake City, Marshall Inds.	801-485-1551
WA	Bellevue, Almac Elctrns.	206-643-9992
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Local Sales Offices & Reps

AL	Huntsville, Glen White Assocs.	205-533-2002
AZ	Phoenix, Syntech	602-893-7776
CA	Fountain Valley, Sy Prevulsky Assocs.	714-547-5177
CA	San Diego, Pathfinder Elctrn. Reps.	619-578-2555
CA	Sunnyvale, Power Supp. Comps.	408-737-1333
CT	Ridgefield, J-Square Mktg.	203-438-3081
FL	Coral Springs, HAI Elctrns.	305-752-7520/50
GA	Norcross, Glen White Assocs.	404-441-1447
IL	Elgin, RHI Sls. Corp.	312-888-0099
IA	Bettendorf, Weisler & Assocs., Inc.	319-344-0566
MA	S. Easton, Intek Sls.	617-238-9283
MI	Adrian, Elctrn. Salesmasters, Inc.	517-263-2500
MI	Livonia, Elctrn. Salesmasters, Inc.	313-421-2520
MN	Minneapolis, O.E.M. Elctrl. Sls., Inc.	612-559-2448
MS	Jackson, Doby Assocs.	601-981-1138
MO	Ellisville, Weisler & Assocs.	314-394-4543
MO	N. Kansas City, Weisler & Assocs.	816-421-1679
NM	Alburquerque, Syntech	505-266-7951
NY	Jericho (Downstate), J-Square Mktg., Inc.	516-935-3200
NC	Raleigh, Glen White Assocs.	919-848-1931
OH	Beachwood, Elctrn. Salesmasters	216-831-9555
OR	Portland, Elctrn. Mktg. Grp.	503-684-5935
TN	Gray, Glen White Assocs.	615-477-8850
TX	Dallas, Weisler & Assocs.	214-437-2386
TX	Houston, Weisler & Assocs.	713-467-1847
WA	Spokane, Elctrn. Mktg. Grp.	509-922-2718

CORECO, INC., 555 St-Thomas Street, Longueuil, Quebec, Canada J4H 3A7, Tel: 800-361-4997, 514-651-3100, TELEX: 76001120 COR UC; Empl.: 23; *Sls. Mgr.:* Pat Urbain

CORLUND ELECTRONICS CORP., 3543 Old Conejo Rd., Ste. 101, Newbury Park, CA 91320, Tel: 805-499-6877, FAX: 818-706-8986; Empl.: 45; *Sls. Mgr.:* Mike Perry

CORMAN TECHNOLOGIES INC., 75 Bathurst Dr., Waterloo, Ontario, Canada N2V 1N2, Tel: 519-884-4430, FAX: 519-884-0204; *Sls. Mgr.:* Bill Lochead; *Dist. Mgr.:* Bill Lochead

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FAX: 617-996-3830

CORNELL-DUBILIER ELCTRNS./SANGAMO WESTON COMPS. DIV., 1605 E. Rodney-French Blvd., New Bedford, MA 02741, Tel: 617-996-8561, TWX: 310-671-1800; Empl.: 5000; *Sls. Mgr.:* Anthony M. Cavuto, VP Sls.; *Dist. Mgr.:* Rex Easterly ..... **A•1070**

Local Sales Offices & Reps

AL	Huntsville, Advanced Comps. Mktg.	205-881-5493
AZ	Tempe, EDS, Inc.	602-438-1547
CA	Agoura Hills, Cornell Dubilier Elect.	818-707-3696
CA	Granada Hills, C & N Assocs.	818-895-2431
CA	Los Altos, Ewing-Foley	415-941-4525
CA	Roseville, Ewing-Foley	916-969-2672
CA	San Diego, CK Assocs.	619-279-0420
CO	Westminster, Western Region Mktg.	303-430-8883
CT	New Haven, Coakley, Boyd & Abbett	203-239-6217
FL	Ft. Lauderdale, Dyne-A-Mark	305-771-6501
FL	Ft. Lauderdale, QXI, Inc.	305-978-0120
FL	Orlando, QXI, Inc.	305-423-3682
FL	St. Petersburg, QXI, Inc.	813-894-4556
GA	Norcross, Advanced Comps. Mktg.	404-448-7025
IL	Rolling Meadows, Eagle Tech. Sls.	312-991-0700
IN	Indianapolis, M & L Elctrn. Sls.	317-359-4742
KS	Overland Pk., Electri-Rep	913-649-2168
MD	Baltimore, Faion Lott & Co.	301-744-4611
MA	Needham Hgts., Coakley, Boyd & Abbott	617-444-5470
MA	New Bedford, Cornell Dubilier Elctrns.	617-996-8561
MI	Brighton, A.P. Assocs.	313-229-6550
MI	Farmington Hills, R. C. Merchant & Co., Inc.	313-476-4600
MI	St. Joseph, R. C. Merchant & Co., Inc.	616-983-7378
MN	Bloomington, P.W.C. Inc.	612-831-5999
MO	St. Louis, Electri-Rep	314-993-4421
NJ	Wayne, Cornell Dubilier	201-256-2000
NY	Camillus, Cornell Dubilier Elctrns.	315-488-5822
NY	Syracuse, Leonard D. Allen, Inc.	315-437-8387
NC	Charlotte, Prime Comps., Inc.	704-522-1150
NC	Raleigh, Prime Comps., Inc.	919-850-9866
OH	Dayton, Lyons Corp.	513-278-0714
OH	Richfield, Lyons Corp.	216-659-9224
OR	Portland, Northwest Mktg.	503-620-0441
TN	Chatanooga, Indl. Mktg. & Sls.	615-894-2219
TX	Austin, Southwestern Tech. Sls.	512-440-0499
TX	Dallas, Southwestern Tech. Sls.	214-243-0180
UT	Salt Lake City, Western Mktg.	801-486-1646
WA	Bellevue, Northwest Mktg.	206-455-5846
PR	San Juan, E.T.S., Inc.	809-720-1300
Can	N. Vancouver, B.C., Arwin Tech. Sls.	604-980-4557
Can	Ottawa, Ont., Source Elctrns.	613-564-0151
Can	Rexdale, Ont., Source Elctrns.	416-675-6235

Local Distributors

AZ	Phoenix, Arizona Comps.	602-269-5655
CA	Chatsworth, Shelley-Ragon	818-998-3333
CA	Milpitas, California Capacitors	408-262-6000
CA	Sunnyvale, Arrow Elctrns.	408-745-6630
CO	Denver, Integrated Elctrns.	303-292-6121
CO	Lakewood, Acacia Sls.	303-232-2882
CT	Wallingford, Arrow Elctrns.	203-265-7741
FL	Orlando, Hammond Elctrns.	305-849-6060
IL	Chicago, Newark Elctrns.	312-784-5100
IA	Cedar Rapids, Arrow Elctrns.	319-395-0197
MD	Columbia, Hall-Mark Elctrns.	301-988-9800
MA	Newton, Green Shaw Co.	617-969-8900
MI	Oak Pk., Newark Elctrns.	313-967-0600
MN	Minneapolis, Stark Elctrns.	612-332-1325
MO	St. Louis, Arrow Elctrns.	314-567-6888
NJ	Clifton, J-Mar Elctrns.	201-772-0242
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Rochester, Arrow Elctrns.	716-427-0300
NC	Raleigh, Arrow Elctrns.	919-876-3132
OH	Cleveland, Pioneer/Cleveland	216-587-3600
PA	McKean, Advacom, Inc.	814-476-7774
TX	Dallas, Hall Mark Elctrns.	214-343-5000
UT	Salt Lake City, Arrow Elctrns.	801-972-0404
WA	Bellevue, Bell Inds.	206-747-1515
WI	Milwaukee, Marsh Elctrns.	414-475-6000

CORNELL-DUBILIER ELCTRNS., Wayne Interchange, Plaza 1, Wayne, NJ 07470, Tel: 201-256-2000; *Sls. Mgr.:* A. Cavuto

CORNELL MANUFACTURING, An Elgin Co., 25 Ramland Road, Orangeburg, NY 10962, Tel: 914-365-0400, TELEX: 13-1572, FAX: 914-359-6809; Empl.: 50; *Sls. Mgr.:* Lou Schnur

CORNING GLASS WORKS, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830, Tel: 607-974-8725, TELEX: 932481; Empl.: 8000; *Sls. Mgr.:* Graham Wells; *Dist. Mgr.:* Betsey Murray

CORNING GLASS WORKS, Materials Business, Main Plant, MP 21-3, Corning, NY 14831, Tel: 607-974-9000, TELEX: 932498; Empl.: 30000; *Sls. Mgr.:* Bryan Lanahan; *Dist. Mgr.:* Richard J. Maxa

Local Distributors

CA	Los Angeles, Leed Plastics Corp.	213-746-5984
CA	Santa Clara, San Jose Delta Assocs., Inc.	408-727-1448
IL	Addison, Circle Fabrication, Inc.	312-543-4440
NJ	Palisades Pk., Duramic Prods., Inc.	201-947-8313
NJ	Washington, Accuratus Ceramic Corp.	201-689-0880
OH	Cincinnati, Astro Met Assocs., Inc.	513-772-1242
TX	Houston, EGC Corp.	713-447-8611
WI	Germantown, Tech. Prods., Inc.	414-255-7355
Can	Ontario, Johns Sci.	416-699-1731

CORNING GLASS WORKS, Telecommunications Products Division, MP-RO-03, Corning, NY 14831, Tel: 607-974-7741, TELEX: 932498; Empl.: 28,000

CORTEC, INC., 15811 Chemical La., Huntington Bch., CA 92649, Tel: 714-897-2529, FAX: 714-897-2170; Empl.: 35

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COSAR CORPORATION, 10375 Brockwood Rd., Dallas, TX 75238, Tel: 214-340-4584, 800-527-1207, TELEX: 506973; FSC No.: 20891; Empl.: 50; *Sls. Mgr.:* Jerry Jarka

COSMO CORPORATION, 3239 W. 14th St., Cleveland, OH 44109, Tel: 216-861-5594; Empl.: 500; *Sls. Mgr.:* B. Gordon

COST EFFECTIVE SYSTEMS, INC., Two LeMans Pl, Pine Brook, NJ 07058, Tel: 201-575-5514, TELEX: 4944668; *Sls. Mgr.:* Phyllis Gross

COTO CORPORATION

FAX: 401-942-0920

COTO CORPORATION, 55 DuPont Drive, Providence, RI 02907, Tel: 401-943-2686, TWX: 710-381-8016; Empl.: 200; *Sls. Mgr.:* Harvey Smith, Natl. Sls. Mgr.; *Dist. Mgr.:* Harvey Smith ..... **B•1395**

Local Sales Offices & Reps

AL	Owens Cross Rds., cmrCross Assocs.	205-883-5991
AZ	Phoenix, Spectrum Mktg. Assocs., Inc.	602-890-9000
CA	Escondido, Cirolia Elctrn. Sls.	619-743-3015
CA	Newport Bch., Forbes Pacific Inc.	714-722-6174
CA	Saratoga, Testco Inc.	408-253-1900
CO	Denver, Spectrum Sls.	303-480-9991
CT	Warren, RI, Wm. Poisson & Assocs. ...	401-245-0260
DE	Hunt Valley, Eagle Sls. Corp.	301-666-3930
DC	Hunt Valley, Eagle Sls. Corp.	301-666-3930
FL	Deerfield Bch., Jack Krutek Assocs. ...	305-427-4202
IL	Downers Grove, Richmar Elctrns.	312-968-0118
IN	Indianapolis, Richmar Elctrns.	317-846-6383
NY	Great Neck, MOS Mktg. Assocs.	516-487-3966
NY	N. Syracuse, Advanced Comps. Corp.	315-699-2671
OR	Tigard, LD Elctrns.	503-829-3146
PA	Huntington Valley, Omega Elctrn. Sls.	215-947-4135
RI	Warren, Wm. Poisson & Assocs.	401-245-0260
TX	Austin, Richmar Elctrns. Corp.	512-251-7582
TX	Plano, Richmar Elctrns.	214-867-8224
UT	Ogden, Spectrum Mktg. Assocs. Inc. ..	801-972-8552
WA	Snohomish, LD Elctrns.	206-568-0511
WA	Spokane, LD Elctrns.	509-922-4883
WI	Butler, Richmar Elctrns.	414-781-1730
Can	Pointe Claire, Que., A. R. Gray Assocs.	514-694-6378

Local Distributors

AL	Huntsville, Allied Elctrns.	800-433-5700
CA	Santa Monica, Master Distrs.	213-452-1229
CA	Saratoga, Testco Inc.	408-253-1900
CO	Denver, Spectrum Distrbn.	303-480-9991
FL	Pompano, Allied Elctrns.	305-486-0500
GA	Norcross, Allied Elctrns.	404-377-3555
IL	Elgin, Allied Elctrns.	312-697-0126
MA	Wilmington, Allied Elctrns.	617-942-0150
NY	Mineola, Allied Elctrns.	516-248-2360
NC	Raleigh, Allied Elctrns.	919-876-5845
OK	Tulsa, Altair Co.	918-252-5781
OR	Saratoga, Testco, Inc.	800-621-0854 (ext 285)
SC	Raleigh, Allied Elctrns.	919-876-5845
TX	Austin, Altair Co.	512-837-4970
TX	Dallas, Allied Elctrns.	214-553-4370
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair Co.	214-231-5166
UT	Ogden, Spectrum Mktg. Assocs., Inc. ..	801-972-8552
WA	Saratoga, Testco, Inc.	800-621-0854 (ext 285)
EXP	TX/Ft. Worth, Allied Elec./Exp. Svcs.	817-336-5401

COTRONICS, 3379 Shore Pkwy., Brooklyn, NY 11235, Tel: 718-646-7996, FAX: 718-646-3028; Empl.: 15; *Sls. Mgr.:* Alan Marks

COVER CRAFT CORP., See Amherst International Corp., Cover Craft Div.

COVOX, INC., 675 D Conger St., Eugene, OR 97402, Tel: 503-342-1271, FAX: 503-342-1283; Empl.: 25; *Sls. Mgr.:* M. R. Stewart

CPS, INC., 1362 Borregas Ave., Sunnyvale, CA 94089, Tel: 408-734-8980, TELEX: 35-7450, FAX: 408-734-8993; FSC No.: 31640; Empl.: 30; *Sls. Mgr.:* Clifford Gaw ... **D•1686**

Local Sales Offices & Reps

GA	Roswell, Electro Comp Sls., Inc.	404-992-2344
MA	Burlington, Intersell	617-273-3844
NH	Concord, CPS, Inc.	603-225-7795
NM	Albuquerque, West Faul & Assocs. ...	505-881-0995
NY	Hartsdale, Spectrum Sls., Inc.	914-472-8600

CP TECHNOLOGY, INC., 21143 Christensen Drive, Cupertino, CA 95014, Tel: 408-996-8069; Empl.: 6

CRAIG SYSTEMS CORP., Hanson Industries, 10 Industrial Way, Amesbury, MA 01913-4848, Tel: 617-388-5662, TWX: 710-347-0590; FSC No.: 81902; Empl.: 400; *Sls. Mgr.:* Roger Chouinard; *Dist. Mgr.:* Roger Chouinard

CRAMER COIL & TRANSFORMER CO., INC., 401 Progress Dr., Saukville, WI 53080, Tel: 414-284-9425, FAX: 414-377-4028; Empl.: 70; *Sls. Mgr.:* Patti Lincoln

CRAMER CO., Mill Rock Rd., Old Saybrook, CT 06475, Tel: 203-388-3574, TELEX: 966-453; Empl.: 210; *Sls. Mgr.:* G. Willis; *Dist. Mgr.:* E. Latourette

CREARE INC., Etna Rd., P.O. Box 71, Hanover, NH 03755, Tel: 603-643-3800, TELEX: 953101, FAX: 603-643-4657; Empl.: 90

CMS

FAX: 213-493-3553

CREATIVE MICRO SYSTEMS, 3822 Cerritos Ave., Los Alamitos, CA 90720, Tel: 213-493-2484; Empl.: 24; *Sls. Mgr.:* Margaret E. Prossen ..... **D•1110**

CRESTRONICS DIV., APPLIED ELECTRO TECHNLG., See STI-Crestronics Div.

CROMEMCO, Dynatech Corp., 280 Bernardo Ave., P.O. Box 7400, Mountain View, CA 94039-7400, Tel: 415-964-7400, TWX: 910-379-6988, FAX: 415-969-3350; Empl.: 135; *Sls. Mgr.:* J C. Depew, VP Sls.; *Dist. Mgr.:* Tom Keating

CROMPTON INSTRUMENTS, 2763 Higgins Road, Elk Grove Village, IL 60007, Tel: 312-593-1107, TELEX: 210295, FAX: 312-439-5474; FSC No.: 53498; *Sls. Mgr.:* Wayne Bordelon

CROMPTON INSTRS., Hawker Siddley, 2763 Old Higgins Rd., Elk Grove Village, IL 60007, Tel: 312-593-1107, TELEX: 210295, FAX: 312-439-5747; Empl.: 38; *Sls. Mgr.:* Wayne Bordelon

CROSS BROTHERS, INC., 5255 Sheila St., Los Angeles, CA 90040, Tel: 213-266-2000, FAX: 213-266-2106; Empl.: 17; *Sls. Mgr.:* Steven S. Krause

CROSS ELECTRONICS, 100 Commonwealth Dr., Warrendale, PA 15086, Tel: 412-776-1591; Empl.: 35; *Sls. Mgr.:* L. R. Craig

CROSSPOINT, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022, Tel: 201-941-4455, FAX: 201-941-4919; FSC No.: FSCM 52116; Empl.: 13; *Sls. Mgr.:* Joseph M. Cartelli; *Dist. Mgr.:* Joseph M. Cartelli ..... **B•1678**

Local Sales Offices & Reps

CA	No. Hollywood, Crown Elctrns.	213-877-3550
CA	Redwood City, Caltronic Assocs.	415-365-2545
CT	Weston, CJA Assoc.	203-226-4317
MI	Plymouth, Leading Edge Sls. Corp.	313-420-3344
NY	Syracuse, Lenard Co.	315-479-9191
OH	Cleveland, A.S.A.	216-232-4946
OH	Dayton, Mohawk Intronics	513-434-8873

CROUZET CONTROLS, INC., 1083 State Pkwy., Schaumburg, IL 60173, Tel: 312-843-2200, TELEX: 210 219, FAX: 312-310-8330; Empl.: 18; *Sls. Mgr.:* Benoit Delcourt ..... **B•1201, 1679**

Local Sales Offices & Reps

CA	San Marino, Motion Control of So. CA	818-796-0189
CA	San Ramon, C. F. M. Sls.	415-866-1705
CO	Denver, Ralph R. Pence & Assocs.	303-936-3464
FL	Clearwater, Gen. Controls, Inc.	813-791-1903
IN	South Bend, Emsco Sls. & Engrg. Co.	219-232-8561
IA	Bettendorf, Custom Controls Ltd.	319-355-4787
MA	Taunton, Electro-Kinetics	617-880-0182
MA	Wellesley, Electro Kinetics	617-235-9415
MA	Wenham, Electro-Kinetics	617-468-4166
MN	Minneapolis, Dr. Beck-Hays Assocs. ..	612-835-3610
MO	Webster Grove, Schutz & Assocs. Ind. Sls., Inc.	314-962-2622
NY	Fairport, Tac Sls.	716-425-1070
NY	Plainview, Motion Control Sls.	516-756-5656
OH	Cincinnati, Bob Gilbert & Assocs.	513-761-4598
OH	Cincinnati, Bob Gilbert & Assocs.	513-574-1932
PA	Horsham, Jacobsen & Assocs.	215-674-2937
UT	Salt Lake City, Control Agency	801-328-4305
WA	Bellevue, Sea Inc.	206-883-4999
WA	Vancouver, Sea Inc.	206-573-5161
Can	St. Hubert, Que., Decofer	514-678-2252
Can	Toronto, Tienkay Inc.	416-736-1221

Local Distributors

CA	Los Angeles, Master Distr.	213-452-1229
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NY Commack, Monarch Comps. 516-499-1770
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NC Gastonia, J.M.T. Elctrn. Supp. 704-867-4401
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
ND Bismarck, Border States Elec. 701-258-6060
OH Cincinatti, Hughes-Peters. 513-351-2000
OH Cleveland, Reserve Motion Control Sys. 216-826-0290
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WA Kent, Motors & Controls Corp. 206-872-8010
WA Seattle, Eicher-Richards Co. 206-523-7888
WI Waukesha, Powermation 414-542-2868
Can Mississauga, Ont., Tracan Elctrns. Corp. 416-625-7752
Can St. Hubert, Que., Decofer 514-678-2252
Can Willowdale, Ont., PS Comps. 416-498-0214

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Local Sales Offices & Reps

AZ Mesa, Sedco Sls. 602-461-9069
CA Northridge, R.L. Assocs. 818-701-0656
CA San Mateo, Melvin Sls. 415-349-7444
FL Palm Bay, Spartech Assocs. 305-727-8045
GA Norcross, Spartech Assocs. 404-446-7300
MA Milton, Naton Assoc. 617-698-0670
MO St. Charles, Hayes Elec. Sls. 314-946-6677
NY Melville, Carnes Assocs. 516-694-1600
OH Englewood, Clayton-Ellier Co. 513-836-3556
PA Glenside, Koebert Assocs. Inc. 215-887-2310
TX Euless, Fralia Co. & Assocs. 817-267-3577
VA Alexandria, Tech Reps Inc. 703-370-2600
WI Oconomowoc, Artmor Ltd. 414-367-8789

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Local Sales Offices & Reps

AL Huntsville, EMA, Inc. 205-830-4030
AR Ft. Smith, Electra Reps, Inc. 501-452-7822
CA Pleasanton, Sierra Sls. Engrg. 415-463-2250
CA Stockton, Sierra Sls. Engrg. 209-465-3968
CA Tustin, Morgan Johnson Co., Inc. 714-832-7282
FL Deerfield Bch., EMA Inc. 305-421-6830
FL Longwood, EMA, Inc. 305-682-1202
GA Roswell, EMA, Inc. 404-992-7240
ID Boise, N.R. Schultz Co. 208-377-8686
IL Elk Grove Village, Control Sls. 312-595-2110
IN Carmel, Technology Mktg. Corp. 317-844-8462
IN Ft. Wayne, Technology Mktg. Corp. 219-432-5553
KY Louisville, Technology Mktg. Corp. 502-893-1377
MD Baltimore, McCourt & Comp., Inc. 301-944-8400
MA Woburn, Alpha Omega Sls. 617-933-0237
MI Livonia, Luebbe Sls. 313-477-3131
MN Eden Prairie, Electronic Innovators, Inc. 612-941-0830
MO St. Louis, Advanced Tech. Sls. 314-878-2921
NY Binghamton, GEN-TECH Elctrns. 607-648-8833
NY Liverpool, Gen-Tech Elctrns. 315-451-3480
NY Penfield, Gen-Tech Elctrns. 716-381-5159
NC Charlotte, EMA, Inc. 704-365-0547
NC Raleigh, EMA, Inc. 919-846-6888
OH Cincinnati, Luebbe Sls. Co. 513-530-0600
OH Cleveland, Cleveland Luebbe Sls. 216-333-0425
OH Columbus, Luebbe Sls. Co. 614-431-0474
OH Dayton, Luebbe Sls. Co. 513-294-0426
OR Beaverton, N.R. Schultz Co. 503-643-1644
PA Chestnut Hill, Deltatronics Inc. 215-248-0294
PA Pittsburgh, Luebbe Sls. Co. 412-364-0490
TX Austin, Electra Reps. 512-339-1163
TX Dallas, Electra Reps. 214-248-3852
UT Salt Lake City, Control Agy. 801-972-8787
VA Richmond, McCourt Co., Inc. 804-741-3253
WA Bellevue, N.R. Schultz Co. 206-454-0300
WI Thiensville, Control Sls. 414-242-4580

Local Distributors

AL Huntsville, Arrow Elctrns. 205-837-6955
AZ Phoenix, Newark Elctrns. 602-968-7411
AR Little Rock, Newark Elctrns. 501-225-8130
CA Canoga Pk., Schweber 818-999-4702
CA Los Angeles, Kierulff Electronics 213-725-0325
CA Los Angeles, Master Distrs. 213-452-1229
CA Orange, Newark Elctrns. 714-634-8224
CA S. San Francisco, Steven Engineering 415-588-9200
CA San Diego, Kierulff Elctrns. 619-278-2112
CO Denver, Newark Elctrns. 303-757-3351
CT Orange, Milgray Elctrns. 203-795-0711
FL Deerfield Bch., Arrow Elctrns. 305-429-8200
GA Norcross, Newark Elctrns. 404-448-1300
HI Aiea, Newark Elctrns. 808-487-8951
ID Boise, Newark Elctrns. 208-342-4311
IL Chicago, R.S. Elctrns. 312-364-4733
IL Elk Grove Vl, Kierulff Elctrns. 312-250-0500
IL Schaumburg, Newark Elect. 312-784-5111
IN Indianapolis, Newark Elctrns. 317-872-7070
IA Cedar Rapids, Newark Elctrns. 319-393-3800
KS Overland Pk., Newark Elctrns. 913-677-0727
KY Louisville, Peerless Elctrns. 502-637-7674
LA Metarie, Newark Elctrns. 504-838-9771
MD Baltimore, Arrow Elctrns. 301-995-6002
MA Bedford, Schweber Elctrns. 617-275-5100
MA Hingham, Sager Electric 617-749-6700
MI Livonia, RS Elctrns. 313-525-1155
MI Livonia, Schweber Elctrns. 313-525-8100
MI Oak Pk., Newark Elctrns. 313-967-0600
MN Edina, Arrow Elctrns. 612-830-1800
MO St. Louis, Arrow Elctrns. 314-567-1164
NE Omaha, Newark Elctrns. 402-392-1221
NH Salem, Sager Elctrns. 603-698-1348
NJ Fair Lawn, Relay Specialties 201-797-3313
NJ Fairfield, Arrow Elctrns. 201-575-5300
NJ Fairfield, Schweber Elctrns. 201-227-7880
NM Albuquerque, Arrow Elctrns. 505-243-4566
NY Buffalo, Summit Distrs. 716-884-3450
NY Farmingdale, Milgray Elctrns. 516-391-3000
NY Melville, Arrow Elctrns. 516-694-6800
NY Rochester, Schweber Elctrns. 716-424-2222
NY Syracuse, Newark Elctrns. 315-437-6611
NY Westbury, Schweber Electronics 516-334-7474
NC Raleigh, Newark Elctrns. 919-781-7677
OH Cincinnati, Hughes Peters 513-351-2000
OH Cincinnati, Schlemmer Assocs., Inc. 513-522-8340
OH Cleveland, Newark Elctrns. 216-391-9330
OH Columbus, Arrow Elctrns. 614-885-8362
OK Tulsa, Newark Elctrns. 918-832-7004
OR Portland, Radar Elect. 503-233-3091
PA Pittsburgh, Cam/RPC 412-782-3770
PA Pittsburgh, Newark Elctrns. 412-343-9090
SC Columbia, Dixie Elctrns. 803-779-5332
TN Memphis, The Genie Grp., Inc. 901-345-9595
TX Dallas, Kierulff Elctrns. 214-840-0110
TX Houston, Newark Elctrns. 713-782-4800
UT Salt Lake City, Kierulff Elctrns. 801-973-6913
WA Bellevue, Arrow Elctrns. 206-643-4800
WA Seattle, Radar Elect. 206-282-2511
WV Charleston, Newark Elctrns. 304-345-6505
WI Milwaukee, Newark Elctrns. 414-463-1100

CRYOMAGNETICS, INC., 739 Emory Valley Rd., Oak Ridge, TN 37830, Tel: 615-482-9551, TELEX: 883 945, FAX: 615-483-5891; *Sls. Mgr.:* D. Michael Coffey

CRYSTAL MARK, INC., Forslund Division, 613 Justin Avenue, Glendale, CA 91201, Tel: 818-240-7520, TELEX: 279974

CRYSTALOID ELECTRONICS, Box 628, Hudson, OH 44236, Tel: 216-655-2429, FAX: 216-655-2176; Empl.: 100; *Sls. Mgr.:* Sharon Weistler/Bill Jakubik

CRYSTEK CORP, P.O. Box 06135, Ft. Myers, FL 33906, Tel: 813-936-2109, TWX: 510-951-7448; FSC No.: 13454; Empl.: 60

CSB/USA, 1204 W. 7th St., Ft. Worth, TX 76102, Tel: 800-3CSB/USA, FAX: 817-332-6036 ..... **D•1446**

Local Sales Offices & Reps

CA Arcadia, Van Gott & Assocs. 818-445-9728
CA Los Altos, Frauman Assocs. 415-941-0660
FL Pompano Bch., HHP Assocs. 305-971-5750
IL Palatine, Technlg. Sls., Inc. 312-991-6600
IN Granger, Wolff Sls., Inc. 219-272-4388
MA Seekonk, Rudolph Mktg. Assocs. 617-399-6270
MI Grand Rapids, Stiles & Assocs. 616-531-7759
NY Franklin Sq., Cooper-Simon & Co., Inc. 516-489-0404
OH Lima, T.C. Co. 419-226-6952
TX Dallas, Electra Reps., Inc. 214-248-3852
WI Milwaukee, Technlg. Sls., Inc. 414-964-5015

CSI Capacitors

CSI CAPACITORS, CSI Technologies, 810 Rancheros Dr., San Marcos, CA 92069, Tel: 619-747-4000, TELEX: 697832; FSC No.: 10026; Empl.: 50; *Sls. Mgr.:* J. D. Kowalsky ..... **A•1071**

Local Sales Offices & Reps

AL Huntsville, Glenn Technical 205-883-2870
AZ Paradise Valley, Astrocom Mktg. 602-991-6646
CA San Jose, Comtech Mktg. 408-365-7474
FL Orlando, Glenn Tech. Sls. Co. 305-299-8700
IL Chicago, Esco Assocs. 312-298-5310
KY Louisville, K. W. Elctrn. Sls. 614-888-0483
MD Middletown, ST/Woolard 301-371-4500
MA E. Sandwich, Radco, Inc. 617-888-7397
NJ Leonia, Peter E. Schmitt Co. 201-944-2806
NM Albuquerque, Cleveland Entprs. 505-265-7893
NY Cazenovia, S. T. Woolard 315-655-8145
OH Dayton, K. W. Elctrn. Sls. 513-890-2150
OR Tigard, Components West 503-684-1671
PA Allison Pk., KW Elctrn. Sls. 412-487-4300
SC Pickens, S.T. Woolard 803-878-3830
TX Dallas, Cunningham Comps. 214-669-9706
TX Houston, Cunningham Comps. 713-461-4197
VA Lynchburg, ST/Woolard 804-528-5421
WA Redmond, Components West 206-885-5880
Can Richmond, BC, Macom Agencies 604-271-2661
Can Toronto, Ont., Anbak Sls. 416-253-0243

C-TEK INCORPORATED

C-TEK INC., 4 Railroad Ave., Wakefield, MA 01880, Tel: 617-246-1720, TELEX: 882485; Empl.: 15; *Sls. Mgr.:* John Vanaman; *Dist. Mgr.:* John Vanaman .... **D•1126-1127**

Local Sales Offices & Reps

AZ Phoenix, Thor Eng. 602-437-1463
CT Ansonia, R. H. Sturdy Co. 203-734-2186
IL Hillside, Cadre Tech. Reps. 312-449-3900
MA Wellesley Hills, R. H. Sturdy Co. 617-235-2330
MI Southfield, Fred H. Gehrke & Assocs. 313-559-5363
MN Minneapolis, Northstar Motion & Control 612-571-9600
MN St. Paul, Northstar Motion & Control .. 612-770-5311
NJ Sparta, E.S. Williams 201-729-4049
NY Pittsford, Controlled Motion Sls. 716-381-1933
NC Charlotte, Jake Rudisill Assocs. 704-377-6901
OH Cincinatti, KCH Co. 513-931-1686
PA Paoli, Tyler Griffin 215-647-1550
VA Richmond, Jake Rudisill Assocs. 804-320-0201

Local Distributors

NY Clarence, Trott Elctrns. 716-634-8500
NY Pittsford, Trott Elctrns. 716-586-8251
NY Syosset, Motion Control Sls. 516-921-5656
NC Charlotte, Joyce Sls. 704-377-6901
WA Seattle, Eicher-Richards Co. 206-523-7888
Can Montreal, Premier Automation 514-684-6610

CTI ELECTRONICS, 955 Connecticut Avenue, Bridgeport, CT 06607, Tel: 203-366-9444, TWX: 710-465-6349, FAX: 203-254-3599; Empl.: 19 ..... **D•1079**

Local Sales Offices & Reps

AL Huntsville, Rakes Engrg. & Mktg. Corp. 205-533-3763
AZ Phoenix, Western Automation 602-973-2384
CA Laguna Hills, Western Automation 714-859-6988
CA San Diego, MACS 619-268-1199
CA San Jose, Motion Sys., Inc. 408-246-0641
CT Bridgeport, CTI Elctrns. 203-366-9444
FL New Port Richey, Spinney Assocs. 813-848-8578
GA Atlanta, Rakes Engrg. & Mktg. Corp. 404-447-6937
MO Blue Springs, A-Tronics Sls. & Engrg. Co. 816-224-2131
NH Manchester, Northeast Comps. 603-627-7242
NY New Hartford, PDQ Assocs. 315-793-3666
NY Roslyn Hgts., Travco Assocs. 516-621-3223
OH Columbus, McFadden Sls. 614-761-3177
PA Glenside, Wyncote Instrmn. Co. 215-572-6500
VA Reston, Delmarva Technlgs. 703-620-3555
WI Appleton, Vine Tech. Sls. 414-731-9873
WI Genoa City, Vine Tech. Sls. 414-279-3871

CTS CORPORATION

FAX: 219-294-5718

CTS CORPORATION, 905 West Blvd. North, Elkhart, IN 46514, Tel: 219-293-7511, TWX: 810-294-2167; Empl.: 6,500; *Dist. Mgr.:* George Greener ..... **A•1904-1910; B•1681**

Local Sales Offices & Reps

AL Huntsville, Interep Assocs., Inc. 205-533-1730
AL Mobile, Interep Assocs., Inc. 205-478-1036
AZ Phoenix, Compass Mktg. & Sls., Inc. 602-996-0635
AZ Tucson, Compass Mktg. & Sls., Inc. 602-293-1220
CA Fremont, CTS Corp. 415-659-1704
CA Los Altos, Ewing & Foley 415-941-4525
CA S. Pasadena, CTS Corp. 213-682-1137
CO Dnever, ELCOM, Inc. 303-337-2300
CT Danbury, CTS Corp. 203-743-3681/1964
CT Wallingford, CompRep Assocs., Inc. 203-269-1145
FL Deerfield Bch., ElectroComp Assocs., Inc. 305-429-0802,800-468-4632
FL Longwood, ElectroComp Assocs., Inc. 305-429-0802
FL Palm Harbor, ElectroComp Assocs., Inc. 813-787-6669
GA Norcross, Interep Assocs., Inc. 404-449-8680
IL Northbrook, Dolin Sls. Co., Inc. 312-498-6770
IN Indianapolis, Elctrn. Reps., Inc. 317-894-1414
IA Cedar Rapids, Seltec Sls. Corp. 319-364-7660
KS Olathe, Advanced Tech. Sls., Inc. 913-782-8702
MD Lutherville, DGR, Inc. 301-583-1360
MA Westwood, CompRep Assocs., Inc. 617-329-3454
MI Farmington Hills, J. L. Montgomery Assocs., Inc. 313-489-0099
MN Minneapolis, Robert W. Marshall Co., Inc. 612-929-0457
MN Minneapolis, S & R Comp. Sls., Inc. 612-559-3090
MO St. Louis, Advanced Tech. Sls., Inc. 314-878-2921
NM Albuquerque, Compass Mktg. & Sls., Inc. 505-888-0800
NY E. Syracuse, Nycom, Inc. 315-437-8343
NY Jamaica, S-J Assocs., Inc. 718-291-3232
NC Raleigh, Zucker Assocs., Inc. 919-782-8433
OH Columbus, Baehr, Greenleaf & Assocs., Inc. 614-847-0220
OH Dayton, Baehr, Greenleaf & Assocs., Inc. 513-439-0724
OH Westlake, Baehr, Greenleaf & Assocs., Inc. 216-892-1770
OR Tigard, Vantage Corp. 503-620-3280
PA Evans City, Baehr, Greenleaf & Assocs., Inc. 412-776-2151
PA Trevose, P.S.A. Inc. 215-245-0513
TN Greenville, Interep Assocs., Inc. 615-639-3491/3492
TX Austin, Southern Sls. Mktg., Inc. 512-835-5822
TX Houston, Southern States Mktg., Inc. .. 713-960-9556
TX Richardson, Southern States Mktg., Inc. 214-238-7500
UT Salt Lake City, ELCOM, Inc. 801-485-7415, 801-486-4233
WA Bellevue, Vantage Corp. 206-455-3460
WI Milwaukee, Dolin Sls. Co., Inc. 414-482-1111
PR Caguas, CompRep Assocs., Inc. 809-746-6550
Can Streetsville, Ont., CTS of Canada, Ltd. 416-826-1141

Local Distributors

AL Huntsville, Arrow Elctrns., Inc. 205-837-6955
AL Huntsville, Bell Inds. 205-837-1074
AL Huntsville, Hall-Mark Elctrns. Corp. 205-837-8700
AL Huntsville, Marshall Inds. 205-881-9235
AZ Phoenix, Marshall Inds. 602-496-0290
AZ Tempe, Arrow Elctrns., Inc. 602-968-4800
AZ Tempe, Bell Inds. 602-966-7800
CA Canoga Pk., Hall-Mark Elctrns. Corp. .. 818-716-3300
CA Chatsworth, Arrow Elctrns., Inc. 818-701-7500
CA Chatsworth, Marshall Inds. 818-407-0101
CA Citrus Hgts., Hall-Mark Elctrns. Corp. .. 916-722-8600
CA El Monte, Marshall Inds. (Corp.) 818-459-5500
CA Garden Grove, Bell Inds. 714-895-7801
CA Gardena, Bell Inds. 213-515-1800
CA Gardena, California Switch & Signal .. 213-538-9830
CA Irvine, Marshall Inds. 714-859-5050
CA Los Angeles, Bell Inds. 213-826-6778
CA Milpitas, Marshall Inds. 408-942-4600
CA Rancho Cordova, Marshall Inds. 916-635-9700
CA Rohnert Pk., First Source Elctrns. Corp. 707-586-0800
CA Roseville, Bell Inds. 916-969-3100
CA San Carlos, Logan Elctrns. 415-594-0700
CA San Diego, Arrow Elctrns., Inc. 619-565-4800
CA San Diego, Bell Inds. 619-268-1277
CA San Diego, Hall-Mark Elctrns. Corp. ... 619-268-1201
CA San Diego, Marshall Inds. 619-578-9600
CA San Jose, Hall-Mark Elctrns. Corp. 408-432-0900
CA San Jose, Rose Elctrns. 408-263-9700
CA Sunnyvale, Arrow Elctrns., Inc. 408-745-6600
CA Sunnyvale, Bell Inds. 408-734-8570
CA Thousand Oaks, Bell Inds. 805-499-6821
CA Torrance, Hall-Mark Elctrns. Corp. 213-217-8400
CA Tustin, Arrow Elctrns., Inc. 714-838-5422
CA Tustin, Hall-Mark Elctrns. Corp. 714-669-4100
CO Aurora, Arrow Elctrns., Inc. 303-696-1111
CO Denver, Integrated Elctrns. Co., Inc. ... 303-292-6121
CO Englewood, Indl. Elctrns. 303-694-9444
CO Englewood, Indl. Elctrns., Inc. 303-694-9444
CO Thorton, Marshall Inds. 303-451-8444
CT Wallingford, Arrow Elctrns., Inc. 203-265-7741
CT Wallingford, Marshall Inds. 203-265-3822
CT Wallingford, Midan Elctrns., Inc. 203-265-2077
CT Wallingford, The Greene-Shaw Co., Inc. 203-265-3333
FL Clearwater, Hall-Mark Elctrns. Corp. ... 813-530-4543
FL Deerfield Bch., Arrow Elctrns., Inc. 305-429-8200
FL Deerfield Bch., Bell Inds. 305-421-1997
FL Ft. Lauderdale, Marshall Inds. 305-977-4880
FL Largo, Bell Inds. 813-541-4434
FL Orlando, Hall-Mark Elctrns. Corp. 305-855-4020
FL Orlando, Marshall Inds. 305-841-1878
FL Palm Bay, Arrow Elctrns., Inc. 305-841-2424
FL Pompano Bch., Hall-Mark Elctrns. Corp. 305-971-9280
GA Norcross, Arrow Elctrns., Inc. 404-449-8252
GA Norcross, Bell Inds. 404-662-0923
GA Norcross, Hall-Mark Elctrns. Corp. 404-447-8000
GA Norcross, Marshall Inds. 404-923-5750
IL Elk Grove Vl., Bell Inds. 312-640-1910
IL Schaumburg, Arrow Elctrns., Inc. 312-397-3440
IL Shaumburg, Marshall Inds. 312-490-0155
IL Wheeling, Hawk Elctrns. 312-459-4030
IL Wooddale, Hall-Mark Elctrns. Corp. ... 312-860-3800
IN Ft. Wayne, Bell Inds. 219-423-3422
IN Indianapolis, Arrow Elctrns., Inc. 317-243-9353
IN Indianapolis, Bell Inds. 317-875-8200
IN Indianapolis, Bell Inds. (JIT Only) 317-299-5487
IN Indianapolis, Marshall Inds. 317-297-0483
IA Cedar Rapids, Arrow Elctrns. 319-395-7230
IA Cedar Rapids, Bell Inds. 319-395-0730
KS Lenexa, Arrow Elctrns., Inc. 913-541-9542
KS Lenexa, Hall-Mark Elctrns. Corp. 913-888-4747
KS Lenexa, Marshall Inds. 913-492-3121
MD Columbia, Arrow Elctrns., Inc. 301-995-0003
MD Columbia, Hall-Mark Elctrns. Corp. 301-988-9800
MD Gaithersburg, Marshall Inds. 301-840-9450
MA Newton, The Greene-Shaw Co., Inc. .. 617-969-8900
MA Wilmington, Marshall Inds. 617-658-0810
MA Woburn, Arrow Elctrns., Inc. 617-933-8130
MI Ann Arbor, Arrow Elctrns., Inc. 313-522-1040
MI Ann Arobor, Bell Inds. 313-971-9093
MI Grand Rapids, Arrow Elctrns. Inc. 616-243-0912
MI Livonia, Marshall Inds. 313-525-5850
MN Eden Prairie, Hall-Mark Elctrns. Corp. 612-941-2600
MN Edina, Arrow Elctrns., Inc. 612-830-1800
MN Minneapolis, Indl. Comps., Inc. 612-831-2666
MN Plymouth, Marshall Inds. 612-559-2211
MO Earth City, Hall-Mark Elctrns. Corp. 314-291-5350
MO St. Louis, Arrow Elctrns., Inc. 314-567-6888
NE Lincoln, Scott Elctrn. Supp. Corp. 402-466-8221
NH Manchester, Arrow Elctrns., Inc. 603-668-6968
NJ Fairfield, Marshall Inds. 201-882-0320
NJ Marlton, Arrow Elctrns., Inc. 609-596-8000
NJ Mt. Laurel, Hall-Mark Elctrns. Corp. 609-235-1900
NJ Mt. Laurel, Marshall Inds. 609-234-9100
NJ Parsippany, Arrow Elctrns., Inc. 201-538-0900
NM Albuquerque, Arrow Elctrns., Inc. 505-243-4566
NM Albuquerque, Bell Inds. 505-292-2700
NY Buffalo, Summit Dists. 716-887-2800
NY Commack, Vantage Comps. 516-543-2000
NY Hauppauge, Arrow Elctrns., Inc. 516-231-1000
NY Hauppauge, Marshall Inds. 516-273-2424
NY Jamaica, Archer Indl. Dists., Inc. 718-291-3232
NY Johnson City, Marshall Inds. 607-798-1611
NY Melville, Arrow Elctrns., Inc. (Corp.) 516-694-6800
NY Melville, Semispecialists of America, Inc. (SAI) 516-293-2710
NY Mt. Vernon, QAR Indl. Elctrns. Sls., Inc. 914-699-2224
NY Rochester, Arrow Elctrns., Inc. 716-427-0300, 1-800-462-6422
NY Rochester, Marshall Inds. 716-235-7620
NY Rome, Rome Elctrns., Inc. 315-337-5400
NC Clifton, Vantage Comps., Inc. (Corp.) .. 201-667-1840
NC Raleigh, Arrow Elctrns., Inc. 919-876-3132
NC Raleigh, Hall-Mark Elctrns. Corp. 919-872-0712
NC Raleigh, Marshall Inds. 919-878-9882
NC Raleigh, RESCO/Raleigh 919-781-5700
NC Winston Salem, Arrow Elctrns., Inc. 919-725-8711
OH Centerville, Arrow Elctrns., Inc. 513-435-5563
OH Dayton, Bell Inds. 513-435-8660
OH Dayton, Marshall Inds. 513-236-8088
OH Solon, Arrow Elctrns., Inc. 216-248-3990
OH Solon, Hall-Mark Elctrns. Corp. 216-349-4632
OH Solon, Marshall Inds. 216-248-1788
OH Worthington, Hall-Mark Elctrns. Corp. 614-888-3313
OK Broken Arrow, Hall-Mark Elctrns. Corp. 1-800-327-9989
OK Tulsa, Arrow Elctrns., Inc. 918-665-7700
OR Beaverton, Arrow Elctrns., Inc. 503-684-1690
OR Beaverton, Marshall Inds. 503-644-5050
OR Lake Oswego, Bell Inds. 503-241-4115
OR Tualatin, Moore Elctrns. 503-692-5333
PA McKean, Advacom 814-476-7774
PA Monroeville, Arrow Elctrns., Inc. 412-856-7000
PA Philadelphia, PEI/Genesis 215-673-0400
PA Pittsburgh, Marshall Inds. 412-963-0441
TN Nashville, Bell Inds. 615-367-4400

TX Austin, Arrow Elctrns., Inc. 512-835-4180
TX Austin, Hall-Mark Elctrns. Corp. 512-258-8848
TX Austin, Marshall Inds. 512-837-1991
TX Austin, Southwest-Elctrns., Inc. 512-837-8971
TX Carrollton, Arrow Elctrns., Inc. 214-380-6464
TX Carrollton, Marshall Inds. 214-233-5200
TX Dallas, Hall-Mark Elctrns. Corp. 214-553-4300
TX Dallas, Hall-Mark Elctrns. Corp. (Corp.) 214-343-5000
TX Dallas, Southwest Elctrns., Inc. 214-234-3050
TX Houston, Arrow Elctrns. 713-530-4700
TX Houston, Hall-Mark Elctrns. Corp. 713-781-6100
TX Houston, Marshall Inds. 713-895-9200
TX Stafford, S.W. Elctrns., Inc. 713-491-4900
TX Stafford, Southwest Elctrns., Inc. 713-491-4900
UT Salt Lake City, Arrow Elctrns., Inc. 801-972-0404
UT Salt Lake City, Bell Inds. 801-972-6969
UT Salt Lake City, Marshall Inds. 801-485-1551
WA Bellevue, Arrow Elctrns., Inc. 206-643-4800
WA Bellevue, Bell Inds. 206-747-1515
WA Bellevue, Marshall Inds. 206-641-6800
WI Brookfield, Arrow Elctrns., Inc. 414-792-0150
WI Brookfield, Marshall Inds. 414-797-8400
WI New Berlin, Hall-Mark Elctrns. Corp. .. 414-797-7844
WI Waukesha, Bell Inds. 414-547-8879
Can Mississauga, Ont., Arrow Elctrns. Canada Ltd. 416-672-7769
Can Montreal, Que., Arrow Elctrns. Canada Ltd. 514-735-5511
Can Quebec City, Que., Arrow Elctrns. Canada Ltd. 418-687-4231

CTS CORPORATION, Connector Division, 9210 Science Center Dr., New Hope, MN 55428, Tel: 612-533-3533, TWX: 910-576-2717; FSC No.: 16512; Empl.: 300; *Sls. Mgr.:* Steve Otto

'Refer to CTS Corp., Elkhart, IN, for sales offices & representatives & for distributor listings.'

CTS CORP., ELECTROMECHANICAL DIV., (Formerly Elkhart Div.), 1142 W. Beardsley Ave., Elkhart, IN 46514, Tel: 219-295-3575; *Sls. Mgr.:* R. G. Sumrak ..... **A•1904-1910; B•1681**

Refer to CTS Corp., Elkhart, IN, for sales offices and representatives and for distributor listings.

CTS CORPORATION

FAX: 815-786-9743

CTS CORP., FREQUENCY CONTROL DIV., (Formerly Knights Div.), 400 Reimann Ave., Sandwich, IL 60548, Tel: 815-786-8411, TWX: 910-642-0860; Empl.: 450; *Sls. Mgr.:* Terry Luxmore, Act. Sls. Mgr. ..... **A•1366-1387**

'Refer to CTS Corp., Elkhart, IN, for sales offices & representatives & for distributor listings.'

CTS CORPORATION, Microelectronics Div., 1201 Cumberland Ave., W. Lafayette, IN 47906, Tel: 317-463-2565, TWX: 810-342-1882; Empl.: 505; *Sls. Mgr.:* Dick Kramer ..... **A•1732-1733**

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CUESTA SYSTEMS CORPORATION, 3440 Roberto Ct., San Luis Obispo, CA 93401, Tel: 805-541-4160, 800-332-3440; *Sls. Mgr.:* Gary Brehmer

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CA Hayward, Pacific Mfg. Inc. 415-887-1620
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CO Englewood, Omega Ltd. 303-762-1921
CT Milford, Sales Engrg. 203-877-2001
CT New Fairfield, Sales Engrg. Co. 203-746-5604
FL Clearwater, Tech-Rep Assocs. 813-576-9900
GA Doraville, Advanced Comps. Mktg. 404-448-7025
IL Downers Grove, Richmar Elctrns. Corp. 312-968-0118
MD Gaithersberg, Naudain Assocs., Southern 301-258-5040
MI Farmington Hills, W. R. Hummon & Assocs. Inc. 313-474-0661
MI Grand Rapids, JFCO, Inc. 616-949-1020
MI Lake Orion, JFCO, Inc. 313-693-2053
MN Minneapolis, Holmgren Assocs. Inc. of MN 612-786-7641
MO Kansas City, Delltron Co., Inc. 816-436-6445
MO St. Louis, Delltron Co., Inc. 314-869-4779
NH Salem, Sales Engrg. Co. 603-893-5521
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NJ Marlton, Naudain Assocs. 609-983-5300
NY Rochester, Apex Assocs. 716-254-6050
NC Raleigh, Crossroads Elctrn. Assocs. ... 919-742-2372
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OH Dayton, Nationwide Comps., Inc. 216-946-3226
IN Indianapolis, Nationwide Comp., Inc. .. 317-872-7202
OH Willoughby, Nationwide Comp. 216-946-3226
RI Warwick, Sales Engrg. 401-738-1319
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TX Garland, Pro-Comp Sls. Co. 214-276-1948
TX Houston, ProComp Sls. Co. 713-556-9622
TX Richardson, Pro Comp 214-669-1500
WA Redmond, Electronic Mktg. Grp. 206-883-0962
WI Milwaukee, Richmar Elctrns. 414-781-1730
Can Ontario, Chartwell Elctrns. 416-477-0400

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AZ Phoenix, Electro-Comps. Distr. 602-258-2665
AZ Tempe, Shelley-Ragon, Inc. 602-894-0258
AR El Dorado, Electra Inc. 501-862-4901
CA Anaheim, Control Design 715-821-1516
CA Chatsworth, Shelley-Ragon, Inc. 818-998-3333
CA Orange, County Wholesale Elec. 714-633-6440
CA San Carlos, Control Design Supp. 415-592-4806
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CA San Jose, Rose Elctrns. 408-263-9700
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CA Santa Monica, Master Distrs. 213-452-1229
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FL Lakeland, A-A Electric 813-665-6941
FL Miami, Indl. Controls & Dvcs. 305-651-0196
FL Tampa, Shelley-Ragon, Inc. 813-623-6560
GA Atlanta, A.C. Equip. 404-451-2747
GA Atlanta, A-A Electric 404-449-8670
GA Stone Mountain, Control Des. Supp. .. 404-979-3500
IL Carol Stream, Lectro Comps. 312-690-0520
IL Elgin, Allied Elctrns. 312-697-8200
IL Genoa, Control Des. Supp. 815-784-6515
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IL Quincy, Klaus Radio, Inc. 217-223-7560
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IN Wabash, Wabash Elec. Supp. 219-563-4146
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IA Marion, Brenneman & Assocs. 319-377-6394
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KY Lexington, American Elec. Supp. 606-293-2611
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CO Denver, Shelley-Ragon 303-744-3601
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MA West Springfield, Control Engrg. 413-781-1330
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MI Augusta, Great Lakes Elctrns. 616-731-4156
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MO Independence, Shelley-Ragon, Inc. 816-254-3410
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MO St. Louis, L Comp, Inc. 314-291-6200
MO St. Louis, Shelley-Ragon, Inc. 314-454-0480
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NJ Oakland, Relay Specialties 201-337-1000
NJ W. Berlin, General Comps. 609-768-6767
NY Albany, Adirondack Elctrns. 518-456-0203
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NY Bohemia, Shelley-Ragon, Inc. 516-567-7751
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NY Rochester, Masline Elctrns. 716-546-5373
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MN St. Paul, Shelley-Ragon 612-642-2828
NC Charlotte, Control Design Supp. 704-588-4410
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Can Markham, Ont., Chartwell Elec. 416-731-3400
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OH Cleveland, Gateway Megatech 216-944-5801
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OH Warren, REM Elctrn. Supp. 216-373-1300
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SC Greenville, Dixie Elctrns. 803-232-5357
SC Greenville, Emsco Elctrns. 803-233-4121
TX Austin, Altair Co. 512-837-4970
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WA Kent, C. B. Parsons & Co. 206-762-7373
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MA Brookline, Harman Assocs. 617-232-6687
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CUSTOM ELECTRONICS, Browne St., Oneonta, NY 13820, Tel: 607-432-3880, TWX: 510-241-8292, FAX: 607-432-3913; FSC No.: 23280; Empl.: 110; *Sls. Mgr.:* D. Hathaway

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CUSTOM MOS ARRAYS, INC. (CMA), 211 Topaz Street, Milpitas, CA 95035, Tel: 408-946-9111, TWX: 9103382304; FSC No.: 62772; Empl.: 24

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PA Penndel, Delta Mktg. 215-750-1440

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MA Taunton, Focus Elctrn. Sls. 617-824-3840
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CYBERNETIC MICRO SYS., P.O. Box 3000, 3000 Hwy. 84, San Gregorio, CA 94074, Tel: 415-726-3000, TWX: 910-350-5842; *Sls. Mgr.:* K. Moty

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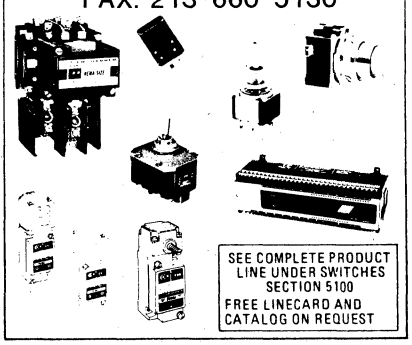

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MA No. Scituate, W. A. Hendrickson 617-545-0652
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OH Cincinnati, John Olsen Co. 513-922-8885
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PA King of Prussia, Freedman-Malta 215-337-9211
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LA New Orleans, Southern Radio Supp. .. 504-524-2343
MN New Brighton, Chris Elctrns. 612-631-2647
MN New Brighton, Parts One 612-633-8079
NJ Cranford, Garden State 201-272-6400
NM Albuquerque, TMA/Connecting Comps. 505-345-8921
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NY Buffalo, Summit Elctrns. 716-887-2800
NY Hauppauge, Broadline 516-231-8100
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PA Philadelphia, A.C. Radio Supp. 215-462-9379
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DADEN ASSOCIATES, 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653, Tel: 714-770-1522, TWX: 910-596-1324, FAX: 714-472-0805; FSC No.: 57032; Empl.: 41; *Sls. Mgr.:* Dennis Hook

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FL Palm Bay, Spartech Assocs. 305-727-8045
GA Norcross, Spartech Assocs. 404-446-7300
MD Owings Mills, Walker-Houck Assocs. .. 301-356-9500
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NY Hartsdale, Spectrum Sls. 914-472-8600
PA Penndel, Delta Mktg., Inc. 215-750-1440
TX Richardson, Southwest Microwave Elctrns. 214-669-1195
WA Seattle, Data Com Assocs., Inc. 206-285-2525

DAHLSTROM OF CANADA LTD., 7 Copeland Street, Toronto, Ontario, Canada M4G 37E, Tel: 416-421-5900, TELEX: 06-219845; Empl.: 50

FAX: 213-631-8078

DAICO INDUSTRIES, INC., 2139 East Del Amo Blvd., Compton, CA 90224, Tel: 213-631-1143, TWX: 910-346-1143; FSC No.: 28983; Empl.: 200; *Sls. Mgr.:* Bill Grunau, VP Mktg. ..... **A•1766-1767**

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AZ Scottsdale, Faser Tech. Sls. 602-948-4404
CA Los Altos, Cain-White & Co. 415-948-6533
CA Los Angeles, Midwin & Olifson 213-838-3455
CA San Diego, Midwin & Olifson, Inc. 619-571-0177
CA Tarzana, Midwin & Olifson 818-996-9093
FL Palm Bay, Spartech Assocs. 305-727-8045
GA Norcross, Spartech Assocs. 404-446-7300
IN Ft. Wayne, Corrao Marsh, Inc. 219-482-2725
IA Cedar Rapids, Lorenz Sls., Inc. 319-377-4666
KS Merriam, Lorenz Sls., Inc. 913-384-6556
ME Ogunquit, Micronic Assocs. 617-933-2121, 207-646-9525
MD Burtonsville, Eastern Instrmn. 301-384-8500
MO University City, Lorenz Sls. 314-997-4558
NE Lincoln, Lorenz Sls. 402-475-4660
NJ Teterboro, Technical Mktg. Assocs. ... 201-393-9330
PA Broomall, SWR Assocs. 215-353-6639
TX Dallas, McDonald Assocs. 214-239-3293
WI Brookfield, Oasis Sls., Inc. 414-782-6660
Can St. Laurent, Que., RF Microwave, Ltd. 514-335-2335

DAI-ICHI SHOJI OF AMER., INC., 150 Fifth Ave., Suite 845, New York, NY 10011, Tel: 212-691-9050, FAX: 212-807-1598; Empl.: 3; *Sls. Mgr.:* A. Takayama .... **B•1691; C•1321**

Local Sales Offices & Reps

NY New York, Dai-Ichi Shoji of America, Inc. 212-691-9050

DALE®

FAX: 402-563-6418

DALE ELECTRONICS, INC., Columbus Div., 2064 12th Ave., Columbus, NE 68601, Tel: 402-564-3131; FSC No.: 91637; Empl.: 2800; *Sls. Mgr.:* Darrell Smejkal; *Dist. Mgr.:* Jerry Jilek ..... **A•1925-1931; B•1047-1049**

Local Sales Offices & Reps

AL Huntsville, JWL Assocs. 205-883-1712
AZ Tempe, Dale Elctrns. Sls. 602-966-0291
CA Los Alamitos, Reed Elctrn. Mktg. 213-598-6676
CA Redwood City, J. S. Heaton Co. 415-367-9000
CA San Diego, Vishay District Office 619-690-5112
CO Colorado Springs, Dale Elctrns., Inc. Sls. 303-593-7529
CO Loveland, Dale Elctrns. Sls. 303-667-7500
FL Coral Springs, Graham Assocs., Inc. .. 305-755-6733
FL Lake Park, Graham Assocs. 305-622-4049
FL Melbourne, Graham Assocs. 305-773-6631
FL Winter Garden, Graham Assocs. 305-656-9369
GA Atlanta, JWL Assocs. 404-320-7643
IL Skokie, Indl. Reps. 312-967-8430
IN Fort Wayne, Scott Elctrns. 219-489-5690
IN Indianapolis, Scott Elctrns. 317-841-0010
KS Shawnee Mission, Dale Sls. 913-432-9140
MD Glen Burnie, Tri-Mark 301-761-6000
MA Wakefield, Howard C. Jappe Co. 617-245-9359
MI Plymouth, Jay Mktg. Assocs. 313-459-1200
MN Bloomington, Merrill Franklin Co. 612-854-8020
NJ Fairlawn, Kaelber & Mack 201-797-7865
NY Commack, Kaelber & Mack 516-499-2924
NY Liverpool, Dale Elctrns. Sls. 315-457-1401
NC Pineville, JWL Assocs. 704-541-5750
NC Raleigh, JWL Assocs. 919-787-4826
OH Cincinnati, Scott Elctrns. 513-791-2513
OH Cleveland, Scott Elctrns. 216-473-5050
OH Dayton, Scott Elctrns., Inc. 513-294-0539
OH Reynoldsburg, Scott Elctrns. 614-863-1281
OR Beaverton, LD Elctrns. 503-684-8221
PA Horsham, TMI 215-441-4300
TX Dallas, E. F. Aymond Co. 214-826-7620
TX San Antonio, E. F. Aymond Co. 512-675-8339
WA Snohomish, LD Elctrns. 206-568-0511
WA Spokane, LD Elctrns. 509-922-4883
WI Milwaukee, Indl. Reps. 414-259-0965

Local Distributors

AL Huntsville, Hamilton/Avnet 205-837-7210
AL Huntsville, Pioneer Technlgs. 205-837-9300
AZ Chandler, Hamilton/Avnet 602-961-6400
AZ Phoenix, Sterling Elctrns. 602-268-2121
AZ Tempe, Acacia, Div. of Univar 602-894-2874
AZ Tempe, Shelley-Ragon, Inc. 602-894-2058
AZ Tempe, T.T.I. Inc. 602-431-1191
CA Chatsworth, Hamilton/Avnet 213-280-3954
CA Chatsworth, Hamilton/Avnet 818-700-6578
CA Chatsworth, Shelley-Ragon, Inc. 818-998-3333
CA Chatsworth, T.T.I, West 818-709-1010
CA Costa Mesa, Avnet Elctrns. 714-754-6021
CA Costa Mesa, Hamilton Electro Sls. 714-641-4100
CA Culver City, Hamilton/Avnet 213-558-2111
CA Gardena, Hamilton Electro Sls. 213-217-6750
CA Gardena, Hamilton Electro Sls. 213-217-6700
CA Inglewood, Newark Elctrns. 213-671-7370
CA Irvine, Acacia Div. of Univar 213-971-2428
CA Milpitas, T. T. I, Inc. 408-946-5577
CA Ontario, Hamilton/Avnet 714-989-8816
CA Sacramento, Hamilton/Avnet 916-920-3150
CA San Diego, Acacia Div. of Univar 619-565-4365
CA San Diego, Hamilton/Avnet 619-571-7536
CA San Diego, Shelley-Ragon, Inc. 619-453-7133
CA San Diego, T.T.I., Inc. 619-587-4888
CA San Jose, Shelley-Ragon, Inc. 408-432-0600
CA Sunnyvale, Acacia Div. of Univar 408-745-7200
CA Sunnyvale, Hamilton/Avnet 408-743-3358
CO Commerce City, Waco Elctrns. 303-289-4743
CO Denver, Newark Elctrns. 303-757-3351
CO Denver, T.T.I. Inc. 303-429-6806
CO Englewood, Hamilton/Avnet 303-740-1020
CO Englewood, Shelley-Ragon, Inc. 303-762-0670
CO Lakewood, Acacia Div. of Univar 303-232-2882
CT Danbury, Hamilton/Avnet 203-797-2854
CT Norwalk, Pioneer Std. 203-853-1515
CT Stratford, Electro/Comp. 203-375-5811
CT Stratford, T. T. I, Inc. 203-375-1400
FL Alamonte Springs, Pioneer Technlgs. 305-834-9090
FL Deerfield Beach, Pioneer Technlgs. ... 305-428-8877
FL Ft. Lauderdale, Hamilton/Avnet 305-979-5211
FL Largo, Lodan Elctrns. 813-586-2851
FL Orlando, T.T.I., Inc. 305-859-1000
FL St. Petersburg, Hamilton/Avnet 813-576-3930
FL Tampa, Reptron Elctrns. 813-855-4656
FL Tampa, Shelley-Ragon, Inc. 813-623-6560
FL Winter Park, Hamilton/Avnet 305-628-3888
GA Norcross, Hamilton/Avnet 404-447-7523
GA Norcross, Pioneer Technlgs. 404-448-1711
GA Norcross, T.T.I., Inc. 404-662-0911
IL Bensenville, Hamilton/Avnet 312-860-8501
IL Chicago, Newark Elctrns. 312-784-5100
IL Elk Grove, Bell Ind. 312-640-1910
IL Elk Grove Village, Pioneer Std. 312-437-9680
IL Lombard, Shelley-Ragon, Inc. 312-629-8833
IL Palatine, Ohm Elctrns. 312-359-5500
IN Carmel, Hamilton/Avnet 317-844-9333
IN Ft. Wayne, Bell Ind.,Graham Div. 219-423-3422
IN Indianapolis, Bell Ind., Graham Div. 317-875-8200
IN Indianapolis, Pioneer Std. 317-849-7300
IA Cedar Rapids, Dee Elctrns. 319-365-7551
IA Cedar Rapids, Hamilton/Avnet 319-362-4757
KS Overland Park, Hamilton/Avnet 913-541-7924
KY Lexington, Hamilton/Avnet 606-259-1475
MD Baltimore, RESCO 301-529-0500
MD Beltsville, RESCO 301-937-9100
MD Columbia, Hamilton/Avnet 301-995-3526
MD Columbia, T. T. I, Inc. 301-995-1331
MD Gaithersburg, Pioneer Technlgs. 301-921-0660
MA Billerica, A. W. Mayer Co. 617-229-2255
MA Lexington, Pioneer Std. 617-861-9200
MA Peabody, Hamilton/Avnet 617-596-7668
MA Wilmington, T.T.I. Inc. 617-658-4700
MA Woburn, Sterling Elctrns. 617-938-6200
MI Grand Rapids, Hamilton/Avnet 616-243-8805
MI Grand Rapids, Pioneer Std. 616-698-1800
MI Grand Rapids, S-F Elctrn. Supp. 616-459-0216
MI Livonia, Hamilton/Avnet 313-522-4700
MI Livonia, Pioneer Std. 313-525-1800
MI Livonia, R-S Elctrns. 313-525-1155
MI Livonia, Reptron Elctrns. 313-525-2700
MI Oak Pk., Newark Elctrns. 313-967-0600
MN Eden Prairie, Pioneer-Std. 612-935-5444
MN Eden Prairie, T. T. I, Inc. 612-944-5080
MN Minneapolis, Newark Elctrns. 612-331-6350
MN Minneapolis, Stark Elctrns. 612-332-1325
MN Minnetonka, Hamilton/Avnet 612-932-0670
MN Minnetonka, Pioneer Std. 612-935-5444
MN St. Paul, Shelley-Ragon, Inc. 612-642-2828

MO	Earth City, Hamilton/Avnet	314-344-1254
MO	Independence, Shelley-Ragon, Inc.	816-254-3410
NH	Manchester, Hamilton/Avnet	603-624-9400
NJ	Cherry Hill, Hamilton/Avnet	609-424-0117
NJ	Cranford, G.S.I. Elec.	201-272-6400
NJ	Fairfield, Hamilton/Avnet	201-575-3490
NJ	Kenilworth, Federated Purchaser	201-272-0505
NJ	Pine Brook, Pioneer Std.	201-575-3510
NM	Albuquerque, Hamilton/Avnet	505-765-1500
NY	Binghamton, Pioneer Std.	607-722-9300
NY	Bohemia, March Elctrns.	516-563-6000
NY	Bohemia, Shelley Elctrns., Inc.	516-567-7751
NY	Buffalo, Summit Distr.	716-887-2800
NY	Endwell, A.S.I. Elctrns.	607-754-3823
NY	Fairport, Pioneer Std.	716-381-7070
NY	Farmingdale, Command Elctrns.	516-293-1212
NY	Hauppauge, Fairmont	516-231-3313
NY	Hauppauge, Hamilton/Avnet	516-231-9800
NY	Rochester, Hamilton/Avnet	716-272-2704
NY	Rome, Rome Elctrns.	315-337-5400
NY	Ronkonkoma, T.T.I., Inc.	516-737-2000
NY	Syracuse, Hamilton/Avnet	315-437-2641
NY	Valley Stream, L&S Elctrns.	516-561-2474
NY	Woodbury, Pioneer Std.	516-921-8700
NC	Charlotte, Pioneer Technlgs.	704-527-8188
NC	Raleigh, Hamilton/Avnet	919-878-0819
NC	Raleigh, RESCO	919-781-5700
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Cleveland, Hamilton/Avnet	216-831-3500
OH	Cleveland, Pioneer Standard	216-587-3600
OH	Columbus, T.T.I. Inc.	614-848-5770
OH	Dayton, Bell Inds.	513-435-8660
OH	Dayton, Bell Inds., Military Div.	513-434-8231
OH	Dayton, Hamilton/Avnet	513-439-6700
OH	Dayton, Hamilton/Avnet	513-439-6730
OH	Dayton, Pioneer Standard	513-236-9900
OH	Dayton, Stotts-Friedman Co.	513-298-5555
OH	Solon, Hamilton/Avnet	216-349-5100
OH	Valley View, Trexon Elctrns.	216-447-8860
OH	Westerville, Hamilton/Avnet	614-882-7004
OK	Tulsa, Hamilton/Avnet	918-252-7297
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Beaverton, Acacia Div. of Univar	503-646-3377
OR	Lake Oswego, Hamilton/Avnet	503-635-8831
OR	Portland, Radar Elec.	503-232-3404
PA	Horsham, Pioneer Technlgs.	215-674-4000
PA	McKean, Advacom	814-476-7774
PA	Pittsburgh, Hamilton/Avnet	412-281-4150
PA	Pittsburgh, Pioneer Std.	412-782-2300
PA	York, E.C.I., Inc.	717-846-5334
TX	Austin, Hamilton/Avnet	512-837-8911
TX	Austin, Pioneer Std.	512-835-4000
TX	Dallas, Pioneer Std.	214-386-7300
TX	Dallas, Shelley-Ragon, Inc.	214-349-2424
TX	Dallas, Sterling Elctrns.	214-243-1600
TX	Ft. Worth, T.T.I., Inc.	817-831-8300
TX	Garland, Newark Elctrns.	214-494-5911
TX	Houston, Lenert Co.	713-225-1465
TX	Houston, Pioneer Std.	713-988-5555
TX	Houston, Sterling Elctrns.	713-627-9800
TX	Irving, Hamilton/Avnet	214-550-6111
TX	Irving, Hamilton/Avnet	214-550-6155
TX	Stafford, Hamilton/Avnet	713-274-9336
UT	Salt Lake City, Hamilton/Avnet	801-974-9649
WA	Bellevue, Hamilton/Avnet	206-453-5842
WA	Redmond, Shelley-Ragon Inc.	206-883-2220
WA	Redmond, T.T.I. Inc.	206-882-0291
WA	Seattle, Radar Elec.	206-282-2511
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	New Berlin, Hamilton/Avnet	414-784-4510

DALE ELECTRONICS, INC., El Paso Div., P.O. Box 26728, El Paso, TX 79926, Tel: 915-592-3253; FSC No.: 91637; Empl.: 272; *Sls. Mgr.:* Douglas Wagenknecht; *Dist. Mgr.:* Jerry Jilek ..... **A•1914-1917; B•1840-1841**

Refer to Dale Electronics, Inc., Columbus, NE for sales office and distributor information.

DALE ELECTRONICS, INC., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701, Tel: 402-371-0080; FSC No.: 91637; Empl.: 1200; *Sls. Mgr.:* Jim Filips; *Dist. Mgr.:* Jerry Jilek ..... **A•1918-1924, 1928-1931**

Refer to Dale Electronics, Inc., Columbus, NE for sales office and distributor information.

DALE ELECTRONICS, INC., Specialty Div., P. O. Box 1179, Robbinsville, NC 28771, Tel: 704-479-6451; FSC No.: 69274; Empl.: 140; *Sls. Mgr.:* Larry Viar; *Dist. Mgr.:* Jerry Jilek ..... **A•1928-1931**

Refer to Dale Electronics, Inc., Columbus, NE for sales office and distributor information.

DALE ELECTRONICS, INC., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282, Tel: 602-967-7874; FSC No.: 22929; Empl.: 139; *Sls. Mgr.:* Bob Klug; *Dist. Mgr.:* Jerry Jilek ..... **A•1388-1390, 2069**

Refer to Dale Electronics, Inc., Columbus, NE for sales office and distributor information.

DALE ELECTRONICS, INC., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, Tel: 605-665-9301; FSC No.: 09969; Empl.: 400; *Sls. Mgr.:* John Elliot; *Dist. Mgr.:* Jerry Jilek .... **A•1232-1239, 2205-2209; C•1322-1324**

Refer to Dale Electronics, Inc., Columbus, NE for sales office and distributor information.

DALE WESTERN THERMISTOR DIVISION, See Dale Norfolk Division

DAMON ELECTRONICS DIV., 80 Wilson Way, Westwood, MA 02090, Tel: 617-329-2460, TWX: 710-348-6722, FAX: 617-329-0551; Empl.: 90; *Sls. Mgr.:* Edward J. Doherty ..... **A•1391**

Local Sales Offices & Reps

AZ	Phoenix, Sanford Sls. Assocs.	602-957-3570
CA	N. Hollywood, Jewett Co.	213-789-8103
CA	Palo Alto, Tri-Rep	415-965-1822,
DC	Washington, Stemler Assocs.	301-944-8262
FL	Melbourne, Repcom	305-254-1877
MD	Baltimore, Stemler Assocs.	301-944-8262
MA	Waltham, Del Tech Sls.	617-890-1020
NJ	Cherry Hill, Stemler Assocs.	609-966-4070
NJ	Hackensack, T.M.A. Assoc.	201-342-4008
TX	Ft. Worth, El-Tec Sls.	817-268-2896

D & B POWER, INC.

FAX: 516-586-5952

D & B POWER, INC., 204 N. Fehr Way, P.O. Box 40M, Bayshore, NY 11706, Tel: 516-586-5955; FSC No.: 54337; Empl.: 25; *Sls. Mgr.:* Gordon Best; *Dist. Mgr.:* Dan Hall ..... **D•1688-1689**

Local Sales Offices & Reps

CA	Pasadena, Electro Mecha. Instrs.	818-795-7193
CA	Santa Clara, SMI, Corp.	408-986-1610
KS	Lenexa, Spectrum Sls.	913-492-3903
MA	Sharon, Adcour, Inc.	617-784-8123
NY	East Setauket, Edgerton Elctrn.	516-751-7089
NY	Rochester, Technical Comp. Sls.	716-342-2406

Local Distributors

MA	Shannon, Adcour, Inc.	617-784-8123

DMC DANIELS MANUFACTURING CORPORATION

FAX: 407-855-6884

DANIELS MANUFACTURING CORP., 6103 Anno Ave., Orlando, FL 32809, Tel: 407-855-6161, TELEX: 564321; FSC No.: 11851; Empl.: 180; *Sls. Mgr.:* Dave Kelly; *Dist. Mgr.:* Ralph R. Recht ..... **C•1759**

Local Sales Offices & Reps

CA	San Diego, Cetinske Sls. Co.	619-487-3335
CA	Yorba Linda, DMC Western Regional	714-996-5881
CO	Englewood, Columbine Fab.	303-761-2121
CT	Orange, DMC N.E. Regional Off.	203-799-2343
MD	Port Tobacco, DMC N.E. Field Off.	301-934-8220
TX	Bedford, DMC S.W. Regional Off.	817-283-2750
VA	Virginia Beach, Summit Inds. & Marine	804-463-8820
WA	Redmond, Pan Pacific Electronics	206-881-7252

Local Distributors

CO	Englewood, Columbine Fabricators	303-761-2121
CT	Hamden, Connector Company	203-288-0044
TX	Fort Worth, Wadco	817-483-9111
VA	Virginia Beach, Summit Inds. & Marine	804-463-8820
WA	Redmond, Pan Pacific Electronics	206-881-7252
Can	Ontario, Patlon Aircraft	416-624-5572

DAN-L INC., 229 Laurel Rd., E. Northport, NY 11731, Tel: 516-757-8000; FSC No.: 28327; Empl.: 22

DANMAR INDS., 9705 Lurline Ave., Chatsworth, CA 91311, Tel: 818-882-7979/5280; FSC No.: 31690; Empl.: 10; *Sls. Mgr.:* Mukund Patel

DANTEL, 2991 N. Argyle Ave., Fresno, CA 93727, Tel: 209-292-1111, TELEX: 35-5457, FAX: 209-292-9355; FSC No.: 56960; Empl.: 120; *Sls. Mgr.:* Dan Finch

Local Sales Offices & Reps

CA	Sebastopol, Dantel, Inc.	707-823-8989
GA	Atlanta, Dantel	404-297-0775
IN	Ft. Wayne, Dantel	219-427-9148

DANTRONICS, INC., 3175 Hafner Ct., St. Paul, MN 55126, Tel: 612-484-2108; Empl.: 22

DASOFT DESIGN SYSTEMS, INC., 1827-B Fifth St., Berkeley, CA 94710, Tel: 415-486-0822, TELEX: 4945245; Empl.: 8

DATA, INC., 7702 Emerald Ave., Box 2071, Ft. Collins, CO 80525, Tel: 303-493-1222; Empl.: 3; *Sls. Mgr.:* Sharon Shilling; *Dist. Mgr.:* Sharon Shilling

D.A.T.A., INC., International Thomson Organization, P.O. Box 26875, San Diego, CA 92126, Tel: 619-578-7600, TWX: 910-322-1340; Empl.: 30; *Sls. Mgr.:* Allen Gressler

DATA CAPTURE TECHNOLOGY, Hathaway Corp., 10837 E. Marshall, Tulsa, OK 74116, Tel: 918-438-5366, TELEX: 796355; FSC No.: 7E812; Empl.: 30; *Sls. Mgr.:* Raymond Johnson

DATA CHECK CORPORATION, 9918 Via Pasar, San Diego, CA 92126, Tel: 619-578-0101, TWX: 910-335-1596; FSC No.: 55792; Empl.: 33; *Sls. Mgr.:* Bill Acosta

DATACHRON INC., 1150 E. Stanford Court, Anaheim, CA 92805, Tel: 714-385-1705, TELEX: 678401; FSC No.: 56259; Empl.: 16; *Sls. Mgr.:* Clyde Davis

Local Sales Offices & Reps

CA	Palo Alto, Egbert Engrg.	415-326-1387
FL	Titusville, Data-Time, Inc.	305-267-5600
NM	Albuquerque, Rustco	505-292-2741

DATA CIRCUITS, Computer Logics Ltd., 6380 Viscount Road, Mississauga, Ontario, Canada L4Z 1H3, Tel: 416-672-3833, FAX: 416-672-3869; Empl.: 85; *Sls. Mgr.:* Rick Way; *Dist. Mgr.:* Rick Way

DATACOM, INC., Box 278, Ft. Walton Beach, FL 32548, Tel: 904-244-6121, TWX: 510-730-7693, FAX: 910-244-6344; Empl.: 50

DATACON, INC., 60 Blanchard Rd., Burlington, MA 01803, Tel: 617-273-5800, TELEX: 951651, FAX: 617-273-4809; Empl.: 275; *Sls. Mgr.:* Stephen J. Day

Local Sales Offices & Reps

AL	Huntsville, Macro Mktg. Assocs.	205-883-9630
CA	Chatsworth, DataCon	818-700-0600
CA	Vista, Circuit Technlgs.	619-941-9718
CT	Brookfield, M & M Assocs.	203-775-6888
FL	Casselberry, Southern Elctrn. Sls.	305-332-4718
IL	Hoffman Estates, Microtex	312-382-3001
IL	Lisle, WG Controls	312-963-5954
IL	Schaumburg, DataCon	312-529-7690
MD	Baltimore, Rep-Tron	301-799-7490
NY	Bohemia, DataCon	516-589-1100
NY	Great Neck, F & F Metro	516-482-4080
NY	Syracuse, Labtronics	315-455-7314
PA	Newton Sq., Hagy Assocs.	215-459-0504

DATACOPY CORP., 1215 Terra Bella Ave., Mountain View, CA 94043, Tel: 415-965-7900, TELEX: 701994 DATACOPY UO; Empl.: 80; *Sls. Mgr.:* Charles Joseph

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FAX: 201-773-9672

DATA DELAY DEVICES, 3 Mount Prospect Ave., Clifton, NJ 07013-1915, Tel: 201-773-2299 ..... **A•1535-1549**

Local Sales Offices & Reps

AL	Huntsville, Mountain Electro Prods.	205-533-0084
AZ	Phoenix, Tech Sls., Inc.	602-246-1614
AR	Coulomb Elec.	713-820-3210
CA	El Toro, Martronix	714-858-0632
CA	Mountain View, Weseloh/Swanson & Assocs.	415-961-0565
CT	Dynamic Sls., Inc.	617-272-5676
DE	Jack McCoy Assocs.	215-363-0350
FL	Casselberry, Southern Elctrns. Mktg.	305-332-4718

GA Stone Mountain, Mountain Electro Prods., Inc. 404-448-5594
IN J. M. Finnegan & Co. 216-238-5905
KY J. M. Finnegan & Co. 216-238-5905
LA Coulomb Elec. 713-820-3210
ME Dynamic Sls., Inc. 617-272-5676
MA Burlington, Dynamic Sls., Inc. 617-272-5676
MI Spring Lake, Jim Finnegan & Co. 616-846-4980
MS Mountain Electro Prods. 404-448-5594
NH Dynamic Sls., Inc. 617-272-5676
NJ Medford, Jack McCoy Assocs. 609-953-0770
NY Pittsford, James E. Zimmmerman Sls. 716-381-3186
NC Durham, Mountain Electro Prods. 919-383-9839
OH Cleveland, Jim Finnegan & Co. 216-238-5905
OK Coulomb Elec. 617-272-5676
PA Downingtown, Jack McCoy, Inc. 215-363-0350
PA Pittsburgh, Jim Finnegan & Co. 412-823-5400
RI Dynamic Sls., Inc. 617-272-5676
SC Mountain Electro Prods. 404-448-5594
TN Mountain Electro Prods, ... 404-448-5594
TX Houston, Coulomb Elec. 713-820-3210
VT Dynamic Sls., Inc. 617-272-5676
VA Jim Finnegan & Co. 216-238-5905
Can Ont., Source Elctrns. 416-675-6235

Local Distributors

CA Sunnyvale, Target Elctrns. 415-961-1170

DATA-DESIGN LABS., P.O. Box 711, 7925 Center Ave., Cucamonga, CA 91730, Tel: 714-987-2511; Empl.: 1100; *Sls. Mgr.:* M. L. Sneller

DATA DEVICE CORP., See ILC Data Device Corp.

DATA DISPLAY PRODUCTS, Box 91072, Los Angeles, CA 90009, Tel: 213-640-0442, FAX: 213-640-7639; FSC No.: 15513; Empl.: 27; *Sls. Mgr.:* Qamar Lodhie

DATA ENGINEERING, INC., 2515 N. State Rd. 7 Ste. 207, Margate, FL 33063, Tel: 305-971-0400

DATA GENERAL, 4400 Computer Dr., Westboro, MA 01581, Tel: 617-366-8911, TELEX: 920-329, TWX: 710-390-1217; Empl.: 17,000; *Sls. Mgr.:* Frank Keaney

DATA INSTRUMENTS, INC., 100 Discovery Way, Acton, MA 01720, Tel: 617-264-9550, TELEX: 200081; Empl.: 285; *Sls. Mgr.:* Ernest C. Lutfy ..... **B•1884**

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Local Sales Offices & Reps

AL Huntsville, FLW Southeast, Inc. 205-536-6207
AZ Scottsdale, Williams Assocs. 602-947-4297
CA Laguna Hills, Elotek Sys., Inc. 714-830-4856
CA San Carlos, Elctrn. Engrg. Assocs. 415-593-2189
CO Englewood, Dynatech, Inc. 303-773-2830
FL Orlando, FLW Southeast, Inc. 305-894-1100
GA Marietta, FLW Southeast, Inc. 404-424-1731
IL Addison, Robert Kanter 312-620-8701
MA Acton, Data Instrs., Inc. 617-264-9550
MA Acton, Dave Hannon 617-264-9550
MN S. St. Paul, Northport Engrg. 612-457-8000
MO Florissant, Delltron Co. 314-839-0033
MO Kansas City, Delltron Co. 816-436-6445
NM Albuquerque, Williams Assocs. 505-255-1638
NY Albany, Robert F. Lamb Co., Inc. 518-869-3355
NY Buffalo, The Robert F. Lamb Co. 716-827-1111
NY Rochester, Robert F. Lamb Co., Inc. ... 716-323-1250
NY Syracuse, Robert F. Lamb Co., Inc. 315-455-2469
NC Charlotte, Emco, Inc. 704-372-8281
OH Sharonville, Production Resources, Inc. 513-777-0400
OH Worthington, Bob Young 614-431-0412
OK Tulsa, Bauman Instr. Corp. 918-492-8086
PA Radnor, Pressure Prods. Inc. 215-688-7795
TN Memphis, FLW Southeast, Inc. 901-345-3563
TX Arlington, Collinsystems, Inc. 817-261-2703
TX Houston, Collinsystem Inc. 713-464-9428
UT Layton, Dynatech, Inc. 801-546-4837
WA Redmond, S.E.A. Sls. 206-883-4999
WA Vancouver, S.E.A. Sls. 206-573-5161
Can Woodbridge, Ont., Technel Engrg. Inc. 416-851-4244

Local Distributors

AL Decatur, MG Elctrns. & Equip. Co. 205-355-6121
CO Lafayette, Big Horn Instrmn. 303-665-4054
CT Meriden, Meriden Cooper 203-237-8448
GA Columbus, Wetherbee Elec. Supp. Inc. 404-568-0157
GA Smyrna, Plant Instrs. Co. 404-436-7393
IL Rockford, Power/mation 815-397-0510
IN Indianapolis, J. N. Fauver Co., Inc. 317-872-3060
MA Billerica, Eastronix 617-670-2400
MI Kalamazoo, North Cen. Engrg., Inc. 616-349-3010
MI Midland, North Cen. Engrg., Inc. 517-631-3274
MI Taylor, North Cen. Engrg., Inc. 313-942-942-0900
MN St. Paul, Power/mation 612-645-0781
MO Kansas City, ISL Corp. 816-587-5400
MO St. Louis, ISL Corp. 314-535-5760
NY Albany, KOM Lamb Inc. 518-382-1044
NY Buffalo, KOM Lamb Inc. 716-874-3530
NY Rochester, KOM Lamb Inc. 716-266-1868
NY Syracuse, KOM Lamb Inc. 315-455-7436
NC Charlotte, EMCO 704-372-8281
OH Sharonville, Production Resources, Inc. 513-777-0400
OH Twinsburg, The Stanley M. Proctor Co. 216-425-7814
OR Portland, Brancom Instr. 503-283-2555
UT Salt Lake City, Rust Automation Equip. 801-486-9865
WA Colbert, Brancom Instr. 509-466-9365
WA Seattle, Brancom Instr. 206-762-6050
WI Green Bay, Power/mation 414-496-0944
WI Waukesha, Power/mation 414-542-2868

DATA I/O CORP., 10525 Willows Rd. N.E., Redmond, WA 98073-9746, Tel: 206-881-6444, TELEX: 15-2167; Empl.: 550

DATAK CORP., 3117 Paterson Plank Rd., N. Bergen, NJ 07047, Tel: 201-863-7667; *Sls. Mgr.:* Theresa Pflueger ..... **C•1604, 1738, 1842**

Local Sales Offices & Reps

AL Birmingham, Henry W. Phillips Co., Inc. 205-979-3572
CA City of Industry, Don Forth Assocs. ... 818-333-8009
CA Foster City, Polach & Bensinger 415-578-8200
CO Denver, MKP Mktg., Inc. 303-759-5661
FL Lauderdale Lakes, Seacom Sls. Co., Inc. 305-486-0260
GA Roswell, Henry W. Phillips Co. 404-992-3070
IL Wheaton, Archie Joyner Assocs. 312-665-6222
IN Indianapolis, Elmarcon, Inc. 317-846-0221
MI Grand Blanc, Inter-Comm, Inc. 313-695-0666
MO Raytown, Marty Taraski Sls. 816-358-1442
NJ Willingboro, Austin Assocs. 609-871-9290
NY Farmington, Integrity Mktg. Co. 716-924-3671
NC Statesville, Henry W. Phillips Co., Inc. 704-876-0730
OH Novelty, L. W. Bennett & Assocs. 216-564-9772
PA Philadelphia, Instrmn. Specialties 215-742-0898
RI Coventry, Adams McGregor 401-726-1300
TX Dallas, J & J Sls. Co. 214-328-9739

Local Distributors

AL Birmingham, ACK Radio Supp. Co. 205-322-0588
AZ Tempe, Circuit Specialists 602-966-0764
AZ Tucson, Inland Elctrns. 602-889-5301
CA Berkeley, Al Lasher's Elec. 415-843-5915
CA Milpitas, Zack Elctrns. 408-942-5432
CA Pasadena, Dow Radio 818-793-1196
CA San Francisco, Zack Elctrns. 415-626-1444
CA San Jose, Quement Elctrns. 408-998-5900
CA Sunnyvale, Fry's Elctrns. 408-733-1770
CA Thousand Oaks, Pace Elctrns. 805-497-7515
CO Denver, Gateway Elctrns. 303-458-5444
CT Greenwich, Wise Comps. 203-531-4880
CT Hartford, Hatry Elec. 203-527-1881
CT Wallingford, Tron Town U.S.A. 203-237-5598
DE Wilmington, Wholesale Elctrns. 302-656-9988
FL Miami, Elctrn. Equip. 305-871-3500
FL Orlando, Orlando Frame & Art 305-898-6271
GA Atlanta, Ack Elctrn. Supp. 404-351-6340
GA Atlanta, Specialty Distrb. Co. 404-873-2521
IL Berwyn, B-B & W, Inc. 312-749-1710
IL Mt. Prospect, Tri-State Elec. 312-255-0600
IL Niles, Joseph Elec. 312-297-4200
IL Peoria, Klaus Radio, Inc. 309-691-4840
IN Evansville, Hutch & Son 812-425-7201
IN Greenwood, Dick Smith Elctrns. 317-887-3425
IN Indianapolis, Bell Inds. 317-634-8202
IA Cedar Rapids, Deeco, Inc. 319-365-7551
KS Wichita, RSC 316-267-5213
KY Louisville, Peerless Elec. 502-637-7674
LA Lafayette, Ralph's 318-233-0105
LA New Orleans, Southern Radio Supp. .. 504-524-2343
MD Baltimore, A S I Elec. 301-265-5100
MD Rockville, Capitol Radio Whlsrs. 301-881-2270
MA Hingham, Sager Elctrl. Supp. 617-749-6700
MA Needham, You-Do-It Elctrns. 617-449-1005
MA Norwood, Gerber Elec. 617-769-6000
MI Flint, Shand Elctrns. 313-743-8940
MI Livonia, Norwest Elctrns. 313-261-4551
MN Minneapolis, Acme Elctrns. 612-338-4754
MO Kansas City, Elctrn. Supp. 816-931-0250
MO St. Louis, Gateway Elec. 314-427-6116
MO St. Louis, Van Sickle 314-621-5000
NE Lincoln, Scott Elec. Supp. 402-466-8221
NV Las Vegas, Hurley Elec. 702-384-5666
NV Reno, Elect. Distr. Co. 702-323-2766
NH Pelham, Radio Kit 603-635-2235
NH Pelham, Radiokit 603-635-2235
NJ Greenbrook, Greenbrook Elctrns. 201-968-3500
NJ Rahway, RSR Elctrns. 201-381-8777
NY Buffalo, Summit Distr. 716-887-2800
NY Hauppauge, Broadline Elctrns. 516-231-4100
NY Plainview, Kelvin Elctrns. 516-349-7620
NC Raleigh, Southeastern Elctrns. 919-828-2311
OH Cincinnati, URI Elec. 513-761-4030
OH Columbus, Hughes Peters 513-351-2000
OK Tulsa, Elctrn. Design 918-438-2349
OR Beaverton, Norvac Elec. 503-644-1025
OR Portland, Portland Radio Supp. 503-228-8647
PA Braddock, Leff Elctrns. 412-351-5000
PA Drexel Hill, Kass Elctrns. 215-449-2300
PA Philadelphia, A.C. Radio 215-462-9379
PA Reading, Barbey Elctrns. 215-376-6116
RI Providence, W. Dandreta & Co. 401-861-2800
SC Charleston, Wholesale Inds. Elctrns. .. 803-722-2634
TN Memphis, Bluff City Distr. 901-345-9500
TX Dallas, Electrotex Elect. Corp. of TX ... 214-234-0433
TX El Paso, Ideal Indl. Elec. Supp. 915-779-6647
TX Houston, Elctrn. Parts Outlet 713-784-0140
TX San Antonio, Altex Elctrns. 512-828-0503
UT Salt Lake City, Kimball Elec. 801-328-2075
UT Salt Lake City, Standard Supp. Co. 801-486-3371
VA Arlington, Arlington Elec. Whlse. 703-524-2412
VA Norfolk, Priest Elctrns. 804-855-0105
WA Seattle, Seattle Art 206-625-0711
WI Milwaukee, Indl. Elctrns. 414-276-1212

DATALINEAR, Sipex Corp., 491 Fairview Way, Milpitas, CA 95035, Tel: 408-943-1079; Empl.: 90

DATAMETRICS CORP., 8966 Comanche Ave., Chatsworth, CA 91311, Tel: 818-341-2901, TWX: 910-495-2009; FSC No.: 19059; Empl.: 275; *Sls. Mgr.:* Jim Foti

DATAMETRICS INC., 340 Fordham Road, Wilmington, MA 01887, Tel: 617-658-5410, TWX: 710-347-7672; Empl.: 150; *Sls. Mgr.:* A. W. Siff

FAX: 714-754-5407

DATAPOWER INC., Power Systems Div., 3545 Cadillac Ave., Costa Mesa, CA 92626, Tel: 714-754-4400, TWX: 910-595-1560; Empl.: 120; *Sls. Mgr.:* Bob Gomez; *Dist. Mgr.:* Edward Blackman ..... **D•1690-1692**

Local Sales Offices & Reps

AL Huntsville, Magaro & Assocs. 205-882-0827
CA San Jose, P & M Elctrns. 408-287-0402,
FL Orlando, Magaro & Assocs. 305-859-6546,
GA Atlanta, Magaro & Assocs. 404-451-8862
IL Schaumburg, Engrg. Prods. 312-882-7640,
IN Cicero, Engrg. Prods. 317-984-5226,
IA Iowa City, Engrg. Prods. 319-354-5344,
MD Upperco, Imagitron Sls. 301-374-5600,
MA Chelmsford, Interstate Sls. Assocs. 617-256-2287
MN Edina, Engrg. Prods. 612-835-9022
NJ Fairfield, G & A Sls. 201-575-8080
NY Rochester, Apex Assocs. 716-254-6050
NY Roslyn Hgts., Travco Assocs. 516-621-3233,
NC Greensboro, Magaro & Assocs. 919-294-4783
OH Wooster, Damar co. 216-264-0971,
OR Beaverton, Quest Mktg. 503-641-7377
TX Houston, Prime Tech. Sls. 713-894-4161,
TX Plano, GW Prods. 214-422-1746
UT Salt Lake City, Harris/CSI 801-467-2299,
WA Bellevue, Quest Mktg. 206-747-9424

DATA POWER, See Beaver Labs

DATA PRECISION CORP., Analogic Corp., Electronics Ave., Danvers, MA 01923, Tel: 617-246-1600, TELEX: 6817144; Empl.: 140; *Sls. Mgr.:* Jay Long

DATAPRINTER CORP., Printronix, 99 Middlesex St., Malden, MA 02148, Tel: 617-321-2400; Empl.: 175; *Sls. Mgr.:* Joseph Marolda, Corp. Sls. Mgr.

DATAPROBE, 170 Coolidge Ave., Englewood, NJ 07631, Tel: 201-569-6464, TELEX: 200679-PROB-UR, FAX: 201-894-0939; Empl.: 20; *Sls. Mgr.:* D. Weiss; *Dist. Mgr.:* S. Weiss

DATAPRODUCTS CORPORATION, 6200 Canoga Ave., Woodland Hills, CA 91365, Tel: 818-888-4014, TELEX: 67-4734; Empl.: 4200; *Sls. Mgr.:* Keith Bauserman; *Dist. Mgr.:* Keith Bauserman

DATAPRODUCTS NEW ENGLAND, INC., 50 Barnes Park North, Wallingford, CT 06492, Tel: 203-265-7151, FAX: 203-265-9101; Empl.: 450; *Sls. Mgr.:* Louis Jurgens

DATAQ INSTRUMENTS, INC., 825 Sweitzer Ave., Akron, OH 44311, Tel: 216-434-4284, TELEX: 6502817028

DATA RACE, INC., 12758 Cimarron Path, San Antonio, TX 78249, Tel: 512-692-3909, TELEX: 517659 RTS TX, FAX: 512-692-7632; Empl.: 28; *Sls. Mgr.:* Garrick C. Colwell

DATARAM CORP., P. O. Box 7528, Princeton, NJ 08543-7528, Tel: 609-799-0071, 800-822-0071, TWX: 510-685-2542, FAX: 609-799-6734; Empl.: 110; *Sls. Mgr.:* James D. Tropp

DATA RAY CORP., 452 Burbank Street, Broomfield, CO 80020, Tel: 303-469-5173, FAX: 303-466-9524; Empl.: 75; *Sls. Mgr.:* E. Yanagida

DATA RENTALS/SLS., INC, 4209 Van Owen Place, Burbank, CA 91505, Tel: 818-843-1221; Empl.: 140; *Sls. Mgr.:* Steven Beaver, VP Mktg.

DATA SET CABLE CO., INC., 748 Danbury Rd., Ridgefield, CT 06877, Tel: 203-438-9684, TWX: 710-467-0668, FAX: 203-431-4657; *Sls. Mgr.:* T. Busch

DATASOUTH COMPUTER CORP., 4216 Stuart Andrew, P.O. Box 240947, Charlotte, NC 28224, Tel: 704-523-8500, TELEX: 6843018, FAX: 704-523-9298; Empl.: 160; *Dist. Mgr.:* Ann Vetas

DATA SPECIALTIES, INC., See Zebra Technologies Corp.

DATA TECH, DIV. OF PENRIL CORP., See Moisture Register Products Div., Aqua Measure Instrument Co.

DATA TECHNOLOGY, INC., 4 Gill St., Woburn, MA 01811, Tel: 617-935-8820, FAX: 617-935-9656; Empl.: 45; *Sls. Mgr.:* D. Skenderian

Local Sales Offices & Reps

CA Lomita, Tech Rep Assocs. 213-539-9070
CA San Jose, Motion Control 408-997-0544
CO Englewood, Thorson Rocky Mtn., Inc. 303-799-3435,
FL Melbourne, R-Rep Co. 305-725-6993
IL Elk Grove Vl, Carlson Elctrn. Sls. 312-956-8240
NY E. Rochester, A & D Dvcs. 716-385-2778
NY Hawthorne, Swedelco, Inc. 914-747-0101
NY Sidney, A & D Dvcs. 607-563-8488
OH Cincinnatti, Drivex Corp. 513-474-5100
TX Dallas, Blackburn Assocs. 214-750-8484,

DATATRAN CORP., 355 Yuma St., Denver, CO 80223, Tel: 303-778-0870, FAX: 303-778-0877; Empl.: 17; *Sls. Mgr.:* Cindi L. Kemper; *Dist. Mgr.:* Cindi L. Kemper

DATA TRANSLATION, INC., 100 Locke Dr., Marlboro, MA 01752, Tel: 508-481-3700, TELEX: 951646, FAX: 617-481-8620; FSC No.: 61867; Empl.: 230; *Sls. Mgr.:* Ellen Wirka

DATATROL, Division of Data Card Corporation, Brent Dr., Hudson, MA 01749, Tel: 617-568-1411; Empl.: 125; *Sls. Mgr.:* Howard Cantor

Distributor

DATATRONICS, LTD., P. O. Box 2839, Blue Jay, CA 92317, Tel: 714-336-3561, TWX: 910-595-1578 DATAN US LKARW 660, 682, 715, 718, 758, 774, 799, 813

DATATRONIC SYSTEMS CORP., Computer Sciences Div., Bx 44128 EEM/NMR, Panorama City, CA 91412-0128, Tel: 818-988-5290; Empl.: 150

DATA WORLD PRODUCTS, Second N.H. Tpke., Francestown, NH 03043, Tel: 603-588-3746; *Sls. Mgr.:* Stephen Berry

DATAWRAP, INC., 37 Water St., Wakefield, MA 01880, Tel: 617-246-5757; Empl.: 16; *Sls. Mgr.:* Tony Lockwood

DATEC, INC., 200 Eastowne Dr., Ste. 116, Chapel Hill, NC 27514, Tel: 919-929-2135; Empl.: 75; *Sls. Mgr.:* Walt Lovett

DA-TECH CORP., 141 Railroad Drive, Ivyland, PA 18974, Tel: 215-322-9410; Empl.: 110; *Sls. Mgr.:* Bradford W. Bentz

DATEL

FAX: 617-339-6356

DATEL, INC., 11 Cabot Blvd., Mansfield, MA 02048, Tel: 617-339-3000, TELEX: 95-1340, TWX: 710-346-1953; Empl.: 650; *Sls. Mgr.:* N. Renaud ..... **D•1153-1161**

Local Sales Offices & Reps

AL Hunstville, Electronic Mfrs' Agts. 205-830-4030
AZ Phoenix, Tech. Sls. 602-246-1614
CA Santa Ana, Datel 714-835-2751
CA Sunnyvale, San Jose 408-297-7944
CO Denver, Elcom, Inc. 303-337-2300
FL Coral Springs, H. A., Inc. 305-752-7520
GA Roswell, Electronic Mfrs' Agts. 404-992-7240
IL Hoffman Estates, Carvel Engrg. & Sls. 312-885-8800
IA Marion, Ensco-Rep, Inc. 319-377-8551
KS Wichita, Ensco-Rep Inc. 316-683-1070
MA Mansfield, Datel 617-339-3000
MI Auburn Hgts., Infinity, Inc. 313-853-9880
MN Edina, Carvel Engrg. & Sls. 612-835-7929
MO Maryland Heights, Ensco-Rep, Inc. 314-423-3935
NM Albuquerque, Cleveland Entprs. 505-265-7893
NY Babylon, Astrorep 516-422-2500
NY Clark Mills, KLM-Garner 315-853-6126
NY Pittsford, KLM-Garner 716-381-8350
OH Cleveland, Arthur Baier Co. 216-461-6161
OH Dayton, Arthur Baier Co. 513-276-4128
PA Pittsburgh, Arthur Baier Co. 412-367-7799
TX Carrollton, Tech. Mktg., Inc. 214-387-3601
TX Houston, Technical Mktg., Inc. 713-783-4497
TX Round Rock, Technical Mktg., Inc. 512-244-2291
UT Salt Lake City, Elcom, Inc. 801-485-7415
VA Arlington, H. J. Heffernan 703-522-6666
WI Sheboygan, Carvel Engrg. & Sls. 414-457-8800

Local Distributors

AL Huntsville, Schweber Elctrns. 205-895-0480
AZ Phoenix, Schweber Elctrns. 602-997-4874
CA Canoga Pk, Schweber Elctrns. 818-999-4702
CA Gardena, Schweber Elctrns. 213-327-8409
CA Irvine, Schweber Elctrns. 714-863-0200
CA Sacramento, Schweber Elctrns. 916-929-9732
CA San Diego, Schweber Elctrns. 619-450-0454
CA San Jose, Schweber Elctrns. 408-432-7171
CO Englewood, Schweber Elctrns. 303-799-0258
CT Danbury, Schweber Elctrns. 203-748-7080
FL Altamonte Springs, Schweber Elctrns. 305-331-7555
FL Pompano Bch., Schweber Elctrns. 305-977-7511
GA Norcross, Schweber Elctrns. 404-446-5842
IL Elk Grove Vl, Schweber Elctrns. 312-364-3750
IA Cedar Rapids, Schweber Elctrns. 319-373-1417
KS Overland Pk, Schweber Elctrns. 913-492-2922
MD Gaithersburg, Schweber Elctrns. 301-840-5900
MA Bedford, Schweber Elctrns. 617-275-5100
MI Livonia, Schweber Elctrns. 313-525-8100
MN Edina, Schweber Elctrns. 612-941-5280
MO Earth City, Schweber Elctrns. 314-739-0526
NJ Fairfield, Schweber Elctrns. 201-227-7880
NY Rochester, Schweber Elctrns. 716-424-2222
NY Westbury, Schweber Elctrns. 516-334-7474
NC Raleigh, Schweber Elctrns. 919-876-0000
OH Beachwood, Schweber Elctrns. 216-464-2970
OH Dayton, Schweber Elctrns. 513-439-1800
OH West Chester, Arthur Baier Co. 513-779-2395
OH Worthington, Arthur Baier Co. 614-764-1144
OK Tulsa, Schweber Elctrns. 918-622-8003
PA Horsham, Schweber Elctrns. 215-441-0600
PA Pittsburgh, Schweber Elctrns. 412-782-1600
TX Austin, Schweber Elctrns. 512-458-8253
TX Dallas, Schweber Elctrns. 214-661-5010
TX Houston, Schweber Elctrns. 713-784-3600
WI New Berlin, Schweber Elctrns. 414-784-9020

DATRON INSTRUMENTS, A Wavetek Company, Hurricane Way, Norwich, England, United Kingdom NR6 6JB, Tel: 603-404824, TELEX: 851975173, FAX: 603-483670

DATRON INSTRS., INC., 3401 SW 42nd Ave., Stuart, FL 33497, Tel: 305-283-0935, TELEX: 525724; FSC No.: 66-15b,66-23F,66 Part II SECT H, J; Empl.: 120; *Sls. Mgr.:* Irene Bugno

DATRON SYSTEMS, INC., 200 West Los Angeles Ave., Simi Valley, CA 93065-1650, Tel: 805-584-1717, TWX: 910-494-2787; FSC No.: 32255; Empl.: 122; *Sls. Mgr.:* Bruce Strean, VP Mktg.

DATUM INC., Timing/Aacom Divisions, 1363 S. State College Blvd., Anaheim, CA 92806-5790, Tel: 714-533-6333, TELEX: 4722045 (intl.), TWX: 910-592-1289; FSC No.: 31160; Empl.: 280; *Sls. Mgr.:* Charles Neumann ..... **D•1062, 1163**

Local Sales Offices & Reps

AL Huntsville, Southern Mktg. Assocs. Ltd. 205-534-6020
CA Anaheim, Datum 714-533-6333
CA San Diego, M. Ficken 619-292-9392
CA Santa Clara, Ward/Davis Assocs. 408-245-3700
CO Denver, Vic Meyers Assocs. Inc. 303-629-9676
CT Mt. Carmel, Scientific Dvcs.- Connecticut 203-248-9361
FL Longwood, Southern Mktg. Assocs. Ltd. 305-682-7317
FL Satellite, Southern Mktg. Assocs. Ltd. 305-777-3587
GA Marietta, Southern Mktg. Assocs. Ltd. 404-565-0603
IL Des Plaines, Marsland Assocs. 312-298-2620
IN Indianapolis, Marsland Assocs. 317-293-5437
MA Waltham, Scientific Devices-New England 617-890-2252
MA Wayland, Daner-Hayes 617-655-0888
WI New Berlin, Marsland 414-786-6611
MN Minneapolis, Marsland Assocs. 612-545-4481
MO St. Louis, Marsland Assocs. 314-991-1399
NJ Haddonfield, G. L. Williams Assocs. 609-428-6060
NM Albuquerque, Vic Meyers Assocs. Inc. 505-884-6878
NC Greensboro, Southern Mktg. Assocs. Ltd. 919-282-6001
OH Centerville, Micro Sls. Corp. 513-433-8171
OH No. Olmsted, Micro Sls. Corp. 216-734-3080
OK Tulsa, Data Mktg. Assocs. 918-494-2711
TX Austin, Data Mktg. Assocs. 512-443-7722
TX Dallas, Data Mktg. Assocs. 214-661-0300
TX Houston, Data Mktg. Assocs. 713-780-2511
TX San Antonio, Data Mktg. Assocs. 512-342-3031
UT Salt Lake City, Vic Meyers Assocs. Inc. 801-581-1760
MD Rockville, Creative Mktg. Assocs. 301-251-4100
WA Seattle, Comptronics 206-284-4842

DAVIDGE CORPORATION, 94 Commerce Dr., Buellton, CA 93427, Tel: 805-688-9598, TWX: 910-250-0233, ESYLNK: 62001250; *Sls. Mgr.:* Dean Davidge

THE DAVID HAFLER CO., Rockford Corp., 5910 Crescent Blvd., Pennsauken, NJ 08109, Tel: 609-662-6355, TELEX: 1561119, FAX: 609-662-9173; *Sls. Mgr.:* R. H. Tucker

DAVIDSON ELCTRN. DEV. CO., 113 E. 13th St., Erie, PA 16512, Tel: 814-454-6448; Empl.: 27

DAVIES, HARRY, MOLDING CO., 4920 Bloomingdale Ave., Chicago, IL 60639, Tel: 312-622-8966; FSC No.: 72512; Empl.: 113; *Sls. Mgr.:* Leo A. Sera; *Dist. Mgr.:* Leo A. Sera

DAVIS ELEC. CO., Box 38, Cape Girardeau, MO 63701, Tel: 314-335-5547; Empl.: 40

DAYCO PRODUCTS, INC., 333 W. First St, Dayton, OH 45401, Tel: 513-226-5923, TELEX: 288219, TWX: 810-459-1822; Empl.: 10000

DAYTRONIC CORP., Hawker Siddeley, 2589 Corporate Pl, Miamisburg, OH 45342, Tel: 513-866-3300, TWX: 810-473-2978, FAX: 513-866-3327; Empl.: 180; *Sls. Mgr.:* John A. Perkins

DBA SYSTEMS, INC., P.O. Drawer 550, Melbourne, FL 32902-0550, Tel: 305-727-0660, TELEX: 56-4383; Empl.: 740

D-B-DEVELOPMENTS, 7709 Kilbourne Rd., Rome, NY 13440, Tel: 315-339-1265; Empl.: 3

D-CEMCO, 3200 N. San Fernando Blvd., Burbank, CA 91504, Tel: 213-849-6341, TWX: 970-498-2228; Empl.: 50; *Sls. Mgr.:* Cliff Crowder

DCI INC., 14812 W. 117th Street, P.O. Box 215, Olathe, KS 66061, Tel: 913-782-5672, TELEX: 988700; FSC No.: 58677; Empl.: 15; *Sls. Mgr.:* Rob Steffens ..... **B•1054; D•1356**

Local Sales Offices & Reps

AL	Huntsville, Saber Assocs.	800-327-0853
AZ	Phoenix, J. Smith & Assoc.	602-267-0981
CA	Los Altos, XEL	415-969-1222,
CA	Los Angeles, Power Partners	213-215-0800,
CA	Redwood City, N-S Assocs.	415-851-2703
CO	Colorado Springs, J. Smith & Assoc.	303-597-5343
CT	Tolland, R. G. Assoc.	203-875-4201
FL	Melbourne, Saber Assocs.	305-724-0920
GA	Lawrenceville, Saber Assocs.	800-327-0853
IL	Chicago, Commodore I	312-394-5441
IN	Indianapolis, Commodore I	317-636-3318
KS	Shawnee Mission, Vertec	816-737-0377
MA	Danvers, R. G. Assocs.	617-837-3290
MN	Minneapolis, Trask Engrg.	612-537-2434
MO	St. Louis, Vertec	314-394-6242
NJ	Cherry Hill, Analectro, Inc.	609-424-2883
NJ	Parsippany, Analectro	201-386-9677
NM	Albuquerque, J. Smith & Assoc.	505-265-3406
NY	Latham, L-Tron	518-785-5032
NC	Clayton, Saber Assocs.	800-327-0853
OH	Dayton, Bradcor	513-294-5477
OH	Euclid, Bradcor	216-261-0888
TX	Richardson, Meas. Sys. & Sls.	214-644-4954
VA	Alexandria, Analectro	703-823-1703
Can	Montreal, Que., Morrison & Force Dvcs.	514-737-0072,

DEAK TECHNOLOGY, INC., See Elpaz Instruments, Inc.

DEARBORN WIRE & CABLE, INC., 250 W. Carpenter, Wheeling, IL 60090, Tel: 312-459-1000, 800-323-0198, TWX: 910-253-0343, FAX: 312-459-0170; FSC No.: 28105; Empl.: 90; *Sls. Mgr.:* Ray Grabowski; *Dist. Mgr.:* Donna Kudlicki

DE COURSEY ENGINEERING LABORATORY, 11828 W. Jefferson, Culver City, CA 90230, Tel: 213-EX7-9668; Empl.: 7

DEGUSSA CORP., 104 New Era Drive, So. Plainfield, NJ 07080, Tel: 201-757-6500, TELEX: 4754247, FAX: 201-757-8561; FSC No.: 630673043; *Sls. Mgr.:* David W. Molnar

Local Sales Offices & Reps

CA	Laguna Hills, Measure-Tech	714-859-3600
CA	Mtn. View, Gado	415-961-2222
CO	Littleton, Bennett Co.	303-933-1690
MA	Hudson, Electro-Svcs. Inc.	617-562-7798
NJ	Hohokus, Par Assocs.	201-444-6200
PA	Bethel Park, Advance Instr.	412-835-6200
PA	Doylestown, Scott Instrs.	215-348-8989
TN	Knoxville, Hile Controls of Tenn.	615-584-0208
VA	Chester, Hile Controls of VA	804-796-3001
WI	Milwaukee, Allan Engrg.	414-353-5070

DEI, 230 N. Market Pl., Escondido, CA 92025, Tel: 619-743-8344; Empl.: 30; *Sls. Mgr.:* Matt Pedote

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DEK INC., 3480 Swenson Ave., St. Charles, IL 60174, Tel: 312-377-2575; Empl.: 115; *Sls. Mgr.:* L. R. Pappone ..... **C•1843**

Local Sales Offices & Reps

CA	El Segundo, El Segundo Elec. Supp.	213-322-9365
CA	Santa Clara, Walter Assocs.	408-727-1200
CO	Denver, Grimes Mktg.	303-759-8969
CO	Englewood, Frontier, Carl Grimes	303-799-6063
FL	Plantation, Tropi-Tec	305-581-0101
MA	Andover, Richard Purinton, Inc.	617-475-7055
MN	Brooklyn Park, North Central Sls.	612-541-1539
NJ	East Orange, Willgold Sls.	201-678-7700
NY	Buffalo, Kopin Sls. & Mktg.	716-835-3957
OR	Milwaukee, Olympic Agencies	503-652-2104
TN	Paris, Southern States Indl. Sls.	901-642-0885
TX	Crowley, Service Assocs.	817-294-0850
VA	Richmond, Triangle Sls.	804-355-5864

Local Distributors

AZ	Tempe, PSN Distrs.	602-623-9800
CA	Freson, EPC Alarm Supp. Distr.	209-275-0206
CA	Gardena, EPC Alarm Supp. Co.	213-327-0001
CA	Riverside, Elctrn. Supp.	714-683-7300
CA	Santa Clara, Waltronic Sls.	408-727-1200
FL	Miami, EPC Alarm Supp. Co.	305-593-0004
GA	Tucker, C.I.D. Inc.	404-491-3143
IL	Addison, L-Comp	312-628-1400
IL	Downers Grove, Great Northern Wire & Cable	213-627-1777
IN	Indianapolis, PEI/Genesis	317-637-5571
KS	Wichita, L-Comp	314-291-6200
LA	Shreveport, Wholesale Elctrns.	318-222-2063
ME	Bangor, Industrial Comps.	207-942-2600
MD	Hanover, Vertex-Mid Atlantic	301-796-5000
MA	No. Wilbraham, Indl. Comps. Corp.	800-628-9646
MI	Lavonia, EPC Supp. Co.	313-591-9100
MN	St. Paul, Arden Indl. Prods.	612-483-6681
MO	Kansas City, L-Comp Kansas	816-221-2400
NJ	Kenilworth, Federated	201-272-0505
NY	Farmingdale, Vertex Elctrns.	516-293-9880
NY	Great Neck, T.W. Comcorp	314-569-2950
NY	Rochester, General Elec. Supp.	716-424-2820
NY	White Plains, Benefield Elec.	914-948-6660
OH	Cleveland, Vertex Wire & Cable	216-831-7140
OH	Columbus, Elctrn. Mktg.	614-299-4161
PA	Philadelphia, PEI/Genesis	215-568-7400
TX	Ft. Worth, Ft. Worth Wire & Cable	817-232-4100
TX	Houston, Litecomm Supp.	713-688-1447
UT	Salt Lake City, Coleman's Mining & Elec.	801-484-5238
VA	Leesburg, Elctrn. Wire & Cable	703-471-9430
WI	Waukeshaw, Cable Comps.	414-785-1060
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DELBERT BLINN CO., Box 2007, Pomona, CA 91769, Tel: 714-629-3900, FAX: 714-622-6218; Empl.: 6 ..... **A•2130**

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NY	Commack, Kaelber & Mack	516-499-2924
WA	Woodinville, W. J. Stulgis Co.	206-486-8539

Local Distributors

MN	Minneapolis, Stark Elctrns.	612-332-1325

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DELCAP, Div. of American Precision Industries, Inc., 274 Sandusky Road, P. O. Box 38, Arcade, NY 14009, Tel: 716-652-3600, TELEX: 91-293; FSC No.: 5910; Empl.: 6; *Sls. Mgr.:* Denis Kohlhagen; *Dist. Mgr.:* Denis Kohlhagen

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DEL ELCTRNS. CORP., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, Tel: 914-699-2000, TWX: 710-562-0130; FSC No.: 01378; Empl.: 115 ..... **A•1072, 2210; D•1693-1697**

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AZ	Tempe, Trembly Assocs.	602-967-2058
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CA	Mountain View, Leddy Assocs., Inc.	415-969-6313
CO	Wheatridge, Trembly Assocs.	303-421-8900
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MA	Burlington, TriTek	617-272-4550
MI	Dearborn, Pitcher-Poulin	313-582-5450
MN	Burnsville, Allied Comps. Reps., Inc.	612-435-7876
NV	Las Vegas, Trembly Assocs.	702-739-9770
NM	Albuquerque, Trembly Assocs.	505-266-8616
NY	E. Syracuse, Nycom Inc.	315-437-8343
PA	Ardmore, Martin Assocs.	215-649-6332
TX	Richardson, Barry Sls.	214-234-0255
UT	Salt Lake City, Trembly Assocs.	801-486-5292

DELEVAN DIV., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, Tel: 716-652-3600, TELEX: 91-293, FAX: 716-652-4814; FSC No.: 99800; Empl.: 300; *Sls. Mgr.:* Denis Kohlhagen ... **A•1241-1243**

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AZ	Phoenix, Toward Engrg.	602-955-3193
CA	Del Mar, Galaxie Sls. Int'l.	619-480-5540
CA	El Toro, Delevan	714-768-5522
CA	Freemont, Advanced Technlg. Sls.	415-651-6402
CA	Santa Ana, Galaxie Sls. Int'l.	714-541-5793
CO	Aurora, High Tech Assocs.	303-695-1990
CO	Englewood, Romulus	303-770-4888
FL	Hollywood, Askland Elctrn. Comps.	305-987-1074
IL	Downers Grove, Momak Sls.	312-963-6400
IN	Fort Wayne, Walter W. Bieberich	219-432-2537
IN	New Albany, Walter W. Bieberich	812-945-3187
IA	Cedar Rapids, C. Horn & Asst.	319-393-8703
KS	Parker, S. W. Wollard	913-898-6552
MD	Lutherville, D. A. Dougherty Sls. Co.	301-321-7890
MA	Sterling, Compatible Comps.	617-422-6762
MN	Mendota Hgts., G-II Sls.	612-454-3086
NJ	Bellmawr, TAI	609-933-2600
NY	Johnson City, Tech-Mark	607-729-6340
NY	Manhassett, Martech Assocs.	516-627-1151
NY	Mendon, Tech-Mark	716-624-3840
NY	Utica, Tech-Mark	315-733-0575
NC	Raleigh, Godwin	919-878-8000
PA	Pittsburgh, Convert & Newman	412-531-2002
TX	Irving, Kite Elctrn. Sls. Co.	214-986-0321
WA	Bellevue, N. R. Schultz	206-454-0300
Can	Mississauga, J. G. Weiss Co. Ltd.	416-673-0011
Can	Nepean, J. G. Weiss Co. Ltd.	613-825-0545
Can	St. Laurent, J. G. Weiss Co. Ltd.	514-337-5022
Can	Vancouver, J. G. Weiss Co. Ltd.	604-873-1112
Can	Winnipeg, J. G. Weiss Co. Ltd.	204-949-1877

Local Distributors

CA	Fountain Valley, Comp. Center	714-979-0433
CA	Irvine, Integrated Elctrns.	716-837-9960
CA	Irvine, ITT Multicomponents	714-727-4001
CA	Santa Clara, WDG/Santa Clara	408-727-2500
CA	Stanton, Inductive Comps.	716-828-3420
FL	Ft. Lauderdale, Bros. Elec. of FL	800-331-8080
FL	Tampa, Passive Technlg.	813-623-1935
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
MA	Burlington, Compatible Comps.	617-270-9246
MA	Sterling, Compatible Comps.	617-422-6762
MN	Fridley, Voyager Elctrns. Corp.	612-571-7766
NJ	E. Brunswick, Brothers Elctrns.	201-238-2200
NJ	Fairfield, CWPS	201-822-0997
NJ	W. Berlin, GCI	609-768-6767
NY	Bohemia, Car-Lac	516-567-4200
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Farmingdale, Milgray/New York	516-420-9800
NY	Plainview, ACI Elctrns.	516-293-6630
PA	Norristown, Century Elctrn. Comp.	215-631-5400
TX	Fort Worth, Patco Supply	817-429-8596
Can	Burnaby B.C., R-A-E Indl. Elctrns. Ltd.	604-291-8866
Can	Don Mills, Ontario, Saynor Varah Elctrns.	416-445-0723
Can	Montreal, Quebec, Prelco Elctrns. Ltd.	514-389-8051
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DELTA ELECTRONICS MFG. CORP., 416 Cabot St., Beverly, MA 01915, Tel: 617-927-1060, TELEX: 710-347-0631; FSC No.: 00795; Empl.: 210; *Sls. Mgr.:* S. J. Somerset; *Dist. Mgr.:* R. J. Cullinan

DELTA M CORPORATION, 525 Warehouse Rd., Oak Ridge, TN 37830, Tel: 615-483-1569; *Sls. Mgr.:* Eugene F. Szafranski

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AL Huntsville, Technlg. Mktg. Assocs. Inc. 205-883-7893
CA Newport Bch., Venture Tech. Sls. 714-646-6475
CA Santa Clara, Gagner-Toomey Assocs. 408-244-2200
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CA Walnut, Cook Entprs. Inc. 714-594-0091
CO Wheatridge, Wescom Mktg. 303-422-8957
CT North Haven, Kitchen & Kutchen 203-239-0212
GA Atlanta, Technlg. Mktg. Assocs., Inc. ... 404-446-3565
FL Largo, Technlg. Mktg. Assocs., Inc. 813-536-3796
FL Melbourne, Technlg. Mktg. Assocs., Inc. 305-676-3776
FL Orlando, Technlg. Mktg. Assocs., Inc. .. 305-857-3760
FL Pompano Beach, Technlg. Mktg. Assocs., Inc. 305-977-9006
IL Wheeling, United Prods. Co. 312-459-1222
MA Burlington, Kitchen & Kutchen 617-229-2660
MN Edina, Hanna Lind Ltd. 612-925-5700
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NY Penfield, Tech. Assocs., Inc. 716-385-4240
NC Charlotte, Robert W. Chapman & Co. 704-525-2421
OH Shaker Hgts., Omega Sls., Inc. 513-434-5507
OH University Hgts., Omega Sls.-Cleveland 216-751-9600
OK Tulsa, Advance Tech. Sls. 918-664-0482
OR Beaverton, Evergreen Mktg. 503-643-8020
SC Greenville, Robert W. Chapman & Co. 803-288-8821
TX Austin, Component Technlg. 512-474-8698
TX Dallas, Ultra Rep 214-783-8831
TX Houston, Component Technlg. 713-961-1262
TX Houston, Texoma Tech. Sls. 713-462-1432
UT Salt Lake City, Wescom Mktg. 801-269-0419
VA Richmond, Glasscook Assocs. 804-740-0063
WA Seattle, Evergreen Mktg. 206-633-3160
PR San Juan, Elctrn. Tech. Sls. 809-720-1300
Can Ontario, Componetics Ltd. 416-479-7200
Can Quebec, Componetics Ltd. Que. 514-331-1498

Local Distributors

AL Huntsville, Hammond Elctrns. 205-830-4764
CA Anaheim, Tary Elctrns. 714-630-2464
CA Buena Park, Cypress Elctrns. 714-521-5230
CA Fullerton, Pyramid Elctrns. 714-773-0781
CA San Diego, Cypress Elctrns. 619-535-0011
CA San Diego, Pyramid Elctrns. 619-271-5404
CA San Diego, Sigma Elctrns. 619-565-2000
CA San Jose, Compass Comp. 408-432-7575
CA San Jose, Sierra West 408-435-7477
CA Santa Clara, Cypress Elctrns. 408-980-2500
CA Santa Clara, Pyramid Elctrns. 408-727-9810
CO Englewood, Industrial Elctrns. 303-694-9444
CO Wheatridge, Added Value Elctrns. 303-422-1701
CO Wheatridge, Cypress Elctrns. 303-431-2622
CT Wallingford, Cronin Elctrn. 203-265-3134
FL Ft. Lauderdale, Hammond Elctrns. 305-973-7103
FL Tampa, Reptron 813-855-4656
GA Norcross, Hammond Elctrns. 404-449-1996
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MA 617-657-6523
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MA Wilmington, JV Elctrns. 617-273-4300
MN Minneapolis, Berquist Co. 612-835-2322
NH Hudson, TNT Elctrns. 603-880-8300
NJ Camden, General Radio 609-964-8560
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WA Bothell, Cypress Elctrns. 206-483-1144
WA Kent, Pyramid Elctrns. 206-872-5800
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Can Montreal, Prelco Elctrns. 514-389-8051
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AL Huntsville, JWL Assocs. 205-883-1712
AZ Tucson, Earl Clemick & Assocs. 602-749-4003
CA Granada Hills, C & W Comp. Sls. 818-368-4032
CA Santa Clara, Gagner-Toomey Assocs. 408-244-2200
CO Boulder, Front Range Mktg. 303-443-4780
CT Bloomfield, Wood Sls. Corp. 203-243-0457
FL Deerfield Bch., Jack Krutek & Assocs. 305-427-4202
GA Atlanta, JWL Assocs. 404-320-7643
IL Glenview, E. J. McCaffrey & Assocs. .. 312-272-2820
IN Wannamaker, Nationwide Comps. 317-872-7207
MA Wakefield, Wood Sls. Corp. 617-245-8300
MI Farmington Hills, W. R. Hummon & Assocs. 313-474-0661
MN St. Paul, Kencotronics, Inc. 612-645-7717
MO Ellisville, Weisler & Assocs. 314-394-4543
NY Pt. Washington, Ashtec Inc. 516-767-0336
NY Rochester, Omni Sls. 716-342-5270
NC Pineville, JWL Assocs. 704-541-5750
OH Willoughby, Nationwide Comps. 216-946-3226
OR Portland, Control Dvcs. N.W. 503-659-3216
PA Jeffersonville, Providence Mktg. 215-630-0629
TX Houston, Weisler & Assocs. 713-467-1862
UT Midvale, Front Range Mktg. 801-566-2500
WA Bellevue, Control Dvcs. N.W. 206-451-8552
WI Milwaukee, Werking Ind. Sls. 414-964-2225
Can Chomedey, Que., Elcom GBM, Inc. 514-668-3361

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AZ Tempe, Control Design 602-829-7981
AR Little Rock, Carlton-Bates Co. 501-562-9100
CA Buena Park, Control Design 213-802-2429
CA Canoga Park, C & A Elctrns. 818-340-6022
CA Los Angeles, Electric Switches 213-660-1310
CA San Jose, Consolidated Parts 408-435-1200
CA Tustin, Western Switches 714-259-8144
CO Denver, Integrated Elctrns. 303-292-6121
CT New Haven, Hatry Elctrns. 203-787-5921
CT Waterbury, Century Elec. 203-755-0405
FL Altamonte Springs, Control Des. 305-788-3220
FL Ft. Lauderdale, SE Elctrns. 305-563-4131
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GA Atlanta, Georgia Control Ctr. 404-876-8833
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IN Indianapolis, Control Design 317-788-4559
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IA Davenport, Warren Radio 319-322-5301
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IA Marion, Control Des. 319-373-2923
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KS Wichita, Kriz-Davis Co. 316-267-4354
KY Louisville, Peerless Elctrn. Equip. 502-637-7674
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MA Brighton, Interstate Elctrns. Equip. 617-782-9000
MA Westborough, In Stock Prods. 617-870-5750
MI Jackson, Fulton Radio Supp. 517-784-6107
MI Madison Hgts., Galco Indl. Elctrns. 313-542-9090
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MO St. Louis, Van Sickle Radio Elctrns. ... 314-621-5000
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NJ Oakland, Relay Specialties 201-337-1000
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ND Minot, John Iverson Co. 801-852-4466
OH Akron, AESCO Elctrns. 216-762-8818
OH Wickliffe, Gateway Megatech 216-944-5801
OK Ardmore, Ardmore Elec. Supp. 405-223-3571
OK Tulsa, Radio, Inc. 918-587-9123
OR Portland, Dunn Elec. 503-285-0214
PA Erie, Rem Elctrns. 814-453-5626
PA Malvern, Control Design 215-296-0150
PA Philadelphia, Lindley Elec. 215-329-7005
SD Aberdeen, Plainsco 605-225-7100
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UT Salt Lake City, Kimball Elctrns. 801-328-2075
VA Glen Allen, Hermitage Distrs. 804-798-3830
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WA Kent, Pyramid Elctrns. 206-872-5800
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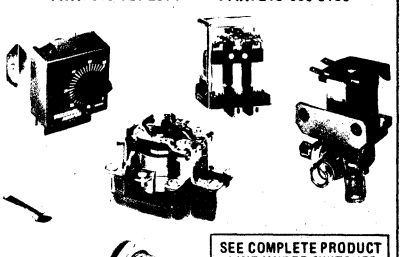

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DENSITRON CORPORATION

FAX: 213-534-8419

DENSITRON CORPORATION, 2540 W. 237th St, Torrance, CA 90505, Tel: 213-530-3530, TWX: 910-349-6200; FSC No.: 62483; Empl.: 65; *Sls. Mgr.:* Robert Turner; *Dist. Mgr.:* Robert Turner ..... **B•1052-1053**

Local Sales Offices & Reps

AL	Huntsville, E.M.A.	205-536-3044
AL	Huntsville, Elctrn. Mktg., Inc.	205-837-7363
AZ	Phoenix, Chaparral Elctrn., Inc.	602-252-0897
CA	Irvine, Comp. Mktg. Assocs.	714-951-5950
CA	Laguna Hills, Comp. Mktg. Assocs.	714-951-6046
CA	Lomita, Comp. Mktg. Assocs.	213-326-1460
CA	San Mateo, Comp. Mktg. Assocs.	415-345-7373
CA	Solana Bch., Comp. Mktg. Assocs.	619-481-9310
CA	Tarzana, Comp. Mktg. Assocs.	818-705-4087
CO	Arvada, Delconec	303-422-7023
CT	W. Hartford, Nova Assocs. (M-R Tech. Sls.)	203-521-2101
FL	Margate, E.P.M. Corp.	305-977-0331
GA	Atlanta, Elctrn. Mktg. Assoc., Inc.	404-448-1215
GA	Decatur, E.A.B., Inc.	404-981-1600
IL	Northbrook, H. Benjamin & Assoc.	312-272-2900
IA	Marion, Ensco-Rep, Inc.	319-377-8551
KS	Wichita, Ensco-Rep, Inc.	316-683-1071
MA	Braintree, Nova Assocs.	617-848-9330
MI	Jenison, R.C. Nordstrom & Co.	616-457-5762
MI	Southfield, R. C. Nordstrom & Co.	313-559-7373
MN	Minneapolis, Electro-Serv	612-338-3475
MO	Maryland Heights, Ensco-Rep, Inc.	314-423-3935
NJ	Cherry Hill, Metz-Benham Assocs., Inc.	609-424-0404
NY	Marcellus, J. G. Welch Assocs.	315-685-6280
NY	Mastic, Optimum Sls. Co.	516-589-4664
NY	Patchogue, Optimum Sls.	516-758-0644
NY	Rochester, J. G. Welch Assocs.	716-244-1100
NY	Rochester, Mullahy-Welch Sls.	716-266-2798
NC	Raleigh, C-Tech Sls.	919-847-0202
NC	Raleigh, Elctrn. Mktg. Assoc., Inc.	919-847-8800
OH	Worthington, Dynel Corp.	614-436-9452
PA	Wynnewood, Metz-Benham Assocs., Inc.	215-896-7300
SC	Greenville, Elctrn. Mktg. Assoc., Inc.	803-233-4637
TX	Seagoville, Delta Comp., Inc.	214-287-6333
WA	Seattle, J. J. Assocs., Inc.	206-246-6619
Can	Scarborough, Ont., Comm. Dvcs.	416-439-6320

DERINGER MFG. CO., 1250 Townline Road, Mundelein, IL 60060, Tel: 312-566-4100, TWX: 910-685-4321, FAX: 312-566-5370; *Sls. Mgr.:* R. Davis

DESIGNATRONICS, INC., See Automatic Coil Corp., Sub. Designatronics, Inc.

DESIGN AUTOMATION, INC., 809 Massachusetts Ave., Lexington, MA 02173-3992, Tel: 617-862-8998, TELEX: 247346 SBSB UR; FSC No.: 4D417; Empl.: 8

DESIGN COMPONENTS, INC., 1 Kenwood Circle, Franklin, MA 02038, Tel: 617-528-7300, 800-341-4811, FAX: 617-520-1424; Empl.: 60; *Sls. Mgr.:* James Boyd

DESIGN TECHNOLOGY, 5710 Ruffin Rd., San Diego, CA 92123, Tel: 619-268-8194, TELEX: 503476; Empl.: 50; *Sls. Mgr.:* Pamela Hamilton; *Dist. Mgr.:* Michael Golden

DESPATCH INDUSTRIES, 619 S.E. 8th St., P.O. Box 1320, Minneapolis, MN 55440-1320, Tel: 612-331-1873, TELEX: 29-0704, TWX: 6288-5512; Empl.: 525; *Sls. Mgr.:* P. Olson

DETORONICS CORPORATION, 10660 E. Rush St., S. El Monte, CA 91733, Tel: 818-579-7130, TWX: 910-587-3436; FSC No.: 29867; Empl.: 45

DEUTSCH CO., Deutsch Fiber Optics Div., 7001 W. Imperial Hwy., Los Angeles, CA 90045, Tel: 213-649-1400; *Sls. Mgr.:* Ken Ahmad

DEUTSCH RELAYS, INC., 65 Daly Road, East Northport, NY 11731, Tel: 516-499-6000, TWX: 510-226-0233, FAX: 516-499-6000-254; Empl.: 400; *Sls. Mgr.:* Jack Riley; *Dist. Mgr.:* Steve Salonitis

DEVAR, INC., P.O. Box 589, Bridgeport, CT 06601, Tel: 203-368-6751, TELEX: 96-4234, FAX: 203-368-3747; Empl.: 80; *Sls. Mgr.:* T. W. Tomasko

DEVCO ENGINEERING, 36 Pier Lane West, Fairfield, NJ 07006, Tel: 201-CA8-0321, TELEX: 139-340; Empl.: 36

DEVELCO, INC., 175 Nortech Pkwy., San Jose, CA 95134-2306, Tel: 408-945-6500, TWX: 910-339-9295; Empl.: 50; *Sls. Mgr.:* W. J. Baker

DEXTER RESEARCH CTR., INC., 7300 Huron River Dr., Dexter, MI 48130, Tel: 313-426-3921, TELEX: 757075 DEXTER RES UD; Empl.: 22; *Sls. Mgr.:* Robert Toth Jr.

DEYOUNG MANUFACTURING, INC., 12920 N.E. 125th Way, Kirkland, WA 98034, Tel: 206-823-4798, FAX: 206-821-8633; FSC No.: 54937; Empl.: 70; *Sls. Mgr.:* Ted Johnson

DGH CORPORATION, P. O. Box 5638, Manchester, NH 03108, Tel: 603-622-0452, TWX: 510 601 6112; Empl.: 10

DIALIGHT CORP., North American Philips, 1913 Atlantic Ave., Manasquan, NJ 08736, Tel: 201-223-9400, TELEX: 244536; Empl.: 400; *Sls. Mgr.:* J. McNamara .. **B•1115-1124, 1692-1693; C•1413, 1415, 1553, 1709**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean	205-830-1540
AZ	Phoenix, Shefler-Kahn Co.	602-257-9015
CA	Los Angeles, Landa & Assocs.	213-879-0770
CA	Pleasanton, Moulthrop Sls.	415-463-0450
CA	Santa Ana, Landa & Assocs.	714-543-7805
CO	Boulder, Comp. Prods. Sls.	303-530-2800
FL	Ft. Lauderdale, Panamtech, Inc.	305-587-3769
GA	Norcross, Cartwright & Bean	404-368-0160
IL	Chicago, Dialight Corp.	312-991-3472
IN	Indianapolis, Elctrn. Reps.	317-894-1414
KS	Shawnee Mission, Lowell Kangas & Assocs.	913-631-3515
LA	Covington, Cartwright & Bean	504-892-1780
MA	Hingham, Northeast Reps., Inc.	617-749-8700
MI	Royal Oak, Hilltronics	313-435-0920
MN	Minneapolis, Professional Sales For Ind.	612-944-8545
MS	Jackson, Cartwright & Bean	601-981-1170
MO	St. Louis, Lowell Kangas & Assocs.	314-821-4050
NY	Liverpool, Gen-Tech	315-451-3480
NC	Charlotte, Cartwright & Bean	704-536-0303
NC	Raleigh, Cartwright & Bean	919-876-4130
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OH	Westlake, Baehr, Greenleaf & Assocs.	216-892-1770
OH	Worthington, Baehr, Greenleaf & Assocs.	614-847-0220
OR	Beaverton, Earl & Brown Assocs.	503-643-5500
PA	Broomall, L.D. Lowery	215-356-5300
PA	Evans City, Baehr, Greenleaf & Assocs.	412-776-2151
TN	Knoxville, Cartwright & Bean	615-693-7450
TN	Memphis, Cartwright & Bean	901-362-8345
TX	Austin, Tesco	512-834-8374
TX	Garland, Tesco	214-681-1376
UT	Woodscross, Comp. Prods. Sls.	801-292-8882
WA	Redmond, Earl & Brown Assocs.	206-885-5064

Local Distributors

AZ	Tempe, Bell Inds.	602-966-7800
AR	Little Rock, Carleton-Bates Co.	501-562-9100
CA	Alhambra, Harper S.I.D.	213-289-0255
CA	Buena Pk., Cypress Elect.	213-744-0355
CA	Compton, Harper;S.I.D.	213-979-5090
CA	Garden Grove, Bell Inds.	714-895-7801
CA	Garden Grove, Richey Western Elec.	714-895-0060
CA	Gardena, Bell Indus.	213-515-1800
CA	Gardena, Cal Switch & Signal	213-770-2330
CA	Inglewood, Newark Elctrns.	213-671-7378
CA	Roseville, Bell Inds.	916-969-3100
CA	Sacramento, Sacramento Elctrns.	916-441-4821
CA	San Diego, Harper S.I.D.	714-560-8545
CA	San Diego, Richey Western Elctrns.	619-271-4511
CA	San Jose, Richey Western	408-432-7100
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Santa Clara, Harper S.I.D.	408-988-6041
CA	Santa Clara, Richey Western Elctrns.	408-727-7411
CA	Sun Valley, Richey Western Elec. Inc.	213-768-3800
CA	Sunnyvale, Arrow Elec.	408-745-6600
CA	Sunnyvale, Bell Indus.	408-734-8570
CA	Sunnyvale, Harper;S.I.D.	408-747-0333
CA	Sunnyvale, Time Elect.	408-734-9888
CA	Thousand Oaks, Bell Inds.	818-340-1940
CO	Denver, CSID Inc.	303-292-9594
CO	Denver, Newark Denver Elctrns.	303-757-3351
CT	Wallingford, Sager Elctrl. Supply	203-265-4600
FL	Ft. Lauderdale, Peerless Radio	305-973-4141
FL	Orlando, Hammond Elctrns.	305-849-6060
FL	Pompano Bch., Peerless Radio	305-973-4141
GA	Atlanta, Specialty Dist.	404-873-2521
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Northbrook, Classic Comps. Supp.	312-272-9650
IL	Palatine, OHM Elctrns.	312-359-5500
IL	Peoria, Klaus Radio & Elect.	309-691-4840
IN	Ft. Wayne, Bell Inds./Graham Elctrn. Div.	219-423-3422
IN	Indianapolis, Bell Inds./Graham Elctrn. Div.	317-634-8202
IN	Indianapolis, PEI-Genesis	317-637-5571
IN	South Bend, PEI-Genesis	219-287-2911
KY	Louisville, P.I. Burks	502-589-3960
LA	Lafayette, Ralph's of Lafayette	318-234-0105
LA	New Orleans, Southern Radio Supp.	504-524-2343
MD	Gaithersburg, Pioneer Washington Elec.	301-948-0710
MD	Rockville, Capitol Radio Whlsrs.	301-881-2270
MD	White Marsh, Resco/Baltimore	301-529-0500
MA	Hingham, Sager Elec. Supp.	617-749-6700
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	W. Springfield, T.F. Cushing	413-788-7341
MA	Wilbraham, Ind'l. Comps.	413-596-3854
MI	Ann Arbor, Wedemeyer Elctrn. Supp.	313-665-8611
MI	Livonia, RS Elctrns.	313-525-1155
MI	Oak Park, Newark Elctrn.	313-967-0600
MN	St. Paul, Gopher Elctrns.	612-483-3322
MO	Kansas City, LCOMP	816-221-2400
MO	Kansas City, Walters Radio Supp.	816-531-7015
MO	Maryland Hgts., LCOMP	314-291-6200
NE	Lincoln, Scott Elctrn. Supp.	402-466-8221
NJ	Hanover, State Elctrns.	201-887-2550
NJ	Kenilworth, Federated Purchaser	201-272-0505
NJ	Pennsauken, Resco Elctrns.	609-662-4000
NY	Buffalo, Summit Dists.	716-887-2800
NY	Elmsford, Ancar Elctrns. Supp.	914-592-7100
NY	Endwell, ASI Elect.	607-754-3823
NY	Hauppauge, Broadline Elec. Dists.	516-231-4123
NY	Long Island City, Dalis Indl. Elect.	718-361-1100
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Melville, Arrow Elctrns.	516-694-6800
NY	Rochester, Summit Elctrns.	716-334-8110
NY	Rome, Rome Elctrns.	315-337-5400
NY	Woodbury, Pioneer Standard	516-921-8700
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Raleigh, Southeastern Elctrns.	919-828-2311
OH	Akron, Akron Elctrn. Supp.	216-762-8818
OH	Akron, Sun Radio	216-434-2171
OH	Cincinnati, Hughes-Peters	513-351-2000
OH	Cincinnati, URI Elctrns.	513-761-4030
OH	Cleveland, Pioneer-Cleveland	216-587-3600
OH	Columbus, Hughes-Peters	614-294-5351
OH	Dayton, Pioneer/Dayton	513-236-9900
OH	Dayton, Stotts-Friedman	513-298-5555
OH	Solon, REPCO Elctrn.	216-248-8900
OH	Warren, REM Elctrns.	216-373-1300
OK	Tulsa, Norvell Elect.	918-254-8606
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Beaverton, Almac Elctrns.	503-629-8090
OR	Lake Oswego, Bell Inds.	503-635-6500
PA	McKean, Advacom	814-476-7774
PA	Montgomeryville, Pyttronic Indus.	215-643-2850
PA	Philadelphia, Almo Elctrns.	215-698-4000
PA	Philadelphia, PEi-Genesis Elctrn.	215-673-0400
PA	Pittsburgh, Cam RPC Elect.	412-782-3770
PA	Reading, Barbey Elctrns.	215-376-7451
RI	Providence, Wm. Dandreta	401-861-2800
SC	Greenville, Emsco	803-233-4121
TN	Kingsport, Radio Elec. Supp.	615-247-8111
TN	Nashville, Carlton-Bates Co.	615-244-3562
TN	Nashville, Electra Dist.	615-256-0800
TX	Austin, Harrison Equip.	512-458-3555
TX	Austin, Norvell	512-837-5555
TX	Dallas, Norvell Elctrns.	214-233-0020
TX	Garland, Newark Elctrns.	214-487-8144
TX	Houston, Newark Elctrns.	713-782-4800
TX	Stafford, Harrison Equip.	713-879-2600
UT	Salt Lake City, Standard Supp.	801-486-3371
VA	Norfolk, Priest Elctrns.	804-855-0105
VA	Richmond, Sterling Elctrns.	804-226-2190
WA	Bellevue, Almac Elctrns.	206-643-9992
WA	Bellevue, Bell Inds.	206-747-1515
WI	Milwaukee, Elctrn. Expeditors	414-228-8100
WI	Milwaukee, Indl. Elect.	414-276-1212
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	Waukesia, Bell Inds.	414-547-8879

DIAL PRODUCTS CO., 19-21 Cottage St., Bayonne, NJ 07002, Tel: 201-HE7-0720; Empl.: 100; *Sls. Mgr.:* Beverly Malen

DIAMOND MAGNETICS, 235 Tank Farm Rd., Ste. G, San Luis Obispo, CA 93401, Tel: 805-544-4019; Empl.: 20; *Sls. Mgr.:* Steven A. Maxwell

DIANACHART INC., 129 Hibernia Ave., Rockaway, NJ 07866, Tel: 201-625-2299; Empl.: 10; *Sls. Mgr.:* S. Byrom

DI/AN CONTROLS, INC., 944 Dorchester Ave., Boston, MA 02125, Tel: 617-288-7700; FSC No.: 06900; Empl.: 60; *Sls. Mgr.:* Robert D. Kodis

DIA-NETICS, INC., 18823 Napa St., Northridge, CA 91324, Tel: 818-886-2616; Empl.: 48

ELGAR

FAX: 619-458-0267

DIEGO POWER, 9250 Brown Deer Rd., San Diego, CA 92121, Tel: 619-587-1925, TELEX: 211063 ELSD UR; Empl.: 250; *Sls. Mgr.:* Martin Sanders; *Dist. Mgr.:* Martin Sanders ..... **D•2098**

Local Sales Offices & Reps

IL	Elmhurst, Sector Engrg. Sls.	312-530-7850
IN	Indianapolis, Sector Engrg. Sls.	317-842-1120
MD	Wheaton, Brimberg Sls. Co.	301-946-2670
MA	Bedford, Eastronix	617-275-5775
MI	Southfield, Comtel Instrs.	313-358-2505
MN	Minneapolis, Sector Engrg. Sls.	612-593-1809
NM	Albuquerque, Odyssey I	505-265-6645
OH	Cleveland, Comtel Instrs.	216-442-8080
OH	Dayton, Comtel Instrs.	513-426-5310
OK	Tulsa, Spectra Sls.	918-663-7188
PA	Pittsburgh, Comtel Instrs.	412-922-5720
TX	Houston, Spectra Sls.	713-747-2798
TX	Richardson, Spectra Sls.	214-234-3600
WA	Seattle, Datacom	206-285-2525
WI	Milwaukee, Sector Engrg. Sls.	414-352-8280

DIELECTRIC COMMUNICATIONS, General Signal, Tower Hill Rd., Raymond, ME 04071, Tel: 207-655-4555, 800-341-9678, TELEX: 710-229-6890; FSC No.: 08441; Empl.: 270; *Sls. Mgr.:* Rolf Olsen

DIELECTRIC INSTRUMENT CORP., 761 Franklin Ave., Pittsburgh, PA 15221, Tel: 412-731-6566; Empl.: 5

DIELECTRIC LABS., Rte. 20 E., Cazenovia, NY 13035, Tel: 315-655-8710, TELEX: 882-691 Dielectric Labs., FAX: 315-655-8179; FSC No.: 55153; Empl.: 100; *Sls. Mgr.:* Gunter Vorlop

DIETZ DESIGN, INC., 100 Electronics Pkwy., Belton, MO 64012, Tel: 816-331-4911; Empl.: 75

DIGI-DATA CORP., 8580 Dorsey Run Rd., Jessup, MD 20794, Tel: 301-498-0200, TELEX: 87-580; Empl.: 40; *Sls. Mgr.:* Allen Grams

DIGIMETER INC., 512 Valley Way, Milpitas, CA 95035, Tel: 408-946-9090, FAX: 408-946-9190; Empl.: 3; *Sls. Mgr.:* Robert Klinger; *Dist. Mgr.:* Robert Klinger ..... **D•1360-1362**

DIGITAL COMMUNICATIONS ASSOCIATES, INC., 1000 Alderman Dr., Alpharetta, GA 30201, Tel: 404-442-4000, TELEX: 261375 DCA UR; Empl.: 1025; *Dist. Mgr.:* Jerry Buran

DIGITAL DATA SYSTEMS, 1551 N.W. 65 Ave., Plantation, FL 33313, Tel: 305-792-3290, TWX: 910-997-4751 (DIGITAL), FAX: 305-581-1325; FSC No.: 65136; Empl.: 20

DIGITAL DYNAMICS, INC., 275 Technology Circle, Scotts Valley, CA 95066, Tel: 408-438-6823; FSC No.: (S.I.C. Code – 3823); Empl.: 15; *Sls. Mgr.:* R. Palmer

DIGITAL ELECTRONICS, 31047 Genstar Road, Hayward, CA 94544-7831, Tel: 415-471-4700, TELEX: 172073 DIGELEC HYWD, FAX: 415-489-3500; *Sls. Mgr.:* John W. McKinney, Mktg. VP

DIGITAL EQUIP., One Iron Way, Marlborough, MA 01752

DIGITAL EQUIPMENT CORP., 33 Cabot Rd., Woburn, MA 01801, Tel: 800-225-5385

DIGITAL MEDIA, 11770 Warner Ave., Ste. 225, Fountain Valley, CA 92708, Tel: 714-751-1373; *Sls. Mgr.:* Ed Burg

DIGITAL PATHWAYS, INC., 201 Ravendale Dr., Mountain View, CA 94043, Tel: 415-964-0707, TWX: 910-379-5034, FAX: 415-961-7487; Empl.: 75; *Sls. Mgr.:* Robert Lewin

DIGITAL PRODUCTS, INC., 108 Water Street, Watertown, MA 02172, Tel: 617-924-1680, 800-243-2333, TELEX: 312345, FAX: 617-924-7814; Empl.: 90; *Sls. Mgr.:* Kay Waxman

DIGITAL RADIO CORP., 601 S. Pacific Coast Hwy., Redondo Beach, CA 90277, Tel: 213-316-9114; Empl.: 27; *Sls. Mgr.:* Arvin L. Perry

DIGITEC CORP., 959 Cheney Ave., Marion, OH 43302, Tel: 614-387-3444, TELEX: 3775688; FSC No.: 16152; Empl.: 45; *Sls. Mgr.:* Bruce Poplin; *Dist. Mgr.:* Bruce Poplin ..... **D•1363**

Local Sales Offices & Reps

AL	Adamsville, Southrep	205-674-3056
AZ	Tempe, Trembly Assocs.	602-967-2058
CA	Bakersfield, AWC, Inc.	805-322-2416
CA	Huntington Beach, AWC	714-969-2468
CA	Santa Clara, Johnson Assocs.	408-984-4626
CO	Wheatridge, Trembly Assocs.	303-421-8900
FL	Clearwater, Structural Engrg./Testing Co.	813-442-7767
IL	Des Plaines, Marsland Assocs.	312-298-2620
IN	Indianapolis, Marsland Assocs.	317-293-5437
IA	Cedar Rapids, Marsland Assocs.	319-365-1908
LA	Baton Rouge, Process Meas. & Monitors, Inc.	504-927-9416
MD	Baltimore, Cavalier Controls, Inc.	301-337-8378
MA	Lexington, R. J. Sickles Assocs.	617-862-5100
MA	Needham, Carl Lueders & Co.	617-449-0345
MI	Southfield, Comtel-Instr.	313-358-2505
MN	Minneapolis, Marsland Assocs.	612-545-4481
MO	St. Louis, Marsland Assocs.	314-991-1399
NV	Las Vegas, Trembly Assocs.	702-739-9770
NJ	Cedar Grove, KLS	201-785-4450
NJ	Pennsauken, Scientific Reps., Inc.	609-662-5222
NM	Albuquerque, Fry-Gates	505-262-1525
NY	Parish, Glen Instrs.	315-625-4426
NY	Rochester, Glen Instrs.	716-338-7148
NC	Charlotte, Metrodyne, Inc.	704-563-2474
OH	Cleveland, Comtel-Instr.	216-442-8080
OH	Hillard, Comtel-Instr.	614-876-8305
OK	Tulsa, Ernie Graves Co., Inc.	918-584-4707
OR	Portland, Showalter Instrs., Inc.	503-629-9254
PA	Pittsburgh, Comtel-Instr.	412-922-5720
TN	Knoxville, J R B Controls, Inc.	615-588-2937
TX	Houston, Dixon Engrg., Inc.	713-644-8052
TX	Longview, Control Devices/Jack Fair Co.	214-759-6471
UT	Centerville, M.C. Squared, Inc.	801-298-3380
VA	Richmond, Cavalier Controls	804-271-5226
WA	Bellevue, Showalter Instrs., Inc.	206-746-7970
WI	New Berlin, Marsland Assocs., Inc.	414-786-6611
Can	Weston, Ont., Megatronix Corp.	514-878-8000

DIGITECH INDUSTRIES, INC., 66 Grove St., P.O. Box 547, Ridgefield, CT 06877, Tel: 203-438-3731, TELEX: 969-623; Empl.: 70

DIGITEK INC., Block & Co., Inc., 11807 N. Creek Pkwy. S., Bothell, WA 98011, Tel: 206-485-6571; Empl.: 16; *Sls. Mgr.:* Herb Vernon

DIGITRAN®

FAX: 818-791-9788

DIGITRAN DIVISION, Xcel Corporation, 3100 New York Dr., Pasadena, CA 91107, Tel: 818-791-5600, TELEX: 67-5485, TWX: 910-588-3794; FSC No.: 07126; Empl.: 300; *Sls. Mgr.:* R. Van Horn; *Dist. Mgr.:* Kathy Privett ..... **B•1055, 1694, 1814**

Local Distributors

AL	Huntsville, Comp. Distrs.	205-883-7501
AL	Huntsville, Powell Elec.	205-539-2731
AZ	Tempe, Powell Elctrns.	602-967-7538
AR	Little Rock, Comp. Distrs.	501-227-6278
CA	Cerritos, El-Com	213-404-2961
CA	Fullerton, Pyramid	714-773-0781, 213-691-0561
CA	San Diego, El-Com	619-578-0900
CA	San Jose, Powell Elctrns.	408-943-9020
CA	Santa Clara, Pyramid Elec.	408-727-9810
CT	Hamden, Impact Elctrns.	203-281-1331
FL	Ft. Lauderdale, Comp. Distrs.	305-971-4950
FL	Ft. Lauderdale, Powell Electr./Fla.	305-972-4300
GA	Norcross, Comp. Distrs.	404-441-3320
IL	Mt. Prospect, Magnuson Elctrns.	312-956-0700
IN	Indianapolis, Graham Elec.	317-634-8202
MD	Columbia, Powell Electr.	301-621-4070
MA	Canton, Impact Sls. Co.	617-821-1500
MA	West Borough, Powell Electrns.	617-336-6100
MI	Livonia, Pioneer/Michigan	313-525-1800
MI	St. Clair Shores, Specialties Mfg.	313-771-2700
MN	St. Paul, Magnuson Elec.	612-227-8495
NJ	Hasbrouck Hgts., Tory Sls.	201-288-5656
NY	Rochester, Modutex Corp.	716-647-9700
NC	Cary, Powell Elec.	919-467-1212
NC	Raleigh, Comp. Distrs.	919-834-9465
OH	Cleveland, Pioneer-Cleveland	216-587-3600
OH	Columbus, Elctrns. Mktg. Corp.	614-299-4161
OH	Dayton, Pioneer/Dayton	513-236-9900
OK	Tulsa, Norvell Elctrns.	918-663-1247
PA	Philadelphia, Powell Electr.	215-365-1900
PA	Pittsburgh, Pioneer/Pittsburgh	412-782-2300

DILLON, W. C., & CO., National Controls, Inc., 1000 Armstrong Dr., Fairmont, MN 56031, Tel: 507-238-4461, TELEX: 756594; Empl.: 500; *Dist. Mgr.:* Randy Newlin

DILOG, 1555 S. Sinclair St., Anaheim, CA 92806, Tel: 714-937-5700, TELEX: 6836051, FAX: 714-978-2420; FSC No.: 95-3205555; Empl.: 105; *Sls. Mgr.:* Dennis Edwards; *Dist. Mgr.:* Steve Ferrari

DILWOL, 3325 North Service Rd., Burlington, Ontario, Canada L7N 3G2, Tel: 416-335-2343, FAX: 416-335-1809; *Sls. Mgr.:* J. R. Mattie

DIMCO-GRAY, 8200 S. Suburban Rd., Dayton, OH 45458, Tel: 513-433-7600, FAX: 513-433-0520; Empl.: 120; *Sls. Mgr.:* R. L. Woehrmyer

DIMENSIONAL SWISS PRODUCTS, 424 Roberson Lane, San Jose, CA 95112, Tel: 408-436-0361; Empl.: 18; *Sls. Mgr.:* D. R. Zamzow

DIMENSIONS UNLIMITED, INC., 1636 Gervais Ave., St. Paul, MN 55109, Tel: 612-770-5630; *Sls. Mgr.:* David Flod

DIODES INC., 9957 Canoga Ave., Chatsworth, CA 91311, Tel: 818-882-4920, 800-821-1178; Empl.: 30; *Sls. Mgr.:* Tim Regan; *Dist. Mgr.:* Tim Regan

DIONICS, 65 Rushmore St., Westbury, NY 11590, Tel: 516-997-7474, TWX: 510-222-0974, FAX: 516-997-7479; Empl.: 50; *Sls. Mgr.:* Mel Geffner

DIO-REY, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022, Tel: 201-941-4455, FAX: 201-941-4919; FSC No.: FSCM 52116; Empl.: 13; *Sls. Mgr.:* Joseph M. Cartelli; *Dist. Mgr.:* Joseph M. Cartelli ..... **B•1056-1062**

Local Sales Offices & Reps

CA	No. Hollywood, Crown Elctrns.	213-877-3550
CA	Redwood City, Caltronic Assocs.	415-365-2545
CT	Weston, CJA Assoc.	203-226-4317
MI	Plymouth, Leading Edge Sls. Corp.	313-420-3344
NY	Syracuse, Lenard Co.	315-479-9191
OH	Cleveland, A.S.A.	216-232-4946
OH	Dayton, Mohawk Intronics	513-434-8873

DIRECT AID, 31332 Via Colinas, Ste. 102, Westlake Vl, CA 91362, Tel: 818-889-1013, 800-443-8080; *Sls. Mgr.:* Todd Smith; *Dist. Mgr.:* Todd Smith

Honeywell
Disc Instruments Subsidiary

FAX: 714-432-7567

DISC INSTRUMENTS, Honeywell, 102 E. Baker St., Costa Mesa, CA 92626, Tel: 714-433-0343, TWX: 910-595-1987; Empl.: 150 ..... **B•1885-1887**

Local Sales Offices & Reps

CA	Costa Mesa, Disc Instrs.	714-979-5300
CA	San Jose, Honeywell/Disc Instrs.	408-433-3025
CT	Glastonbury, Honeywell/Disc Instrs.	203-659-4011
FL	Margate, EPM Corp.	305-977-0331
GA	Dunwoody, Hilco, Inc.	404-393-1771
MD	Glen Burnie, Macrotech Assocs. Ltd.	301-437-5588
MI	Troy, Disc Instr.	313-649-1340
MN	Edina, J. H. Hanson Co.	612-893-9960
NY	Hamburg, Application Specialists	716-627-3893

NY	Rochester, Application Specialists	716-586-6226
NY	Syracuse, Application Specialists	315-437-2814
NC	Cary, Hilco, Inc.	919-481-0321
OH	Chagrin Falls, Kilroy Corp.	216-543-3370
OH	Dayton, Kilroy Corp.	513-294-1235
OR	Portland, Controltek Sls. Ltd.	503-641-0877
SC	Mount Pleasant, Hilco, Inc.	803-884-0289
TX	Dallas, Measurement Sys. & Sls., Inc.	214-243-5781
WA	Redmond, Controltek Sls.	206-883-8844

DISPLAY DEVICES, INC., Box 667, Encinitas, CA 92024, Tel: 619-753-0113; FSC No.: 26107

DISPLAYS, INC., Mifflin Countey Indl. Pk., Rte. 4, Box 6AAA, Lewistown, PA 17044, Tel: 717-242-2541, TELEX: 842540; Empl.: 65

DISPLAYTECH, INC., 2200 Central Ave., Boulder, CO 80301, Tel: 303-449-8933, FAX: 303-449-8934; Empl.: 13; *Sls. Mgr.:* Ann Perry

DISPLEX, INC.
A SUBSIDIARY OF NORTH HILLS ELECTRONICS INC

FAX: 516-759-3327

DISPLEX, INC., North Hills Electronics, Inc., Alexander Place, Glen Cove, NY 11542, Tel: 516-671-4400, TELEX: 46-6886 NOHILL CI; Empl.: 12; *Sls. Mgr.:* Jay Mohr ..... **D•1700-1701, 2091**

Local Sales Offices & Reps

AZ	Glendale, Adtek, Inc.	602-931-9289
CA	Huntington Bch., Mil-Com Sls., Inc.	714-840-2425
CA	San Diego, Mil-Com Sls., Inc.	619-484-3402
CA	Thousand Oaks, Mil-Com Sls., Inc.	805-647-8569
CT	Hathaway Elctms., Inc.	617-861-7010
MA	Lexington, Hathaway Elctms., Inc.	617-861-7010
NJ	Parlin, Eastland Sls., Inc.	201-721-5116
NY	Centerport, Big Apple Reps.	516-261-3012

DISTRIBUTED LOGIC CORP., See DILOG

DISTRIBUTED PROCESSING TECHNLGY., Div. of S. I. Goldman Mechanical Contractors, 132 Candace Drive, Maitland, FL 32751, Tel: 305-830-5522, TELEX: 494 7078; *Sls. Mgr.:* Steve Holler

DISTRIBUTOR & SPECIAL PRODUCTS, Thomson Consumer Electronics, Inc., 2000 Clements Bridge Rd., Deptford, NJ 08096, Tel: 609-541-3636; *Sls. Mgr.:* H. L. Craton

DISTRIBUTOR SPECIALISTS, 1942 14th Street, Santa Monica, CA 90404-4606, Tel: 213-452-3445

DIVERSIFIED CASE CO., Ellis Ave., Off. 2, Whitesboro, NY 13492, Tel: 800-553-2411, 800-258-1188; Empl.: 75; *Sls. Mgr.:* Charlie Fisher

DIVERSIFIED ELECTRONICS, INC., P.O. Box 1140, Evansville, IN 47706-1140, Tel: 812-426-2806, FAX: 812-425-8930; Empl.: 55; *Sls. Mgr.:* Ken Qualls

DIVERSIFIED TECHNLG., P.O. Box 748, Ridgeland, MS 39157, Tel: 601-856-4121, TELEX: 585326, TWX: 810-966-2626; Empl.: 65; *Sls. Mgr.:* Bill Long; *Dist. Mgr.:* Bill Long

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AL	Birmingham, Sesco-Birmingham	404-458-6423
AZ	Phoenix, Finn-Pat Co. Inc.	602-954-0301
CA	Costa Mesa, FLW	714-751-7512
CA	Los Angeles, FLW	818-719-0037
CA	Monterey, Adams McDonald-Int'l.	408-373-3607
CA	Newark, Jacobson & Assocs.	415-791-2336
CA	San Diego, FLW	619-434-5251
CO	Lakewood, Loritz Controls	303-232-7803
CT	Hamden, Pond Tech. Sls.	203-284-1500
FL	W. Palm Bch., Sesco-Florida	404-458-6423
GA	Atlanta, Sesco-Atlanta	404-458-6423
IL	Lombard, Patrick & Douglas	312-971-1800
LA	Baton Rouge, Sesco-Baton Rouge	512-892-2490
ME	W. Buxton, Pond Tech. Sls.	207-637-2200
MD	Crofton, Federal Resources	301-858-1099
MA	Waltham, Pond Tech. Sls.	617-890-5535
MI	Troy, R. H. Jackson Co.	313-689-9950
MN	Minneapolis, Trask Engrg.	612-537-2434
MO	Manchester, Control Sys. Des.	314-227-4212
NJ	Emerson, Techtrol, Inc.	201-967-7640
NY	Cazanovia, D & O Engrg. Co.	315-655-8602
NY	Rochester, D & O Engrg. Co.	716-247-6838
NY	Youngston, D & O Engrg. Co.	716-754-7650
NC	Cary, Sesco-Raleigh	404-458-6423
OH	Cleveland, Marlowe Assocs., Inc.	216-991-6500
OH	Dayton, Marlow & Assocs.	513-274-9666
OK	Tulsa, Sesco-Tulsa	512-892-2490
OR	Portland, Fry Controls, Inc.	503-244-3313
PA	Frazer, FLW of PA, Inc.	215-251-9700
PA	Pittsburgh, Marlow & Assocs.	412-367-8886
TX	Austin, Sesco-Austin	512-892-2490
TX	Dallas, Sesco-Dallas	512-892-2490
TX	Houston, Sesco-Houston	512-892-2490
TX	Plano, Sesco-Military Sls.	512-892-2490
UT	Murray, Instr. Specialists, Inc.	801-261-0142
VA	Richmond, Dynamation	804-794-7667
WA	Federal Way, Fry Controls, Inc.	206-282-9270

Local Distributors

OH	Cleveland, Pioneer-Standard Elctrns.	800-262-3600,800-362-9127

D. O. INDUSTRIES, 317 E. Chestnut St., E. Rochester, NY 14445, Tel: 716-385-4920, TELEX: 200802, FAX: 716-381-7032; *Sls. Mgr.:* Jeremy Goldstein

DOLAN-JENNER INDS., Box 1020, Woburn, MA 01801, Tel: 617-935-7444, TELEX: 94-8161, FAX: 617-938-7219; Empl.: 120; *Sls. Mgr.:* S. Futran; *Dist. Mgr.:* S. Futran

Local Sales Offices & Reps

CA	Fremont, C/G Assocs.	415-790-1193
CA	Hollywood, Duncan Engrg.	213-462-5880
IL	Buffalo Grove, Jim Laganowski Assoc.	312-520-0130
MA	Hingham, R. J. Wilson	617-749-7575
MI	Detroit, Qualitron	313-534-1511
MO	Independence, Gribble Sls.	816-796-4333
NJ	Medford, Speck Controls Engrg.	609-654-6976
NJ	Tenafly, Budd-Tronics	201-567-4888
NY	Utica, Fiber Instr. Sls.	315-735-1691
NC	Greensboro, Ron Ingle	919-273-4042
OH	Novelty, Rogers Sls.	216-338-8500
TN	Knoxville, Stephenson Controls & Sys.	615-588-7473
TX	Lewisville, KSE	214-436-4702

DOLCH LOGIC INSTRS., 2029 O'Toole Avenue, San Jose, CA 95131, Tel: 408-435-1881, TWX: 910-338-2023; *Sls. Mgr.:* Greg Hayes

DOLPH, JOHN C., CO., New Rd., Monmouth Junction, NJ 08852, Tel: 201-329-2333; *Sls. Mgr.:* J. E. Rooze

DONTECH, INC., 700 Airport Blvd., Doylestown, PA 18901, Tel: 215-348-5010, TELEX: 685 1155 DONTK, FAX: 215-348-9959; FSC No.: 63009; *Sls. Mgr.:* Jordan C. Miller, Sls. Engr.

DORAN MANUFACTURING CO., 2834 Sidney Ave., Cincinnati, OH 45225, Tel: 513-681-5424; Empl.: 40; *Sls. Mgr.:* Jeff Stegman ..... **C•1325**

DORMAN BOGDONOFF CORP., Corp. Center, Willow Pond, Andover, MA 01810, Tel: 617-470-0001, TWX: 710-347-0333; *Sls. Mgr.:* Charles P. Centore

FAX: 312-283-4927

DORMEYER INDS., A. F. Dormeyer Mfg. Co., Inc., 3418 N. Milwaukee, Chicago, IL 60641, Tel: 312-283-4000; Empl.: 400; *Sls. Mgr.:* Richard Henry, Dir. Sls. & Engrg. ..... **B•1619-1621**

Local Sales Offices & Reps

CA	Valencia, T & C Engrg.	805-254-8778
IL	Chicago, Dormeyer Inds.	312-283-4000
IA	Marion, J. Taylor Hersey Co.	319-366-3402
NY	Rochester, H.C. Johnson Agencies	716-586-0777

Local Distributors

AZ	Tempe, Anjon Entprs.	602-894-1332
CA	Santa Monica, Master Distrs.	213-452-1229
FL	Lakeland, AA Electric	800-237-8274
GA	Norcross, A A Electric	404-449-8670
MA	Lynn, Land Elctrns.	617-592-2220
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Mamaroneck, Logicomp Elctrns.	914-698-9332
NY	Rochester, Summit Distrs.	716-334-8110
OH	Akron, Sun Radio Co.	216-434-2171
OH	Dayton, Stotts Friedman	513-298-5555
PA	Montgomeryville, Pyttronic Inds., Inc.	215-643-2850
TX	Corpus Christi, Douglas Elctrns.	512-883-5103
WI	Milwaukee, Elctrn. Expeditors, Inc.	800-558-8547

DOTRONIX, 160 First St. SE, New Brighton, MN 55112, Tel: 612-633-1742, TWX: 910-563-3541, FAX: 612-633-7025; Empl.: 570; *Sls. Mgr.:* Len Stewart, Natl. Sls. Mgr.

Local Sales Offices & Reps

CA	Gilroy, Dotronix, Inc.	408-848-2499
CA	Upland, Dotronix, Inc.	714-982-8667
CO	Boulder, Dotronix, Inc.	303-440-8001
MN	New Brighton, Dotronix	612-633-1742
NJ	Middletown, Dotronix, Inc.	201-671-4888
EXP	W. Germnay/Munich, Dotronix, Inc.	089-448-8405

DOUGLAS ELECTRONICS, 718 Marina Blvd., San Leandro, CA 94577, Tel: 415-483-8770

DOUGLAS RANDALL, 6 Pawcatuck Ave., Pawcatuck, CT 06379, Tel: 203-599-2075, FAX: 203-599-1754; Empl.: 125; *Sls. Mgr.:* D. Aves ..... **B•1402-1410**

Local Sales Offices & Reps

AZ	Tempe, Trembly Assoc.	602-967-2058
CA	Oakland, Powermatic Assoc.	415-635-6825
CO	Wheat Ridge, Trembly Assoc.	303-421-8900
CT	Yalesville, JMG-Glynn Connecticut	203-265-9452/2498
FL	Oldsmar, Boggs & Assocs.	813-855-1812
GA	Marietta, Micro Sls., Inc.	404-992-4350
IL	Chicago, Ropek-Cahill-Vogt	312-806-0066
IN	Carmel, Berndt Assocs., Inc.	317-844-0114
MA	Norwood, JMG, Inc.	617-762-5333
MN	Osseo, Gaffney Sls. Co.	612-425-5484
MO	Kansas City, Delltron Co., Inc.	816-436-6445
MO	St. Louis, Delltron Co.	314-869-4779
NV	Las Vegas, Trembly Assoc.	702-739-9770
NJ	Hightstown, Total Control	609-448-3076
NJ	Morristown, Andrews & Andrews	201-569-8800
NM	Albuquerque, Trembly Assoc.	505-266-8616
NY	Fayetteville, C. W. Floring & Assocs.	315-637-4552
NY	Glen Head, Andrews & Andrews	516-692-8686
NY	Roochester, J. G. Welch Assoc.	716-244-1100
NY	Syracuse, Mullahy/Welch	315-685-6280
NC	Raleigh, Micro Sls.	919-872-7922
OH	Cleveland, Geotronix Mktg. Assoc.	216-659-6100
OH	Trotwood, Geotronix, Inc.	513-252-6700
TX	Dallas, Paramount Controls	214-341-4561
Can	Mont., Que., Solid State Engrg. Co.	514-481-3313

Local Distributors

CA	Chatsworth, Mill-Comm Dist.	213-998-3111
CA	S. San Francisco, Steven Engrg.	415-588-9200
FL	Hollywood, MRO Elctrn. Distrs.	305-966-4847
MA	Middleboro, Glynn Elect.	617-947-4262
OH	Cleveland, Alpha Corp.	216-659-7100
PA	Narberth, Power Modules	215-668-0664
PA	Yeadon, Y-L Prods.	215-583-2800
TX	Houston, Butler & Land	713-896-0808

DOVA CONTROLS, 4052 148th Ave. N.E., Redmond, WA 98052, Tel: 206-881-7414, ESYLNK: 62027625, FAX: 206-881-2569; Empl.: 7; *Sls. Mgr.:* Lynn Myers

DOVER ELECTRONICS MANUFACTURING, Kirkwood Industrial Park, P.O. Box 5212, Binghamton, NY 13902-5212, Tel: 607-772-7563, 1-800-PWB-ASSY, TWX: 510-252-1990, FAX: 607-772-9274; Empl.: 371; *Sls. Mgr.:* Robert P. Egan ..... **D•2165**

Local Sales Offices & Reps

NY Binghamton, Dover Elctrns. Mfg. 607-772-7563

DOW CHEMICAL CO., 2020 Dow Center, Midland, MI 48674, Tel: 517-636-1000, TELEX: 227455, TWX: 810-266-9490; Empl.: 51,300

DOW CORNING CORP., Box 0994, Midland, MI 48686-0994, Tel: 517-496-4000, TELEX: 227450, TWX: 810-266-9006; Empl.: 6,100

DOW-KEY MICROWAVE CORPORATION, 1667 Walter St., Ventura, CA 93003, Tel: 805-650-0260, TWX: 910-380-4327; FSC No.: 00471; Empl.: 130; *Dist. Mgr.:* Jack Dysart

DOW SWITCH, Screenprint/Dow, 271 Ballardvale St., P.O. Box 1332, Wilmington, MA 01887, Tel: 617-935-6395, FAX: 617-658-2307; Empl.: 19; *Sls. Mgr.:* Toni Stevens

Local Sales Offices & Reps

CA Calabasas, Centaur 818-704-1655
IN Carmel, F. Dorsey & Assocs. 317-884-4842
NJ Pt. Pleasant, Jade Mktg. 201-899-8108
NC Charlotte, D. P. Riggins & Assocs. 704-375-7550

DOWTY RFL INDS. INC./COMMUNICATIONS DIV., The Dowty Grp. PLC, Powerville Rd., Boonton, NJ 07005-0239, Tel: 201-334-3100, TWX: 710-987-8352; FSC No.: 49673; Empl.: 300

FAX: 201-334-3863

DOWTY RFL INDS. INC./INSTRUMENTATION DIV., The Dowty Grp. PLC, Powerville Rd., Boonton, NJ 07005-0239, Tel: 201-334-3100, TWX: 710-987-8352; FSC No.: 49673; Empl.: 300 ..... **D•1237-1239**

DOWTY ELECTRONICS CO., Thermocontrol Div., Prospect St., P.O. Box 250, Brandon, VT 05733, Tel: 802-247-6811, TWX: 710-987-8352, FAX: 802-247-3946; Empl.: 150; *Sls. Mgr.:* Bob Berman; *Dist. Mgr.:* Bob Berman

DRACON DIV., See Harris Corp., Dracon Div.

DRANETZ TECHNOLOGIES, INC., 1000 New Durham Rd., P.O. Box 4019, Edison, NJ 08818-4019, Tel: 201-287-3680, TELEX: 499-7808, TWX: 710-997-9553, FAX: 201-287-8627; FSC No.: 23207; Empl.: 230; *Sls. Mgr.:* A. Orlacchio ..... **D•1240**

DRAWN METAL PRODUCTS, 6143 W. Howard St., Niles, IL 60648, Tel: 312-647-8941; Empl.: 60; *Sls. Mgr.:* Tom Amundsen

DREEFS SWITCH, INC., 3782 Hawthorn Ct., Waukegan, IL 60087, Tel: 312-662-7667, 800-323-9605, TELEX: 703784 MTL DREEFS UD, FAX: 312-662-0906; Empl.: 63; *Sls. Mgr.:* Ed Magiera; *Dist. Mgr.:* Ed Magiera ..... **B•1695**

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CA Los Altos, Nickerson-Gray & Assocs. 415-941-5777
CA Poway, Spectrum Assocs. 619-487-5691
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CT Madison, Reptron Sls. 203-245-2242
FL Ft. Lauderdale/Tampa, Hollingsworth & Still 800-241-5712
GA Norcross, Hollingsworth & Still 404-447-1700
IL Waukegan, DSI 312-662-7667
IA Cedar Rapids, Delltron Co. 319-362-2526
MA Newton Highlands, WM. Valle Assocs., Inc. 617-965-0002
MS Jackson, Hollingsworth & Still 800-241-5712
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MO Kansas City, Delltron Co. 816-436-6445
NV Las Vegas, Trembly Assocs., Inc. 702-739-9770
NJ Ocean, P. Saftler Assocs.,Inc./Gordon 201-922-3014
NM Albuquerque, Trembly Assocs., Inc. ... 505-266-8616
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NY Lynbrook, P. Saftler Assocs. 516-593-7880
NC Charlotte, Hollingsworth & Still 800-241-5712
OH Cleveland, Allied Entprs. 216-779-0080
PA Malvern, Stitzer Assocs. 215-644-5500
PA Murrysville, Allied Entprs. 412-325-3200
SC Columbia, Hollingsworth & Still 800-241-5712
TN Cleveland, Hollingsworth & Still 800-241-5712
TX Dallas, Blackburn Assocs. 214-750-8484
WI Mequon, Badgerep, Inc. 414-241-9200
EXP Waukegan,IL, Dreefs Switch, Inc. 312-662-7667
Can Concord, Astec Comps. 416-669-4022

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CA Santa Clara, Cypress Elctrns. 408-980-2500
CA Sunnyvale, Power Supp. Comps. 408-737-1333
CO Denver, C.S.I.D. 303-292-9594
IL Wheeling, Hawk Elctrns. 213-459-4030, 800-843-4295
EXP Waukegan, IL, Dreefs Switch Inc. 312-662-7667
Can Mississauga, Ont., Prelco Elctrns., Ltd. 416-745-9370,800-387-3874

DRESSEN-BARNES ELCTRNS., 1600 E. Valencia Dr., Fullerton, CA 92631, Tel: 714-871-3020, TWX: 910-592-1256; FSC No.: 89321; Empl.: 220; *Sls. Mgr.:* B. Guy

DRESSER INDS., 1505 Elm St., Dallas, TX 75201, Tel: 214-746-6000, TELEX: 73-2489, TWX: 910-861-4136; Empl.: 55,000

DSP TECHNOLOGY, 48500 Kato Rd., Fremont, CA 94538, Tel: 415-657-7555, TELEX: 263608, FAX: 415-657-7576; Empl.: 60; *Sls. Mgr.:* Robert LeBrun

DUBBLEDEE DIAMOND CORPORATION, D. Drukker & Zn., N.V., 100 Stierli Ct., Mt. Arlington, NJ 07856, Tel: 201-770-1420, TELEX: RCA 236064, FAX: 201-770-1549; *Sls. Mgr.:* Keith Harris

DUKANE CORP., Communications Sys. Div., 2900 Dukane Dr., St. Charles, IL 60174-9984, Tel: 312-584-2300, TELEX: 720426, FAX: 312-584-2370; Empl.: 700; *Sls. Mgr.:* Doug Fellabaum; *Dist. Mgr.:* Doug Fellabaum

DUMONT/E & R ELECTRONICS, INC., 40 Fairfield Pl., W. Caldwell, NJ 07006, Tel: 201-575-8666, TELEX: 219236 DOLI-UR; FSC No.: 30669; Empl.: 30; *Sls. Mgr.:* Edward Petrasek

DUNCAN ELECTRONICS, INC., 2865 Fairview Rd., Costa Mesa, CA 92626, Tel: 714-545-8261, TWX: 910-595-1128; FSC No.: 5905;Multiple; Empl.: 160; *Sls. Mgr.:* J. Colligan; *Dist. Mgr.:* S. Anderson

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DUPLICON, INC., 516 E. Second St., S. Boston, MA 02127, Tel: 617-269-5484; FSC No.: 0ASD8; Empl.: 6; *Sls. Mgr.:* William A. Currier

DUPONT DE NEMOURS, E. I., & CO., 1007 Market St., Wilmington, DE 19898, Tel: 302-773-3218; Empl.: 130,000

DUPONT ELECTRONICS, (Interconnect & Packaging Grp.), 515 Fishing Creek Rd., New Cumberland, PA 17070, Tel: 800-237-2374; *Sls. Mgr.:* F. Wigfield; *Dist. Mgr.:* E. Abbott (W. Coast)/R. Hoffman (E. Coast)

DUPREE, INC., 14395 Romona Ave., Chino, CA 91710, Tel: 714-597-4889, TWX: 510-100-0281; Empl.: 60; *Sls. Mgr.:* J. Bonderud; *Dist. Mgr.:* Jean Bonderud

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Local Sales Offices & Reps

CA Irvine, Duracell Inc. 714-476-1811
CT Bethel, Duracell 203-264-3935
IL Oak Brook, Duracell Inc. 312-954-2714

Local Distributors

CA Mtn. View, Energy Sls. Inc. 415-969-0800
CA San Diego, Tauber Elctrns. Inc. 619-274-7242
GA Norcross, Applied Power Inc. 404-263-0421
IL Downers Grove, TDI 312-971-4360
MA Sharon, Adcour 617-784-8123
MI Brighton, Applied Power Inc. 313-229-6550
MN St. Paul, dc Battery Prods. 612-646-7478
MO Maryland Hgts., LComp 314-291-6200
NJ Clifton, Engrd. Assemblies Corp. 1-800-BATTERY
NY Commack, Bren-Tronices Inc. 516-499-5155
TX Houston, K-Tec Inc. 713-780-7770
WA Redmond, Energy Sls. Inc. 206-883-2343

DURAKOOL INC.
An American Electronic Components Company

FAX: 219-264-4681

DURAKOOL, INC., American Electronic Components, 1010 N. Main St., Elkhart, IN 46514, Tel: 219-264-1116, TELEX: 25-8482; Empl.: 230; *Sls. Mgr.:* Dave Deuel ..... **B•1696**

Local Sales Offices & Reps

CA Burlingame, Campbell & George 415-697-2965
CA Sunnyvale, Pass Assocs. 408-735-9040
CA Tustin, Morgan Johnson Co., Inc. 714-832-7782
CO Englewood, Harthun Assocs. 303-792-5050
FL Clearwater, J. J. Galleher Co. 813-461-7706
GA Atlanta, A. Brown Assocs. 404-455-1216
IN Mishawaka, Power Comps. of Midwest 219-256-6630
IA Davenport, Volco Co. 319-326-5233
KS Overland Park, R. Greene Co. 913-492-6886
LA Baton Rouge, L. Elliott Co. 504-272-2877
MA Hingham, Hingham Bay Corp. 617-740-1900
MI Novi, Advanced Controls & Technig. .. 313-349-0260
MN Minneapolis, Volco Co. 612-933-6631
MS Corinth, World Dists. 205-533-9108
MO St. Louis, R. Greene Co. 314-994-0222
NE Omaha, Volco Co. 402-346-2203
NY Buffalo, Niagara Elec. Sls. Co. 716-825-3100
NY Wantagh, DONY Tech. Sls. 516-826-5550
NC Pineville, Mel Sls. 704-541-5750
OH Parma, Orr Assocs. 216-885-1324
OK Tulsa, L. Elliott Co. 918-663-4616
OR Portland, Branom Instr. Co. 503-283-2555
PA Narberth, Power Modules Inc. 215-668-0664
TN Brentwood, A. Brown Assocs 615-373-2068
TX Addison, L. Elliott Co. 214-239-8533
TX Midland, Lynn Elliott Co. 915-684-8414
TX Missouri City, L. Elliott Co. 713-499-1571
UT Salt Lake City, Western Controls 801-266-1500
WA Bothell, Temco N.W. 206-821-5434

Local Distributors

IN Mishawaka, Power Comps. of Midwest 219-256-6630
PA Narberth, Power Modules 215-839-1331

DURGIN & BROWNE, See Tridyne Process Systems, DBI Inds.

DVE/CALTRONIC CO., LTD., A Sub. of Dee Van Entrp. Co., Ltd., 407 S. Palm Ave., Alhambra, CA 91803, Tel: 818-289-0310

DY-4 SYSTEMS INC., 21 Credit Union Way, Nepean, Ontario, Canada K2H 9G1, Tel: 613-596-9911, TELEX: 053-4111, FAX: 613-596-0574; Empl.: 210; *Sls. Mgr.:* Mitch Robinson

DYLON, A DIV. OF LIKEN INDS. INC., 130 McCormick Ave., Ste. 112, Costa Mesa, CA 92626, Tel: 714-540-2205, TELEX: 295-603 PTBX-MLBX; Empl.: 10; *Sls. Mgr.:* A. Lichen

DYLON GRAPHITE CO., 124 First Avenue, Berea, OH 44017, Tel: 216-234-1600; Empl.: 35; *Sls. Mgr.:* K. A. Partee

DYMA ENGINEERING, Box 1535, Los Lunas, NM 87031, Tel: 505-865-6700; Empl.: 14; *Sls. Mgr.:* Wiley R. Cunningham; *Dist. Mgr.:* Thom Johnson

DYMEC, INC., 8 Lowell Ave., Winchester, MA 01890, Tel: 617-729-7870, 800-225-1151, TWX: 710-348-6596; Empl.: 50; *Sls. Mgr.:* J. Dennis Santucci

DYNACAST, Div. Coats & Clark Inc., 1401 Front Street, Yorktown Heights, NY 10598, Tel: 914-245-0060, TELEX: 6716096; Empl.: 150

DYNACIRCUITS INC., 11230 W. Addison, Franklin Park, IL 60131, Tel: 312-451-1700, FAX: 312-455-0191; *Sls. Mgr.:* Dan Ciesla (Western U.S.), Carl Morahan (Eastern U.S.)

DYNAGE/CONTROLS, INC., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, Tel: 605-296-3487, TELEX: 753243 (OAKLEAFINC); Empl.: 12; *Sls. Mgr.:* Sidney C. Oakleaf

DYNAGE/POWER & MAGNETICS, Division Of Oakleaf, Inc., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, Tel: 605-296-3462/3487, TELEX: 753243 (OAKLEAFINC); FSC No.: 9Y852; Empl.: 14; *Sls. Mgr.:* Sidney C. Oakleaf ..... **A•2212-2213; D•1702**

DYNALOY, INC., 7 Great Meadow La., Hanover, NJ 07936, Tel: 201-887-9270, TELEX: 642-033, FAX: 201-887-3678; FSC No.: 27908; Empl.: 19; *Sls. Mgr.:* Jay Parton

DYNAMIC AIR ENGRG., INC., 620 E. Dyer Rd., Santa Ana, CA 92705-5697, Tel: 714-540-1000, TWX: 910-595-2588, FAX: 714-545-9145; FSC No.: 4140-6105; *Sls. Mgr.:* Carl A. Grisier

DYNAMIC AIR ENGRG., INC., 620 E. Dyer Rd., Santa Ana, CA 92705-5697, Tel: 714-540-1000, TWX: 910-595-2588, FAX: 714-545-9145; FSC No.: 4140-6105; *Sls. Mgr.:* Carl A. Grisier

DYNAMICS, Div. of Waugh Controls Corp., 9001 Fullbright Ave., Chatsworth, CA 91311, Tel: 818-998-8281, TELEX: 69-6171, FAX: 818-407-1320; Empl.: 100; *Sls. Mgr.:* Tony Mastroianni

DYNAMICS RESEARCH CORP., Encoder Division, 60 Concord St., Wilmington, MA 01887-2193, Tel: 617-658-6100, FAX: 617-658-0522; Empl.: 125; *Sls. Mgr.:* Dave Silva

DYNAMIC TIME SYSTEMS, INC., 1331 S. State, Provo, UT 84601, Tel: 801-377-9154; *Sls. Mgr.:* Graham Hawkins; *Dist. Mgr.:* Graham Hawkins

DYNAPAR, 1675 Delany Rd., Gurnee, IL 60031, Tel: 312-662-2666, TWX: 910-235-1865; Empl.: 150

DYNAPLEX INC., Interplex, 120-12 28th Ave., Flushing, NY 11354, Tel: 212-961-6750, TWX: 710-582-3048; *Sls. Mgr.:* Lester Zimmerman; *Dist. Mgr.:* Lester Zimmerman

DYNAPOWER CORPORATION

FAX: 313-553-9096

DYNAPOWER CORPORATION, Box 3180, Farmington Hills, MI 48333, Tel: 313-553-4300, TWX: 810-242-8804; Empl.: 75 ..... **D•1703-1706**

DYNATECH COMPUTER POWER, INC., 5800 Butler Ln., Scotts Valley, CA 95066, Tel: 408-438-5760, TELEX: 887-247, FAX: 408-438-5793

DYNATECH CORP., 1225 E. Wakeham Ave., P.O. Box 1019, Dept. E, Santa Ana, CA 92702, Tel: 714-558-8755, TWX: 910-595-1951; Empl.: 340; *Sls. Mgr.:* Rick Burbank

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DYNISCO, 10 Oceana Way, Norwood, MA 02062, Tel: 617-769-6600, TELEX: 174-292; FSC No.: 15687; Empl.: 153; *Sls. Mgr.:* Warden B. Hunt

DYTRONICS CO., See Ryan Intl. Corp.

DZUS FASTENER, 425 Union Blvd., W. Islip, NY 11795, Tel: 516-669-6000, TELEX: 71-4974043; FSC No.: 72794; Empl.: 100; *Sls. Mgr.:* Victor Cappetta

EAGLE

EAGLE, P.O. Box 911, Fallbrook, CA 92028, Tel: 619-728-6000 ..... **A•1647**

EAGLE MAGNETIC COMPANY, INC., P.O. Box 24283, Indianapolis, IN 46224, Tel: 317-297-1030, FAX: 317-299-1323; Empl.: 44; *Sls. Mgr.:* Robert Jackson ..... **C•1747**

EAGLE EP PICHER ELECTRONICS DIVISION

FAX: 417-776-2257

EAGLE-PICHER INDUSTRIES, INC., P.O. Box 130, Bethel Road, Seneca, MO 64865, Tel: 417-776-2256, TWX: 910-774-4533; FSC No.: 3L498; Empl.: 400; *Sls. Mgr.:* H. M. York; *Dist. Mgr.:* H. M. York ..... **D•1450-1451**

Local Sales Offices & Reps

AL	Huntsville, L & D Inc.	205-837-1469
AZ	Scottsdale, S.W. Sls.	602-391-3180
AR	Hot Springs, Automation Supp. Inc. (ASI)	501-767-5444
CA	Anaheim, Spectrum Assocs.	714-630-6977
CA	San Jose, O'Donnell Assocs.-North	408-263-6500
CT	Bloomfield, Zaslow Sls. Co.	203-242-7781
FL	Longwood, NSL Assocs., Inc.	305-629-5226
GA	Atlanta, L & D Inc.	404-395-7079
ID	Elk Grove Vl., Parcom, Inc.	312-228-6360
IA	Des Moines, SPS Assocs., Ltd.	515-225-0607
KS	Olathe, SPS Assocs., Ltd.	913-764-4460
MA	Westboro, Zaslow Sls. Co.	617-393-8150
MN	Minneapolis, Ohlin Sls. Co.	612-929-6924
MO	Earth City, SPS Assocs., Ltd.	314-291-0520
NE	Panama, SPS Assocs., Ltd.	402-788-2536
NH	Londonderry, Zaslow Sls. Co.	603-432-8907
NM	Albuquerque, WJM Sls.	505-268-9499
NY	Massapequa Pk., HC Assocs.	516-541-0262
NY	Morrisville, Naylor Elec. Co.	315-684-9620
NC	Raleigh, L & D Inc.	919-876-5301
OH	Dayton, Lyons Corp.	513-278-0714
OR	Beaverton, William J. Purdy Co.	503-641-9373
PA	Exton, Kiley Elec. Co.	215-363-8550
TX	Dallas, Rem Air Comps.	214-234-1069
VA	Richmond, L & D Inc.	804-359-0125
WA	Redmond, William J. Purdy Co.	206-882-3144

Local Distributors

AZ	Tempe, Lynntronics	602-433-0288
AR	Hot Springs, Automation Supp. Inc.	501-767-5444
CA	Anaheim, Carefree Unltd.	714-630-3433
CA	Palo Alto, The Power Source, Inc.	415-856-0700
CO	Denver, J & B Sls.	303-698-2211
FL	Duneoin, Battery Powered Lighting & Sys.	813-734-9498
GA	Austell, DC Power Prods.	404-948-2593
GA	Smyrna, Mark C. Pope Assocs.	404-435-2471
IL	Arlington Hgts., Lodan Elctrns.	312-398-5311
KS	Wichita, RSC Elctrns.	316-267-5213
LA	Shreveport, Indl. Elctrn. Supp. Inc.	318-222-9459
MD	Baltimore, Professional Elctrns.	301-661-2126
MA	Sharon, Adcour	617-784-8123
MN	Minneapolis, Ohlin Sls. Co.	612-929-6924
NE	Lincoln, Spectronics Corp.	402-467-3651
NH	Nashua, Sentinel Battery	603-882-9022
NJ	E. Brunswick, Brothers Elctrns.	201-238-2200
NY	Amityville, Battery Power of LI.	516-691-1993
NY	Brewster, WHI Batteries	914-278-6151
NC	Greensboro, Indl. Elecs.	919-274-3251
OH	Cincinnati, M & B Battery	513-385-5900
OH	Cleveland, Battery Empire	216-266-2244
OH	Columbus, Promark Elctrns., Inc.	614-876-8885
OK	Tulsa, Altair Co.	918-252-5781
OK	Tulsa, Radio Inc.	918-587-9123
PA	Bensalem, Scotts Emergency Lighting	215-639-1777
SC	Greenville, EMSCO	803-233-4121
TN	Goodlettsville, Waller Sls.	614-859-0039
TX	Stafford, Southwest Elctrns.	713-240-4000
VA	Portsmouth, Indl. Parts Corp.	804-393-4033
WA	Tacoma, C & G Elctrns.	206-272-3181
Can	Winnipeg, Manitoba, Westrock Battery Supp. Ltd.	204-786-6034

EAGLE-PICHER INDS., INC., Elctrns. Div., Box 47, Joplin, MO 64801, Tel: 417-623-8000, TWX: 910-774-4508; Empl.: 700

EAGLE SIGNAL CONTROLS, A Wickes Mfg. Co., Box 16100, Austin, TX 78761, Tel: 512-837-8300; Empl.: 600

EALING ELECTRO-OPTICS, New Englander Industrial Park, Holliston, MA 01746, Tel: 617-429-8370, 1-800-343-4912, TELEX: 240041, FAX: 617-875-5616; *Sls. Mgr.:* James F. Babb

E & L INSTRUMENTS, Interplex Electronics, Inc., 70 Fulton Terrace, New Haven, CT 06512, Tel: 203-624-3103, FAX: 203-468-0060; Empl.: 70; *Sls. Mgr.:* Dan Marley

Local Sales Offices & Reps

AZ	Phoenix, S.W. Education Sys.	602-992-2838
CA	San Pedro, Kenex Educational Prods.	213-831-8431
CO	Denver, Bill Newman & Co.	303-425-9503
CT	Woodbridge, Electronic Mktg. Co.	203-397-1461
FL	Winter Pk., D. C. Jaeger Co.	305-645-1500
GA	Calhoun, Learning Labs, Inc.	404-629-4624
IL	Downers Grove, Aidex Corp.	312-963-4270
IA	Hiawatha, Gib Klein Co.	319-393-4048
MN	Afton, L.A.B. Corp.	612-436-1169
MS	Jackson, Sivad, Inc.	601-355-3110
MO	Columbia, Advanced Education Sys.	314-449-5200
NJ	Kenilworth, Shortess-Rawson & Assocs.	201-276-2525
OH	Dayton, Rixan Assocs.	513-222-0011
TN	Santa Fe, Technical Lab. Assocs.	615-682-2509
TX	Houston, Tech. Lab. Sys., Inc.	713-465-9793
UT	Salt Lake City, Tech. Training Sys.	801-943-6699
VA	Berryville, Diversified Educational Sys.	703-955-2782
WA	Seattle, Interactive Training, Inc.	206-251-0886
Can	Georgetown, Ont., Merlan Sci., Ltd. E.	416-877-0171

EAO SWITCH CORP., 198 Pepe's Farm Rd., P.O. Box 552 MO, Milford, CT 06460, Tel: 203-877-4577, TELEX: 96-4347, FAX: 203-877-3694; FSC No.: 61706; Empl.: 19; *Sls. Mgr.:* George T. Bracci ..... **B•1697**

Local Sales Offices & Reps

AZ	Scottsdale, Luscombe Engrg. Co. of AZ	602-949-9333
CA	Los Gatos, Luscombe Engrg. Co. of S.F.	408-370-2020
CA	Pasadena, Luscombe Engrg. Co. of L.A.	213-684-2000
CA	San Diego, Luscombe Engrg. Co. of S.D.	619-549-9699
CO	Longmont, Luscombe Engrg. Co. of CO	303-772-3342
CT	Farmington, Ray Perron & Co., Inc.	203-673-4825
FL	Tampa, Florida Comp. sls.	813-960-7044
GA	Norcross, Mtn. Electro Mktg.	404-448-5594
IL	Arlington Hgts., Brainard-Wilson Mktg., Inc.	312-437-2700
IN	Ft. Wayne, M/S Sls. & Assocs.	219-436-3023
IN	Greenwood, M/S Sls. & Assocs.	317-881-0110
IA	Cedar Rapids, Delltron Co., Inc.	319-362-2526
MD	Columbia, Delta III Assocs., Inc.	301-730-4700
MA	Needham, Ray Perron & Co., Inc.	800-225-4280, 617-449-6162
MI	Plymouth, Jay Mktg. Assocs., Inc.	313-459-1200
MN	Golden Valley, Highland Elctrn. Sls.	612-546-2123
MO	Florissant, Delltron Co., Inc.	314-839-0033
MO	Gladstone, Delltron Co., Inc.	816-436-6445
NH	Merrimack, Ray Perron & Co., Inc.	603-424-4423
NJ	Englewood, Sprung/Nussbaum	201-569-5666
NY	Rochester, Apex Assocs., Inc.	716-254-6050
NC	Raleigh, C-Tech Sls., Inc.	919-847-0202
OR	Lake Oswego, Luscombe Engrg. Northwest	503-636-6664
PA	Horsham, Jacobsen Assocs.	215-674-2937
PA	Pittsburgh, R. W. Kneip	412-823-0169
TX	Dallas, Glidden Electro Equip. Co	214-341-0610
TX	Houston, Glidden Electro Equip. Co.	713-681-1415
UT	Salt Lake City, Luscombe Engrg. Co.	801-532-4118

WA Bellevue, Luscombe Engrg. N.W. 206-223-1541
WI Mequon, Badgerep 414-241-9200

Local Distributors

AZ Phoenix, Minarik Elec. 602-233-3000
AZ Tempe, Harper SID 602-967-1464
CA Compton, Harper SID 213-979-5090
CA Gardena, California Switch & Sig. 213-770-2330
CA Hawthorne, Electrosonic Comps. 213-970-0997
CA Los Angeles, Minarik Elec. Co. 213-624-3161
CA San Diego, Harper SID 619-578-2500
CA San Diego, Minarik Elec. Co. 619-560-6632
CA San Jose, Dansco Comp. Sls., Inc. 408-292-9740
CA Santa Clara, Bell Elctrl. Supp. 408-727-0575
CA Santa Clara, Minarik Elec. Co. 408-727-0575
CA Santa Minica, Master Distrs. 213-452-1229
CA Sunnyvale, Harper SID 408-747-0333
CO Denver, CSID, Inc. 303-292-9594
CO Denver, Minarik Elec. Co. 303-329-3525
CT Wallingford, Sager Elec. Supp. co. 203-265-4600
CT Waterbury, Century Elec. Supp. 203-755-0405
FL Lakeland, Wes-Garde/Switch Controls, Inc. 813-644-7564
FL Oviedo, Dixie Sls. 305-365-5211
IL Crystal Lake, Sub-Sem, Inc. 312-782-3954
IL Elk Grove, Martec Assoc. 312-956-8090
IL Rosemont, Advent Elctrns., Inc. 312-297-6200
IL Schaumburg, Minarik Elec. Co. 312-885-9337
IN Indianapolis, Mar Elctrns. 317-633-6699
IN Indianapolis, R.M. Indiana 317-291-7110
IA Cedar Rapids, Advent Elctrns., Inc. 319-363-0221
KS Wichita, Radio, Inc. 316-264-2798
KY Louisville, Peerless Elctrns. 502-637-7674
LA Baton Rouge, Menard Elctrns. 504-355-0323
ME W. Buxton, Nelson & Wright 207-929-8238
MD Gaithersburg, Axis Elctrns. 301-840-9640, 800-492-3190
MD Jessup, Treeko Sls. 301-792-0112
MA Canton, Impact Sls. Co. 617-821-1500
MA Hingham, Sager Elec. Supp. Co. 617-749-6700
MA N. Billerica, Minarik Elec. Co. 617-663-0740
MI Grand Rapids, R. M. Elctrns. Co. 616-531-9300
MI St. Claire Shores, SPEMCO Switches 313-771-2700
MN Minneapolis, Electronic Ctr., Inc. 612-371-5200
MO St. Louis, Beckwith, Inc. 314-343-6463
NH Salem, Sager Elec. Supp. Co. 603-898-1348
NJ Cranford, Garden State Indl. Elctrns., Inc. 201-272-6400
NJ Oakland, Relay Specialties 201-337-1000
NY Bohemia, Key Comps., Inc. 516-567-7500
NY Buffalo, Summit Distrs., Inc. 716-887-2800
NY New York, Martin-Audio/Video 212-541-5900
NY Rochester, Simcona Elctrns. 716-328-3230
NY Rochester, Summit Elctrns., Inc. 716-334-8110
NY Victor, ADD/Modutex 716-924-4400
NY Woodside, Switches Unlimited 718-478-5000
NC Charlotte, Dixie Elctrns. 704-377-4348
NC Charlotte, Elctrns. Mktg. Corp. 704-394-6195
NC Winston-Salem, Kirkman Elctrns., Inc. 919-722-9131,800-334-8688
OH Columbus, Electronics Mktg. Corp. 614-299-4161
OH Highland Hgts., Electronics Mktg. Corp. 216-442-3441
OK Tulsa, Radio, Inc. 919-587-9123
OR Portland, Minarik Elc. Co. 503-253-3402
PA Harrisburg, Ad-Tech Elctrns. 717-939-8337
PA McKean, Advacom 814-476-7774
PA Norristown, Kimberly-James Co. 215-666-7286
PA Pittsburgh, Grant Indl. Controls, Inc. ... 412-787-9770
PA Wayne, Peak Elctrns. Corp. 215-293-9000
SC Columbia, Dixie Elctrns. 803-779-5332
TX Garland, Indl. Equip. Co. of Dallas 214-271-5494
TX Irving, Harper SID 214-621-0500
TX Irving, Minarik Elec. Co. 214-929-4111
TX San Antonio, Minarik Elec. Co. 512-822-7097
WA Seattle, Platt Elec. 206-624-4083
WI Milwaukee, Marsh Elctrns. Corp. 414-475-6000

E-A-R DIV., Cabot Corp., 7911 Zionsville Rd., Indianapolis, IN 46268, Tel: 317-872-1111, TWX: 810-341-3412; *Sls. Mgr.:* Lawrence K. Landers

EASCO/K D TOOLS, See Hunter Tools, Easco/K D Tools

EASTERN AIR DEVICES, INC., 1 Progress Dr., Dover, NH 03820, Tel: 603-742-3330, TWX: 510-297-4454, FAX: 603-742-9080; Empl.: 175 ..... **B•1202**

Local Sales Offices & Reps

CA San Jose, Motion Sys. 408-246-0641
CA Tustin, Schoenbachler-Dobson Co. ... 714-544-1888
CO Boulder, R. G. Entprs. 303-447-9211
FL Orlando, Perrott Assoc. 305-275-1132
IL Arlington Hgts., CMA 312-577-7924
MA Marlborough, Gerald Rosen Co. 617-481-9277
MN St. Paul, REPCO 612-488-0201
NJ Ridgefield, Rical Assocs. 201-945-5250
NY Rochester, Elcom Sls. 716-385-1400
NY Syracuse, ELCOM Sls. 315-685-8245
NC Charlotte, Jake Rudisill Assocs. 704-377-6901
OH Cincinnati, KCH Co. 513-931-1686
PA Paoli, ETC Sales 215-296-3527
TX Austin, Oeler & Menelaides Inc. 512-453-0275
TX Richardson, D.J. Sls. 214-783-8876
WA Seattle, Eltech 206-767-4330

Local Distributors

NY Plainview, Controls Sls. Inc. 516-756-5652
NC Charlotte, Joyce Sls. Co. 704-377-6901
PA Pittsburgh, EXONIC Sys. 412-784-8400

EASTERN ELECTRONICS MFG. CORP., National Patent Dev. Corp., 180 Roberts St., East Hartford, CT 06108, Tel: 203-528-9821; FSC No.: 203-289-7639; Empl.: 200; *Sls. Mgr.:* Wayne M. Baker

EASTERN MARKING MACHINES, 422 S Franklin St., Hempstead, NY 11550, Tel: 516-483-7070, TELEX: 968095; Empl.: 8; *Sls. Mgr.:* George Rosales; *Dist. Mgr.:* L. Sherman

EASTERN MICROWAVE, 40 Ray Ave., Burlington, MA 01803, Tel: 617-273-4700; FSC No.: 30616; Empl.: 45; *Sls. Mgr.:* S. C. Lowe

EASY HEAT WIREKRAFT, See Electrical Systems, Div. of Bristol Corp.

EATON CORP., Aerospace Controls/Systems Div., 2074 Whitfield Ave., East, Sarasota, FL 33578, Tel: 813-758-7726

EATON CORP., AIL, Commack Rd., Deer Park, NY 11729, Tel: 516-595-3094, TWX: 510-227-6073; FSC No.: 00752; Empl.: 5000; *Sls. Mgr.:* H. N. Kreisberg

EATON CORP, Durant Products, 901 S. 12th St., Watertown, WI 53094, Tel: 414-261-4070, TWX: 910-260-3713; Empl.: 400; *Sls. Mgr.:* H. L. Sisson; *Dist. Mgr.:* Dennis G. Walz

EATON CORP., Electronic Instrument Div., 5340 Alla Rd., Los Angeles, CA 90066, Tel: 213-822-3061, TWX: 910-343-6969; Empl.: 250; *Sls. Mgr.:* Jeff Shahan, VP Sls.

EATON CORPORATION, Microwave Products Division, 785 Palomar Ave., Sunnyvale, CA 94086, Tel: 408-730-6410, TWX: 910-339-9556; FSC No.: 27338; Empl.: 495; *Sls. Mgr.:* Anton Schaffer

Local Sales Offices & Reps

AZ Tempe, Sierra Tech. Grp. 602-894-2335
CA Irvine, EBA Microwave 714-240-8181
CA Morgan Hill, Loroco Sls. 408-779-5117
FL Winter Pk., Microwave Mktg. 305-678-2141
IL Northfield, Feller Assocs. 312-446-8065
IA Cedar Rapids, S & O Sls. 319-363-7323
MD Silver Springs, Youth Assocs. 301-598-5740
MA Wakefield, Spectrum Mktg. 617-246-4740

EATON CORP., Microwave Products Division, 785 Palomar Ave., Sunnyvale, CA 94086, Tel: 408-773-3700, TWX: 910-339-9395; FSC No.: 27338; Empl.: 495; *Sls. Mgr.:* J. R. Campbell

EATON CORP./MSC PRODUCTS, 1640 Monrovia Avenue, Costa Mesa, CA 92627, Tel: 714-642-2427, TELEX: 67-8433; FSC No.: 96182; Empl.: 500ò; *Sls. Mgr.:* J. R. McDonough

EATON CORP., Printer Prods Oper., Technical Research Park, Riverton, WY 82501, Tel: 307-856-4821, TWX: 910-949-4864, FAX: 307-856-0412; Empl.: 185; *Sls. Mgr.:* Rich Phillips; *Dist. Mgr.:* Rich Phillips

EATON (LORLIN) CORP., See Lorlin, Div. of Axiam, Inc.

EATON CORP./CUTLER-HAMMER PRODS, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216, Tel: 414-449-7487, TELEX: 26-716; FSC No.: 81640; *Sls. Mgr.:* J. R. McDonough

EBERHARD MFG. CO., DIV., Eastern Co., 21944 Drake Rd., Strongsville, OH 44136, Tel: 216-238-9720, TELEX: 98-5301, FAX: 216-572-2732; FSC No.: 19220; *Sls. Mgr.:* Edward Hongosh

FAX: 203-674-8536

EBM INDS., INC., 525 New Britain Ave., Unionville, CT 06085, Tel: 203-674-1515, TWX: 710-423-8723; FSC No.: 62292; *Sls. Mgr.:* Robert Sobolewski ..... **C•1642, 1655-1659**

Local Sales Offices & Reps

AL Huntsville, Raycom 205-859-2017
AZ Scottsdale, Harris And Croy 602-951-9121
AZ Tucson, Harris and Croy 602-888-0642
CA Los Angeles, Wiley Co. 213-666-1611
CA San Diego, Wiley Co. 619-453-9018
CA Santa Clara, Ross Mktg. Assocs. 408-988-8111
CO Littleton, Simpson Assocs. 303-794-8381
FL Altamonte Springs, Raycom, Inc. 305-682-0032
FL Davie, Raycom, Inc. 305-475-3022
FL Melbourne, Raycom, Imc. 305-259-7988
FL Orlando, Raycom, Inc. 305-859-5504
FL Wellborn, Raycom, Inc. 904-963-5023
GA Marietta, Raycom 404-952-6061
IL Glendale Hgts., Beta Technlg. Sls. 312-790-9886
IA Des Moines, Houk & Assocs., Inc. 515-276-6741
KS Overland Park, Web Elctrns. 913-381-7986
MA Millis, Selmark Assocs. 617-376-2914
MI Warren, Burcaw Co. 313-573-4605
MI Wyoming, Burcaw 800-572-1610
MN St. Paul, Arkco Sls. 612-777-7454
MO Florissant, Web Elctrns. 314-921-5720
NH Hopkinton, Selmark Assocs. 603-746-3299
NJ Marlton, b.g.r. Assocs. 609-983-1020
NY Buffalo, NRM Mktg. Grp. 716-634-4300
NY Frankilin Sq., Cooper-Simon & Co., Inc. 516-489-0404
NY Skaneateles, NRM Mktg. Grp. 315-685-8991
NC Raleigh, Raycom 919-847-8276
OH Maple Hgts., Versatron 216-581-0090
OK Tulsa, Bonser-Philhower Sls. 918-744-9964
OR Hillsboro, Temco Northwest 503-649-8375
PA Harrison City, NRM Mktg. Grp. 412-327-0858
TX Austin, Bonser-Philhower Sls. 512-346-9186
TX Houston, Bonser-Philhower Sls. 713-782-4144
TX Richardson, Bonser-Philhower Sls. 214-234-8438
UT Midvale, Simpson Assocs. 801-566-3691
WA Kirkland, Temco Northwest 206-821-5434
WA Maple Falls, Temco Northwest 206-599-2750
WA Spokane, Temco Northwest 509-534-8635
WI Milwaukee, Beta Technolg. Sls., Inc. 414-543-6609
PR Bayamon, Selmark 809-797-9176

Local Distributors

AL Huntsville, Powell Elec. 205-539-2731
AZ Phoenix, Arizona Comps. Co. 602-269-5655
AZ Tempe, Supply Team Intl. 602-968-1192
AZ Tucson, Southwest Sls. 602-628-1613
CA Anaheim, Deco Elec. 714-630-8252
CA Costa Mesa, Powell 714-754-1717
CA Fullerton, Pyramid/Fullerton 714-773-0781
CA Hollywood, Yale Elctrns. 818-465-3186
CA Irvine, Integrated Elctrns. 714-837-9960
CA San Diego, Deco Elctrns. 619-693-1595
CA San Diego, Pyramid 619-271-5404
CA San Jose, Integrated 408-435-1000
CA San Jose, Powell Elec. 408-943-9020
CA Santa Clara, Pyramid Elctrns. 408-727-9810
CA Sunnyvale, Power Supply Comps. 408-737-1333
CO Denver, Integrated Elctrns. 303-292-6121
CO Englewood, Indl. Elctrns. 303-694-9444
CT Danbury, Pilgrim Elctrns. 203-792-7274
CT E. Haven, J. V. Elctrns. 203-469-2321
CT Wallingford, Cronin Elec. 203-265-3134
CT Yalesville, Glynn Elctrns. 203-265-2498
FL Ft. Lauderdale, Powell Elec. 305-979-5000
FL Ft. Lauderdale, Reptron 305-735-1112
FL Tampa, Reptron 813-855-4656
GA Atlanta, ACK Radio Supp. 404-351-6340
GA Fayetteville, Frankland 404-461-4026
GA Norcross, Reptron 404-446-1300
IL Hoffman Estates, I.E.C. Intercomp 312-843-2040
IL Rosemont, Advent Elctrns. 312-297-6200
IL Schaumburg, Reptron/Illinois 312-882-1700
IN Indianapolis, Advent Elctrns. 317-872-4910
IA Cedar Rapids, Advent Elctrns. 319-363-0221
MD Baltimore, Resco/Baltimore 301-529-0500
MD Beltsville, Resco/D.C. 301-937-9100
MD Columbia, Powell 301-621-8080
MA Canton, Impact Sls. Co. 617-821-1500
MA Middleboro, Glynn Elctrns. 617-947-4262
MA Needham, Cronin 617-449-5000
MA Westborough, Powell 617-366-6100
MA Wilmington, Heilind Elctrns. 617-657-4870
MI Farmington Hills, Advent Elctrns. 313-477-1650
MI Livonia, Reptron 313-525-2700
MN Minneapolis, Control Des. Supp. 612-721-1628
MN Minneapolis, Reptron 612-938-0000
NV Carson City, Integrated Elctrns. 702-883-9399
NH Manchester, Cronin 603-624-0105
NH Manchester, Glynn Elctrns. 603-622-8131
NH Nashua, Brevan Elctrns. 603-889-7230

NJ	Englewood, Powell Elec.	201-894-0800
NJ	W. Berlin, General Comps.	609-768-6767
NY	Farmingdale, Addem Sls.	516-752-9303
NY	Hauppauge, Broadline Elec. Distr.	516-231-4100
NY	Hicksville, Janesway Elctrns.	516-935-1827
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Mt. Vernon, Janesway Elctrns.	914-699-6710
NY	Rochester, Simcona	716-328-3230
NC	Cary, Powell Elec.	919-467-1212
NC	Raleigh, Century	919-782-2116
OH	Akron, Akron Elctrns.	216-762-8818
OH	Twinsburg, Advacom	216-425-8477
OH	Worthington, Reptron Ohio	614-436-6675
OR	Beaverton, Integrated Elctrns.	503-641-1690
PA	Export, Advacom	412-733-5400
PA	Malvern, Control Design Supp.	215-296-0150
PA	McKean, Advacom/Erie	814-476-7774
PA	Norristown, Century Elctrn. Comp. Co.	215-631-5400
PA	Philadelphia, Powell	215-365-1900
TN	Hixson, Techni-Tronics	615-842-0514
TX	Dallas, Omni Pro Elctrns.	214-233-9368
TX	Irving, Powell Elctrns.	214-550-0547
TX	Richardson, Janesway Elctrns.	214-437-5125
UT	N. Salt Lake, Integrated Elctrns.	801-298-1868
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
WA	Bellevue, Integrated Elctrns./Jaco	206-455-2727
WA	Kent, Pyramid Elctrns.	206-872-5800
WI	Mequon, Taylor Elec. Co.	414-241-4321
WI	New Berlin, Control Design Supp.	414-784-1015
WY	Mequon, Lakeview Elctrns.	414-377-8250

EBY COMPANY, Pullman Co., 2751 Southampton Rd., Philadelphia, PA 19154, Tel: 215-969-4200, TWX: 710-670-0452; FSC No.: 72825; Empl.: 92

ECG, 14123 21st Ave. N., Plymouth, MN 55441, Tel: 612-554-0720

ECO INSTRS. DIV., Sea Data Corp., 1 Bridge St., Newton, MA 02158, Tel: 617-964-8360, TELEX: 951107; Empl.: 40; *Sls. Mgr.:* Jill Shipman

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Local Sales Offices & Reps

AL	Huntsville, EMA	205-830-4030
CA	Laguna Hills, WESTEC	714-770-6229
CA	Mtn. View, Kim Buurma	415-494-8343
CO	Littleton, Electronic Comp. Sys.	303-797-0894
FL	Orlando, Honeyco, Inc.	305-299-1000
MD	Baltimore, Burgin-Kreh Assocs.	301-265-8500
MA	Westwood, Apex Assocs.	617-326-5042
NJ	Teaneck, Noreast Tech. Sls.	201-833-2044
OR	Grants Pass, ECS Inc.	503-476-8871
PA	Horsham, Jacobsen Assocs.	215-674-2937
TX	Dallas, Advance Tech. Sls.	214-340-1300
WA	Bellevue, Comtec	206-453-1188
Can	Stittsville, Ont., Production Case Co.	613-836-2248

Ectron CORPORATION

FAX: 619-278-0372

ECTRON CORP., 8159 Engineer Rd., San Diego, CA 92111, Tel: 619-278-0600, TWX: 910-335-1259; FSC No.: 24856; Empl.: 50; *Sls. Mgr.:* W. W. Hanford ..... **D•1010**

Local Sales Offices & Reps

AZ	Phoenix, Aztec Entprs.	602-944-9185
CA	Canoga Pk., FLW Inc.	818-719-0037,
CA	Costa Mesa, FLW Inc.	714-751-7512
CA	Hayward, FLW Inc.	415-786-9070
CO	Denver, Aztec Entprs.	303-779-5285
FL	Melbourne, Saber Assocs.	305-724-0920
GA	Norcross, Saber Assoc. Inc.	800-327-0853
IL	Elmhurst, Sector Engrg. Sls.	312-530-7850
IN	Indianapolis, Seotor Engrg. Sls.	317-842-1120
KS	Lenexa, Ramsey Assocs.	913-541-1007
LA	Baton Rouge, Sesco	504-928-4951
MD	Laurel, Elctrn. Mktg. Assoc.	301-792-9300
MA	Needham, Addelco Corp.	617-444-4754
MI	Troy, Satullo Assocs.	313-585-4811,
MN	Minneapolis, Sector Eng. Sls. Inc.	612-593-1809
MO	Maryland Hgts., Ramsey Assocs.	314-878-5042
NM	Albuquerque, Westfhal & Assocs.	505-881-0995,
NY	East Syracuse, Ossmann Instrs.	315-437-7052
NY	Plainview, Eastern-Metro Assoc.	516-931-1414
NY	Rochester, Ossmann Instrs.	716-359-1200,
NC	Clayton, Saber Assocs.	800-327-0853
OH	Cleveland, Instrmn. Sys.	216-845-8800
OH	Dayton, Instrmn. Sys.	513-294-2838
OK	Tulsa, Sesco	918-622-3868
PA	Pittsburgh, Instrmn. Sys.	412-823-7005
PA	Plymouth Meeting, Elctrn. Mktg. Assoc.	215-828-7400
SC	Columbia, Saber Assoc. Inc.	800-327-0853
TX	Dallas, Sesco	214-231-9364
TX	Houston, Sesco	713-999-3510
UT	Ogden, Aztec Entprs.	801-621-1655
WA	Seattle, Datacom Assoc. Inc.	206-285-2525
WI	Milwaukee, Sector Eng. Sls. Inc.	414-352-8280

EDAC INC., 20 Railside Rd., Toronto, ON, Canada M3A 1A4, Tel: 416-445-2292, TWX: 610-492-1398, FAX: 416-445-4394; FSC No.: 31781; Empl.: 120; *Sls. Mgr.:* Alan Little; *Dist. Mgr.:* Alan Little

EDA INSTRUMENTS, INC., 4 Thorncliffe Park Dr., Toronto, ON, Canada M4H1H1, Tel: 416-425-7800, TELEX: 06 23222 FEDA TOR, FAX: 416-425-8135; Empl.: 70; *Sls. Mgr.:* Scott Hepburn

EDCLIFF DIV., Systron Donner, 1711 So. Mountain Ave., Monrovia, CA 91016, Tel: 818-358-4571, TWX: 910-585-3248, FAX: 818-359-5719; FSC No.: 00153; Empl.: 110; *Sls. Mgr.:* Cosmo L. Avellis

EDL, INC., 385 Oser Ave., Hauppauge, NY 11788, Tel: 516-435-2808, 1-800-DIAL EDL; Empl.: 50; *Sls. Mgr.:* Ann Marie Capuanno

EDMAN CORP., Subsidiary of Rospatch, 7500 Main St., P.O. Box 750, Fishers, NY 14453-0750, Tel: 716-924-4000, TWX: 510-254-2896; Empl.: 170; *Sls. Mgr.:* Howard Potter

EDO CORP./ELINCO DIV., See Electrical Indicator Co., Inc.

EDO WESTERN CORP., EDO Corp., 2645 South 300 W., Salt Lake City, UT 84115, Tel: 801-486-7481/3846, TELEX: 388-315; Empl.: 360; *Sls. Mgr.:* Ken Etulain

EDSYN, INC., 15958 Arminta Ave., Van Nuys, CA 91406, Tel: 818-989-2324, 213-873-5115, TELEX: 65-1469; *Sls. Mgr.:* Wayne Murry

EDWARDS CO., Signaling Prods. Div., P.O. Box 1188, Farmington, CT 06034, Tel: 203-678-0410; Empl.: 1000; *Sls. Mgr.:* Al Canevari; *Dist. Mgr.:* Al Canevari

EECO INCORPORATED, 1601 E. Chestnut Ave., P.O. Box 659, Santa Ana, CA 92702-0659, Tel: 714-835-6000, TELEX: 67-8420, TWX: 910-595-1550; Empl.: 850; *Sls. Mgr.:* Greg Littler; *Dist. Mgr.:* Dick Fried ..... **B•1698-1700, 1815**

Local Sales Offices & Reps

CA	Santa Ana, Jones & McGeoy Sls., Inc.	714-547-6466
AL	Huntsville, Montgomery Mktg., Inc.	205-830-0498
AZ	Scottsdale, S.W. Sls.	602-391-3180
CA	Los Altos, Recht Assocs.	415-964-6321
CA	San Diego, Harvey King Inc.	619-587-9300
CO	Denver, Delltron Co.	303-373-0300
CT	S. Windsor, Northeast Reps., Inc.	203-644-3728
FL	Altamonte Springs, Carter Assocs.	305-260-5566
FL	Pompano Beach, Carter Assocs.	305-942-4428
GA	Norcross, Montgomery Mktg., Inc.	404-447-6124
IL	Elk Grove Village, TriStar Grp., Inc.	312-593-0200
IN	Fort Wayne, M/S Sls. & Assoc.	219-436-3023
IN	Indianapolis, M/S Sls. & Assocs.	317-257-8915
IA	Cedar Rapids, Palatine Engr. & Sls., Inc.	319-365-8071
KS	Blue Springs, Palatine Engr. & Sls., Inc.	816-229-4007
KS	Wichita/W. Kansas, Palatine Engrg.	316-262-1020
MD	Laurel, EMA, Inc.	301-953-7800
MA	Hingham, Northeast Reps., Inc.	617-749-8700
MI	Livonia, Lowell-Wendt Mktg. Co.	313-464-2722
MI	Wyoming, Lowell-Wendt Mktg. Co.	606-531-4499
MN	Minneapolis, R.K. Sls. Assocs., Inc.	612-571-1001
MO	Hazelwood, Palatine Engr. & Sls., Inc.	314-839-0800
NH	Milford, Northeast Reps., Inc.	603-673-1406
NJ	Englewood, Tecnimat	201-569-4200
NY	Clarence Ctr., Tech-Mark, Inc.	716-741-9138
NY	Mendon, Tech-Mark, Inc.	716-624-3840
NY	Utica, Tech-Mark, Inc.	315-733-0575
NC	Cary, Montgomery Mktg.	919-467-6319
NC	Raleigh, Montgomery Mktg.	919-851-0010
OH	Aurora, Engrg. Mktg. Assocs.	216-562-6104
OH	Centerville, Engrg. & Mktg. Assocs.	513-433-2800
OK	Tulsa, West Assocs.	918-665-3465
OR	Beaverton, Blair Hirsh Co.	503-641-1875
PA	Huntingdon Valley, Omega Elctrn. Sls.	215-947-4135
TX	Austin, West Assocs.	512-339-6886
TX	El Paso, S.W. Sls.	915-594-8259
TX	Houston, West Assocs.	713-777-4108
TX	Richardson, West Assocs.	214-680-2800
WA	Lynnwood, Blair Hirsh Co.	206-774-8151
WI	Brookfield, TriStar Grp., Inc.	414-782-2670
Can	Montreal, EECO Incorporated	514-286-7105
Can	Napean, Ont., Renmark Elctrns. Ltd.	613-727-0320
Can	Richmond Hill, Ont., Renmark Elctrns. Ltd.	416-881-8844

Local Distributors

CA	Santa Monica, Master Distrs.	213-452-1336
AL	Huntsville, Hall-Mark Elctrns.	205-837-8700
AL	Huntsville, Marshall Inds.	205-881-9235
AZ	Phoenix, Hall-Mark Elctrns.	602-437-1200
AZ	Phoenix, Marshall Inds.	602-496-0290
AZ	Tempe, Harper SID	602-967-1464
CA	Canoga Park, Hall-Mark Elctrns.	818-716-7300
CA	Chatsworth, Marshall Inds.	818-407-0101
CA	Compton, Harper SID	213-979-5090
CA	El Monte, Marshall Inds.	818-459-5500
CA	Irvine, Marshall Inds.	714-859-5050
CA	Milpitas, Marshall Inds.	408-943-4600
CA	Rancho Cordova, Marshall Inds.	916-635-9700
CA	San Diego, Hall-Mark Elctrns.	619-268-1201
CA	San Diego, Harper SID	619-578-2500
CA	San Diego, Marshall Inds.	619-578-9600
CA	San Jose, Hall-Mark Elctrns.	408-946-0900
CA	Santa Clara, Master Dists.	408-496-6151
CA	Santa Fe Springs, MICRONET Computer Sys.	213-921-0068
CA	Sunnyvale, Harper SID	408-747-0333
CA	Sunnyvale, Marshall Inds.	408-943-4600
CA	Sunnyvale, Time Electronics	408-734-9888
CA	Torrance, Hall-Mark Elctrns.	213-217-8400
CA	Tustin, Hall-Mark Elctrns.	714-669-4700
CO	Englewood, Hall-Mark Elctrns.	303-790-1662
CO	Thornton, Marshall Inds.	303-451-8444
CT	Wallingford, Hall-Mark Elctrns.	203-269-0100
CT	Wallingford, Marshall Inds.	203-265-3822
CT	Wallingford, Sager Electrical Supply Co.	203-265-4600
FL	Clearwater, Hall-Mark Elctrns.	813-576-8691
FL	Orlando, Hall-Mark Elctrns.	305-855-4020

FL Orlando, Marshall Inds. 305-841-1878
FL Pompano Beach, Hall-Mark Elctrns. ... 305-971-9280
GA Norcross, Hall-Mark Elctrns. 404-447-8000
GA Norcross, Marshall Inds. 404-923-5750
IL Schaumburg, Marshall Inds. 312-490-0155
IL Wood Dale, Hall-Mark Elctrns. 312-860-3800
IN Indianapolis, Hall-Mark Elctrns. 317-872-8875
IN Indianapolis, Mar Elctrns., Inc. 317-633-6699
IN Indianapolis, Marshall Inds. 317-297-0483
KS Lenexa, Hall-Mark Elctrns. 913-888-4747
KS Lenexa, Marshall Inds. 913-492-3121
MD Baltimore, Hall-Mark Elctrns. 301-988-9800
MD Gaithersburg, Marshall Inds. 301-840-9450
MA Billerica, Hall-Mark Elctrns. 617-667-0902
MA Hingham, Sager Elctrn. Supp. Co. 617-749-6700
MA Wilmington, Marshall Inds. 617-658-0810
MI Livonia, LWC Distrs. 313-464-7700
MN Eden Prairie, Hall-Mark Elctrns. 612-941-2600
MN Plymouth, Marshall Inds. 612-559-2211
MO Earth City, Hall-Mark Elctrn. 314-291-5350
MO Maryland Hgts., Chelsea Inds. 314-997-7709
NJ Fairfield, Hall-Mark Elctrns. 201-575-4415
NJ Fairfield, Marshall Inds. 201-882-0320
NJ Mt. Laurel, Marshall Inds. (Philadelphia Div.) 215-627-1920
NM Albuquerque, International Elctrns. 505-345-8127
NY Buffalo, Summit Distrs. 716-887-2800
NY Hauppauge, Marshall Inds. 516-273-2424
NY Johnson City, Marshall Inds. 716-798-1611
NY Lynbrook, L.I., Peerless Radio Corp. ... 516-593-2121
NY Rochester, Marshall Inds. 716-235-7620
NY Ronkonkoma, Hall-Mark Elctrns. 516-737-0600
NC Raleigh, Hall-Mark Elctrns. 919-872-0712
NC Raleigh, Marshall Inds. 919-878-9882
OH Dayton, Marshall Ind. 513-236-8088
OH Solon, Hall-Mark Elctrns. 216-349-4632
OH Solon, Marshall Inds. 214-248-1788
OH Worthington, Hall-Mark Elctrns. 614-888-3313
OR Beaverton, Almac Elctrns. 503-629-8090
OR Beaverton, Marshall Inds. 503-644-5050
PA Mt. Laurel, Marshall Inds. 215-627-1920
TX Austin, Hall-Mark Elctrns. 512-258-8848
TX Austin, Marshall Inds. 512-837-1991
TX Carrollton, Marshall Inds. 214-233-5200
TX Dallas, Hall-Mark Elctrns. 214-341-1147
TX El Paso, International Elctrns. 915-598-3406
TX Harper SID, Harper Sls. 214-621-0500
TX Houston, Hall-Mark Elctrns. 713-781-6100
TX Houston, Marshall Inds. 713-895-9200
UT Salt Lake City, Marshall Inds. 801-485-1551
UT West Valley, Hall-Mark Elctrns. 801-972-1008
VT West Valley, Hall-Mark Elctrns. 801-972-1008
WA Bellevue, Almac Elctrns. 206-643-9992
WA Bellevue, Marshall Inds. 206-747-9100
WA Spokane, Almac Elctrns. 509-924-9500
WI New Berlin, Hall-Mark Elctrns. 414-797-7844
WI Waukesha, Marshall Inds. 414-797-8400
Can Burnaby, BC, RAE Indl. Elec. Ltd. 604-291-8866
Can Calgary, Alb., Cardinal Ind. Elec. Ltd. .. 403-259-6817
Can Calgary, Alta., Future Elctrns. 403-235-5325
Can Downsview, Ont., Future Elctrns. 416-638-4771
Can Edmonton, Alb., Cardinal Ind. Elec. Ltd. 403-483-6266
Can Edmonton, Alta., Future Elctrns. 403-438-2858
Can Guelph, Ont., EMJ Data Sys. Ltd. 416-454-2940, 519-837-2444
Can Montreal, Que., EMJ Data Sys. Ltd. 514-849-4171
Can Nepean, Ont., Carsten Elctrns., Ltd. 613-726-9250
Can Ottawa, Ont., Future Elctrns. 613-820-8313
Can Pointe Claire, Que., Future Elctrns. 514-694-7710
Can Scarborough, Ont., Carsten Elctrns., Ltd. 416-751-5002
Can St. Laurent, Que., Carsten Elctrns., Ltd. 514-334-8321
Can Vancouver, BC, EMJ Data Sys. Ltd. ... 604-732-7268
Can Vancouver, BC, Future Elctrns. 604-438-5545
Can Winnipeg, Manitoba, Future Elctrns. ... 204-339-0554

EEMCO DIV., Datron Systems Inc., 4585 Electronics Pl, Los Angeles, CA 90039, Tel: 818-247-7060, TWX: 910-497-2269; FSC No.: 72121; Empl.: 300; *Sls. Mgr.:* Russell Johnson

EEV INC., 4 Westchester Plaza, Elmsford, NY 10523, Tel: 914-592-6050, TELEX: 6818096, FAX: 914-682-8922; Empl.: 42; *Sls. Mgr.:* Tom Soldano

EFECTOR, INC., 805 Spring Dale Dr., Exton, PA 19341, Tel: 215-524-2000, 800-441-8246, TELEX: 84-6437, FAX: 215-524-2010; Empl.: 35; *Sls. Mgr.:* J. Kelly

EFI CORPORATION, 350 West 2700 South, Salt Lake City, UT 84115, Tel: 801-486-5871, 800-221-1174, FAX: 801-466-8311; Empl.: 60; *Sls. Mgr.:* George O. Stewart

EG&G, INC., Electro-Optics Div., 35 Congress St., Salem, MA 01970, Tel: 617-745-3200, TELEX: 681-7405 EGGSA; FSC No.: 25506; Empl.: 500; *Sls. Mgr.:* J. Murachver

EG&G, INC., Electronics Components Div., 35 Congress St., Salem, MA 01970, Tel: 617-745-3200, TELEX: 681-7405 EGGSA; FSC No.: 25506; Empl.: 500; *Sls. Mgr.:* J. Murachver

EG&G, INC., Photon Devices, 35 Congress St., Salem, MA 01970, Tel: 617-745-3200, TELEX: 681-7405 EGSA; FSC No.: 25506; Empl.: 500; *Sls. Mgr.:* James Melnyk

EG & G ALMOND INSTRUMENTS, 1330 E. Cypress St., Covina, CA 91724, Tel: 818-967-9521, TWX: 910-584-1320, FAX: 818-967-3151; Empl.: 380; *Sls. Mgr.:* Dave Adams ..... **D•1708-1709**

Local Sales Offices & Reps
FL Orlando, Truex Assocs. 305-859-2160
NY Yonkers, Sonkin Assocs. 914-968-8282

EG & G BIRTCHER, EG & G, Inc., 4505 N. Arden Dr./P. O. Box 5268, El Monte, CA 91734-1268, Tel: 818-442-2572, TELEX: 247345 EGGUR, FAX: 818-442-8127; FSC No.: 18915; *Sls. Mgr.:* H. Robert Sproul; *Dist. Mgr.:* H. Robert Sproul ..... **C•1028-1029**

Local Sales Offices & Reps
AL Huntsville, Remco 205-533-3763
AZ Phoenix, Mercury Engrg. Sls. 602-244-0123
CA Brea, Masco 714-529-0866
CA San Diego, Masco 619-234-6905
CA Santa Clara, Nova-Tronix, Inc. 408-727-9530
CO Broomfield, Connors Co. 303-466-9628
FL Clearwater, HHP, Assocs. 813-797-4447
FL Maitland, HHP, Assocs., Inc. 305-831-2474
FL Pompano Beach, HHP Assocs., Inc. ... 305-971-5750
GA Atlanta, Remco 404-447-6937
IL Rollings Meadows, Heartland Technlg. Mktg., Inc. 312-577-9222
KS Shawnee Mission, M-S-B Assocs., Inc. 913-262-5500
MD Ellicott City, Eastern Tech. Corp. 301-461-7720
MA Burlington, Conti-Younger Assocs., Inc. 617-273-1582
MI Spring Lake, Jim Finnegan & Co. 616-846-4980
MN Minneapolis, Hei-Lite Sls., Inc. 612-861-6051
NJ Haddonfield, Tritek Sls., Inc. 609-429-1551
NY Great Neck, Coakley, Boyd A Bett/Tylinsky 516-466-9070
NY Syracuse, IA Hotze Assocs. 315-479-6641
NC Raleigh, Remco 919-787-2112
OH Cleveland, Jim Finnegan & Co. 216-238-5905
OH Dayton, Jim Finnegan & Co. 513-890-8322
OR Beaverton, Eclipse Mktg. Grp. 503-642-1661
PA Doylestown, Monteiro Assocs., Inc. 215-345-5855
PA Pittsburgh, Jim Finneagan & Co. 412-823-5400
TX Dallas, El-Com Mktg., Inc. 214-241-2166
TX Houston, El-Com Mktg. 713-350-8064
WA Redmond, Eclipse Mktg. Grp. 206-885-6991
WI Milwaukee, Heartland Technlg. Mktg., Inc. 414-931-0606
Can Markham, Ont., P. J. Heenan, Ltd. 416-474-0111

Local Distributors
CA Fullerton, Pyramid Elctrns. 714-773-0781
CA Manhattan Beach, Prime Electro Prods. 213-379-1724
CA Santa Ana, El-Com, Inc. 213-404-2961
CA Santa Clara, Pyramid Elctrns. 408-727-9810
CO Aurora, Jet Elctrns. Supp. Co., Inc. 303-364-5487
CT S. Windsor, Car-Lac Elctrns. 203-282-0631
MA Milford, Car-Lac Elctrns. 617-478-7797
MA Winchester, Rush Inds., Inc. 617-729-5800
MN Minneapolis, Stark Elctrns., Inc. 612-332-1325
NH Hudson, C & H Elctrns., Inc. 603-882-1133
NY Bohemia, Car Lac Inds. Sls., Inc. 516-567-4200
NY Buffalo, Summit Distrs. 716-884-3450
NY Rochester, Summit Distrs. 716-334-8110
OH Englewood, Argent Inds. 513-836-8633
OR Beaverton, Murphy Elctrns. 503-642-2001
TX Ft. Worth, Industrial Elctrns. 817-731-7321
WA Kent, Pyramid Elctrns. 206-872-5800
WA Redmond, Murphy Elctrns. 206-881-1234
Can Mississauga, Ont., Rush Elctrns. 416-677-7280

EG&G GAMMA SCIENTIFIC, Div. of EG&G Inc., 3777 Ruffin Rd., San Diego, CA 92123, Tel: 619-279-8034, TELEX: 697938, FAX: 619-576-9286; Empl.: 75; *Sls. Mgr.:* Robert Ruff

EG&G GEOMETRICS, Div. of EG&G Inc., 395 Java Dr., Sunnyvale, CA 94089, Tel: 408-734-4616, TELEX: 357435; FSC No.: 34314; *Dist. Mgr.:* Doug Crice

EG & G JUDSON, 21 Commerce Dr., Montgomeryville, PA 18936, Tel: 215-368-6900, TELEX: 846120, ESYLNK: 62820476, FAX: 215-362-6107; Empl.: 65

EG&G RETICON, Div. of EG&G, 345 Potrero Ave., Sunnyvale, CA 94086-4197, Tel: 408-738-4266, TWX: 910-339-9343; *Sls. Mgr.:* John Skurla

EG & G ROTRON, Commercial Div., Saugerties, NY 12477, Tel: 914-246-3615, TELEX: 551496; *Sls. Mgr.:* Michael Keating; *Dist. Mgr.:* Ralph Stevens

EG & G ROTRON, Custom Div., Hasbrouck La., Woodstock, NY 12498, Tel: 914-679-5201, FAX: 914-679-7080; FSC No.: 82877; *Sls. Mgr.:* Mike Lyon; *Dist. Mgr.:* Mary Fellows

EG&G ROTRON, Industrial Division, Saugerties, NY 12477, Tel: 914-246-3401, TELEX: 551496; FSC No.: 551496; *Sls. Mgr.:* Jay Jarboe; *Dist. Mgr.:* Jay Jarboe

Local Sales Offices & Reps
CA Huntington Bch., GL Sls. 714-841-1898
PA West Chester, James Gasho Assocs. 215-399-1665

EG & G TORQUE SYSTEMS, 36 Arlington St., Watertown, MA 02172, Tel: 617-924-6000, TELEX: 95-1736; Empl.: 200; *Sls. Mgr.:* W. F. O'Leary; *Dist. Mgr.:* H. D. Waddell

EG & G VACTEC, 10900 Page Blvd., St. Louis, MO 63132, Tel: 314-423-4900, TWX: 910-764-0811, FAX: 314-423-3956; Empl.: 250; *Sls. Mgr.:* D. Hartley; *Dist. Mgr.:* D. Hartley ..... **B•1271**

Local Sales Offices & Reps
AZ Scottsdale, Interstate Mktg. 602-244-9050
CA Encino, King-Way Assocs. 818-788-4124
CA Redwood City, Ault Assocs. 415-367-1710
CO Buena Vista, C-Tech 303-395-2025
FL Orlando, EAB Assocs. 305-898-7444
IL Highland Park, T. B. Hunter Assocs. ... 312-433-7000
IN Fort Wayne, Scott Elctrns. 219-484-7865
IN Indianapolis, Scott Elctrns. 317-841-0010
MD Laurel, R. W. Mitscher Co. 301-498-6090
MA Norwood, MacInnis Co. 617-762-8090
MI Southfield, O.E.M. Technical Sls. 313-444-1680
MN Eden Prairie, Rockmore Sls. 612-941-1390
MO St. Louis, Acorn Elctrns. 314-644-2510
NJ Marlton, B.G.R. Assocs. 609-428-2440
NY Pittsford, C. W. Beach Co. 716-586-3200
NY Syracuse, C. W. Beach Co. 315-446-9587
OH Cincinnati, Scott Elctrns. 513-791-2513
OH Cleveland, Scott Elctrns. 216-473-5050
OH Dayton, Scott Elctrns. 513-294-0539
OH Reynoldsburg, Scott Elctrns. 614-863-1281
TX Dallas, S. W. Mktg. Assocs. 214-341-8631
VA Shipman, R. W. Mitscher Co. 804-263-5154

Local Distributors
CA Encino, King Way West 818-788-4124
CA Palo Alto, Zack Elctrns. 415-326-5432
CA Santa Clara, Allied Elctrns. 408-727-1690
FL Orlando, Nico 305-898-7444
IL Chicago, Newark Elctrns. 312-638-4411
IL Elgin, Allied Elctrns. 312-697-8200
MO St. Louis, Olive Indl. Elec. 314-426-4500
OH Dayton, Televox, Inc. 513-294-4499
TX Fort Worth, Allied Elctrns. 817-336-5401

EG & G WAKEFIELD ENGINEERING, 60 Audubon Rd., Wakefield, MA 01880, Tel: 617-245-5900, FAX: 617-246-0874; Empl.: 250; *Sls. Mgr.:* Frank Casdia; *Dist. Mgr.:* Carl Swanson ..... **C•1660**

Local Sales Offices & Reps
AL Huntsville, Over & Over, Inc. 205-837-7105
CA Los Altos, Recht Assocs. 415-964-6321
CA San Diego, Mesa Elctrns. 619-278-8021
CO Denver, Delltron Co. 303-373-0300
FL Tampa, Over & Over Inc. 813-626-9100
GA Norcross, Over & Over, Inc. 404-449-6205
IL Rolling Meadows, Sumer, Inc. 312-991-8500
IA Cedar Rapids, C. H. Horn Assocs. 319-393-8703
MD Timonium, Bresson Assocs. 215-664-6460
MI Livonia, Luebbe Sls. 313-477-3131
MN Mendota Heights, G-II Sls. 612-454-3086
MO St. Louis, John Macke Co. 314-432-2830
NY Commack, ERA, Inc. 516-543-0510
NY E. Rochester, Tri Tech Elctrns. 716-385-6500
NY Fayetteville, Tri Tech Elctrns. 315-446-2881
NC Charlotte, Over & Over, Inc. 704-542-9111
OH Cincinnati, Luebbe Sls. Co. 513-530-0600
OH Cleveland, Luebbe Sls. Co. 215-333-0425
OR Lake Oswego, RTS Inc. 503-244-4123
PA Narbeth, Bresson Assocs. 215-664-6460
TX Austin, Milco Mktg. 512-453-3023
TX Richardson, Milco Mktg. 214-783-2716
TX Stafford, Milco Mktg. 713-723-5003
UT Sandy, Delltron Co. 801-942-4678
VA Forrest, Bresson, Assocs. 215-664-6460
WA Vashon, RTS Inc. 206-285-1363
WI Brookfield, Sumer, Inc. 414-784-6641

Local Distributors
AL Birmingham, Newark 205-942-4044
AZ Phoenix, Wyle 602-249-2232

AZ Tempe, Bell 602-966-7800
AZ Tempe, Newark 602-968-7441
CA Buena Pk., Cypress 213-521-5230
CA El Segundo, Wyle 213-322-8100
CA Foster City, Newark 415-572-8300
CA Fountain Valley, Comp. Center 714-979-0433
CA Garden Grove, Bell 714-220-0681
CA Gardena, Bell 213-515-1800
CA Inglewood, Newark 213-678-0441
CA Irvine, Wyle 714-863-9953
CA Rancho Cordova, Wyle 916-638-5282
CA Roseville, Bell 916-969-3100
CA San Diego, Bell 619-268-1277
CA San Diego, Cypress 619-292-5611
CA San Diego, Newark 619-481-1251
CA San Diego, Wyle 619-565-9171
CA Santa Ana, Elcom 213-404-2961
CA Santa Ana, Wyle 408-727-2500
CA Santa Clara, Comps. Ctr. 408-988-3751
CA Santa Clara, Cypress 408-435-8400
CA Sunnyside, Bell 408-734-8570
CA Thousand Oaks, Bell 805-499-6821
CO Denver, Newark 303-757-3351
CO Thornton, Wyle 303-457-9953
CO Wheat Ridge, Bell 303-424-1985
CO Wheat Ridge, Cypress 303-431-2622
CT Bloomfield, Newark 203-243-1731
CT S. Windsor, Carlac 203-282-0631
CT Wallingford, Midan 203-265-2077
FL Casselberry, AFCOM 305-767-6565
FL Ft. Lauderdale, Newark 305-587-2372
FL Graham/Largo, Bell 813-541-4434
FL Lake Mary, Elctrn. Fasteners 305-321-4000
FL Miami, Elctrn. Equip. 305-871-3500
FL Orlando, Newark 305-896-8350
GA Atlanta, Newark 404-448-1300
GA Norcross, Bell 404-662-0923
GA Norcross, Specialty 404-458-6341
IL Chicago, Bell 312-640-1910
IL Chicago, Newark 312-784-5100
IL Elk Grove VL, GBL Elec. 312-593-3220
IN Carmel, Altex 317-848-1323
IN Ft. Wayne, Bell 219-423-3422
IN Indianapolis, Bell 317-634-8202
IN Indianapolis, Newark 317-298-7070
IN Lafayette, Bell 317-423-5564
IA Cedar Rapids, Bell 319-395-0730
IA Cedar Rapids, Dee Elctrns. 319-365-7551
IA Cedar Rapids, Newark 319-362-1171
KS Lenexa, Newark 913-492-6000
KS Wichita, RSC 316-267-5213
KY Louisville, Newark 502-423-0280
KY Metarie, Newark 504-888-5174
LA Shreveport, Indl. Elec. Supp. 318-222-9459
MD Beltsville, Newark 301-937-5085
MD Columbia, G.R.S. 301-995-6744
MD Rockville, Capitol Radio Whlsrs. 301-881-2270
MA Canton, Impact Sls. 617-821-1500
MA Milford, CAR-LAC 617-478-7797
MA Norwood, Emtel Elctrns. 617-769-9500
MA Winchester, Rush Inds. 617-729-5800
MA Woburn, JACO 617-933-7760
MA Woburn, Newark 617-935-8350
MI Ann Arbor, Bell 313-971-9093
MI Ann Arbor, Wedemeyer 313-665-8611
MI Grand Rapids, Newark 616-241-6681
MI Livonia, RS Elec. 313-525-1155
MN Minneapolis, Newark 612-331-6350
MN St. Paul, Gophers 612-483-3322
MO Hazelwood, Newark 314-731-1204
MO St. Louis, Newark 314-298-2505
NE Omaha, Newark 402-392-1221
NJ Camden, G.R.S. 609-964-8560
NJ Clifton, Engrd. Assemblies 201-340-0600
NJ E. Hanover, Delburn 201-884-0800
NJ Kenilworth, Newark 201-272-8410
NJ Penshauken, Newark 609-663-9490
NJ Springfield, Route Elec. 201-379-7710
NM Albuquerque, Bell 505-292-2700
NY Bohemia, Car-Lac 516-567-4200
NY Buffalo, Genesee Radio 716-873-9661
NY Buffalo, Summit 716-884-3450
NY Commack, CAR-LAC 516-282-0631
NY Farmingdale, Semispecialists 516-293-2710
NY Hauppauge, JACO 516-273-5500
NY Henrietta, CAM/RPC 716-334-5600
NY Rochester, Newark 716-473-6600
NY Rochester, Summit 716-334-8110
NY Suffern, Nobel Elec. 914-357-4500
NY Valley Stream, Newark 516-887-2100
NC Greensboro, Newark 919-292-7240
NC Raleigh, Southeastern Elctrns. 919-828-2311
NC Winston-Salem, Kirkman Elec. 919-722-9131
OH Cincinnati, Bell 513-772-1661
OH Cincinnati, Hughes Peters 513-351-2000
OH Cleveland, CAM/Ohio 216-461-4700
OH Cleveland, Darrah 216-631-0912
OH Columbia, Newark 614-451-0002
OH Columbus, Bell 614-895-1590
OH Columbus, Hughes Peters 614-294-5351
OH Dayton, Bell 513-434-8231
OH Dayton, Stotts Friedman 513-298-5555
OH Warren, REM Elec. 216-373-1300
OK Oklahoma City, Newark 405-495-5000
OK Tulsa, Altair 918-252-5781
OK Tulsa, Radio Inc. 918-587-9123
OR Beaverton, Comp. Resources 503-641-8488
OR Hillsboro, Wyle 503-640-6000
OR Lake Oswego, Bell 503-241-4115
OR Portland, Newark 503-620-1614
OR Wilsonville, Shelley-Ragon 503-682-2929
PA Allentown, Newark 215-434-7171
PA Montgomeryville, Pyttronic 215-643-2850
PA Pittsburgh, CAM-RPC 412-782-3770
PA Pittsburgh, Newark 412-787-7740
PA Reading, Barbey 215-376-7451
RI Knoxville, Newark 615-588-6493
RI Warwick, Newark 401-738-4010
TN Nashville, Bell 615-367-4400
TX Austin, Wyle 512-834-9957
TX Dallas, Cypress 214-869-1435
TX Dallas, Newark 214-494-5911
TX Houston, Altair 713-462-3029
TX Houston, Newark 713-782-4800
TX Houston, Wyle 713-879-9953
TX McKinney, Prime 214-542-7915
TX Richardson, Altair 214-231-5166
TX Richardson, JACO 214-235-9575
TX Richardson, Wyle 214-235-9953
TX Stafford, Harrison Equip. 713-879-2660
TX Sugarland, Quality Comps. 713-491-2255
UT Salt Lake City, Bell 801-972-6969
UT Salt Lake City, Newark 801-484-8611
UT Salt Lake City, Wyle 801-974-9953
VA Arlington, Newark 703-522-0880
VA Charlottesville, Virginia Elec. 804-296-4184
WA Bellevue, Bell 206-747-1515
WA Bellevue, Newark 206-641-9800
WA Bellevue, Wyle 206-453-8300
WA Redmond, Shelley-Ragon 206-241-1980
WI Milwaukee, Indl. Elec. 414-276-1212
WI Milwaukee, Newark 414-463-1100
WI Oconomowoc, GW Elec. 414-567-9445
WI Waukesha, Bell 414-547-8879

EGIS CORPORATION, P. O. Box 751, Barrington, IL 60011-0751, Tel: 312-639-4448, TELEX: 650-336-1335 IMD, FAX: 312-639-8710; Empl.: 14; *Sls. Mgr.:* Tim Neale; *Dist. Mgr.:* Glenn P. Antonic

EH ELECTRONICS, INC., See Wavetek San Diego, Inc., Tel. 619-279-2200

EH ELECTRONICS, INC., Sub. EH Intl., Inc., 48507 Milmont Drive, Fremont, CA 94538, Tel: 415-651-2340, TWX: 910-366-7258; FSC No.: 13488; Empl.: 67; *Sls. Mgr.:* Donald F. Smith

EHRHORN TECHNOLOGICAL OPERS., INC., P.O. Box 888, Canon City, CO 81212, Tel: 303-275-1613; Empl.: 70; *Sls. Mgr.:* Mark Forbes

FAX: 401-738-7154

EICHHOFF ELECTRONICS, 205 Hallene Rd., Warwick, RI 02886, Tel: 401-738-1440; Empl.: 280; *Sls. Mgr.:* Gernot O. Gust, VP, Sls. & Mktg.; *Dist. Mgr.:* Glenn Johannsen ..... **A•1648-1651; B•1412-1413**

Local Sales Offices & Reps
CA Redwood City, James S. Heaton Co., Inc. 415-367-9000
CA Simi Valley, Tri-Electro Sls., Inc. 805-527-3317
CO Denver, Quorum 3 303-696-8480
CT Simsbury, Electrotechnika, Inc. 203-658-6762
FL Tampa, Std. Mktg. Inc. 813-933-5833
FL W. Melbourne, Dale Moats 305-725-7073
IL Franklin Pk., Stetco, Inc. 312-671-4208
MA Chelmsford, Encotronics, Inc. 617-256-4207
MI Livonia, Wenner & Assocs. 313-591-7955
MN Minneapolis, Electro-Serv Co. 612-338-3475
NY Great Neck, F & F Metro, Inc. 516-482-4080
NY Rochester, Lupton Assocs. 716-381-4800
NC Charlotte, W. L. Moorhead & Co. 704-366-2791
OH Mansfield, R. J. Goosman & Assocs. 419-756-5746
OR Portland, Michael Carroll 503-629-9871
PA Birchrunville, Jadelectronics Assocs. 215-296-3800
TN Chattanooga, Stetco, Inc. 615-899-6831
TX Dallas, Comp. Technlg. 214-783-8831
UT Salt Lake City, Quorum 3 801-943-9227
WA Seattle, W3C Technlg. Grp., Inc. 206-285-0210
Can Oakville, Ont., Haltronics Ltd. 416-844-2121

EIKONIX, Electronic Pre-Press Systems, Inc., 15 Wiggins Avenue, Bedford, MA 01730, Tel: 617-276-7161, TELEX: Vern Heinz; Empl.: 175; *Sls. Mgr.:* Vern Heinz

EI MICROCIRCUITS, INC., 1650 Madison Ave., Mankato, MN 56001, Tel: 507-345-5786; Empl.: 25; *Sls. Mgr.:* Perry Eimers

EI NORTH AMERICA, 435 E. 79th St., New York, NY 10021, Tel: 212-517-5622, TELEX: 803347 'EINA'

EIP MICROWAVE, INC., 2731 North First St., San Jose, CA 95134, Tel: 408-433-5900, TWX: 910-338-0155, FAX: 408-434-0258; FSC No.: 34257; Empl.: 200; *Sls. Mgr.:* Bob Loft

EITEL MFG., 33208 Paseo Cerveza, Ste. G, San Juan Capistrano, CA 92675, Tel: 714-240-3933; Empl.: 6; *Sls. Mgr.:* H. Mengel

ELANTEC, INC., 1996 Tarob Ct., Milpitas, CA 95035, Tel: 408-945-1323, 800-821-7429, TWX: 910-997-0649; FSC No.: 64762; Empl.: 90; *Sls. Mgr.:* Ralph Granchelli

ELASTIC STOP NUT DIV., Harvard Inds. Inc., 3200 Country Club Rd., Pocahontas, AR 72455, Tel: 501-892-5201; Empl.: 175; *Sls. Mgr.:* R. Durette; *Dist. Mgr.:* G. Bennett

ELASTOMERIC TECHNOLOGIES INC., (FORMERLY PCK ELASTOMERICS), See PCK Elastomerics

ELCO, KTRONICS, 1333 Lawrence Expwy., Suite 145, Santa Clara, CA 95051, Tel: 408-241-3024, FAX: 408-241-6546

ELCO CORP., Electronic Connector Div., Huntingdon Ind'l. Park, Huntingdon, PA 16652, Tel: 814-643-0700, TWX: 510-691-3117; Empl.: 500; *Sls. Mgr.:* W. J. Graef; *Dist. Mgr.:* W. G. Solomon

ELCOM INDUSTRIES, INC., 10268 Bach Blvd., St. Louis, MO 63132, Tel: 314-429-3100, TELEX: 1561229 ELCOM UT; Empl.: 20; *Sls. Mgr.:* Thomas C. Noel

ELCOM SYSTEMS, INC., 932 Clint Moore Rd., Boca Raton, FL 33487, Tel: 305-994-1774; FSC No.: 32424; Empl.: 8; *Sls. Mgr.:* D. Pollachek ..... **A•1768**

Local Sales Offices & Reps
EXP MA, Mattapoisett, Clark Export-Import Co. 617-758-6448

ELCON PRODUCTS INTERNATIONAL COMPANY, 42700 Lawrence Place, Fremont, CA 94538, Tel: 415-490-4200, FAX: 415-490-3740; FSC No.: 85901; Empl.: 33; *Sls. Mgr.:* Shirlee Gendreau (inside Sls. Mgr.)

Local Sales Offices & Reps
CA La Miranda, Isys West 714-738-1582
CA San Jose, Isys, Inc. 408-259-0800
CT Danbury, Hathaway Elctrns. 203-790-6993
GA Norcross, S.E. Power Comps. 404-448-2458
KS Kansas City, Bonner & Assocs. 816-756-0082
MA Lexington, Hathaway Elctrns. 617-861-7010
MN Minneapolis, Boerger & Assocs. 612-560-3435
MO Kansas City, Bonner & Assocs. 816-756-0082
NJ Basking Ridge, Churchill Assocs. 201-204-0744
NY Larchmont, Hingston Walsh Assocs. .. 914-834-5781
NC Greensboro, S.E. Power Comps. 919-275-4711
OH Beachwood, Elctrn. Salesmasters, Inc. 216-831-9555
OR Lake Oswego, RTS, Inc. 503-635-4927
PA Trevose, P.S.A. 215-245-0513
TX Dallas, Dynamark Tech. Sls. 214-437-3333
WA Vashon, RTS, Inc. 206-285-1363
Can Mississauga, Ont., Patlon Aircraft & Inds. 416-624-5572

ELDEC CORP., Monitor & Control Div., 16700 13th Ave. W., P.O. Box 100, Lynnwood, WA 98046-0100, Tel: 206-743-1313, TELEX: 32-8959, TWX: 910-449-2855; Empl.: 1321

ELDEC CORP., Power Conversion Div., 16700 13th Ave. W., P.O. Box 100, Lynnwood, WA 98046-0100, Tel: 206-743-1313, TELEX: 497-0640, TWX: 910-449-2855; Empl.: 1400

ELDEC CORPORATION, Sensing Systems Div., 22000 Bothell Way-S.E., Bothell, WA 98041-3002, Tel: 206-487-4000, TELEX: 910-449-0873

ELDRE CORPORATION, 1500 Jefferson Rd., Rochester, NY 14623, Tel: 716-427-7280, TWX: 510-253-4347, FAX: 716-272-0018; FSC No.: 19648; Empl.: 220; *Sls. Mgr.:* James N. Fitzpatrick

ELEC-TEK, INC., 10280 Alliance Rd., Cincinnati, OH 45242, Tel: 513-793-7937; FSC No.: 5U373; Empl.: 10; *Sls. Mgr.:* Rick Groth

ELECTRAC, INC., 1614 Orangethrope Way, Anaheim, CA 92801, Tel: 714-879-6021, TELEX: 692433; FSC No.: 016154; Empl.: 35; *Sls. Mgr.:* Roland H. Wills

ELECTRICAL INDUSTRIES, North American Philips Corp., 691 Central Ave., Murray Hill, NJ 07974, Tel: 201-464-3200, TWX: 710-984-7979; FSC No.: 20093; Empl.: 300; *Sls. Mgr.:* D.V. Wilson

ELECTRICAL INSTRUMENT SERVICE, 25 Dock St., Mt. Vernon, NY 10550, Tel: 914-699-9717; FSC No.: 32590;16034A; Empl.: 35 ..... **D•1320-1321**

Local Sales Offices & Reps

AZ	Scottsdale, Williams Assocs.	602-947-4297
CO	Commerce City, Williams Assocs.	303-289-5647
DC	Washington, Whitcomb Assocs.	202-737-0763
IL	Lincolnwood, Saffro & Assocs.	312-677-9720
KS	Shawnee Mission, Comtel - Midwest	913-268-0762
MD	Baltimore, Whitcomb Assocs.	301-889-1245
MA	Lexington, Zieco	617-861-8300
MI	Southfield, Comtel Instrs. Co.	313-358-2505
MN	Minneapolis, Hei-Lite Sls.	612-861-6051
MO	St. Louis, Comtel - Midwest	314-991-5363
NM	Albuquerque, Williams Assocs.	505-255-1638
NY	Mount Vernon, Elctrl. Instr. Svc.	914-699-9717
OH	Cleveland, Comtel Instrs. Co.	216-442-8080
OH	Dayton, Comtel Instrs. Co.	513-426-5310
OH	Hilliard, Comtel Instrs. Co.	614-876-8305
OK	Tulsa, Data Mktg. Assocs.	918-494-2711
PA	Pittsburgh, Comtel Instrs. Co.	412-922-5720
TX	Austin, Data Mktg. Assocs.	512-443-7722
TX	Dallas, Data Mktg. Assocs.	214-661-0300
TX	Houston, Data Mktg. Assocs.	713-780-2511
TX	San Antonio, Data Mktg. Assocs.	512-342-3031
UT	Salt Lake City, Williams-Assocs.	801-532-7701
WI	Lake Mills, Saffro & Assocs.	414-648-2605
Can	Beaconsfield, Que., Mesurina Ltee/Ltd.	514-697-6581

ELECTRICAL STANDARDS DIV., E.S.R.S., Inc., 7337 Greenbush, N. Hollywood, CA 91605, Tel: 818-765-4224; Empl.: 6

ELECTRICAL WINDINGS, INC., 2015 N. Kolmar Ave., Chicago, IL 60639, Tel: 312-235-3360; FSC No.: 72128; Empl.: 160; *Sls. Mgr.:* Donal R. Murphy

ELECTRIC DEVICE, PO Box 337, Canfield, OH 44406, Tel: 216-533-1111, FAX: 216-533-2639

ELECTRIC INDICATOR COMPANY INC., 272 Main Ave., Norwalk, CT 06851, Tel: 203-847-5861; FSC No.: 73693; Empl.: 60

ELECTRIC MOTOR ENGINEERING, 1847 Victory Blvd., Glendale, CA 91201, Tel: 818-502-1866, TELEX: 4973366 EME INC LSA, FAX: 818-502-1780; Empl.: 5; *Sls. Mgr.:* Jerry Kibler; *Dist. Mgr.:* Jerry Kibler

Distributor

ELECTRIC SWITCHES, INC., 2478 Fletcher Dr., Los Angeles, CA 90039, Tel: 213-660-1310, TWX: 910-321-2971; Empl.: 42; *Sls. Mgr.:* Louis Lim ..... **B•1708-1709**
617, 619, 621, 624, 638, 641, 643, 644, 657, 663, 695, 706, 714, 716, 721, 727, 734, 740, 747, 755, 772, 789, 794

ELECTRIC TACHOMETER, 68th & Upland Sts., Philadelphia, PA 19142, Tel: 215-SA6-7723, TELEX: 83-1475, FAX: 215-724-3682; FSC No.: 20049; Empl.: 50; *Sls. Mgr.:* F. M. Porter

ELECTRIC TIME COMPANY, INC., P.O. Box 466, Medfield, MA 02052, Tel: 617-359-4396, FAX: 617-359-4482; FSC No.: 6645; Empl.: 10

ELECTRO ASSEMBLIES CORP., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062, Tel: 312-498-6520; FSC No.: 09250; Empl.: 60; *Sls. Mgr.:* Greg Andrews

ELECTROCHEM INDUSTRIES

FAX: 716-759-7390

ELECTROCHEM INDUSTRIES, Wilson Greatbatch Ltd., 10000 Wehrle, Clarence, NY 14031, Tel: 716-759-7320, TELEX: 137-084; FSC No.: 6U589; Empl.: 300; *Dist. Mgr.:* R. Altieri ..... **D•1453**

Local Sales Offices & Reps

AZ	Scottsdale, S.M.S. Assocs.	602-998-0831
AR	Little Rock, Erickson Sls., Inc.	501-455-0618
CA	Garden Grove, Elsco Elctrns., Inc.	714-891-4621
CA	San Diego, Elsco Elctrns., Inc.	619-292-1771
CA	Santa Clara, Nova-Tronix, Inc.	408-727-9530
CO	Englewood, Omega Ltd.	303-762-1921
FL	Boca Raton, R. W. Mitscher Co.	305-368-3841
FL	Sanford, R. W. Mitscher Co.	305-322-7141
IL	Park Ridge, Metcom Assocs. Corp.	312-696-1490
IN	Indianapolis, STB & Assocs., Inc.	317-844-9227
LA	Chalmette, Erickson Sls., Inc.	504-271-1976
MA	Waltham, Del Tech Sls.	617-894-4550
NJ	Berkeley Hgts., Cambridge Allen & Assocs.	201-464-0203
NJ	Medford, Champion Elctrn. Sls., Inc.	609-983-0932
NY	Clarence, R. W. Mitscher Co., Inc.	716-759-2350
NC	Pineville, JWL Assocs., Inc.	704-541-5750
OH	Beachwood, Electronic Salesmasters	216-831-8647
TX	Dallas, Erickson Sls., Inc.	214-739-5833
TX	Houston, Erickson Sls., Inc.	713-953-9513
TX	Round Rock, Erickson Sls., Inc.	512-244-3068
UT	Salt Lake City, Omega Ltd.	801-277-8061
WA	Bellevue, Nova-Tronix, Inc.	206-634-7355
Can	Downsview, Designtronics	416-747-1171
Can	Vancouver, Blakewood Elctrns.	604-261-8099

Local Distributors

CA	Long bch., Battery Specialties	213-437-1809
CA	San Diego, Tauber Elctrns.	619-274-7242
CA	San Jose, Rose Elctrns.	408-263-2934
CO	Englewood, Colorado IEI, Inc.	303-694-9444
MA	Sharon, Adcour, Inc.	617-784-8123
MI	Ann Arbor, Wedemeyer Elctrns. Supp. Co.	313-665-8611
NJ	Clifton, Engrd. Assemblies Corp.	201-340-0600
TX	Houston, Kent Elctrns.	713-978-5890
WA	Redmond, Priebe Elctrns.	206-881-2363
Can	Calgary, Alberta, Saynor Varah Inc.	403-255-9550
Can	Don Mills, Ont., Saynor Varah Inc.	416-445-2340
Can	Edmonton, Alberta, Saynor Varah Inc.	403-461-2222
Can	Vancouver, BC, Saynor Varah Inc.	604-873-3211
Can	Victoria, BC, Pacific Coast Elctrns. Ltd.	604-385-5111
Can	Winnipeg, Manitoba, Saynor Varah Inc.	204-633-6190

ELECTROCOM INDUSTRIES, 1105 N. Ironwood Dr., S. Bend, IN 46615, Tel: 219-232-2743; FSC No.: 27114; *Sls. Mgr.:* B. Jaffe

ELECTRO COMP., INC., 2415 Main St., Stratford, CT 06497, Tel: 203-375-5811

ELECTRO CORPORATION, Sub. of Fasco Industries Inc., 1845 57th Street, P.O. Box 3049, Sarasota, FL 33578, Tel: 813-355-8411, TELEX: 52683, FAX: 813-355-3120; FSC No.: 81692; Empl.: 200; *Sls. Mgr.:* John MacKay; *Dist. Mgr.:* Ron Essig

ELECTRO-CRAFT, 1600 2nd St. S., Hopkins, MN 55343, Tel: 612-931-2700

ELECTROCUBE, 1710 So. Del Mar Ave., San Gabriel, CA 91776, Tel: 818-573-3300, FAX: 818-280-9259; FSC No.: 14752; Empl.: 175; *Sls. Mgr.:* Gene Williams; *Dist. Mgr.:* Gene Williams

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AZ	Scottsdale, EDP & Assocs.	602-991-6119
AR	Doby Assocs.	601-981-1138
CA	Newport Bch., Forbes Pacific	714-722-6174
CA	Palo Alto, Horne Electro Sls.	415-494-6777
CA	San Diego, Forbes Pacific	714-722-6179
CO	Englewood, Megatronix	303-799-3700
FL	Tarpon Springs, LP Sls.	813-934-4749
GA	Atlanta, JWL Assocs.	404-320-7643
ID	Boise, Ray Over Sls.	206-695-6179
IL	Downers Grove, Richmar Elctrn. Sls.	312-968-0118
IN	Indianapolis, Richmar Elctrn. Sls.	317-846-6383
MD	Chevy Chase, T. Griffin Co.	301-951-0112
MA	Reading, C. Godfrey Co.	617-944-2230
MN	Minneapolis, Electro-Serv Co.	612-338-3475
MS	Jackson, Doby Assocs.	601-981-1138
MO	Raytown, Centech Sls.	816-358-8100
MO	St. Louis, Centech Sls.	314-291-4230
NM	Albuquerque, EDP & Assocs.	602-991-6119
NY	Great Neck, MOS Assocs.	516-487-3966
NY	Rochester, Gislason Sls.	716-454-4741
NC	Raleigh, JWL Assocs.	919-781-7566
OH	Cleveland, K.W. Elctrn. Sls.	216-491-9177
OH	Dayton, K.W. Elctrn. Sls.	513-890-2150
OR	Portland, Ray Over Sls., Inc.	206-695-6179
PA	Allison Park, K.W. Elctrn. Sls.	412-487-4300
PA	Paoli, T. Griffin Co.	215-647-1550
TX	Austin, Richmar Elctrn. Sls.	515-251-7582
TX	Plano, Richmar Elctrns. Corp.	214-424-8388
WA	Kirkland, J. Findley Co.	206-822-7510
WA	Seattle, Ray Over Sls.	206-695-6179
WI	Butler, Richmar Elctrn. Sls.	414-781-1730

Local Distributors

AZ	Tempe, Acacia Sls. Inc.	602-894-2874
CA	Chatsworth, Mil-Comm Distrs.	213-998-3111
CA	Irvine, Acacia Sls. Inc.	714-660-0834
CA	San Diego, Acacia Sls. Inc.	619-565-4365
CA	San Diego, Mock III Sls.	619-560-0515
CA	Sunnyvale, Acacia Sls.	408-745-7200
CO	Lakewood, Acacia Sls.	303-232-2882
FL	N. Clearwater, Elctrn. Precepts	813-530-9781
FL	Pompano Bch., Elcon	305-781-8600
IL	Elk Grove Village, Nu-Way Elctrns.	312-437-7120
IL	Morton Grove, Nedco Elctrns.	312-966-6000
NJ	Newark, Meltronics	201-242-1686
NY	Ronkonkoma, Prime Comps.	516-737-1730
OH	Englewood, Argent Inds.	513-836-8633
OH	Solon, Repco, Inc.	216-248-8900
OK	Tulsa, Altair Co.	918-252-5781
OR	Beaverton, Acacia Sls. Inc.	503-646-3377
PA	McKean, Advacom	814-476-7774
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair Co.	214-231-5166
WA	Sumner, Acacia Sls., Inc.	206-862-6931
Can	Concord, Ont., Astec Comps.	416-668-4022

ELECTRODATA, INC., 23020 Miles Rd., Bedford Heights, OH 44128, Tel: 216-663-3333, TWX: 810-427-2280; FSC No.: 34-1173465; Empl.: 15; *Sls. Mgr.:* Philip Ardire; *Dist. Mgr.:* Philip Ardire

ELECTRODYNAMICS

FAX: 312-255-3827

ELECTRODYNAMICS, INC., A Talley Inds. Co., 1200 Hicks Rd., Rolling Meadows, IL 60008, Tel: 312-259-0740, TELEX: 28-1070; FSC No.: 10236; Empl.: 250; *Sls. Mgr.:* Frank Rafferty ..... **D•1129**

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CA	Alhambra, M. W. Riedel & Co.	213-283-7694
CA	Hayward, Liaison, Inc.	415-783-1131
CO	Denver, West High-Tech, JV	303-477-8180
CT	Old Saybrook, FJS Assocs.	203-388-5374
IA	Cedar Rapids, J.R. Sales Engrg.	319-393-2232
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NY Pittsford, Noeth Honsinger Assocs. 716-586-9002
OR Tigard, ElTech, Inc. 503-684-3458
PA Norristown, Rivco January Inc. 215-631-1414
TX Roanoke, CMR 817-379-6540
WA Bellevue, ElTech, Inc. 206-643-4330

ELECTRO DYNAMICS, Sub. of SFE Technologies, 9075 Cody, Overland Park, KS 66214 Elec. Dyna., Tel: 913-888-1750, TELEX: 42254

ELECTRO-DYNAMICS DEV. CO., 475 Mt. Hood Dr. S.W., Issaquah, WA 98027-4038, Tel: 206-392-2493; FSC No.: 9J838; *Sls. Mgr.:* W. A. Pommer

ELECTRO-DYN CORPORATION, 90 Sparta Ave., Sparta, NJ 07871, Tel: 201-729-9350, FAX: 201-729-8412; Empl.: 40; *Sls. Mgr.:* Alex Jordan ..... **D•1711**

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CA Mtn. View, Poltronics 415-960-3020
FL Pompano Bch., Bolton Assocs. 305-975-7245
IL Wheeling, Ed Joyner & Co. 312-520-1200
MD Annapolis, Parogem 301-269-1898
MA Needham Hgts., Todino Engrg. Sls. 617-444-7925
NJ Englewood Cliffs, Masin Esco 201-569-8868
NY Hauppauge, Masin Esco 516-273-3500
OH Solon, Five-Star Elctrns. 216-349-1611
PA Dresher, CMS Mktg. 215-885-4424
TX Irving, Space Elctrns. 214-251-3636

ELECTROFILM, 27727 Avenue Scott, P.O. Box 55669, Valencia, CA 91355, Tel: 805-257-2240, TELEX: 65-1438; FSC No.: 85932; Empl.: 75; *Sls. Mgr.:* Richard W. Pearson

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FAX: 401-738-4389

ELECTRO-FILMS, INC., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, Tel: 401-738-9150, TWX: 710-382-0405; FSC No.: 57252; Empl.: 240; *Sls. Mgr.:* Frank Urrico, Dir., Mktg. Sls. ..... **A•1932-1933**

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CA Santa Ana, Weatherman Assocs. 714-544-1304
CA Sunnyvale, NES Assocs. 408-738-3259
CO Ft. Collins, Rep Sls. 303-226-1504
FL St. Petersburg, QXI 813-894-4556
GA Chamblee, BCI, Inc. 404-455-0405
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MA Bedford, Vector Assocs. 617-271-0000
MI Livonia, Electro Sls. Assocs. 313-421-7500
MN Minneapolis, PSA 612-835-5281
NM Albuquerque, Western High Tech. Mktg. 505-884-2256
NY Plainview, Robert Smith Assocs. 516-681-3155
NY Syracuse, Labtronics 315-455-7314
NJ Whippany, Robert Smith Assocs. 201-340-0204
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ELECTROHOME LIMITED, Circuit Board Operations, 809 Wellington St. N., Kitchener, Ontario, Canada N2G 4J6, Tel: 519-744-7111, TELEX: 069-55449, FAX: 519-749-3131; Empl.: 2000; *Sls. Mgr.:* Joe Moser

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ELECTRO IMPULSE, Box 870, Red Bank, NJ 07701-0870, Tel: 201-741-0404, TWX: 710-722-5717 EILRENK; FSC No.: 91161; Empl.: 105; *Sls. Mgr.:* Mark Rubin ..... **C•1662-1663; D•1241**

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MD Ellicott City, Saltech 301-461-7350,
MA Reading, Geder Assocs. 617-944-3105
NY Plainview, B. D. Aaron & Co. 516-349-7399
EXP NJ, Oradell, Sylvan Ginsbury Ltd. 201-261-3200

ELECTRO INDUSTRIES, Div. E.I. Elctrns., Inc., 1800 Shames Drive, Westbury, NY 11590, Tel: 516-334-0870, TELEX: 4948652 ELECTRO, FAX: 516-338-4741; Empl.: 20; *Sls. Mgr.:* S. Kagan ..... **D•1368**

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Local Sales Offices & Reps
AL Huntsville, Beacon Elctrn. Assocs. 205-881-5031
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AR Little Rock, Beacon Elctrn. Assocs. 501-224-5449
CA Garden Grove, Elsco 714-891-4621
CA San Jose, Vernexx 408-972-9072
CO Denver, Elcom 303-337-2300
FL Boca Raton, Beacon Elctrn. Assocs. .. 305-392-3500
FL Clearwater, Beacon Elctrn. Assocs. ... 813-796-2378
FL Ft. Lauderdale, Beacon Elctrn. Assocs. 305-491-1054
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FL Melbourne, Beacon Elctrn. Assocs. ... 305-724-8010
GA Atlanta, Beacon Elctrn. Assocs. 404-256-9640
IL Des Plaines, Lincoln, Hodges & Assocs. 312-297-3810
MA Framingham, Stone Comps. 617-875-3266
MI Ypsilanti, TechRep 616-642-6594
MN Minneapolis, R. K. Sls. Assocs. 612-571-1001
NY Clark Mills, KLM-Garner Co. 315-853-6126
NY North Syracuse, KLM-Garner Co. 315-458-6214
NY Pittsford, KLM-Garner Co. 716-381-8350
NY Yonkers, Sonkin Assocs. 914-968-8282
NC Greensboro, Beacon Elctrn. Assocs. .. 919-275-9997
NC Raleigh, Beacon Elctrn. Assocs. 919-787-0330
OH Columbus, Mulligan & Assoc. 614-457-2242
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PA Birchrunville, Jadelectronics 215-296-3800
TX Houston, Aid Elctrns. 713-955-6204
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CA Anaheim, Arrow Elctrns. 714-774-5290
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CA Irvine, Acacia Sls. 714-549-0954
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CA Sunnyvale, Acacia Sls. 408-745-7200
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CA Sunnyvale, Sierra West 408-747-1188
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NY Liverpool, Arrow Elctrns. 315-652-1000
NY Rochester, Arrow Elctrns. 716-275-0300
NY Rochester, Simcona Elctrns. Corp. 716-328-3230
NY Yonkers, Kin-Tronics 914-968-7736
NC Raleigh, Arrow Elctrns. 919-876-3132
NC Raleigh, Comp. Distrs. 919-834-9465
NC Winston Salem, Arrow Elctrns. 919-725-8711
OH Centerville, Arrow Elctrns. 513-435-5563
OH Dayton, Bell Inds. 513-434-8231
OH Solon, Arrow Elctrns. 216-248-3990
OH Solon, Repco 216-248-8900
OR Beaverton, Acacia Sls. 503-646-3377
PA Monroeville, Arrow Elctrns. 412-856-7000
PA Philadelphia, Shap Elctrns. 215-969-3300
TX Austin, Arrow Elctrns. 512-835-4180
TX Dallas, Arrow Elctrns. 214-386-7500
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ELECTROMATIC CONTROLS CORP., 2495 Pembroke Road, Hoffman Estates, IL 60195-2010, Tel: 312-882-5757, TWX: 910-222-3452; FSC No.: 75203; Empl.: 400; *Sls. Mgr.:* Mike Meurer; *Dist. Mgr.:* Lawrence Tolvaysh

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ELECTRO MECHANICAL SYSTEMS, INC., 801 W. Bradley Ave., Champaign, IL 61820, Tel: 217-359-7125, FAX: 217-359-2075; Empl.: 20; *Sls. Mgr.:* Julie L. Redman

ELECTRO-MECHANICS CO., Box 1546, Austin, TX 78767, Tel: 512-835-4684, TELEX: 767178

FAX: 818-303-2189

ELECTRO-MECHANISMS, INC., 2745 E. Huntington Dr., Duarte, CA 91010, Tel: 818-359-2535; FSC No.: 52592; Empl.: 27 ..... **B•1622-1623**

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TX	Dallas, Marcom	214-351-4532
TX	Houston, Marcom	713-271-5635

ELECTRO-MECH COMPONENTS, INC., 1826 N. Floradale Ave., South El Monte, CA 91733-3689, Tel: 818-442-7180, TWX: 510-601-8764, FAX: 818-350-8070; FSC No.: 07150; Empl.: 25; *Sls. Mgr.:* T. Trumbull; *Dist. Mgr.:* Terry Trumbull **B•1702-1703**

Local Sales Offices & Reps

CA	Los Angeles, Universal Comps. Co.	213-641-4255
CA	San Diego, Qualtronics	619-695-0118
CA	Santa Clara, Engrg. Assocs.	408-988-5001
CO	Englewood, Franklin Sls.	303-789-2526
CT	Milford, Todino Engrg.	203-874-6643
FL	Orlando, Publicover	305-898-9361
IL	Chicago, IRI	312-967-8430
MA	Needham Hgts., Todino Engrg.	617-444-7925
MI	Plymouth, Leading Edge Sls.	313-420-3344
MN	Minneapolis, D. A. Case Assocs.	612-869-3700
NJ	Medford, Comp. Consits.	609-654-5300
NY	Mamaroneck, Bassin Tech.	914-698-9332
NY	Orchard Pk, SHR	716-662-0555
OH	Cincinnati, KCH Co.	513-931-1686
OR	Forest Grove, Doran Sls.	503-357-3333
SC	Greenville, Eltron Sls.	803-234-6931
TX	Leander, McCoy Assocs.	512-259-1109
TX	Richardson, McCoy Assocs.	214-238-1017
VA	Front Royal, Eltron Sls.	703-635-7201
WA	Redmond, Doran Sls.	206-885-1885
WI	Milwaukee, IRI	414-259-0965

Local Distributors

AZ	Phoenix, Parts Elctrn.	602-258-6476
CA	Los Angeles, Elec. Switches	213-660-1310
CA	Los Angeles, Master Distrs.	213-452-1229
CA	Redwood City, SLD, Inc.	415-364-9881
NY	Buffalo, Industrial Elctrns.	716-873-9661
NY	Mamaroneck, Logicomp Elctrns.	800-431-2625

ELECTRO-METRICS, Penril Corp., 100 Church St., Amsterdam, NY 12010, Tel: 518-843-2600, TWX: 710-446-4798, FAX: 518-843-2812; FSC No.: 18581; Empl.: 105; *Sls. Mgr.:* James Havlicek

ELECTRO NATIONAL, Matthews Ave., Canton, MS 39046, Tel: 601-859-5511, TWX: 810-990-0938, FAX: 601-859-5518; FSC No.: M-54208; Empl.: 40; *Sls. Mgr.:* Patsy Hicks

ELECTRONETICS, INC., Paine Field Bldg 335, Everett, WA 98204, Tel: 206-355-1855; Empl.: 10

ELECTRONIC COIL CORP., Farmington Industrial Park, Farmington, CT 06032, Tel: 203-677-6731, FAX: 203-677-1902; Empl.: 127; *Sls. Mgr.:* Raymond Gorski, Jr.

ELECTRONIC COMPONENT ASSEMBLY, INC., 7181-Construction Ct., San Diego, CA 92121, Tel: 619-549-0808; Empl.: 180; *Sls. Mgr.:* Denise N. Winter

ELECTRONIC COMPONENTS GROUPE

FAX: 612-375-1905

ELECTRONIC COMPONENTS GROUPE, Stein Industries, Inc., 26 North 5th Street, Minneapolis, MN 55403, Tel: 612-375-9639, 800-826-8719, TELEX: 62985650, TWX: 910-240-7878 (for Overseas); *Sls. Mgr.:* Rick Hampton; *Dist. Mgr.:* Rick Hampton **B•1704**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean	205-830-1540
CA	Cupertino, F & F Assocs.	408-446-2349
CA	Irvine, Groh Assocs.	714-837-9871
CA	San Diego, Groh Assocs.	619-453-7572
CO	Littleton, Electronic Comp. Sls.	303-797-0894/2772
CT	Cheshire, A & M Elctrns., Inc.	203-271-3065
CT	Cheshire, MacInnis Co.	203-272-3797
FL	Margate, EPM Corp.	305-977-0331
FL	Orlando, EPM Corp.	305-977-0331
GA	Atlanta, Cartwright & Bean, Inc.;GA Div.	404-368-0160
GA	Norcross, Cartwright & Bean, Inc./GA Div.	404-368-0160
IL	Downers Grove, Richmar Elec.	312-968-0118
IN	Indianapolis, Richmar Elctrns.	317-577-9950
KS	Overland Pk., Electri-Rep	913-649-2168
LA	Covington, Cartwright & Bean, Inc.	504-892-1780
MA	Norwood, MacInnis Co.	617-762-8090
MI	St. Joseph, OBE, Inc.	616-429-7788
MI	W. Bloomfield, OBE, Inc.	313-332-4900
MN	New Brighton, Complete Sls.	612-731-2923
MN	Oakdale, Complete Sls.	612-731-2923
MS	Jackson, Cartwright & Bean, Inc.	601-981-1170
MO	St. Louis, Electri-Rep	314-993-4421
NJ	Mtn. Lakes, Comps. Technlg.	201-334-2921
NM	Albequerque, Syntech	505-266-7951
NY	Islip, ABS Technlgs.	516-277-7101
NY	Rochester, Tech. Comp. Sls.	716-342-2406
NC	Charlotte, Cartwright & Bean, Inc.	704-536-0303
NC	Raleigh, Cartwright & Bean, Inc.	919-876-4130
OH	Centerville, Components Inc.	513-436-0255
OH	Cleveland, Components, Inc.	216-243-9200
OR	Portland, Elctrn. Engrg. Sls.	503-639-3978
PA	West Chester, TCA Assocs., Inc.	215-692-6853
TN	Knoxville, Cartwright & Bean	605-693-7450
TN	Memphis, Cartwright & Bean, Inc.	901-362-8345
TX	Dallas, Rem Air Comps. Corp.	214-234-1069
TX	Houston, Dunkel Assocs.	713-729-1670
VA	Randallstown, Beacon North, Inc.	703-478-2480
VA	Sterling, Beacon North, Inc.	703-478-2480
WA	Redmond, Elctrn. Engrg. Sls.	206-883-3374
WI	Butler, Richmar Elctrns.	414-781-1730

Local Distributors

AL	Huntsville, C.D.I.	205-883-7501
AR	Little Rock, C.D.I.	501-227-6278
CA	Chatsworth, Poco Sls.	818-700-8727
CA	Hollywood, Yale Elec.	213-465-3186
CA	Manhattan Beach, Prime Electro	213-379-3642
CA	San Carlos, Logan Elec.	415-594-0700
CA	Santa Ana, El-Com, Inc.	714-432-6630
CA	Santa Monica, Master Distrs.	213-452-1229
CA	Sunnyvale, Target Elctrns.	408-734-5611
CA	Van Nuys, Wes-Garde Comps.	213-873-4802
CO	Englewood, Industrial Elctrns.	303-694-9444
CT	Hartford, Wes-Garde Comps.	203-527-7705
CT	Waterbury, Century Elec. Supp.	203-755-0405
FL	Ft. Lauderdale, C.D.I. (Acct. Only)	305-973-6650
FL	Ft. Lauderdale, KSM Elctrns.	305-971-5900
FL	Lakeland, Wes-Garde Comps.	813-644-7564
FL	Melbourne, C.D.I.	305-724-9910
GA	Atlanta, KSM Elctrns.	404-458-2013
GA	Norcross, C.D.I.	404-441-3320
IL	Carol Stream, Wes-Garde	312-653-1460
KS	Wichita, Radio Inc.	316-264-2798
MD	Beltsville, PSI	301-937-4960
MD	Columbia, D. K. Elctrns.	301-995-1950
MA	Holliston, Add Elctrns.	800-541-7400,800-343-4933
MA	Newton, Greene-Shaw Co.	617-969-8900
MN	New Brighton, Chris Elctrns.	612-631-2647
MO	Florrissant, Delltron Co., Inc.	314-839-0033
MO	St. Louis, Wes-Garde Elctrns.	314-567-7776
NH	Nashua, Wes-Garde Elctrns.	603-880-1971
NJ	Mt. Laurel, Wes-Garde Elctrns.	609-778-8190
NJ	W. Berlin, G.C.I.	609-768-6767
NY	E. Syracuse, Add Elctrns.	315-437-0300
NY	Victor, Add Elctrns. Corp.	716-924-4400
NC	Raleigh, C.D.I.	919-834-9465
OH	Westerville, Wes-Garde Elctrns.	614-885-0319
OH	Youngston, Add Elctrns.	216-792-6900
OK	Oklahoma City, Radio Inc.	405-789-0741
OK	Tulsa, Radio Inc.	918-587-9123
OR	Beaverton, Comp. Resources	503-641-8488
OR	Portland, Radar Elec.	503-232-3404
TX	Dallas, C.D.I.	214-644-0373
TX	Dallas, Off-the-Shelf Comps.	214-247-0052
TX	Dallas, Wes-Garde Elctrns.	214-357-1768
TX	Richardson, Off-the-Shelf Comps.	214-238-0808
WA	Kent, Comp. Resources	206-454-8666
WA	Redmond, Shelly Ragon	206-883-2220
WA	Seattle, Radar Elec. Co., Inc.	206-282-2511
WA	Seattle, Shelly (Zepher) Ragon	206-241-1980
WA	Spokane, Radar Elec.	509-747-3053

FAX: 201-542-0524

ELECTRONIC CONCEPTS, INC., Box 1278, Eatontown, NJ 07724, Tel: 201-542-7880, TELEX: 7107226661; FSC No.: 50558; Empl.: 240; *Sls. Mgr.:* Philip N. Lepore **A•1076-1081**

Local Sales Offices & Reps

AZ	Tempe, Piper Sls. Co.	602-949-0048
CA	La Mirada, Select Elctrns.	714-739-8891
IL	Wheaton, Elctrn. Concepts, Inc.	312-668-8747
MN	Minneapolis, Components Grp.	612-374-1250
MO	Grandview, Harris-Hanson Co.	816-763-6200
NJ	Eatontown, Elctrn. Concepts, Inc.	201-542-7880
NM	Albuquerque, Piper Sls. Co.	505-883-9090
MO	St. Louis, Harris-Hanson Co.	314-432-3611
OR	Tigard, Comps. West, Inc.	503-684-1671
TX	Richardson, Milred Assocs., Inc.	214-644-6731
WA	Redmond, Components West	206-885-5880
WA	Spokane, Components West	509-922-2412

Local Distributors

NJ	Clifton, Elcon Sls.	201-546-5022

ELECTRONIC CONNECTOR DIV., Midland-Ross Corp., One Alewife Pl., Cambridge, MA 02140, Tel: 617-491-5400, TELEX: 6817363; *Sls. Mgr.:* Bill Hickey; *Dist. Mgr.:* Karen McMillan

ELECTRONIC CONTROLS, INC., 431 Park Industrial Dr., La Habra, CA 90631, Tel: 213-697-4189; Empl.: 9

ELECTRONIC CONTROLS DESIGN, 13626 S. Freeman Rd., Mulino, OR 97042, Tel: 503-829-9108, TELEX: 703874 ECDINC UD, FAX: 503-829-4113; Empl.: 120; *Sls. Mgr.:* Steven Glass

ELECTRONIC DEVELOPMENT ASSOCIATES, INC., 1 Westcliff Drive, Dix Hills, New York 11746, Tel: 516-673-3881; FSC No.: 9V841

ELECTRONIC DEVELOPMENT CORP., EDC, 11 Hamlin St., Boston, MA 02127-4198, Tel: 617-268-9696, TELEX: 951596, FAX: 617-268-6754; FSC No.: 12619; *Sls. Mgr.:* R. B. Ross **D•1243**

Local Sales Offices & Reps

AL	Huntsville, MOCO	205-881-5968
AK	Anchorage, Topp Engrg.	907-243-4131
AZ	Tempe, Mesa Technlg.	602-279-5243
CA	Carlsbad, F.L.W. Inc.	619-434-5251
CA	Carlsbad, FLW, Inc.	619-434-5251
CA	Costa Mesa, FLW, Inc.	714-751-7512
CA	Hayward, FLW, Inc.	415-786-9070
CA	Van Nuys, FLW, Inc.	213-989-5238
CO	Englewood, R. A. Mayes Co.	303-761-9447
FL	Orlando, Gentry Assocs.	305-859-7450
IL	Hoffman Estates, Carvel Engrg.	312-885-8800
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Lenexa, Ramsey Assts.	913-541-1007
MA	Reading, Scheinfein Assocs.	617-944-2304
MI	Hazel Park, Tiby Co.	313-547-3550
MN	Edina, Carvel Engrg. & Sls.	612-835-7929
MO	St. Louis, Ramsey Assocs.	314-878-5042
NJ	Neptune, C.P.N. Assts.	201-774-5244
NM	Albuquerque, Mesa Technlg.	505-292-2330
NY	E. Syracuse, Ossmann Instrs.	315-437-7052
NY	Henrietta, Ossmann Instrs.	716-359-3801
NJ	Spring Lake, C.P.N. Assocs.	201-774-5244
NC	Raleigh, Lee Assocs.	919-848-8818
OH	Cleveland, Tiby Co.	216-371-5335
OH	Dayton, Tiby Co.	513-277-3822
OR	Portland, Topp Engrg. Sls.	503-244-7265
PA	Willow Grove, Rhodes Technlg.	215-657-0330
TX	El Paso, R. A. Mayes Co.	Enterprise 750
TX	Farmers Branch, Tech Rep Mktg.	214-241-2434
TX	Kemah, Hi Tech Sys.	713-783-3856
UT	West Jordan, R. A. Mayes Co.	801-292-6781
VT	Burlington, Scheinfein Assocs.	802-864-0933
WA	Bellevue, Topp Engrg. Sls.	206-747-5400
WI	Sheboygan, Carvel Engrg.	414-457-8800
PR	Santurce, Sisco	809-726-7635

ELECTRONIC DEVELOPMENT LABS., See EDL Inc.

ELECTRONIC DEVICES, INC., 21 Gray Oaks Ave., Yonkers, NY 10710, Tel: 914-965-4400, TELEX: 681-8047; Empl.: 200; *Sls. Mgr.:* Paul Dengler; *Dist. Mgr.:* Paul Dengler **A•2131**

Local Sales Offices & Reps

AZ	Tempe, Cantec Sls.	602-345-1276
CA	San Jose, Nelson Elctrn. Sls., Inc.	408-293-2600
CO	Golden, Dossett Elctrn. Mktg. Inc.	303-278-4620
FL	Melbourne, Kennedy Assocs.	305-676-6875
IN	Carmel, Berndt Assocs.	317-844-0114
MA	Sharon, Cummings Assocs.	617-784-5600
MI	Grand Blanc, Inter-Comm, inc.	313-695-0665
MN	Brooklyn Ctr., P Lydon	612-535-6526
MO	St. Louis, Rep-tronics Inc.	314-576-9816
NY	Mastic, Optimum Sls. Co.	516-589-4664
NY	Morrisville, Promark Elctrns.	315-662-3310
NC	Raleigh, B. T. Funderburk Inc.	919-782-3493
OR	Portland, IVC Inds. Vehicle Corp.	503-297-3364
PA	Newtown, Yax Assocs.	215-860-2540
PA	Waterford, Bacon Elec. Sls.	814-796-2381

TX Ft. Worth, El-tec Sls. 817-643-4812
WI Mequon, Stumm Sls. 414-241-8414
Can Montreal, Que., Elcom GMB Inc. 514-643-4812

Local Distributors

AL Huntsville, Comp. Dists. 205-883-7501
AR Little Rock, Comp. Dists. 501-227-6278
CA Anaheim, A-Z Elctrns. 714-632-1620
CO Denver, Regon Elctrn. Parts 303-744-1992
CO Englewood, Indl. Elctrns. 303-694-9444
CT Greenwich, Wise Comps. 203-531-4880
FL Melbourne, Comp. Dists. 305-724-9910
GA Atlanta, Specialty Dist. 404-873-2521
GA Norcross, Comp. Dists. 404-441-3320
IL Chicago, E M D 312-577-0067
IN Indianapolis, Gateway Megatech 317-577-0067
KY Louisville, Peerless Elctrn. Equip. 502-637-7674
MA Billerica, Mayer Elctrns. Inc. 617-667-6900
MI Livonia, Reptron Inc. 313-525-2700
MI Wyoming, Gateway Megatech 616-538-7925
MN Minneapolis, Bergquist Co. 612-835-2322
MO St. Louis, Ric-Tronics 314-576-9816
NJ Fairfield, Verdura Sls. Co. 201-785-1242
NJ Nutley, Eacon Elctrns. 201-667-5117
NY Albany, E. E. Taylor Co. 518-438-7811
NY Buffalo, Summit Dists. 716-887-2820
NY Mt. Vernon, QAR Elec. Sls. 914-699-2224
NY Rochester, Summit Dists. 716-334-8110
NC Raleigh, Century Elec. Comps. 919-872-2203
NC Raleigh, Comp. Dists. 919-834-9465
OH Wickliffe, Gateway Megatech 216-944-5801
OH Worthington, Reptron/Ohio 614-436-6675
OK Oklahoma City, Trice Whlsl. Elec. 405-528-2632
OK Tulsa, Quality Comps. 918-664-8812
OR Portland, Radar Elec. Co. 503-232-3404
TX Addison, Quality Comps. 214-733-4300
TX Austin, Quality Comps. 512-835-0220
TX Sugarland, Quality Comps. 713-491-2255
VA Roanoke, Peoples Elctrns. 703-342-8933
WA Seattle, Radar Elec. 206-282-2511
WI Racine, Badger Elctrns. 414-637-1256
PR Rio Piedras, Klamco Elctrns. 809-752-6169
Can Downsview, Ont., Westburne 416-635-2980
Can Montreal, Que., Elctrn. Whlslrs. 514-769-8851
Can Ottawa, Ont., Elctrn. Whlslrs. 613-746-4413

ELECTRONIC ENCLOSURES, Div. Wyle Labs, 225 South Aviation Blvd., El Segundo, CA 90245, Tel: 213-643-8181, FAX: 213-643-8565; FSC No.: 09097; Empl.: 230; *Sls. Mgr.:* Hillard W. Sorey ..... **C•1030**

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Local Sales Offices & Reps

AL Huntsville, Shivers Instrs. 205-881-7617
CA Campbell, Carlson & Assocs. 408-370-1284
CA El Segundo, Wyle Labs.;Elctrn. Encl. .. 213-643-8181
CA San Diego, Wyle Labs.;Elctrn. Encl. ... 619-489-2957
CO Wheat Ridge, Waugaman & Assocs., Inc. 303-423-1020
FL Casselberry, T-Squared Mktg. 305-699-9992
IL Elmhurst, Scott Assocs. 312-279-5681
KS Olathe, C-Tron Inc. 913-829-0073
MD Upperco, Imigtron Sls. Co. 301-374-5600
MA Lexington, Zieco Inc. 617-861-8300
MI Jackson, Norwood Scroggs Co. 517-750-1170
NE C-Tron Inc. 314-928-8078
NJ Pennsauken, Wyle Labs.;Elctrn. Encl. 609-665-6810
NJ Teaneck, Noreast Tech. Sls., Inc. 201-833-2044
NM Albuquerque, Brytec Sls. Inc. 505-884-1123
OH Galion, J. R. Bright Agy. 419-468-3787
OR Eugene, H. Hogstrom & Assocs. 503-689-1076
TX Ft. Worth, Zonk Engrg. Co. 817-429-9551
TX Houston, Zonk Engrg. Co. 713-895-9131
TX Richardson, Zonk Engrg. Co. 214-238-7651

ELECTRONIC ENGRG. CO. OF CAL., See EECO

ELECTRONIC ESSENTIALS, 60-20 34th Avenue, Woodside, NY 11377, Tel: 718-898-8300, TELEX: 384-873, ESYLNK: 6275-6172, FAX: 718-899-7995; Empl.: 49

ELECTRONIC FILM CAPACITORS, INC., Reidville Industrial Pk., 41 Interstate Ln., Waterbury, CT 06705, Tel: 203-755-5629, FAX: 203-755-0659; Empl.: 65; *Sls. Mgr.:* Robert Fountain Sr.

ELECTRONIC HARDWARE, 320 Broad Hollow Rd., Farmingdale, NY 11735, Tel: 516-752-1950, FAX: 516-752-1971; Empl.: 100; *Sls. Mgr.:* V. DiSalvo

ELECTRONIC INSTRUMENTS & SPECIALTY CORP., 42 Pleasant St., Stoneham, MA 02180, Tel: 617-438-5300, TELEX: 948-025; FSC No.: 14908; Empl.: 100

ELCTRN. INSTR. & SPEC. CORP., MC DIV., See Millen Comps.

ELECTRONIC MEASUREMENTS, 405 Essex Rd., Neptune, NJ 07753, Tel: 201-922-9300, TELEX: 132-424; Empl.: 250; *Sls. Mgr.:* Charles Lehmann ..... **D•1712-1715**

Local Sales Offices & Reps

AL Huntsville, Sci. Devices 205-536-1969
AZ Phoenix, Sci. Devices 602-957-0401
CA Huntington Beach, Sci. Devices 714-840-3501
CA San Diego, Sci. Devices 619-573-0157
CA San Jose, Sci. Devices 408-554-0455
CO Broomfield, Sci. Devices 303-469-5145
FL Orlando, Sci. Devices 305-841-8180
GA Marietta, Sci. Devices 404-427-8660
IL Chicago, Comtel 312-539-4838
IN Indianapolis, Comtel 317-253-1681
IA Cedar Rapids, Comtel 319-377-9434
MA Winchester, FJS Assoc. 617-729-3135
MI Southfield, Comtel 313-358-2510
MN Wayzata, Comtel 612-476-1551
NM Albuquerque, Sci. Devices 505-883-3668
NY East Syracuse, Ossmann Insts. 315-437-7052
NC Winston-Salem, Sci. Devices 919-765-5776
OH Dayton, WKM Assoc. 513-434-7500
PA Pittsburgh, WKM Assoc. 412-892-2953
PA Plymouth Meeting, Electronic Mktg. Assocs. 215-828-7400
TX Austin, Alphatech 512-458-9179
WA Redmond, Sci. Dvcs. 206-885-0004
WI New Berlin, Comtel 414-544-6042

ELECTRONIC MODULAR SYSTEMS, INC., Pasadena Technology Corp., 1325 Capital Pkway, No. 109, Carrollton, TX 75006, Tel: 214-446-2900, TELEX: 791688, FAX: 214-245-1559; Empl.: 45; *Sls. Mgr.:* Dale R. Sparrow

ELECTRONIC NAVIGATION INDUSTRIES, See ENI, Inc.

ELECTRONIC PACKAGING TECHNOLOGY, INC., 132 Gloster Road, Lawrenceville, GA 30245, Tel: 404-925-8149; Empl.: 5; *Sls. Mgr.:* Al Lipphardt

ELECTRONIC PRECISION COMPONENTS CORPORATION, 11 W. Sandford Blvd., Mt. Vernon, NY 10550, Tel: 914-664-2333; FSC No.: 75898; Empl.: 8; *Sls. Mgr.:* Don Edwards ..... **A•1652**

Local Sales Offices & Reps

CA Granada Hills, W. H. Inds., Inc. 213-363-3910
CO Denver, Midwest Meridian Corp. 303-341-7550
IL Elk Grove Village, Midwest Meridian Corp. 312-640-9540
IA Cedar Rapids, Midwest Meridian Corp. 319-365-6561
MA Andover, William Crawford Assocs. ... 617-470-2122
MN Prior Lake, Midwest Meridian Corp. ... 612-447-8222
MO Marylan Heights, Midwest Meridian Corp. 314-878-4441
OH Fairborn, Midwest Meridian Corp. 513-879-7100
TX Fort Worth, Midwest Meridian Corp. ... 817-654-2132
WA Kirkland, W.H. Industries 206-827-1024

ELECTRONIC RESEARCH ASSOCIATES, INC., See ERA/Refac, ERA Transpac

ELECTRONIC RESEARCH CO., 7618 Wedd St., Overland Park, KS 66204, Tel: 913-631-6700, TWX: 910-749-6477; FSC No.: 13571; Empl.: 60; *Sls. Mgr.:* Charles Ditzler ..... **A•1392**

Local Sales Offices & Reps

NJ Riverdale, Comp-Tech Sls. 201-935-5454
NJ Union, Comp-Tech Sls. 201-687-2484
NY New Hyde Pk., Comp-Tech Sls. 516-593-2628

ELECTRONIC RESOURCES INC., 568 Weddell Dr., No. 8, Sunnyvale, CA 94089, Tel: 408-745-1420, TWX: 510-600-7616, FAX: 408-745-0533; Empl.: 6; *Dist. Mgr.:* Cari Ikya

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ELECTRONIC SOLUTIONS, A Unit of Zero Corp., 6790 Flanders Dr., San Diego, CA 92121, Tel: 619-452-9333, TELEX: 910-335-1169; Empl.: 100 ..... **C•1032-1034**

Local Sales Offices & Reps

AZ Phoenix, Holder Hauer 602-242-4025
CA Concord, Qualtech Assoc. North 415-680-1800
CA Orange, Qualtech South 714-639-9820
CA San Diego, Mesa Engrg. 619-278-8021
CA Sunnyvale, Qualtech North 408-732-4800
CA Thousand Oaks, Qualtech South 805-495-7100
CO Denver, Holder Hauer 303-427-3443
CT Stamford, Tech. Applications Assocs. 203-327-2934
FL Casselberry, Dyne-A-Mark 305-629-5557
FL Clearwater, Dyne-A-Mark 813-441-4702
FL Ft. Lauderdale, Dyne-A-Mark 305-771-6501
GA Norcross, Mtn. Electro Prods. 404-448-5594
IL Elk Grove Vl., Control Sls. 312-595-2110
KS Lenexa, Midtec 913-541-0505
MD Rockville, Spectro 301-294-9770
MA Framingham, TA Squared 617-875-3586
MA Westborough, Tech. Applications Assocs. 617-366-9781
MI Grosse Pointe Pk., Greiner Assocs. ... 313-499-0188
MN Edina, Micro Res. 612-830-1454
MO St. Louis, Midtec 314-275-8666
NM Albuquerque, S & S Technlgs. 505-255-5599
NY New York, Gebhardt Mktg. 201-376-4415
NJ Springfield, Gebhardt Mktg. 201-376-4415
NC Wake Forest, Mtn. Electro Prods. 919-556-7103
OH Richfield, Geotronix 216-659-6100
OH Trotwood, Geotronix 513-252-6700
OK Stillwater, Acudata, Inc. 405-743-1886
OR Beaverton, Thorson Co., N.W. 503-644-5900
PA Allison Park, Monument Tech. 412-487-1770
PA Jenkintown, Monument Tech. Assocs. 215-884-3737
TX Austin, Acudata 512-478-1018
TX Houston, Acudata 713-580-2451
TX Plano, Acudata 214-424-3567
UT Salt Lake City, Holder Hauer 801-532-2111
WA Bellevue, Thorson Co. N.W. 206-455-9180
WI Thiensville, Control Sys. 414-242-4580

ELECTRONIC SPACE SYSTEMS CORP., Old Powder Mill Rd., Concord, MA 01742, Tel: 617-369-7200, TELEX: 923480 ESSCO WCRD, FAX: 617-369-7641; FSC No.: 15175; Empl.: 100; *Sls. Mgr.:* Susan M. Cuevas

ELECTRONIC SPECIALISTS, 171 South Main St., Natick, MA 01760, Tel: 617-655-1532, 800-225-4876, TELEX: 955-329 ATTN: ESP; Empl.: 42; *Sls. Mgr.:* Dan Gendron

FAX: 206-573-4635

ELECTRONIC SPECIALTY CORP., 14511 N.E. 13th Ave., P.O. Box 3501, Vancouver, WA 98668-3501, Tel: 206-574-5000, TELEX: 152-386, TWX: 910-444-0005; FSC No.: 98927;Multiple; Empl.: 132; *Sls. Mgr.:* L. Fuller ..... **B•1416-1419, 1624-1625**

Local Sales Offices & Reps

CA	Anaheim, Gabriel & Assocs.	714-666-0660
CA	San Jose, Ruppert Sls. & Engrg.	408-998-8717
CO	Denver, Tri Tec Sls.	303-440-7862
CT	Bethel, Livera-Polk Assocs.	203-748-4639
FL	Lighthouse Point, Jack Krutek & Assocs.	305-427-4202
KS	Olathe, SPS Assocs. Ltd.	913-764-4460
MD	Gaithersburg, Eastern Comp.	215-825-8610
MA	Lexington, Hathaway Elec.	617-861-7010
MN	Hopkins, The Kits Co.	612-933-1888
NJ	Madison, Livera-Polk Assocs.	201-377-3239
NY	Glen Head, Livera-Polk Assocs.	516-759-9300
NC	Raleigh, Eastern Comp.	919-787-3416
OH	Cleveland, Components Inc.	216-243-9200
OH	Englewood, Newberry & Assocs.	513-832-2114
PA	West Conshohocken, Eastern Comp.	215-825-8610
TX	Dallas, Barry Sls.	214-234-0255
TX	Houston, Barry Sls.	713-784-5860
VA	Annandale, Eastern Comp.	703-354-0723

ELECTRONIC SYS. & PROGRAMMING, See Augat/ESjsP, Inc.

ELECTRONIC TESTING & CONSULTING, 812 Carver St., Mesquite, TX 75149, Tel: 214-288-0331; Empl.: 3

ELECTRONIC TRANSFORMER CORP., P.O. Box 188, Totowa, NJ 07511, Tel: 201-942-2222; FSC No.: 72149; Empl.: 130; *Sls. Mgr.:* Dan Rovine

ELECTRON-MACHINE CORP., Box M, Umatilla, FL 32784, Tel: 904-669-3101, TELEX: 56-4300; Empl.: 55; *Sls. Mgr.:* S. K. Kemp V.P. Mktg

ELECTRON PRODUCTS, 2084 Central Ave., Duarte, CA 91010, Tel: 818-359-8281, TELEX: 910-333-9810; FSC No.: 99515; Empl.: 65; *Sls. Mgr.:* John Williams; *Dist. Mgr.:* Ann Meunier

ELECTRO-NUMERICS, INC., 1811 Reynolds, Irvine, CA 92714, Tel: 714-250-1501, TELEX: 68-5612, FAX: 714-250-0958; FSC No.: 51666; Empl.: 18 ..... **D•1369**

Local Sales Offices & Reps

AL	Huntsville, FLW S.E., Inc.	205-536-6207
CA	Costa Mesa, FLW, Inc.	714-751-7512
CA	San Jose, Gamma Saturn	408-248-4143
CO	Boulder, Herb Bass Assocs.	303-530-7509
FL	Orlando, FLW S.E., Inc.	305-894-1100
GA	Atlanta, FLW S.E., Inc.	404-424-1731
IL	Chicago, PVA Corp.	312-655-3355
KS	Topeka, R. E. Pedrotti Co.	913-677-3366
KY	Louisville, Instr. & Tech. Sys., Inc.	502-244-1498
LA	Lafayette, Kemp Engrg. Co., Inc.	318-269-9452
MA	Boston, Di-Ana Sls. Co.	617-363-5420
MI	Detroit, Satullo Assocs., Inc.	313-585-4811
MN	Minneapolis, Kits Co.	612-933-1888
NY	Hewlett, Metropolitan Sls. Co.	516-599-7900
NC	Charlotte, FLW S.E., Inc.	205-536-6207
OH	Cleveland, Meas. Instr. E., Inc.	216-476-0277
OK	Tulsa, Golden Rule Sls. Co.	918-836-7556
OR	Portland, Topp Engrg. Sls. Corp.	503-244-7265
PA	Philadelphia, FLW of PA, Inc.	215-251-9700
PA	Pittsburgh, Meas. Instr. E., Inc.	412-459-8090
TN	Oak Ridge, Instr. & Tech. Sys.	615-483-5715
TX	Houston, E. V. Smith Sls. Co.	713-931-0403
WA	Seattle, Topp Engrg. Sls. Corp.	206-747-5400
WI	Milwaukee, Stapleman Corp.	414-352-5777
Can	Toronto, Smart Control Sys.	416-474-0550

Local Distributors

AL	Huntsville, FLW S.E., Inc.	205-536-6207
CA	Costa Mesa, FLW, Inc.	714-751-7512
FL	Orlando, FLW S.E., Inc.	305-894-1100
GA	Atlanta, FLW S.E., Inc.	404-424-1731
MI	Detroit, RAM Meter, Inc.	313-398-6767
NC	Charlotte, FLW S.E., Inc.	704-391-8812
PA	Philadelphia, FLW of PA, Inc.	215-251-9700

ELECTRO-OPTICAL INDUSTRIES, Box 3770, Santa Barbara, CA 93130, Tel: 805-964-6701 (ext. 280), TELEX: 65-8427 EOIND SNC, FAX: 805-967-8590; Empl.: 130

ELECTRO-PACIFIC, 5770 Thornwood Dr., Goleta, CA 93117, Tel: 805-964-0751; FSC No.: 29853; Empl.: 60; *Sls. Mgr.:* T. Calhoun

ELECTRO PHYSICS CO., INC., 3009 Central Ave., Waukegan, IL 60085, Tel: 312-249-5801; Empl.: 6; *Sls. Mgr.:* Abe Siegelman

ELECTROPHYSICS CORP., 48 Spruce St., Nutley, NJ 07110, Tel: 201-667-2262, TELEX: 642277

ELECTROPREP, INC., Rt 28A, P.O. Box 437, Cataumet, MA 02534, Tel: 617-563-5559; Empl.: 10; *Sls. Mgr.:* R. M. Sullivan

ELECTRORACK PRODUCTS CO., 1443 S. Sunkist St., Anaheim, CA 92806, Tel: 714-776-5420; FSC No.: 26073; Empl.: 50; *Sls. Mgr.:* Donn Krauser

Local Sales Offices & Reps

AL	Huntsville, Remco	205-533-3763
AZ	Scottsdale, Western Mktg. Eng.	602-948-1773
CA	San Jose, Silicon Valley Sls.	408-432-1967
CO	Thornton, E & C Johnson Co.	303-457-2247
IA	Des Moines, Beams Corp.	515-255-1148
MD	Wheaton, Brimberg Sls.	301-946-2670
MA	Burlington, Intersell	617-273-3844
OK	Tulsa, Spectra Sls.	918-663-7188
TX	Houston, Spectra Sls.	713-270-8212
TX	Richardson, Spectra Sls.	214-234-3600
WA	Seattle, Horton Assocs.	206-322-1500

ELECTRO RENT CORP., 4209 Van Owen Place, Burbank, CA 91505, Tel: 818-843-1221, TELEX: 314225, TWX: 910-498-2238; Empl.: 400; *Sls. Mgr.:* D. Kebadle

ELECTRO SCIENTIFIC INDS., 13900 N.W. Science Pk. Dr., Portland, OR 97229, Tel: 503-641-4141, TELEX: 474-2064; FSC No.: 11837; Empl.: 800; *Sls. Mgr.:* Dick Donaca, Sys./Gay Gasque

FAX: 215-682-2133

ELECTRO SPACE FABRICATORS, 300 W. High St., P.O. BOX 67, Topton, PA 19562-0067, Tel: 215-682-7181; Empl.: 205; *Sls. Mgr.:* T. Roth ..... **C•1035-1038**

Local Sales Offices & Reps

CA	Campbell, Shursales	408-374-5577
CA	Irvine, Vale Assocs.	714-551-4004, 4821
FL	Deerfield Beach, Jack Krutek & Assocs., Inc.	305-427-4202
FL	Melbourne, Winter Assocs.	305-254-6556
GA	Norcross, Hollingsworth & Still	404-447-1700
MD	Upperco, Imagitron Sls. Co.	800-638-3592
MA	Waltham, Betronic Assocs.	617-894-8400
NJ	Boonton, Winter Assocs.	201-334-3434
NY	Morrisville, Promark Elctrns., Inc.	315-662-3310
OH	Galion, James R. Bright	419-468-3787
OR	Beaverton, Electronics Northwest, Inc.	503-629-9241
PA	Huntingdon Valley, OMEGA Elctrn. Sls., Inc.	215-947-4135
PA	McKean, Ecco Electrns. Sls.	814-476-1376
TX	Dallas, Blair Engrg.	214-241-5655
WA	Redmond, Electronics Northwest, Inc.	206-883-1959
WA	Spokane, Electronic Northwest, Inc.	509-924-0450

Local Distributors

CA	Redwood City, HdB Elctrns.	415-368-1388
NJ	Frenchtown, SINTEC	201-996-4093
NY	Baldwin, Accessories for Elctrns.	516-546-1751

ELECTROSPACE SYSTEMS, INC., P. O. Box 831359, Richardson, TX 75083-1359, Tel: 214-470-2106/2107, TWX: 910-867-4768; FSC No.: 33875; Empl.: 2618

Local Sales Offices & Reps

CA	Newbury Pk., Electrospace Sys., Inc.	805-498-9733
FL	Orlando, Electrospace Sys., Inc.	305-273-3310
MA	Acton, Electrospace Sys., Inc.	617-861-6009
NJ	Holmdel, Electrospace Sys., Inc.	201-264-5958
OH	Dayton, Electrospace Sys., Inc.	513-426-3200
VA	Arlington, Electrospace Sys., Inc.	703-979-1220

ELECTRO STANDARDS LAB., INC., P.O. Box 9144, Providence, RI 02940, Tel: 401-943-1164, TELEX: 697-2057 ESLAB, FAX: 401-946-5790; Empl.: 25; *Sls. Mgr.:* R. B. Sepe; *Dist. Mgr.:* R. B. Sepe

ELECTROSTATICS, 7718 Clairemont Mesa Blvd., San Diego, CA 92111, Tel: 619-279-1414; FSC No.: 34538; Empl.: 17

ELECTROSWITCH, Unit of Electro Switch Corp., 180 King Ave., Weymouth, MA 02188, Tel: 617-335-5200, FAX: 617-335-4253; FSC No.: 82121; Empl.: 290; *Sls. Mgr.:* W. M. Mello ..... **B•1705**

Local Sales Offices & Reps

AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Los Angeles, Wiley	213-666-1611
CA	Mtn. View, W. Nott & Co.	415-969-7411
CA	San Diego, Wiley Co.	619-453-9018
CO	Boulder, Comp. Prods. Sls.	303-530-2800
FL	Winter Park, Floritronics	305-886-4818
GA	Atlanta, Holman-Gillespie	404-992-8820
IL	Elk Grove Village, Electroswitch	312-593-2225
IA	Bettendorf, Weisler & Assocs.	319-355-5911
MD	Gaithersburg, Naudain Assocs.-Southern	301-258-5040
MI	Royal Oak, Hilltronics	313-435-0920
MN	St. Paul, Kencotronics	612-645-7717
MO	Ellisville, Weisler & Assocs.	314-394-4543
MO	No. Kansas City, Weisler & Assocs.	816-421-1679
NJ	Fairfield, Electroswitch	201-227-6559
NJ	Marlton, Naudain Assocs.	609-983-5300
NY	Rochester, Sweetco Assocs.	716-225-2383
NY	Utica, Sweetco Assocs.	315-797-6721
NC	Winston-Salem, L.G. White Southern	919-725-3612
OH	Dayton, Rockford Controls	513-898-5452
OH	Medina, Rockford Controls	216-725-3705
PA	Pittsburgh, R. F. Clark	412-242-9500
SC	Greenville, L.G. White Southern	803-271-0630
TX	Dallas, Brice Co.	214-233-9808
TX	Stafford, Brice Co.	713-240-1788
VA	Ruther Glen, L.G. White Southern	804-448-4476
WA	Kent, C.B. Parsons & Co.	206-762-7373
WI	Wauwatosa, Larsen Assocs.	414-258-0529

Local Distributors

CA	Los Angeles, Electric Switches	213-660-1310
FL	Ft. Lauderdale, Peerless Radio Corp. of Fla.	305-973-4141
GA	Atlanta, Georgia Control Ctr.	404-876-8833
IL	Bridgeview, Midco Comp. Sls.	312-599-7777
MD	Kensington, Marine Air Supp.	301-949-9560
MN	St. Paul, K. D. I.	612-645-7717
NY	Hempstead, Electronic Equip. Co.	516-538-5510
NC	Raleigh, Wholesale Elctrns.	919-878-9400
OH	Medina, Rockford Controls Ohio	216-725-3705
TX	Stafford, Barclay Whls.	713-240-1788
WA	Seattle, C.B. Parsons Co.	206-762-7373

ELECTROSWITCH, SOUTHERN DIV., Electro Switch Corp., 2510 North Blvd., Raleigh, NC 27604, Tel: 919-833-0707, TWX: 910-240-4611, FAX: 919-833-8016; Empl.: 70; *Sls. Mgr.:* Doyle N. Evans; *Dist. Mgr.:* Lisa C. Tillis ..... **B•1706**

Local Sales Offices & Reps

AL	Huntsville, R. W. Mitscher Co., Inc.	205-882-6050
CA	Campbell, Luscombe Engrg. Co. of S.F.	408-370-2020
CA	Irvine, Vale Elctrns.	714-551-4004
CA	San Diego, Vale Elctrns.	619-693-0113
FL	Clearwater, Electrocraft, Inc.	813-578-2233
GA	Lawrenceville, R. W. Mitscher Co.	404-923-3239
IL	Itasca, Janus, Inc.	312-250-9650
IN	Indianapolis, C.C. Electro Sls.	317-255-1508
KS	Overland Pk., Electri Rep., Inc.	913-649-2168
MD	Laurel, R. W. Mitscher Co., Inc.	301-498-6090
MI	Royal Oak, Hilltronics, Inc.	313-435-0920
MN	Minneapolis, HMR, Inc.	612-888-2122
MO	St. Louis, Electri Rep., Inc.	314-993-4421
NH	Salem, Sls. Engrg. Co.	603-893-5521
NJ	Englewood, Sprung/Nussbaum, Inc.	201-569-5666
NY	Clarence, R. W. Mitscher Co., Inc.	716-759-2350
NC	Raleigh, R. W. Mitscher Co., Inc.	919-848-0941
OR	Beaverton, Luscombe Engrg. Co.	503-636-6664
PA	Huntingdon Valley, R. W. Mitscher Co.	215-355-4452
PA	Pittsburgh, Cliff Price	412-831-1588
TN	Johnson City, R. W. Mitscher Co., Inc.	615-929-7258
TX	Austin, Allied Comps., Inc.	512-331-4494
TX	Dallas, Allied Comps., Inc.	214-238-0408
VA	Shipman, R. W. Mitscher Co., Inc.	804-263-5154
Can	Mississauga, Ont., Gidden-Morton Assocs., Inc.	416-671-8111

Local Distributors

CA	Hayward, KEA Elctrns.	415-887-2900
IL	Lisle, Components, Inc.	312-852-7707
MA	Canton, Impact Sls.	617-821-1500

MA Hingham, Sager Elctrns. 617-749-6700
NJ Cranford, Garden State Inds. 201-272-6400
NY Buffalo, Summit Distrs. 716-887-2800
NY Mt. Vernon, QAR Indl. Elctrns. 914-699-2224
NY Rome, Rome Elctrns. 315-337-5400
NY Woodside, Switches Unltd. 718-478-5000
NC Charlotte, Dixie Elctrns. 704-377-4348
OH Solon, Repco Elctrns., Inc. 216-248-8900
OR Portland, United Radio Supp. 503-233-5341
SC Columbia, Dixie Elctrns. 803-779-5332
WI Waukesha, Bell Inds. 414-547-8879

ELECTRO-TECH SYSTEMS, INC., 115 E. Glenside Ave., Glenside, PA 19038, Tel: 215-887-2196, TELEX: 797137; Empl.: 13; *Sls. Mgr.:* Sharon Sandy; *Dist. Mgr.:* Stanley Weitz

ELECTRO VECTOR, INC., 6555 Covey Rd., Forestville, CA 95436, Tel: 707-887-2292, TWX: 510-746-6024; *Sls. Mgr.:* Wayne Brigden

ELECTROVERT, INC., 466 Main St., New Rochelle, NY 10801, Tel: 914-633-0222

ELECTRO WEAVE, 425 Shrewsbury St., Worcester, MA 01604, Tel: 617-752-8932, FAX: 617-753-2173; FSC No.: 54207; Empl.: 18; *Sls. Mgr.:* Peter Andrews

ELFAB CORPORATION, Augat, Inc., 1097 Yates Street, Lewisville, TX 75067, Tel: 214-221-8776, TWX: 910-860-5460, FAX: 214-221-9667; Empl.: 250; *Dist. Mgr.:* Peter Kiddy

ELFORM, INC., P.O. Box 7362, Reno, NV 89510, Tel: 702-356-1734, TWX: 510-600-5662 ELFORM, FAX: 702-356-1742; *Sls. Mgr.:* Roger R. Reinke

ELGAR

FAX: 619-458-0267

ELGAR CORP., 9250 Brown Deer Rd., San Diego, CA 92121, Tel: 619-450-0085, 800-854-2213, TELEX: 211063 ELSD UR; FSC No.: 25965; Empl.: 275; *Dist. Mgr.:* Doug Caldwell ..... **D•2092-2096**

Local Sales Offices & Reps

AL Huntsville, Beacon 205-881-5031
AZ Tempe, Trembly Assoc. 602-967-2058
CA Costa Mesa, Ward Davis Assocs. 714-556-0955
CA Redondo Beach, Ward/Davis Assocs. 213-643-6977
CA San Diego, Ward/Davis Assocs. 619-292-1000
CA Santa Clara, Ward Davis Assocs. 408-245-3700
CO Wheat Ridge, Trembly Assocs. 303-421-8900
CT Wallington, Pat Jenks Assocs., Inc. 203-265-9939
FL Boca Raton, Beacon 305-997-5740
FL Clearwater, Beacon 813-796-2378
FL Longwood, Beacon 305-332-1940
GA Atlanta, Beacon 404-256-9640
IL Arlington Heights, Dytec/Central 312-394-3380
IN Indianapolis, Dytec/Central 317-297-5988
KS Lenexa, Dytec/South 913-888-0215
KS Wichita, Dytec/South, Inc. 316-945-7090
MD Laurel, Elctrn. Mktg. Assocs. 301-953-7800
MA Danvers, P. Jenks Assocs. 617-777-5600

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NM Albuquerque, Trembly Assoc. 505-266-8616
NY Great Neck, RTI 516-829-3770
NY Liverpool, Northern Tech. Sls. 315-451-1091
NC Raleigh, Beacon 919-787-0330
OH Dayton, WKM Assocs. 513-434-7500
OH Independence, WKM Assocs. 216-524-5930
TX Richardson, Testech, Inc. 214-644-5010
OR Lake Oswego, Syntek 503-636-6793
PA Pittsburgh, WKM Assocs. 412-892-2953
PA Plymouth Meeting, Elctrn. Mktg. Assocs. 215-828-7400
UT Salt Lake City, Trembly Assocs. 801-295-4703
WA Kirkland, Syntek 206-488-0394
WI Brookfield, Dytec Central Inc. 414-792-0320
EXP CA, San Diego, Elgar Intl. Corp. 619-450-0085
PR Santurce, Beacon 809-728-5040

Local Distributors

AZ Tempe, Micro Source 602-968-6062
CA Mtn. View, Costa Dist. 415-968-1200
CA San Jose, Vitek 408-436-8026
CA San Marcos, Vitek 619-744-8305
FL Ft. Lauderdale, Manchester Equip. 305-491-7660
FL Tampa Bay, CPU Corp. 813-886-1711
IL Northbrook, PC Dist. 312-298-1400
MD Hunt Valley, Micro Wholesalers, Inc ... 301-785-6300
MD Laurel, Trimarc Sys. 301-725-7869
MA Milford, Microserv Tech. 617-478-1600
MA Wellesley, Power Sys Distrb 617-235-7884
MO St. Louis, Indl. Battery 314-423-7005
NH Londonderry, Power Sys Distrb 603-434-2841
NJ Carlstadt, Costa Distbg. 201-507-8700
NY Hauppauge, Manchester Equp. Co., I .. 516-434-8700
NY W. Hempstead, TriCom 516-483-9700
OH Toledo, Tel-Matic 419-241-8141
TX Houston, CPU Corp. 713-987-0234
TX Houston, Q.C. Distrb, Inc 713-988-2290
TX Richardson, Computer-Mate 214-669-9370
VT Bountiful, Sudico 801-298-9346
VA Roanoke, ComTech 703-981-0326
Can Mississauga, Ont., Bertex 416-238-9379
Can Mississauga, Ont., Drake 416-629-2606

ELGAR/INTEPRO SYSTEMS, 9250 Brown Deer Road, San Diego, CA 92121, Tel: 619-458-0261, 1-800-854-2213, TELEX: 211063 ELSO UR, FAX: 619-458-0267; Empl.: 250; *Sls. Mgr.:* Sam Lewis ..... **D•2097**

Local Sales Offices & Reps

AL Huntsville, Beacon 205-881-5031
AZ Tempe, Trembly Assocs. 602-967-2058
CA Costa Mesa, Ward Davis Assocs. 714-556-0955
CA Redondo Bch., Ward/Davis Assocs. .. 213-643-6977
CA San Diego, Ward/Davis Assocs. 619-292-1000
CA Santa Clara, Ward Davis Assocs. 408-245-3700
CO Wheat Ridge, Trembly Assocs. 303-421-8900
CT Wallington, Pat Jenks Assocs., Inc. 203-265-9939
FL Boca Raton, Beacon 305-997-5740
FL Clearwater, Beacon 813-796-2378
FL Longwood, Beacon 305-332-1940
GA Atlanta, Beacon 404-256-9640
IL Arlington Hgts., Dytec/Central 312-394-3380
IN Indianapolis, Dytec/Central 317-297-5988
KS Lenexa, Dytec/South 913-888-0215
KS Wichita, Dytec/South, Inc. 316-945-7090
MD Laurel, Elctrn. Mktg. Assocs. 301-953-7800
MD Maryland Hgts., Dytec/South 314-739-0665
MA Danvers, P. Jenks Assocs. 617-777-5600
MI Madison Hgts., WKM Assocs. 313-588-2300
MN Minneapolis, Berndt Assocs. 612-546-2021
NV Las Vegas, Trembly Assocs. 702-739-9770
NM Albuquerque, Trembly Assocs. 505-266-8616
NY Great Neck, RTI 516-829-3770
NY Liverpool, Northern Tech. Sls. 315-451-1091
NC Raleigh, Beacon 919-787-0330
OH Dayton, WKM Assocs. 513-434-7500
OH Independence, WKM Assocs. 216-524-5930
OR Lake Oswego, Syntek 503-636-6793
PA Pittsburgh, WKM Assocs. 412-892-2953
PA Plymouth Meeting, Elctrn. Mktg. Assocs. 215-828-7400
TX Richardson, Testech, Inc. 214-644-5010
UT Salt Lake City, Trembly Assocs. 801-295-4703
WA Kirkland, Syntek 206-488-0394
WI Brookfield, Dytec Central Inc. 414-792-0320
EXP CA/San Diego, Elgar Intl. Corp. 619-450-0085
PR Santurce, Beacon 809-728-5040

ELGENCO, INC., Box 460, Hurricane, UT 84737, Tel: 801-635-4954; FSC No.: 15455; *Sls. Mgr.:* D. E. Beecher ..... **D•1244-1249**

Local Sales Offices & Reps

CA Mtn. View, N-S Westronics 415-960-1111
CA Sherman Oaks, Windsor Dynamics ... 818-990-4173
CT Meriden, Polytek Assoc. 203-621-4521
MA Waban, Polytek Assoc. 617-881-4741
NJ Marmore, SWR Tech., Inc. 609-390-0094
NM Albuquerque, Technology Mktg. Assoc. 505-345-8921
PA Broomall, SWR Tech., Inc. 215-353-6639

ELGIN ELECTRONICS, Combustion Engineering, 5533 New Perry Hwy., Erie, PA 16509-3570, Tel: 814-864-4921, TWX: 510-699-6870, FAX: 814-864-1260; Empl.: 500; *Sls. Mgr.:* D. Selmon

ELITE ELECTRONICS, INC., 1408 Summit - Suite 65, Plano, TX 75074, Tel: 214-881-0026, 800-553-4376, FAX: 214-424-7299; Empl.: 4

ELITE SOFTWARE DEVELOPMENT, INC., P.O. Drawer 1194, Bryan, TX 77806, Tel: 409-846-2340, TELEX: 910-997-6760; Empl.: 9; *Sls. Mgr.:* Terri J. King

ELLIOTT/JORDAN, A Sub. of Vishay Intertechnology, 63 Lincoln Highway, Malvern, PA 19355, Tel: 215-644-1300, TWX: 510-668-8944, FAX: 215-296-0657; Empl.: 500; *Dist. Mgr.:* Iris Demeritt ..... **A•1934-1935**

For sales office, representative, and distributor information, see Vishay Resistive Systems Group.

ELMA

FAX: 415-656-3783

ELMA ELECTRONIC INC., 41440 Christy Street, Fremont, CA 94538, Tel: 415-656-3400 ..... **B•1707; C•1040-1041, 1605; D•1111**

Local Sales Offices & Reps

AL Huntsville, Elctrn. Sls. Inc. 205-533-1735
CA Anaheim, Impact Elctrns., Inc. 714-533-1351
CA Fremont, ELMA Elctrn. Inc. 415-656-3400
CA Santa Ana, Caltronics, Inc. 714-751-9162
GA Norcross, Elctrn. Sls. Inc. 404-448-6554
IL Elmhurst, F.F./Hill Gray Inc. 312-832-4101
IN Indianapolis, John Sukup, Inc. 317-253-5501
MD Lisbon, Samuel K. MacDonald Inc. 301-982-1088
MI Royal Oak, Hilltronics 313-435-0920
NH Nashua, Bell Controls Inc. 603-882-6984
NJ Englewood, Harold Gray Assocs. Inc. 201-894-0894
NY Rochester, Lamb Comps., Inc. 716-323-1250
NC Greensboro, Hile Assocs. Inc. 919-288-1500
MA Beachwood, Land Elctrn. Supp. Co. 216-831-9555
PA Philadelphia, Samuel K. MacDonald Inc. 215-545-1205

Local Distributors

CA Canoga Pk., Panel Parts Co. 818-884-8898
CO Lakewood, ACACIA Sls. Inc. 303-232-2882
CT Wallingford, Sager Elctrl. Supp. Co. 203-265-4600
IL Chicago, Federal Screw Prods. Inc. 800-225-5377
IL Villa Pk., Melvin Elctrns. 312-279-5010
MA Lynn, Land Elctrn. Cupp. Co. 617-592-2220
MA Waltham, Vantage Elctrns. Corp. 617-894-8690
NJ Cranford, Garden State Indl. Elect. 201-272-6400
NJ Cranford, Garden State Indl., Inc. 201-272-6400
NY Buffalo, Summit Distrs. Inc. 716-884-3450
NC Raleigh, Meter Metrics 804-275-1431
OK Tulsa, Radio, Inc. 918-587-9123
PA Philadelphia, PEI-Genesis 215-568-7400
VA Richmond, Meter Metrics 804-275-1431

ELMA ENGINEERING, 1066 E. Meadow Circle, Palo Alto, CA 94303, Tel: 415-494-7303, TELEX: 345-560; FSC No.: 59810; Empl.: 38; *Sls. Mgr.:* T. A. Beno; *Dist. Mgr.:* T. A. Beno

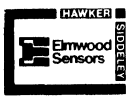
ELMAG DIVISION, Lindgren RF Enclosures, 54 Clark St., Newark, NJ 07104, Tel: 201-481-1600; FSC No.: 23160; Empl.: 15

ELMEC
DELAY LINE

FAX: 213-265-1908

ELMEC TECHNOLOGY OF AMERICA, 1225 Ridgecrest St., Monterey Pk., CA 91754, Tel: 213-265-1861; *Sls. Mgr.:* Steve Sameshima ..... **A•1552-1557**

ELM SYSTEMS, 1101 Brown St, Wauconda, IL 60084, Tel: 312-526-5003



FAX: 401-728-5390

ELMWOOD SENSORS, 500 Narragansett Park Drive, Pawtucket, RI 02861, Tel: 401-727-1300, TELEX: 6814066 ELMWOOD; Empl.: 700; *Sls. Mgr.:* Steve Fox ..... **B•1843-1845**

Local Sales Offices & Reps

AL	Decatur, Tenn. Tech. Sls.	205-350-0630
AZ	Phoenix, O'Donnell SW	602-944-9542
AR	Tulsa, Ion Assoc.-Arkla	918-644-0187
CA	San Diego, O'Donnell Assocs.	619-578-1645
CA	San Jose, O'Donnell Assocs.	408-263-6500
CA	Torrance, O'Donnell Assocs.	213-539-9664
CO	Boulder, Front Range Mktg.	303-443-4780
FL	Coral Springs, CBC Electronics	305-755-1111
GA	Marietta, Tenn. Tech. Sls.	404-428-9594
IL	Arlington Heights, Thermek	312-577-6900
IN	Fort Wayne, O. Bromberg	219-456-6010
KY	Louisville, O. Bromberg	502-456-1498
MD	Glen Burnie, Faber-Renoff, Inc.	301-768-4554
MA	Danvers, C. H. Burnham Assoc.	617-774-0111
MI	Brooklyn, Engineered Comps.	517-592-3236
MN	Minneapolis, C. Listug Sls.	612-537-6740
MO	St. Louis, Hill & Co.	314-432-1136
NH	Durham, C. H. Burnham Assoc.	603-868-2282
NJ	Pitman, Colrud Corp.	609-589-5866
NY	Fairport, Bastian Sls.	716-223-0237
NY	Larchmont, G. M. Moch Co.	914-834-3530
NY	Syracuse, Canavan-Scanlon	315-437-1271
NC	Raleigh, Tenn-Tech	919-266-3610
OH	Cincinnati, O. H. Bromberg	513-771-9333
OH	Cleveland, Allied Entprs.	216-779-0080
OK	Tulsa, Ion Assoc.	918-644-0186
OR	Hillsboro, Temco-Northwest	503-649-8375
PA	Murrysville, Allied Entprs.	412-325-3200
NJ	Pittman, Colrud Corp.	609-589-5866
RI	Johnston, C. H. Burnham Assoc.	401-231-7475
TX	Austin, Ion Assocs.	512-331-7251
TX	Grand Prairie, Ion Assocs.	214-647-8225
TX	Houston, Ion Assocs.	713-537-7717
UT	Salt Lake City, Front Range Mktg.	801-364-6481
VA	Midlothian, Daniel E. Boehling Assocs.	804-794-5879
WA	Bellevue, Lehr Assocs.	206-453-9993
WA	Bothell, Temco Northwest	206-821-5434
WI	Milwaukee, R. Zingler	414-351-5005
Can	Mississauga, Ont., Andy Baumen Assocs.	416-828-2600

ELNA AMERICA, INC., 153 E. Savarona Way, Carson, CA 90746, Tel: 213-327-6090, TELEX: 68-6427, TWX: 910-346-6730; *Sls. Mgr.:* Don L. Bilsing; *Dist. Mgr.:* Isao Kikuchi

ELNETIC ELECTRONICS, INC., P.O. Box 88232, Los Angeles, CA 90009-8232, Tel: 213-515-1546; FSC No.: 98460; Empl.: 25; *Sls. Mgr.:* Ernest H. Carlson, Jr.

ELOGRAPHICS, 105 Randolph Rd., Oak Ridge, TN 37830, Tel: 615-482-4100, TELEX: 350348; *Sls. Mgr.:* R. Highfill

FAX: 714-241-7293

ELPAC COMPONENTS, Elpac Electronics, Inc., 3131 S. Standard Ave., Santa Ana, CA 92705, Tel: 714-979-4440, TWX: 910-595-1513; Empl.: 130 ... **A•1082-1083**

Local Sales Offices & Reps

AZ	Phoenix, Eltron	602-266-2164
CA	San Diego, Wes-K Assocs.	619-655-2040
CA	San Jose, Ruppert Sls.	408-998-8717
CA	Van Nuys, Wes-K Assocs.	213-989-3070
CT	Milford, Todino Engr. Sls.	203-874-6643
FL	Orlando, Honeyco Inc.	305-299-1222
IL	Highland Park, Bransky Sls.	312-433-2375
MA	Needham Heights, Todino Engr. Sls.	617-444-7925
MN	Bloomington, Smiley-Scott Assocs.	612-888-5551
NJ	Englewood, Harold Gray Assocs.	201-894-0894
OH	Dayton, J. C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-241-4880
WA	Seattle, Harry Levinson Co.	206-382-1300
WI	Cedarburg, Bransky Sls.	414-377-8507

Local Distributors

AZ	Phoenix, T.T.I.	602-861-0222
CA	Chatsworth, Mil-Comm	818-998-3111
CA	Chatsworth, TTI	818-709-8693
CA	Irvine, Kelex	714-863-1230
CA	San Diego, T.T.I.	619-587-4888
CA	San Jose, T.T.I.	408-946-5577
CO	Westminster, T.T.I.	303-429-6806
CT	Stratford, T.T.I.	203-375-1400
FL	Orlando, T.T.I. Florida	305-859-1000
GA	Norcross, T.T.I.	404-662-0911
IL	Northbrook, Classic Components	312-272-9650
IL	Skokie, Kellner Elctrns.	312-677-1120
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
MA	Wilmington, Aved Elctrns.	617-657-9310
MA	Woburn, T.T.I., Inc. NE	617-938-8800
MN	Eden Prairie, T.T.I.	612-944-5080
MN	Minneapolis, Northern	612-944-1167
NJ	S. Hackensack, Waltech	201-641-7300
NY	Bohemia, T.T.I.	516-737-2000
NY	Mamaroneck, New Yorker Elec.	914-698-7600
NY	Elmsford, Ancar	914-592-7100
OH	Dayton, Electro Supp.	513-299-5020
OK	Tulsa, Altair Co.	918-252-5781
TX	Ft. Worth, T.T.I.	817-831-8300
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair	214-231-5166
VA	Charlotte, Kellner	802-425-3250
WA	Seattle, Kam Elec.	206-382-1300
WI	New Berlin, Classic	414-786-5300
WI	Racine, Badger Elctrns.	414-637-1256, 414-933-6685

ELPAC POWER SYSTEMS, Elpac Electronics, Inc., 3131 S. Standard Ave., Santa Ana, CA 92705, Tel: 714-979-4440, TWX: 910-595-1513, FAX: 714-241-7293; Empl.: 270; *Sls. Mgr.:* H. Myers; *Dist. Mgr.:* H. Myers

ELPAZ INSTRUMENTS, INC., 160 N. Craig St., Pittsburgh, PA 15213, Tel: 412-687-8700, TELEX: 382960; Empl.: 15; *Sls. Mgr.:* Stephen Phelps; *Dist. Mgr.:* Stephen Phelps

ELPOWER CORPORATION, 2117 S. Anne St., Santa Ana, CA 92704, Tel: 714-540-6155, TELEX: 678354 ELPOWER SNA; Empl.: 200; *Sls. Mgr.:* R. Calvert; *Dist. Mgr.:* Ronnie LeFevre

E-L PRODUCTS CORP., Sub.of Astronics Co., 77 Olean Rd., E. Aurora, NY 14052, Tel: 716-655-0800, FAX: 716-655-0309; Empl.: 100; *Sls. Mgr.:* Patrick McCann

EL-RAD MFG., 2800 W. Cullom Ave., Chicago, IL 60618, Tel: 312-478-7300, TWX: 910-221-0104; FSC No.: 11253; Empl.: 225; *Sls. Mgr.:* Marvin S. Christ

ELTEC INSTRUMENTS INC., P.O. Box 9610, Daytona Bch., FL 32020, Tel: 904-253-5328, TWX: 810-832-6294, FAX: 904-258-3791; Empl.: 120; *Sls. Mgr.:* Douglas S. Armstrong

ELTROL CORPORATION, 20942 Osborne Street, Bldg. I, Canoga Park, CA 91304, Tel: 818-709-0131, FAX: 818-709-0132; FSC No.: IER54; Empl.: 6; *Sls. Mgr.:* Terry E. Donovan ..... **B•1203**

Local Sales Offices & Reps

CA	Glendale, Halbar Assocs.	818-246-8263
OH	Broadview Hgts., Controlled Prods.	216-838-5700

ELVO ELECTRONICS CORPORATION, 140 Kisco Avenue, Mt. Kisco, NY 10549, Tel: 914-241-1008, TWX: 910-250-5181, FAX: 914-241-7096; *Sls. Mgr.:* Thomas H. Stein

EMCA, Sub. Rohm and Haas Advanced Matls. Co., 605 Center Ave., Mamaroneck, NY 10543, Tel: 914-698-8434, TWX: 710-566-1128; Empl.: 70; *Sls. Mgr.:* Dennis Hanley

EMCO ELECTRONICS, 104 S. Central Ave., Valley Stream, NY 11580, Tel: 516-825-3330, TELEX: 276590; Empl.: 9; *Sls. Mgr.:* K. Berkowitz; *Dist. Mgr.:* Jay Robinson

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GA	Roswell, Henry W. Phillips Co.	404-992-3070,
CA	Long Bch., Ross Sls. Co.	213-424-9818
CT	Hartford, John Colavecchio	203-522-0596,
FL	Venice, JGG Sls.	813-497-0177
HI	Honolulu, Lee Gaber	808-536-2457
IA	W. Des Moines, Nevco Inc.	515-225-9866,
MD	Baltimore, David S. Linz	301-435-0012
MO	No. Kansas City, Nevco Inc.	816-421-1751,
NY	Bellmore, Mike Sussman	516-221-7867,
OH	Akron, Buckeye Mktg.	216-836-7875
OH	Jamestown, Buckeye Mktg.	513-675-2059
PA	Philadelphia, David S. Linz Co.	215-379-0734
NC	Statesville, Henry W. Phillips	803-244-6254
TX	Garland, Nesbitt Co.	214-270-9867
EXP	Valley Stream, NY, Bysk Elctrns.	516-825-7302
Can	Vancouver, H. W. Cowan Ltd.	604-576-8236,

EMCO HIGH VOLTAGE CO. 11126 Ridge Road Sutter Creek, CA 95685 CALL... 209-223-EMCO

FAX: 209-223-2779

EMCO HIGH VOLTAGE CO., 11126 Ridge Road, Sutter Creek, CA 95685, Tel: 209-223-3626, TELEX: 5101008006; FSC No.: 3T243; Empl.: 38; *Sls. Mgr.:* Roxanne McCoy ..... **D•1717**

E/M CORPORATION, 2801 Kent Avenue, P.O. Box 2400, W. Lafayette, IN 47906, Tel: 317-497-6100, FAX: 317-497-6348; FSC No.: 11770

Emcor Products

FAX: 507-287-3405

EMCOR PRODUCTS, Crenlo, Inc., 1600 Fourth Ave. NW, Rochester, MN 55901, Tel: 507-289-3371; *Sls. Mgr.:* John Horton ..... **C•1039**

EMC TECHNOLOGY INC, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034, Tel: 609-429-7800, TWX: 710 896 0193, FAX: 609-429-6814; FSC No.: 24602; Empl.: 75; *Sls. Mgr.:* Peter Semitschew

EMDS, INC., 16618 Oakmont Ave., Gaithersburg, MD 20877, Tel: 301-840-5710, FAX: 301-840-8589; *Sls. Mgr.:* Patrick E. Roney ..... **D•1250**

EMERSON, INDL. CONTROLS DIV., 3300 Standard St., Santa Ana, CA 92702, Tel: 714-545-5581, TELEX: 67-8460, FAX: 714-540-6718; Empl.: 800; *Sls. Mgr.:* W. Sgro; *Dist. Mgr.:* S. Leschin

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EMERSON & CUMING, W. R. Grace & Co., 59 Walpole St., Canton, MA 02021, Tel: 617-828-3300, TWX: 710-348-1324; Empl.: ò500

EMHART CANADA, LTD., See Mallory Components Div.

EMICO INC., Box 368, Dublin, PA 18917, Tel: 215-249-9330, FAX: 215-249-9336; FSC No.: 85925; Empl.: 100; *Sls. Mgr.:* C. Altschul

EMI GENCOM INC., See THORN EMI Gencom Inc.

EMI TECHNOLOGY INC., See THORN EMI Technology Inc.

EMM SEMI, SUB OF EM & M, See GTE Microcircuits

FAX: 317-823-4835

EMPRO MANUFACTURING COMPANY, INC., P.O. Box 26060, Indianapolis, IN 46226, Tel: 317-823-4478; Empl.: 25 ..... **D•1251**

Local Sales Offices & Reps

CA	La Canada, Brooks-Moore & Assocs.	818-790-8358
CA	Orange, Brooks-Moore & Assocs.	714-771-1220
CA	Santa Ana, Brooks-Moore & Assocs.	714-544-8900
GA	Atlanta, Brownell Electro Inc.	404-762-5181
IL	Chicago, Best Rep Co.	312-992-1055

MA Burlington, E.I.L. Instr. 617-272-9450
NJ Belleville, D. F. Tobias & Co. 201-751-8680
OH Cleveland, Weschler Elec. Corp. 216-238-2550
PA Philadelphia, Sunshine Sci. Instr. Inc. .. 215-673-5600
TX Arlington, Ev Smith Sls. 817-572-2911
TX Houston, Ev Smith Sls. 713-931-0403

Local Distributors
CA Dublin, Std. Meter Lab 415-828-4837
CA Glendale, Instr. Meter Specialties 818-243-0416
CA S. Pasadena, Dae Instr. & Svc., Inc. ... 213-258-0578
LA Harahan, Indl. Instrs. Works 504-733-8355
MD Sparks, E.I.L. Instrs. 301-771-4800
NJ Belleville, Miscorp 201-751-1190
PA Norristown, Kimberly-James 215-666-7186
TX Beaumont, Straughn Elctrns. 409-838-4563
TX Houston, American Analog 713-941-7265
TX Houston, Meters & Instrs. 713-644-1631
WI Milwaukee, E-M Instrs. 414-272-7799

EMR DATA SYSTEMS, DIV. SANGAMO- WESTON, Box 3041, Sarasota, FL 33578, Tel: 813-371-0811, TELEX: 052-890, TWX: 810-864-0406; Empl.: 1100; *Sls. Mgr.:* F. V. Hinkel

EMS

FAX: 714-838-2967

E.M.S., Div. of Sandberg Industries, 2922 Dow Street, Tustin, CA 92680, Tel: 714-669-9473, TWX: 910-595-2767; Empl.: 125; *Sls. Mgr.:* Duane Halverson, Opers. Mgr.; *Dist. Mgr.:* Noel Kennedy ..... **C•1726**

Local Sales Offices & Reps
OH Mansfield, Ralph Meckling Assocs. 419-526-2352
TX Austin, Allied Comps., Inc. 512-258-7558
TX Dallas, Allied Comps., Inc. 214-238-0408
VA Reston, Tytronics Tech. Sls. 703-620-4600

E M S DEVELOPMENT CORP., 100 Sea La., Farmingdale, NY 11735, Tel: 516-293-7900, TWX: 510-224-6480; FSC No.: 51435; Empl.: 125; *Sls. Mgr.:* Ed Simkovich

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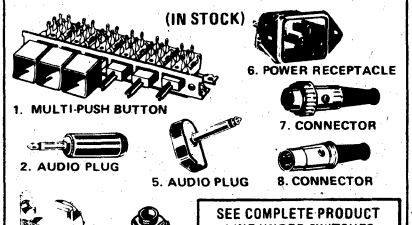

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IL Schaumburg, PosiTech Sls. 312-980-9407
IN Carmel, STB & Assocs. 317-844-9227
WI Colgate, Rep I & Assocs., Inc. 414-628-4016

EMULATION TECHNOLOGY, INC., 2368B Walsh Ave, Bldg. D, Santa Clara, CA 95051, Tel: 408-982-0660, TELEX: 981866, FAX: 408-982-0664; Empl.: 7; *Sls. Mgr.:* Joseph J. Bagliere, Jr. ..... **C•1326**

Local Distributors
CA Monterey, Adams/MacDonald Entrps. 408-373-3607
TX Allen, Prime Distributing Co. 214-231-0170

ENCLOSURE CORP., 2900 Wharton Rd., Bristol, PA 19007, Tel: 215-785-2900, FAX: 215-785-2960; FSC No.: 32360; Empl.: 120; *Sls. Mgr.:* Gene Goldner

ENCODER DIV., LITTON SYSTEMS, INC., See Litton Encoder Div.

ENCODER PRODUCTS, 1601B Dover Rd., Sandpoint, ID 83864, Tel: 208-263-8541, TWX: 510-776-1595; Empl.: 70; *Sls. Mgr.:* Vance Conner

ENDEVCO, 30700 Rancho Viejo Rd., San Juan Capistrano, CA 92675, Tel: 714-493-8181, TELEX: 68-5608, TWX: 910-596-1415; FSC No.: 95411; Empl.: 400; *Sls. Mgr.:* D. McMahon

ENDICOTT COIL, 24 Charlotte St., Binghamton, NY 13905, Tel: 607-797-1263, TELEX: 932411; Empl.: 110; *Sls. Mgr.:* Thomas E. Frank

ERC®

FAX: 607-754-9255

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Local Sales Offices & Reps
AZ Phoenix, Finn-Pat Co., Inc. 602-954-0301
CA Irvine, Component Mktg. Assocs. 714-951-5950
CA Saratoga, Testco 408-253-1900
CA Solana Bch., Component Mktg. Assoc. 619-268-4612
CO Littleton, MRC 303-794-4684
CT Bloomfield, Sands Co./Sir Assocs. 203-243-9343
FL Maitland, EIR, Inc. 305-660-9600
GA Atlanta, Wallace Electronics 800-334-3518
IL Elk Grove Village, Carlson Elctrn. Sls. 312-956-8240
IN Indianapolis, Precision Elctrn. Comps. 317-842-3740
IA Cedar Rapids, Carlson Elctrn. Sls. 319-377-6341
KS Wichita, Palatine 319-365-8071
MA Westford, SIR Assocs. 617-692-2500
MI West Bloomfield, Granneman & Mize 317-849-2000
MN Minneapolis, OEM Prods. 612-541-0236
MO Hazelwood, Palatine 314-839-0800
NJ Livingston, Eagle Sls. Co. 201-992-2030
NY Jericho, Metro-Tech 516-935-3330
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NC Kernersville, Wallace Electronics 919-996-2742
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PA Glenshaw, H. C. Johnson Agencies ... 412-487-1246
PA King of Prussia, Freedman-Malta Assocs. 215-337-9211
TX Austin, Component Technlg. 512-250-2450
TX Dallas, Component Technlg. 214-783-8831
TX Houston, Component Technlg. 713-961-1262
UT Salt Lake City, MRC 303-794-4684
WA Bellevue, Testco 206-454-7422
WI Milwaukee, Carlson Elctrn. Sls. 414-476-2790
Can Toronto, Ont., Norgay Entprs., Ltd. 416-259-9663

ENERCO, INC., 9615 W. Marginal Way S., Seattle, WA 98108, Tel: 206-762-1422; Empl.: 5; *Sls. Mgr.:* Lee Rabie

ENERGETEC SYSTEMS, INC., 130 E. St. Charles Rd, Carol Stream, IL 60188, Tel: 312-653-1920, TELEX: 910-380-8574; Empl.: 40

ENERGY CONCEPTS INC., 5205D Avenida Encinas, Carlsbad, CA 92008, Tel: 619-438-2202, TELEX: 01830, FAX: 619-438-0694; FSC No.: 01830; Empl.: 16; *Sls. Mgr.:* Tim O'Connell

Local Sales Offices & Reps
CA Carlsbad, Energy Concepts 619-438-2202
IL Wilmette, Energy Concepts Cen. 312-256-6197
Can Bramalea, Ont., EC Battery Canada Corp. 416-458-4572
Can Mississauga, Ont., EC Battery Canada Corp. 416-624-6626

ENERGY ELECTRONIC SYSTEMS, INC, 9486 Deereco Rd., Timonium, MD 21093, Tel: 301-252-2240, 800-233-4544, FAX: 301-561-5412; Empl.: 35; *Sls. Mgr.:* Mike Lynch

ENERGY ENGINEERING, Rt. 4, Box 330, Fayetteville, AR 72701, Tel: 501-521-4707; Empl.: 3; *Sls. Mgr.:* David F. Scott; *Dist. Mgr.:* David F. Scott

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FAX: 301-699-8107

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Local Sales Offices & Reps
MD Bladensburg, Energy, Ltd. 301-699-1144

Local Distributors
MD Bladensburg, Energy, Ltd. 301-699-1144

ENERGY SYSTEMS

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OH Cincinnati, Makin Assocs. 513-871-2424
OR Beaverton, Ravencraft 503-646-9261
TX Plano, Zeus Engrg. 214-423-2027
VA Reston, Tytronics Tech. Sls. 703-620-4600
WI Milwaukee, Carlson Elctrn. Sls. Co. 414-476-2790
EXP NJ, Palisades Pk, ESC Elctrns. Corp. 201-947-0400
Can Toronto, Ont., CEA Assocs. 416-231-9717

ESE, 142 Sierra St., El Segundo, CA 90245, Tel: 213-322-2136; FSC No.: 58525; Empl.: 25; *Sls. Mgr.:* R. Mayers; *Dist. Mgr.:* R. Mayers

ESICO/TRITON, Triton Industries Inc., Box 247, Deep River, CT 06417, Tel: 203-526-5361, TELEX: 955439, FAX: 203-526-9524; FSC No.: 54195; *Sls. Mgr.:* Robert W. Mead

E-SQUARED TECHNOLOGY CORP., 4475 Dupont Ct 69, Ventura, CA 93003, Tel: 805-644-9544, TELEX: 887971 E Sq. Tech. UD; Empl.: 19; *Sls. Mgr.:* Larry D. Emery

ESSCO INDS., P.O. Box 515, Sierra Madre, CA 91024-0515, Tel: 818-355-8315; Empl.: 33

ESSEX GROUP, 9933 13th St., Ft. Wayne, IN. 46809, Tel: 219-478-1521; Empl.: 300-500; *Sls. Mgr.:* J. Scott

ESSEX GRP., Power Conductor Div., 2601 S. Adams, Marion, IN 46953, Tel: 317-664-6211, TWX: 317-667-6972; Empl.: 700; *Sls. Mgr.:* J. Burdick

ESTERLINE ANGUS INSTRUMENT CORP., Box 24000, Indianapolis, IN 46224, Tel: 317-244-7611, TELEX: 027-419, ESYLNK: 317-247-4749; FSC No.: 72264; Empl.: 200ò; *Sls. Mgr.:* Donald E. Allen, Pres. & Sls. Mgr.

E-SYSTEMS, Greenville Div., P.O. Box 1056, Greenville, TX 75401, Tel: 214-457-4694, TELEX: 73-2392; *Sls. Mgr.:* C. L. Byrom

E-SYSTEMS, Melpar Div., 7700 Arlington Blvd., Falls Church, VA 22046, Tel: 703-560-5000, TELEX: 89-9494, TWX: 710-831-9802, FAX: 703-280-4627; Empl.: 2400; *Sls. Mgr.:* Richard F. Kolasheski

E-SYSTEMS, See Memcor-Truohm, Inc.

E-T-A®

FAX: 312-647-7494

E-T-A CIRCUIT BREAKERS, 7400 N. Croname Rd., Chicago, IL 60648, Tel: 312-647-8303, TELEX: 253780; Empl.: 20; *Sls. Mgr.:* John J. Palsir ..... **B•1311-1313, 1890; D•1364**

Local Sales Offices & Reps

CA	Los Angeles, Sierra-Pacific Eng.	714-731-3411
CA	San Francisco, Moulthrop Sls.	415-463-0450
CO	Denver, Candal, Inc.	303-233-0155
CT	East Haven, Eagle Assocs.	203-467-6542
FL	Orlando, EAB Inc.	305-898-7444
IN	Ft. Wayne, Needler Sls. Co.	219-447-2123
IN	Indianapolis, Needler Sls. Co.	317-255-8056
IA	Bettendorf, Weisler & Assocs.	319-344-0566
MA	Boston, Eagle Assocs.	617-444-3446
MI	Detroit, Hilltronics	313-398-5556
MN	Minneapolis, Chris & Assocs.	612-861-1634
MO	N. Kansas City, Weisler & Assocs.	816-421-1679
MO	St. Louis, Weisler & Assocs.	314-394-4543
NY	New York, Schmitt Indl. Mktg. Corp.	516-486-3510
NY	Rochester, Lamb Comps.	716-323-1250
NY	Syracuse, Lamb Comps.	315-455-6286
OH	Cincinnati, J. O. Olsen Co.	513-922-8885
OH	Cleveland, J. O. Olsen Co.	216-662-3454
OR	Portland, Doran Sls.	503-357-3333
PA	Philadelphia, Jacobsen Assocs.	215-674-2937
TN	Hendersonville, Stark & Assoc.	615-822-1667
TX	Austin, Delta Comps.	512-458-4288
TX	Dallas, Delta Comps.	214-287-6333
UT	Salt Lake City, Frank Merchant	801-277-3775
VA	Forest, Beacon North	804-239-8486
VA	Sterling, Beacon North	703-478-2480
WA	Seattle, Doran Sls. Assocs.	206-885-1885
WI	Milwaukee, Star Engineering	414-645-3680

ETA POWER, See JETA Power Systems

ETD TECHNOLOGY, INC., 605 West County Road E, Shoreview, MN 55126, Tel: 612-482-7760; Empl.: 35; *Sls. Mgr.:* John Parsons

ETI SYSTEMS

FAX: 619-757-2305

ETI SYSTEMS, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, Tel: 619-757-7770, TWX: 910-322-1396; FSC No.: 952 762672; Empl.: 25; *Sls. Mgr.:* Bill Tice; *Dist. Mgr.:* Bill Tice ... **A•2070-2074; B•1205**

Local Sales Offices & Reps

MD	Baltimore, Eltron Sls.	707-635-1933
MN	Minneapolis, Holmgren Assocs.	612-786-7641
NJ	Haddon Hgts., Eltron Sls.	609-428-3311
NY	Clifton Pk., Net Sls.	518-371-6864
NY	Cortland, Net Sls.	607-756-6592
NY	DeRuyter, Net Sls.	315-662-7996
NY	Fairport, Net Sls.	716-223-1030
OH	Beachwood, Electronic	216-831-9555
PA	Westchester, Eltron Sls.	215-793-1468
SC	Greenville, Eltron Sls.	803-234-6931
VA	Front Royale, Eltron Sls.	703-635-7201
VA	Midlothian, Eltron Sls.	804-744-1337
Can	Downsview, Ont., Electrodesign, Ltd.	416-665-4405
Can	Lachine, Ont., Electrodesign, Ltd.	613-727-5220
Can	Que., Electrodesign, Ltd.	514-636-4838

Local Distributors

AZ	Tempe, Anjon Enterprises	602-894-1332
CA	Anaheim, A To Z Elctrns.	714-632-1620
CA	Garden Grove, Allied Elctrns.	714-544-0731
CA	Hayward, Allied Elctrns.	415-487-5250
CA	Los Angeles, Allied Elctrns.	213-725-7111
CA	San Jose, Allied Elctrns.	408-727-1690
CO	Wheatridge, Allied Elctrns.	303-425-7144
CT	Hamden, Allied Elctrns.	203-248-8900
FL	Ft. Lauderdale, Allied Elctrns.	305-486-0500
GA	Atlanta, Allied Elctrns.	404-237-3366
IL	Elgin, Allied Elctrns.	312-697-8200
IL	Lisle, Components, Inc.	312-852-7707
MD	Marlow Heights, Allied Elctrns.	301-423-0161
MA	Holliston, Mac Bearing Co.	617-429-7945
MA	Wilmington, Allied Elctrns.	617-942-0150
MA	Woburn, Mac Bearing Co.	617-933-2110
NY	E. Syracuse, Add Elctrns.	315-437-0300
NY	Mineola, Allied Elctrns.	516-248-2360
NY	Victor, Add Elctrns.	716-924-4760
NC	Raleigh, Allied Elctrns.	919-467-0720
OH	Cleveland, Specialized Comp. Sls.	216-464-0405
OK	Oklahoma City, Trice Wholesales Elec.	405-524-4411
OK	Tulsa, Allied Elctrns.	918-663-7630
PA	Bala Cynwyd, Allied Elctrns.	215-667-6940
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Houston, Lenert Co.	713-225-1465
TX	Humble, Allied Elctrns.	713-852-3730
WA	Seattle, Allied Elctrns.	206-767-5772
WI	Milwaukee, Allied Elctrns.	414-235-4233
WI	Oshkosh, Electronic Inds.	414-235-4233

ETM ELECTROMATIC INC, 35451 Dumbarton Ct., Newark, CA 94560, Tel: 415-797-1100, FAX: 415-797-4358; Empl.: 85; *Sls. Mgr.:* Kenneth F. Lillis

ETRI, INC., 608 Broome St., Monroe, NC 28110, Tel: 704-289-5423, FAX: 704-283-7170; *Sls. Mgr.:* G. Wolf ..... **C•1664-1668**

Local Sales Offices & Reps

CA	Los Gatos, Norwest Elctrns.	408-395-1190
CA	San Diego, Bestronics	619-693-1111
CA	Westminster, West Elctrn. Sls.	714-898-0120
CO	Boulder, Comp. Prods. Sls.	303-530-2800
FL	Ft. Lauderdale, QXI, Inc.	305-978-0120
FL	Orlando, QXI, Inc.	305-423-3682
FL	St. Petersburg, QXI, Inc.	813-894-4556
IL	Des Plaines, Lincoln, Hodges & Assocs.	312-297-3810
KS	Overland Pk., Spectrum Sls.	913-648-6811
MI	Farmington Hills, Tritech Sls., Inc.	313-553-3370
MI	Kalamazoo, Tritech Sls., Inc.	616-382-5570
MN	Minneapolis, Milt Westlund Assocs.	612-866-5002
MO	Hazelwood, Spectrum Sls.	314-731-5151
NH	Salem, Sls. Engrg. Co.	603-893-5521
NY	Marcellus, Noeth-Honsinger	315-673-1052
NY	Pittsford, Noeth-Honsinger	716-586-9002
NY	Port Washington, Ashtec, Inc.	516-767-0336
NC	Raleigh, Tingen Tech. Sls., Inc.	919-878-4440
OH	Cincinnati, Makin & Assocs., Inc.	513-871-2424
OH	Colombus, Makin & Assocs., Inc.	614-848-5454
OH	Solon, Makin & Assocs., Inc.	216-248-7370
OK	Tulsa, Nova Mktg.	918-660-5105
OR	Lake Oswego, RTS, Inc.	503-244-4123
TX	Austin, Nova Mktg.	512-343-2321
TX	Dallas, Nova Mktg.	214-750-6082
TX	Houston, Nova Mktg.	713-988-6082
WA	Seattle, RTS, Inc.	206-527-7945
WA	Vashon, RTS, Inc.	206-285-1363
WI	Janesville, Antek/Lincoln Hodges & Assocs.	608-754-4214
Can	Mississauga, Ont., R-Theta	416-890-0221

Local Distributors

AZ	Tempe, Acacia Sls., Inc.	602-894-2874
AZ	Tempe, Harper, S.I.D.	602-967-1464
CA	Alhambra, Harper, S.I.D.	213-979-5090
CA	Fountain Valley, Components Ctr.	714-979-0433
CA	Irvine, Acacia Sls., Inc.	714-660-0834
CA	San Diego, Acacia Sls., Inc.	619-565-4365
CA	San Diego, Harper, S.I.D.	619-578-2500
CA	San Jose, Dansco	408-292-9740
CA	Santa Clara, Comp. Ctr., Inc.	408-988-3751
CA	Sunnyvale, Acacia Sls., Inc.	408-745-7200
CA	Sunnyvale, Harper, S.I.D.	408-747-0333
CO	Lakewood, Acacia Sls., Inc.	303-232-2882
CT	Milford, Jaco Elctrns., Inc.	203-874-0006
CT	Orange, Milgray Elctrns.	203-795-0711
FL	Altamonte Springs, Pioneer Elctrns.	305-834-9090
FL	Deerfield Beach, Pioneer Elctrns.	305-428-8877
FL	Winter Park, Milgray Elctrns.	305-647-5747
GA	Atlanta, Milgray Elctrns.	404-393-9666
IL	Bensenville, Milgray Elctrns.	312-350-0490
IL	Bensenville, Voyager Elctrns.	312-860-1300
IL	Palatine, OHM Elctrns.	312-359-5500
IN	Indianapolis, Advent Elctrns.	317-872-4910
KS	Overland Park, Milgray Elctrns.	913-236-8800
KS	Wichita, L-Comp	316-265-5100
MD	Columbia, Milgray Elctrns.	301-621-6169
MD	Gaithersburg, MS Elctrns.	301-921-0200
MA	Wilmington, Jaco Elctrns., Inc.	617-273-1860
MA	Wilmington, Milgray Elctrns.	617-657-5900
MI	Grand Rapids, Calder Elctrns.	616-698-7400
MN	Minneapolis, Stark Elctrns.	612-332-1325
NH	Hudson, Bell Inds.	603-882-1133
NJ	Marlton, Milgray Elctrns.	609-983-5010
NY	Bohemia, Key Comps.	516-567-7500
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Farmingdale, Milgray Elctrns.	516-420-9800
NY	Rochester, Milgray Elctrns.	716-235-0830
NY	Rochester, Summit Elctrns.	716-334-8110
NC	Charlotte, Electronic Mktg. Corp.	704-394-6195
OH	Cleveland, Milgray Elctrns.	216-447-1520
OH	Columbus, Electronic Mktg. Corp.	614-299-4161
OH	Dayton, Electronic Mktg. Corp.	513-439-4711
OH	Highland Heights, Electronic Mktg. Corp.	216-442-3441
OK	Tulsa, Norvell Elctrns.	918-254-8606
OR	Beaverton, Acacia Sls., Inc.	503-646-3377
PA	Allentown, P.A. Peters	215-434-5237
PA	Montgomeryville, Pyttronics Inds.	215-643-2850
TX	Austin, Norvell Elctrns.	512-837-5555
TX	Dallas, Milgray Elctrns.	214-248-1603
TX	Dallas, Norvell Elctrns.	214-233-0020
TX	Houston, Norvell Elctrns.	713-777-1666
TX	Irving, Harper, S.I.D.	214-621-0500
UT	Salt Lake City, Bell Indus.	801-972-6969
VA	Charlottesville, Virginia Elctrn. Comps.	804-296-4184
WI	Milwaukee, Indl. Elctrns.	414-276-1212
Can	Mississauga, Ont., R-Theta	416-890-0221
Can	Vancouver B.C., Intek Elctrns.	604-324-6831

E-TRON CORPORATION, 30 Ethel Rd., Edison, NJ 08817, Tel: 201-287-9039; FSC No.: 06007; Empl.: 65; *Sls. Mgr.:* Ray Lanihan

E-TRONICS, 16774 Schoenborn, Sepulveda, CA 91343, Tel: 818-892-7279; FSC No.: 29077; Empl.: 28

E.T. TECH INC., Empire Telecommunications, 15 S. Van Brunt St., Englewood, NJ 07631, Tel: 201-569-3339, FAX: 201-569-5838; Empl.: 12; *Sls. Mgr.:* Burton Green ..... **D•1723**

EUBANKS ENGINEERING, 1307 So. Myrtle Ave., Monrovia, CA 91016, Tel: 818-357-7011, TELEX: 675403; Empl.: 90; *Sls. Mgr.:* Alex Vallin

EVANS & SUTHERLAND COMPUTER CORP., P.O. Box 8700, 580 Arapeen Dr., Salt Lake City, UT 84108, Tel: 801-582-5847, TELEX: 389492, TWX: 910-925-5818; Empl.: 850; *Sls. Mgr.:* David Luther

EVANS ELECTRONICS, Box 5055, Berkeley, CA 94705, Tel: 415-653-3083

EVAPORATED COATINGS, INC., 2365 Maryland Rd., Willow Grove, PA 19090, Tel: 215-659-3080; Empl.: 24; *Sls. Mgr.:* Stephen L. Schaffer

EVENTIDE, INC., One Alsan Way, Little Ferry, NJ 07643, Tel: 201-641-1200, 800-446-7878, TWX: 710-991-8715; Empl.: 48; *Sls. Mgr.:* Gil Griffith; *Dist. Mgr.:* Gil Griffith

EVEREADY ENERGIZER®
EVEREADY BATTERY COMPANY, INC.

FAX: 314-982-4078

EVEREADY BATTERY CO. INC., Checkerboard Square, St. Louis, MO 63164, Tel: 314-982-2000 ..... **D•1456-1457**

Local Sales Offices & Reps

CA	Fountain Valley	714-964-9203
GA	Norcross	404-446-2400
IL	Itasca	312-773-3444
MO	St. Louis	314-982-1990
NJ	Saddle Brook	201-845-5400
OH	Middleburg Hgts.	216-826-4444
TX	Dallas	214-241-9100

EVEREST ELECTRONIC EQUIPMENT, 1800-G MacLeod Dr., Lawrenceville, GA 30243, Tel: 404-995-8688, FAX: 404-995-9371; Empl.: 200; *Sls. Mgr.:* Barry Holman; *Dist. Mgr.:* Mike Bullock ..... **C•1053**

Local Sales Offices & Reps

AZ	Phoenix, Holder Hauer, Inc.	602-242-4025
CA	Anaheim, Everest Elctrn. Equip., Inc.	714-634-2200
CO	Broomfield, B-5, Inc.	303-466-1761
CO	Denver, Holder Hauer, Inc.	303-427-3443
CT	Tariffville, OEM Mktg. & Sls	203-241-1612
FL	Orlando, Honeyco, Inc.	305-299-1222
GA	Lawrenceville, Everest Elctrn. Equip., Inc.	404-995-8688
GA	Lawrenceville, Tek-Rep Mktg.	404-963-1600
GA	Marietta, Southern Equip. Add-On, Inc.	404-953-3970
MD	Linthicum, KD Assocs.	301-859-5151
MA	Dedham, Pall Assocs.	617-461-0402
MA	Franklin, OEM Mktg. & Sls.	617-528-4983
MN	Eden Prairie, Choice-Tech, Inc.	612-941-5099
MN	Golden Valley, Tech Resources, Inc.	612-546-6099
NH	Salem, OEM Mktg. & Sls.	603-893-0009
NM	Albuquerque, Holder Hauer, Inc.	505-888-9614
NY	Liverpool, Syronics, Inc.	315-451-0968
NC	Winston-Salem, Southern Equip. Add-On, Inc.	919-724-1187
OH	Akron, Augnat Assocs.	216-273-1211
PA	Churchville, Dynamic Elctrn. Sls.	215-322-2611
PA	W. Conshohocken, Hopkins Assocs.	215-828-7191
TX	Dallas, SCI Sls., Inc.	214-931-1487
UT	Salt Lake City, Holder Hauer, Inc.	801-532-2111

EVEREST ELECTRONIC EQUIPMENT, INC., 2100 E. Orangewood Avenue, Anaheim, CA 92806, Tel: 714-634-2200, TWX: 910-591-2303, FAX: 714-634-1369; Empl.: 200; *Sls. Mgr.:* Barry Holman; *Dist. Mgr.:* Mike Bullock ..... **C•1053**

EVEREST INTERSCIENCE, INC., P. O. Box 3640, Fullerton, CA 92634-3640, Tel: 714-992-4461, TELEX: 295368 EVER UR, FAX: 714-556-8325; Empl.: 20; *Sls. Mgr.:* Steve A. Giffin

Local Sales Offices & Reps

CA	Camarillo, Delta Thermographics	805-388-2010
CO	Littleton, Radco Tech. Sls.	303-794-4279
IL	La Grange, Karon Co.	312-354-4833
ME	Sudbury, Poulin Assocs., Inc.	617-443-7333
NJ	Milltown, New Process Dev.	201-390-8893
NY	Rochester, TechNY	716-288-0921
NC	Fayetteville, Zim-Tek Sls. Co.	919-488-4101
OH	Cincinnati, Pro-Con Analytical	513-272-3300
PA	Upper Darby, Shelby Jones Co.	215-446-6600
TX	Coppell, Microlec, Inc.	214-987-1827
VA	Richmond, Jadex Corp.	804-232-1959
Can	Scarborough, Ont., Brosz & Assocs.	416-299-4224

EVERETT/CHARLES CONTACT PRODUCTS, 700 E. Harrison Ave., Pomona, CA 91767, Tel: 714-625-5551, TELEX: 67-55-78, TWX: 910-581-1210; Empl.: 75; *Sls. Mgr.:* Bud Fabian

EVERETT/CHARLES TEST EQUIPMENT, INC., 2887 N. Towne Ave., Pomona, CA 91767, Tel: 714-621-9511, TWX: 910-581-3838; Empl.: 110; *Sls. Mgr.:* James Hall

EVERSHED & VIGNOLES, LTD., Meggitt Holdings P. L. C., Acton Lane, Chiswick, London, England W4 5HJ, Tel: 01-994-3670, TELEX: 22583, FAX: 01-994-5246; Empl.: 300; *Sls. Mgr.:* J. Gilpin

EVI, INC., 8300 Guilford Rd., Ste. A, Columbia, MD 21046, Tel: 301-290-9550; Empl.: 20

EVOX, INC., 100 Tri State International, Lincolnshire, IL 60015, Tel: 312-948-9511, TELEX: 206997, FAX: 312-948-9320; FSC No.: 7422160666; Empl.: 300; *Sls. Mgr.:* Dale Price; *Dist. Mgr.:* Dale Price ..... **A•1084**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs.	205-533-9108
AZ	Phoenix, ISDS	602-971-6250
CA	Burbank, DeAngelo, Rothman & Co.	818-504-2425
CA	Santa Clara, Caltron Comps. Corp.	408-980-0181
CO	Wallingford, Apex Assocs.	203-269-8401
FL	Deerfield Bch., Sls. Engrg. Concepts	305-426-4601
GA	Alphretta, FBO Sls.	404-475-3421
ID	Boise, Cascade Comps.	208-343-9826
IL	Chicago, Marvin Gottlieb Assocs.	312-775-1151
IN	Kokomo, Marvin Gottlieb Assocs.	317-455-0444
MA	Westwood, Apex Assocs.	617-326-5042
MI	Livonia, Aetech Reps.	313-474-8300
MN	Bloomington, Murnco	612-854-4161
NJ	Ft. Lee, Caravan Sls. Corp.	201-944-9476
NJ	Kenilworth, Ventronics	201-272-9262
NY	Melville, Comtronic Assocs.	516-249-0505
NC	Greensboro, Caravan Sls. Corp.	919-294-1500
OH	Cincinnati, G & H Sls.	513-272-0580
OH	Lakewood, G & H Sls.	216-226-6800
OR	Portland, Westmark	503-641-0760
TN	Nashville, Hughes Assocs.	615-753-2719
TX	Dallas, Tesco, Inc.	214-553-1200
VA	Portsmith, FBO Sls.	804-488-6145
WA	Seattle, Westmark	206-281-4025
Can	Markham, Ont., SP Intl.	416-475-5305

Local Distributors

CA	Burbank, TAW	818-846-3911
CA	Garden Grove, Natl. Capacitor	714-892-7749
CA	Industry, Ital Elctrn. Sls.	818-968-8515
CA	Milpitas, California Capacitors	408-262-6000
CA	Santa Ana, Projections Unltd.	714-261-2323
CT	Norwalk, Delta Elctrns.	203-847-7285
FL	Ft. Lauderdale, NRC	305-772-4500
IL	Addison, Belford Elctrns.	312-691-1100
IL	Chicago, Bell Inds.	312-982-9210
MD	Bletsville, Resco/Washington	301-937-9100
MA	Burlington, TLC	617-273-0140
MA	Wilmington, JV Elctrns.	617-657-6523
MN	Eitzen, Capacitor Assocs.	507-495-3130
MN	New Brighton, Chris Elctrns.	612-631-2647
NJ	E. Brunswick, Varitech	516-593-9300
NJ	Kenilworth, Ventronics/Mutronics	201-272-9262
NY	Farmingdale, SAI	516-293-2710
NY	Hauppauge, JACO Elctrns.	516-273-5500
NY	Ronkonkoma, Prime	516-737-1730
OR	Lake Oswego, Bell Inds.	503-241-4115
PA	Philadelphia, JAN Indl.	215-922-1321
TX	Ft. Worth, C & W Supp.	817-831-0395

EWALD INSTRUMENTS CORP., Rte. 7R, Kent, CT 06757, Tel: 203-927-3278

EWC® INC.

FAX: 201-245-8430

EWC, INC., 725 Federal Ave., Kenilworth, NJ 07033, Tel: 201-245-3200, 800-526-4048, TWX: 710-996-5993; FSC No.: 15387;MIL-T-27D; Empl.: 230; *Sls. Mgr.:* P. D. MacMillan; *Dist. Mgr.:* P. D. MacMillan ..... **A•1244, 2216-2228**

Local Sales Offices & Reps

CA	Canoga Park, Cummings & Assocs.	818-340-6035
CA	Los Gatos, Featherstone Sls.	408-356-3243
CO	Denver, AKI Entprs.	303-388-4488
FL	Clearwater, Tech-Rep Assocs.	813-576-9900
IL	Schaumburg, Delta Tech. Sls. Corp.	312-310-0280
IA	Cedar Rapids, Pattison Sls.	319-395-9866
MD	Hagerstown, Stinson Assocs.	301-790-1193
MA	Chelmsford, Interstate Sls. Assocs.	617-256-2287
MO	St. Louis, Clyde Logsdon & Assocs.	314-849-5125
NJ	E. Brunswick, Winch Assoc.	201-828-4615
NY	Fairport, Net Sls.	716-223-1030
NY	Plainview, Winch Assocs.	516-681-3163
NC	Raleigh, Mead & Assocs. Mktg.	919-782-3094
OH	Dayton, J. C. Hofstetter	513-296-1010
OH	Medina, J. C. Hofstetter	216-241-4880
OR	Portland, SPS Elctrns.	203-243-9343
PA	Bensalem, Cimperman Assocs.	215-638-4850
PA	Greensberg, Pro-Mark	412-832-3800
VA	Cloverdale, Stinson Assocs.	703-992-5459
VA	Reston, Stinson Assoc.	703-620-0088
WI	Mequon, Tumy Assocs.	414-473-6997

Local Distributors

CA	Mountain View, Abacus Elctrns.	415-961-1500

EXACT ELECTRONICS, Div. of Dynatech Nevada Inc., Box 1925, 2000 Arrowhead Dr., Carson City, NV 89701, Tel: 702-883-3400, 800-648-7952, TELEX: 170054; FSC No.: 34511; Empl.: 60; *Sls. Mgr.:* Mike Brisbin

EXAR CORP., 2222 Qume Dr., P.O.Box 49007, San Jose, CA 95161-9007, Tel: 408-732-7970, TWX: 910-339-9233; Empl.: 600; *Dist. Mgr.:* Tom Wargo

EXATRON AUTOMATIC TEST EQUIP., 2842 Aiello Dr., San Jose, CA 95111, Tel: 408-629-7600, 800-EXA-TRON, TELEX: 172-090, FAX: 408-629-2832; Empl.: 17; *Sls. Mgr.:* Kathryn Henderson

EXCEL SPECIALTY CORP., 6335 N. Broadway, Chicago, IL 60660, Tel: 312-262-4781; Empl.: 50

EXCEL TECHNOLOGY INTL. CORP., 4-5 Stryker La., Hillsborough Indl. Pk., Belle Mead, NJ 08502, Tel: 201-874-4747, TWX: 910-333-9588; *Sls. Mgr.:* Michi Chen ..... **B•1068-1069**

Local Sales Offices & Reps

IL	Westchester, W. G. Brouillette & Assocs., Inc.	312-345-6500
MO	Independence, Engrg. Svcs. Co.	816-254-3600
MO	St. Louis, Engrg. Svcs. Co.	314-997-1515
OR	Portland, Frank Jackson, Assoc.	503-292-2638
TX	Dallas, Southwest Elctrn. Inds.	214-690-9881

Local Distributors

CA	Los Angeles	213-824-0988

EXCELTA CORPORATION, 3740 Skypark Dr., Torrance, CA 90505, Tel: 213-772-0751, FAX: 213-378-4923; Empl.: 25; *Sls. Mgr.:* G. Johnson; *Dist. Mgr.:* L. Johnson

EXEL MICROELECTRONICS, INC., Sub. of Exar Corp., 2150 Commerce Dr., San Jose, CA 95131, Tel: 408-432-0500, TELEX: 171339, TWX: 910-338-2116, FAX: 408-434-6444; Empl.: 180; *Sls. Mgr.:* Victor Okumoto

EXFO E.O. ENGINEERING, 352 St-Sacrement Ave., Quebec City, Quebec, Canada G1N 3Y2, Tel: 418-683-0211, TELEX: 051-3786, FAX: 418-683-2170; Empl.: 15; *Sls. Mgr.:* Germain Lamonde; *Dist. Mgr.:* Ginette Bourgeois

EXIDE CORPORATION, 645 Penn St., Reading, PA 19601, Tel: 215-378-0500, TWX: 510-651-5288, FAX: 215-378-0345; Empl.: 2200

EXIDE ELCTRNS., 3201 Spring Forest Rd., Raleigh, NC 27604, Tel: 919-872-3020, TELEX: 289968; FSC No.: 31795; Empl.: 900; *Sls. Mgr.:* Phil Tompkins

EXPRESS TEST CORP., 1161 D San Antonio Rd., Mountain View, CA 94043, Tel: 415-968-8818, TELEX: 4942091; *Sls. Mgr.:* Frank S. Gavin

EXTECH INSTRUMENTS CORP., 150 Bear Hill Rd., Waltham, MA 02154, Tel: 617-890-7440, TELEX: 940913; *Sls. Mgr.:* Robert M. Shipione

EYRING RESEARCH INST., INC., 1455 W. 820 N., Provo, UT 84601, Tel: 801-375-2434, TELEX: 882000, FAX: 801-374-8339; Empl.: 350

E-Z-HOOK, Div. Tektest Inc., Box 450 - 225 N. Second Ave., Arcadia, CA 91006, Tel: 818-446-6175, TWX: 910-582-1614; FSC No.: 08505; Empl.: 23; *Sls. Mgr.:* C. Haskin; *Dist. Mgr.:* P. Wood

Fabricast, Inc.

FABRICAST, 2517 Seaman Ave., P.O. Box 3176, S. El Monte, CA 91733, Tel: 818-443-3247; FSC No.: 13345; Empl.: 8 ..... **B•1206-1211**

FAB-TEK INC., 68 Morgan Ave., Danbury, CT 06810, Tel: 203-743-3312; Empl.: 5

FACET ENTERPRISES, INC., Elmira, NY 14903, Tel: 607-737-8011, TELEX: 93-2490, TWX: 510-252-1594; Empl.: 400; *Sls. Mgr.:* Gene Ebbrecht

FACET ENTERPRISES, Fluid Technology Group, 2225 E. Randol Mill Rd., Ste. 223, Arlington, TX 76011, Tel: 816-649-5597

FACTRON/SCHLUMBERGER, 299 Old Niskayuna Rd., Latham, NY 12110, Tel: 518-783-3600, TWX: 710-444-4968; Empl.: 126; *Sls. Mgr.:* Marvin Cox

FAGOR ELCTRN. COMPS., INC., CORP. HDQTRS. & SLS. OFF., Fagor Electronica S. Coop., 121 W. 27th St, 4th Fl, New York, NY 10001, Tel: 212-463-7168, 800-283-8383, FAX: 212-463-7199; *Sls. Mgr.:* Marvin R. Zidel, VP Mktg. ..... **A•2132-2133**

FAGOR ELCTRN. COMPS., INC., NATL. MKTG. SLS. OFFS., Fagor Electrotecnica S. Coop., 8419 Canoga Ave., Canoga Pk, CA 91304, Tel: 818-718-2500, 800-624-5367, TWX: 910-494-1948, FAX: 818-341-2860; Empl.: 18,000; *Sls. Mgr.:* Marvin R. Zidel, VP Mktg.; *Dist. Mgr.:* Marvin R. Zidel, VP Mktg. ..... **A•2132-2133**

Local Sales Offices & Reps

CA	Burbank, Darco, Inc.	818-504-2425
CA	San Jose, Silicon Valley Sls.	408-432-1967
CO	Denver, West Inc.	303-477-8180
CT	Madison, Conti-Younger Assocs., Inc.	203-245-1136
FL	Umatilla, Jim Slade Assocs., Ltd.	904-669-4738
GA	Alpharetta, DeWitt Austin Co. Inc.	404-442-1326
GA	Marietta, DeWitt Austin Co., Inc.	404-926-4943
IL	Highland Pk., Bransky Sls. Co.	312-433-2375
IN	Indianapolis, CC Electro Sls., Inc.	317-255-1508
MA	Burlington, Conti-Younger Assocs. Inc.	617-273-1582
MI	Grand Rapids, DEM Elctrn. Sls.	616-364-4024
MI	St. Clair Shores, DEM Elctrn. Sls.	313-777-1750
MN	Minneapolis, Microelctrn. Sls.	612-829-0948
MO	St. Louis, KKB & Co.	314-647-2400
NJ	Berkeley Hgts., Cambridge Allen & Assocs.	201-464-0203
NJ	Willingboro, Austin Assocs.	609-871-9290
NC	Charlotte, DeWitt Austin Co., Inc.	704-334-0174
OR	Beaverton, Olson Tech. Sls. Corp.	206-883-7792
TX	Austin, Vielock Assocs.	512-346-4037
TX	Plano, Vielock Assocs.	214-881-1940
WA	Bellevue, Olson Tech. Sls. Corp.	503-643-9488

Local Distributors

CA	Industry, Ital Sls.	818-968-8515
CA	San Jose, All American	408-287-0190
CA	Torrance, All American	213-320-0240
CA	Westlake Vl, Semtex	805-373-6850
CT	Norwalk, Cobra Comps., Inc.	203-272-9650
FL	Ft. Lauderdale, Universal Semiconductor, Inc.	305-972-8111
FL	Miami, All American	305-621-8282
FL	Miami, Intermark Inds., Inc.	305-591-8930
FL	Riviera Bch., Semiconductors, Inc.	305-842-0305
FL	W. Palm Bch., Nurmi Inds.	305-686-8553
IL	Addison, Belford Elctrns., Inc.	312-691-1100
IL	Chicago, Newark Elctrns.	312-784-5100
IA	Cedar Rapids, Dee Elctrns., Inc.	319-365-7551
MD	Rockville, All American	301-251-1205
MA	Salem, J & C Elctrns.	617-745-5809
MA	Woburn, Semtex	617-935-2150
MN	Minneapolis, All American	612-884-2220
NY	Freeport, Semtex	516-223-0200
NY	Ronkonkoma, All American	516-981-3935
NC	Raleigh, Southeastern Elctrns.	919-828-2311
OH	Cleveland, CAM/RPC Elctrns.	216-461-4700
OH	Dayton, Semtex	513-435-6600
PA	Pittsburgh, CAM/RPC Elctrns.	412-782-3770
TX	Channelview, Henry Elctrns.	713-452-4451
TX	Richardson, All American	800-541-1435
VA	Roanoke, Southeastern Elctrns.	703-344-6611
WA	Kent, Shannon Indl., Inc.	206-575-8600
WI	Milwaukee, Marsh Elctrns., Inc.	414-475-6000
Can	Montreal, Que., Prelco Elctrns., Ltd.	514-389-8051

FAIRBANKS WEIGHING DIV., Colt Industries, 711 E. St. Johnsbury Rd., St. Johnsbury, VT 05819, Tel: 800-451-4107, 802-748-5111

FAIRCHILD SEMICONDUCTOR CORP., 333 Western Avenue, So. Portland, ME 04106, Tel: 207-775-8700, TELEX: 710-221-1980; *Sls. Mgr.:* Dan Bongatti; *Dist. Mgr.:* Brigid O'Rourke

FAIRCHILD CAMERA & INSTR. CORP., Linear Div., 313 Fairchild Dr., Mountain View, CA 94139, Tel: 415-962-4011, TELEX: MVLD

FAIRCHILD SEMICONDUCTOR, M&HSL, 1111 39th Ave. S.E., Puyallup, WA 98373, Tel: 206-841-6700, TELEX: 206-841-6723; *Sls. Mgr.:* Jim Brye

FAIRCHILD WESTON, DATA RECORDERS, P.O. Box 3041, Sarasota, FL 34230, Tel: 813-371-0811, TWX: 494-7160; FSC No.: GS-00K-8301-S0078; Empl.: 750; *Sls. Mgr.:* Ron Johnson

FAIRCHILD WESTON SYSTEMS, INC., CCD Imaging Division, 810 W. Maude Ave., Sunnyvale, CA 94086, Tel: 408-720-7600, TWX: 910-373-2110, FAX: 408-720-8438; *Sls. Mgr.:* Jim Johnson; *Dist. Mgr.:* Patricia A. Lippe

FAIRCHILD - WESTON - TELEMETRY, P.O. Box 3041, Sarasota, FL 34230, Tel: 813-371-0811, TELEX: 4947160; FSC No.: 06141; Empl.: 825; *Sls. Mgr.:* F. V. Bud Hinkel

FAIR-RITE PRODS., PO Box J, Wallkill, NY 12589, Tel: 914-895-2055, TWX: 510-249-4819; FSC No.: 34899; Empl.: 200ò; *Sls. Mgr.:* B. G. Tolen ..... **C•1750**

Local Sales Offices & Reps

AL	Huntsville, Macro-Mktg. Assocs.	205-883-9630
CA	Anaheim, Micrometals	714-630-7420
CA	Sunnyvale, Schwerin & Merrill Assocs.	408-735-7900
CO	Littleton, TMC	303-773-0643
CT	W. Hartford, R. S. Pettigrew & Assocs.	203-236-5891
FL	New Smyrna Beach, J. Wetzel	904-423-5707
IL	Wheaton, Charles D. Atwater Assocs.	312-653-5701
IN	Indianapolis, Frank J. Campisano Co.	317-253-7651
MI	Southfield, J. L. Montgomery Assocs.	313-358-2616
MN	Bloomington, Holmes & Ladky Assocs. of Minn.	612-884-2125
NY	Hempstead, Kahgan Sls.	516-538-2300
OH	Cincinnati, F. J. Campisano & Assocs.	513-574-7111
PA	Easton, Kendon Co.	215-253-3100
TX	Dallas, S.E.I., Inc.	214-690-9881
VA	Front Royal, Eltron Sls., Ltd.	703-635-7201
VA	Roanoke, A. B. Kreger & Co.	703-989-4738
WA	Bellevue, Quest Mktg., Inc.	206-747-9424
WI	Milwaukee, Frank W. Ladky Assocs.	414-351-2112

FANCORT INDUSTRIES, INC., 31 Fairfield Place, W. Caldwell, NJ 07006, Tel: 201-575-0610, TELEX: 130540, FAX: 201-575-9234; Empl.: 18; *Sls. Mgr.:* Ron Corey; *Dist. Mgr.:* Ron Corey

FAN-S CORP., See Qualtek Electronics Corp.

FARADAY ELECTRONICS, 749 N. Mary Avenue, Sunnyvale, CA 94086, Tel: 408-749-1900, TELEX: 706738, FAX: 408-738-1671; Empl.: 85; *Sls. Mgr.:* Nick Antonopoulos

FARIA, THOMAS G., CORP., P.O. Box 983, Uncasville, CT 06382-0983, Tel: 203-848-9271, TELEX: 4970991 TGF CORP; FSC No.: 09527; Empl.: 250; *Sls. Mgr.:* A. Knupp

FARINON DIV., Harris Corp., 1691 Bayport, San Carlos, CA 94070, Tel: 415-594-3000, TELEX: 34-8491; *Sls. Mgr.:* George Woodruff

FARRAND CONTROLS, Div. of Farrand Industries, Inc., 99 Wall St., Valhalla, NY 10595, Tel: 914-761-2600, TELEX: 646-640, FAX: 914-761-0405; Empl.: 120; *Sls. Mgr.:* George A. Quinn; *Dist. Mgr.:* George A. Quinn

FASCO INDUSTRIES, INC., Div. of Hawker Siddeley Grp. Plc., 601 North Federal Highway, Boca Raton, FL 33432, Tel: 305-368-0600, TELEX: 51-5612; *Sls. Mgr.:* O. J. Binnette; *Dist. Mgr.:* Paul R. Reid

FASTEK TEST SYSTEMS, Div. of International Fastek Corp., 5235-A Avenida Encinas, Carlsbad, CA 92008, Tel: 619-438-7818, TELEX: 188912 ATSD UT, FAX: 619-438-8205

FASTEX, 195 Algonquin Rd., Des Plaines, IL 60016, Tel: 312-299-2222, TWX: 910-233-2786; FSC No.: 02768; *Sls. Mgr.:* Andy Flis; *Dist. Mgr.:* Denis Singery

FAST FEEDBACK TECHNOLOGIES, 1505 Aviation Blvd., Redoudo Beach, CA 90278, Tel: 213-379-6100; Empl.: 4; *Sls. Mgr.:* M. Lacas

FCM PLASTICS, Plastics Technologies Inc., 2555 Oak Industrial Dr. NE, Grand Rapids, MI 49505, Tel: 616-451-4502, TWX: 810-273-6038; *Sls. Mgr.:* Patrick K. Parsons

FDK

FAX: 213-404-2850

FDK AMERICA, INC., Fuji Electromechanical Co., Ltd., 17326 Edwards Rd., Ste. A-130, Cerritos, CA 90701, Tel: 213-404-1770, TELEX: 18-1998; *Sls. Mgr.:* Yasu Yasutani ..... **A•1319, 1654-1655, 1734-1735, 1769; B•1166; D•1458-1459, 1724-1726**

Local Sales Offices & Reps

NJ	Englewood Cliffs, FDK America, Inc.	201-567-1900

F-DYNE ELCTRNS., 449 Howard Ave., Bridgeport, CT 06605, Tel: 203-367-6431, TWX: 710-453-0087; Empl.: 175; *Sls. Mgr.:* Robert Furst

FEDERAL ELECTRONICS, 75 Stamp Farm Rd., Cranston, RI 02921, Tel: 401-944-6200, FAX: 401-946-6280; FSC No.: 69343; Empl.: 140; *Sls. Mgr.:* Timothy Collins

FEEDBACK, 620 Springfield Ave., Berkeley Hghts., NJ 07922, Tel: 201-464-5181; Empl.: 28; *Sls. Mgr.:* John Lawson

FEI MICROWAVE, INC., Frequency Electronics, Inc., 825 Stewart Dr., Sunnyvale, CA 94086, Tel: 408-732-0880, TWX: 910-339-9207; FSC No.: 21847; Empl.: 450; *Sls. Mgr.:* P. Thesing

FEMA ELCTRNS. CORP., 12-6 Edgeboro Rd., E. Brunswick, NJ 08816, Tel: 201-238-1223, TELEX: 299425 FEMA UR, FAX: 201-238-7981; Empl.: 10 to 20; *Sls. Mgr.:* Bob Cheng; *Dist. Mgr.:* E. Wong

FEMCO, INC., P.O. Box 26710 Parkmoor Sta., San Jose, CA 95159, Tel: 408-946-1188, TELEX: 17-1618, TWX: 910-338-2290

FEME ELECTRONICS, INC., 661 W. Germantown Pike, No. 206, Plymouth Meeting, PA 19462, Tel: 215-941-0366, TWX: 910-240-4181, ESYLNK: 62773739, FAX: 215-941-0377

FENWAL, 400 Main St., Ashland, MA 01721, Tel: 505-881-2000, TELEX: 948421, FAX: 508-881-6729; Empl.: 1000; *Sls. Mgr.:* F. R. Shea

Fenwal Electronics
Division of Kidde Inc
american power devices

FAX: 617-473-6035

FENWAL ELECTRONICS/APD, Kidde, Inc., 450 Fortune Blvd., Milford, MA 01757, Tel: 617-478-5255, TELEX: 299550; Empl.: 500; *Sls. Mgr.:* W. M. Minnucci; *Dist. Mgr.:* Chester Tricca ..... **B•1846**

Local Sales Offices & Reps

AL	Huntsville, Macro Mktg. Assocs., Inc.	205-883-9630
AZ	Phoenix, Dorton Entprs., Inc.	602-944-2957
CA	Cupertino, Codella Mktg. Grp., Inc.	408-257-2561
CA	Garden Grove, Eisco Elctrns., Inc.	714-891-4621
CO	Denver, Spectrum Mktg. Assocs., Inc.	303-480-9991
CT	Southington, The Orion Grp. Inc.	203-621-8371
FL	Orlando, Datarep, Inc.	305-843-5224
GA	Norcross, Macro Mktg. Assocs., Inc.	404-662-5580
IL	Chicago, Century Elctrns. Corp.	312-777-9700
IN	Greenwood, Valentine & Assocs.	317-888-2260
IN	South Bend, Valentine & Assocs.	219-288-7070
IA	Cedar Rapids, Palatine Engrg. & Sls., Inc.	319-365-8071
MD	Gaithersburg, Naudain Assoc. So., Inc.	301-258-5040
MA	Wakefield, The Orion Grp., Inc.	617-245-5220
MI	Ferndale, Hilltronics, Inc.	313-398-5556
MN	So. St. Paul, Northport Engrg., Inc.	612-457-8000
MO	Blue Springs, Palatine Engrg. & Sls., Inc.	816-229-4007
MO	Hazelwood, Palatine Engrg. & Sls., Inc.	314-839-0800
NY	Huntington, CDB Entprs.	516-692-5200
NY	Penfield, Upstate Comps. Sls., Inc.	716-381-6070
NC	Charlotte, Prime Comps., Inc.	704-522-1150
OH	Cleveland, Arthur H. Baier Co.	216-461-6161
OH	Dayton, Arthur H. Baier Co.	513-276-4128
OH	Westchester, Arthur H. Bair Co.	513-779-2395
OH	Worthington, Arthur H. Baier Co.	614-764-1144
OR	Tigard, Elctrn. Comp. Sls.	503-245-2342
PA	Pittsburgh, Covert & Newman Co.	412-531-2002
PA	Wynnewood, Metz-Benham Assoc., Inc.	215-896-7300
TX	Austin, W. Pat Fralia Co. & Assoc., Inc.	512-835-7911
TX	Evless, W. Pat Fralia Co. & Assoc., Inc.	817-267-3577
TX	Houston, W. Pat Fralia Co. & Assoc., Inc.	713-772-1572
UT	Ogden, Spectrum Mktg. Assocs., Inc.	801-972-8552
WA	Mercer Island, Elctrn. Comp. Sls.	206-232-9301
WI	Milwaukee, Century Elctrns. Corp.	414-645-3680
EXP	MA, Milford, Fenwal Elctrns.	617-478-5255
Can	Que., John G. Weiss Co., Ltd.	514-337-5022

Local Distributors

CA	Chatsworth, Mil-Comm Distr.	818-998-3111
CA	San Jose, Rose Elctrn. Distr.	408-263-9700
CO	Denver, Newark-Denver Elctrn. Supp.	303-757-3351
CO	Englewood, Indl. Elctrns. Corp.	303-694-9444
FL	Ft. Lauderdale, Newark Elctrns.	305-587-2372
GA	Norcross, Newark Elctrns.	404-448-1300
IL	Chicago, Newark Elctrns. Corp.	312-784-5100

IN Indianapolis, Bell Inds. 317-634-8202
MD Cheverly, Newark Elctrns. 301-699-8880
MA Woburn, Newark Elctrns. 617-935-8350
MI Grand Rapids, Newark Elctrns. 616-455-9190
MI Oak Park, Newark Elctrns. 313-967-0600
MN Hopkins, The Joel Co. 612-935-6202
MN Minneapolis, Stark Elec. 612-332-1325
NJ Union, Newark Elctrns. 201-851-2290
NY Buffalo, Summit Dists. 716-887-2800
NY Huntington, CDB Dev. Corp. 516-692-5200
NY Melville, Arrow Elctrns., Inc. 516-467-1000
NY Rochester, Summit Elctrns. 716-334-8110
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Warrensville Hgts., Newark Elctrns. ... 216-587-1700
OK Tulsa, Radio, Inc. 918-587-9123
PA Wynnewood, Metz-Benham Assoc., Inc. 215-896-7300
TX Fort Worth, Patco Supply 817-429-8596
TX Garland, Newark Elctrns. 214-487-8144
UT Salt Lake City, Standard Supp. 801-486-3371
WI Mequon, Lake-View Elctns. Corp. 414-377-8250
Can Que., John G. Weiss Co., Ltd. 514-337-5022

FERNO-SALESMAKER, Ferno-Washington, Inc., 70 Weil Way, Wilmington, OH 45177, Tel: 513-382-1451, TELEX: 214282; Empl.: 300

FERRANTI ELEC., 87 Modula Ave, Commack, NY 11725, Tel: 516-543-0200, TWX: 510-226-1490; *Sls. Mgr.:* Mike Kennett

FERRANTI INTERDESIGN, INC., 1500 Green Hills Rd, Scotts Valley, CA 95066, Tel: 408-438-2900, TELEX: 4940840, TWX: 910-339-9374; Empl.: 240

FERRETEC INC., 544 Gibralter Dr., Milpitas, CA 95035-6315, Tel: 408-263-1216, TWX: 910-338-2353; FSC No.: 7W279; Empl.: 65; *Sls. Mgr.:* Allen E. Rosenzweig

Local Sales Offices & Reps
AL Huntsville, Gentry Assocs. 205-837-0692
AZ Phoenix, Blackhart Assocs. 602-893-3488
CA Cupertino, Allis Assocs. 408-252-2883
CA Westlake Vl, HyTech Assocs., Inc. 818-336-1234
CO Parker, Exelcis Engrg. Reps. 303-841-4305
CT Norwalk, Nemarco Assocs. 203-852-9117
FL Orlando, Gentry Assocs. 305-859-7450
GA Atlanta, Gentry Assocs. 404-998-2828
IL Wauconda, Cudahy Sls. Co. 312-526-2484
MD Severna Park, Delmarva Engrg. Assocs. 301-647-8007
MA Chelmsford, BBC 617-452-7211
MO Leasburg, EIR Co. 314-245-6860
NJ Palisades Pk, Nemarco Assocs. 201-224-2768
NY E. Islip, Nemarco Assocs. 516-277-5831
NC Burlington, Gentry Assocs. 919-227-3639
PA N. Wales, Scientific Dvcs.-PA 215-699-7707
SC Columbia, Gentry Assocs. 803-772-6786
TX Garland, McBride Scientific Sls. 214-494-5000
WA Bellevue, James Findlay Co. 206-455-9597

FERRO CORPORATION, Coated Fabrics Division, 34 Smith St., Norwalk, CT 06852, Tel: 203-853-2123, TELEX: 96-5929; *Sls. Mgr.:* Wally Kimball; *Dist. Mgr.:* John Sandusky, Sls. Coord.

FERRO CORPORATION, Coatings Div., 4150 East 56th St., Cleveland, OH 44101, Tel: 216-641-8580, TELEX: 98-0165

FERRO CORPORATION, Complas Thermoplastics Div., 5001 O'Hara Dr., Evansville, IN 47711, Tel: 812-423-5218; *Sls. Mgr.:* L. Steven Edge

FERRO CORPORATION, Electronic Materials Div., 27 Castilion Dr., Santa Barbara, CA 93117-3092, Tel: 805-968-5000, TELEX: 98-0165; Empl.: 49; *Sls. Mgr.:* Terry H. Baker

FERRO CORPORATION, Houston Thermoplastics Div., 1370 E. 40 St, Houston, TX 77022, Tel: 713-691-1407; *Sls. Mgr.:* Larry Lynch; *Dist. Mgr.:* Robert Dobecki, G/M

FERRO CORPORATION, Stryker Thermoplastics Div., 3 Railroad Ave., Stryker, OH 43557, Tel: 419-682-3311; *Sls. Mgr.:* Bruce Heine

FERRO CORPORATION, Transelco Div., P.O. Box 217, Penn Yan, NY 14527-0127, Tel: 315-536-3357, TELEX: 98-0165; *Sls. Mgr.:* James F. Arthur

FERRO INDUSTRIAL PRODUCTS LTD., Canadian Thermoplastics Division, 354 Davis Road, Oakville, ONT. L6J 2X1, Tel: 416-845-4277, TELEX: 06-982218; *Sls. Mgr.:* J. Zeman

FERRONICS, 52 N. Main St, Fairport, NY 14450, Tel: 716-388-1020, TELEX: 256549, FAX: 716-388-0036; FSC No.: 33062; Empl.: 35; *Sls. Mgr.:* Thayne Wilbur

FERROTRAN ELCTRNS. CO., INC., 11 W. 25th St, New York, NY 10010, Tel: 212-691-3610; *Sls. Mgr.:* H. King

FERROXCUBE, Amperex Electronic Corp., 5083 Kings Hwy., Saugerties, NY 12477, Tel: 914-246-2811, TWX: 510-247-5410, FAX: 914-246-2811(Ext 427); FSC No.: 02114; Empl.: 400; *Sls. Mgr.:* B. Grindle; *Dist. Mgr.:* Terry Parisian

FG ENGINEERING, Box 476, Fredonia, AZ 86022, Tel: 602-643-7375; Empl.: 6; *Sls. Mgr.:* F. Griswold

FIBERGUIDE INDUSTRIES INC., 1 Bay St., Stirling, NJ 07980, Tel: 201-647-6601, TWX: 510-100-9180, FAX: 201-647-8464; Empl.: 25; *Sls. Mgr.:* Kelly Moran

FIBEROPTICS TECHNOLOGY, INC., Quassett Rd., Pomfret, CT 06258, Tel: 203-928-0443, FAX: 203-928-7664; *Sls. Mgr.:* J. H. Castonguay

FAX: 805-583-4018

FIBEROPTIC SYSTEMS, INC., 4680-B E. Los Angeles Ave., Simi Valley, CA 93063, Tel: 805-583-2088; Empl.: 30; *Sls. Mgr.:* Richard Lockett ..... **B•1167**

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FAX: 301-881-0530

FIC CORP., 12216 Parklawn Dr., Rockville, MD 20852, Tel: 301-881-8124, 800-638-6594, TWX: 710-828-9809; FSC No.: 3613; Empl.: 46; *Sls. Mgr.:* Robert E. Frye; *Dist. Mgr.:* Robert E. Frye ..... **B•1314**

FIDELITY CHEMICAL PRODUCTS CORP., 472 Frelinqhuysen Ave., Newark, NJ 07114, Tel: 201-242-4110, FAX: 201-242-5796; Empl.: 35

FIELD-FAB, 43 School St., N. Springfield, VT 05150, Tel: 802-886-8278; *Sls. Mgr.:* Harold Lombard

FAX: 609-599-9508

FIFTH DIMENSION, INC., 801 New York Ave., Trenton, NJ 08638, Tel: 609-393-8350, TWX: 510-681-8412; Empl.: 60; *Sls. Mgr.:* Dick Clawges, Prod. Mgr. ..... **B•1420-1421, 1710-1711**

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NJ Trenton, Fifth Dimension 609-393-8350

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FILM MICROELECTRONICS, See General Microcircuits

FILTER CONCEPTS INC., 2624 S. Rousselle, Santa Ana, CA 92707, Tel: 714-545-7003, FAX: 714-545-4607; *Sls. Mgr.:* Les Edelberg ..... **A•1656-1657**

FILTRON CO., INC., Sub. of ARX Inc., 148-E Sweet Hollow Rd., Old Bethpage, NY 11804, Tel: 516-752-1144, FAX: 516-752-0905; FSC No.: 81831; Empl.: 90; *Sls. Mgr.:* Harold Samkoff ..... **A•1659**

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AL Huntsville, Rakes Engrg. & Mktg. 205-533-3763
CA Sunnyvale, Esco Assoc. 408-745-1410
CA Tarzana, High Voltage Sls. 818-881-9194,
CO Boulder, A. Bissell Co. 303-444-1173
FL Winter Pk, Lorenze & Assocs. 305-629-0445
KS Olathe, Technical Sls. Assoc. 913-829-2800,
MD Baltimore, Bernard White & Co. 301-484-5400
MO Ferguson, Technical Sls. Assocs. 314-725-5361,
MS Jackson, Benton Ballard Co. 956-3560
NH Manchester, Charles A. Wallace Co. .. 603-622-5864
NM Albuquerque, WJM Sls. 505-268-9499,
NY Melville, Carnes Assoc. 516-694-1600
NY Syracuse, Material Svcs. 315-437-7093,
PA Huntingdon Valley, Rabal Assoc. 215-947-4825
TX Bedford, De Armond Ent. 817-267-2048

FINCOR, 3750 E. Market St., York, PA 17402, Tel: 717-751-4206, TELEX: 840-432, FAX: 717-751-4372; FSC No.: 3622; Empl.: 700; *Sls. Mgr.:* Robert Spangler

FINISHERS, INC., 517 Aldo Avenue, Santa Clara, CA 94054, Tel: 408-988-0222; Empl.: 10; *Sls. Mgr.:* Harry McRae

FISCHER AMERICA, INC.

FAX: 818-362-7045

FISCHER-AMERICA, INC., 28245 Avenue Crocker, Valencia, CA 91355, Tel: 818-362-9395, TELEX: 499-4182; *Sls. Mgr.:* Steve DeFeo ..... **C•1327-1329**

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CA Fairfield, Baribeault Assocs. 707-428-6095
CA Santa Ana, Wayne Champa Assocs. .. 714-662-2228
CO Englewood, Omega Ltd. 303-762-1921
FL Indian Harbour Bch., Bill Toy & Assocs. 305-773-5805
GA Norcross, Hollingsworth & Still 800-241-5712
IA Marion, MSB Assocs. 319-377-6261
KS Roland Pk., MSB Assocs. 913-432-2131
MA Newton, M. A. Olson Assocs. Inc. 617-244-4030
MN Minneapolis, Electro tec Assocs. 612-927-5878
MO St. Louis, MSB Assocs. 314-946-5577
NJ Ho-Ho-Kus, D. J. Fisher Inc. 201-652-0090
EXP Switzerland/CH-1143 Apples, W. W. Fischer SA 021-800-3711
Can Oakville, Ont., Haltronics 416-844-2233

FISHERCAST, Fisher Gauge Limited, 194 Sophia Street, P.O. Box 179, Peterborough, Ontario, Canada K9J 6Y9, Tel: 705-748-9522, TELEX: 06-962943, FAX: 705-745-8818; Empl.: 180ò; *Sls. Mgr.:* Larry Hatfield

FISHERTECH, Fisher Gauge Limited, 194 Sophia Street, P.O. Box 179, Peterborough, Ontario, Canada K9J 6Y9, Tel: 705-748-9522, TELEX: 06-962838, FAX: 705-748-6312; Empl.: 200ò; *Sls. Mgr.:* Larry Curtis

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AZ Phoenix, J. Smith & Assocs., Inc. 602-267-0981
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CA Del Mar, T. Louis Snitzer Co. 619-226-0305
CA Los Angeles, T. Louis Snitzer Co. 213-836-6170
CO Colorado Springs, J. Smith & Assocs., Inc. 303-597-5343
FL Melbourne, Reynolds & Assocs. 305-259-7000
GA Lilburn, Reynolds & Assocs. 305-259-7000
IL Wheeling, Ed Joyner & Co. 312-520-1200
IN Noblesville, R & D Elctms. 317-849-2026

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NY	Whitney Pt, Tae-Rep	607-692-3705
NC	Raleigh, Reynolds & Assocs.	305-259-7000
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TX	Austin, Thorson Co.	512-345-1985
TX	Dallas, Thorson Co.	214-233-5744
WA	Seattle, Datacom Assocs.	206-285-2525
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Can	Calgary, Alberta, Atelco, Inc.	403-230-1697
Can	Markham, Ont., Atelco, Inc.	416-497-8590
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FLEX-CORE DIV., Morlan & Assocs., Inc., 6625 McVey Blvd., Worthington, OH 43235, Tel: 614-889-6152; Empl.: 7; *Sls. Mgr.:* D. Morlan ..... **A•2229**

FLEX-KEY CORP., Sub. of Astronics Corp., 18 Sargent St., Gloucester, MA 01930, Tel: 617-281-2040, TELEX: 94-0333, FAX: 617-281-4730; FSC No.: 51163; Empl.: 50; *Sls. Mgr.:* Philip P. Bodoni ..... **B•1817**

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KS	Wichita, Bud Johnson & Assocs.	316-838-9345
MI	Birmingham, Riley-Cotter Sls.	313-644-0161
NY	Huntington, J. A. Keeneth Co.	516-351-7008
Can	Mississauga, Ont., Lloyd A. Meredith	416-535-1832

FLIGHT CONNECTOR, Trans-Technology Electronics, 233 E. Manville St., Rancho Dominguez, CA 90220-9006, Tel: 309-693-3355, TWX: 510-390-3691; FSC No.: 28680; *Sls. Mgr.:* John Williams; *Dist. Mgr.:* John Williams

FL JENNINGS, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696, Tel: 408-292-4025, TELEX: 34-6311, TWX: 910-338-0159, FAX: 408-286-1789; FSC No.: 73905; Empl.: 350; *Sls. Mgr.:* E. V. Valehrach ..... **A•1085; B•1422-1425; D•1253**

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CA	Encino, King-Way Assocs.	818-788-4124
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FL	Deerfield Beach, Brandel-Stephens	305-427-8558
FL	Orlando, Brandel-Stephens	305-425-3202
GA	Atlanta, Brandel-Stephens	404-261-7579
IL	Arlington Hgts., Berndt Assocs.	312-632-0900
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Shawnee Mission, Lowell-Kangas & Assoc.	913-631-3515
MD	Hunt Valley, Marktron	301-628-1111
MD	Rockville, Marktron	301-251-8990
MA	Haverhill, L.K. Assocs.	617-373-1313
MN	Minneapolis, Berndt Assocs.	612-546-2021
MO	St. Louis, Lowell-Kangas & Assoc.	314-821-4050
NJ	Flanders, K&R Engrg. Sls.	201-584-5235
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NY	N. Syracuse, Micro-Tech Mktg.	315-458-5254
NY	Rochester, Micro-Tech Mktg. Inc.	716-328-3000
NC	Greensboro, Brandel-Stephens	919-274-6952
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OH	Dayton, Covert & Newman & Co.	513-439-5788
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PA	Pittsburgh, Covert & Newman & Co.	412-531-2022
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TX	Richardson, Barry Sales	214-234-0255
UT	Salt Lake City, Lindberg Co.	801-277-2643
WI	Milwaukee, Berndt Assocs.	414-545-8400

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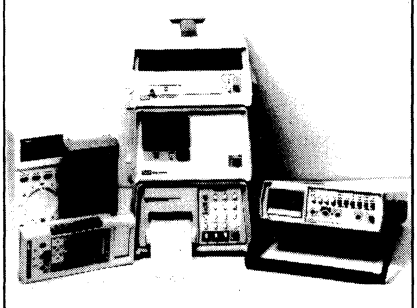
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NJ	Budd Lake, Guido Assocs.	201-347-4643
OH	Dayton, Santer Sls.	513-434-8212
PA	Erie, Frandot Co.	814-455-9751
TX	Dallas, Weisler & Assocs.	214-437-2386
TX	Houston, Weisler & Assocs.	713-467-1847
WI	Genoa City, Vine Tech. Sls.	414-279-3871

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FAX: 813-693-1554

FOX ELECTRONICS, 5842 Corporation Circle, Ft. Meyers, FL 33905, Tel: 813-693-0099, TWX: 510-951-7386; FSC No.: 61429; *Sls. Mgr.:* E. L. Fox, Jr./Mason Flake ..... **A•1397**

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AL	Huntsville, Beacon	205-881-5031
AZ	Tempe, System Sls. of Arizona	602-829-9338
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CA	Mountain View, Brooks Tech. Grp.	415-960-3880
CO	Englewood, Megatronix	303-799-3700
CT	Orange, Access Sys.	203-877-5891
FL	Altamonte Springs, Semtronics Assocs.	303-831-8233
FL	Clearwater, Semtronics Assocs.	813-461-4675
FL	Ft. Lauderdale, Semtronics Assocs.	305-731-2484
GA	Atlanta, Electronic Mktg. Assocs. Inc.	404-448-1251
IL	Itaska, Janus Inc.	312-250-9650
IN	Indianapolis, Wilson Tech. Sls. Inc.	317-872-2513
LA	Hammond, Design Mktg.	504-294-3076
MD	Randallstown, Beacon North Inc.	703-478-2480
NH	Nashua, Access	603-888-8160
MI	Benton Harbor, McNab & Assoc.	616-925-2166
MN	Minnetonka, Gibb Elctrn.	612-935-4600
MO	St. Louis, Reps Inc.	314-298-8262
NJ	Medford, Component Consultants	609-654-5300
NJ	Parsippany, HLM NJ	201-263-1535
NM	Albuquerque, System Sls. of New Mexico	505-889-2901
NY	Northport, HLM NY	516-757-1606
NY	Syracuse, Pitronics	315-455-7346
NC	Raleigh, Electronic Mktg. Assocs. Inc.	919-847-8800
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OR	Portland, E. S. Chase	503-292-8840
PA	Pittsburgh, Covert & Newman Co.	412-531-2002
SC	Greenville, Elctrn. Mktg. Assocs. Inc.	803-233-4637
TX	Austin, Design Mktg.	512-263-9151
TX	Dallas, Design Mktg.	214-480-8151
TX	Ft. Worth, Design Mktg.	817-232-3155
TX	Houston, Design Mktg.	713-550-3318
TX	Irving, Design Mktg.	214-607-0611
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CA	Sacramento, Integrated Elctrns.	916-424-5297
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CA	San Diego, CETEC/Future	619-278-5020
CA	San Jose, Distel Inc.	408-432-9290
CA	San Jose, Future	408-435-9100
CA	San Jose, Integrated Elctrns.	408-435-1000
CA	Santa Clara, Cypress	408-980-2500
CA	Santa Clara, CETEC/Future	408-434-1114
CA	South Gate, CETEC/Future	213-773-6521
CA	Westlake Vl., Distel Inc.	805-495-9998
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CO	Denver, Integrated Elctrns.	303-292-6121
CO	Westminster, Future Elctrns.	303-650-0123
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TX	Dallas, Cypress Elctrns.	214-869-1435
TX	Farmer Branch, Force Elctrns. of Texas	214-247-9955
TX	Ft. Worth, C & W Elctrns.	817-831-0395
TX	Houston, Force Elctrns. of Texas	713-561-8644
TX	Richardson, Future Elctrns.	214-437-2437
TX	Richardson, Jaco	214-235-9575
UT	North Salt Lake, Integrated Elctrns.	801-298-1868
UT	Salt Lake City, Future	801-972-8489
WA	Bellevue, Almac Elctrns.	206-643-9992
WA	Bellevue, Integrated Elctrns.	206-455-2727
WA	Bothell, Cypress Elctrns.	206-483-1144
WA	Redmond, Future Elctrns.	206-881-8199
WA	Spokane, Almac	509-924-9500
WI	Mequon, Lake-View Elctrns.	414-377-8250
WI	Milwaukee, Progressive Image Inc.	414-321-4722
Can	Downsview, Ont., Future Elctrns.	416-638-4771
Can	Nepean, Ont., Carsten Elctrns.	613-726-9250
Can	Ottawa, Ont., Future Elctrns.	613-820-8313
Can	Pointe Claire, Que., Future Elctrns.	514-694-7710
Can	Scarborough, Ont., Carsten Elctrns.	416-495-9999
Can	St. Laurent, Que., Carsten Elctrns.	514-334-8321
Can	Vancouver, B.C., Future Elctrns.	604-294-1166

FRAMAR METAL PRODUCTS CO., INC., 345 Carnegie Avenue, Kenilworth, NJ 07033, Tel: 201-241-0710, FAX: 201-241-1876; Empl.: 7; *Sls. Mgr.:* John W. Moore, Jr.

FRAZIER, 1930 Valley View La., Dallas, TX 75234, Tel: 214-241-3441; Empl.: 20; *Sls. Mgr.:* W. A. Wadkins

FREDERICK COMPONENTS INTL., 20806 Plummer St., Chatsworth, CA 91311, Tel: 818-882-0868, 800-354-0660, TELEX: 691531

FREDERICK ELECTRONICS CORP., 7630 Hayward Rd., P.O. Box 502, Frederick, MD 21701-0502, Tel: 301-662-5901, TELEX: 197639, 248862; FSC No.: 197639, 64682; Empl.: 350; *Sls. Mgr.:* John W. Seniff

FREED TRANSFORMER, 1718 Weirfield St., Ridgewood, NY 11385, Tel: 212-386-1300; FSC No.: 73386; Empl.: 200; *Sls. Mgr.:* M. Salzberg

FTS

FAX: 508-927-4099

FREQUENCY AND TIME SYSTEMS, INC., DATUM, INC., 34 Tozer Rd., Beverly, MA 01915, Tel: 508-927-8220, TELEX: 94-0518 FTS BVLY; FSC No.: 56219; Empl.: 126; *Sls. Mgr.:* Martin W. Levine ..... **D•1254**

Local Sales Offices & Reps

AL	Huntsville, Southern Mktg. Assocs.	205-534-6020
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CA	Costa Mesa, Ward Davis Assocs.	714-556-7466
CA	Redondo Bch., Ward Davis Assocs.	213-643-6977
CA	San Diego, Ward Davis Assocs.	619-292-1000
CA	Santa Clara, Ward-Davis Assocs.	408-245-3700
FL	Largo, Electrocraft	813-530-4749
FL	Longwood, Southern Mktg. Assocs.	305-682-7317
GA	Marietta, Southern Mktg. Assocs.	404-565-0603
IL	Park Ridge, Electronic Instr. Assocs.	312-298-2290
IN	Indianapolis, Electronic Instr. Assocs.	317-257-7231
IA	Hiawatha, Gassner & Clark Co.	319-393-5763
MD	Rockville, Creative Mktg. Assocs., Ltd.	301-251-4100
MA	Tewksbury, Del-Con Sls.	617-851-9911
MN	Minneapolis, Electronic Instr. Assocs.	612-374-5628
NJ	Haddonfield, G. L. Williams Assocs.	609-428-6060
NJ	Union, Friedman Assocs., Inc.	201-964-6204
NY	Liverpool, R & D Assocs.	315-457-0100
NC	Greensboro, Southern Mktg. Assocs.	919-282-6001
OH	Centerville, Micro Sls. Corp.	513-433-8171
TX	Houston, Lear Assocs., Inc.	713-488-7893
TX	Richardson, Lear Assocs., Inc.	214-231-5388
WA	Seattle, Comptronics	206-284-4842

FREQUENCY CONTROL PRODUCTS, INC., American Time Products Div., 430 Commack Rd., Deer Pk., NY 11729, Tel: 516-243-5730, TWX: 710-581-0014, FAX: 516-243-5745; FSC No.: 59559;03040; Empl.: 100; *Sls. Mgr.:* A. Caggiano

FAX: 617-521-1839

FREQUENCY DEVICES, INC., 25 Locust St., Haverhill, MA 01830, Tel: 617-374-0761, TWX: 710-347-0314; Empl.: 40; *Sls. Mgr.:* Frank J. DeGiso ..... **A•1660-1661**

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CA	San Diego, K/Rep Sls.	619-457-9654
CA	San Ramon, Tech. Consultants, Inc.	415-830-0829
CA	Upland, HAB Assocs.	714-981-0529
FL	Orlando, Digital Analog Intl. Sls.	305-299-7754
IL	Chicago, Kingston Comps.	312-477-7800

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OH Chagrin Falls, Hester Assocs. 216-247-6655
PA Sellersville, Tech-Com Mktg. 215-723-0820
TX Houston, TCI Elctrns. 713-774-5019
WA Seattle, Brett Assocs. 206-431-8090
Can Don Mills, Ontario, R. D. Assocs. 416-444-0959

FAX: 516-794-4340

FREQUENCY ELECTRONICS, INC., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, Tel: 516-794-4500, TWX: 510-223-0418; Empl.: 950; *Sls. Mgr.:* John Cuthbertson ..... **A•1398-1399**

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CA Mountainview, Disman-Baker 415-969-3010
CO Englewood, Western Sls., Inc. 303-798-0945
FL Orlando, Truex Assoc. 305-859-2160
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MD Rockville, Marktron 301-251-8990
MA Cochituate, High-Tech Sls. 617-653-3838
NJ East Windsor, Micro Lambda 609-443-3113
NY E. Syracuse, EM-Tech Assocs., Inc. ... 315-437-7052
OH Cleveland, Tiby Co. 216-371-5335
VA Charlottesville, Marktron 804-973-5874

FREQUENCY SELECTIVE NETWORKS, 69-20 Garfield Ave., Woodside, NY 11377, Tel: 718-424-7500, FAX: 718-424-3459; FSC No.: 56662; Empl.: 30; *Sls. Mgr.:* Michael L. Izzolo ..... **A•1400**

Local Sales Offices & Reps
FL Melbourne, Aschbacher Elec. 305-729-0628
NY Huntington, Carnes Assocs. 516-694-1600
OH Dayton, Aschbacher Assocs. 513-252-7785
VA Alexandria, Tech-Rep Inc. 703-370-2600

FREQUENCY SOURCES, INC., Semiconductor Div., 16 Maple Rd., Chelmsford, MA 01824, Tel: 617-256-4113/8101, TWX: 710-343-0404, FAX: 617-256-8227; FSC No.: 26629; Empl.: 90; *Sls. Mgr.:* D. Langan

FREQUENCY WEST, INC., Subsidiary of LORAL Corporation, 214 Devcon Dr., San Jose, CA 95112-4210, Tel: 408-436-4500, TWX: 910-338-0163; FSC No.: 8F150; Empl.: 130; *Sls. Mgr.:* John Tarvin

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FL Orlando, E. G. Holmes & Assocs. 305-281-0067
GA Atlanta, E. G. Holmes & Assocs. 404-451-6161
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IN Indianapolis, Dytec/Central, Inc. 317-297-5988
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MO St. Louis, Midtec Assocs, Inc. 314-275-8666
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NY Smithtown, Metro M.I.C.S. 516-361-6134
NC Cary, E. G. Holms & Assocs. 919-469-8850
OH Centerville, Micro Sls. Corp. 513-433-8171
PA Plymouth Meeting, Elctrn. Mktg. Assocs. 215-828-7400
TX Dallas, Data Mktg. Assocs. 214-661-0300
WA Kirkland, Allis-Northwest 206-828-0444
WI Brookfield, Dytec/Cen., Inc. 414-792-0320

FRESNEL OPTICS, Div. of Alliance Tool Corp., 1300 Mt. Read Blvd., Rochester, NY 14606, Tel: 716-647-1140, TELEX: 97-8322; *Sls. Mgr.:* Helmut Walter

FRONTIER ELECTRONICS, 6311 DeSoto Ave., Ste. K, Woodland Hills, CA 91367, Tel: 818-888-6242, TELEX: 294582, FAX: 818-888-5239; Empl.: 200

FRONT PANEL DEVICES, INC., 38-7 Raymor Ave., Ronkonkoma, NY 11779, Tel: 212-471-9800, TELEX: 645-580; Empl.: 20; *Sls. Mgr.:* Maureen Quinn

FSI/FORK STANDARDS, INC., 666 Western Ave., Lombard, IL 60148, Tel: 312-231-3511, 312-932-9380, FAX: 312-932-0016; FSC No.: 14986; Empl.: 20; *Sls. Mgr.:* Alfredo J. Ramirez; *Dist. Mgr.:* A. E. Toht

FTS SYSTEMS, INC., Rte. 209, P.O. Box 158, Stone Ridge, NY 12484, Tel: 800-824-0400, TWX: 510-247-0547, FAX: 914-687-7481; Empl.: 100ò; *Sls. Mgr.:* Brian Adams

FUJI ELECTRIC CORP. OF AMERICA, 727 W. 7 St., Ste. 235, Los Angeles, CA 90017, Tel: 213-622-4490, TELEX: 677318, FAX: 213-488-9382; Empl.: Yasuko Suzuki; *Sls. Mgr.:* Atsuo Noguchi; *Dist. Mgr.:* Masano Deguchi

FUJITSU AMERICA, INC., Computer Products Group, 3055 Orchard Dr., San Jose, CA 95134, Tel: 408-432-1300, TWX: 910-338-2193; *Sls. Mgr.:* David Krevanko; *Dist. Mgr.:* Bill Clark ..... **D•1082-1091**

Local Sales Offices & Reps
CA Irvine, Fujitsu America 714-553-1250
CA San Jose, Fujitsu America 408-434-9250,
CA Sherman Oaks, Fujitsu America 818-905-1985
FL Ft. Lauderdale, Fujitsu America 305-771-7705,
GA Atlanta, Fujitsu America 404-953-0130
IL Itasca, Fujitsu America 312-250-8230,
MA Burlington, Fujitsu America 617-273-1341,
MN Minnetonka, Fujitsu America 612-932-9800,
NJ Manasquan, Fujitsu America 201-223-8222,
OR Beaverton, Fujitsu America 503-643-6098,
PA Malvern, Fujitsu America 215-648-3958
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TX Richardson, Fujitsu America 214-437-9377,
Can Mississauga, Fujitsu Canada 416-673-8666

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CA Gardena, Schweber Elctrns. 213-327-8409,
CA Irvine, Wyle Laborotories 714-863-9953,
CA Richmond, Gates Distrbg. 415-526-4444,
CA Santa Clara, Wyle Laboratories 408-727-2500
CO Englewood, R2 Mktg. 303-799-9292
CT Danbury, Schweber Elctrns. 203-748-7080,
FL Ft. Lauderdale, Gentry Assocs. 305-791-8405
GA Atlanta, Gentry Assocs. 404-998-2828
IL Bensenville, Avnet Computer Technlgs. 312-350-2480,
IL Elmhurst, Fast Access 312-530-2450
IA Cedar Rapids, Data Link 314-395-0245
LA Gretna, Gentry Assocs. 504-367-3975
MD Gaithersburg, Mesa Technlg. 301-948-4350
MA Bedford, Schweber Elctrns. 617-275-5100,
MI Detroit, Cranel, Inc. 313-855-0166
MN Minneaplis, Datalink 612-944-3456
NJ Summit, Hopkins Assocs. 201-273-2770
NY Rochester, Cameron Computers 716-427-8190
OH Cleveland, Cranel, Inc. 216-589-4744
OH Columbus, Cranel, Inc. 614-433-0045
OK Tulsa, Dallas Digital 918-622-5708
OR Hillsboro, Wyle Laborotories 503-640-6000,
PA W. Conshocken, Hopkins Assocs 215-828-7191
TX Houston, Dallas Digtal 713-469-7151
TX Plano, Dallas Digital 214-424-2800
UT Salt lake, R2 Mktg. 801-595-0631
WA Redmond, Gates Distrbg. 206-883-8575,

FUJITSU

FAX: 408-980-1042

FUJITSU COMPONENTS OF AMERICA, 3320 Scott Blvd., Santa Clara, CA 95054, Tel: 408-727-1700, TWX: 910-338-0190; Empl.: 40; *Sls. Mgr.:* Jack Foster (acting); *Dist. Mgr.:* Hal Mumma ..... **B•1032, 1070, 1427-1446; C•1330-1369**

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CA Tustin, Hi-Tech Rep Co.(HTRC) 714-730-9561
CA Westlake Village, Hi-Tech Rep Co.(HTRC) 818-706-2916
CO Lakewood, Candal 303-935-7128
CT Cheshire, Connecticut Applied Technlg. 203-272-6564
FL Altamonte Springs, Semtronics Assocs. 305-831-8233
FL Clearwater, Semtronics 813-461-4675
FL Ft. Lauderdale, Semtronics 305-731-2484
GA Atlanta, C.S.R. Elctrns. 404-396-3720
IL Highland Park, Brensky Sls. 312-433-2375
IA Cedar Rapids, Electromec Sls., Inc. ... 319-362-6413
KS Overland Pk., Kebco 913-541-8431
MD Baltimore, Comp. Sls. Inc. 301-484-3647
MA Woburn, Mill-Bern Assocs., Inc. 617-932-3311
MI Farmington Hills, W. R. Hummon Assocs. 313-474-0661
MN Burnsville, Electromec Sls., Inc. 612-894-8200
MO St. Louis, Kebco 314-576-4111
NJ Fairfield, Tech. Applications & Mktg. ... 201-575-9130
NJ Marlton, BGR Assocs. 609-983-1020
NM Albuqueque, F.P. Sls. 505-345-5553
NY Rochester, H.C. Johnson Agy. 716-586-0777
NC Raleigh, C.S.R. Elctrn. 919-878-9200
OH Columbus, McFadden Sls. Inc. 614-761-3177
OR Beaverton, L-Squared Ltd. 503-629-8555
PA Glenshaw, H.C. Johnson Agy. 412-487-1246
TN Knoxville, C.S.R. Elctrn. 615-577-1317
TX Carrollton, Tech. Mktg. Inc. (TMI) 214-387-3601
TX Houston, Tech. Mktg. Inc. 713-783-4497
TX Round Rock, Tech. Mktg. 512-244-2291
WA Seattle, L-Squared Ltd. 206-827-8555
WI Cedarburg, Bransky Sls. 414-377-6837
Can St. Laurent, Que., John G. Weiss Co. .. 514-337-5022
Can Vancouver, Davetek Mktg. 604-430-3680

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FUJITSU MICROELECTRONICS, INC., Sub. of Fujitsu Limited, 3545 North First St., San Jose, CA 95134, Tel: 408-922-9000, TWX: 910-338-0190; FSC No.: 408-980-1047; Empl.: 350; *Sls. Mgr.:* Rich Christopher; *Dist. Mgr.:* Dan Buist

FURANE PRODS. CO./ISOCHEM OPERS., A Ciba-Geigg Co., 99 Cook St., Lincoln, RI 02865, Tel: 401-723-2100, TWX: 510-601-1913, FAX: 401-723-2930; Empl.: 26; *Sls. Mgr.:* W. Lott

FURMAN SOUND, INC., 30 Rich St., Greenbrae, CA 94904, Tel: 415-927-1225, FAX: 415-927-4548; Empl.: 22; *Sls. Mgr.:* Joe Desmond; *Dist. Mgr.:* Joe Desmond

FURNAS ELEC., 1197 McKee St., Batavia, IL 60510, Tel: 312-879-6000, TELEX: 72-0458; Empl.: 1360; *Sls. Mgr.:* R. Doty; *Dist. Mgr.:* P. Welch

FUSECOM, 14864 NE 95th St., Redmond, WA 98052, Tel: 206-881-2442; *Sls. Mgr.:* Bruce Barndt

FUSES UNLIMITED, 9300 Mason Av., Chatsworth, CA 91311, Tel: 818-882-1515; Empl.: 35; *Sls. Mgr.:* Bruce Barndt; *Dist. Mgr.:* Pat White

FUSION INC., 4658 E. 355th. St., Willoughby, OH 44094, Tel: 216-946-3300, TELEX: 275300; Empl.: 85; *Sls. Mgr.:* Raymond C. Yuhasz

FUTABA CORPORATION OF AMERICA, Electronic Components Division, 711 East State Pkwy., Schaumburg, IL 60173, Tel: 312-884-1444, TELEX: 206-833, TWX: 910-291-1057, FAX: 312-884-1635; *Sls. Mgr.:* Bill Lichtner; *Dist. Mgr.:* Bill Lichtner

GABRIEL ELECTRONICS, Box 70, Scarborough Indl. Pk., Scarborough, ME 04074, Tel: 207-883-5161, TELEX: 95-0113, ESYLNK: 62042511, FAX: 207-883-4469; Empl.: 225; *Sls. Mgr.:* D. B. Crisman

GALILEO ELECTRO-OPTICS CORP., Galileo Pk., Sturbridge, MA 01518, Tel: 617-347-9191, TELEX: 4999014; FSC No.: 28719; Empl.: 600; *Sls. Mgr.:* Lawrence T. Guzowski

GALIL MOTION CONTROL, INC., 1054 Elwell Ct., Palo Alto, CA 94303, Tel: 415-964-6494, TELEX: 171409, FAX: 415-964-0426; Empl.: 10; *Sls. Mgr.:* Lisa Wade

GALITE, 2 Tower Dr., Wallingford, CT 06492, Tel: 203-265-7126, TWX: 710-476-0764; FSC No.: 56447; *Sls. Mgr.:* James W. Campbell, Jr.

GAMBLE, CHARLES T., INDS., 605 Perkins La., Delanco, NJ 08075, Tel: 609-461-1900, FAX: 609 461-8216; Empl.: 150; *Sls. Mgr.:* Chuck Gamble

FAX: 914-667-5225

GAMMA HIGH VOLTAGE RESCH. INC., 30 N. MacQuesten Pkwy., Mt. Vernon, NY 10550, Tel: 914-667-5050; Empl.: 15 ..... **D•1728-1731**

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IN Indianapolis, Comtel Midwest 317-253-1681,
IA Cedar Rapids, Comtel Midwest 319-377-9434,
KS Shawnee Mission, Comtel Midwest ... 913-268-0762,
MN Wayzata, Comtel Midwest 612-476-1551,
MO St. Louis, Comtel Midwest 314-991-5363,
NJ Nutley, Irwin Brill Sls. 201-667-0653
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TX Houston, Elctrl. Mktg. Assocs. 713-523-8602,
WI New Berlin, Comtel Midwest 414-544-6042,

GAMMA SCIENTIFIC INC., 3777 Ruffin Rd., San Diego, CA 92123, Tel: 619-279-8034, TELEX: 69-7938; Empl.: 65; *Sls. Mgr.:* Robert Ruff

GANDALF DATA INC., Gandalf Technologies Inc., 1020 S. Noel Ave., Wheeling, IL 60090, Tel: 312-541-6060, 800-GANDALF, TWX: 910-651-4951, FAX: 312-541-6060 (ext 411); Empl.: 3500; *Sls. Mgr.:* Kerry Hawkins

GANDALF TECHNOLOGIES, INC, See Gandalf Data, Inc.

GAP INSTRUMENT CORP., 40 Oser Ave., Hauppauge, NY 11787, Tel: 516-273-0909, TWX: 510-227-6237; FSC No.: 00607; Empl.: 50

GARDINER SOLDER CO., Div. of Gardiner Metal Co., 4820 S. Campbell Ave., Chicago, IL 60632, Tel: 312-847-0100, TWX: 910-221-2510; Empl.: 100; *Sls. Mgr.:* Daniel Frailey

GAR ENTERPRISES, 2029 N. Lincoln Ave., Pasadena, CA 91103, Tel: 818-798-0785; Empl.: 45

GARNER GLASS CO., 177 S. Indian Hill Blvd., Claremont, CA 91711, Tel: 714-624-5071, FAX: 714-624-7212; FSC No.: 53101; Empl.: 50; *Sls. Mgr.:* Joseph C. Hyatt

GARRY ELECTRONICS, Div. of Brintec Corp., 9 Queen Anne Ct., Laghorne, PA 19047, Tel: 215-949-2300; Empl.: 100; *Sls. Mgr.:* Tom Malek; *Dist. Mgr.:* Kate Simpson ..... **C•1370-1373, 1739; D•1112**

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AL Huntsville, Macro Mktg. 205-883-9630
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OH Chagrin Falls, J. J. Bair & Assocs. 216-247-8244
OH Dayton, A.D. Dircksen & Assoc. 513-256-0351
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PA Southeastern, Quality Comps. 215-687-3553
TX Austin, Richmar Elctrns. 512-251-7582
TX Dallas, Sundance Sls. 214-699-0451
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WA Redmond, Eclipse Mktg. 206-885-6991
WA Redmond, Freed Assocs. 206-883-4828
WI Butler, Richmar Elctrns. 414-781-1730

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FL Ft. Lauderdale, Time 305-974-4800
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KS Lenexa, Arrow/Kierulff 913-541-9542
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MI Grand Rapids, Arrow/Kierulff 616-243-0912
MI Grand Rapids, Caulder Elctrns. 616-949-2900
MI Grand Rapids, S-F Elctrns. 616-459-0216
MN Edina, Arrow/Kierulff 612-830-1800
MO St. Louis, Arrow/Kierulff 314-567-6888
MO St. Louis, Ensco Distr. Co. 314-567-3935
NH Hudson, Interconnect of N.E. 603-883-1515
NH Manchester, Arrow/Kierulff 603-668-6968
NJ Clifton, Afcom 201-365-2700
NJ Marlton, Arrow/Kierulff 609-596-8000
NJ Parsippany-Troy Hills, Arrow/Kierulff 201-538-0900
NJ Springfield, Route Elctrns. 201-379-7710
NM Albuquerque, Arrow/Kierulff 505-243-4566
NM Albuquerque, Elctrn. Devices 505-293-1935
NY Bohemia, March Elctrns. 516-563-6000
NY Hauppauge, Arrow/Kierulff 516-231-1000
NY Hauppauge, Jaco Elctrns. 516-273-5500
NY Lynbrook, Peerless Radio 516-593-2121
NY Mt. Vernon, Asap 914-699-2727
NY Rochester, Arrow/Kierulff 716-427-0300
NY Rochester, Rochester Radio 716-454-7800
NY West Hempstead, March 516-486-6511
NC Greensboro, Hammond 919-275-6391
NC Raleigh, Arrow/Kierulff 919-876-3132
NC Winston-Salem, Arrow/Kierulff 919-725-8711
OH columbus, Arrow/Kierulff 614-436-0928
OH Centerville, Arrow/Kierulff 513-435-5563
OH Solon, Arrow/Kierulff 216-248-3990
OK Tulsa, Arrow/Kierulff 918-252-7537
OR Beaverton, Arrow/Kierulff 503-645-6456
OR Beaverton, Integrated Elec. 503-641-1690
PA Broomall, Time 215-359-1200
PA Monroeville, Arrow/Kierulff 412-856-7000
PA Montgomeryville, Pyttronics 215-643-2850
TX Austin, Arrow/Kierulff 512-835-4180
TX Carrollton, Arrow/Kierulff 214-380-6464
TX Dallas, Afcom 214-238-7845
TX Dallas, R.V. Weatherford Co. 214-980-1110
TX Houston, Arrow/Kierulff 713-530-4700
TX Houston, Lenert 713-225-1465
TX Houston, R.V. Weatherford 713-688-7406
UT N. Salt Lake City, Integrated Elctrns. 801-298-1869
UT Salt Lake City, Arrow/Kierulff 801-973-6913
VA Roanoke, Technico 703-563-4975
WA Bellevue, Integrated Elctrns. 206-455-2727
WA Bellevue, Jaco Elctrns. 206-455-2727
WA Kent, Arrow/Kierulff 206-575-4420
WA Seattle, R.V. Weatherford Co. 206-575-1340
WI Brookfield, Arrow/Kierulff 414-792-0150
WI Mequon, Taylor Elctrns. 414-241-4321
PR Hato Rey, Arrow/Kierulff 809-764-4384
Can Mississauga, Ont., Pyle National 416-822-3710

GASKET INTERNATIONAL INC., 49 Ackerman St., Bloomfield, NJ 07003, Tel: 201-338-6814; Empl.: 5; *Sls. Mgr.:* Russell L. Steinman

GATES, GEO. W., & CO., INC., 1209 Hempstead Tpke., Franklin Sq., NY 11010, Tel: 516-352-2904; Empl.: 10; *Sls. Mgr.:* T. E. Schulz, Jr

Gates Energy Products

FAX: 904-462-4726

GATES ENERGY PRODUCTS, P.O. Box 114, Gainesville, FL 32602, Tel: 904-462-3911, TWX: 810-836-8500; Empl.: 3300; *Sls. Mgr.:* C. W. Garstang; *Dist. Mgr.:* K. Sparks ..... **D•1460-1466**

Local Sales Offices & Reps

CA Newport Bch. 714-852-9033
CT Meriden 203-238-6812
GA Atlanta 404-458-8755
IL Des Plaines 312-827-9130

Local Distributors

CA Los Angeles, Battery Specialties 213-437-1809
CA San Diego, Tauber Elctrns. 619-274-7242
CA San Jose, Rose Elctrns. 408-263-2934
GA Norcross, Applied Power 404-263-0421
IL Chicago, Joseph Elctrns. 312-297-4200
IL Chicago, Power-Pak, Inc. 312-966-6000
MA Boston, Adcour 617-784-8123
MI Brighton, Applied Power 313-227-3604
MN St. Paul, Shelley-Ragon 800-328-9427
NJ Clifton, Engineered Assemblies 201-340-0600
NC Raleigh, Engrd. Assemblies 919-790-9700
OH Columbus, Promark 614-876-8885
TX Houston, Kent Elctrns. 713-780-7770
TX Houston, Southwest Elctrns. 713-240-4000
WA Redmond, Priebe Elctrns., Inc. 206-881-2363
WA Seattle, Priebe Electronics 206-821-4695

GAVITT WIRE & CABLE, Brookfield, MA 01506, Tel: 617-867-6476, FAX: 617-867-5126; Empl.: 75

GAYNOR ELECTRIC CO., 135 South Main St, P.O. Box 316, Thomaston, CT 06787-0316, Tel: 203-283-4388, FAX: 203-283-4107; Empl.: 50; *Sls. Mgr.:* John Swanson; *Dist. Mgr.:* John Swanson

GC-THORSEN, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209, Tel: 815-968-9661, TELEX: 383956 GC Elect; Empl.: 260; *Sls. Mgr.:* Larry Adams, VP Sls.; *Dist. Mgr.:* Raymond D. Camacho

GEBEX CORPORATION, 2221 Walnut Hill Ln., Irving, TX 75038, Tel: 214-550-8955, FAX: 214-580-0173; Empl.: 35

GECO, 145 Penn St., Millheim, PA 16854, Tel: 814-349-5656; Empl.: 21

FAX: 507-263-4887

GEMINI, 103 Mensing Way, Cannon Falls, MN 55009, Tel: 507-263-3957, 800-533-3631; *Sls. Mgr.:* Gary Pearson ..... **C•1054-1055**

Local Sales Offices & Reps

AR North Little Rock, Leo Barker Co. 501-834-2537
CA Orange, XBX Sls., Inc. 714-998-8200
CA Sacramento, Gemini, Inc. 916-927-7776
CA San Diego, Qualtronics 619-560-8955
CO Broomfield, Conners Co. 303-466-9628
FL Oviedo, Tech. Sls. & Applications, Inc. 305-365-2233
GA Lilburn, Tech. Sls. & Applications, Inc. 404-925-1276
IL Palatine, JRS Assocs. 312-991-6626
IN Noblesville, R & D Elctrns. 317-849-2026
LA Slidell, Leo Barker Co. 504-643-4751
MD Glen Burnie, Freedman-Malta Assocs. 301-837-3155

MA Brookline, Harman Assocs. 617-232-6687
MI Dearborn, Pitcher-Poulin, Inc. 315-582-5450
MO St. Louis, Harris Hanson Co. 816-763-6200
NY Buffalo, Leonard D. Allen, Inc. 716-542-2728
NY Rochester, Leonard D. Allen, Inc. 716-377-3530
NY Syracuse, Leonard D. Allen, Inc. 315-437-8387
NC Kernersville, Wallace ELctrns. Sls. 919-996-2742
OH Cincinnati, Bob Gilbert & Assocs. 513-574-1932
OR Forest Grove, Doran Sls., Inc. 503-357-3333
PA King of Prussia, Freedman-Malta Assocs. 215-337-9211
TX Dallas, J. Clay Co. 214-350-1281
TX Taylor, Gemini, Inc. 512-352-5207
UT Salt Lake City, Medax 801-266-4545
WA Redmond, Doran Sls., Inc. 206-885-1885
WI Wauwatosa, Larsen Assocs. 414-258-0529
Can Markham, Ont., Avotronics, Ltd. 416-475-2024

GEN/COMP INC., 6 Algonquin Rd., Canton, MA 02021, Tel: 617-828-2008; *Sls. Mgr.:* G. Nutter

GENCO PRECISION CORP., 247 Skidmore Road, Deer Park, NY 11729, Tel: 516-242-3006, FAX: 516-242-3118

GENERAL AUTOMATIC CORP., See E-Tron Corp.

GENERAL BUSINESS TECH., 1891 McGaw Ave., Irvine, CA 92714, Tel: 714-261-1891, FAX: 714-261-8285; Empl.: 44; *Dist. Mgr.:* Barbara A. Foy

GENERAL CABLE CO., Fiber Optics Div., 160 Fieldcrest Ave., P.O. Box 7810, Edison, NJ 08818-7810, Tel: 201-225-4780, TELEX: 642892; *Sls. Mgr.:* Pieter deBruijn

GENERAL COMPUTERS, 1624 Veteran Ave., Los Angeles, CA 90024; Empl.: 10

Distributor

GENERAL CONTROLS, INC. 2350 Brickvale Ave., Elk Grove Vollage, IL 60007, Tel: 312-595-2152; FAX 312-595-2271 ..... 775, 796

GENERAL CONTROL CO., 11 Cote Indl. Pk., Goffston, NH 03045, Tel: 603-669-2844; Empl.: 7

Local Sales Offices & Reps
NH Goffstown, Gen. Control Co., Inc. 603-669-2844

GENERAL DEFENSE CORPORATION, Tactical Systems Division, Box 500, Pinellas Pk., FL 34290-0500, Tel: 813-541-6681, TWX: 810-866-0433, FAX: 813-544-4944; FSC No.: 1M813; Empl.: 250; *Sls. Mgr.:* Sam Gray

GENERAL DEVICES
Electronic Hardware Manufacturers

FAX: 317-898-2917

GENERAL DEVICES CO., INC., Box 39100, Indianapolis, IN 46239-9632, Tel: 317-897-7000; Empl.: 250; *Sls. Mgr.:* Jack Bradford; *Dist. Mgr.:* Dan McCauley ..... **C•1057**

Local Sales Offices & Reps
AL Huntsville, Hughes Assocs., Inc. 205-533-9108
AZ Phoenix, Snyder Engrg. 602-279-2010
CA Fullerton, Groh Assoc. 714-837-9871
CA Mountain View, G. Woempner Co. 415-964-5454
CO Boulder, R. F. Mayo Assoc. 303-499-2155
CT North Haven, Coakley, Boyd & Abbett 203-481-2828
FL Lighthouse Point, J. Krutek & Assoc. .. 305-427-4202
FL Maitland, J. Krutek 305-628-4837
GA Norcross, Hughes Assocs., Inc. 404-622-1587
IL Glencoe, Howard Benjamin 312-272-2900
IN Noblesville, Century Elctrns. 317-849-2026
KS Overland Pk., Thomas Dowell & Assocs. 913-648-7373
MD Elicott City, Eastern Tech. Corp. 301-461-7720
MA Needham, Coakley, Boyd & Abbett 617-444-5470
MN St. Paul, Northport Engrg. 612-457-8000
MS Corinth, Hughes Assocs., Inc. 601-287-2915
MO St. Louis, Thomas Dowell & Assocs. .. 314-849-4234
NH Plaistow, Coakley, Boyd & Abbett 617-444-5470
NJ Mountainside, Henry G. Richter 201-233-4615
NY Fayetteville, H.G. Richter 315-637-6713
NC Raleigh, Hughes Assocs., Inc. 919-782-2065
OH Cleveland, Electronic Comps., Inc. 216-331-5330
OH Dayton, Electronic Comps., Inc. 513-866-3340
OK Tulsa, Advance Tech. Sls. 918-664-0482
TN Morristown, Hughes Assocs., Inc. 615-587-2433
TX Austin, Advance Tech. Sls. 512-440-7677
TX Dallas, Advance Tech. Sls. 214-340-1300
TX Houston, Advance Tech. Sls. 713-440-3888
WA Olympia, Bergford & Assocs. 206-866-2001

Local Distributors
AZ Tempe, Acacia/VWR Elctrns. 602-894-2874
CA Irvine, Acacia/VWR Elctrns. 714-660-0834
CA San Diego, Acacia/VWR Elctrns. 619-565-4365
MA Newton, In-Stock Products Co. 617-964-6200
NJ Atlantic Highlands, Freedom Elctrns., Inc. 201-872-2300

GENERAL DIGITAL CORP., 160 Chapel Rd., Box 1657, Manchester, CT 06040, Tel: 203-647-9700; Empl.: 50

GENERAL DIGITAL INDUSTRIES INC., 6705 Odyssey Dr., Huntsville, AL 35806, Tel: 205-837-2200; Empl.: 29; *Sls. Mgr.:* John Robinson

GENERAL ELECTRIC CO., Accessory Equipment Plant, 1285 Boston Ave., Bridgeport, CT 06602, Tel: 203-382-2000, TELEX: 96-4209; Empl.: 700; *Sls. Mgr.:* H. C. Wallace

GENERAL ELEC. CO., Electromaterials Dept., 1350 South Second Street, Coshocton, OH 43812, Tel: 614-622-5310, TELEX: 810-255-2921; Empl.: 600; *Sls. Mgr.:* Dick Hurlbut

GENERAL ELECTRIC CO., Instrument Prods. Section, See Yokogawa Corp. of America

GE MICROELECTRONICS CENTER, GE Aerospace, P.O. Box 13049, Research Triangle Park, NC 27709, Tel: 919-549-3100, FAX: 919-549-3598; Empl.: 500; *Sls. Mgr.:* Don B. Dickerman, Jr.

POWER SUPPLY OPERATION, General Electric Co., 1701 College Street, Fort Wayne, IN 46801, Tel: 219-420-2000; *Sls. Mgr.:* Stan Williams or Chris Copestake

GENERAL ELECTRIC SOLID STATE DIV., G.E. Corporation, Route 202, Somerville, NJ 08876, Tel: 201-685-6530, FAX: 201-685-7008; FSC No.: 19089; *Sls. Mgr.:* Edward Parker; *Dist. Mgr.:* Thomas Piterra

GENERAL ELECTRIC CO., Specialty Mktg. Oper., Nela Park, Cleviand, OH 44112, Tel: 216-266-3494; *Sls. Mgr.:* W. D. Wells

GENERAL ELECTRIC CO., RELAY OPERATION, See Genicom Corp.

GENERAL FIBER OPTICS, INC., 98 Commerce Rd., Cedar Grove, NJ 07009, Tel: 201-239-3400, TELEX: 132741, FAX: 201-239-3400; *Sls. Mgr.:* Herb Berkowitz

GENERAL HARDWARE MFG., 80 White St., New York, NY 10013, Tel: 212-431-6100, FAX: 212-431-6499; *Sls. Mgr.:* Tom McGannon

GENERAL INDUSTRIES, Taylor & Olive St., Elyria, OH 44035, Tel: 216-323-3136, TWX: 810-424-2109; Empl.: 1100

GENERAL INSTRUMENT, Govt. Systems, 600 W. John St., C. S. 710, Hicksville, NY 11802-0709, Tel: 516-933-3000, TELEX: 311512, TWX: 510-221-1865, FAX: 516-933-3432; Empl.: 768; *Sls. Mgr.:* A. Heckler/C. Turner

GENERAL INSTRUMENT

FAX: 704-328-2400

GENERAL INSTRUMENT, NETWORK CABLE DIV., P. O. Box 1729, Hickory, NC 28603, Tel: 704-324-2200, 800-438-3331, TELEX: 802-166; *Sls. Mgr.:* Nita Hunsucker ..... **C•1844-1849**

Local Sales Offices & Reps
CA Los Angeles, Richard Bolf 213-305-1025
IL Palatine, Gregg Winn 312-705-9190
KS Overland Pk., Bob Barker 913-888-6270
NH Nashua, Dan Heffernan 603-673-4908
NC Hickory, Kathy Miller 704-327-0509
TX Plano, Steve Britton 214-596-6065

GENERAL INSTR., Optoelctrns. Div., 3400 Hillview Ave., Palo Alto, CA 94304, Tel: 415-493-0400, TELEX: 348430, TWX: 910-373-1767; FSC No.: 58361; Empl.: 500; *Sls. Mgr.:* J. Beach; *Dist. Mgr.:* W. Clark

GENERAL LASER, INC., 7950 E. Redfield Rd., Scottsdale, AZ 85260, Tel: 602-991-0674, FAX: 602-991-1462

GENERAL MAGNETICS, 211 Grove St., Bloomfield, NJ 07003, Tel: 201-743-2700; FSC No.: 99165; Empl.: 20

GENERAL MANUFACTURING, 724 Ruberta Ave., Glendale, CA 91201, Tel: 818-243-2069; FSC No.: 10454

GENERAL MIRCOCIRCUITS, 780 Boston Rd., Billerica, MA 01821, Tel: 508-663-9101, FAX: 508-663-9132; Empl.: 40; *Sls. Mgr.:* Michael Lioz

FAX: 516-226-8966

GENERAL MICROWAVE CORPORATION, 5500 New Horizons Blvd., Amityville, NY 11701, Tel: 516-226-8900, TELEX: 310-287-780; FSC No.: 11332; Empl.: 300 ..... **A•1770; D•1255**

Local Sales Offices & Reps
AL Huntsville, Saber Assocs. 800-327-0853
CA Los Angeles, RF Assocs. 213-478-1586
CA Palo Alto, RF Assocs. 415-494-3331
FL Apopka, Saber Assocs. 800-432-6288
FL Bradenton, Saber Assocs. 800-432-6288
FL Coral Springs, Saber Assocs. 800-432-6288
FL Melbourne, Saber Assocs. 305-724-0920
FL Palm Bch., Saber Assocs. 800-432-6288
GA Atlanta, Saber Assocs. 800-327-0853
IL Mt. Prospect, Cain Forlaw 312-253-3578
MA Burlington, Microwave Mktg. Specialists 617-272-7530
NJ West Orange, EF Tech. Sls. 201-731-7203
NY Huntington Sta., EF Tech. Sls. 516-549-1818
NY Rochester, TCS (Technical Comp. Sls.) 716-342-2406
NC Clayton, Saber Assocs. 800-327-0853
OH Lancaster, Cain Forlaw 614-654-4800
PA Newtown, Hes Assocs. 215-860-9338
TX Dallas, Cain & Co. 214-247-3901

GENERAL NUMERIC CORPORATION, 390 Kent Avenue, Elk Grove Village, IL 60007, Tel: 312-640-1595, TELEX: 210036, FAX: 312-228-5490; Empl.: 125; *Sls. Mgr.:* James Scott

GENERAL OPTRONICS CORP., 2 Olsen Ave., Edison, NJ 08820, Tel: 201-549-9000, TELEX: 240302, FAX: 201-549-3926; FSC No.: 7W944; Empl.: 175; *Sls. Mgr.:* H. R. Moeller

GENERAL POWER SYS., 1045 S. East St., P.O. Box 65008, Anaheim, CA 92805-8508, Tel: 714-956-9321, TELEX: 678870; FSC No.: 04801; Empl.: 200; *Sls. Mgr.:* Ernest R. Murillo; *Dist. Mgr.:* Ernest R. Murillo

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Local Sales Offices & Reps

Instruments

AL	Birmingham, SESCO	205-988-8304
AZ	Tempe, Qualtech, Inc.	602-967-4655
CA	Long Beach, Saber Entprs.	213-595-5646
CA	Mountain View, Gado Instr. Sls.	415-961-2222
CA	San Diego, Saber Entrps.	619-271-1523
CO	Littleton, Radco	303-794-4279
CT	Cheshire, MECO, Inc.	203-271-0026
FL	St. Petersburg, SESCO	813-576-6991
GA	Altanta, SESCO	404-458-6423
IL	Des Plaines, Marsland Assocs.	312-694-2262
IA	Cedar Rapids, Marsland Assocs.	319-365-1908
LA	Baton Rouge, SESCO	504-928-4951
MD	Joppa, Electra-Tech	301-877-0344
MA	Reading, MECO, Inc.	617-944-6660
MI	Mt. Clemens, O'Hara Assocs.	313-791-7140
MN	Minneapolis, Marsland Assocs.	612-545-4481
MO	St. Louis, Marsland Assocs.	314-991-1399
NJ	Hillsdale, CB Associates	201-664-6230
NM	Albuquerque, Qualtech	505-243-5605
NY	Rochester, TAE-REP	716-586-8710
NY	Schenectady, Tae-Rep, Inc.	607-692-3705
NY	Whitney Point, TAE-REP, Inc.	607-692-3705
NC	Cary, SESCO, INC.	919-467-7482
OH	Dayton, RIXAN Assocs.	513-278-4216
OH	Stow, Rixan Assocs.	216-686-2909
OK	Tulsa, SESCO	918-622-3868
SC	Greenville, SESCO, Inc.	803-297-8306
TN	Maryville, SESCO, Inc.	615-977-8239
TX	Austin, SESCO	512-892-2490
TX	Dallas, SESCO	214-231-9364
TX	Houston, SESCO	713-999-3510
TX	Plano, SESCO, Inc.	214-867-8880
VA	Dumfries, Electra-Tech	703-670-6962
WA	Seattle, Datacom Assocs.	206-285-2525
WI	New Berlin, Marsland Assocs.	414-786-6611

Components

AZ	Tempe, Qualtech, Inc.	602-967-4655
CA	Saratoga, TESTCO	408-253-1900
CO	Golden, J. F. Hurlbut Co.	303-279-7796
MD	Randallstown, Beacon North, Inc.	703-591-1300
MI	Farmington, W. R. Hummon & Assoc.	313-474-0661
OH	Dayton, RIXAN Assocs.	513-278-4216
OH	Stow, Rixan Assocs.	216-686-2909
TX	Dallas, Blackburn Assocs.	214-750-8927
TX	Houston, Blackburn Assocs.	713-463-1354
UT	Salt Lake City, J. F. Hurlbut Co.	801-531-7472
VA	Sterling, Beacon North, Inc.	703-478-2480

Local Distributors

CA	Saratoga, TESTCO	408-253-1900
OH	Dayton, RIXAN Assocs.	513-278-4216

GENERAL SCANNING, 500 Arsenal St, P.O. Box 307, Watertown, MA 02272, Tel: 617-924-1010, TELEX: 443-0105, FAX: 617-926-0708; Empl.: 275; *Sls. Mgr.:* Richard Colonna ..... **D•1418**

Local Sales Offices & Reps

CA	Redondo Bch., Gen. Scanning	213-543-4525

GENERAL SEMICONDUCTOR IND., INC., Square D Company, 2001 W. 10 Pl, Tempe, AZ 85281, Tel: 602-968-3101, TELEX: 910-950-1942; FSC No.: 24444;19500; Empl.: 625; *Sls. Mgr.:* Harold Blomquist; *Dist. Mgr.:* Howard Israel

GENERAL TECHNOLOGY CORP., 6816 Washington Avenue, NE, Albuquerque, NM 87109, Tel: 505-345-5591, FAX: 505-344-3227; Empl.: 75; *Sls. Mgr.:* Ralph H. Anderson

GENERAL TRANSISTOR CORP., 216 W. Florence Av., Inglewood, CA 90301, Tel: 213-673-8422, TELEX: 653474; FSC No.: 1P738; Empl.: 39; *Sls. Mgr.:* Al Barrios

GENERAL WIRE PRODUCTS, INC., 425 Shrewsbury Street, Worcester, MA 01604, Tel: 617-752-8260, FAX: 617-753-2173; FSC No.: 5F262; Empl.: 58; *Sls. Mgr.:* Thomas P. Andrews, Jr.

GENICOM

FAX: 703-949-1416

GENICOM CORP., 1 Genicom Dr., Waynesboro, VA 22980, Tel: 703-949-1471, TWX: 710-839-0407; FSC No.: 01526; Empl.: 2300; *Sls. Mgr.:* W. O. Bare ..... **B•1448-1451**

Local Sales Offices & Reps

AZ	Tempe, Genicom Corp.	602-968-6999
CA	Bell Canyon, Genicom Corp.	818-884-1638
CA	Fremont, Genicom Corp.	415-796-7600
CA	Santa Ana, Genicom Corp.	714-549-5101
CA	Westlake, Genicom Corp.	805-373-8509
CT	Meriden, Genicom Corp.	203-238-6876
GA	Norcross, Genicom Corp.	404-449-1021
IL	Rolling Meadows, Gencicom Corp.	312-577-1100
MD	Rockville, Genicom Corp.	301-770-4434
MA	Woburn, Genicom Corp.	201-737-9696
MN	Bloomington, Genicom Corp.	612-854-2909
NJ	Edison, Genicom Corp.	201-738-9696
NY	Hauppauge, Genicom Corp.	516-434-8228
TX	Dallas, Genicom Corp.	214-387-5774
Can	Nepean, Ont., Genicom Corp.	613-726-0215

Local Distributors

CA	Santa Ana, Norstan	800-854-8344
CA	Santa Ana, Norstan Elctrns.	714-540-4168
FL	Orlando, T & T Prods., Inc.	305-857-2282
FL	Orlando, T & T Products	305-857-2282
MD	Towson, Electronic Comp. Sls.	800-638-4221
NY	Farmingdale, Midway Indl. Elctrns.	516-293-6800
NY	Farmingdale, Midway Indl. Elctrns., Inc.	516-293-6800
NY	Rochester, Aquas Elctrns.	716-454-7800
NC	Charlotte, Electronics Mktg. Corp.	704-394-6195
OH	Cleveland, Electronics Mktg. Corp.	216-442-3441
OH	Columbus, Electronics Mktg. Corp.	614-299-4161
OH	Dayton, Elctrns Mktg. Corp.	513-278-5745
OH	Highland Heights, Electronics Mktg. Corp.	216-442-3441
TX	Dallas, Associated Aircraft Supp. Co.	214-331-4381
WA	Redmond, Pan Pacific Elctrns.	206-881-7252
WA	Redmond, Pan Pacific Elctrns., Inc.	206-881-7252

GENISCO MEMORY PRODS. CORP., 10874 Hope St, Cypress, CA 90630, Tel: 714-220-0720, TWX: 910-347-6773, FAX: 714-952-1932; FSC No.: 96682; Empl.: 248; *Sls. Mgr.:* John Krill

GENISCO TECHNOLOGY CORP., Eldema Div., 18435 Susana Rd., Rancho Dominguez, CA 90221, Tel: 213-537-4750, TWX: 910-346-6773; FSC No.: 03797; Empl.: 450; *Sls. Mgr.:* W. R. Esser

GENISCO TECHNOLOGY CORP., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221, Tel: 213-537-4750, TWX: 910-346-6773; FSC No.: 07294; Empl.: 450; *Sls. Mgr.:* T. Cantine

GENISCO TECHNOLOGY CORP., 18435 Susana Rd., Rancho Dominguez, CA 90221, Tel: 213-537-4750, TWX: 910-346-6773; FSC No.: 13946; Empl.: 450; *Sls. Mgr.:* F. Schodlbauer

GENISCO TECHNOLOGY CORP., Transducers Products Div., 650 Easy St, Simi Valley, CA 93065, Tel: 805-581-3985, TWX: 910-494-4782; FSC No.: 65998; Empl.: 450; *Sls. Mgr.:* John E. Smith

GENNUM CORPORATION, Linear Technology Inc., P.O. Box 489, Sta. A, Burlington, ON, Canada L7R 3Y3, Tel: 800-263-9353, 416-632-2996, TELEX: 061-8525, FAX: 416-632-2055; Empl.: 180; *Sls. Mgr.:* C. Marshall/I. H. Scott

GENRAD, INC., 300 Baker Ave., Concord, MA 01742, Tel: 617-369-4400

GENROCO, INC., 205 Kettle Moraine Drive North, Slinger, WI 53086-9407, Tel: 414-644-8700, TELEX: 158279420, FAX: 414-644-6667; *Sls. Mgr.:* Donald D. Woelz; *Dist. Mgr.:* Barbara Pick

GENSTAR RSI SALES COMPANY

FAX: 818-715-9249

GENSTAR RENTAL ELECTRONICS, INC., 6307 De Soto Ave., Suite J, Woodland Hills, CA 91367, Tel: 800-331-3440 (in CA), 800-227-8409 ..... **D•1257**

GENTEX, Box 315, Carbondale, PA 18407, Tel: 603-434-0311, TELEX: 831-883; FSC No.: 97427; *Sls. Mgr.:* Ture Heline

GENTRON CORP., 6667 N. Sidney Pl, Milwaukee, WI 53209, Tel: 414-351-1660, TELEX: 26881, FAX: 414-351-4573; FSC No.: 270-7400; Empl.: 100; *Sls. Mgr.:* William Tennie; *Dist. Mgr.:* W. Schmidt/D. Janes/B. Foye

Local Sales Offices & Reps

CA	Alhambra, M. W. Riedel & Co.	213-283-7694
CA	Fullerton, Robert Arnstein-Gentron Sls.	714-773-0843
DE	Clinton, Selmark Assoc., Inc.	203-573-9088
IL	Berkeley, ESA Tech. Mktg.	312-544-0120
MA	Millis, Selmark Assocs.	617-376-2914
MN	Minneapolis, Furber Sls.	612-881-3620
MO	Grandview, R. R. Burton & Assocs.	816-763-5385
NH	Hopkinton, Selmark Assocs.	603-746-3299
NJ	Wyckoff, North East Comps. Co., Inc.	201-848-1102
OH	Columbus, Tom Mulligan Co.	614-457-2242
OR	Portland, SPS Elctms.	503-297-6919
TX	Dallas, John B. Guenther, Inc.	214-691-8500
WA	Redmond, SPS Elctms.	206-323-4140

Local Distributors

CA	San Francisco, Steven Engrg.	415-588-9200
MA	Hingham, Sager Elec. Supp. Co.	617-749-6700
MI	Madison Hgts., Galco	800-521-1615
MI	Mount Clemens, Excel	313-463-3811
NC	Gastonia, JMT Elctrn. Supply Co.	704-867-4401
TX	Fort Worth, Allied Elctms.	817-336-5401
WI	Milwaukee, Seaker Elctms.	414-878-3727
WI	Salem, DST/Drive Sys. Technlg.	414-843-3177

GEOPHYSICAL SURVEY SYSTEMS, INC., 15 Flagstone Dr., Hudson, NH 03051, Tel: 603-889-4841, TELEX: 953038; FSC No.: 02-0278634; Empl.: 45; *Sls. Mgr.:* J. V. Rosetta, Jr.

FAX: 703-368-1078

GEORATOR CORP., Box 70, Manassas, VA 22110-0070, Tel: 703-368-2101, TELEX: 892-431; Empl.: 49; *Sls. Mgr.:* Charles E. Trefzger ..... **D•2110-2112**

GERMANIUM POWER DEVICES, Box 3065, Shawsheen Village Sta., Andover, MA 01810, Tel: 617-475-5982, TELEX: 94-7150, FAX: 617-470-1512; FSC No.: 53399; Empl.: 100; *Sls. Mgr.:* R. W. Kassiotis

GETTYSBURG TRANSFORMER CORPORATION, 1380 Old Harrisburg Rd., P.O. Box 99, Gettysburg, PA 17325, Tel: 717-334-2191, FAX: 717-334-4961; Empl.: 55; *Sls. Mgr.:* Charles A. Ritter

GEYER SYSTEMS, See GSI Corp.

GFC/HAMMOND ELECTRONICS, INC., Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225, Tel: 716-894-5710, FAX: 716-894-1156; *Sls. Mgr.:* Dave Oliver

GGB INDUSTRIES, INC., Picoprobe Division, P.O. Box 125, Gillette, NJ 07933, Tel: 201-464-1749, TELEX: 136692 GGB, FAX: 201-647-2460; *Sls. Mgr.:* Greg Boll

Local Sales Offices & Reps

MN	Minneapolis, Marketiers	612-890-5406
NJ	New Foundland, Bob Most Assoc.	201-697-0800

GHIELMETTI, INC., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770, Tel: 213-463-5111, TWX: 910-321-2903; Empl.: 4; *Sls. Mgr.:* David Mendoza

GIANNINI PETRO MARINE, 9474 Chesapeake Dr., San Diego, CA 92123, Tel: 619-569-1668; FSC No.: 24727; Empl.: 10

GIBSON/EGAN, See Textool Test & Interconnect Prods. Dept., 3M, Electronic Prods. Div.

GIC THERMODYNAMICS, 2611 Parmenter, Royal Oak, MI 48073, Tel: 313-280-1648, TELEX: 23-5714, FAX: 313-280-0998; Empl.: 20; *Sls. Mgr.:* Denny Desmond

GIDDINGS & LEWIS ELECTRONICS, A Unit of AMCA International, 666 S. Military Rd., P.O. Box 1658, Fond du Lac, WI 54935, Tel: 414-921-7100, TELEX: 26-2722, TWX: 910-275-1100; Empl.: 200; *Sls. Mgr.:* Jim Wickert

GILTRONIX, 3780 Fabian Way, Palo Alto, CA 94303, Tel: 415-493-1300, TELEX: 345542, FAX: 415-493-5410; *Sls. Mgr.:* Dave Littlefield

Gilway Technical Lamp

FAX: 617-938-5867

GILWAY TECHNICAL LAMP, 800 W. Cummings Pk., Woburn, MA 01801, Tel: 617-935-4442, TELEX: 287617 GWAY UR; FSC No.: 3T059; Empl.: 17; *Sls. Mgr.:* Clark Benjamin III; *Dist. Mgr.:* W. C. Fotino ..... **B•1126-1129**

GIMIX, INC., 1337 W. 37th Place, Chicago, IL 60609, Tel: 312-927-5510, TWX: 910-221-4055; Empl.: 14; *Sls. Mgr.:* Richard Don

GLAR-BAN, A MARK IV COMPANY, 199 Wales Ave., Tonawanda, NY 14150, Tel: 716-694-5076, TELEX: 91578; Empl.: 50; *Sls. Mgr.:* William H. Scoville

GLASGAL COMMUNICATIONS, INC., 151 Veterans Dr., Northvale, NJ 07647, Tel: 201-768-8082, TWX: 710-991-8585; Empl.: 130; *Sls. Mgr.:* Al Harnish

FAX: 201-534-5672

GLASSMAN HIGH VOLTAGE INC., P.O. Box 551, Salem Indl. Pk., Whitehouse Sta., NJ 08889, Tel: 201-534-9007, TWX: 710-480-2839; Empl.: 60; *Sls. Mgr.:* John R. Belden ..... **D•1732-1743**

GLATZER INDUSTRIES CORP., 15 River St., New Rochelle, NY 10801, Tel: 914-576-2700; Empl.: 25; *Sls. Mgr.:* Patricia M. Wyllie

GLENAIR INC., 1211 Air Way, Glendale, CA 91201-2497, Tel: 818-247-6000, TELEX: 67-3485, TWX: 910-437-2066, FAX: 818-500-9912; FSC No.: 06324; Empl.: 485; *Sls. Mgr.:* Ronald E. Platz

GLENMARC MANUFACTURING INC., 970 Woodlands Pkwy., Vernon Hills, IL 60061, Tel: 312-634-6080, TELEX: 754427 GLEN UD, FAX: 312-634-9527; Empl.: 13; *Sls. Mgr.:* David Greenwood

GLEN MILLS INC., 203 Brookdale St., Maywood, NJ 07607, Tel: 201-845-4665, TELEX: 134 656, FAX: 201-487-8469; Empl.: 11; *Sls. Mgr.:* Stanley I. Goldberg

GLENRO, INC., 39 McBride Ave. Extension, Paterson, NJ 07501, Tel: 201-279-5900, 800-922-0106, FAX: 201-279-9103; Empl.: 50; *Sls. Mgr.:* Sterling Pitt

GLOBAL SPECIALTIES, Interplex Electronics, Inc., 70 Fulton Terrace, P.O. Box 1942, New Haven, CT 06509, Tel: 203-624-3103, FAX: 203-468-0060; Empl.: 70; *Sls. Mgr.:* Dan Marley

GLOBAL TECHNOLOGY INTERNATIONAL, INC., 917-134th Street S.W., Everett, WA 98204, Tel: 206-742-9111, ESYLNK: 759633, FAX: 206-743-7420; Empl.: 61; *Sls. Mgr.:* Ruskin A. Whaley, V.P. Sls. & Mktg.

GLOBE BATTERY DIV., See Johnson Controls, Globe Battery Div.

GLOBE MOTORS, 2275 Stanley Avenue, Dayton, OH 45404, Tel: 513-228-3171, TELEX: 288-224, TWX: 810-459-1642, FAX: 513-229-8531; Empl.: 580; *Sls. Mgr.:* Bill Pelfrey; *Dist. Mgr.:* Tom Coyle

GLOBE PLASTICS, 1342 S. Signal Dr., Pomona, CA 91766, Tel: 714-623-2747; FSC No.: 21071; Empl.: 23; *Sls. Mgr.:* J. R. Humphreys

Local Distributors

CA	Fremont, Alatec Prods.	408-279-8895
CA	N. Hollywood, Alatec Prods.	818-764-5600
NJ	Pine Brook, Alatec Prods.	201-227-8140
TX	Arlington, APX Plastics	817-275-3883

GLOBE UNION, See Johnson Controls, Globe Battery Div.

GM NAMEPLATE, INC., 2040 15th Ave. West, Seattle, WA 98119, Tel: 206-284-2200, FAX: 206-284-3705; Empl.: 340; *Sls. Mgr.:* Ed Westfall ..... **B•1819**

Local Sales Offices & Reps

AZ	Tempe, Elctrn. Dev. & Sls.	602-438-1547
CA	Orange, GM Nameplate	818-574-6960
CA	Redwood City, G. R. McKnight Co., Inc.	415-365-3703
CA	San Jose, GM Nameplate, Inc.	408-435-1666
CO	Loveland, GM Nameplate, Inc.	303-688-4154
GA	Atlanta, Electramark, Inc.	404-446-7915
FL	Deerfield Bch., Jack Krutek & Assocs.	305-427-4202
HI	Honolulu, Menehune Unltd.	808-737-3472
ID	Eagle, GM Nameplate	208-939-7202
IL	Elgin, Custom Engineered Parts, Inc.	312-741-8556
IN	Zionsville, Custom Engineered Parts, Inc.	317-873-5626
MI	Southfield, E & A Inds.	313-647-0330
MO	St. Louis, Halpin D. Burke & Son	314-968-2727
NH	Mont Vernon, GM Nameplate, Inc.	603-673-9737
NJ	Pitman, Colrud Corp.	609-589-5866
NJ	W. Caldwell, Grimm, Siegel Assocs.	201-575-9300
NC	Raleigh, Eastern Elctrns.	919-876-7591
OH	Akron, Augnat Assocs.	216-239-2499
OR	Eugene, Charles Huntington	503-726-1835
TX	Irving, Elctrn. Dev. & Sls.	214-929-8140
VA	Reston, Colrud Corp.	703-620-6612
WA	Bellevue, American Intl. Entprs.	206-455-4697
EXP	Singapore, S & T Entprs.	065-745-9235

GMR CO., 8801 Sepulveda Blvd., Los Angeles, CA 90045, Tel: 213-216-9516, TELEX: 499 2468; Empl.: 87; *Sls. Mgr.:* Harvey Mushman

GNB INCORPORATED, 2010 Cabot Blvd. W., Langhorne, PA 19047, Tel: 215-750-2600, TELEX: 4761219 GNBLAHN

GPE

FAX: 714-993-6023

GOLDEN PACIFIC ELECTRONICS, INC, 560 S. Melrose St., Placentia, CA 92670, Tel: 714-993-6970; Empl.: 15; *Sls. Mgr.:* Pat Waldron ..... **D•1029, 1467, 1744**

Local Sales Offices & Reps

CA	Garden Grove, ELSCO Elctrns	714-891-4621
CA	Norwalk, Ed Rivers Assocs.	213-868-1471
CA	San Jose, Applied Eltcrns Mktg	408-971-9377
CO	Longmont, Butler Tech. Sls.	303-651-7703
IL	Arlington Heights, M.J. Peterson & Assocs.	312-577-8220
NH	Londonderry, Bennetron	603-432-9092
NJ	Wayne, Breen Assocs	201-696-8683
NY	Syracuse, Northeastern Elctrns., Inc.	315-455-7561
OR	Beaverton, Core II Mktg	503-641-0877
UT	Bountiful, Duven Assocs	801-295-0353

GOOD-ALL ELECTRIC, INC., 3725 Canal Drive, Fort Collins, CO 80524, Tel: 303-484-3080, 800-826-7891, TWX: 910-930-9015, FAX: 303-484-8649; FSC No.: 22096; Empl.: 100; *Sls. Mgr.:* David J. Wilkening

GOODNIGHT SYSTEMS, 18523 Collins, Ste. 4, Tarzana, CA 91356, Tel: 818-703-1524; *Sls. Mgr.:* Jim Goodnight

GORDON CO., 5710 Kenosha St., Richmond, IL 60071, Tel: 815-678-2211, TELEX: 72-2427; Empl.: 260

GORDON, L., PACKAGING, 1050 S. Paca St., Baltimore, MD 21230, Tel: 301-539-6537; Empl.: 150

GORDON PRODUCTS, 67 Del Mar Dr., Brookfield, CT 06804, Tel: 203-775-4501; Empl.: 45; *Sls. Mgr.:* Leon Najman; *Dist. Mgr.:* Leon Najman

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Local Sales Offices & Reps

CA	Milpitas, Maxim Elctrns. Sls.	408-946-6001
CA	Westminster, West Elctrn. Sls.	213-493-5569
CO	Arvada, Gemini Elctrns.	303-428-5600
CT	Woodbury, Anacon Sls. Assocs.	203-266-0707
FL	Tampa, Florida Comp. Sls., Inc.	813-960-7044
IL	Schaumburg, Martan, Inc.	312-303-5660
IN	Indianapolis, Hi-Tek Sls.	317-887-2564
IA	Marion, Ensco Reps., Inc.	319-377-8551
KS	Countryside, Ensco Reps., Inc.	913-384-0840
KS	Wichita, Ensco Reps., Inc.	316-683-1070
MD	Glen Burnie, Tri-Mark	301-761-6000
MA	Wilmington, Anacon Sls. Assocs.	617-270-3712
MO	Maryland Hgts., Ensco Reps., Inc.	314-423-3935
NJ	Budd Lake, Guido Assocs.	201-347-4643
NJ	Lawrenceville, D.V.S. Co.	609-896-1112
NM	Albuquerque, Syntech	505-266-7951
NY	Pittsford, Noeth-Honsinger Assocs.	716-586-9002
NC	Silver City, Crossroads Elctrn. Assocs.	919-742-2372
OH	Centerville, Omega Sls., Inc.	513-434-5507
OH	Shaker Hgts., Omega Sls., Inc.	513-434-5507
OK	Tulsa, Advanced Tech. Sls.	918-664-0482
TX	Austin, Advanced Tech. Sls.	512-225-6304
TX	Dallas, Advanced Tech. Sls.	214-340-1300
TX	Houston, Advanced Tech. Sls.	613-440-3888
WA	Bellevue, Venture Elctrns., Inc.	206-454-4594
WI	Grafton, Martan, Inc.	414-377-6640

GORDOS CORPORATION, A Flint Industries Company, 1000 N. Second St., P.O. Box 824, Rogers, AR 72757, Tel: 501-636-5000, TWX: 910-720-7998, FAX: 501-636-2305 ..... **A•1736; B•1452-1463**

Local Sales Offices & Reps

CA	Costa Mesa, Jim Pancake	714-751-6760
CA	Milpitas, Maxim Elctrn. Sls.	408-946-6001
CA	San Diego, West Elctrn. Sls. Co.	619-233-0236
CA	Westminster, West Elctrn. Sls. Co.	213-493-5569
CO	Arvada, Gemini Elctrns.	303-428-5600
CT	Woodbury, Anacon Sls. Assocs.	203-266-0707
FL	Deerfield Bch., Florida Comps., Inc.	305-429-1758
FL	Tampa, Florida Comps., Inc.	813-960-7044
IL	Schaumberg, Martan, Inc.	312-303-5660
IN	Indianapolis, Hy-Tek Sls. Co.	317-887-2564
MD	Glen Burnie, Tri-Mark	301-761-6000
MA	Wilmington, Anacon Sls. Assocs.	617-270-3712
MI	Troy, Pyramid Integrated Control Sys.	313-362-5375
MO	Maryland Hgts., Ensco Rep, Inc.	314-423-3935
NJ	Budd Lake, Guido Assocs.	201-347-4643
NJ	Lawrenceville, DVS Co.	609-896-1112
NY	Pittsford, Noeth-Honsinger	716-586-9002
NC	Silver City, Crossroads Elctrn. Assocs.	919-742-2372
OH	Centerville (Dayton), Omega Sls., Inc.	513-434-5507
OH	Shaker Hgts., Omega Sls., Inc.	216-751-9600
OK	Tulsa, Advanced Tech. Sls.	918-664-0482
OR	Beaverton, Venture Elctrns., Inc.	503-626-7418
TX	Austin, Advanced Tech. Sls.	512-331-9979
TX	Dallas, Advanced Tech. Sls.	214-340-1300
TX	Houston, Advanced Tech. Sls.	613-440-3888
WA	Bellevue, Venture Elctrns., Inc.	206-454-4594
WI	Grafton, Martan, Inc.	414-337-6640
WI	Milwaukee, Bill Swanson	414-543-2727
EXP	AZ/Rogers, Gordos	501-636-5000

Local Distributors

AL	Auburn, Interstate Elctrl. Supp.	205-821-3341
AL	Birmingham, Sesco	205-988-8304
AL	Montgomery, Control Comps.	205-264-3325
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CA Anaheim, Control Design 213-821-1516
CA Anaheim, Time Elctrns. 714-937-0911
CA Chatsworth, Time Elctrns. 818-998-7200
CA Hayward, Kea Elctrns. 415-887-2900
CA Irvine, Future 714-250-4141
CA Irvine, Integrated Elctrns. 714-837-9960
CA Los Angeles, Control Design 213-802-1371
CA Los Angeles, Elec. Switches 213-660-1310
CA Riverside, Elctrn. Supp. 714-683-7300
CA Sacramento, Integrated Elctrns. 916-424-5299
CA San Carlos, Control Design 415-592-4808
CA San Diego, Elctrn. Supp. 619-693-8222
CA San Diego, Time Elctrns. 619-586-1331
CA San Francisco, Control Design 408-996-9197
CA San Jose, Future 408-434-1114
CA San Jose, Integrated Elctrns. 408-435-1000
CA Santa Ana, Ben-Dec 714-545-3968
CA Santa Clara, Future 408-748-8550
CA Sunnyvale, Time Elctrns. 408-734-9888
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CO Denver, Bell 303-424-1985
CO Denver, Integrated Elctrns. 303-292-6121
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CO Westminster, Future 303-650-0123
CT Bethel, Future Elctrns. 203-743-9594
CT Cheshire, Time Elctrns. 203-271-3200
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FL Clearwater, Future 813-578-2770
FL Ft. Lauderdale, Control Design 305-782-1388
FL Ft. Lauderdale, Hammond 305-973-7103
FL Ft. Lauderdale, Time Elctrns. 305-974-4800
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FL Miami, Sesco 305-832-0770
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FL Orlando, Hammond 305-849-6060
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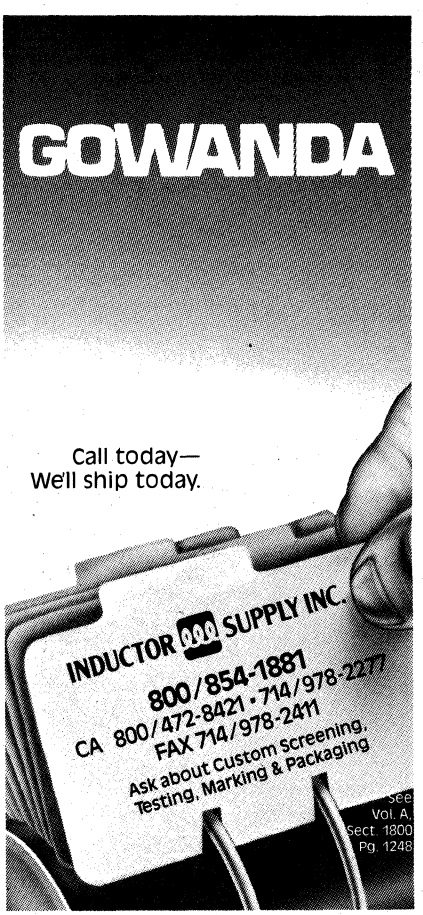

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MN Bloomington, Time Elctrns. 612-944-9192
MN Eden Prairie, Future 612-944-2200
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MN Minneapolis, Newark Elctrns. 612-331-6350
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MO St. Louis, Control Design 314-426-3150
MO St. Louis, Future 314-537-0688
MO St. Louis, L Comp 314-291-6200
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NJ Mt. Laurel, Future 609-778-7600
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NY Buffalo, Summitt 716-884-3450
NY Hauppauge, Future 516-234-4000
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NY Rochester, Summitt 716-334-8110
NY Syracuse, Future 315-432-1355
NY Syracuse, Time Elctrns. 315-432-1355
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NC Charlotte, Future 704-529-5500
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NC Raleigh, Sesco 919-467-7482
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PA Malvern, Control Design 215-296-0150
PA Newton Sq., QDI 215-359-1000
PA Philadelphia, Future 609-778-7600
PA Willow Grove, Resco Elctrns. 215-659-4575
SC Greenville, Ensco (Hammon) 803-233-4121
SC Greenville, Sesco 803-297-8306
SC Spartanburg, Roberts Elec. Supp. Inc. 803-574-0350
TN Hixson, Techni-Tronics 615-842-0514
TN Knoxville, B&K Sls. 615-584-2255
TN Knoxville, Sesco 615-588-5455
TN Nashville, AA Elec. 615-832-6632
TX Austin, Sesco 512-892-2490
TX Carrollton, Time Elctrns. 214-241-7441
TX Dallas, Control Design 214-358-1441
TX Dallas, Newark Elctrns. 214-340-3585
TX Dallas, Sesco 214-231-9364
TX Houston, GEA of TX 713-781-3005
TX Houston, Newark Elctrns. 713-782-4800
TX Houston, Sesco 713-999-3510
TX Houston, Time Elctrns. 713-530-0800
TX Richardson, Future 214-437-2437
TX Richardson, Jaco 214-235-9575
UT N. Salt Lake City, Integrated Elctrns. 801-298-1869
UT Salt Lake City, Bell Inds. 801-972-6969
UT Salt Lake City, Future 801-972-8489
UT Salt Lake City, Time Elctrns. 801-973-8181
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VA Roanoke, Virginia Control Equip. Co. 703-342-6927
WA Bellevue, Bell 206-747-1515
WA Bellevue, Cascade Data Mktg. 206-747-6190
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WA Bellevue, Integrated Elctrns. 206-455-2727
WA Bellevue, Time Elctrns. 206-641-3640
WA Redmond, Time Elctrns. 206-882-1600
WI Milwaukee, Indl. Elctrns. 414-276-1212
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GOULD INC., Meas. Sys. Div., 2230 Statham Blvd., Oxnard, CA 93030, Tel: 805-487-8511, TELEX: 65-9223; Empl.: 500

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GOULD INC., Test and Measurement, 3631 Perkins Avenue, Cleveland, OH 44114, Tel: 216-361-3315, TELEX: 196113GLD RS UT; FSC No.: 96795; Empl.: 550

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CA San Diego, Earle & Assocs. 619-278-5441
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CA Westminster, West Elctrn. Sls. 714-898-1646
CO Westminster, Western Region Mktg. .. 303-430-8883
FL Longwood, NSL Assocs. 305-629-5226
GA Atlanta, L & D, Inc. 404-395-7079
IL Niles, W. F. Hamilton Co. 312-965-8757
IA Cedar Rapids, Snider Sls. Co. 319-362-4410
KS Overland Park, Barnes MidWest Sls. .. 913-469-9688
MA Reading, Lincoln Assocs. 617-664-4434
MI Southfield, Fred H. Gehrke & Assocs. 313-559-5363
MN Chanhassen, Barnes Sls. Assocs. 612-934-2907
NJ Whippany, Robert Smith Assocs. 201-540-0204
NY Morrisville, Naylor Electric 315-684-9620
NY Plainview, Robert Smith Assocs. 516-681-3155
NC Raleigh, L & D, Inc. 919-876-5301
OH Cincinnati, Stegman Blaine Mktg. 513-729-1969
OH Cleveland, Stegman Blaine Mktg. 216-572-0003
PA Exton, Linear Sls. 215-524-8080
TX Dallas, Scanlon, Hughes & Assocs. ... 214-739-2888
WA Olympia, Bergford & Assocs. 206-866-2001
Can St. Laurent, Componetics 514-334-1464

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CA Huntington Beach, Inductor Supp. 714-891-4524
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CT Bridgeport, Park Distributors 203-366-7200
MN Chanhassen, G&F Distribution 612-934-2907
NY Hauppauge, Broadline Electric 516-231-4100

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FAX: 914-631-0862

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GA Atlanta, Metermaster 404-446-0166
IL Chicago, Metermaster 312-593-8650
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MA Boston, Calibron 617-894-6440
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NY Great Neck, Instr. Mart Inc. 516-487-7430
OH Cleveland, Metermaster 216-651-4100
TX Dallas, Metermaster 214-271-5671

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GRASSLIN CONTROLS CORP., Dieter Grasslin Feinwerktechnik, 45 Spear Rd., Ramsey, NJ 07446, Tel: 201-825-9696, TELEX: 4949211, FAX: 201-825-8694; Empl.: 5

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IN Ft. Wayne, Menze Sls. 219-747-5616
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KS Overland Pk., Spectrum Sls. 913-648-6811
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NY Wappingers Falls, Bob Dean, Inc. 914-297-6406
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NC Raleigh, R. W. Chapman 919-782-2624
OH Cleveland, A. H. Baier Co. & Assocs. .. 216-461-6161
OH Dayton, A. H. Baier Co. & Assocs. 513-276-4128
OR Tigard, Eltech, Inc. 503-684-3458
PA Pittsburgh, Covert & Newman Co. 412-531-2002
SC Greenville, Robert W. Chapman & Co. 803-288-8821
TN Jefferson City, Rep, Inc. 615-475-9012
TX Austin, W. Pat Fralia Co. 512-835-7911
TX Euless, W. Pat Fralia Co. 817-267-3577
TX Houston, W. Pat Fralia Co. 713-772-1572
UT Salt Lake City, Lindberg Co. 801-277-2643
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WI Mequon, Badgerep 414-241-9200
Can Pickering, Ont., A. C. Simmonds & Sons Ltd. 416-839-8041

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CA Riverside, Electronic Supp. 714-683-7300
CA San Diego, Electronic Supply 619-693-8222
CA San Diego, Harper S.I.D. 619-578-2500
CA San Diego, Richey/Western Electrns. 619-271-4511
CA San Jose, Powell Elctrns. 408-943-9020
CA Santa Clara, Cypress Elctrns. 408-980-2500
CA Santa Clara, Richey/Western Electrns. 408-432-7100
CA Santa Monica, Master Distributors 213-452-1229
CA Sunnyvale, Harper SID 408-747-0333
CO Denver, CSID, Inc. 303-292-9594
CO Denver, Newark Elctrns. 303-757-3351
CO Englewood, Industrial Elctrns. 303-694-9444
CO Englewood, Shelley Ragon, Inc. 303-762-0670
CT Wallingford, Midan Elctrns. 203-265-2077
CT Wallingford, Sager 203-265-4600
FL Ft. Lauderdale, Hammond Elctrns. 305-973-7103
FL Orlando, Hammond Elctrns., Inc. 305-849-6060
FL Pompano Beach, Peerless Radio 305-973-4141
GA Norcross, Hammond Elctrns., Inc. 404-449-1996
GA Norcross, Pioneer/Georgia 404-448-1711
HI Honolulu, Precision Radio 808-537-5291
IL Chicago, Newark Elctrns. 312-784-5100
IL Chicago, NEP Elctrns. 312-625-8400
IL Chicago, Waldom Elctrns. 312-585-1212
IL Elk Grove, GBL Goold 312-593-3220
IL Northbrook, Classic Comp. Supp. 312-272-9650
IL Palatine, Ohm Elctrn. 312-359-5500
IL Peoria, Klaus Radio 309-691-4840
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IN Fort Wayne, Bell Inds./Graham Div. 219-423-3422
IN Indianapolis, Bell Ind./Graham Div. 317-875-8200
IN Indianapolis, PEI/Genesis 317-637-5571
IA Cedar Rapids, Advent Elctrns. 319-332-8407
IA Cedar Rapids, Dee Elctrns., Inc. 319-365-7551
MD Baltimore, Rescoe/Baltimore 301-529-0500
MD Columbia, Powell Elctrns. 301-621-8080
MD Gaithersburg, Pioneer/Wash. 301-921-0660
MD Jessup, Treeko S/S, Inc. 301-792-0112
MD Kensington, Marine Air Supp. 301-949-9560
MA Hingham, Sager Elctrns. 617-749-6700
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MI Livonia, R.S. Elctrns. 313-525-1155
MI Oak Park, Newark/Detroit Elctrns. 313-967-0600
MI St. Clair Shores, Spemco 313-771-2700
MN Minneapolis, Newark Elec. 612-331-6350
MN St. Paul, Gopher Elctrns. 612-483-3322
MO Kansas City, LComp, Inc. 816-221-2400
MO Maryland Hgts., LComp, Inc. 314-291-6200
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NM Albuquerque, Walker Elctrn. Supp. 505-883-2992
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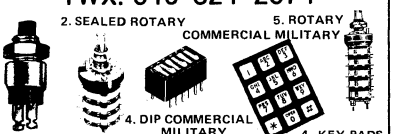

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MA	Burlington, Omni-Rep	617-245-4511
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MO	St. Louis, Abrams & Assocs.	314-569-0447
NJ	Ho-Ho-Kus, D. J. Fisher Co., Inc.	201-652-0090
OH	Rocky River, Norm Case Assocs.	216-333-0400
RI	Cumberland, Omni-Rep	401-333-2353
TX	Irving, Elctrn. Dev. & Sls.	214-570-5122
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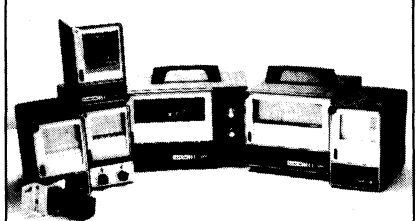

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HARTMAN SYSTEMS, Figgie Intl, 360 Wolf Hill Rd., Huntington Sta., NY 11746, Tel: 516-427-7500, TWX: 510-226-6982; FSC No.: 92220; Empl.: 310; *Sls. Mgr.:* Robert Griffith

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HASCO COMPONENTS, INC., 247-40 Jericho Tpke., Bellrose Village, NY 11001, Tel: 516-328-9292, TWX: 710-582-5750, FAX: 516-326-9125; Empl.: 30; *Sls. Mgr.:* Tab Hauser ..... **B•1468-1476, 1723**

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HAYDON SWITCH & INSTRUMENT, 1500 Meriden Rd., P.O. Box 3329, Waterbury, CT 06705, Tel: 203-756-7441, TELEX: 643852 - HSIINTLWBY; FSC No.: 02005; Empl.: 350; *Sls. Mgr.:* Christopher Bertellotti

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HECON CORP., 31 Park Rd., Tinton Falls, NJ 07724, Tel: 201-542-9200, TELEX: 13-2457; Empl.: 200; *Sls. Mgr.:* P. Shine; *Dist. Mgr.:* R. Drum

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IN Elkhart, La Vanture Prods. Co. 219-264-0658
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MA Newton, In-Stock Prods. 617-964-6200
MN St. Paul, Arden Fasteners 612-483-6681
MO St. Louis, Engrd. Fastener Co. 314-434-2888
NJ Manasquan, Kulka-Smith Inc. 201-223-9400
NY Amityville, Yorkville Inds. Inc. 516-225-2100
OK Oklahoma City, Wesco 405-232-5521
TN Nashville, Arden Fasteners 615-889-7043
TX Houston, Rainbow 713-957-0500
WI Waukesha, Cable Comps. 800-558-4388

HGA ELECTRONICS, 519 S. Fifth Ave., Mt. Vernon, NY 10550, Tel: 914-664-5393; Empl.: 2

HH CONTROLS CO., INC., 16 Frost St., Arlington, MA 02174, Tel: 617-646-2626; Empl.: 13

HHK IND., Telan Int., Rte. 611, P. O. Box 690, Plumsteadville, PA 18949, Tel: 215-766-0990; *Sls. Mgr.:* Fred Yodis; *Dist. Mgr.:* Fred Yodis

HICKOK ELECTRIC INSTRUMENT, 10514 DuPont Ave., Cleveland, OH 44108, Tel: 216-541-8060; Empl.: 450; *Sls. Mgr.:* Norm Holliday; *Dist. Mgr.:* Jeff Snider

HICO HORIZONS INTL. CO., See Maxon Precision Motors

HI-G COMPANY, A Subsidiary of Nytronics Inc., 101 Locust St., Hartford, CT 06114, Tel: 203-522-8600, TELEX: 643394, TWX: 710-425-1379, FAX: 203-524-8540; FSC No.: 02289; Empl.: 550; *Sls. Mgr.:* J. Parsons ..... **B•1478-1493**

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AL Huntsville, 20th Century Mktg. 205-533-9281
AZ Phoenix, Westrep 602-997-8899
CA Anaheim, Westrep 213-404-3881
CA San Diego, Westrep 619-566-6580
CA Santa Clara, Westrep 408-988-8833
CO Englewood, Omega 303-762-1921
CT Bloomfield, Friedman Sls. 203-243-3122
FL Longwood, Beacon 305-647-3498
GA Norcross, 20th Century Mkt. 404-446-1999
IL Highland Park, Bransky Sls. 312-433-2375
IN Fort Wayne, TX Sls. 219-489-4447
IA Cedar Rapids, Pattison Sls. 319-395-9866
KS Olathe, Advanced Tech. Sls. 913-782-8702
MD Monkton, Imagitron Sls. Co. 301-374-5600
MA Woburn, Friedman Sls. 617-459-7399
MI Ann Arbor, Jordan-Elliott Inc. 313-662-4087
MN St. Paul, Repco 612-642-2828
MO St. Louis, Advanced Tech. Sls. 314-878-2921
NE Omaha, Pattison Sls. 402-895-4431
NJ Wayne, Astrorep 201-696-8200
NY Babylon, Astrorep 516-422-2500
NY E. Rochester, Tri-Tech Elctrns. 716-385-6500
NC Gary, 20th Century Mkt. 919-481-3370
OH Miamisburg, Elctrns. Comps., Inc. 513-866-3340
OK Tulsa, Bonser-Philhower Sls. 918-744-9964
OR Lake Oswego, RTS 503-244-4123
PA Maple Glen, Imagitron Sls. Co. 215-540-9122
TN Knoxville, 20th Century Mkt. 615-966-2099
TX Richardson, Bonser - Philhower Sls. .. 214-234-8438
WA Vashon, RTS 206-285-1363
WI Cedarburg, Bransky Sls. 414-377-6837
Can Downsview, Ont., Designtronics 416-747-1171

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AL Huntsville, Hallmark Elctrns. 205-837-8700
AZ Phoenix, Hallmark Elctrns. 602-437-1200
AR Little Rock, Electro Entprs. 501-562-6936
CA Buena Pk., Cypress Elctrns. 213-744-0355
CA Canoga Park, Hall-Mark Elctrns. 818-716-7300
CA Citrus Hgts., Hall-Mark Elctrns. 916-722-8600
CA Irvine, Integrated Elctrns. 714-660-1055
CA San Diego, Hallmark Elctrns. 714-268-1201
CA San Jose, Cypress Elctrns. 408-945-8400
CA San Jose, Hall-Mark Elctrns. 408-946-0900
CA Santa Ana, Norstan Elctrns. 714-250-4903
CA Torrance, Hall-Mark Elctrns. 213-217-8400
CA Tustin, Hallmark Elctrns. 714-359-0330
CO Denver, Integrated Elctrns. 303-292-6121
CO Englewood, Hallmark Elctrns. 303-790-1662
CT Wallingford, Hallmark Elctrns. 203-269-0100
FL Clearwater, Hallmark Elctrns. 305-530-4543
FL Orlando, Hallmark Elctrns. 305-855-4020
FL Pompano, Hallmark Elctrns. 305-971-9280
GA Norcross, Hallmark Elctrns. 404-447-8000
IL Northbrook, Classic Comps. 312-272-9650
IL Wood Dale, Hallmark Elctrns. 312-860-3800
IN Indianapolis, Hallmark Elctrns. 317-876-7165
KS Lenexa, Hallmark Elctrns. 913-888-4747
KS Wichita, Lee Prods. 316-264-2172
MD Columbia, Hallmark Elctrns. 301-988-9800
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MO Maryland Heights, Hallmark Elctrns. ... 314-291-5350
NJ Clifton, Vantage Comps. 201-777-4100
NJ Fairfield, Hallmark Elctrns. 201-575-4415
NJ Mt. Laurel, Hallmark Elctrns. 609-235-1900
NJ Oakland, Relay Specialties 201-337-1000
NY Commack, Vantage Comps. 516-543-2000
NY Hauppauge, Jaco Elctrns. 516-273-5500
NY Hauppauge, Sherburn Elctrns. 516-231-4300
NY Ron Kon Koma, Hallmark Elctrns. 516-737-0600
NC Raleigh, Hallmark Elctrns. 919-872-0902
OH Solon, Hallmark Elctrns. 216-349-4632
OH Worthington, Hallmark Elctrns. 614-888-3313
OK Oklahoma City, Electro Entprs. 405-427-6591
OK Tulsa, Hallmark Elctrns. 918-665-3200
OR Beaverton, Integrated Elctrns. 503-641-1690
TX Austin, Hallmark Elctrns. 512-258-8848
TX Dallas, Hallmark Elctrns. 214-553-4300
TX Houston, Hallmark Elctrns. 713-781-6100
UT West Valley City, Hall-Mark Elctrns. ... 801-972-1008
WA Bellevue, Integrated Elctrns. 206-455-2727
WI New Berlin, Classic Comps. 414-786-5300
Can Pointe Claire, Future 514-694-7710

HIGH ENERGY, Inductotherm Industries, Lower Valley Rd., Parkesburg, PA 19365, Tel: 215-593-2800, TELEX: 759888, TWX: 510-0663-0332; Empl.: 100

HIGHLAND TECHNOLOGY, INC., 320 Judah Street, San Francisco, CA 94122, Tel: 415-753-5814

HIGH REL BURN-IN, Riverside Assoc. Inc., 1710 Ringwood Ave., San Jose, CA 95131, Tel: 408-437-0300, FAX: 408-437-1918; FSC No.: 4Y548; Empl.: 30; *Sls. Mgr.:* Beth Pagano

HIGH TECHNOLOGY SENSORS, INC., 262 E. Hornbeam Dr., Longwood, FL 32779, Tel: 305-423-1755; Empl.: 7; *Sls. Mgr.:* R. M. Mindock

HIGH VOLTAGE ENGRG. CORP., S. Bedford St., Burlington, MA 01803, Tel: 617-272-1313, TWX: 710-332-0245; Empl.: 750

HIGH VOLTAGE TECHNOLOGY INC., 127 Hillcrest Ave.:P.O. Box 437, Yonkers, NY 10705, Tel: 914-423-6636, TELEX: 4998104, FAX: 914-779-8731; *Sls. Mgr.:* Pete Gonzalez

HILEVEL TECHNOLOGY, 31 Technology Drive, Irvine, CA 92718, Tel: 714-727-2100, TELEX: 655316, FAX: 714-727-2101; Empl.: 82; *Sls. Mgr.:* Richard Condon

HILTON INDUSTRIES, INC., Subsidiary of Core Industries, 1177 Cattlemen Road, Sarasota, FL 34232, Tel: 813-371-2600, TWX: 810-864-4363, FAX: 813-371-7750; Empl.: 137; *Sls. Mgr.:* F. Moloney; *Dist. Mgr.:* F. Moloney

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MA Natick, 3H Inds. 617-532-5660
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HIPOTRONICS INC., P.O. Drawer A, Brewster, NY 10509, Tel: 914-279-8091; FSC No.: 25284; Empl.: 200; *Sls. Mgr.:* Robert Schlesinger ..... **A•2236-2238; D•1262-1265, 1750-1751, 2114-2116**

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CA San Dimas, RDX Corp. 714-599-0985
CA Sunnyvale, RDX Corp. 408-734-4500
CO Parker, Equal Elec. Inc. 303-841-8982
CT Branford, Abbott Allison Co. 203-481-0405
FL Daytona Bch. Shores, W. Rihm Assocs. 904-761-7130
GA Griffin, Hipotronics 404-228-9222
HI Honolulu, B. F. Wittenberg 808-833-1602
IL Hawthorne Woods, Ryan & Assocs. ... 312-438-2905
MO St. Louis, Fitzgerald Sls. Co. 314-862-1660
MN Edina, Ainslie Co. 612-920-2996
NJ Union, Friedman Assocs., Inc. 201-964-6200
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PA Downingtown, Kenn Ebert-Hipotronics 215-269-5898
UT Salt Lake City, Riter Engrg. Co. 801-973-9063
WA Redmond, Gore Elec. Co. 206-883-4505
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Can Weston, Ont., U-Tek Svcs. & Supp. 416-747-1879

HI-Q CRYSTALS, Hybrids International Ltd., 311 N. Lindenwood Dr., Olathe, KS 66062, Tel: 913-764-4544, TWX: 910-743-0029, FAX: 913-764-6400; Empl.: 18; *Sls. Mgr.:* Abdul Ghafoor ..... **A•1478**

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HIRAM JONES ELECTRONICS, 11607 Vanowen St., No. Hollywood, CA 91605, Tel: 213-875-0213; FSC No.: 04867; Empl.: 8 ..... **C•1376-1379**

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TX Houston, Lenert Co. 713-225-1465

HIROSE ELECTRIC U.S.A., INC. (HRS), Div. of Hirose Electric Co. Ltd. (Japan), 9254 Deering Avenue, Chatsworth, CA 91311, Tel: 818-709-1247, FAX: 818-341-4158; Empl.: 25 (USA), 720 (Japan); *Sls. Mgr.:* Jim Erickson

Hirschmann

FAX: 201-835-8354

RICHARD HIRSCHMANN OF AMERICA INC., Industrial Row, P.O. Box 229, Riverdale, NJ 07457, Tel: 201-835-5002, TELEX: 133576; *Sls. Mgr.:* C. Patten ..... **C•1380-1383**

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OH Highland Hgts., Major Electronix Corp. 216-461-2100
PA Bristol, AIM Elctrns. 215-785-3500
TX Richardson, Centurion Mktg. 214-783-6762

HISONIC, INC., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061, Tel: 913-782-0012, TELEX: 4-2562, ESYLNK: 62829955, FAX: 913-782-0562; FSC No.: 11402; Empl.: 140; *Sls. Mgr.:* W. S. Bonebright ..... **A•2239**

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FL Ft. Lauderdale, MacKay, Smith & Assocs. 305-467-3888
FL Madeira Beach, MacKay, Smith & Assocs. 813-393-7144
FL Orlando, MacKay, Smith & Assocs. ... 305-277-1513
FL St. Petersburg, MacKay, Smith & Assocs. 813-393-7144
GA Atlanta, MacKay, Smith & Assocs. 404-449-7444
KS Shawnee Mission, Florence & Meyer 913-722-5210
MO St. Louis, Florence & Meyer 913-722-5210
NC Raleigh, MacKay, Smith & Assocs. 919-847-2277
TX Houston, AID Elctrns. 713-777-3882
TX Irving, AID Elctrns. 214-259-4761

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HI-TECH, INC., 3600 16th St., Zion, IL 60099, Tel: 312-746-2447; Empl.: 35; *Sls. Mgr.:* Sue Lawson ..... **C•1669**

Local Sales Offices & Reps
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AR Fort Smith, Electro-Related Prods. 501-452-4030
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MA Lynn, Maher Assocs. 617-581-3244
MI Sheridan, MacDougall and Assocs. ... 517-291-3334
MN Minneapolis, Elec. Comp. Sls. 612-933-2594
MO Florrisant, Delltron Co., Inc. 314-839-0033
NJ Rochelle Pk., Maher Assocs. 201-587-1354
NC Fairview, Maher Assocs. 704-628-2191
OH Seven Hills, Nenadal Entprs. 216-524-4293
TN Chattanooga, Wade Prods. Co. 615-266-2262
WA Spokane, Cripe Co. 509-448-5349

HITEMP TECHNOLOGIES, INC., 118 Charcot Ave., San Jose, CA 95131-1101, Tel: 408-922-0740, FAX: 408-922-0534; Empl.: 10; *Sls. Mgr.:* JoAnn Ricci

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FAX: 201-782-9733

HITRAN CORP., Agex, 362 Highway 31, Flemington, NJ 08822-9301, Tel: 201-782-5525; FSC No.: 27672; Empl.: 120; *Sls. Mgr.:* Karl Newquist ..... **A•2240; D•1753, 2118-2119**

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ID Boise, Calvert Controls 208-345-3082
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LA Metairie, RAPCO Assocs., Inc. 504-887-9500,
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NC Charlotte, Servicon Sls. Corp. 704-525-4800,
OH Broadview Hgts., MC, Inc. 216-526-6511,
OR Eugene, Calvert Controls 503-683-2018
OR Portland, Calvert Controls 503-236-1358
PA Fort Washington, Hostvedt-Pavoni, Inc. 215-643-5757
PA Pittsburgh, Greye Glass Assocs. 412-366-6664
UT Salt Lake City, Calvert Controls 801-531-8129
WA Seattle, Calvert Controls 206-251-6135
WA Spokane, Calvert Controls 509-244-3601
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WI Brookfield, Kirchmayer-Seidel 414-781-5469

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PA Huntingdon Valley, Valley Power Inc .. 215-443-7000
RI Providence, WALCO Elec. Co. 401-467-6500,

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HOBART ENGINEERING, 4143 Cheshire Dr., Cypress, CA 90630, Tel: 714-827-2135; *Sls. Mgr.:* D. C. Hobart

HOBSON BROS., 4940 W. Lawrence Ave., Chicago, IL 60630-3884, Tel: 312-283-3600, FAX: 312-283-3606; Empl.: 75; *Sls. Mgr.:* Betty Maager

HODGE MANUFACTURING CO., INC., 55 Fisk Ave., Springfield, MA 01107, Tel: 413-781-6800, TWX: 710-350-7583, FAX: 413-733-6573

HOFFMAN, P. R., CO., MATERIALS PROCESSING DIV., Spreckels Industries Inc., 321 Cherry St., Carlisle, PA 17013, Tel: 717-243-2011, TWX: 510-650-2285, FAX: 717-243-1672; Empl.: 125; *Sls. Mgr.:* Lee Kingsborough

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HOFFMAN PRODUCTS, Premier Industrial Corp., 170 Allen Blvd., Farmingdale, NY 11735, Tel: 516-293-5244, TELEX: 14-4578; Empl.: 30; *Sls. Mgr.:* Neil DeMaria; *Dist. Mgr.:* J. Dunnells

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HOLLIS ENGRG., INC., Charron Ave., Box 1189, Nashua, NH 03061, Tel: 603-889-1121, TWX: 710-228-1881; Empl.: 121; *Sls. Mgr.:* R. Abercrombie

HOLLIS ENGRG./WIRE-WRAP, 15 Charron Ave., Nashua, NH 03061, Tel: 603-889-1121, TELEX: 710-2281881; Empl.: 250; *Sls. Mgr.:* Gary Barrett

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HOLMBERG ELCTRNS., Asheville Hwy., Inman, SC 29349, Tel: 803-472-4141, TWX: 810-690-2302; Empl.: 300; *Sls. Mgr.:* Kerry Holmberg ..... **C•1385-1387**

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OH Dayton, JFCO, Inc. 513-890-8322
OR Beaverton, Eclipse Mktg. Grp. 503-642-1661
PA Philadelphia, Check Assocs. 215-487-3007
PA Pittsburgh, JFCO, Inc. 412-823-5400
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TX Dallas, Erickson Sls., Inc. 214-739-5833
TX Houston, Erickson Sls., Inc. 713-266-1604
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VA Herndon, Stinson Assocs. 703-620-0088
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Can Burlington, Ont., White Radio Ltd. 416-632-6894

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GA Atlanta, K.S.M. Elctrns. 404-458-2013
GA Marietta, Deanco 404-429-0126
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IL Lisle, Components, Inc. 312-852-7707
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MD Gaithersburg, Deanco 301-948-5444
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NY Mt. Vernon, QAR Indl. Elctrn. Sls., Inc. 914-699-2224
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NC Raleigh, Deanco 919-851-2065
OH Dayton, Televox, Inc. 513-454-1225
OR Beaverton, Murphy Elctrns. 503-642-2001
OR Lake Oswego, Bell Inds. 503-241-4115
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PA Norristown, Century Elctrn. Comps. ... 215-631-5400
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TX Dallas, Texas Connector Corp. 214-484-7508
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EXP Irvine, CA, Product Supp. Co. 714-250-0622
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IL Downers Grove, Mornak Sls. 312-936-6400
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MD Baltimore, Tyler Griffin Co. EN9-4821
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HYTEK MICROSYSTEMS, 980 University Ave., Los Gatos, CA 95030, Tel: 408-395-2300, TWX: 910-597-5393; FSC No.: 57474; Empl.: 300; *Sls. Mgr.:* Greg Kizik; *Dist. Mgr.:* Richard Fryhoff

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CT Wallingford, Midstate Elctrns. 203-265-9900
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TX Irving, Cable & Connector Warehouse 800-232-5875
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CA Santa Clara, Ross Mktg. Assocs. 408-988-8111
CA Sherman Oaks, Wes-K Assoc., Inc. 818-990-1302
CO Denver, Elcom, Inc. 303-337-2300
FL Boca Raton, Sls. Specialties 305-395-5371
FL Plant City, Sls. Specialists 813-754-1329
FL Temple Terrace, Sls. Specialists 813-988-0561
IL Mt. Prospect, Magnuson & Assocs. ... 312-956-0700
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KS Wichita, Thunderbird Tech. Sls. 316-684-3941
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MN Minneapolis, Magnuson Assocs. 612-521-1235
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NY Syracuse, Ossman Comp. Sls. Corp. .. 315-437-7052
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OH Cleveland, Norm Case & Assocs. 216-333-0400
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PA Philadelphia, Kenneth B. Erdman Co. 215-224-1833
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TX Richardson, Barry Sls., Inc. 214-234-0255
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CA Canoga Pk., Tim-Co Comp. Sls. 818-992-5040
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CT Bridgeport, Park Distrs., Inc. 203-366-7200
FL Clearwater, Lynch Gentry Assocs. 813-433-2697
IL Mt.Prospect, Magnuson & Assocs. 312-956-0700
MD Towson, Jones-Maryland Elctrns. 301-823-5721
MA Billerica, A. W. Mayer Co., Inc. 617-229-2255
NH Hudson, C & H Elctrns., Inc. 603-882-1133
NM Albuquerque, Betatron Elctrns. 505-344-2381
NM Albuquerque, Ram Elctrns. 505-262-0888
NM Albuquerque, Walker Elctrn. Supp. 505-883-2992
NY Bohemia, Car-Lac Elctrn. Indl. Sls. 516-567-4200
NY E. Syracuse, Modutex Corp. 315-437-7052
NY West Hempstead, March Elctrns. 516-485-4700
OH Englewood, Argent Inds., Inc. 513-836-8633
OR Portland, United Radio Supp. 503-233-5341
PA McKeesport, Barno Radio 412-751-5966
RI Providence, William Dandreta & Co. .. 401-861-2800
TX El Paso, ERA 915-855-3600
TX Fort Worth, C & W Supp. 817-831-0395
TX Houston, Lenert Co. 713-225-1465
WA Redmond, Elwood Inds. 206-881-7277
WA Seattle, Rose Elctrns. 206-721-4997
WA Seattle, United Radio Supp. 800-547-4557
WA Spokane, Rose Elctrns. 509-624-8867

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FAX: 516-334-5988

IET LABS, INC., 534 Main St., Westbury, NY 11590, Tel: 516-334-5959; FSC No.: 62015; *Sls. Mgr.:* Sam Sheena ..... **D•1268-1274**

DDC ILC DATA DEVICE CORPORATION

FAX: 516-567-7358

ILC DATA DEVICE CORP., 105 Wilbur Pl., Bohemia, NY 11716, Tel: 516-567-5600, TWX: 310-685-2203; FSC No.: 19645; Empl.: 910; *Sls. Mgr.:* J. P. Sheahan; *Dist. Mgr.:* Marshall Lacoff ..... **D•1164-1165**

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AL Huntsville, Montgomery Mktg. 205-830-0498
AZ Scottsdale, Fred Board Assocs. 602-994-9388
AZ Tuscon, Fred Board Assocs. 602-299-1508
CA Garden Grove, ILC Data Dvcs. Corp. .. 714-895-9777
CA Santa Clara, ILC Data Dvcs. Corp. 408-244-0831
CA Woodland Hills, ILC Data Dvcs. Corp. 818-992-1772
CO Denver, Quorum 3 Sls. Grp. 303-696-8480
CT Canton Center, Dynamic Sls. of New Eng. 203-693-6567
FL Clearwater Beach, Perrott Assocs. 813-443-5214
FL Orlando, Perrott Assocs. 305-298-7748
GA Norcross, Montgomery Mktg., Inc. 404-447-6124
IL Des Plaines, Elctrn. Mktg. 312-298-2330
IN Carmel, Giesting & Assocs. 317-844-5222
IN Fort Wayne, Giesting & Assocs. 219-486-1912
KS Lenexa, Dytec/South 913-888-0215
MA Burlington, Dynamic Sls. of New Eng. 802-863-6665
MI Coloma, Giesting & Assocs. 616-468-4200
MI Livonia, Giesting & Assocs. 313-478-8106
MN Minneapolis, Comprehensive Techn. .. 612-888-7011
MO Maryland Hgts., Dytec/South 314-569-2990
NJ Totowa, ILC Data Dvcs. Corp. 201-785-1734
NM Albuquerque, Quatra Assocs. 505-821-1455
NY E. Rochester, Tri Tech Elctrns. 716-385-6500
NY Endwell, Tri Tech Elctrns. 607-754-1094
NY Fayetteville, Tri Tech Elctrns. 315-446-2881
NY Fishkill, Tri Tech Elctrns. 914-897-5611
NC Cary, Montgomery Mktg., Inc. 919-467-6319
OH Cincinnati, Giesting & Assocs. 513-385-1105
OH Euclid, Giesting & Assocs. 216-261-9705
OK Tulsa, Bonser-Philhower Sls. 918-744-9964
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PA Pittsburgh, Giesting & Assocs. 412-963-0727
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TX Houston, Bonser-Philhower Sls. 713-782-4144
TX Richardson, Bonser-Philhower Sls. 214-234-8438
UT Salt Lake City, Quroum 3 Sls. Grp. 801-943-9227
VT Burlington, Dynamic Sls. of New Eng. 802-863-6665
VA Vienna, ILC Data Dvcs. Corp. 703-893-7989
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WI Waukesha, Electron Mktg. 414-547-1505
Can Montreal, Repco Engrg. 514-694-1877

ILC TECHNOLOGY, INC., 399 Java Dr., Sunnyvale, CA 94089, Tel: 408-745-7900, TWX: 910-339-9389; *Sls. Mgr.:* Robert Turner

ILLINOIS CAPACITOR, INC.

FAX: 312-673-2850

ILLINOIS CAPACITOR, INC., 3757 W. Touhy Ave., Lincolnwood, IL 60645, Tel: 312-675-1760, TELEX: 72-4361; Empl.: 64; *Sls. Mgr.:* C. Kurland .... **A•1086-1087**

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CA Woodland Hills, Illinois Capacitor, Inc. 800-323-3652
CO Denver, Lindberg Co. 303-758-5863
CT Bristol, Technology Prods. Grp. 617-731-0858
FL Pompano Bch., HHP & Assocs. 305-971-5750
IL Lincolnwood, Illinois Capacitor, Inc. ... 312-675-1760
IN Indianapolis, Precision Elctrn. Comp. .. 317-842-3740
KS Overland, AEM Inc. 913-888-0022
KY Louisville, Precision Elec. Co. 502-897-0989
MA Brookline, Technology Prods. Grp. 617-731-0858
MI Farmington Hills, Tritech Sls. Inc. 313-553-7126
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MN Golden Valley, Highland Elctrn. Sls. Co. 612-545-2123
MS Jackson, Doby Assocs. 601-981-1138
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MO Kansas City, Jim Moore & Assocs., Inc. 816-756-0262
NJ Englewood Cliffs, Masin-Esco, Inc. 201-569-8868
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NY Clinton, Advanced Comps. Corp. 315-853-6438
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NY N. Syracuse, Advanced Comps. Corp. 315-699-2671
NY Rochester, Advanced Comps. 716-544-7017
NY Scottsville, Advanced Comps. Corp. 716-889-1429
NC Raleigh, Positive Comp. Sls. 919-772-8073
OH Dayton, Baehr, Greenleaf & Assocs. .. 513-439-0724
OH Westlake, Baehr, Greenleaf & Assocs. 216-892-1770
OH Worthington, Baehr, Greenleaf & Assocs. 614-847-0220
OR Beaverton, Luscombe Engrg. Co. 503-636-6664
PA Evans City, Baehr, Greenleaf & Assocs. 412-776-2151
PA Narberth, J. Bresson Assocs. 215-664-6460
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UT Salt Lake City, Lindberg Co. 801-277-2643
WA Renton, Luscombe Engrg. Co. 206-223-1541
WI Milwaukee, Erdman Sls. Co. 414-281-1330

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CA Anaheim, A to Z Elctrns. 714-632-1620
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CA Milpitas, Projections Unltd. 408-942-1717
CA San Diego, Neumann Elctrns. 619-695-3005
CA San Diego, Projections Unltd. 619-453-7900
CA Tustin, Projections Unltd. 714-544-2700
CO Colorado Springs, Kimball Elctrns. 303-528-7066
CO Englewood, Indelco 303-694-9444
CT Norwalk, Cobra Comps., Inc. 203-847-6442
FL Ft. Lauderdale, Hammond Elctrns. 305-973-7103
FL Orlando, Hammond Elctrns. 305-841-1010
GA Norcross, Hammond Elctrns. 404-449-1996
ID Boise, Kimball Elctrns. 208-342-3559
ID Pocatello, Kimball Elctrns. 208-232-2201
IL Chicago, NEP Elctrns. 312-625-8400
IL Northbrook, Classic Comps. 312-272-9650
IN Carmel, Altex Elctrns. 317-848-1323
LA Shreveport, Carleton Bates 318-636-9975
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MO Kansas City, Walters Indl. Supp. 816-531-7015
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NJ Camden, General Radio Supp. Co. 609-964-8560
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TX Texarcana, Carleton Bates 214-792-6923
UT Salt Lake City, Kimball Elctrns. 801-328-2075
WI Milwaukee, Badger Capacitor Sls. 414-281-1330
WI New Berlin, Classic Comps. Supp. Co. 414-786-5300
WI New Berlin, NEP Elctrns. 414-785-9100

Illinois Lock Company

FAX: 312-537-1881

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CA Los Angeles, Spectrum Assocs. 213-641-4255
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CT W. Hartford, M-R Tech Sls., Inc. 203-521-2101
FL Tampa, SRT Mktg. 813-884-4805
MI Farmington Hills, Fisher Sls. Assocs. 313-553-9035
MN Minneapolis, W. F. Just Co. 612-925-1220
MO St. Louis, Thomas L. Dowell & Assocs. 314-849-4234
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NY New York, Cambridge Allen Assocs. 201-464-0203
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OH Dayton, Shamrock Elctrn. Sls. 513-258-1227
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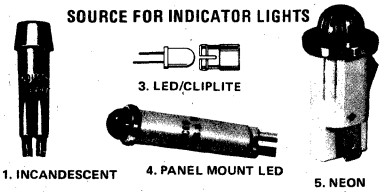

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IMC MAGNETICS CORP., Florida Division, 14025 N.W. 60th Ave., Miami Lakes, FL 33014, Tel: 305-822-2558, FAX: 305-825-3850

IMC MAGNETICS CORP., IMC/Hansen, Box 23, Princeton, IN 47670-0023, Tel: 812-385-3415, FAX: 812-386-6387; *Sls. Mgr.:* George A. Gilbert

IMC MAGNETICS CORP., Thermal Products Group., 100 Jericho Quad., Ste. 221, Jericho, NY 11753, Tel: 516-938-0800, TWX: 510-221-2126, FAX: 516-938-0752; *Sls. Mgr.:* R. Lavochkin

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IMEC CORP., 3065 Beyer Blvd, San Diego, CA 92154, Tel: 619-690-2622; Empl.: 1400; *Sls. Mgr.:* R. L. Hill

IMO DELAVAL INC., 325 Halstead St, Pasadena, CA 91109-7087, Tel: 818-351-4241, TELEX: 200445 RCA, FAX: 818-351-0557; Empl.: 210

IMO DELAVAL, INC., Cowles Rd, Plainville, CT 06062-9990, Tel: 203-677-1311, TELEX: 99-306, FAX: 203-747-4244; Empl.: 203; *Sls. Mgr.:* M. W. Brown; *Dist. Mgr.:* M. W. Brown

I.M.S. EQUIPMENT, INC., See Worldnet Marketing, Inc.

IMTRONICS INDUSTRIES, 11930 31st Ct. N., St. Petersburg, FL 33716, Tel: 813-572-9010, TELEX: 566027 IMTRON CWTR UD, FAX: 813-572-9012; Empl.: 10; *Sls. Mgr.:* Steven B. Cohen

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VA Front Royal, Eltron Sls. Inc. 703-635-7201
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IL Palatine, OHM Electronics 312-359-5500
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OH Columbus, Thompson Elctrn. 614-228-6191

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INDUSTRIAL DEVICES CORPORATION, 35 Pamaron Way, Novato, CA 94949-6284, Tel: 415-883-3535, FAX: 415-883-2094; Empl.: 25

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OH Columbus, Hughes Peters 614-294-5351
OH Dayton, Stotts-Friedman Co. 513-298-5555
OH Toledo, Warren Radio 419-248-3364
OK Tulsa, PEI Genesis 918-622-8520
OR Portland, United Radio Supp. 503-233-7151
PA Erie, REM Elctrns. 814-453-5626
PA Harrisburg, Cumberland Elctrns. 717-233-5883
PA Philadelphia, PEI/Genesis 215-673-0400
TN Memphis, Bluff City Elctrns. 901-345-9500
TN Nashville, Randolph & Rice 615-255-5601
TX Ft. Worth, Allied Elctrns. 817-336-5401
TX Houston, Altair Co. 713-462-3029
TX Richardson, Altair Co. 214-231-5166
TX San Antonio, Sherman Elctrns. Supp. 512-224-1004
UT Salt Lake City, Standard Supp. 801-486-3371
VA Arlington, Arlington Elctrn. Whlsrs. 703-524-6256
VA Glen Allen, Hermitage Distrs. 804-798-3830
WA Redmond, Murphy Elctrns. 206-881-1234
WI Milwaukee, Marsh Elctrns. 414-475-6000

FAX: 703-731-0847

INDUSTRIAL DRIVES, A Kollmorgen Div., 201 Rock Rd., Radford, VA 24141, Tel: 703-639-2495, TWX: 710-875-3743; FSC No.: 11384; Empl.: 343; *Sls. Mgr.:* Wayne Coleman/Robert White Jr.; *Dist. Mgr.:* Hurley Gill ..... **B•1218-1220**

FAX: 818-376-1075

INDUSTRIAL ELECTRONIC ENGINEERS, 7740 Lemona Ave., Van Nuys, CA 91405, Tel: 818-787-0311, TELEX: 4720693/4720120; Empl.: 425; *Sls. Mgr.:* Darryl Bloom/J. Hart/S. Spiegel; *Dist. Mgr.:* J. Hart ... **B•1074**

Local Sales Offices & Reps

AL Huntsville, DHR Mktg., Inc. 205-533-5165
AL Huntsville, TMA Technlg. Mktg. Assocs. 205-883-7893
AZ Phoenix, Howe & Howe Sls., Inc. 602-264-7971
CA Brea, Masco Elctrns., Inc. 714-529-0866
CA Campbell, LCO Tech. Sls. 408-378-9900
CA Los Angeles, Masco Elctrns., Inc. 714-529-0866
CA Vista, Masco Elctrns., Inc. 619-758-5562
CO Lakewood, Cristee-Meade Co. 303-232-0287
CA San Jose, Class One Elctrns. 408-297-8666
CT North Haven, Kitchen & Kutchin, Inc. .. 203-239-0212
FL Largo, TMA Technlg. Mktg. Assocs. ... 813-536-3796
FL Melbourne, TMA Tech. Mktg. Assocs. 305-676-3776
FL Orlando, TMA Tech. Mktg. Assocs. 305-857-3760
FL Pompano Beach, TMA Tech. Mktg. Assocs. 305-977-9006
GA Atlanta, DHR Mktg., Inc. 404-451-9848
GA Norcross, TMA Tech. Mktg. Assocs. ... 404-446-3565
IL Arlington Hgts., Phoenix Elctrn. Sls. ... 312-394-4422
IL Highland Park, Bransky Sls. 312-433-2375
IN Indianapolis, Wilson Tech. Sls. 317-872-2513
KS Lenexa, Midtec 913-541-0505
MD Hunt Valley, Marktron, Inc. 301-628-1111
MD Rockville, Marktron, Inc. 301-251-8990
MA Burlington, Kitchen & Kutchin, Inc. 617-229-2660
MI Southfield, L. H. Dickelman Co. 313-353-8210
MN Burnsville, 2M Sales, Inc. 612-890-7774
NY N. Syracuse, Advanced Comps. Corp., Inc. 315-699-2671
MO St. Louis, Midtec 314-275-8666
NC Raleigh, DHR Mktg, Inc. 919-781-1961
OH Richfield, Geotronix, Inc. 216-659-6100
OH Trotwood, Geotronix, Inc. 513-252-6700
OR Beaverton, Olson Tech. Sls. Corp. 503-643-9488
PA Allison Pk., Geotronix, Inc. 412-487-1770
PA Norristown, RJI 215-631-1414
SC Greenville, DHR Mktg., Inc. 803-235-3594
TX Dallas, MGR Elctrns., Inc. 214-238-5246, 713-759-0187
VA Springfield, Pantech 703-451-5700
WA Bellevue, Olson Tech. Sls. Corp. 206-883-7792
WI Cedarburg, Bransky Sls. 414-377-6837

Local Distributors

AL Birmingham, American Elctrns. 205-942-4656
AZ Phoenix, Tri-Tek, Inc. 602-371-0860
AZ Tempe, Circuit Specialist Co. 602-966-0764
CA Garden Grove, Richey/Western Elctrns. 714-895-0060,800-227-0060
CA Gardena, California Switch & Signal Co. 213-538-9830
CA Industry, Ital Elctrn. Sls., Inc. 818-968-8515, 714-990-0922
CA Lakeside, Mouser Elctrn. Corp. 619-449-2229
CA San Diego, Richey/Western Elctrns. .. 619-271-4511
CA Santa Clara, Richey/Western Elctrns. 408-727-7411
CA Santa Clara, Waltronic Sls. 408-727-1200
CA Santa Monica, Master Distrs. 213-452-1229
CA Sunnyvale, Target Elctrns. Inc. 408-734-5611
CO Denver, Integrated Elctrns. 303-292-6121
CT East Haven, J. V. Elctrns. 203-469-2321
CT Wallingford, Cronin Elctrns. 203-265-3134
FL Alamonte Springs, Pioneer Technlgs. Grp., Inc. 305-834-9090,800-432-6094
FL Miami, Elctrn. Equip. Co., Inc. 305-871-3500, 800-432-1235
GA Norcross, Whitehead Elctrns. 404-923-6667
IL Bensenville, Voyager Elctrns. Corp. ... 312-860-1300
IL Chicago, Bell Inds. 312-640-1910
IL Chicago, Newark Elctrns. 312-784-5100
IL Elgin, Allied Elctrns. 312-697-8200
IL Elmhurst, Semiconductor Specialists, Inc. 312-279-1005
IL Northbrook, Classic Comps. 312-272-9650
IN Carmel, Altex Elctrns., Inc. 317-848-1323, 800-692-6039
MD Gaithersburg, Pioneer Technlgs. Grp., Inc. 301-921-0660
MD Jessups, Treeko Elctrns., Inc. 301-792-0112
MA Billerica, A. W. Mayer Co., Inc. 617-667-6900
MA Needham, Cronin Elctrns., Inc. 617-449-5000
MI Grand Rapids, S-F Elctrn. Supp. Inc. .. 616-459-0216
MI Southfield, Michigan Lectrols Corp. 313-353-1350, 800-445-5714
MN Minneapolis, Stark Elctrns. 612-332-1325
MO Kansas City, Semiconductor Specialists, Inc. 816-452-3900
MO Maryland Hgts., Chelsea Inds. 314-997-7709
NM Albuquerque, Betatron Elctrns. 505-821-1122
NM Albuquerque, Intl. Elctrns. 505-293-3497
NY Farmingdale, Pride Elctrns. 516-293-4020
NY Farmingdale, S.A.I. 516-293-2710
NY Mamaroneck, Logicomp Elctrns. 914-698-9332
NY Rochester, Masline Elctrns. 716-546-5373
NC Greensboro, Hammond Elec. 919-275-6391
NC Raleigh, So. Eastern. Elctrns. 919-828-2311
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Cleveland, Alpha Distr. Corp. 216-659-7100
OH Dayton, The Stotts-Friedman Co. 513-298-5555
OK Oklahoma City, Electro Entrs., Inc. 405-427-6591
PA Philadelphia, Herbach & Rademan, Inc. 215-426-1700
PA Philadelphia, PEI/Genesis Elctrns. 215-673-0400
SC Greenville, EMSCO 803-233-4121
SC Taylors, Cantrell Whls. 803-268-1194
TN Knoxville, MAC-1 615-966-4143
TX Austin, Southwest Elctrns. 512-837-8971
TX Austin, The Altair Co. 512-837-4490
TX Farmers Branch, Force Elctrns. Inc. of Texas 214-247-9955
TX Fort Worth, Allied Elctrns. 817-336-5401
TX Houston, Force Elctrns. Inc. of Texas 713-561-8644
TX Houston, The Altair Co. 713-462-3029
TX Richardson, Southwest Elctrns. 214-234-3050
TX Richardson, The Altair Co. 214-231-5166
TX Stafford, Southwest Elctrns. 713-240-4000
WI Mequon, Taylor Elec. Co. 414-241-4321
WI Milwaukee, Marsh Elctrns. 414-475-6000

INDUSTRIAL ELECTRONIC HARDWARE CORP., 109 Prince St., New York, NY 10012, Tel: 212-677-1881, TWX: 710-581-4338, FAX: 212-674-1048; FSC No.: 97913; Empl.: 250; *Sls. Mgr.:* Louis Roberts; *Dist. Mgr.:* Louis Roberts ..... **C•1397-1399**

Local Sales Offices & Reps

AL Huntsville, Cartwright-Bean 205-830-1540
AZ Phoenix, Knight Co. 602-994-1311
CA Los Angeles, Knight Co 213-670-2833
CA San Diego, Knight Co. 619-743-5136
CA San Jose, QCI Assocs. 408-432-1070
CO Denver, Advance Technlg. 303-798-4200
FL Orlando, Cartwright-Bean 800-432-6714
GA Atlanta, Cartwright-Bean 404-368-0160
IL Orange, Heartland 312-577-9222
IN Kokomo, Schillinger Assocs. 317-452-4057
KS Kansas City, Midtec 913-541-0505
MD Ellicot City, Techn. Sls. 301-461-2400
MA Plainview, ET Assocs. 617-695-4700
MN Maple Grove, Design Technlg. 612-424-7605
MO St. Louis, Midtec 314-275-8666
NJ Sicklerville, Brown Assocs. 609-629-2240
NJ West Field, Artec 201-233-4113
NY Pittsford, Franklin Sls. 315-793-3161
NY Ronkonkoma, PMR 516-467-8200
NC Raleigh, Cartwright-Bean 919-876-4130
OH Medina, Hofstetter Co. 216-241-4880
OR Beaverton, Eclipse Mktg. 503-642-1661
TX Dallas, Comptech 817-265-6007
WA Redmond, Eclipse Mktg. 206-885-6991

INDUSTRIAL FABRICATING CO., 481 Shelton Ave., Hamden, CT 06517, Tel: 203-787-9111; Empl.: 30; *Sls. Mgr.:* Ray Peterson

INDUSTRIAL INDEXING SYSTEMS, INC., 626 Fishers Run, Victor, NY 14564, Tel: 716-924-9181; Empl.: 30; *Sls. Mgr.:* Raymond F. Coller

Local Sales Offices & Reps

IL	Clearview, Microcon, Inc.	312-390-0290
MA	Southborough, Motion Engrg.	617-485-2144
NY	East Rochester, A & D Dvcs.	716-385-2778
PA	Media, Homersmith, Inc.	215-543-2434

Local Distributors

MI	Grand Rapids, Ackerman Elec.	616-459-8327
OH	Cincinnati, Tapco Prods., Inc.	513-683-4481
WI	Oneida, MCL Inds., Inc.	414-434-1500

INDUSTRIAL MIDWEC CAPACITOR CORP., 4902 Tollview Dr., Rolling Meadows, IL 60008, Tel: 312-577-0120, TWX: 910-687-3375, FAX: 312-398-0318; Empl.: 100; *Sls. Mgr.:* Dale Rasmussen

Powertron

FAX: 516-883-7155

INDUSTRIAL TEST EQUIPMENT, 21 Yennicock Ave., Port Washington, NY 11050, Tel: 516-883-1700; FSC No.: 99074; *Sls. Mgr.:* Jay Monroe ..... **D•2120-2124**

INDUSTRIAL TIMER CO., 1500 Meriden Rd., P.O. Box 3329, Waterbury, CT 06705, Tel: 203-753-2487

INERTIAL MOTORS, 280 N. Broad St., Doylestown, PA 18901, Tel: 215-345-1010, TELEX: 83-1633; Empl.: 17; *Sls. Mgr.:* Joanne Dorr

INFICON LEYBOLD-HERAEUS, INC., See Leybold Inficon, Inc.

INFINETICS INC., Friskem Div., 201 Vandever Ave., Wilmington, DE 19802, Tel: 302-658-2471, TWX: 510-666-2332; *Sls. Mgr.:* M. Schwartz

INFODEX, INC., 10 Venus Dr., Wolcott, CT 06716, Tel: 203-757-9291, FAX: 203-757-9291 (x230); FSC No.: 09087; Empl.: 48; *Sls. Mgr.:* E. H. Ulm

INFO-LITE CORP., See Dio-Rey and Crosspoint

INFORMATION CONTROL, Dept. EM7 9610 Bellanca Ave., Los Angeles, CA 90045, Tel: 213-641-8520, TWX: 910-328-7234; Empl.: 55; *Sls. Mgr.:* Carol J. Smith

INFORMATION CONTROL CORP., Abacus Div. Dept. EM7, 9610 Bellanca Ave., Los Angeles, CA 90045, Tel: 213-641-8520, TWX: 910-328-7234; Empl.: 50

INFORMATION CONTROL CORP., 9610 Bellanca Ave., Los Angeles, CA 90045, Tel: 213-641-8520, TWX: 910-328-7234; Empl.: 30; *Sls. Mgr.:* J. M. Boyle

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Local Sales Offices & Reps

AZ	Scottsdale, Luscombe Engrg.	602-949-9333
CA	Pasadena, Luscombe Engrg.	213-684-2000
CA	San Diego, Luscombe Engrg.	619-272-6600
CO	Littleton, Pond Assocs., Inc.	303-798-2904
CT	Marion, Polytek Assocs.	203-621-4542
FL	Port Charlotte, John E. Wiseman Co.	813-625-5740
IL	Schaumburg, Kenneth W. Meyers Co.	312-882-4808
IN	Indianapolis, Kenneth W. Meyers Co.	317-783-1030
IA	Cedar Rapids, Kenneth W. Meyers Co.	319-363-8987
MA	Ashland, Polytek Assocs.	617-881-4741
MN	Minneapolis, Kenneth W. Meyers Co.	612-920-7080
NJ	Oxford, Malin Assocs.	201-689-7398
OR	Portland, Tasco	503-245-8168
PA	Melrose Park, Robert Meyers Assocs.	215-224-1663
TX	Houston, Sci. Sls. Co.	713-460-9170
TX	Richardson, Sci. Sls. Co.	214-231-6541
WA	Bellevue, Tasco	206-453-1414
WI	Brookfield, Kenneth W. Meyers Co.	414-784-3790

INFRARED INDUSTRIES, INC., 12151 Research Parkway, Orlando, FL 32826, Tel: 305-282-7700, TELEX: 568908, FAX: 305-273-9046; Empl.: 80; *Sls. Mgr.:* Thomas Chisholm

INJECTORALL ELECTRONICS (WOMAN OWNED), 110 Keyland Court, Bohemia, NY 11716, Tel: 516-563-3388 ..... **C•1123**

Local Sales Offices & Reps

AL	Birmingham, John F. Russell Co.	205-822-2196

Local Distributors

AL	Birmingham, ACK Radio Supp.	205-322-0588
AZ	Tucson, Electronic City	602-622-1173
CA	San Luis Obispo, Midstate Elctrns. Supp.	805-543-2770
CA	San Rafael, Elctrns. Plus	415-457-0466
CA	Sunnyvale, Halted Specialties	408-732-1573
FL	Jacksonville, Mitchell Elctrns.	904-356-8426
GA	Atlanta, Delta	404-458-4690
IL	Lombard, Tron Elctrns.	312-691-8900
IN	Evansville, Tri-State Supp. Co.	812-423-4257
IA	Cedar Rapids, Iowa Radio Supp. Co.	800-332-5296
KY	Louisville, P.I. Burkes	502-589-3960
MD	Rockville, Capitol Radio Whlsrs.	301-881-2270
MA	Needham, Y.D.I.	617-449-1005
MI	Canton, The Elctrn. Connection	313-595-6655
NY	Endicott, Rogan Elctrns.	607-754-3590
NY	Lindenhurst, RNJ Elctrns.	516-226-2700
NY	Long Island City, Typeco	718-706-6666
NY	Richmond Hill, Anchor	212-846-2420
NC	Charlotte, Slayton Elctrns.	704-375-6600
OK	Oklahoma City, Radio Supp., Inc.	405-332-6127
OR	Beaverton, Norvac	503-644-1025
PA	Philadelphia, H & R Elctrns.	215-426-1700
SC	Charleston, Wholesale Indl. Elctrns.	803-722-2634
TX	Fort Worth, Sweico	817-335-6521
VA	Roanoke, H. C. Baker	703-344-9209

INLAND MOTOR
KOLLMORGEN CORPORATION

FAX: 602-458-2161

INLAND MOTOR, 4020 E. Inland Rd., Sierra Vista, AZ 85635, Tel: 602-459-1150, TELEX: 62858, TWX: 910-973-9869; *Sls. Mgr.:* David Richards ..... **B•1214-1217**

INLAND MOTOR, Kollmorgen Corp., 501 First St., Radford, VA 24141, Tel: 703-639-9045, TWX: 710-875-3740; FSC No.: 11384; Empl.: 500

INMARK CORP., 147 West Cedar St., Norwalk, CT 06854, Tel: 203-866-8474, TELEX: 99-6419, FAX: 203-866-0918; *Sls. Mgr.:* Theo Notaras

INMOS CORP., P.O. Box 16000, Colorado Springs, CO 80935, Tel: 303-630-4000 Ext. 4454, TWX: 910-920-4904; Empl.: 300; *Sls. Mgr.:* Don Carrigan; *Dist. Mgr.:* Jackson Cole

INNOVATEK MICROSYSTEMS, INC., Smithfield Rd., R1 Box 104, Millerton, NY 12546-9720, Tel: 914-373-9003, TELEX: Easylink 62264170; Empl.: 8; *Sls. Mgr.:* Paul F. Fitts

INNOVATIVE ELECTRONICS, INC., Dynatech Corporation, 10110 USA Today Way, Miramar, FL 33025, Tel: 305-432-0300, FAX: 305-432-0705; Empl.: 32; *Sls. Mgr.:* Marshall Roper

INRECO, See Ransco Industries

INRESCO, INC., 654 Ocean Road, Pt. Pleasant, NJ 08742, Tel: 201-892-5881; Empl.: 16; *Sls. Mgr.:* G. L. Martin

INSTRON CORP., 100 Royall St., Canton, MA 02021, Tel: 617-828-2500, TELEX: 924434; Empl.: 1000; *Sls. Mgr.:* Lawrence Frost; *Dist. Mgr.:* Patrick Heck

INSTRULAB, P.O. B. 98, Dayton, OH 45404, Tel: 513-223-2241; Empl.: 22; *Sls. Mgr.:* Philip C. Alderton

ICS inc

FAX: 312-543-6244

INSTRUMENTATION & CONTROL SYS., 520 Interstate Rd, Addison, IL 60101, Tel: 312-543-6200, TELEX: 271503 ICS UR, TWX: 910-991-5945; Empl.: 50; *Sls. Mgr.:* Donald G. Baltzer; *Dist. Mgr.:* Sue Earnest ..... **B•1499; D•2125**

Local Distributors

NC	Raleigh, Allied Elctrns.	800-638-1381

Local Sales Offices & Reps

Industrial Control Component Reps.

FL	Orlando, Werndli Assocs.	305-851-1923
IL	Elmhurst, F.F./Hill-Gray Inc.	312-832-4101
IN	Indianapolis, E.M.C.I.	317-253-1668
MA	Randolph, Elctrl. Agencies	617-961-4330
NJ	Whippany, Robert Smith Assocs.	201-540-0204
NY	Plainview, R. Smith Assocs.	516-681-3155
PA	Willogrove, Delta Tech.	215-657-7250
Can	Downsview, Ont., EPT Instrs.	416-665-3772

Power Conditioning Reps.

AL	Birmingham, C. S. Phillips Co.	205-870-0640
MA	Randolph, Elctrl. Agencies	617-961-4330
FL	Orlando, Werndli Assocs.	305-851-1923
IN	Indianapolis, E.M.C.I.	317-253-1668
NJ	Spring Lake, CPN Assocs.	201-774-5224
NY	Brentwood, CPN Assocs.	516-273-8348
NY	Hyde Pk., CPN Assocs.	914-229-7395
NC	Charlotte, Fred Lekson Assocs.	704-536-1868
PA	Willow Grove, Delta Tech.	215-657-7250
TX	Houston, Gettys-Eads-Adair	713-827-7155
Can	Downsview, Ont., EPT Inds.	416-665-3773
AL	Huntsville, Allied Elctrns.	800-241-7122
CA	Canoga Park, C & A Elctrns.	818-340-6022
CA	Hayward, Allied Elctrns.	415-487-5250
CA	Tustin, Allied Elctrns.	213-860-0090
MA	Wilmington, Allied Elctrns.	617-942-0150
FL	Pompano Bch., Allied Elctrns.	305-486-0500
GA	Norcross, Allied Elctrns.	404-377-3555
GA	Norcross, Automatic Controls Co.	404-447-5644
IL	Berwyn, B-B & W, Inc.	312-749-1710
IL	Elgin, Allied Elctrns.	312-697-8200
IL	Rosemont, Advent Elctrns.	312-297-6200
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
IA	Indianapolis, Advent Elctrns.	317-872-4910
MD	Marlow Hgts., Allied Elctrns.	301-423-0161
MI	Farmington Hills, Advent Elctrns.	313-447-1650
MN	St. Paul, Powermation	612-645-0781
NY	Hauppauge, N & L Instrs.	516-234-9797
NY	Mineola, Allied Elctrns.	516-248-2360
OH	Chagrin Falls, Comm-Omni	216-543-1328
OH	Warren, REM Elctrn. Supp. Co., Inc.	216-373-1300
TX	Brownsville, Garden Indl. Grp.	512-546-1612
TX	Ft. Worth, Allied Elctrns.	817-336-5401, 214-265-9341
TX	Ft. Worth, Allied Export Svcs.	817-336-5401

TX Garland, Powertronics 214-272-4640
WA Seattle, Allied Elctrns. 206-767-2827
WI Fond du Lac, Fedco Elctrns. 414-922-6490
WI Waukesha, Powermation 414-542-2868

INSTRUMENTATION MEAS. LAB., See Lockheed Electronics Co., Inc.

INSTRUMENTATION PRODS., 3M Co., 300 S. Lewis Rd., Camarillo, CA 93010, Tel: 805-482-1911, TWX: 910-336-1676; Empl.: 500

INSTRUMENTATION SERVICES, INC., 957 Winnetka Ave. N., Minneapolis, MN 55427, Tel: 612-544-8916, FAX: 612-544-4887; Empl.: 30; *Sls. Mgr.:* G. Ryan

INSTRUMENT ENCLOSURES, 9767 Glenoaks Blvd., Sun Valley, CA 91352, Tel: 818-768-4622, TELEX: 70-5097, FAX: 818-767-4988; FSC No.: 62012; Empl.: 28; *Sls. Mgr.:* William B. Taylor

THE INSTRUMENT MART, 295 Community Dr., Great Neck, NY 11021, Tel: 516-487-7430

INSTRUMENT RESEARCH CO., Box 40207, Santa Barbara, CA 93103, Tel: 805-962-8336; Empl.: 6

INSTRUMENT RESISTOR CO., See INRESCO/Instr. Resistor

INSTRUMENTS, INC., 7263 Engineer Rd., Ste. G, San Diego, CA 92111, Tel: 619-571-1111, TELEX: 910-350-7239 INST INC., FAX: 619-571-0188; FSC No.: 34563; Empl.: 28; *Sls. Mgr.:* Ken Kalbfell

INSTRUMENTS & CONTROLS DIV., See Technology Systems Div., KRUG Intl.

INSTRUMENTS FOR INDUSTRY, INC.

FAX: 516-467-8558

INSTRUMENTS FOR INDUSTRY, INC., 731 Union Parkway, Ronkonkoma, NY 11779, Tel: 516-467-8400, TWX: 510-222-0876; Empl.: 25; *Sls. Mgr.:* Ethel Smarz ..... **D•1012**

Local Sales Offices & Reps

AL Eva, Barr Elctrn. Instrs. 205-796-7533
AL Huntsville, Scientific Dvcs. S.E. 205-536-1969
AZ Mesa, DJM Elctrns. 602-820-4030
CA Sunnyvale, DJM Elctrns. 408-749-8936
CA Valencia, DJM Elctrns. 805-255-3291
CO Englewood, R. A. Mayes Co. 303-761-9447
CA San Diego, DJM Elctrns. 619-726-1266
FL Orlando, Scientific Dvcs. S.E. 305-841-8180
IA Cedar Rapids, EIR Co. 319-395-7500
MD Laurel, CSDS, Inc. 301-490-3800
MN Minneapolis, Deerland Distrs. 612-331-6433
MO Kansas City, EIR Co. 816-452-7030
MO Leasburg, EIR Co. 314-895-4100
NH Hudson, EMC Sls., Inc. 603-889-5751
NJ N. Plainfield, Brady Co. 201-755-7900
NM Albuquerque, R. A. Mayes Co. Southwest 505-292-2330
NC Winston-Salem, Scientific Dvcs. S.E. .. 919-765-5776
OH Cincinnati, Bill Teplitz Assocs. 513-481-1648
OH Cleveland, Bill Teplitz Assocs. 216-439-3265
PA Sewickley, Bill Teplitz Assocs. 412-741-3628
TX Austin, Scientific Dvcs. 512-388-3982
TX Houston, Scientific Dvcs. 713-376-8666
TX Richardson, Scientific Dvcs. 214-231-8016
WI Milwaukee, Deerland Distrs. 414-784-1414

INSTRUMENT SPECIALTIES CO., P.O. Box A, Delaware Water Gap, PA 18327, Tel: 717-424-8510, TWX: 510-671-4526, FAX: 717-424-6213; Empl.: 300; *Sls. Mgr.:* Thys Rienstra ..... **C•1748-1749**

Local Sales Offices & Reps

AZ Phoenix, O'Donnell Assocs. 602-944-9542
CA San Jose, O'Donnell Assocs. 408-432-1940
CA Torrance, O'Donnell Assocs. 213-539-9664
CO Englewood, D. M. Harthun Assocs., Inc. 303-792-5050
ID Boise, Temco Northwest 208-345-2051
MN St. Paul, Arkco Sls. 612-777-7454
NM Albuquerque, O'Donnell Assocs. S.W. 505-883-1030
OR Hillsboro, Temco Northwest 503-649-8375
TX Dallas, J. M. Spell 214-620-0040
WA Bothell, Temco Northwest 206-821-5434
Can Pickering, Ont., A. C. Simmonds & Sons, Ltd. 416-839-8041

INSULCAST, Permagile, 101 Commercial St., Plainview, NY 11803, Tel: 516-349-1100, TELEX: 221720 PERM UR, FAX: 516-349-1156; *Sls. Mgr.:* William P. Flaim, Natl. Sls. Mgr.

INTECH, Instruments Div., 282 Brokaw Rd., Santa Clara, CA 95050, Tel: 408-727-0500, TWX: 910-338-0254; Empl.: 120; *Sls. Mgr.:* Howard Randall; *Dist. Mgr.:* Howard Randall

INTEGRA, INC., 2368 Walsh Ave., Santa Clara, CA 95051, Tel: 408-727-9601, TWX: 910-338-0585; FSC No.: 51162; Empl.: 14; *Sls. Mgr.:* Len Johnson

FAX: 206-882-1990

INTEGRATED CIRCUITS, INC., 10301 Willows Roads, P.O. Box 97005, Redmond, WA 98073-9705, Tel: 206-882-3100; FSC No.: 50821; Empl.: 290; *Sls. Mgr.:* D. T. Baughman ..... **A•1740-1741; D•1754-1761**

Local Sales Offices & Reps

AL Huntsville, Novus Grp. 205-534-0044
AZ Tempe, Gassner & Clark 602-968-9037
CA El Toro, Martronix 714-858-0632
TX Irving, Kite Elctrn. Sls. 214-674-1330
CA San Diego, Martronix 619-728-0384
CO Parker, Tech. Mktg. Assocs. 303-841-3435
FL Deerfield Bch., Krutek & Assocs. 305-427-4202
GA Lilburn, Novus Grp. 404-381-1015
IL Elgin, Gassner & Clark Co. 312-698-9540
IA Des Moines, Beams Co. 515-255-1148
KS Shawnee Mission, Beams Co. 913-631-0300
MD Owings Mills, Neal Deoul Assocs. 301-363-4311
MA Wakefield, Howard C. Jappe Co. 617-245-9359
MN Eden Prarie, Electromark 612-944-5850
MO St. Louis, Beams Co. 314-569-1060
MO St. Louis, Beams Co. 314-934-8448
NJ Flanders, K & R Engrg. Sls. 201-584-5235
NY N. Syracuse, Advanced Comps. Corp. 315-699-2671
NC Raleigh, Novus Grp. 919-872-3966
OH Cleveland, Arthur H. Baier Co. 216-461-6161
PA Newtown, Yax Assocs. 215-860-2540
TX Irving, Kite Electrn. Sls. 416-674-1330
Can Ontario/Scarborough, Bestec Elctrns., Ltd. 416-674-1330

INTEGRATED COMPUTER SYSTEMS, 5800 Hannum Ave., Culver City, CA 90230, Tel: 213-417-8888, TELEX: 4995168 ICS LA; Empl.: 100; *Sls. Mgr.:* John Valenti

INTEGRATED DEVICE TECHNOLOGY, INC., 3236 Scott Blvd., Santa Clara, CA 95054-3090, Tel: 408-727-6116, TWX: 910-338-2070; FSC No.: 61772; Empl.: 1200; *Sls. Mgr.:* Joe Zabkar (VP); *Dist. Mgr.:* Rick Keeling

INTEGRATED DIGITAL PRODUCTS, 1470 N. Hundley St., Anaheim, CA 92806, Tel: 714-666-1133; Empl.: 15; *Sls. Mgr.:* Vince Imani; *Dist. Mgr.:* Meda Tharlson

INTEGRATED MICROWAVE, 3422 Tripp Ct., San Diego, CA 92121, Tel: 619-259-2600, TWX: 910-335-2037; FSC No.: 60656; Empl.: 75; *Sls. Mgr.:* Randy D. Mouber

INTEGRITY TECHNOLOGY, 105 Serra Way, Ste. 230, Milpitas, CA 95035, Tel: 408-262-8640, TELEX: 697-2396, ESYLNK: MCI Mail:209837; Empl.: 12

INTELCO, 8 Craig Road, Acton, MA 01720, Tel: 617-264-4485, TELEX: 62923380; Empl.: 25

Intelligence Power Technology

FAX: 805-987-0271

INTELLIGENCE POWER TECHNOLOGY, 829 Flynn Rd., Camarillo, CA 93010, Tel: 805-484-4441, TWX: 910-591-1893; Empl.: 35; *Sls. Mgr.:* Sharon Ellis .... **D•1763**

Local Sales Offices & Reps

CA Los Altos, Frauman Assocs., Inc. 415-941-0660
CA Los Angeles, Mil Com Sls. 714-840-2424
CA San Diego, Mesa Engrg. 619-278-8021
MA Chelmsford, Encotronics 617-256-4207
KY Ft. Mitchell, G. W. Thelen 606-341-8181
PA Horsham, Jacobsen Assocs. 215-674-2937
OH Medina, G. W. Thelen 216-723-1293
WA Bellevue, Underwood-Hanify 206-643-1793
WA Vancouver, Underwood-Hanify 206-695-2311
WI Greenfield, Olympic 414-281-9294

INTEPRO SYSTEMS INC., 450 Bedford St., Lexington, MA 02173, Tel: 617-863-9500, FAX: 617-861-1957; Empl.: 50; *Sls. Mgr.:* Mike O'Connor; *Dist. Mgr.:* Mike O'Connor

INTERACTION SYSTEMS INC., 130 Lincoln St., Brighton, MA 02135, Tel: 617-789-5900, TELEX: 753582 ..... **D•1092**

INTERACTIVE COMPUTER PRODUCTS, INC., 23482 Peralta, unit C, Laguna Hills, CA 92653, Tel: 714-770-5332; Empl.: 20; *Sls. Mgr.:* Jim Bearden

Distributor

Interconnect Specialties Inc. Tel: 800-752-4777, 714-773-0411, FAX: 714-447-3976; Telex: 910 321 0310..... 614, 615, 617, 721, 730, 781, 809, 820

FAX: 913-342-7043

INTERCONNECT DEVICES, INC., 5101 Richland Ave., Kansas City, KS 66106, Tel: 913-342-5544, TELEX: 286767 IDIKC UR; *Sls. Mgr.:* Greg Tafel

INTERCONNECT TECHNOLOGIES, INC., 75 Heathridge Rd., Hamden, CT 19355, Tel: 203-288-8428, FAX: 203-288-6783; *Sls. Mgr.:* Jennifer Lavelle; *Dist. Mgr.:* Melinda Lavelle

INTERDYNE CO., 157 Topaz St., Milpitas, CA 95035, Tel: 408-943-9133; FSC No.: 31598; Empl.: 30

INTERELECTRONICS CORP., Interelectronics Park, 550 U.S. Rte. 303, Congers, NY 10920, Tel: 914-EL8-8000; Empl.: 82; *Sls. Mgr.:* M. H. Pintell; *Dist. Mgr.:* G. Sherwood ..... **D•1765**

INTERFACE, INC., 7401 E. Butherus Dr., Scottsdale, AZ 85260, Tel: 602-948-5555, TELEX: 825-882; FSC No.: 32311

INTERFACE ENGINEERING INC., 275/300 Centre St., Unit 7, Holbrook, MA 02343, Tel: 617-986-2600, TELEX: 249-545; FSC No.: 14352; Empl.: 30; *Sls. Mgr.:* Thomas Scanlon ..... **D•1170-1171**

Local Sales Offices & Reps

NY Great Neck, Industron Assoc. 516-487-2620
VA Arlington, Gans & Pugh 703-527-3262

INTERFACE PRODUCTS, INC., 2185 S. Grand Ave., Santa Ana, CA 92705, Tel: 714-549-4977, TWX: 910-595-2569; FSC No.: 55300; Empl.: 60; *Sls. Mgr.:* Western Sls. Mgr./Larry Green

INTERFACE TECHNOLOGY, Dynatech Corp., 2100 E. Alosta Ave., Glendora, CA 91740, Tel: 818-914-2741, TELEX: 4945489

INTERFAN
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FAX: 415-340-1670

INTERFAN, William J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-347-1203; Empl.: 12; *Sls. Mgr.:* F. L. Nelson ..... **C•1678-1679**

Local Sales Offices & Reps

AZ Phoenix, Mercury Engrg. Sls., Inc. 602-265-0344
AR Mabelvale, Erickson Sls., Inc. 501-455-0618
CA Anaheim, Impact Elctrns., Inc. 714-533-1351,
CA Burlingame, William J. Purdy Co. 415-347-7701
CA San Diego, Miner Assocs., Inc. 619-566-9891,
CO Englewood, William J. Purdy Co., Assocs. 303-790-2211,
FL Maitland, Hutto Hawkins Assocs. 305-831-2474,

FL Pompano Bch., Hutto Hawkins Assocs. 305-979-0330,
FL Tampa, Hutto Hawkins Assocs. 813-251-6443,
GA Atlanta, Millar Elctrns., Inc. 404-634-3350
IL Elmhurst, F.F./Hill-Gray Assocs., Inc. .. 312-832-4101
IN Indianapolis, John Sukup, Inc. 317-253-5501
LA Chalmette, Erickson Sls., Inc. 504-271-1976
MD Lisbon, Samuel K. MacDonald, Inc. 301-442-1590
MI Royal Oak, Hilltronics Inc. 313-435-0920
MN Minneapolis, Boerger & Assocs. 612-560-3435
NH Nashua, Bell Controls, Inc. 603-882-6984
NJ Englewood, Sprung/Nussbaum, Inc. .. 201-569-5666
NM Albuquerque, William J. Purdy Co. 505-266-7959
NC Raleigh, Millar Elctrns., Inc. 919-828-8840
OH Cleveland, KT/DEPCO 216-442-6200
OH Columbus, KT/DEPCO 614-447-0106
OR Beaverton, Pacific Mktg. Specialists ... 503-641-9373
PA Pittsburgh, KT/DEPCO 412-367-1011
PA Willow Grove, Samuel K. MacDonald, Inc. 215-659-4414,
TX Austin, Erickson Sls., Inc. 512-244-3068
TX Dallas, Erickson Sls., Inc. 214-739-5833
TX Houston, Erickson Sls., Inc. 713-266-1604
WA Redmond, Pacific Mktg. Specialists ... 206-882-3144
Can Lachine, Que., Bytewide Mktg. 514-636-4121,

INTERGALACTIC CORP., Box 7025, Salt Lake City, UT 84107, Tel: 801-262-0094, TWX: 910-530-0888; *Sls. Mgr.:* Shawn MacGregor

INTERLOK, Wm. J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-348-5625, TELEX: 677-1439 (Purdy UW); FSC No.: 55951; Empl.: 30; *Sls. Mgr.:* Clarence Bruce

INTER-MARKET, 1946 Lehigh Ave., Glenview, IL 60025, Tel: 312-729-5330, TWX: 910-651-1997; FSC No.: 34165; Empl.: 10; *Sls. Mgr.:* Phil Gardanier ..... **B•1153, 1728**

Local Sales Offices & Reps
MN St. Paul, Kenco Tronics 612-645-7717
PA Rydal, Espy Sls. 215-576-0780
WA Redmond, Elctrn. Mktg. 206-882-0962
Can Montreal, Que., Braydon Electro 514-332-5650

Local Distributors
CA Chatsworth, Mil-Comm Distr. 818-998-3111
ID Spirit Lake, A-1 Elctrns. 800-635-1545
IL Chicago, Newark Elctrns. 312-638-4411
MN St. Paul, K.D.I., Inc. 612-645-5090
NH Hudson, C & H Elctrns. 603-882-1133
NJ Oakland, Relay Specialties 201-337-1000
Can Montreal, Que., Braydon Electro 514-332-5650

INTERMATIC, Intermatic Plaza, Spring Grove, IL 60081, Tel: 815-675-2321, TELEX: 25-265; Empl.: 1000

INTER METRO INDUSTRIES CORP., North Washington St., Wilkes-Barre, PA 18705, Tel: 717-825-2741, TELEX: 831-833

INTERNATIONAL COMPONENTS CORP., 105 Maxess Rd., Melville, NY 11747, Tel: 516-293-1500, TELEX: 221576, FAX: 516-293-4983; Empl.: 100; *Sls. Mgr.:* Richard Weiner; *Dist. Mgr.:* Richard Weiner ..... **A•1088; D•1030-1031**

Local Sales Offices & Reps
AL Huntsville, Rick Burns Assocs. 205-461-7888
AR Little Rock, Erickson Sls. 501-455-0618
CA Anaheim, Impact Elctrns. 714-533-1351
CA Redwood City, Hickey Inds. 415-368-3849
CO Parker, Parker Webster 303-841-4888
IL Arlington Heights, MJ Petersen & Assoc. 312-577-8200
IA Cedar Rapids, IOWA Tech. Sls. 319-393-8644
LA Chalmette, Erickson Sls. Inc. 501-271-1976
MD Spencerville, Espy Sls. Co. 301-384-3300
NJ Fairfield, T.A.M. 201-575-4130
NY Syracuse, Nycom 315-437-8343
NC Raleigh, Rick Burns Assocs. 919-876-2224
OH Cincinnati, G & H Sls. Co. 513-272-0580
OH Lakewood, G & H Sls. Co. 216-226-6800
OK Broken Arrow, Erickson Sls. Inc. 918-455-4276
PA Rydal, Espy Sls. Co. 215-576-0780
SC Greer, Rick Burns Assocs. 803-297-8486
TX Austin, Erickson Sls. Inc. 512-244-3068
TX Dallas, Erickson Sls. Inc. 214-739-5833
TX Houston, Erickson Sls. Inc. 713-266-1604
UT Murray, Parker Webster 801-266-9939
PR Hato Rey, Casanova Indl. Sls. Corp. ... 809-753-8674

Local Distributors
CA Canoga Park, Myco Vickers 213-340-2025
CA Redwood City, Hi-Cor 415-365-5087
CT East Haven, JV Elctrns. 203-469-2321
FL Ft. Lauderdale, National Resistor Co. 305-772-4500
IA Cedar Rapids, Dee Elctrns. 319-365-7551
MA Burlington, T.L.C. 617-273-0140
MN Eden Prarie, Cassidy Elctrns. 612-944-0100
MN Minneapolis, Cassidy Elctrns. 612-835-7746
MN New Brighton, Chris Elctrns. 612-631-2647
NJ Clifton, Vantage Comps. 201-667-1840
NJ Rockaway, Tonar Inds. 201-586-9000
NY Commack, Vantage Comps. Corp. 516-543-2000
PA Philadelphia, Mur'Tronics 215-632-4330
TX Ft. Worth, C & W Supp. Co. 817-831-0395

INTERNATIONAL CONFIGURATIONS, INC., P. O. Box 3374, Enfield, CT 06082, Tel: 203-749-6380, TELEX: 643 067; FSC No.: 62484; Empl.: 4; *Sls. Mgr.:* Mr. L. Baldwin

INTERNATIONAL CONTROLS & MEASUREMENTS CORP., P.O. Box 2819, Syracuse, NY 13220, Tel: 315-699-5266; FSC No.: 52516; Empl.: 50; *Sls. Mgr.:* Don Plath; *Dist. Mgr.:* Don Plath

INTERNATIONAL CONVERTER CORP., 770-101 Wooten Road, Colorado Springs, CO 80915, Tel: 719-570-6900, FAX: 719-570-6180; Empl.: 7 (U.S.), 1100 (Offshore); *Sls. Mgr.:* Deanna Thompson

INTERNATIONAL CRYSTAL MFG., 701 W. Sheridan, P.O. Box 26330, Oklahoma City, OK 73126, Tel: 405-236-3741, TELEX: 747-147, FAX: 405-235-1904; Empl.: 224; *Sls. Mgr.:* Paul E. Denwalt

INTERNATIONAL DATA SCIENCES, 7 Wellington Rd., Lincoln, RI 02865, Tel: 401-333-6200, TWX: 710-384-1911; Empl.: 125

INTERNATIONAL DATA TECHNOLOGY, INC., 7440 N.W. 13th St., Ft. Lauderdale, FL 33313, Tel: 305-587-6823, TWX: 910-997-4751 (DIGITAL); Empl.: 15

INTERNATIONAL DIGITAL ELECTRONICS, 2045 S. Arlington Hgts. Rd., Ste. 119, Arlington Hgts., IL 60005, Tel: 312-439-8858/8861/8863, FAX: 312-439-8864; Empl.: 6; *Sls. Mgr.:* Masanori Kotani

INTERNATIONAL DIODE, 229 Cleveland Ave., Harrison, NJ 07029, Tel: 201-482-6518; Empl.: 9; *Sls. Mgr.:* Lee Toong

INTERNATIONAL ELECTRO MAGNETICS, INC., 350 N. Eric Dr., Palatine, IL 60067, Tel: 312-358-4622, TELEX: 4932869 IEM UI; Empl.: 15; *Sls. Mgr.:* T. Pretto ..... **D•1032**

Local Distributors
CA Hollywood, Scottsound 213-462-6981
CA Pleasant Hill, ALC 415-777-5525
NY Morris, Boynton Studio 607-263-5695
NY New York, United Research Labs. 212-751-4660

INTERNATIONAL HIGH VOLTAGE ELCTRNS., INC., Finance Drive, Danbury, CT 06810, Tel: 203-792-7820, 800-634-0740, FAX: 203-743-3370; *Sls. Mgr.:* D. Steers ..... **D•1766-1767**

Local Sales Offices & Reps
CA Santa Ana, Power House, Inc. 714-549-9599

INTERNATIONAL INSTRUMENTATION, INC., 2282 Townsgate Rd., Westlake Vlg., CA 91361, Tel: 805-495-7673, FAX: 805-379-0701; Empl.: 32; *Sls. Mgr.:* Ted Rush; *Dist. Mgr.:* Dan Kimberling

INTERNATIONAL INSTRUMENTS

FAX: 203-481-8937

INTERNATIONAL INSTRUMENTS, A PRIME TECHNOLOGY CO., Twin Lakes Rd, P.O. Box 185, N. Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092; Empl.: 150; *Dist. Mgr.:* Bruce Granoff ..... **D•1374-1375**

Local Sales Offices & Reps
KS Olathe, Tech. Sls. Assoc. 913-829-2800
MD Joppa, Electra-Tech 301-877-0344
MO Ferguson, Tech. Sls. Assocs. 314-725-5361
NJ Berkley Heights, NBS Assocs. 201-464-8500
NY Rochester, H. C. Johnson Agys. 716-586-0777
OH Westlake, Advanced Tech. Assocs. ... 216-835-5050
PA Glenshaw, H. C. Johnson Agys. 412-487-1246
PA Malvern, Stitzer Assocs. 215-644-5500
VA Dumfries, Electra-Tech 703-670-6962

Local Distributors
AZ Phoenix, Metermaster 602-437-1425
CA Los Angeles, E.I.L. Instrs., Inc. 213-685-7020
CA Los Angeles, Metermaster 213-685-4340
CA Palo Alto, Metermaster 415-968-0313
CA San Diego, Metermaster 619-560-4841
CA Santa Clara, Dynametron 408-727-6531
CA Santa Clara, E.I.L. Instrs., Inc. 408-727-0396
CO Denver, E.I.L. Instrs., Inc. 303-534-4160
CO Denver, Metermaster Instr. Corp. 303-722-5766
CT Middletown, E.I.L. Instrs., Inc. 203-346-6646
FL Palm Bay, E.I.L. Instrs., Inc. 305-735-8300
GA Norcross, Metermaster 404-446-0166
IL Bridgeview, E.I.L. Instrs., Inc. 312-430-2292
IL Itasca, Metermaster 312-250-0605
IN Indianapolis, E.I.L. Instrs., Inc. 317-545-1373
KY Louisville, E.I.L. Instrs., Inc. 502-454-3420
LA New Orleans, Industrial Instr. Works .. 504-733-8355
MD Gaithersburg, Pioneer Instrs. Div. 301-948-2242
MA Burlington, E.I.L. Instrs. 617-272-9450
MI Ferndale, Ram Meter Inc. 313-398-6767
MN Minneapolis, Process Meas. Co. 612-544-4035
NJ Pensauken, E.I.L. Instrs., Inc. 609-488-0474
NY Clarence, Trott Elctrns., Inc. 716-634-8500
NY Hauppauge, E.I.L. Instrs., Inc. 516-231-6333
OH Cleveland, Metermaster 216-651-4100
OH Cleveland, Pioneer/Instrmn. Div. 216-587-3600
OH Dayton, E.I.L. Instrs., Inc. 513-435-2134
OR Beaverton, Eicher-Richards 503-641-3300
PA Philadelphia, Sunshine Scientific 215-673-5600
PA Pittsburgh, E.I.L. Instrs. 412-731-5230
TX Dallas, E.I.L. Instrs., Inc. 214-931-1236
TX Garland, Metermaster 214-271-5671
TX Houston, E.I.L. Instrs., Inc. 713-271-3100
TX Houston, Meters & Instr. Corp. 713-644-1631
VA Springfield, E.I.L. Instrs., Inc. 703-354-4330
VA Virginia Beach, E.I.L. Instrs., Inc. 804-499-3746
WA Seattle, E.I.L. Instrs., Inc. 206-762-0800
WA Seattle, Eicher Richards 206-523-7888

INTERNATIONAL LASER SYS., 3404 N. Orange Blossom Trail, Orlando, FL 32804, Tel: 305-295-4010, TWX: 810-850-0195; Empl.: 408; *Sls. Mgr.:* W. C. Hudson

INTERNATIONAL LIGHT, Dexter Industrial Green, Newburyport, MA 01950-4092, Tel: 617-465-5923, TELEX: 94-7135, FAX: 617-462-0759; Empl.: 19; *Sls. Mgr.:* Jack Kelley; *Dist. Mgr.:* Jack Kelley

INTERNATIONAL MANUFACTURING SERVICES, 50 Schoolhouse La., Portsmouth, RI 02871-2418, Tel: 401-683-9700, FAX: 401-683-5571; FSC No.: 45177; Empl.: 25; *Sls. Mgr.:* Jay Benson ..... **A•1936**

Local Sales Offices & Reps
MA Attleboro, Antex-Overseas Sls. 617-222-5221
NJ Flanders, K & R Engr. Sls. 800-452-9767

INTERNATIONAL MICROELECTRONIC PRODS., 2830 North First Street, San Jose, CA 95134, Tel: 408-432-9100, TELEX: 499-1041, TWX: 910-338-2274; Empl.: 380; *Sls. Mgr.:* Robert Kromer

INTERNATIONAL MICROSYSTEMS, 461 Valley Way, Milpitas, CA 95035, Tel: 800-237-4734; Empl.: 10; *Sls. Mgr.:* Peter Schade

INTERNATIONAL MICROTRONICS CORP. EXCELLENCE THRU DESIGN

FAX: 602-790-2808

INTERNATIONAL MICROTRONICS CORP., 4016 E. Tennessee St., Tucson, AZ 85714, Tel: 602-748-7900, TWX: 910-952-1170; Empl.: 30; *Sls. Mgr.:* H. Statler ..... **D•1377-1379**

Local Sales Offices & Reps
CA La Jolla, John Garvin Assocs. 619-454-6274
CA Torrance, Cutlass Elctrns. 805-527-1905
LA Metairie, R. E. Owens, Inc. 504-866-5813
MA Wayland, Daner-Hayes 617-655-0888
OH North Royalton, Techno Instrs. Inc. 216-237-8815
TX Midland, Total Flow Measures 915-697-9621
PR Guaynabo, Escobar, Owen & Assocs. 809-789-9008

Local Distributors
CA Santa Clara, Tech-Ser, Inc. 408-496-1004
CA Torrance, Tech-Ser, Inc. 213-370-7200
GA Atlanta, Process Meas. Co. 404-696-7481
IL Chicago, Data Elctrns. Co., Inc. 312-283-0300
IL Countryside, Pacific Indicator 312-352-3500

IN Indianapolis, Data Elctrns. 317-359-5368
MA Waltham, Calibron Instrs. 617-894-6440
MN Plymouth, Data Elctrns. 612-559-1434
NY Rochester, Maseline Elctrns., Inc. 716-546-5373
TX Dallas, Textrol, Inc. 214-484-9961
VA Richmond, Meter Metrics 804-275-1431
WI Wauwatosa, Data Elctrns. Co., Inc. 414-259-9088

INTERNATIONAL POLARIZER, INC., 320 Elm Street, Marlborough, MA 01752, Tel: 617-481-7495, ESYLNK: 601 6454; Empl.: 6

INTERNATIONAL POWER
DC POWER SUPPLIES

FAX: 805-388-2686

INTERNATIONAL POWER D.C., Power Supplies Inc., 355 N. Lantana, Ste. 710, Camarillo, CA 93010, Tel: 805-987-7900, TWX: 510-600-6944, ESYLNK: 62911592; Empl.: 25; *Sls. Mgr.:* Craig Johnson; *Dist. Mgr.:* Ron Ostlund ..... **D•1768-1772**

Local Sales Offices & Reps
AZ Phoenix, S.W. Tech. Sls. 602-893-1209
CA El Cajon, Atronix 619-444-1501
CA Oceanside, Atronix 619-438-2537
CA San Jose, Nelson Elctrn. Sls. 408-293-2600
CA Woodland Hills, Atronix 818-703-7212
CT Bethel, Livera Polk Assocs. 203-748-4639
FL Land O Lakes, A.J. Power Source 813-996-2583
GA Lawrenceville, R. L. Panyik & Assocs. 404-923-3703
IL Wheeling, Ed Joyner & Co. 312-520-1200
IN Indianapolis, JFCO, Inc. 317-576-9363
MD Randallstown, Beacon North, Inc. 703-478-2480
MI Grand Rapids, JFCO, Inc. 616-245-4621
MI Lake Orion, JFCO, Inc. 313-693-2053
MN Richfield, Clay Rep Co. 612-861-2191
NH Londonderry, Bennetron 603-432-9092
NJ Madison, Livera-Polk Assocs. 201-377-3220
NY Glen Head, Livera-Polk Assocs. 516-759-9300
OH Cleveland, JFCO, Inc. 216-398-6300
OH Vandalia, JFCO, Inc. 513-890-8322
OR Beaverton, Luscombe Engrg. 206-223-1541, 206-636-6664
PA Pittsburgh, JFCO, Inc. 412-823-5400
TX Austin, Barry Sls., Inc. 512-837-3616
TX Houston, Barry Sls., Inc. 713-784-5860
TX Richardson, Barry Sls., Inc. 214-234-0255
UT Ogden, Taylor Mktg. 801-546-9570
VA Sterling, Beacon North, Inc. 703-478-2480
WI Milwaukee, Ed Joyner & Co. 414-481-0547
Can St. Laurent, Que., Componetics, Ltd. ... 514-334-1464
Can Surrey, B.C., Enerlec Sls., Ltd. 604-888-1667

Local Distributors
CA Canoga Pk., Sandy's Elctrn. Supp. 818-346-8353
CA N. Hollywood, Sandy's Elctrn. Supp. 818-765-8585, 818-983-2550
CA Thousand Oaks, Pace Elctrns. 818-889-1209, 805-497-7515
IL Champaign, Klaus Radio 217-356-1896
IL Mt. Prospect, Feed Control 312-253-3898
IL Villa Pk., Melvin Elctrns. 312-279-5015
IN Evansville, Evansville Supp. Co. 812-424-7541
MD Gaithersburg, Axis Elctrns. 301-840-9640
MD Glen Burnie, Baytronics 301-766-0081, 301-953-7050
MN Maplewood, Edison Controls 612-770-5122
NH Hudson, C & H Elctrns. 603-882-1133, 603-273-4450
NH Londonderry, Orion Inds., Inc. 603-437-4446
NY Glen Head, Livera Polk Assocs. 516-759-9300
NC Raleigh, Sager/Svc. Plus Elctrns. 919-850-9550
OK Oklahoma City, Radio Supp. Inc. 405-232-6127
PA McKean, Advacom, Inc. 814-476-7774
TX Richardson, All-Power 214-234-0255
VA Sterling, ICE Comps., Inc. 703-478-2677
WI Cedarburg, A-A Elec. 414-377-7500
Can St. Laurent, Que., Componetics, Ltd. ... 514-334-1460
Can Surrey, B.C., Enerlec Sls. 604-888-1667

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FAX: 617-782-7416

INTERNATIONAL POWER DEVICES, 155 N. Beacon St., Brighton, MA 02135, Tel: 617-782-3331, ESYLNK: 989-752; Empl.: 65; *Sls. Mgr.:* Aileen Liu, G/M ..... **D•1774-1778**

Local Sales Offices & Reps
AL Huntsville, Macro Mktg. 205-883-9630
AZ Mesa, Elec-Com Assocs. 602-844-0566
CA Los Angeles, Power Partners 213-215-0800
CA San Diego, Power Partners 619-560-0099
CA San Ramon, Tech. Consits. 415-830-0829
FL Clearwater, Electrocraft, Inc. 813-578-2233
FL Coral Springs, Electrocraft, Inc. 305-753-8566
GA Norcross, Macro Mktg. 404-441-1081
IL Lincolnwood, Electro-Tech Mktg. Assocs., Inc. 312-676-3151
MI Ann Arbor, Augnat Assocs. 313-668-3134
MN Bloomington, Smiley/Scott Inc. 612-888-5551
MO Maryland Hgts., Ensco-Rep, Inc. 314-423-3935
NH Londonderry, Bennetron 603-432-9092
NJ Englewood, Tecnimat 201-569-4200
NJ Haddonfield, Sunday O'Brien 609-429-4013
NY Buffalo, Ed Westgren Assocs. 716-632-0011
NC Raleigh, Micro Sls., Inc. 919-881-0007
OH Akron, Augnat Assocs. 216-273-1211
OH Dayton, Augnat Assocs. 513-298-1507
OR Portland, Power Sources, Unltd. 503-292-0820
TX Dallas, Seaton Corp. 214-380-0414
TX Houston, Seaton Corp. 713-731-2649
VA Richmond, Glasscock Assocs. 804-740-0063
WA Lynnwood, Power Sources, Unltd. 206-743-6641
WI Brookfield, Electro-Tech Mktg., Inc. 414-785-9554

INTERNATIONAL POWER MACHINES, 2975 Miller Park North, Garland, TX 75042, Tel: 800-527-1208, TELEX: 794078 IPM POWER, FAX: 214-494-2690; *Sls. Mgr.:* Wayne Harper

INTERNATIONAL POWER SOURCES, INC., 10 Cochituate St., Natick, MA 01760, Tel: 617-651-1818, TWX: 510-100-3635, FAX: 617-655-7984

International
IOR Rectifier

FAX: 213-640-6515

INTERNATIONAL RECTIFIER CORP., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245, Tel: 213-772-2000, TELEX: 472-0403, TWX: 910-348-6291; Empl.: 1900; *Sls. Mgr.:* Don Prescott; *Dist. Mgr.:* Shawn Fogarty ..... **B•1501**

Local Sales Offices & Reps
AL Huntsville, Montgomery Mktg., Inc. 205-830-0498
AZ Phoenix, Sun State Tech. Sls. 602-220-0595
CA Chatsworth, First Rep 818-718-6155
CA Mtn. View, Brooks Tech. Grp. 415-960-3880
CA San Diego, Harvey King, Inc. 619-587-9300
CA Tarzana, Power Comp. Sls. 818-881-9111
CO Wheat Ridge, Waugaman Assocs., Inc. 303-423-1020
CT Fairfield, N.R.G. Ltd., Inc. 203-384-1112
FL Boca Raton, Lawrence Assocs., Inc. 305-368-7373
GA Norcross, Montgomery Mktg., Inc. 404-447-6124
IL Hoffman Estates, Micro-Tex, Inc. 312-382-3001
IL Palatine, International Rectifier 312-397-0002
IN Carmel, Technlg. Mktg. Corp. 317-844-8462
IA Cedar Rapids, Hitec Cen., Inc. 319-396-3228
KY Louisville, Technlg. Mktg. Corp. 502-893-1377
MD Columbia, L. D. Lowery, Inc. 301-381-0225
MA Burlington, AD/Nova Sls., Inc. 617-270-9600
MI Livonia, Luebbe Sls. Co. 313-477-3131
MN Eden Prairie, Elctrn. Innovators 612-941-0830
MN Edina, Mel Foster Tech. Sls. 612-941-9790
MO Florissant, Hitec Control, Inc. 314-831-9377
NJ Pallisades Park, International Rectifier 201-943-4554
NJ Wyckoff, Northeast Comps. 201-848-1100
NM Albuquerque, Reptronix Ltd. 505-292-1718
NY E. Syracuse, Nycom, Inc. 315-437-8343
NY Melville, Parallax 516-351-1000
NC Raleigh, Montgomery Mktg., Inc. 919-851-0010
OH Cincinnati, Luebbe Sls. Co. 513-530-0600
OH Cleveland, Luebbe Sls. Co. 216-333-0425
OH Columbus, Luebbe Sls. Co. 614-431-0474
OH Dayton, Luebbe Sls. Co. 513-294-0426
OH Independence, International Rectifier .. 216-447-9717
OK Tulsa, BP Sls. 918-744-9964
OR Portland, N.W. Mktg. Assocs. 503-620-0441
PA Broomal, L. D. Lowery, Inc. 215-356-5300
TX Austin, BP Sls. 512-346-9186
TX Houston, BP Sls. 713-782-4144
TX Richardson, BP Sls. 214-234-8438
UT Salt Lake City, BP Mktg. 801-595-0631
WA Bellevue, N.W. Mktg. Assocs. 206-455-5846
WI Elm Grove, International Rectifier 414-784-2480
WI Waukesha, Micro-Tex, Inc. 414-542-5352

IRC
A Member of the Crystalate Group

FAX: 704-264-8865

INTERNATIONAL RESISTIVE COMPANY, P.O. Box 1860, Boone, NC 28607, Tel: 704-264-8861, TELEX: 46-9902; Empl.: 1700; *Sls. Mgr.:* Larry J. Johnston; *Dist. Mgr.:* Hugh Bolen ..... **A•1739, 1937-1940; B•1011**

Local Sales Offices & Reps
AL Huntsville, R. O. Whitesell & Assocs. .. 205-883-5110
AZ Scottsdale, SW Sls. Inc. 602-391-3180
CA Pasadena, Luscombe Engrg. Co. 213-684-2000
CA Sacramento, ETS 916-962-3030
CA San Jose, ETS 408-433-9366
CO Westminster, Straube Assocs. 303-426-0890
CT E. Norwalk, Tech. Sls. Assocs. 203-853-4466
FL Orlando, S. Atlantic Comp. Sls. 305-857-3650
GA Norcross, S. Atlantic Comp. Sls. 404-447-6154
IL Itasca, Circuit Sls. Inc. 312-773-0200
IN Ft. Wayne, R. O. Whitesell & Assocs. .. 219-432-5591
IN Indianapolis, R. O. Whitesell & Assocs. 317-359-9283
IA Cedar Rapids, C. H. Horn & Assocs. .. 319-393-8703
KS Lenexa, Midtec Assocs. 913-541-0505
KY Pewee Valley, R. O. Whitesell & Assocs. 502-241-1441
MD Columbia, L. D. Lowery Inc. 301-381-0225
MA Needham Hgts., Coakey, Boyd, & Abbett 617-444-5470
MI Grand Blanc, R. O. Whitesell & Assocs. 313-695-0770
MI Grand Rapids, R. O. Whitesell & Assocs. 616-942-5420
MI Southfield, R. O. Whitesell & Assocs. .. 313-559-5454
MN Minneapolis, Tecteam Sls., Inc. 612-854-6616
MO St. Louis, Jack Macke Co. 314-432-2830
NY Rochester, Electra Sls. 716-427-7860
NC Greensboro, S. Atlantic Comp. Sls. 919-852-4676
OH Cincinnati, R. O. Whitesell & Assocs. .. 513-521-2290
OH Cleveland, R. O. Whitesell & Assocs. .. 216-447-9020
OH Columbus, R. O. Whitesell & Assocs. 614-888-9396
OH Dayton, R. O. Whitesell & Assocs. 513-298-9546
OK Tulsa, Ion Assocs. 918-664-0186
OR Portland, RTS 503-632-3925
PA Broomall, L. D. Lowery Inc. 215-356-5300
PA Pittsburgh, R. O. Whitesell & Assocs. 412-963-6161
TN Nashville, R. O. Whitesell & Assocs. ... 615-352-4760
TX Austin, Ion Assocs. 512-331-7251
TX El Paso, S. W. Sales 915-594-8259
TX Grand Prairie, Ion Assocs. 214-647-8225
UT Salt Lake City, Straube Assocs. 801-263-2640
VA Earlysville, L. D. Lowery Inc. 804-973-6672
WA Vashon, RTS 503-632-3925
WA Vashon, RTS 206-285-1363
WI Brookfield, Circuit Sls., Inc. 414-784-7773
Can Toronto, Renmark 416-494-5445

Local Distributors
AZ Tempe, Hamilton/Avnet 602-231-5100
CA Campton, Harper S.I.D. 213-979-5090
CA Chatsworth, Hamilton Electro Sls. 818-700-6500
CA Culver City, Hamilton Electro Sls. 213-558-2121
CA Gardena, Bell Inds. 213-515-1800
CA Sunnyvale, Bell Inds. 408-734-8570
CA Sunnyvlae, Harper S.I.D. 408-988-6041
FL Tampa, Impala Elctrns. 813-885-4747
IL Schaumburg, Arrow Elctrns. 312-397-3440
IN Indianapolis, Graham Elctrns. 317-634-8202
IA Cedar Rapids, Deeco 319-365-7551
MD Columbia, Hamilton/Avnet 301-995-3500
MA Woburn, Jaco Elctrns. 617-933-7760
MN Edina, Arrow Elctrns. 612-830-1800
NJ Hanover, State Elctrns. 201-887-2550
NJ Marlton, Arrow Elctrns. 609-596-8000
NY Hauppauge, Hamilton/Avnet 516-231-9800
NY Hauppauge, Jaco Elctrns. 516-273-5500
NC Raleigh, Arrow Elctrns. 919-876-3132
NC Raleigh, Resco/Raleigh 919-781-5700
OH Columbus, Electronic Mktg. 614-299-4161
OH Dayton, Hamilton/Avnet 513-439-6700
PA Philadelphia, Philadelphia Elctrns. 215-568-7400
TX El Paso, Intl. Elctrns. 915-778-9761
TX Irving, Hamilton/Avnet 214-659-4100
TX Richardson, Jaco Elctrns. 214-235-9575
WA Bellevue, Hamilton/Avnet 206-643-3950
WA Bellevue, Priebe Elctrns. 206-821-4695

INTERNATIONAL RESOURCE SVCS., 7792 N.W. 72nd Ave., Miami, FL 33166, Tel: 305-884-2924, TELEX: 529076 SUN MIA UD; Empl.: 5; *Sls. Mgr.:* Richard L. Winn ..... **B•1729**

FAX: 402-694-6180

INTERNATIONAL SENSOR SYSTEMS, INC., Aurora Industrial Pk, Box 345, Aurora, NE 68818, Tel: 402-694-6111, ESYLNK: 62942952; Empl.: 45; *Sls. Mgr.:* Wayne Roblee ..... **A•1742-1743**

Local Sales Offices & Reps

CA	Mission Viejo, EAB Assocs. Inc	714-859-7701
CA	Palo Alto, Tri-Rep	415-965-1822
CO	Ft. Collins, Rep Sls. Inc.	303-226-1504
CT	Roxbury, Kimble Assocs.	203-354-1954
KS	Wichita, DLE Elctrns.	316-744-1229
MD	Baldwin, Quarterback Sls. Inc.	301-764-9400
MO	Jefferson City, Williams Assocs. Co.	314-893-2459
NE	Omaha, IONEB	402-895-4431
NJ	Springfield, F. F. Sylvester Assocs.	201-376-3324
NY	Liverpool, Syronics, Inc.	315-451-0968
OH	Cincinnati, Applied Data Mgt.	513-579-8108
PA	Southampton, Campbell Assocs.	215-322-6630
TN	McMinnville, B & D Mktg.	615-473-7155
TX	El Paso, Nokomis of El Paso, Inc.	915-778-2801
TX	Lewisville, Elctrn. Prod. Reps.	214-436-4772
WA	Bellevue, Advanced Power Comps.	206-747-9127

INTERNATIONAL TRANSDUCER CORP., Channel Technologies, Inc., 869 Ward Dr., Santa Barbara, CA 93111, Tel: 805-683-2575, TELEX: 658 495; FSC No.: ID 532; Empl.: 65; *Sls. Mgr.:* Christine M. Bashforth

INTERNATIONAL WIRE PRODUCTS CO., 500 W. Main St., Wyckoff, NJ 07481, Tel: 201-891-5800, TELEX: 642580; Empl.: 700; *Sls. Mgr.:* C. D. Abbott

INTEROPTICS

FAX: 415-340-1670

INTEROPTICS, Purdy Group, 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-347-7727, TELEX: 677-1439 (PURDY UW); Empl.: 35; *Sls. Mgr.:* Thomas B. Kinney ..... **B•1169**

Local Sales Offices & Reps

AZ	Phoenix, Laser Tech. Intl.	602-978-5756
CA	Burlingame, William J. Purdy Co.	415-347-7701
CO	Denver, William J. Purdy Co.	303-753-6800
FL	Melbourne, Panterra Sls., Inc.	305-452-4454
GA	Decatur, Panterra Sls., Inc.	404-325-0165
IL	Des Plaines, Flaherty-Haines, Inc.	312-298-2710
MN	Bloomington, Heil's Termatech Elctrn. Mktg.	612-854-2001
MO	St. Louis, Midtec Assocs., Inc.	314-275-8666
NH	Nashua, Bell Controls, Inc.	603-882-6984
NJ	Passaic, Lightcomm Sls. Assocs.	201-778-6540
NM	Albuquerque, William J. Purdy Co.	505-266-7959
NY	New York, Lightcomm Sls. Assocs.	212-807-8924
NY	Utica, Fiber Instrs. Sls.	315-735-1691
NC	High Pt., EME, Inc.	919-869-3335
OK	Park Hill, Scientific Dvcs.	918-457-4888
OR	Beaverton, William J. Purdy Co.	503-641-9373
TN	Fayetteville, Panterra Sls., Inc.	615-759-4155
TX	Richardson, Scientific Dvcs.	214-231-8106
TX	Roundrock, Scientific Dvcs.	512-388-3982
TX	Spring, Scientific Dvcs.	713-376-8666
VA	Williamsburg, EME IV, Inc.	804-253-0171
WA	Redmond, William J. Purdy Co.	206-882-3144

Local Distributors

CA	Anaheim, Fibertron	714-634-3449
Can	Burnaby, BC, C.D. Nova, Ltd.	604-430-5612

INTERSIL, 2450 Walsh Ave., Santa Clara, CA 95051, Tel: 408-996-5000, TWX: 910-338-0583; FSC No.: 32293; Empl.: 4102; *Dist. Mgr.:* Bruce Mattern

INTERSTATE ELECTRONICS CORP., Box 3117, 1001 E. Ball Rd., Anaheim, CA 92803, Tel: 714-635-7210, TELEX: 655443, TWX: 910-591-1197; FSC No.: 6625, 5985; Empl.: 1500; *Sls. Mgr.:* Darryl Watanabe; *Dist. Mgr.:* R. Sorenson

INTERSTATE WIRE CO., INC., 10820 Sanden Dr., Dallas, TX 75238, Tel: 214-553-1311, TWX: 910-860-5084, FAX: 214-348-7106; *Sls. Mgr.:* Chris B. Brandon

INTERSWITCH

FAX: 415-340-1670

INTERSWITCH, Wm. J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-347-8217, TELEX: 677-1439; FSC No.: (Purdy UW); Empl.: 30; *Sls. Mgr.:* Clarence Bruce ..... **B•1823**

Local Sales Offices & Reps

CA	Burlingame, Interswitch	415-347-8217
CA	Anaheim, Impact	714-533-1351
CA	Burlingame, William J. Purdy Co.	415-347-7701
CO	Denver, William J. Purdy Co.	303-790-2211
CT	Meriden, Advanced Comp. Sls.	203-238-6891
IL	Elmhurst, F.F./Hill-Gray	312-832-4101
IN	Indianapolis, John Sukup Inc.	317-253-5501
MD	Lisbon, S. K. MacDonald	301-982-1088
MI	Royal Oak, Hilltronics, Inc.	313-435-0920
MA	Farmingham, Gallagher	617-626-2346
NM	Albuquerque, William J. Purdy Co.	505-266-7959
NY	Rochester, Net Sls.	716-223-1030
OH	Cleveland, Marlow	216-991-6500
OH	Dayton, Marlow	513-274-9666
OR	Beaverton, Pacific Mktg.	503-641-9373
PA	Philadelphia, S. K. MacDonald, Inc.	215-545-1205
TX	Dallas, Elcom Mktg.	214-241-2166
TX	Houston, Elcom Mktg.	713-350-8064
WA	Redmond, Pacific Mktg.	206-882-3144

Local Distributors

AZ	Tempe, Anjon Entprs.	602-894-1332
AZ	Tempe, Waltronic Sls.	602-967-1020
CA	Burbank, Merit Comp. Supp.	818-842-8162
CA	Canoga Pk., Panel Parts Co.	818-884-8898
CA	Costa Mesa, Powell	714-754-1717
CA	San Jose, Powell	408-943-9020
CA	Santa Clara, Waltronic Sls.	408-727-1200
FL	Ft. Lauderdale, Powell	305-973-4141
MD	Columbia, Powell	301-621-8080
MA	Lynn, Land Elctrn. Co.	617-592-2220
MN	Minneapolis, Bergquist	612-835-2322
NJ	Englewood, Powell Elctrns.	201-894-0800
NM	Albuquerque, Walker Elctrn. Supp.	505-883-2992
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Rochester, Summit Elctrns.	716-334-8110
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
PA	Philadelphia, Powell	215-365-1900
PA	Philadelphia, Resco Elctrns.	215-659-4575
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Irving, Powell	214-550-0547
WI	Mequon, Taylor Elec. Co.	414-241-4321
Can	Don Mills, Ont., Saynor Varah	416-445-0723
Can	Willowdale, Ont., Electrosonic	416-494-1666

The Inter-Technical Group Inc.
WIMA Division

FAX: 914-591-7336

INTER-TECHNICAL GROUP INC., WIMA Div., One Bridge Street, Irvington, NY 10533, Tel: 914-591-8822, TWX: 710-564-0802; Empl.: 17; *Sls. Mgr.:* Gary M. Fey; *Dist. Mgr.:* Andrew E. Dvorscak ..... **A•1089**

Local Sales Offices & Reps

AL	Huntsville, J. R. Assocs.	205-830-2130
CA	Campbell, Shur Sls.	408-374-5577
CO	Englewood, B C & Assocs.	303-694-3999
FL	Altamonte Springs, 'C' Assocs., Inc.	305-831-1717
GA	Conyers, J.R. Assocs.	404-922-1231
IL	Westchester, W. G. Brouilette & Assocs.	312-345-6500
KS	Overland Pk., EPI West	913-642-9118
MA	Newton, Normell Assocs.	617-969-5478
MI	Grand Rapids, JFCO, Inc.	616-949-1020
MI	Lake Orion, JFCO, Inc.	313-693-2053
MN	Minneapolis, Intl. Sls. Co.	612-831-8423
MO	St. Louis, EPI, Inc.	314-962-1411
NJ	Upper Montclair, McCarron Entprs., Inc.	201-783-3112
NY	Rochester, BKT Assocs., Inc.	716-461-9880
NY	Smithtown, T & K Sls.	516-724-3456
NC	Lewisville, J.R. Assocs.	919-945-9574
OH	Cleveland, JFCO, Inc.	216-398-6300
OH	Dayton, JFCO, Inc.	513-890-8322
OR	Portland, Harry Levinson Co.	503-245-1902
PA	Pittsburgh, JFCO, Inc.	412-823-5400
TN	Chattanooga, J. R. Assocs.	615-892-7630
TN	Chattanooga, J.R. Assocs.	615-892-7630
TX	Houston, Barry Sls., Inc.	713-784-5860
TX	Richardson, Barry Sls, Inc.	214-234-0255
UT	Murray, Butterworth Mktg.	801-268-2244
VA	Richmond, Glasscock Assocs.	804-740-0063
WA	Seattle, Harry Levinson Co.	206-382-1300

Local Distributors

CA	San Jose, Shelly-Ragon, Inc.	408-432-0600
CA	Sunnyvale, Capsco Sls., Inc.	408-734-3020
FL	Melbourne, T.C. Pridmore Co.	305-727-2491
GA	Norcross, Spectrum Elctrns., Inc.	404-448-1516
IL	Rosemont, Advent Elctrns., Inc.	312-297-6200
IN	Indianapolis, Advent Elctrns., Inc.	317-872-4910
IA	Cedar Rapids, Advent Elctrns., Inc.	319-363-0221
MA	Ashland, March Elctrns.	617-881-6715
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MN	New Brighton, Chris Elctrns. Distr.	612-631-2647
NY	Bohemia, March Elctrns.	516-563-6000
NY	Port Chester, MKM Elctrn. Comps., Inc.	914-939-3940
OH	Englewood, Argent Inds., Inc.	513-836-8633
PA	Exton, VSH Elctrns.	215-363-2250
PA	Zelienople, Argent Electra Div.	412-776-4330
TX	McKinney, Prime Distrbg. Co.	214-231-0170
WA	Seattle, Kam Elctrns. Div.	206-382-1300

INTRA-COMPUTER, 101 W. 31st St., New York, NY 10001, Tel: 212-947-5533, TELEX: 64-5067; Empl.: 9; *Sls. Mgr.:* Art Yaglian

FAX: 617-527-3310

INTRONICS, INC., 57 Chapel St., Newton, MA 02158, Tel: 617-964-4000, TELEX: 200095, TWX: 710-335-6835; Empl.: 75; *Sls. Mgr.:* William Dudjoc ..... **D•1779**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs.	205-533-9108
CA	Campbell, Situr Sls.	408-374-5577
CA	Los Alamitos, Power Specialists	213-594-9418
IL	Arlington Hgts., Coombs Assocs.	312-439-9810
IA	Cedar Rapids, Technical Elctrns.	319-366-5443
MA	Lowell, Underwood Sls. Corp.	617-256-8191
MN	Albuquerque, Trembly Assocs.	505-266-8616
NY	Utica, Fiber Instr. Sls.	315-735-1691
OH	Dayton, Del Steffen & Assocs.	513-293-3145
PA	Montgomeryville, Eastern Sci. Mktg.	215-368-4570
TX	Richardson, Scientific Sls. Co.	214-231-6541
UT	Salt Lake City, Trembly Assocs., Inc.	801-295-4703
VA	Reston, Stinson Assocs.	703-478-2252
Can	Lachine, Que., Electro Design	514-636-4838
Can	Surry, BC, Enerlec Sls., Ltd.	604-888-1667

ION PHYSICS CO., 323 Andover St., Wilmington, MA 01887, Tel: 617-658-6030, TWX: 510-600-6134

IOTECH, INC., 23400 Aurora Road, Cleveland, OH 44146, Tel: 216-439-4091, TELEX: WUI 6502820864

IPAC GRP., 3047 Indl. Blvd., Bethel Pk., PA 15102, Tel: 412-831-9200, TWX: 510-697-3935; Empl.: 50; *Sls. Mgr.:* D. T. Cusack

Local Sales Offices & Reps

AL	Huntsville, Jim Springer, Inc.	205-883-4163
AZ	Paradise Valley, Lee Assocs.	602-947-9003
CA	Walnut Creek, Briggs Process Instrs.	415-932-5772
MA	Norwell, BESCO	617-659-4915
NC	Smithfield, HESCO	919-934-5115
PA	Bethlehem, Carl Anderson Agy.	215-868-7275
TX	Houston, CPI Sys.	713-580-9411

IPM, INC., Elnik Systems, 3 Edison Place, Fairfield, NJ 07006, Tel: 201-882-8033, TELEX: 13-0567, FAX: 201-882-8037; Empl.: 8; *Sls. Mgr.:* Claus J. Joens

IRONICS INCORPORATED, 798 Cascadilla St., Ithaca, NY 14850, Tel: 607-277-4060, TELEX: 705-742; *Sls. Mgr.:* R. Chris Martens

IR SCIENTIFIC, Box 110, Carlisle, MA 01741, Tel: 617-667-7110; Empl.: 10; *Sls. Mgr.:* S. J. Sommer

ISC CARDION ELECTRONICS, INC., Long Island Expwy., Woodbury, NY 11797, Tel: 516-921-7300, TELEX: 221683 CARD, TWX: 510-221-2179; FSC No.: 12909; Empl.: 450; *Sls. Mgr.:* F. J. Gareffa

ISC DATACOM, ISC Defense & Space, 1288 Reamwood Ave., Sunnyvale, CA 94089, Tel: 408-747-0300, FAX: 408-747-1873; FSC No.: 74444; Empl.: 30; *Sls. Mgr.:* C. Frank

ISC MAGNETICS DIV., See Aeroflex Labs., Inc., Magnetic Prods. Div.

ISKRA ELECTRONICS, INC., 222 Sherwood Ave., Farmingdale, NY 11735, Tel: 516-753-0400, 800-862-2101, TELEX: 221527, FAX: 516 753-0658; *Sls. Mgr.:* Debbie Gremito

Local Sales Offices & Reps

CA	San Diego, C. K. Assocs.	619-279-0420
FL	Largo, Burke Assocs.	813-536-4335,
IL	Elmhurst, Utronix Sls.	312-834-1100
IN	Ft. Wayne, Naunas Sls. Co.	219-432-4792
MN	Minneapolis, R.K. Sls. Assocs. Inc.	612-571-1001
NJ	Glasboro, R. P. Luce & Co.	609-881-2877,
NY	New Hyde Pk, R. P. Luce & Co.	516-437-4550
OH	Mentor, Sales Plus	216-255-6917,
SC	Easley, R A Sls.	803-859-1859
TN	Rutherford, R.A. Sls.	901-665-6301,
TX	Dallas, J. Clay Co.	214-458-8833
TX	El Paso, EPEC Elctrns. Inc.	915-593-8481
UT	South Jordan, MAC III	801-569-1095

FAX: 516-937-3840

ISL PRODUCTS INT'L, LTD., 235 P Robbins Lane, Syosset, NY 11791-6093, Tel: 516-937-3475, TELEX: 503242; Empl.: 25,000; *Sls. Mgr.:* Ken Kawaller **A•1094, 2241; C•1401, 1856; D•2167**

Local Sales Offices & Reps

IL	Chicago, Trans World Products	312-486-5474
IN	Indianapolis, C.C. Electro Sales	317-255-1508
MD	Pikesville, Muncy-Semless Assoc.	301-484-6376
MN	St. Paul, Countryman Assoc.	612-645-9151
NJ	West Berlin, Muncy-Semless Assoc.	609-346-4402

ISOLATION PRODUCTS, INC., 157 San Lazaro Ave., Sunnyvale, CA 94086, Tel: 408-730-4672; Empl.: 5

ISOREG CORP., 410 Great Rd., P.O. Box 486, Littleton, MA 01460, Tel: 617-486-9483, FAX: 617-486-3539; Empl.: 75; *Sls. Mgr.:* Paul Foss; *Dist. Mgr.:* Paul Foss

ISOTEMP RESEARCH, INC.

FAX: 804-977-1849

ISOTEMP RESEARCH, INC., 1750 Broadway St, P.O. Box 3389, Charlottesville, VA 22901, Tel: 804-295-3101; FSC No.: 031785; Empl.: 30 **A•1402-1403**

Local Sales Offices & Reps

AZ	Scottsdale, Faser Technical Sls.	602-948-4404
CA	Fremont, Wm. Parks & Assocs.	415-796-0875
CA	Irvine, EBA Microwave	714-857-6079
CA	San Diego, Qualtronics	619-695-0118
IL	Woodridge, Trend-Tronics	312-985-0626
IN	Fort Wayne, Given Corp.	219-432-5585
NC	Raleigh, Godwin Assocs.	919-847-3006

ISOTRONICS, Augat, Industrial Park, New Bedford, MA 02745, Tel: 617-998-2000, TWX: 710-344-1961; *Sls. Mgr.:* Max Treptow

ITC SYSTEMS, INC., 813 Anapamu St. 2C, Santa Barbara, CA 93103, Tel: 805-965-8900, TELEX: 295-298 INTERTEL SNC; *Sls. Mgr.:* W. Schulz

ITEK ENCODER, 27 Christina St., Newton, MA 02164-1515, Tel: 617-969-7300, TWX: 710-335-6783, FAX: 617-964-3705; Empl.: 100 **B•1892-1893**

Local Sales Offices & Reps

CA	Long Bch., Itek Encoder	213-598-8575
CA	Woodland Hills, Clifton Precision	818-347-0603
FL	Orlando, K. S. Chaney	305-293-5656
IL	Des Plaines, Marsland Assocs.	312-298-2620
IN	Indianapolis, Marsland Assocs.	317-293-5437
MI	Grand Rapids, Midwest & Meridian Corp.	616-698-7391
MN	Minneapolis, Marsland Assocs.	612-545-4481
MO	St. Louis, Midwest & Meridian Corp.	314-878-4441
NJ	Metuchen, Itek Encoder	201-548-1500
TX	Garland, Carey, McMahill & Assocs., Inc.	214-494-1212

Local Distributors

FL	Orlando, Kenneth S. Chaney	305-293-5656
IL	Des Plaines, Marsland Assocs.	312-298-2620
IN	Indianapolis, Marsland Assocs.	317-293-5437
MN	Minneapolis, Marsland Assocs.	612-545-4481

ITHACO, INC., Meas. & Control Instrs. Div., 735 W. Clinton St., P.O. Box 6437, Ithaca, NY 14851-6437, Tel: 607-272-7640, TWX: 510-255-9307, FAX: 607-272-4550; Empl.: 120; *Sls. Mgr.:* E. W. Seymour

ITL CIRCUITS, 90 Don Park Road, Markham, Ontario, Canada L3R 1C4, Tel: 416-475-6658, 416-492-9307, FAX: 416-475-5097; *Sls. Mgr.:* Derk Wissink

ITT CANNON, 666 E. Dyer Road, Santa Ana, CA 92705-5684, Tel: 714-557-4700, TELEX: 75-3917, TWX: 910-997-0523; FSC No.: 71468;Multiple; Empl.: 2500; *Sls. Mgr.:* Richard Torson; *Dist. Mgr.:* Richard Torson

ITT Components
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FAX: 714-727-2109

ITT COMPONENTS, ITT Corporation, 5 Jenner .st, Ste. 100, Irvine, CA 92718, Tel: 714-727-3001, TELEX: 681-389, TWX: 910-595-1744; FSC No.: 61725; Empl.: 29; *Dist. Mgr.:* K. Rider **A•1092-1093, 1404-1405; B•1502-1509**

Local Sales Offices & Reps

AZ	Scottsdale, Bill Earl Assocs. Inc.	602-994-3813
CO	Englewood, Romulus Elctrns.	303-770-4888
CT	Guilford, Data Mark, Inc.	203-453-0575
FL	Pompano Bch., Bolton Assocs.	305-781-8887
IL	Rolling Meadows, Heartland Tech. Sls.	312-577-9222
IN	Ft. Wayne, M/S Sls.	219-436-3023
KS	Wichita, Thunderbird Tech. Sls.	316-684-3941
MA	Sudbury, KSA of New England	617-443-5881
MI	Brighton, Elctrn. Sources Inc.	313-227-3598
MN	Minnetonka, J.P. & Assocs.	612-935-7930
MO	Maryland Hgts., Thunderbird Tech. Sls.	314-298-8940
NM	Albuquerque, Syntech	505-266-7951
NY	Fairport, Net Sls. Co.	716-223-1030
NY	Manhasset, Win Cor Elctrns.	516-627-9474
NC	Pineville, JWL & Assocs.	704-541-5750
OH	Centerville, Omega Sls.	513-434-5507
OH	Shaker Hgts., Omega Sls.	216-751-9600
PA	Prospect Pk., Elf Sls.	215-534-3340
TX	Richardson, Milco Mktg.	214-783-2716
VA	Front Royal, Eltron Sls.	703-635-7201
WA	Redmond, EMG	206-882-0962

Local Distributors

AZ	Tempe, Richey Western Elctrns.	602-894-9251
CA	Chatsworth, Shelley Ragon	818-998-3333
CA	Garden Grove, Richey Western Elctrns.	714-895-0060
CA	Irvine, Integrated Elctrns.	714-837-9960
CA	Irvine, ITT Multi Comps.	714-727-4001
CA	Sacramento, Integrated Elctrns.	916-424-5297
CA	San Diego, Richey Western Elctrns.	619-271-4511
CA	San Diego, Shelley Ragon	619-453-7133
CA	San Jose, Integrated Elctrns.	408-263-1100
CA	San Jose, ITT Multicomps.	408-279-0685
CA	San Jose, Shelley Ragon	408-942-9111
CA	Santa Clara, Richey Western Elctrns.	408-727-7411
CA	Santa Monica, Distr. Specialties	213-452-3445
CA	Santa Monica, Master Distrs.	213-452-1229
CA	Sunnyvale, Capsco Sls.	408-734-3020
CO	Denver, Integrated Elctrns.	303-292-6121
CO	Englewood, NEP Elctrns.	303-799-9898
CT	East Haven, J.V. Elctrns.	203-469-2321
CT	New Haven, Greene Shaw Co.	203-397-0710
FL	Davie, ARCO Distrs.	305-473-2550
FL	Ft. Lauderdale, NRC	305-772-4500
IL	Chicago, Leeds Electro Comps.	312-825-3800
IL	Chicago, NEP Elctrns.	312-625-8400
IL	Hoffman Estates, Integrated Elctrns.	312-843-2040
IN	Indianapolis, Mar Elctrns.	317-633-6699
MD	Beltsville, RESCO-Washington	301-937-9100
MD	Jessup, TREEKO Sls.	301-792-0112
MD	White Marsh, Resco	301-529-0500
MA	Canton, Impact Sls.	617-821-1500
MA	Newton, Greene-Shaw Co.	617-969-8900
MI	Livonia, Key Elctrns.	313-261-5972
MN	Minneapolis, Industrial Comps.	612-831-2666
NV	Las Vegas, Kiesub Elctrns.	702-733-3888
NJ	Clifton, J-Mar Elctrns.	201-772-6400
NJ	Oakland, Relay Specialties	201-337-1000
NJ	Rockaway, Tonar Inds.	201-586-9000
NM	Albuquerque, Betatron Elctrns.	505-344-2381
OH	Middleburg Hgts., Prehler Elctrns.	216-243-5510
OK	Tulsa, Altair Co.	918-252-5781
OR	Beaverton, Integrated Elctrns.	503-641-1690
OR	Wilsonville, Shelley Ragon	503-641-1691
PA	Essington, Tri-Com	215-521-3080
TX	El Paso, ERA Elctrns.	915-855-3600
TX	El Paso, International Elctrns.	915-598-3406
WA	Bellevue, Integrated Elctrns.	206-455-2727
WA	Seattle, Richey Western Elctrns.	206-575-1910
WA	Seattle, Shelley Ragon	206-241-1980
WI	New Berlin, NEP Elctrns.	414-785-9100

ITT ELECTRON TUBE, ITT Corp., Box 100, Easton, PA 18042, Tel: 215-252-7331, TELEX: 847494; FSC No.: 20948; Empl.: 350

ITT ELECTRO-OPTICAL PRODS., ITT Corporation, 7635 Plantation Rd., Roanoke, VA 24019, Tel: 703-563-0371, TELEX: 829458; Empl.: 1000; *Sls. Mgr.:* R. Bruce; *Dist. Mgr.:* P. Williams

ITT GENERAL CONTROLS DIV., Intl. Telephone & Telegraph Corp., 801 Allen Ave., Glendale, CA 91201, Tel: 213-842-6131, TELEX: 673147, TWX: 910-498-2225; Empl.: 1545; *Sls. Mgr.:* Phillip Vaughn

ITT GILFILLAN, ITT Corp., 7821 Orion Ave., P.O. Box 7713, Van Nuys, CA 91409, Tel: 818-988-2600, TELEX: 651421, TWX: 910-495-1787; FSC No.: 24930; Empl.: 1800; *Sls. Mgr.:* Hollis White

ITT-HIGBIE MFG., Wagner Rd., Rochester, MI 48063, Tel: 313-651-5300, FAX: 313-651-2365; Empl.: 1500; *Sls. Mgr.:* C. J. Clemens

ITT POWERSYSTEMS CORP., Box 688, Galion, OH 44833-0688, Tel: 419-468-5200, TELEX: 4972923, FAX: 419-468-3235; Empl.: 750; *Sls. Mgr.:* S. L. Benedict

Schadow ITT

FAX: 612-934-9121

ITT SCHADOW, 8081 Wallace Rd., Eden Prairie, MN 55344, Tel: 612-934-4400, TELEX: 29-0556, TWX: 910-576-2469; Empl.: 150; *Sls. Mgr.:* Darrell Wilk; *Dist. Mgr.:* Scott Mork **B•1730-1733**

Local Sales Offices & Reps

AL	Huntsville, Brandel-Stephens	205-883-0445
AZ	Phoenix, Shefler-Kahn	602-257-9015
CA	Los Angeles, Landa & Assocs.	213-879-0770
CA	Santa Ana, Landa & Assocs.	714-543-7805
CA	Santa Clara, C-Com	408-727-2266
CO	Boulder, Component Prod. Sls.	303-530-2800
CT	Guilford, Richard Purinton Inc.	203-453-4505
FL	Deerfield Beach, Brandel-Stephens	305-427-8558
FL	Orlando, Brandel-Stephens	305-425-3202
GA	Atlanta, Brandel-Stephens	404-261-7579
IL	Elk Grove, Control Sls.	312-595-2110
IN	Indianapolis, EMCI (Elec. Mktg. Consits., Inc.)	317-253-1668
IA	Marion, W. Saunders Assoc.	319-377-5244
MA	Andover, Richard Purinton, Inc.	617-475-7055
MA	Canton, Richey/Impact Sls. Co.	617-821-1500
MI	Brighton, A.P. Assocs.	313-229-6550
MN	Edina, Hanna/Lind	612-925-5700
MO	St. Louis, W. Saunders Assocs., Inc.	314-576-4650
NJ	W. Caldwell, Grimm, Siegal Assocs.	201-575-9300
NY	East Rochester, L-Mar, Inc.	716-381-9100
NC	Greensboro, Brandel-Stephens	919-274-6952
OH	Dayton, K. W. Elctrns.	513-890-2150
OH	Shaker Heights, K.W. Elctrns.	216-491-9177
OR	Beaverton, James J. Backer Co.	503-627-0775
PA	Allison Pk., K.W. Elctrn. Sls., Inc.	412-487-4300
PA	Trevose, P.S.A., Inc.	215-245-0513
TX	Austin, Fralia & Assocs.	512-835-7911
TX	Euless, Fralia & Assocs.	817-267-3577
TX	Houston, Fralia & Assocs.	713-772-1572
TX	Stafford, Southwest Elctrns/	713-240-4000
WA	Seattle, Jas. J. Backer Co.	206-285-1300

WI	Milwaukee, Indl. Reps., Inc.	414-259-0965
Can	Ontario, Whitby, ITT Cannon-Canada	416-668-8881

Local Distributors

AZ	Tempe, Time Elctrn.	602-967-2000
CA	Gardena, Cal-Switch	213-538-9830
CA	Los Angeles, Richey Western	213-820-3777
CA	Riverside, Electronic Supply	714-787-9220
CA	Sunnyvale, Time Elctrns.	408-734-9888
CO	Denver, Integrated Elctrns.	303-292-6121
FL	Fort Lauderdale, Time Elctrn.	305-974-4800
FL	Miami, Hallmark	305-971-9280
FL	Orlando, Hallmark	305-855-4020
IL	Bensenville, Hallmark	312-860-3800
IL	Crystal Lake, Sub-Sem	312-782-3954
IL	Wheeling, Hawk Elctrns.	312-459-4030
KS	Wichita, R.S.C. Elctrns.	316-267-5213
MD	Beltsville, Treeko Sls.	301-470-3300
MA	Canton, Richey / Impact Sls. Co.	617-821-1500
MA	Hingham, Sager Elec.	617-749-6700
MI	Kentwood, R.M. Elctrns.	616-531-9300
MI	St. Clair Shores, Specialties Mfg.	313-771-2700
MN	Minneapolis, Berquist Co.	612-835-2322
MO	Maryland Heights, Hallmark	314-291-5350
NJ	Oakland, Relay Specialties	201-337-1000
NY	Buffalo, Summit Distr.	716-884-3450
NY	Hauppauge, Sager Elctrn.	516-348-1300
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Rochester, SIMCONA	716-328-3230
NC	Raleigh, Hallmark	919-872-0712
OH	Cincinnati, Schuster Elec.	313-489-1400
OH	Twinsburg, Schuster/Cleveland	216-425-8134
PA	Philadelphia, Phila. Elctrns.	215-568-7400
TX	Austin, Hallmark	512-258-8848
TX	Dallas, Hall-Mark	214-343-5000
TX	Stafford, Southwest Elctr.	713-240-4000
WA	Bellevue, Almac Elctrns	206-643-9992
WA	Bellevue, Integrated Elctrn.	206-455-2727
WI	New Berlin, Hallmark	414-797-7844

ITT SEMICONDUCTORS, ITT Corp., 55 Merrimack St., So. Lawrence, MA 01843, Tel: 617-688-1881, TELEX: 947413, FAX: 617-975-7109; Empl.: 2300; *Sls. Mgr.:* S. Rastogi; *Dist. Mgr.:* S. Rastogi

ITW CORTRON, Illinois Tool Works, 400 W. Grand Ave., Elmhurst, IL 60126, Tel: 312-279-9110, FAX: 312-279-9709; Empl.: 125; *Sls. Mgr.:* Ken Buheit

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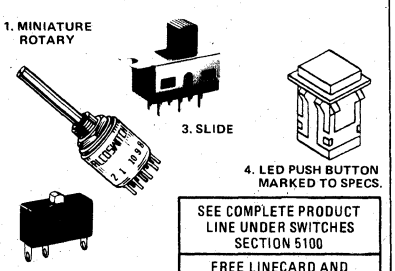

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ITW PAKTRON, Div. of Illinois Tool Works, P.O. Box 4539, 1205 McConville Rd., Lynchburg, VA 24502, Tel: 804-239-6941, TELEX: 8711533; FSC No.: 19396; *Sls. Mgr.:* Tom Lee; *Dist. Mgr.:* Curt Miller .... **A•1095-1097**

Local Sales Offices & Reps

AL	Huntsville/Doraville, ACM, Inc.	205-883-9720
CA	Santa Clara, Synelect Mktg.	408-244-9900
CO	Edgewood, High Plains Mktg.	303-792-2020
FL	Orlando/Ft. Lauderdale, Delmac Sls., Inc.	305-898-4688
IL	Elk Grove Vl., Tri-Star Grp. Inc.	312-593-0200
IN	Indianapolis, Central Regional Off.	317-257-3704
IN	Indianapolis, Leslie M. Devoe	317-842-3245
IA	Des Moines, SPS Assocs., Ltd.	515-225-0607
KS	Olathe, SPS Assocs., Ltd.	913-764-4460
MA	Randolph, Hatch Assocs.	617-963-3306
MI	Oak Pk., A. Blumenberg Assocs. Inc.	313-968-3230
MN	Edina, Hanna Lind Ltd.	612-925-5700
MO	Earth City, SPS Assocs., Ltd.	314-291-0520
NE	Panama, SPS Assocs.	913-764-4460
NJ	Haddonfield, ELF Sls.	215-534-3340
NY	Rochester, L-Mar Assocs., Inc.	716-323-1000
NC	Raleigh, C-Tech	919-847-0202
OH	Richfield, Bear Mktg.	216-659-3131
TX	Austin/Fort Smith, Electra Reps, Inc.	713-778-4201
TX	Dallas, Electra Reps, Inc.	214-248-3852
VA	Lynchburg, Paktron Div.	804-239-6941
WA	Bellevue, Caruso & Co.	206-455-8811
WI	Brookfield, TriStar Grp.	414-782-2670
Can	Markham, Ont., Avotronics	416-475-2024
Can	Pointe Claire, Que., Avotronics	514-697-2135

Local Distributors

AZ	Phoenix, Cetec-Future	602-272-7951
AZ	Tempe, Acacia Sls., Inc.	602-882-9054
CA	Chatsworth, Cetec-Future	818-700-0914
CA	Irvine, Acacia Sls., Inc.	714-660-0834
CA	Irvine, Cetec-Future	714-250-4141
CA	San Diego, Acacia Sls., Inc.	619-565-4365
CA	San Diego, Cetec-Future	619-278-5020
CA	San Jose, Cetec-Future	408-434-1114
CA	Sunnyvale, Acacia Sls., Inc.	408-745-7200
CO	Westminster, Future Elctrns., Inc.	303-650-0123
CT	Bethel, Future Elctrns.	203-743-9594
FL	Altamonte Springs, Future Elctrns., Inc.	305-767-8414
FL	Clearwater, Future Elctrns., Inc.	813-578-2770
FL	Clearwater, Hall-Mark Elctrns.	813-530-4543
FL	Melbourne, Rome Elctrns., Inc.	305-242-8152
FL	Orlando, Hall-Mark Elctrns.	305-855-4020
GA	Augusta, Dixie Elctrns., Inc.	404-722-2055
GA	Norcross, Future Elctrns., Inc.	404-441-7676
IL	Elk Grove Village, Bell Inds.	312-640-1910
IL	Rolling Meadows, RM Elctrns. Co., Inc.	312-358-0300
IL	Schaumburg, Future Elctrns., Inc.	312-882-1255
IN	Indianapolis, Advent Elctrns.	317-872-4910
IN	Indianapolis, MAR Elctrns.	317-633-6699
IN	Indianapolis, RM Elctrns. Co., Inc.	317-291-7110
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
MD	Columbia, Future Elctrns. Inc.	301-995-1222
MD	Gaithersburg, Axis Elctrns., Inc.	301-840-9640
MD	Jessup, Treeko	301-470-3300
MA	Andover, Aved Elctrns., Inc.	617-688-3800
MA	Billerica, A. W. Mayer Co., Inc.	--
MA	Westboro, Future Elctrns., Inc.	617-366-2400
MI	Grand Rapids, RM Elctrns. Co., Inc.	616-531-9300
MI	Livonia, Future Elctrns., Inc.	313-261-5270
MN	Eden Prairie, Future Elctrns., Inc.	612-944-2200
MN	Eitzen, Capacitor Assocs.	507-495-3130
MN	St. Paul, Gopher Elctrns.	612-483-4450
MO	St. Charles, Finnigan Elctrns., Inc.	314-946-6201
NJ	Bellmaur, Mid Atlantic Elctrns.	609-931-5303
NJ	Fairfield, Future Elctrns.	201-227-4346
NJ	Hanover, State Elctrns.	201-887-2550
NJ	Mt. Laurel, Future Elctrns.	609-778-7600
NY	Farmingdale, Pride Elctrns.	516-293-4020
NY	Hauppauge, Broadline Elctrns.	516-231-4100
NY	Hauppauge, Future Elctrns. Inc.	516-234-4000
NY	Liverpool, Future Elctrns.	315-451-2371
NY	Rochester, Future Elctrns.	716-272-1120
NY	Rochester, Simcona Elctrns.	716-328-3230
NY	Rome, Rome Elctrns. Inc.	315-337-5400
NC	Charlotte, Dixie Elctrns.	704-377-4348
NC	Charlotte, Elctrn. Mktg. Corp.	704-394-6195
NC	Charlotte, Future Elctrns. Inc.	704-529-5500
NC	Greensboro, Golden Elctrns.	919-294-4653
NC	Winston-Salem, Dixie Elctrns., Inc.	919-724-5961
OH	Columbus, Elctrn. Mktg. Corp.	614-299-4161
OH	Dayton, Elctrn. Mktg. Corp.	513-439-4711
OH	Highland Heights, Elctrn. Mktg. Corp.	216-442-3441
OK	Tulsa, Altair Co.	918-252-5781
OR	Beaverton, Acacia Sls., Inc.	503-646-3377
OR	Beaverton, Future Elctrns. Inc.	503-645-4454
OR	Lake Oswego, Bell Inds.	503-241-4115
PA	McKean, Advacom, Inc.	814-476-7774
SC	Columbia, Dixie Elctrns., Inc.	803-779-5332
SC	Greenville, Dixie Elctrns., Inc.	803-297-1435
SC	N. Charleston, Dixie Elctrns.	803-552-2671
TN	Gray, Dixie Elctrns., Inc.	615-477-3838
TN	Knoxville, Dixie Elctrns., Inc.	615-938-4131
TX	Austin, Altair Co.	512-837-4970
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair Co.	214-231-5166
TX	Richardson, Future Elctrns., Inc.	214-437-2437
UT	Salt Lake City, Future Elctrns. Inc.	801-972-8489
WA	Redmond, Future Elctrns., Inc.	206-881-8199
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WI	Racine, Badger Elctrns. Co. Inc.	414-637-1256
WI	Waukesha, Bell Inds.	414-547-8879
EXP	Bucks, Eng., C & CD Ltd.	494-882-848
Can	Calgary, Alberta, Future Elctrns., Inc.	403-235-5325
Can	Downsview, Ont., Future Elctrns., Inc.	416-638-4771
Can	Edmonton, Future Elctrns., Inc.	403-438-2858
Can	Ottawa, Ont., Future Elctrns., Inc.	613-820-8313
Can	Point Claire, Que., Future Elctrns., Inc.	514-694-7710
Can	St. Foy, Que., Future Elctrns., Inc.	418-682-8092
Can	Vancouver, B.C., Future Elctrns., Inc.	604-294-1166
Can	Winnipeg, Manitoba, Future Elctrns., Inc.	204-786-7711

ITW Switches

FAX: 312-545-4450

ITW SWITCHES, Illinois Tool Works, 6615 W. Irving Park Rd., Chicago, IL 60634, Tel: 312-282-4040, TELEX: 275226; Empl.: 500; *Sls. Mgr.:* R. Mueller; *Dist. Mgr.:* P. Barthell ..... **B•1734-1745**

Local Sales Offices & Reps

AL	Huntsville, Electro Mech	205-880-0592
AZ	Phoenix, The Knight Co.	602-994-1311
AR	Fort Smith, Electra Reps	501-452-7822
CA	Los Angeles, The Knight Co.	213-670-2833
CA	Santa Clara, Westrep	408-988-8833
CO	Parker, High Plains Mktg.	303-841-6464
CT	North Haven, Kitchen & Kutchin	203-239-0212
FL	Altamonte Springs, Semtronics	305-831-8233
GA	Atlanta, Electro Mech.	404-447-6478
IL	Elk Grove Village, Parcom	312-228-6360
IA	Cedar Rapids, R. F. Welch Co.	319-377-1575
KS	Kansas City, BC Elctrns.	913-342-1211
MD	Baltimore, MicroComp	301-644-5700
MA	Burlington, Kitchen & Kutchin	617-229-2660
MI	Grand Rapids, Urban & Assoc.	616-245-0511
MN	Minneapolis, Comstrand	612-788-9234
MO	St. Louis, BC Elctrns.	314-521-6683
NJ	Florham Pk., Varrelman-Gorman Co.	201-822-9616
NY	Syracuse, Fountain, Young & Co.	315-437-7733
NC	Raleigh, Electro Mech	919-790-9300
OH	Medina, Rockford Controls	216-725-3705
PA	Oreland, Precision Mktg.	215-233-9233
TX	Dallas, Electra Reps.	214-248-3852
WA	Redmond, EMG-Elctrn. Mktg. Grp.	206-882-0962
WI	Mequon, Parcom Inc.	414-241-8544

ITW THIELEX, 201 11th St., Piscataway, NJ 08854, Tel: 201-968-5300, TWX: 710-997-9662, FAX: 201-968-6998; *Sls. Mgr.:* Edward Gayowski

IVEK CORP., 43 School St., N. Springfield, VT 05150, Tel: 802-886-2238, FAX: 802-886-8274; Empl.: 6; *Sls. Mgr.:* Gene Williams

IVERON PACIFIC, 1150 Morena Boulevard, San Diego, CA 92110-3899, Tel: 619-275-1500; Empl.: 16; *Sls. Mgr.:* Lee Kerl

IVO INDUSTRIES, INC., 201 Industrial Way W., Eatontown, NJ 07724, Tel: 201-542-5151, TELEX: 132-414; Empl.: 10; *Sls. Mgr.:* Daniel Vannote ..... **B•1076, 1747, 1894; D•1132-1133**

Local Sales Offices & Reps

CA	Tustin, Sierra-Pacific Engrg.	714-731-3411

Local Distributors

CA	Agoura, Sibbald Instrs.	213-991-3864
CA	Santa Monica, Master Distr.	213-452-1229
FL	Lakeland, A A Electric	813-665-6941
GA	Norcross, A A Electric	404-449-8670
IL	Arlington Heights, Martec Assocs.	312-956-8090
MD	Towson, Kraft Indl.	301-828-5838
MN	St. Paul, Power/Mation Div.	612-645-0781
NJ	E. Rutherford, A A Electric	201-777-5477, 800-223-0119

NY Clarence, Trott Elctrns. 716-634-8500
NC Charlotte, Trott Elctrns. 704-376-2237
NC Huntersville, Scott Equip. 704-875-1611
SC Greenville, Automation Supp. Co. 800-845-5274
TX Dallas, Dallas Meter Tek 214-349-6044
WI Waukesha, Power/Mation Div. 414-542-2868
WI Wausau, Control Specialist 715-359-9122

THE IVYNET COMPANY, One Gale Rd., Brick, NJ 08723, Tel: 201-920-6807; *Sls. Mgr.:* Doug Slocum

IWATSU INSTRUMENTS, INC., 430 Commerce Blvd., Carlstadt, NJ 07072, Tel: 201-935-5220; Empl.: 9; *Sls. Mgr.:* Alex Orloff

IXYS CORP., 2355 Zanker Rd., San Jose, CA 95131-1109, Tel: 408-435-1900, TELEX: 384928 SNJ SU; FSC No.: 408-435-1033; Empl.: 50; *Sls. Mgr.:* Dan Schwob

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FAX: 714-250-8957

JAE ELECTRONICS INC., 1901A E. Carnegie Ave., Santa Ana, CA 92705-5504, Tel: 714-250-8770, TELEX: 681-438 JAE US; Empl.: 3400 (Worldwide); *Sls. Mgr.:* David Shaff; *Dist. Mgr.:* N. Leidig ..... **B•1748-1749; C•1402-1405**

Local Sales Offices & Reps

AL Huntsville, Glen White Assocs. 205-882-6751
AZ Glendale, Camda, Inc. 602-842-2927
CA Canoga Pk., Camda, Inc. 818-703-6132
CA Lawndale, Camda, Inc. 213-219-0320
CA Newport Beach, Camda, Inc. 714-852-9228
CA San Diego, Camda, Inc. 619-571-4818
CA Santa Clara, Pinnacle Sls. 408-249-7400
CO Littleton, Con-Tek Mktg. 303-973-8490
CT Southington, Cycle Sls. 203-755-2888
FL Clearwater, Glen White Assocs. 813-726-0577
FL Ft. Lauderdale, Glen White Assocs. 305-977-5885
FL Ft. Lauderdale, JAE Elctrns. 305-563-3484, 800-248-0737
FL Satellite Bch., Glen White Assocs. 305-773-4832
GA Norcross, Glen White Assocs. 404-441-1447
IL Arlington Hgts., Berndt Assocs. Inc. 312-632-0900
IN Ft. Wayne, Frank J. Campisano Co. 219-486-6443
IN Indianapolis/Ft. Wayne, Campisano Co. 317-253-7651
MD Baltimore, Glen White Assocs. 301-321-7235
MA Harvard, Cycle Sls. 617-456-6868
MN Minneapolis, Berndt Assocs., Inc. 612-546-2021
MS Jackson, Glen White Assocs. 601-856-5411
NJ Mountainside, Henry R. Richter Co. 201-233-4615
NY Fayetteville, Henry G. Richter Co. 315-637-6713
NC Greensboro, Caravan Sls. 919-294-1500
NC Raleigh, Glen White Assocs. 919-848-1931
OH Cincinnati, Campisano Co. 513-574-7111
OH Cincinnati, Frank J. Campisano Co. 513-574-7111
OH Columbus, Campisano Co. 614-876-5405
OH Medina, Frank J. Campisano Co. 216-722-5550
OH Mentor, Frank J. Campisano 513-575-7111
OH Mentor, Frank J. Campisano Co. 216-257-2961
OR Hillsboro, Rhodes Sls. Corp. 503-640-6666
PA Coraopolis, Campisano Co. 412-264-5151
PA Paoli, Stitzer Assoc. 215-644-5500
PA Phoenixville, Henry G. Richter Co. 215-495-6176
PA Phoenixville, Henry Richter, Inc. 215-495-6176
SC Greenville, Ellenburg Sls. 803-233-9942
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Local Distributors

AZ Scottsdale, Cypress Elctrns. 602-949-0802
CA Buena Pk., Cypress Elctrns. 213-744-0355, 714-521-5230
CA San Diego, Cypress Elctrns. 619-535-0011
CA Santa Clara, Cypress Elctrns. 408-980-2500
CO Wheatridge, Cypress Elctrns. 303-431-2622
CT Yalesville, Glynn Elctrns. 203-265-2498
MA Middleboro, Glynn Elctrns. 617-947-4262
NH Manchester, Glynn Elctrns. 603-622-8131
NY Deer Pk., Ramtronix Inc. 516-242-4700
OH Akron, Aesco Elctrns. 216-762-8818
OH Columbus, Aesco Elctrns. 614-882-6762
OR Beaverton, Cypress Elctrns. 503-641-2233
TX Dallas, Cypress Elctrns. 214-869-1435
WA Bothell, Cypress Elctrns. 206-483-1144

JAICO PRODUCTS, Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, IL 60622, Tel: 312-421-1090, FAX: 312-421-1165; Empl.: 35; *Sls. Mgr.:* John S. Jaidinger

JAMESBURY CORP., Div. of Combustion Engineering, Inc., 640 Lincoln St., Worcester, MA 01605, Tel: 617-852-0200, TELEX: 92-0448, TWX: 710-240-1268; Empl.: 900; *Sls. Mgr.:* C. A. Richardson

JAMES ELECTRONICS, 4050 N. Rockwell, Chicago, IL 60618, Tel: 312-463-6500, TWX: 910-221-5034; Empl.: 220; *Sls. Mgr.:* Vincent Kennedy

JAM POWER SYSTEMS, INC., P. O. Box 710, Bronxville, NY 10708-0710, Tel: 914-793-3344; Empl.: 53; *Sls. Mgr.:* Michael Scott; *Dist. Mgr.:* Michael Scott

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AZ Tempe, Piper Sls. 602-949-0048
AR Dallas, Kruvand Assocs. 214-437-3355
CA Cupertino, Codella 408-257-2561
CA San Diego, WES-K San Diego 619-695-2040
CO Longmont, Piper Sls. 303-651-2378
FL Orlando, MacKay, Smith & Assocs. 305-423-4353
GA Atlanta, MacKay, Smith & Assocs. 404-449-7444
IL Addison, Vikeland Sls. 312-832-8425
IN Ft. Wayne, Aktron Corp. 219-747-3650
KS Wichita, T-Bird Tech. Sls. & Svc. 316-684-3941
MD Silver Spring, H. R. Sieber co. 301-681-3770
MA Swansea, Eastrep Co. 617-672-0788
MN St. Paul, Cahill, Schmitz & Cahill 612-646-7217
MO Maryland Heights, T-Bird Sls. & Svc. 314-298-8940
NJ Cherry Hill, Quality Comps. 609-428-6266
NY Fairport, TAC Sls. Inc. 716-377-2250
NC Charlotte, MacKay, Smith & Assocs. 704-372-1188
OH Columbus, Tom Mulligan Company 614-457-2242
TX Dallas, Kruvand Assocs. 214-437-3355
WA Seattle, Norwest 206-827-9562

Local Distributors

CA Burbank, Merit Comp. Supp. 818-842-7607
CA Westlake Village, Tech-Cable Prods. 818-991-4697

JAN HARDWARE MFG. CO., 47-27 36th St., Long Island City, NY 11101, Tel: 718-361-0800; FSC No.: 99813; Empl.: 60; *Sls. Mgr.:* Irwin E. Wasserman ..... **C•1602, 1607-1632**

Local Sales Offices & Reps

CA Hillsboro, Long Assocs. 415-342-6544
CA San Diego, James E. Fitch & Assocs. 213-945-2624
CA Santa Fe Springs, James E. Fitch & Assoc. 213-945-2624
IN Huntingdon, Ellet Sls. 219-356-1866
IA W. Des Moines, Nevco Inc. 515-225-9866
MD Gaithersburg, Naudain Assocs. South. 301-258-5040
MA Brookline, Harman Assoc., Inc. 617-232-6687
MA Lee, Harman Assoc., Inc. 413-243-1158
MN Golden Valley, A.I.M. 612-542-8437
MO Crestwood, Nevco, Inc. 314-343-7406
NJ Englewood, Harold Gray Assoc. 201-894-0894
NJ Marlton, Naudain Assoc. 609-983-5300
OH Kettering, F. L. Ohmer & Assoc. 513-434-1454
OR Beaverton, Cascade Sls. Co. 503-626-7978
TX Richardson, AGM Sls. Co. 214-644-1475
Can Scarborough, Ont., Banke Elctrns., Ltd. 416-292-5152

JAPANESE PRODUCTS CORP., 7 Westchester Plaza, Elmsford, NY 10523, Tel: 914-592-8880, TELEX: 516929 ANS BACK ENFD, FAX: 914-592-7001; Empl.: 8; *Sls. Mgr.:* Don Cassalia

JARO COMPONENTS, INC., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883, Tel: 305-771-7000, TELEX: 159007, FAX: 305-772-8899; Empl.: 30; *Sls. Mgr.:* Floyd Burwell; *Dist. Mgr.:* Floyd Burwell

JAY CONTROL CO., 21 Sequin Dr., Glastonbury, CT 06033, Tel: 203-633-5294; Empl.: 40; *Sls. Mgr.:* Mike Colomonico

JAYCO

FAX: 714-998-4954

JAYCO PLASTICS OF CALIFORNIA, INC., 507 W. Blueridge Ave., Orange, CA 92665, Tel: 714-974-1701, TELEX: 67840; Empl.: 26; *Sls. Mgr.:* Hemant Mistry ..... **B•1824-1825**

Local Sales Offices & Reps

AZ Scottsdale, Advent Comps. Corp. 602-481-0044
CA San Diego, Coastal Elctrn. Sls. 619-459-4148
CO Boulder, Stratford Grp. 303-530-3194
IL Palatine, Somers-Reagan 312-991-1108
NY New York, Breen Assocs. 201-696-8633
OH West Carrollton, Scientific Sys. 513-253-3141

JAYCOR, P.O. Box 85154, San Diego, CA 92138, Tel: 619-453-6580, TWX: 910-322-1064; Empl.: 500; *Sls. Mgr.:* Steven Lutjens

JAY-EL PRODS., Sub. Ducommun Inc., 1859 W. 169th St., Gardena, CA 90247, Tel: 213-323-7130, TWX: 910-346-7633; FSC No.: 08719;Multiple; Empl.: 480

JB ELECTRONIC TRANSFORMERS, 2300 W. Armitage Ave., Chicago, IL 60647, Tel: 312-342-0080; FSC No.: 11700; Empl.: 150

JBM ELECTRONICS, INC., 531 Front St., Manchester, NH 03102, Tel: 603-623-0222, TELEX: 953134, TWX: 710-220-8978, FAX: 603-623-0446; FSC No.: 62694; Empl.: Approx. 100

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MN	Minneapolis, Hei-Lite Sls.	612-861-6051
TX	Dallas/Houston, Elcom Mktg., Inc.	214-241-2166
Can	Thornhill, Ont., R. C. Kahnert Sls., Ltd.	416-221-7755
Can	Winnipeg, Vancouver, Smith-Paterson & Assocs.	604-681-0743

Local Distributors

AL	Montgomery, Southern Controls	205-277-5030
CA	Los Angeles, CMI/Metermaster	213-685-4340
CA	Sacramento, Sacramento Elctrns.	916-441-4821
CA	Wilmington, Wilmington Instrs.	213-834-1133
CO	Denver, E.I.L. Instrs.	303-534-4160
CO	Denver, Ward/Brownell	303-333-3541
CT	New Haven, Hatry Elctrns.	203-787-5921
FL	Miami, Florida Precision	305-324-1731
GA	Augusta, Speciality Distributing	404-873-2521
IL	Bridgeview, E.I.L. Instrs.	312-430-2292
IL	Elk Grove Village, CMI/Metermaster	312-593-8650
LA	Lafayette, Ralph's Elctrns.	318-234-4507
MD	Sparks, E.I.L. Instrs.	301-771-4800
MA	Burlington, E.I.L. Instrs.	617-272-9450
MI	Grand Rapids, S-F Electra, Inc.	616-459-0216
MN	Minneapolis, Instrument Controls	612-871-2514
MS	Jackson, Ellington Elctrn. Supp.	601-355-0561
NJ	Belleville, Miscorp	201-751-8680
NJ	Newfoundland, Hosica Labs	201-697-6111
NY	Long Island City, Metermod	718-726-4850
NY	Lynbrook, Peerless Radio	516-593-2121
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Cleveland, Weschler Elec.	216-238-2550
OH	Dayton, Scott-Friedman	513-298-5555
TN	Nashville, Electra Distributing	615-329-3971
TX	Ft. Worth, Swieco	817-335-6521
TX	Garland, CMI/Metermaster	214-271-5671
TX	Houston, Harrison Equip.	713-879-2600
WA	Seattle, Eicher-Richards	206-523-7888
WV	St. Albans, Preiser Scientific	304-727-2902
Can	Willowdale, Ont., Electrosonic	416-494-1666

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JEFFERS ELECTRONICS, Grand Plaza, 945 Grand Ave., Nogales, AZ 85621, Tel: 602-287-5851, TELEX: 165036; FSC No.: 59474; Empl.: 400; *Sls. Mgr.:* Ken Shobert; *Dist. Mgr.:* Steve Morris

JEFFERSON ELEC., MagneTek, Inc., 1400 Center Circle Drive, Downers Grove, IL 60515-1021, Tel: 312-691-2400, TELEX: 72-8408; Empl.: 1200; *Sls. Mgr.:* Tom Hull; *Dist. Mgr.:* Frank Michalik

JENSEN TOOLS, INC., Axia, Inc., 7815 S. 46th St., Phoenix, AZ 85044, Tel: 602-968-6241, TWX: 910-950-0115; Empl.: 200; *Sls. Mgr.:* Herb Oberman

JEROME INDUSTRIES CORPORATION

FAX: 201-353-1021

JEROME INDUSTRIES CORP., 730 E. Division St., Elizabeth, NJ 07201, Tel: 201-353-5700; Empl.: 150; *Sls. Mgr.:* Anthony Di Girolamo ..... **A•2242; D•1780-1783**

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JETA POWER SYSTEMS, INC., 2675 Junipero, Signal Hill, CA 90806, Tel: 213-427-0095, TWX: 510-101-1804; Empl.: 100; *Sls. Mgr.:* Derek Steel ..... **D•1785-1787**

Local Sales Offices & Reps

AL	Huntsville, R. O. Whitesell & Assocs.	205-883-5150
CA	Anaheim, Alpha Sls.	213-215-0249
CA	Mission Viejo, The Powerhouse, Inc.	714-770-9009
CA	San Diego, Miner Assocs.	619-566-9891
CA	Santa Clara, Basic Sys. Corp.	408-727-1800
CT	Vernon, George Urban & Assocs.	203-647-3991
FL	Altamonte Springs, Semtronic Assocs., Inc.	305-831-8233
FL	Clearwater, Semtronic Assocs.	813-461-4675
FL	Ft. Lauderdale, Semtronic Assocs.	305-731-2484
GA	Atlanta, R. O. Whitesell & Assocs.	404-449-9190
GA	Norcross, R.O. Whitesell & Assocs.	404-449-9190
IL	St. Charles, XYZ Mktg.	312-584-3001
IN	Indianapolis, R. O. Whitesell	317-359-9283
MD	Wheaton, Brimberg Sls.	301-946-2670
MA	Dover, George Urban & Assocs.	617-329-4068
MI	Farmington Hills, Comstrand	612-788-9234
MN	Minneapolis, Comstrand Co.	612-788-9234
NY	Fairport, Hi-Tec Sls.	716-223-5922
NY	Yonkers, Sonkin Assocs.	914-968-8282
NC	Greensboro, R.O. Whitesell & Assocs.	919-273-1945
OH	Cincinnati, R. O. Whitesell	513-521-2290
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OR	Salem, Jas. J. Backer Co.	503-362-0717
PA	Huntingdon Valley, Lynbar Grp., Inc.	215-947-3554
PA	Pittsburgh, R. O. Whitesell	412-963-6161
TN	Knoxville, R.O. Whitesell & Assocs.	205-883-5150
TX	Dallas, S. W. Tech. Sls.	214-243-0180
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Local Sales Offices & Reps

CA	El Cajon, A-Tronics	619-444-1501
CA	Woodland Hills, A-Tronics	818-703-7212
NY	New York, Eltron Export Co.	212-944-7635

JEWELL ELECTRICAL INSTRUMENTS, Grenier Industrial Air Park, 850 Perimeter Rd., Manchester, NH 03108-4038, Tel: 603-669-6400, TELEX: 943435 JEWELL MAN, FAX: 603-669-5962; Empl.: 250; *Sls. Mgr.:* George Molleur; *Dist. Mgr.:* Bill Bolia

JFD ELCTRNS., See Murata Erie No. Amer., Inc.

JF MICROSYSTEMS, 3641 Frontier Road, Pasco, WA 99301, Tel: 509-297-4294, 800-JF-CARDS; Empl.: 2; *Sls. Mgr.:* Jim Follansbee

JFW INDUSTRIES, INC., 5134 Commerce Sq. Dr., Indianapolis, IN 46237, Tel: 317-887-1340, FAX: 317-881-6790; FSC No.: 61162; Empl.: 70; *Sls. Mgr.:* Jackie Buescher

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FAX: 818-897-3056

JKL COMPONENTS CORPORATION, 13343 Paxton St., Pacoima, CA 91331, Tel: 818-896-0019; FSC No.: 55335; Empl.: 19; *Sls. Mgr.:* Bob Brandt ..... **B•1135**

Local Sales Offices & Reps

AL	Huntsville, Southern Sls. & Mktg.	205-830-9322
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CA	San Diego, Lawsco	619-755-0200
IL	Park Ridge, Bob Burns & Assocs.	312-823-9360
IN	Carmel, APEX TEC, Inc.	317-846-3333
MI	Farmington Hills, Clark Sls.	313-553-0610
OH	Chagrin Falls, Clark Sls. Co.	216-247-7848
PA	Philadelphia, Check Assoc.	215-487-3007
TX	Irving, Kite Elec. Sls.	214-986-0321

Local Distributors

AL	Huntsville, Powell Elec.	205-539-2731
AL	Mobile, Specialty Distr. Co.	205-344-0450
AZ	Phoenix, Capital Elctrns.	602-252-5899
CA	Garden Grove, Richey Western	714-895-0060
CA	Gardena, Cal. Switch & Signal	213-770-2330
CA	San Jose, Powell Elec.	408-943-9020
CA	Santa Clara, Richey/Western Elec.	408-727-7411
CA	Sunnyvale, Target Elec.	415-961-1170
CT	Cheshire, Time Elec.	203-271-3200
FL	Clearwater, Elec. Precepts of Florida	813-530-9781
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IN	Indianapolis, Meunier Elctrns.	317-635-3511
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MN	St. Paul, Gopher Elec.	612-483-4450
MO	Richland, ATR Ent.	314-765-5219
NV	Sparks, Capital Lighting	702-356-6162
NH	Hudson, C & H Elec.	603-882-1133
NJ	Clifton, Vantage Comps.	201-777-4100
NJ	Englewood, Powell Elec.	201-894-0800
NJ	Pomton Lakes, Pan American Elec.	201-839-0077
NM	Albuquerque, Walker Elec. Supply	505-883-2992
NY	E. Syracuse, Modutex	716-924-4400
NY	Hauppauge, Genelco	516-231-1144
NC	Cary, Powell Elec.	919-467-1212
NC	Greensboro, Hammond	919-275-6391
OH	Cincinnati, Schuster Elec.	216-425-8134
OK	Oklahoma City, Radio Supp. Inc.	405-232-6127
PA	Philadelphia, Powell Elec.	215-365-1900
PA	Wayne, Peak Elec.	215-293-9000
TN	Chattanooga, Specialty Distr. Co.	615-624-1040
TN	Chattanooga, Techni-Tronics	615-875-5449
TX	Dallas, Norvell Comp. Sls.	214-233-0020
TX	Dallas, Off-the-Shelf Comps.	214-247-0052
TX	Las Colinas, Powell Elec.	214-550-0547
WA	Greenacres, Mica Co.	509-928-1720
WA	Seattle, Radar Elec.	206-282-2511
WI	Milwaukee, Elctrn. Expeditors	414-228-8100
WI	Oshkosh, Electronic Inds.	414-235-8930

JMJ TECHNICAL PRODS., 50 Wheeler Point Rd., Newark, NJ 07105, Tel: 201-589-4257; Empl.: 8; *Sls. Mgr.:* Kevin Kolenut ..... **C•1633**

JMK

JMK, INC., 15 Caldwell Dr., Amherst, NH 03031, Tel: , , , 603-886-4115, TELEX: 955329; Empl.: 200; *Sls. Mgr.:* J. Kennedy ..... **A•1663-1665**

Local Sales Offices & Reps

CA	Santa Clara, Cummings & Assocs.	408-247-8656
IL	Chicago, Momak Sls.	312-963-6400
MD	Silver Springs, Mid-Atlantic Sls. Co.	301-593-7749
MA	Framingham, Sullivan Tech. Sls.	617-620-0195
MN	St. Paul, Arkco Sls.	612-777-7454
NJ	Princeton, Murtronics Assocs.	609-394-3737
NY	Syracuse, Nycom Inc.	315-437-8343
OR	Hillsboro, Temco N.W.	503-649-8375
WA	Bothell, Temco N.W.	206-821-5434
Can	Montreal, Que., A. R. Gray	514-694-6378

JMR ELECTRONICS, 1525 Blondell Ave., Bronx, NY 10461, Tel: 212-597-6050, FAX: 212-597-6137; Empl.: 50; *Sls. Mgr.:* Joel Howard

JM TRANSFORMER CO., INC., 112 Florida St., Farmingdale, NY 11735, Tel: 516-293-0475; Empl.: 13; *Sls. Mgr.:* J. Millman ..... **A•2243-2247**

JOBMASTER CORP., 9008 Liberty Rd., Randallstown, MD 21133, Tel: 301-655-1400, 800-642-1400, FAX: 301-521-5461; Empl.: 22; *Sls. Mgr.:* Wendy Goldman ..... **A•1320**

JOHANSON DIELECTRICS, 2220 Screenland Dr., Burbank, CA 91505, Tel: 818-848-4465, TWX: 910-498-2735, FAX: 818-841-7261; Empl.: 300; *Sls. Mgr.:* Fred Luhrs ..... **A•1098**

Local Sales Offices & Reps

AZ	Phoenix, Compass Mktg. & Sls.	602-996-0635
AZ	Tucson, Compass Mktg. & Sls.	602-293-1220
CA	Glendale, Mission Mktg.	818-247-9110
CA	Mountain View, Straube Assocs.	415-969-6060
CO	Westminster, Straube Assocs.	303-426-0890
FL	Boca Raton, Lawrence Assocs	305-368-7373
FL	Clearwater, Lawrence Assocs.	305-339-3855
IL	Lisle, WG Controls	312-963-5954
IN	Kokomo, Schillinger Assocs.	317-452-4057
KS	Shawnee Mission, Florence & Meyer	913-722-5210
CT	Wethersfield, Compac Sls.	203-563-4784
MI	Troy, C. B. Jensen & Assocs.	313-643-0506
MN	Minneapolis, Bill Deming & Assocs.	612-888-5000
NY	Huntington, Compar New York Inc.	516-423-5660
NY	Syracuse, Pitroncis	315-455-7346
NC	Winston-Salem, Murcota	919-722-9445
OH	Westlake, Baehr Greenleaf Assocs.	216-892-1770
PA	Trevose, PSA Co.	215-245-0513
TX	Dallas, C & J Assocs.	214-539-0140
WA	Seattle, Northmar Inc.	206-524-5170
Can	Hamilton, Ont., Cartwright/Southhall	416-528-0294

Local Distributors

CA	Los Alamitos, SEMI DICE	213-594-4631
CA	Santa Clara, SEMI DICE	408-980-9777
CA	Sunnyvale, Bell Inds.	408-734-8570
FL	Orlando, Chip Supp.	305-298-7100
IL	Chicago, Newark	312-638-4411
MA	Canton, Semi Dice	617-821-0070
NJ	Fairfield, CHPS Inc.	201-882-0997

JOHANSON MANUFACTURING CORPORATION, 400 Rockaway Valley Rd., Boonton, NJ 07005, Tel: 201-334-2676, TWX: 710-987-8367, FAX: 201-334-2954; FSC No.: 91293; Empl.: 200 ..... **A•1099**

Local Sales Offices & Reps

AL	Huntsville, Murcota Corp.	205-539-8476
AZ	Phoenix, Compass Mktg. & Sls.	602-996-0635
AZ	Tucson, Compass Mktg. & Sls.	602-293-1220
CA	Escondido, Knight Co.	619-743-5136
CA	Los Angeles, Knight Co.	213-670-2833
CA	Mountain View, Straube Assocs.	415-969-6060
CO	Westminster, Straube Assoc., Mt. States	303-426-0890
CT	Wetherfield, Compak, Inc.	203-563-4784
FL	Boca Raton, Perrott Assocs.	305-482-6909
FL	Clear Water Bch., Perrott Assocs.	813-443-5214
FL	Orlando, Perrott Assocs.	305-298-7748
IL	Lisle, W.G. Controls	312-963-5954
IN	Kokomo, Schillinger Assocs.	317-455-2708
IA	Hiawatha, ARD Sales Co.	319-393-6392
MA	Hudson, Compak, Inc.	617-568-0331
MN	Bloomington, Bill Deming & Assoc.	612-888-5000
MO	St. Louis, Midtec Assocs.	314-275-8666
NJ	Boonton, Johanson Mfg. Corp.	201-334-2676
NY	Mount Vernon, Friedman-Smith Elctrn. Sls.	914-664-4866
NY	Pittsford, NHA, Inc.	716-586-9002
NC	Winston-Salem, Murcota Corp.	919-722-9445
OH	Columbus, Baehr, Greenleaf & Assocs.	614-847-0220
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OH	Westlake, Baehr, Greenleaf & Assoc.	216-842-1770
PA	Evans City, Baehr, Greenleaf & Assocs.	412-776-2151
PA	Trevose, P.S.A.	215-245-0513
TX	Austin, W. Pat Fralia & Assocs.	512-835-7911
TX	Bedford, W. Pat Fralia Co.	817-267-3577
TX	Houston, W. Pat Fralia & Assocs.	713-772-1572
UT	Salt Lake City, Straube Assocs., Mt. States	801-263-2640
VA	Oakton, PSA South	703-281-1806
WA	Seattle, Northmar	206-524-5170

Local Distributors

AZ	Tempe, Bell Inds.	602-966-7800
CA	Garden Grove, Bell Inds.	714-895-7801
CA	Gardena, Bell Inds.	213-515-1800
CA	San Diego, Bell Inds.	619-268-1277
CA	San Jose, All American Semiconductor	408-287-0190
CA	San Pedro, ASAP Elctrns./West	213-519-8377
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Thousand Oaks, Bell Inds.	213-826-6778
CA	Van Nuys, CW Swift & Assocs.	818-989-1133
CA	Westlake Vl, Distel, Inc.	805-495-9998
CO	Wheatridge, Bell Inds.	303-424-1985
FL	Deerfield Bch., Bell Inds.	305-421-1997
FL	Orlando, Pelcor Co.	305-299-1541
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Elk Grove Vl, Bell Inds.	312-640-1910
IN	Indianapolis, Bell Inds.	317-634-8202
MD	Baltimore, Radio Elec. Svc.	301-529-0500
MD	Beltsville, Radio Elec. Svc.	301-937-9100
MA	Seekonk, M-Squared	617-761-5490
MA	Wilmington, RC/Jaco Elctrns.	617-273-1860
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Mt. Vernon, ASAP Elctrns.	914-699-2727
NY	Syracuse, Newark Elctrns.	315-437-6611
OH	Dayton, Bell Inds.	513-435-8660
OR	Lake Oswego, Bell Inds.	503-241-4115
PA	Philadelphia, PEI-Genesis	215-673-0400
TX	Ft. Worth, PATCO Supplies	817-429-8596
TX	Irving, Newark Elctrns.	817-534-3696
UT	Salt Lake City, Bell Inds.	801-972-6969
WA	Bellevue, Bell Inds.	206-747-1515

JOHNSON, E. F., CO., 11095 Viking Dr., Eden Prairie, MN 55344, Tel: 612-942-1000, TELEX: 290470; Empl.: 1400; *Sls. Mgr.:* Charles Ard

JOHNSON CONTROLS, Battery Grp.-Indl. Prods. Div., Janet A. Korol, Milwaukee, WI 53212, Tel: 414-961-6500, FAX: 414-961-6506; Empl.: 20,000; *Sls. Mgr.:* James M. Szollar

JOLO

FAX: 714-554-0303

JOLO INDUSTRIES, 13921 Nautilus Dr., Garden Grove, CA 92643, Tel: 714-554-6840, TWX: 910-595-1138; FSC No.: 30035; Empl.: 20; *Sls. Mgr.:* J.S. Giampiccolo, Jr. ..... **C•1408-1410**

Local Sales Offices & Reps

CA	Mountain View, Leddy Assocs.	415-969-6313
CA	Santa Ana, Bee Jay Enterprises	714-836-7870
FL	Longwood, Mathias Assocs., Inc.	305-682-1700
IL	Chicago, Jack Elsley & Assocs.	312-827-6360
MA	Reading, Lincoln Tech. Sls.	617-944-9594
NJ	Berkeley Heights, Cambridge-Allen & Assocs.	201-464-0203
NY	Corbettsville, SHR	717-967-2607
OH	Cleveland, Geotronix Mktg. Assocs.	216-659-6100
WA	Seattle, Evergreen Mktg. Grp. Inc.	206-633-3160
Can	Nepean, Ont., Intrade(Canada)	613-727-1272

Local Distributors

CA	San Ramon, Xstor	415-820-2048
FL	Miami, Electronic Equip.	305-871-3500
NJ	Berkeley Heights, Rockwood Sls. Co.	201-464-0203
OH	Richfield, Alpha Distr. Corp.	216-659-6100

JONARD INDUSTRIES CORP., 134 Marbledale Rd, Tuckahoe, NY 10707, Tel: 914-793-0700, TELEX: 996570, TWX: 710-562-0107; Empl.: 65; *Sls. Mgr.:* R. Fersen

JONATHAN MANUFACTURING CORP., 1101 So. Acacia Ave., Fullerton, CA 92631, Tel: 714-526-4651, TWX: 910-592-1241, FAX: 714-773-5582, 714-879-1212; Empl.: 375; *Sls. Mgr.:* Todd Leverich; *Dist. Mgr.:* Wm. Valitus

JONES, HIRAM, ELCTRNS. INC., See Hiram Jones Elctrns. Inc.

JORI RESOURCES, 2128 Knoll Dr., Ventura, CA 93003, Tel: 805-642-2266; Empl.: 4

JOSLYN ELECTRONIC SYSTEMS, P.O. Box 817, Goleta, CA 93116, Tel: 805-968-3551, TWX: 910-334-3464; FSC No.: 23663; Empl.: 210; *Sls. Mgr.:* M. Melcher

JRW INDUSTRIES, INC., 2312 N Second St, Harrisburg, PA 17110, Tel: 717-236-1418; Empl.: 4; *Sls. Mgr.:* Bryan J. Williams, Sls. Mgr.

JSC WIRE & CABLE, Box 248, Burgess Pl, Wayne, NJ 07474, Tel: 201-694-6200; Empl.: 40; *Sls. Mgr.:* Richard Wojtovitz

JTM SYSTEMS & CONSULTING, INC., Terrace Hill, Ithaca, NY 14850, Tel: 607-272-0808; Empl.: 12

JUDCO MFG. INC., P.O. Box 487-E84, 24030 Frampton Ave., Harbor City, CA 90710, Tel: 213-534-0959

JUDD WIRE, High Voltage Engrg., 57 Turnpike Rd, Turners Falls, MA 01376, Tel: 413-863-4357, TWX: 510-290-2147; FSC No.: 3357; Empl.: 148; *Sls. Mgr.:* Steve Fritz ..... **B•1012; C•1857**

Local Sales Offices & Reps

AL	Huntsville, R & G Assocs.	205-536-6300
CA	Laguna Hills, English/Damco	714-837-3801
CA	Los Altos, Ewing Foley	415-941-4525
CO	Denver, Elcom	303-337-2300
FL	Coral Springs, HAI Elctrns.	305-752-7520
GA	Gainsville, R & G Assocs.	404-532-3850
IL	Arlington Heights, Rozner Sls. Co.	312-577-0067
KS	Overland Pk., Spectrum Sls.	913-648-6811
MD	Baltimore, R. A. Wafer Assocs.	301-744-1133
MA	Marlborough, O.K. Engrg.	617-481-6400
MN	Brooklyn Center, Willman Assocs.	612-566-5010
MO	Florissant, Spectrum Sls.	314-731-5151
NJ	Haddonfield, Mesa Tech. Assocs.	609-429-9531
NM	Albuquerque, O'Donnell Assocs.	505-883-1030
NY	Attica, B. H. Tollefson Assocs.	716-591-1219
NY	Auburn, B. H. Tollefson Assocs.	315-253-4109
NY	Rochester, B. H. Tollefson Assocs.	716-271-4141
NC	Resch. Triangle Pk., Naylor Assocs.	919-544-6630
OH	Worthington, Simcox Assocs.	614-885-8995
OR	Portland, Jas. J. Backer Co.	503-297-8744
TX	Denton, Stevens Sls. Co.	817-382-4735
UT	Salt Lake City, Elcom	801-486-4233
WA	Seattle, Jas. J. Backer Co.	206-285-1300

Local Distributors

AL	Madison, Sea Wire & Cable	205-772-9616
CA	Anaheim, Innovative Sys.	714-968-6383
CA	Concord, Control Master	415-939-3600
CA	Irvine, Republic Elctrns.	714-855-2222
CA	San Leandro, Anixter	415-352-3100
CA	Torrance, Blake Wire & Cable	213-533-8141
CA	Valencia, Wirenetics Co.	805-257-2400
CO	Colorado Springs, Colorado Mfg. Technlg.	303-598-6888
CT	East Hartford, E. J. Stephens Co.	203-282-9400
CT	Manchester, I.M.S.	203-649-4415
FL	Altamonte Springs, Royce Elctrns.	305-869-4700
FL	Ft. Lauderdale, Anixter	305-485-4455
FL	Ft. Lauderdale, Pacer Elctrns.	305-462-0902
IL	Brookfield, Conductors Unltd.	312-485-7855
MA	Woburn, Pacer Elctrns.	617-935-8330
MN	Bloomington, K. L. Tannehill	612-881-6700
NH	Amherst, North Country Wire & Cable	603-889-0063
NJ	Atlantic Highlands, Freedom Elctrns.	201-872-2300
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NM	Albuquerque, Southwest Wire	505-888-3400
NY	Farmingdale, Weico Elctrns.	516-293-0050
NY	Johnson City, HELP Elctrns.	607-729-3528
NY	Rochester, Pacer Elctrns.	716-288-6750
NY	Rochester, Simcona Elctrn.	716-328-3230
NY	Ronkonkoma, Zenith Wire	516-585-1444
OH	Dayton, Astro Inds.	513-429-5900
PA	Montgomeryville, Pyttronic Ind.	215-242-6700
TX	Dallas, Interstate Wire	214-553-1311
WA	Woodinville, Storm Prods.	206-488-7400
WI	New Berlin, Indl. Elec. Wire & Cable	414-782-2323

JUDD WIRE, High Voltage Engrg., 870 Los Vallecitos Blvd., San Marcos, CA 92069, Tel: 619-744-7720, TWX: 910-322-1149, FAX: 619-744-6089; FSC No.: 3357

Refer to Judd Wire, Turners Falls, MA for sales office and distributor information.

JULIE RESEARCH

FAX: 212-757-0904

JULIE RESEARCH LABS., 211 West 61st St, New York, NY 10023, Tel: 212-245-2727, TWX: 710-581-5138; FSC No.: 07062; Empl.: 45; *Sls. Mgr.:* Pamela Spencer; *Dist. Mgr.:* Pamela Spencer ..... **A•1961; D•1278-1282**

Local Sales Offices & Reps

Resistors

CA	Northridge, Craig Assocs.	213-993-4060

JUMO PROCESS CONTROL, INC., 410 Garibaldi Ave., Lodi, NJ 07644, Tel: 201-779-7744, FAX: 201-779-1928; *Sls. Mgr.:* Bert Robinson

Local Sales Offices & Reps

IL	Algonquin, Marshall Wolf, Assoc.	312-658-8130,

JUPITER SYSTEMS, 1100 Marina Village Parkway, Alameda, CA 94501, Tel: 415-523-9000, TELEX: 6713004, FAX: 415-523-9151; FSC No.: 63872; *Sls. Mgr.:* Glenn Meyer

KAHGAN ELECTRONICS CORP., 605 Peninsula Blvd, Hempstead, NY 11550, Tel: 516-538-2300, TELEX: 261097 KAHG UR; Empl.: 31; *Sls. Mgr.:* Fred Strauss; *Dist. Mgr.:* Bernard Stapler

KAHLE ENGINEERING, 50 S. Center St., Orange, NJ 07050, Tel: 201-678-2020, TELEX: 42-7757, TWX: 710-992-8835; Empl.: 50; *Sls. Mgr.:* Julie Clark

KAISER ELECTRONICS, Kaiser Aerospace & Elctrns., 2701 Orchard Pkwy., San Jose, CA 95134, Tel: 408-432-3000, TWX: 910-338-0196, FAX: 408-433-0553; Empl.: 1300

KAISER ELECTROPRECISION, Kaiser Aerospace & Elctrns., 1700 S. Redhill Ave., Irvine, CA 92714, Tel: 714-250-1015, TELEX: 678467; FSC No.: 86831; Empl.: 387; *Sls. Mgr.:* Gerald W. Allen

KSI

FAX: 508-922-8374

KAISER SYSTEMS, INC., 126 Sohier Road, Beverly, MA 01915, Tel: 508-922-9300; FSC No.: IFD78; Empl.: 100 ..... **D•1788-1791**

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KALAMAZOO TECHNICAL FURNITURE, P.O. Box 1165, Kalamazoo, MI 49005, Tel: 616-385-2255, 800-832-5227; Empl.: 42; *Sls. Mgr.:* B. Smith ..... **C•1061**

KALGLO ELCTRNS. CO., INC., 6584 Ruch Rd., E. Allen Twp., Bethlehem, PA 18017-9359, Tel: 215-837-0700, 800-524-0400, TWX: 510-651-2101; FSC No.: 64521; *Sls. Mgr.:* Christopher L. Criswell

KALMUS & ASSOCS., INC., 2424 S. 25th Ave., Broadview, IL 60153, Tel: 312-343-7004, FAX: 312-343-7016; Empl.: 346

KAM COMPONENTS, INC., P. O. Box 192-EEM, Nesconset, NY 11767, Tel: 516-585-0666, FAX: 516-585-1580; Empl.: 29; *Sls. Mgr.:* Cheryl Day

K&L MICROWAVE, INC., 408 Coles Circle, Salisbury, MD 21801, Tel: 301-749-2424, FAX: 301-749-5725; FSC No.: 50140; Empl.: 550; *Sls. Mgr.:* Charles J. Schaub

K & L QUARTZTEK, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043, Tel: 602-272-7944, TWX: 910-951-1305; FSC No.: 59492; *Sls. Mgr.:* Mark H. Story

K & M ELECTRONICS, 221 Interstate Dr., Dock No. 3, W. Springfield, MA 01089, Tel: 413-781-1350, TWX: 710-350-6463; FSC No.: 66613; Empl.: 700; *Sls. Mgr.:* Gerard F. Voity ..... **A•1943**

Local Sales Offices & Reps

CA	Fremont, C/G Assocs., Inc.	415-790-1193
CA	Tarzana, High Voltage Sls.	818-881-9194
CT	Marlborough, Precision Sls., Inc.	203-295-0580
FL	Melbourne, Reynolds & Assocs., Inc.	305-259-7000
IL	Westchester, W. G. Brouillette & Assocs.	312-345-6500
WA	Bellevue, Advanced Power Comps., Inc.	206-747-9127

KANTZ ELECTRONIC INDUSTRY, 1804 Wall Church Rd., Wall Township, NJ 07719, Tel: 201-974-0090; Empl.: 12; *Sls. Mgr.:* L. Herold

KAPPA NETWORKS, INC., 1443 Pinewood St, Rahway, NJ 07065, Tel: 201-396-9400, 1-800-223-0603, TELEX: 130081 Kappa Rhwy, FAX: 201-388-4786; FSC No.: 20933; Empl.: 237; *Sls. Mgr.:* D. Pearl ..... **A•1575-1593**

Local Sales Offices & Reps

AZ	Scotsdale, M. W. Riedel & Co.	602-251-5902
CA	Alhambra, M. W. Riedel & Co.	213-283-7694
CA	Sherman Oaks, Kappa Networks	818-995-2401
CO	Wheatridge, Wescom Mktg.	303-422-8957
CT	Clinton, Selmark Assocs., Inc.	203-573-9088
FL	Boynton Bch., D-Assocs., Inc.	305-830-8976
FL	Longwood, D-Assocs., Inc.	305-830-8976
FL	Maitland, D. J. Ellis & Assocs., Inc.	305-645-1101
MD	Middletown, S.T./Woolard Co., Inc.	301-371-4500
MA	Millis, Selmark Assocs.	617-376-2914
MN	Osseo, Gaffney Sls. Co.	612-425-5484
NH	Hopkinton, Selmark Assocs., Inc.	603-746-3299
NJ	Madison, Livera-Polk Assocs., Inc.	201-377-3220
NY	Cazenovia, S.T./Woolard Co., Inc.	315-655-8145
NY	Glen Head, Livera-Polk Assocs.	516-759-9300
PA	Erdenheim, Omni Sls., Inc.	215-233-4600

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TX Richardson, Mil-Rep Assocs., Inc. 214-644-6731
UT Riverdell, Dytox Elctrns. 801-621-0310
UT Salt Lake City, Wescom Mktg. 801-269-0419
VA Lynchburg, S.T./Woolard Co., Inc. 804-528-5421

Local Distributors

CA Sherman Oaks, Delay Line Distrs. Co. 800-624-2617

KAPPA SCIENTIFIC CORP., Box 30585, Santa Barbara, CA 93105, Tel: 805-687-9648; Empl.: 4

KARKAR ELECTRONICS, INC., A Unit of General Signal, 1950 Army Street, San Francisco, CA 94124-1132, Tel: 415-552-1247, TWX: 910-372-7754 or 650-157-2515 MCI; FSC No.: 017857; *Sls. Mgr.:* Andy Lovas

KATES SCIENTIFIC INSTRUMENTS, 142 Adam St., Newton, MA 02158, Tel: 614-527-2711; Empl.: 28; *Sls. Mgr.:* D. Kates

KAUT & BUX MANUFACTURING CO., 675 Tower Rd., P.O. Box 867, Mundelein, IL 60060, Tel: 312-949-8505; *Sls. Mgr.:* Heinz Kutschera

Local Sales Offices & Reps

CA Palo Alto, Baribeault Assocs. 415-493-4441
CA San Diego, Frank Polese & Assocs. ... 619-271-1993
FL Longwood, Mathias Assocs., Inc. 305-682-1700
NY Pittsford, Elcom Sls. Inc. 716-385-1400

KAVLICO CORP., 14501 Los Angeles Ave., Moorpark, CA 93021, Tel: 805-523-2000, TELEX: 65-1481, FAX: 805-523-7125; Empl.: 400; *Dist. Mgr.:* Peter Swift

KAYE INSTRUMENTS, INC., 15 De Angelo Dr., Bedford, MA 01730, Tel: 617-275-0300, TELEX: 6817183; Empl.: 170

KAY ELEMETRICS CORP., 12 Maple Ave., Pine Brook, NJ 07058-9798, Tel: 201-227-2000, TWX: 710-734-4347; FSC No.: 80138; Empl.: 70; *Sls. Mgr.:* Stephen P. Crump ..... **A•1771**

KAY-TOWNES, Div. of Alco Industries, Inc., P.O. Box 593, Rome, GA 30161, Tel: 404-291-9871, TWX: 810-764-4809; Empl.: 60; *Sls. Mgr.:* Charles S. Ford

KB ELECTRONICS, 73 Wortman Ave., Brooklyn, NY 11207, Tel: 718-257-3300, TWX: 710-584-2308, FAX: 718-257-4740; Empl.: 125; *Sls. Mgr.:* A Bueller

KBI, A Div. of Cabot Corp., PO Box 1462, Reading, PA 19603, Tel: 215-371-3600, TELEX: 902251, TWX: 510-651-0106; Empl.: 600; *Sls. Mgr.:* Robert J. Longenecker

KD COMPONENTS, INC., 2710 S. Main St., Santa Ana, CA 92707, Tel: 714-545-7108, TWX: 910-595-2678, FAX: 714-549-7966; FSC No.: 58421; Empl.: 32; *Sls. Mgr.:* Wayne Devine

KDI ELECTRONICS, INC., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981, Tel: 201-887-8100, TWX: 710-986-8220; FSC No.: 64537; Empl.: 300

KEARNEY/WABASH ELECTRICAL COMPONENTS, 1375 Swan Street, Huntington, IN 46750, Tel: 219-356-8300, TWX: 510-100-2867; Empl.: 1000; *Sls. Mgr.:* Stanley P. Bickhart

KEC ELECTRONICS, INC., 20817 Western Ave., Torrance, CA 90501, Tel: 213-320-3902, TWX: 910-349-6962, FAX: 213-618-1197; Empl.: 8; *Sls. Mgr.:* Y. Furuya

KEDMAN CO., Box 25667, Salt Lake City, UT 84125, Tel: 801-973-9112, TWX: 910-925-4116; Empl.: 100

KEENE LAMINATES, Keene Corp., 199 Amaral St., E. Providence, RI 02914, Tel: 800-556-7683, FAX: 401-434-2557; Empl.: 50

For sales offices and reps. in the Northeastern region, call Rom Sencer- 401-434-2340 For sale offices and reps. in California, call Rick Kirchhoff- 714-540-2811 For sales offices and reps. in Michigan, Ohio, and Indiana, call STAFFCO- 216-331-5100

KEITHLEY INSTRS., 28775 Aurora Rd., Cleveland, OH 44139, Tel: 216-248-0400, TELEX: 98-5469; Empl.: 461; *Sls. Mgr.:* Mike Sciulli

KEL AM, See Teltec, Inc.

KELMET, INC., 569 W. Covina Blvd., San Dimas, CA 91773, Tel: 714-599-0954, FAX: 714-599-2835; Empl.: 6; *Sls. Mgr.:* Paul Hodge

KELTEC FLORIDA, INC., MICROWAVE PRODUCTS, Amstar Electronics Group, P.O. Box 862, Shalimar, FL 32579, Tel: 904-651-9749, TWX: 510-730-7654; FSC No.: 09062; Empl.: 625; *Sls. Mgr.:* M. Yount ..... **D•1423**

Local Sales Offices & Reps

AL Huntsville, Beacon Elctrns. Assocs. ... 205-881-5031
AZ Phoenix, J. Smith Assoc. 602-267-0981
CA Los Altos, Stout Inds. 408-746-0470
CA Mtn. View, Disman Bakner 415-969-3010
CA Orange, Cain Technology 714-997-7311
CA Sacramento, Disman Bakner 916-483-2664
CA Van Nuys, Cain Technology 818-904-9392
CO Colorado Springs, J. Smith Assoc. 303-597-5343
GA Atlanta, Beacon Elctrns. Assocs. 404-256-9640
IL Pk. Ridge, Elctrn. Instr. Assocs. 312-298-2290
IL Schaumburg, Engrg. Prods. Assocs. ... 312-882-7640
IN Cicero, Engrg. Prods. Assocs. 317-984-5226
IN Indianapolis, Elctrn. Instr. Assocs. 317-257-7231
KS Lenexa, Dytec/South 316-945-2090
MD Ellicott City, VPI 301-461-2525
MA Lexington, O'Sullivan & Murphy 617-862-6570
MA Needham Hgts., O'Sullivan & Murphy 617-749-8680/1
MN Edina, Engrg. Prods. Assocs. 612-835-9022
MN Minneapolis, Elctrn. Instr. Assocs. 612-374-5628
MO Maryland Hgts., Dytec/South 314-739-0665
NJ Ironia, Metro-MICS 201-584-1606
NJ Westfield, Metro-M.I.C.S. 201-233-6116
NM Albuquerque, J. Smith Assoc. 505-265-3406
NY Smithtown, Metro MICS 516-361-6134
NY Syracuse, Em-Tech 315-437-6410
OK Tulsa, Beacon Elctrns. Assocs. 918-622-1494
PA Montgomerysville, Rufo Sys. 215-368-8495
TX Austin, Beacon Elctrns. Assocs. 512-345-3543
TX Dallas, Beacon Elctrns. Assocs. 214-437-1505
WA Seattle, J. J. Assocs. Inc. 202-246-6619

KELTLON CORP., Viking Modules Div., 225 Crescent St., Waltham, MA 02154, Tel: 617-894-8700, FAX: 617-899-9602; Empl.: 75; *Sls. Mgr.:* T. Chadurjian

KELTRON CORPORATION

FAX: 617-899-9602

KELTRON CORP., High Voltage Power Supply Div., 225 Crescent St., Waltham, MA 02154, Tel: 617-894-8700, TELEX: 948197; Empl.: 170; *Sls. Mgr.:* T. Chadurjian ..... **D•1094-1095, 1792**

Local Sales Offices & Reps

GA Roswell, Electro Comp. S.L.S. 404-992-2344
IL Park Ridge, Probe Elec. 312-696-2828
MA Hingham, Shain Assoc. 617-740-2334
MN Edina, J. H. Hanson Co. 612-893-9960
NH Nashua, Shain Assoc. 603-881-4881
NY Commack, R.C. Engrg. 516-543-3325
PA Glenside, Koebert Assoc. 215-887-2310

KELTRON CORP., Miniprinters Div., 225 Crescent St., Waltham, MA 02154, Tel: 617-894-8700, TELEX: 948197, FAX: 617-899-9602; FSC No.: 18662; Empl.: 170; *Sls. Mgr.:* Ted Chadurjian ..... **D•1094-1095**

Local Sales Offices & Reps

AZ Tempe, Thor Engrg. 602-438-8494
CA Canoga Pk., Dolphin Tech Entprs. 818-710-1966
IL Palatine, T-Squared Assocs. 312-991-2144
MD Baltimore, Advanced Tech. Sls., Inc. ... 301-583-8252
NY Amsterdam, Traxonics 518-843-1445
PA Oreland, Precision Mktg. Grp. 215-233-9233

KELVIN INDUSTRIES, INC., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501, Tel: 818-990-1192, FAX: 818-995-6460; FSC No.: 19587; Empl.: 180; *Sls. Mgr.:* R. A. Featherston ..... **A•1944-1945**

Local Sales Offices & Reps

AZ Phoenix, Sunwest Mktg. 602-893-7677
CA Mountain View, Woempner-Arnold 415-964-5454
CA San Diego, Wes-K Assoc. 619-695-2040
CA Sherman Oaks, Wes-K Assocs. 818-990-1302
FL Lighthouse Point, R. C. Simon & Co. .. 305-941-2757
IL Deerfield, Walt Krueger 312-945-3720
MA Needham Hgts., Todino Engrg. 617-444-7925
MI Birmingham, Forand Sls. 313-644-0087
MN Minneapolis, Furber Sls. 612-881-3620
MO St. Louis, Abrams & Assocs. 314-569-0447
NY Great Neck, Trionic 516-466-2300
NY Rochester, Foster & Wager 716-385-7744
NC Burlington, P. J. Nahser 919-226-8053
OH New Lebanon, J. N. Bailey & Assocs. 513-687-1325
OK Tulsa, John B. Guenther 918-660-5126
OR Portland, Frank Jackson 503-645-8511
PA Southampton, Campbell Assocs. 215-322-6630
TX Dallas, John B. Guenther 214-691-8500
VA Front Royal, Eltron Sls. 703-635-7201
WA Redmond, Frank Jackson 206-881-7277

Local Distributors

AZ Phoenix, TTI, Inc. 602-861-0222
CA Anaheim, Zeus 714-632-6880
CA Chatsworth, Petell/Passive Comps. ... 818-341-1745
CA Chatsworth, TTI 818-709-1010
CA No. Hollywood, TTI, Inc. 818-709-1010
CA San Diego, TTI, Inc. 619-587-4888
CA San Jose, TTI, Inc. 408-946-5577
CA San Jose, Zeus 408-998-5121
CO Westminster, TTI 303-429-6806
CT Stratford, Electro Comp. 203-375-1400
FL Ft. Lauderdale, NRC 305-772-4500
FL Orlando, TTI, Inc. 305-859-1000
GA Norcross, TTI, Inc. 404-662-0911
ID Spirit Lake, A-I Elctrns 802-635-1545
MD Columbia, TTI 301-995-1331
MA Woburn, TTI, Inc. 617-938-8800
MN Eden Prairie, TTI 612-944-5080
NY Farmingdale, Command Elec. 516-293-1212
NY Ronkonkoma, TTI, Inc. 516-737-2000
OH Dayton, Wright Source 513-293-1341
PA York, ECI 717-843-8971
TX Ft. Worth, TTI, Inc. 817-831-8300
TX Richardson, Zeus 214-783-7010
WA Tacoma, C & G Elec. 206-272-3181

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KEMET ELECTRONICS CORPORATION, Box 5928, Greenville, SC 29606, Tel: 803-963-6621, TELEX: 57-0496, TWX: 810-287-2536; FSC No.: 31433; Empl.: 5,100; *Sls. Mgr.:* Robert Taylor; *Dist. Mgr.:* Dan Manly ..... **A•1100-1101**

Refer to Kemet, Union Carbide Corp., Elctrns. Div. for sales office information and for distributor listings.

Local Sales Offices & Reps

AL Huntsville 205-830-1090
AZ Tempe 602-831-2151
CA Culver City 213-568-8384
CA Newport Beach 714-640-9320
CA Santa Clara 408-986-0424
CO Englewood 303-790-0494
FL Ft. Lauderdale 305-731-2187
FL Orlando 407-855-8886
GA Norcross 404-441-7701
IL Schaumburg 312-843-1030
IN Carmel 317-844-7756
MD Columbia 301-992-5600
MA Stoneham 617-279-0400
MI Farmington Hills 313-489-5850
MN Edina 612-929-4642
NY Elmsford 914-332-4390
NY Liverpool 315-451-0720
NC Raleigh 919-872-2877
OH Columbus 614-885-3330
OK Tulsa 918-664-8592
PA Exton 215-363-8310
SC Greenville 803-242-5789
TX Austin 512-458-3181
TX Irving 214-556-0009
WA Kirkland 206-828-4853

Local Distributors

CA Compton, Harper, S.I.D. Elctrns. 213-979-5090
CA Culver City, Hamilton/Avnet Elctrns. .. 213-558-2662
CA Los Angeles, Bell Inds. 213-826-6778
CA Sunnyvale, Time Elctrns. 408-747-4704
CA West Lake Vl, Distel, Inc. 805-495-9998
CO Denverale, Integrated Elctrns. 303-292-5537
IL Chicago, Newark 312-784-5100
MA Wilmington, J V Elctrns. 617-273-4300
NJ Perth Amboy, Arm Bar Inds. 201-442-0990
NM Albuquerque, Alliance Elctrns., Inc. 505-292-3360
NY Buffalo, Summit 716-884-3450
NY Cen. Islip, Semicap 516-582-4400
NY Hauppauge, JACO Elctrns., Inc. 516-273-5500
NY Westbury, Schweber 516-334-7474
NC Greensboro, Golden Elctrns. 919-294-4653
OH Cleveland, Pioneer Elctrns. 216-587-3600
TX Ft. Worth, TTI Elctrns. 817-831-0441

KEMLITE LABS., INC., 1819 W. Grand Ave., Chicago, IL 60622, Tel: 312-829-6050; Empl.: 65; *Sls. Mgr.:* J.V. Daniels

KEMTRON CIRCUITS & ELCTRNS. CORP., 48 Merrick Rd., Rockville Centre, NY 11570, Tel: 516-766-2772; Empl.: 7; *Sls. Mgr.:* Walter Carlock

M.S. KENNEDY CORP., Sub of Hybrilonics, Inc., 8170 Thompson Rd., Clay, NY 13041, Tel: 315-699-9201, TWX: 710-541-0465; FSC No.: 51651; Empl.: 41; *Sls. Mgr.:* Greg Overend

KENTRON, INC., P.O. Box 142, Cedarburg, WI 53012-0142, Tel: 414-377-3733; *Sls. Mgr.:* Kenneth L. Krolski

KEN-TRON MFG., INC., 1204 Industrial Dr., Owensboro, KY 42301, Tel: 502-684-0431, TELEX: 20-4305, FAX: 502-684-0435; Empl.: 100; *Sls. Mgr.:* J. Douglas

KEPCO, INC., 131-38 Sanford Ave., Flushing, NY 11352, Tel: 718-461-7000, TWX: 710-582-2631; Empl.: 300; *Sls. Mgr.:* Paul Birman; *Dist. Mgr.:* Paul Birman ..... **D•1793-1823**

Local Sales Offices & Reps

AL	Huntsville, W. A. Brown, Inc.	205-830-9224
AZ	Phoenix, Aztec Entprs.	602-944-9185
CA	Los Alamitos, Reed Elctrn. Mktg.	213-598-6676
CA	Mtn. View, N-S Westronics	415-960-1111
CA	San Diego, Earle Assocs., Inc.	619-278-5441
CO	Denver, Aztec Entprs.	303-779-5285
CT	Bethel, Ray Perron & Co., Inc.	203-798-0261
CT	Farmington, R. Perron Co.	203-673-4825
DC	Washington, Eastern Instrmn. Corp.	301-384-8500
FL	Ft. Lauderdale, W. A. Brown Instrs., Inc.	305-776-6661
FL	Melbourne, W. A. Brown Instrs., Inc.	305-723-0776
FL	Orlando, W. A. Brown Instrs., Inc.	407-648-9660
GA	Atlanta, W. A. Brown Instrs., Inc.	404-449-7160
IL	Chicago, Century Elctrns.	312-777-9700
KS	Kansas City, ATECH, Div. of ATA, Inc.	913-268-9644
MD	Baltimore, Eastern Instrmn. Corp.	301-792-7039
MA	Boston, R. Perron Co.	617-449-6162
MI	Detroit, Carter McCormic & Peirce	313-477-7700
MN	S. St. Paul, Northport Engrg.	612-457-8000
MO	St. Louis, ATECH, Div. of ATA, Inc.	314-576-2884
NH	Merrimack, Ray Perron & Co., Inc.	603-424-4423
NJ	Woodcliff Lake, Eastern Instrmn.	201-664-0907
NM	Albuquerque, Techn. Mktg. Assoc.	505-345-8921
NY	Liverpool, NTS Assocs., Inc.	315-451-1091
NC	Cary, W. A. Brown Instrs., Inc.	919-460-1120
OH	Cleveland, Carter McCormic & Peirce	216-826-0400
OH	Dayton, Carter McCormic & Peirce	513-836-0951
OK	Tulsa, Airep Elctrns.	918-494-7711
OR	Beaverton, H. Levinson Co.	503-690-1312
PA	Philadelphia, Eastern Instrmn.	215-355-7700
PA	Pittsburgh, Carter McCormic & Peirce	412-733-7490
TX	Austin, Airep Elctrns.	512-327-0778
TX	Dallas, Airep Elctrns.	214-349-4360
TX	Houston, Airep Elctrns.	713-644-8171
UT	Ogden, Aztec Entprs., Inc.	801-621-1655, 801-355-9256
WA	Seattle, H. Levinson Co.	206-382-1300
WI	Milwaukee, Century Elctrns. Sls.	414-645-3680
Can	Calgary, Alberta, Digidyne, Inc.	403-262-7744
Can	Montreal, DigiDyne Inc.	514-631-1891
Can	Ottowa, Ont., Digidyne, Inc.	613-727-5632
Can	Rexdale, Ont., Digidyne, Inc.	416-674-0444
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KEP

FAX: 201-294-8097

KESSLER-ELLIS PRODS., 120 1st Ave., Atlantic Highlands, NJ 07716, Tel: 201-291-0500, 800-631-2165, TELEX: 13-2496; FSC No.: 28222; Empl.: 85; *Sls. Mgr.:* Karen Henderson ..... **D•1134**

Local Sales Offices & Reps

AL	Brimingham, Bryco	205-672-9760
CA	Costa Mesa, FLW	714-751-7512
CA	Hayward, FLW	415-786-9070
CA	San Diego, FLW	619-277-0993
IN	Indianapolis, Ronald Ray & Assoc.	317-841-9144
MA	Salem, CDM Assocs.	617-741-3166
MI	Southfield, Bill Coombe Sls. Co.	313-355-1511
NJ	Stanhope, Nota-Tek	201-347-1490
NC	Kernersville, Heritage Elctrl. Sls. Assocs.	919-996-4374
OH	Chagrin Falls, RPM Indl. Sls.	216-247-3295
TX	Dallas, Devices, Inc.	214-991-1202
WI	Oconomowoc, Atlas Instr.	414-367-8759

Local Distributors

CA	Los Angeles, E.I.L. Instrs.	213-685-7020
CT	Middletown, E.I.L. Instrs.	203-346-6646
FL	Bartow, Chemco Elec. Supp.	813-533-3165
FL	St. Petersburg, Chemco Elec. Supp.	813-577-7774
FL	Tampa, Chemco Elec. Supp.	813-621-8611
GA	Norcross, A A Elec.	404-449-8670
HI	Honolulu, Process Valve & Control	808-834-7675
IL	La Salle, Complete Indl. Entprs.	815-224-1485
IA	Cedar Rapids, Hupp Elec. Motors	319-366-0761
IA	Davenport, Hupp Elec. Motors	319-322-3168
LA	W. Monroe, Weaks Supp. Co.	318-323-8831
ME	Bangor, Holmes Distrs.	207-942-7357
ME	Portland, Holmes Distrs.	207-774-5901
MD	Sparks, E.I.L. Instrs.	301-771-4800
MA	Burlington, E.I.L. Instrs.	617-272-9450
MA	W. Springfield, Control Engrg.	413-781-1330
MA	Wilmington, Stan. Elec. Supp.	617-658-5050
MI	Ann Arbor, Madison Elec.	313-665-6131
MI	Ann Arbor, McNaughton & McKay	313-995-9515
MI	Jackson, Madsion Elec.	517-783-2735
MI	Kalamazoo, Madison Elec.	616-342-1965
MI	Madison Hgts., McNaughton & McKay	313-399-7500
MO	Maryland Hgts., French Gerleman Elec.	314-569-3122
NH	Manchester, Holmes Distrs.	603-669-5060
NJ	Green Brook, Apparatus Elctrl. Supp.	201-752-8400
NY	Clarence, Trott Elctrns.	716-634-8500
NY	Elmira, Brady Supp.	607-733-6591
NY	Pittsford, Trott Elctrns.	716-586-8251
NC	Charlotte, Trott Elctrns.	704-376-2237
OH	Cleveland, Pioneer Stan.	216-587-3600
OH	Dayton, Pioneer Dayton	513-236-9900
OH	Toledo, Girkins Elec.	419-478-5600
TN	Nashville, A A Elec.	615-832-6632
WI	Oconomowoc, Atlas Instrs.	414-367-8759

KESTER

FAX: 312-390-9338

KESTER SOLDER DIV., Litton Sys., Inc., 515 E. Touhy Ave, Des Plaines, IL 60018, Tel: 312-297-1600, TWX: 910-221-2100; Empl.: 350; *Sls. Mgr.:* Mack J. Haraburd; *Dist. Mgr.:* Carl Voelkel ..... **C•1758**

Local Sales Offices & Reps

CA	Anaheim	714-871-0280
NJ	Newark	201-589-0246

KEVLIN MICROWAVE CORP., 26 Conn St., Woburn, MA 01801, Tel: 617-935-4800, TWX: 710-393-1239; FSC No.: 25634; Empl.: 120; *Sls. Mgr.:* James E. Riley

Keystone CARBON COMPANY

FAX: 814-781-7648

KEYSTONE CARBON, Thermistor Div., 1935 State Street, St. Marys, PA 15857, Tel: 814-781-1591, TELEX: 91-4517; FSC No.: 75-263; Empl.: 1200; *Sls. Mgr.:* John A. Brock; *Dist. Mgr.:* John A. Brock ..... **B•1847-1849**

Local Sales Offices & Reps

CA	Orange, El Dorado Sls.	714-538-7252
CA	Redwood City, Hickey Inds. Sls.	415-594-9978
CA	San Diego, El Dorado Sls.	619-549-2202
CT	Wethersfield, L.J. Labant	203-529-0048
GA	Marietta, J.J. Arnold	404-427-1062
IL	West Dundee, W. S. Heffron	312-426-6472
IN	Fort Wayne, R.O. Whitesell & Assocs.	219-432-5591
IN	Indianapolis, R.O. Whitesell & Assocs.	317-359-9283
IN	Kokomo, R.O. Whitesell & Assocs.	317-457-9127
KS	Shawnee, Benson Engrg.	913-491-4446
MI	Farmington Hills, J.L. Montgomery Assocs.	313-489-0099
MN	Minneapolis, Dave Marrone	612-566-6573
MO	St. Louis, Frank H. Ring	314-863-2511
NY	Rochester, Foster & Wager	716-385-7744
OH	Cincinnati, R.O. Whitesell & Assocs.	513-521-2290
OH	Cleveland, R.O. Whitesell & Assocs.	216-447-9020
OH	Columbus, R.O. Whitesell & Assocs.	614-888-9396
OH	Dayton, R.O. Whitesell & Assocs.	513-298-9546
NC	Cary, J. E. Shea	919-481-2475
PA	Pittsburgh, R.O. Whitesell & Assocs.	412-963-6161
TX	Dallas, Benson Engrg.	214-352-7541
TX	Houston, Benson Engrg.	713-672-2194
EXP	NY, Inwood, Minthorne Int'l.	516-239-0767
Can	Burlington, Ont., Donald J. Hyslop	416-333-3520

Local Distributors

AZ	Scottsdale, Allied Elctrns.	602-990-9549
CA	Garden Grove, Allied Elctrns.	714-554-0731
CA	Inglewood, Newark Elctrns.	213-671-7066
CA	Santa Clara, Allied Elctrns.	408-727-1690
CO	Wheatridge, Allied Elctrns.	303-425-7144
FL	Ft. Lauderdale, Allied Elctrns.	305-486-0500
GA	Atlanta, Allied Elctrns.	404-237-3366
IL	Elgin, Allied Elctrns.	312-697-8200
MA	Wilmington, Allied Elctrns.	617-942-0150
MI	Westland, Allied Elctrns.	313-595-6565
MN	Minneapolis, Allied Elctrns.	612-559-9545
MO	St. Louis, Allied Elctrns.	314-878-1229
NJ	Springfield, Newark Elctrns.	201-376-9500
NY	Mineola, Allied Elctrns.	516-248-2360
NC	Cary, Allied Elctrns.	919-467-0720
OH	Willoughby, Allied Elctrns.	216-951-0908
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TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Houston, Allied Elctrns.	713-445-7123
VA	Alexandria, Allied Elctrns.	703-836-5002
WA	Seattle, Allied Elctrns.	206-767-5772
WI	Milwaukee, Allied Elctrns.	414-463-2662

KEYSTONE ELECTRONICS CORP., 31-07 20th Rd., Astoria, NY 11105-2017, Tel: 718-956-8900, TELEX: 35-3700, FAX: 718-956-9040; FSC No.: 91833; Empl.: 80; *Sls. Mgr.:* Charles Gold; *Dist. Mgr.:* Len Lenzen .... **C•1705**

KEYTEK INSTRUMENT CORP., 260 Fordham Rd., Wilmington, MA 01887, Tel: 617-658-0880, TELEX: 951389 KEYTEK BURL; *Sls. Mgr.:* Michael Hopkinbs

KEYTEK KEYBOARDS CANADA INC., 16 Mary St., Units 3 & 4, Aurora, Ontario, Canada L4G 3W8, Tel: 416-727-9491; Empl.: 20

KEY TRONIC, P.O. Box 14687, Spokane, WA 99214, Tel: 509-928-8000, TWX: 510-773-1885; FSC No.: 52833; Empl.: 1350

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KGS ELECTRONICS, INC., 2029 N. Lincoln Ave., Pasadena, CA 91103, Tel: 818-798-0786; Empl.: 50 ..... **D•2126-2127**

Local Sales Offices & Reps

TX Hurst, McGarrah & Assocs. 817-268-3557

WALTER KIDDE, Div. of Kidde, Inc., Fire Sys. Operations, P.O. Box 1147, Wake Forest, NC 27587, Tel: 919-556-6811, TELEX: 802569 WALTKIDDE; Empl.: 250; *Sls. Mgr.:* Andy Halasz

K.I. INDUSTRIES INC., P. O. Box 166, Elmhurst, IL 60126, Tel: 312-449-1990, TELEX: 721498; Empl.: 30; *Sls. Mgr.:* Henry W. Faller

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Local Sales Offices & Reps

AL Huntsville, Morard & Co.(MOCO) 205-881-5968
AZ Chandler, Vic Myers Assocs. 602-241-9324
CA Carson, Amasco South 213-516-8561
CA Sunnyvale, Amasco North 408-733-8690
CO Aurora, R & R Instrmn. 303-340-8728
CT Madison, Eastronix, Inc. 203-421-4514
FL Melbourne, EMS, Inc. 305-724-1027
FL Plantation, EMS, Inc. 305-587-7146
FL Sarasota, EMS, Inc. 813-923-2804
HI Honolulu, Honolulu Elctrns. 808-949-5564
IL Elmhurst, Sector Engrg. Sls. 312-530-7850
IN Indianapolis, Sector Engrg. Sls. 317-842-1120
KS DeSoto, Midtec Assocs. 913-441-6565
MD Wheaton, Brimberg Sls. (Power Supp.) 301-946-2670
MA Bedford, Eastronix 617-275-5775
MI Plymouth, EQS Sys., Inc. 313-455-7920
MN Minneapolis, Sector Engrg. Sls. 612-593-1809
MO St. Louis, Midtech Assocs. 314-275-8666
NJ Teaneck, Scientific Dvcs. East 201-837-1035
NM Albuquerque, Vic Myers Assocs., Inc. 505-884-6878
NY Rochester, EIC Elctrns. 716-544-4392
OH Chesterland, EQS Sys., Inc. 216-729-2222
OH Dayton, EQS Sys., Inc. 513-236-7676
OK Parkhill, Scientific Dvcs.-S.W. 918-457-4888
OR Portland, Syntek, Inc. 503-636-6793
PA Pittsburgh, EQS Sys., Inc. 412-261-2604
PA Springhouse, Scientific Dvcs. East 215-643-3335
TX Austin, Scientific Dvcs. SW 512-442-6215
TX Houston, Scientific Dvcs. SW 713-864-1711
TX Richardson, Scientific Dvcs. SW 214-231-8106
UT Salt Lake City, Intermountain Instrs. ... 801-487-3151
VT Shelburne, Eastronix 802-985-3743
WA Kirkland, Syntek, Inc. 206-488-0394
WI Milwaukee, Sector Engrg. Sls. 414-352-8280
PR San Juan, David S. Ternent 809-762-2688
Can Burnaby, BC, Interfax Sys., Inc. 604-430-1410
Can Mississauga, Ont., Interfax Sys., Inc. ... 416-671-3920
Can Nepean, Ont., Interfax Sys., Inc. 613-726-8888
Can St. Laurent, Que., Interfax Sys., Inc. 514-336-0392

KILO INTERNATIONAL

FAX: 714-596-0681

KILO INTERNATIONAL, 2118 D Street, La Verne, CA 91750, Tel: 714-593-4626; FSC No.: 05129; Empl.: 50; *Sls. Mgr.:* James T. Davis; *Dist. Mgr.:* James T. Davis ..... **A•2076**

Kilovac Corporation

FAX: 805-684-9679

KILOVAC CORP., Box 4422, Santa Barbara, CA 93140, Tel: 805-684-4560, TWX: 910-336-1141; FSC No.: 18741; Empl.: 85; *Sls. Mgr.:* Patrick McPherson, VP Sls. & Mktg. ..... **B•1510-1515**

Local Sales Offices & Reps

CA Campbell, Kottmeier Assocs. 408-371-8700
CA Tarzana, High Voltage Sls. 818-881-9194
FL St. Petersburg, K-Square 813-381-1893
GA Atlanta, Electro Tech 404-262-1522
IL Elgin, Gassner & Clark, Inc. 312-695-9540
IA Cedar Rapids, H. R. Brown Sls. Co. ... 319-366-0635
KS Olathe, M. E. Bettis Co. 913-764-0621
KS Wichita, M. E. Bettis Co. 316-265-8250
MD Columbia, Tyler Griffin Co. 301-995-1215
MN Osseo, Gaffney Sls. 612-425-5484
MO St. Louis, Abrams & Assocs. 314-569-0447
NM Albuquerque, Cleveland Entprs., Inc. .. 505-265-7893
NY Great Neck, Trionic Assocs. 516-466-2300
NY Rochester, Lamb Comp., Inc. 716-323-1250
NY Syracuse, Lamb Comps., Inc. 315-455-2469
NC Winston-Salem, DGW, Inc. 919-768-7166
OH Cleveland, Electronic Components, Inc. 216-331-5330
OH Columbus, Electronic Comp., Inc. 614-231-2318
OH Miamisburgh, Electronic Comps., Inc. 513-866-3340
OR Tigard, Components West, Inc. 503-684-1671
PA Paoli, Tyler Griffin Co. 215-647-1550
TX Dallas, Edward F. Aymond Co. 214-826-7620
WA Redmond, Components West, Inc. 206-885-5880
Can Brit. Columbia, Macom Agencies, Ltd. 604-271-2661
Can Etobicoke, Ont., Dynasty Comps. 416-674-8060
Can Nepean, Ont., Dynasty Comps. 613-723-0725
Can Quebec, Dynasty Comps. 514-694-0275

KINEMETRICS/SYSTEMS, Kinemetrics, Inc., 222 Vista Ave., Pasadena, CA 91107, Tel: 818-795-2220, TELEX: 67-5402; Empl.: 65; *Sls. Mgr.:* A. M. Sereci

KINEMETRICS/TRUETIME, 3243 Santa Rose Ave, Santa Rosa, CA 95407, Tel: 707-528-1230, TELEX: 176687 (TRUETIME SARO), FAX: 707-527-6640; Empl.: 38; *Sls. Mgr.:* R. J. Dielman

KINETIC SYSTEMS, 11 Maryknoll Dr., Lockport, IL 60441, Tel: 815-838-0005, TWX: 910-638-2831, FAX: 815-838-4424; Empl.: 170; *Sls. Mgr.:* R. H. Brislan

KINGS ELECTRONICS CO., INC., 40 Marbledale Rd., Tuckahoe, NY 10707, Tel: 914-793-5000

KING WIRE & CABLE CORP., 179-45 110 Ave., Jamaica, NY 11433, Tel: 718-657-4422, TELEX: 96-8858; FSC No.: 06145; *Sls. Mgr.:* David Berger

KIPP & ZONEN, Enraf-Nonius, 390 Central Ave., Bohemia, NY 11716, Tel: 516-589-2885, 800-645-1025, TELEX: 0960250, FAX: 516-589-2068; Empl.: 25; *Sls. Mgr.:* Wm. Novack; *Dist. Mgr.:* Wm. Novack

KISTLER-MORSE, 10201 Willows Rd. N.E., P.O. Box 3009, Redmond, WA 98073, Tel: 206-881-8000, FAX: 206-883-4893; *Sls. Mgr.:* Stan Isenhath

KLC/KARL LAMBRECHT CORP., 4204 N. Lincoln Ave., Chicago, IL 60618, Tel: 312-472-5442, TELEX: 759819, FAX: 312-472-2724; Empl.: 29; *Sls. Mgr.:* Raymond Lambrecht

KLM ELECTRONICS, 16890 Church St., P.O. Box 816, Morgan Hill, CA 95037, Tel: 408-779-7363, TWX: 910-590-4468; Empl.: 250; *Sls. Mgr.:* Chuck McKinney

KLOCKNER MOELLER, 4 Strathmore Rd., Natick, MA 01760, Tel: 617-655-1910, TELEX: 94-8434; Empl.: 250

KMC SYSTEMS, INC., 140 Greenwood Ave. (Bldg. 3), Midland Pk., NJ 07432, Tel: 201-447-0007; Empl.: 120; *Sls. Mgr.:* E. Verder

Local Sales Offices & Reps

UT Bountiful, Lectrol, Inc. 801-292-7674
Can Downsview, Ont., Displayco, Ltd 416-663-6405

KNOWLEDGEWARE, INC., 3340 Peachtree Rd., N.E., Ste. 1100, Atlanta, GA 30026, Tel: 404-231-8575, TELEX: 544080; FSC No.: 7030-0003; Empl.: 125ò; *Sls. Mgr.:* Donald P. Addington

KNOWLES ELECTRONICS, INC., 3100 N. Mannheim Rd., Franklin Park, IL 60131, Tel: 312-455-3600, TWX: 433-0330, FAX: 1-312-455-9203; *Sls. Mgr.:* Reginald G. Garratt, VP-Mktg.

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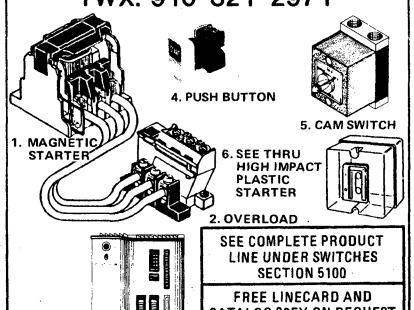

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Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean	205-830-1540
AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Garden Grove, ELSCO Elctrns.	714-891-4621
CA	San Diego, Westrep	619-566-6580
CA	Santa Clara, Caltron Comps.	408-980-0181
CO	Boulder, R. G. Entprs.	303-447-9211
CT	Middletown, Gerber Sls.	203-347-3000
FL	Altamonte Springs, APM Assocs.	305-869-6831
FL	Ft. Lauderdale, APM Assocs.	305-978-9941
FL	Tampa, APM Assocs.	813-886-2457
GA	Norcross, Cartwright & Bean	404-368-0160
IL	Arlington Hgts., C. L. Greenslade Sls.	312-593-3450
IN	Fort Wayne, John F. Kilfoil	219-436-7233
KS	Overland Pk., Spectrum Sls.	913-648-6811
LA	Covington, Cartwright & Bean	504-892-1780
MA	Waltham, Gerber Sls.	617-890-3334
MI	Troy, C. B. Jensen & Assocs.	313-643-0506
MN	Edina, Grayden & Flemmer	612-941-1120
MS	Jackson, Cartwright & Bean	601-981-1170
MO	Hazelwood, Spectrum Sls.	314-731-5151
NM	Albuquerque, SynTech	505-266-7951
NY	East Rochester, Tri-Tech Elctrns.	716-385-6500
NY	Endwell, Tri-Tech Elctrns.	607-754-1094
NY	Fayetteville, Tri-Tech Elctrns.	315-446-2881
NY	Fishkill, Tri-Tech Elctrns.	914-897-5611
NY	Great Neck, MOS Assocs.	516-487-3966
NC	Charlotte, Cartwright & Bean	704-536-0303
NC	Raleigh, Cartwright & Bean	919-876-4130
OH	Cincinnati, John F. Kilfoil	513-791-6150
OR	Beaverton, Earl & Brown Co.	503-643-5500
PA	Wynnewood, Metz-Benham Assocs.	215-896-7300
TN	Knoxville, Cartwright & Bean	615-693-7450
TN	Memphis, Cartwright & Bean	901-362-8345
TX	Lewisville, Jim Hughes	214-221-1536
WA	Redmond, Earl & Brown Co.	206-885-5064
PR	San German, Digit-Tech Sls.	809-892-4260
Can	Ontario, Cantronics Ltd.	416-297-8668

Local Distributors

AZ	Ftn. Hill, RCD Inds.	602-483-6412
AZ	Phoenix, Camco Elctrn. Comps.	602-269-6201
AZ	Phoenix, Sterling Elctrns.	602-268-2121
AZ	Tempe, T.T.I.	602-431-1191
AR	Little Rock, Carlton-Bates	501-562-9100
CA	Campbell, Lartronics	408-379-6454
CA	Chatsworth, MIL-Comm Distrs.	818-998-3111
CA	Chatsworth, T.T.I.	818-709-1010
CA	Costa Mesa, Eric Elctrns.	714-751-1185
CA	Fountain Valley, Comps. Ctr.	714-979-0433
CA	Garden Grove, Natl. Elctrns.	800-854-2451
CA	Irvine, KELEX	714-863-1230
CA	Milpitas, T.T.I.	408-946-5577
CA	Orange, Ryno Elctrns.	714-637-0200
CA	San Diego, Ryno Elctrns.	619-453-8430
CA	San Diego, T.T.I.	619-587-4888
CA	San Jose, Eric Elctrns.	408-432-1111
CA	Santa Clara, Components Ctr.	408-988-3751
CA	Sunnyvale, SAI	408-745-0800
CO	Boulder, R. G. Entprs.	303-447-9211
CO	Denver, T.T.I.	303-429-6806
CO	Englewood, Shelly-Ragon Elec. Parts	303-744-3601
CT	Stratford, T.T.I.	203-375-1400
CT	Stratford, Utronics	203-378-4201
CT	Wallingford, Midstate Elctrns.	203-265-9900
FL	Orlando, TTI	305-859-1000
FL	Tampa, Reptron Elec.	813-855-4656
FL	W. Palm Beach, Nurmi Elctrn. Supp.	305-684-0320
GA	Atlanta, Prehler Elctrns.	404-447-5540
GA	Norcross, T.T.I.	404-662-0911
IL	Elk Grove Village, GBL/Goold Elctrns.	312-593-3220
IL	Elk Grove Vl., Prehler Elctrns.	312-364-6070
IL	Rosemont, Advent Elctrns.	312-298-4210
IN	Indianapolis, Advent Elctrns.	317-872-4910
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
MD	Baltimore, Radio Elec. Svc. Co.	301-529-0500
MD	Beltsville, Radio Elec. Svc.	301-937-9100
MD	Columbia, Jaco Comps.	301-995-6620
MD	Columbia, T.T.I.	301-995-1331
MA	Billerica, Baldwin Comp. Ctr.	617-667-6710
MA	Hingham, Sager Elec. Supp.	617-749-6700
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	Wilmington, J.V. Elctrns.	617-657-6523
MA	Wilmington, T.T.I.	617-658-4700
MA	Woburn, Sterling Elec.	617-938-6200
MI	Ann Arbor, Wedemeyer	313-665-8611
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	Farmington Hills, Prehler Elctrns.	313-476-7084
MI	Livonia, Reptron Elctrns.	313-525-2700
MI	St. Clair Shores, SPEMCO	313-771-2700
MN	Eden Prairie, T.T.I.	612-944-5080
MN	Hibbing, Minn Tech Elctrns.	218-262-5228
MN	St. Paul, Shelley-Ragon Elctrns.	612-642-2828
MO	Independence, Shelley-Ragon Elctrns.	816-254-3410
MO	St. Louis, Franklin Elctrns.	314-993-5333
NE	Lincoln, Scott Elctrns.	402-466-8221
NH	Nashua, Brevan Elctrns.	603-889-7230
NJ	Mountainside, Enox Resistor Co.	201-654-7600
NJ	Parsippany, Fabe Electro Sls.	201-299-1123
NY	Amherst, Standard Elctrns.	716-691-3801
NY	Buffalo, Summit Distrs.	716-887-2845
NY	E. Syracuse, Add Elctrns.	315-437-0300
NY	Hauppauge, Fairmont Elctrn. Sls.	516-231-3313
NY	Hauppauge, Jaco	516-273-5500
NY	Melville, S.A.I.	516-293-2710
NY	Rochester, Summit Distrs.	716-334-8110
NY	Ronkonkoma, Baldwin Comp. Ctr.	516-588-5700
NY	Ronkonkoma, Prime Comps.	516-737-1730
NY	Ronkonkoma, T.T.I.	516-737-2000
NY	Valley Stream, L & S Elctrns.	516-561-2474
NC	Greensboro, Golden Elctrns.	919-294-4653
NC	Raleigh, Resco	919-781-5700
NC	Raleigh, Southeastern Radio	919-828-2311
OH	Cleveland, Roberts Elect. Corp.	216-238-1711
OH	Columbus, T.T.I.	614-848-5770
OH	Worthington, Reptron	614-436-6675
OK	Tulsa, Altair Co.	918-252-5781
OR	Beaverton, Murphy Elctrns.	503-642-2001
PA	Drexel Hill, Kass Elctrns. Dist.	215-449-2300
PA	Erie, Rem Elctrns.	814-453-5626
PA	Harrisburg, Cumberland Elctrns.	717-233-5883
PA	Philadelphia, PEI/Genesis	215-673-0400
PA	Philadelphia, Shap	215-969-3300
RI	Pawtucket, Major Edwards	401-725-7400
TN	Knoxville, Bondurant Bros.	615-573-9151
TN	Memphis, Bluff City Elctrns.	901-345-9500
TN	Nashville, Bluff City Elctrns.	615-242-8000
TX	Dallas, Shelley-Ragon	214-349-2424
TX	Ft. Worth, T.T.I.	817-831-8300
TX	Ft. Worth, T.T.I. Inc.	817-831-0441
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair Co.	214-231-5166
TX	Richardson, CCI	214-644-3444
TX	Richardson, Jaco	214-235-9575
WA	Redmond, Murphy Elctrns.	206-881-1234
WA	Redmond, Shelley-Ragon	206-883-2220
WA	Redmond, T.T.I.	206-882-0291
WI	Oconomowac, G W Elctrns.	414-567-9445
Can	Mississauga, Ont., Prelco	416-678-0401
Can	Montreal, Que., Prelco	514-389-8051

KODE, Odetics, 1515 S. Manchester Ave., Anaheim, CA 92802, Tel: 714-758-0400, TWX: 910-595-2680; FSC No.: 62767; Empl.: 40; *Sls. Mgr.:* Dick Miller

KOEP PRECISION STANDARDS, INC., IC Coan Place, Metuchen, NJ 08840, Tel: 201-549-9280/9282, TWX: 710-998-0503; FSC No.: 57114; Empl.: 9; *Sls. Mgr.:* Cynthia Keep; *Dist. Mgr.:* Cynthia Keep ..... **D•1283**

Local Sales Offices & Reps

AZ	Scottsdale, Williams Assocs.	602-947-4297
CA	Torrance, Cutlas Elctrns.	213-324-7360
CO	Commerce City, Williams Assocs.	303-289-5647
NM	Albuquerque, Williams Assocs.	505-255-1638
NY	Binghamton, Tae-Rep	607-722-9265
NY	Rochester, Tae-Rep	716-586-8710
UT	Salt Lake City, Williams Assocs.	801-532-7701

KOLIN INDS., Box 300, Pound Ridge, NY 10576, Tel: 914-764-5775, FAX: 914-764-5386; Empl.: 30; *Sls. Mgr.:* J. Kolinsky

KOLLSMAN INSTR., 220 Daniel Webster Hwy., Merrimack, NH 03054, Tel: 603-889-2500, TELEX: 94-3537, TWX: 710-366-6883; Empl.: 2200

KONTES, Kimble Div. of Owens/IL, 1001 Spruce St., Vineland, NJ 08360, Tel: 609-692-8500, TWX: 510-687-8967

KONTRON ELCTRNS., 630 Clyde Avenue, Mountain View, CA 94039-7230, Tel: 415-965-7020, TWX: 910-378-5207, FAX: 415-965-3505; Empl.: 60; *Sls. Mgr.:* Bob Woyciehowsky

KOOLTRONIC, INC., Hamilton Ave., Hopewell, NJ 08525, Tel: 609-466-3400, TELEX: 843345, FAX: 609-466-1114; Empl.: 180

KOOLTRONIC, INC., 1700 Morse Avenue, Ventura, CA 93003, Tel: 805-642-8521, FAX: 805-658-2901

KORRY ELECTRONICS CO., Criton Technologies, 901 Dexter Ave. N., Seattle, WA 98109, Tel: 206-281-1300, TWX: 910-444-2295; Empl.: 410; *Sls. Mgr.:* Bob Simpson

KRAFT DYNATRONIX, INC., 105 Power St., Amery, WI 54001, Tel: 715-268-8118, 800-826-7172, TWX: 297861 DYTX UR, FAX: 715-268-8183; Empl.: 25; *Sls. Mgr.:* R. W. Kappler; *Dist. Mgr.:* R. W. Kappler, Natl. Sls. Mgr.

KRECKMAN, HERB, CO., Cresco, PA 18326, Tel: 717-595-2212; Empl.: 4

KR ELECTRONICS, INC., 91 Avenel St., Avenel, NJ 07001, Tel: 201-636-1900; FSC No.: 55259; Empl.: 15; *Sls. Mgr.:* Frank Senkewicz ..... **A•1666-1668**

Local Sales Offices & Reps

CO	Englewood, Tech. Mktg. Co.	303-770-8994
IL	Elmhurst, Utronix Sls., Inc.	312-834-1100
OH	Kettering, Frank Bold & Assocs.	513-298-6145
TX	Dallas, Kay Todd Assocs.	214-458-8833

FAX: 603-624-0634

KRL/BANTRY COMPONENTS, INC., 160 Bouchard St., Manchester, NH 03103, Tel: 603-668-3210; FSC No.: 18235; Empl.: 75; *Sls. Mgr.:* Bert A. Spiller ..... **A•1951-1953**

Local Sales Offices & Reps

AZ	Tempe, Toribre Entprs., Inc.	602-820-5866
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CA	Mtn. View, Francisco & Assocs.	415-962-1717
CA	San Diego, Francisco/SMC Sls.	619-224-0013
FL	Boca Raton, Sls. Specialists	813-754-1329
IN	Indianapolis, CC Electro Sls.	800-423-7799
MN	Minneapolis, PSI, Inc.	612-944-8545
NH	Amherst, D. A. Crowley & Assocs.	603-673-7050
NY	Port Washington, Ashtec	516-767-0336
NY	Rochester, H. C. Johnson Agencies	716-586-0777
OH	Akron, Augnat Assocs.	216-273-1211
OK	Tulsa, Milco Mktg.	918-664-2277
PA	Wyndmoor, Precision Mktg. Grp.	215-233-9233
TX	Houston, Milco Mktg.	713-723-5003
TX	Richardson, Milco Mktg.	214-738-2716
UT	Salt Lake City, Sage Assocs.	801-467-5451
WA	Seattle, The Harry Levinson Co.	206-382-1300

Local Distributors

MA	Billerica, Baldwin Comps.	617-667-6710
NJ	Mountainside, ENOX Resistors	201-654-7600
NY	Ronkonkoma, Baldwin Comps. Center	516-588-5700,800-645-5608
PA	Harrisburg, Ad-Tech	717-939-8337

KROHN-HITE CORP., Avon Indl. Pk., Bodwell St., Avon, MA 02322, Tel: 508-580-1660, FAX: 617-583-8989; Empl.: 60; *Sls. Mgr.:* Warren Howard, Sls. Mgr. ..... **A•1669; D•1285**

Local Sales Offices & Reps

AL	Huntsville, Gentry Assocs.	205-837-0692
AZ	Phoenix, Odyssey 1	602-246-8846
CA	Huntington Bch., Sci-Dev West	714-840-3501
CA	San Jose, MCH Assocs.	408-246-7330
CO	Englewood, Odyssey 1	303-773-8176
FL	Ft. Lauderdale, Gentry Assocs.	305-791-8405
FL	Orlando, Gentry Assocs.	305-859-7450
FL	Tampa, Gentry Assocs.	813-886-0720
GA	Atlanta, Gentry Assocs.	404-998-2828
IL	Chicago, Berndt Assocs.	312-283-0713
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Overland Park, Ramsey Assocs.	913-649-6996
LA	Gretna, Gentry Assocs.	504-367-3975
MD	Baltimore, Sci-Rep	703-385-0600
MI	Detroit, EQS Sys.	313-961-3042
MN	Minneapolis, Berndt Assocs.	612-546-2021
MO	St. Louis, Ramsey Assocs.	314-878-5042
NJ	Englewood, Sci. Devices E.	201-871-3916
NM	Albuquerque, Odyssey 1	505-265-6645
NY	Syracuse, Labtronics	315-455-7314

OH Chesterland, EQS Sys. 216-729-2222
OH Columbus, EQS Sys. 614-228-3453
WA Bellevue, Sci. Dvcs., N.W. 206-747-5189
PA Pittsburgh, EQS Sys. 216-729-2222
PA Spring House, Scientific Devices East 215-643-3335
SC Columbia, Gentry Assocs. 803-772-6786
TN Knoxville, Gentry Assocs. 615-584-0281
TX Houston, Barnhill Assocs. 713-444-1733
VA Fairfax, Sci-Rep 703-385-0600
WA Bellevue, Sci. Dvcs. N. W. 206-747-5169
WI Milwaukee, Berndt Assocs. 414-545-8400

KRYSTINEL CORP., 126 Pennsylvania Ave., Paterson, NJ 07509, Tel: 201-345-8900, TWX: 710-988-5931, FAX: 201-345-1172; Empl.: 200; *Sls. Mgr.:* Stuart Gordon, VP Sls./Mktg.

KSI, See Kaiser Systems, Inc.

K-SYSTEMS, INC., 3902 Lilac, Las Cruces, NM 88005, Tel: 505-526-3209, TELEX: WUI 6502763972; Empl.: 5; *Sls. Mgr.:* J. C. Kates

K-TWO INDUSTRIES, 4331 Miranda Ave., Palo Alto, CA 94306, Tel: 408-720-9316; Empl.: 5

H. KUHNKE, INC., 26 W. Highland Ave., Atlantic Highlands, NJ 07716, Tel: 201-291-3334, 800-221-0714, TELEX: 854041; Empl.: 12; *Sls. Mgr.:* John Chapski

KULITE SEMICONDUCTOR PRODS., INC., One Willow Tree Rd., Leonia, NJ 07605, Tel: 201-461-0900, TELEX: 685-3296, FAX: 201-461-0990; Empl.: 300

KULKA (DIALIGHT COMPANY), 1913 Atlantic Ave., Manasquan, NJ 08736, Tel: 201-223-9400 .. **B•1115, 1121-1124, 1692-1693; C•1412-1415, 1553, 1709**

See Dialight Corp. for sales offices & representatives.

KURZ INSTRUMENTS INC., 2411 Garden Rd., Monterey, CA 93940, Tel: 800-424-7356, TELEX: 172275; FSC No.: 94-24-11681; Empl.: 72; *Sls. Mgr.:* Phil Hickerson

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K-W MANUFACTURING CO., INC., P. O. Box 508, Prague, OK 74864, Tel: 405-567-2285, TELEX: 4932625, FAX: 405-567-4153; Empl.: 28; *Sls. Mgr.:* Freda Pickard

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LANSING RESEARCH CORP., 705 Willow Ave., Ithaca, NY 14850, Tel: 607-272-3265, 607-257-7613, 800-847-3535; *Sls. Mgr.:* Fred B. Widding ..... **C•1062**

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FL	Oviedo, Conley & Assocs., Inc.	305-365-3283
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MD	Rockville, Marktron	301-251-8990
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MN	Edina, Mel Foster Tech. Sls.	612-941-9790
MO	St. Louis, Leach Corp.	314-524-2880
NM	Albuquerque, O'Donnell Assocs.	505-883-1030
NY	Commack, Leach Corp.	516-499-2449
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PA	Trevose, PSA, Inc.	215-245-0513
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WA	Bellevue, Leach Corp.	206-746-7236
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Can	Kirkland, Que., Robin Aerospace Prods., Ltd.	514-694-1315
Can	Mississauga, Ont., Robin Aerospace Prods., Ltd.	416-673-1666

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CT	Cheshire, Time Elctrns.	203-271-3200
FL	Ft. Lauderdale, Time Elctrns.	305-974-4800
FL	Orlando, Time Elctrns.	305-841-6565
GA	Atlanta, Electro Air Corp.	404-351-3545
GA	Norcross, Time Elctrns.	404-448-4448
IL	Wood Dale, Time Elctrns.	312-350-0610
MD	Columbia, Time Elctrns.	301-964-3090
MA	Peabody, Time Elctrns.	617-532-6200
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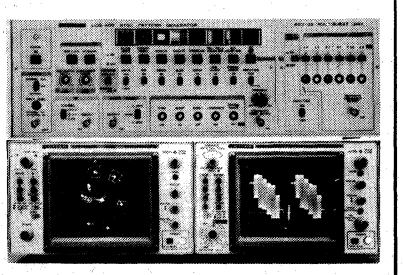

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CA	San Mateo, Halbar Assocs.	415-349-4700
CO	Denver, Quorum 3	303-696-8480
FL	Oviedo, Conley & Assocs.	305-365-3283
GA	Norcross, Montgomery Mktg., Inc.	404-447-6124
IL	Elgin, RHI Sls. Corp.	312-888-0099
KS	Wichita, Baka Corp.	316-682-8411
MD	Hunt Valley, Marktron	301-628-1111
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MA	Needham, Comp. Techn.	617-449-8490
MI	Southfield, Rathsburg Assocs., Inc.	313-559-9700
MN	Edina, Mel Foster Tech. Sls., inc.	612-941-9790
MO	St. Louis, Leach Corp.	314-524-2880
NM	Albuquerque, O'Donnell Assocs. S.W.	505-883-1030
NY	Commack, Leach Corp.	516-499-2449
NC	Cary, Montgomery Mktg., Inc.	919-467-6319
OH	Dayton, Leach Corp.	513-434-8151
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TX	Dallas, Leach Corp.	214-341-0811
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WA	Bellevue, Leach Corp.	206-746-7263
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CA	San Diego, Time Elctrns.	619-586-1331
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Torrance, Time Elctrns.	213-320-0880
CO	Englewood, Time Elctrns.	303-799-8851
CT	Cheshire, Time Elctrns.	203-271-3200
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NY	E. Syracuse, Time Elctrns.	315-432-0355
NY	Hauppauge, Time Elctrns.	516-273-0100
NC	Charlotte, Time Elctrns.	704-522-7600
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MI	Detroit, Hummon Assocs.	313-474-0661
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NY	Fayettesville, Floring & Assocs.	315-637-4552
NY	Scottsville, Floring & Assocs.	716-889-4614
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LECROY CORP., 700 S. Main St., Spring Vly., NY 10977, Tel: 914-425-2000, TWX: 710-577-2832; Empl.: 300; *Sls. Mgr.:* Henry Bickel

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KS	Wichita, Radio Inc.	316-264-2798
KS	Wichita, RSC Elctrns.	316-267-5213
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OH	Cleveland, CAM/RPC	216-461-4700
OH	Westerville, Wes-Garde	614-885-0319
OK	Oklahoma City, Radio Inc.	405-789-0741
OK	Oklahoma City, RSC Elctrns.	405-631-7729
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Portland, O4-Controls	503-231-8058
PA	Drexel Hill, Kass Elctrns.	215-449-2300
PA	Pittsburgh, CAM/RPC	412-782-3770
SC	Charleston, Wholesale Inds.	803-722-2634
SC	Greenville, EMSCO	803-233-4121
TX	Austin, Southwest Elexs.	512-837-8971
TX	Beaumont, Ralphs	409-833-9443
TX	Brownsville, Carden Inds.	512-541-3660
TX	Dallas, Southwest Elctrns.	214-234-3050
TX	Dallas, Wes-Garde	214-357-1768
TX	Dickinson, RSI	713-337-1757
TX	Pflugerville, RSI	512-251-1161
TX	Richardson, RSC Elctrns.	214-644-3444
TX	Stafford, Southwest Elexs	713-240-4000
TX	Texas City, Electronic Supp.	409-945-7757
UT	W. Valley City, Aved Inc.	801-975-9500
VA	Charlottesville, Virginia Elctrns.	804-296-4184
VA	Norfolk, Priest Elctrns.	804-855-0105
WA	Seattle, Westlake Elctrns.	206-622-6600
WI	Milwaukee, Progressive Image	414-321-4722

LEECRAFT MFG., 21-02 44th Rd., Long Island City, NY 11101, Tel: 718-392-8800, TWX: 710-582-2897; Empl.: 250; *Sls. Mgr.:* John Inzerillo

LEE DATA CORPORATION, 7075 Flying Cloud Drive, Minneapolis, MN 55344, Tel: 612-828-0300, TWX: 910-576-1690; Empl.: 1075; *Sls. Mgr.:* James McCormack, VP Commercial Sls.

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LEIGH INSTRUMENTS LTD., Components Division, 141 Bond Ave., Don Mills, ON, Canada M3B 1M2, Tel: 416-447-8531, TELEX: 06-966626, FAX: 416-447-8535; FSC No.: 02533; Empl.: 158; *Sls. Mgr.:* R. W. Parkins

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FAX: 707-578-0869

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Local Sales Offices & Reps

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CA	Irvine, Balzer-Wolf Assocs.	714-261-6877
CA	San Diego, Balzer-Wolf Assocs.	619-581-6060
CA	San Jose, Ruppert Sls. & Engrg.	408-998-8717
CO	Wheat Ridge, Trembly Assocs.	303-421-8900
FL	Melbourne, Southern Elctrns., Inc.	305-242-9661
GA	Norcross, Hughes Assocs., Inc.	404-662-1587
IL	Northbrook, Raines & Assocs.	312-498-0890
KS	Lenexa, Midtec Assocs.	913-541-0505
MD	Rockville, Mechtronics Sls., Inc.	301-340-2130
MA	Lexington, Zieco	617-861-8300
MI	Detroit, Jack M. Thorpe Co.	313-779-6363
MN	Edina, Hanna Lind	612-925-5700
MS	Corinth, Hughes Assocs., Inc.	601-287-2915
MO	St. Louis, Midtec Assocs.	314-275-8666
NV	Las Vegas, Trembly Assocs.	702-739-9770
NJ	Englewood, Sprung/Nussbaum, Inc.	201-569-5666
NM	Albuquerque, Trembly Assocs.	505-266-8616
NY	Syracuse, Canavan-Scanlon Assocs.	315-437-1271
NY	Victor, Canavan-Scanlon Assocs.	716-924-7450
NC	Cary, Hughes Assocs., Inc.	919-467-7029
OH	Cleveland, K/T Depco	216-442-6200
OH	Columbus, K/T Depco	614-262-9151
OR	Portland, Earl & Brown Co.	503-643-5500
PA	Hatboro, Jacobsen Assocs.	215-674-2937
PA	Pittsburgh, K/T Depco	412-367-1011
TN	Jonesboro, Hughes Assocs.	615-753-2719
TX	Lewisville, Jim Hughes Co.	214-221-1536
UT	Salt Lake City, Trembly Assocs.	801-295-4703
WA	Redmond, Earl & Brown Co.	206-885-5064
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CA	Palo Alto, TriRep	415-965-1822
CO	Aurora, Butler Tech. Sls.	303-343-3787
IL	Bartlett, Lemvig Assocs.	312-830-2241
IL	McHenry, Mesa Inc.	815-344-2820
KS	Mission, McAllister Assocs.	913-262-5500
MA	Framingham, Stone Comps.	617-875-3266
MI	Farmington Hills, Stone Comps. Sls.	313-476-6090
NJ	Oak Ridge, P.G. Assocs.	201-697-0128
NJ	Pensauken, Vantage Sls.	609-663-6660
NC	Fripp Island, NPM Assocs.	803-838-2691
OH	Fairview Pk., Comp. Specialty	216-734-0655
SC	Fripp Island, N.P.M. Assocs.	803-838-2691

LENCO ELECTRONICS, INC., 300 N. Maryland St., Jackson, MO 63755, Tel: 314-243-3147, TWX: 910-760-1382; Empl.: 70; *Sls. Mgr.:* Bob Bergfeld; *Dist. Mgr.:* Mark A. Hill, Intl. Sls. Mgr.

LENOX-FUGLE ELECTRONICS, 100 Sylvania Pl., S. Plainfield, NJ 07080, Tel: 201-756-1164; Empl.: 25; *Sls. Mgr.:* Henry J. Lenox

LENOX INSTRUMENT, 265 Andrews Rd., Trevose, PA 19047, Tel: 215-322-9990, TWX: 710-670-1440; FSC No.: 35733; Empl.: 30; *Sls. Mgr.:* William Lang

LEPCO/LEONARD ELEC. PRODS., 85 Industrial Dr., Brownsville, TX 78521, Tel: 512-546-1625, FAX: 512-546-4112; Empl.: 180; *Sls. Mgr.:* Andrew C. Smith

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FL	Tampa, RFS Mktg.	813-962-0562

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MD	Randallstown, Chesapeake Indl. Mktg.	301-922-5997
MA	Burlington, Omni-Rep	617-245-4511
MN	N. Mankato, E. I. Sls.	507-345-5786
NC	Cary, RFS Mktg.	919-469-4150
OH	Cleveland, Engrd. Indl. Sls.	216-371-4350
OK	Tulsa, Advance Tech. Sls.	918-664-0482
PA	Newton, Indl. Sls. Assocs.	215-860-2076
TX	Austin, Advance Tech. Sls.	512-331-9979
TX	Dallas, Advance Tech. Sls.	214-340-1300
TX	Houston, Advance Tech. Sls.	713-440-3888

LEPEL, 50 Heartland Blvd., Edgewood, NY 11717, Tel: 516-586-3300, TELEX: 12303, FAX: 516-586-3232; Empl.: 150; *Sls. Mgr.:* Richard Sutton

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LEVITON TELCOM, Leviton Manufacturing, 2222 222nd St, S.E., Bothell, WA 98021-4416, Tel: 206-485-4288, FAX: 206-483-5270; Empl.: 40; *Sls. Mgr.:* Jerry Cooley

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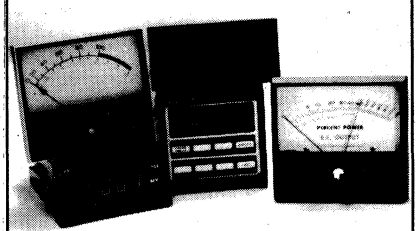

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FAX: 714-669-2544

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CA	Tustin, LH Resch., Inc.	800-824-5429
CA	Tustin, LH Resch., Inc.	800-LHS-ALES

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CA	Hayward, Featherstone Sls. Co.	415-785-1926
CO	Arvada, Gemini Elctrns.	303-428-5600
CT	Cheshire, The MacInnis Co.	203-272-3797
IL	Palatine, Goldbeck Milota Assocs. Inc.	312-705-0602
KS	Olathe, Advanced Tech. Sls.	913-782-8702
MA	Norwood, The MacInnis Co.	617-762-8090
MI	Detroit, R. P. Urban & Assocs.	313-535-2355
MI	Grand Rapids, R. P. Urban & Assocs.	616-245-0511
MN	St. Paul, Countryman Assocs.	612-645-9151
MO	St. Louis, Advanced Tech. Sls.	314-878-2921
NJ	Englewood Cliffs, Mason-Esco Inc.	201-569-8868
NY	Hauppauge, Mason-Esco Inc.	516-273-3500
NY	Rochester, BRS Sls. Assocs.	716-586-1522
OH	Dayton, J. C. Hoffsteller Co.	513-296-1010
OH	Medina, J. C. Hoffstetter Co.	216-241-4880
OR	Portland, SPS Elctrns., Inc.	503-297-6919
TX	Dallas, Reese & Assocs.	214-351-0703
UT	Slat Lake City, Gemini Elctrns.	801-278-0201
WA	Redmond, SPS Elctrns., Inc.	206-323-4140

LIBERTY ENGINEERING, 9300 Mason Avenue, Chatsworth, CA 91311

LIBERTY INTL. CORP., FIRSTOHM, 2539 237th St., Suite F, Torrance, CA 90505, Tel: 213-539-6452, FAX: 213-539-8450; Empl.: 5; *Sls. Mgr.:* Gary Lee; *Dist. Mgr.:* Maria A. Lauro

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AL	Adamsville, Southrep	205-674-3056
CA	Fremont, William Parks Assocs.	415-796-0875
CO	Parker, The Remington Grp.	303-841-0523
GA	Norcross, Southrep	404-262-6942
MA	Canton, Dave Taggart Assocs.	617-828-6064
MI	St. Clair Shores, D.E.M. Sls., Inc.	313-777-1750
MN	Roseville, TLC Elctrns.	612-483-2226
NJ	Wayne, Howard Kagan Assocs.	201-694-1115
OH	Miamisburg, ECI Distbn. Corp.	513-866-3340
PA	Harrisburg, Beil & Whitaker	717-564-6900
WA	Seattle, Harry Levinson Co.	206-382-1300

Local Distributors

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AZ	Fountain Hills, RCD Inds.	602-483-6412
CA	La Selva, Coast Comps.	408-684-1185
CA	San Diego, Sigma Elctrns.	619-565-6000
CA	San Jose, Compass Components	408-432-7575
CO	Aurora, Jet Elctrn. Supply Co., Inc.	303-364-1000
FL	Melbourne, TC Pridmore Co.	305-727-2491
IL	Chicago, Century Elctrns. Corp.	312-777-9700
MD	Gaithersburg, Axis Elctrns., Inc.	301-840-9640
MA	Norwood, Emtel Elctrns.	617-769-9500
MI	Grand Rapids, S.F. Elctrns.	616-459-0216
MI	Livonia, Key Elctrns.	313-261-5391
MN	New Brighton, Chris Elctrns.	612-631-2647
MO	St. Louis, Ric-Tronics, Inc.	314-576-9816
NJ	Kenilworth, Ventronics, Inc.	201-272-9262
NJ	Mt. Laurel, HB Sls., Inc.	609-234-1858
NY	Utica, Paul Reile Co./Royal Elctrns.	315-732-6042
OH	Miamisburg, ECI Distbn.	513-866-3340
PA	Harrisburg, Ad-Tech Elctrns., Inc.	717-939-8337
RI	Pawtucket, Major/Edward Elctrns.	401-725-7400
TN	Knoxville, Industrial Elctrns.	615-573-7135
TX	Garland, J & S Elctrns.	214-487-8808
WA	Seattle, V.E.S.C.O.	206-575-3607

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LIGHT CONTROL SYSTEMS INC., 2 Bridgeview Circle, Tyngsboro, MA 01879, Tel: 617-649-9870, FAX: 617-649-9636; Empl.: 25; *Sls. Mgr.:* Karen A. Hausmann

LIGHTNING PROTECTION CORP., Box 6086, Santa Barbara, CA 93160, Tel: 805-967-5089/4577, FAX: 805-967-4320; FSC No.: 56618; Empl.: 25; *Sls. Mgr.:* Chester J. Kawiecki

LIGHTWAVE COMMUNICATIONS, INC., 650 Danbury Rd, Ridgefield, CT 06877, Tel: 203-438-3591, FAX: 203-431-3001; *Sls. Mgr.:* Greg Pollack

LINCOLN INSTRUMENTS, 456 W. Montana St, Pasadena, CA 91103, Tel: 818-798-0733; Empl.: 11; *Sls. Mgr.:* Barbara J. Burchette

LINCOLN LASER CO., 234 East Mohave, Phoenix, AZ 85004, Tel: 602-257-0407, TELEX: 165-718; FSC No.: 602-257-0728; Empl.: 100; *Sls. Mgr.:* Robert S. Nehrbas, Jr.

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NJ	Lawrenceville, Riverside Comps.	609-896-1112

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CA	San Francisco, Steven Engrg.	415-588-9200
CO	Denver, Mundix Control Co.	303-893-2390
CT	E. Hartford, R & S Elctrn. Distrs.	203-528-9901
CT	Hartford, Hatry Elctrns.	203-527-1881
CT	Plainville, TDI Catalog Sls.	203-747-4788
FL	Hialeah, Atlas Elec. Supp.	305-885-8941
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FL	Miami, ESL Elctrn. Distrs.	305-633-6973

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IL Des Plaines, Byron Ellis Assocs. 312-298-7626
MD Baltimore, Bio Chem Elctrns. Inc. 301-488-2729
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NM Albuquerque, J. Smith & Assocs. Inc. 505-345-6501
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NC Burlington, P. J. Nahser Co. 919-226-8053
OH Dayton, Hocker Assocs. 513-253-3642
TX Argyle, Milestek, Inc. 817-455-7444
UT Highland, Highland Tech. Mktg. 801-756-2634
WA Bellevue, TOPP Engrg. Sls. 206-747-5400
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LISK, G. W., CO., 2 South St., Clifton Springs, NY 14432, Tel: 315-462-2611, TELEX: 71-6854113, FAX: 315-462-7661; Empl.: 300; *Sls. Mgr.:* R. A. Nelson; *Dist. Mgr.:* R. A. Nelson

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CA Irvine, Gravley & Assocs. 714-852-9994
CO Englewood, Wm. J. Purdy 303-790-2211
CT North Haven, Coakley, Boyd & Abbett 203-239-6217
FL Maitland, Hutto-Hawkins Assocs. 305-831-2474
FL Pompano Beach, Hutto-Hawkins Assocs. 305-979-0330
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NY Clarence, R. W. Mitscher 716-759-2350
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VA Richmond, Mid-Atlantic Sls. 804-320-2674
Can Pickering, Ont., A. C. Simmonds 416-839-8041

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LITTON ENCODER DIV., 20745 Nordhoff St., Chatsworth, CA 91311, Tel: 818-341-6161, TWX: 910-494-1229, FAX: 818-882-4553; FSC No.: 17080; Empl.: 350 ..... **B•1895**

Local Sales Offices & Reps
AZ Phoenix, Clifton Precision 602-242-0910
CA Los Angeles, Clifton Precision 818-347-0603
CA Los Gatos, Luscombe Engrg. 408-370-2020
CO Longmont, Luscombe Engrg. 303-938-8666
FL Longwood, Boetto Corp. 305-331-1771
MA Newton, Itek Encoder 617-969-7307
MI Grand Rapids, Midwest Meridian Corp. 616-698-7391
MN Bloomington, PWC, Inc. 612-831-5999
MO St. Louis, Midwest Meridian Corp. 314-878-4441
OR Tigard, Vantage Corp. 503-620-3280
PA Clifton Heights, Clifton Precision 215-622-1000
TX Garland, Carey, McMahill & Assocs. ... 214-681-1414
WA Bellevue, Vantage Corp. 206-455-3460
Can Markham, Ont., E.P. Elctrns. 416-475-8316

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LITTON POLY-SCIENTIFIC, 1213 N. Main St., Blacksburg, VA 24060-3100, Tel: 703-953-4751, TWX: 710-875-3694; Empl.: 700 ... **B•1170-1171, 1221-1230**

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AZ Phoenix, Dick Palmer 602-242-0910
CA Huntington Beach, Mike Baggetta 714-968-0434
CA Woodland Hills, Bob Billington 818-347-0603
FL Fern Park, Blair Engrg. 305-834-1244
MA Sturbridge, Russ Persson 203-871-8900
MI Stockbridge, Erhart Engrg. 517-851-8770
MN Prior Lake, Midwest Meridian 612-447-8222
KS Olathe, Technical Sls. Assoc. 913-829-2800
NY Mineola, Kahn Assocs. 516-742-1900
TX Dallas, Blair Engrg. 214-241-5655
OH Medina, Stress Analysis Svcs. 216-725-7733
TX Garland, Carey, McMahill & Zerbe Co. 214-681-1414
WA Bellevue, Thorson Co. 206-455-9180

LITTON POTENTIOMETER DIV., 750 So. Fulton Ave., Mt. Vernon, NY 10551, Tel: 914-664-7733, TWX: 710-562-0129, FAX: 914-664-2466; FSC No.: 04454;Multiple; Empl.: 300; *Sls. Mgr.:* E. R. Cubbin

LITTON SYSTEMS, INC., Electron Dvcs. Div., 960 Industrial Rd, San Carlos, CA 94070, Tel: 415-591-8411, TELEX: 910-376-4900

LITTON SYS. INC., Winchester Elecs/Use Co, 13536 G Saticoy St, Van Nuys, CA 91409, Tel: 213-786-9381, TELEX: 67-4088, TWX: 910-495-1700; FSC No.: 88245; Empl.: 250; *Sls. Mgr.:* E. Wallen

LIXI, INC., 1438 Brook Dr., Downers Grove, IL 60515, Tel: 312-620-4646, TELEX: 6871077 DKROB, FAX: 312-620-7776; Empl.: 16; *Sls. Mgr.:* Susan Cochran

LJ TECHNICAL SYSTEMS, 19 Power Drive, Hauppauge, NY 11788, Tel: 516-234-2100; Empl.: 25; *Sls. Mgr.:* Christopher Rowe

LMB HEEGER, INC., 2946 E. 11th St, Los Angeles, CA 90023, Tel: 213-261-0382, FAX: 213-261-2214; *Sls. Mgr.:* Robert Heeger

LMI CONNECTORS, INC., 6290 Sunset Blvd, Ste. 1126, Los Angeles, CA 90028, Tel: 213-463-2295, TWX: 910-321-2903, FAX: 213-463-4319; *Sls. Mgr.:* Norman Sutherland

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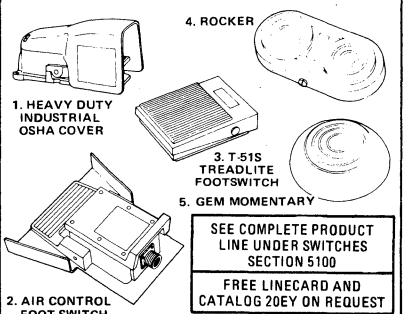

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LOCUS, Box 740, State College, PA 16804, Tel: 814-466-6275, FAX: 814-466-7351; Empl.: 420; *Sls. Mgr.:* Anthony J. Coray

LOGICAL DESIGN GROUP, INC., 6301 Chapel Hill Rd., Raleigh, NC 27607, Tel: 919-851-1101, TELEX: 9102400475 - LDGVMEBUS USA, ESYLNK: 62947014; Empl.: 9; *Sls. Mgr.:* Rich Jansma; *Dist. Mgr.:* Rich Jansma

LOGI COMP ELECTRONICS, INC., 895 Mamaroneck Ave., Mamaroneck, NY 10543, Tel: 914-698-9332, 800-431-2625

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LOGIC TECHNOLOGY, INC., 2452 Charleston Rd., Mtn. View, CA 94043, Tel: 415-967-1007, FAX: 213-641-4691; FSC No.: 51019; *Sls. Mgr.:* Mel Morgan

LOGIMETRICS, 121-03 Dupont St, Plainview, NY 11803, Tel: 516-349-1700, TWX: 510-221-1833, FAX: 516-349-8552; FSC No.: 33013; Empl.: 91; *Sls. Mgr.:* Eugene Blum

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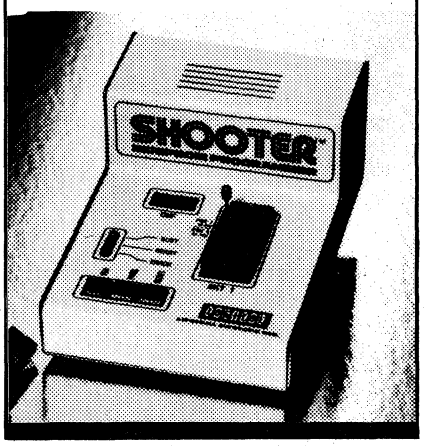

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CA	Encinitas, Craig Assocs.	619-942-8166
CA	Thousand Oaks, Craig Assoc.	818-887-2444
CT	Hartford, Dynamic Sls. of New England	203-693-6567
FL	Coral Springs, HAI Elctrns.	305-752-7520
KS	Wichita, D&O Engrg. Co.	316-686-2808
MA	Burlington, Dynamic Sls. of New England	617-272-5676
MI	Union Lake, G. L. Ashby Assoc. Inc.	313-363-1100
MN	Wayzata, White Sls. Co.	612-544-1374
NY	N. Syracuse, Advanced Comps. Corp.	315-699-2671
NY	Ronkonkoma, JL Sls.	516-737-2801
OH	Cleveland, G. L. Ashby Assoc. Inc.	216-461-0826
OH	Dayton, G. L. Ashby Assoc. Inc.	513-252-5627
OK	D&O Engrg. Co.	316-686-2808
PA	Churchville, Dynamic Elctrn. Sls.	215-322-2611
TX	Dallas, D&O Engrg. Co.	214-241-3099
VT	Burlington, Dynamic Sls. of New England	802-863-6665
VA	Front Royal, Eltron Sls. Ltd.	703-635-1933
WA	Seattle, Rep-West	206-283-8351
Can	Lachine, Que., Electrodesign Ltd.	514-636-4838

LOHUIS U.S.A. INC., 949 Piner Place, Santa Rosa, CA 95401, Tel: 707-579-1703, 800-922-5267, 800-345-5267, TWX: 510-601-7723 (LEE USA), FAX: 707-579-2860; Empl.: 4; *Sls. Mgr.:* Thomas Hallstein; *Dist. Mgr.:* Thomas Hallstein

LORAIN PRODUCTS, Reliance Electric, 1122 F St, Lorain, OH 44052, Tel: 216-288-1122, TELEX: 98-0505, TWX: 196131; Empl.: 1200; *Sls. Mgr.:* T. F. McFadden

LORAL TERRACOM, Sub. of Loral Corp., 9020 Balboa Ave., San Diego, CA 92123, Tel: 619-278-4100, TELEX: TERRACOM A SDG 18-2774, TWX: TERRACOM SDG 910-335-1202; *Sls. Mgr.:* Michael A. Lapadula

LORCH ELECTRONICS, Sub. of Vernitron Corp., 105 Cedar La., Englewood, NJ 07631, Tel: 201-569-8282, TWX: 710-991-9718, FAX: 201-569-1150; FSC No.: 29971; Empl.: 70

LORLIN, Axiam Inc., 4 Precision Rd., Danbury, CT 06810, Tel: 203-744-0096, TELEX: 4990519, TWX: 710-456-5030; *Sls. Mgr.:* Michael MacKesey

LORTEC POWER SYSTEMS, INC., 145 Keep Court, Elyria, OH 44035-2214, Tel: 216-327-5050, TELEX: 384868 LORTEC UPS UD, FAX: 216-327-9628; Empl.: 65; *Sls. Mgr.:* Dale I. Lamirand

LOVE CONTROLS CORP., 1475 S. Wheeling Rd., Wheeling, IL 60090, Tel: 312-541-3232, TELEX: 297115, FAX: 312-541-7366; FSC No.: 8L919; Empl.: 110; *Sls. Mgr.:* Harold B. Koenen

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LOYOLA CONTROLS INC., 1099 N. Batavia St., Orange, CA 92667, Tel: 714-639-0526, FAX: 714-639-9342

LSI COMPUTER SYSTEMS, INC., 1235 Walt Whitman Rd., Melville, NY 11747, Tel: 516-271-0400, TWX: 510-226-7833; FSC No.: 55261; Empl.: 30; *Sls. Mgr.:* Sherry Smith

LSI LOGIC CORP., 1551 McCarthy Blvd., Milpitas, CA 95035, Tel: 408-433-8000, TELEX: 172153; *Dist. Mgr.:* John Mucciaro

LTI, INC., 6445 N. Hamlin Ave., Lincolnwood, IL 60645, Tel: 312-679-7500, TWX: 5101008622; Empl.: 60; *Sls. Mgr.:* Patricia Uster

LTX, LTX Pk. @ University Ave., Westwood, MA 02090, Tel: 617-461-1000, TELEX: 4430108, TWX: 710-348-6621; Empl.: 1,500; *Sls. Mgr.:* Roger Blethen, Sr. V.P. Sls.

LUCAS DURALITH CORPORATION, 525 Orange St., Millville, NJ 08332, Tel: 609-825-6900, TWX: 510-687-7520, FAX: 609-825-6345; Empl.: 500; *Sls. Mgr.:* James Potter

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..... **B•1629-1632, 1752-1754, 1896-1897**

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AL	Huntsville, DHR Mktg., Inc.	205-533-5165
AZ	Scottsdale, Arcom Sls.	602-947-5745
CA	San Diego, Interstate Mktg. Assoc.	619-693-3220
CA	Saratoga, Testco Co.	408-253-1900
CA	Woodland Hills, Interstate Mktg. Assocs.	818-883-7606
CO	Englewood, Dynatech Inc.	303-773-2830
CT	Bloomfield, SIR-SANDS Co.	203-243-9343
CT	Marion, SIR-SANDS Co.	203-628-4363
FL	Largo, Techn. Mktg. Assocs.	813-536-3796
FL	Melbourne, Techn. Mktg. Assocs.	305-676-3742
FL	Orlando, Techn. Mktg. Assocs.	305-857-3760
FL	Pompano Beach, Techn. Mktg. Assocs.	305-977-9006
GA	Atlanta, DHR Mktg., Inc.	404-451-9848
IL	Elk Grove Village, Control Sls.	312-595-2110
IN	Beech Grove, Control Sls. Inc.	317-786-2272
IA	Des Moines, Jos-Co/Melius Inc.	515-277-8597
KS	Leawood, Thunderbird Tech. Sls. & Svcs.	913-642-7220
KS	Wichita, Thunderbird Tech. Sls. & Svcs.	316-684-3941
MA	Westford, SIR Assocs.	617-692-2500
MI	Royal Oak, Hilltronics, Inc.	313-435-0920
MN	Minneapolis, Jos-Co/Melius Inc.	612-861-3343
MO	Maryland Heights, Thunderbird Tech. Sls. & Svcs.	314-298-8940
NY	Clark Mills, KLM-Garner Co.	315-853-6126
NY	Oceanside, Bittan Assocs.	516-678-6222
NY	Pittsford, KLM-Garner Co.	716-381-8350
NC	Raleigh, DHR Mktg., Inc.	919-781-1961
OH	Cleveland, Del Steffen & Assoc.	216-461-8333
OH	Dayton, Del Steffen & Assoc.	513-293-3145
OH	Lexington, Del Steffen & Assoc.	419-884-2313
PA	Carnegie, Del Steffen & Assocs., Inc.	412-276-7366
PA	King of Prussia, Freedman-Malta Assoc.	215-337-9211
SC	Greenville, DHR Mktg., Inc.	803-235-3594
TX	Austin, ION Assocs., Inc.	512-331-7251
TX	Grand Prairie, ION Assocs., Inc.	214-647-8225
TX	Houston, ION Assocs., Inc.	713-537-7717
VA	Richmond, DHR Mktg., Inc.	804-359-8803
WA	Bellevue, Testco	206-454-7422
WA	Vancouver, Testco	206-693-7262
WI	Thiensville, Control Sls.	414-242-4580

LUFF RESEARCH, Box 449, Jackson Hgts., NY 11372, Tel: 718-429-5900; Empl.: 4; *Sls. Mgr.:* R. Scheer

LUFT INSTRUMENTS, INC., Hillside Rd., P.O. Box 214, Lincoln, MA 01773, Tel: 617-259-9215, TELEX: 247316 RCA; Empl.: 12

LUMITRON, P.O. Box 12, Summit, NJ 07901, Tel: 201-273-8998; FSC No.: 6240; Empl.: 20; *Sls. Mgr.:* Gil Chassie

LUMONICS MATERIAL PROCESSING CORP., 12163 Globe Rd., Livonia, MI 48150, Tel: 313-591-0101, TWX: 810-242-3270; Empl.: 121; *Sls. Mgr.:* Daniel J. Gafgen

LUTRON ELECTRONICS CO., Box 205, Suter Rd., Coopersburg, PA 18036, Tel: 215-282-3800, TELEX: 847475, TWX: 510-651-3755; Empl.: 378; *Sls. Mgr.:* John McKiernan; *Dist. Mgr.:* Robert Van Horne

LUXO LAMP CORP., P.O. Box 951, Port Chester, NY 10573, Tel: 914-937-4433, TELEX: 137-336, FAX: 914-937-7016; Empl.: 150; *Sls. Mgr.:* Kay E. Sweetingham

LVC INDUSTRIES, INC., 23 Hanse Ave., Freeport, NY 11520, Tel: 516-868-1900; FSC No.: 32759; *Sls. Mgr.:* Adam Kiecun

LXD, INC., 24500 Highpoint Road, Beachwood, OH 44122, Tel: 216-292-3300, TELEX: 98-5442 LXD BCWD; FSC No.: 66706; Empl.: 100; *Sls. Mgr.:* Gerald G. Gross; *Dist. Mgr.:* Gerald G. Gross

LYNN ELECTRONICS, 915 Pennsylvania Blvd., Feasterville, PA 19047, Tel: 215-677-6700, 800-523-6075, TWX: 510-667-1988, FAX: 215-364-2944; FSC No.: 19151; Empl.: 125; *Sls. Mgr.:* H. T. Colas

LYN-TRON, INC., 3150 Damon Way, Burbank, CA 91505, Tel: 213-849-6211, 800-423-2734, TELEX: 662729, FAX: 818-423-2734; FSC No.: 05791; *Sls. Mgr.:* Alfred C. Redlitz; *Dist. Mgr.:* Alfred C. Redlitz

LYON METAL PRODUCTS, 47 Railroad Ave., Aurora, IL 60507, Tel: 312-892-8941, TWX: 910-232-3132; Empl.: 600; *Sls. Mgr.:* R. R. Bodlund

LYTRON INCORPORATED, Dragon Court, Woburn, MA 01801, Tel: 617-933-7300, TELEX: 951-934, FAX: 617-935-4529; Empl.: 75; *Sls. Mgr.:* Edwin Carell

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FAX: 301-670-0436

LZR ELECTRONICS, INC., 8174 Beechcraft Ave., Gaithersburg, MD 20879, Tel: 301-921-9440; Empl.: 25; *Sls. Mgr.:* Ron Riser; *Dist. Mgr.:* Phil Aliff ..... **B•1756-1757; C•1430-1447, 1858-1861; D•1033-1035, 1834-1839**

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CT	Guilford, Data Mark, Inc.	203-453-0575
FL	Melbourne, Kennedy Assocs.	305-676-6875
IL	Arlington Hgts., Gaertner & Assocs.	312-593-2332
MA	Norwood, JMG, Inc.	617-762-5333
NJ	Clifton, ROI Sls.	201-340-1515
NY	Liverpool, M. M. Hare Co.	315-457-6859
OH	Lyndhurst, Technical Sls. Assocs.	216-461-0826
OK	Tulsa, Advance Tech. Sls.	918-664-0462
PA	West Chester, TCA Assocs.	215-692-6853
TX	Austin, Advance Tech. Sls.	512-346-5322
TX	Dallas, Advanced Tech. Sls.	214-340-1300
TX	Houston, Advance Tech. Sls.	713-440-3888
Can	Downsview, Ont., Telbit Elctrns., Inc.	416-633-5050

MABUCHI MOTOR AMERICA CORP., 475 Park Ave. South, New York, NY 10016, Tel: 212-686-3622, TELEX: 23-4374, TWX: MABU; Empl.: 6000 ..... **B•1231**

PANAFAX: 212-532-4263

MACCOR, INC., 3203 W. 41st St., Tulsa, OK 74107, Tel: 918-446-1874; FSC No.: 6625; *Sls. Mgr.:* Andrew D. MacKay

MACHINE COMPONENTS CORP., 70 Newtown Rd., Plainview, NY 11803, Tel: 516-694-7222, FAX: 516-694-7252; FSC No.: 15531; Empl.: 45; *Sls. Mgr.:* D. L. Dubov

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M/A COM LTD., Humphrey Rd., Dunstable, Bedfordshire, England LU5 4SX, England, Tel: 44(582)471200, TELEX: 82295; Empl.: 500; *Sls. Mgr.:* S. Shopcraft

M/A-COM MICROWAVE COMPONENTS, INC., South Avenue, Burlington, MA 01803, Tel: 617-272-3000, TELEX: 94-9464, TWX: 710-332-6789; Empl.: 500; *Sls. Mgr.:* Tom Rose

M/A-COM MICROWAVE POWER DVCS., 330 Oser Ave., Hauppauge, NY 11788, Tel: 516-231-1400, TWX: 510-227-6239; FSC No.: 34874; Empl.: 385

M/A-COM OMNI SPECTRA, INC., 21 Continental Blvd., Merrimack, NH 03054, Tel: 603-424-4111, TELEX: 6817280, TWX: 710-366-0674; FSC No.: 16179; Empl.: 750

M/A-COM OSW, INC., 2626 S. Hardy Dr., Tempe, AZ 85282, Tel: 602-966-1471, TELEX: 668-332, TWX: 910-950-1296; *Sls. Mgr.:* Bob Blaisdell

M/A-COM PHI, INC., M/A-COM, 1742 Crenshaw Blvd., Torrance, CA 90501, Tel: 213-320-6160, TWX: 910-349-6651; Empl.: 260; *Sls. Mgr.:* Fred McAdara

MAC PANEL

FAX: 919-887-1565

MAC PANEL CO., P. O. Box 7728, 551 W. Fairfield Rd., High Point, NC 27264, Tel: 919-884-8111, TWX: 510-926-1542; FSC No.: 16654; Empl.: 90; *Sls. Mgr.:* T. A. Hayworth ..... **C•1728-1729; D•1427**

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CA	Tustin	714-669-1400

MACROAMP INC., P.O. Box 1512, Ukiah, CA 95482, Tel: 707-462-2222, FAX: 707-462-4103; Empl.: 25; *Sls. Mgr.:* Terry L. Sholin; *Dist. Mgr.:* Terry L. Sholin

MACRODYNE, 1004 Princetown Rd., Schenectady, NY 12301, Tel: 518-356-3500; Empl.: 22; *Sls. Mgr.:* Robert L. Grinnell

MACROLINK, 1500 N. Kellogg Drive, Anaheim, CA 92807, Tel: 714-777-8800, TWX: 910-591-1671; Empl.: 25; *Sls. Mgr.:* Bill Goodale

MACRONETICS, See Veeco Instrs. Inc.

MAG-CON, 1626 Terrace Dr., St. Paul, MN 55113, Tel: 612-633-8820; Empl.: 40; *Sls. Mgr.:* M. Crellin

MAGNAPOWER, 70 Rainor Ave., Ronkonkoma, NY 11779, Tel: 516-737-3800, FAX: 516-737-3062; *Sls. Mgr.:* Hugh Whitsit

MAGNATROL VALVE CORP., 67 Fifth Ave., Hawthorne, NJ 07507, Tel: 201-427-4341, ESYLNK: 130357, FAX: 201-427-7611; *Sls. Mgr.:* R. Kretschmer

Magnecraft ELECTRIC COMPANY

FAX: 312-564-3027

MAGNECRAFT ELECTRIC CO., 1910 Techny Road, Northbrook, IL 60062-5376, Tel: 312-564-8800, TWX: 910-221-0122; FSC No.: 94696; Empl.: 700; *Sls. Mgr.:* Wiley Greenwood; *Dist. Mgr.:* Wiley Greenwood ..... **B•1535**

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AL	Huntsville, Electronic Mktg. Assocs.	205-536-3044
AZ	Scottsdale, Bill Earl Assocs., Inc.	602-994-3813
CA	Campbell, Kottmeier Assocs.	408-371-8700
CA	Los Angeles, Universal Comp. Corp.	213-641-4255
CO	Parker, Technology Mktg. Assocs.	303-841-3435
CT	Bethel, Ray Perron & Co., Inc.	203-798-0261
CT	Farmington, R. Perron & Co.	203-673-4825
DC	Owings Mills, MD, Walker-Houck Assocs.	301-356-9500
FL	Orlando, Honeyco, Inc.	305-299-1222
GA	Atlanta, Electrn. Mktg. Assocs.	404-448-1215
IL	Northbrook, Magnecraft Elec. Co.	312-564-8800
IN	Ft. Wayne, Scott Elctrns., Inc.	219-489-5690
IN	Indianapolis, Scott Elctrns., Inc.	317-841-0010
IA	Cedar Rapids, R. W. Kunz & Assocs.	319-396-5386
KS	Olathe, R. W. Kunz & Assocs.	913-648-3535
MD	Owings Mills, Walker-Houck Assocs.	301-356-9500
MA	Needham, R. Perron & Co.	617-449-6162
MI	Royal Oak, Hilltronics	313-435-0920
MN	Edina, Hanna Lind Ltd.	612-925-5700
NH	Dover, R. Perron & Co.	603-742-2321
NH	Merrimack, Ray Perron & Co.	603-424-4423
NY	Islandia, Schmitt Ind. Mkt.	516-582-5888
NY	Pittford, Franklin Sls. Corp.	716-248-8251
NC	Raleigh, Electrn. Mktg. Assocs.	919-847-8800
OH	Cincinnati, Scott Elctrns., Inc.	513-791-2513
OH	Cleveland, Scott Elec., Inc.	216-473-5050
OH	Dayton, Scott Elec., Inc.	513-294-0539
OH	Reynoldsburg, Scott Elctrns., Inc.	614-863-1281
PA	Horsham, Jacobsen Assoc.	215-674-2937
SC	Greenville, Elctrn. Mktg. Assoc.	803-233-4637
TX	Dallas, Raven Sls. Inc.	214-490-8230
UT	Salt Lake City, Techn. Mktg. & Assocs.	801-483-1009
WI	Colgate, Rep 1 & Assocs.	414-628-4016

MAGNETEK CORP., 7315 Red Deer Dr., Boulder, CO 80301-4696, Tel: 303-442-6700, FAX: 303-447-1588; FSC No.: 58439; Empl.: 25; *Sls. Mgr.:* Carl A. Forsberg ..... **A•2250-2251**

Local Sales Offices & Reps

CA	San Diego, Mesa Sls. & Engrg.	619-278-8021
KS	Shawnee Mission, Robinson & Assoc.	913-262-1374

MagneTek Triad

FAX: 219-356-3148

MAGNETEK TRIAD, 1124 E. Franklin St., Huntington, IN 46750, Tel: 219-356-6500; Empl.: 850; *Dist. Mgr.:* Pete Amick, Prod. Mgr. ..... **A•2252-2261**

Local Sales Offices & Reps

AZ	Scottsdale, Bill Earl Assocs.	602-994-3813
CA	Los Altos, Recht Assocs.	415-964-6321
CA	Upland, Tracy Elctrns. Sls.	714-985-0423
CO	Denver, Lindberg Co.	303-758-9033
FL	Maitland, Hutto-Hawkins Assocs.	305-831-2474
GA	Norcross, Glen White Assocs.	404-441-1447
HI	Honolulu, Hawaii Elctrn. Svc.	808-845-8207
IL	Wilmette, J. Wasserman Assocs.	312-256-3566
KS	Overland Pk., Electri-Rep	913-649-2168
LA	Little Rock, J. Y. Schoonmaker	501-375-2168
MA	Westboro, Bay Colony	617-870-1930
MI	Southfield, Rathsburg Assocs., Inc.	313-559-9700
MN	Minneapolis, Bicon Sls.	612-936-2322
MO	St. Louis, Electri-Rep	314-993-4421
PA	Narberth, Bresson Assocs.	215-664-6460
NY	Islandia, Schmitt Indl. Mktg.	516-582-5888
NY	Rochester, Apex Assocs.	716-254-6050
OH	Cincinnati, F.E. Kahsar Sls.	513-922-3133
TX	Dallas, J. Y. Schoonmaker Co.	214-349-1650
WA	Redmond, Earl & Brown Co.	206-885-5064
Can	Inwood, N.Y., Minthorne Int'l.	516-239-0767

Local Distributors

AL	Birmingham, Forbes Distrbg.	205-251-4104
AZ	Phoenix, Dalis Elctrn. Supp.	602-275-2885
AR	Little Rock, Carlton Bates Co.	501-562-9100
CA	Milpitas, Zack Elctrns.	408-942-5432
CA	Riverside, Electronic Supp.	714-683-7300
CA	Sunnyvale, Abacus Elctrns.	408-732-2000
CO	Denver, Newark Elctrns.	303-757-3351
FL	Ft. Lauderdale, Peerless Radio Corp. of Fla.	305-973-4141
GA	Atlanta, Ack Radio Supp.	404-351-6340
IL	Chicago, Bell Inds.	312-982-9210
IL	Chicago, Newark Elctrns.	312-638-4411
IN	Indianapolis, Graham Elctrns.	317-634-8202
IA	Cedar Rapids, Deeco, Inc.	319-365-7551
KY	Louisville, P. I. Burks Co.	502-589-3960
LA	New Orleans, William B. Allen Co.	504-525-8222
MD	Rockville, Capitol Radio Whls.	301-881-2270
MA	Hingham, Sager Elec.	617-749-6700
MA	Needham, Cronin Elctrns.	617-449-5000
MI	Grand Rapids, S-F Elctrns.	616-459-0216
MI	Livonia, R. S. Elctrns.	313-525-1155
MN	St. Paul, Gopher Elctrns.	612-483-4450
MO	St. Louis, Olive Indl. Elctrn.	314-426-4500
NE	Lincoln, Scott Elctrn. Supp. Corp.	402-466-8221
NH	Hudson, C & H Elctrns.	603-882-1133
NJ	Camden, General Radio Supp.	215-922-7037

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NY	Hauppauge, Broadline Elctrn. Distr.	516-231-4100
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Rochester, Simcona	716-328-3230
NY	Rome, Rome Elctrns.	315-337-5400
NC	Greensboro, Hammond Elctrns.	919-275-6391
OH	Cleveland, Pioneer Std. Elctrns.	216-587-3600
OH	Dayton, Pioneer/Dayton	513-236-9900
OK	Oklahoma City, Radio Supp.	405-232-6127
OR	Portland, United Radio Supp.	503-233-5346
PA	Philadelphia, Almo Elctrns.	215-698-4000
SC	Greenville, Hammond Elctrns.	803-233-4121
TN	Memphis, Bluff City Elctrns.	901-345-9500
TX	Dallas, Sterling Elctrns.	214-243-1600
TX	Houston, Altair Co.	713-462-3029
UT	Salt Lake City, Standard Supply	801-486-3371
WA	Seattle, Almac	206-643-9992
WI	Milwaukee, Marsh Elctrns.	414-475-6000

MAGNETIC AUDIO/VIDEO PRODUCTS DIV., 3M Co., 3M Center, Bldg. 223-5 South, St. Paul, MN 55101, Tel: 612-733-1110, TWX: 910-563-3712; Empl.: 38,351

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Local Sales Offices & Reps

CA	Santa Clara, R-C Elctrns.	408-988-0701
WA	Bellevue, Advanced Power Comps.	206-747-9127
WA	Seattle, Advanced Power Comps.	206-527-7945

MAGNETIC COILS, INC., See MCI Transformer Corporation

MAGNETIC COMPONENT ENGINEERING, INC., 11379 Playa Street, Culver City, CA 90230, Tel: 213-398-4761; FSC No.: 52634; Empl.: 12; *Sls. Mgr.:* D. V. Cropsey

MAGNETIC DEVICES INC., 5575 Kearny Villa Rd., San Diego, CA 92123, Tel: 619-279-7054; FSC No.: 13786; *Sls. Mgr.:* Dave Loughlin

mi

FAX: 317-549-0502

MAGNETIC INSTRUMENTATION, 8350 E. 48TH ST., Indianapolis, IN 46226, Tel: 317-545-2102, TELEX: 27-2111; Empl.: 35 ..... **D•1289**

Local Sales Offices & Reps

EXP	NY, Irvington, Inter Technical Export Corp.	914-591-8822

MAGNETICO INC., 182 Morris Ave., Holtsville, NY 11742, Tel: 516-654-1166, FAX: 516-758-7408; Empl.: 65 ..... **A•2262**

MAGNETICS, Spang & Co., Box 391, Butler, PA 16003-0391, Tel: 412-282-8282, TWX: 710-373-3821, FAX: 412-282-6955; Empl.: 650; *Sls. Mgr.:* J. F. Huth

MAGNETIC SHIELD CORPORATION, Perfection Mica Co., 750 North Thomas Dr., Bensenville, IL 60106, Tel: 312-766-7800, TWX: 910-256-4815; FSC No.: 06682; Empl.: 43 ..... **C•1751-1753**

Local Sales Offices & Reps

CA	Woodland Hills, Cal-Ward Sls. Co.	213-883-2202
FL	Orlando, Ludlum Assoc. Co.	305-894-7761
MD	Baltimore, Bernard White & Co.	301-484-5400
MA	Framingham, Harvard Technlg.	617-899-4568
MI	Farmington, Amtech Reps.	313-474-8300
MN	Minneapolis, Josco-Meluis & Assocs.	612-861-3343
NM	Albuquerque, IMEC	505-883-9010
NJ	Morristown, Kenneth L. Love Assocs.	201-540-0204
NY	Syracuse, Canavan-Scanlon Assocs.	315-437-1271
OH	Cleveland, Bill Teplitz & Co.	216-439-3265
OR	Hillsboro, Temco Northwest	503-648-8171
PA	Media, W. Reeves Assocs.	215-566-6709
TX	Dallas, Talo Prods.	214-644-6010
WA	Kirkland, Temco Northwest	206-488-1254

MAGNETIC SPECS., 10 Albemarle Ave., Trenton, NJ 08638, Tel: 609-883-3150; Empl.: 23

MAGNETIC SYSTEMS, 1021 Pecten Ct., Milpitas, CA 95035, Tel: 408-263-6680; Empl.: 7

MAGNETIC SYSTEMS, 770 Linden Avenue, Rochester, NY 14625, Tel: 716-385-9010, FAX: 716-385-5625; Empl.: 50; *Sls. Mgr.:* Gordon H. McNeil

MAGNETIC TECHNOLOGY, 21001 Kittridge St., Canoga Pk., CA 91303, Tel: 818-887-7700, TWX: 910-494-1217; FSC No.: 15828; Empl.: 150; *Sls. Mgr.:* David Mighdoll

MAGNETOELASTIC DEVICES, Box 625, Pittsfield, MA 01201, Tel: 413-445-5608

MAGNET SALES & MFG. CO. INC., 11250 Playa Court, Culver City, CA 90230-6127, Tel: 213-391-7213, 800-421-6692; FSC No.: 95-2916141; Empl.: 35; *Sls. Mgr.:* Anil Nanji; *Dist. Mgr.:* Anil Nanji

MAGNOS, 6 Old School-House Rd., Harvard, MA 01451, Tel: 617-456-8880, TELEX: 951417 MAGN; Empl.: 5 ..... **D•1290**

MAGNUM MICROWAVE CORP., 4575 Cushing Pkwy., Fremont, CA 94538, Tel: 415-657-9898, TELEX: 4992965; FSC No.: 59277; Empl.: 50; *Sls. Mgr.:* Harry L. Fowler

Local Sales Offices & Reps

AZ	Phoenix, Odyssey 1	602-246-8846
CA	Mtn. View, Pacific Tech. Mktg.	415-969-3010
CA	Signal Hill, Thorson Co.	213-595-0361
FL	Clearwater, Beacon Instrmn.	813-796-2378
GA	Atlanta, Beacon Instrmn.	404-256-9646
IL	Palatine, R-Tek	312-991-4404
IN	Ft. Wayne, R-Tek	219-432-8783
MD	Marriottsville, Neal Deoul Assocs.	301-795-5775
MA	Chelmsford, Matrix Sls. Inc.	617-459-4000
MO	Leasburg, EIR Co.	314-895-4100
NY	Clark Mills, KLM Garner, Inc.	315-853-6126
NY	New Rochelle, Robert Diamond, Inc.	914-632-2828
TX	Garland, Carey, McMahill Assocs.	214-681-1414

MAGNUM OPUS CUSTOM ELCTRN. ENGRG., 284 Kennedy St., Iselin, NJ 08830, Tel: 201-283-4925; *Sls. Mgr.:* R. Galanty ..... **D•1113**

MAG-TEK, 20725 S. Annalee Ave., Carson, CA 90746, Tel: 213-631-8602, TWX: 510-600-0621 MAG TEK CRSN, FAX: 213-631-3956; *Dist. Mgr.:* Shelley Schira

maida

FAX: 804-722-1194

MAIDA DEVELOPMENT CO., 20 Libby St., Hampton, VA 23663, Tel: 804-723-0785, TELEX: 82-3443; Empl.: 299; *Sls. Mgr.:* Edward T. Maida, Frank Thompson ..... **A•1103-1107, 1954-1955**

Local Sales Offices & Reps

CA	Redwood City, Hickey Indl. Sls.	415-368-3849
CA	Tarzana, High Voltage Sls.	818-881-9194
FL	Vero Bch., John M. Hansen Assocs.	305-562-2328
IL	Arlington Hgts., Russell Elctrns. Sls.	312-394-5560
NH	Milford, D. A. Crowley & Assocs.	603-673-7050
SC	Mauldin, Carl Hart	803-288-2323
VA	Danville, F.B.D. Sls.	804-791-1499
WA	Snohomish, L.D. Elctrns.	206-568-0511
Can	Ontario, D. J. Hyslop & Co.	416-648-0061

MALCO, DIV. OF MICRODOT, INC., See Microdot, Interconnect Sys. Div.

MALCO SYSTEMS, THORN EMI Malco, Inc., 74 Gwynns Mill Court, Owings Mills, MD 21117, Tel: 301-363-1600, TELEX: TRT14005, ESYLNK: 62933125, FAX: 301-363-4336; *Sls. Mgr.:* William Newill

MALLORY BATTERY, See Duracell Intl.

MALLORY

FAX: 317-856-2500

MALLORY CAPACITOR CO., Emhart Elctrl./Elctrn. Grp., 3029 E. Washington St., Dept. EM, P.O. Box 1284, Indianapolis, IN 46201, Tel: 317-636-5353, TELEX: 687-6027, TWX: 687-6015; FSC No.: 317-261-1581; Empl.: 450; *Sls. Mgr.:* Tom Pilcher, Mktg. Mgr.; *Dist. Mgr.:* Tom Green, Dir. of Fld. Sls. ..... **A•1108-1111; D•1036-1037**

Local Sales Offices & Reps

AL	Huntsville, Jack Harvey & Assocs., Inc.	205-536-4414
AZ	Scottsdale, Summit Sls.	602-998-4850
CA	Buena Pk., Mallory Capacitor Co.	714-523-7992, 213-921-7939
CO	Denver, United Sls. Assocs., Inc.	303-758-8851
FL	Altamonte Springs, Semtronic Assocs., Inc.	305-831-8233
FL	Clearwater, Semtronic Assocs., Inc.	813-461-4675
FL	Ft. Lauderdale, Semtronic Assocs., Inc.	305-731-2484,305-944-0149
GA	Norcross, Jack Harvey & Assocs., Inc.	404-449-4643
IL	Elk Grove Vl., Mallory Capacitor Co.	312-364-5750
IN	Indianapolis, D-M Assocs.	317-842-4424

MD Lisbon, S. K. Macdonald, Inc. 301-982-1088, 301-442-1590
MA Needham Hgts., The Newscott Co., Inc. 617-444-1923
MN Minneapolis, Technical Comps. Grp. ... 612-536-9512, 612-536-9659
MO St. Louis, KKB & Co. 314-647-2400
NM Albuquerque, Summit Sls. 505-345-5003
NY Fairport, LamTec Sls. Corp. 716-377-1210
NY Manlius, LamTec Sls. Corp. 315-637-3738
NY N. Bellmore, Aurora Mktg., Inc. 516-221-0764
NC Raleigh, Mallory Capacitor Co. 919-872-0711
OH Beachwood, Elctrn. Salesmasters, Inc. 216-831-9555
PA Pittsburgh, S. K. Macdonald, Inc. 412-366-0861
PA Willow Grove, S. K. Macdonald, Inc. ... 215-659-4414
TX Hurst, Pro-Comp Sls. Co. 817-589-0336
TX Richardson, Pro-Comp Sls. Co. 214-669-1500
WA Redmond, Quadra Sls. Corp. 206-883-3550, 503-635-3545
Can Pickering, Ont., A. C. Simmonds & Sons 416-839-8041

MALLORY COMPONENTS DIVISION, Emhart Elec./Elctrn. Grp., 222 Dixon Rd, Weston, Ont., Canada M9P 3S5, Tel: 416-244-4239, TELEX: 064-74132; FSC No.: 37942;76055; *Sls. Mgr.:* Peter Balodis; *Dist. Mgr.:* Russ Jones ..... **A•1113, 2077**

Local Sales Offices & Reps

CT E. Haven, Eagle Assocs. 203-467-6542
IL Palatine, M&S Sls. Co. 312-934-1200
MI Grand Rapids, DEM Elctrn. Sls. 616-361-5414
MI Warren, Dem Elctrn. Sls. 313-575-9444
MN St. Paul, Johnson Co. 612-641-1878
NJ Burlington, VDE Elctrns. Sls. 609-387-9331
NY Rochester, Dasson 716-338-1699
PA Doylestown, Monteiro Assocs. 215-345-5855
TX Ft. Worth, El-Tec Sls. 817-268-2896

MALLORY

FAX: 317-634-4214

MALLORY TIMERS, Emhart Elec./Elctrn. Grp., 3029 E. Washington St., Indianapolis, IN 46201, Tel: 317-636-5353; Empl.: 2,000; *Sls. Mgr.:* Lewis Jones ..... **A•1113, 2077; B•1536**

MANAGE, INC., Fibre Optics Elctrns. Sys. Grp., P.O. Box 175, 40 Nichols Rd., Chicopee, MA 01014, Tel: 413-592-9123, FAX: 413-594-4891; Empl.: 33; *Sls. Mgr.:* David Menard

MANGER ELECTRIC COMPANY, INC., W. Henry St., Stamford, CT 06902, Tel: 203-348-7761, FAX: 203-324-5447; FSC No.: 20262; Empl.: 100; *Sls. Mgr.:* J. V. Judge

MANHATTAN ELECTRIC CABLE, 225 Passaic St., Passaic, NJ 07055, Tel: 201-779-8900, TELEX: 137-387; Empl.: 125; *Sls. Mgr.:* Ed Harvey; *Dist. Mgr.:* Allan Marconi

MANHATTAN ELECTRIC CABLE CORPORATION, 1 Station Plaza, Rye, NY 10580, Tel: 914-967-8000, TELEX: 137-387, FAX: 914-967-1616; Empl.: 125; *Sls. Mgr.:* Linda M. Goodwins

Local Sales Offices & Reps

CA Los Angeles, Manhattan Elec. Cable Corp. 800-423-4040
CA San Francisco, Manhattan Elec. Cable Corp. 800-231-0152
IL Chicago, Bensdorf & Johnson 800-942-1147
MA Boston, Manhattan Elec. Cable Corp. 800-255-1429
NJ Bridgeton, Manhattan Elec. Cable Corp. 800-225-2293,800-257-7071
NJ Harrison, Manhattan Elec. Cable Corp. 201-484-9111,800-826-5171
OH Cleveland, Dynamic Elec. Sls. 216-362-7900
TX Houston, Manhattan Elec. Cable Corp. 800-231-3868,800-392-4948
TX Irving, Huemmer-O.K. Inc. 800-442-7733

Local Distributors

CA Burlingame, TRAC Sls. 415-692-5255
CO Denver, Gaer Sls. 303-777-3740
GA Atlanta, Robert B. Paul 404-696-7100
IN Indianapolis, Wiltrout Sls. 317-259-0779
LA New Orleans, Wells-Keown 504-244-0330
MI Highland, Nova Elec. Sls. Inc. 313-887-0064
MN Brooklyn Pk., North Central Sls. 800-328-8322
MS Brandon, Service Elec. Sls. 601-992-9122
MO St. Louis, Jones Elec. Entprs. 314-428-5665

MANN, HENRY, INC., 3983 Mann Road, Huntingdon Valley, PA 19006, Tel: 215-355-7200, TELEX: 6851160, FAX: 215-355-5134; Empl.: 52; *Sls. Mgr.:* Dan Martin; *Dist. Mgr.:* Mickey Hoffer

MANTEX CORP., 1800 Metamora Rd., P.O. Box 15E, Oxford, MI 48051, Tel: 313-628-8200, FAX: 313-628-1520; Empl.: 100; *Sls. Mgr.:* John R. Santiago

MANUFACTURERS COMPONENT, INC., 2260 W. 77 St., Hialeah, FL 33016, Tel: 305-556-4481, 800-367-0377, TELEX: 514181, FAX: 305-823-8934; Empl.: 5; *Sls. Mgr.:* Jackie Barker

MARATHON FLITE-TRONICS COMPANY, A Marathon Power Technologies Co., 2525 N. Naomi St., Burbank, CA 91504, Tel: 818-841-3210, TELEX: 69-1487; Empl.: 65

MARATHON POWER TECHNOLOGIES, P.O. Box 8233, Waco, TX 76714-8233, Tel: 817-776-0650, TWX: 910-894-5203 MARATHON WAC

MARATHON SPECIAL PRODS., 13300 Van Camp Rd., Bowling Green, OH 43402, Tel: 419-352-8441, TWX: 810-499-2988, FAX: 419-352-0875; Empl.: 150; *Sls. Mgr.:* J. Campisi

MAR-CHAR CORPORATION, ATR Electronics, Inc., 167 East Fifth Street, Montello, WI 53949, Tel: 608-297-2106; Empl.: 10; *Sls. Mgr.:* Charles G. Nutter

MARCON AMERICA CORP., 310 Era Drive, Northbrook, IL 60062, Tel: 312-564-2820, FAX: 312-564-1150; Empl.: 11; *Sls. Mgr.:* Tony Olita; *Dist. Mgr.:* Helen A. Stubbs

MARCONI INSTRUMENTS, 3 Pearl Court, Allendale, NJ 07401, Tel: 201-934-9050, TWX: 710-991-9752; *Sls. Mgr.:* William E. Bean ..... **D•1291-1295**

Local Sales Offices & Reps

AL Huntsville, Beacon Elctrns. Assocs. ... 205-881-5031
CA Carson, Amasco-South 213-516-8561
CA San Diego, Amasco-South 619-565-9676
CA Sunnyvale, Amasco-North 408-773-8690
FL Boca Raton, Beacon Electrns. Assocs. 305-392-3500
GA Atlanta, Beacon Electrns. Assocs. 404-256-9640
IL Chicago, K.W. Meyers 312-882-4808
IN Indianapolis, K. Meyers 317-783-1030
MD Burtonsville, Eastern Instrmn. 301-792-7039
MA Chelmsford, ICS Assocs. 617-256-3350
MN Minneapolis, K.W. Meyers 612-920-7080
MO Maryland Hgts., Comms. Equip. Specialties 314-291-7841
NJ Elmwood Park, L & M Assocs. 201-797-0441
NM Albuquerque, Scientific Dvcs. 505-883-3668
NY New York City, L & M Assocs. 212-243-6155
NY Whitney Point, Tae-Rep 607-692-3705
NC Raleigh, Beacon Electrns. Assoc. 919-787-0330
OH Chesterland, EQS Systems 216-729-2222
PA Andalusia, L & M 215-245-6658
TX Dallas, EES 214-644-8881
MD Burtonsville, Eastern Instrmn. 301-384-8500
WA Marysville, The Western Rep 206-653-6031

MAREL INSTR. CO., 907 South East 13th Pl., Cape Coral, FL 33990, Tel: 813-574-8788; Empl.: 14; *Sls. Mgr.:* T. Swift

MARINE ELECTRIC RPD, INC., See CML Macarr Div. Marine Electric RPD, Inc.

WILD OATS

MARKAT DIV., Wild Oats Corp., 902 Charles St., N. Myrtle Bch., SC 29582, Tel: 803-448-0083; Empl.: 216; *Sls. Mgr.:* K. L. Campbell; *Dist. Mgr.:* W. B. Heather

Local Sales Offices & Reps

AZ Scottsdale, Southworth Sls. 602-945-3464
IN Carmel, Hoosier Sls. 317-844-4535
NY Plainview, Indl. Controls, Inc. 516-349-0231
OH Centerville, Grimm & Co. 513-433-1717

Markel CORPORATION

FAX: 215-270-3138

MARKEL CORP., P.O. Box 752, Norristown, PA 19404, Tel: 215-272-8960, TWX: 510-660-0929; FSC No.: 03890; Empl.: 228; *Dist. Mgr.:* L. J. Clemente ..... **C•1715**

Local Sales Offices & Reps

AL Huntsville, Alpha Mktg. 205-533-0766
AZ Phoenix, Shefler-Kahn 602-257-9015
AR Hot Springs, MYA, Inc. 501-262-1365
CA Anaheim, Indl. Dielectrics 714-776-7411
CA L.A., Natl. Wire & Cable 213-225-5611
CA Santa Clara, Penmark Sls. 408-980-1303
CO Arvada, Arrowhead Sls. 303-423-5556
CT Hamden, Datcom 203-288-7005
FL Deerfield Bch., Jack Krutek & Assoc. .. 305-427-4202
IL Schiller Pk., Wm. R. Bolles 312-678-7888
IN Indianapolis, D. M. Assocs. 317-842-4424
KS Lenexa, Midtec 913-541-0505
MD Glen Burnie, F. Lott 301-744-4611
MA Waltham, Datcom 617-891-4600
MI Farmington, L. George & Assoc. 313-474-1505
MN Edina, PWC 612-933-3393
MO Florissant, O C B Sls. 314-837-3361
NJ Colonia, Heft & Ficarra 201-381-5193
NM Albuquerque, Shefler-Kahn 305-296-0749
NY Lynbrook, Heft & Ficarra 516-599-3351
NY Rochester, Apex 716-254-6050
OH Chagrin Falls, Electrolock 216-543-5125
OR Portland, James J. Backer 503-297-8744
PA Flourtown, C. Newson 215-248-3377
SC Greenville, Electrolock Inc. 803-297-9830
TN Murfreesboro, Alpha Mktg. 615-896-6102
TX Richardson, C.J. Garvey 214-234-3371
UT Salt Lake City, Arrowhead Sls. 801-261-1661
WA Seattle, James J. Backer 206-285-1300
WI Mequon, Wm. R. Bolles 414-241-3320
EXP Blue Bell, PA, Markel Corp., Exp. Dept. 215-825-5710
Can Mississauga, Ont., Marflex-Barrett Ltd. 416-828-0220

Local Distributors

CA Anaheim, Indl. Dielectrics West 714-776-5215
CA Berkeley, Riggs/LaMoree 415-841-0601
CA Los Angeles, Natl. Wire & Cable 213-225-5611
CA Torrance, Insulation Supp. 213-320-9400
CO Denver, Ward Elec. Supp. 303-333-3541
CT Greenwich, R. H. Carlson 203-531-5500
CT Hartford, Atlantic Switch 203-527-7705
FL Davie, Arco Distrs. 305-473-2550
FL Lakeland, Switch Controls 800-282-7619
GA Atlanta, Accu-Tech Cable 404-455-6422
IL W. Chicago, J. J. Glenn 312-293-7800
IN Indianapolis, Marian Rubber 317-638-6525
KS Wichita, Midwest Aircraft Supp. 316-267-3318
LA New Orleans, Long Elctrl. Supp. 504-524-8383
MD Rockville, Read Plastics 301-881-7900
MI St. Clair Shores, Spemco 313-771-2700
MO St. Charles, Lectronix 314-946-6424
NJ Mt. Laurel, Jersey Switch 609-778-8190
NY Rochester, Simcona Elctrns. 716-328-3230
OH Chagrin Falls, Electrolock 216-543-6626
SC Greenville, Electrolock, Inc. 803-297-9830
TN Chattanooga, Technitronics 615-875-5449
VA Norfolk, Read Plastics 804-627-0111
VA Roanoke, Control Distr. Inc. 703-989-7925
Can Mississauga, Ont., Marflex-Barrett Ltd. 416-828-0220

MARKEM CORP., 150 Congress St, Keene, NH 03431, Tel: 603-352-1130, TWX: 710-366-1800; FSC No.: 38360; Empl.: 1200; *Sls. Mgr.:* Carl Panza

MARKENRICH CORP., 1812 Flower Avenue, Duarte, CA 91010, Tel: 818-359-9190, TELEX: 298727, FAX: 818-359-9190; Empl.: 8

Local Sales Offices & Reps

FL Sarasota, Camtech, Inc. 813-923-2804
IL Palatine, Somers-Reagan 312-991-1108
IA Coralville, EPA, Inc. 319-354-5344
MA Reading, Lincoln Tech. Sls. 617-944-9594
MN Edina, EPA, Inc. 612-835-9022
NJ Vincentown, Imagineering Assocs. 609-268-8859
NY Syracuse, I. A. Hotze Assocs. 315-479-6641

MARK EYELET INC., AMP, Inc., 63 Wakelee Rd., Wolcott, CT 06716, Tel: 203-756-8847, TELEX: 69-6191, FAX: 203-755-9410; Empl.: 70

MARKTECH INTERNATIONAL CORP., 120 Broadway, Menands, NY 12204, Tel: 518-436-5865, FAX: 518-436-5877; Empl.: 14; *Dist. Mgr.:* Jayne Kenderian Moore ..... **B•1138-1139, 1275-1277**

Local Sales Offices & Reps

AL Huntsville, Action Comp. Sls. 205-533-0287
CA Maywood, Management Mktg. & Sls. .. 213-560-5584
CA San Jose, Eclipse Sls. 408-435-3800
CO Westminster, Western Region Mktg. .. 303-430-8883
CT Cheshire, Connecticut Applied Technlg. 203-272-6564
FL Tampa, SRT Mktg. 813-884-4805
GA Roswell, Action Comp. Sls. 404-998-7227
IL Elk Grove Vl, Tristar Grp., Inc. 312-593-0200
KS Olathe, Tech. Sls. Assocs. 913-829-2800
MA Westborough, Bay Colony Reps., Inc. 617-870-1930
MI Plymouth, Leading Edge Sls. Corp. 313-420-3344
MN Golden Valley, Ambassador Indl. Mkg. 612-542-8437
MO Ferguson, Technical Sls. Assocs. 314-521-2044
NJ Cherry Hill, Vantage Sls. 609-424-6777
NJ Hewitt, CRG Grp., Inc. 201-728-3377
NY Syracuse, Canavan-Scanlon 315-437-1271
OH maple Hgts., Versatron 216-581-0090
OK Tulsa, Mil-Co Mktg. 918-664-2277
TX Richardson, Mil-Co Mktg. 214-783-2785
UT Salt Lake City, Western Region Mktg. 801-486-1646
WA Bellevue, Caruso & Co. 206-455-8811
WI Brookfield, Tristar Group 414-782-2670
Can Markham, Avotronics 416-475-2024

Local Distributors

CA Anaheim, Pacesetter Elctrns. 714-777-4711
CA Chatsworth, Cetex/Future 818-900-0914
CA Irvine, J & J Elctrns. 714-455-0104
CA San Jose, All American Semiconductor 408-287-0190
CO Westminster, Future Elctrns. 303-650-0123
CT Danbury, Pilgrim Elctrns. 203-792-7274
FL Miami, All American Semiconductor ... 305-621-8282
GA Norcross, Future Elctrns. 404-441-7676
IL Schaumberg, Future Elctrns. 312-882-1255
MD Columbia, Future Elctrns. 301-995-1222
MA Westborough, Future Elctrns. 617-366-2400
MI Livonia, Future Elctrns. 313-261-5270
MN Bloomington, All American Semiconductor 612-884-2220
NJ Fairfield, Future Elctrns. 201-227-4246
NJ Moorestown, Marlac Elctrns. 609-234-4200
NY Ronkonkoma, All American Semiconductor 516-981-3935
NY Ronkonkoma, Baldwin Comps. 516-588-5700
NY Syracuse, Future Elctrns. 315-451-2371
NC Raleigh, Resco 919-781-5700
OR Beaverton, Norvac Elctrns. 503-644-1025
PA McKean, Advacom 814-476-7774
TX Dallas, Omni Pro Elctrns. 214-233-9368
UT Salt Lake City, Future Elctrns. 801-972-8489
WA Redmond, Future Elctrns. 206-881-8199
Can Pointe Claire, Future Elctrns. 514-694-7710

MarLee Switch Company

MARLEE SWITCH CO., 933-D N. Central Ave., Upland, CA 91786, Tel: 714-982-8988; Empl.: 10; *Sls. Mgr.:* LeRoy Tichy ..... **B•1758**

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FAX: 214-341-5212

MARLOW INDUSTRIES, INC., 10451 Vista Park Rd., Dallas, TX 75238, Tel: 214-340-4900, TWX: 910-860-5161; FSC No.: 55686; Empl.: 170; *Sls. Mgr.:* John Nelson; *Dist. Mgr.:* David Marlow ..... **C•1680-1681**

FAX: 315-655-8042

MARQUARDT SWITCHES INC., Route 20 East, P.O. Box 465, Cazenovia, NY 13035, Tel: 315-655-8050, TELEX: 703-287-UD; *Sls. Mgr.:* J. J. Kennedy, VP Sls.; *Dist. Mgr.:* R. A. Philipchik, VP Mktg. ..... **B•1759-1763**

Local Sales Offices & Reps

AL Huntsville, Electrosales Co. 205-883-9648
AZ Scottsdale, Memco Sls., Inc. 602-952-2254
CA Los Angeles, Universal Components, Inc. 213-641-4255
CA Santa Clara, Nova-Tronix Inc. 408-727-9530
FL Hollywood, Stand. Mktg., Inc. 305-435-1047
FL Tampa, Stand. Mktg., Inc. 813-933-5833
FL W. Melbourne, Stand. Mktg., Inc. 305-725-7073
GA Atlanta, Electrosales Co. 404-394-1122
IL Franklin Pk., Stetco 312-671-4208
IN Fort Wayne, J & B Engrg. 219-483-2813
IN Indianapolis, J & B Engrg. Sls. Co. 317-842-3008
IA Marion, M-S-B Assocs., Inc. 319-377-6261
KS Shawnee Mission, M-S-B Assocs., Inc. 913-432-2131
MD Middletown, S.T./Woolard Co., Inc. 301-371-4500
MI Grand Blanc, Inter-Comm 313-695-0665/0666
MN St. Paul, Arkco Sls Co. 612-777-7454
MO St. Louis, M-S-B Assocs. 314-946-5577
NH Nashua, Bell Controls, Inc. 603-882-6984
NJ Medford, Champion Elctrn. Sls. Co., Inc. 609-983-0932/0807/9007
NY Cazenovia, S.T./Woolard Co. 315-655-8145
NC New Bern, R-A Sls. 919-244-2672
OH Cleveland, J & B Engrg. Sls. Co. 216-642-9312
OR Portland, Elctrn. Comp. Sls. 503-245-2342
PA Phoenixville, Gil-Tronics, Inc. 215-933-8525
SC Easley, R-A Sls. Co. 803-859-1859
SC Pickens, S.T./Woolard Co., Inc. 803-878-3830
TX Dallas, Rem-Air Comps. 214-234-1069
TX Houston, Dunkel Assocs. 713-729-1670
CO Lakewood, Cristee Meade Co. 303-232-0287
VA Lynchburg, S.T./Woolard Co., Inc. 804-528-5421
WA Kirkland, Manon Engrg. 206-827-7449
WA Mercer Island, Elctrn. Comp. Sls. 206-232-9301
WI Milwaukee, Key Entpr., Inc. 414-453-9462

Local Distributors

AZ Tempe, Control Design Supp., Inc. 602-829-7981
CA Covina, Selecta Switch 213-967-4123, 800-722-6445
CA Gardena, California Switch & Signal ... 213-770-2330, 800-225-7924
CA San Jose, Sierra West 408-435-7477
CA Van Nuys, Pacific Switch Controls, Inc. 213-873-4802
CO Aurora, Jet Elctrns. 303-364-1000
CO Denver, CSID, Inc. 303-292-9594
CT Hartford, Atlantic Switch Controls, Inc. 203-527-7705
CT Hartford, Wes-Garde Comps. Grp., Inc. 203-527-7705
FL Ft. Lauderdale, N.R.C. Elctrns., Inc. 305-772-4500
FL Lakeland, Switch Controls 813-644-7564
FL Longwood, Stetco, Inc. 305-767-0209
FL West Palm Beach, Nurmi Electrns. 305-686-8553
GA Atlanta, KSM Elctrns., Inc. 404-458-2013
GA Stone Mtn., Control Design Supp. 404-979-3500
IL Addison, L Comp 312-628-1400
IL Bensenville, Voyager Elctrns. 312-860-1300
IL Carol Stream, Conectrix, Inc. 312-653-1460
IL Franklin Pk., Stetco, Inc. 615-671-4208
KS Wichita, L Comp 316-265-5100
KS Wichita, Radio, Inc 316-264-2798
MA Wilmington, J-V Elctrns. 617-657-6523
MI Grand Rapids, S.F. Elctrns. 616-459-0216
MI St. Clair Shores, Spemco 313-771-2700
MN Fridley, Voyager Elctrns. 612-571-7766, 612-571-9519
MN Minneapolis, Control Design Supp. 612-721-1628
MO Kansas City, L Comp 816-221-2400
MO Maryland Heights, L-Comp 314-291-6200
MO St. Louis, Midwest Switch & Controls, Inc. 314-567-7776
NH Nashua, Atlantic Switch Controls, Inc. 603-880-1971,800-345-0600
NJ Allendale, B & R Electronics 201-934-8600
NJ Mt. Laurel, Jersey Switch 609-778-8190
NY Baldwinsville, Scibetta Dists. 315-622-3993
NY Hempstead, Elctrn. Equip. Co. 516-538-5510
NY Woodside, Switches unltd. 718-478-5000
NC Charlotte, Control Design Supp., Inc. .. 704-588-4410
NC Gastonia, J.M.T. Electronics 704-867-4401
OH Westerville, Ohioswitch, Inc. 614-885-0319
OK Oklahoma City, Radio, Inc. 405-789-0741
OK Tulsa, Radio, Inc. 918-587-9123
OR Beaverton, Murphy Electrns,Inc. 503-642-2001
PA Newton Sq., Q.D.I. 215-359-1000
TN Chattanooga, Stetco, Inc. 615-899-6831
TN Chattanooga, Techni Tronics Inc. 615-842-0514
TX Austin, Southwest Electrns. 512-837-8971
TX Dallas, Southwest Electrns. 512-343-7694
TX Dallas, Texas Switch, Inc. 214-357-1768
TX Houston, Wofford Elctrns., Inc. 713-847-3583
TX Stafford, Southwest Electrns. 713-240-4000
WA Redmond, Murphy Electrns. 206-881-1234
Can Concord, Ont., Votron Elctrns., Ltd. 416-669-9870, 619-661-5190

MARSH PRODUCTS, INC., 336 McKee St., Batavia, IL 60510, Tel: 312-879-8008; *Sls. Mgr.:* Mel Ruskin

MARTEL ELECTRONICS, 27 Roulston Rd., P.O. Box 897, Windham, NH 03087, Tel: 603-893-0886, 800-821-0023, TELEX: 95-1232; *Sls. Mgr.:* David DeVries

MARTIN SOUND PRODS., 28 Alpha Park, Cleveland, OH 44143-2297, Tel: 216-442-2286; Empl.: 2; *Sls. Mgr.:* DeWayne (Bud) Martin; *Dist. Mgr.:* DeWayne (Bud) Martin

MARWAY PRODUCTS INC.

FAX: 714-973-2931

MARWAY PRODS. INC., 311 N. Clara St., Santa Ana, CA 92703, Tel: 714-973-1800; FSC No.: 800-833-3334..722332; Empl.: 12; *Sls. Mgr.:* Tom Goreth ..... **D•2132-2133**

Local Sales Offices & Reps

CT N. Haven, Marway Prods. 203-281-7270
MA Wellesley, Marway Prods. 617-235-7884
NH Londonderry, Power Conversion Sys. 603-434-2371
PA Bridgeport, Penncat Corp. 215-272-0505
TX Richardson, Interactive Comp. Sls. 214-669-2277

MASTECH, INC., Lorlin Test Systems, Precision Rd., Danbury, CT 06810, Tel: 203-744-0096, TELEX: 7104565030; Empl.: 48; *Sls. Mgr.:* Ruthe Ploskunyak

MASTER APPLIANCE CORP., 2420 18th St., Box 68, Racine, WI 53403, Tel: 414-633-7791, TELEX: 269-505; FSC No.: 83284; Empl.: 50; *Sls. Mgr.:* G. E. Mertins; *Dist. Mgr.:* G. E. Mertins

MASTER BOND, 154 Hobart St., Hackensack, NJ 07601, Tel: 201-343-8983, FAX: 201-343-2132; FSC No.: 59504; Empl.: 16; *Sls. Mgr.:* James Brenner

Distributor

Master Distributors, P.O. Box 25662, Los Angeles, CA 90025, Tel: 213-452-1229; 473 Sapena Ct., Ste 112, Santa Clara, CA, 95054, Tel: 408-496-6151; FAX 408-496-0325..... **A•**1299, 1671, 2138, 2193, 2263, 2417; **B•**1162, 1258, 1301, 1411, 1447, 1537, 1628, 1687,1755, 1851, 1921;**C•**10321,1125, 13051411, 1460, 1549, 1606, 1695, 1901;**D•**1125,1131; 601, 608, 609, 611, 613615, 620, 621, 625, 630, 635, 638, 639,640, 645, 652, 653, , 654, 656, 657, 666, 668, 670, 673, 674, 678,681, 691, 693, 695, 696, 699, 703, 704708, 716, 720, 723, 725, 726, 727, 729,730, 732, 734, 740, 741, 753, 754, 755,756, 760, 771, 772, 779, 786,789, 793,795, 804, 808, 810, 813, 816, 821

MASTER ELECTRONIC CONTROLS, P.O. Box 25905, Los Angeles, CA 90025, Tel: 213-452-1336, TELEX: 182041, FAX: 213-399-8600; Empl.: 74; *Sls. Mgr.:* Don Minassian; *Dist. Mgr.:* Jesse Jaurretche

MASTERITE CORPORATION, 2841 Lomita Blvd., Torrance, CA 90505, Tel: 213-775-3471, TWX: 910-347-6237; FSC No.: 05041; Empl.: 680; *Sls. Mgr.:* C.J. Huebert; *Dist. Mgr.:* G. Peterson

MATEC INSTRUMENTS, INC., 75 South St., Hopkinton, MA 01748, Tel: 617-435-9039, TELEX: 948332, FAX: 617-435-5289; Empl.: 55; *Sls. Mgr.:* Harry Ives

MATERIALS RESEARCH CORPORATION, Route 303, Orangeburg, NY 10962, Tel: 914-359-4200, TELEX: 221862 MRC UR; Empl.: 560; *Sls. Mgr.:* Mel Lipton

MATH ASSOCS., 2200 Shames Dr., Westbury, NY 11590, Tel: 516-334-6800, TELEX: 238-667 RAPID UR, FAX: 516-334-6473; Empl.: 45; *Sls. Mgr.:* Ed Henckel

MATHEMATICAL SYSTEMS DESIGN, INC., 11835 W. Olympic Blvd., Suite 745, Los Angeles, CA 90064, Tel: 213-479-7180; *Sls. Mgr.:* Lorr Kramer

MATRA DESIGN SEMICONDUCTOR, 2840 San Tomas Expressway, Santa Clara, CA 95051, Tel: 408-986-9000, TELEX: 299-656; *Sls. Mgr.:* David T. Fletcher

MATRIX CORP., 2260 Distributors Dr., Indianapolis, IN 46241, Tel: 317-248-2036; Empl.: 10 ..... **D•1172**

Local Sales Offices & Reps

FL	Orlando, James Terry & Assoc.	305-894-4717

MATRIX CORP., 1203 New Hope Rd., Raleigh, NC 27610, Tel: 919-833-2000, FAX: 919-833-2550; Empl.: 50; *Sls. Mgr.:* Ray Alderman

FAX: 818-992-8521

MATRIX SYSTEMS CORP., 5177 N. Douglas Fir Rd., Calabasas, CA 91302, Tel: 818-992-6776, TWX: 910-494-4975; FSC No.: 33281; Empl.: 60; *Sls. Mgr.:* Randy Sue Rabideau ..... **A•1773**

Local Sales Offices & Reps

AL	Huntsville, Reynolds Assoc., Inc.	305-259-7000
AZ	Scottsdale, Faser Techn. Sls.	602-948-4404
CA	Milpitas, IFM Inc.	408-945-5920
CA	N. Hollywood, Crown Elctrns.	213-877-3550
CO	Broomfield, Scientific Dvcs.	303-469-5145
CT	Marion, Polytek Assocs.	203-621-4542
FL	Melbourne, Reynolds Assoc., Inc.	305-259-7000
FL	Tampa/Ft. Lauderdale, Reynolds Assocs.	305-259-7000
GA	Atlanta, Reynolds Assoc., Inc.	305-259-7000
IL	Arlington Hgts., Comtel Midwest	312-392-4040
IN	Indianapolis, Comtel Midwest	317-253-1681
KS	Shawnee Mission, Comtel Midwest	913-268-0762
MA	Ashland, PolyTek Assocs.	617-881-4741
MA	Falmouth Heights, RJC Assocs.	617-540-8832
MI	Southfield, Comtel-Instr.	313-358-2505
MN	Wayzata, Comtel Midwest	612-476-1551
MO	St. Louis, Comtel Midwest	314-991-5363
NY	Mamaroneck, Bassin Tech. Sls. Co.	914-698-9358
NC	Raleigh, Reynolds Assoc.	305-259-7000
OH	Cleveland, Comtel Instr.	216-442-8080
OH	Dayton, Comtel Instr.	513-426-5310
OH	Hillard, Comtel Instr.	614-876-8305
OR	Portland, Topp Engrg. Sls.	503-244-7265
PA	Pittsburgh, Comtel Instr.	412-922-5720
TX	Carrollton, Seaton Corp.	214-380-0414
VA	Fairfax, Schibley Assocs.	703-591-3008
WA	Bellevue, Topp Engrg. Sls.	206-747-5400
WI	New Berlin, Comtel Midwest	414-544-6042

MATROX ELECTRONIC SYSTEMS, 1055 St. Regis Blvd., Dorval, QU, Canada H9P 2T4, Tel: 514-685-2630, TELEX: 05-822798, FAX: 514-685-2853; Empl.: 462; *Sls. Mgr.:* Ed Dwyer

FAX: 714-960-6492

MATSUO ELECTRONICS, 2134 Main Street, Suite 200, Huntington Beach, CA 92648, Tel: 714-969-2491, TWX: 910-596-1828; FSC No.: (714) 960-6492; Empl.: 854; *Sls. Mgr.:* Emmalee Shaw ..... **A•1114-1119**

Local Sales Offices & Reps

AZ	Phoenix, Howe & Howe	602-264-7971
CA	Mission Viejo, Angle Assocs.	714-582-8858
CA	Redwood City, James S. Heaton Co.	415-367-7158
FL	Plantation, Gallagher	305-473-2101
GA	Norcross, Macro Mktg.	404-662-5580
ID	Boise, N. R. Schultz	208-377-8686
IL	Des Plaines, ESCO Assocs.	312-298-5310
IN	Indianapolis, Needler	317-255-8056
MD	Randallstown, Chesapeake Mktg.	301-922-5997
MA	Randolph, Hatch Assocs.	617-963-3306
MI	Grand Rapids, DEM Elctrn. Sls.	616-364-4024
MI	St. Clair Shores, DEM Elctrns.	313-777-1750
MN	St. Paul, Proud Inds.	612-646-9428
NJ	Ft. Lee, Neptune Elctrns.	201-461-2789
NM	Albuquerque, FP Sls.	505-345-5553
NY	Clifton Pk., Net Sls.	518-371-6864
NY	Fairport, Net Sls.	716-223-1030
NY	Webster, Net Sls.	716-467-4538
OH	Dayton, Dolfuss-Root & Co.	513-433-6776
OH	Strongsville, Dolfuss-Root & Co.	216-238-0300
OK	Tulsa, Beacon	918-252-5181
OR	Beaverton, N. R. Schultz	503-643-1644
PA	Pittsburgh, Dolfuss-Root & Co.	412-221-4420
TX	Dallas, Beacon	214-437-1505
WA	Bellevue, N. R. Schultz	206-454-0300
Can	Scarborough, Ont., Bach-Simpson	416-288-9932

Local Distributors

AZ	Phoenix, Camco	602-269-6241
CA	Garden Grove, Capacitor Supp.	714-638-0510
CA	Garden Grove, National Chip	714-892-7749
CA	San Diego, Projections	619-453-7900
CA	San Jose, Passive Technlg.	408-435-5566
CA	San Jose, Projections	408-748-9280
CA	Santa Maria, Garrett Instrs.	805-922-0594
CA	Tustin, Projection Unltd.	714-544-2700
CA	W. Covina, CSI	818-960-4761
MD	Gaithersburg, Axis Elctrns.	301-840-9640
MA	Billerica, A. W. Mayer Co.	617-229-2255
MA	Billerica, Baldwin Comps.	617-667-6710
MA	Wilmington, Aved Elctrns.	617-657-6310
NJ	Fairfield, C.H.P.S., Inc.	201-882-0997
NJ	Kenilworth, Ventronics	201-272-9262
NY	Ronkonkoma, Baldwin Comps.	516-588-5700
NY	Ronkonkoma, Prime Comps.	516-737-1730
PA	Norristown, Century Elctrn. Comps.	215-631-5400
TX	Dallas, C & W	817-831-0395
Can	Montreal, Que., Prelco	514-389-8051
Can	N. London, CM Peterson	519-434-3204
Can	Willowdale, Ont., Electro Sonic	416-494-1666

MATTHEY ELECTRONICS, Television Equipment Associates, Box 393, South Salem, NY 10590, Tel: 914-763-8893, TELEX: 493-0698, FAX: 914-763-9158; *Sls. Mgr.:* Bill Pegler ..... **A•1670**

MAUELL CORP., 31 Old Cabin Hollow Rd., P.O. Box 339, Dillsburg, PA 17019, Tel: 717-432-8686, TELEX: 466003, FAX: 717-437-8688; Empl.: 25; *Sls. Mgr.:* Haubold Vom Berg; *Dist. Mgr.:* Haubold Vom Berg

MAUREY INSTRUMENT CORP., 4555 W. 60th St., Chicago, IL 60629, Tel: 312-581-4555, FAX: 312-581-2576; FSC No.: 03942; Empl.: 50; *Sls. Mgr.:* E. Maurey; *Dist. Mgr.:* Louis Derdzinski ..... **A•2078-2085**

Local Sales Offices & Reps

CT	Killingworth, Gallagher Assocs.	203-663-2338
FL	Largo, L-P Sls.	813-531-2664
FL	Orlando, ASI	305-851-7929
FL	Plantation, Innovative Mktg.	305-583-8895
MA	Framingham, Gallagher Assocs.	617-626-2346
MI	Grand Blanc, Inter-Comm	313-595-0665
TX	Dallas, THT Sls. Co.	214-783-1501
WA	Vancouver, Sls. & Engrg. Assoc.	206-573-5161

Local Distributors

CA	Garden Grove, Allied Elctrns.	714-554-0731
CA	Santa Clara, Allied Elctrns.	408-727-1690
CO	Wheatridge, Allied Elctrns.	303-425-7144
CT	Ridgefield, PIC	203-451-1533
FL	Margate, Allied Elctrns.	305-973-3070
MA	Wilmington, Allied Elctrns.	617-942-0150
MI	Battle Creek, Great Lakes Elctrns.	616-963-6282
MI	Grand Rapids, SF Elctrn. Supp.	616-459-0216
MI	Westland, Allied Elctrns.	313-595-6565
MO	St. Louis, Allied Elctrns.	314-878-1229
NY	Mineola, Allied Elctrns.	516-248-2360
NC	Raleigh, Allied Elctrns.	919-821-0415
OH	Akron, Stotts-Friedman	216-253-7000
OH	Cincinnati, Stotts-Friedman	513-574-7701
OH	Dayton, Stotts-Friedman	513-298-5555
OH	Willoughby, Allied Elctrns.	216-951-0908
OK	Tulsa, Allied Elctrns.	918-663-7630
PA	Bala Cynwyd, Allied Elctrns.	215-267-6940
TN	Knoxville, Shields Elctrns.	615-588-2421
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Houston, Allied Elctrns.	713-932-7321
VA	Alexandria, Allied Elctrns.	703-836-5002
WA	Seattle, Allied Elctrns.	206-767-5772

MAURY MICROWAVE CORP., 8610 Helms Ave., Cucamonga, CA 91730, Tel: 714-987-4715, TWX: 910-581-3408, FAX: 714-987-1112; FSC No.: 13047; Empl.: 104; *Sls. Mgr.:* M. A. Maury, Jr.

MAXI-SWITCH CO., Sub. of EECO, 9697 East River Rd., Minneapolis, MN 55433, Tel: 612-755-7660, TWX: 910-576-2690; Empl.: 160; *Dist. Mgr.:* E. C. Helme, Jr.

MAXON PRECISION MOTORS, INC., 838 Mitten Rd., Burlingame, CA 94010, Tel: 415-697-9614, FAX: 415-697-2887; *Sls. Mgr.:* Edward Graham ..... **B•1232**

MAXTOR CORPORATION, 211 River Oaks Pkwy., San Jose, CA 95134, Tel: 408-432-1700, TELEX: 171074, FAX: 408-434-6469; Empl.: 2500; *Sls. Mgr.:* Jim Daly; *Dist. Mgr.:* Bob Cascarino

MAXWELL ELECTRONICS, P.O. Box 12033, Research Triangle Park, NC 27609, Tel: 919-846-1633; Empl.: 8; *Sls. Mgr.:* Joe Harrison

MAXWELL LABORATORIES, 8888 Balboa Avenue, San Diego, CA 92123-1506, Tel: 619-279-5100, TWX: 910-335-2063, FAX: 619-277-6754; Empl.: 600; *Sls. Mgr.:* William Fox (Prods.)

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MO	University City, Lorenz Sls., Inc.	314-997-4558
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TX	Richardson, R. F. Kimball Co.	214-231-3447
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WI	Milwaukee, Beta Technlg. Sls., Inc.	414-543-6609
EXP	NJ, Oradell, Sylvan Ginsbury Ltd.	201-261-3200

MCE SEMICONDUCTOR, INC., 1111 Fairfield Dr., West Palm Beach, FL 33407, Tel: 305-845-2837, TELEX: 441405 (MCE UI), FAX: 305-863-8275; Empl.: 54; *Sls. Mgr.:* Richard H. McCargar

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MCG

FAX: 516-586-5120

MCG ELCTRNS., 12 Burt Dr., Deer Park, NY 11729, Tel: 516-586-5125, TELEX: 645518; FSC No.: 29779; Empl.: 45; *Sls. Mgr.:* Carolyn Schultz ..... **B•1296, 1327-1341**

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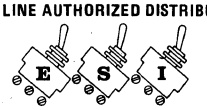

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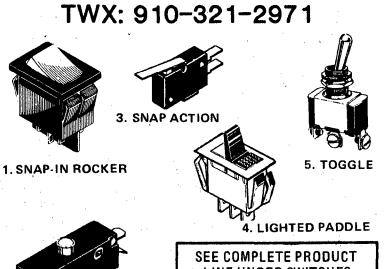

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GA	Norcross, Cartwright & Bean, Inc.	404-368-0160
IL	Elk Grove Vl., Parcom, Inc.	312-228-6360
MA	Plainville, Entpr. Technlg.	617-695-4700
NY	Hauppauge, Sticom	516-724-6814
NC	Raleigh, Cartwright & Bean, Inc.	919-876-4130
OH	Englewood, Allen Nace Co., Inc.	513-836-8931
PA	Paktron Tech. Sls.	814-643-0240
TX	Dallas, JYS Co., Inc.	214-349-1650
Can	Ontario, White Radio Ltd.	416-632-6894

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CA	Glendale, Halbar Assocs.	818-246-8263
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CO	Englewood, Component Tech.	303-758-5750
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IL	Elmhurst, Scott Assocs.	312-279-5681
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MD	Hunt Valley, Marktron	301-628-1111
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MO	St. Louis, Harris-Hanson	314-432-3611
NJ	Springfield, Sylvester Assocs.	201-376-3324
NM	Albuquerque, Fry-Gates	505-262-1525
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OH	Dayton, Jim Finnegan	513-890-8322
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TX	Dallas, Component Distrs.	214-644-0373
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TX Richardson, Scientific Sls. Co. 214-231-6541
VA Richmond, Robert Elctrn. Sls. 804-276-3979

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FL Ft. Lauderdale, APM Assocs. 305-565-0056
FL Tampa, APM Assocs. 813-886-2457
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IL Downers Grove, Richmar Elctrns. 312-968-0118
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NC Raleigh, Cartwright & Bean Inc. 919-876-4130
OH Cleveland, Components, Inc. 216-243-9200
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MN Minneapolis, Glen Mark 612-941-4825
NH Nashua, Atlantic Switch 603-880-1971
NJ Mt. Laurel, Jersey Switch 609-778-8190
OH Columbus, Ohio Switch 613-885-0391
OR Portland, Component Resources 503-641-8488
TX Dallas, TexaSwitch 214-357-1768
WA Seattle, Component Resources 206-454-8666
WA Seattle, Radar Elctrns. 507-747-3053
Can Toronto, Ont., Deskin Sls. 416-475-1412

MECHANICAL ENGRAVING, 4500 Bullard Ave, Bronx, NY 10470, Tel: 212-324-4455; FSC No.: 99040; Empl.: 35; *Sls. Mgr.:* Bernard W. Mandel

MECHANICAL ENTERPRISES, 461 Carlisle Dr., Herndon, VA 22070, Tel: 703-435-9496, TWX: 710-832-0942, FAX: 703-435-1837; Empl.: 25; *Sls. Mgr.:* R.H. Twyford ..... **B•1767, 1826-1827**

Local Sales Offices & Reps

AL Huntsville, Remco 205-533-3763
CA Cupertino, West-Comp 408-245-3100
CA Irvine, Vale Electrn. Assocs. 714-551-4821, 619-693-0113
CT Bristol, Technlg. Prod. Grp. 203-793-9186
IL Arlington Heights, Coombs Assocs., Inc. 312-439-9810
MA Brookline, Technlg. Prods. 617-731-0858
MI Jackson, Norwood Scroggs Co. 517-750-1170
MS Jackson, Doby Assocs. 601-981-1138
NY Cooperstown, Fitzelle Assoc. 607-547-9333
NY LeRoy, Fitzelle Assocs. 716-494-1554
TN Memphis, Doby Assocs. 901-763-5730
TX Dallas, Stasco 214-239-4517
WI Milwaukee, Coombs Assocs., Inc. 414-351-6123

Local Distributors

CA Los Angeles, Electric Switches, Inc. 213-660-1310
CA San Diego, Sigma Electrns. 619-565-2000
IL Wheeling, Hawk Elctrns., Inc. 312-459-4030
NY Yonkers, Kintronics, Inc. 914-968-7736, 800-431-1658
Can Burnaby, B.C., Rae Ind. Electrns.,LTD 604-291-8866

MP

FAX: 517-782-2810

MECHANICAL PRODUCTS INC., 1824 River St. P. O. Box 729E, Jackson, MI 49204, Tel: 517-782-0391, TWX: 810-253-0827; *Sls. Mgr.:* Bob Vangermeersch ..... **B•1342**

Local Sales Offices & Reps

AL Huntsville, Electro-Mech 205-533-2100
AZ Tempe, Cantec Sls., Inc. 602-829-0191
CA Los Angeles, Universal Components Co. 213-641-4255
CA Sunnyvale, Pass Associates 408-735-9040
FL Orlando, OEM Mktg. 305-299-1000
GA Atlanta, Electro-Mech 404-447-6478
IL Barrington, Perhats Assocs. 312-381-6360
MD Pikesville, Muncy Sls. 301-484-6376
MN St. Paul, John J. Exon Co., Inc. 612-636-5533
NH Durham, C. H. Burnham Assocs. 603-868-2282
NJ West Caldwell, Grimm, Siegel Assocs., Inc. 201-575-9300
NY Pittsford, Noeth-Honsinger Assoc., Inc. 716-586-9002
NC Raleigh, Electro-Mech 919-851-8165
OH Dayton, Rockford Controls Ohio, Inc. .. 513-898-5452
OH Euclid, Rockford Controls Ohio, Inc. 216-725-3705,
OH Euclid, Rockford Controls Ohio, Inc. 216-731-5250
OK Tulsa, John B. Guenther, Inc. 918-660-5126
RI Johnston, C. H. Burnham Assocs. 401-231-7475
TN Jonesboro, Electro-Mech 615-753-2964
TX Austin, John B. Guenther, Inc. 512-472-3825
TX Dallas, John B. Guenther, Inc. 214-691-8500
Can Bells Corners, Nepean, Ont., Har Tech 613-726-9410
Can Downsview, Ont., Har Tech 416-665-7773
Can Pointe Claire, Que., Har Tech 514-694-6110

Local Distributors

CA Gardena, Cal Switch ... 213-770-2330/213-538-9830
CA Hawthorne, Electro-Sonics 213-970-0997
CA San Carlos, Campbell & George Co. .. 415-594-1994
CA So. San Francisco, Nasam, Inc. 415-872-1155
FL Ft. Lauderdale, Zelcon, Inc. 305-565-2555/6
IL Chicago, Nep Elctrns. 312-625-8400,
KS Edwards, Tennant Elctrns. 913-441-1801
KS Edwardsville, Tennant Elctrns. 913-441-1801
KS Wichita, Airtechnics 316-267-2849
MI Grand Rapids, S & F Elec. Supp. Co., Inc. 616-459-0216
MN Minneapolis, Berquist 612-835-2322
NJ Mount Laurel, Techtron Components Corp. 609-234-1940
NJ Oakland, Relay Specialties 201-337-1000
NY Hauppauge, Genelco 516-231-1144/800-645-9802
NY Plainview, Linrose Elctrns. 516-293-2520
NY Woodside, Switches Unlimited 800-221-0487
OH Euclid, Rockford Controls Ohio, Inc. 216-731-5250
TX Arlington, Bell Components Sls., Inc. .. 817-461-5303
TX Dallas, Associated Aircraft Supp., Inc. 214-331-4381
Can Montreal, Que., Ferro Technique Ltd. ..... TLX 05-824863
Can Scarborough, Ont., Carsten Elctrns. Ltd. 416-495-9999
Can St. Laurent, Que., Tara Inds. Corp. 514-331-6550

MECHANIZED ELCTRN. ASSEMBLEY DIV., UNIVERSAL INSTRS. CORP., See Dover Electronics Manufacturing

MECHATRONICS/SAB INC., 2835 82nd Ave. S.E., P.O. Box 20, Mercer Island, WA 98040, Tel: 206-236-1000, TWX: 910-444-4126, FAX: 206-232-3734; Empl.: 40; *Sls. Mgr.:* David Ray ..... **C•1637**

Local Sales Offices & Reps

CA San Jose, SAB Mechatronics 408-370-7018
CA Westlake Vl, SAB Mechatronics 805-373-0631
GA Atlanta, SAB Mechatronics 404-928-7137
TX Dallas, SAB Mechatronics 817-488-6634
NH Exeter, SAB Mechatronics 603-772-4282

MEDA, INC., Macintyre Electronics Design Assocs., 11260 Roger Bacon Dr., Ste. 202, Reston, VA 22090, Tel: 703-471-1445, TELEX: 910-350-0132; Empl.: 8

MEDIA RECOVERY INC., Box 1407, Graham, TX 76046, Tel: 800-527-9497, 214-630-9625 (Texas), TELEX: 73-2561; Empl.: 130; *Sls. Mgr.:* J. Ricciardi

MEGATRAN ELECTRONIC POWER, Rising Sun Rd., Bordentown, NJ 08505, Tel: 609-298-7300, TWX: 510-685-3645, FAX: 609-298-1982; Empl.: 25; *Sls. Mgr.:* C. W. Harrison

MEISSNER INDUSTRIES, 551 Rte. 10, Dover, NJ 07801, Tel: 201-366-1700; Empl.: 10

MELCHER INC., 10 Cochituate St., Natick, MA 01760, Tel: 617-653-9979, TWX: 510-100-3630, FAX: 617-655-7984; *Sls. Mgr.:* Richard Sakakeeny

Local Sales Offices & Reps

AL Huntsville, Over & Over Inc. 205-837-7105
AZ Phoenix, Blackhart & Assocs. 602-893-3488
CA Santa Clara, Sourcetronics 408-988-8801
CO Englewood, Taylor Mktg. 303-850-0207
FL Altamonte Springs, Over & Over Inc. .. 305-332-1222
FL Tampa, Over & Over Inc. 813-626-9100
GA Norcross, Over & Over Inc. 404-449-6205
IL Arlington Hgts., Phoenix Elctrn. Sls. ... 312-394-4422
IA Des Moines, The Bearns Co. 515-255-1148
MD Hunt Valley, Eagle Sls. Corp. 301-666-3930
MA Whitinsville, Power Factor & Assocs. .. 617-234-6415
NJ Englewood, Technimat 201-569-4200
NC Charlotte, Over & Over Inc. 704-542-9111
NC Raleigh, Over & Over Inc. 919-782-9111
PA Horsham, TMI 215-441-4300
TX Richardson, Jim D. Gray & Assocs., Inc. 214-699-9976
TX Richmond, Jim D. Gray & Assocs., Inc. 713-342-1710
UT Ogden, Taylor Mktg. 801-546-9570
WA Lynwood, Power Sources Unltd. 206-743-6641

FAX: 609-393-9461

MELCOR/MATERIALS ELCTRN. PRODS., 994 Spruce St., Trenton, NJ 08648, Tel: 609-393-4178, TELEX: 84-3314; FSC No.: 32333; Empl.: 150; *Sls. Mgr.:* M.A. Levine ..... **C•1686-1687**

Local Sales Offices & Reps

CO Fort Collins, Rep Sls., Inc./Andy Cornedi 303-226-1504
NY Rochester, R. G. Minges Agency 716-328-3410

MELFESS FIVE, INC., 12304 Santa Monica Blvd., No. 121, Los Angeles, CA 90025, Tel: 213-826-8133, 800-533-2297, FAX: 213-820-6958; Empl.: 4; *Sls. Mgr.:* Michael S. Fisher

MELLES GRIOT, Optics, 1770 Kettering St., Irvine, CA 92714, Tel: 714-261-5600, TELEX: 678447; Empl.: 90; *Sls. Mgr.:* David W. Kuntz, Mktg. Mgr.

MEL-RAIN CONTROLS, 42974 M-43 Hwy., Paw Paw, MI 49079, Tel: 616-657-2527; FSC No.: 639; Empl.: 20; *Sls. Mgr.:* Howard F. Walter

MEL TEC, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090, Tel: 617-329-1508, TELEX: 95-1110, TWX: 710-348-0484; Empl.: 180

MEMBRONICS DIVISION, Chicago Decal Company, 3310 North Elston Avenue, Chicago, IL 60618, Tel: 312-463-4007, FAX: 312-463-4065; *Sls. Mgr.:* Dick Gorney

FAX: 219-356-7376

MEMCOR-TRUOHM, INC., 1320 Flaxmill Rd., Huntington, IN 46750, Tel: 219-356-4300, TWX: 510-601-7258, ESYLNK: 62938315; FSC No.: 24681; Empl.: 250; *Sls. Mgr.:* Ray Vanderspool ..... **A•1956, 2086**

Local Sales Offices & Reps

AL Huntsville, Murcota 205-539-8476
CA Huntington Bch., Mil-Com Sls. 714-840-2424
CA Santa Clara, D.H. Ross 408-988-8111
FL Indialantic, Raycom 305-727-8860
GA Atlanta, Murcota 404-875-2525
IL Chicago, D. Dolin Sls. 312-286-6200
IN Ft. Wayne, Menze Sls. 219-747-5616
MI St. Clair Shores, J.M. Thorpe 313-779-6363
MO Blue Springs, Cairns Sls. Co. 816-229-1404
MO St. Charles, Hayes Elec. Sls. Co. 314-946-6677
NH Atkinson, Mark Rep Assoc. 603-382-9563
NJ Englewood Cliffs, Masin Esco 201-569-8868
NY Hauppauge, Masin Esco 516-273-3500
NY Marcellus, Mullahy Sls. Inc. 315-685-6280
NC Burlington, Murcota 919-585-1577
NC Winston-Salem, Murcota 919-723-1001
OH Cleveland, Glover Sls. 216-842-4520
PA Newtown Square, G.M. Conneen 215-353-2241
TX Dallas, SW Elctrn. Ind. 214-233-9816
TX Houston, SW Elctrn. Ind. 713-729-1670
WA Redmond, Barrett-Squibb 206-885-6991

MEMODYNE, 200 Reservoir St., Needham Hgts., MA 02194, Tel: 617-444-7000, TELEX: 92-2537, TWX: 510-600-8774, FAX: 617-449-7023; Empl.: 40; *Sls. Mgr.:* Leonard Sacon ..... **D•1096-1098**

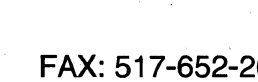
Local Sales Offices & Reps

AZ Scottsdale, Williams Assocs. 602-947-4297
CA Carson, Amasco 213-516-8561
CO Commerce City, Williams Assocs. 303-289-5647
CT Portland, BBI Elctrns. 203-342-0648
FL Orlando, DAI Sls. 305-299-7754
IL Elmhurst, Scott Assocs. 312-279-5681
MA Holbrook, McLellan Assocs. 617-767-4771
MI Detroit, EQS Sys. 313-961-3042
MI Pontiac, EQS Sys., Inc. 313-338-2280
NM Albuquerque, Williams Assocs. 505-255-1638
OH Chesterland, EQS Sys. 216-729-2222
OH Columbus, EQS Sys. 614-228-3453
OH Dayton, EQS Sys., Inc. 513-236-7676
OH Huber Hgts., EQS Sys., Inc. 216-729-2222
OK Tulsa, J. Wisdom & Assocs., Inc. 918-663-4814
OR Lake Oswego, Syntek 503-636-6793
PA Sellersville, Penn-Tech Sls. 215-257-2756
UT Salt Lake City, Williams Assocs. 801-485-6511
WA Kirkland, Syntek 206-488-0394

MEMORY PROTECTION DEVICES, INC., See Bogen Communications, Inc.

FAX: 619-292-0774

MEMORY X, 5205 Kearny Villa Way, No. 106, San Diego, CA 92123, Tel: 619-292-1151 ..... **A•1746**



FAX: 517-652-2659

MEMTRON TECHNOLOGIES, INC., 1400 Weiss St., Frankenmuth, MI 48734, Tel: 517-652-2656, 800-234-7525; FSC No.: 6 V 417; Empl.: 103; *Sls. Mgr.:* Daniel T. Ortner ..... **B•1828**

Local Sales Offices & Reps

AZ Mesa, Inmark 602-830-9104
AZ Mesa, R. F. Mayo & Assocs. 602-953-1295
CA Irvine, Cal-Rep 714-250-0567
CA Saratoga, Edward King & Assocs. 408-867-2111
CO Boulder, R. F. Mayo 303-442-2155
FL Maitland, EIR, Inc. 305-660-9600
GA Lawrenceville, Tek-Rep Mktg., Inc. 404-963-1600
IL Wheaton, Chadra-Schilke & Assocs., Inc. 312-653-8126
IN Indianapolis, EMCI, Inc. 317-253-1668
MA Framingham, Stone Comp. Sls. Corp. 617-875-3266
MI Detroit, Memtron Technlgs. 313-399-7078
MI Detroit, Memtron Technlgs., Inc. 313-545-8880
MO Saint Charles, Buckman & Assocs. 314-946-6201
NY Islip, ABS Technlgs., Inc. 516-277-7010
NY Liverpool, Syronics 315-451-0968
OH Columbus, Tom Mulligan Co. 614-457-2242
PA Southampton, Campbell Assocs. 215-322-6630
TX Richardson, Zonk & Assocs. 214-238-7651, 214-895-9131
VA Alexandria, Tech-Reps. Inc. 703-370-2600
WA Federal Way, K. R. Jensen Sls. 206-874-2772
Can Rexdale, Ont., Bestec Elctrns., Ltd. 416-674-1330

FAX: 407-881-3300

MEPCO/CENTRALAB CORP. HDQRTR., North American Philips Corporation, 2001 W. Blue Heron Blvd., Riviera Beach, FL 33404, Tel: 407-881-3200, TELEX: 136461, TWX: 810-848-0228
.. **A•1747, 1958, 1960, 2087; B•1014-1015, 1768-1770**

Local Sales Offices & Reps

AL	Huntsville, Over & Over	205-837-7105
AZ	Tempe, Mepco/Centralab	602-820-2225
CA	Anaheim, Mepco/Centralab	714-441-0385
CA	Harbor City, Refrigeration Comp.	213-325-3420
CA	Mission Hills, Mepco/Centralab	818-891-6299
CA	Mtn. View, Brooks Tech. Grp.	415-960-3880
CA	Pleasanton, Mepco/Centralab	415-462-2833
CA	San Diego, Mepco/Centralab	619-453-0332
CO	Englewood, Mepco/Centralab	303-779-9696
FL	Altamonte Springs, Mepco/Centralab	305-339-5073
FL	Ft. Lauderdale, Mepco/Centralab	305-485-0115
GA	Norcross, Over & Over, Inc.	404-449-6205
IL	Bannockburn, GMR Sls., Inc.	312-295-8440
IL	Des Plaines, Mepco/Centralab	312-827-4487
IN	Ft. Wayne, Corrao Marsh, Inc.	219-482-2725
IN	Greenfield, Carrao Marsh, Inc.	317-462-4446
IN	Indianapolis, Leslie M. Devoe Co.	317-842-3245
IA	Cedar Rapids, Lorenz Sls., Inc.	319-377-4666
KS	Merriam, Lorenz Sls.	913-384-6556
MD	Columbia, Delta III Assocs.	301-730-4700
MA	Stoneham, Mepco/Centralab	617-438-6050
MI	Farmington Hills, Mepco/Centralab	313-553-6010
MN	Minneapolis, Electric Comps. Sls., Inc.	612-933-2594
MO	University City, Lorenz Sls.	314-997-4558
NE	Lincoln, Lorenz Sls.	402-475-4660
NJ	Englewood Cliffs, Ed Glass Assocs.	201-592-0200
NJ	Mendham, Mepco/Centralab	201-543-2556
NY	Binghamton, Empire Tech. Assocs.	607-772-0651
NY	Skaneateles, Empire Tech. Assocs., Inc.	315-685-5703
NC	Charlotte, Over & Over, Inc.	704-542-9111
NC	Raleigh, Over & Over	919-782-9111
OH	Dayton, Mepco/Centralab	513-436-0066
OH	Wickliffe, Mepco/Centralab	216-731-7721
OR	Beaverton, Eclipse Mktg. Grp.	503-642-1661
PA	Narberth, Bresson Assocs.	215-664-6460
TX	Austin, Mepco/Centralab	512-331-8828
TX	Richardson, Mepco/Centralab	214-231-8274
WA	Redmond, Eclipse Mktg. Grp.	206-885-6991
WA	Spokane, Eclipse Mktg. Grp.	509-922-3972
WI	Milwaukee, Mepco/Centralab	414-228-4244
PR	Hato Rey, M. Anderson Co.	809-751-2026
Can	Montreal, PQ, Philips Elctrns.	514-342-9180
Can	N. Vancouver, BC, Arwin Tech. Sls.	604-980-4557
Can	Ottawa, Ont., Philips Elctrns.	613-722-1093
Can	Pickering, Ont., Alltemp Prod. Co.	416-831-3311
Can	Pickering, Ont., McHugh Elctrns.	416-831-4770
Can	Scarborough, Ont., Philips Elctrns.	416-292-5161
Can	Scarborough, Ont., Philips Elctrns.	416-292-8200
Can	Vancouver, B.C., Philips Elctrns.	604-435-4411

MEPCO/CENTRALAB, North American Philips Corporation, 4561 Colorado Blvd., Los Angeles, CA 90039, Tel: 818-240-4880, TWX: 910-497-2282; *Sls. Mgr.:* G. Ollen ..... **A•1123, 1957-1958; B•1014-1015**

MEPCO/CENTRALAB, North American Philips Corporation, 5900 Australian Avenue, W. Palm Bch., FL 33407, Tel: 305-842-3201, TELEX: 820677, TWX: 510-952-7631, FAX: 305-863-1811 ..... **A•1120**

MEPCO/CENTRALAB, INC., A North American Philips Co., 2566 Northwestern Ave., West Lafayette, IN 47906, Tel: 317-463-2536, TELEX: 810-342-1889; *Sls. Mgr.:* Pierre Lavignette ..... **A•1959; B•1014-1015**

MEPCO/CENTRALAB, North American Philips Corporation, Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501, Tel: 515-573-1300, FAX: 515-573-1342; FSC No.: 71590 ..... **A•2087; B•1768-1770**

MEPCO/CENTRALAB, North American Philips Corporation, 6071 St. Andrews Rd., Columbia, SC 29212-3198, Tel: 803-772-2500, TELEX: 805024, FAX: 803-772-2445 ..... **A•1121-1122**

DC Aluminum Electrolytic Capacitors (Computer Grade, Radial) Military, Industrial & Consumer AC Motor Starts, Film Capacitors (Film/Foil, Metallized) Tantalum Capacitors (Foil) Film Trimmer Capacitors

MEPCO/CENTRALAB, North American Philips Corporation, 7158 Merchant Ave., El Paso, TX 79915, Tel: 915-779-3961, TWX: 910-964-1311, FAX: 915-775-0149; *Sls. Mgr.:* R. Michaels ..... **A•1124**

MEPCO/CENTRALAB, North American Philips Corporation, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, Tel: 817-325-7871, TELEX: G.P.R.-881857/S.P.R.-820545, FAX: 817-325-7876 ..... **A•1957, 1960; B•1014-1015**

MEPCO/CENTRALAB, INC., A North American Philips Co., 2601 S. Moorland Rd., New Berlin, WI 53131, Tel: 414-785-6506, TWX: 910-262-3032 ..... **A•1747**

MEPCOPAL

FAX: 619-481-1123

MEPCOPAL COMPANY, 11468 Sorrento Valley Rd., San Diego, CA 92121, Tel: 619-453-0332, TELEX: 62547100, TWX: 910-337-1120; Empl.: 150 ..... **A•2088-2089; B•1771**

Potentiometers (Cermet, Carbon) Industrial & Military

Local Sales Offices & Reps

AL	Huntsville, Over & Over, Inc.	205-837-7105
AZ	Tempe, Mepco/Centralab	602-820-2225
CA	Anaheim, Mepco/Centralab	714-441-0385
CA	Mission Hills, Mepco/Centralab	818-891-6299
CA	Mtn. View, Brooks Tech. Grp.	415-960-3880
CO	Englewood, Mepco/Centralab	303-779-9696
FL	Altamonte Springs, Mepco/Centralab	305-339-5073
GA	Norcross, Over & Over Inc.	404-449-6205
IL	Bannockburn, Heth Inc.	312-295-8440
IL	Des Plaines, Mepco/Centralab	312-827-4487
IN	Indianapolis, Leslie M. Devoe Co.	317-842-3245
IA	Cedar Rapids, Lorenz Sls. Inc.	319-377-4666
KS	Merrian, Lorenz Sls. Inc.	913-384-6574
MD	Columbia, Delta III Assocs.	301-730-4700
MA	Stoneham, Mepco/Centralab	617-438-6050
MI	Farmington, Mepco/Centralab	617-438-6050
MI	Lathrup Vl., Mepco/Centralab	313-559-9095
MN	Minneapolis, Elec. Comps.	612-933-2594
MO	University City, Lorenz Sls. Inc.	314-997-4558
NE	Lincoln, Lorenz Sls. Inc.	402-475-4660
NJ	Mendham, Mepco/Centralab	201-543-2556
NY	Binghamton, Empire Tech. Assocs.	607-772-0651
NY	Rochester, Empire Tech. Assocs.	716-425-3775
NY	Skaneateles, Empire Tech. Assocs.	607-772-0651
NC	Charlotte, Over & Over Inc.	704-542-9111
OH	Dayton, Mepco/Centralab	513-436-0066
OH	Mentor, Mepco/Centralab	216-354-4350
OR	Beaverton, Eclipse Mktg. Grp.	503-642-1661
PA	Narberth, Bresson Assocs.	215-664-6460
TX	Austin, Mepco/Centralab	512-331-8828
TX	Richardson, Mepco/Centralab	214-231-8274
WA	Redmond, Eclipse Mktg. Grp.	206-885-6991
WI	Milwaukee, Mepco/Centralab	414-228-4245
Can	Ottawa, Philips Elctrns.	613-237-3134

mercer ELECTRONICS

FAX: 312-697-2272

MERCER ELECTRONICS, Simpson Electric Co., 853 Dundee Ave., Elgin, IL 60120, Tel: 312-697-2260, TELEX: 72-2416; *Sls. Mgr.:* Mike Scala; *Dist. Mgr.:* George Oskandy ..... **D•1298-1299**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean, Inc. of GA	205-830-1540
AZ	Tempe, Trembly Assocs.	602-967-2058
CA	Burlingame, William J. Purdy Co.	415-347-7701
CA	Downey, Simpson Elec. Co.	213-862-4259
CO	Denver, William J. Purdy Co.	303-753-6800
CT	Hartford, Sturgeon Co.	203-249-7800
FL	Lauderdale Lakes, Seacom Sls. Co.	305-486-0260
GA	Norcross, Cartwright & Bean, Inc. of GA	404-368-0160
IL	Park Ridge, Bob Burns & Assocs.	312-823-9360
IN	Carmel, Technlg. Mktg. Corp.	317-844-8462
LA	Covington, Cartwright & Bean, Inc. of TN	504-892-1780
MD	Lisbon, Samuel K. Macdonald, Inc.	301-982-1088
MA	Needham, Sturgeon Co.	617-444-6603
MI	Farmington Hills, R. C. Merchant & Co., Inc.	313-476-4600
MI	St. Joseph, R. C. Merchant & Co., Inc.	616-983-7378
MN	Edina, Mel Foster Tech. Sls., Inc.	612-941-9790
MS	Jackson, Cartwright & Bean, Inc. of TN	601-981-1170
MO	Blue Springs, Kathrinus-Kelly-Baumhaure Co.	816-229-0001
MO	St. Louis, Kathrinus-Kelly-Baumhauer & Co.	314-647-2400
NV	Las Vegas, Trembly Assocs.	702-739-9770
NM	Albuquerque, C. T. Carlberg & Asoc., Inc.	505-836-1448
NY	Clarence Ctr., L. D. Allen, Inc.	716-835-1955
NY	Clifton Pk., L. D. Allen, Inc.	518-371-2798
NY	Rochester, L. D. Allen, Inc.	716-244-9618
NY	Syracuse, Leonard D. Allen, Inc.	315-437-8387
NC	Charlotte, Cartwright & Bean	704-377-5673
IL	Elgin, Simpson Elec.	312-697-2260
NC	Raleigh, Cartwright & Bean	919-876-4130
OH	Dayton, Baehr-Greenleaf & Assocs.	513-439-0724
OH	Westlake, Baehr-Greenleaf & Assoc., Inc.	216-892-1770
OH	Worthington, Baehr-Greenleaf & Assocs.	614-847-0220
OK	Oklahoma city, J. Y. Schoonmaker Co.	214-349-1650
OR	Beaverton, Earl & Brown	503-643-5500
PA	Monroeville, Samuel K. Macdonald	412-373-1723
PA	Willow Grove, Samuel K. Macdonald	215-659-4414
TN	Knoxville, Cartwright & Bean	615-693-7450
TN	Knoxville, Cartwright & Bean, Inc. of GA	615-693-7450
TN	Memphis, Cartwright & Bean Co.	901-276-4442
TX	Dallas, J. Y. Schoonmaker Co., Inc.	214-349-1650
TX	Houston, J. Y. Schoonmaker Co.	214-349-1650
WA	Redmond, Earl & Brown Co., Inc.	206-885-5064
EXP	IL/Elgin, Simpson Elec.	312-697-2260

MERCURY PLASTICS, A UNIT OF ZERO CORP., 672 Fuller Rd., Chicopee, MA 01020, Tel: 413-267-5561, TWX: 710-354-1450; Empl.: 100; *Sls. Mgr.:* Roger St. Martin

MERECO PRODUCTS DIV., Metachem Resins Corp., 1505 Main St., West Warwick, RI 02893, Tel: 401-828-4550; Empl.: 100; *Sls. Mgr.:* John E. Powell, Jr.

MERET, INC., 1815 24th St., Santa Monica, CA 90404-4998, Tel: 213-828-7496, TELEX: 65-246 8 SNM, FAX: 213-828-7567; Empl.: 45; *Sls. Mgr.:* Jonathan Medved ..... **B•1172**

Local Sales Offices & Reps

CA	West Covina, Eureka Tech. Sls., Inc.	213-331-8766
CO	Lakewood, Technical Mktg. Mfg. Inc.	303-232-1516
MA	Brookline, Boston Elctrn. Corp.	617-566-3821
MO	St. Louis, Engrg. Svcs. Co.	314-997-1515
NM	Albuquerque, Tech. Mktg. & Mfg.	505-298-6893
IL	Northrock, Emtech	312-564-2505
NY	Elmsford, Metro-Tek Assocs.	914-347-4112
VA	Fairfax, Schibley Assocs.,Inc.	703-591-3008

MERIX CHEMICAL CO., 2234 East 75th St., Chicago, IL 60649, Tel: 312-221-8242; Empl.: 15; *Sls. Mgr.:* E. O. Sonneman; *Dist. Mgr.:* E. O. Sonneman

MERRILL, POB 308, 1316 Sumneytown Pike, Gwynedd Valley, PA 19437, Tel: 215-643-2116; FSC No.: 58624; Empl.: 10; *Sls. Mgr.:* J. Fournier

MERRIMAC INDUSTRIES, 41 Fairfield Pl., West Caldwell, NJ 07006, Tel: 201-575-1300, TELEX: 6853128, FAX: 201-575-0531; FSC No.: 12457; Empl.: 300

Local Sales Offices & Reps

AZ	Scottsdale, Territorial Mktg.	602-994-8665
CA	Mountain View, Pacific Tech Mktg.	415-969-3010
CA	Westlake Village, MCA Repco	818-889-5553
CO	Boulder, Herb Bass Assoc.	303-530-7509
FL	Orlando, Techn. Mktg. Assocs.	305-857-3760
IL	Chicago, Techn. Sls.	312-237-7210
MD	Baltimore, Burgin-Kreh Assocs.	301-265-8500
MA	Wakefield, Spectrum Mktg.	617-246-4740
NJ	Teterboro, Tech. Mktg. Assoc.	201-393-9330
NY	Syracuse, T-Squared Elecs.	315-463-8592
PA	S. Hampton, Eastern Instrmn.	215-355-7700
TX	Richardson, Carl Tinch Sls.	214-231-1322

MERRIMACK MAGNETICS CORP., 121 Hale St., Lowell, MA 01851, Tel: 617-458-1487; Empl.: 450; *Sls. Mgr.:* Richard Boucher; *Dist. Mgr.:* Mellisa Lavers

J. R. MERRITT CONTROLS, INC., 8 Crimmins Rd., Darien, CT 06820, Tel: 203-656-0143, TWX: 510-601-6932JRMC, FAX: 203-656-0162

MESUR-MATIC ELCTRNS., 10 Colonial Rd., Ste. 6, Salem, MA 01970-2294, Tel: 617-745-7000; Empl.: 29; *Sls. Mgr.:* Kosma L. Evangelidis

METATEK INC., 290 Coon Rapids Blvd. N. W., P.O. Box 33129, Minneapolis, MN 55433, Tel: 612-786-8253, TELEX: 4994418 Metatek; Empl.: 6; *Sls. Mgr.:* Don Hallblade; *Dist. Mgr.:* Don Hallblade

METEREX CORP., 25 Industrial Park Rd., Hingham, MA 02043, Tel: 617-749-8100; Empl.: 4; *Sls. Mgr.:* K. Sharples

METERMASTER, 5646 Jullson St, Los Angeles, CA 90040, Tel: 213-685-4340

METHODE ELECTRONICS, INC., 7444 W. Wilson Ave., Chicago, IL 60656, Tel: 312-867-9600, TWX: 910-221-2468; Empl.: 2000; *Sls. Mgr.:* S. Landeene; *Dist. Mgr.:* K. Lindsey

METHODE ELECTRONICS, INC., Interconnect Prods Div, 1700 Hicks Rd, Rolling Meadows, IL 60008, Tel: 312-392-3500, TWX: 910-687-0760, FAX: 312-392-9404; FSC No.: 95354; Empl.: 250; *Sls. Mgr.:* Suzi Landeene; *Dist. Mgr.:* Kathy Lindsey

METIS, P.O. Box 1499, Bowie, MD 20716, Tel: 301-249-1702; Empl.: 2; *Sls. Mgr.:* Eric K. Pritchard

METRA BYTE CORP., 440 Myles Standish Blvd., Taunton, MA 02780, Tel: 617-880-3000, TELEX: 503989; FSC No.: 1 FG 11; Empl.: 50; *Sls. Mgr.:* Bendrix Bailey; *Dist. Mgr.:* Bendrix Bailey ..... **D•1173**

Local Sales Offices & Reps

AL	Huntsville, Magaro Assocs.	205-882-0827
AZ	Phoenix, Louis James & Assocs.	602-992-0872
CA	Orange, X. B. X. Sls.	714-998-8200
CA	Santa Clara, Nelson Elctrn.	408-980-1950
CO	Commerce City, Louis James & Assocs.	303-287-4657
GA	Atlanta, Magaro Assocs.	404-451-8862
IL	Chicago, Berndt Assocs.	312-283-0713
IN	Carmel, Berndt Assocs.	317-844-0114
MI	Livonia, Lowell-Wendt Mktg.	313-464-2722
MN	Minneapolis, Berndt Assocs.	612-546-2021
NJ	W. Caldwell, PCS	201-575-7464
NC	Greensboro, Magaro Assocs.	919-294-4783
PA	Jenkintown, Monument Tech. Assocs.	215-884-3737
UT	Salt Lake City, Louis James & Assocs.	801-487-3851
WA	Woodinville, Louis James & Assocs.	206-788-5228
WI	Milwaukee, Berndt Assocs.	414-545-8400
Can	St. Laurant, Quebec, Techmatron Inst., Inc.	514-689-5889

METRA INSTRUMENTS, 2056 Bering Dr., San Jose, CA 95131, Tel: 408-436-8530, TELEX: 296698; Empl.: 30; *Sls. Mgr.:* John R. Hook

METRAPLEX CORP., 5305 Spectrum Dr., Frederick, MD 21701, Tel: 301-662-8000, TELEX: 697-4248 MPX CORP, FAX: 301-695-8099

METRIC SYSTEMS, 645 Anchors St., Ft. Walton Beach, FL 32548-9990, Tel: 904-244-9600, TELEX: 70-2447; FSC No.: 12339; Empl.: 700

METRIX INSTRUMENT CO., 1711 Townhurst, Houston, TX 77043, Tel: 713-461-2131, TELEX: 77-5486, FAX: 713-461-8223; Empl.: 50; *Sls. Mgr.:* W. B. Brown

METROLAB INSTRUMENTS SA, 6, Chemin du Clos, Geneva (Lancy), Switzerland CH-1212, Tel: (41-22) 941121, FAX: 41-22-941120

METRON OPTICS INC., P.O. Box 690, Solana Beach, CA 92075-0690, Tel: 619-755-4477, FAX: 619-755-4752; Empl.: 22

METROPOLE PRODUCTS INC., P. O. Box 309, Stafford, VA 22554, Tel: 703-659-2132, 703-971-7082, FAX: 703-659-2133; FSC No.: 55908; *Sls. Mgr.:* John DePaola

METROSONICS, INC., Box 23075, Rochester, NY 14692-3075, Tel: 716-334-7300, TELEX: 853348, FAX: 716-334-2635; FSC No.: 55381; Empl.: 80; *Sls. Mgr.:* R. Branch; *Dist. Mgr.:* S. Macioulis

FAX: 201-679-3222

METUCHEN CAPACITORS, INC., 139 White Oak Ln., P.O. Box 499, Old Bridge, NJ 08857, Tel: 201-679-3366, TWX: 710-998-0892; FSC No.: 55969; Empl.: 25; *Sls. Mgr.:* George Wolter ..... **A•1126-1133, 1672-1673; C•1452-1455**

Local Sales Offices & Reps

MD	Potomac, C.E. Tech. Elctrns.	301-235-1942
MA	Lowell, Underwood Sls.	617-256-8191
MO	Ellisville, Gateway Tech. Sls.	314-391-6543
MO	Grandview, R. R. Burton Assocs.	816-763-5385
NJ	Brielle, EMC Technigsts.	201-223-6699
NY	Islip, EMC Technigsts.	516-277-2395

MEYER WIRE & CABLE CO., Div. of Cole Hersee Co., 1072 Sherman Avenue, Hamden, CT 06514, Tel: 203-281-0817, TWX: 910-240-0340, ESYLNK: 62938426, FAX: 203-281-9648; Empl.: 45; *Sls. Mgr.:* Spencer G. Molloy, VP Sls.

MFE INSTRUMENTS CORP., 19 Keewaydin Dr., Salem, NH 03079, Tel: 603-893-1921, ESYLNK: 953145; Empl: 60; *Sls. Mgr.:* Dennis Doscher; *Dist. Mgr.:* Dennis Doscher

MF ELCTRNS. CORP., 10 Commerce Dr., New Rochelle, NY 10801, Tel: 914-576-6570, TWX: 710-563-0643; FSC No.: 08111; Empl.: 100; *Sls. Mgr.:* Zaw Nawaday; *Dist. Mgr.:* Frank Aliberga ..... **A•1418-1419**

Local Sales Offices & Reps

AZ	Scottsdale, Bill Earl Assocs.	602-944-3813
CA	Irvine, J. V. Earley & Assocs.	714-833-1806
CA	San Jose, Mac Tron	408-446-8224
CO	Denver, Matthews & Assocs.	303-450-6476
CT	Meriden, Orion Group	203-621-8371
FL	Tampa, SRT Mktg.	813-884-4805
MA	Wakefield, The Orion Group	617-245-5220
MN	Edina, Peterson Sls. & Assoc.	612-944-0030
NC	Raleigh, Tingen Tech. Sls.	919-878-4440
OR	Portland, Core II	503-641-0877
PA	Prospect Park, ELF Sls.	215-534-3340
TX	Dallas, Matthews & Assocs.	214-248-7881
WA	Seattle, Core II Mktg.	206-467-0622

Local Distributors

CA	Anaheim, Pacesetter Elctrns.	714-779-5855
CA	Burbank, Atwater Elctrns.	714-670-1426
CA	Sunnyvale, Pacesetter	408-734-5470
NJ	Bellmawr, Mid Atlantic	609-931-5303
NY	Bohemia, RBD Elec.	516-589-7717
NY	Cen. Islip, Domino Comps.	609-931-5303
NY	Mt. Vernon, Janesway Elec.	914-699-6710

MFG-WEST, Parabam Div., 1130 Watsoncenter Rd., Carson, CA 90745, Tel: 213-549-5044; Empl.: 85

MFI, 12304 Santa Monica Blvd., Ste. 121, Los Angeles, CA 90025, Tel: 213-826-8133, 800-533-2297, FAX: 213-820-6958 ..... **D•1093**

MFM TECHNOLOGY, INC., Affiliate of Unitrode Corp., 200 Thirteenth Ave., Ronkonkoma, NY 11779, Tel: 516-467-5151, TELEX: 221-500ASAS, FAX: 516-467-5176; Empl.: 25 ..... **B•1233**

Local Sales Offices & Reps

CT	Vernon, Jerry Pfau Assocs.	203-647-9852
MN	Cottage Grove, Applied Motion Technlg.	612-459-0600
NJ	Princeton, Associated Controls, Inc.	609-799-7020
NC	Charlotte, Servicon Sls. Corp.	704-525-4800
OH	Toledo, Cubbedge Controls, Inc.	419-535-5530
TX	Denton, Texonics, Inc.	817-382-4159
CA	San Jose, Motion Control-North	408-997-0544

FAX: 516-582-3229

MG ELECTRONICS, 32 Ranick Rd., Hauppauge, NY 11788, Tel: 516-582-3400, TELEX: 645113; Empl.: 14; *Sls. Mgr.:* John Kibbit; *Dist. Mgr.:* Stan Grey ..... **D•1039**

MHOTRONICS., INC., 444 Lake Cook Rd., Ste. 8, Deerfield, IL 60015, Tel: 312-948-5600, TWX: 910-686-0630, FAX: 312-948-5604; Empl.: 10; *Sls. Mgr.:* David McFadden

MICA CORPORATION, 8536 National Blvd., Culver City, CA 90232, Tel: 213-837-8100, TELEX: ITT 4720769; FSC No.: 06216;Multiple; Empl.: 300

MICHIGAN MAGNETICS, 203 W. Third St., Vermontville, MI 49096, Tel: 517-726-0590; Empl.: 35; *Sls. Mgr.:* Tom Krul

MICOM SYSTEMS, INC., 4100 Los Angeles Ave, P.O. Box 8100, Simi Valley, CA 93062-8100, Tel: 805-583-8600, TELEX: 687-497, TWX: 910-494-4910

MICRA CORP., 120 Ricefield Lane, Hauppauge, NY 11788, Tel: 516-231-8600, TWX: 882633 MICRA US; FSC No.: 63071; Empl.: 200; *Sls. Mgr.:* Ronald P. Colino

MICREL, INC., 1235 Midas Way, Sunnyvale, CA 94086, Tel: 408-245-2500, TWX: 910-379-0007, FAX: 408-245-4175; FSC No.: 60496; Empl.: 120; *Sls. Mgr.:* Stan Ericsson

MICROAVIONICS CORP., 3198-K Airport Loop Dr., Costa Mesa, CA 92626, Tel: 714-957-6904; Empl.: 15; *Sls. Mgr.:* B. H. Corzine ..... **C•1634; D•1136**

Local Sales Offices & Reps

CA	Los Angeles, Forbes Pacific, Inc.	714-722-6174

MICROBAR SYSTEMS, INC., 785 Lucerne Drive, Sunnyvale, CA 94086, Tel: 408-720-9300, TWX: 910-373-2047; *Sls. Mgr.:* W. Barrett Burton

MICROCAP, INC., A MicroSemi Company, 501 South Andreasen Drive, Escondido, CA 92025, Tel: 619-480-1906, FAX: 619-480-6741; Empl.: 65; *Sls. Mgr.:* Ken Miller, Sls. Mgr.

MICROCHIP TECHNOLOGY INC., Sub. of General Instrument Corp., 2355 W. Chandler Blvd., Chandler, AZ 85224, Tel: 602-963-7373, TWX: 910-950-1963, FAX: 602-899-9210; *Sls. Mgr.:* Phil Hubbert

MICRO-CIRCUIT ENGRG., See MCE Semiconductor

MICRO-CIRCUITS CO., INC., 10792 Maublin Rd., New Buffalo, MI 49117, Tel: 616-469-2727, FAX: 616-469-2742 ..... **C•1121**

MICRO-COAX COMPONENTS, INC., a UTI Company, Box E, Collegeville, PA 19426, Tel: 215-489-3700, TELEX: 84-6428, TWX: 510-660-6107, ESYLNK: 62961019, FAX: 215-489-1103; Empl.: 50; *Sls. Mgr.:* Lloyd Deery

MICROCOMPUTER POWER, 15875 Concord Circle, Morgan Hill, CA 95037, Tel: 408-779-5700, TWX: 910-338-7694; Empl.: 60; *Sls. Mgr.:* Ray Parker; *Dist. Mgr.:* Ray Parker

MICROCOSM, INC., 15275 S.W. Koll Parkway, Beaverton, OR 97006, Tel: 503-626-6100, TELEX: 759527 (Microcosm UD); Empl.: 30; *Sls. Mgr.:* M. L. Epperson

MICRO CRYSTAL DIVISION / SMH

FAX: 212-505-6787

MICRO CRYSTAL DIVISION, SMH, 35 E. 21st Street, New York, NY 10010, Tel: 212-505-5340, TELEX: 239 865 eta ur; *Dist. Mgr.:* Thomas Camazza ..... **A•1421-1423**

Local Sales Offices & Reps

CA	Palo Alto, Saronix	415-856-6900
FL	Pompano Bch., H H P Assocs.	305-971-5750
NH	Nashua, Bell Controls	603-882-6984
OH	Mt. Orab, Ben Jenn Engrg.	513-444-3175

MICRO DEVICES PRODUCT GROUP

FAX: 419-756-4542

MICRO DEVICES PRODUCT GROUP, Therm-O-Disc, Inc., 1320 South Main Street, P.O. Box 3538, Mansfield, OH 44907, Tel: 419-756-5911, TELEX: 987455 ..... **B•1343, 1873**

MICRODOT, INTERCONNECT SYSTEMS DIVISION, 201 Progress Dr., Montgomeryville, PA 18936, Tel: 215-699-5373, FAX: 215-699-5536; FSC No.: 91886; *Sls. Mgr.:* K. A. Neumuller ..... **B•1016-1017; C•1456-1459, 1730-1731, 1862-1863**

Local Sales Offices & Reps

AZ	Mesa, Sedco Sls.	602-461-9069
CA	Fullerton, Libratronix	714-871-1513
CO	Longmont, Todd & Fry Assocs.	303-776-7331
CT	Simsbury, Pettigrew Co.	203-651-4321
FL	Largo, Q Rep	813-393-6393
IL	Rolling Meadows, Heartland Tech. Mktg.	312-577-9222
IA	Cedar Rapids, S & O Sls.	319-363-7323
KS	Overland Park, AME Sls.	913-262-3971

MA Needham, Component Tech. 617-449-8490
MI Farmington Hills, Carter, McCormic & Pearce 313-477-7700
MN Eden Prairie, The Twist Co. 612-941-2040
NM Albuquerque, Reptronix 505-292-1718
NY E. Syracuse, Ossman Assocs. 315-437-7052
NY Ossmann Assocs., Ossman Comps. .. 716-424-4460
NY Yonkers, Sonkin Assocs. 914-968-8282
OH Berea, Carter, McCormic & Pearce 216-826-0400
OR Beaverton, Blair Hirsh Co. 503-641-1875
PA Horsham, Jacobsen Assocs. 215-674-2937
TX Dallas, M Rep 214-484-5711
VA Sterling, Beacon North 703-478-2480
WA Lynnwood, Blair Hirsh Co. 206-774-8151
WI Brookfield, Heartland Tech. Mktg. 414-796-1128

Local Distributors

AZ Tempe, Hamilton Avnet 602-231-5100
CA Chatsworth, Hamilton Avnet 818-700-6500
CA Culver City, Hamilton Avnet 213-558-2657
CA Placentia, Telesis Elctrns. 714-579-7555
CA San Diego, Hamilton Avnet 619-571-7510
CA Santa Clara, Pyramid Elctrns. 408-727-9810
CA Sunnyvale, Hamilton Avnet 408-743-3372
CT Danbury, Hamilton Avnet 203-797-2800
FL Ft. Lauderdale, Hamilton Avnet 305-971-2900
FL Winter Park, Hamilton Avnet 305-628-3888
IL Bensenville, Hamilton Avnet 312-860-7700
MD Columbia, Hamilton Avnet 301-995-3500
MA Peabody, Hamilton Avnet 617-531-7430
NH Manchester, Yankee Elctrn. Supp. 603-625-9746
NJ Cherry Hill, Hamilton Avnet 609-424-0100
NJ Fairfield, Hamilton Avnet 201-575-3390
NJ Old Bridge, BTC Elctrn. Comps. 201-536-8000
NY Hauppauge, Hamilton Avnet 516-231-9800
NY Rochester, Hamilton Avnet 716-475-9130
NY Syracuse, Hamilton Avnet 315-437-2641
NY Westbury, Hamilton Avnet 516-997-6868
PA Pittsburgh, Hamilton Avnet 412-281-4150
PA Wayne, Peak Elctrn. Corp. 215-293-9000
TX Irving, Hamilton Avnet 214-659-4912
UT Salt Lake City, Hamilton Avnet 801-972-2800

MICRODRY CORP., Golden Grain Macaroni Co., 3111 Fostoria Way, San Ramon, CA 94583, Tel: 415-866-9012, TELEX: 33-5320; Empl.: 40; *Sls. Mgr.:* Dave Northrup

MICRO ELECTRONIC SYSTEMS, INC., 3 Quarry Road, Brookfield, CT 06804, Tel: 203-775-1440, 800-243-7254, TELEX: 969659, FAX: 203-775-6903

MICRO-ETCH PRODUCTS, INC., 94 Dodge Ave., P.O. Box 9712, Stratford, CT 06497, Tel: 203-378-8610, FAX: 203-375-6276; FSC No.: 24846; Empl.: 42; *Sls. Mgr.:* Frank Dichiara; *Dist. Mgr.:* Frank Dichiara

MICROFLECT CO., INC., 3575 25th St. S.E., P.O. Box 12985, Salem, OR 97309-0985, Tel: 503-363-9267, TWX: 510-599-0107, FAX: 503-363-4613; Empl.: 100; *Sls. Mgr.:* John J. Kranitz

MICRO HYBRIDS, INC., 2864 Route 112, Medford, NY 11763, Tel: 516-732-3448, FAX: 516-732-3393; FSC No.: 5962; Empl.: 7; *Sls. Mgr.:* Bruce Richardson

MICRO INDUSTRIES, 691 Greenscrest Drive, Westerville, OH 43081, Tel: 614-895-0404, ESYLNK: 759200, FAX: 614-882-6357; *Dist. Mgr.:* Linda Van Fleet

MICRO INSTRUMENT COMPANY, 2250 Micro Pl, Escondido, CA 92025, Tel: 619-746-2010, TELEX: 882205 MICROINST ESCD, FAX: 619-746-0433; FSC No.: FSCM 24836; Empl.: 45; *Sls. Mgr.:* C. Marks (Eastern), C. Blakeslee (Western)

MICROLAB/FXR, 10 Microlab Rd., Livingston, NJ 07039, Tel: 201-992-7700, TWX: 710-994-4850; FSC No.: 00929; Empl.: 80

MICRO LAMPS INC., 1055 Paramount Pkwy., Batavia, IL 60510, Tel: 312-879-0900; *Sls. Mgr.:* Shirley A. Jaeger

MICROLOGIC, INC., 108 Water St., Watertown, MA 02172, Tel: 617-923-1700; *Sls. Mgr.:* Yogendra Jain

MICROMETALS, 1190 N. Hawk, Anaheim, CA 92807, Tel: 714-630-7420, TWX: 910-591-1690, FAX: 714-630-5891; FSC No.: 12856; Empl.: 70; *Sls. Mgr.:* K. Baker, Jr.

Local Sales Offices & Reps

MA Westborough, Anchor Engrg. 617-898-2724
NY Hempstead, Kahgan Sls. 516-538-2300
TX Dallas, Southwest Elctrns. 214-690-9881

MICRO MODE PRODS., 1870 John Towers Ave., El Cajon, CA 92020, Tel: 619-449-3844, TWX: 910-331-1673; FSC No.: 15907; Empl.: 40; *Sls. Mgr.:* V. DeMarco; *Dist. Mgr.:* V. DeMarco

Micro Mo

FAX: 813-821-6220

MICRO MO ELECTRONICS, INC., 742 2nd Ave. S., St. Petersburg, FL 33701, Tel: 813-822-2529, TELEX: 807-982; Empl.: 25; *Sls. Mgr.:* S. J. O'Neil ..... **B•1180, 1234-1237, 1898; D•2174**

MICRO-MOUNTING DEVICES, 4092 Keith Dr., Campbell, CA 95008, Tel: 408-866-4626; FSC No.: 59058

micronel®

FAX: 619-727-4436

MICRONEL U.S., 2142F Industrial Ct., Sycamore Research Center, Vista, CA 92083, Tel: 619-727-7400; FSC No.: 61655; Empl.: 10; *Sls. Mgr.:* N. Linko ..... **C•1688-1689**

MICRONETICS, 36 Oak St., Norwood, NJ 07648, Tel: 201-767-1320, TWX: 710-991-9603; FSC No.: 54487; Empl.: 26; *Sls. Mgr.:* Dick Farrell ..... **D•1300**

MICRO NETWORKS, Unitrode Corporation, 324 Clark St., Worcester, MA 01606, Tel: 617-852-5400, TELEX: 951808, TWX: 710-340-0067, FAX: 617-853-8296; Empl.: 318; *Sls. Mgr.:* Martha Cheesman

MICRONICS TECHNOLOGY INC., 7 Alexander Place, Glen Cove, NY 11542, Tel: 516-759-5600, FAX: 516-759-5603; *Sls. Mgr.:* John Mruz

MICRON INDUSTRIES, 1830 N. 32nd Ave., Stone Park, IL 60165, Tel: 312-345-0788, FAX: 312-345-0047; FSC No.: 30882; Empl.: 115; *Sls. Mgr.:* Michael Kitun; *Dist. Mgr.:* Mike Kadrowicz

MICRO-NOW INSTR. CO., INC., 8260 N. Elmwood St., P. O. Box 1488, Skokie, IL 60077, Tel: 312-677-4700, TELEX: RCA 297214-MICRO-UR, FAX: 312-677-0394; FSC No.: 33288; Empl.: 25; *Sls. Mgr.:* C. Arnow

Local Sales Offices & Reps

AL Huntsville, W. A. Brown Instr. 205-830-9224
CA Los Angeles, Mc Dougall/Mc Laughlin 213-477-8556
CA Mountain View, Mark V Assoc. 415-964-6275
CO Boulder, H. Bass Assocs. 303-499-7509
CT Wallingford, Pat Jenks Assoc. 203-265-9939
MA Woburn, Pat Jenks Assoc. 617-938-0488
NM Albuquerque, IMEC 505-344-2212
NY E. Syracuse, E.M. Tech 315-437-6410
NY Kings Park, USTM Tech. Mktg. 516-724-4250
PA Melrose Park, Robert Meyers Assoc. .. 215-224-1663
WA Seattle, Datacom 206-285-2525

FAX: 818-358-6478

MICRO-OHM CORP., 1088 Hamilton Rd., Duarte, CA 91010, Tel: 818-3575377, TWX: 910-587-3425; FSC No.: 20940; Empl.: 109; *Sls. Mgr.:* Chas. Schwab; *Dist. Mgr.:* Chas. Schwab ..... **A•1962-1967; B•1850**

Local Sales Offices & Reps

AL Huntsville, Remco 205-533-3763
AZ Phoenix, Toward Engrg. 602-955-3193
CA Laguna Hills, Cravins Assoc. 714-240-7242
CA San Diego, Cerco 619-450-1754
CO Denver, William Purdy Co. 303-790-2211
IL Lake Bluff, R & R Mktg. Assocs. 312-295-6600
MA Canton, N E E S Co. 617-828-4835
OH Cleveland, Jim Finnigan & Co. 216-238-5905
OR Beaverton, P.M.S. 503-641-9373
TX Austin, Sage Mktg. 512-335-0300

Local Distributors

CA Burlingame, Rose Elctrns. 415-348-2740
CA Canoga Park, Myco-Vickers 213-340-2025
CA Costa Mesa, Orange County Comps. 714-979-3597
CA San Diego, Shelley Elctrns. 619-453-7133
MN Minneapolis, Electronic Ctr. 612-371-5200
NH Hampstead, Astrum Elctrns. 603-329-5656
NY New Rochelle, Derf Elctrns. 914-235-4600
NY Oceanside, Tritech 516-678-6222
PA McKean, Advacom 814-476-7774
TX Ft. Worth, Industrial Elect. 817-731-7321
UT Provo, Central Utah Elctrns. Supp. 801-373-7522
UT Salt Lake City, Nytronics 800-242-7612

MICROPAC INDS., INC., General Sensors Div., 905 E. Walnut St., Garland, TX 75040, Tel: 214-272-3571, TWX: 910-860-5186, FAX: 214-494-2281; Empl.: 120; *Sls. Mgr.:* Richard Schlueter

MICROPHASE, 587 Connecticut Ave., Norwalk, CT 06856, Tel: 203-866-8000, TWX: 710-468-0003; Empl.: 230; *Sls. Mgr.:* F. S. Parin

MICRO PLASTICS INC., Hwy 178 North, P.O. Box 149, Flippin, AR 72634, Tel: 501-453-2261, TELEX: 783036, FAX: 501-453-8676; FSC No.: 13764; Empl.: 150; *Sls. Mgr.:* J. H. Beijen; *Dist. Mgr.:* N. Vandermast

MICROPLEX, INC., 1977 State College Blvd., Anaheim, CA 92806, Tel: 714-979-8833, 714-634-1535, FAX: 714-634-8375; Empl.: 30

MICRO POWER INTL., INC., 9420 Activity Rd., San Diego, CA 92126, Tel: 619-271-0831, 619-271-5942; Empl.: 39

MICRO POWER SYS. INC., 3100 Alfred St., Santa Clara, CA 95050, Tel: 408-727-5350, TWX: 910-338-0154; FSC No.: 54186; Empl.: 305; *Sls. Mgr.:* Don Cavallo; *Dist. Mgr.:* Reed Neddermeyer

MICRO-PRODUCTS ENGINEERING CO., 230 Ridgewood Ave., Newark, NJ 07108, Tel: 201-824-8467; Empl.: 100; *Sls. Mgr.:* Gerald Muller

MICROSCIENCE, INC., 182 Forbes Rd., Braintree, MA 02184, Tel: 617-849-1952, TELEX: 750-480, FAX: 617-843-9812; Empl.: 17; *Sls. Mgr.:* William Hall

MICROSEMI CORP., 2830 S. Fairview St., Santa Ana, CA 92704, Tel: 714-979-8220, TELEX: 4720306, FAX: 714-557-5989; FSC No.: 14552; Empl.: 1100; *Sls. Mgr.:* R. M. Shultz; *Dist. Mgr.:* G. Avila

MICROSEMI CORP. COLORADO, Microsemi Corp., 800 Hoyt St., Broomfield, CO 80020, Tel: 303-469-2161, TWX: 510-601-5396, FAX: 303-466-3775; Empl.: 140; *Sls. Mgr.:* Robert H. Werner; *Dist. Mgr.:* Patrick J. Gormley

MICROSIGNAL INC., P.O. Box 60312, Santa Barbara, CA 93160, Tel: 805-964-2227; Empl.: 6; *Sls. Mgr.:* Jim Norton

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FAX: 617-337-4208

MICROSONICS INC., 60 Winter St., Weymouth, MA 02188, Tel: 617-337-4200, TWX: 710-388-6833; FSC No.: 11869; Empl.: 200; *Sls. Mgr.:* James Crehan ... **A•1425**

Local Sales Offices & Reps

AZ Scottsdale, Detomasi & Grupp 602-947-3724
CA Los Altos, Kolm Mktg. 415-948-2635
CA Mission Hills, Detomasi & Grupp 818-365-8285
CA San Diego, Detomasi & Grupp 619-277-0178
CA Torrance, Detomasi & Grupp 213-618-8898
FL Orlando, TMA 305-857-3760
IL Mt. Prospect, Cain forlaw Co. 312-253-3578
MD Ellicott City, V.P.I. 301-461-2525
MA Lexington, O'Sullivan & Murphy 617-862-6570
NJ Glen Gardner, F & M Tech. Sls. 201-832-7216
NY Liverpool, R & D Assocs. 315-457-0100
OH Lancaster, Cain Forlaw Co. 614-654-4800
TX Dallas, Gamma Opt 214-783-4758

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a Honeywell Division

FAX: 815-235-5574

MICRO SWITCH, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032, Tel: 815-235-6600, Telex: 257499; TWX: 910-642-0922. Empl.: 3000; *Sls Mgr.:* J. J. Tropsa; *Dist. Mgr.* R. A Garner ..... **B•1772-1773**

Local Sales Offices & Reps

CA	Orange	714-953-4875
CA	San Jose	408-433-3008
CO	Englewood	303-792-1632
CT	Hartford	203-695-4011
GA	Atlanta	404-982-2565
IL	Bensenville	312-860-3968
IA	Bettendorf	319-359-3441
MA	Newton	617-969-0265
MI	Southfield	313-424-3569
MN	Minneapolis	612-830-3516
MO	St. Louis	314-569-7620
NJ	Westfield	201-233-9200
NY	Rochester	716-424-2700
NC	Charlotte	704-364-4770
OH	Brooklyn Heights	216-459-6075
OH	Dayton	513-237-4075
PA	Valley Forge	215-666-8340
TX	Dallas	214-701-2876
TX	Houston	713-780-6651
WA	Bellevue	206-453-7591
WI	Brookfield	414-784-6260
Can	Edmonton	403-453-4727
Can	Ottawa	613-224-3822
Can	Vancouver	604-291-6631
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MICRO SYSTEMS ENGINEERING, INC., 6024 S.W. Jean Rd., Lake Oswego, OR 97035, Tel: 503-635-4016, TELEX: 151-538; FSC No.: 75800; Empl.: 60; *Sls. Mgr.:* Maury Reiter

MICROTECH, 1420 Conchester Hwy., Boothwyn, PA 19061, Tel: 215-459-3566; Empl.: 22; *Sls. Mgr.:* H. Carter

MICRO TECHNICAL INDUSTRIES, 23132 La Cadena Dr. Ste. E, Laguna Hills, CA 92653, Tel: 714-855-4326, TELEX: 371-9688, FAX: 714-855-9545; Empl.: 20; *Sls. Mgr.:* Joe Duarte

Local Sales Offices & Reps

CA	San Juan Capistrano, Craven & Assocs.	714-240-7242
MA	Cohasset, Resch. Ultd.	617-482-5959
OR	Portland, Core II Mktg., Inc.	503-641-0877
PA	Jenkintown, Arnold Assocs.	215-887-7870
TX	Dallas, Dean Assocs.	214-458-1321
WA	Seattle, Core II Mktg., Inc.	206-451-8163
WA	Spokane, Core II Mktg., Inc.	509-922-2971

MICRO-TEL DIVISION, Adams Russell Elctrns., 10713 Gilroy Rd., Hunt Valley, MD 21030, Tel: 301-771-0077, TELEX: 87442, FAX: 301-771-6025; FSC No.: 29644; *Sls. Mgr.:* William R. Trussell

MICROTOUCH SYSTEMS INC., Ten State Street, Woburn, MA 01801, Tel: 617-935-0080, TELEX: 530264; FSC No.: 935-0133; Empl.: 60; *Sls. Mgr.:* William N. Keller

FAX: 516-561-1117

MICROTRAN CO. INC., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, Tel: 516-561-6050, TWX: 510-225-8412; FSC No.: 00348; Empl.: 75; *Sls. Mgr.:* W. Benscher ..... **A•1246, 2152, 2280-2296**

Local Sales Offices & Reps

AL	Huntsville, Over & Over	205-837-7105
AZ	Scottsdale, F. Schoeffler	602-948-1004
CA	Campbell, Kottmeier Assocs.	408-371-8700
CA	Walnut, Cook Entprs.	714-594-0091
CO	Englewood, Omega, Ltd.	303-762-1921
FL	Altamonte Springs, Over & Over, Inc./Florida	305-332-1222
FL	Brandon, Over & Over, Inc./Florida	813-689-9104
GA	Norcross, Over & Over	404-449-6205
IL	Wheaton, Chadra-Schilke Assoc.	312-653-8126
IN	Noblesville, R & D Elctrn. Sls.	317-849-2026
KS	Olathe, AEM, Inc.	913-764-1079
MD	Baltimore, Burgin-Kreh Assocs.	301-265-8500
MA	Reading, Meco, Inc.	617-944-6660
MN	Minnneapolis, RK Sales	612-571-1001
MO	Hazelwood, AEM, Inc.	314-731-2240
NJ	Englewood Cliffs, E. Glass Assocs.	201-592-0200
NM	Albuquerque, C.T. Carlberg & Assocs.	505-888-3883
NY	Rochester, J.G. Welch Assocs.	716-244-1100
NC	Charlotte, Over & Over	704-542-9111
NC	Raleigh, Over & Over Inc.	919-782-9111
OH	Cincinnati, J.O. Olsen Co.	513-922-8885
OH	Garfield Heights, J.O. Olsen	216-662-3454
PA	Jenkintown, Arnold Assocs.	215-887-7870
PA	Pittsburgh, J.O. Olsen Co.	412-279-2550
TX	Dallas, Howell Sls.	214-353-2707
VA	Lynchburg, Burgin-Kreh Assocs.	804-239-2626
Can	Montreal, Quebec, H. W. Brieger Sls., Inc.	514-486-5869

Local Distributors

AL	Birmingham, MG Elctrns. & Equip.	205-328-4525
CA	Fullerton, Pyramid/Fullerton	714-773-0781
CA	San Diego, Pyramid Elctrns.	619-271-5404
CA	San Jose, Sierra West Elctrns.	408-435-7477
CA	Santa Clara, Pyramid Elctrns.	408-727-9810
CA	Santa Monica, Master Distrs.	800-421-8153
CO	Englewood, Shelley/Ragon Inc.	303-762-0670
FL	Ft. Lauderdale, Peerless Radio Corp.	800-327-4993
FL	Largo, Elctrn. Precepts of Florida	813-544-3636
IL	Northbrook, Classic Comp.	312-272-9650
IN	Indianapolis, Graham Elctrns.	317-634-8202
IA	Cedar Rapids, Deeco, Inc.	319-365-7551
MA	Hingham, Sager Elec. Supp.	617-749-6700
MN	Minneapolis, Bergquist	612-835-2322
NJ	Kenilworth, Federated Elctrns.	201-272-0505
NM	Albuquerque, Walker Elctrn. Supp.	505-883-2992
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Johnson City, Help Elctrns.	607-729-3528
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Rochester, Summit Distrs.	716-334-8110
NC	Raleigh, Southeastern Elctrns.	919-828-2311
OH	Dayton, J.A. Becker Co.	513-226-1341
PA	McKeesport, Barno Radio Co.	412-751-5971
PA	Philadelphia, Shap Elctrns.	215-969-3300
TX	Houston, Lenert Co.	713-225-1465
UT	Salt Lake City, Newark Elctrns.	801-486-1048
WA	Redmond, Priebe Elctrns.	206-881-2363
WI	Mequon, Lake-View Elctrns. Corp.	414-377-8250
WI	New Berlin, Classic Comp.	414-786-5300

MICROWAVE APPLICATIONS GROUP, 3030 Industrial Pkwy., Santa Maria, CA 93455, Tel: 805-928-5711, TWX: (MAGSAMA) 910-351-5808, FAX: 805-925-5903; Empl.: 55; *Sls. Mgr.:* D. W. Prigge

MICROWAVE DEVELOPMENT LABORATORIES, 10 Michigan Dr., Natick, MA 01760, Tel: 617-655-0060, TWX: 710-386-6850, FAX: 617-655-6972; Empl.: 180; *Sls. Mgr.:* R. Tucker

Local Sales Offices & Reps

AZ	Phoenix, Blackhart Assocs.	602-893-3488
CA	Chino, MDL W. Coast	714-628-4731
CA	San Mateo, H. R. Grove	415-579-0555
CO	Boulder, Herb Bass Assocs.	303-530-7509
FL	Winter Springs, Hi Co.	305-897-2051
IA	Marion, Ensco-Rep	319-377-8551
KS	Wichita, Ensco-Rep	316-683-1070
MA	Wayland, Hi-Tech Sls.	617-653-3838
MO	Maryland Heights, Ensco-Rep	314-423-3935
NY	DeWitt, D.B. Assocs.	315-446-0220
NY	Great Neck, Trionic	516-466-2300
NC	Raleigh, M. Lader Co.	919-848-3253
PA	Lafayette Hill, M. Lader	215-825-3177
TX	Dallas, Texas Microwave	214-351-4773
UT	Bountiful, Herb Bass Assocs.	801-295-7100
VA	Alexandria, Vanguard Engrg.	703-768-1660
WA	Seattle, J.J. Assocs.	206-246-6619
Can	Montreal, Hooker Elctrns.	514-487-5151

MICROWAVE DIODE CORP., Washington St-Box 250, W. Stewartstown, NH 03597, Tel: 603-246-3362/3363, FAX: 603-246-8161; FSC No.: 57777; Empl.: 15; *Sls. Mgr.:* Daniel E. Shea

MICROWAVE FILTER INC., 6743 Kinne St., East Syracuse, NY 13057-0486, Tel: 315-437-3953, 800-448-1666, TELEX: 249-613, FAX: 315-463-1467; FSC No.: 27834; Empl.: 95; *Sls. Mgr.:* E. Bostick, Sls. & Mktg.

MICROWAVE PRODUCTS DIV., Adams-Russell Elctrns. Co. Inc., 9533 Irondale Ave., Chatsworth, CA 91311, Tel: 818-882-3434, TWX: 910-494-2771, ESYLNK: 62770857, FAX: 818-709-8094; FSC No.: 16798; Empl.: 100; *Sls. Mgr.:* Daniel L. Esau

MICROWAVE SEMICONDUCTOR CORP., 100 School House Rd., Somerset, NJ 08873, Tel: 201-563-6300, TELEX: 833473, TWX: 710-480-4730; Empl.: 430; *Sls. Mgr.:* Carl Lump

MICROWAVE SOLUTIONS, INC., 3200 Highland Ave., National City, CA 92050, Tel: 619-234-7966, FAX: 619-263-2995; FSC No.: 65151; Empl.: 10; *Sls. Mgr.:* Edward M. Teyssier

MICROWAVE SYSTEMS INC., 6075 E. Molloy Rd., Syracuse, NY 13211-2100, Tel: 315-437-9951, TWX: 710-541-0408, FAX: 315-437-8095; FSC No.: 26058; Empl.: 35; *Sls. Mgr.:* Diane L. Conklin

MICTRON INC., 6050 Porter Way, Sarasota, FL 33582, Tel: 813-371-6659; *Sls. Mgr.:* M. Weinstein

MIDCOM, INC., 121 Airport Dr., Watertown, SD 57201, Tel: 605-886-4385, FAX: 605-886-4486; Empl.: 200; *Sls. Mgr.:* Dean Ward

MIDDLEBURG CORP., Middco Connectors, 95 Albany Turnpike, Canton, CT 06019, Tel: 203-693-8361, TELEX: 643529; Empl.: 20; *Sls. Mgr.:* Judy Nelson

MID-EASTERN INDUSTRIES, 100 Campus Dr., RR30, Mt. Holly, NJ 08060, Tel: 609-267-3811; FSC No.: 06179; Empl.: 10; *Sls. Mgr.:* Daniel Ellenback .... **D•1840-1844**

Local Sales Offices & Reps

CA	Los Angeles, Dyna Sls.	213-268-1175
CA	San Ramon, Tech. Consits.	415-830-0829
IL	Des Plains, Marsland Assocs., Inc.	312-298-2620
IN	Indianapolis, Marsland Assocs., Inc.	317-293-5437
IA	Cedar Rapids, Marsland Assocs., Inc.	319-364-1575
MI	Warren, Dietrich & Assocs.	313-751-4990
MN	Minneapolis, Marsland Assocs., Inc.	612-545-4481
MO	St. Louis, Marsland Assocs., Inc.	314-991-1399
NH	Londonberry, Bennetron	603-732-9092
NM	Albuquerque, Westahl Assocs.	505-881-0995
NY	Huntington, C.R. Mayer Co.	516-WA1-7876
OH	Cincinnati, Dietrich & Assocs.	513-984-8924
OH	Independence, Dietrich & Assocs.	216-642-7965
PA	Pittsburgh, Dietrich & Assocs.	412-892-2992
WA	Seattle, Eicher-Richards Co.	206-LA3-7888
WI	New Berlin, Marsland	414-786-6611

MIDGET LOUVER, 800 Main Ave., Norwalk, CT 06852, Tel: 203-866-2342; Empl.: 10; *Sls. Mgr.:* Francis J. Miller; *Dist. Mgr.:* Holly Monroe

MIDLAND-ROSS CORP., NEL UNIT, See NEL Frequency Controls, Inc.

MIDLAND STANDARD, INC., 1355 Holmes Rd., Elgin, IL 60120, Tel: 312-741-6600; Empl.: 38; *Sls. Mgr.:* Bernie McGuinn

Midtex Relays, Inc.

FAX: 915-772-1116

MIDTEX RELAYS, INC., 9B2 Butterfield Trail, El Paso, TX 79906, Tel: 915-772-1061, 1-800-MIDTEX1, TWX: 910-240-3407, ESYLNK: 62752541; Empl.: 275; *Sls. Mgr.:* Ted Anderson; *Dist. Mgr.:* Ted Anderson ..... **B•1538-1543**

Local Sales Offices & Reps

AL	Huntsville, Twentieth Century Mktg.	205-533-9281
AZ	Tempe, A5 Co.	602-968-4923
AR	Hot Springs, Automation Suppliers, Inc.	501-767-5444
CA	Hayward, Pacific Mktg., Inc.	415-887-1620
CA	Tustin, Schoenbachler-Dobson	714-544-1888
GA	Norcross, Twentieth Century Mktg.	404-446-1999
IL	Downers Grove, Richmar Elctrns.	312-968-0118
IN	Indianapolis, Richmar Elctrns.	317-577-9950
KS	Overland Pk., Thomas Dowell	913-638-7373
MN	Edina, Graydon & Flemmer	612-941-1120
MO	St. Louis, Thomas Dowell & Assocs.	314-849-4234
NH	Nashua, Bell Controls	603-882-6984
NJ	Englewood, Harold Gray & Assocs.	201-894-0894
NY	Rochester, Lamb Comps.	716-323-1250
NC	Cary, Twentieth Century Mktg.	919-481-3370
OH	Beachwood, Elctrn. Salesmasters, Inc.	216-831-9555
PA	Trevose, PSA	215-245-0513
TN	Knoxville, Twentieth Century Mktg.	615-966-2099
TX	Richardson, Milco Mktg.	214-783-2716
WA	Vashon, RTS, Inc.	206-285-1363
WI	Butler, Richmar Elctrns.	414-781-1730
Can	Toronto, Ont., CEA Assocs.	416-231-9717

Local Distributors

AL	Huntsville, Hall-Mark	205-837-8700
AZ	Phoenix, Hall-Mark	602-437-1200
AZ	Tempe, Control Design Supp.	602-829-7981
AR	Little Rock, Newark Elctrns.	501-225-8130
CA	Anaheim, Control Design Supp.	714-821-1516
CA	Bay Area, Hall-Mark	408-432-0900
CA	Irvine, Integrated Elctrns.	714-837-9960
CA	Orange County, Hall-Mark	714-669-4100
CA	San Carlos, Control Design Supp.	415-592-4806
CA	Santa Monica, Master Dists.	213-452-1229
CO	Denver, Integrated Elctrns.	303-292-6121
CT	Wallingford, Mid State Elctrns.	203-265-9900
FL	Altamonte Springs, Control Design	305-788-3220
FL	Ft. Lauderdale, Hall-Mark	305-971-9280
GA	Stone Mtn., Control Design	404-979-3500
IL	Chicago, Hall-Mark	312-860-3800
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Genoa, Control Design	312-882-7232
IN	Indianapolis, Control Design	317-788-4559
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
KS	Kansas City, Control Design	913-362-4248
KY	Louisville, Newark	502-423-0280
LA	Shreveport, Indl. Elec. Supp.	318-222-9459
MD	Columbia, Hall-Mark	301-988-9800
MA	Boston, Hall-Mark	617-935-9777
MA	Newton, Green-Shaw Inc.	617-969-8900
MA	Woburn, Control Design Supp.	1-800-537-0045
MI	Oak Pk., Newark	313-967-0600
MI	St. Clair Shores, Spemco	313-771-2700
MN	Minneapolis, Control Design	612-721-1628
MN	Minneapolis, Hall-Mark	612-941-2600
MS	Jackson, Newark	601-956-3834
MO	St. Louis, Control Design Supp.	314-426-3150
NE	Omaha, Newark	402-392-1221
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NH	Nashua, Newark	603-883-9110
NY	Buffalo, Genesse Indl.	716-873-9661
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NJ	Oakland, Relay Specialties	201-337-1000
NJ	Paterson, Feldman Bros.	201-742-7329
NY	Rochester, Masline	716-546-5373
NY	Woodside, Switches Unltd.	718-478-5000
NC	Charlotte, Control Design	704-588-4410
NC	Raleigh, Hall-Mark	919-872-0712
OH	Cincinnati, Schuster Elec.	513-489-1400
OH	Twinsburg, Advacom	216-425-8477
OK	Tulsa, Hall-Mark	918-251-1108
OR	Tigard, Integrated Elctrns.	503-641-1690
PA	Malvern, Control Design Supp.	215-296-0150
PA	McKean, Advacom	814-476-7774
PA	Philadelphia, Hall-Mark	215-355-7300
SC	Greenville, Newark	803-288-9610
TN	Memphis, Newark	901-365-8060
TX	Dallas, Control Design Supp.	1-800-441-0385
TX	Dallas, Force-Heiland	214-247-9955
TX	Dallas, Hall-Mark	214-343-5000
TX	El Paso, Midtex (Export)	915-772-1061
TX	Houston, Hall-Mark	713-781-6100
UT	Murray, Hall-Mark	801-268-3779
VA	Arlington, Newark	703-522-0880
WA	Bellevue, Integrated Elctrns.	206-455-2727
WV	Charleston, Newark	304-345-6511
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WY	Gillette, Gifford	307-682-7203
Can	Scarborough, Ont., Carsten Elctrns.	416-495-7705

MIDWAY MFR. CO., 10750 W. Grand Ave., Franklin Park, IL 60131, Tel: 312-451-1360, TELEX: 72-1596; Empl.: 2000; *Dist. Mgr.:* Allan Stearns

MIDWEC, See Industrial Midwec Capacitors

MIDWEST COMPONENTS INC.

FAX: 616-773-4307

MIDWEST COMPONENTS, INC., 1981 Port City Blvd., Muskegon, MI 49443, Tel: 616-777-2602, TWX: 510-394-4130; FSC No.: 50157; Empl.: 125; *Sls. Mgr.:* Greg Hoffman ..... **B•1852-1859**

Local Sales Offices & Reps

AL	Huntsville, Glen White Assoc.	205-883-7938
CA	San Diego, Hadden Assocs.	619-565-9444
CA	Saratoga, Testco	408-253-1900
CA	Westminster, West Elctrns.	714-898-0120
GA	Norcross, Glen White Assoc.	404-441-1447
IL	Chicago, D. Dolin Sls.	312-286-6200
IN	Ft. Wayne, TMC Corp.	219-432-5553
MD	Timonium, Glen White Assoc.	301-252-6360
MN	St. Paul, R. G. Ragon	612-488-0201
NJ	West Cauldwell, Grimm, Siegel Assoc.	201-575-9300
NC	Raleigh, Glen White Assoc.	919-787-7023
OH	Dayton, Jay Engrg.	513-253-2151
OH	N. Royalton, Jay Engrg.	216-237-4235
OK	Tulsa, Norcom	918-664-9526
TN	Gray, Glen White Assoc.	615-477-8850
TX	Dallas, Norcom	214-386-4888
TX	Houston, Norcom	713-988-0022
VA	Lynchburg, Glen White Assoc.	804-237-6291
WA	Seattle, Jas. J. Backer	206-285-1300
WI	Milwaukee, D. Dolin Sls.	414-482-1111

MIKRON INSTR., 445 W. Main St., Wyckoff, NJ 07481, Tel: 201-891-7330, TELEX: 361870, FAX: 201-891-1205; Empl.: 60; *Sls. Mgr.:* K. Irani

MIL-COMM DISTRIBUTORS, INC., 9400 Lurline Ave. 6C, Chatsworth, CA 91311, Tel: 818-998-3111 ..... **D•1452**

MIL ELECTRONICS, INC., 1 Mill st., Dracut, MA 01826, Tel: 617-453-8000, TELEX: 4998157, FAX: 617-957-6761; FSC No.: 07862; Empl.: 40; *Sls. Mgr.:* Mark Ryan

MILFORD RIVET & MACH., 857 Bridgeport Ave., Milford, CT 06460, Tel: 203-878-4631, TELEX: 964363, TWX: 710-462-0538, FAX: 203-878-5071; Empl.: 250

MILLEN COMPONENTS, Electronic Instr. & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180, Tel: 617-438-6951, TELEX: 948-025; FSC No.: 57285; Empl.: 20; *Sls. Mgr.:* R. A. Boisseau

MILLER DIAL CORP., 4400 N. Temple City Blvd., El Monte, CA 91731, Tel: 818-444-4555, TWX: 910-587-3438, FAX: 818-443-3267; Empl.: 200; *Sls. Mgr.:* P. J. Wener, V.P. Membrane

MILLER, J.W., CO., See Bell Inds.

MILLER, L.C., CO., 717 Monterey Pass Rd., Monterey Pk., CA 91754, Tel: 213-268-3611; Empl.: 45

MILLER, SANFORD, CORP., See Sanford-Miller Corp.

MILLER, W. A., CO., Mingo Loop, P.O. Box 337, Oquossoc, ME 04964-0337, Tel: 207-864-3344, 800-227-1415; Empl.: 15; *Sls. Mgr.:* Wes Miller, Jr.

MILLER-STEPHENSON CHEM. CO., INC., George Washington Hwy., Danbury, CT 06810-7378, Tel: 203-743-4447, TELEX: 643-711

MILLIFLECT, 37444 Sycamore St., Bldg. A, Newark, CA 94560, Tel: 415-791-5188, TELEX: 466465, FAX: 415-791-5237; Empl.: 39; *Sls. Mgr.:* Don Koijane

MILLI-SWITCH CORP., Box 67, Gladwyne, PA 19035, Tel: 215-MI2-9222; Empl.: 15

MILLIVAC INSTRUMENTS, INC., Box 997, Curry Rd. Ext., Schenectady, NY 12301, Tel: 518-355-8300; FSC No.: 85711; Empl.: 30; *Sls. Mgr.:* (Mrs.) Pola Metzger ..... **D•1301**

Local Sales Offices & Reps

MA	Needham, Addelco Corp.	617-444-4754
NY	Fayetteville, Martin P. Andrews	315-637-5291
PA	Media, S & S Div. of Klinetics	215-565-5388
TX	Houston, Scientific Sls.	713-460-9170
TX	Richardson, Scientific Sls.	214-231-6541
Can	Downsview, Ont., Tradeport Elctrns. Grp.	416-736-0866

MILL-MAX MANUFACTURING CORP., P.O. Box 300, Oyster Bay, NY 11771-0300, Tel: 516-922-6000, TWX: 510-221-1820, FAX: 516-922-9253; FSC No.: 3N087; Empl.: 160 ..... **C•1461-1463**

Local Sales Offices & Reps

CA	Dana Point/W. Covina, Patrick M. Conahan Assocs.	714-493-9822
CA	San Jose, Patrick M. Conahan Assocs.	408-723-2200
CO	Boulder, R. G. Enterprises, Inc.	303-447-9211
FL	Seminole, Chaco Sls. of America, Inc.	813-397-4843
IL	Palatine, Houlihan Sls. Co.	312-705-0400
IA	Davenport, Electro-Tech Assocs.	319-386-1134
ME	Kittery, Olsen Tech. Sls.	207-439-6872
NY	Edgewood, Olsen Tech. Sls.	516-242-6606
MN	Minneapolis, Electro-Tech. Assocs.	612-927-5878

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NC Matthews, Cardinal Sls. Co. 704-847-0248
PA Doylestown, G. A. Recentio Assocs. ... 215-348-7577
TX 214-247-9955
TX Dallas, deForest Sls. Co. 214-349-3290

Local Distributors

AZ Tempe, Acacia/VWR Elctrns. 602-894-2874
AZ Tempe, Electronic Hardware, Ltd. 602-967-1691
AZ Tucson, Pioneer Screw & Nut 602-623-9800
CA Anaheim, Bisco Inds. 714-635-0380
CA Campbell, Gourmet Elctrns. 408-374-0552
CA Chatsworth, West Valley Inds. 818-700-0700
CA Fremont, Alatec Prods. 415-657-7701
CA Mission Hills, Coast Air 818-898-2288
CA N. Hollywood, Alatec Prods. 818-764-5600
CA N. Hollywood, Electronic Hardware, Ltd. 818-982-6100
CA San Jose, Bisco Inds., Inc. 408-946-8980
CA San Jose, Pro Fasteners 408-943-9177
CO Denver, Hardware Specialty Co., Inc. .. 303-322-3700
CT Bethel, Heilind Elctrns., Inc. 203-797-8600
FL Lake Mary, Electronic Fasteners, Inc. 305-321-4000
FL Winter Pk, Hardware Specialty 305-677-8500
GA Norcross, Atlanta Hardware Specialty Co. 404-449-3000
IL Addison, Belford Elctrns., Inc. 312-691-1100
IL Franklin Park, Bisco Inds., Inc. 312-451-1230
MD Gaithersburg, Capital Fasteners 301-948-9310
MA Canton, EPC Elctrns., Inc. 617-821-2111
MA Marlborough, Hardware Specialty Co., Inc. 617-481-8622
MA Wilmington, Heilind Elctrns., Inc. 617-657-4870
MA Winchester, Rush Inds., Inc. 617-729-5800
MI Grand Rapids, S. F. Elctrn. Supply, Inc. 616-459-0216
MN Minneapolis, Aero-Space Computer Supplies, Inc. 612-884-4725
MO Bridgeton, Alatec Prods. 314-298-0010
NJ Cherry Hill, Hardware Specialty 609-663-0034
NJ Pinebrook, Alatec Prods. 201-227-8140
NJ Union, Meridian Mfg. & Supply Co., Inc. 201-687-6220
NY Baldwinsville, Scibetta Distr. 315-622-3993
NY Fairport, Willex Indl. 716-223-9365
NY Hauppauge, Kaytech Inds. 516-435-0560
NY Holtsville, Tower Fasteners Co. 516-289-8800
NY Long Island City, Hardware Specialty Co., Inc. 718-361-9393
NY Mount Vernon, QAR Industrial Elctrn. Sls., Inc. 914-699-2224
NC Greensboro, Meridian Mfg. & Supply Co., Inc. 919-674-7042
NC Raleigh, Century Fasteners 919-787-1800
OR Beaverton, Acacia/VWR Elctrns. 503-646-3377
OR Beaverton, Component Resources 503-641-8488
PA McKean, Advacom 814-476-7774
TX Farmers Branch, Force Elctrns. of Texas 214-351-2050
TX Houston, Wofford Elctrns. 713-847-3583
Can Mississauga, Ont., Rush Elctrns., Ltd. 416-677-7280

MILROSS CONTROLS, INC., 511 Second St. Pike, Southampton, PA 18966, Tel: 215-355-0200, TWX: 510-667-1702, FAX: 215-355-6326; FSC No.: 07047; Empl.: 100; *Sls. Mgr.:* Patricia J. Matthews

MILLS RESISTOR CO., 3840 Catalina St., Los Alamitos, CA 90720, Tel: 213-598-2454; FSC No.: 34238; Empl.: 50 ..... **A•1968**

Local Sales Offices & Reps

CA Los Altos, Frauman Assocs. 415-941-0660
CA Sacramento, Mills Resistor Co. 916-422-5461
CT Rocky Hill, Jim McPhail 203-721-1802
KS Leawood, James Dick Co. 913-649-0805
MA Waltham, Dynasel Assocs. 617-890-6777
OR Gaston, SPS Elctrns. 206-323-4140
TX Houston, Ev Smith Co. 713-649-5756
WA Seattle, SPS Elctrns. 206-323-4140

Local Distributors

FL Ft. Lauderdale, Jaro Elctrns. 800-327-5551
PA Harrisburg, ADTECH 717-939-8337
PA McKean, Advacom 814-476-7774

MILTOPE BUSINESS PRODUCTS, Miltope Grp., 1770 Walt Whitman Rd., Melville, NY 11747, Tel: 516-420-0200, TWX: 510-221-1803, FAX: 516-756-7606; Empl.: 650

MILTOPE CORP., 1770 Walt Whitman Rd., Melville, NY 11747, Tel: 516-420-0200, TWX: 510-221-1803; Empl.: 500; *Sls. Mgr.:* R. Douglas Shute; *Dist. Mgr.:* William Jennings

MRC

FAX: 414-271-9876

MILWAUKEE RESISTOR CORP., 700 W. Virginia St., Milwaukee, WI 53204, Tel: 414-271-9900; FSC No.: 82807;15109; Empl.: 65; *Sls. Mgr.:* W. R. Pollock; *Dist. Mgr.:* W. R. Pollock ..... **A•1970-1974**

Local Sales Offices & Reps

CA San Carlos, Electro Pacific 415-592-3114
IL Burr Ridge, PVA Corp. 312-655-3355
LA Covington, Cartwright & Bean 504-892-1780
MA Stoughton, EECS-Mel Boysian 617-586-3385
MS Jackson, Cartwright & Bean 601-981-1170
NY Rochester, Gislason Sls. 716-328-7400
NY Whitestone, M. H. Lynn co. 718-352-9233
OH Westlake, Assocd. Elctrl. Comps. 216-835-9960
TN Memphis, Cartwright & Bean 901-362-8345

MILWAUKEE TRANSFORMER CO., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223, Tel: 414-358-5300; *Sls. Mgr.:* Fred A. Lewis; *Dist. Mgr.:* Fred A. Lewis

MIMIC, INC., P. O. Box 705, Islington, MA 02090-0705, Tel: 617-329-9593; Empl.: 5; *Sls. Mgr.:* S. Thurston

MINCO PRODUCTS, 7300 Commerce La., Minneapolis, MN 55432, Tel: 612-571-3121, FAX: 612-571-0927; FSC No.: 09359; Empl.: 475; *Sls. Mgr.:* J. Anderson

MIN-E-CON, 1791 Reynolds, Irvine, CA 92714, Tel: 714-250-0474, TWX: 910-595-1144, FAX: 714-250-1713; FSC No.: 54455; *Sls. Mgr.:* Jeff Sander

MINELCO INC. - A TALLEY IND., 135 S. Main St., Thomaston, CT 06787-0459, Tel: 203-283-8261, TWX: 710-475-1091, FAX: 203-283-6527; FSC No.: 07479; Empl.: 70; *Sls. Mgr.:* James A. Myles ..... **B•1140-1141**

Local Sales Offices & Reps

AL Huntsville, L & D Inc. 205-837-1469
AZ Phoenix, R. W. Riedel & Co. 213-283-7694
CA Alhambra, M.W. Riedel & Co. 213-283-7694
CA Hayward, Liaison, Inc. 415-783-1131
CO Denver, West Inc. 303-477-8180
CT Old Saybrook, FJS Assocs. 203-388-5374
FL Orlando, Delmac 305-831-0040
GA Atlanta, L & D, Inc. 404-395-7079
MI Grand Rapids, Midwest Meridian 616-698-7391
IA Cedar Rapids, J.R. Sls. Engrg. 319-393-2232
MD Owings Mills, Walker-Houk Assocs. ... 301-356-9500
MA Burlington, F.J.S. Assocs. 617-273-5959
MN Minneapolis, TWC Sls. 612-636-1770
MO St. Louis, Midwest Meridian 314-878-4441
NJ Hasbrouck Hgts., Comp-Tech Sls. 201-288-7400
NY Syracuse, J. R. Costello 315-472-0322
NC Greensboro, L & D, Inc. 919-292-3201
OH Cleveland, Jim Finnegan & Co. 216-238-5905
PA Downingtown, McCoy, Inc. 215-363-0350
TX Fort Worth, CMR 817-379-6540
WA Bellevue, Caruso & Co. 206-455-8811
Can Rexdale, Ont., Myelco, Inc. 416-674-1636

MINIATURE METAL FORMING DIV., 4819 Emerald St., P.O. Box 2962, Torrance, CA 90509, Tel: 213-370-3679, FAX: 213-370-5430; Empl.: 35; *Sls. Mgr.:* Fred Kramer

Mini-Circuits

FAX: 718-332-4661

MINI-CIRCUITS LAB., 2625 E. 14th St., P.O. Box 350166, Brooklyn, NY 11235-0003, Tel: 718-934-4500, TELEX: 125460, 620156 (Intl.); FSC No.: 15542 ... **A•1774-1837**

Local Sales Offices & Reps

AL Huntsville, Beacon Elctrns. 205-881-5031
AZ Scottsdale, Thorson Desert States, Inc. 602-998-2444
CA Los Altos, Cain-White & Co. 415-948-6533
CA N. Hollywood, Crown Elctrns. 213-877-3550
CO Aurora, Thorson Desert States, Inc. ... 303-671-7344
FL Boca Raton, Beacon Elctrns. 305-997-5740
FL Clearwater, Beacon Elctrns. 813-796-2378
FL Longwood, Beacon Elctrns. 305-332-1940
GA Atlanta, Beacon Elctrns. 404-256-9640
IL Mount Prospect, Cain Forlaw Co. 312-253-3578
MD Columbia, M. Lader & Co. 202-296-2497
MA Waltham, Scientific Devices 617-890-2252
NM Albuquerque, Thorson Desert States, Inc. 505-293-8555
NY Hartsdale, Spectrum Sales, Inc. 914-472-8600
NY Skaneateles, Robtron 315-685-5731
NC Raleigh, Beacon Elctrns. 919-787-0330
NC Raleigh, M. Lader Co. 919-828-3870
OH Lancaster, Cain Forlaw Co. 614-654-4800
OK Tulsa, Beacon Elctrns. 918-622-1494
PA Lafayette Hill, M. Lader & Co. 215-825-3177
TX Austin, Beacon Elctrns. 512-345-3543
TX Dallas, Beacon Elctrns. 214-437-1505
UT Salt Lake City, Thorson Rocky Mtn., Inc. 801-973-7969
WA Bellevue, Cain-White & Co. 206-462-2118
PR Santurce, Beacon Elctrns. 809-728-5040
Can Brockville, Ont., R.F. Specialists 613-345-2343
Can Ottawa, Ont., Giga-Tron Assocs., Ltd. 613-225-4000
Can Vancouver, B.C., Penstock/Canada ... 604-662-3475

Local Distributors

AL Huntsville, Comp. Distrs., Inc. 205-883-7501
AZ Scottsdale, Spirit Elctrns. 602-998-1533
AR Little Rock, Comp. Distrs., Inc. 501-227-6278
CA N. Hollywood, Crown Elctrns. 213-877-3550
CA Sunnyvale, Penstock, Inc. 408-730-0300
CO Aurora, Spirit Distrs. 303-671-7344
FL Melbourne, Comp. Distrs., Inc. 305-724-9910
GA Norcross, Comp. Distrs., Inc. 404-441-3320
IL Mt. Prospect, CFC Distrs., Inc. 312-253-3578
MD Columbia, MLC Distrs. 215-825-3177
NY New Rochelle, RDI Dists. Inc. 914-632-2828
NC Raleigh, Comp. Distrs., Inc. 919-834-9465
NC Raleigh, MLC Distrs. 919-848-3253
PA Lafayette Hills, MLC Distrs. 215-825-3177
TX Dallas, Comp. Distrs., Inc. 214-644-0373

MINI COMPUTER TECHNOLOGY, 696 E. Trimble Rd., San Jose, CA 95131, Tel: 408-435-1616, TWX: 910-338-2281, FAX: 408-435-2709; Empl.: 16; *Sls. Mgr.:* John P. Lazare; *Dist. Mgr.:* John P. Lazare

MINI-MAGNETICS CO., INC., 1100 Fulton Place, Fremont, CA 94539, Tel: 415-490-7500, FAX: 415-490-7502; Empl.: 45; *Sls. Mgr.:* William Fine

MSI

FAX: 617-695-6076

MINI-SYSTEMS, INC., 20 David Rd., North Attleboro, MA 02761, Tel: 617-695-0203, TWX: 710-348-0564; FSC No.: 50316; Empl.: 150 ..... **A•1975**

Local Sales Offices & Reps

TX Lewisville, C & J Assocs. 214-539-0140

MINI-SYSTEMS, INC., Electronic Package Div., 168 E. Bacon St., P.O. Box 1597, Plainville, MA 02762, Tel: 508-695-2000, TWX: 510-600-4340, FAX: 508-695-8758; *Sls. Mgr.:* Heather Edwards ..... **A•1748**

MINNTRONICS CORPORATION, 2599 White Bear Ave., St. Paul, MN 55109, Tel: 612-770-5247

MINOR RUBBER CO., INC., Ackerman St., Bloomfield, NJ 07003, Tel: 201-338-6800, 800-631-8574, TELEX: 138817; *Sls. Mgr.:* Stan Messing

MISCO/MINNEAPOLIS SPEAKER CO, 3806 Grand Avenue, Minneapolis, MN 55409, Tel: 612-825-1010; FSC No.: 14208; *Sls. Mgr.:* Don Ringham

MITEC ELECTRONICS, 104 Gun Avenue, Pointe Claire, Quebec, Canada H9R 3X3, Tel: 514-694-6666, TWX: 510-101-2790, FAX: 514-694-3814; FSC No.: FSCM 38494; Empl.: 100; *Sls. Mgr.:* M. Monzon

MITEL SEMICONDUCTOR, Mitel Corp., P. O. Box 13320, Kanata, ON, Canada K2K 1X5, Tel: 613-592-5630, TELEX: 053-3221, TWX: 610-562-8529; Empl.: 700; *Sls. Mgr.:* Howard Tweddle; *Dist. Mgr.:* Howard Tweddle

MITEQ INC., 100 Davids Drive, Hauppauge, NY 11788, Tel: 516-436-7400, TELEX: 6718148, FAX: 516-864-1586; Empl.: 200

MITRONICS, 2908 Oregon Court - Bldg. I-2, Torrance, CA 90503, Tel: 213-320-7011

MITSUBISHI ELECTRONICS, 991 Knox Street, Torrance, CA 90502, Tel: 213-515-3993, TELEX: 06-4703-M USA LSA, TWX: 66-4787-MELA TRNC; Empl.: 423; *Sls. Mgr.:* Mike Foster

MITSUBISHI ELCTRNS. AMERICA, INC., Semiconductor Div., 1050 East Arques Ave., Sunnyvale, CA 94086, Tel: 408-730-5900, TELEX: 172296, TWX: 910-339-9549, FAX: 408-749-0453; Empl.: 105; *Sls. Mgr.:* John Zucker; *Dist. Mgr.:* Bob Olszewski

MITSUMI ELEC. CO., LTD., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, Japan, Tel: 489-5333, TELEX: J28846/J24935; Empl.: 1700; *Sls. Mgr.:* H. Sato; *Dist. Mgr.:* U. Nishimura

MIYAKAWA AMERICA CORP., 408 E. Devon Ave., Elk Grove Village, IL 60007, Tel: 312-640-0515, FAX: 312-640-0531

MIZAR, INC., 20 Yorkton Court, St. Paul, MN 55117, Tel: 612-224-8941, TELEX: 469542; Empl.: 35; *Sls. Mgr.:* William K. Simons

MKC ELECTRONICS CORP., 9205 Quivira Road, Overland Park, KS 66215, Tel: 913-894-9711; Empl.: 26

MKS INSTRUMENTS, INC., Six Shattuck Road, Andover, MA 01810, Tel: 617-975-2350, TELEX: 94-9375, FAX: 617-975-0094; Empl.: 350

MOBILE-TRONICS CO., INC., Box 1022, Tustin, CA 92680, Tel: 714-546-0884; Empl.: 2

MODERN CONTROLS CORP., 2233 Indl. Blvd., Sarasota, FL 33580, Tel: 813-355-5183; FSC No.: 66258; Empl.: 9

MODICON PROGRAMMABLE CONTROL DIV., Gould Inc., P.O. Box 83 S.V.S., Andover, MA 01810, Tel: 617-475-4700, TELEX: 94-7402, TWX: 710-347-6610; *Sls. Mgr.:* Steven Mader (PC's); *Dist. Mgr.:* George Dannecker (Micro 84)

MODULAR AUDIO PRODUCTS, Modular Devices, Inc., 50 Orville Dr., Bohemia, NY 11716, Tel: 516-567-9620; *Sls. Mgr.:* C. Liptman

MODULAR DEVICES, Brookhaven R & D Plaza, 1 Roned Rd., Shirley, NY 11967, Tel: 516-345-3100, TELEX: 4949781; FSC No.: 52202; Empl.: 65; *Sls. Mgr.:* C. Liptman ..... **D•1846-1847, 2128**

Local Sales Offices & Reps

GA Roswell, Electro Comp. Sls. 404-992-2344
MD Linthicum, Advanced Technlg. Sls., Inc. 301-789-9360
NH Manchester, Northeast Comps. 603-627-7242
NY Wantagh, Tri-Tek Assocs. 516-221-7600

MODULAR DEVICES INC., 4115 Spencer St., Torrance, CA 90503, Tel: 213-542-8561, FAX: 213-371-6331; Empl.: 90; *Sls. Mgr.:* A. C. Augusta

MODULAR SYSTEMS, INC., 905 Albemarle St., Charlottesville, VA 22901, Tel: 804-295-7882; Empl.: 9; *Sls. Mgr.:* H. N. Patel

MODUTEC, 18 Marshall St., Norwalk, CT 06854, Tel: 203-853-3636, TWX: 710-468-2039, FAX: 203-853-2147; Empl.: 300

MOISTURE REGISTER PRODUCTS DIV., Aqua Measure Instrument Co., 2583 Pomona Blvd., Pomona, CA 91768-3267, Tel: 714-594-5545, TELEX: 6503137369 MRP; Empl.: 25; *Sls. Mgr.:* G. Dean Curd

MOLDCON, Div. of K & M Electronics, 221 Interstate Dr., W. Springfield, MA 01089, Tel: 413-736-0371, TWX: 710-350-6463; Empl.: 200; *Sls. Mgr.:* Robert Krzynowek

MOLDTRONICS, INC., 703 Rogers St., Downers Grove, IL 60515, Tel: 312-968-7000, FAX: 312-968-5068; Empl.: 140; *Sls. Mgr.:* Jack Beal

Molecu Wire

FAX: 201-938-3189

MOLECU-WIRE, P.O. Box 495, Farmingdale, NJ 07727, Tel: 201-938-9473, TWX: 710-723-6943; Empl.: 125 ..... **C•1865-1869**

Local Sales Offices & Reps

CA Montrose, Roger D. Dahl 213-245-3817
CT Orange, KLS Sls. 203-795-6210
MO Independence, Hi Tech Cen. 816-796-6684
KY Louisville, Waddle & Assocs. 502-897-6419
NC Charlotte, QED 704-525-3053
PA Ligonier, Patterson Elec. 412-238-6238
WA Seattle, Comptronics 206-284-4842
WI Mequon, Robco 414-241-3348

molex®

FAX: 312-969-1352

MOLEX, INC., 2222 Wellington Ct., Lisle, IL 60532, Tel: 312-969-4550, TELEX: 25-4069; Empl.: 5000; *Sls. Mgr.:* Ed Parkinson; *Dist. Mgr.:* Dave Root ..... **B•1775; C•1464-1467, 1871**

Local Sales Offices & Reps

CA Laguna Hills, Molex 714-586-0950
CA Milpitas, Molex 408-946-4700
CO Englewood, Molex 303-779-8321
GA Atlanta, Molex 404-396-6120
IL Lisle, Molex 312-969-4550
IN Indianapolis, Molex 317-299-0099
KY Louisville, Molex 502-245-8337
MA Woburn, Molex 617-935-8983
MI Troy, Molex 313-879-7400
TX Dallas, Molex 214-931-0999

Local Distributors

AL Huntsville, Hamilton/Avnet 205-837-7210
AL Huntsville, Time Elctrns. 205-721-1133
AZ Chandler, Hamilton Avnet 602-961-6400
AZ Tempe, Harper S.I.D. 602-967-1464
AZ Tempe, Time Elctrns. 602-967-2000
AR Ft. Smith, Carlton Bates 501-646-8201
AR Little Rock, Carlton Bates 501-562-9100
AR Pine Buff, Carlton Bates 501-535-1354
AR Springdale, Carlton Bates 501-756-5012
CA Anaheim, Time Elctrns. 714-937-0911
CA Chatsworth, Hamilton Avnet 818-700-1222
CA Chatsworth, Time Elctrns. 818-998-7200
CA Compton, Harper S.I.D. .. 800-253-5527,213-979-5090
CA Costa Mesa, Avnet Elctrns. 714-754-6111
CA Costa Mesa, Hamilton Electro Sls. 714-641-4110
CA Culver City, Hamilton Avnet 213-558-2143
CA El Segundo, Force Elctrns. 213-772-1324, 714-522-1324
CA Garden Grove, Richey Western Elctrns. Ltd. 800-227-0060,714-895-0060
CA Gardena, Hamilton Avnet 213-217-6700
CA Ontario, Hamilton Avnet 714-989-4602
CA S. San Francisco, Peters-de Laet 415-873-9595
CA Sacramento, Hamilton Avnet 916-920-3150
CA San Diego, Force Elctrns. 619-569-9661
CA San Diego, Hamilton Avnet 619-571-7510
CA San Diego, Harper S.I.D. 619-578-2500
CA San Diego, Richey Western Elctrns. Ltd. 619-271-4511
CA San Diego, Time Elctrns. 619-586-1331
CA San Jose, Force Elctrns. 408-435-1324
CA San Jose, Richey Western Elctrns. Ltd. 408-432-7100
CA Sunnyvale, Hamilton Avnet 408-743-3355
CA Sunnyvale, Hamilton Avnet 408-743-3000
CA Sunnyvale, Harper S.I.D. 408-747-0333
CA Sunnyvale, Time Elctrns. 408-734-9888
CA Torrance, Time Elctrns. 213-320-0880
CO Denver, Integrated Elctrns. 303-292-6121
CO Englewood, Hamilton Avent 303-740-1000
CO Englewood, Time Elctrns. 303-799-8851
CO Wheatridge, Bell Inds. 303-424-1985
CT Bethel, Heilind Elctrns. 203-797-8600
CT Cheshire, Time Elctrns. 203-271-3200
CT Danbury, Hamilton Avnet 203-797-2800
CT Milford, RC Comps. 203-874-0006
FL Ft. Lauderdale, Hamilton Avnet 305-979-2802
FL Ft. Lauderdale, Time Elctrns. 305-974-4800
FL Orlando, Time Elctrns. 305-841-6565
FL St. Petersburg, Hamilton Avnet 813-576-3930
FL Winter Pk., Hamilton Avnet 305-628-3888
GA Atlanta, Electro Air Corp. 404-351-3545
GA Norcross, Hamilton Avnet 404-447-7500
GA Norcross, Time Elctrns. 404-448-4448
IL Bensenville, Hamilton/Avnet 312-860-7700
IL Chicago, Waldom Elctrns. Inc. 312-585-1212
IL Crystal Lake, Sub-Sem, Inc. 312-782-3954
IL Mt. Prospect, Magnuson Elctrns. 312-956-0700
IL Wood Dale, Time Elctrns. 312-350-0610
IN Carmel, Hamilton Avnet 317-844-9333
IN Indianapolis, Gateway Megatech 317-844-3906
IA Cedar Rapids, Hamilton Avnet 319-362-4757
KS Overland Pk, Hamilton Avnet 913-888-8900
KY Lexington, Hamilton Avnet 606-259-1475
LA Shreveport, Carlton Bates 318-636-9975
MD Baltimore, Hamilton Avnet 301-995-3500
MD Columbus, Time Elctrns. 301-964-3090
MD Savage, Pyttronic Inds. 301-792-0780
MA Canton, Richey/Impact Elctrns. Ltd. ... 617-821-1500
MA Peabody, Hamilton Avnet 617-532-3701
MA Peabody, Time Elctrns. 617-532-6200
MA Wilmington, Heilind Elctrns. 617-657-4870
MA Wilmington, RC Jaco 617-273-1860
MA Wilmington, SAI 616-657-5700
MI Ann Arbor, Gateway Megatech 313-761-2980
MI Grand Rapids, Gateway Megatech 616-243-8805
MI Livonia, Gateway Megatech 313-522-4700
MI Troy, Empire Elctrns. 313-585-8130
MN Bloomington, Time Elctrns. 612-944-9192
MN Minneapolis, Indl. Comps. 612-831-2666
MN Minnetonka, Hamilton Avnet 612-932-0600
MO Earth City, Hamilton Avnet 314-344-1200
MO St. Charles, Lectronix ... 800-325-3348,314-946-6424
MO St. Louis, Time Elctrns. 314-391-6444
NH Manchester, Hamilton Avnet 603-624-9400
NJ Camden, Gen. Radio 609-964-8560
NJ Cherry Hill, Hamilton Avnet 609-424-0100
NJ Clifton, JMAR Elctrns. 201-772-6400
NJ Fairfield, Hamilton Avnet 201-575-3390
NJ Lake Hiawatha, Time Elctrns. 201-316-8644
NM Albuquerque, Hamilton Avnet 505-765-1500
NY Buffalo, Summit Dists. 716-887-2800
NY E. Syracuse, Time Elctrns. 315-432-0355
NY Hauppauge, Time Elctrns. 516-273-0100
NY Melville, Diplomat Westates 516-454-6334
NY Melville, S.A.I. 516-293-2710
NY Rochester, Hamilton Avnet 716-475-9130
NY Rochester, S.A.I. 716-334-8110
NY Syracuse, Hamilton Avnet 315-437-2641/2541
NC Charlotte, Time Elctrns. 704-522-7600
NC Raleigh, Hamilton Avnet 919-878-0819
NC Raleigh, Resco/Raleigh 919-781-5700
OH Cleveland, Hamilton Avnet 216-831-3500
OH Columbus, Gateway Megatech 614-447-0222
OH Dayton, Hamilton Avnet 513-439-6700
OH Dublin, Time Elctrns. 614-761-1100
OH Solon, Hamilton Avnet 216-349-5100
OH Westerville, Hamilton Avnet 614-882-7004
OH Wickliffe, Gateway Megatech 216-944-5801
OH Willoughby, Gateway Megatech 800-331-7628, 216-953-0333
OK Oklahoma City, Carlton Bates 405-691-4446
OK Tulsa, Carlton Bates 918-250-1626
OK Tulsa, Hamilton Avnet 918-252-7297
OR Lake Oswego, Hamilton Avnet 503-635-8157
OR Portland, Radar Elec. 503-232-3404
OR Portland, Time Elctrns. 503-684-3780
PA King of Prussia, Time Elctrns. 215-337-0900
PA McKean, Advacom 814-476-7774
PA Montgomeryville, Pyttronic Inds. 215-643-2850
PA Pittsburg, Hamilton Avnet 412-281-4150
TN Hixson, Techni-Tronics, Inc. 615-842-0514
TN Memphis, Carlton Bates 901-365-3539
TN Nashville, Carlton Bates 615-244-3562
TX Austin, Hamilton Avnet 512-837-8911
TX Austin, Kent Elctrns. 512-834-1900
TX Austin, Time Elctrns. 512-339-3051
TX Carrollton, Time Elctrns. 214-241-7441
TX Dallas, Force Elctrns. 214-247-9955
TX Houston, Force Elctrns. 713-561-8644
TX Houston, Kent Elctrns. 713-780-7770
TX Houston, Time Elctrns. 713-530-0800
TX Irving, Hamilton Avnet 214-550-6111
TX Irving, Harper S.I.D. 214-621-0500
TX Richardson, Kent Elctrns. 214-669-2600
TX Stafford, Hamilton Avnet 713-240-7733
TX Texarkana, Carlton Bates 214-792-6923
UT N. Salt Lake City, Integrated Elctrns. .. 801-298-1869
UT Salt Lake City, Bell Inds. 801-972-6969
UT Salt Lake City, Hamilton Avnet 801-972-2800
UT Salt Lake City, Time Elctrns. 801-973-8181
UT West Valley, Time Elctrns. 801-973-8181
WA Bellevue, Hamilton Avnet 206-643-3950
WA Redmond, Time Elctrns. 206-882-1600
WA Richland, Radar Elec. 509-943-8336
WA Seattle, Radar Elec. 206-282-2511
WA Spokane, Radar Elec. 509-747-3053
WI New Berlin, Hamilton Avnet 414-784-4510

MOLI ENERGY LIMITED, 3958 Myrtle St., Bunaby, BC, Canada V5C 4G2, Tel: 604-437-6927, TELEX: 04-356708, FAX: 604-437-5195; FSC No.: 6140; Empl.: 160; *Sls. Mgr.:* Mary Connolly; *Dist. Mgr.:* Noulan Bowker

MOLON MOTOR & COIL CORP., 3737 Industrial Ave., Rolling Meadows, IL 60008, Tel: 312-259-8700, TWX: 910-687-0428; Empl.: 350; *Sls. Mgr.:* J. Bailey

MONITOR LABORATORIES, INC., 10180 Scripps Ranch Blvd., San Diego, CA 92131, Tel: 619-578-5060, TELEX: 182794; Empl.: 96; *Sls. Mgr.:* Paul Stenberg

FAX: 619-434-0255

MONITOR PRODUCTS CO., INC., 502 Via Del Monte, Oceanside, CA 92054, Tel: 619-433-4510, ESYLNK: 629 5085; FSC No.: 54331; Empl.: 65; *Sls. Mgr.:* Matthew J. Mulvihill; *Dist. Mgr.:* Matthew J. Mulvihill ..... **A•1426-1427**

Local Sales Offices & Reps

AL	Huntsville, CSR Elctrns.	205-533-2444
AZ	Phoenix, Eltron	602-266-2164
CA	Los Angeles, Monitor Prods. Co.	619-433-4510
CA	Mountain View, Straube Assocs.	415-969-6060
CA	Orange County, Monitor Prods. Co.	618-433-4510
CO	Aurora, Electrodyne	303-695-8903
CT	Bloomfield, Zaslow Sls., Inc.	203-242-7781
FL	Apopka, Tech Rep Assocs.	813-576-9900
FL	Ft. Lauderdale, Tech Rep Assocs.	813-576-9900
FL	Lake Worth, Tech-Rep Assocs.	813-576-9900
FL	St. Petersburg, Tech-Rep Assocs.	813-576-9900
GA	Atlanta, CSR Elctrns.	404-396-3720
MA	Westboro, Zaslow Sls., Inc.	617-393-8150
MN	Eden Prairie, Elctrn. Innovators	612-941-0830
NY	Fayetteville, C. W. Floring & Assocs.	315-637-4552
NY	Poughkeepsie, C. W. Floring & Assocs.	914-471-2973
NY	Scottsville, C. W. Floring & Assocs.	716-889-4614
NC	Raleigh, CSR Elctrns.	919-878-9200
PA	Gladwyne, J. S. Wurts Co.	215-649-6300
TN	Knoxville, CSR Elctrns.	615-673-0222
TX	Austin, Mil-Rep Assocs.	512-346-6331
TX	Houston, Mil-Rep Assocs.	713-444-2557
TX	Richardson, Mil-Rep Assocs.	214-644-6731

Local Distributors

AL	Huntsville, Component Distrs., Inc.	205-883-7501
AL	Huntsville, Resistacap, Inc.	205-883-4270
AZ	Tempe, Harper SID	602-967-1464
AR	Little Rock, Component Distrs., Inc.	501-227-6305
CA	Compton, Harper SID	213-979-5090
CA	San Diego, Harper SID	619-560-8545
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	Sherman Oaks, Delay Line Distrs.	818-986-9455
CA	Sunnyvale, Harper SID	408-747-0333
CA	Tustin, Added Value Elctrns.	714-259-8258
CO	Wheatridge, Added Value Elctrn.	303-422-1701
FL	Ft. Lauderdale, Component Distrs., Inc.	305-723-8874
FL	Melbourne, Rome Elctrns.	305-242-8151
GA	Norcross, Component Distrs., Inc.	404-441-3320
IL	Bensenville, Voyager Elctrns.	312-773-4900
MA	Hudson, DSC, Inc.	617-562-6920
MN	Fridley, Voyager Elctrns.	612-571-7766
NY	Johnson City, Help Elctrns.	607-729-3528
NC	Greensboro, Golden Elctrns.	919-294-4653
TX	Dallas, Component Distrs., Inc.	214-644-0373
TX	Fort Worth, C & W Supply	817-831-0395
TX	Richardson, Harper SID	214-235-3177
VA	Falls Church, Component Distrs., Inc.	703-241-8227

MONOLITHIC SYS., 84 Inverness Circle E., Englewood, CO 80112, Tel: 303-790-7400, TELEX: 45-4498; Empl.: 100; *Sls. Mgr.:* Mike Hart

MONSANTO CO., 800 N. Lindbergh Blvd., St. Louis, MO 63167, Tel: 314-694-1000, TELEX: 44-7282; Empl.: 50,000

MONTEK MICROSYSTEMS, P.O. Box 1845, Huntsville, AL 35807, Tel: 205-723-2927; *Sls. Mgr.:* Paul Rainosek; *Dist. Mgr.:* Paul Rainosek

MOODY TOOLS, INC., 43 Crompton Ave., E. Greenwich, RI 02818, Tel: 401-885-0911; Empl.: 11; *Sls. Mgr.:* J. H. Moody; *Dist. Mgr.:* D .H. Moody

J. L. MOON & COMPANY, 11323 East 20 Street, Tulsa, OK 74128, Tel: 918-234-6330; Empl.: 5; *Sls. Mgr.:* Karen Moon; *Dist. Mgr.:* Karen Duggan

MORRIS, J. I., CO., 372 Elm St., Southbridge, MA 01550, Tel: 617-764-4394, FAX: 617-764-7350; FSC No.: 95548; Empl.: 30

MORRIS ENTERPRISES, 16799 Schoenborn St, Sepulveda, CA 91343, Tel: 818-894-9103, TELEX: 6-74681, TWX: 910-496-1525; FSC No.: 54918; Empl.: 50; *Sls. Mgr.:* J. Dumpert

MORS TECHNOLOGIES INC., Mors Group-France, 3430 Griffith, St. Laurent, Quebec, Canada H4T 1A7, Tel: 514-735-4411, TELEX: 05-824132, FAX: 514-735-8000; *Sls. Mgr.:* Christian Acard; *Dist. Mgr.:* Christian Acard

MOTION CONTROL DEVICES, An EG & G Torque Systems Co., 80 Stedman St., Lowell, MA 01851, Tel: 617-454-3407, FAX: 617-924-0254; Empl.: 25; *Sls. Mgr.:* Carl M. Pauli

MOTION CONTROL GROUP, American Precision Industries, 3229 Roymar Rd., Oceanside, CA 92054, Tel: 619-439-7500, TELEX: 18-1196; FSC No.: 32423; Empl.: 100; *Sls. Mgr.:* Andrew Boyer

MOTION SENSORS, INC., 12 Park Street, Cranford, NJ 07701, Tel: 201-925-3553; Empl.: 6; *Sls. Mgr.:* Arthur Bergman

MOTOROLA CERAMIC PRODUCTS, Components Division, 4800 Alameda Blvd. N.E., Albuquerque, NM 87113, Tel: 505-822-8801, TELEX: 4999100; Empl.: 250; *Sls. Mgr.:* Tom Gilder

MOTOROLA INC., Auto. & Indl. Elctrns. Grp., 1299 E. Algonquin Rd., Schaumburg, IL 60196, Tel: 312-576-4850, TELEX: 4999036 MOT APD; *Sls. Mgr.:* Jay A. Bonk

MOTOROLA, INC., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131, Tel: 312-451-1000, TELEX: 4990104, TWX: 910-255-4619; Empl.: 1400; *Sls. Mgr.:* Ed Feldman

MOTOROLA MICROELECTRONICS DIV., 8000 W. Sunrise, Ft. Lauderdale, FL 33322

MOTOROLA SEMICONDUCTOR PRODS. SECTOR, 3102 North 56th Street, Phoenix, AZ 85018-6606, Tel: 602-244-6900, TWX: 910-951-1334, FAX: 602-952-4002; FSC No.: 04713; *Sls. Mgr.:* Brian Hilton; *Dist. Mgr.:* Bruce Brammer

MOTOR TECHNOLOGY, INC., 2798 Culver Ave., Dayton, OH 45429, Tel: 513-294-1041, FAX: 513-294-8336; Empl.: 35 ..... **B•1239-1241**

Local Sales Offices & Reps

OH	Dayton, Motor Technology, Inc.	513-294-1041

MOTOR-TRONICS, INC., 2142 Industrial Ct., Bldg. 'F', Vista, CA 92083, Tel: 619-727-7430; *Sls. Mgr.:* Bill Linko

MOTRONICS CORP., 15 Industrial Park, Little Falls, NY 13365, Tel: 315-823-4050; Empl.: 90; *Sls. Mgr.:* Otto Demuth

MOUSER ELECTRONICS, 11433 Woodside Ave., Santee, CA 92071, Tel: 619-449-2222, TWX: 910-331-1175; Empl.: 200; *Sls. Mgr.:* J. L. Kahler

MOUSER ELECTRONICS, 2401 Hwy. 287 North, Mansfield, TX 76063, Tel: 817-483-4422, TWX: 510-601-0375; Empl.: 200; *Sls. Mgr.:* D. L. Niedecken

MOXNESS PRODUCTS, INC., Versa Technologies, 1914 Indiana St., Racine, WI 53405, Tel: 414-554-5050, 800-558-5706, FAX: 414-554-2321; Empl.: 300; *Sls. Mgr.:* Thomas D. Hynes; *Dist. Mgr.:* Thomas D. Hynes

MPB CORP., Miniature Precision Bearings Div., Precision Park, Keene, NH 03431, Tel: 603-352-0310, TWX: 710-366-1801; Empl.: 1600; *Dist. Mgr.:* R. F. Chartier

MPB CORPORATION, Split Ballbearing Division, Highway 4, Lebanon, NH 03766

MPC, Div. of Consulting Systems, RFD No. 1, Box 441, Fremont, NH 03044, Tel: 603-642-5913, FAX: 603-642-5913; *Sls. Mgr.:* W. Morse ..... **D•1848**

Local Distributors

TN	Knoxville, Indl. Elctrns.	615-573-7135

MPI, 4426 S. Century Dr., Salt Lake City, UT 84107, Tel: 800-821-8848; *Sls. Mgr.:* Jamie Johnston

MSC TECHNOLOGIES, INC., 2600 San Tomas Expressway, Santa Clara, CA 95051, Tel: 408-988-0211, TELEX: 467848; *Sls. Mgr.:* David Witkowski; *Dist. Mgr.:* Alan Pettit

MSI DATA CORP., 340 Fischer Ave., Costa Mesa, CA 92626, Tel: 714-549-6000, TWX: 910-595-1719; Empl.: 700; *Sls. Mgr.:* Jack Bertch; *Dist. Mgr.:* Janis Agopran

MSI ELECTRONICS, INC., 34-32 57th St., Woodside, NY 11377, Tel: 718-672-6500, TELEX: 426407, FAX: 718-397-0972; FSC No.: 18518; Empl.: 22; *Sls. Mgr.:* A. Lederman

Local Sales Offices & Reps

AZ	Glendale, Fetty/Schoenduve	602-241-9009
CA	San Diego, Fetty/Schoenduve	619-292-5136
CA	El Segundo, Fetty/Schoenduve	213-322-4991
CA	Palo Alto, Tri-Rep	415-965-1822
FL	Lighthouse Pt., R. C. Simon & Co.	305-941-2757
FL	Riverview, R. C. Simon & Co.	813-689-1947
IL	McHenry, Mesa, Inc.	815-344-2820
IN	Ft. Wayne, Menze Sls. Inc.	219-747-5616
MD	Laurel, CSDS Inc.	301-490-3800
MA	Framingham, Stone Comp. Sls.	617-875-3266
PA	Elkins Park, Arnold Assocs.	215-887-7870
TX	Richardson, Eagle Mktg. Inc.	214-238-5358

MTE CORP., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223, Tel: 414-358-5300; *Sls. Mgr.:* T. Kettner

MTI TECHNOLOGY CORPORATION, 6385 Rose Lane, Carpinteria, CA 93013, Tel: 805-684-6676, FAX: 805-684-6319; *Sls. Mgr.:* William Henrikson

FAX: 605-665-1709

M-TRON INDUSTRIES, P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, Tel: 605-665-9321, TWX: 910-668-3603; FSC No.: 23875; Empl.: 110; *Sls. Mgr.:* S. D. Sinkler ..... **A•1428-1429**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs.	205-533-9108
AZ	Phoenix, Howe & Howe Sls., Inc.	602-264-7971
CA	San Diego, Bestronics	619-693-1111
CA	Sunnyvale, Electec Sls. Inc.	408-747-1722
CA	Thousand Oaks, SC Cubed	805-496-7307
CA	Tustin, SC Cubed	714-731-9206
CO	Littleton, Simpson Assoc.	303-794-8381
CT	Broad Brook, Comptech	203-623-8014
CT	Torrington, Phoenix Sls.	203-496-7709
FL	Ft. Lauderdale, QXI of Florida	305-978-0120
FL	Orlando, QXI of Florida	813-894-4556
FL	St. Petersburg, QXI of Florida	813-894-4556
GA	Norcross, Hughes Assocs.	404-662-1587
IL	Arlington Hgts., Micro Sls.	312-956-1000
IN	Ft. Wayne, Alpha Tech, Inc.	219-447-0040
IA	West Des Moines, SPS Assoc.	515-225-0607
KS	Olathe, SPS Assoc.	913-764-4460
MD	Hunt Valley, Eagle Sls.	301-666-3930
MA	Tyngsboro, Comptech, Inc.	617-649-3030
MI	Detroit, Rathsburg Assoc.	313-559-9700
MN	Eden Prairie, Com-Tek Sls.	612-941-7181
MS	Corinth, Hughes Assocs. Inc.	601-287-2915
MO	Earth City, SPS Assoc.	314-291-0520
NE	Panama, SPS Assoc.	913-764-4460
NJ	E. Brunswick, Winch Sls. Assocs.	201-613-1515
NJ	Marlton, Naudain Assoc., Inc.	609-983-5300
NM	Albuquerque, Syntech	505-266-7951
NY	Pittsford, James E. Zimmerman Sls.	716-381-3186
NY	Plainview, Winch Sls. Assocs.	516-681-3163
NC	Matthews, ADI	704-847-4323
NC	Smithfield, ADI	919-934-8136
OH	Dayton, Lyons Corp.	513-278-0714
OH	Richfield, Lyons Corp.	216-659-9224
OH	Westerville, Lyons Corp.	614-895-1447
TX	Austin, Texoma Tech. Sls.	512-331-4694
TX	Freeport, Texoma Tech. Sls.	409-233-8192
TX	Houston, Texoma Tech. Sls.	713-462-1432
TX	Lewisville, Texoma Tech. Sls.	214-324-8097
UT	Midvale, Simpson Assoc.	801-566-3691
WA	Redmond, Quadra Sls.	206-883-3550
WI	Menominee, Micro Sales Inc.	414-251-0151
Can	Mississaqua, Ontario, John Weiss Co.	416-673-0011
Can	Nepean, Ontario, John Weiss Co.	613-825-0545
Can	St. Laurent, Quebec, John Weiss Co.	514-377-5022
Can	Vancouver, B. C., John Weiss Co.	604-873-1112

Local Distributors

AL	Huntsville, Bell Inds.	205-837-1074
AL	Huntsville, Pioneer Elctrns.	205-837-9300
AZ	Phoenix, Sterling Elect.	602-268-2121

AZ Phoenix, Wyle Distr. Grp. 602-866-2888
AZ Tempe, Bell Inds. 602-966-7800
AR Little Rock, Carlton-Bates 501-562-9100
CA Agoura, Image Elctrns. 818-707-0911
CA Calabasas, Wyle Labs. 818-880-9000
CA El Segundo, Wyle Labs. 213-322-8100
CA Fullerton, Pyramid Elctrns. 714-773-0781
CA Garden Grove, Bell Inds. 714-895-7801
CA Gardena, Bell Inds. 213-515-1800
CA Irvine, Wyle 714-863-9953
CA Los Angeles, Bell Inds. 213-826-6778
CA Orange, Ryno Elctrns. 714-637-0200
CA Rancho Cordova, Wyle 916-638-5282
CA Sacramento, Bell Inds. 916-969-3100
CA San Diego, Bell Inds. 619-268-1277
CA San Diego, Ryno Elctrns. 619-453-8430
CA San Diego, Wyle 619-565-9171
CA San Jose, Compass Comps. 408-432-7525
CA Santa Clara, Pyramid 408-727-9810
CA Santa Clara, Wyle Distr. Grp. 408-727-2500
CA Stanton, Inductive Comp/Crystal 714-828-3420
CA Sunnyvale, Bell Inds. 408-734-8570
CA Thousand Oaks, Bell Inds. 805-499-6821
CA Tustin, Image Elctrns. 714-259-0900
CO Englewood, Sterling Elctrns. 303-796-7338
CO Thornton, Wyle Distr. Grp. 303-457-9953
CO Wheatridge, Bell Inds. 303-424-1985
CT E. Haven, J. V. Elctrns. 203-469-2321
CT Norwalk, Pioneer Elctrns. 203-853-1515
CT Wallingford, Mid-State Elect. 203-265-9900
FL Altamonte Springs, Pioneer 305-834-9090
FL Deerfield Bch., Bell Inds. 305-421-1997
FL Deerfield Beach, Pioneer Elctrns. 305-428-8877
FL Ft. Lauderdale, Reptron Elctrns. 305-735-1112
FL Largo, Bell Inds. 813-541-4434
FL Tampa, Reptron Elctrns. 813-855-4656
GA Norcross, Bell Inds. 404-662-0923
GA Norcross, Pioneer Elctrns. 404-448-1711
GA Norcross, Reptron Elctrns. 404-446-1300
IL Elk Grove, Pioneer Elctrns. 312-437-9680
IL Elk Grove Vl, Bell Inds. 312-640-1910
IL Schamberg, Reptron Elctrns. 312-882-1700
IL Urbana, Bell Inds. 217-328-1077
IN Ft. Wayne, Bell Inds. 219-423-3422
IN Indianapolis, Advent 317-872-4910
IN Indianapolis, Bell Inds. 317-875-8200
IN Indianapolis, Pioneer/IN 317-849-7300
IA Cedar Rapids, Advent 319-363-0221
IA Cedar Rapids, Bell Inds. 319-395-0730
KS Lenexa, Pioneer Elctrns. 913-492-0500
MD Baltimore, Resco Washington 301-529-0500
MD Beltsville, Resco/Wash. 301-937-9100
MD Gaithersburg, Pioneer 301-921-0660
MA Billerica, A. W. Mayer Co. Inc. 617-229-2255
MA Lexington, Pioneer Elctrns. 617-861-9200
MA Wilmington, J.V. Elctrns. 617-657-6523
MA Winchester, Bell Inds. 617-729-5800
MI Ann Arbor, Bell Inds. 313-971-9093
MI Farmington Hills, Advent Elec. 313-477-1650
MI Grand Rapids, Pioneer Elctrns. 616-698-1800
MI Livonia, Pioneer Elctrns. 313-525-1800
MN Bloomington, All American 612-884-2220
MN Hibbing, Minntech Elctrns. 218-262-5228
MI Livonia, Reptron Elctrns. 313-525-2700
MN Minneapolis, Stark Elec. 612-332-1325
MN Minnetonka, Pioneer 612-935-5444
MN Minnetonka, Reptron Elctrns. 612-938-0000
MO St Louis, Ric-tronics 314-576-9816
NH Judson, Bell Inds. 603-882-1133
NH Nashua, Brevan Elctrns. 603-889-7230
NJ Berlin, GCI 609-768-6767
NJ Mt. Laurel, P.A.C. Elctrns. 609-234-1940
NJ Pinebrook, Pioneer Elctrns. 201-575-3510
NM Albuquerque, Bell Inds. 505-292-2700
NM Albuquerque, Sterling Elect. 505-884-1900
NY Binghamton, Pioneer Elctrns. 607-748-8211
NY Bohemia, Key Comps. Inc. 516-567-7500
NY Fairport, Pioneer 716-381-7070
NY Long Island, Bell Inds. 516-752-9303
NY Stony Brook, Dove Elctrns. 516-689-7733
NY Woodbury, Pioneer Elctrns. 516-921-8700
NC Charlotte, Pioneer Elctrns. 704-527-8188
NC Raleigh, Century Elctrns. 919-782-2116
NC Raleigh, QC Southeast Inc. 919-876-7767
OH Cleveland, Pioneer Elctrns. 216-587-3600
OH Dayton, Bell Inds. (Industrial) 513-435-8660
OH Dayton, Bell Inds. (Military) 513-434-8231
OH Dayton, Pioneer Elctrns. 513-236-9900
OH Worthington, Reptron 614-436-6675
OK Oklahoma City, Radio Inc. 405-789-0741
OK Tulsa, Altair 918-252-5781
OK Tulsa, Radio Inc. 918-587-9123
OR Hillsboro, Wyle Distr. Grp. 503-640-6000
OR Lake Oswego, Bell Inds. 503-241-4115
PA Horsham, Pioneer Elctrns. 215-674-4000
PA Norristown, Century Elec. 215-631-5400
PA Pittsburgh, Pioneer Elctrns. 412-782-2300
TN Nashville, Bell Inds. 615-367-4400
TX Austin, Altair 512-837-4970
TX Austin, Pioneer 512-835-4000
TX Austin, Wyle Distr. 512-834-9957
TX Dallas, Pioneer Elctrns. 214-386-7300
TX Houston, Altair 713-462-3029
TX Houston, Pioneer 713-988-5555
TX Houston, Wyle Laboratories 713-879-9953
TX Richardson, Altair 214-231-5166
TX Richardson, Bell Inds. 214-690-0466
TX Richardson, Wyle Electric 214-235-9953
UT Salt Lake City, Bell Inds. 801-972-6969
UT Salt Lake City, Standard Supp. 801-486-3371
UT Salt Lake City, Wyle Distr. Grp. 801-974-9953
VA Richmond, Sterling Elctrns. 804-226-2190
VA Sterling, Sterling Elctrns. 703-450-2373
WA Bellevue, Bell Inds. 206-747-1515
WA Bellevue, Wyle Distr. Grp. 206-453-8300
WA Kent, Pyramid Elec. 206-872-5800
WA Redmond, Priebe Elctrns. 206-881-2363
WI Milwaukee, Marsh Elect. 414-475-6000
WI Waukesha, Bell Inds. 414-547-8879
Can Burnaby, BC, R A E Ltd. 604-291-8866
Can Burnaby, BC, R-A-E Ltd / Camgaard 604-291-8866
Can Calgary, Alberta, Future 403-235-5325
Can Calgary, AB, Cardinal Elec. Ltd. 306-934-3443
Can Calgary, AB, Saynor Varah 403-255-9550
Can Dartmough NS, R A E Ltd. 902-465-2350
Can Dartmouth, N. S., Saynor Varah 902-465-2322
Can Downsvie, Ont., R A E Ltd. 416-736-1750
Can Downsview, Ont., Future 416-638-4771
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Can Edmonton, AB, R A E Ltd. 403-451-4001
Can Edmonton, AB, Saynor Varah 403-461-2222
Can Edmonton, ALB., Cardinal Elec. 403-483-6266
Can Moncton, NB, R A E Ltd. 506-855-2200
Can Montreal, Que., Versatech 514-481-0196
Can Nepean, Ont., Saynor Varah 613-726-8884
Can Oakville, ONT., Saynor Varah 416-842-8484
Can Ottawa, Ont., Future 613-820-8313
Can Pointe Claire, Que., Future 514-694-7710
Can Saskatoon, SK, Cardinal Elec. Ltd. 306-934-3443
Can Saskatoon, SK, R A E Ltd. 306-933-2888
Can Vancouver, B.C., Future 604-294-1166
Can Vancouver, BC, Saynor Varah 884-873-3211
Can Willowdale, Ontario, Electro Sonic 416-494-1666
Can Winnipeg, MN, R A E Ltd. 204-786-8401
Can Winnipeg, MN, Saynor Varah 204-633-6190

MTS SYSTEMS, Box 24012, Minneapolis, MN 55424, Tel: 612-937-4000, TELEX: 163548 MULAM DL, FAX: 214-333-3533; Empl.: 1200; *Sls. Mgr.:* Ted Beaudoin

MU-DEL ELECTRONICS, INC., 2426 Linden Lane, Silver Spring, MD 20910-1288, Tel: 301-587-6087, TELEX: 292038; FSC No.: 31563; Empl.: 8; *Sls. Mgr.:* Heinz E. Blum

MUELLER ELEC. CO., 1583 E. 31st St, Cleveland, OH 44114, Tel: 216-771-5225, FAX: 216-771-3068; Empl.: 156; *Sls. Mgr.:* J. E. Wisneski ..... **C•1468-1473**

Local Sales Offices & Reps

AZ Phoenix, The Heath Grp. 602-248-9091
CA Gardena, Ungar Sls. Assocs. 213-532-6837
CA Mountainview, Del Bucchia/Onken 415-965-8045
FL Pensacola, Mfg. Sls. & Mktg. 904-479-7472
GA Buckhead, Mfg. Sls. & Mktg. 404-342-3503
IL Bensenville, Heighway Tech. Sls. 312-860-7900
IN Indianapolis, M & L Elctrns. 317-359-4742
MD Randallstown, Chesapeake Inds. 301-922-5997
MA Adams, Richard W. Bieniek Assocs. 413-743-4164
MA Lynnfield, Keene Sls. Co. 617-245-9400
MA Scituate, Olsen Tech. Sls. 617-878-9386
MA Springfield, Keene Sls. Co. 413-525-1049
MI Royal Oak, Hilltronics 313-435-0920
MN Minneapolis, Boerger & Assocs. 612-561-2819
MS Hattiesburg, Mfg. Sls. & Mktg. 601-264-4755
NJ Clifton, R.O.I. Sls. Co. 201-340-1515
NJ Medford, Champion Elctrns. 609-983-0932
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OR Portland, Jud Lebrun Co. 503-244-6805
PA Pittsburgh, F. P. Yarussi Co. 412-221-1717
TN Memphis, Mfg. Sls. & Mktg. 901-377-5382
TX Austin, SW Mktg. Assocs. 512-442-8715
TX Dallas, SW Mktg. Assocs. 214-341-8631
TX Houston, SW Mktg. Assocs. 713-537-8166
EXP Tecnolink Elctrns. Co. 216-543-7710
Can Markham, Ont., Birde Mktg. Inc. 416-477-7722

MULTI-AMP CORP., TBG, 4271 Bronze Way, Dallas, TX 75237, Tel: 214-333-3201, TELEX: 163548 MULAM DL, FAX: 214-333-3533; Empl.: 350; *Sls. Mgr.:* Robert D. Libbey

MULTICORE SOLDERS, Cantiague Rock Rd., Westbury, NY 11590, Tel: 516-334-7997, TWX: 510-222-5185; Empl.: 1000

MULTI PRODUCTS INTERNATIONAL, 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, Tel: 201-239-8183, TELEX: 219289, FAX: 201-239-8449; Empl.: 25; *Sls. Mgr.:* LeRoy Gray ..... **A•1135, 2298-2299; D•1849-1851**

Local Sales Offices & Reps

CA Campbell, Kottmeier Assocs. 408-371-8700
CA Westminster, West Elctrn. Sls. 714-898-0120,
UT Ogden, Taylor Mktg. 801-546-9570,
FL Longwood, Elctrn. Mfgs. Agt. 305-682-1202,
GA Lawrenceville, Tek Rep Mktg. 404-963-1600
IL Des Plaines, Esco Assocs. 312-298-5310
IN Frankfort, C-S Elctrns. Sls. 317-659-1874
KS Overland Park, Electri-Rep 913-649-2168
MD Ellicott City, Eastern Tech. Corp. 301-461-7720
MA Norwood, Mac Innis Co. 617-762-8090
MI Lathrup Vl, R. C. Nordstrom & Co. 313-559-7373
MN St. Paul, Proud Inds. 612-646-9428
NJ Cedar Grove, Legtonics Assocs. 201-239-4098
NY Fairport, Hi Tec Sls. 716-223-5922,
OH Columbus, McFadden Sls. 614-459-1280
TX Dallas, MGR Elctrns. 214-238-5246
WA Bellevue, Eltech 206-643-4330
Can Lachine, Bytewide Mktg. 514-636-4121

MULTI-TECH SYSTEMS, INC., 82 Second Ave. S.E., New Brighton, MN 55112, Tel: 612-631-3550, 800-328-9717, TWX: 910-563-3610, FAX: 612-631-3575; Empl.: 145; *Sls. Mgr.:* Thomas Heimerman; *Dist. Mgr.:* Peter Hanlon/Jan Hubbard

MULTIWIRE DIVISION, Kollmorgen Corp., 250 Miller Place, Hicksville, NY 11801, Tel: 516-933-8300, TWX: 510-223-0639; Empl.: 500; *Sls. Mgr.:* Frank Melaccio

MULTIWIRE NE, Kollmorgen, 41 Simon St., Nashua, NH 03061, Tel: 603-889-0083; FSC No.: 60490; Empl.: 165; *Sls. Mgr.:* Paul Lavigne

MUPAC®
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FAX: 508-588-0498

MUPAC, 10 Mupac Dr., Brockton, MA 02401, Tel: 508-588-6110; Empl.: 130; *Sls. Mgr.:* James L. Gallagher ..... **C•1732-1733**

Local Sales Offices & Reps

AL Huntsville, Macro Mktg. Assocs., Inc. .. 205-883-9630
AZ Tempe, Piper Sls. 602-949-0048
AR Richardson, Lear Assocs., Inc. 214-231-5388
CA Burbank, Gemini Assocs. 818-846-2633
CA Los Alamitas, Gemini Assocs. 213-594-9618
CA San Diego, Hadden Assocs. Inc. 619-565-9444
CA Santa Clara, Interconnect Sls. Grp. 408-980-1166
CA Sepulveda, Gemini Assocs. 818-891-1000
CA Sunnyvale, Computer Modules 408-737-7727
CA Tustin, Gemini Assocs. 714-838-1675
CA West Covina, Mupac - West Coast Off. 213-960-3042
CO Longmont, Piper Sls. Co. 303-443-5337
FL Jupiter, Southern Elctrns. Sls. Co. 305-744-0028
GA Norcross, Macro Mktg. Assocs. 404-662-5580
IL Hoffman Estates, Micro-Tex, Inc. 312-382-3001
IN Batesville, Applied Data Mgt. 317-257-8949
MD Baltimore, Rep-Tron 301-799-7490
MI Whitmore Lake, Applied Data Mgt. 313-965-5859
MN Minneapolis, L. F. Green Assoc. 612-571-6666
NM Albuquerque, Piper Sls. Co. 505-883-9090
NY Great Neck, F & F Metro, Inc. 516-482-4080
NY Syracuse, Labtronics 315-455-7314
OH Cincinnati, Applied Data Mgt. 513-579-8108
PA Norristown, RJI 215-631-1414
PA Pittsburgh, Applied Data Mgt. 412-642-4202
TX Houston, Lear Assoc. 713-488-7893
TX Richardson, Lear Assocs. 214-231-5388
TX Seagoville, Delta Comps. 214-287-6333
UT Salt Lake City, Piper Sls. 801-466-9336
WA Bellevue, Comtec 206-453-1188
WI Waukesha, Micro-Tex, Inc. 414-542-5352

Local Distributors

CT Wallingford, Sager Electrical Supp. Co. 203-265-4600
MA Hingham, Sager Electrical Supp. Co. .. 617-749-6700

muRata ERIE

FAX: 404-436-3030

MURATA ERIE NORTH AMERICA, INC., 2200 Lake Park Dr., Smyrna, GA 30080, Tel: 404-436-1300, TELEX: 54-2329, TWX: 810-766-1531; Empl.: 1800; *Sls. Mgr.:* Jack Driscoll; *Dist. Mgr.:* Kenneth O'Connor ..... **A•1136-1140, 1430-1431, 1675-1676, 1838, 1976-1977, 2090-2092; B•1899; D•1040-1042**

Local Sales Offices & Reps

AL Madison, Jack Harvey & Assocs. 205-461-8591
AZ Scottsdale, American Mktg. Reps., Inc. 602-948-2778
AZ Scottsdale, Murata Erie N. America ... 602-941-2667
CA El Toro, English/Damco Sls. 714-837-3801
CA Los Altos, Recht. Assocs. 415-964-6321
CA San Diego, Murata Erie North America, Inc 619-259-1055
CA Santa Ana, Murata Erie North America 714-835-4822
CA Santa Clara, Murata Erie N. America, Inc. 408-496-0177
CO Longmont, Luscombe Engrg. Co. 303-772-3342
FL Clearwater, Glen White Assocs. 813-726-0577
FL Ft. Lauderdale, Glen White Assocs. ... 305-977-5885
FL Maitland, Murata Erie North America, Inc. 407-644-0954
GA Norcross, Jack Harvey & Asssocs. 404-449-4643
IL Park Ridge, Metcom Assocs 312-696-1490
IL Schaumburg, Murata Erie North America, Inc. 312-397-0099
IN Indianapolis, Jack Harvey & Assocs. .. 317-872-1031
IN Kokomo, Jack Harvey & Assocs., Inc. 317-453-4260
IA Cedar Rapids, C-Tron Inc. 319-373-2029
KS Olathe, C-Tron, Inc. 913-829-0073
KY Prospect, Jack Harvey & Assocs. 502-228-4100
MD Baltimore, Glen White Assocs. 301-321-7235
MD Columbia, Murata Erie North America 301-992-6612
MA North Adams, Jack Harvey & Assocs 413-664-9993
MA Wakefield, Murata Erie North America 617-245-7880
MA Westwood, Apex Assocs. 617-326-5042
MI W. Bloomfield, Jack Harvey & Assocs. 313-737-9122
MN Minneapolis, Stan Clothier Co., Inc. 612-944-3456
MO St. Charles, C-Tron, Inc. 314-928-8078
NJ Springfield, Radix, Inc. 201-467-4970
NY Syracuse, Rep. Tech, Inc. 315-437-2845
NC Raleigh, Glen White Assocs 919-848-1931
OH Dayton, K W Elctrn. Sls., Inc. 513-890-2150
OR Beaverton, Murata Erie North America 503-646-4973
PA Allison Pk., K W Elctrn. Sls., Inc. 412-487-4300
TN Knoxville, Jack Harvey & Assocs., Inc. 615-524-7057
TX Austin, Murata Erie North America, Inc. 512-343-9484
TX Richardson, Murata Erie North America 214-238-8211
VA Lynchburg, Glen White Assocs. 804-525-1993
WA Bellevue, Murata Erie North America 206-454-9699
WI West Allis, Metcom Assocs. 414-476-1300
Can Mississuaga, Ont., Gidden Morton Assocs. 416-671-8111
Can Nepean, Ont., Gidden Morton Assocs. 613-726-0844
Can St. Laurent, Que., Gidden Morton Assocs. 514-335-9572

Local Distributors

AL Huntsville, Time Elctrns. 205-721-1133
AZ Phoenix, Cetec-Future 602-268-2121
AZ Tempe, Acacia Sls. 602-894-2874,602-882-9054
AZ Tempe, Time 602-967-2000
CA Agoura Hills, Time Elctrns. 818-707-2890
CA Anaheim, Time Elctrns. 714-937-0911
CA Chatsworth, Cetec-Future 818-700-0914
CA Chatsworth, Passive Technlg. 818-882-2277
CA Chatsworth, Time Elctrns. 818-998-7200
CA Garden Grove, Natl. Elctrns. Corp. 714-892-7749
CA Inglewood, Newark Elctrns. 213-671-7377
CA Irvine, Acacia Sls. 213-971-2428,714-660-0834
CA Irvine, Cetec-Future 714-250-4141
CA San Diego, Acacia Sls. 619-565-4365
CA San Diego, Cetec-Future 619-278-5020
CA San Diego, Time Elctrns. 619-586-1331
CA San Jose, Cetec-Future 408-434-1114
CA San Jose, Future Elctrns. 408-434-1122
CA San Jose, Passive Technlg. Sls. 408-435-5566
CA Sunnyvale, Acacia Sls. .. 408-745-7200,916-442-5300
CA Sunnyvale, Capsco 408-734-3020
CA Sunnyvale, Time Elctrns. 408-734-9888
CA Torrance, Time Elctrns. 213-320-0880
CO Denver, Newark Elctrns. 303-423-7941
CO Englewood, Sterling Elctrns. 303-796-7338
CO Englewood, Time Electrns. 303-799-8851
CO Lakewood, Acacia Sls. 303-232-2882
CO Westminster, Future Elctrns. 303-650-0123
CT Cheshire, Time Elctrns. 203-271-3200
CT Orange, Milgray Elctrns. 203-795-0711
CT Wallingford, Cronin Elctrns. 203-265-3134
FL Ft. Lauderdale, Time Elctrns. 305-974-4800
FL Orlando, Time Elctrns. 407-841-6565
FL Tampa, Pass Tech 813-623-1935
FL Winter Park, Milgray Elctrns. 305-647-5747
GA Norcross, Milgray Elctrns. 404-446-9777
GA Norcross, Spectrum Elctrns. 404-448-1516
GA Norcross, Time Elctrns. 404-448-4448
IL Bensenville, Milgray Elctrns. 312-350-0490
IL Chicago, Newark Elctrns. 312-784-5100
IL Elk Grove Vl, Goold Elctrns. Corp. 312-593-3220
IL Rosemont, Advent Elctrns. 312-297-6200
IL Wooddale, Time 312-350-0610
IN Indianapolis, Advent Elctrns. 317-872-4910
IA Cedar Rapids, Advent Elctrns. Inc. 319-363-0221
KS Overland Park, Milgray Elctrns. 913-236-8800
KS Overland Pk., Sterling Elctrns. 913-236-5589
MD Beltsville, Resco (Washington) 301-937-9100
MD Columbia, Milgray Elctrns. 301-621-8169
MD Columbia, Time Elctrns. 301-964-3090
MD White Marsh, Resco (Baltimore) 301-529-0500
MA Hopkinton, Interface Elctrns. Corp. 617-435-6858
MA Needham, Cronin Elctrns. 617-449-5000
MA Peabody, Time 617-532-6200
MA Wilmington, Milgray Elctrns. 617-657-5900
MI Farmington Hills, Advent Elctrns. 313-477-1650
MI Oak Park, Newark 313-967-0600
MN Bloomington, Time Elctrns. 612-944-9192
MN Hopkins, The Joel Co. 612-935-6202
MN Minneapolis, Newark Elctrns. 612-331-6350
MN Minneapolis, Sterling/LCI. 612-831-2666
MO St. Louis, Time Elctrns. 314-391-6444
NH Manchester, Cronin Elctrns. 603-624-0105
NJ Camden, Gen. Radio Supp. Co. 609-964-8560
NJ E. Brunswick, Varitech 201-390-4700
NJ Marlton, Milgray 609-983-5010
NJ Pine Brook, Time Elctrns. 201-882-4611
NJ Rockaway, Tonar Inds. 201-586-9000
NM Albuquerque, Sterling Elctrns. 505-884-1900
NY E. Syracuse, Time 315-432-0355
NY Farmingdale, Milgray Elctrns. 516-420-9800
NY Hauppauge, Time Elctrns. 516-273-0100
NY Rochester, Milgray Elctrns. 716-235-0830
NC Charlotte, Elctrn. Mktg. Corp. 704-394-6195
NC Charlotte, Time 704-522-7600
NC Oxford, Time Elctrns. 919-693-5166
OH Cleveland, Milgray Elctrns. 216-447-1520
OH Columbus, Elctrn. Mktg. Corp. 614-299-4161
OH Dublin, Time 614-761-1100
OH Highland Hts., Elctrn. Mktg. Corp. 216-442-3441
OH Kettering, Electronic Mktg. Corp. 513-439-4711
OH Solon, Repco Elctrns. 216-248-8900
OH Valleyview, Newark 216-447-8860
OK Tulsa, Sterling Elctrns. 918-663-2410
OR Beaverton, Acacia Sls. 503-646-3377
OR Beaverton, Future Elctrns. 503-645-9454
OR Portland, Time Elctrns. 503-684-3780
OR Tualatin, Moore Elctrns. 503-692-5333
PA King of Prussia, Time Elctrns. 215-337-0900
TX Austin, Sterling Elctrns. 512-836-1341
TX Austin, Time 512-339-3051
TX Carrollton, Time 214-241-7441
TX Dallas, Milgray Elctrns. 214-248-1603
TX Dallas, Sterling Elctrns. 214-243-1600
TX Garland, Newark Elctrns. 214-487-8144
TX Houston, Newark 713-270-4800
TX Houston, Sterling Elctrns. 713-623-6600
TX Houston, Time 713-530-0800
UT Salt Lake City, Future Elctrns. 801-972-8489
UT Salt Lake City, Milgray Elctrns. 810-272-4999
UT Salt Lake City, Time 801-973-8181
WA Redmond, Time Elctrns. 206-882-1600
WI Mequon, Taylor Elec. Co., Inc. 414-241-4321
Can Downsview, Future Elctrns. 416-638-4771
Can Mississauga, Ont., Prelco Elctrns. 416-678-0401
Can Montreal, Prelco 514-389-8051
Can Montreal, PQ, Tonar Inds. 514-286-4061
Can Montreal, Quebec, Future Elctrns. 514-694-7710
Can Nepean, Ont., Carsten 613-726-9250
Can Nepean, Ont., Prelco Elctrns. 613-726-1800
Can Scarborough, Ont., Carsten Elctrns. 416-495-9999
Can St. Laurent, Quebec, Carsten Elctrns. .. 514-334-8321
Can Vancouver, BC, Future Elctrns. 604-294-1166
Can Willowdale, Ont., Milgray Elctrns./Toronto 416-756-4481

MURATA MANUFACTURING CO., LTD., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan 617, Tel: 075-951-9111, TELEX: J64270, FAX: 075-954-7720; Empl.: 2,771; *Sls. Mgr.:* O. Otaka

MUSHIELD CO., Div. Bomco, Inc., 103 Madison St., P.O. Box W, Malden, MA 02148, Tel: 617-321-4410, TELEX: 95-5439; FSC No.: 22780; Empl.: 10; *Sls. Mgr.:* A. A. Caron ..... **C•1754**

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CA Los Angeles, Atwood Assocs. 714-528-8778
CA San Anselmo, Technology Sys. 415-459-2774
CO Littleton, The McCarthy Co. 303-773-0643
MN Edina, Wendell Lee & Assoc. 612-831-5056
PA Orwigsburg, Jase Assoc. 717-366-1109
TX Cypress, Wessco 713-469-7814

MVP ELCTRNS., P. O. Box 5534, Orange, CA 92613-5534, Tel: 714-788-8734, TELEX: 678401; Empl.: 4; *Sls. Mgr.:* M. Vander Plaats

MWS Wire Industries

FAX: 818-706-0911

MWS WIRE INDUSTRIES, 31200 Cedar Valley Dr., Westlake Village, CA 91362, Tel: 818-991-8553, TWX: 910-336-1689; FSC No.: 51668; Empl.: 55; *Sls. Mgr.:* Greg Fancon ..... **C•1872-1873**

H. WM. MYERS & ASSOCS., 361 Virginia St, Crystal Lake, IL 60014, Tel: 815-459-0100; Empl.: 5; *Sls. Mgr.:* L. Peter Baenziger

NAE, 69 Bennett St., Lynn, MA 01905, Tel: 617-598-4800, TWX: 710-334-0254; FSC No.: 51182; Empl.: 100; *Sls. Mgr.:* Rick Kassiotis; *Dist. Mgr.:* Ellen Madden

NAMCO CONTROLS, An Acme-Cleveland Co., 7567 Tyler Blvd., Mentor, OH 44060, Tel: 216-946-9900, TELEX: 24-1566, FAX: 216-946-1228; Empl.: 200; *Sls. Mgr.:* Jon Slayburgh, VP & G/M, Elctrn. Bus.

NAMIKI PRECISION JEWEL CO., LTD., 15 Warren Street, Hackensack, NJ 07601, Tel: 201-343-3080, TWX: 710-990-1273; FSC No.: 201-343-3172

NANMAC CORP., 9 Mayhew St., Framingham, MA 01701, Tel: 617-872-4811, TELEX: 951711 FMH; Empl.: 32; *Sls. Mgr.:* G. Nanigian; *Dist. Mgr.:* J. Manigian

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NANO PULSE INDUSTRIES, 440 Nibus St., Brea, CA 92670, Tel: 714-529-2600, TWX: 910-997-0422; FSC No.: 57222; *Sls. Mgr.:* Michael J. Schubert

Local Sales Offices & Reps

AL Huntsville, MacKay & Smith Assocs. .. 205-467-3888
CA Los Gatos, Hitek Professional 408-353-2424
CA San Diego, Qualtronics 619-695-0118
CO Arvada, Delconec, Inc. 303-422-7023
FL Orlando, MacKay & Smith Assocs. 305-423-4353
GA Atlanta, MacKay & Smith Assocs. 404-496-9913
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MN Eden Prairie, Aldridge Assocs. 612-994-8433
NC Raleigh, MacKay Smith Assocs. 919-847-2277
OH Ft. Wayne, T.X. Sls. 219-489-4447
PA Newtown, Yax Assocs. 215-860-2540
TX Austin, Mathews & Assocs. 512-346-2969
TX Dallas, Mathews & Assocs. 214-248-7881
WA Redmond; Electronics Northwest, Inc. 206-883-1959

NARDA MICROWAVE CORP., Subsidiary of Loral Corp., 435 Moreland Rd., Hauppauge, NY 11788, Tel: 516-231-1700, TWX: 510-221-1867, FAX: 516-231-1711

N

FAX: 805-584-4357

NATEL ENGINEERING CO., INC., 4550 Runway St., Simi Valley, CA 93063, Tel: 805-581-3950, TWX: 910-494-1959; Empl.: 150; *Sls. Mgr.:* Anthony Carbone ..... **D•1174-1175**

Local Sales Offices & Reps

AL Huntsville, Saber Assocs. 800-327-0853
CA San Diego, McMillen & Assocs. 619-484-3402
CO Parker, Howard Assocs. 303-841-5755
FL Melbourne, Saber Assocs. 800-432-6288
GA Norcross, Saber Assocs. 800-327-0853
IL Glendale Hgts., Beta Technlg. Sls., Inc. 312-790-9886
IA Cedar Rapids, Midwest Tech. Sls., Inc. 319-365-4011
KS Lenexa, Midwest Tech. Sls., Inc. 913-888-5100
KS Wichita, Midwest Tech. Sls., Inc. 316-393-6705
MO St. Charles, Midwest Tech. Sls., Inc. ... 314-441-1012
NY N. Syracuse, Advanced Comps. Corp. 315-699-2671
NC Clayton, Saber Assocs. 800-327-0853
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PA Morrisville, Nexus Technlg. Sls. Inc. ... 215-295-6549
TX Richardson, Lear Assocs. 214-231-5388
WA Mercer Island, Eagle Entprs., Inc. 206-232-7401
WI Milwaukee, Beta Technlg. Sls., Inc. 414-543-6609

NATIONAL ELECTRONICS CORP., 11731 Markon Dr., Garden Grove, CA 92641, Tel: 714-892-7749, 800-854-2451, TWX: 910-596-1316; Empl.: 50; *Sls. Mgr.:* Steve Noyes ..... **A•1125, 1276, 1439, 1969**

Local Sales Offices & Reps

CA San Jose, Natl. Elctrns. Supp. 408-922-0500
CO Denver, Natl. Elctrns. Supp. 800-854-2451

NATIONAL CONTROLS CORP., 1725 Western Dr., W. Chicago, IL 60185, Tel: 312-231-5900, FAX: 312-231-1377; Empl.: 250; *Dist. Mgr.:* Cy Pfeifer

NATIONAL INFORMATION SYSTEMS, INC., 1190 Saratoga Avenue, San Jose, CA 95129, Tel: 408-985-7100, TELEX: 750031, FAX: 408-246-3127; Empl.: 50

NATIONAL INSTRUMENTS, 12109 Technology Blvd., Austin, TX 78727-6204, Tel: 512-250-9119, TELEX: 756737 NAT INST AUS; Empl.: 147; *Sls. Mgr.:* Don Nadon, VP Sls. ..... **D•1114**

Local Distributors

CA Mtn. View, Thorson West 415-964-9300
CA Riverside, Cal Tech Prods. 714-682-8506
CO Englewood, Odyssey 1 303-773-8176
MD Linthicum, KD Assocs. 301-859-5151
MA Reading, Scheinfein Assocs. 617-944-2304
NJ Manalapan, Beta Lambda 201-446-1100
NM Albuquerque, Odyssey 1 505-265-6645
UT Salt Lake City, Odyssey 1 801-485-4728
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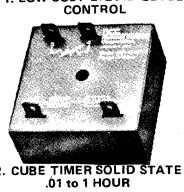
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NEW ENGLAND SMELTING WORKS, INC., 502 Union St., Box 29, W. Springfield, MA 01090, Tel: 413-734-6491; FSC No.: 3439; Empl.: 40; *Sls. Mgr.:* David R. Saffer

NEW HAMPSHIRE BALL BEARINGS, INC., NMB (USA), Inc., Rte. 202, Peterborough, NH 03458, Tel: 603-924-3311, TWX: 710-364-1805; Empl.: 1000

NEWMAN, M. M., CORP., Heli-Tube Div., P.O. Box 615, Marblehead, MA 01945, Tel: 617-631-7100, FAX: 617-631-8887; FSC No.: 09106; *Sls. Mgr.:* C. Loutrel; *Dist. Mgr.:* C. Loutrel ..... **C•1890**

NEW MEDIA GRAPHICS CORP., Matrix Corp., 780 Boston Rd., Billerica, MA 01821, Tel: 617-663-0666, FAX: 617-663-6678; Empl.: 44

NEWPORT

FAX: 714-546-3022

NEWPORT ELECTRONICS, 630 E. Young St., Santa Ana, CA 92705, Tel: 714-540-4914, TWX: 910-595-1787; Empl.: 150; *Sls. Mgr.:* Jim Way ..... **D•1388-1389**

Local Sales Offices & Reps

AZ	Phoenix, CPS Assocs.	602-246-1097
CA	Milpitas, IFM, Inc.	408-945-5920
CA	Orange, Electramation	714-997-8420
CO	Denver, AKI Entprs.	303-388-4488
FL	Orlando, Datarep, Inc.	305-843-5224
IL	Arlington Hgts., Brainard-Wilson	312-437-2700
IN	Ft. Wayne, Walter M. Bierberich Inc.	219-432-2537
IA	Des Moines, H & H Vega Sls. Assocs.	515-280-8088
KS	Wichita, H & H Vega Sls.	316-722-7856
MD	Joppa, Electra-Tech	301-877-0344
MA	Billerica, Eastronix, Inc.	617-670-2400
MI	Livonia, Amtech Reps.	313-474-8300
MN	Eden Prairie, Rockmore Sls. Corp.	612-941-1390
MO	St. Charles, Power Transmission Sys.	314-928-1750
NJ	Parlin, JMR Sls.	201-254-8484
NY	Skaneateles, NRM Mktg. Grp.	315-685-8991
NY	Wading River, JMR Sls., Inc.	516-929-5756
NC	Charlotte, SPK Instrmn.	704-535-2345
OH	Dayton, Dolfuss-Root & Co.	513-433-6776
OH	Strongsville, Dolfuss-Root & Co.	216-238-0300
PA	Bridgeville, Dolfuss-Root & Co.	412-221-4420
PA	Valley Forge, J. E. Cuesta & Co., Inc.	215-935-0400
SC	Greenville, SPK Instrmn.	803-297-4133
TX	Addison, Associated Dyn., Inc.	214-387-3800
VA	Dumfries, Electra-Tech	703-670-6962
WA	Redmond, Sls. & Engrg. Assocs.	206-883-4999
WI	Waukesha, Brainard-Wilson	414-797-7940

Local Distributors

AL	Birmingham, Brownell Instrs.	205-332-3374
AZ	Phoenix, Metermaster	602-437-1425
AR	Little Rock, Brownell Instrs.	501-562-2061
CA	Costa Mesa, FLW, Inc	714-751-7512
CA	Foster City, Therm-X	415-571-1166
CA	Hayward, FLW, Inc.	415-786-9070
CA	Los Angeles, EIL Instrs., Inc.	213-685-7020
CA	Los Angeles, Metermaster	213-685-4340
CA	S. San Francisco, Steven Engrg.	415-588-9200
CA	San Leandro, Coast Instr.	415-483-3774
CO	Aurora, R & R Instrmn.	303-340-8728
CT	Middletown, EIL Instrs., Inc.	203-346-6646
FL	Orlando, FLW, Inc.	305-894-1100
GA	Atlanta, Sesco, Inc.	404-458-6423
GA	Atlanta (Hapeville), Brownell Electro	404-762-5181
GA	Marietta, FLW Southeast	404-424-1731
HI	Kailua, FLW, Inc.	808-945-1030
IL	Chicago, Data Elctrns. Co.	312-283-0300
IL	Countryside, Pacific Indicator	312-352-3500
IL	Itasca, CMI Metermaster	312-250-0606
IN	Evansville, Electro-Lab Svcs.	812-423-5211
IA	Davenport, Universal Precision Instr.	319-326-5757
KS	Kansas City, Kornfeld Thorp	913-321-7070
KS	Silver Lake, Universal Precision	913-582-4050
KY	Louisville, P. I. Burkes Co.	502-589-3960
LA	Slidell, Process & Engrg. Prod.	504-641-0652
MD	Gaithersburg, Pioneer Instrs.	301-948-2242
MD	Sparks, EIL Instr.	301-771-4800
MA	Waltham, Calibron Instrs.	617-894-6440
MI	Royal Oak, George Instr.	313-280-1111
MN	Minneapolis, Instrmn. Svcs.	612-544-8916
MN	Minneapolis, Process Meas.	612-544-4035
MN	Plymouth, Data Elctrns.	612-559-1434
MO	Kansas City, ISL Corp.	816-587-5400
MO	St. Louis, Universal Precision Inst.	314-394-4693
NE	Omaha, Interstate Indl.	402-331-3535
NJ	Newfoundland, Hosica Labs.	201-697-6111
NY	Buffalo, KOM Lamb	716-874-3530
NY	Clarence, EIL/Trott Elctrns.	716-634-8500
NY	Fairport, Pioneer Instr. Div.	716-381-7070
NY	Farmingdale, Brownell Electro	516-420-5990
NC	Charlotte, EIL/Trott Elctrns.	704-376-2237
OH	Cincinnati, Schlemmer	513-522-8340
OH	Cleveland, Pioneer Instr.	216-587-3600
OH	Cleveland, Weschler Elec.	216-238-2550
OH	Dayton, Pioneer Instr.	513-236-9900
OH	Toledo, Girkins Elec.	419-478-5600
OK	Tulsa, Inotek	918-627-1500
OR	Portland, Eicher-Richards	503-221-1123
OR	Portland, Westcon	503-283-0132
PA	Philadelphia, Sunshine Scientific	215-673-5600
PA	York, Trola Inds.	717-848-3700
SC	Columbia, Brownell Instrs.	803-772-6111
TN	Knoxville, Brownell	615-966-3441
TX	Dallas, Dallas Meter Tek	214-349-6044
TX	Dallas, Inotek	214-243-7000
TX	Houston, American Analog	713-941-7265
UT	N. Salt Lake, Western Controls	801-292-5900
VA	Richmond, Metermetrics	804-275-1431
WA	Seattle, Branom Instrs.	206-762-6050
WA	Seattle, Eicher-Richards Co.	206-523-7888
WI	Milwaukee, E-M Instrs.	414-272-7799
WI	Waukesha, Machine Drive Sls.	414-549-9063

NEW WAVE INSTRUMENTS, 3760 Masters Court, San Jose, CA 95111, Tel: 408-629-3105, TWX: 510-601-2474, ESYLNK: 62925379; *Sls. Mgr.:* Larry Christensen ..... **D•1067**

THE J. M. NEY COMPANY, Ney Industrial Park, Bloomfield, CT 06002, Tel: 203-242-2281, TELEX: 9-9238; *Sls. Mgr.:* Hal Poschmann

NGK BERYLCO, NGK Metals Corporation, P.O. Box 13367, Reading, PA 19612-3367, Tel: 215-921-5000, TWX: 510-651-0677; Empl.: 600; *Sls. Mgr.:* Robert E. Strock

NH RESEARCH

FAX: 714-474-7062

NH RESEARCH, INCORPORATED, Instrumentation Products Division, 16601 Hale Ave., Irvine, CA 92714, Tel: 714-474-3900, TELEX: 67-8377; Empl.: 120; *Sls. Mgr.:* Fred Sabatine ..... **D•1302-1303, 2129**

Local Sales Offices & Reps

FL	Treasure Island, NH Research	813-367-5101
NJ	Franklin Lakes, Hansen & Hughes	201-848-8900

NH RESEARCH, Powertest Automatic Power Supply Test Systems, 16601 Hale Avenue, Irvine, CA 92714, Tel: 714-474-3900, TELEX: 67-8377, FAX: 714-474-7062; FSC No.: 24862; Empl.: 125; *Sls. Mgr.:* Sam Duran ..... **D•2129**

Local Sales Offices & Reps

CA	Irvine, NH Research, Inc.	714-474-3900
IL	Naperville, NH Research, Inc.	312-355-5991
NJ	Totowa, NH Research, Inc.	201-785-2261

NIC COMPONENTS CORP., 6000 New Horizons Blvd., N. Amityville, NY 11701, Tel: 516-226-7500, TELEX: 221-228, FAX: 516-226-6262; Empl.: 50; *Sls. Mgr.:* Robert Schatz; *Dist. Mgr.:* Nancy Lamendola

NICHICON (AMERICA) CORP., 927 E. State Pkwy., Schaumburg, IL 60173, Tel: 312-843-7500, TELEX: 20-6577, FAX: 312-843-2798/7125; *Sls. Mgr.:* Russ Edwards; *Dist. Mgr.:* Buddy Black

NICHIFU AMERICA, INC., 1494 N. Charlotte St., Pottstown, PA 19464, Tel: 215-323-7120, FAX: 215-970-2096; *Sls. Mgr.:* Roy Allen

NICOLET INSTRUMENT CORP., Test Instrument Division, 5225 Verona Rd., P.O. Box 4288, Madison, WI 53711, Tel: 608-271-3333, TELEX: 608-273-5061, TWX: 910-286-2737; Empl.: 700; *Sls. Mgr.:* Mike Dambach

NICOLET PARATRONICS, 201 Fourier Ave., Fremont, CA 94539, Tel: 415-490-8300, TWX: 910-381-7030; FSC No.: 6625; Empl.: 95; *Sls. Mgr.:* Bob Francisco

NICOLET COMPUTER GRAPHICS DIV., See Bruning Computer Graphics

NIDEC-TORIN CORPORATION, 100 Franklin Drive, Torrington, CT 06790, Tel: 203-482-4422, TELEX: 643963; Empl.: 350; *Sls. Mgr.:* Robert Murphy; *Dist. Mgr.:* Rich Brache

NIDUS SYSTEMS, 4333 Orange St., No. 17, Riverside, CA 92501, Tel: 714-781-0531, TWX: 910-240-5178, ESYLNK: 6275-3594; Empl.: 3; *Sls. Mgr.:* Earl Chafin

NISSEI SANGYO AMERICA, LTD., 1701 Golf Rd., Ste. 401, Rolling Meadows, IL 60008, Tel: 312-981-8989, TELEX: 28-0547, TWX: 910-233-5865; *Sls. Mgr.:* Y. Hamada

NITTANY PIEZO CERAMICS, See Piezo Kinetics, Inc.

NJE

FAX: 201-329-6185

NJE CORPORATION, 329 Culver Rd, P.O. Box 669, Dayton, NJ 08810-0669, Tel: 201-329-4611, TWX: 710-480-5674; FSC No.: 98380; Empl.: 105; *Sls. Mgr.:* John Slavik ..... **D•1853-1855**

Local Sales Offices & Reps

CA	Palo Alto, Bytec Sls., Inc.	415-493-1053
CA	San Jose, Bytec Sls., Inc.	408-435-8004
MN	Edina, Grayden & Flemmer	612-941-1120
NV	Reno, Bytec Sls., Inc.	702-852-4006
NJ	Dayton, NJE Corp.	201-329-4611

nkk switches OF AMERICA INC.

FAX: 602-998-1435

NKK SWITCHES OF AMERICA, INC., 14415 N. Scottsdale Rd., Scottsdale, AZ 85260, Tel: 602-991-0942; FSC No.: 63426; Empl.: 50; *Sls. Mgr.:* Joseph Nessim; *Dist. Mgr.:* Joseph Nessim ..... **B•1776-1777**

Local Sales Offices & Reps

AL	Huntsville, Over & Over	205-837-7105
AZ	Mesa, Elec-Com Assocs. Inc.	602-844-0566
AZ	Scottsdale, NKK Switches	602-991-0942
CA	Anaheim, Spectrum Assocs. Inc.	714-630-6977
CA	Santa Clara, Caltron Components Corp.	408-980-0181
CO	Wheatridge, Cluff & Assocs. Inc.	303-425-6604
CT	Sandy Hook, Schumacher & Yarrington, Inc.	203-426-3874
FL	Altamonte Springs, Over & Over, Inc.	305-332-1222
FL	Coral Springs, Over & Over Inc.	305-753-7050
FL	Tampa, Over & Over Inc.	813-626-9100
GA	Norcross, Over & Over, Inc.	404-449-6205
ID	Boise, Bob Sickler Sls. Co.	208-344-9588
IL	Mt. Prospect, The Dombrow Co., Inc.	312-253-3326

IN Carmel, Frank E. Kahsar Sls. 317-844-9353
IA Cedar Rapids, Midwest Tech. Sls. 319-365-4011
KS Goddard, Midwest Tech. Sls. 316-794-8565
KS Lenexa, Midwest Tech. Sls. 913-888-5100
MA Winchester, Schumacher & Yarrington, Inc. 617-721-2515
MI Ann Arbor, Frank E. Kahsar Sls. 313-769-0131
MN Minnetonka, J. P. & Assocs. 612-935-7930
MO St. Charles, Midwest Tech. Sls. 314-441-1012
NH Nashua, Schumacher & Yarrington, Inc. 603-882-2664
NY Clifton Pk., NET Sls. Co. 518-371-6864
NY Cortland, NET Sls. Co. 607-756-6592
NY De Ruyter, NET Sls. Co. 315-662-7996
NY Fairport, NET Sls. Co. 716-223-1030
NY Melville, Comtronic Assocs., Inc. 516-249-0505
NY Webster, NET Sls. Co. 716-223-1030
NC Charlotte, Over & Over Inc. 704-542-9111
NC Raleigh, Over & Over Inc. 919-782-9111
OH Cincinnati, Frank E. Kahsar Sls. 513-922-3133
OH Columbus, Frank E. Kahsar Sls. 614-252-4009
OH Mentor, Frank E. Kahsar Sls. 216-257-1166
OR Portland, James J. Backer Co. 503-297-8744
PA Sewickley, Frank E. Kahsar Sls. 412-741-4155
PA West Conshohocken, Eastern Comps. Sls. 215-825-8610
RI Warwick, Schumacher & Yarrington, Inc. 401-884-5671
TX Dallas, Rem Air Components Corp. 214-234-1069
TX Houston, Rem-Air Assocs. 713-729-7160
UT Salt Lake City, Cluff & Assocs. 801-486-7297
WA Seattle, James J. Backer Co. 206-285-1300
Can Mississauga, Ont., John G. Weiss Co., Ltd. 416-673-0011
Can Nepean, Ont., John G. Weiss Co., Ltd. 613-825-0545
Can St. Laurent, Que., John G. Weiss Co., Ltd. 514-337-5022
Can Vancouver, B.C., John G. Weiss Co., Ltd. 604-873-1112
Can Winnipeg, Manitoba, John G. Weiss Co., Ltd. 204-949-1877

Local Distributors

AL Huntsville, Allied Elctrns. 205-721-3500
AL Huntsville, Powell Elctrns. 205-539-2731
AZ Phoenix, Dalis Elctrn. Supp. 602-275-2885
AZ Phoenix, Powell Elctrns. 602-938-5552
AZ Tucson, Inland Elctrn. Supp. 602-889-5301
AR Ft. Smith, Radio, Inc. 501-646-5200
AR Little Rock, Bluff City Elctrns. 501-376-7044
CA Costa Mesa, Eric Elctrns. 714-751-1185
CA Costa Mesa, Powell Elctrns. 714-754-1717
CA Fountain Valley, Components Ctr. 714-979-0433
CA Fremont, Allied Elctrns. 415-770-0590
CA Los Angeles, Electric Switches, Inc. 213-660-1310
CA Milpitas, Zack Elctrns. 415-326-5482
CA Monterey, Zack Elctrns. 408-375-3144
CA Sacramento, Zack Elctrns. 916-446-3131
CA San Diego, Mock III Sls. Co., Inc. 619-560-0515
CA San Diego, Shanks & Wright 619-239-0176
CA San Diego, Southland Comps. 619-578-6634
CA San Francisco, Zack Elctrns. 415-626-1444
CA San Jose, Eric Elctrns. 408-432-1111
CA San Jose, Powell Elctrns. 408-943-9020
CA San Jose, Rose Elctrn. Dist. Co. 408-263-9700
CA Santa Clara, Components Ctr. 408-988-3751
CA Tustin, Allied Elctrns. 714-669-4190
CA Tustin, Western Switches & Controls 714-259-8144
CA Vallejo, Zack Elctrns. 707-644-6676
CO Arvada, Denver Beta 303-431-7161
CO Aurora, Jet Elctrns. Supp. Co. 303-364-1000
CO Colorado Springs, Kimball Elctrns. 303-528-7066
CO Denver, Allied Elctrns. 303-790-1664
CO Englewood, NEP Elctrns. 303-799-9898
CT Danbury, Pilgrim Elctrns., Inc. 203-792-7274
CT Middletown, Midstate Elctrns. 203-632-1138
CT Wallingford, Midstate Elctrns. 203-265-9900
FL Altamonte Springs, Control Des. Supp., Inc. 305-788-3220
FL Altamonte Springs, Control Design Supp. 305-788-8220
FL Clearwater, Allied Elctrns. 813-539-0369
FL Ft. Lauderdale, Bros. Elctrns. 305-561-6700
FL Ft. Lauderdale, Powell Elctrns. 305-979-5000
FL Miami, Electronic Equip. Co. 305-871-3500
FL Pompano Bch., Allied Elctrns. 305-978-3008
FL Tampa, Elctrn. Equip. Co., Inc. 813-988-0810
FL West Palm Beach, Nurmi Elctrn. Supp., Inc. 305-686-8553
GA Augusta, Dixie Elctrns., Inc. 404-772-2055
GA Norcross, Allied Elctrns. 404-446-8595
GA Norcross, Applied Power, Inc. 404-263-0421
GA Norcross, Whitehead Elctrns. 404-923-6667
ID Boise, Kimball Elctrns., Inc. 208-342-3559
ID Pocatello, Kimball Elctrns., Inc. 208-232-2201
IL Addison, Belford Elctrns. 312-691-1100
IL Addison, L Comp, Inc. 312-628-1400
IL Chicago, Leeds Electro Comps. 312-625-3800
IL Elgin, Allied Elctrns. 312-697-8200
IL Geneva, Melvin Elctrns., Inc. 312-232-8050
IL Villa Park, Melvin Elctrns., Inc. 312-279-5015
IL Wheeling, Hawk Elctrns., Inc. 312-459-4030
IN Indianapolis, MAR Elctrns. 317-633-6699
IA Cedar Rapids, L-Comp 319-373-1028
KS Great Bend, RSC Elctrns., Inc. 316-793-3507
KS Salina, RSC Elctrns., Inc. 913-823-6353
KS Wichita, Airtechnics, Inc. 316-267-2849
KS Wichita, L-Comp 316-265-5100
KS Wichita, Radio Inc. 316-264-2798
KS Wichita, RSC Elctrns., Inc. 316-267-5213
KY Florence, URI Elctrns., Inc. 606-371-4423
LA New Orleans, Southern Radio Supp. Co. 504-524-2343
MD Columbia, Allied Elctrns. 301-381-1560
MD Columbia, Powell Elctrns. 301-995-6410
MD Gaithersburg, Axis Elctrns., Inc. 301-840-9640
MD Kensington, Marine Air Supply Co. 301-949-9560
MD Marlow Hgts., Allied Elctrns. 301-423-0161
MA Avon, Controller Svc. & Sls. 617-584-9010
MA Billerica, A. W. Mayer Co., Inc. 617-229-2255
MA Boston, Controller Svc. & Sls. 617-269-1375
MA Westborough, Powell Elctrns. 617-366-6100
MA Wilmington, Allied Elctrns. 617-942-0150
MI Ann Arbor, Wedemeyer Elctrn. Supp. 313-665-8611
MI Grand Rapids, RM Elctrns. 616-531-9300
MI Lansing, Wedemeyer Elctrn. Supp. 517-484-9009
MI St. Clair Shores, Spemco 313-771-2700
MN Burnsville, Cassidy Elctrns. 612-895-9026
MN Eden Prairie, Allied Elctrns. 612-829-7554
MN Minneapolis, Stark Elctrns. Supp., Inc. 612-332-1325
MS Columbus, Bluff City Elctrns. 601-328-6212
MS Tupelo, Bluff City Elctrns. 601-842-6832
MO Kansas City, L Comp., Inc. 816-221-2400
MO Maryland Hgts., L Comp., Inc. 314-291-6200
MO St. Louis, Franklin Elctrns. Co. 314-993-5333
NH Manchester, Controller Svc. & Sls. 603-623-7225
NJ E. Brunswick, Brothers Elctrns. 201-238-2200
NJ Englewood, Powell Elctrns. 201-894-0800
NJ Kenilworth, Federated Purchaser 201-272-0505
NJ Mt. Laurel, Allied Elctrns. 609-234-7769
NM Albuquerque, Dalis Elctrns., Inc. 505-888-4525
NY Bohemia, Key Components 516-567-7500
NY Hempstead, Electronic Equip. Co. 516-538-5510
NY Mineola, Allied Elctrns. 516-248-2360
NY Mt. Vernon, QAR Industrial Elctrn. Sls., Inc. 914-699-2224
NY Rochester, Allied Elctrns. 716-244-9440
NY Rochester, Masline Elctrns., Inc. 716-546-5373
NY Rome, Rome Elctrns. 315-337-5400
NY Troy, Trojan Elctrn. Supp. Co. 518-274-4481
NY Yonkers, Kin-Tronics Inc. 914-968-7736
NC Cary, Powell Elctrns. 919-467-1212
NC Charlotte, Dixie Elctrns., Inc. 704-377-5413
NC Pineville, Resco 704-588-1530
NC Raleigh, Allied Elctrns. 919-876-5845
NC Raleigh, Resco 919-781-5700
NC Winston-Salem, Dixie Elctrns., Inc. 919-724-5961
OH Canton, Whitehead Elctrns. 216-477-9576
OH Cincinnati, Schuster Elctrns. 513-489-1400
OH Cincinnati, URI Elctrns. 513-761-4030
OH Columbus, Wedemeyer Elctrn. Supp. Co., Inc. 614-436-9600
OH Columbus, Whitehead Elctrns. 614-224-1186
OH Twinsburg, Schuster Elctrns. 216-425-8134
OK Oklahoma City, Radio, Inc. 405-789-0741
OK Oklahoma City, RSC Elctrns. 405-631-7729
OK Tulsa, Radio, Inc. 918-587-9123
OR Beaverton, Comp. Resources 503-641-8488
OR Beaverton, Norvac Elctrns. 503-644-1025
OR Beaverton, Rose Elctrn. Distr. 503-629-9288
OR Eugene, Norvac Elctrns. 503-345-2905
OR Portland, URS Elctrns. 503-233-7151
OR Tigard, Priebe Elctrns. 206-881-2363
PA Allentown, Federated Purchaser 215-437-4481
PA Philadelphia, H & R Elctrns. 215-426-1700
PA Philadelphia, Powell Elctrns. 215-365-1900
PA Pittsburgh, Allied Elctrns. 412-367-4124
PA Wayne, Peak Elctrns. 215-293-9000
RI Providence, Controller Svc. & Sls. 401-781-7100
SC Columbia, Dixie Elctrns. 803-779-5332
SC Greenville, Dixie Elctrns. 803-297-1430
SC N. Charleston, Dixie Elctrns. 803-552-2671
SC Taylors, Cantrell Whlse. Prods. 803-268-1194
TN Gray, Dixie Elctrns. 615-477-3838
TN Jackson, Bluff City Elctrns. 901-424-0236
TN Knoxville, Dixie Elctrns. 615-938-4131
TN Memphis, Bluff City Elctrns. 901-345-9500
TN Nashville, Bluff City Elctrns. 615-242-8000
TX Austin, Southwest Elctrns. 512-837-8971
TX Austin, Wofford Elctrns. 512-339-1131
TX Brownsville, Carden Indl. Grp. 512-541-3660
TX Dallas, Allied Elctrns. 214-553-4370
TX Dallas, Off The Shelf Comps., Inc. 214-247-0052
TX Dallas, Southwest Elctrns. 214-234-3050
TX Dallas, Wallace Elctrns. 214-340-0400
TX Ft. Worth, Allied Elctrns. 817-336-5401
TX Ft. Worth, Swieco, Inc. 817-335-6521
TX Houston, Wofford Elctrns. 713-847-3583
TX Humble, Allied Elctrns. 713-446-8005
TX Irving, Powell Elctrns. 214-550-0547
TX Richardson, Off the Shelf Comps., Inc. 214-238-0808
TX Richardson, RSC Elctrns. 214-644-3444
TX Stafford, Southwest Elctrns. 713-240-4000
UT Salt Lake City, Ballard Supp. Corp. 801-972-2430
UT Salt Lake City, Kimball Elctrns. 801-328-2075
UT Salt Lake City, Salt Lake Beta 801-966-0236
UT Salt Lake City, Std. Supp. Co. 801-486-3371
WA Bellevue, Powell Elctrns. 206-641-4446
WA Kent, Comp. Resources 206-251-9771
WA Redmond, Priebe Elctrns. 206-881-2363
WA Seattle, Allied Elctrns. 206-547-2827
WA Seattle, URS Elctrns. 206-451-9393
WI Mequon, Taylor Elec. Co. 414-241-4321
WI New Berlin, NEP Elctrns., Inc. 414-785-9100
WI Oconomowoc, GW Elctrns., Ltd 414-367-6003
WI Waukesha, Hawk Elctrns. 414-547-4457
Can Burnaby, BC, ITT Multicomps. 604-291-8866
Can Calgary, Alberta, ITT Multicomps. 403-253-8575
Can Concord, Ont, Trade Elctrns. 416-661-7111
Can Concord, Ont., ITT Multicomps. 416-736-1144
Can Dartmouth, NS, ITT Multicomps. 902-465-2350
Can Edmonton, Alberta, ITT Multicomps. 403-451-4001
Can Monkton, NB, ITT Multicomps. 506-857-8011
Can Nepean, Ont., ITT Multicomps. 613-226-7406
Can Saskatoon, SK, ITT Multicomps. 306-373-7138
Can St. Laurent, PQ, ITT Multicomps. 514-335-7697
Can Winnipeg, Manitoba, ITT Multicomps. 204-786-8401

NKR PRECISION MANUFACTURING, Rte. 17M, Box 333, Harriman, NY 10926, Tel: 914-782-8562; Empl.: 17

NMB TECHNOLOGIES INCORPORATED

FAX: 818-341-8207

NMB TECHNOLOGIES, 9730 Independence Avenue, Chatsworth, CA 91311, Tel: 818-341-3355 ..... **A•1750-1751; B•1242, 1829; C•1690**

NOBEX DIV., Griffith Plastics Corp., 1027 California Dr., Box 4365, Burlingame, CA 94010, Tel: 415-342-8170; FSC No.: 32767; Empl.: 35

NOBLE U.S.A., INC., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008, Tel: 312-364-6038, TELEX: 206745, FAX: 1-312-364-6045; *Sls. Mgr.:* Robert K. Burdick; *Dist. Mgr.:* Vyto Omilijonas

NOHAU CORPORATION, 51 E. Campbell Ave., Ste. 107E, Campbell, CA 95008, Tel: 408-866-1820, 408-866-4493, FAX: 408-370-3155 ..... **D•1304**

Local Sales Offices & Reps

CA Long Bch., Softwired Sys. 213-434-9409
CA San Diego, Microware Technlg. Inc. 619-693-4280

NOKIA-MOBIRA, Sub. of the Nokia Corp.-Helsinki, 2300 Tall Pines Drive, Largo, FL 34641, Tel: 813-536-5553; Empl.: 4,000; *Sls. Mgr.:* P. Chelgren

NOLATRON, P.O. Box 4042, Harrisburg, PA 17111, Tel: 717-564-3398, FAX: 717-939-5831; Empl.: 5

NOLL, J. A. CO., P.O. Box 312, Monroeville, PA 15146, Tel: 412-733-1089; *Sls. Mgr.:* P. Carson; *Dist. Mgr.:* P. Carson

NON-LINEAR SYSTEMS/DIV. OF KAYPRO CORP., 533 Stevens Ave., Solana Bch., CA 92075, Tel: 619-481-3953, TWX: 910-322-1132; Empl.: 55; *Sls. Mgr.:* Ben W. Fisher; *Dist. Mgr.:* Jeanne Simmons

NORELCOM INDS., 63 Marine St., Farmingdale, NY 11735, Tel: 516-249-7245, FAX: 516-249-3745; Empl.: 30

NOREN PRODUCTS INC., 1010 O'Brien Blvd., Menlo Pk., CA 94025, Tel: 415-322-9500, TELEX: 17-1410 Noren MNPK, FAX: 415-324-1348

NORGREN, 5400 South Delaware, Littleton, CO 80120-1663, Tel: 303-794-2611, TELEX: 45541; Empl.: 661; *Sls. Mgr.:* Patrick Maley

NORITAKE CO., INC., Noritake Co., Limited (Japan), 23820 Hawthorne Blvd., Ste. 100, Torrance, CA 90505, Tel: 213-373-6704; FSC No.: 213-772-3918; Empl.: 7; *Sls. Mgr.:* Y. Tatsuta

NORLAND CORPORATION, Norland Dr., Ft. Atkinson, WI 53538, Tel: 414-563-8456, TELEX: 26-5448; Empl.: 250; *Sls. Mgr.:* Jay Singer

NORPLEX/OAK INC., Allied-Signal Inc., P.O. Box 1448, La Crosse, WI 54602-1448, Tel: 608-784-6070, TELEX: 59-2257; Empl.: 2,200; *Sls. Mgr.:* George Gabuzda

NORSAL INDUSTRIES, 85 D Hoffman Lane S., Central Islip, NY 11722, Tel: 516-234-1200, TWX: 510-234-1200, FAX: 516-234-1589; Empl.: 45; *Sls. Mgr.:* Marc Spector

NORTH AMERICAN PHILIPS CONTROLS CORP., See Airpax Corporation, Cheshire Div.

NORTH AMERICAN PHILIPS LIGHTING, Bank St., Hightstown, NJ 08520, Tel: 609-448-4000, TWX: 510-685-5651; Empl.: 600; *Sls. Mgr.:* C. J. Lehmann

NORTH AMERICAN PRINTED CIRCUIT DIV., Tyco Labs., Inc., Box 145, Stafford, CT 06075, Tel: 203-684-2703; Empl.: 230

NORTH ATLANTIC INDUSTRIES, 60 Plant Ave., Hauppauge, NY 11788, Tel: 516-582-6060, TWX: 510-227-9660, FAX: 516-582-8079; FSC No.: 07342; Empl.: 320; *Sls. Mgr.:* K. Salz ..... **D•1305, 1391**

Local Sales Offices & Reps

AL	Huntsville, Periphix-Teqspec	205-721-1701
AZ	Phoenix, Aztec Entprs.	602-944-9185
CA	Cupertino, T. Louis Snitzer Co.	408-257-8333
CA	Los Angeles, T. Louis Snitzer Co.	213-836-6170
CO	Denver, Aztec Entprs.	303-779-5285
CT	Middletown, Intersell	203-528-5357
FL	Cocoa Beach, TeqSpec	305-783-3444
FL	Palm Harbor, Teqspec	813-785-2276
GA	Shellville, Periphex-Teqspec	404-972-7955
IL	Chicago, Pat Lind Elctrns.	312-726-3513
IN	Indianapolis, Pat Lind Elctrns.	317-632-7444
KS	Lenexa, Ramsey Assocs.	913-541-1007
MD	Wheaton, Brimberg Sls. Co.	301-946-2670
MA	Burlington, Intersell	617-273-3844
MN	Circle Pines, P. Lind	612-786-5770
MO	Chesterfield, Ramsey Assocs.	314-532-9386
NJ	Teaneck, Sci. Dvcs.-East	201-837-1004
NM	Albuquerque, Aztec Entprs.	505-262-1688
NC	Winston-Salem, Teqspec III	919-723-8102
PA	Horsham, Pennsylvania Sci. Dvcs.	215-956-0700
TX	Houston, Scientific Sls.	713-460-9170
TX	Richardson, Sci. Sls.	214-231-6541
UT	Ogden, Aztec Entprs.	801-621-1655
WA	Kirkland, Syntek	206-488-0394
WI	Milwaukee, Pat Lind Elctrns.	414-224-0146
Can	Scarborough, Ont., John DeGroot Assocs.	416-431-9331

NORTHEAST INNOVATIONS, INC., International Science Technology, P.O. Box 120, Concord, NH 03302, Tel: 603-736-8260; *Sls. Mgr.:* James P. Diggins

NORTHEAST SCIENTIFIC CORP., 30 Wetherbee St., Acton, MA 01720, Tel: 508-263-2711; Empl.: 10; *Sls. Mgr.:* C. Moritz

NORTHERN AMPOWER CORPORATION, 47087 Grand River Avenue, Novi, MI 48050, Tel: 313-349-4860, FAX: 313-344-2575; Empl.: 35; *Sls. Mgr.:* Ronald E. Kirsch

NORTHERN PRECISION LABS., 11 Madison Rd., Fairfield, NJ 07006, Tel: 201-227-4800, TWX: 710-734-4301; Empl.: 95; *Sls. Mgr.:* P. Pytal

NORTHERN TECHNOLOGIES, 747 Main St., Ste. 207, Concord, MA 01742, Tel: 617-371-0915, TELEX: 948337, FAX: 617-371-2580; Empl.: 400

North Hills Electronics, Inc.

FAX: 516-759-3327

NORTH HILLS ELECTRONICS, 1 Alexander Pl, Glen Cove, NY 11542, Tel: 516-671-5700, TELEX: 46-6886; FSC No.: 98821; Empl.: 125; *Sls. Mgr.:* Herb Marx ..... **A•1247, 2300-2302**

Local Sales Offices & Reps

CA	Palo Alto, Tri Rep	415-965-1822
CT	Wethersfield, Underwood Sls. Corp.	203-563-3046
MA	Lowell, Underwood Sls. Corp.	617-256-8191
MN	Minneapolis, Hei-Lite Sls.	612-861-6051
NJ	Glen Gardner, F & M Tech. Sls.	201-832-7216
OR	Portland, Evergreen Mktg. Grp.	503-643-8020
TX	Dallas, Milestek, Inc.	817-455-7444
TX	Houston, Milestek, Inc.	713-376-6776
WA	Seattle, Evergreen Mktg. Grp.	206-633-3160
Can	Montreal, Componetics Ltd.	514-331-9930

NORTHLAKE ENGINEERING, INC., 999 Anita Ave., Antioch, IL 60002, Tel: 312-395-5710, FAX: 312-395-9101; FSC No.: 50638; Empl.: 120; *Sls. Mgr.:* W. A. Hardt

NORTHWEST MICROCIRCUITS, INC., 5464SW Philomath Blvd., Corvallis, OR 97333, Tel: 503-753-8242; Empl.: 12; *Sls. Mgr.:* Wm. H. Ferwalt

Local Sales Offices & Reps

MN	Minneapolis, E.P.M. Inc.	612-434-9446

NORTON ASSOCIATES, INC., 10 Di Tomas Ct., Copiague, NY 11726, Tel: 516-842-4666; FSC No.: 08739

NOVA ELECTRIC INC., 263 Hillside Ave., Nutley, NJ 07110, Tel: 201-661-3434, TELEX: 427386, FAX: 201-661-3926; FSC No.: 29019; Empl.: 50; *Sls. Mgr.:* Kenneth Niovitch ..... **D•2130-2131**

Local Sales Offices & Reps

AL	Huntsville, VESCO	205-881-1494
AZ	Phoenix, Aspen Power, Inc.	602-931-9287
FL	Orlando, Data Rep	305-682-6548
GA	Macon, VESCO	912-745-5200
HI	Honolulu, Victor Kim Elctrns.	808-841-6266
IN	Indianapolis, CMP	317-244-1685
MD	Lanham, Sel-Tronics	301-731-8080
MI	Farmington Hills, CMP	313-477-7700
MO	St. Louis, P.E.M. Sls. Co.	314-427-7200
NJ	Nutley, Nova Elec. Sls.	201-661-3434
NY	Buffalo, J & M Schaefer, Inc.	716-825-8050
NY	E. Syracuse, J & M Schaefer, Inc.	315-463-5223
NY	Rochester, J & M Schaefer, Inc.	716-586-9300
NC	Raleigh, VESCO	919-859-1550
OH	Berea (Cleveland), CMP	216-826-0400
OH	Englewood, CMP	513-836-0951
PA	Washington, Battery Sys., Inc.	412-228-7500
TX	Ft. Worth, ATM/Qualified Power	817-572-3788
UT	Salt Lake City, Computer Environments	801-466-6002
Can	N. Vancouver, B.C., Interworld Elctrns.	604-984-4471

NOVATEK CORPORATION, 900 East Atlantic Blvd., Pompano Beach, FL 33060, Tel: 305-782-4397, TELEX: 522600 AAA EXECT, FAX: 305-971-0316; Empl.: 5; *Sls. Mgr.:* Joe DiBrigida

NOVATRONICS, Box 878, Pompano Beach, FL 33061, Tel: 305-942-5200, TWX: 510-956-9878, FAX: 305-776-7147; Empl.: 460; *Sls. Mgr.:* Joseph P. Muni

NOVATRONICS OF CANADA LTD., 677 Erie St., P.O. Box 610, Stratford, Ontario, Canada N5A 6V6, Tel: 519-271-3880, TELEX: 06-955394, FAX: 519-271-9781; Empl.: 100; *Sls. Mgr.:* Laraine Murray ..... **B•1243**

Local Sales Offices & Reps

WA	Seattle, Bill Knorr Sls.	206-643-4330

NOVOTECHNIK U.S., INC., Village Plaza, 488 Boston Post Rd., Rte. 20 E., Marlborough, MA 01752, Tel: 617-485-2244, FAX: 617-485-2430; FSC No.: MULTIPLE; Empl.: 5 ..... **B•1900**

NRD INC., Mark IV Ind., Inc., 2937 Alt Blvd. N., Grand Island, NY 14072, Tel: 716-773-7634, TELEX: 91578 NRD GRDI, FAX: 716-773-7744; Empl.: 100; *Sls. Mgr.:* James R. Curtis; *Dist. Mgr.:* Larry Keating ..... **D•2170**

Local Sales Offices & Reps

AZ	Phoenix, Pam Hopkins Assoc.	602-253-7888
CA	San Jose, Tech-Ser, Inc.	408-496-1004
CA	Torrance, Tech-Ser, Inc.	213-370-7200
FL	Tampa, SRT Mktg.	813-884-4805
GA	Atlanta, Electro-Rep Assocs.	404-320-1134
IL	Chicago, M. Gottlieb Assocs., Inc.	312-775-1151
IN	Kokomo, M. Gottlieb Assocs., Inc.	317-455-0444
MA	Clinton, Devaney Assocs., Inc.	617-368-1436
MI	Southfield, Comp. Assocs., Inc.	313-355-4110
MN	Edina, Omni-Tec	612-881-4447
MO	Liberty, Lectro-Reps	816-781-2522
NY	Rochester, TCS	716-342-2406
NC	Charlotte, Electro-Rep Assocs.	704-527-2530
PA	Langhorne, AMS Assocs.	215-364-1050
TX	Dallas, Scalon, Hughes & Assocs.	214-739-2888
Can	Toronto, Ont., Sigma Mktg.	416-757-5757

Local Distributors

CT	Wallingford, Astech, Inc.	203-265-4241
CT	West Hartford, Signal Ind. Elec.	203-236-6005
IA	Cedar Rapids, Storage Engrg. Co., Inc.	319-363-7775
KS	Witchita, R.S.C. Elctrns.	316-267-5213
MD	Gaithersburg, R. S. Willard Co., Inc.	703-948-7700
MI	Grand Rapids, S.F. Elctrns.	616-459-0216
MI	Pontiac, Techno Inds., Inc.	313-628-4090
MO	Kansas City, Elctrns. Supp.	816-931-0250
MO	St. Louis, Van Sickle Elctrns.	314-621-5000
NY	Cortland, Monroe-Metz	1-800-424-2442
NY	Rochester, Batty Hoyt	716-647-9400
OH	Dayton, Griffith Dist. Co.	513-224-9102
TN	Johnson City, Tri-Citys Ind. Supp. Co.	615-929-8106
VA	Arlington, Arlington Elctrns. Whlsrs.	703-524-6256
PR	Rio Piedras, Rubber & Gasket Co. of P.R.	809-763-8787
Can	Mississauga, Ont., Prelco Elctrns.	416-678-0401
Can	Montreal, Que., Prelco Elctrns.	514-389-8051
Can	Nepean, Prelco Elctrns.	613-726-1800

NTE ELECTRONICS, INC., 44 Farrand St., Bloomfield, NJ 07003, Tel: 201-748-5089, FAX: 201-748-6224; FSC No.: 7T184; Empl.: 60; *Sls. Mgr.:* Annette Fuchs; *Dist. Mgr.:* Mary Damiano

NTK

FAX: 201-467-5794

NTK TECHNICAL CERAMICS, NGK Spark Plugs (USA), Inc., 99 Morris Ave., Springfield, NJ 07081, Tel: 201-376-6070, TELEX: 95-246-1286; FSC No.: 95-246-1286; *Sls. Mgr.:* Mark Ota; *Dist. Mgr.:* Earl Hanson ..... **A•1438, 1772; B•1901; D•1044-1045, 2171**

Local Sales Offices & Reps

AL	Huntsville, L&D, Inc.	205-837-1469
CA	Culver City, DeAngelo Rothman and Co. Inc.	213-827-2202
CT	Brookfield, M & M Assocs.	203-775-6888
FL	Longwood, D-Assocs.	305-830-8976
FL	Maitland, D. J. Ellis & Assocs., Inc.	305-645-1101
FL	Maitland, D. J. Ellis Assocs.	305-645-1101
FL	Maitland, D.J. Ellis & Assocs. Inc.	305-645-1101
GA	Atlanta, L&D Inc.	404-455-3483
IL	Chicago, Greenslade Sls.	312-593-3450
IN	Ft. Wayne, T.X. Sls.	219-489-4447
IA	Chanhassen, Barnes Sls. Assocs.	612-934-2907
MA	Framingham, G/M Assocs., Inc.	617-380-0785
MI	Ann Arbor, Jordan-Elliott Sls. Inc.	313-662-4087
MI	Jackson, Jordan-Elliottt Inc.	517-788-8353
MN	Chanhassen, Barnes Sales Assocs.	612-934-2907
NC	Raleigh, L&D Inc.	919-876-5301
PA	Rydal, Espy Sls. Assocs.	215-576-0780
PA	Rydal, ESPY Sls.	215-576-0780
TN	Seymour, L & D, Inc.	315-573-6511
VA	Richmond, L & D, Inc.	804-257-7717
WA	Seattle, Northmar Inc.	206-524-5170

NT.T/WAVECONN, State Rd. Hill, Meadville, PA 16335, Tel: 800-535-3162, 914-591-4173, FAX: 914-591-7783; Empl.: 100; *Sls. Mgr.:* Sigmund Jay Silberstein

NUCLEAR RESEARCH CORP., 125 Titus Ave., Box H, Warrington, PA 18976, Tel: 215-343-5900, TELEX: 510-665-8525 NRC WNTN; FSC No.: 96696; Empl.: 85; *Sls. Mgr.:* James R. Lee

NUCLEONIC PRODS., See Thomson-CSF Comps. Corp., Passive Comps. Div.

NU-CONCEPT SYSTEMS, 2725 Advance La.,P. O. Box 587, Colmar, PA 18915, Tel: 215-822-8400, FAX: 215-822-1427; FSC No.: 58561; Empl.: 17; *Sls. Mgr.:* Robert F. Scheuerle

Local Sales Offices & Reps

CA	Glendale, Tooltronics	818-240-4000,
CO	Denver, Prod. Equip. Sls.	303-650-0344,
CT	Lyme, Art Meyers	203-767-0555,
FL	Altamonte Springs, PFI of Florida, Inc.	305-365-4781,
GA	Woodstock, Protech Sys.	404-926-0342,
IL	Downers Grove, Physics Equip.	312-960-4054,
MD	Baltimore, Art Meyers	301-574-7054,
MO	Raytown, Versatech	816-353-9303,
NH	Hampton, Matrix Sls.	603-926-1965,
NJ	Camden, Arch Mfg. & Sls.	609-966-3835
OH	Heath, Howden Co.	614-928-6666,

TX Dallas, Torenko & Assocs. 214-340-6565,
WA Mukilteo, Systems Specialists 206-355-0404,

NU DATA, 32 Fairview Ave., Little Silver, NJ 07739, Tel: 201-842-5757, TELEX: 271139, TWX: 710-722-5754; Empl.: 20; *Sls. Mgr.:* Richard A. Previte

NU-MEDIA, 1075 Featherstone, Pontiac, MI 48057, Tel: 313-373-1165; FSC No.: 2450; Empl.: 26; *Sls. Mgr.:* Brett W. Lincoln

NUMERIX CORP., 20 Ossipee Rd., Newton, MA 02164, Tel: 617-964-2500, TELEX: 948032, FAX: 617-969-4380

NU-METRICS INC., Cedar Valley Bldg., Box 471, Vanderbilt, PA 15486, Tel: 412-628-6370, 800-346-2025, FAX: 412-628-8875; Empl.: 12; *Sls. Mgr.:* Bernie Ames

NWL CAPACITORS, NWL Transformers, 8050 Monetary Dr., Riviera Bch., FL 33404, Tel: 305-848-9009, FAX: 305-848-9011; Empl.: 20

NWL TRANSFORMERS

FAX: 609-298-1982

NWL TRANSFORMERS, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, Tel: 609-298-7300, TWX: 510-685-3645; Empl.: 225; *Sls. Mgr.:* C. W. Harrison ..... **A•2303; D•1857**

NYE, WILLIAM F. CO., Div. of New Bedford Thread Co., Inc., P.O. Box G-927, New Bedford, MA 02742-0927, Tel: 617-996-6721, TELEX: 940807; Empl.: 22; *Sls. Mgr.:* Donald R. Fairbanks

NYLTITE, 3451 S. Clinton Ave., S. Plainfield, NJ 07080, Tel: 201-561-1300; *Sls. Mgr.:* Frances Gould

Nytronics Components Group

FAX: 803-393-5421 (x362)

NYTRONICS COMPONENTS GRP., INC., 700 Orange St., Darlington, SC 29532, Tel: 803-393-5421, TWX: 810-665-2182; FSC No.: 83125; Empl.: 502; *Sls. Mgr.:* Mack W. Windham
.... **A•1144-1157, 1192, 1248-1269, 1594-1600, 1979; B•1019**

Local Sales Offices & Reps

AL Huntsville, B.C.I. 205-529-4411
AZ Tucson, Clemick & Assocs. 602-749-4003
CA Los Angeles, MG Sls. 213-476-3113
CA Sunnyvale, W.W. Posey 408-746-0771
CO Englewood, Component Sls. 303-779-8060
CT Bloomfield, Astrorep of New England 203-243-3122
FL Longwood, Beacon 305-332-1940
GA Chamblee, B.C.I. 404-455-0405
IL Glendale Hgts., Beta 312-790-9886
IN Indianapolis, EMCI 317-253-1668
KS Lenexa, Mid-Tec Assoc. 913-541-0505
MA Lowell, Astrorep of New England 617-459-7399
MI Ann Arbor, Kahsar Sls., Inc. 313-769-0131
MN Minneapolis, Dunlop Consits. 612-544-1070
MO St. Louis, Mid-Tec Assoc. 314-275-8666
NJ West Orange, National Atlantic 201-731-0730
NY Pittsford, W.A. Franklin Sls. 716-248-8251
NY Valley Cottage, LRC Assocs. 914-268-4435
OH Cincinnati, Kahsar Sls., Inc. 513-922-3133
OH Columbus, Kahsar Sls., Inc. 614-252-4009
OR Tigard, Eltech, Inc. 503-684-3458
PA Narberth, Bresson Assocs. 215-664-6460
TX Dallas, Texoma 214-324-8097
TX Houston, Texoma 713-462-1432
UT Salt Lake City, Component Sls. 801-268-8440
VA Lynchburg, Bresson Assocs. 703-237-1304
WA Bellevue, Eltec 206-643-4330
WI Milwaukee, Beta 414-543-6609
Can Ottawa,Ont, Dynasty Elctrns. 613-738-1200

Local Distributors

CA Garden Grove, Inductive Prods. 714-891-2572
CA Gardena, Bell Inds. 213-515-1800
CA San Diego, Mock III 619-560-0515
CA San Diego, Neumann Elctrns. 619-695-3005
CA Santa Clara, Cypress 408-980-2500
CA Sunnyvale, Bell Inds. 408-734-8570
CA Thousand Oaks, Bell 805-499-6821
CA Walnut, A. C. I. 818-331-0735
CO Englewood, Industrial Elctrns. 303-694-9444
CO Wheatridge, Bell Inds. 303-424-1985
IL Chicago, Bell Inds. 312-982-9210
IL Chicago, Newark Elect. 312-638-4411
IN Indianapolis, Bell Inds. 317-634-8202
MD Beltsville, Newark Elec. 301-937-5085
MD White Marsh, RESCO/Baltimore 301-529-0500
MA Needham, Cronin Elctrns. 617-449-5000
MA Woburn, Sterling Elec. 617-938-6200
MN Minneapolis, Joel Co. 612-545-5669
NY Farmingdale, Pride Elctrns. 516-293-4020
NY Hauppauge, Fairmont Elctrns. 516-231-3313
NY Hauppauge, Jaco Elect. 516-273-5500
NY Plainview, ACI Elect. 516-293-6630
NY Rome, Rome Elect. 315-337-5400
NC Raleigh, Radio Elec. Svc. 919-781-5700
OH Centerville, C.V. Clark 513-435-3000
OR Lake Oswego, Bell Inds. 503-241-4115
PA Montgomeryville, Pyttronic Inds. 215-643-2850
PA Philadelphia, Herback Rademan 215-426-1700
PA Philadelphia, PEI 215-568-7400
PA York, E. C. I. 717-843-8971
TX Dallas, Wholesale Elect. 214-824-3001
WA Bellevue, Bell Inds. 206-747-1515

OAK MATERIALS GROUP INC., Laminates Div., 1 Mechanic Street, Hoosick Falls, NY 12090, Tel: 518-686-4379, TELEX: 710-965-9721; FSC No.: 53240; *Sls. Mgr.:* Robert L. Fidrych; *Dist. Mgr.:* Richard Spiak

OAK Switch Systems Inc.

FAX: 815-459-5000 (x2218)

OAK SWITCH SYSTEMS, 100 S. Main St., Crystal Lake, IL 60014, Tel: 815-459-5000, TWX: 910-634-3353; FSC No.: 76854; Empl.: 500; *Dist. Mgr.:* Gary LeMaire ..... **B•1778, 1830**

Local Sales Offices & Reps

AL Huntsville, Electramark, Inc. 205-539-7040
AZ Scottsdale, Harris & Croy 602-951-9121
AZ Tucson, Harris & Croy Inc. 602-575-5109
CA Granada Hills, C & N & Assocs., Inc. .. 818-895-2431
CA San Mateo, Stewart/Fullerton & Assocs. 415-570-7666
CO Broomfield, Technet Sls. & Svcs. 303-466-7777
FL Winter Springs, Oak Switch Sys., Inc. 305-699-4010
GA Norcross, Electramark, Inc. 404-446-7915
IL Crystal Lake, Oak Switch Sys. Inc. 815-459-5000
IL Palatine, Golbeck/Milota 312-705-0602
IA Cedar Rapids, Pattison Sls. 319-395-9866
KS Olathe, C-Tron, Inc. 913-829-0073
MA Acton, Boston Elctrns. Assocs. 617-264-4456
MI White Pigeon, Oak Switch Sys. Inc. ... 616-483-7179
MN Maplewood, Ziegenbein Assoc., Inc. ... 612-772-1324
MO St. Charles, C-Tron 314-928-8078
NE Omaha, IO Neb 402-895-4431
NJ Cherry Hill, Eastern Elctrns. 609-662-2113
NJ Mountainside, Henry G. Richter 201-233-4615
NY Fayetteville, Henry G. Richter 315-637-6713
NC Raleigh, Eastern Elctrns. 919-876-7591
OH Cincinnati, JMK Elctrns. 513-271-3860
OH Cleveland, JMK Elctrns. 216-886-7100
OH Dayton, JMK Elctrns. 513-435-6228
OR Tigard, Matrix Sls. & Mktg. 503-639-0325
PA Phoenixville, Henry G. Richter 215-495-6176
TX Dallas, Dal/Tex Rep., Inc. 214-991-7799
UT Sandy, Technet-Utah 801-572-3107
WI Brookfield, Ziegenbein Assocs., Inc. ... 414-785-1350
Can Don Mills, Ont., R. D. Assocs. 416-444-0959

Local Distributors

AL Huntsville, Component Distr. 205-883-7501
AL Huntsville, Marshall Elctrns. 205-881-9235
AZ Phoenix, Marshall Elctrns. 602-496-0290
AZ Tempe, Harper SID 602-967-1464
AR Little Rock, Component Distr. 501-277-6278
CA Chatsworth, Marshall Elctrns. 818-407-4100
CA Compton, Harper SID 213-979-5090
CA Inglewood, Newark Elctrns. 213-671-7066
CA Irvine, Marshall Elctrns. 714-859-5050
CA Milpitas, Marshall Elctrns. 408-943-4600
CA Mountain View, I/O Sls. Inc. 415-968-1080
CA Palo Alto, Zack Elctrns. 415-326-5432
CA Rancho Cordova, Marshall Elctrns. 916-635-9700
CA San Diego, Harper SID 619-578-2500
CA San Diego, Marshall Elctrns. 619-578-9600
CA San Francisco, Zack Elctrns. 415-626-1444
CA Sunnyvale, Harper SID 408-747-0333
CO Denver, CSID 303-292-9594
CO Denver, Newark Elctrns. 303-757-3351
CO Englewood, Component Distrs. 303-799-4916
CO Thornton, Marshall Elctrns. 303-451-8383
CT Wallingford, Marshall Elctrns. 203-265-3822
FL Ft. Lauderdale, Marshall Elctrns. 305-977-4880
FL Melbourne, Component Distr. 305-724-9910
FL Orlando, Marshall Elctrns. 305-841-1878
FL W. Palm Bch., Wings Electro Sls. Co. 305-798-6606
GA Norcross, Component Distr. 404-441-3320
GA Norcross, Marshall Elctrns. 404-923-5750
IL Chicago, Newark Elctrns. 312-784-5100
IL Crystal Lake, Sub-Sem, Inc. 815-459-4139
IL Palatine, Ohm/Elctrns. 312-359-5500
IL Rosemont, Advent Elctrns. 312-297-6200
IL Schaumburg, Marshall Elctrns. 312-490-0155
IN Indianapolis, Advent Elctrns. 317-874-2190
IN Indianapolis, Graham Elctrns. 317-634-8202
IN Indianapolis, Marshall Elctrns. 317-297-0483
KS Edwardsville, C. Tennant Co. 913-441-1801
KS Lenexa, Marshall Elctrns. 913-492-3121
MD Gaithersburg, Marshall Elctrns. 301-840-9450
MA Canton, Impact Sls. 617-821-1500
MA Westborough, In-Stock Prods. 617-870-5750
MA Wilmington, Marshall Elctrns. 617-658-0810
MI Farmington Hills, Advent Elctrns. 313-477-1650
MI Livonia, Marshall Elctrns. 313-525-5850
MI Oak Park, Newark Elctrns. 313-967-0600
MN Minneapolis, Newark Elctrns. 612-331-6350
MN Minneapolis, Northern, Inc. 612-944-1167
MN Plymouth, Marshall Elctrns. 612-559-2211
MO St. Louis, Olive Elctrns. 314-426-4500
NJ Fairfield, Marshall Elctrns. 201-882-0320
NJ Mt. Laurel, Marshall Elctrns. 609-234-9100
NJ Springfield, Route Elctrns. 201-379-7710
NM Albuquerque, Walker Radio 505-883-2992
NY East Syracuse, Modutex Corp. 315-437-7052
NY Hauppauge, Fairmont Elec. 516-231-3313
NY Hauppauge, Marshall Elctrns. 516-273-2424
NY Jamaica, Calson Co. 718-525-5900
NY Johnson City, Marshall Elctrns. 607-798-1611
NY Northport, Coke-el Aerospace Co. 516-754-2233
NY Rochester, Marshall Elctrns. 716-235-7620
NC Raleigh, Component Distr. 919-787-7311
NC Raleigh, Marshall Elctrns. 919-878-9882
OH Centerville, IPD 513-435-2086
OH Dayton, Marshall Elctrns. 513-236-8088
OH Solon, Marshall Elctrns. 216-248-1788
OH Westerville, Marshall Elctrns. 614-891-7580
OR Beaverton, Marshall Elctrns. 503-644-5050
OR Portland, Radar Elec. 503-232-3404
PA Pittsburgh, Marshall Elctrns. 412-963-0441
TN Nashville, Graham Elctrns. 615-367-4400
TX Austin, Marshall Elctrns. 512-837-1991
TX Carrollton, Marshall Elctrns. 214-233-5200
TX Dallas, Component Distr. 214-644-0373
TX El Paso, Ideal Indl. Elect. 915-779-6647
TX Garland, Newark Elctrns. 214-494-5911
TX Houston, Marshall Elctrns. 713-895-9200
TX Irving, Harper S. I. D. 214-621-0500
UT Salt Lake City, Marshall Elctrns. 801-485-1551
WA Bellevue, Marshall Elctrns. 206-747-9100
WA Seattle, Radar Elec. 206-282-2511
WA Spokane, Radar Elec. 509-747-3053
WI Brookfield, Marshall Elctrns. 414-797-8400
Can Burlington, Ont., White Radio 416-632-6894
Can Burnaby, B.C., Semad Elctrn. Dist. 604-438-2515
Can Calgary, Alberta, Semad Elctrn. Dist. .. 403-252-5664
Can Downsview, Ont., Westburne Elctrns. 416-635-2980
Can Markham, Ont., Semad Elctrn. Dist. 416-475-3922
Can Ottawa, Ont., Semad Elctrn. Dist. 613-727-8325
Can Ottawa, Ont., Westburne Elctrns. 613-737-5570
Can Pointe Claire, Semad Elctrn. Dist. 514-694-0860

OAKTRON INDUSTRIES, INC., 704 30th St, Monroe, WI 53566, Tel: 608-328-5560, TELEX: 260-266; FSC No.: 07109; Empl.: 250; *Sls. Mgr.:* J. F. Disch; *Dist. Mgr.:* Jim Hendrickson

OAL ASSOCIATES, P.O. Box J, Escondido, CA 92025, Tel: 619-743-7143, FAX: 619-743-2460; Empl.: 18; *Sls. Mgr.:* Mark Lohkemper

OAS INC., See Optimum Applied Systems

OCEAN MARINE INSTRUMENT, P. O. Box 3963, Tustin, CA 92680, Tel: 714-832-4627 ..... **D•2140**

OCTAGON SYSTEMS, 6510 W. 91st Ave., Westminster, CO 80030, Tel: 303-426-8540, TELEX: 4931919

ODELL, M. P., CO., 1620 Chesapeake Dr., Hoffman Estates, IL 60195, Tel: 312-991-2828; *Sls. Mgr.:* Maria McClurkin

OECO CORP., 4607 S.E. International Way, Milwaukie, OR 97222, Tel: 503-659-7932, TELEX: 36-0350; FSC No.: 95266; *Sls. Mgr.:* Dave Fuller

OGALLALA ELCTRNS., Div. Arnold Engrg. Co., Box 59, Ogallala, NE 69153, Tel: 308-284-4093, FAX: 308-284-4093 (ext 29); Empl.: 37; *Sls. Mgr.:* H. L. Harrington

OSI

FAX: 614-486-0743

OHIO SEMITRONICS, INC., 1205 Chesapeake Ave., Columbus, OH 43212, Tel: 614-486-9561; FSC No.: 12066; Empl.: 36; *Sls. Mgr.:* G. Clagett ..... **B•1902-1917; D•1306-1309**

Local Sales Offices & Reps

AZ	Tucson, Sheldon Equip.	602-722-1452
CA	Arcadia, Van Gott & Assocs.	818-445-9728
CA	Hayward, FLW, Inc.	415-786-9070
CT	Wallingford, Pat Jenks Assocs.	203-265-9939
FL	Orlando, Datarep	305-843-5224
GA	Marietta, FLW	404-424-1731
IL	Columbia, R. L. Weisheimer & Assocs.	618-281-4148
IL	Park Ridge, Elctrn. Instr. Assocs.	312-298-2290
MD	Baltimore, Electra-Tech, Inc.	301-877-8344
MA	Danvers, Pat Jenks Assocs.	617-777-5600
MI	Milford, TMS	313-360-1514
MN	Minneapolis, The Mark Co.	612-933-3026
NJ	Garwood, E. R. Mertz, Inc.	201-272-0687
NY	Latham, L-Tron Corp.	518-785-5032
NC	Charlotte, Zelco Assocs.	704-541-6122
OH	Dayton, Mohawk Intronics	513-434-8873
OH	No. Ridgeville, TMS, Inc.	216-327-3527
OR	Portland, Topp Engrg. Sls. Corp.	503-244-7265
PA	Carnegie, Flow Media	412-276-8055
PA	Frazier, FLW, PA, Inc.	215-251-9700
TN	Memphis, Jordan/Marlar/Hale, Inc.	901-452-7441
TX	Houston, Scientific Sls. Co.	713-460-9170
TX	Richardson, Scientific Sls. Co.	214-231-6541
UT	Salt Lake City, MC Squared, Inc.	801-298-3388
WA	Bellevue, Topp Engrg. Sls. Corp.	206-747-5400

FAX: 312-675-1505

OHMITE MANUFACTURING CO., 3601 W. Howard St., Skokie, IL 60076, Tel: 312-675-2600, TELEX: 72-4433, TWX: 910-223-0805; FSC No.: 44655 ..... **A•1980-1994, 2094-2095**

OHMTEK SFERNICE, INC.

FAX: 716-283-5932

OHMTEK INC., Sfernice Group Company, 2160 Liberty Dr., Niagara Falls, NY 14304, Tel: 716-283-4025; FSC No.: 57489; Empl.: 175; *Sls. Mgr.:* William Cuviello ..... **A•1848, 2020-2025**

Local Sales Offices & Reps

AZ	Scottsdale, Semper Fi Sls., Inc.	602-991-4601
CA	Chatsworth, Raltech	818-700-0933
CA	Del Mar, Chapman & Chapman	619-755-0412
CA	Glendale, Mission Mktg. Grp.	818-247-9110
CA	Santa Clara, I Square, Inc.	408-988-3400
CO	Denver, West, Inc.	303-477-8180
FL	St. Petersburg, J.C.J. Assocs.	813-343-2679
IL	Downers Grove, Richmar Elctrns.	312-968-0118
IN	Ft. Wayne, John F. Kilfoil Co.	219-436-7233
IA	Hiawatha, Ard Sls.	319-393-6392
MA	Sterling, Compatible Comps., Inc.	617-422-7641
MI	Jackson, T.P.S. & Assocs.	517-783-1722
MN	Minneapolis, Dunlop Consits.	612-544-1070
NJ	Piscataway, R. P. Luce & Co.	201-752-8750
NY	Chappaqua, Micrel, Inc.	914-238-4961
NY	New Hyde Pk., R. P. Luce & Co.	516-437-4550
NY	Rochester, Fritz Dasson	716-338-1699
OH	Wooster, T.P.S. & Assocs.	216-264-0971
OR	Beaverton, Eclipse Mktg. Grp.	503-642-1661
PA	Wynnewood, Metz-Benham Assocs., Inc.	215-896-7300
TX	Richardson, Pro-Comp Sls. Co.	214-669-1500
UT	Salt Lake City, West, Inc.	801-466-5739
WA	Redmond, Eclipse Mktg. Grp.	206-885-6991
Can	Rexdale, Ont., Source Elctrns.	416-675-6235

Local Distributors

MA	Sterling, Compatible Comps. Dvcs.	617-422-7356

OK INDUSTRIES, INC., 4 Executive Plaza, Yonkers, NY 10701, Tel: 914-969-6800, TELEX: 12-5091; Empl.: 200; *Sls. Mgr.:* John Malboeuf

OKONITE CO., Box 340, Ramsey, NJ 07446, Tel: 201-825-0300, TWX: 710-988-1017; Empl.: 1700; *Sls. Mgr.:* F. R. Postma

OLEKTRON CORP., Signal Technology Corp., 61 Sutton Road, Webster, MA 01570, Tel: 617-943-7440, TELEX: 710-347-1602, FAX: 617-949-1804; FSC No.: 32252

OLFLEX WIRE & CABLE, INC., 30 Plymouth Street, Fairfield, NJ 07006, Tel: 201-575-1101, TELEX: 130-327, ESYLNK: 201-575-7178; Empl.: 25; *Sls. Mgr.:* Michael R. Picone

OLIVER ADVANCED ENGINEERING, 320 W. Arden St., Glendale, CA 91203, Tel: 818-240-0080, TWX: 510-600-8099, FAX: 818-240-6131; Empl.: 28; *Sls. Mgr.:* J. Gilberts

OLYMPIC WIRE & CABLE, 1 Madison Rd., Fairfield, NJ 07006, Tel: 201-227-7996, FAX: 201-227-1606; FSC No.: 63830; Empl.: 35; *Dist. Mgr.:* Yvette Archer

OMEGA ENGINEERING, Box 4047, Stamford, CT 06907, Tel: 203-359-1660, TELEX: 99-6404; Empl.: 500; *Sls. Mgr.:* Peter Casiraghi & Nelson Hart ..... **B•1779, 1860-1861, 1932-1933; C•1891; D•1013, 1099, 1138, 1177, 1312, 1392-1393, 1420**

OMEGA PRECISION CORP., 1384 Pompton Ave., Cedar Grove, NJ 07009, Tel: 201-256-3422; FSC No.: 9Y506; Empl.: 16; *Sls. Mgr.:* Leon Komsa

Local Sales Offices & Reps

CA	Mountain View, Lindsay Assocs.	415-965-3307
CO	Littleton, TMC	303-773-0643
MD	Baltimore, Bernard White & Co., Inc.	301-484-5400
OH	Hudson, J. A. Chluda & Assocs.	216-650-1638
PA	Westfield, Roberson Assocs.	201-256-3422

OMNIBYTE CORP., 245 W. Roosevelt Rd., Bldg. 1-5, W. Chicago, IL 60185, Tel: 312-231-6880, 1-800-638-5022, FAX: 1-312-231-7042; Empl.: 38; *Sls. Mgr.:* Mike Hansen

OMNIPrint

FAX: 408-747-0358

OMNIPRINT, INC., 1188 Elko Drive, Sunnyvale, CA 94089, Tel: 408-745-6400; Empl.: 12 ..... **D•1100**

Local Sales Offices & Reps

CA	Irvine, OBI Distrs.	714-250-9003
CA	Mountain View, I/O Sls. Inc.	415-968-1080
IL	Arlington Heights, Coombs Assoc., Inc.	312-439-9810
NJ	Fords, Marlin Data	201-738-7200
TX	Austin, The Thorson Co.	512-345-1985
TX	Dallas, The Thorson Co.	214-233-5744
TX	Houston, The Thorson Co.	713-771-3504
WI	Milwaukee, Coombs Assocs., Inc.	414-351-6123

OMNI SPECTRA, INC., Microwave Subsystems Div., 2626 So. Hardy Dr., Tempe, AZ 85282, Tel: 602-966-1471, TWX: 910-950-1296; *Sls. Mgr.:* Carl Seburn; *Dist. Mgr.:* Carl Seburn

OMNI SWITCH USA, INC., 21630 N. 19th Ave., Ste. B-16, Phoenix, AZ 85027, Tel: 602-582-0629, FAX: 602-582-0665; Empl.: 100; *Sls. Mgr.:* Laurie Ball

OMNITEK, INC., P.O. Box 102, 820 Pennsylvania Blvd., Feasterville, PA 19047, Tel: 215-355-4443, TWX: 510-667-1730; FSC No.: 54316; *Sls. Mgr.:* Frank Shandelman

OMRON ELCTRNS., INC., Control Comps. Div., One E. Commerce Dr., Schaumburg, IL 60173, Tel: 312-843-7900, TWX: 910-291-2494, FAX: 312-843-7787 (ext. 8568); Empl.: 209; *Sls. Mgr.:* F. Newburn ..... **B•1550-1554, 1780-1781**

Local Sales Offices & Reps

CA	Anaheim	714-978-6008,
CA	Cupertino	408-255-9231
IL	Schaumburg	312-843-7900
KS	Kansas City	913-262-0560
MA	Danvers	617-774-6501
MI	Detroit	313-357-6666,
PA	Wayne	215-964-9376

OMUTEC, Odetics, Inc., 1515 S. Manchester Ave., Anaheim, CA 92802, Tel: 714-758-0200, TWX: 910-594-1461; *Sls. Mgr.:* Stan Tomlinson

ONAN POWER/ELECTRONICS, 4801 W. 81st St., Minneapolis, MN 55437, Tel: 612-921-5600, FAX: 612-921-5627; FSC No.: 3Z577; *Sls. Mgr.:* John R. Michael

ONEAC CORPORATION, 27944 N. Bradley Rd., Libertyville, IL 60048, Tel: 312-816-6000, 800-243-4543; *Sls. Mgr.:* Frank Brletich

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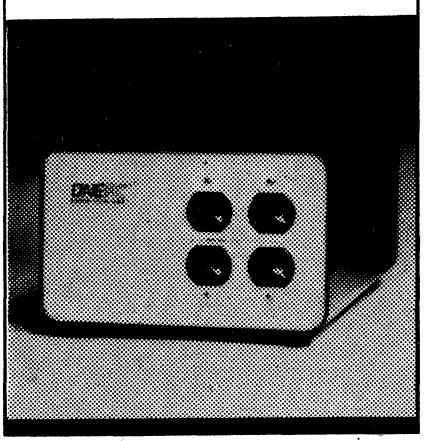

ONSET COMPUTER CORP., 199 Main St, PO Box 1030, N. Falmouth, MA 02556, Tel: 617-563-2267, TELEX: 469915; Empl.: 8; *Sls. Mgr.:* Lon Hocker

OPAMP LABS, INC., 1033 N. Sycamore Ave., Los Angeles, CA 90038, Tel: 213-934-3566; FSC No.: 24699; Empl.: 18 ..... **D•1015**

OPTEK

FAX: 214-542-1739

OPTEK TECHNOLOGY, INC., 345 Industrial Blvd., McKinney, TX 75069, Tel: 214-542-9461, TWX: 910-860-5625; Empl.: 610; *Sls. Mgr.:* James Trautwein; *Dist. Mgr.:* Betty Renfro ..... **B•1278**

Local Sales Offices & Reps

AZ	Scottsdale, Earl & Haas Assoc.	602-994-3813
CA	Escondido, Uni Rep	714-746-5131
CA	Santa Clara, Criterion	408-988-6300
CA	Thousand Oaks, Sc Cubed	805-496-7307
CA	Tustin, Sc Cubed	714-731-9206
CO	Wheatridge, Waugaman Assocs.	303-423-1020
CT	Madison, Conti-Younger Assocs.	203-245-1136
FL	Coral Springs, H A I	305-752-7520
FL	Melborne, H A I	305-676-1639
FL	Tampa, HAI	813-963-0743
IL	Rolling Meadows, KMA Sales	312-398-5300
IN	Indianapolis, J & W Sales	317-842-3740
MA	Burlington, Conti-Younger Assocs.	617-273-1582
MI	Grosse Pointe Pk, Greiner Assocs.	313-499-0188
MN	Eden Praire, Elctm. Innovators	612-941-0830
MO	St. Louis, Engineering Services	314-997-1515
NY	Clark Mills, KLM/Garner	315-853-6126
NY	Manhasset, Win-Cor Elec.	516-627-9474
NY	Pittsford, KLM/Garner	716-381-8350
NY	Syracuse, KLM/Garner	315-458-6214

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OR	Tigard, Vantage Corp.	206-455-3460
PA	Prospect Park, Elf Sls. Co.	215-534-3340
TX	Austin, ProSales	512-467-9947
TX	Dallas, Prosales	214-492-8870
TX	Houston, Prosales	713-495-8130
UT	Salt Lake City, Waugaman Assocs.	801-261-0802
WA	Bellevue, Vantage Corp.	206-455-3460
WA	Spokane, Vantage Corp.	509-924-4410
WI	Milwaukee, KMA	414-259-1771

Local Distributors

AZ	Tempe, Anthem	602-968-3888
CA	Chatsworth, Anthem	818-700-1000
CA	East Irvine, Anthem	714-768-4444
CA	San Diego, Anthem	619-453-9005
CA	San Jose, Anthem	408-295-4000
CA	Tustin, AVED	714-259-8258
CO	Englewood, Anthem	303-790-4500
IL	Elk Grove Village, RM Elctrns.	312-364-6622
IL	Palatine, Ohm Elctrns.	312-359-5500
IN	Indianapolis, RM Elctrns.	317-291-7110
MA	Andover, R2 Elctrns.	617-470-3777
MA	Newton, Greene Shaw	617-969-8900
MI	Grand Rapids, RM Elctrns.	616-531-9300
MN	Fridley, Voyager	612-571-7766
NJ	West Berlin, General Comps., Inc.	609-768-6767
NY	New York, Moneloa Elctrns.	212-764-3028
NC	Greensboro, Golden Elctrns.	919-294-4653
WA	Belleview, Bell Inds.	206-747-1515
WI	Milwaukee, Taylor	414-241-4321

OPTELECOM, INC., 15930 Luanne Dr., Gaithersburg, MD 20877, Tel: 301-840-2121, FAX: 301-948-6357; FSC No.: 59338; Empl.: 50; *Sls. Mgr.:* Harish K. Jain

OPTICAL & CONDUCTIVE COATINGS, Meridian Inds., Inc., 428 N. Buchanan Cir., 68, Pacheco, CA 94553, Tel: 415-798-6066, TELEX: 470166 HQ WNCK; FSC No.: 9U775; Empl.: 8; *Sls. Mgr.:* Glenn G. Grupe

OPTICAL ELECTRONICS, INC., 2700 E. Bisby Rd., Tucson, AZ 85706, Tel: 602-889-8811, TELEX: 283347 (via RCA); FSC No.: 5962; Empl.: 16; *Sls. Mgr.:* Victoria Acosta

OPTICS FOR RESEARCH, INC., P.O. Box 82, Caldwell, NJ 07006, Tel: 201-228-4480, TELEX: 130-224, FAX: 201-228-0905; Empl.: 21; *Sls. Mgr.:* Donald K. Wilson

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OPTIMA ENCLOSURES, 2166 Mountain Indl. Blvd., Tucker, GA 30084, Tel: 404-496-4000, TWX: 810-766-3967; FSC No.: 10110; Empl.: 250; *Sls. Mgr.:* Robert J. Tomlin ..... **C•1063-1066**

Local Sales Offices & Reps

AZ	Scottsdale, Arcom Sls.	602-947-5745
CA	Brea, Masco Elctrns.	714-529-0866
CA	Santa Clara, Nova-Tronix	408-727-9530
FL	Oviedo, Conley & Assocs., Inc.	305-365-3283
GA	Atlanta, Optima Enclosures	404-496-4000
IL	Itasca, Janus, Inc.	312-250-9650
KS	Kansas City, BC Elctrn. Sls.	913-342-1211
MD	Randallstown, Beacon North	703-478-2480
MA	Millis, Selmark Assocs., Inc.	617-376-2914
MN	Minneapolis, Holgren Assocs.	612-786-7641
MO	Ferguson, BC Elctrn. Sls.	314-521-6683
NJ	Berkeley, Cambridge Allen	201-464-0203
NJ	Marlton, Beacon North Inc.	609-596-9456
NY	Binghamton, Empire Tech. Assoc.	607-772-0651
OH	Cleveland, C. A. Robinson Co.	216-473-6044
OH	Dayton, C. A. Robinson Co.	513-278-7969
TX	Austin, Matthews & Assocs.	512-346-2969
TX	Dallas, Matthews & Assocs.	214-248-7881
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OPTIMA PRECISION, INC., 3626 Hightide Drive, Rancho Palos Verdes, CA 90274, Tel: 800-544-4418, 213-377-4118, FAX: 213-544-0264; Empl.: 6

OPTIMATION, See Julie Research Labs

OPTIMEM, 435 Oakmead Parkway, Sunnyvale, CA 94086, Tel: 408-737-7373, TWX: 910-339-9615; Empl.: 120; *Sls. Mgr.:* Tom Jarrett; *Dist. Mgr.:* Tom Jarrett

OPTIMIZED DEVICES, INC., 220 Marble Ave., Pleasantville, NY 10570, Tel: 914-769-6100; Empl.: 30

OPTIMUM APPLIED SYSTEMS, 145 Palisade St., Dobbs Ferry, NY 10522-1696, Tel: 914-693-9001, TELEX: 646141:FSA PBO DOBB; Empl.: 30; *Sls. Mgr.:* H. Joseph Brakl

OPT INDUSTRIES INC., 300 Red School La., Phillipsburg, NJ 08865, Tel: 201-454-2600, TWX: 510-235-2920; Empl.: 450; *Sls. Mgr.:* John T. Cain

OPTOELECTRONICS, INC., 5821 N.E. 14th Ave., Ft. Lauderdale, FL 33334, Tel: 305-771-2050, TELEX: 514849, FAX: 305-771-2052; Empl.: 25; *Sls. Mgr.:* L. R. Hufft; *Dist. Mgr.:* L. R. Hufft

OPTOELECTRONICS/TEXTRON, 1309 Dynamic St., Petaluma, CA 94975-0039, Tel: 707-763-4181, TELEX: 34-0186; Empl.: 175

OPTO PLUS, 25922 Minerva Ct., Mission Viejo, CA 92691, Tel: 714-380-8654 ..... **B•1077**

OPTO TECHNOLOGY, INC., 562 Chaddick Dr., Wheeling, IL 60090, Tel: 312-537-4277, FAX: 312-537-4785; Empl.: 35; *Sls. Mgr.:* Richard E. Hegberg

Local Sales Offices & Reps

CA	San Clemente, Sigwell Entprs.	714-492-6127
IL	Des Plaines, Coombs Assocs.	312-298-4830
IA	Cedar Rapids, Omni-Tec, Inc.	612-881-4447
MD	Baltimore, Stitzer Assocs.	301-823-2600
MI	Bloomfield Hills, Enco Mktg.	313-642-0203
MN	Edina, Omni-Tec, Inc.	612-881-4447
NJ	Springfield, F. F. Sylvester Assocs.	201-376-3324
NJ	Springfield, F. F. Sylvester Assocs.	212-344-3155
NY	Rochester, A-J Electromarketing	716-426-3598
PA	Paoli, Stitzer Assocs.	215-644-5500
TX	Plano, Vielock & Assocs.	214-881-1940

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OH	North Royalton, Great Lakes Controls Corp.	216-582-0020
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GA Atlanta, Ack Radio 404-351-6340
GA Atlanta, Specialty Distr. Co. 404-454-9813
GA Norcross, EMSCO 404-925-8366
HI Honolulu, Precision Radio, Ltd. 808-537-5291
IL Berwyn, BB & W Inc. 312-242-1533
IL Champaign, Klaus Radio 217-356-1896
IL Elk Grove, Martec Assocs. 312-956-8090
IL Mt. Prospect, Tri State Elctrns. 312-255-0600
IL Northbrook, Classic Comps. 312-291-0019
IL Peoria, Klaus Radio 309-691-4840
IL Rosemont, Advent Elctrns. 312-298-4210
IL Villa Pk., Melvin Elctrns. 312-279-5015
IN Indianapolis, Advent Elctrns. 317-872-4910
IA Cedar Rapids, Iowa Radio Supply 319-393-4510
KS Overland Park, Burnstein & Assocs. ... 913-642-6444
KS Salina, Electronics, Inc. 913-827-7377
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NY Rochester, Summit Distr. 716-334-8110
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NC Greensboro, Hammond Elctrns. 919-275-6391
NC Raleigh, Sager Svc. Plus Elctrns. 919-850-9550
NC Raleigh, Southeastern Elctrns. 919-828-2311
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PA Exton, VSH Elctrns. 215-363-2250
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PA Philadelphia, Almo Grp. 215-698-4000
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TN Chattanooga, Techni-Tronics 615-842-0514
TN Columbia, Randolph & Williams, Inc. .. 615-388-7566
TN Memphis, Bluff City 901-345-9500
TN Nashville, Bluff City 615-242-8000
TN Nashville, Randolph & Rice 615-255-5602
TX Austin, Galtronics 512-837-7470
TX Austin, Wofford Elctrns. 512-339-1131
TX Dallas, Force Elctrns. 214-247-9955
TX Dallas, Off-the-Shelf Comps. 214-247-0052
TX Dallas, Wholesale Elctrns. Supp. 214-824-3001
TX Ft. Worth, Allied Elctrns. 817-336-5401
TX Houston, Ace Elctrns. 713-688-8114
TX Houston, Force Elctrns. 713-561-8644
TX Houston, Wofford Elctrns. 713-847-3583
TX Richardson, Off-the-Shelf Comps. 214-238-0808
TX San Antonio, Altex Elctrns. 512-828-0503
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VA Charlottesville, Virginia Elctrn. Comps. 804-296-4184
WA Bellevue, Almac Elctrns. DKM Co. 206-643-9992
WA Seattle, Radar Elec. 206-282-2511
WI Milwaukee, Industrial Elctrns., Inc. 414-276-1212
WI Milwaukee, Marsh Elctrns. 414-475-6000
WI New Berlin, Classic Comps. Supp., Inc. 414-786-5300
WI Oshkosh, Electronic Inds., Inc. 414-235-8930
Can Burnaby, BC, Intek Elctrns. 604-294-8100
Can Mississauga, Ont., Rush Elctrns. 416-677-7280
Can Pointe Claire, Que., Future Elctrns. 514-694-7710
Can Vancouver, BC, Future Elctrns. 604-294-1206
Can Victoria, BC, Queale Elctrns., Ltd. 604-388-6111

PAINE CORPORATION, 2401 S. Bayview St., Seattle, WA 98144, Tel: 206-329-8600, 800-426-0366, ESYLNK: 6294-5057, FAX: 206-329-1615; FSC No.: 13624; Empl.: 93; *Sls. Mgr.:* R. E. Helmick

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PAMRAN INC., 1900 Williams St., Young Ind. Pk., Racine, WI 53404, Tel: 414-637-7999; Empl.: 28; *Sls. Mgr.:* R. C. Pfeil

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Panasonic

FAX: 201-392-4782

PANASONIC INDUSTRIAL CO., Battery Sls. Div., Box 1511, Secaucus, NJ 07096-1511, Tel: 201-348-5266; Empl.: 25 ..... **D•1470-1477**

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CA Glendale, Halbar Assocs. Inc. 818-246-8263
CA Pleasanton, Moulthrop Sls. Inc. 415-463-0450
CA San Diego, Tauber & Assocs. 619-274-7242
FL Deerfield Bch., S.E.C. 305-426-4601
IN Indianapolis, Marketing Engs. Inc. 317-872-5665
KS Overland Pk., Spectrum Sls. 913-648-6811
MA Burlington, Conti-Younger Assocs. Inc. 617-273-1582
MN Eden Prairie, Electro Mark Inc. 612-944-5850
OH Beachwood, Elctrn. Salesmasters Inc. 216-831-9555
OR Beaverton, Advanced Power Prods. 503-646-0994
TX Dallas, Dunbar Assocs. 214-239-7151

Local Distributors

AL Huntsville, Resistacap Inc. 205-883-4270
AZ Scottsdale, Electro Mktg. 602-991-0110
CA Chatsworth, Mil-Comm 818-998-3111
CA San Diego, Tauber Elctrns. Inc. 619-274-7242
CA San Jose, Rose Elec. Distrbg. Co. 408-263-2934
CA Santa Clara, Cypress Elctrns. Inc. 408-980-2500
CA Van Nuys, NESCO 818-781-0505
CO Arvada, Denver/Wintronics 303-431-7161
CO Englewood, Colorado Indl. Elec. Ind. .. 303-694-9444
CT Woodbury, Cell Technlg. 203-266-4105
FL St. Petersburg, Micro Precision 813-821-5504
GA Norcross, Applied Power, Inc. 404-263-0421
IL Morton Grove, Power Pak Inc. 312-966-6000
IL Palatine, Ohm Elctrns. 312-359-5500
IN Indianapolis, Bell Inds. 317-634-8202
MD Aberdeen, Harco Elctrns. 301-575-6885
MD Beltsville, Mark Elctrns. 301-792-0072
MA Canton, Impact Sls. Co. Inc. 617-821-1500
MA Danvers, Generation Elctrns. Inc. 617-777-4866
MI Brighton, Applied Power Inc. 313-227-3604
MN Thief River Falls, Digi-Key 800-346-5144
MO St. Louis, Indl. Battery Prod. Inc. 314-423-7005
NJ Camden, Gen. Radio 609-964-8560
NJ Clifton, Engineered Assem. 201-340-0600
NY Commack, Brentronics Inc. 516-499-5155
NY Farmingdale, Pride Elctrns. 516-293-4020
NC Raleigh, Engrd. Assemblies Inc. 919-790-9700
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TX Fort Worth, Allied Elctrns. 817-336-5401
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Panasonic

FAX: 201-392-4441

PANASONIC INDUSTRIAL COMPANY, Electronic Components Division, 1 Panasonic Way, Secaucus, NJ 07094, Tel: 201-392-4290/4264; *Sls. Mgr.:* J. Ambrose/E. Budenieks/K. Sasaki; *Dist. Mgr.:* Liz Morgan ..... **D•1860-1861**

Local Sales Offices & Reps

AL Huntsville, Rep, Inc. 205-830-0470
AZ Phoenix, O'Donnell Assts. 602-944-9542
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CO Englewood, Comp. Sls., Inc. 303-779-8060
FL Coral Springs, HAI Elctrns. Inc. 305-752-7520
GA Tucker, Rep, Inc. 404-938-4358
IL Palatine, Technlg. Sls. 312-991-6600
IN Indianapolis, Mktg. Engrs., Inc. 317-872-5665
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MN Eden Prairie, Electro-Mark, Inc. 612-944-5850
MO St. Louis, KKB & Co. 314-647-2400
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NJ Medford, Jack McCoy, Inc. 609-953-0770
NJ Secaucus, Panasonic 201-392-4290
NM Albuquerque, O'Donnell Assts. 505-883-1030
NY Mendon, Tech-Mark, Inc. 716-624-3840
NC Morrisville, Rep., Inc. 919-469-9997
NC Raleigh, Rep, Inc. 919-851-3007
OH Dayton, Del Steffan & Assocs. 513-293-3145
OH Lexington, Del Steffan & Assocs. 419-884-2313
OR Tigard, Elctrn. Engrg. Sls. 503-639-3978
PA Carnegie, Del Steffan & Assocs. 412-276-7366
PA Exton, Jack McCoy, Inc. 215-363-0350
TN Jefferson City, Rep., Inc. 615-475-4105
TX Dallas, Erickson Sls., Inc. 214-739-5833
UT Salt Lake City, Comp. Sls., Inc. 801-268-8440
WA Redmond, Elctrn. Engrg. Sls. 206-883-3374
Can Concord, Ont., Astec Comps., Ltd. 416-669-4022

Local Distributors

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CA Santa Clara, Cypress Elctrns., Inc. 408-980-2500
CT E. Haven, J.V. Elctrns. 203-469-2321
MI Livonia, RS Elctrns. 313-525-1155
MN Minneapolis, Indl. Comps., Inc. 612-831-2666
TX Dallas, Computer Comps. Corp. 214-239-0271
WI Milwaukee, Taylor Elec. Co. 414-241-4321

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PANDUIT CORP., 17301 Ridgeland Ave., Tinley Park, IL 60477-0981, Tel: 312-532-1800, TELEX: 25-4560; FSC No.: ;06383; Empl.: 1200 .... **C•1476-1478, 1892-1893**

Local Sales Offices & Reps

AL Birmingham, Frank Parker & Assocs. 205-655-4801
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AR Little Rock, Byron Carson Co. 501-663-6870
CA Anaheim, Panduit Corp. 714-978-2299
CA Los Altos, Ewing-Foley 415-941-4525
CA Sacramento, Ewing-Foley, Inc. 916-786-0796
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CO Denver, Panduit Corp. 303-985-1900

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FL	Lakeland, Panduit Corp.	800-282-9209
FL	Orlando, Panduit Corp.	800-282-9209
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LA	New Orleans, Wells-Keown & Assocs.	504-244-0330
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MI	Grand Rapids, Panduit Corp.	800-777-3300
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MO	St. Louis, Panduit Corp.	314-894-7800
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NH	Salem, Sales Eng. Co.	603-893-5521
NJ	Leonia, Panduit Corp.	201-461-7790
NM	Albuquerque, F P Sls.	505-345-5553
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NY	Rochester, Panduit Corp.	800-777-3300
NY	Schenectady, Panduit Corp.	800-777-3300
NY	Syracuse, Panduit Corp.	800-777-3300
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NC	Winston-Salem, L. G. White Southern	919-725-3612
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OH	Cleveland, Panduit Corp.	800-777-3300
OH	Columbus, Panduit Corp.	614-888-6224
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TN	Memphis, Byron Carson Co.	901-276-0614
TN	Nashville, Panduit Corp.	800-777-3300
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TX	Houston, Panduit Corp.	713-686-5600
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VA	Richmond, L. G. White Southern	804-448-4476
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CO	Englewood, Omega Ltd.	303-762-1921
FL	Deerfield Beach, Newell-Hynes Assoc., Inc.	305-429-3207
GA	Atlanta, DHR Mktg., Inc.	404-451-9848
IL	Northbrook, Raines & Assocs.	312-498-0890
IA	Marion, M-S-B Assocs., Inc.	319-377-6261
KS	Shawnee Mission, M-S-B Assocs., Inc.	913-432-2131
MA	Scituate, Olsen Tech. Sls.	617-878-9386
MN	St. Paul, Arkco Sls.	612-777-7454
MO	St. Charles, M-S-B Assocs., Inc.	314-946-5577
NC	Raleigh, DHR Mktg., Inc.	919-781-1961
OH	Cleveland, K-T Depco	216-442-6200
PA	Philadelphia, Eastern Sci. Mktg.	215-368-4570
PA	Pittsburgh, K-T Depco	412-367-1011
SC	Greenville, DHR Mktg. Inc.	803-235-3594
TX	Lewisville, Jim Hughes Co.	214-221-1536
EXP	Burnaby, B. C., Darmac Agencies, Ltd.	604-438-3523
Can	Ottawa, Ont., Lloyd Ellam Assocs.	613-727-3892

PAN-MAGNETICS, See Tamura Corp. of America

PAPST

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PAPST MECHATRONIC CORP., Aquidneck Indl. Pk., Newport, RI 02840, Tel: 401-849-8810 ... **C•1692-1694**

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CA	Campbell, Papst Mechatronic Corp.	408-377-4842
CA	Pasadena, Luscombe Engrg. Co.	213-684-2000
CA	San Diego, Luscombe Engrg. Co.	619-549-9699
CO	Denver, Quorum 3	3030-750-3267
CT	Hartford, Sturgeon Co.	203-249-7800
FL	Ovieda, Conley & Assocs.	305-365-3283
GA	Norcross, Robert O. Whitesell & Assocs.	404-449-9190
IL	Arlington Hgts., Brainard-Wilson Mktg.	312-437-2700
IN	Indianapolis, Elctrn. Mktg. Consits.	317-253-1668
IA	Marion, MSB Assocs. Inc.	319-377-6261
KS	Shawnee Mission, MSB Assocs., Inc.	913-432-2131
MA	Needham, Sturgeon Co.	617-444-6603
MN	Edina, Mel Foster Tech. Sls., Inc.	612-941-9790
MO	St. Charles, MSB Assocs.	314-946-5577
NJ	Cherry Hill, Trinkle Sls., Inc.	609-795-4200
NJ	Englewood, Harold Gray Assocs., Inc.	201-894-0894,215-922-2080
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NY	Mendon, Tech-Mark, Inc.	716-624-3840
NY	Utica, Tech-Mark, Inc.	315-733-0575
NC	Greensboro, Robert O. Whitesell & Assocs.	919-273-1945
OH	Beachwood, Elctrn. Salesmasters, Inc.	216-831-9555
OR	Beaverton, Venture Elctrns.	503-626-7418
TN	Knoxville, Robert O. Whitesell & Assocs.	615-694-9476
TX	Dallas, JYSCO/Comps., Inc.	214-349-1650
WA	Bellevue, Venture Elctrns.	206-454-4594
WI	Waukesha, Brainard-Wilson Mktg.	414-797-7940
Can	Pickering, Ont., A.C. Simmonds & Sons, Ltd.	416-839-8041

PARAGON ELECTRIC CO., INC., 606 Parkway Blvd., Two Rivers, WI 54241, Tel: 414-793-1161, TELEX: 26-3450, FAX: 414-793-3736; Empl.: 500; *Sls. Mgr.:* Don Karman

PARALINE

FAX: 818-281-5867

PARA-LINE TRANSFORMER CO., INC., 511 South Palm Ave., Alhambra, CA 91803, Tel: 818-281-0222; FSC No.: 59465; Empl.: 52 ..... **A•2318**

PARK ELECTRONICS, 16 Xenia Court, Mine Hill, NJ 07801, Tel: 201-328-9299; Empl.: 60; *Sls. Mgr.:* Kelly Faulkenham

PARKER HANNIFIN CORP., 17325 Euclid Ave., Cleveland, OH 44112, Tel: 216-531-3000, TELEX: 980636

PARKER HANNIFIN CORPORATION, Compumotor Division, 1179 N. McDowell Blvd., Petaluma, CA 94952, Tel: 707-778-1244, 800-358-9068, TWX: 510-744-2155

PARKER MCCRORY MFG. CO., 2000 Forest Ave., Kansas City, MO 64108, Tel: 816-221-2000; *Sls. Mgr.:* Ken Turner; *Dist. Mgr.:* Ken Turner

PARKER SEAL GRP., P.O. Box 11751, Lexington, KY 40512, Tel: 606-269-2351, TELEX: 218-442; Empl.: 2,200; *Sls. Mgr.:* Frank Chesnik; *Dist. Mgr.:* John Dutton

PARLEX CORP., 145 Milk St., Methuen, MA 01844, Tel: 617-685-4341, Ext. 265, TWX: 710-342-1528; Empl.: 650; *Sls. Mgr.:* Gary Marraccini

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PAR METAL PRODUCTS, INC., 1260 Atlantic Ave., Brooklyn, NY 11216, Tel: 718-774-5900, TELEX: 424 823 SNDS UI Attn: Par; Empl.: 100; *Sls. Mgr.:* J. Troiano ..... **C•1072**

PARSONS MANUFACTURING, 1055 O'Brien Dr., Menlo Park, CA 94025-1476, Tel: 415-324-4726, FAX: 415-324-3051; Empl.: 45; *Sls. Mgr.:* C. E. Plummer

PARVEX DIVISION, Alsthom International, Inc., Two Ram Ridge Road, Spring Valley, NY 10977, Tel: 914-425-6908, FAX: 914-425-8108

PASO SOUND PRODUCTS, 14 First St, Pelham, NY 10803, Tel: 914-738-4800, FAX: 914-738-3954; Empl.: 50; *Sls. Mgr.:* David Moore

PASTERNACK ENTERPRISES, P.O. Box 16759, Irvine, CA 92713, Tel: 714-261-1920; FSC No.: 53919; Empl.: 26; *Sls. Mgr.:* Heather Marshall

PATTON-MACGUYER INC., 17 Virginia Ave., Providence, RI 02905, Tel: 401-941-6000, FAX: 401-941-5290; FSC No.: 77147; Empl.: 55; *Sls. Mgr.:* J. Allen

PAYNE ENGINEERING, Box 70, Scott Depot, WV 25560, Tel: 304-757-7353, TELEX: 88-5452; Empl.: 40; *Sls. Mgr.:* Matthew J. Gilberto

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AZ	Phoenix, Toward Engrg. Assocs.	602-955-3193
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CA	Santa Clara, Fahrner-Miller Assocs.	408-727-9800
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FL	Goldenrod, Sunland Assocs.	305-365-9533
IL	Westchester, W. G. Brouillette & Assocs.	312-345-6500
IN	Carmel, W. G. Brouillette & Assocs., Inc.	317-848-2016
MA	Sudbury, KSA of New England	617-443-5881
MN	Minneapolis, Bill Deming and Assocs.	612-888-5000
NJ	Springfield, F. F. Sylvester	201-376-3324
NJ	Wayne, Howard Kagan Assocs.	201-694-1115
OH	Dayton, Electro-Com	513-898-5140
OR	Portland, Elctrn. Comp. Sls.	503-245-2342
PA	King of Prussia, Eltron Comp. Sls.	215-783-5350
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WA	Seattle, Elctrn. Comp. Sls.	206-232-9301

Local Distributors

CA	Buena Pk., Cypress Elctrns. Inc.	714-521-5230
CA	San Diego, Cypress Elctrns. Inc.	619-535-0011
CA	San Jose, Cypress Elctrns.	408-980-2500
CA	Santa Clara, Cypress Elctrns. Inc.	408-980-2500
CO	Wheatridge, Cypress Elctrns. Inc.	303-431-2622
MA	Sudbury, ASK Elctrns.	617-443-5881
NJ	Parsippany, Fabe Electro-Sales	201-299-1123
OR	Beaverton, Cypress Elctrns.	503-641-2233
WA	Bothwell, Cypress Elctrns.	206-483-1144

PCB PIEZOTRONICS, 3425 Walden Ave., Depew, NY 14043-2495, Tel: 716-684-0001, TWX: 710-263-1371; Empl.: 150; *Sls. Mgr.:* Roy Maines

Local Sales Offices & Reps

CA	Alhambra, Dale-Dahl Assocs.	213-682-3417
FL	Orlando, Microspec, Inc.	305-898-3504
IL	Woodstock, TMI Inc.	815-385-2212

PCD, 5 Lowell Avenue, Winchester, MA 01890, Tel: 617-721-1280, FAX: 617-729-1898; FSC No.: 58982; *Sls. Mgr.:* A. Arcisz

PCK ELASTOMERICS, INC., 2940 Turnpike Dr., Hatboro, PA 19040, Tel: 215-672-0787, 215-672-4741, TWX: 510-387-236, FAX: 215-672-4633; FSC No.: 64914; *Sls. Mgr.:* John H. Seibert; *Dist. Mgr.:* George Glatts **C•1485-1487**

Local Sales Offices & Reps

AZ	Scottsdale, TC Elctrn. Sls., Inc.	602-994-5153
CA	Fullerton, Libratronix	714-871-1513
CA	San Jose, Western Indl. Network	408-559-8118
CO	Denver, Sunbird Inds.	719-481-2900
CT	S. Dartmouth, Remtron	617-444-5256
FL	Melbourne, Southern Elctrns. Sls.	305-242-9661
IL	Barrington, Fisk Mktg.	219-478-1057
IN	Ft. Wayne, R. L. Bontempo & Assocs.	219-478-1057
MD	Gaithersburg, Carwithen Assocs.	301-921-9545
MA	Needham Hgts., Remtron	617-444-9566
MI	Troy, C. B. Jensen & Assocs.	313-643-0506
MN	Brooklyn Center, Willman Assocs.	612-566-5010
NJ	Madison, Livera-Polk Assocs., Inc.	201-377-3220
NY	E. Rochester, L-Mar Assocs.	716-381-9100
NY	Glen Head, Livera-Polk Assocs., Inc.	516-759-9300
NC	Raleigh, KZJ Comp. Sls.	919-782-8100
OH	Cincinnati, G & H Sls.	513-272-0580
OH	Grove City, G & H Sls.	614-878-1128
OH	Richmond Hgts., G & H Sls.	216-248-8490
OR	Beaverton, L. D. Elctrns.	503-684-8221
PA	Hatboro, J. S. Wurts	215-674-3562
TX	Dallas, Marcom	214-351-4532
TX	Houston, Marcom	713-271-5635
UT	Salt Lake City, Sunbird Inds.	801-943-5609
WA	Snohomish, L. D. Elctrns.	206-568-0511
WA	Spokane, LD Elctrns.	509-922-4883

PCK TECHNOLOGY DIV., Kollmorgen Corp., 322 South Service Rd., Melville, NY 11747, Tel: 516-454-4400, TELEX: 6852163, FAX: 516-454-0317; Empl.: 180; *Sls. Mgr.:* J. F. Dennis-Browne

PC TRANSFORMER CORP., 64 D Nancy St., West Babylon, NY 11704, Tel: 516-491-3300, FAX: 516-491-3689; FSC No.: 62281; Empl.: 11; *Sls. Mgr.:* Stanley L. Goldstein **A•2308-2315**

PEARSON ELECTRONICS, INC., 1860 Embarcadero Rd., Palo Alto, CA 94303, Tel: 415-494-6444, TELEX: 171-412, FAX: 415-494-6716; FSC No.: 05280; Empl.: 23; *Sls. Mgr.:* Patricia L. Pearson **A•2316**

PECA, INC., 592 Winks Lane, Bensalem, PA 19020, Tel: 215-245-1550; Empl.: 30; *Sls. Mgr.:* Jean Douglass

PENFIELD, INC., 8 West St., Plantsville, CT 06479, Tel: 203-621-9141, TWX: 5101003285, ESYLNK: 6287757, FAX: 203-621-2380; Empl.: 77

PENN AIRBORNE PRODS., 950 Industrial Hwy., Southampton, PA 18966, Tel: 215-355-3400, TELEX: 834-759, FAX: 215-322-2194; FSC No.: 25805; Empl.: 41; *Sls. Mgr.:* Claude Mercier

PENN ENGINEERING & MANUFACTURING CORP., P.O. Box 1000, Danboro, PA 18916, Tel: 215-766-8853, FAX: 215-766-0143; FSC No.: 46384; Empl.: 480; *Sls. Mgr.:* John E. O'Brien

PENN KEYSTONE CORP., Div. of C & K Components, Ives Road, Wallingford, CT 06492, Tel: 203-269-8701, TELEX: 96-3485, TWX: 710-476-1397, FAX: 203-265-5398; FSC No.: 03034; *Sls. Mgr.:* Martin Wakefield

The New PENN-TRAN

FAX: 814-355-1524

PENN-TRAN CORP., Box 1321, Rte. 144N, Wingate, PA 16880, Tel: 814-355-1521, TELEX: 706473; FSC No.: 50783; Empl.: 87; *Sls. Mgr.:* William Holt **A•1280; D•1862**

Local Sales Offices & Reps

AZ	Tempe, Systems Sls. of Arizona	602-829-9338
CA	Los Altos, Cain-White & Co.	415-948-6533
CA	Pasadena, A-F Sls. Engrg., Inc.	213-681-5631
CA	San Diego, AF Sls. Engrg. Inc.	619-581-1206
CO	Englewood, Dynatech, Inc.	303-773-2830
CT	Madison, United Comp.	203-245-4810
IL	Lake Bluff, R & R Mktg. Assoc.	312-295-6660
IN	Ft. Wayne, Aktron	219-747-3650
MA	Bourne, United Comps.	617-759-3556
MN	Minneapolis, International Sls. Co.	612-831-8423
NY	Johnson City, Teckmark, Inc.	607-729-6340
NY	Mendon, Tech-Mark, Inc.	716-624-3840
OH	Sharon Center, Merit Elctrns., Inc.	216-725-1460
OR	Portland, Intertech Sls.	503-775-7885
PA	Glenside, Koebert Assocs., Inc.	215-887-2310
TX	Dallas, Seaton Corp.	214-380-0414
UT	Layton, Dynatech, Inc.	801-546-4837
WV	Inwood, Koebert Assoc.	304-229-8401

PENN VIDEO INC., 929 Sweitzer Ave., Akron, OH 44311, Tel: 216-762-4840, TELEX: 98-6327 PVI-AKR, FAX: 216-762-4840 (ext. 34); Empl.: 66; *Sls. Mgr.:* Sandra Donaldson; *Dist. Mgr.:* Gary Wagner

PENNWALT CORP., Three Pkwy., Philadelphia, PA 19102, Tel: 215-587-7520, TELEX: 84-5234, FAX: 215-587-7497

PENNY & GILES, 1640 Fifth Street, Suite 224, Santa Monica, CA 90401, Tel: 213-393-1497, TELEX: 65-2337

PENRIL DATACOMM, Penril Corp., 207 Perry Parkway, Gaithersburg, MD 20877, Tel: 301-921-8600, TWX: 710-828-0522; Empl.: 250; *Sls. Mgr.:* Bob Maranzani

PENSTOCK ENGINEERING LABS., Penstock, Inc., 520 Mercury Dr., Sunnyvale, CA 94086-4018, Tel: 408-730-0300, TWX: 910-370-7450, FAX: 408-730-4782; Empl.: 24; *Sls. Mgr.:* Steve Ulett; *Dist. Mgr.:* Jerry Quinnell **A•1844**

Local Sales Offices & Reps

AZ	Phoenix, Penstock Desert States	800-255-6788
CA	Sunnyvale, Penstock Intl.	408-730-0300
CA	Sunnyvale, Penstock, Inc.	408-730-0300
IL	Palatine, Penstock Midwest	312-934-3700
NJ	Teterboro, Penstock East	201-288-7313
OR	Portland, Penstock Northwest	206-454-2371
WA	Bellevue, Penstock Northwest	206-454-2371
EXP	CA/Sunnyvale, Penstock Intl.	408-730-0300
Can	Vancouver, BC, Penstock Canada	604-662-3475

Local Distributors

AZ	Phoenix, Penstock Desert Sls.	800-255-6788
CA	Sunnyvale, Penstock Intl.	408-730-0300
CA	Sunnyvale, Penstock, Inc.	408-730-0300
IL	Palatine, Penstonck Midwest	312-934-3700
NJ	Teterboro, Penstock East	201-288-7313
OR	Portland, Penstock Northwest	206-454-2371
WA	Bellevue, Penstock Northwest	206-454-2371
EXP	CA/Sunnyvale, Penstock Intl.	408-730-0300
Can	Vancouver, BC, Penstock Canada	604-662-3475

PERCON (PERIPHERAL CONNECTIONS, INC.), 2190 W. 11th, Eugene, OR 97402, Tel: 503-344-1189, FAX: 503-344-1399; Empl.: 15; *Sls. Mgr.:* Palmer Parker

PERFECT GEAR & INSTRUMENT, Designatronics, Inc., 2101 Jericho Tpk., New Hyde Park, NY 11040, Tel: 516-328-3300, TWX: 510-223-0642, FAX: 516-326-8827; Empl.: 210; *Sls. Mgr.:* Murray Ores

PERFECTION MICA CO., See Magnetic Shield Corp.

PERFORMANCE CONTROLS, INC., 433 Caredean Drive, Horsham, PA 19044, Tel: 215-675-6500, TELEX: 88-1478; FSC No.: 61773; Empl.: 35

PERIPHERALS, 1363 Logan Ave., Costa Mesa, CA 92626, Tel: 714-540-4925, 800-468-6888, TELEX: 4996258 Berlan; Empl.: 20; *Sls. Mgr.:* Elizabeth O'Rouke

PERKIN-ELMER CORP., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132, Tel: 203-762-4786, TWX: 710-468-3213; Empl.: 70; *Sls. Mgr.:* D. P. Duggan **A•2317**

Local Sales Offices & Reps

CA	Agoura Hills, C.D.H. Assocs.	818-707-1970

PERMAG, 400 Karin La., Hicksville, NY 11801, Tel: 516-822-3311, TWX: 710-581-5264; Empl.: 50

PERMALUSTER, INC., 1844 N. Keystone St., Burbank, CA 91504, Tel: 213-849-4543, 213-849-6454; Empl.: 6; *Sls. Mgr.:* J. Ross

THE PERMANENT MAGNET CO., INC., 4437 Bragdon St., P. O. Box 26226, Indianapolis, IN 46226, Tel: 317-547-1336; Empl.: 70; *Sls. Mgr.:* Jack Amigh

PERMA POWER ELCTRNS., 5601 W. Howard Ave., Chicago, IL 60648, Tel: 312-647-9414; Empl.: 80/100; *Sls. Mgr.:* Michael Shatz; *Dist. Mgr.:* Michael Shatz **B•1346; C•1706-1707**

Local Sales Offices & Reps

AL	Birmingham, Adams & Assocs.	205-781-6467
CA	Hayward, Techn. Sls.	415-887-6616
CA	Sun Valley, Teqni-Rep.	818-768-4223
CO	Denver, KC Mktg.	800-733-5561
CT	Hartford, The Smith Co.	203-523-0512
MA	Woburn, W & D Mktg.	617-935-5610
GA	Atlanta, Adams & Assocs.	404-973-0853
IL	Buffalo Grove, GB Mktg. Inc.	312-520-4008
IN	Indianapolis, Green-Wissler	317-872-9981
LA	Slidell, Dick Bellew Sls.	214-644-7881
MI	Plymouth, J. Malcolm Flora	313-453-4296
MN	St. Paul, R. W. Sls.	612-646-2710
MO	Jefferson City, C. A. Vignola	314-636-3121
NH	Manchester, W&D Mktg.	603-622-5097
NJ	Medford, Fahy Mktg.	609-654-1022
NY	Phelps, L. S. M. Assocs.	315-548-4891
NY	Plainview, Landau & Mack	516-293-3310
NC	Greensboro, Adams & Assocs.	919-272-6838
OH	Stow, J. Lehner Co.	216-686-1985
TX	Dallas, Berthold Sls.	214-328-0067
WA	Seattle, Northmar, Inc.	206-524-5170
WI	Milwaukee, Voss-Dent & Assocs.	414-781-0555
EXP	N.Y., Plainview, Morhan Export.	516-293-5582

Local Distributors

AL	Birmingham, Forbes Distrbg.	205-251-4104
CA	Los Angeles, ITC Corp.	213-388-0621
CO	Denver, Fistells Elctrn. Supp.	303-623-7864
FL	Orlando, Hammond Elctrns.	305-849-6060
GA	Atlanta, Specialty Distrbg.	404-458-6341
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Palatine, OHM Elctrns.	312-359-5500
IN	Lafayette, CWY Elctrns.	317-448-1611
IA	Des Moines, Mid-State Distrbg.	515-244-7231
KY	Louisville, Peerless Elctrns.	502-637-7674
LA	New Orleans, Wm. B. Allen	800-535-9593
MA	N. Wilbraham, Indl. Comps.	413-596-3854
MN	Minneapolis, Acme Elctrns.	612-338-4754
MO	Kansas City, Elctrns. Supp. Co., Inc.	816-931-0250
NY	Hauppauge, Broadline Elctrns.	516-231-4100
NC	Raleigh, Southeastern Elctrns.	919-828-2311
OH	Columbus, Whitehead Elctrns.	614-224-1186
TN	Nashville, Electra	615-256-0800
TX	Dallas, Wallace Elctrns.	214-340-0400
TX	Ft. Worth, Allied Elctrns.	800-433-5700
UT	Ogden, Carter Supp. Co.	801-393-8603
WA	Tumwater, JW Elctrns.	206-943-1071
EXP	Plainview, NY, Morhan Exporting	516-293-5582

PERRY AMPLIFIER, 138 Fuller St., Brookline, MA 02146, Tel: 617-734-0844; Empl.: 18; *Sls. Mgr.:* N. Geskos

PERSONAL TOUCH CORPORATION, 4320-290 Stevens Creek Blvd., San Jose, CA 95129, Tel: 408-246-8822, TELEX: 499-4986ABC UI, FAX: 408-246-8822

PERTEC PERIPHERALS CORP., Digital Development Corp., P.O. Box 2198, Chatsworth, CA 91311, Tel: 818-882-0300, 800-821-4126, 800-443-9577 (outside CA), TWX: 910-494-2093; Empl.: 300; *Sls. Mgr.:* Wm. Greenfield

PERX, 1730 S. Amphlett Blvd., Ste. 222, San Mateo, CA 94402, Tel: 415-573-0801; Empl.: 4; *Sls. Mgr.:* Bob Croshaw

PFC, See Southern Elctrns. Co. Inc.

PFT INC. PRECISION FABRICATION TECHNOLOGIES, INC.

FAX: 219-253-6570

PFT, INC., State Road 16 W., Monon, IN 47959, Tel: 1-800-558-7297, 219-253-6666; Empl.: 62; *Sls. Mgr.:* Joseph Rogers; *Dist. Mgr.:* Duane Nagel ..... **C•1073-1077**

Local Sales Offices & Reps

CA	Saratoga, Edward King & Assocs.	408-867-2111
CA	Valencia, Lessing & Assocs.	805-295-0225
FL	Tampa, SRT Mktg.	813-884-4805
IN	Indianapolis, Elctrn. Reps.	317-894-1414
MI	Warren, Burcaw Co.	313-573-4605
NJ	Medford, Champion Elctrn. Sls.	609-983-0932
NY	Islandia, Schmitt Mktg. Corp.	516-582-5888
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OH	Westlake, Baehr, Greenleaf & Assocs.	216-892-1770
OR	Portland, James J. Backer Co.	503-297-8744
TX	Dallas, S.W. Mktg. Assocs.	214-341-8631
TX	Houston, S.W. Mktg. Assocs.	713-537-8166
WA	Seattle, James J. Backer Co.	206-285-1300
WI	Colgate, Rep One & Assocs.	414-628-4016

PHALO CORP., Transitron Corp., 900 Holt Ave., Manchester, NH 03103, Tel: 603-669-4347, TELEX: 710-220-9878; Empl.: 150

PHASE CONTROL ELECTRONICS, 87-27 Myrtle Ave., Glendale, NY 11385, Tel: 718-441-4728; Empl.: 16; *Sls. Mgr.:* Jack Stanley ..... **D•1140**

PHELPS DODGE MAGNET WIRE, P.O. Box 600, Ft. Wayne, IN 46801, Tel: 219-456-4444, 800-255-2542, TWX: 810-332-1501; *Sls. Mgr.:* G. H. Guyer; *Dist. Mgr.:* W. H. Deininger

PHILADELPHIA INSULATED WIRE CO. INC., 333 New Albany Rd., Moorestown, NJ 08057, Tel: 609-235-6700, FAX: 609-235-5480; Empl.: 150; *Sls. Mgr.:* Fred Newman

PHILAMON, INC., 33 Dubon Ct., Farmingdale, NY 11735, Tel: 516-249-2700, TWX: 510-224-6512; FSC No.: 95267; Empl.: 27; *Sls. Mgr.:* B.F. Grib

PHILIPS AUDIO VIDEO SYS. CORP., See AKG Acoustics

PHILIPS CIRCUIT ASSEMBLIES, A Subdivision of North American Philips Corp., 2566 Northwestern Avenue, West Lafayette, IN 47906, Tel: 317-463-2536, TWX: 810-342-1889; *Sls. Mgr.:* Pierre Lavignette

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PHILIPS CIRCUIT ASSEMBLIES, 3602 W. Waters Avenue, Tampa, FL 33684, Tel: 813-933-5113, TELEX: 3727509, FAX: 813-932-1373; *Sls. Mgr.:* T. Borkes

PHILIPS CIRCUIT ASSEMBLIES, 1515 Sixth St. South, Hopkins, MN 55343, Tel: 612-933-4600, FAX: 612-935-6012; *Sls. Mgr.:* B. Callahan

PhilipsECG

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FAX: 617-890-7096

PHILIPS ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254, Tel: 617-890-6107; Empl.: 4213; *Sls. Mgr.:* D. R. Kronenwetter; *Dist. Mgr.:* E. H. Frost ... **A•2134-2135**

Local Sales Offices & Reps

CA	Los Alamitos, Philips ECG	714-220-1387
CA	Pleasanton, Philips ECG	408-727-6132
GA	Norcross, Philips ECG	404-368-2401
IL	Wood Dale, Philips ECG	312-860-7373
MA	Norwood, Philips ECG	617-762-8090
MO	Kansas City, Philips ECG	816-741-4019
NY	Seneca Falls, Philips ECG	315-568-5432
OH	Dayton, Philips ECG	513-898-9577
TX	Dallas, Philips ECG	214-231-3481

For distributor information, call 1-800-225-8326. (In Massachusetts, call 1-890-6107.)

PHILIPS ELECTRONICS LTD., Elcoma Division, 601 Milner Avenue, Scarborough, Ontario, Can. M1B 1M8, Tel: 416-292-5161, TELEX: 065-25100, FAX: 416-297-1019; Empl.: 40; *Sls. Mgr.:* Phil Cain; *Dist. Mgr.:* Dean Xamin

PHILIPS ELMET, 1560 Lisbon Rd., Lewiston, ME 04240, Tel: 207-784-3591, TWX: 710-223-0675; Empl.: 250

PHILIPS TEST & MEASURING INSTRS., 85 McKee Dr., Mahwah, NJ 07430, Tel: 201-529-3800; Empl.: 70; *Sls. Mgr.:* Michael Leeds

PHILMORE MANUFACTURING, 40 Inip Dr., Inwood, NY 11696, Tel: 516-239-6161; Empl.: 22

PHI TECHNOLOGIES, INC., 4605 North Stiles, Oklahoma City, OK 73105, Tel: 405-521-9000, TWX: 910-831-3286, FAX: 405-524-4254; Empl.: 60; *Sls. Mgr.:* Michael Morgan ..... **D•1068-1072**

PHOENIX CONTACT, P.O. Box 4100, Harrisburg, PA 17111, Tel: 717-944-1300, TWX: 510-650-4913, FAX: 717-944-1625; *Sls. Mgr.:* Howard C. Minnick, Jr.; *Dist. Mgr.:* Mark F. Gilliford

PHOENIX DATA, INC., 3384 W. Osborn Rd., Phoenix, AZ 85017, Tel: 602-278-8528, TWX: 910-951-1364; Empl.: 55; *Sls. Mgr.:* Irv Wilson

Local Sales Offices & Reps

AZ	Phoenix, Holder Haver, Inc.	602-242-4025
CA	Sunnyvale, RDX Corp.	408-734-4500
CO	Denver, Holder Haver, Inc.	303-427-3443
CT	Tolland, R. G. Assocs.	203-875-4201
MA	Lowell, R.G. Assocs.	617-458-9802
MA	Marshfield, R.G. Assocs.	617-837-3290
MI	Madison Hgts., WKM Assocs., Inc.	313-588-2300
NM	Albuquerque, Holder Haver, Inc.	505-888-9614
OH	Dayton, WKM Assocs.	513-434-7500
OH	Independence, WKM Assocs., Inc.	216-524-5930
UT	Salt Lake City, Holder Haver, Inc.	801-532-2111
WA	Bellevue, Underwood Hanify, Inc.	206-643-1793
WA	Vancouver, Underwood Hanify, Inc.	503-224-0583

PHOENIX MICROSYSTEMS, 991 Discovery Dr., Huntsville, AL 35806, Tel: 205-721-1200, TELEX: 752592; Empl.: 110; *Sls. Mgr.:* Mel Mayo

PHOENIX WIRE, INC.

PHOENIX WIRE, INC., 100 Teflon Ave., S. Hero, VT 05486, Tel: 802-372-4561, TELEX: 372-9109; Empl.: 25; *Sls. Mgr.:* Ohmer Corbin; *Dist. Mgr.:* Ohmer Corbin ..... **C•1899**

PHONON CORPORATION, 7 Herman Drive, P.O. Box 549, Simsbury, CT 06070, Tel: 203-651-0211, TELEX: 294705, FAX: 203-651-8618; FSC No.: 6Y858; Empl.: 30

PHOTOBELL, 40 Vreeland Ave., Totowa, NJ 07512, Tel: 201-785-0049; Empl.: 50; *Sls. Mgr.:* Bernard M. Clongoli

PHOTOCIRCUITS GLEN COVE, DIV., KOLLMORGEN CORP., 31 Sea Cliff Ave., Glen Cove, NY 11542, Tel: 516-674-1303, TWX: 516-671-3155; Empl.: 850

PHOTODYNE INC., 3760 Calle Tecate, Camarillo, CA 93010, Tel: 805-388-8378, TELEX: 18-1159, FAX: 1-805-499-9311; FSC No.: 59912; Empl.: 100; *Sls. Mgr.:* Eamon Murphy; *Dist. Mgr.:* Eamon Murphy

PHOTON, INC., 970 University Ave., Los Gatos, CA 95030, Tel: 408-354-5600, TELEX: 493-1183 PHOT, FAX: 408-354-7138; Empl.: 12; *Sls. Mgr.:* John M. Fleischer

PHOTON SOURCES, INC., See Lumonics Material Processing Corp.

PHOTO RESEARCH, Kollmorgen Corp., 9330 DeSoto Avenue, Chatsworth, CA 91311, Tel: 818-341-5151, TELEX: 69-1427; FSC No.: 92434; Empl.: 86; *Sls. Mgr.:* M. L. Woolsey

PHOTOSWITCH DIV., Allen Bradley Co., 265 Winter St., Waltham, MA 02154, Tel: 617-466-8000; *Sls. Mgr.:* S. L. Davis

PHO-TRONICS DIV., E. R. Wagner Mfg. Co., 8701 W. Bradley Rd., Milwaukee, WI 53224, Tel: 414-355-6704, TWX: 910-262-3099; Empl.: 140; *Sls. Mgr.:* Steven J. O'Brien, Sls./Mktg. Mgr.

PIC DESIGN, P.O. Box 1004, Middlebury, CT 06762, Tel: 203-758-8272, TWX: 910-997-0989; FSC No.: 00141; Empl.: 105; *Sls. Mgr.:* George N. Kaniwec

PICO CRIMPING TOOLS, 9832 Jersey Ave., Santa Fe Springs, CA 90670, Tel: 213-723-2150, FAX: 213-949-7404; Empl.: 12

PICO Electronics, Inc.

FAX: 914-699-5565

PICO ELECTRONICS, INC., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, Tel: 914-699-5514, 800-431-1064, TWX: 710-562-0113; FSC No.: 31669; *Sls. Mgr.:* Joe Sweeney ..... **A•1270-1275, 2319-2348; D•1863-1882**

Local Sales Offices & Reps

CA	Santa Clara, Fisher Assocs.	408-733-7350
IN	Ft. Wayne, Denton Mktg., Inc.	219-486-0665/1264
WA	Seattle, W. Spaulding Co.	206-282-9173

FAX: 617-649-9643

PICONICS, 26 Cummings Road, Tyngsboro, MA 01879, Tel: 617-649-7501, TELEX: 754759; FSC No.: 26618; Empl.: 48; *Sls. Mgr.:* I. Kadesh ..... **A•1277-1279, 1678, 2001**

Local Sales Offices & Reps

AL	Huntsville, Murcota Corp.	205-539-8476
AZ	Scottsdale, Semper-Fi Sls.	602-730-9553

CA N. Hollywood, Jewett Co. 818-789-8103
CA Palo Alto, J/M Assocs. 415-857-1260
CO Parker, Mikro Sls. Co. 303-841-2529
FL Lighthouse Point, R. C. Simon 305-941-2757
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MO St. Louis, Harris-Hanson Co. 314-432-3611
NY Huntington, Regulus Indl. Sls. Co. 516-673-6252
NY Rochester, J. G. Welch Assocs. 716-244-1100
OH Cincinnati, G & H Sls. Co. 513-272-0580
PA Glenside, Koebert Assocs. Inc. 215-887-2310
TX Ft. Worth, El-Tec Sls. 817-268-2896
WV Inswood, R. F. Koebert & Assocs. 304-229-8401

PICOSEND PULSE LABS, INC., P.O. Box 44, Boulder, CO 80306, Tel: 303-443-1249, TELEX: 650 301 3779; Empl.: 10

PIEZO CRYSTAL, 100 K St., Box 619 , Carlisle, PA 17013, Tel: 717-249-2151, TWX: 510-650-2280, FAX: 717-249-2151; FSC No.: 74306; Empl.: 250; *Sls. Mgr.:* Glen R. Kurzenknabe

PIEZO ELECTRIC PRODUCTS, INC., 212 Durham Ave., Metuchen, NJ 08840, Tel: 201-548-2800, TWX: 710-998-0592, FAX: 201-548-2800; Empl.: 105; *Sls. Mgr.:* Mark Rickman

PIEZO KINETICS INC., Box 756, Pine and Mill Streets, Bellefonte, PA 16823, Tel: 814-355-1593, 814-355-1594; FSC No.: 5Y690; Empl.: 28; *Sls. Mgr.:* H. D. Shirey

PIEZO TECHNOLOGY INC., 2525 Shader Rd., Orlando, FL 32804, Tel: 407-298-2000, TWX: 810-850-4136; FSC No.: 25120; Empl.: 400; *Sls. Mgr.:* Paul Dechen

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GA Atlanta, DHR Mktg. 404-451-9848
IL Rolling Meadows, Basic Mktg. Co. 312-981-5180
IN Angola, Giesting & Assocs. 219-833-1960
IN Carmel, Giesting & Assocs. 317-844-5222
MA S. Weymouth, Adams & Assocs. 617-337-9339
NC Raleigh, D.H.R. Mktg. 919-781-1961
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SC Greenville, D.H.R. Mktg. 803-235-3594
TN Nashville, D.H.R. Mktg. 615-331-2745
VA Richmond, D.H.R. Mktg. 804-359-8803
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WI PR, San Juan, David S. Ternent 809-762-2688
Can Markham, Ont., Componetics 416-479-7200
Can St. Laurent, Que., Componetics 514-331-9930

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CA Anaheim, A.Z. Elctrns. 714-632-1620
CA Burbank, T.A.W. 818-846-3911
CA Chatsworth, Passive Comps. 818-341-1745
CA Fountain Valley, Components Ctr. 714-979-0433
CA Marina del Rey, N.M.I./Intervend 213-821-7936
CA Milpitas, California Capacitors 408-262-6000
CA San Diego, Newman Elctrns. 619-695-3005
CA Van Nuys, E. W. Elctrns. 714-857-4422
CT Wallingford, Midstate Elctrns. 203-265-9900
FL Ft. Lauderdale, N.R.C. 305-772-4500
FL Longwood, Intertec Comps., Inc. 305-834-7777
FL Melbourne, T. C. Pridmore 305-727-2491
IL Addison, Belford Elec. 312-691-1100
IL Chicago, Nep. Elctrns. 312-625-8400
IL Des Plaines, Rangus Elctrns. 312-299-1600
IL Northbrook, Classic Comps. 312-272-9650
IL Northbrook, Mar-Lyn Elctrns. 312-272-2338
IL Schaumburg, Components Importer .. 312-843-7111
IL Schaumburg, Q.P.S. Elctrns. 312-884-6620
IN Elkhart, Earlynn Elec. Ind. 219-862-2425
IA Cedar Rapids, Dee Elctrns. 319-365-7551
KY Louisville, Peerless Elctrns. 502-637-7674
MD Gaithersburg, Axis Elctrns. 301-840-9640
MA Billerica, A. W. Meyer Co., Inc. 617-667-6900
MI Grand Rapids, Calder Elctrns. 616-698-7400
MN Burnsville, Cassidy Elec. 612-895-9026
MN Eilzen, Capacitor Assocs. 507-495-3130
MN Minneapolis, Bergquist Co. 612-835-4156
MS St. Louis, Rie Tronics, Inc. 314-576-9816
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NJ Kenilworth, Ventronics 201-272-9296
NJ W. Berlin, General Comps. 609-768-6767
NM Albuquerque, International Elec. 505-345-8127
NY Buffalo, Summit Elctrns. 716-887-2800
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PA York, Elctrn. Comps. 717-846-5334
SC Columbia, Dixie Elctrns. 803-779-5332
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TX El Paso, International Elctrns. 915-598-3406
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TX Richardson, Component Technlg. 214-437-2211
TX Richardson, Components Center 214-644-3447
UT New Berlin, Classic Comps. 414-786-5300
UT Salt Lake City, Standard Supp. 801-486-3371
WA Redmond, Robert E. Priebe 206-881-2363
WI Mequon, Lakeview 414-377-8250
WI New Berlin, Nep. Elctrns. 414-785-9100
WI Oconomowoc, G. W. Elctrns. 414-367-6003

PILLAR INDUSTRIES, INC., 15318 E. Valley Blvd., City of Industry, CA 91736, Tel: 818-369-3750, 818-333-8803, FAX: 818-369-2961; Empl.: 3 ..... **D•1884-1886**

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CA Santa Cruz, LEREP 408-458-0667

PIONEER COMPONENTS, 2352 E. 66th St., Brooklyn, NY 11234, Tel: 718-444-3880; Empl.: 3; *Sls. Mgr.:* Michael R. Verter; *Dist. Mgr.:* Michael R. Verter

FAX: 213-453-3929

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CO Commerce City, Williams Assocs. 303-289-5647
FL Boca Raton, Pen-Tech Assocs. 305-394-7400
GA Marietta, Pen-Tech Assocs. 404-424-1931
IL Chicago, Heartland Tech. Mktg. 312-577-9222
IN Milwaukee, Heartland Tech. Mktg. 312-577-9222
MD Columbia, Stein Instrmn. 301-596-3748
MA Wayland, Daner-Hayes 617-655-0888
MI Ann Arbor, KRW Sls., Inc. 313-769-0056
MN Eagan, Pioneer Magnetics 612-452-7747
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NH Wilton, Daner-Hayes Inc. 603-654-6543
NJ Glen Gardner, Daner-Hayes Inc. 201-537-4534
NM Albuquerque, Williams Assocs. 505-255-1368
NY Brewster, Daner-Hayes Inc. 914-279-2168
NY E. Norwich, Daner-Hayes Inc. 516-922-0080
NY Rochester, Daner-Hayes Inc. 716-288-0921
NC Greensboro, Pen-Tech Assocs. 919-852-6000
OH Columbus, KRW Sls. Inc. 614-885-2598
OH Westlake, KRW Sales 216-871-7521
OR Oregon City, RTS, Inc. 503-632-3925
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TX Dallas, Kruvand 214-437-3355
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Can Lachine, Electrodesign Ltd. 514-636-4838

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CA Glendale, Halbar Assocs. 818-246-8263
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CT Old Saybrook, M. L. Assocs., Inc. 203-388-9718
FL Palm Bay, Motion Technlg., Inc. 800-438-1380
GA Lilburn, Motion Technlg., Inc. 800-438-1380
IL Mount Prospect, K-W Assocs. 312-253-6680
IN Fort Wayne, Aktron 219-747-3650
MA Wayland, M. L. Assocs. 617-358-5540
NY Great Neck, Marcus Sls. Assocs., Inc. 516-671-6820
NY Rochester, Application Spec. 716-586-6226
NC Charlotte, Motion Technlg., Inc. 800-438-1380
OH Cleveland, Servo-Mark 216-871-2353
OK Tulsa, Blair Engrg. 918-622-3100
PA Exton, Kiley Elect. Co., Inc. 215-363-8550
SC Greenville, Motion Technlg., Inc. 800-438-1380
TX Austin, Blair Engrg. 512-346-3032
TX Dallas, Blair Engrg. 214-241-5655
TX Houston, Blair Engrg. 713-973-8800
WA Redmond, Halbar Assocs. 206-882-0990
WA Vancouver, Halbar Assocs. 206-696-0170
Can Montreal, Brian Engrg. Ltd. 514-738-5757

PKS - DIGIPLAN LTD., 1859 Charter Lane, Lancaster, PA 17601, Tel: 717-299-2706, TELEX: 887352; Empl.: 100; *Sls. Mgr.:* David P. Overy

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PLASMA RESEARCH CORP., 2900 Main St., Alameda, CA 94501, Tel: 415-521-5532; FSC No.: 8Y067; Empl.: 7

PLASTIC CAPACITORS, INC., 2623 N. Pulaski Rd., Chicago, IL 60639, Tel: 312-489-2229, TWX: 910-221-1354, FAX: 312-489-0496; FSC No.: 99120; Empl.: 90; *Sls. Mgr.:* Thomas J. Brown; *Dist. Mgr.:* Thomas J. Brown

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FAX: 213-539-8325

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CA Orange County, Jackson & Rogers ... 714-645-7431
IL Chicago, Eschner & Kerangn 312-456-0333
IL Chicago, Walt Bajus 312-456-0333
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PLASTIGLIDE MFG., 2701 W. El Segundo Blvd., Hawthorne, CA 90250, Tel: 213-777-8108, TWX: 910-321-5755; Empl.: 425; *Sls. Mgr.:* William Kauble

PLASTOID CORPORATION, 45 Gingerbread Castle Rd., Hamburg, NJ 07419, Tel: 201-827-7141, FAX: 201-827-7141 (ext 52); Empl.: 200

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CA Fullerton, Bertech 714-526-3700
CA San Diego, Wassco 619-578-2102
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CO Denver, Solder Tec 303-922-6214
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MA N. Andover, Contact East 617-682-2000
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NJ Fairfield, Deanco, Inc. 201-575-7960
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NY Ithaca, Deanco, Inc. 607-257-4444
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TX Pflugerville, Briggs-Weaver 512-244-3343
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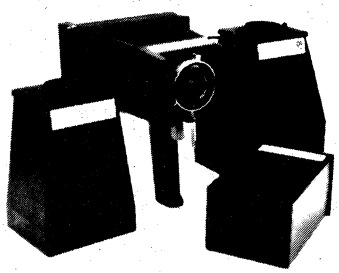

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Can N. York, Ont., W. J. Neil Sls. Ltd. 416-236-7302

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FAX: 206-525-2350

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FL Orlando, MacKay, Smith & Assocs. 305-423-4353
GA Tucker, MacKay, Smith & Assocs. 404-496-9913
IL Woodridge, Trend-Tronics 312-985-0626
MA Randolph, Bengal 617-961-4120
MN St. Paul, Countryman 612-645-9151
NC Raleigh, MacKay, Smith & Assocs. 919-847-2277
OH Centerville, Omega 513-434-5507
OH Shaker Hgts., Omega 216-751-9600
TX Richardson, Eagle 214-238-5383
WA Redmond, Halbar 206-882-0990
WY Jackson, Tetonics 307-733-1077
Can Montreal, Que., Promark 514-773-5344

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CA Sunnyvale, Capsco 408-734-3020
CA Sunnyvale, Target 408-734-5611
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WA Redmond, Priebe 206-881-2363

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POLARA ENGINEERING INC., 4115 W. Artesia Ave., Fullerton, CA 92633, Tel: 714-521-0900, TELEX: 688489, FAX: 714-522-8001; Empl.: 62

POLAROID CORPORATION, Polarizer Div., 1 Upland Rd., Norwood, MA 02062, Tel: 800-225-2770, FAX: 617-446-4600 ..... **B•1084**

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CA San Diego, M. W. Riedel Co. 619-272-2359
FL Maitland, D. J. Ellis & Assocs. 305-645-1101
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MA Brookline, Technig. Prods. Grp. 617-731-0858
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TX Richardson, Mil-Rep Assocs., Inc. 214-644-6731

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VA Lynchburg, Parogem Inc. 804-528-0681
WA Bellevue, Al Smith Co. 206-746-6770

POMFRET RESEARCH OPTICS, P. O. Box 1265, Orange, VA 22960, Tel: 703-854-4350; Empl.: 5

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POMONA ELECTRONICS, 1500 E. 9th St., P.O. Box 2767, Pomona, CA 91766, Tel: 714-623-3463, TWX: 910-581-3822; FSC No.: 05276; Empl.: 170; *Sls. Mgr.:* Thomas Barber; *Dist. Mgr.:* Thomas Barber ..... **C•1489-1517, 1708**

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WA Spokane, Eclipse Mktg. Grp. Ltd. 509-922-3972
EXP CA, Tarzana, Nate Beckerman & Co., Inc. 818-708-0021
Can Whitby, ITT Cannon Canada 416-668-8881

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NJ Fair Lawn, March Inds. 201-794-0088
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FAX: 812-386-2335

POTTER & BRUMFIELD, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001, Tel: 812-386-1000, TELEX: 27-8451, TWX: 810-350-2343; Empl.: 3000; *Dist. Mgr.:* Gordon Collins .. **B•1348, 1559-1575**

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POULIN ASSOCIATES, INC., 302 North Rd., Sudbury, MA 01776, Tel: 617-443-7333; *Sls. Mgr.:* Scott Spalding; *Dist. Mgr.:* Michael Dow

POWERBOX INC., 1503 Spruce St., Boulder, CO 80302, Tel: 303-444-1461, 800-444-1461, FAX: 303-444-3135; *Sls. Mgr.:* James Jones ..... **C•1083**

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POWER CONTROL, 122 Gamma Dr., Pittsburgh, PA 15238, Tel: 412-782-3120, TELEX: 882226; Empl.: 75

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WA Seattle, Telcom Mktg. Ltd. 206-722-5759

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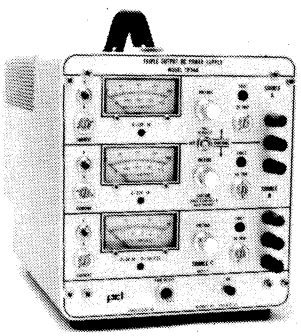

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OH Kettering, Electro-Com 513-299-0864
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WA Mercer Island, Elctrn. Comp. Sls. 206-232-9301
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CA San Diego, Sigma Elctrns. 619-565-2000
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CA San Jose, Rose Elctrns. 408-263-9700
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CT Wallingford, Sager Elect. Supp. Co. 203-265-4600
FL Ft. Lauderdale, KSM Elctrns. 305-971-5900
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IL Crystal Lake, Sub-Sem 312-782-3954
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RI Warwick, Major Edwards Elctrns. 401-725-7400
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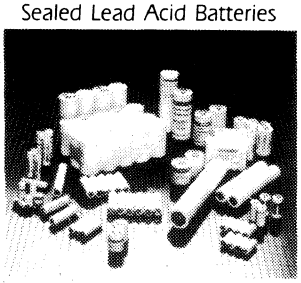

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TX Texas city, Elctrn. Supp. 409-945-4401
VA Arlington, Arlington Elctrns. 703-524-2412
WA Redmond, Energy Sls. 206-883-2343

POWER SOURCES INTERNATIONAL INC., Sources Electronics, 15014 Malachite Ct., Reno, NV 89506, Tel: 702-972-1224, TWX: 510-600-5831, FAX: 702-329-1360

Power Star, Inc.

POWER STAR, INC., 17346 Eastman St., Irvine, CA 92714, Tel: 714-261-5377, 800-854-9420; Empl.: 15; *Sls. Mgr.:* Thomas A. Goreth ..... **D•2142-2145**

Local Sales Offices & Reps

CT North Haven, Power Conversion Sys. 203-281-7270
MA Wellesley, Power Conversion Sys. 617-235-7884
NH Londonberry, Power Conversion Sys. 603-434-2371
NJ Fairfield, SDM Reps. 201-882-5005
NJ Pennsauken, S.C.I. Reps. 609-662-5222
OR Portland, Underwood & Hanify 503-224-0583
TX Dallas, Seaton Corp. 214-380-0414
WA Bellevue, Underwood & Hanify 206-643-1793

POWER SWITCH Corp.

FAX: 201-641-7871

POWER SWITCH CORPORATION, 50 Graphic Place, Moonachie, NJ 07074, Tel: 201-641-4544; Empl.: 27; *Sls. Mgr.:* Danice Donito ..... **D•1915-1917**

Local Sales Offices & Reps

CA Los Gatos, Reptronics 408-429-5997
CA Westlake Vl, The Tricamo Co. 805-496-3177
CO Aurora, High Technlg. Assocs. 303-695-1990
FL Melbourne, VM2 Mktg. 305-984-1918
GA Norcross, Futron, Inc. 404-263-9688
IL Berkeley, ESA Tech. Mktg. 312-544-0120
IN Indianapolis, STB & Assocs. 317-844-9227
MD Middletown, S.T./Woolard Co. 301-371-4500
MA Whitinsville, Lew Smith Assocs. 617-234-2940
MN Minneapolis, Electro-Serv 612-338-3475
MO Clayton, Seltronix 314-862-0100
MO Grandview, R. R. Burton Assocs. 816-763-5385
NJ Franklin Lakes, Hansen & Hughes 201-848-8900
NY Cazenovia, S.T./Woolard Co. 315-655-8145
NY Greenlawn, Hansen & Hughes 516-754-3608
OH Cleveland, Bradcor Elctrns. 216-261-0888
OH Dayton, Bradcor Elctrns. 216-671-1200

PA Hatboro, Electro Rep Engrg. 215-674-4421
RI Providence, ISM 401-351-7348
SC Pickens, S.T./Woolard Co. 803-878-3830
TX Houston, Barry Sls. 713-784-5860
TX Richardson, Barry Sls. 214-234-0255

Power Systems, Inc.

FAX: 203-726-1495

POWER SYSTEMS, INC., 45 Griffin Rd., South, Bloomfield, CT 06002, Tel: 203-726-1300, TWX: 710-425-8778; FSC No.: 5046З; Empl.: 250; *Sls. Mgr.:* Richard Milne ..... **D•1919**

Local Sales Offices & Reps
AZ Tempe, A5 Co. 602-968-4923
CA Los Gatos, Luscombe Engrg. of San Francisco 408-370-2020
CA Mission Viejo, The Powerhouse, Inc. .. 714-770-9009
CO Parker, A5 Co. 303-841-3651
AL Decatur, R. K. Welter & Assocs. 205-350-3441
FL Mt. Dora, R. K. Welter & Assocs., Inc. .. 904-357-3021
GA Dunwoody, R. K. Welter & Assocs., Inc. 404-390-9718
IL Rolling Meadows, Eagle Tech. Sls. 312-991-0700
MD Timonium, Bresson Assocs., Inc. 800-523-5572
MA Tyngsboro, Comptech, Inc. 617-649-3030
MN Edina, Mel Foster Tech. Sls., Inc. 612-941-9790
NY Mendon, Marchese, Marsey & Barden, Inc. 716-582-2240
NY N. Syracuse, Marchese, Marsey & Barden, Inc. 315-458-6920
PA Narberth, Bresson Assocs., Inc. 215-664-6460
TX Houston, Barry Sls., Inc. 713-784-5860
TX Richardson, Barry Sls., Inc. 214-234-0255
UT Salt Lake City, A5 Co. 801-483-1034
VA Lynchburg, Bresson Assocs. 800-523-5512
WA Kirkland, Northwest Comps. Sls. 206-828-4838
Can Burnaby, BC, Davetek Mktg., Inc. 604-430-3680

POWER SYSTEMS & CONTROLS, INC., 3206 Lanvale Ave., Richmond, VA 23230, Tel: 804-355-2803, FAX: 804-358-0498; Empl.: 55

POWER SYS. GRP., Rantec Div., Emerson Elec., 9401 Oso Ave., Chatsworth, CA 91311, Tel: 818-885-8223, TWX: 910-493-1247; FSC No.: 04971; Empl.: 265; *Sls. Mgr.:* Fred Silver

POWERTEC, INC.

FAX: 818-998-4225

POWERTEC, INC., 20550 Nordhoff St., Chatsworth, CA 91311-6168, Tel: 818-882-0004, TELEX: 277483, TWX: 910-494-2092; Empl.: 349; *Sls. Mgr.:* Barry A. Chenes ..... **D•1920-1936**

POWERTECH, INC., 0-02 Fairlawn Ave., Fairlawn, NJ 07410, Tel: 201-791-5050, TELEX: 353970; FSC No.: 32953; Empl.: 49; *Sls. Mgr.:* Alan J. Melnyk .... **A•2137**

POWER TECHNOLOGY, INC., P.O. Box 9769, Little Rock, AR 72219, Tel: 501-568-1995, TWX: 910-722-7313, FAX: 501-568-1994; Empl.: 75; *Sls. Mgr.:* John Webb ..... **D•1937**

POWER TEN, INC., 486 Mercury Dr., Sunnyvale, CA 94086, Tel: 408-738-5959, FAX: 408-738-4326; FSC No.: 61987; *Sls. Mgr.:* Vince Mutascio ..... **D•1938**

Local Sales Offices & Reps
AL Huntsville, Reynolds & Assocs. 205-881-9362
AZ Phoenix, Jayson Co., Inc. 602-867-1964
CA Los Alamitos, Power Specialists 213-594-9418
CA San Diego, Power Specialists 619-726-4799
FL Melbourne, Reynolds & Assocs. 800-255-1965
GA Atlanta, Reynolds & Assocs. 404-934-8525
MA Acton, Framar 617-263-2285
NY Fairport, Hi-Tec Sls. 716-223-5922
NC Raleigh, Reynolds & Assocs. 919-872-6668
PA Glenside, Koebert 215-887-2310
TX Austin, Eberts Elctrns. Sls. 512-258-1067
TX Latexo, Eberts Elctrns. Sls. 409-687-4342
WA Bellevue, A. J. Smith Co. 206-746-6770
Can N. Vancouver, BC, Jerome & Francis 604-986-1286

POWERTREND, INC., 1111 Rancho Conejo Blvd., Ste. 401, Newbury Pk., CA 91320-1415, Tel: 805-496-2945, FAX: 805-498-6880; *Sls. Mgr.:* R. Jones

Powertron

FAX: 516-883-7155

POWERTRON, See Industrial Test Equipment Co., Inc.

POWERTRON, Contraves Goerz Corp., 3821 Barranger Dr., Charlotte, NC 28210, Tel: 704-525-8962, TELEX: 572-444; *Sls. Mgr.:* Sam LoBue

POWERTRON CORPORATION, Rte. 15, Box 932, Sparta, NJ 07871, Tel: 201-579-5599, TELEX: 136198; *Sls. Mgr.:* William E. Cannon; *Dist. Mgr.:* William E. Cannon ..... **D•1948**

POWR-UPS CORP., Brookhaven R&D Plaza, 1 Roned Rd., Shirley, NY 11967, Tel: 516-345-5700, 1-800-333-POWR; Empl.: 50; *Sls. Mgr.:* Alon Kopstein ..... **B•1250-1251**

Local Sales Offices & Reps
CA Fullerton, ESCO 714-879-7260
CT Ridgefield, E. S. Williams 203-438-7474
IL Oak Brook, A.G. Erickson 312-323-1367
KS Shawnee Mission, LSC, Inc. 913-362-2121
OH Dover, AJ Assocs. 216-343-2224
PA Audubon, Holmes Assocs. 215-666-0636

Local Distributors
NY Long Island City, B & B Motor & Control Corp. 800-638-7808

PPC PRODUCTS CORPORATION, 7516 Central Industrial Dr., Riviera Beach, FL 33404, Tel: 305-848-9606, TWX: 510-952-7611, FAX: 305-848-1607; FSC No.: 33178; Empl.: 90; *Sls. Mgr.:* Nick Ernick

PPD, INC., 6001 Resco Ct., Raleigh, NC 27612, Tel: 919-781-3955, FAX: 919-781-4980 ..... **A•1158-1166**

Local Sales Offices & Reps
NC Raleigh, Godwin Assocs. 919-878-8000

PPM, INC., 5385 Harper Rd., Cleveland, OH 44139, Tel: 216-349-2300; Empl.: 20; *Sls. Mgr.:* A. L. Bletcher ..... **D•1313**

Local Sales Offices & Reps
AL Huntsville, Jim Springer, Inc. 205-883-4163
AZ Phoenix, J. Smith & Assocs. 602-267-0981
CO Denver, J. Smith & Assocs. 303-597-5343
MI Ferndale, Tiby Co. 313-547-3550
NM Albuquerque, J. Smith & Assocs. 505-345-6501
OH Cleveland, Tiby Co. 216-371-5335
OH Dayton, Tiby Co. 513-277-3822

PRACTICAL AUTOMATION, INC., 2 Research Dr., Shelton, CT 06484, Tel: 203-929-5381, TELEX: 6813310, FAX: 203-929-9941; Empl.: 150; *Sls. Mgr.:* R. M. Banzaca

Local Sales Offices & Reps
AL Huntsville, Elctrn. Mfr. Agts., Inc. 205-830-4030
CA Mountain View, Thorson West 415-964-9300
CA Riverside, Cal Tech Pro, Inc. 714-682-8506
CT Hamden, JBL Assocs. 203-281-3161
FL Longwood, Elctrn. Mfr. Agts., Inc. 305-682-1202
MI Livonia, Electro Sls. Assocs. 313-421-7500
MN Minneapolis, Chris & Assocs. 612-861-1634
NC Raleigh, Elctrn. Mfg. Agts. 919-846-6888
OH Cleveland, Electro Sls. Assoc. 216-729-0190
OH Dayton, Electro Sls. Assoc. 513-426-5551
WA Bellevue, Tasco Inc. 206-453-1414

PRD ELCTRNS., DIV. OF HARRIS CORP., see Harris Corp., PRD Electronics Div.

Precicontact, inc.

FAX: 215-757-8025

PRECICONTACT, INC., 835 Wheeler Way, Langhorne, PA 19047, Tel: 215-757-1202, TELEX: 37-29448; FSC No.: 60197; *Sls. Mgr.:* Stephen Lawler ..... **C•1524-1525, 1734**

Local Sales Offices & Reps
AZ Phoenix, G.B. Elctrns. Inc. 602-935-3984
CA San Diego, Qualtronics 619-695-0118
CA San Jose, Applied Elctrn. Mktg. 408-971-9377
CA Woodland Hills, First Rep 818-718-6155
CO Colorado Springs, Peak Sls. 303-574-8700
FL Orlando, C Assocs. 305-831-1717
IL Chicago, Joel Wasserman Assocs. 312-256-3566
IN Greenwood, Valentine & Assocs. 317-888-2260
MD Towson, Arbotek 301-825-0775
MA Norwood, The Mac Innis Co. 617-762-8090
MN Minneapolis, Midcon Corp. 612-894-8205
NJ Marlton, Naudain Assocs. 609-983-5300
NY Port Washington, Ashtec, Inc. 516-767-0336
NY Victor, Integrity Mktg. Co. 716-924-3671
OH Cincinnati, Makin & Assocs. 513-871-2424
OH Cleveland, Makin & Assocs. 216-248-7370
OH Columbus, Makin & Assocs. 614-848-5424
OR Portland, Elctrn. Mktg. Grp. 503-684-5935
TX Dallas, J.Y. Schoonmaker Co. 214-349-1650
TX Houston, J. Y. Schoonmaker Co. 713-738-2427
UT Salt Lake City, Charles Fields & Assocs. 801-531-6177
VA Harrisonburg, Blueridge Prods. 703-433-0990
WA Redmond, Electronic Mktg. Grp. 206-882-0962
Can Ontario, Avotronics 416-475-2024
Can Vancouver, B.C., Davetek Mktg. 604-430-3680

Local Distributors
AZ Litchfield Park, GB Elctrns. 602-935-3984
AZ Phoenix, Future/Cetec 602-272-7951
CA Buena Pk., Cypress/RPS Elctrns. 213-744-0355
CA Chatsworth, Future/Cetec 818-700-0914
CA Irvine, Future/Cetec 714-250-4141
CA Orange, Electronic Connexions Corp. 714-998-2901
CA San Diego, Cypress/RPS Elctrns. 619-292-5611
CA San Diego, Future/Cetec 619-278-5020
CA San Jose, Cypress Elctrns. 408-945-8400
CA San Jose, Future Elctrns. 408-945-9100
CO Denver, CSID, Inc. 303-292-9594
CO Westminster, Future Elctrns. 303-650-0123
CO Wheatridge, Cypress Elctrns. 303-431-2622
CT Bethel, Future Elctrns. 203-743-9594
CT Bridgeport, Park Distrs. 203-366-8414
CT Wallingford, Cronin Elctrns., Inc. 203-265-3134
CT Wallingford, Sager 203-265-4600
FL Altamonte Springs, Future Elctrns. 305-767-8414
FL Clearwater, Electronic Precepts of FL 813-530-9781
FL Clearwater, Future Elctrns. 813-441-4771
FL Orlando, Reptron Elctrns. 305-735-1112
FL Tampa, Reptron Elctrns. 813-855-4656
GA Atlanta, Reptron Elctrns. 404-446-1300
GA Atlanta, Future Elctrns. 404-441-7676
IL Crystal Lake, Subsem 815-459-4139
IL Lisle, Components, Inc. 312-852-7707
IL Palatine, OHM Elctrns., Inc. 312-359-5500
IL Schaumburg, Future Elctrns. 312-882-1255
IL Schaumburg, Reptron Elctrns. 312-882-1700
IN Indianapolis, Mar Elctrns. 317-875-4510
MD Columbia, Future Elctrns. 301-995-1222
MD Rockville, Wire Tech., Inc. 301-340-1445
MA Andover, Aved Elctrns. 617-688-3800
MA Hingham, Sager 617-749-6700
MA Needham, Cronin Elctrns. 617-449-5000
MA Norwood, Emtel Elctrns. 617-769-9500
MA Westborough, Future Elctrns. 617-366-2400
MA Wilmington, J.V. Elctrns. 617-273-4300
MI Detroit, Reptron Elctrns. 313-525-2700
MN Minnetonka, Reptron Elctrns. 612-938-0000
MO Kansas City, Walters Elctrns. 816-531-7015
MO St. Charles, Finnegan Elctrns. 314-946-6201
NH Salem, Sager 603-898-1348
NJ Bellmawr, Mid-Atlantic Elctrns. 609-931-5303
NJ Berlin, GCI Corp. 609-768-6767
NJ Mt. Laurel, Future Elctrns. 609-778-7600
NJ Parsippany, Fabe Electro Sls., Inc. 201-299-1123
NM Albuquerque, Connecting Comps. Div. 505-345-8921
NY Brooklyn, Connector Resources 718-383-2208
NY Hauppauge, Jaco Elctrns. 516-273-5500
NY Hauppauge, Sager 516-348-1300
NY Liverpool, Future Elctrns. 315-451-2371
OH Dayton, Televox, Inc. 513-294-4499
OH Mansfield, Rush Elctrns. Distrs., Inc. 419-756-2322
OH Worthington, Reptron Elctrns., Inc. 614-436-6675
OR Beaverton, Component Resources 503-641-8488
OR Beaverton, Future Elctrns. 503-645-9454
PA Wayne, Peak Elctrns. 215-293-9000
PA York, E.C.I. 717-846-5334
TN Hixon, Techni-Tronics, Inc. 615-842-0514
TX Allen, Prime Distrbg. Co. 214-231-0170
TX Austin, Southwest Elctrns. 512-837-8971
TX Dallas, Cypress Elctrns. 214-869-1435
TX Richardson, Jaco Elctrns. 214-235-9575
TX Richardson, Southwest Elctrns. 214-234-3050
TX Stafford, Southwest Elctrns. 713-491-4900
UT Salt Lake City, Future Elctrns. 801-972-8489

WA Bellevue, Future Elctrns. 206-881-8199
WA Seattle, Pacific Elctrns. 206-575-1050
Can Calgary, Alb., Future Elctrns. 403-235-5325
Can Downsview, Ont., Future Elctrns. 416-638-4771
Can Edmonton, Alb., Future Elctrns. 403-438-2858
Can Ottawa, Ont., Future Elctrns. 613-820-8313
Can Pointe Claire, Que., Future Elctrns. 514-694-7710
Can Vancouver, B.C., Future Elctrns. 604-438-5545
Can Winnipeg, Manitoba, Future Elctrns. 204-339-0554

PRECISION COMPONENTS, INC., 1110 W. National Ave., Addison, IL 60101, Tel: 312-543-6400, TELEX: 910-221-0158

PRECISION CONTROL MANUFACTURING, INC., 1509 B Queen Anne Ave. N., Seattle, WA 98109, Tel: 206-281-9380; FSC No.: 64782 ..... **A•2097**

Local Sales Offices & Reps
WA Seattle, Precision Control Mfg., Inc. 206-281-9380

Local Distributors
CA Tarzana, Nate Beckerman & Co., Inc. 818-708-0021

PRECISION DIGITAL CORP., 80 Coolidge Hill Rd., Watertown, MA 02172, Tel: 617-924-2256

PRECISION ELECTRONICS, 9101 King Ave., Franklin Park, IL 60131, Tel: 312-678-5350, FAX: 312-678-0511; Empl.: 25; *Sls. Mgr.:* William Stow

PRECISION EXTRUSIONS, INC., Box 120, Bensenville, IL 60106, Tel: 312-766-0340; *Sls. Mgr.:* Richard Ziehm

PRECISION FILTERS, INC.

FAX: 607-227-4466

PRECISION FILTERS, 240 Cherry St., Ithaca, NY 14850, Tel: 607-277-3550, TELEX: 646846; FSC No.: 66-II-F & 66-II-I; Empl.: 82; *Sls. Mgr.:* D. F. Chandler ..... **A•1680-1686; D•1016-1017**

Local Sales Offices & Reps
AL Huntsville, Burnette Techno-Metrics Inc. 205-830-2832
AZ Tempe, Cleveland Entprs. 602-820-1127
CA Laguna Hills, Elotek Sys., Inc. 714-830-4856
CA San Jose, Synergistic Sls. 408-292-6573
CO Broomfield, Hannah-Hill, Inc. 303-460-0602
AZ Phoenix, Western Region Sls. Off. 602-953-0345
DC Arlington, Gans & Pugh 703-527-3262
FL Osprey, Dick Ridgewell Co. 813-484-2020
MD W. Friendship, Gans & Pugh Assocs. 301-442-2189
MA Beverly, Ellis Assocs. 617-922-2015
MO Manchester, Vertec Assocs., Inc. 314-394-6242
NY Saugerties, Beckrep, Inc. 914-246-3031
TX Houston, ABCOR, Inc. 713-486-9251
VA Arlington, Gans & Pugh Assocs. 703-527-3262
WA Bellevue, Topp Engrg. Sls. 206-747-5400
EXP Can./Ottawa, Ont., Rayonics Sci. 613-521-8251
Can Downsview, Ont., Rayonics Scientific 416-736-1600
Can St. Laurent, Que., Rayonics Sci. 514-335-0105

PRECISION INTERCONNECT, 16640 SW 72nd Ave., Portland, OR 97224, Tel: 503-620-9400, TELEX: 36-0963; FSC No.: 60381; Empl.: 150; *Sls. Mgr.:* Walt Harwood ..... **C•1902-1904**

Local Sales Offices & Reps
CA Hayward 415-785-1277
DE Wilmington 302-798-7071
NH Rye, Precision Interconnect 603-964-9322
OR Portland 503-620-9400

PRECISION LAMP, INC., 480 Aaron Dr., Cotati, CA 94928, Tel: 707-792-0333, TELEX: 348498 GOLDLAMP, FAX: 707-792-2738; FSC No.: FSCM 58451; Empl.: 25

PRECISION LEVEL VIAL CO., P.O. Box 320, 760 Edison-Furlong Rd., Furlong, PA 18925, Tel: 215-794-0800, 800-345-7517; Empl.: 12; *Sls. Mgr.:* Susan Mazzanti

PRECISION MECHANISMS, 44 Brooklyn Ave., Westbury, NY 11590, Tel: 516-ED3-5955; FSC No.: 08127; Empl.: 26; *Sls. Mgr.:* Leon N. Canick

PRECISION METAL PRODUCTS CO., Centennial Indl. Pk., Peabody, MA 01961-6026, Tel: 617-532-5500, TWX: 710-347-0123; FSC No.: 86577; Empl.: 54; *Sls. Mgr.:* Robert H. Degnan

PRECISION MONOLITHICS, INC., 1500 Space Park Dr., Santa Clara, CA 95054-3499, Tel: 408-727-9222, TWX: 910-338-0218; FSC No.: 06665; Empl.: 900; *Sls. Mgr.:* Jo Nall; *Dist. Mgr.:* Mike Dennison

Precision Resistive Products, Inc.

FAX: 319-394-9280

PRECISION RESISTIVE PRODUCTS, INC., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, Tel: 319-394-9131, TWX: 510-100-8039; Empl.: 50; *Sls. Mgr.:* Oscar Cline; *Dist. Mgr.:* Oscar Cline ..... **A•2002-2003**

Local Sales Offices & Reps
AL Huntsville, Hughes & Assocs. 205-533-9108
CA Anaheim, Impact Electrns. Inc. 714-533-1351
CA Los Altos, Frauman Assoc. 415-941-0660
CA San Diego, KCE 619-278-7640
CO Denver, Williams Assocs. 303-373-4730
IL Chicago, Ellinger Sls. 312-763-1570
IN Greenwood, Valentine Assocs. 317-888-2200
MA Waltham, Jesco, Inc. 617-893-0094
MI Warren, DEM Elctrns. Sls. 313-575-9444
MN Minneapolis, Intl. Sls. 617-831-8423
NJ Mountainside, Kevtron Elctrns. 201-654-7600
OH Cincinnati, G & H Sls. Co. 513-272-0580
TX Richardson, Campion Sls. Co. 214-238-8145
WA Seattle, W3 Assocs., Inc. 206-285-2667

PRC

FAX: 813-546-9515

PRECISION RESISTOR CO., INC., 10601 75 St. N., Largo, FL 34647, Tel: 813-541-5771, TELEX: 821788; FSC No.: 48615; Empl.: 45; *Sls. Mgr.:* Arleen Reid ..... **A•2004-2007**

PRECISION SPECIALTIES, INC., 19414 Londelius St., Northridge, CA 91324, Tel: 818-349-9774; FSC No.: 66785; Empl.: 5

PRECISION STANDARD TIME, INC., 105 Fourier Avenue, Fremont, CA 94539, Tel: 415-656-4447, FAX: 415-656-1671; *Sls. Mgr.:* Ken Brandt

PRECISION TECH. SEWING, 921 E. Charleston Rd., Palo Alto, CA 94303, Tel: 415-856-2128

PRECISION TUBE, Church Rd. & Wissahickon, N. Wales, PA 19454, Tel: 215-699-5801, FAX: 215-699-0761; FSC No.: 82413; Empl.: 240; *Sls. Mgr.:* William J. McNeil

PREFERRED ELECTRONICS, INC., Main Line Dr., P.O. Box 248, Westfield, MA 01086, Tel: 413-568-2301, TELEX: 955-339, FAX: 413-562-7275; Empl.: 175; *Sls. Mgr.:* Merton I. Rosenberg

PREH ELECTRONIC INDUSTRIES, INC., 470 E. Main St., Lake Zurich, IL 60047-2578, Tel: 312-438-4000, TELEX: 297-112 PEI, FAX: 312-438-5522; FSC No.: 36-3193682; Empl.: 7; *Sls. Mgr.:* Ken Wood .... **A•2098; B•1786, 1832; C•1526**

Local Sales Offices & Reps
CA Carlsbad, Bart Budge Assocs. 619-471-2554
CA Laguna Niguel, Bart Budge Assocs. ... 714-582-8720
CA Mtn. View, Bart Budge Assocs. 415-961-0940
CO Littleton, Anodyne Tech. Sls. 303-979-2435
CT Cheshire, MacInnis 203-272-8877
FL Miami, Indl. Comps. 305-477-0387
MI Troy, C. B. Jensen & Assocs. 313-643-0506
NJ Haddon Hgts., Eltron Sls. Ltd. 609-546-6171
NJ Woodbridge, John Chirico Assocs. 201-855-9600
OH Cincinnati, Bob Gilbert & Assocs. 513-574-1932
PA Pocopson, Eltron Sls. Ltd. 215-793-1468
SC Greenville, Eltron Sls. Ltd. 803-234-6931
TX Round Rock, Encore Tech. Comps. ... 512-388-7930
VA Front Royal, Eltron Sls. Ltd. 703-635-7201
Can Markham, Ont., Avotronics Ltd. 416-475-2024

Local Distributors
CA Belmont, LoDan Elctrns. Inc. 415-592-4600
CA Gardena, California Switch & Signal .. 213-770-2330
CT Norwalk, Cobra Comps. 203-847-6442
FL Largo, LoDan Elctrns., Inc. 813-586-2851
IL Arlington Hgts., LoDan Elctrns. 312-398-5311
IL Wheeling, Hawk Elctrns. 312-459-4030
MA Hingham, Sager Elctrl. Supp. Co. 617-749-6700
MA Hopedale, Teccon Elctrns. 617-478-8544
MA Westborough, In Stock Prods. Co. 617-870-5750
NJ Camden, Gen. Radio Supp. Co. 609-964-8560
NY Bohemia, Key Comps. 516-567-7500
NY Hauppauge, Broadline Elctrns. 516-231-4100
NY Hempstead, Elctrn. Equip. 516-538-5510
NY Rochester, Whirlwind Music Distrs. ... 716-663-8820
PA Harrisburg, Cumberland Elctrns. 717-232-5999
TX Dallas, Off the Shelf Comps. 214-247-0052
Can London, Ont., C. M. Peterson Co. Ltd. 519-434-3204
Can Montreal, Que., Ferro Technique 514-341-3450
Can Scarborough, Ont., Carsten Elctrns. Ltd. 416-495-9999
Can Toronto, Ont., Atlas Elctrns. Ltd. 416-789-7761
Can Willowdale, Ont., Electrosonic Inc. 416-494-1666

PREMA PRECISION ELECTRONICS, INC., 6290 Sunset Blvd., Suite 1126, Los Angeles, CA 90028-8770, Tel: 213-463-2294, TWX: 910-321-2903, FAX: 213-463-4319

FAX: 212-993-9211

PREMIER METAL PRODS. CO., 381 Canal Pl., Bronx, NY 10451, Tel: 212-993-9200; Empl.: 75; *Sls. Mgr.:* Anthony E. Bozza ..... **C•1084-1085**

Local Sales Offices & Reps
AZ Phoenix, Scientific Dvcs. 602-957-0401
CA Fontana, Premier Metal 714-829-3089
CA Huntington Bch., Scientific Dvcs. 714-840-3501
CA San Jose, Scientific Dvcs. 408-554-0455
CO Denver, AKI Enterprises 303-338-4488
CT East Haven, Eagle Assocs. 203-467-6542
GA Marietta, Adams & Assocs. 404-973-0853
IL Elmhurst, Utronix Sls. 312-834-1100
KS Kansas City, Delltron Co. 816-436-6445
MD Burtonsville, Eastern Instrmn. 301-384-8500
MA Needham, Eagle Assocs. 617-444-3446
MI Brighton, Electronic Sources 313-227-3598
MN Minneapolis, J.E.M. Anderson Co. 612-823-6459
MO Florissant, Delltron Co. 314-839-0033
NM Albuquerque, Scientific Dvcs. 505-293-3494
NY New Hyde Park, Harris & Aldrich Sls. 516-488-2622
NY Syracuse, Lewis-Dunnigan Co. 315-446-5522
NY Yonkers, Sonkin Assocs. 914-968-8282
NC Greenboro, Adams & Assocs. 919-272-6838
OH Sharon Center, Merit Elctrns. 216-725-1460
PA Penndel, Delta Mktg. 215-750-1440
TX Euless, W. Pat Fralia Co. Inc. 817-354-9720
TX Houston, W. Pat Fralia Co. Inc. 713-772-1572
WA Redmond, Scientific Dvcs. 206-885-0004
EXP FL, Ft. Lauderdale, GM Intl. 305-434-6617

Local Distributors
AL Huntsville, Mock Elctrns. 205-539-2401
AL Opelika, Southern Elctrns. 205-745-5298
AZ Phoenix, Dalis Elctrns. 602-275-2885
CA Burlingame, Rose Elctrns. 415-348-2740
CA San Jose, Quement Elctrns. 408-998-5900
CT Danbury, Pilgrim Elctrns. 203-792-7274
FL Miami, Electronic Equip. Co. 305-871-3500
IL Elk Grove Village, GBL/Gould Elctrns. 312-593-3220
IN Fort Wayne, Graham Elctrns. 219-423-3422
LA Baton Rouge, Menard Elctrns. 504-355-0323
MD Baltimore, ASI Elctrns. 301-265-5100
MD Baltimore, Resco 301-823-0070
MD Bethesda, Empire Elctrns. 301-656-3300
MA Hingham, Sager Electrical Supp. 617-749-6700
MA Newton, Greene-Shaw Co. 617-969-8900
MI Ann Arbor, Purchase Radio Supp. 313-668-8696
MO St. Louis, Gateway Elctrn. Supp. 314-427-6116
NJ Cranford, Garden State Indl. Elec. 201-272-6400
NJ Hanover, State Elctrns. PTS 201-887-2550
NJ Kenilworth, Federated Purchaser 201-272-0505
NY Buffalo, Summit Distrs. 716-884-3450
NY E. Farmingdale, Ahirter Telewire 516-293-7788
NY Hauppauge, Broadline Elec. Dist. 516-231-4100
NY Hempstead, Davis Elctrn. Corp. 516-483-9200
NY Lynbrook, Peerless Radio Dist. 212-523-3456
NY LIC, H. L. Dalis Inc. 212-361-1100
NY New York, Martin Audio/Video Corp. 212-541-5900

NY Portchester, Wise Comps. 914-939-8600
NY Rochester, Simcona Elctrn. Corp. 716-328-3230
NY Rochester, Summit Elctrns. 716-334-8110
NC Raleigh, Southeastern Radio 919-828-2311
OH Dayton, Carver Supp., Inc. 216-666-1185
PA Allentown, Federated Elctrns. 215-437-4481
PA Horsham, Toner Cable Equip. 215-675-2053
PA Pittsburgh, South Hills Elctrns. 412-921-9000
PA West Chester, West Chester Elec. Supp. 215-696-7500
SC Charleston, Wholesale Indl. Elec. 803-722-2634
TN Clarksville, Randolph Hale & Matthews 615-647-2325
TN Cookeville, Randolph & Parks 615-526-6184
TN Nashville, Randolph & Rice 615-255-5601
TN Tullahoma, Randolph Rice & Williams 615-455-4531
TX Ft. Worth, Swieco Inc. 817-335-6521
TX Houston, Lenert Co. 713-225-1465
VA Arlington, Arlington Elctrns. 703-524-2412
WA Seattle, Radar Elec. Co. 206-282-2511

PREMIER MICROWAVE, 35 New Broad St., Port Chester, NY 10573, Tel: 914-939-8900, TWX: 710-569-1609; FSC No.: 15870; Empl.: 90; *Sls. Mgr.:* Mel Radner

PREM MAGNETICS, INC., 3521 N. Chapel Hill Rd., McHenry, IL 60050, Tel: 815-385-2700, FAX: 815-385-8578; FSC No.: 20462; Empl.: 300; *Sls. Mgr.:* D. Hertel ..... **A•2355-2365**

PRES:AIR:TROL CORP

FAX: 914-698-9456

PRES-AIR-TROL CORP., 1009 Boston Post Rd., Mamaroneck, NY 10543, Tel: 914-698-2026, 800-431-2625 (outside NY) ..... **B•1787**

PRESIDIO COMPONENTS, INC., 7185 Construction Ct., San Diego, CA 92121, Tel: 619-578-9390, TWX: 310-371-6407; FSC No.: 60212

PRESS-ON PRODUCTS, 21 Factory Rd., Addison, IL 60101, Tel: 312-628-2255, FAX: 312-543-4414; Empl.: 20; *Sls. Mgr.:* T. Cummins

PRESSURE CONTROLS, INC., 406 Cortlandt St., Belleville, NJ 07109, Tel: 201-751-5003; Empl.: 15; *Sls. Mgr.:* P. Emmarco

PRESSURE SYSTEMS, INC., 34 Research Dr., Hampton, VA 23666, Tel: 804-865-1243, TELEX: 901406, FAX: 804-766-2644; Empl.: 77; *Sls. Mgr.:* J. S. Yakshe

PRESTON SCIENTIFIC, 805 E. Cerritos Ave., Anaheim, CA 92805, Tel: 714-776-6400, TELEX: 5101004596 ESL UD, FAX: 714-776-3660; Empl.: 60; *Sls. Mgr.:* Charles J. McGuire

PRIMELINE, Soltec Corporation, P. O. Box 670, San Fernando, CA 91341-0670, Tel: 818-365-0101, TELEX: 494-3094 SOLTEC UI, FAX: 818-365-7839; *Sls. Mgr.:* Byron McIntire

PRIME POWER, A Prime Technology Co., Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092, FAX: 203-481-8937; *Sls. Mgr.:* J. L. Jamieson

PRIME TECHNOLOGY, INC., See General Resistance, A Prime Technology Co.

PRIMO COMPANY LIMITED, 25-1, 6-Chome, Mure, Mitakashi, Tokyo, Japan 181, Tel: 0422-43-3121, TELEX: 2822-326; FSC No.: 0422 49 8865; Empl.: 391; *Sls. Mgr.:* K. Shinai

PRINCETON CASE CO., INC., 667 Lehigh Ave., Union, NJ 07083, Tel: 201-687-1750; Empl.: 60; *Sls. Mgr.:* S. E. Parker

PRINCETON ELECTRONIC PRODUCTS, Box 101, North Brunswick, NJ 08902, Tel: 201-297-4448, TWX: 710-380-3832; Empl.: 29; *Sls. Mgr.:* H. Center; *Dist. Mgr.:* H. Center

PRINCO INSTRUMENTS, INC., 1020 Industrial Hwy., Southampton, PA 18966; FSC No.: 48620; Empl.: 70; *Sls. Mgr.:* G. G. Pfaff

PRINTER PRODUCTS, Capitol Circuits Corporation, 25 Denby Road, Boston, MA 02134, Tel: 617-254-1200; Empl.: 200; *Sls. Mgr.:* Blaine Wotring ..... **D•1101**

Local Sales Offices & Reps
AZ Scottsdale, Digital Bus. Sys. 602-991-9831
CA Mountainview, IFM Inc. 415-961-2828
IL Chicago, Data Elctrns. 312-283-0300
IN Indianapolis, John Sukup, Inc. 317-253-5501
PA Ambler, Denco Data Equip. Corp. 215-542-9876
TX Richardson, Scientific Sls. Co. 214-231-6541
VA Alexandria, Scott Data Corp. 703-765-7901
Can Scarborough, Ontario, Technical Logistics Support 416-298-9486

PROBE MASTER, INC., 4898 Ronson Ct., San Diego, CA 92111, Tel: 619-560-9676, 800-854-1519, 800-772-1519; *Sls. Mgr.:* Dick Press

PROBE-RITE, INC., P.O. Box 242, Santa Clara, CA 95052, Tel: 408-727-0100, TWX: 910-338-0260; *Sls. Mgr.:* Frank J. Ardezzone

PRODELIN CORPORATION, P.O. Box 368, Conover, NC 28613, Tel: 704-464-4141, FAX: 704-464-5725; Empl.: 60; *Sls. Mgr.:* Dan Johnson

PRODUCTS FOR RESEARCH, 88 Holten St., Danvers, MA 01923, Tel: 508-774-3250, TELEX: 940-287, FAX: 617-245-1628; Empl.: 21; *Sls. Mgr.:* Harry Martin

PTI PRODUCT TECHNOLOGY INC.

FAX: 714-474-1340

PRODUCT TECHNOLOGY, INC., 2811-B McGaw Avenue, Irvine, CA 92714, Tel: 714-474-8998; FSC No.: 1Z295; Empl.: 20; *Sls. Mgr.:* Gerald F. Hammel ..... **C•1735**

Local Sales Offices & Reps
AZ Redlands, Lugen Inds. 714-371-5259
CA Fremont, Sidann Sls. 415-659-1394
CA Santa Ana, Sidann Sls. 714-850-0280
CO Broomfield, Ramark Sls. 303-469-1758
WI Milwaukee, Lugen Inds. 414-671-1047

PROGRAMMABLE DEVICES, INC., 155-T New Boston St., Woburn, MA 01801, Tel: 617-935-9530, FAX: 617-935-3654; Empl.: 10

PTS FREQUENCY SYNTHESIZERS

FAX: 617-486-4495

PROGRAMMED TEST SOURCES, Beaver Brook Rd., P.O. Box 517, Littleton, MA 01460, Tel: 617-486-3008; FSC No.: 66381; Empl.: 20 ..... **D•1314**

PROJECTS UNLIMITED, 3680 Wyse Rd., Dayton, OH 45414, Tel: 513-890-1918, TWX: 810-450-2523, FAX: 513-890-4911; Empl.: 90; *Sls. Mgr.:* Greg Kimpton

PRO-LOG, 2411 Garden Rd., Monterey, CA 93940, Tel: 408-372-4593, TWX: 910-360-7082; Empl.: 200

PROTEON, INC., Two Technology Dr., Westborough, MA 01581-5008, Tel: 617-898-2800, TELEX: 928124; Empl.: 150; *Sls. Mgr.:* Patrick F. Lally

PROTO PC INC., 2424 Territorial Rd., St. Paul, MN 55114, Tel: 612-644-4660, TWX: 910-380-7623; *Sls. Mgr.:* Danie Watson

PROTO STAMPING CORP., 850 Charter St., Redwood City, CA 94063, Tel: 415-365-0498, TELEX: 709241; Empl.: 35; *Sls. Mgr.:* David Duncan

PROTO SYSTEMS OF ATLANTA, 625 Sims Industrial Blvd., Alpharetta, GA 30201, Tel: 404-475-1330, TELEX: 469432; *Sls. Mgr.:* John Gregory

PROTOTEK, INC., 25 Standen Dr., Hamilton, OH 45015, Tel: 513-874-5094, FAX: 513-874-2252; FSC No.: 60813; Empl.: 45; *Sls. Mgr.:* Larry Frank; *Dist. Mgr.:* Earl Rohe

PSG INDS., 1225 Tunnel Road, Perkasie, PA 18944, Tel: 215-257-3621, TELEX: 827361; FSC No.: 18509; Empl.: 150; *Sls. Mgr.:* Robert Banion

PTC TRANSFORMERS, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505, Tel: 609-298-8200, TELEX: 510-685-3645; Empl.: 25; *Sls. Mgr.:* C. W. Harrison

PTK/RANTEC DIVISION, 1173 Los Olivos Ave., Los Osos, CA 93402, Tel: 805-528-5858, TELEX: 88-8863, TWX: 910-351-5802; FSC No.: 60132; Empl.: 145; *Sls. Mgr.:* Francesca Peterson

PTS CORPORATION, Box 272, Bloomington, IN 47401, Tel: 812-824-9331; Empl.: 350; *Sls. Mgr.:* Jeff Hamilton; *Dist. Mgr.:* David Melwid

PTX-PENTRONIX INC., 1737 Cicotte, Lincoln Park, MI 48146, Tel: 313-388-3100, TELEX: 23-0398; Empl.: 21; *Sls. Mgr.:* J. Schultz

Z-LINE

FAX: 714-641-9062

PULIZZI ENGINEERING, INC., 3260 S. Susan St., Santa Ana, CA 92704-6865, Tel: 714-540-4229; FSC No.: 70513; Empl.: 35; *Sls. Mgr.:* Michael B. Pulizzi; *Dist. Mgr.:* Michael B. Pulizzi ..... **D•2146-2149**

Local Sales Offices & Reps
CA Los Angeles, Power Partners 213-215-0800, 714-261-9200
CA Los Gatos, Norwest Elctrns. 408-395-1190
IA Des Moines, Beams 500 to 528 515-255-1148
MD Silver Spring, L. G. White & Co., Inc. ... 301-792-0660
MA N. Reading, Tech. Instrs., Inc. 617-944-3930

Local Distributors
CA San Jose, Dansco Comp. Sls., Inc. 408-292-9740

PULNIX AMERICA, INC., 770-A Lucerne Drive, Sunnyvale, CA 94086, Tel: 408-733-1560, TELEX: 172541 PULNIX AMERICA, FAX: 408-737-2966; *Sls. Mgr.:* Richard Hofmeister

PULSAR PRODUCTS DIV., Physics International, 2700 Merced St., San Leandro, CA 94577, Tel: 415-577-7236, TWX: 910-366-7033; Empl.: 360

PULSE ENGINEERING, INC., 7250 Convoy Ct., P.O. Box 12235, San Diego, CA 92112, Tel: 619-268-2400, FAX: 619-268-2515; Empl.: 150; *Sls. Mgr.:* Leonard M. Luner

PULSE INSTRUMENTS CO., 1234 Francisco, Torrance, CA 90502, Tel: 213-515-5330; Empl.: 20; *Sls. Mgr.:* Ron Perry

PULSE TRONIC INC., P.O. Box 5196, Ville St. Laurnet, Que., Canada H4L 4Z8, Tel: 514-747-6028, TELEX: 05-826652, FAX: 514-747-7330; *Sls. Mgr.:* Pamela Hirsh

PURE DATA LTD., 200 W. Beaver Creek, Richmond Hill, Ont., Canada L4B 1B4, Tel: 416-731-6444, TELEX: 06-966707, FAX: 416-731-7016; Empl.: 75; *Sls. Mgr.:* Terrence Hickey; *Dist. Mgr.:* Chris Bergman

PYLE INDUSTRIES, INC., 501 Center St., P.O. Box 620, Huntington, IN 46750, Tel: 219-356-1200, FAX: 219-356-2830; Empl.: 275; *Sls. Mgr.:* Frank Pyle, Jr.; *Dist. Mgr.:* Mark Pyle

PYLE-NATIONAL DIVISION, BRIntec Corp., 1334 N. Kostner Ave., Chicago, IL 60651, Tel: 312-342-6300, TELEX: 25251, TWX: 910-221-0335; FSC No.: 49367; Empl.: 650; *Sls. Mgr.:* Mike Carroccia; *Dist. Mgr.:* Mike Curroccia

PYLON CO., See Augat/Pylon Corp., Inc.

PYLON ELEX DEVELOPMENT CO. LTD., 2300 Victoria, Lachine, PQ, Canada H8S 1Z3, Tel: 514-637-1186, TELEX: 05-821680, FAX: 514-636-1970; Empl.: 50; *Sls. Mgr.:* Sydney Harland

PYROCOM CO., 924 N. 143rd St., Seattle, WA 98133, Tel: 206-365-3535; *Sls. Mgr.:* Bill Kurtz

PYROFERRIC INTERNATIONAL, INC., 200 Madison St., Toledo, IL 62468, Tel: 217-849-3300, TWX: 910-663-0616; Empl.: 50; *Sls. Mgr.:* S. John Horner

Local Sales Offices & Reps

AZ	Phoenix, Charles T. Fink & Assocs., Ltd.	602-992-9884
CA	Alhambra, Deniston/JDA, Inc.	818-289-2844
CA	Santa Clara, C. B. King Assocs.	408-988-7551
OH	Shaker Hgts., Don Gype Co.	216-283-5380

PYROFILM RESISTOR CO., See KDI Electronics

PYROHM, INC., 24268 Indoplex Circle, Farmington Hills, MI 48018, Tel: 313-478-5060; *Sls. Mgr.:* Charles R. Berry

QPL MAGNETICS, INC., P.O.BOX C, Lake Grove, NY 11755, Tel: 516-589-3331; *Sls. Mgr.:* Joseph Surrusco

QSI CORPORATION, 1740 North Research Park Way, Logan, UT 84321, Tel: 801-753-3657, TELEX: 887430; Empl.: 10; *Sls. Mgr.:* Dennis R. Durfee

Q-TECH CORP., 10150 W. Jefferson Blvd, Culver City, CA 90232-3510, Tel: 213-836-7900, TELEX: 69-6140; FSC No.: 51774; Empl.: 125; *Sls. Mgr.:* Sandra Rappaport **A•1450-1452**

Local Sales Offices & Reps

CA	Cupertino, F & F Assoc.	408-446-2349
CA	Northridge, Tauber-Dreyer	818-993-0048
CO	Parker, Howard Assoc.	303-841-5755
IL	Northbrook, Allied Comp. Reps., Inc.	312-498-6658
IN	Fort Wayne, TX Sales Indiana	219-489-4447
MA	Malden, J-K Assocs.	617-321-2922
MO	St. Louis, Abrams & Assoc.	314-569-0447
NJ	Glen Gardner, F & M Tech. Sls.	201-832-7216
NJ	Paramus, Eltech Sls.	201-967-1309
TX	Austin, Texoma Technical Sales, Inc.	512-459-0802
TX	Houston, Texoma Technical Sales, Inc.	713-462-1432
Can	Ont./Don Mills, C.R. Snelgrove Co.	416-447-8531

Qualidyne

FAX: 619-429-1011

QUALIDYNE SYSTEMS, Unitech Ltd., 3055 Del Sol Blvd., San Diego, CA 92154, Tel: 619-575-4000, 800-445-0425, TELEX: 7090290; Empl.: 300; *Sls. Mgr.:* James J. Louden **D•1939-1947**

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns.	205-881-5031
AZ	Phoenix, Thor Engrg.	602-438-8494
CA	Laguna Hills, Electroventure	714-581-9244
CA	San Diego, Qualidyne	619-575-4400
CA	Santa Clara, Gagner-Toomey Assocs.	408-244-2200
CO	Westminster, Gemini	303-428-5600
CT	Tariffville, O.E.M. Mktg. & Sls.	203-241-1612
FL	Boca Raton, Beacon Elctrns.	305-997-5740
GA	Atlanta, Beacon Elctrns.	404-256-9640
ID	Boise, N. R. Schultz Co.	208-377-8687
IL	Northbrook, Howard Benjamin & Assocs.	312-272-9200
KS	Lenexa, Midtec	913-541-0505
MA	Franklin, OEM Mktg. & Sls.	617-528-4983
MN	Burnsville, Electrome	612-894-8200
MO	St. Louis, Midtec	314-275-8666
NH	Salem, O.E.M. Mktg. & Sls.	603-893-0009
NJ	Madison, Livera-Polk	201-377-3220
NY	Glen Head, Livera-Polk	516-759-9300
NY	Rochester, Elcom Sls., Inc.	716-385-1400
NY	Syracuse, Elcom Sls., Inc.	315-685-8245
NC	Raleigh, Beacon Elctrns.	919-787-0330
OH	Brunswick, Power Mktg.	216-225-9618
OR	Beaverton, N. R. Schultz Co.	503-643-1645
PA	Chestnut Hill, Deltatronics, Inc.	215-248-0294
TX	Richardson, Jim D. Gray & Assocs., Inc.	214-699-9976
UT	Murray, Butterworth	801-268-2244
VA	Alexandria, Tech Reps	703-370-2600
WA	Bellevue, N. R. Schultz Co.	206-454-1585

QUALITEC TECHNOLOGIES, INC., 2251 E. Euclid Ave., Palo Alto, CA 94303-1706, Tel: 408-984-1763; Empl.: 30; *Sls. Mgr.:* Kevin Daniels

QUALITY POWER SYSTEMS, INC., 2400 S. Texas Ave., Pearland, TX 77581, Tel: 713-997-1700, 800-992-1701, FAX: 713-997-1907; Empl.: 20; *Sls. Mgr.:* Alan Oliver; *Dist. Mgr.:* Alan Oliver

QUALITY THERMISTOR, 2147 Centurion Pl., Boise, ID 83709, Tel: 208-377-3373, FAX: 208-376-4754; FSC No.: 56866; Empl.: 30; *Sls. Mgr.:* John Mahoney **B•1863-1865**

QUALTEK ELECTRONICS CORP., 7158 Industrial Pk. Blvd., Mentor, OH 44060, Tel: 216-951-3300, TELEX: 985319, FAX: 216-951-7252; Empl.: 75; *Dist. Mgr.:* James Bof

QUAM-NICHOLS CO., 234 E. Marquette Rd., Chicago, IL 60637, Tel: 312-488-5800, FAX: 312-488-6944; Empl.: 200; *Sls. Mgr.:* William G. Little; *Dist. Mgr.:* Greg Johns **D•1046-1047**

QUAN-TECH, Stansbury Industries Inc., P.O. Box 28, Rte. 206, Flanders, NJ 07836, Tel: 201-927-1766, TWX: 710-987-7500; FSC No.: 63921; *Sls. Mgr.:* Helen A. Kronen

QUANTRONIX, 49 Wireless Blvd., P.O. Box 9014, Smithtown, NY 11788, Tel: 516-273-6900, TELEX: 685-2167, FAX: 516-273-6958; Empl.: 175; *Sls. Mgr.:* R. J. Bruno; *Dist. Mgr.:* R. J. Bruno

QUANTUM DATA™

FAX: 312-888-2802

QUANTUM DATA, INC., 2111 Big Timber Road, Elgin, IL 60123, Tel: 312-888-0450, TELEX: 206725; Empl.: 30 **D•1315**

QUANTUM ELECTRONICS, INC., R.D. 4, Box 6AAA, Lewistown, PA 17044, Tel: 717-242-1132, TELEX: 842540; Empl.: 70; *Sls. Mgr.:* Kit C. Kennedy

QUARTZITE PROCESSING, INC., 6 Holyoke St., Malden, MA 02148, Tel: 617-322-3611, FAX: 617-322-9623; Empl.: 11; *Sls. Mgr.:* P. S. Yanofsky

QUA TECH, INC., 478 East Exchange St., Akron, OH 44304, Tel: 216-434-3154, ESYLNK: 5101012726, FAX: 216-434-1409; *Sls. Mgr.:* Brian Bell; *Dist. Mgr.:* Michael Armstrong

Q.V.S., INC., 20 North 15th St., East Orange, NJ 07017, Tel: 201-673-3996; FSC No.: 89820; Empl.: 45

QWINT DATA, INC., 3455 Commercial Ave., Northbrook, IL 60062, Tel: 312-564-0910, TELEX: 27-0498, FAX: 312-564-4714; Empl.: 105; *Sls. Mgr.:* K. S. Berland

RACAL-DANA INSTRS. INC., 4 Goodyear St., Irvine, CA 92718, Tel: 714-859-8999; FSC No.: 21793; Empl.: 230

RACAL-MILGO, 1601 N. Harrison Parkway, Sunrise, FL 33323-2899, Tel: 305-475-1601, 800-327-4440, TWX: 510-955-4145; Empl.: 3,000; *Sls. Mgr.:* H. Cheli

RACET COMPUTES, LTD., 3150 E. Birch St., Brea, CA 92621, Tel: 714-579-1725, TELEX: 701160, TWX: RACET UD; Empl.: 18; *Sls. Mgr.:* Timothy Mahoney

RADIAL CONTROLS, 2555 E. 55th Place, Indianapolis, IN 46220, Tel: 317-255-2796; Empl.: 25; *Sls. Mgr.:* R. L. Newsom

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FAX: 317-762-6814

RADIO MATERIALS CORP., P. O. Box 339, Attica, IN 47918, Tel: 317-762-2491, 1-800-356-9956; Empl.: 140; *Sls. Mgr.:* James Vogt; *Dist. Mgr.:* James Vogt **A•1168-1170**

Local Sales Offices & Reps

AL	Huntsville, Elctrn. Mktg. Assocs., Inc.	205-536-3044
AZ	Mesa, Elec-Com-Assocs., Inc.	602-844-0566
CA	Buena Pk., Eclipse Sls. Co.	714-522-6310
CT	Stamford, Carlisle Tech. Sls.	203-322-0240
FL	Deerfield Bch., Delmac Sls., Inc.	305-427-7788
GA	Atlanta, Elctrn. Mktg. Assocs., Inc.	404-448-1215
IL	Elk Grove VL, Tristar Grp., Inc.	312-593-0200
IN	Indianapolis, Elctrn. Reps., Inc.	317-894-1414
IA	Davenport, Rush & West Assocs., Inc.	319-388-9494
KS	Olathe, Rush & West Assocs., Inc.	913-764-2700
MA	Waltham, Carlisle Tech. Sls., Inc.	617-890-8800
MO	St. Louis, Rush & West Assocs., Inc.	314-394-7271
NY	Franklin Sq., Cooper-Simon & Co., Inc.	516-489-0404
NY	Rochester, Foster & Wager, Inc.	716-385-7744
NC	Raleigh, Elctrn. Mktg. Assocs., Inc.	919-847-8800
OH	Beechwood, Elctrn. Salesmasters, Inc.	216-831-9555
OR	Tigard, Comps. West, Inc.	503-684-1671
PA	Erie, Frandot Co., Inc.	814-455-9751
SC	Greenville, Elctrn. Mktg. Assocs., Inc.	803-233-4637
TX	Dallas, Dunbar Assocs., Inc.	214-239-7151
WI	Brookfield, Tristar Grp., Inc.	414-782-2670

RADIOMETRICS, INC., 12021 South Memorial Pkwy., Huntsville, AL 35803, Tel: 205-881-1272; FSC No.: 62951; *Sls. Mgr.:* W. Shelton Ray

RADIO RESEARCH INSTRUMENT CO., INC., 584 North Main Street, Waterbury, CT 06704-3506, Tel: 203-753-5840, TELEX: 962444 RADAR DURY, FAX: 203-754-2567; FSC No.: 57174; *Sls. Mgr.:* E. B. Doyle

RADIO SWITCH CORP., 64 S. Main St., P.O. Box A, Marlboro, NJ 07746, Tel: 201-462-6100; FSC No.: 74217; Empl.: 40; *Sls. Mgr.:* J. L. Bernard

RAF ELECTRONIC HARDWARE, 95 Silvermine Rd., Seymour, CT 06483, Tel: 203-888-2133, TWX: 710-472-6216; FSC No.: 55566; Empl.: 120; *Sls. Mgr.:* William R. Bailey, Jr.; *Dist. Mgr.:* Dave Granger/John Capece

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RAG ELECTRONICS, INC., 21418 Parthenia St., Canoga Park, CA 91304, Tel: 818-998-6500, 800-732-3457 616, 622, 628, 629, 630, 687, 700, 702, 724, 728, 753, 762, 763, 788, 801, 822

RAGEN CORP., Systems Div., 9 Porete Ave., N. Arlington, NJ 07032, Tel: 201-997-1000, TWX: 710-995-4752; Empl.: 400; *Sls. Mgr.:* Robert Hurley

RAGEN DATA SYSTEMS, INC., 3 Oval Dr., Central Islip, NY 11722, Tel: 516-234-3800, TELEX: 685-2305, TWX: 510-227-4901; FSC No.: 13068; Empl.: 150; *Sls. Mgr.:* Kevin Douglas

RALTRON ELECTRONICS, 2315 N.W. 107th Ave., Miami, FL 33172, Tel: 305-593-6033, TELEX: 441588, FAX: 305-594-3973; Empl.: 10; *Sls. Mgr.:* Alexander Wolloch; *Dist. Mgr.:* Ramon Quinones **A•1453, 2009**

Local Sales Offices & Reps

AL	Huntsville, J.R. Assocs.	205-850-2130
CA	Los Angeles, Cummings & Assocs.	818-340-6035
CA	San Diego, Scott Gould Co.	619-755-0824
CA	Santa Clara, Cummings & Assoc. N.	408-247-8656
CO	Denver, Summitwest Mktg.	303-460-9600
CT	Guilford, Data Mark	203-453-0575
FL	Boca Raton, Sales Specialists	305-391-3718
GA	Atlanta, J.R. Assocs.	404-922-1231
IL	Chicago, Gaertner & Assocs.	312-593-2332
IN	Ft. Wayne, MS Sls.	219-436-3023
MA	Boston, KSA of New England	617-443-5881
MI	Detroit, Elcon Michigan Sls.	313-855-3240
MN	Minneapolis, Hanna-Lind	612-925-5700
NC	Winston Salem, J.R. Assocs.	919-919-9574
OK	Tulsa, Advanced Tech. Sls.	918-664-0482
OR	Portland, Quest Mktg.	503-641-7377
PA	Horsham, Nexus Technlg. Sls.	215-675-9600
TN	Chattanooga, J.R. Assocs.	615-892-7630
TX	Austin, Advanced Tech. Sls.	512-331-9979
TX	Dallas, Advanced Tech. Sls.	214-340-1300
UT	Salt Lake City, Component Well	801-263-8131
VA	Richmond, Glasscock Assocs.	804-740-0063
WA	Seattle, Quest Mktg.	206-747-9424

Local Distributors

CA	Canoga Pk., C & A Corp.	818-340-6035
CA	Hayward, KEA Elctrns.	415-887-2900
CO	Denver, Indl. Elctrns.	303-694-9444
CT	E. Haven, J. V. Elctrn.	203-469-2321
CT	Stratford, Utronics	203-378-4201
FL	Ft. Lauderdale, N.R.C.	305-949-2400
IL	Northbrook, Classic Comps.	312-272-9650
IA	Cedar Rapids, Bergquist Co.	319-366-8733
MD	Gaithersburg, Axis Elctrns.	301-840-9640
MA	Burlington, TLC Components	617-273-0140

MA Needham, Cronin Elctrns. 617-449-5000
MN Minneapolis, Bergquist Co. 612-835-2322
NY Hauppauge, Circuit Sls. 516-348-7670
NY Plainview, A.C.I. Elctrns. 516-293-6630
NY Ronkonkoma, Baldwin Comps. 800-645-5608
PA Exton, V.S.H. Corp. 215-363-2250
WI Mequon, Taylor Elec. 414-241-4321

RAM CHEMICALS, DIV. WHITTAKER CORP., 210 E. Alondra Blvd., Gardena, CA 90248, Tel: 213-321-0710; Empl.: 65; *Sls. Mgr.:* G. M. Steinman

RAMCOM SYSTEMS, 3007 Washington Blvd., Ste. 205, Marina Del Rey, CA 90292, Tel: 213-827-4432; *Sls. Mgr.:* Ralph Tisdale

RAMKO RESCH., INC., 11355A Folsom Blvd., Rancho Cordova, CA 95670, Tel: 800-821-2545, TELEX: 176493; *Sls. Mgr.:* Jim Lucy; *Dist. Mgr.:* Jim Lucy

RAM TECHNOLOGIES, Div. of WISCO Intl., 690 W. 28th St., Hialeah, FL 33010, Tel: 305-888-1676/1677/1682, TWX: 510-100-7723

RANK BRIMAR INC., 227 Technology Circle, Scotts Valley, CA 95066, Tel: 408-438-6440, TELEX: 172855; FSC No.: 60750; *Sls. Mgr.:* David Hurst

RANSCO INDUSTRIES, INC., Sub. Despatch Ind., Inc., 1400 E. Statham Pkwy., Oxnard, CA 93033, Tel: 805-487-7777, TELEX: 6-59235; Empl.: 200; *Sls. Mgr.:* P. Coffey

Local Sales Offices & Reps
IL Wheeling, Ransco Inds. 312-459-7400
MA Medway, Ransco Inds. 617-533-4915
TX Plano, Ransco Inds. 214-881-9093

RANTEC, Emerson Electric, 9401 Oso Ave., Chatsworth, CA 91311, Tel: 818-885-8223, TWX: 910-493-1247, FAX: 818-993-7780; Empl.: 2000; *Sls. Mgr.:* Fred R. Silver

RAPID POWER TECHNOLOGIES, Graysbridge Rd., P.O.BOX 291, Brookfield, CT 06804, Tel: 203-775-0411, 800-332-1111, TELEX: 643:012, FAX: 203-775-0666; *Sls. Mgr.:* Mario Napolitano

RAPIDSUN, See Motion Control Grp., American Precision Inds.

RAPID SYSTEMS INC., 433 N. 34th St., Seattle, WA 98103, Tel: 206-547-8311, TELEX: 265017 UR; FSC No.: 91-1197314; Empl.: 30; *Sls. Mgr.:* Bo Ray

RASTER GRAPHICS, INC., P. O. Box 5157, Bend, OR 97701, Tel: 503-388-2584

RATELCO, Power Systems Div., 1260 Mercer, Dept. EEM, Seattle, WA 98109-5589, Tel: 206-624-7770, TELEX: 888729, FAX: 206-382-5447; FSC No.: 14259; Empl.: 160; *Sls. Mgr.:* D. Terpstra

RATH MICROTECH CORP., Rath Affiliated Cos., 2505 Foster Ave., Janesville, WI 53545, Tel: 608-754-2222, 800-356-9464, TELEX: 26-5409; *Sls. Mgr.:* Jim Coenen

RAULAND-ZENITH ELECTRONICS CORP., 2407 W. North Ave., Melrose Pk., IL 60160, Tel: 312-450-8992, TELEX: 72-1488, FAX: 312-450-8985; Empl.: 2300

RAYCHEM CORP., Elctrns. Grp., 300 Constitution Dr., Menlo Park, CA 94025, Tel: 415-361-3860, TELEX: 34-8316, TWX: 910-373-1728; *Sls. Mgr.:* Robert Simpson; *Dist. Mgr.:* Joseph Rodgers ..... **B•1349**

RAYMOND ENGRG. INC., Raycorder Prods. Div., 217 Smith St., Middletown, CT 06457, Tel: 203-632-1000, TWX: 710-428-7944; FSC No.: 92059; Empl.: 550; *Sls. Mgr.:* Bruce Greenfield

RAYOVAC

FAX: 608-275-4577

RAYOVAC CORPORATION, 601 Rayovac Drive, Madison, WI 53711-0960, Tel: 608-275-4692, TELEX: 190428; FSC No.: 6135; Empl.: 2000; *Sls. Mgr.:* Jeff Heberlein ..... **D•1482**

Local Sales Offices & Reps
AL Birmingham, Adams & Assocs., Inc. ... 205-788-0305
AZ Phoenix, Howe & Howe Sls. 602-264-7971
CA Santa Clara, Nova-Tronix, Inc. 408-727-9530
CA Westminster, West Elctrn. Sls. Co. 714-898-0120
CO Englewood, William J. Purdy Co. 303-790-2211
CT Brookfield, M & M Assocs. 203-775-6888
FL Port Orange, Adams & Assocs., Inc. ... 904-760-1395
GA Marietta, Adams & Assocs., Inc. 404-973-0853
IL Park Ridge, G MCL Cole Co. 312-692-6040
IN Indianapolis, Elctrn. Sls. & Engrg. 317-849-4260
IA Cedar Rapids, R. W. Kunz & Assocs. .. 319-396-5386
KS Prairie Vl, R. W. Kunz & Assocs. 913-648-3535
LA New Orleans, The Hancoci Grp. 504-568-0580
MA Framingham, Stone Comp. Sls. 617-875-3266
MI Southfield, Colliton & Finan 313-352-4623
MN Eden Prairie, PWC Inc. 612-934-1409
MO St. Louis, R. W. Kunz & Assocs. 314-966-4977
NJ Berkeley Hgts., Cambridge Allen & Assocs. 201-464-0203
NY Skaneateles, Empire Tech. Assocs., Inc. 315-685-5703
NC Raleigh, Adams & Assocs., Inc. 919-872-0410
OH Westlake, Baehr Greenleaf 216-892-1770
OR Beaverton, Pacific Mktg. Specialists, Inc. 503-641-9373
PA Birchrunville, Jadelectronic Assocs., Inc. 215-296-3800
TX Dallas, TESCO 214-553-1200
WA Redmond, Pacific Mktg. Specialists, Inc. 206-882-3144

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AK Anchorage, Frigid North 907-561-4633
AZ Scottsdale, Cypress Elctrns. 602-949-0802
CA Buena Pk., Cypress Elctrns. 213-635-8888
CA Palo Alto, Power Source 415-856-0700
CA San Diego, Cypress Elctrns. 619-535-0018
CA Santa Clara, Cypress Elctrns. 408-980-2500
CO Wheat Ridge, Cypress Elctrns. 303-431-7191
FL Ft. Lauderdale, Selex/Southeastern ... 305-563-4131
IL Chicago, Neward Elctrns. 312-784-5100
IL Elk Grove Vl., GBL/Goold 312-593-3220
KS Wichita, RSC Elctrns. 316-267-5213
MD Gaithersburg, Axis Elctrns. 800-368-2815
MA Hingham, Saeger 617-749-6700
MO Kansas City, Elctrn. Supp. 816-931-0250
NE Lincoln, Scotts Elctrns. 402-466-8221
NH Nashua, Brevan Elctrns. 603-889-7230
NJ W. Berlin, GCI Corp. 800-524-1463
NY E. Farmingdale, Battery Expeditors 516-752-0011
NY Rochester, Masline Elctrns. 716-546-5373
OH Columbus, Promark 614-876-8885
OR Beaverton, Micro-Power 503-626-7086
UT Salt Lake City, Kimball Elctrns. 801-328-2075
VA Virginia Bch., Norfolk Wire & Elctrns. .. 804-499-1100
WA Seattle, Radar Elec. 206-282-2511
WI Milwaukee, Marsh Elctrns. 414-475-6000

RAY PROOF, Shielding Systems Corp., 50 Keeler Ave., P.O. Box 5060, Norwalk, CT 06856-5060, Tel: 800-243-5704, TELEX: 96-5812; *Sls. Mgr.:* James A. Graham, VP Bus. Dev.

RAYTEK, INC., 1201 Shaffer Rd., Santa Cruz, CA 95060, Tel: 408-458-1110, TELEX: 171890; *Sls. Mgr.:* S. Brager; *Dist. Mgr.:* Stuart Brager

RAYTHEON CO., 465 Centre St., Quincy, MA 02169, Tel: 617-479-5300, TWX: 710-337-1020; *Sls. Mgr.:* R. Whitt

RAYTHEON CO., Laser Products, 465 Centre St., Quincy, MA 02169, Tel: 617-479-5300, TELEX: 92-3455, TWX: 710-324-6568, FAX: 617-479-5300 (ext. 2359); Empl.: 75; *Sls. Mgr.:* B. Werschler

RAYTHEON CO., Microwave & Power Tube Div., 190 Willow St., Waltham, MA 02154, Tel: 617-899-8400, TWX: 710-324-6568; *Sls. Mgr.:* J. Hieber

RAYTHEON SEMICONDUCTOR, 350 Ellis St., Mountain View, CA 94043, Tel: 415-968-9211, TWX: 910-379-6481; FSC No.: 07933; Empl.: 1200; *Sls. Mgr.:* Al Enamait, Dir. Worldwide Sls.; *Dist. Mgr.:* R. Johnson

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RCA SOLID STATE DIV., See GE/RCA Solid State Div.

RCA SOLID STATE DIV., CMOS IC Mktg., Rte. 202, Somerville, NJ 08876, Tel: 201-685-6000, TWX: 710-480-9333

See RCA Solid State Div. for Sls. Reps.

RCA SOLID STATE DIV., Linear Integrated Circuits, Rte. 202, Somerville, NJ 08876, Tel: 201-685-6000, TWX: 710-480-9333

See RCA Solid State Div. for Sls. Reps.

RCA SOLID STATE DIV., Micro Processors/Memories/Peripherals, Route 202, Somerville, NJ 08876, Tel: 201-685-6000, TWX: 710-480-9333

See RCA Solid State Div. for Sls. Reps.

RCA SOLID STATE DIV., Thyristors & Rectifiers, Rte. 202, Somerville, NJ 08876, Tel: 201-685-6000, TWX: 710-480-9333

See RCA Solid State Div. for Sls. Reps.

RCA SOLID STATE DIV., Transistors, Rte. 202, Somerville, NJ 08876, Tel: 201-685-6000, TWX: 710-480-9333

See RCA Solid State Div. for Sls. Reps.

RCD COMPONENTS, INC., 520 E. Industrial Pk. Dr., Manchester, NH 03103, Tel: 603-669-0054, TELEX: 943-512 RCD COMP MAN, FAX: 603-669-5455; Empl.: 450 ..... **A•2010-2011**

Local Distributors
CA Anaheim, A to Z Inds. 714-634-3620
CA City of Industry, Ital Elctrns. 213-968-8515
CA San Diego, Neumann Elctrns. 619-695-3005
CA San Jose, Capacitors Unlimited 408-946-7676
CA San Jose, Passive Technlg. Sls. 408-435-5566
CO Englewood, Indl. Elctrns. 303-694-9444
FL Orlando, Stetco 305-298-0321
IL Lisle, Components, Inc. 312-852-7707
IN Wakavusa, Earlynn 219-862-2425
IA Cedar Rapids, Dee Elctrns. 319-365-7551
MA Newton, Greeneshaw 617-969-8900
MA Springfield, C & D Elctrns. 413-781-1776
MA Worchester, Coghlin 800-922-8565
MI Livonia, Reptron 313-525-2700
MN New Brighton, Parts One 612-633-8079
NJ E. Brunswick, Brothers 201-238-2200
NY Hauppauge, Broadline 800-645-5444
OH Warren, REM Elctrn. Supp. 216-373-1300
PA McKean, Advacom 814-476-7774
PA York, Elctrn. Comps. Ind. 717-846-5334
TN Memphis, Bluff City Elctrns. 901-345-9500
TX Ft. Worth, Allied Elctrns. 817-336-5401
TX Richardson, Kent Elctrns. 214-669-2600
WI Oshkosh, Elctrn. Inds. 414-235-8930

R. C. ELECTRONICS INC., 5386 Hollister Ave., Ste. D, Santa Barbara, CA 93111, Tel: 805-964-6708, TELEX: 295281; Empl.: 15; *Sls. Mgr.:* Chao-Sun Pang; *Dist. Mgr.:* Chao-Sun Pang

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..... **A•2012-2017**

Local Sales Offices & Reps

AL	Huntsville, CSR Elctrns	205-533-2444
AZ	Phoenix, ISDS Elctrns	602-971-6250
CA	Anaheim, Westrep, Inc	714-527-2822
CA	Palo Alto, Mollard Mktg	415-961-0456
CA	San Diego, Westrep, Inc	619-566-6580
CT	North Haven, Kitchen & Kutchen	203-239-0212
FL	Alamonte Sprs., APM Assocs	305-869-6831
FL	Ft. Lauderdale, APM Assocs	305-565-0056
FL	Tampa, APM Assocs	813-886-2457
GA	Atlanta, CSR Elctrns	404-396-3720
IL	Elgin, Gassner & Clark	312-695-9540
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NY	Manlius, Quality Comps	315-682-8885
NY	Melville, Comtronic Assoc.	516-249-0505
NC	Matthews, CSR Elctrns.	704-847-5806
NC	Raleigh, CSR Elctrns.	919-878-9200
OH	Cincinnati, Luebbe Sls. Co.	513-891-5770
OH	Cleveland, Luebbe Sls. Co.	216-333-0425
OH	Columbus, Luebbe Sls. Co.	614-431-0474
OH	Dayton, Luebbe Sls. Co.	513-294-0426
OR	Portland, James J. Backer Co.	503-297-8744
PA	Huntingdon Valley, Inacker Sls., Inc.	215-947-5660
PA	Pittsburgh, Luebbe Sls. Co.	412-364-0490
TN	Knoxville, CSR Elctrns.	615-673-0222
TX	Austin, Allied Comps.	512-331-4494
TX	Dallas, Allied Comps.	214-238-0408
TX	Hurst, Allied Comps.	817-589-0456
WA	Seattle, James J. Backer Co.	206-285-1300
Can	Mississauga, Ont., Gidden-Morton Assocs.	416-671-8111
Can	Nepean, Ont., Gidden-Morton Assocs.	613-726-0844
Can	St. Laurent, Que., Gidden-Morton Assocs.	514-335-9572

Local Distributors

AZ	Tempe, Harper/SID	602-967-1464
AZ	Tempe, Shelley-Ragon	602-894-2058
CA	Chatsworth, Shelley-Ragon	818-998-3333
CA	Chatsworth, TTI	818-709-1010
CA	Compton, Harper/SID	213-979-5090
CA	Milipitas, TTI	408-943-9155
CA	San Diego, Harper/SID	619-560-8545
CA	San Diego, Shelley-Ragon	619-453-7133
CA	San Diego, TTI	619-587-4888
CA	San Jose, Shelley-Ragon	408-942-9111
CA	Sunnyvale, Harper/SID	408-747-0333
CO	Englewood, Shelley-Ragon	303-762-0670
CO	Westminster, TTI	303-429-6806
CT	East Haven, J. V. Elctrns.	203-469-2321
FL	Orlando, TTI	305-859-1000
FL	Tampa, Impala Elctrns.	813-885-4747
FL	Tampa, Shelley-Ragon	813-884-0946
IL	Addison, Belford Elctrns.	312-865-2400
IL	Elk Grove Village, Shelley-Ragon	212-595-6633
IL	Northbrook, Classic Comps	312-272-9650
IA	Cedar Rapids, Shelley-Ragon	319-373-0525
MD	Columbia, Aztech Elctrns.	301-995-1760
MD	Columbia, TTI	301-995-1331
MA	Woburn, TTI	617-938-8800
MI	Grand Rapids, S-F Elctrns. Supp.	616-459-0216
MN	El Prairie, TTI	612-944-5080
MN	Minneapolis, Aerospace Comptr. Supp.	612-884-4725
MN	St. Paul, Shelley-Ragon	612-642-2828
MO	Independence, Shelley-Ragon	816-254-3410
MO	St. Louis, Shelley-Ragon	314-454-0480
NH	Hudson, TNT Elctrns.	603-880-8300
NY	Bohemia, Shelley-Ragon	516-567-7751
NY	Buffalo, Summit Elctrns.	716-887-2862
NY	Farmingdale, Command Elctrns.	516-293-1212
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Rochester, Simmcona Elctrns.	716-328-3230
NY	Rome, Rome Elctrns.	315-337-4500
NY	Ronkonkoma, TTI	516-737-2000
NC	Raleigh, Resco-Raleigh	919-781-5700
OH	Dayton, Stotts, Friedman	513-298-5555
OH	Englewood, Argent Electra	513-836-8633
OK	Tulsa, Altair	918-252-5781
OR	Beaverton, Shelley-Ragon	503-682-2929
PA	McKean, Advacom	814-476-7774
PA	Norristown, Century Elctrn. Comps.	215-631-5400
PA	Zelienople, Argent Electra	412-776-4330
TX	Austin, Altair	512-837-4970
TX	Fort Worth, TTI	817-429-0441
TX	Houston, Altair	713-462-3029
TX	Richardson, Altair	214-231-5166
WA	Seattle, Shelley-Ragon	206-241-1980
WI	New Berlin, Classic Comps.	414-786-5300
Can	Scarborough, Ont., Carsten Elctrns.	416-495-9999

RCL-SHALLCROSS, INC., U.S. Hwy. 70 East, Smithfield, NC 27577, Tel: 919-934-5181, TWX: 510-939-1463, FAX: 919-934-5186; FSC No.: 54294; Empl.: 150
..... **A•2012-2017**

See RCL-Shallcross for Local Sales Reps. and Distributors

R-COLUMBIA PRODS. CO., INC., 2008 St. Johns Ave., Highland Park, IL 60035, Tel: 312-432-7915, TWX: 910-692-2160; Empl.: 20

RDF CORPORATION, 23 Elm Ave., Hudson, NH 03051, Tel: 603-882-5195, TWX: 710-228-1882; Empl.: 120; *Sls. Mgr.:* Arthur Di Venuti

REACTEL, INC., 687-D Lofstrand La., Rockville, MD 20850, Tel: 301-279-5535, ESYLNK: 990876, FAX: 301-340-7304; FSC No.: 60458; Empl.: 30; *Sls. Mgr.:* D. E. Claycomb

Local Sales Offices & Reps

CA	Sunnyvale, ESCO Assocs.	408-745-1410
FL	Clearwater, Brennan Assocs.	813-446-5006
NJ	Keansburg, Reps Five	201-495-2315
VA	Fairfax, Beacon North	703-591-1300

REAL TIME DEVICES, INC., Mattemville Ctr., US 322, Port Matilda, PA 16870, Tel: 814-234-8087, TELEX: 4948141 SEDACOG; Empl.: 15

REAL TIME SYSTEMS, 152 S. MacQuesten Pkwy., Mt. Vernon, NY 10550, Tel: 914-667-0425; *Sls. Mgr.:* A. Citrin

RECOGNITION TECHNOLOGY, INC., 160 E. Main St., Westborough, MA 01581, Tel: 617-366-4800; Empl.: 12; *Sls. Mgr.:* Avi Zimmerman

RECORDER SYS. DIV., See Gulton Instruments Div.

RECORTEC, INC., 275 Santa Ana Ct., Sunnyvale, CA 94086, Tel: 408-737-8441, TWX: 910-379-5022, FAX: 408-737-8448; *Sls. Mgr.:* R. R. Troxell

RECOTON CORP., 46-23 Crane St., Long Island City, NY 11101, Tel: 718-392-6442, TELEX: 236047 RCTN; Empl.: 150; *Sls. Mgr.:* Peter Dayton

REDINGTON COUNTERS, 130 Addison Rd., Windsor, CT 06095, Tel: 203-688-6205, FAX: 203-688-1591; *Sls. Mgr.:* Dennis O'Shea; *Dist. Mgr.:* Dennis O'Shea

REEVE ELECTRONICS, Mellish E. Murray, 1715 W. Carroll Ave., Chicago, IL 60612, Tel: 312-670-0150; Empl.: 25; *Sls. Mgr.:* Ed Martinez

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FAX: 717-243-0079

REEVES-HOFFMAN DIV., Dynamics Corporation of America, 400 W. North St., Carlisle, PA 17013, Tel: 717-243-5929; Empl.: 310; *Sls. Mgr.:* Larry Barbary
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Local Sales Offices & Reps

AZ	Phoenix, Chaparral Elctrns.	602-252-0897
CA	Culver City, Westaironics	213-641-4123
CA	Mountain View, Peninsula Tech. Sls.	415-965-3636
CO	Boulder, R.G. Entprs.	303-447-9211
FL	Tampa, APM Assocs.	813-886-2457
GA	Duluth, DTM, Inc.	404-381-5592
ID	Boise, N. R. Schultz	208-377-8686
IL	Des Plaines, ESCO Assocs.	312-298-5310
MD	Ellicott City, Nelson Elctrns.	301-747-7887
MA	Wakefield, H. Jappe Co.	617-245-9359
MN	Minneapolis, Intl. Elctrns.	612-571-0000
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OH	Cincinnati, Tri-State Mktg.	513-761-7993
OR	Beaverton, N. R. Schultz	503-643-1644
PA	Hatboro, Electro Rep Engrg.	215-674-4421
TX	Irving, Kite Elctrns. Sls.	214-438-9336
WA	Bellevue, N. R. Schultz	206-454-0300
Can	Rexdale, Ont., Myelco, Inc.	416-674-1636

REGDON SOLENOID, INC., 3713 Grand Blvd., Brookfield, IL 60513, Tel: 312-485-5152, FAX: 312-485-0083; FSC No.: 27190; Empl.: 65 ..... **B•1634-1635**

Local Sales Offices & Reps

AL	Decatur, Tenn Tech	205-350-0630
CA	Los Altos, J. W. Wilhoit	415-961-3660
CA	Valencia, DJM Elctrns.	818-362-4309
CT	Woodbury, Mark-Rep Assocs.	203-263-3047
FL	Maitland, EIR, Inc.	305-660-9600
GA	Atlanta, Tenn Tech	404-622-5784
IL	Downers Grove, Richmar Elect. Corp.	312-968-0118
IN	Indianapolis, Richmar Elctrns.	317-846-6383
MN	Hopkins, S. J. Collins & Assocs.	612-933-7661
NH	Plaistow, Mark-Rep Assocs.	603-382-9563
NJ	Florham Park, Varrelman-Gorman Co.	201-992-2505
NY	Binghamton, NHA	607-754-3214
NY	Pittsford, NHA	716-586-9002
NC	Raleigh, Tenn Tech	919-266-3610
OH	Cleveland, J. N. Bailey	216-892-1510
OH	New Lebanon, J. N. Bailey	513-687-1325
PA	Huntingdon Valley, Edwin Leiby & Assocs.	215-659-8938
TN	Chattanooga, Tenn Tech.	615-894-3012
TX	Austin, K & H Sales	512-258-8841
TX	Plano, K & H Sales	214-423-6520
WI	Butler, Richmar Elctrns.	414-781-1730

Local Distributors

CA	San Carlos, Logan Elctrn. Supp.	415-594-0700
MA	Lynn, Land Elctrns.	617-592-2220
NJ	Fairlawn, Relay Specialties	201-797-3313

REGENCY LAND MOBILE, INC., 7707 Records St, Indianapolis, IN 46226, Tel: 317-545-4281, FAX: 317-545-2170; Empl.: 500

REGENT CONTROLS, INC., 39 Fanny St, P.O. Box 767, Shelton, CT 06484-0767, Tel: 203-736-2924, FAX: 203-736-2928; Empl.: 35; *Sls. Mgr.:* Lora C. Minor

REHLANDER ASSOCS., 118A Bridge St, Beverly, MA 01915, Tel: 617-922-5961; *Sls. Mgr.:* Michael Rehlander ..... **B•1274**

REICH ASSOCIATES, Rt. 4, Box 4620, Lakehills, TX 78063, Tel: 512-751-3220, TELEX: 358048, ESYLNK: 62705740, FAX: 512-751-3054; FSC No.: 55916; Empl.: 10; *Sls. Mgr.:* W. Reich

RE INSTRUMENTS CORP., 31029 Center Ridge Rd., Westlake, OH 44145, Tel: 216-871-7617; Empl.: 15; *Sls. Mgr.:* Steve Watts

REKCO INCORPORATED

FAX: 414-255-0653

REKCO, INC., N. 114 W. 19225 Clinton Dr., Germantown, WI 53022, Tel: 414-784-3430, TWX: 910-262-3005; *Sls. Mgr.:* Dick Koerber ..... **D•1141**

Local Sales Offices & Reps

CA	Huntington Bch., Brindle Assocs.	714-847-4738
FL	Largo, Burke Assocs.	813-536-4335
IL	Geneva, Applied Comp. Sls.	312-232-2669
NH	Amherst, Eva Tec Mktg.	603-673-4830
NJ	Bordentown, Eva Tec Mktg.	609-298-4307
NY	Ronkonkoma, Eva Tec Mktg.	516-467-5066
TX	Dallas, Titan Reps.	214-241-1398

RELAY SERVICE CO., 1300 N. Pulaski Rd., Chicago, IL 60651, Tel: 312-252-2700; Empl.: 25; *Sls. Mgr.:* Chas. H. Badger

RELAY SPECIALTIES, 17 Raritan Rd., Oakland, NJ 07436, Tel: 201-337-1000, TELEX: 642751, FAX: 201-337-1862; Empl.: 48; *Sls. Mgr.:* S. R. Gershberg

Local Sales Offices & Reps

CA	Los Alamitos, The Rep House	213-598-3379
CT	Manchester, Vin-Tech, Inc.	203-646-3007
MI	Dearborn, Pitcher Poulin Inc.	313-582-5450
MN	Minneapolis, Engrg. Prods. Assocs.	612-835-9022
NJ	Haddon Hgts., Walt Woodward	609-547-5000
NY	Rochester, Clark & Assocs.	716-436-1320
OH	Cincinnati, Annett Indl. Sls. Inc.	513-271-0030

RELCO PRODUCTS, 5594 E. Jefferson Ave., Denver, CO 80237, Tel: 303-756-1143; FSC No.: 14454; Empl.: 7

RELIABILITY, INC., P. O. Box 218370, Houston, TX 77218, Tel: 713-492-0550, TWX: 910-881-1739; FSC No.: 54098; Empl.: 575; *Sls. Mgr.:* J. Marcussen

RELIANCE COMM/TEC, Reliance Electric, P. O. Box 99502, Cleveland, OH 44199, Tel: 800-245-4501

RELIANCE ELECTRIC CO., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199, Tel: 800-245-4501

RELIANCE PLASTICS & PACKAGING, 225 Belleville Ave., Bloomfield, NJ 07003, Tel: 201-748-2222, FAX: 201-748-5257; Empl.: 60; *Sls. Mgr.:* Hale Smith

REMEE PRODUCTS CORP., 41 Bridge St., Florida, NY 10921, Tel: 914-651-4431, TELEX: 64-6715, FAX: 914-651-4160; FSC No.: 4R362; Empl.: 135; *Sls. Mgr.:* Ken Pimental; *Dist. Mgr.:* Ken Pimental

REMTEK CORPORATION, 46107 Landing Parkway, Fremont, CA 94538, Tel: 415-490-3999, TELEX: 1171121, FAX: 415-659-1849; Empl.: 40; *Sls. Mgr.:* Robert A. Wold; *Dist. Mgr.:* Robert T. Collins ..... **C•1717**

Local Sales Offices & Reps

AZ	Tempe, Rich Sls. Co.	602-968-7787
CA	Fallbrook, Gary Chilcote Assocs.	619-728-7678
CA	Fremont, Nicor-II	415-490-5975
CA	Fremont, Remtek Corp.	415-490-3999
CA	Montrose, Signal Entprs.	818-957-0640
CO	Boulder, R. F. Mayo & Assocs.	303-442-2155
FL	Deerfield, Brandel Stephens	305-427-8558
GA	Marietta, Remtek Corp.	404-977-1630
IL	Deerfield, Flaherty-Haines	312-948-7800
IN	Ft. Wayne, Hoyle Assocs.	219-485-6433
KS	Wichita, Baka Corp.	316-682-8411
MA	Clinton, Browning & Naughton	617-365-6365
MI	Birmingham, Forand Sls. Co.	313-644-0087
MN	Eden Prairie, EMT Engrg.	612-934-4147
NJ	Hicksville, J-Square Mktg.	516-935-3200
NY	Rochester, L-Mar Assocs.	716-323-1000
OH	Cleveland, Versatron	216-581-0090
OR	Tualatin, Nicor-I	503-692-0421
PA	Telford, Dalbrook	215-723-3300
TX	Dallas, R. D. Spooner	214-357-6636

RENARD MANUFACTURING COMPANY, INC., 3131 N.W. 79th Avenue, Miami, FL 33122-1011, Tel: 305-592-1500, TELEX: 989326, ESYLNK: 62929141, FAX: 305-593-9990

RENCO, Robbins & Myers, 26 Coromar Dr., Goleta, CA 93117-3094, Tel: 805-968-1525, TWX: 910-334-1180; FSC No.: 34479; Empl.: 170; *Sls. Mgr.:* Sid Russell; *Dist. Mgr.:* Marshal French

RENCO ELECTRONICS, INC.

FAX: 516-586-5562

RENCO ELECTRONICS, INC., 60 Jefryn Blvd., East, Deer Pk., NY 11729, Tel: 516-586-5566, 1-800-645-5828, TELEX: 220-883; Empl.: 200; *Sls. Mgr.:* Edward W. Rensing; *Dist. Mgr.:* Rhonda Rizzo ..... **A•1282-1285, 2367-2369**

Toll-Free Engineering Hot Line 800-645-5828, in NY State 516-586-5566

Local Sales Offices & Reps

AZ	Tempe, Allegro Assocs.	602-967-1337
AR	Ft. Smith, Electra Reps	501-452-7822
CA	San Diego, Coastal Sls.	619-459-4148
CO	Parker, The Remington Grp.	303-841-0523
CT	Norwalk, Northeast Reps.	203-886-6030
FL	Casselberry, S.A. Assocs.	305-695-6010
GA	Tucker, Stephen & Assocs.	404-493-4666
IL	Addison, Baldwin Sls. Assocs.	312-279-0352
IA	Davenport, Rush & West Assocs.	319-388-9494
KS	Olathe, Rush & West Assocs.	913-764-2700
MD	Gaithersburg, Eltron Sls.	301-963-7082
MA	Hingham, Northeast Reps.	617-749-8700
MN	Minneapolis, All Phase	612-835-4940
MO	St. Louis, Rush & West Assocs.	314-965-3322
NH	Nashua, Northeast Reps.	603-880-8199
NJ	Marlton, BGR Assocs.	609-983-1020
NY	Great Neck, Pacent Engrg.	516-482-4678
NC	Raleigh, Eltron Sls.	919-846-6215
OH	Columbus, Baehr Greenleaf & Assocs.	614-486-4046
OH	Westlake, Baehr Greenleaf & Assocs.	216-892-1770
OR	Hillsboro, Temco Northwest	503-649-8375
PA	Evans City, Baehr Greenleaf & Assocs.	412-776-2151
TX	Austin, Electra Reps	512-339-1163
TX	Dallas, Electra Reps	214-248-3852
UT	Parker, The Remington Grp.	303-841-0523
VA	Front Royal, Eltron Sls.	703-635-1933
WA	Kirkland, Temco Nortwest	206-823-6388
WI	Milwaukee, Bert Wartchow Assocs.	414-964-0942
Can	Montreal, Eli Manis, Inc.	514-861-5571

REN ELECTRONICS CORPORATION, C.C.G., An Insico Co., 755 New Ludlow Rd., S. Hadley, MA 01075, Tel: 413-536-1800, TELEX: 315617, FAX: 413-536-8425; FSC No.: 70143; Empl.: 75; *Sls. Mgr.:* S. W. Pai, Div. Mgr.

REPCO, 2421 N. Orange Blossom Trail, Box 7065, Orlando, FL 32854, Tel: 305-843-8484, TELEX: 56-6536

REPRODUCTION TECHNOLOGIES INC., Dept. EM, P.O. Box 790, Bristol, IN 46507-0518, Tel: 219-848-5233, TELEX: 510 600 2378 R T I; Empl.: 15 ..... **D•1043**

Local Sales Offices & Reps

AL	Birmingham, Secom Systems	205-854-5451
CA	Agoura Hills, CDH & Assocs.	818-707-1970
CO	Arvada, BBS Communications	303-422-8810
FL	Palm Coast, Secom Sys.	904-445-4654
GA	Doraville, Secom Sys.	404-455-0672
IL	Arlington Hgts., VLR Comms.	312-520-5208
IN	Indianapolis, R F Mktg.	317-849-8662
MD	Rockville, Joe Then	301-984-3945
MA	Falmouth Heights, R J C Assocs.	617-540-8832
MI	Ferndale, Shalco	313-547-4771
MN	Minneapolis, KODO Assocs.	612-881-1255
MO	Kansas City, Forristal-Young Sls.	816-358-6771
NM	Albuquerque, BBS Comms.	505-877-0277
NC	Raleigh, Secom Sys.	919-846-6013
OH	Columbus, Micronics, Inc.	614-442-6677
OR	West Lynn, Dave Leonard Co.	503-636-2380
TX	Dallas, Dobbs Stanford Inc.	214-358-0800

REPUBLIC ELCTRNS. CORP., 176 E. 7th St., Paterson, NJ 07524, Tel: 201-279-0300, TWX: 710-988-5908, FAX: 201-345-1937; FSC No.: 93958; Empl.: 125; *Sls. Mgr.:* W. Eisenberger

REPUBLIC ELECTRONICS CO., 200 Wireless Blvd., Hauppauge, NY 11788, Tel: 516-273-9800, TELEX: 96-1460; FSC No.: 95750; Empl.: 145; *Sls. Mgr.:* William Shaver

RESDEL ENGRG. CORP, Resdel Inds., 300 E. Live Oak Ave., Arcadia, CA 91006, Tel: 213-684-2600, TWX: 910-582-3219; FSC No.: 10412; Empl.: 225; *Dist. Mgr.:* W. Schwartz

RESISTANCE TECHNOLOGY INC., 1260 Red Fox Rd., St. Paul, MN 55112, Tel: 612-636-9770, FAX: 910-563-3601; *Sls. Mgr.:* T. Michael Ferris

FAX: 312-863-4272

RESISTORS, INC., 5226 W. 26th St., Chicago, IL 60650, Tel: 312-652-7555; Empl.: 35; *Sls. Mgr.:* Marlene Pingel ..... **A•2019**

Local Sales Offices & Reps

AR	Little Rock, Erickson Sls.	501-455-0618
CA	Santa Clara, K M Entprs.	408-986-1458
FL	Tampa, SRT Mktg.	813-884-4805
IL	Bensenville, Heighway Tech. Sls.	312-860-7900
IN	Indianapolis, Elctrn. Reps., Inc.	317-894-1414
IA	Cedar Rapids, J.R. Sls.	319-393-2232
KS	Overland Pk., EPI/Inc.	913-642-9118
LA	Chalmette, Erickson Sls.	504-271-1976
MS	Jackson, EPI, Inc.	601-856-6251
NY	Albany, Net Sls. Co.	518-371-6964
NY	Cortland, Net Sls. Co.	607-756-6592
NY	Rochester, Net Sls. Co.	716-223-1030
NY	Syracuse, Net Sls. Co.	315-662-7996
NY	Webster, Net Sls. Co.	716-671-0022
NC	Charlotte, Polytech Svcs.	704-372-4161
TX	Dallas, Erickson Sls.	214-739-5833
TX	Round Rock, Erickson Sls.	512-244-3068
WA	Mercer, E.C.S.	206-232-9301

RESONANT POWER TECHNOLOGY, 3350 Scott Blvd., Bldg. 60, Santa Clara, CA 95051, Tel: 408-982-0200, FAX: 408-748-9694; FSC No.: 0BZ13; Empl.: 6; *Sls. Mgr.:* Dan H. Burgoon

REVERE CORPORATION OF AMERICA, 845 N. Colony Rd., Wallingford, CT 06492, Tel: 203-269-7701, TELEX: 96-3482, TWX: 710-476-3197; Empl.: 389; *Sls. Mgr.:* R. Paukstys

REXNORD CHEMICAL PRODUCTS, Engineered Products Div., 6120 E. 58th Ave., Commerce City, CO 80022, Tel: 303-289-5651, FAX: 303-289-5283; *Sls. Mgr.:* Michael P. Manegold

RFD, INC., 5024 Nassau St., Tampa, FL 33607, Tel: 813-872-1502, TWX: 810-876-9146; *Sls. Mgr.:* Thomas W. Facer

RFI CORPORATION, 100 E. Pine Aire Dr., Bay Shore, NY 11706, Tel: 516-231-6400, TWX: 510-227-6233, FAX: 516-231-6465; FSC No.: 13619; Empl.: 350; *Sls. Mgr.:* Robert Fitzpatrick ..... **A•1687**

Local Sales Offices & Reps

AL	Huntsville, Murcota Corp.	205-539-8476
AZ	Scottsdale, Williams-Assocs.	602-947-4297
CA	Alhambra, M.W. Riedel Co.	213-283-7694
CA	Mountain View, Peninsula Tech. Sls.	415-965-3636
CO	Commerce City, Williams Assocs.	303-289-5647
FL	Clearwater, Tech-Rep Assocs.	813-576-9900

IL Palatine, Technlg. Sls., Inc. 312-991-6600
IN Fort Wayne, Denton Mktg., Inc. 219-486-0665
IA Marion, Ensco-Rep 319-381-1466
KS Wichita, Ensco-Rep 316-683-1070
MD Rockville, Mechtronics Sls. 301-340-2130
MO Maryland Heights, Ensco-Rep 314-423-3935
NH Hudson, EMC Sls., Inc. 603-889-5751
NJ Cherry Hill, H.J. White Co. 609-428-4544
NM Albuquerque, Williams-Assocs. 505-255-1638
NY Great Neck, Trionic Assocs. 516-466-2300
NC Winston-Salem, Murcota Corp. 919-722-9445
TX Garland, McBride Sci. Sls. 214-494-5000
UT Salt Lake City, Williams Assocs. 801-485-6511
WI Waukesha, Technlg. Sls., Inc. 414-786-5015

RF MONOLITHICS, INC., 4441 Sigma Rd., Dallas, TX 75244, Tel: 214-233-2903, TELEX: 463-0088, FAX: 214-387-8148; FSC No.: 2U874; Empl.: 90; *Sls. Mgr.:* C. Baker, T. Hinkle, W. Spurgeon

RF POWER LABORATORIES, INC., 22125 17th Ave. S.E., , Bothell, WA 98021, Tel: 206-481-8833, TELEX: 32-1042, FAX: 206-486-1002; FSC No.: 057143; Empl.: 17; *Sls. Mgr.:* Kris Parmar

RHG ELECTRONICS LABORATORY, INC., Adams Russell, 161 E. Industry Ct., Deer Park, NY 11729, Tel: 516-242-1100, TWX: 510-227-6083, FAX: 516-242-1222; Empl.: 250; *Sls. Mgr.:* Sid Wolin

FAX: 714-896-0971

RHOMBUS INDUSTRIES, 15801 Chemical Ln., Huntington Bch., CA 92649-1595, Tel: 714-898-0960, TWX: 910-596-1826; Empl.: 60; *Sls. Mgr.:* L. G. Luthy; *Dist. Mgr.:* L. G. Luthy ..... **A•1613-1617**

Local Sales Offices & Reps
AL Huntsville, Cross Assocs., Inc. 205-534-4477
AL Huntsville, CMR Cross Assocs. 205-883-5991

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AZ Tempe, A-5 Company 602-968-4923
CA Fallbrook, Gary Chilcote Assocs. 619-728-7678
CA Irvine, J. V. Earley & Assocs. 714-833-1806
CA Santa Clara, Westrep 408-988-8833
CO Parker, A-5 Co. 303-841-3651
FL Orlando, Perrott Assocs., Inc. 305-298-7748
ID Boise, Cascade Comps. 208-343-9886
IL Skokie, Rendell Sls. Co. 312-967-1513
MA Malden, J. K. Assocs. 617-321-2922
MI Warren, D.E.M. Elctrn. Sls. 313-595-9444
MN Eden Prairie, Electro-Mark, Inc. 612-944-5850
NJ Leonia, Peter E. Schmitt Co. 201-944-2806
NC Raleigh, Eltron Sls., Ltd. 703-635-1933
OH Cleveland, JMK Elctrns. 216-886-7100
PA Phoenixville, Henry G. Richter, Inc. 215-495-6176
TX Austin, Space Elctrns. 512-346-2215
TX Houston, Space Elctrns. 713-266-9245
Can Toronto, Ont., True North Technlg., Ltd. 416-744-2233

Local Distributors
CA Agoura, Image Elctrns. 818-707-0911
CA Costa Mesa, Eric Elctrns. 714-751-1185
CA Manhattan Bch., Prime Electro Prods. 213-379-3642
CA Milpitas, California Capacitor, Inc. 800-624-9579
CA San Diego, Sigma Gen. Corp. 619-565-2000
CA San Jose, Eric Elctrns. 408-432-1111
CA Tustin, Image Elctrns. 714-259-0900
MA Danvers, Nu Horizons Elctrns. Corp. .. 617-777-8800
MN Minneapolis, Stark Elctrns. Supp. 612-332-1325
NJ Pine Brook, Nu Horizons Elctrns. Corp. 201-882-8300
NY Amityville, Nu Horizons Elctrns. Corp. 516-226-6000
NY E. Rochester, Nu Horizons Elctrns. Corp. 716-248-5980
NY Mt. Vernon, QAR Indl. Elctrn. Sls. 914-699-2224
WI Mequon, Taylor Elec. Co. 414-241-4321
Can Nepean, Ont., Carsten Elctrns. Ltd. 613-726-9250
Can Scarborough, Ont., Carsten Elctrns. Ltd. 416-495-7705
Can St. Laurent, Que., Carsten Elctrns. Ltd. 514-334-8321

RICHARD HIRSCHMANN OF AMERICAN, See Hirschmann

RICHARD-LEE CO., Box 724, New Providence, NJ 07974, Tel: 201-276-0710, FAX: 201-276-6179; Empl.: 8

RICHARDS, ARKLAY S., CO., INC., 72 Winchester St., Newton Highlands, MA 02161-1793, Tel: 617-527-4385; *Sls. Mgr.:* L. K. Richards

RICHCO PLASTIC CO., P.O. Box 804238, Chicago, IL 60680, Tel: 312-539-4060, TWX: 910-221-1938; FSC No.: 06915; Empl.: 250; *Sls. Mgr.:* Ted E. Pavoris; *Dist. Mgr.:* Ted Pavoris

RIDGE TOOL CO., Sub. Emerson Elec. Co., 400 Clark St., Elyria, OH 44036, Tel: 216-323-5581, TELEX: 0243420

RIFA, INC., 403 International Pkwy., Ste. 500, Richardson, TX 75081, Tel: 214-480-8300, TELEX: 735389 ERICS RCHN, FAX: 680-1059 ..... **D•1949**

Local Sales Offices & Reps
AL Huntsville, EMA, Inc. 205-536-3044
CA Garden Grove, Elsco Elctrns. 714-891-4621
CA Los Altos, PEI 415-968-1803
CA San Diego, Elsco Elctrns. 619-292-1771
CT Seymour, Sturdy Corp. 203-888-1480
FL Indiatlantic, Burke Assoc. 305-723-0618
FL Largo, Burke Assoc. 813-536-4335
FL N. Palm Harbor, Burke Assoc. Inc. 813-785-1954
FL Oldsmar, Burke Assoc. Inc. 813-786-8105
IL Elk Grove Village, Carlson Elctrns. Sls. 312-956-8240
IA Cedar Rapids, Carlson Elec. Sls. Assoc. 319-377-6341
MD Hunt Valley, Eagle Sls. 301-666-3930
MA Wellesley Hills, Sturdy Corp. 617-235-2330
MN Minneapolis, Holmgren Assocs. 612-786-7641
NV Reno, Unitronics 916-268-1737
NJ Marlton, Naudain Assocs., Inc. 609-983-5300
NJ Parlin, JMR Sls., Inc. 201-254-8484
NY Latham, H. C. Johnson 518-383-2239
NY Rochester, H.C. Johnson 716-586-0777
NY Wading River, JMR Sls. 516-929-5756
NC Raleigh, EMA, Inc. 919-847-8800
TX Austin, Tesco, Inc. 512-834-8374
TX Dallas, Tesco, Inc. 214-553-1200
WA Redmond, EMG-Elec. Mktg. Grp. 206-882-0962
WI Milwaukee, Carlson Elctrns., Sls. 414-476-2790

RIL ELCTRNS., INC., 125 Titus Ave., P.O. Box H, Warrington, PA 18976, Tel: 215-EL5-1361; Empl.: 25

RISK, GEORGE, INDS., 802 S. Elm St., Kimball, NE 69145, Tel: 308-235-4645, TWX: 910-620-9040, FAX: 308-235-3561; FSC No.: 24229; Empl.: 100; *Sls. Mgr.:* J. Fisher; *Dist. Mgr.:* J. Fisher ..... **B•1833**

Local Sales Offices & Reps
AL Huntsville, BCI 205-539-4411
CA Escondido, Cirolia Elctrn. Sls. 619-743-3015
CA Santa Ana, VR Elctrns. 714-558-1295
CA Santa Clara, Context Engrg. Co. 408-748-8676
FL Casselberry, T Squared Mktg. 305-628-8911
GA Chamblee, BCI 404-455-0405
IL Wheaton, Chadra-Schilke & Assoc. ... 312-653-8126
MA Lexington, Jodan Tech. 617-863-8898
NY Huntington Sta., Morgan Elctrn. Sls. ... 516-549-5180
OH Painesville, JAC Mktg. 216-357-9858
OR Beaverton, Advanced Power Prods. ... 503-646-0994
WA Redmond, Advanced Power Prods. ... 206-852-9558
Can Toronto, Ont., Tienkay, Inc. 416-736-1221

Local Distributors
CA Los Angeles, Electric Switches 213-660-1310
CA Santa Ana, Advanced Computer Prods. 714-558-8813
MA Cambridge, Hi Tek Elctrns., Inc. 617-491-0442

RITTAL

FAX: 513-325-0399

RITTAL CORP., 1900 E. Leffel Lane, Springfield, OH 45505, Tel: 800-637-4425, TELEX: 241 354; Empl.: 35 ..... **C•1086-1088**

Local Sales Offices & Reps
CA Anaheim, Rittal Corp. 714-527-7337
CA Concord, Q-Con 415-682-2020
CA San Jose, Rittal Corp. 408-258-6968
CO Littleton, Elctrn. Comp. Sys. 303-797-0894
CT Bristol, Rittal Corp. 203-589-1134
CT Bristol, Rittal Corp./Mike Seib 203-589-1134
GA Lawrenceville, Lakewood Inds. 404-995-8842
IL Downers Grove, Rockford Controls Co. 312-960-2046
IL Downers Grove, Rockford Controls Co. 312-960-2447
IN Fort Wayne, Rockford Controls Co. ... 312-960-2113
MD Towson, Affiliated Technlg. 301-583-8822
MI Brighton, Rittal Corp. 313-229-7072
MI Brighton, Rittal Corp./Chuck Marino .. 313-229-7072
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OH Columbus, Rittal Corp.-Scott Puderbaugh 614-764-1108
OH Springfield, Rittal Corp.-Hdqrs. 513-325-1141
PA Exton (Phil.), Rittal Corp.-Todd Davis 215-524-7388
RI Cranston, Rittal Corp.-Greg Demirjian 401-942-3344
TX Dallas, The Power Connection 214-357-8207
Can Toronto, Werner Pischel-PTS Engrg. .. 416-842-8680

Relco

FAX: 519-696-2670

RITZ ELECTRONICS/RELCO, 196 Queen St. N., New Dundee, Ont., Canada N0B 2E0, Tel: 519-696-2616; Empl.: 30; *Sls. Mgr.:* Leonard Snow; *Dist. Mgr.:* Leonard Snow ..... **C•1089; D•1950-1951**

Local Sales Offices & Reps
CA Redondo Bch. 213-318-9601
CA Torrance, U.S. Power Converting Co. 213-316-9984
Can New Dundee, Ont., Ritz Elctrns. 519-696-2616

Local Distributors
CA Redondo Bch. 213-318-9601
CA Torrance, Leonard Snow & Assocs./U.S. Power 213-316-9984
Can New Dundee, Ont., Ritz Elctrns. 519-696-2616

RLC ELECTRONICS, INC., 83 Radio Cir., Mt. Kisco, NY 10549, Tel: 914-241-1334, TWX: 710-571-2103, FAX: 914-241-1753; FSC No.: 12598; Empl.: 75; *Sls. Mgr.:* Philip H. Wright; *Dist. Mgr.:* Sheldon Seissler/Joe Norelli

RMC POWER SEMICONDUCTOR, BBC, 2150 W. 6th Ave., Broomfield, CO 80020, Tel: 303-469-1883, 1-800-992-0312, TELEX: 299745, FAX: 303-469-8394; Empl.: 16; *Sls. Mgr.:* Dave Whitcomb; *Dist. Mgr.:* Dave Whitcomb

RMF PRODUCTS, INC., 1275 Paramount Pkwy., P.O. Box 520, Batavia, IL 60510, Tel: 312-879-0020, FAX: 312-879-6749; Empl.: 11; *Sls. Mgr.:* R. Frieders ..... **C•1635**

RMS COMPANY, Connector Division, 980 Osborne Rd., Minneapolis, MN 55432, Tel: 612-786-1520, FAX: 612-786-1771; *Sls. Mgr.:* Jack M. Lundeen

RMS ELECTRONICS INC., 50 Antin Pl, Bronx, NY 10462, Tel: 212-892-6700, 800-223-8312, FAX: 212-829-7740; Empl.: 50; *Dist. Mgr.:* Lee R. Heller

RMS TECHN., 11833 Bunker Blvd., Ste. 100, Newport News, VA 23601, Tel: 804-873-0100; FSC No.: 59606; Empl.: 42

ROANWELL, 180 Varick St., New York, NY 10014, Tel: 212-989-1090, TWX: 710-581-6555; FSC No.: 82872; Empl.: 75; *Sls. Mgr.:* Ken Dobbins; *Dist. Mgr.:* Ken Dobbins

RO ASSOCIATES

FAX: 408-744-1521

RO ASSOCIATES, INC., 246 Caspian Dr., Box 61419, Sunnyvale, CA 94088, Tel: 408-744-1450, TWX: 910-339-9304; FSC No.: 24230; Empl.: 90; *Sls. Mgr.:* R. D. Okada ..... **D•1952-1957**

Local Sales Offices & Reps

AL	Huntsville, Lee Assocs.	205-533-5896
AZ	Phoenix, Tech. Sls. Inc.	602-246-1614
CA	Los Angeles, West Coast Reps.	714-558-6100
CA	San Francisco, Richards Assocs.	408-297-3010
CO	Denver, F.G. Mktg.	303-795-9176
DC	Washington, Gans & Pugh	703-527-3262
FL	Orlando, Honeyco	305-299-1222
IL	Chicago, Mar-con Assocs. Inc.	312-675-6450
KS	Lenexa, Midtec	913-541-0505
MD	Baltimore, Gans & Pugh	703-527-3262
MA	Boston, Power Factor	617-234-6415
MN	Minneapolis, R J Inc.	612-866-3661
MO	St. Louis, Midtec	314-275-8666
NM	Albuquerque, Fry-Gates, Inc.	505-262-1525
NY	Mt Vernon, Sonkin Assocs.	914-968-8282
OH	Centerville, Omega Sls., Inc.	513-434-5507
PA	Philadelphia, Gans & Pugh	215-699-6655
TX	Dallas, Barry Sls.	214-234-0255
TX	Houston, Barry Sls.	713-784-5860
WA	Seattle, West Coast Reps.	206-243-3340
Can	Missisauga, Ont., T. W. Wilson Sls.	416-677-8200
Can	Vancouver, BC, Tracan Elctrn. Western Ltd.	604-984-4141

ROBBINS & MYERS, Motion Control Group, 1600 Second St. South, Hopkins, MN 55343, Tel: 612-931-2700, TELEX: 4310124; *Sls. Mgr.:* Harry Webber; *Dist. Mgr.:* Marshall French

ROBERT SHAW INSTRUMENT DIV., Kendall Lane, Natick, MA 01760, Tel: 617-875-9711, TWX: 710-346-0398, FAX: 617-872-8437; Empl.: 600; *Sls. Mgr.:* David LeBlanc

ROBINSON-HALPERN, Teleflex, Inc., One Apollo Rd., P.O. Box 248, Plymouth Meeting, PA 19462-0248, Tel: 215-825-9200, TWX: 510-660-8637; FSC No.: 12400; Empl.: 80; *Sls. Mgr.:* Robert C. Rehborn, Prod. Mgr.

Robinson Nugent

FAX: 812-945-0804

ROBINSON NUGENT, INC., 800 East 8th St., New Albany, IN 47150, Tel: 812-945-0211, TWX: 810-540-4082; Empl.: 567; *Sls. Mgr.:* Terry Johnson; *Dist. Mgr.:* Vic Siccone ..... **C•1527-1530**

Local Distributors

MO	Maryland Heights, LComp	314-291-6200

ROBISON ELECTRONICS, P.O. Box 8121, San Luis Obispo, CA 93403-8121, Tel: 805-544-8000, FAX: 805-544-8091; FSC No.: 19080; Empl.: 45

ROCHESTER INSTRUMENT SYSTEMS, 255 N. Union St., Rochester, NY 14605, Tel: 716-263-7700, TELEX: 978457, TWX: 82971, FAX: 716-262-4777; Empl.: 330

ROCKLAND INSULATED WIRE & CABLE, 87 Broadway, Haverstraw, NY 10927, Tel: 914-429-3103, FAX: 914-947-1712; FSC No.: 12111

ROCKLAND SCIENTIFIC CORPORATION, 10 Volvo Dr., Rockland Indl. Pk., Rockleigh, NJ 07647, Tel: 201-767-7900, TWX: 710-991-9852; Empl.: 60; *Sls. Mgr.:* M. Schiavone

ROCKWELL FILTER PRODUCTS, 2990 Airway Ave., Costa Mesa, CA 92626, Tel: 714-641-5311, TELEX: 685532 (COLLINS CSMA), FAX: 714-641-5380; FSC No.: 2X491; Empl.: 75; *Sls. Mgr.:* Bob Johnson

ROCKWELL INT'L, 4311 Jamboree Rd., Newport Beach, CA 92660, Tel: 800-854-8099, TWX: 910-591-1654; FSC No.: 34576; Empl.: 1995; *Sls. Mgr.:* K. MacDonald; *Dist. Mgr.:* K. Foster

ROCKWELL INTERNATIONAL TELECOMMUNICATIONS, 1200 N. Alma Rd., Richardson, TX 75081, Tel: 214-996-5000, TELEX: 73-307, 73-2490, TWX: 910-867-4709; Empl.: 7,000; *Sls. Mgr.:* Phil Ritzmann

RODALE ELCTRNS. CORP., 603 Chestnut St., Garden City, NY 11530, Tel: 516-222-0050, TWX: 510-222-0274; *Sls. Mgr.:* John B. Clement

RODELCO ELECTRONICS CORP., 111 Haynes Ct., Ronkonkoma, NY 11779, Tel: 516-981-0900; Empl.: 44

ROD-L ELECTRONICS, INC.

FAX: 415-326-1993

ROD-L ELECTRONICS, INC., 1098 Hamilton Ct., Menlo Park, CA 94025, Tel: 415-322-0711, TWX: 296210; Empl.: 20; *Sls. Mgr.:* Tom Cooke ..... **D•1316-1317**

Local Sales Offices & Reps

CA	Menlo Park, ROD-L (factory)	415-322-0711
CO	Conifer, Energy Equip. Sls.	303-972-3335
IL	Elk Grove, Loren Green Assocs.	312-593-0282
IN	Indianapolis, Loren Green Assocs.	317-293-9827
KS	Lenexa, Midtec Assocs.	913-541-0505
MD	Cockeysville, Sci. Reps.	301-321-1411
MA	Reading, Scheinfein Assocs.	617-944-2304
MI	Detroit, Micro Sls	313-464-4520
MN	Minneapolis, Hei-Lite Sls	612-861-6051
MO	St. Louis, Midtec Assocs.	314-275-8666
NJ	Fairfield, Addem Sls.	201-882-0993
NJ	Pennsauken, Sci. Reps.	609-662-5222
NY	De Witt, DB Assocs.	315-446-0220
OH	Centerville, Micro Sls.	513-433-8171
OH	N. Olmsted, Micro Sls	216-734-3080
OK	Tulsa, Spectra Sls	918-663-7188
OR	Beaverton, Core II Mktg	503-641-0877
TX	El Paso, Venturesearch	915-594-4094
TX	Houston, Spectra Sls.	713-270-8212
TX	Richardson, Spectra Sls.	214-234-3600
VA	Fairfax, Sci. Reps.	703-385-0600
WA	Redmond, Core II Mktg	206-885-4344
WA	Spokane, Core II Mktg	509-922-2971
WV	Pittsburg, Micro Sls	412-471-0105
Can	Ontario, Webster Instrs. Ltd.	416-625-0600

Local Distributors

CA	Menlo Park, Rod-L (Factory)	415-322-0711
Can	Ontario, Webster Instrs. Ltd.	416-625-0600

ROEAN INDUSTRIES, INC., 12970 Branford, Ste. C, Pacoima, CA 91331, Tel: 818-767-7047, TELEX: 758630, FAX: 818-768-4974; Empl.: 8

ROEDERSTEIN ELCTRNS., INC., P.O. Box 5588, Statesville, NC 28677, Tel: 704-872-8101, TELEX: 240802, TWX: 301-240802, FAX: 704-872-8023; *Sls. Mgr.:* Rick Price; *Dist. Mgr.:* Fred Fernandez

ROGAN, 3455 Woodhead Dr., Northbrook, IL 60062, Tel: 312-498-2300, 800-423-1543, FAX: 312-498-2334; FSC No.: 86797; Empl.: 100; *Sls. Mgr.:* D. Pelletier; *Dist. Mgr.:* D. Pelletier

ROGERS CORP., Bus Products Division, 5750 East McKellips Rd., Mesa, AZ 85205, Tel: 602-830-3370, FAX: 602-830-3370

ROGERS CORPORATION, Circuit Components Div., 2400 S. Roosevelt St., Tempe, AZ 85282, Tel: 602-967-0624, FAX: 602-967-9385

ROGERS CORPORATION, Circuit Materials Div., Box 4000, Chandler, AZ 85244, Tel: 602-963-4584, FAX: 602-732-9381

ROGERS CORPORATION, Flexible Interconnections Div., Box 700, Chandler, AZ 85244, Tel: 602-963-4584, TELEX: 140-223, TWX: 910-950-1961, FAX: 602-963-4584 (ext 521)

ROGERS CORPORATION, Microwave Materials Div., 100 S. Roosevelt Ave., Chandler, AZ 85244, Tel: 602-961-1382, FAX: 602-961-1302

ROGERS CORPORATION, Molding Materials Div., P.O. Box 550, Manchester, CT 06040, Tel: 203-646-5500, FAX: 203-646-5503

ROGERS CORPORATION, Soladyne Div., 7447 Convoy Ct., San Diego, CA 92111, Tel: 619-279-7872, FAX: 619-277-9105

ROGERS CORPORATION, Special Products Div., 645 W. 24th St., Tempe, AZ 85282, Tel: 602-967-0624, FAX: 602-966-8851

ROGERS CORP., One Technology Dr., Rogers, CT 06263, Tel: 203-774-9605, TWX: 710-448-0047; Empl.: 2500; *Sls. Mgr.:* Paul L. Anderson

ROHDE & SCHWARZ, INC., 4425 Nicole Drive, Lanham, MD 20706, Tel: 301-459-8800, FAX: 301-459-2810; FSC No.: 82199; Empl.: 65; *Sls. Mgr.:* David R. Cook

ROHM CORP., 8 Whatney, Irvine, CA 92718, Tel: 714-855-2131, TWX: 910-595-1721; Empl.: 125; *Sls. Mgr.:* Al Kirwan; *Dist. Mgr.:* Al Kirwan

ROHM CORPORATION, 8 Whatney, Irvine, CA 92718, Tel: 714-855-2131, TWX: 910-595-1721, FAX: 714-855-1669; Empl.: 125

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ROLM SYSTEMS DIVISION, IBM Corp., 4900 Old Ironsides Dr., M/S 605, Santa Clara, CA 95054, Tel: 408-986-1000; Empl.: 4,100; *Dist. Mgr.:* Ken Batorski

ROLYN OPTICS CO., 706 Arrowgrand Circle, Covina, CA 91722-2199, Tel: 818-915-5707/5717, TELEX: 67-0380, FAX: 818-915-1379

ROSE ELECTRONIC, INC., Energy Products Group, 2461 Autumn Vale Dr., San Jose, CA 95131, Tel: 408-263-2934, FAX: 408-263-4263; Empl.: 13; *Sls. Mgr.:* Ted Williams; *Dist. Mgr.:* Ted Williams

ROSE ENCLOSURES SYS., INC., 12140 Parklawn Dr., Rockville, MD 20852, Tel: 301-984-1783, TELEX: 908-107 Resi Rove, FAX: 301-984-8670; FSC No.: 4Y520/C0242; Empl.: 35; *Sls. Mgr.:* Warren Hudacek ..... **C•1090**

Local Sales Offices & Reps

AL	Adamsville, South Rep	205-674-3056
CA	Irvine, Comp. Mktg.	714-951-5950
FL	Tampa, Florida Comp. Sls.	813-960-7044
GA	Atlanta, South Rep	404-262-6942
IL	Chicago, Paddock Mktg.	312-452-7852
IA	Cedar Rapids, Tech. Elctrns.	319-366-5443
NY	Rochester, J. G. Welch Assocs.	716-244-1100
NC	Kernersville, Heritage Sls.	919-996-4374
OH	Chagrin Falls, Pine Sls.	216-247-6198
PA	Frazer, ICI	215-889-0650
WA	Federal Way, K. R. Jensen Sls.	206-874-2772
WI	Milwaukee, Taylor Mktg.	414-332-1211

Local Distributors

Can	Vancouver, BC, Memco	604-590-1553

ROSEMOUNT CORP., Sensall/National Sonics, 250 Marcus Blvd., Hauppauge, NY 11788, Tel: 516-273-6600, FAX: 516-273-6651; Empl.: 140; *Sls. Mgr.:* V. McCormack

ROSEMONT-NASHVILLE, INC., See Chromalox Instrs. & Controls

ROSS ENGINEERING CORP., 540 Westchester Dr., Campbell, CA 95008, Tel: 408-377-4621, TELEX: 858840, TWX: 910-590-8033; FSC No.: 23598; Empl.: 45; *Sls. Mgr.:* Hugh C. Ross ..... **B•1577**

ROTEK INSTRUMENT CORP., 390 Main St., Waltham, MA 02254, Tel: 617-899-4611, TELEX: 928034; FSC No.: 06678; *Sls. Mgr.:* Eliot Warner

ROTORQUE TECHNOLOGY CORP., 47915 Westinghouse Drive, Fremont, CA 94539, Tel: 415-659-1552, FAX: 415-659-1601; Empl.: 20; *Sls. Mgr.:* Beth Doolin

ROWE INDUSTRIES, INC., 6225 Benore Rd., P.O. Box 6877, Toledo, OH 43612, Tel: 419-729-9761, TWX: 810-442-1734; FSC No.: 82878; Empl.: 89; *Sls. Mgr.:* D. L. Mang; *Dist. Mgr.:* D. L. Mang ..... **C•1532-1534, 1905**

RTE AEROVOX INC., 740 Belleville Ave., New Bedford, MA 02745, Tel: 617-994-9661, TWX: 710-344-6985, FAX: 617-994-9635; FSC No.: 4K459; Empl.: 850; *Sls. Mgr.:* Jack Chmura; *Dist. Mgr.:* Bob Ritchie .... **A•1688-1690**

Local Sales Offices & Reps

AL	Huntsville, 20th Century Mktg.	205-533-9281
AZ	Scottsdale, Interstate Mktg.	602-244-9050
CA	Campbell, Luscombe Engrg. Co.	408-370-2020
CA	San Diego, Bestronics, Inc.	714-452-5500
CA	Woodland Hills, Interstate Mktg.	818-883-7606
CO	Littleton, M.R.C.	303-794-4684
CT	North Haven, J.E. Boeing Co.	203-239-5369
DE	Greenville, H. Anderson	302-655-2917
FL	Orlando, E.P.M. Corp.	305-425-6149
GA	Norcross, 20th Century Mktg.	404-446-1999
IL	Elk Grove Village, Carlson Elctrn. Sls.	312-956-8240
IN	Ft. Wayne, F. J. Campisano Co.	219-747-2633
IN	Indianapolis, F. J. Campisano Co.	317-253-7651
IA	Cedar Rapids, Carlson Elctrn. Sls.	319-377-6341
MD	Monkton, Imagitron Sls. Co.	301-374-5600
MA	Chelmsford, J. E. Boeing Co.	617-256-5800
MI	Farmington Hills, Carrier & Gable	313-477-8700
MN	Minneapolis, Comstrand	612-788-9234
MO	Grandview, Beneke & McCaul	816-765-2998
NM	Albuquerque, Hewitt & Assocs.	505-299-7746
NY	Ithaca, B. Dean	607-257-1111
NY	Melville, Comtronic Assocs.	516-249-0505
NY	Wappingers Falls, Bob Dean	914-297-6406
NC	Matthews, R. G. Sls.	704-847-0049
OH	Cincinnati, F. J. Campisano Co.	513-574-7111
OH	Cleveland, F.J. Campisano Co.	216-749-5550
OH	Dayton, Schmidt & Assocs.	513-293-6652
OK	Tulsa, Ammon & Rizos Co.	918-663-8788
PA	Coraopolis, F.J. Campisano Co.	412-264-5151
TN	Knoxville, 20th Century Mktg., Inc.	615-966-2099
TX	Austin, Ammon & Rizos	512-454-5131
TX	Houston, Ammon & Rizos Co.	713-781-6240
TX	Richardson, Ammon & Rizos	214-644-5591
WI	Milwaukee, Carlson Elctrn. Sls.	414-476-2790
EXP	Santurce, PR, J. E. Boeing Co.	809-722-6942

Local Distributors

AL	Huntsville, Marshall Inds.	205-881-9235
AZ	Phoenix, Arizona Comps. Co.	602-269-5655
AZ	Phoenix, Elctrn. Supp.	602-276-1199
AZ	Phoenix, Future Elctrns.	602-968-7140
CA	Chatsworth, Future/Cetec	818-700-0914
CA	Chatsworth, Marshall Inds.	818-407-4150
CA	El Monte, Marshall Inds.	818-459-5590
CA	Hayward, Kea Elctrns.	415-887-2900
CA	Irvine, Future Elctrns.	714-250-4141
CA	Irvine, Integrated Elctrns. Corp.	714-837-9960
CA	Irvine, Marshall Inds.	714-458-5395
CA	Milpitas, Marshall Inds.	408-943-4600
CA	Milpitas, Projections Unltd., Inc.	408-748-9280
CA	Rancho Cordova, Marshall Inds.	916-635-9700
CA	Riverside, Elctrn. Supp. Co.	213-626-6795
CA	Sacramento, Integrated Elctrns. Corp.	916-424-5297
CA	San Diego, Elctrn. Supp. Co.	619-693-8222
CA	San Diego, Future/Cetec	619-278-5020
CA	San Diego, Marshall Inds.	619-578-9606
CA	San Diego, Projections Unltd., Inc.	619-453-7900
CA	San Jose, Elctrn. Supp. Co.	408-297-3726
CA	San Jose, Future/Cetec	408-434-1114
CA	San Jose, Integrated Elctrns. Corp.	408-435-1000
CA	Tustin, Projections Unltd., Inc.	714-544-2700
CA	Westlake VL, Distel/JACO	805-495-9998
CO	Denver, Integrated Elctrns. Corp.	303-292-5537
CO	Thornton, Marshall Inds.	303-451-8383
CO	Westminster, Future Elctrns.	303-650-0123
CT	Bethel, Future Elctrns.	203-624-0105
CT	E. Haven, J-V Elctrns.	203-469-2321
CT	Meriden, JACO Elctrns.	203-235-1422
CT	Wallingford, Cronin Elctrns.	203-265-3134
CT	Wallingford, Marshall Inds.	203-265-3822
FL	Altamonte Springs, Future Elctrns.	305-767-8414
FL	Clearwater, Future Elctrns.	813-578-2770
FL	Ft. Lauderdale, Marshall Inds.	305-928-0661
FL	Ft. Lauderdale, NRC Elctrns.	305-772-4500
FL	Melbourne, GRS/Rome Elctrns.	305-242-8151
FL	Orlando, Marshall Inds.	305-841-1878
GA	Augusta, Dixie Elctrns.	404-722-2055
GA	Norcross, Future Elctrns.	404-441-7676
GA	Norcross, Marshall Inds.	404-923-5750
ID	Boise, Radar Elec. Co.	208-336-2227
IL	Hoffman Estates, Integrated Elctrns. Corp.	312-843-2040
IL	Mt. Prospect, Magnuson Elctrns.	312-956-0700
IL	Schaumberg, Future Elctrns.	312-882-1255
IL	Schaumberg, Marshall Inds.	312-490-0155
IL	Schaumburg, QPS Elctrns.	312-884-6620
IL	W. Chicago, PEI/Genesis	312-232-0394
IN	Indianapolis, Magnuson Elctrns.	317-247-5108
IN	Indianapolis, Marshall Inds.	317-297-0483
IN	Indianapolis, PEI/Genesis	317-637-5571
IN	South Bend, PEI/Genesis	219-287-2911
IA	Cedar Rapids, DEE Elctrns.	319-365-7551
KS	Lenexa, Marshall Inds.	913-492-3121
KS	Overland Pk., Franklin Elctrns. Co.	913-888-4982
MD	Baltimore, PEI/Genesis	301-529-2200
MD	Columbia, Future Elctrns.	301-995-1222
MD	Gaithersburg, Marshall Inds.	301-840-9450
MA	Burlington, TLC Comps. Corp.	617-273-0140
MA	Needham, Cronin-Elctrns.	617-449-5000
MA	Westborough, Future Elctrns.	617-366-2400
MA	Wilmington, JACO Elctrns.	617-273-1860
MA	Wilmington, Marshall Inds.	617-658-0810
MI	Benton Harbor, PEI/Genesis	616-927-3519
MI	Livonia, Chelsea Inds./R.S. Elctrns.	313-525-1155
MI	Livonia, Future Elctrns.	313-261-5270
MI	Livonia, Marshall Inds.	313-525-5850
MN	Eden Prairie, Future Elctrns.	612-944-2200
MN	Plymouth, Marshall Inds.	612-559-2211
MO	Maryland Hgts., Chelsea Inds.	314-997-7709
MO	St. Louis, Franklin Elctrns.	314-993-5333
NH	Hudson, C & H Elctrns.	603-882-1133
NH	Manchester, Cronin Elctrns.	603-624-0105
NJ	Camden, GRS Elctrns.	609-964-8560
NJ	Camden, PEI/Genesis	609-541-4200
NJ	Clifton, J-Mar Elctrns.	201-772-6400
NJ	Fairfield, Future Elctrns.	201-227-4346
NJ	Fairfield, Marshall Inds.	201-882-0320
NJ	Mt. Laurel, Future Elctrns.	609-778-7600
NJ	Mt. Laurel, Marshall Inds.	609-234-9100
NJ	Rutherford, JACO Elctrns.	201-942-4000
NY	Hauppauge, Future Elctrns.	516-234-4000
NY	Hauppauge, JACO Elctrns.	516-273-5500
NY	Hauppauge, LI., Marshall Inds.	516-273-2424
NY	Johnson City, Marshall Inds.	607-798-1611
NY	Liverpool, Future Elctrns.	315-451-2371
NY	Rochester, Future Elctrns.	716-272-1120
NY	Rochester, Marshall Inds.	716-235-7620
NY	Rome, Rome Elctrns.	315-337-5400
NC	Charlotte, Dixie Elctrns.	704-377-4348
NC	Raleigh, Marshall Inds.	919-878-9882
NC	Winston-Salem, Dixie Elctrns.	919-724-5961
OH	Akron, AESCO	216-762-8818
OH	Columbus, AESCO	614-882-6762
OH	Dayton, Marshall Inds.	513-236-8088
OH	Solon, Marshall Inds.	216-248-1788
OR	Beaverton, Future Elctrns.	503-645-9454
OR	Beaverton, Integrated Elctrns. Corp.	503-641-1690
OR	Beaverton, Marshall Inds.	503-643-5555
OR	Portland, Radar Elec. Co.	503-232-3404
PA	Cornwell Hgts., PEI/Genesis	215-673-0400
PA	McKean, Advacom, Inc.	814-476-7774
PA	Pittsburgh, Marshall Inds.	412-963-0441
SC	Columbia, Dixie Elctrns.	803-779-5332
SC	Greenville, Dixie Elctrns.	803-297-1435
TN	Gray, Dixie Elctrns.	615-477-3838
TN	Knoxville, Dixie Elctrns.	615-938-4131
TX	Austin, Marshall Inds.	512-837-1991
TX	Carrollton, Marshall Inds.	214-770-0616
TX	El Paso, Marshall Inds.	915-593-0706
TX	Houston, Marshall Elctrns.	713-895-9200
TX	Richardson, JACO Elctrns.	214-235-9575
UT	N. Salt Lake City, Integrated Elctrns. Corp.	801-298-1869
UT	Salt Lake City, Future Elctrns.	801-972-8489
UT	Salt Lake City, Marshall Inds.	801-485-1551
WA	Bellevue, Integrated Elctrns. Corp.	206-455-2727
WA	Bellevue, Marshall Inds.	206-641-6800
WA	Redmond, Future Elctrns.	206-881-8199
WA	Richland, Radar Elec. Co.	509-943-8336
WA	Seattle, Radar Elec. Co.	206-282-2511
WA	Spokane, Radar Elec. Co.	509-747-3053
WI	Brookfield, Marshall Inds.	414-797-8400
WI	Milwaukee, Marsh Elctrns.	414-475-6000
Can	Calgary, Alberta, Future Elctrns.	403-235-5325
Can	Downsville, Ont., Future Elctrns.	416-638-4771
Can	Edmonton, Alberta, Future Elctrns.	403-438-2858
Can	Ottawa, Ont., Future Elctrns.	613-820-8313
Can	Pointe Claire, Que., Future Elctrns.	514-694-7710
Can	Scarborough, Ont., Carsten Elctrns.	416-495-9999
Can	St. Fox, Que., Future Elctrns.	418-682-8092
Can	Vancouver, BC, Future Elctrns.	604-294-1166
Can	Winnipeg, Manitoba, Future Elctrns.	204-786-7711

RTE DELTEC CORP., 2727 Kurtz St., San Diego, CA 92110, Tel: 619-291-4211, 800-854-2658, TELEX: 910-335-1241; FSC No.: 52297; Empl.: 200; *Sls. Mgr.:* Jeff Frank

RTE POWER/MATE

FAX: 619-291-2584

RTE POWER/MATE, 2727 Kurtz St., San Diego, CA 92110, Tel: 800-843-8544, 619-299-3800, TWX: 910-335-1241; Empl.: 175 ..... **D•1958-1959**

RTRON CORP., 7324 Lawndale, Skokie, IL 60076, Tel: 312-679-7180, TWX: 910-223-0810; FSC No.: 19130; *Sls. Mgr.:* R. McLean

RTS Systems

FAX: 818-843-7953

RTS SYSTEMS, INC., 1100 W. Chestnut St., Burbank, CA 91506, Tel: 818-840-7119, TELEX: 194855; Empl.: 75; *Sls. Mgr.:* Shelley Brown Harrison; *Dist. Mgr.:* Shelley Brown Harrison ..... **B•1026; D•1074-1075**

RUSH ENTERPRISES INC., 20 Hampshire Drive, Hudson, NH 03051, Tel: 603-886-9460; Empl.: 10; *Sls. Mgr.:* Richard Mulcahy

RUSH/HOUSTON, INC., 600 Kealrick, Ste C-40, Houston, TX 77060, Tel: 713-682-5151; *Sls. Mgr.:* Fred Murphy

RUSSTECH ENGINEERING COMPANY, INC., 23322 (D) Madero Road, Mission Viejo, CA 92691, Tel: 714-472-0880

RUSTRAK INSTRUMENTS, Mark IV Company, Rte. 2 & Middle Rd., E. Greenwich, RI 02818, Tel: 401-884-6800, 800-332-3202, TWX: 710-387-1500; Empl.: 250; *Sls. Mgr.:* John Olobri; *Dist. Mgr.:* John Olobri

RUTHERFORD RESEARCH, Box 249, Rutherford, NJ 07070, Tel: 201-933-2091; Empl.: 4; *Sls. Mgr.:* Dr. A. Blanck; *Dist. Mgr.:* Dr. A. Blanck

RVS ELECTRONICS, INC., 40 North St., Middletown, NY 10940, Tel: 914-342-3199, TELEX: 820778; Empl.: 15

DYTRONICS

RYAN INTERNATIONAL CORP., 4800 Evanswood Dr., Columbus, OH 43229-6207, Tel: 614-885-3303; Empl.: 30 ..... **D•1318**

RYE INDUSTRIES, INC., 125 Spencer Pl, P.O. Box M, Mamaroneck, NY 10543, Tel: 914-698-0080; Empl.: 50

S A B NIFE, INC., Div. of Sonesson, P. O. Box 100, George Washington Hwy., Lincoln, RI 02865, Tel: 401-333-1170, 800-556-6764, TELEX: 92-9407; Empl.: 150; *Sls. Mgr.:* Alan Feo; *Dist. Mgr.:* Alan Feo

SABRE COMMUNICATIONS CORP., 3400 Hwy 75 N., P.O. Box 536, Sioux City, IA 51102, Tel: 712-258-6690, FAX: 712-258-8250; FSC No.: 60348; *Sls. Mgr.:* Jerry W. Audus; *Dist. Mgr.:* Richard Krone

SABRITEC, 1733 Kaiser Ave., Irvine, CA 92714, Tel: 714-660-1970, TELEX: 678401, FAX: 714-660-9136; FSC No.: 58795; Empl.: 35

SAFE POWER SYSTEMS, 528 W. 21st St., Tempe, AZ 85023, Tel: 602-894-6864

SAFE POWER SYSTEMS, Acme Electric Corporation, 528 W. 21st St., Tempe, AZ 85282, Tel: 602-894-6864, FAX: 602-921-0470; *Sls. Mgr.:* Rod Pullen; *Dist. Mgr.:* Jim Heidenreich

SAFT AMERICA INC., Box 1886, Valdosta, GA 31601, Tel: 912-247-2331, TELEX: 547620, TWX: 810-786-5866 ..... **D•1428, 1483-1490**

SAFT AMERICA INC., 107 Beaver Ct., Cockeysville, MD 21030, Tel: 301-771-3200, TWX: 710-862-2637 ..... **D•1428, 1483-1490**

Local Sales Offices & Reps

CA	Chatsworth, Mike Murphy, Zone Mgr.	818-998-0626
CA	Grenada Hills, Don Sandler	818-360-1853
CA	Redwood City, John Marciano	415-365-4539
FL	Boca Raton, Vince Malkiewicz	305-395-1535, 800-328-5049
GA	Marietta, Doug Thompson, Zone Mgr.	404-992-6950
IL	Carol Stream, Tom Roberts	312-690-8035
IL	Oak Forest, Dan Misheck, Zone Mgr.	312-687-6690
MA	W. Hanover, Chuck Dare	617-871-0204
MN	Maplewood, George Petrich	612-770-0082
OH	Brownsville, Roy Edgar	216-861-1877
PA	Bensalem, Milton Batley	215-831-9520

Local Distributors

AZ	Tempe, Anjon Entprs.	602-894-1332
CA	Chatsworth, Mil-Com Dist. Inc.	818-998-3111
CA	Mountain View, Energy Sls.	415-969-0800
CA	N. Hollywood, CH & M Entprs.	818-980-7358
CA	San Rafael, Elctrns. Plus	415-457-0466
CO	Englewood, Indl. Elctrns.	303-694-9444
FL	Altamonte Springs, TNR Tech., Inc.	800-346-0601
FL	Ft. Lauderdale, P.A. Intl.	305-566-5799
FL	Hialeah, Pro Battery Specialists	305-944-8800
GA	Decatur, ELS Prods.	800-521-2903,800-334-5066
IL	Downers Grove, Telecomm. Dvcs. (TDI)	800-323-7307,312-971-3460
IL	Rosemont, Advent Elctrns.	312-297-6200
IN	Indianapolis, Advent Elctrns.	317-872-4910
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
MA	Billerica, A. W. Mayer	617-229-2255
MA	Danvers, Generation Elctrns.	617-777-4866
MA	Middleboro, Glynn Elctrns.	617-947-4262
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MN	Minneapolis, D.C. Battery Prods, Inc.	612-721-8547
NM	Albuquerque, Alliance Elctrns.	505-292-3360
NY	Deer Pk., TNR Tech., Inc.	516-242-4800
NY	Rochester, Masline Elctrns.	716-546-5373
NC	Charlotte, Electro Sys., Inc.	704-525-2421
OH	Cincinnati, Schuster Elctrns.	216-425-8134
PA	Bensalem, Avex Elctrns.	215-638-3300
TN	Mt. Juliet, Batteries Unltd.	615-754-8179
TX	Houston, K-Tec (Kent) Elctrns.	713-780-7770
TX	Spring, Battery Pak, Inc.	713-367-9393, 1-800-245-1138
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
VA	Falls Church, Perrott Engrg. Labs, Inc.	703-532-0700
WA	Redmond, Energy Sls. (N.)	206-883-2343

SAFT AMERICA, INC., Portable Battery Division, 711 Industrial Blvd., Valdosta, GA 31601, Tel: 912-247-2331, TELEX: 547-620; Empl.: 1200; *Sls. Mgr.:* R. Bartmes ..... **D•1428, 1483-1490**

Local Sales Offices & Reps

CA	Chatsworth, SAFT America, Inc.	818-998-0626
CA	Granada Hills, SAFT America, Inc.	818-360-1853
CA	Redwood City, SAFT America Inc.	415-365-4539
FL	Boca Raton, SAFT America, Inc.	305-338-7730
GA	Marietta, SAFT America, Inc.	404-992-6950
IL	Carol Stream, SAFT America, Inc.	312-690-8035
IL	Oak Forest, SAFT America, Inc.	312-687-6690
MA	Hanover, SAFT America, Inc.	617-871-0204
MN	Minneapolis, SAFT America, Inc.	612-770-0082
OH	Columbus, SAFT America, Inc.	216-861-1877
PA	Philadelphia, SAFT America, Inc.	215-831-9520

Local Distributors

AZ	Phoenix, Lynntronics	602-433-0288
AZ	Tempe, Anjon Entprs.	602-894-1332
CA	Carlsbad, Energy Concepts	619-942-3144
CA	Chatsworth, Mill Comm. Distrs., Inc.	818-998-3111
CA	Mountain View, Energy Sls.	415-969-0800
CA	N. Hollywood, C.H. & M	818-980-7358
CA	San Rafael, Elctrns. Plus	415-457-0466
CO	Englewood, Industrial Elctrns.	303-694-9444
FL	Altamonte Springs, TNR Tech.	800-346-0601
FL	Hialeah, Pro Battery	305-944-8800
GA	Decatur, ELS Prods.	404-981-2288
IL	Downers Grove, Jabro Batteries	312-964-9358
IL	Downers Grove, Telecomms. Dvcs., Inc.	800-323-7307
MA	Billerica, A. W. Mayer Co., Inc.	800-225-6600
MA	Middleboro, Glynn Elctrns.	617-947-4262
MI	Livonia, R. S. Elctrns.	313-525-1155
MI	Livonia, Vidcom	313-261-9444
MN	Minneapolis, D. C. Battery Prods. Inc,	612-721-8547
NM	Albuquerque, Alliance Elctrns., Inc.	505-292-3360
NY	Deer Park, TNR Tech., Inc.	516-242-4800
NY	Flushing, W & W Assocs.	718-961-2103
NC	Charlotte, Electro Sys., Inc.	704-525-2421
PA	Bensalem, Avex Elctrns. Corp.	800-345-1295
TN	Mt. Juliet, Batteries Unlimited	615-754-8179
TX	Houston, Kent Elctrns.	713-780-7770
TX	Richardson, Kent Elctrns.	214-669-2600
TX	Spring, Battery Pk.	713-367-9393
UT	Salt Lake City, Standard Supp. Co.	800-453-7036
VA	Falls Church, Perrott Engrg. Labs, Inc.	703-532-0700
WA	Redmond, Energy Sls.	206-883-2343

SAGE LABORATORIES, INC., 11 Huron Dr., Natick, MA 01760, Tel: 617-653-0844, TWX: 710-346-0390, FAX: 617-653-5671; FSC No.: 07180; *Sls. Mgr.:* Tony Cieri

SAIA

FAX: 219-262-8819

SAIA INC., Div. of American Electronic Components, 1010 N. Main Street, Elkhart, IN 46514, Tel: 219-262-4418, TELEX: 25-8482 ..... **B•1252-1253, 1660**

SAINT SWITCH, INC., 103 N. 11th Ave.,Box 604, St. Charles, IL 60174, Tel: 312-377-3779, FAX: 312-377-7438; FSC No.: 60198; Empl.: 30

SAMARIUS PRECISION INSTRUMENTS, INC., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418, Tel: 203-735-7405, TWX: 710-451-2495; FSC No.: 18065; Empl.: 90

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FAX: 812-948-5047

SAMTEC, INC., 810 Progress Blvd., P.O. Box 1147, New Albany, IN 47150, Tel: 812-944-6733, TWX: 810-540-6733; FSC No.: 55322; Empl.: 150; *Sls. Mgr.:* Mike Hynes ..... **C•1535-1545**

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CA	Anaheim, Westrep	213-404-3881
CA	Campbell, Kottmeier	408-371-8700
CA	Fallbrook, Gary Chilcote Assocs.	619-728-7678
CO	Boulder, Front Range Mktg.	303-443-4780
FL	Coral Springs, Hal Elec.	305-752-7520
IL	Lisle, W.G. Controls	312-963-5954
IN	Indianapolis, Needler Sls.	317-255-8056
KS	Parker, S. W. Wollard	913-898-6552
MD	Gaithersburg, Naudain Assocs.	301-258-5040
MN	Shorewood, Frank Anthony Mktg.	612-474-2850
MO	St. Louis, S. W. Wollard/Saunders	314-576-4650
NM	Albuquerque, C. T. Carlberg & Assocs.	505-888-3883
NY	Great Neck, CBA Tylinski Assocs.	516-466-9070
NY	Rochester, J. G. Welch	716-244-1100
NC	Raleigh, B. T. Funderburk	919-846-2373
NC	Raleigh, Century Elec.	919-782-2116
OH	Medina, J. C. Hofstetter	216-241-4880
PA	Huntington Valley, Inacker Sls.	215-947-5660
RI	Warwick, Schumacher & Yarrington	401-884-5671
TX	Plano, High Tech Sls.	214-612-0216
UT	Midvale, Front Range Mktg.	801-566-2500
WA	Redmond, Quadra Sls.	206-883-3550
WI	Mequon, Badgerep	414-241-9200
PR	Caguas, K. D. Tronics	809-746-0275
Can	Oakville, Ont., Haltronics	416-844-2121

Local Distributors

AL	Birmingham, Forbes	205-251-4104
AL	Huntsville, Forbes	205-837-1579
AZ	Phoenix, Force Elec.	602-437-1060
CA	Buena Pk., Cypress	714-521-5230
CA	Chatsworth, Milcomm	818-998-3111
CA	San Diego, Cypress	619-292-5613
CA	San Diego, Southland	619-578-6634
CA	Santa Clara, Cypress	408-980-2500
CA	Sunnyvale, Abacus	408-732-2000
CO	Englewood, Indl. Elec., Inc.	303-694-9444
CO	Wheat Ridge, Cypress	303-431-2622
CT	East Haven, J.V. Elec.	203-469-2321
CT	Yatesville, Schaal, Inc.	203-269-3779
FL	Winter Pk., Deanco	305-671-5100
GA	Marietta, Deanco	404-429-0126
IL	Addison, Belford Elec.	312-691-1100
IN	Carmel, Altex	317-848-1323
MD	Gaithersburg, Deanco	301-948-5444
MD	Middletown, Current Comps.	301-473-5333
MA	Burlington, Schaal, Inc.	617-272-1506
MA	Canton, Impact Sls.	617-821-1500
MI	Grand Rapids, Calder Elctrns.	616-698-7400
MN	Hibbing, Minn Tech	218-262-5228
MN	New Brighton, Parts 1	612-633-8079
MO	Kansas City, Elec. Supp.	816-931-0250
MO	St. Louis, Franklin Elec.	314-993-5333
NJ	Fairfield, Deanco	201-575-7960
NM	Albuquerque, Walker Elec.	505-883-2992
NY	Hauppauge, Broadline Elec.	516-231-4100
NY	Ithaca, Deanco	607-257-4444
NC	Raleigh, Century Elec.	919-782-2116
NC	Raleigh, Deanco	919-851-2065
NC	Winston-Salem, Kirkman Elec.	919-722-9131
OH	Cincinnati, Schuster	513-489-1400
OH	Twinsburg, Schuster Elec.	216-425-8134
OR	Tualatin, Moore	503-692-5333
PA	McKean, Advacom	814-476-7774
PA	Norristown, Century Elec.	215-631-5400
TX	Dallas, Cypress	214-869-1435
TX	Stafford, Southwest	713-240-4000
VA	Virginia Bch., Deanco	804-499-3322
WA	Redmond, Priebe Elec.	206-881-2363
WI	Milwaukee, Marsh	414-475-6000
Can	Montreal, Que., Ferro Technique Ltd.	514-341-3450
Can	Scarborough, Ont., Carsten Elctrns. Ltd.	416-495-7705
Can	Surrey, BC, Memco	604-590-1553

S & EI MANUFACTURING, Box 832, Northridge, CA 91324, Tel: 818-349-4111, TWX: 910-493-1252; FSC No.: 24152; Empl.: 65

SANDERS ASSOCIATES, INC., ECBD, A Lockheed Company, 955 Perimeter Rd., Manchester, NH 03108-8500, Tel: 603-645-5548, TWX: 710-220-1845; FSC No.: 31637; Empl.: 760; *Sls. Mgr.:* James Korcuba; *Dist. Mgr.:* James Korcuba

SANDERS ASSOCIATES, INC., A Lockheed Company, EMC Dept., 95 Canal St., Nashua, NH 03061-2004, Tel: 603-885-3602, TELEX: 94-3430, TWX: 710-228-1894, FAX: 603-885-2066; FSC No.: 94117; *Sls. Mgr.:* (EMC) R. Bossart

SANDERS ASSOCIATES, INC., MICROWAVE, 955 Perimeter Rd., Manchester, NH 03108, Tel: 603-645-6000 Ext. 4299, TELEX: 710-220-1845; Empl.: 760; *Sls. Mgr.:* James C. Korcuba

S & H INDUSTRIES, INC.

FAX: 215-822-3417

S & H INDS., 2257 North Penn Rd., Hatfield, PA 19440, Tel: 215-822-7211; Empl.: 50; *Sls. Mgr.:* Frank Picciano ..... **D•1960, 2150**

SAN FERNANDO ELEC. MFG., SFE Technlg.

SANFORD-MILLER CORP., 8 John St., Lynbrook, NY 11563, Tel: 516-593-2025, 800-645-5900; Empl.: 10

SAN FRANCISCO CUSTOM LABEL, 999 Blandford Blvd., Redwood City, CA 94062, Tel: 415-573-6365; Empl.: 27; *Sls. Mgr.:* D. R. Zamzow

SANKEN ELECTRIC CO., LTD., Overseas Operations, 1-22-8 Nishi-Ikebukuro, Toshima-ku, Tokyo, Japan 171, Tel: 03-986-6164, TELEX: 272-2323 SANKEN J; FSC No.: 03-986-8637; Empl.: 4,830; *Sls. Mgr.:* K. Imaizumi; *Dist. Mgr.:* Kerry Ochiai

SAN-O INDUSTRIAL CORP., 85 Orville Dr., Bohemia, NY 11716, Tel: 516-567-5556, TWX: 510-228-7701, FAX: 516-567-5128; Empl.: 50; *Sls. Mgr.:* S. Terry/P. Wernick/A. Konon

SANTA BARBARA RESCH. CTR., 75 Coromar Dr., Goleta, CA 93117, Tel: 805-968-3511, TELEX: 910-334-1885, TWX: Hacsbar; Empl.: 2025; *Sls. Mgr.:* D.K. Smith

SANTA FE TEXTILES, Barcel Wire & Cable, 3151 W. Adams St., Santa Ana, CA 92704-5863, Tel: 714-751-7733, TELEX: 910-595-1959; FSC No.: 31415; Empl.: 20; *Sls. Mgr.:* Mike Ross

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CA	San Diego, Sanyo Energy	619-690-6620
CO	Denver, West Inc.	303-477-8180
FL	Gainesville, Sanyo Energy	904-376-6711
IL	Bensonville, Sanyo Elec., Inc.	312-595-5600
MN	Edina, Hanna-Lind Ltd.	612-925-5700
NJ	Little Ferry, Sanyo Energy	201-641-2333
TX	Austin, Swearingen Sls.	512-339-8663
UT	Centerville, West Inc.	801-295-5544
UT	Salt Lake City, Stand. Supp.	801-486-3371

Local Distributors

CA	Long Bch., Battery Specialists	213-437-1809
CA	San Jose, Powell Elctrns.	408-943-9020
CO	Denver, Car-Go Battery Co.	303-296-8763
MA	Stoughton, Adcour	617-784-8123
NJ	Clifton, Engrd. Assemblies	201-340-0600
NC	Raleigh, Engrd. Assemblies	919-790-9700
NC	Winston-Salem, Progressive Technlgs.	919-761-1375
OR	Aloha, Elctrn. Concepts	503-642-9715
PA	Philadelphia, Powell Elctrns.	215-365-1900
TX	Houston, Kent Elctrns.	713-780-7770
WA	Seattle, Rep West	206-283-8351

SANYO SEMICONDUCTOR CORP., 7 Pearl Ct., Allendale, NJ 07401, Tel: 201-825-8080, TELEX: 135138 SANYOSEMI ALNJ; Empl.: 22; *Sls. Mgr.:* Koichi Takahashi; *Dist. Mgr.:* Aki Goto

SAPHIKON, INC., 51 Powers St., Milford, NH 03055, Tel: 603-673-5831, TELEX: 95-3067, FAX: 603-673-1256; Empl.: 32; *Sls. Mgr.:* Paul Sullivan

SARONIX, 4010 Transport at San Antonio, Palo Alto, CA 94303, Tel: 415-856-6900, TELEX: 348465, FAX: 415-856-4732; FSC No.: 61441; Empl.: 32; *Sls. Mgr.:* Dean Ransom; *Dist. Mgr.:* Dean Ransom ..... **A•1458-1462**

Local Sales Offices & Reps

AL	Huntsville, Electramark, Inc.	205-883-9948
CA	Fallbrook, Gary Chilcote Assocs.	619-728-7678
CA	Irvine, Saronix	714-955-1220
CO	Denver, Lindberg Co.	303-758-9033
FL	Altamonte Springs, Sls. Engrg. Concepts	305-682-4800
FL	Deerfield Beach, Sls. Engrg. Concepts	305-426-4601
FL	St. Petersburg, Sls. Engrg. Concepts Inc.	813-823-6221
GA	Norcross, Electramark, Inc.	404-446-7915
GA	Snellville, J & B Sls., Inc.	404-985-1940
IL	Elk Grove Vl., Parcom, Inc.	312-228-6360
IN	Kokomo, Schillinger Assocs., Inc.	317-455-2708
KS	Kansas City, BC Elctrn. Sls., Inc.	913-342-1211
KS	Wichita, BC Elctrn. Sls., Inc.	316-722-0104
MA	Hingham, Northeast Reps., Inc.	617-749-8700
MI	Jenisen, R. C. Nordstrom & Co.	616-457-5762
MI	Southfield, R. C. Nordstrom & Co.	313-559-7373
MO	St. Louis, BC Elctrn. Sls.	314-521-6683
NV	Reno, Galena Technlg. Grp.	702-786-5030
NJ	Cherry Hill, Trinkle Sls.	609-795-4200
NJ	Englewood, Harold Gray Assocs.	201-894-0894
NM	Albuquerque, Lindberg Co.	505-881-1006
NC	Raleigh, J & B Sls.	919-783-9440
OH	Dayton, J. C. Hofstetter	513-296-1010
OH	Medina, J. C. Hofstetter	216-241-4880
OK	Tulsa, Logic 1	918-494-0765
OR	Beaverton, William J. Purdy Co.	503-641-9373
TX	Austin, Logic 1 Sls.	512-459-1297
TX	Richardson, Logic 1 Sls.	214-234-0765
UT	Salt Lake City, Lindberg Co.	801-277-2643
WA	Redmond, William J. Purdy Co.	206-882-3144
EXP	CA, Palo Alto, SaRonix	415-856-6900
Can	Rexdale, Ont., Bestec Elctrns.	416-674-1330

Local Distributors

CA	Anaheim, Deco Elctrns.	714-630-8252
CA	Manhattan Bch., Prime Electro Prods.	213-379-3642
CA	Manhattan Beach, Prime Electro Prods.	213-379-3642
CA	San Diego, Deco Elctrns.	619-693-1595
CA	San Diego, Southland Comps.	619-578-6630
CA	Sherman Oaks, Delay Line Dists., Inc.	818-986-9455
CA	Sunnyvale, Target Elctrns.	408-734-5611
CO	Englewood, Indl. Elctrns.	303-694-9444
IL	Palantine, Technlg. Sls. Inc.	312-991-6600
IN	Indianapolis, MAR Elctrns., Inc.	317-633-6699
KS	Overaland Pk., Chelsea Inds.	913-362-1923
MD	Columbia, Aztech Elctrns., Inc.	301-995-6800
MI	Livonia, Chelsea Elctrns./RS	313-525-1155
MO	Maryland Hgts., Chelsea Elctrns./Olive	314-426-4500
NH	Atkinson, Astrum Elctrns., Inc.	603-898-3399
NJ	Camden, General Radio Supp. Co.	609-964-8383
NJ	Whippany, ADI	201-428-0510
NY	Hauppauge, Chelsea Elctrns./Fairmont	516-231-3313
NY	Mt. Vernon, QAR	914-699-2224
NY	Stonybrook, Dove Elctrn. Comps.	516-689-7733
NC	Raleigh, Sager/Service Plus	919-850-9550
OR	Portland, Radar Elec. Co.	503-232-3404
PA	McKean, Advacom, Inc.	814-476-7774
TX	Richardson, Ewing Elctrns., Inc.	214-231-6725
UT	Salt Lake City, Standard Supp.	801-486-3371
WA	Seattle, Radar Elec. Co.	206-282-2511
WI	Milwaukee, Technlg. Sls. Inc.	414-786-5015
Can	Downsview, Ont., Westburne Elctrns.	416-635-2980

SAVOY ELECTRONICS, P.O. Box 5727, Ft. Lauderdale, FL 33310, Tel: 305-563-1333, 800-327-1282, FAX: 305-563-1378; FSC No.: 13075; Empl.: 50; *Sls. Mgr.:* J. Marlowe

SAWTEK INC., P.O. Box 609501, Orlando, FL 32860-9501, Tel: 407-886-8860, TELEX: 514083, TWX: 810-862-0835; FSC No.: 58068; Empl.: 150 ..... **A•1463**

Local Sales Offices & Reps

AL	Huntsville, L & D, Inc.	205-837-1469
AZ	Scottsdale, Faser Tech. Sls.	602-948-4404
CA	Los Altos, Cain-White & Co.	415-948-6533
CA	Van Nuys, R-L Assocs.	818-782-7826
FL	Maitland, D. J. Ellis & Assocs.	305-645-1101
GA	Atlanta, L & D	404-395-7079
IL	Elk Grove Vl., Oasis Sls. Corp.	312-640-1850
IN	Ft. Wayne, J & B Engrg. Sls. Co.	219-483-2813
KS	Overland Park, Barnes-Midwest Sls.	913-469-9688
MD	Burtonsville, Eastern Instr. Corp.	301-384-8500
NH	Merrimack, John Callahan Assoc., Inc.	603-424-5700
NJ	Clarksburg, Micro-Lambda	609-259-0400
NY	Buffalo, Quality Comps.	716-837-5430
NY	Manlius, Quality Comps.	315-682-8885
NY	New Rochelle, Robert Diamond, Inc.	914-632-2828
NC	Greensboro, L & D Inc.	919-292-3201

NC Raleigh, L & D Inc. 919-876-5301
TX Richardson, Vector Sls. 214-234-4291
WA Bellevue, Cain-White & Co. 206-462-2118
WI Brookfield, Oasis Sls. Corp. 414-782-6660

SAXTON WIRE AND CABLE, 215 N. Rte. 303, Congers, NY 10920, Tel: 914-268-6848, 800-431-2774, 800-872-9866, FAX: 914-268-7542; FSC No.: 16164; Empl.: 75; *Sls. Mgr.:* Bill Cullen

SAYLOR ELECTRONICS INT'L, INC., 1824 Calash Dr., Carson City, NV 89701, Tel: 702-883-4184; Empl.: 4

SCANBE
UNIT OF ZERO CORPORATION

FAX: 818-444-3953

SCANBE, Unit of Zero Corporation, 3445 Fletcher Ave., El Monte, CA 91731, Tel: 818-579-2300, TWX: 910-587-3437; Empl.: 125; *Sls. Mgr.:* Frank Cooper/Gary Smith; *Dist. Mgr.:* Annamrie Trunco ..... **C•1091**

Local Sales Offices & Reps

AZ Phoenix, Holder Hauer 602-242-4025
CA Concord, Qualtech North 415-680-1800
CA Corona, Assocd. Rep Network 714-371-6280
CA Orange, Qualtech South 714-639-9820
CA San Diego, Mesa Engrg. 619-278-8021
CA Sunnyvale, Qualtech North 408-732-4800
CA Thousand Oaks, Qualtech South 805-495-7100
CO Denver, Holder Hauer 303-427-3443
CT Stamford, Tech Applications Assocs. 203-327-2934
FL Casselberry, Dyne-A-Mark 407-629-5557
FL Clearwater, Dyne-A-Mark 813-441-4702
FL Ft. Lauderdale, Dyne-A-Mark 305-771-6501
GA Norcross, Mtn. Electro Prods., Inc. 404-448-5594
IL Elk Grove Village, Control Sls. 312-595-2110
KS Lenexa, Midtec 913-541-0505
MD Rockville, Spectro 301-294-9770
MA Westborough, Tech. Applications Assocs. 617-366-9781
MI Grosse Pt. Pk., Greiner Assocs. 313-499-0188
MN Edina, Micro Resources 612-830-1454
MO St. Louis, Midtec 314-275-8666
NJ Springfield, Gebhardt Mktg. 201-376-4415
NM Albuquerque, Nelco Electronix 505-293-1399
NM Albuquerque, S & S Technlgs. 505-255-5599
NC Wake Forest, Mtn. Electro Prods. 919-556-7103
OH Richfield, Geotronix 216-659-6100
OH Trotwood, Geotronix 513-252-6700
OK Stillwater, Acudata 405-743-1886
OR Beaverton, Thorson Co. 503-644-5900
PA Allison Pk., Monument Tech. 412-487-1770
PA Jenkintown, Monument Tech. 215-884-3737
TX Austin, Acudata 512-478-1018
TX Houston, Acudata 713-580-2451
TX Plano, Acudata 214-424-3567
UT Salt Lake City, Holder Hauer 801-532-2111
WA Bellevue, Thorson Co. 206-455-9180
WA Lynnwood, Blair Hirsh Co., Inc. 206-774-8151
WI Thiensville, Control Sys. 414-242-4580

Local Distributors

AZ Phoenix, Cetec 602-272-7951
CA Fountain Valley, Comps. Ctr. 714-979-0433
CA San Jose, Rose Elctrns. 408-263-9700
CA South Gate, Cetec 213-773-6521
CO Englewood, Hall-Mark 303-790-1662
CT Bethel, Heilind Elctrns. 203-797-8600
CT East Haven, J.V. Elctrns. 203-469-2321
FL Orlando, Hall-Mark Elctrns. 305-855-4020
FL Pompano Bch., Hall-Mark Elctrns. 305-971-9280
IL Wooddland, Hall-Mark Elctrns. 312-860-3800
IN Indianapolis, Advent Elctrns. 317-872-4910
KS Lenexa, Hall-Mark Elctrns. 913-888-4747
MD Columbia, Hall-Mark Elctrns. 301-988-9800
MD Jessup, Treeko Sls. 301-470-3300
MA Newton, Greene-Shaw 617-969-8900
MA Wilmington, Heilind Elctrns. 617-657-4870
MI Livonia, R.S. Elctrns. 313-525-1155
MN Eden Prairie, Hall-Mark Elctrns. 612-941-2600
MN Minneapolis, Indl. Comps. 612-831-2666
MO Earth City, Hall-Mark Elctrns. 314-291-5350
MO St. Louis, Olive Elctrns. 314-426-4500
NJ Cranford, Garden State Elctrns. 201-272-6400
NM Albuquerque, International Elctrns. 505-345-8127
NY Bohemia, Car-Lac Elctrns. 516-567-4200
NY Buffalo, Summit Elctrns. 716-887-2800
NY Lynbrook, Peerless Radio 516-593-2121
NY Rochester, Summit Elctrns. 716-334-8110
NC Raleigh, Hall-Mark Elctrns. 919-872-0712
OH Solon, Hall-Mark Elctrns. 216-349-4632
OR Beaverton, Rose Elec. Distr. Co. 503-629-9288
PA Essington, Tri-Com 215-521-3080
TX Austin, Hall-Mark Elctrns. 512-258-8848
TX Dallas, Hall-Mark Elctrns. 214-553-4300
TX Dallas, International Elctrns. 214-233-9323
TX Houston, Hall-Mark Elctrns. 713-781-6100
WA Seattle, R.V. Weatherford 206-575-1340
WI Milwaukee, Marsh Elctrns. 414-475-6000

SCANNING DEVICES, INC., 108 Elm St., Waltham, MA 02154, Tel: 617-891-8991; Empl.: 12; *Sls. Mgr.:* David Chanoux

SCHAEVITZ ENGINEERING, U.S. 130, Union Ave., Pennsauken, NJ 08110, Tel: 609-662-8000, TWX: 710-892-0714; FSC No.: 93190; Empl.: 325; *Sls. Mgr.:* Charles Gaver

SCHAFFNER EMC, INC., Components Division, 825 Lehigh Avenue, Union, NJ 07083, Tel: 201-851-0644, 800-367-5566, TELEX: 685-3444, FAX: 201-467-1330; *Sls. Mgr.:* Ken Schnitzer ..... **A•1691**

Local Sales Offices & Reps

AL Huntsville, Elctrn. Mfrs. Agts. 205-830-4030
AZ Tucson, Clemick & Assocs. 602-744-4003
CA Los Angeles, Universal Comps. 213-641-4255
CA Palo Alto, Mollard Mktg. 415-961-0456
CO Denver, Delltron Co. 303-373-0300
FL Orlando, Honey Co. 305-299-1000
GA Roswell, Elctrn. Mfrs. Agt. 404-992-7240
IL Highland Pk., Bransky Sls. 312-433-2375
IN Indianapolis, Mktg. Engrs. Inc. 317-872-5665
MD Randallstown, Beacon North 703-478-2480
MA Millis, Selmark Assocs. 617-376-2914
MI Holland, Com-Tek Sls. 616-399-7273
MN Mendota Hgts., G-II Sls. 612-454-3086
MO Hazelwood, Jim Moore & Assocs. 314-731-2240
NJ Clifton, R.O.I. Sls. 201-340-1515
NJ Marlton, BGR Assocs. 609-483-1020
NY Rochester, H. C. Johnson Agys. 716-586-0777
NC Charlotte, Elctrn. Mfrs. Agts. 704-365-0547
OH Cleveland, Comps. Inc. 216-243-9200
OR Portland, Harry Levinson Co. 503-245-1902
TX Dallas, D.J. Sls. 214-783-8876
VA Sterling, Beacon North 703-478-2480
WA Seattle, Harry Levinson Co. 206-382-1300

Local Distributors

AZ Tempe, Acacia/VWR Elec. 602-894-2874
CA Buena Pk., Cypress Elctrns. 213-744-0355
CA Gardena, Cal Switch 213-770-2330
CA Irvine, Acacia/VWR Elec. 714-666-0834
CA Manhattan Bch., Prime Electro Prods. 213-379-3642
CA San Diego, Acacia/VWR Elctrns. 619-565-4365
CA San Diego, Cypress Elctrns. 619-535-0011
CA San Diego, Southland Comps. 619-578-6630
CA San Jose, Rose Elctrns. 408-263-9700
CA Santa Clara, Cypress Elctrns. 408-980-2500
CA Sunnyvale, Acacia/VWR Elec. 408-745-7200
CO Lakewood, Acacia/VWR Elctrns. 303-232-2882
CT Bridgeport, Millenium Sls. 203-372-2037
IL Schaumburg, QPS Elctrns. 312-884-6620
MD Columbia, D.K. Elctrns. 301-621-5775
MA Canton, Impact Sls. 617-821-1500
MA Framingham, Now Elctrns. 617-872-5816
MI Grand Rapids, RM Elctrns. 616-531-9300
MN New Brighton, Chris Elctrns. 612-631-2647
MO St. Charles, Finnigan Elctrns. 314-946-6201
NV Rancho Cordova, Acacia/VWR Elctrns. 916-638-1861
NJ Kenilworth, Federated Purchasers 201-272-0505
NJ Moorestown, Marlac 609-234-4200
NJ Parsippany, Fabe Electro Sls. 201-299-1123
NY Rochester, Masline Elctrns. 716-546-5373
NY Ronkonkoma, Baldwin Comps. 516-588-5700
PA McKean, Advacom 814-476-7774
TX Plano, Tactic Elctrns. 214-422-0777
TX Richardson, Comp. Tech. Corp. 214-437-2211
WA Seattle, Kam Elctrns. 206-382-1300
WI Racine, Badger Elctrns. 414-637-1256

SCHAFFNER

FAX: 201-467-1330

SCHAFFNER EMC, INC., Instr. Div., 825 Lehigh Avenue, Union, NJ 07083, Tel: 201-851-0644, 800-367-5566, TELEX: 685-3444; *Sls. Mgr.:* Albert A. Chiaravallo ..... **D•1319**

Local Sales Offices & Reps

AL Sci. Dvcs., S.E. 205-536-1969
AZ Odyssey I 602-246-8846
CA (North), Microwave Meas. 415-846-0377
CA (South), Advanced Prods. Sls. 818-706-8351
CO Odyssey I 303-773-8176
DC Electra Tech 703-670-6962
FL Sci. Dvcs., S.E. 305-841-8180
GA Sci. Dvcs., S.E. 404-979-7971
IL Loren F. Green/Cen. 312-593-0282
IN Carter, McCormick & Peirce 317-244-1685
KY Carter, McCormick & Peirce 513-836-0951
MD Electra-Tech 301-877-0344
MA Intersell 617-273-3844
MI Carter, McCormick & Peirce 313-477-7700
MN Loren F. Green/Minn. 612-571-6666
MS Sci. Dvcs., S.E. 904-651-4407
NJ (South), Robert Meyers Assocs. 215-224-1663
NM Odyssey I 505-265-6645
NY (Metro), Bytec 516-781-7400
NY (State), Labtronics 315-455-7314
NC Sci. Dvcs., S.E. 919-765-5776
OH Carter, McCormick & Peirce 216-779-5100
OK Jim Wisdom & Assocs. 918-665-8899
OR Syntek 503-636-6793
PA Roebert Meyers Assocs. 215-224-1663
TX Jim Wisdom & Assocs. 214-470-9093
UT Odyssey I 801-531-1216
VA (North), Electra-Tech 703-670-6962
VA (South), Electra-Tech 804-834-2417
WA Syntek 206-488-0394
WV Carter, McCormick & Peirce 412-733-7490
Can (East), Amos, Mitchell & Assocs. 416-584-2238
Can (West), Jerome & Francis Co. 604-986-1286

SCHAUER MANUFACTURING, 4500 Alpine Ave., Cincinnati, OH 45242, Tel: 513-791-3030, TELEX: 21-4576; Empl.: 195; *Sls. Mgr.:* A. A. Groenewold; *Dist. Mgr.:* Dan Shaw

SCHLAGE ELECTRONICS, 5452 Betsy Ross Drive, Santa Clara, CA 95054-1102, Tel: 408-727-5170, FAX: 408-727-6707; Empl.: 200

SCHLUMBERGER INSTRUMENTS, Schlumberger Technologies, 20 North Avenue, Burlington, MA 01803, Tel: 617-229-4825, ESYLNK: 5106007263, FAX: 914-592-9328; FSC No.: 1T316; Empl.: 44; *Sls. Mgr.:* John Jansen

SCHONSTEDT INSTRUMENT CO., 1775 Wiehle Ave., Reston, VA 22090, Tel: 703-471-1050, TWX: 710-833-9880; Empl.: 45

SCHOTT CORP., 1000 Parkers Lk. Rd., Wayzata, MN 55391, Tel: 612-475-1173, TWX: 910-576-2964; FSC No.: 80023; Empl.: 325; *Sls. Mgr.:* A. Schmitt

SCHOTT ELECTRONICS, 42 Silvermine Road, Seymour, CT 06483, Tel: 203-881-0102, TWX: 710-451-8911, FAX: 203-881-0098; Empl.: 150; *Sls. Mgr.:* Ross Wieringa

SCHOTT GLASS TECHNOLOGIES, INC., 400 York Ave., Duryea, PA 18642, Tel: 717-457-7485, TWX: 510-671-4535; FSC No.: 23-169-1403; Empl.: 500; *Sls. Mgr.:* Josef Nimmerfroh

SCHRACK NORTH AMERICA CORP., 1995 Pond Rd., Ronkonkoma, NY 11779-7209, Tel: 516-737-0099, TELEX: 646149, FAX: 516-737-2550; Empl.: 10; *Sls. Mgr.:* John Walsh; *Dist. Mgr.:* James Amor ..... **B•1578-1584**

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AL Huntsville, DHR Mktg. 205-533-5165
AZ Glendale, Aspen Power 602-931-9289

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CO Boulder, Stratford Grp. 303-530-3194
FL Tampa, Florida Comps. 813-960-7044
GA Atlanta, DHR Mktg. 404-451-9848
IL Wheaton, Chadra-Schilke & Assocs. .. 312-653-8126
IN Indianapolis, C.C. Elctrns. 317-255-1508
KS Shawnee Mission, Microtronics (K&M) 913-262-1444
MA Waltham, Gerber Sls. 617-890-3334
MN Roseville, TLC 612-483-2226
MO St. Charles, Microtronics 314-946-8500
NJ Lawrenceville, DVS Co. 609-896-1112
NJ Westwood, Jarms 201-666-9390
NY Syracuse, PI Tronics 315-455-7346
NC Raleigh, DHR 919-781-1961
SC Greenville, DHR Mktg. 803-235-3594
TX Irving, Kite Elctrns. 214-986-0321
VA Richmond, DHR Mktg. 804-359-8803
WA Seattle, Krebs & Assocs. 206-285-8015
Can St. Laurent, Electromatic Comps. Ltd. 514-337-1104

Local Distributors

CA Buena Park, Ford Elctrns. 714-521-8080
CA Santa Monica, Distributor Specialist ... 213-393-9666
CT Hartford, Wes-Garde/Switch Controls 203-527-7705
CT New Haven, Hatry Elctrns. 203-755-1181
FL Lakeland, West-Garde/Swich Controls 813-644-7564
GA Norcross, Wholesale Ind. Elec., Inc. ... 404-447-8431
IL Carol Stream, Lectro Comps. 312-690-0520
IL Crystal Lake, Sub Sem, Inc. 815-459-4139
IA Boise, Bolen's Control House 208-375-3070
MD Gaithersburg, Axis Elctrns. 301-840-9640
MA Andover, Aved Elctrns. 617-657-8310
MA Wilmington, Standard Elctrns. 617-658-5050
MI Troy, Empire Elctrns. 313-585-8130
MN New Brighton, Chris Elctrns. 612-631-2647
NJ Oakland, Relay Specialties 201-337-1000
NY Buffalo, Summit Elctrns. 716-334-8110
NY New Rochelle, Derf Elctrns. 914-235-4600
OH Cincinnati, Schuster Distrs. 216-425-8134
OR Portland, O-Four Controls 503-231-8058
PA Redding, R.A.M. Motor Control 215-376-7102
SC Spartanburg, Harley's Elctrns. 803-582-7961
TX Dallas, Off The Shelf Comps. 214-247-0052
TX Garland, Industrial Equip. 214-271-5494
UT Salt Lake City, Ballard Supp. 801-972-2430
WA Seattle, Radar Elec. Co., Inc. 206-282-2511
WI Cedarburg, Lake-View Elctrns. Corp. .. 414-377-8250

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Local Sales Offices & Reps

AL Huntsville, 20th Century Mktg., Inc. 205-933-9281
AZ Scottsdale, Luscombe Engr. 602-949-9333
CA Los Gatos, Luscombe Engrg. 408-370-2020
CA Pasadena, Luscombe Engr. 213-684-2000
CA San Diego, Luscombe Engr. 619-549-9699
CO Longmont, Luscombe Engrg. 303-772-3342
FL Altamont Springs, Carter Assocs. 305-671-6800
GA Norcross, 20th Century Mktg., Inc. 404-446-1999
IL Hillside, Cadre Tech. Rep. 312-449-3900
IA Marion, MSB Assocs. 319-377-6261
KS Roeland Park, MSB Assocs. 913-432-2131
MD Columbia, Delta III Assocs. 301-730-0790
MI Troy, C. B. Jensen 313-643-0506
MN Minneapolis, D. A. Case Assoc. 612-869-3700
MO St. Charles, MSB Assocs. 314-946-5577
NH Salem, Sales Engr. 603-893-5521
NJ Englewood, Sprung-Nussbaum 201-569-5666
NY Clifton Park, Bastian Sls. 518-452-2026
NY E. Syracuse, Bastian Sls. 315-437-1482
NY Fairport, Bastian Sls. 716-223-0237
NC Cary, 20th Century Mktg., Inc. 919-481-3370
OH Aurora, EMA 216-562-6104
OH Centerville, EMA 513-433-2800
OR Tigard, Elctrn. Comps. Sls. 503-245-2342
PA Huntington Valley, Omega Elctrn. Sls. 215-947-4135
TN Knoxville, 20th Century Mktg., Inc. 615-966-2099
TX Austin, CMZ 512-255-1663
TX Garland, CMZ 214-681-1414
WA Mercer Island, Elctrn. Comp. Sls. 206-232-9301

SCHROFF UK LTD., Maylands Ave., Hemel Hempstead, Herts, England HP2 4SG, Tel: 0442-40471/6, TELEX: 825658; FSC No.: 0442 3508; *Sls. Mgr.:* Mr. B. U. Kaupisch; *Dist. Mgr.:* Mr. K. G. Reynolds

SCHURTER, INC., 1016 Clegg Ct., Petaluma, CA 94952, Tel: 707-778-6311, TELEX: 176-084; FSC No.: 61935; *Sls. Mgr.:* Bruno H. Schurter ... **A•1692-1693; C•1546-1548**

Local Sales Offices & Reps

AL Athens, Effective Mktg. Force 205-233-2947
AZ Scottsdale, Elctrns. Tech. Sls. Assocs., Inc. 602-941-9137
CA Fullerton, Gru Assocs. 714-738-0903
CA Moraga, Ruppert Sls. & Engrg. 415-376-8040
CA San Jose, Ruppert Sls. & Engrg. 408-998-8717
CO Lakewood, Cristee-Meade Co. 303-232-0287
FL Pompano, IMR, Inc. 305-942-2449
GA Lawrenceville, Effective Mktg. Force .. 404-925-2060
GA Lithia Springs, Effective Mktg. Force .. 404-948-4209
IL Arlington Hgts., MJ Petersen & Assoc., Ltd. 312-577-8200
IN Carmel, Newton & Assocs. 317-848-2016
IN Indianapolis, CC Elctrn. Sls. 317-255-1508
MN Minnetonka, Frank Anthony Mktg. 612-934-0773
MS Jackson, Doby Assocs. 601-981-1138
NH Nashua, Bell Controls 603-882-6984
NJ Ho-Ho-Kus, D. J. Fisher Co. 201-652-0090
NJ Medford, Champion Elctrn. Sls. Co. 609-983-0932
NY Fairport, TAC Sls, Inc. 716-425-1070
NC Lillington, Effective Mktg. Force 919-893-9650
OH Beachwood, Electronic Salesmasters 216-831-9555
OR Portland, Westmark 503-641-8780
TN Memphis, Doby Assocs. 901-763-5730
TX Dallas, Reese & Assocs. 214-351-0703
WA Seattle, Westmark 206-281-4025

Local Distributors

CA Scotts Valley, Quail Elctrns. 408-438-6126
CA Sunnyvale, Target Elctrns., Inc. 408-734-5611
IL Elk Grove Village, Nu-Way Elctrn. Distrbs. Inc. 312-437-7120
MD Rockville, FIC Corp. 800-638-6594
MA Wilmington, JV ELctrns. 617-657-6523
OH Strongsville, Fuse World 216-238-1330
OR Tualatin, Moore Elctrns., Inc. 503-692-5333
TX Dallas, Fuses, Inc. 214-341-6407
Can Markham, Ont., Birde Mktg. 416-477-7722

S≈≈≈F

SCHUSTER ELECTRONICS, 8 Beattie Court, Huntington, NY 11530, Tel: 516-271-0590; *Sls. Mgr.:* Max Schuster

SCIENCE ACCESSORIES CORP., 970 Kings Hwy. W., Southport, CT 06490, Tel: 203-255-1526, TELEX: 964300 SAC SPRT, FAX: 203-254-7271; Empl.: 40; *Sls. Mgr.:* H. A. Cleveland

SCIENCE/ELECTRONICS, P. O. Box 986, Dayton, OH 45401-0986, Tel: 513-228-6011, FAX: 513-228-3353; Empl.: 25; *Sls. Mgr.:* E. E. Pohl; *Dist. Mgr.:* J. Tanksley

SCIENTECH, INC., 5649 Arapahoe Ave., Boulder, CO 80303, Tel: 303-444-1361, 800-525-0522, TWX: 910-940-0994; Empl.: 57

SCIENTIFIC-ATLANTA, INC., See Optima Enclosures

SCIENTIFIC COLUMBUS, INC., Esterline Corporation, 1900 Arlingate Lane, Columbus, OH 43223, Tel: 614-274-0400, TELEX: 245-426, FAX: 614-272-2288; *Sls. Mgr.:* Donald M. Yore

SCIENTIFIC COMMUNICATIONS, INC., 3425 Kingsley Rd., Garland, TX 75041, Tel: 214-271-3685, TWX: 910-860-5172; *Sls. Mgr.:* Donald G. Luiken

SCIENTIFIC RESEARCH CORP., See TRAK Microwave Corp.

SCIENTIFIC SYSTEMS, INC., One Alewife Pl., 35 Cambridge Pk., Cambridge, MA 02140, Tel: 617-661-6364, TELEX: 928201, FAX: 617-661-6253; FSC No.: 2N787; Empl.: 63; *Sls. Mgr.:* Ralph Hawes, VP Sls. & Mktg.

SCIENTIFIC TECHNOLOGIES, Optical Sensor Div. Inc., 31069 Genstar Rd., Hayward, CA 94544, Tel: 415-471-9717, TELEX: 34-5506, FAX: 415-471-9752; Empl.: 100

SCITEQ ELECTRONICS, INC., 8401 Aero Dr., San Diego, CA 92123, Tel: 619-292-0500, TELEX: 882008, FAX: 619-292-9120; FSC No.: 70561; Empl.: 35; *Sls. Mgr.:* Phil Feinberg

SCOPE INCORPORATED, 1860 Michael Faraday Dr., Reston, VA 22090, Tel: 703-471-5600, TWX: 710-883-1178; Empl.: 260; *Sls. Mgr.:* Richard Gizzie

SCREEN DATA CORP., 80 S. Jefferson Rd., Whippany, NJ 07981, Tel: 201-887-7713, 800-248-1212, TELEX: 710-387-209; *Sls. Mgr.:* Michael A. Kling

SC TECHNOLOGY, INC., 2450 Armstrong St., Livermore, CA 94550, Tel: 415-373-9230, FAX: 415-373-9416; *Sls. Mgr.:* Susan L. Karl

SCREENPRINT DOW, See Dow Switch, Div. of Screenprint Dow

SEABOARD ELECTRONICS, 70 Church St., New Rochelle, NY 10805, Tel: 914-235-8073, TELEX: 646289; Empl.: 40; *Sls. Mgr.:* Bernie Klempner; *Dist. Mgr.:* Dr. Richard Ader

SEAC INDUSTRIES, INC., 8237 Hermitage, Richmond, VA 23228, Tel: 804-262-3698

SEACOR INC.

FAX: 201-664-8544

SEACOR, INC., 123 Woodland Ave, Westwood, NJ 07675, Tel: 201-666-5600; Empl.: 45 ..... **A•1171**

Local Sales Offices & Reps

CT Beacon Falls, KSA of England 203-756-8040
IL Rolling Meadows, Heartland Tech. Mktg. 312-577-9222
MA Sudbury, KSA of New England 617-443-5881
MN St. Paul, The Johnsony Co. 612-641-1878
NY Rochester, Upstate Engrg. Sls. 716-225-2383
NY Westwood, Jarms Elctrns. 201-666-9390
NC New Hill, Tom Santel Assocs. 919-362-4091
OH Powell, Val-Skol Sls. 614-889-0174
OH Willoughby, Val-Skol Sls. 216-942-6021
OK Tulsa, Encore Technlg. Co. 918-665-3562
PA King of Prussia, Freedman-Malta Assocs. 215-337-9211
SC Mauldin, Carl Hart Assocs. 803-288-2323
TX Richardson, Encore Technlg. Co. 214-669-0232
TX Round Rock, Encore Technlg. Co. 512-388-7930
WI Brookfield, Heartland Tech. Mktg. 414-796-1128

Local Distributors

CA Garden Grove, Natl. Cap. Supp. 714-892-7744
CA San Jose, Compass Comps. 408-432-7575
CT Wallingford, Mid-State Elctrns. 203-265-9900
FL Ft. Lauderdale, Brothers Elec. 305-561-6700
FL Ft. Lauderdale, NRC Elctrns. 305-772-4500
IL Bensenville, Voyager Elec. 312-860-1300
IL Schaumburg, Q.P.S. 312-884-6620
MA Burlington, T.L.C. 617-273-0140
MA Burlington, TLC 617-273-0140
MA Framingham, Now Elctrns. 617-235-9501
MA N. Chelmsford, Pilgrim Elec. 617-454-9889
MA Needham, Cronin 617-449-5000
MN Eitzen, Capacitor Assocs. 507-495-3130
MN Fridley, Voyager Elctrns. 612-571-7766
NH Hudson, T.N.T. 603-880-8300
NJ E. Brunswick, Brothers Elctrns. 201-238-2200
NY Farmingdale, Pride Elctrns. 516-293-4020
NY Hauppauge, Jaco Elctrns. 516-273-5500
NY Melville, S.A.I. 516-293-2710
NY Ronkonkoma, Spectrum Comp. 516-737-6900
TX Dallas, Off-the-Shelf Comps. 214-238-0808
TX Ft. Worth, C & W Supp. 817-831-0395
TX Richardson, G.T.T. Elctrns. 214-234-1555
WA Seattle, Vesco Elctrns. 206-575-3607

SEA DATA, INC., One Bridge St., Newton, MA 02158, Tel: 617-244-8191, TELEX: 951107; Empl.: 30; *Sls. Mgr.:* D. Crouse

SEALECTRO-BICC ELECTRONICS, 40 Lindeman Dr., Trumbull, CT 06611, Tel: 203-372-4118, TELEX: 71-425-501, FAX: 203-372-6224; FSC No.: 98291; Empl.: 1600; *Sls. Mgr.:* P. Tynan, Dir. Dist. Sls.; *Dist. Mgr.:* P. Tynan, Dist. Sls. Mgr.

SEALTRON, INC., 9705 Reading Road, Cincinnati, OH 45215, Tel: 513-733-8400, TELEX: 62872030, FAX: 513-733-0131; Empl.: 120; *Sls. Mgr.:* James Dawson

SEASTROM MANUFACTURING CO., INC., 701 Sonora Ave., Glendale, CA 91201, Tel: 213-245-9121, TWX: 910-497-2271, FAX: 818-246-6803; FSC No.: 86926; Empl.: 75; *Sls. Mgr.:* Bob Seastrom

SECTOR MICROWAVE IND. INC., 999 Grand Blvd., Deer Park, NY 11729, Tel: 516-242-2300, TWX: 510-227-6075; Empl.: 40; *Sls. Mgr.:* Victor Nelson

SECOINSA/DIGI POWER, 686 E. Gish Rd., San Jose, CA 95112, Tel: 408-288-5600, TELEX: 910-338-0579; Empl.: 90; *Sls. Mgr.:* Ron Murphy; *Dist. Mgr.:* Ron Murphy

SECURITY PLASTICS, INC., 14427 N.W. 60th Ave., Miami Lakes, FL 33014, Tel: 305-823-5440, FAX: 305-557-1431; Empl.: 400; *Sls. Mgr.:* Nelson Rodriguez

SEEQ TECHNOLOGY, 1849 Fortune Dr., San Jose, CA 95131, Tel: 408-432-9550, TELEX: 296609, TWX: 9103382313, FAX: 408-432-9549; Empl.: 400; *Sls. Mgr.:* Phil Ortiz, V.P. Sls.; *Dist. Mgr.:* Carolyn Troland

SEIKO INSTRUMENTS

FAX: 213-517-7792

SEIKO INSTRUMENTS U.S.A., INC., 2990 W. Lomita Blvd., Torrance, CA 90505, Tel: 213-517-7770; *Sls. Mgr.:* John Hawkins, Lee Guio; *Dist. Mgr.:* Lee Guio, John Hawkins ..... **A•1464, 1753; B•1085; D•1102**

Local Sales Offices & Reps

AL	Huntsville, Electro-Mech	205-880-0592
AZ	Scottsdale, Fred Board Assocs.	602-994-9388
AZ	Tucson, Fred Board Assocs.	602-299-1508
CA	Irvine, Groh Assoc.	714-837-9871, 619-696-0054
CA	San Diego, Groh Assocs.	619-453-7572
CA	San Jose, Exis, Inc.	408-287-6680
CO	Lakewood, Candal, Inc.	303-935-7128
CT	Madison, Focus Elctrn. Sls.	203-245-4314
FL	Plantation, Gallagher & Assocs.	305-473-2101
GA	Norcross, Electro-Mech	404-447-6478
IL	Elk Grove Village, TriStar Grp., Inc.	312-593-0200
IN	Greenwood, Valentine & Assocs.	317-888-2260
IN	South Bend, Valentine & Assocs.	219-233-1779
IA	Cedar Rapids, J.R. Sls. Engrg., Inc.	319-393-2232
KS	Overland Park, Kebco	913-541-8431
KS	Wichita, Kebco	316-733-1301
MD	Middleton, S. T. Woolard Co.	301-371-4500
MA	Taunton, Focus Elctrns.	617-824-3840
MI	Grosse Pointe Pk., Greiner Assoc.	313-499-0188
MN	Eden Prairie, High Tech	612-944-7274
MO	St. Louis, Kebco	314-576-4111
NJ	Manville, DynoRep, Inc.	201-685-1851
NM	Albuquerque, Fred Board Assocs.	505-888-1121
NC	Raleigh, Electo-Mech	919-790-9300
OH	Brunswick, J. N. Bailey & Assocs.	216-273-3798
OH	Columbus, J. N. Bailey & Assocs.	614-262-7274
OH	New Lebanon, J. N. Bailey & Assocs.	513-687-1325
OR	Tigard, Elctrn. Comp. Sls.	503-245-2342
TN	Jonesboro, Electro-Mech	615-753-2964
TX	Austin, TL Mktg.	512-453-4586
TX	Dallas, TL Mktg.	214-484-6800
TX	Houston, TL Mktg. Inc.	713-589-2763
UT	Salt Lake City, Aspen Sls.	801-467-2401
WA	Mercer Island, Elctrn. Comps. Sls.	206-232-9301
WA	Spokane, Elctrn. Comp. Sls.	509-456-0100
WI	Brookfield, TriStar Grp., Inc.	414-782-2670
Can	Burnaby, B.C., Tech-Trek, Ltd.	604-439-1373
Can	Mississauga, Ont., Tech-Trek, Ltd.	416-238-0366
Can	Nepean, Ont., Tech-Trek Ltd.	613-726-9562
Can	Richmond, B.C., Tech-Trek, Ltd.	604-271-2764
Can	Ville St. Laurent, Tech-Trek, Ltd.	514-337-7540

Local Distributors

AZ	Phoenix, Sterling Elctrns.	602-268-2121
CA	Agoura Hills, Pacesetter Elctrns.	818-991-3984
CA	Anaheim, Pacesetter Elctrns. USA	714-779-5855
CA	Benicia, Paragon Sys.	707-746-5950
CA	Irvine, OBI	714-250-9003
CA	Mountain View, I/O Sls.	415-968-1080
CA	Reseda, Jan Dvcs.	818-708-1100
CA	San Diego, Added Value Elctrns.	619-278-1990
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	San Jose, Merit Elctrns.	408-434-0800
CA	Sunnyvale, Pacesetter Elctrns. USA	408-734-5470
CA	Tustin, Added Value Elctrns.	714-259-8258
CO	Englewood, Sterling Elctrns.	303-796-7338
CT	Wallingford, Sager Elctrns.	203-265-6865
CT	Wallingford, Sterling Elctrns.	203-265-9535
FL	Tampa, Lectro Distrs.	813-960-1631
ID	Boise, Radar Elec.	208-336-2227
IL	Elk Grove Vl, RM Elctrns.	312-358-0300
IL	Northbrook, Classic Comps.	312-272-9650
IN	Indianapolis, RM Elctrns.	317-291-7110
IA	Cedar Rapids, Dee Elctrns., Inc.	319-365-7551
KS	Overland Park, Sterling Elctrns.	913-236-5589
MD	Middletown, Current Comps.	301-473-5333
MA	Hingham, Sager Elctrns.	617-749-6700
MA	Norwood, Emtel	617-769-9500
MA	Woburn, Sterling Elctrns.	617-938-6200
MI	Grand Rapids, RM Elctrns.	616-531-9300
MN	Minneapolis, Aerospace Computer Supps.	612-884-4725
NH	Salem, Sager Elctrns.	603-898-1348
NJ	S. Plainfield, Sterling Elctrns.	201-769-7000
NJ	Sparta, Instrs. & Equip.	201-729-4293
NM	Albuquerque, Sterling Elctrns.	505-884-1905
NY	E. Syracuse, Add Elctrns.	315-437-0300
NY	Hauppauge, Sager Elctrns.	516-348-1300
NY	Mt. Vernon, QAR	914-699-2224
NY	Victor, ADD Elctrns.	716-924-4760
NC	Raleigh, Sager/Svc. Plus Elctrns.	919-850-9550
OH	Cincinnati, Schuster	513-489-1400
OK	Tulsa, Sterling Elctrns.	918-663-2410
OR	Portland, Radar Elec.	503-232-3404
OR	Tualatin, Moore Elctrns.	503-692-5333
PA	Exton, VSH Elctrns.	215-363-2250
PA	Pittsburgh, CAM/RPC	412-782-3770
TX	Austin, Sterling Elctrns.	512-836-1341
TX	Dallas, Sterling Elctrns.	214-243-1600
TX	Houston, Sterling Elctrns.	713-627-9800
VA	Sterling, Sterling Elctrns.	703-450-2373
WA	Richland, Radar Elec.	509-943-8336
WA	Seattle, Radar Elec.	206-282-2511
WA	Spokane, Radar Elec.	509-747-3053
WI	New Berlin, Classic Comps.	414-786-5300
CO	Wheatridge, Added Value Elctrns.	303-422-1701
Can	Burnaby, B.C., ITT/RAE Multicomps.	604-291-8866
Can	Concord, Ont., ITT Multicomps.	416-736-1144
Can	Downsview, Westburne Indl. Entprs.	416-635-2980
Can	Markham, Semad Div. DEW Elctrns.	416-475-8500

SEIKO INSTRUMENTS U.S.A., INC., Robotics/Automation Div., 2990 W. Lomita Blvd., Torrance, CA 90505, Tel: 213-517-7863, FAX: 213-517-7792

SEKAI ELECTRONICS OF AMERICA, INC., 14700 E. Firestone Blvd., Suite 122, La Mirada, CA 90638, Tel: 714-670-1854, TELEX: 882756, FAX: 714-670-1855; FSC No.: 8V398; Empl.: 6; *Sls. Mgr.:* Larry Klementowski

selco

FAX: 714-739-1507

SELCO PRODUCTS CO., SEL Sales, Inc., 7580 Stage Rd., Buena Park, CA 90621, Tel: 714-521-8673, TELEX: 65-5457; Empl.: 18; *Sls. Mgr.:* Bill Wilkinson; *Dist. Mgr.:* Bill Keneipp ..... **B•1867; C•1636; D•1394**

Local Sales Offices & Reps

CA	Arcadia, HMC, Inc.	818-447-0958
CA	La Mesa, Summit Sls.	619-697-0646
CA	Sunnyvale, Pass Assocs.	408-735-9040
IL	Elk Grove Vl, Parcom Inc.	312-228-6360
MA	Andover, Crawford Assocs.	617-470-2122
NJ	Watchung, Dolan Assocs.	201-753-2671
OR	Beaverton, Luscombe Engrg.	503-636-6664
PA	Hatboro, J. S. Wurts Co.	215-674-3562
UT	Salt Lake city, Sage Assocs.	801-467-5451
WA	Bellevue, Luscombe Engrg.	206-223-1541

Local Distributors

CA	Arcadia, Parco	818-447-0958
IL	Wheeling, Hawk Elctrns.	312-459-4091
MA	Andover, Crawford Assocs.	617-470-2122
NJ	Watchung, Dolan Sls.	201-753-2671
NY	New York City, Martin Audio/Video	212-541-5900

SEL-REX DIV., OMI Intl. Corp., 75 River Rd., Nutley, NJ 07110, Tel: 201-667-5200, TELEX: 133-320, TWX: 710-989-1423; Empl.: 250; *Sls. Mgr.:* Larry Price

SEMICOA, 333 McCormick Ave., Costa Mesa, CA 92626, Tel: 714-979-1900, TELEX: 678-315, TWX: 910-595-1961, FAX: 714-557-4541; FSC No.: 34156; Empl.: 85; *Sls. Mgr.:* M. Gregson

SEMICON COMPONENTS, INC., Div. of Semicon, Inc., 10 North Ave., Burlington, MA 01803, Tel: 617-272-9015, TWX: 710-332-1919; Empl.: 300; *Sls. Mgr.:* Jack Lawrence

SPM
SPM

FAX: 914-698-5386

SEMICONDUCTOR PACKAGING MATERIALS CO., 431 Fayette Ave., Mamaroneck, NY 10543, Tel: 914-698-5353, ESYLNK: 910-380-9209 ..... **C•1122**

Local Sales Offices & Reps

AZ	Tempe, Spectrum Assoc., S.W.	602-966-1788
CA	Anaheim, California Tech Svcs.	714-630-8470
CA	Santa Clara, California Tech. Svcs.	408-496-1155
CO	Fort Collins, Rep Sls., Inc.	303-226-1504,
CT	Southington, Libby Assocs.	203-747-5601
FL	Pompano Beach, J. P. Elctrn. Sls.	305-782-6830
IL	Downers Grove, Physics Equip.	312-960-4054
NC	Raleigh, Spears & Assocs.	919-846-9711,
PA	Franconia, Scharas Assocs.	215-582-0450
TX	Dallas, Dallas Indl. Sls.	214-669-2608
WA	Bellevue, Mars	206-747-3292

SEMICONDUCTOR TECHNOLOGY, INC., 3131 S.E. Jay St., Stuart, FL 34997, Tel: 305-283-4500, TWX: 510-953-7511, FAX: 305-286-8914; FSC No.: 50891; Empl.: 45

Local Sales Offices & Reps

AL	Huntsville, Micro Sls. Inc.	205-881-0001
AZ	Scottsdale, Fred Board Assocs.	602-994-9388
CA	Costa Mesa, Solid State Sls.	714-650-8414
CA	Mountain View, Leddy Assocs.	415-969-6313
CO	Englewood, Comp. Sls.	303-779-8060
CT	Guilford, Bay Colony	203-453-5424
FL	Altamonte Springs, APM Assoc.	305-869-6831
FL	Ft. Lauderdale, APM Assoc.	305-565-0056
FL	Tampa, APM Assoc.	813-886-2457
GA	Marietta, Micro Sls. Inc.	404-971-3037
IL	Downers Grove, Splon Assocs.	312-665-5993
IN	Fort Wayne, Scott Elect.	219-484-7865

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IA Cedar Rapids, Lorenz Sls. 319-377-4666
KS Overland Pk, Lorenz Sls. 913-649-5556
MD Towson, Arbotek 301-825-0775
MA Westboro, Bay Colony 617-870-1930
MI Plymouth, Leading Edge Sls. 313-420-3344
MN Minneapolis, Bill Deming & Assocs. ... 612-888-5000
MO Bridgeton, Lorenz Sls. 314-298-8585
NE Lincoln, Lorenz Sls. 402-475-4660
NJ Hasbrouck Heights, Comp Tech Sls. .. 201-288-7400
NM Albuquerque, Q. A. Elctrns. 505-888-1121
NY New Hyde Park, Comp Tech Sls. 516-593-2628
NY Syracuse, Electra Sls. 315-463-1248
NC Raleigh, Micro Sls. Inc. 919-881-0007
OH Cincinnati, Scott Elect. 513-791-2513
OH Cleveland, Scott Elect. 216-473-5050
OH Dayton, Scott Elect. 513-294-0539
OH Reynoldsburg, Scott Elctrns. 614-863-1281
OH Vandalia, Cleary Sls. 513-890-8642
OR Portland, IVC Inc. 503-297-3364
PA Paoli, Stitzer Assocs. 215-644-5500
TX Dallas, M-Rep 214-484-5711
UT Salt Lake City, Component Sls. 801-268-8440

SEMIKRON, INC., 11E Executive Dr., P.O. Box 66, Hudson, NH 03051-0066, Tel: 603-883-8102, 1-800-258-1308, TELEX: 6711011, FAX: 603-883-8021; FSC No.: 58687; Empl.: 60; *Sls. Mgr.:* Frank Haase; *Dist. Mgr.:* Bruce Sessler

SEMTECH, 652 Mitchell Rd., Newbury Park, CA 91320, Tel: 805-498-2111, TWX: 910-336-1264; FSC No.: 14099;Multiple; Empl.: 200; *Sls. Mgr.:* John Pennant-Jones; *Dist. Mgr.:* John Pennant-Jones

SEMTRONICS CORP., 211 Prospect Pk, P.O. Box 2248, Peachtree City, GA 30269, Tel: 404-487-6681, TELEX: 8107662244, FAX: 404-487-1128; Empl.: 30; *Sls. Mgr.:* Gregory Galaida

SENCORE, 3200 Sencore Dr., Sioux Falls, SD 57107, Tel: 605-339-0100, 800-843-3338, TWX: 910-660-0300, FAX: 605-335-6379; FSC No.: 33347; Empl.: 250; *Sls. Mgr.:* Doug Bowden

SENSITEK CORPORATION, See Biddle Instruments

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SENSITIVE RESEARCH INSTRUMENTS, 25 Dock St., Mt. Vernon, NY 10550, Tel: 914-699-9717; FSC No.: 32590;16034A; Empl.: 35 ..... **D•1320-1321**

Local Sales Offices & Reps
AZ Scottsdale, Williams Assocs. 602-947-4297
CO Commerce City, Williams Assocs. 303-289-5647
DC Washington, Whitcomb Assocs. 202-737-0763
IL Lincolnwood, Saffro & Assocs. 312-677-9720
KS Shawnee Mission, Comtel - Midwest .. 913-268-0762
MD Baltimore, Whitcomb Assocs. 301-889-1245
MA Lexington, Zieco 617-861-8300
MI Southfield, Comtel Instrs. Co. 313-358-2505
MN Minneapolis, Hei-Lite Sls. 612-861-6051
MO St. Louis, Comtel - Midwest 314-991-5363
NM Albuquerque, Williams Assocs. 505-255-1638
NY Mount Vernon, Elctrl. Instr. Svc. 914-699-9717
OH Cleveland, Comtel Instrs. Co. 216-442-8080
OH Dayton, Comtel Instrs. Co. 513-426-5310
OH Hilliard, Comtel Instrs. Co. 614-876-8305
OK Tulsa, Data Mktg. Assocs. 918-494-2711
PA Pittsburgh, Comtel Instrs. Co. 412-922-5720
TX Austin, Data Mktg. Assocs. 512-443-7722
TX Dallas, Data Mktg. Assocs. 214-661-0300
TX Houston, Data Mktg. Assocs. 713-780-2511
TX San Antonio, Data Mktg. Assocs. 512-342-3031
UT Salt Lake City, Williams Assocs. 801-532-7701
WI Lake Mills, Saffro & Assocs. 414-648-2605

SENSORAY, 44106 Old Warm Springs Blvd., Fremont, CA 94538, Tel: 415-657-7290; Empl.: 5; *Sls. Mgr.:* Karen Reeves

SENSOR CORP., Box 140, Scottdale, PA 15683, Tel: 412-887-4080; Empl.: 6

Sensor Scientific, inc.

FAX: 201-227-8063

SENSOR SCIENTIFIC, INC., 1275 Bloomfield Ave., Fairfield, NJ 07006, Tel: 201-227-7790, 800-524-1610, TWX: 910-240-3313; Empl.: 60; *Sls. Mgr.:* Carol Dunbar ..... **B•1868-1869**

Local Sales Offices & Reps
CA Irvine, Vale Elctrn. Assoc. 714-551-4004
CA San Diego, Vale Elctrns. 619-693-0113
CA Saratoga, Mead Advantage 408-741-5300
CA Van Nuys, Vale Elctrns. 818-705-0283
CO Ft. Collins, Rep. Sls. 303-226-1504
CT Hartford, Sturgeon Co. 203-249-7800
FL Hollywood, Askland Elctrn. Corp. 305-987-1074
IL Des Plaines, ESCO Assocs. 312-298-5310
MA Needham, Sturgeon Co. 617-444-6603
NJ Wayne, Breen Assocs. 201-696-8683
NY E. Syracuse, Bastian Sls. Agy. 315-437-1482
NY Fairport, Bastian Sls. Agy. 716-223-0237
NY Port Crane, Bastian Sls. Agy. 607-772-3421
NY Roslyn Hts., November Elctrn. Sls. 516-621-6378
TX Dallas, Allied Comps. Inc. 214-238-0408
TX Houston, Allied Comps. Inc. 713-988-1600

SENSOR SYSTEMS, INC., 8929 Fullbright Ave., Chatsworth, CA 91311, Tel: 818-341-5366, TELEX: 69-1583; *Sls. Mgr.:* E. Schneider

SENSOR TECHN., 21012 Lassen St., Chatsworth, CA 91311, Tel: 213-882-4100, TWX: 910-494-4776; Empl.: 350; *Sls. Mgr.:* Robert Bryden

SENSOTEC, INC., 1200 Chesapeake Ave., Columbus, OH 43212, Tel: 614-486-7723, TWX: 810-482-1188; FSC No.: 29927; *Sls. Mgr.:* Jack Feil ..... **B•1918-1920**

Local Sales Offices & Reps
AL Birmingham, Sesco, Inc. 205-988-8304
AZ Sun City, Hannah-Hill, Inc. 602-933-4623
CA Carlsbad, FLW, Inc. 619-434-5251
CA Costa Mesa, FLW, Inc. 714-751-7512
CA Hayward, FLW, Inc. 415-786-9070
CA Van Nuys, FLW, Inc. 818-989-5236
CO Broomfield, Hannah-Hill, Inc. 303-460-0602
CT Wallingford, Pat Jenks Assocs. 203-265-9939
FL St. Petersburg, Sesco, Inc. 813-576-6991
GA Atlanta, Sesco, Inc. 404-458-6423
IL Chicago, Comtel Midwest Corp. 312-539-4838
IN Indianapolis, Comtel Midwest Corp. ... 317-253-1681
IA Cedar Rapids, Comtel Midwest Corp. 319-377-9434
KS Overland Pk, Advanced Indl. Sys. 913-432-8065
LA Baton Rouge, Sesco, Inc. 504-926-4951
MD Rockville, Farrell Assocs. 301-424-9460
MA Woburn, Pat Jenks Assocs. 617-938-0488
MI Southfield, Comtel Instrs. 313-358-2505
MN Wayzata, Comtel Midwest Corp. 612-476-1551
MO Ellisville, Advanced Indl. Sys. 314-391-0366
NJ Elizabeth, Instrmn. Prods. Inc. 201-351-1155
NY Williamsville, Maxwell Bennett Assocs. 716-634-2107
NC Cary, Sesco, Inc. 919-467-7482
OH Cleveland, Comtel Instrs. 216-442-8080
OH Columbus, Comtel Instrs. 614-876-8305
OH Dayton, Comtel Instrs. 513-426-5310
OK Tulsa, Sesco, Inc. 918-622-3868
PA Frazer, FLW, Inc. 215-251-9700
PA Pittsburgh, Comtel Instrs. 412-922-5720
SC Greenville, Sesco, Inc. 803-297-8306
TN Knoxville, Sesco, Inc. 615-588-5455
TX Austin, Sesco, Inc. 512-892-2490
TX Dallas, Sesco, Inc. 214-231-9364
TX Houston, Sesco, Inc. 713-999-3510
TX Plano, Sesco, Inc. 214-867-8880
WA Bellevue, Showalter Instrs. 206-746-7970
WA Richland, Showalter Instrs. 509-943-5288
WI New Berlin, Comtel Midwest Corp. 414-544-6042

SENSYM, INC., 1255 Reamwood Ave., Sunnyvale, CA 94089, Tel: 408-744-1500, TELEX: 176376, FAX: 408-734-0407; FSC No.: 67234; Empl.: 150; *Sls. Mgr.:* Fred James; *Dist. Mgr.:* Tom Johnson

SENTRY MANUFACTURING, Crystal Park, Chickasha, OK 73018, Tel: 405-224-6780; Empl.: 30; *Sls. Mgr.:* Barbara Maberry

SEQUENTIAL INFORMATION SYSTEMS INC., 249 N. Saw Mill River Rd., Elmsford, NY 10523, Tel: 914-592-5930, TWX: 710-567-1212, FAX: 914-592-6014; Empl.: 85; *Sls. Mgr.:* Murray E. Vinarub

SERCO

FAX: 818-331-8584

SERCO PRODUCTS DIVISION, Serco Mold, 612 Commercial Ave., Covina, CA 91723, Tel: 818-331-0517, 800-843-8172(Calif.); Empl.: 45; *Sls. Mgr.:* Neil Reckon ..... **C•1094-1095**

Local Sales Offices & Reps
CA Corta Madera, Paul O'Neal & Assocs. 415-924-1691,408-778-2599
CA Covina, Serco Prods. 818-331-0517
CA Valencia, Lessing & Assocs. 805-295-0225
GA Norcross, Hollingsworth & Still, Inc. ... 404-447-1700
IL Cary, Ellinger Sls. Corp. 312-639-1850
MA Waltham, Gerber Sls. Corp. 617-890-3334
MI Farmington Hills, A. B. Friedman Sls. Co. 313-851-0659
NY Pt. Washington, Ashtec, Inc. 516-767-0336
TX Richardson, R. F. Kimball Co., Inc. 214-231-3447
Can Ontario, Avotronics Ltd. 416-475-2024

Local Distributors
AL Montgomery, Handley's Elctrn. Ctr. Inc. 205-262-4885
AZ Phoenix, Capital Elctrns. 602-252-5897
AZ Phoenix, Elctrn. Distrs. 602-955-8303
AZ Phoenix, Elctrn. Emporium Inc. 602-437-8633
AZ Tucson, Electronic City 602-622-1173
CA Canoga Park, Sandy's Elctrns. 818-346-0510
CA Costa Mesa, Mar Vac Elctrns. 714-650-2001
CA Fremont, Fry's Elctrns. 415-683-8969
CA Fullerton, RF Elctrns. 714-447-1133
CA Goleta, DOW Elctrns. 805-968-7272
CA Hawiian Gardens, DOW Elctrns. 213-421-3786
CA Hollywood, Pacific Radio Exchange ... 213-462-1393
CA Inglewood, Inglewood Elctrns. 213-674-2366
CA Oxnard, DOW Elctrns. 805-486-6353
CA Pasadena, DOW Elctrns. 818-793-1195
CA Pomona, DOW Elctrns. 818-966-8461
CA Sacramento, Mar Vac California Radio 916-922-6531
CA San Jose, Quement Elctrns. 408-998-5900
CA Santa Clara, Comps. Ctr. 408-988-3751
CA Santa Maria, Elctrn. Parts Supermart .. 805-925-8604
CA Sunnyvale, Fry's Elctrns. 408-733-1770
CT Wallingford, Midstate Elctrns. 203-265-9900
FL Delray Bch., Fastbolt FL Corp. 305-272-3100, 800-233-5036
FL Largo, Applied Specialties of FL Inc. .. 800-722-4599
FL Tampa, Sunnex Elctrn. Supp. Inc. 813-885-4074
GA Norcross, Whls. Indl. Elctrns. Inc. 404-447-8431, 800-282-1857
IL S. Holland, Union Elctrn. Distrs. 312-333-4100, 800-648-6657
MA Lynn, Land Elctrns. Inc. 617-592-2220
MA Waltham, Atlantic Comps. 617-890-3334
MI Detroit, Elctrn. Parts Co. 313-891-7400
MN S. Minneapolis, Tor Tec Corp. 612-866-3661
NY Hempstead, Davis Elctrns. 516-483-9200
NC Durham, Southeastern Elctrns. 919-638-8204
NC Greensboro, Guilford Elctrn. Supp. Inc. 919-275-1385
NC Raleigh, Southeastern Elctrns. 919-828-2311
NC Winston-Salem, Elctrn. Distrbg. Inc. ... 919-723-1097
TN Clarksville, Randolph, Hale & Matthews Inc. 615-647-2325
WI Fond du Lac, Fedco Elctrns. Inc. 414-922-6490
WI Milwaukee, Marsh Elctrns. Inc. 414-475-6000

SERIAL LAB PRODS., INC., 162 Cook Lane, P.O. Box 766, Marlboro, MA 01752, Tel: 617-481-1684, TELEX: 955318 Attn: SERIAL LAB; Empl.: 12; *Sls. Mgr.:* R. L. Wiedeman; *Dist. Mgr.:* D. Kreck

SERMETEL, 155 Limerick Rd., Limerick, PA 19468, Tel: 215-948-5100, TELEX: 84-6335, TWX: 710-637-1263; Empl.: 177; *Sls. Mgr.:* Luke McLaughlin

SERVO-TEK®

FAX: 201-427-4249

SERVO-TEK PRODUCTS CO., 1086 Goffle Rd., Hawthorne, NJ 07506, Tel: 201-427-3100, TELEX: 130273; Empl.: 60; *Sls. Mgr.:* T. J. Daly ..... **B•1254**

SETRA SYSTEMS, INC., 45 Nagog Park, Acton, MA 01720, Tel: 508-263-1400, 1-800-25-SETRA, TELEX: 4430243, FAX: 508-264-0292; FSC No.: 53367; Empl.: 95; *Sls. Mgr.:* Ed Cope ..... **B•1922-1923**

Local Sales Offices & Reps

AL	Huntsville, Burnette Techno Metrics	205-830-2832
AK	Anchorage, Unit Process	907-561-5600
CA	Concord, QCon, Inc.	415-682-2020
CA	Los Angeles, Dynasales Co.	213-268-1175
CO	Westminster, RMS Sls.	303-429-1111
FL	Orlando, Datarep	305-843-5224
GA	Atlanta, Craft Assocs.	404-256-0420
HI	Honolulu, Unit Process	808-488-7625
IL	Wheaton, Ray Knitter Assocs., Inc.	312-690-6363
IN	Ft. Wayne, Domino, Inc.	219-456-5512
LA	Metairie, Slaton & Assocs., Inc.	504-455-3855
MD	Columbia, Stein Instrs.	301-596-3748
MA	Framingham, J. M. Lancaster Co.	617-875-8893
MI	Hazel Park, Tiby Co.	313-547-3550
MN	Plymouth, Data Elctrns.	612-559-1434
MO	St. Louis, Adelphi, Inc.	314-821-1232
MT	Billings, Unit Process	406-252-0455
NJ	Cedar Grove, KLS Assocs.	201-785-4450
NM	Albuquerque, TMA, Inc.	505-345-8921
NY	E. Rochester, A & D Dvcs.	716-385-2778
NY	Sydney, A&D Dvcs.	607-563-8488
OH	Cleveland, Tiby Co.	216-371-5335
OH	Dayton, Tiby Co.	513-277-3822
OK	Tulsa, Inotek Corp.	918-627-1500
OR	Portland, Unit Process	503-227-5264
PA	Cheltenham, Stein Instrm.	215-379-1990
TX	Dallas, Inotek Corp.	214-243-7000
TX	Houston, Inotek Corp.	713-688-7000
WA	Kirkland, Unit Process	206-827-0433
Can	Ont., B. H. McGregor	416-677-1431

SEVEN MOUNTAINS SCI. INC., P.O. Box 650, Boalsburg, PA 16827, Tel: 814-466-6559; Empl.: 4; *Sls. Mgr.:* Josephine Chesworth

SFERNICE, INC.

FAX: 303-242-5917

SFERNICE, INC., 461 North 22nd Street, Grand Junction, CO 81502, Tel: 303-242-0810; FSC No.: 05347; *Sls. Mgr.:* G. W. (Jerry) Krebill; *Dist. Mgr.:* Danny Jagirdar ..... **A•1848, 2020-2030, 2099; B•1870-1871**

Local Sales Offices & Reps

AZ	Tempe, Semper Fi Sls., Inc.	602-730-9553
CA	Chatsworth, WCV Raltech	818-700-0933
CA	Del Mar, Chapman & Chapman	619-755-0412
CA	Glendale, Mission Mktg. Grp.	818-247-9110
CA	Santa Clara, I-Square, Inc.	408-988-3400
CO	Denver, West, Inc.	303-477-8180
CT	Bloomfield, F.S.I.	203-243-3122
FL	St. Petersburg, J.C.J. Assocs.	813-343-2679
IL	Downers Grove, Richmar Elctrns. Corp.	312-968-0118
IN	Ft. Wayne, Denton Mktg., Inc.	219-486-0665
IA	Hiawatha, Ard Sls.	319-393-6392
MA	Glouchester, F.S.I.	617-281-3864
MI	Jackson, T.P.S. & Assocs.	517-783-1722
MN	Plymouth, Dunlop Consits.	612-544-1070
NJ	Piscataway, R. P. Luce & Co.	201-752-8750
NY	Chappaqua, Micrel, Inc.	914-238-4961
NY	New Hyde Pk., R. P. Luce & Co.	516-437-4550
NY	Rochester, Fritz Dasson	716-338-1699
OH	Wooster, T.P.S. & Assocs.	216-264-0971
PA	Wynnewood, Metz-Benham Assocs., Inc.	215-896-7300
UT	Salt Lake City, West, Inc.	801-292-8787
WA	Bellevue, Olson Tech. Sls. Corp.	206-883-7792
WI	Butler, Richmar Elctrns. Corp.	414-781-1730
Can	Mississauga, Ont., Source Elctrns., Ltd.	416-676-0830

Local Distributors

CA	Chatsworth, Petell/Passive Comps.	818-341-1743
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	Westlake Vl, Distel, Inc.	805-495-9998
CA	Yorba Linda, Zeus Comps.	714-921-9000
CO	Denver, Integrated Elctrns.	303-292-6121
CT	Meriden, Jaco Elctrns.	203-235-1422
FL	Tampa, Impala Elctrns.	813-885-4747
IL	Hoffman Estates, Integrated Elctrns.	312-843-2040
MD	Columbia, Aztech Elctrns.	301-995-6800
MA	Burlington, TLC Comps.	617-273-0140
MN	St. Paul, Shelley-Ragon	612-648-2828
NJ	Clifotn, J-Mar Elctrns.	201-772-6400
NY	Bohemia, Justin Elctrns.	516-589-4000
NY	Cicero, Andco Elctrns.	315-699-2660
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Portchester, Zeus Comps.	914-937-7400
NY	Whippany, American Dists.	201-428-0510
OH	Cincinnati, Eclipse of Ohio	513-661-7733
OH	Dayton, Televox, Inc.	513-454-1225
OR	Beaverton, Integrated Elctrns.	503-641-1690
TX	Richardson, Jaco, Inc.	214-235-9575
TX	Richardson, Zeus Comps.	214-783-7010
UT	N. Salt Lake City, Integrated Elctrns.	801-298-1869
VT	Rutland, SAI, Inc.	802-775-7126
WA	Bellevue, Integrated Elctrns.	206-455-2727

SFE TECHNOLOGIES, 1501 1st St, San Fernando, CA 91340, Tel: 818-365-9411, TWX: 910-496-1535, FAX: 818-365-5117; FSC No.: 96733; Empl.: 2000; *Sls. Mgr.:* Joe Lucia

S. F. PRODUCTS CORPORATION, P. O. Box 369, Southport, CT 06490, Tel: 203-929-6180; Empl.: 8; *Sls. Mgr.:* Norman W. Johanson; *Dist. Mgr.:* R. S. Johanson

SGS-ATES SEMICONDUCTOR CORP., 240 Bear Hill Rd, Waltham, MA 02154, Tel: 617-890-6688, TELEX: 923495; Empl.: 9000

SGS SEMICONDUCTOR CORPORATION, 1000 E. Bell Road, Phoenix, AZ 85022, Tel: 602-867-6100, TELEX: 249976,667479(Western Union), TWX: 910-950-4654; FSC No.: 7X328; Empl.: 200; *Sls. Mgr.:* Tony Santoni; *Dist. Mgr.:* Jim Nord

Shallco

FAX: 919-934-3298

SHALLCO, INC., Box 1089, Smithfield, NC 27577, Tel: 919-934-3135; Empl.: 40; *Sls. Mgr.:* M. D. Sutton ..... **B•1788-1793**

Local Sales Offices & Reps

CA	Irvine, Groh Assocs.	714-837-9871
CA	Santa Clara, Fischer Assocs.	408-733-7350
FL	Melbourne, Reynolds & Assocs., Inc.	305-259-7000
IN	Fort Wayne, J & B Engrg. Sls. Co.	219-483-2813
IA	Cedar Rapids, S & O Sls.	319-363-7323
MD	Towson, Holden Engrg. Sls.	301-823-3763
MA	Norwood, MPS Elctrn.	617-769-8700
MN	Minneapolis, R-J Inc.	612-866-3661
NY	E. Rockaway, HLJ	516-599-2999
NY	Manhattan, Lothar Sanford Corp.	212-757-3881
NY	Pittsford, D. Hurley Sls.	716-586-6159
OH	Englewood, Allen Nace Co.	513-836-0931
OR	Portland, Comp. Technlg., Inc.	503-292-1518
PA	King of Prussia, Freedman-Malta Assocs.	215-337-9211
TX	Dallas, Oeler & Menelaides, Inc.	214-361-8876

Local Distributors

FL	Jacksonville, Southeast Elctrns.	904-356-3007
OH	Cincinnati, United Radio	513-761-4030
TN	Bristol, Broadcast Equip. & Supp.	615-878-2531
TX	Dallas, Wholesale Elctrns.	214-824-3001
Can	Montreal, Que., Braydon Electro	514-332-5650

SHALLTRONIX CORP., Preston St., P.O. Box 235, Selma, NC 27576, Tel: 919-965-6346; FSC No.: 58258; *Sls. Mgr.:* Joe Deans ..... **D•1322**

Local Sales Offices & Reps

TX	Arlington, Electronic Prod. Reps.	817-467-0377

SHAPE MAGNETRONICS, INC., 901 DuPage Ave., Lombard, IL 60148, Tel: 312-620-8394, TWX: 910-991-2352, FAX: 312-620-0784; Empl.: 110; *Sls. Mgr.:* Judy M. Madden; *Dist. Mgr.:* Judy M. Madden

SHAPIRO SCIENTIFIC INST., 3500 E. Coast Hwy., Corona del Mar, CA 92625, Tel: 714-675-1024; Empl.: 7

SHARP, Microelectronics Div., Display Grp., Sharp Plaza, Mahwah, NJ 07430, Tel: 201-529-8757, TELEX: 71 134327, FAX: 201-529-8759 ..... **B•1086-1091**

Local Sales Offices & Reps

AL	Huntsville, Interep Assocs.	205-533-1730
AL	Mobile, Interep Assocs.	205-478-1036
AZ	Scottsdale, Thorson Desert State, Inc. (TDSI)	602-998-2442
CA	Newport Bch., Plustronics	714-476-8009
CA	San Diego, Mesa Comps.	619-278-8021
CA	Santa Clara, Quorum Tech. Sls.	408-0812
CA	Sherman Oaks, Plustronics	818-995-8908
CO	Denver, Seale & Assocs., Inc.	303-756-8855
CT	Southington, Orion/DSA Grp.	203-621-8371
FL	Boca Raton, Lawrence Assocs.	407-368-7373
FL	Casselberry, Lawrence Assocs.	305-830-6174
FL	Oldsmar, Lawrence Assocs.	813-787-2773
GA	Norcross, Interep Assocs.	407-449-8680
IL	Des Plaines, Electron Mktg.	312-298-2330
IN	Indianapolis, STB & Assocs.	317-844-9227
KS	Wichita, Baka Corp.	316-682-8411
MD	Linthicum, Advanced Technlg. Sls., Inc.	301-789-9360
MA	Marlborough, Orion/DSA Grp.	617-480-0516
MA	Wakefield, Orion/DSA Grp.	617-245-5220
MI	Grand Rapids, DEM Sls., Inc.	616-364-4024
MI	St. Clair Shores, DEM Sls. Inc.	313-777-1750
MN	Minneapolis, Cornstrand	612-788-9234
MO	Creve Coeur, Baka Corp.	314-878-4224
NJ	Allendale, Eastec Assocs.	201-934-7135
NJ	W. Berlin, QED Elctrns.	609-346-9254
NY	Pittsford, Noeth-Honsinger	716-586-9002
NC	Raleigh, Zucker Assocs.	919-782-8433
OH	Dayton, Five Star Elctrns., Inc.	513-299-1718
OH	Solon, Five Star Elctrns., Inc.	216-349-1611
OR	Beaverton, Blair Hirsh	503-641-1875
PA	Spring House, QED Elctrns., Inc.	215-643-9200
TN	Greenville, Interep Assocs.	615-639-3491
TX	Austin, Impaq Sls. Co.	512-474-1125
TX	Carrollton, Impaq Sls. Co.	214-247-3300
TX	Houston, Impaq Sls. Co.	713-820-0288
WA	Lynwood, Blair Hirsh	206-774-8151
WI	Waukesha, Blair Hirsh	414-547-1505
Can	Mississauga, Ont., Hi-Tech Sls. Co., Ltd.	416-672-0284
Can	Montreal, Que., Hi-Tech Sls.	514-386-4728
Can	Surrey, B.C., Enerlec Sls.	604-888-1667

Local Distributors

AL	Huntsville, Marshall	205-881-9235
AZ	Phoenix, Marshall	602-496-0290
CA	Del Mar, Added Value	619-792-0257
CA	Irvine, Marshall	714-458-5394
CA	Los Angeles, Marshall	818-407-4150
CA	Orange, Milgray	203-795-0711
CA	Orange, Western Micro	714-637-0200
CA	Sacramento, Marshall	916-635-9700
CA	San Diego, Marshall	619-578-9606
CA	San Diego, Western Micro	619-453-8430
CA	San Francisco, Marshall	408-943-4600

CA Saratoga, Western Micro 408-725-1660
CA Tustin, Added Value 714-259-8258
CO Denver, Marshall 303-451-8444
CO Wheat Ridge, Added Value 303-422-1701
CT Wallingford, Marshall 203-265-3822
DC Washington, Milgray 301-621-8169
FL Ft. Lauderdale, Marshall 305-977-4880
FL Orlando, Marshall 305-767-8585
FL Tampa, Marshall 813-573-1399
FL Winter Pk., Milgray 305-647-5747
GA Atlanta, Marshall 404-923-5750
GA Atlanta, Milgray 404-393-9666
IL Chicago, Marshall 312-490-0755
IL Chicago, Milgray 312-350-0490
IN Indianapolis, Marshall 317-297-0483
KS Kansas City, Marshall 913-492-3121
KS Kansas City, Milgray 913-236-8800
KS Wichita, Marshall 316-264-6333
MD Baltimore, Milgray 301-995-6169
MD Gaithersburg, Marshall 301-840-0228
MA Boston, Marshall 617-658-0810
MA Burlington, Milgray 617-657-5900
MA Burlington, Western Micro 617-273-2800
MI Livonia, Marshall 313-525-5850
MN Minneapolis, Marshall 612-559-2255
MO St. Louis, Marshall 314-291-4650
NJ Fairfield, Marshall 201-882-0169
NJ Marlton, Milgray 609-983-5010
NY Farmingdale, Milgray 516-391-3000
NY Hauppauge, Marshall 516-273-1515
NY Johnson City, Marshall 607-798-1611
NY Pittsford, Milgray 716-235-0830
NY Rochester, Marshall 716-235-7620
NC Raleigh, Marshall 919-876-7383
OH Cleveland, Marshall 216-248-1788
OH Cleveland, Milgray 216-447-1520
OH Columbus, Marshall 614-891-7580
OH Dayton, Marshall 513-898-4480
OR Beaverton, Western Micro 503-629-2082
OR Portland, Marshall 503-643-5555
PA Philadelphia, Marshall 609-778-8720
PA Pittsburgh, Marshall 412-963-0441
TX Austin, Added Value 512-459-8519
TX Austin, Marshall 512-837-1991
TX Brownsville, Marshall 512-542-4589
TX Dallas, Added Value 214-404-1144
TX Dallas, Marshall 214-233-5200
TX Dallas, Milgray 214-248-1603
TX El Paso, Marshall 915-593-0706
TX Houston, Marshall 713-895-9200
UT Murray, Marshall 801-261-1888
UT Salt Lake City, Added Value 801-975-9500
UT Salt Lake City, Marshall 801-485-1580
UT Salt Lake City, Milgray 801-272-4999
VA Redmond, Western Micro 206-881-6737
WA Seattle, Marshall 206-641-6800
WI Waukesha, Marshall 414-797-8400
Can Calgary, Alberta, Space Elctrns. 403-235-5325
Can Edmonton, Alberta, Space Elctrns. 403-438-2858
Can Montreal, Que., Marshall 514-848-9112
Can Montreal, Que., Space Elctrns. 514-694-7710
Can Ontario, Marshall 416-674-2161
Can Ontario, Milgray 416-756-4481
Can Ottawa, Ont., Marshall 416-674-2168
Can Ottawa, Ont., Space Elctrns. 613-820-8313
Can Toronto, Ont., Milgray 416-756-4481
Can Toronto, Ont., Space Elctrns. 416-638-4771
Can Vancouver, B.C., Space Elctrns. 604-438-5545
Can Winnipeg, Manitoba, Space Elctrns. ... 204-339-0554

SHARP, Microelectronics Div., Integrated Circuits, Sharp Plaza, Mahwah, NJ 07430, Tel: 201-529-8757, TELEX: 71 134327, FAX: 201-529-8759 ..... **A•1754-1756**

Local Sales Offices & Reps

AL Huntsville, Interep Assocs. 205-533-1730
AL Mobile, Interep Assocs. 205-478-1036
AZ Scottsdale, Thorson Desert State, Inc. (TDSI) 602-998-2442
CA Newport Bch., Plustronics 714-476-8009
CA San Diego, Mesa Comps. 619-278-8021
CA Santa Clara, Quorum Tech. Sls. 408-980-0812
CA Sherman Oaks, Plustronics 818-995-8908
CO Denver, Seale & Assocs, Inc. 303-756-8855
CT Southington, Orion/DSA Grp. 203-621-8371
FL Boca Raton, Lawrence Assocs. 407-368-7373
FL Casselberry, Lawrence Assocs. 305-830-6174
FL Oldsmar, Lawrence Assocs. 813-787-2773
GA Norcross, Interep Assocs. 404-449-8680
IL Des Plaines, Electron Mktg. 312-298-2330
IN Indianapolis, STB & Assocs. 317-844-9227
KS Wichita, Baka Corp. 316-682-8411
MD Linthicum, Advanced Technlg. Sls., Inc. 301-789-9360
MA Marlborough, Orion/DSA Grp. 617-480-0516
MA Wakefield, Orion/DSA Grp. 617-245-5220
MI Grand Rapids, DEM Sls., Inc. 616-364-4024
MI St. Clair Shores, DEM Sls., Inc. 313-777-1750
MN Minneapolis, Comstrand 612-788-9234
MO Creve Couer, Baka Corp. 314-878-4224
NJ Allendale, Eastec Assocs. 201-934-7135
NJ W. Berlin, QED Elctrns. 609-346-9254
NY Pittsford, Noeth-Honsinger 716-586-9002
NC Raleigh, Zucker Assocs. 919-782-8433
OH Dayton, Five Star Elctrns., Inc. 513-299-1718
OH Solon, Five Star Elctrns., Inc. 216-349-1611
OR Beaverton, Blair Hirsh 503-641-1875
PA Spring House, QED Elctrns., Inc. 215-643-9200
TN Greenville, Interep Assocs. 615-639-3491
TX Austin, Impaq Sls. Co. 512-474-1125
TX Carrollton, Impaq Sls. Co. 214-247-3300
TX Houston, Impaq Sls. Co. 713-820-0288
WA Lynwood, Blair Hirsh 206-774-8151
WI Waukesha, Electron Mktg. 414-547-1505
Can Mississauga, Ont., Hi-Tech Sls. Co., Ltd. 416-672-0284
Can Montreal, Que., Hi-Tech Sls. 514-386-4728
Can Surrey, B.C., Enerlec Sls. 604-888-1667

Local Distributors

AL Huntsville, Marshall 205-881-9235
AZ Phoenix, Marshall 602-496-0290
CA Del Mar, Added Value 619-792-0257
CA Irvine, Marshall 714-458-5394
CA Los Angeles, Marshall 818-407-4150
CA Orange, Milgray 203-795-0711
CA Orange, Western Micro 714-637-0200
CA Sacramento, Marshall 916-635-9700
CA San Diego, Marshall 619-578-9606
CA San Diego, Western Micro 619-453-8430
CA San Francisco, Marshall 408-943-4600
CA Saratoga, Western Micro 408-725-1660
CA Tustin, Added Value 714-259-8258
CO Denver, Marshall 303-451-8444
CO Wheatridge, Added Value 303-422-1701
CT Wallingford, Marshall 203-265-3822
DC Washington, Milgray 301-621-8169
FL Ft. Lauderdale, Marshall 305-977-4880
FL Orlando, Marshall 305-767-8585
FL Tampa, Marshall 813-573-1399
FL Winter Pk., Milgray 305-647-5747
GA Atlanta, Marshall 404-923-5750
GA Atlanta, Milgray 404-393-9666
IL Chicago, Marshall 312-490-0755
IL Chicago, Milgray 312-350-0490
IN Indianapolis, Marshall 317-297-0483
KS Kansas City, Milgray 913-236-8800
KS Wichita, Marshall 316-264-6333
MD Baltimore, Milgray 301-995-6169
MD Gaithersburg, Marshall 301-840-0228
MA Boston, Marshall 617-658-0810
MA Burlington, Milgray 617-657-5900
MA Burlington, Western Micro 617-273-2800
MI Livonia, Marshall 313-525-5850
MN Minneapolis, Marshall 612-559-2255
MS Kansas City, Marshall 913-492-3121
MO St. Louis, Marshall 314-291-4650
NJ Fairfield, Marshall 201-882-0169
NJ Marlton, Milgray 609-983-5010
NY Farmingdale, Milgray 516-391-3000
NY Hauppauge, Marshall 516-273-1515
NY Johnson City, Marshall 607-798-1611
NY Pittsford, Milgray 716-235-0830
NY Rochester, Marshall 716-235-7620
NC Raleigh, Marshall 919-876-7383
OH Cleveland, Marshall 216-248-1788
OH Cleveland, Milgray 216-447-1520
OH Columbus, Marshall 614-891-7580
OH Dayton, Marshall 513-898-4480
OR Beaverton, Western Micro 503-629-2082
OR Portland, Marshall 503-643-5555
PA Philadelphia, Marshall 609-778-8720
PA Pittsburgh, Marshall 412-963-0441
TX Austin, Added Value 512-459-8519
TX Austin, Marshall 512-837-1911
TX Brownsville, Marshall 512-542-4589
TX Dallas, Added Value 214-404-1144
TX Dallas, Marshall 214-233-5200
TX Dallas, Milgray 214-248-1603
TX El Paso, Marshall 915-593-0706
TX Houston, Marshall 713-895-9200
UT Murray, Marshall 801-261-1888
UT Salt Lake City, Added Value 801-975-9500
UT Salt Lake City, Marshall 801-485-1580
UT Salt Lake City, Milgray 801-272-4999
WA Redmond, Western Micro 206-881-6737
WA Seattle, Marshall 206-641-6800
WI Waukesha, Marshall 414-797-8400
Can Calgary, Alberta, Space Elctrns. 403-235-5325
Can Edmonton, Alberta, Space Elctrns. 403-438-2858
Can Montreal, Que., Marshall 514-848-9112
Can Montreal, Que., Space Elctrns. 514-694-7710
Can Ontario, Marshall 416-674-2161
Can Ontario, Milgray 416-756-4481
Can Ottawa, Ont., Marshall 416-674-2168
Can Ottawa, Ont., Space Elctrns. 613-820-8313
Can Toronto, Ont., Milgray 416-756-4481
Can Toronto, Ont., Space Elctrns. 416-638-4771
Can Vancouver, B.C., Space Elctrns. 604-438-5545
Can Winnipeg, Manitoba, Space Elctrns. ... 204-339-0554

SHARP, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, Tel: 201-529-8757, TELEX: 71 134327, FAX: 201-529-8759; *Sls. Mgr.:* Terry Manton; *Dist. Mgr.:* Dave Matthews ..... **A•2142-2144; B•1148-1151, 1178-1179, 1282-1294, 1585, 1925**

Local Sales Offices & Reps

AL Huntsville, Interep Assocs. 205-533-1730
AL Mobile, Interep Assocs. 205-478-1036
AZ Scottsdale, Thorson Desert State Inc. (TDSI) 602-998-2442
CA Newport Bch., Plustronics 714-476-8009
CA San Diego, Mesa Comps. 619-278-8021
CA Santa Clara, Quorum Tech. Sls. 408-980-0812
CA Sherman Oaks, Plustronics 818-995-8908
CO Denver, Seale & Assocs., Inc. 303-756-8855
CT Southington, Orion/DSA Grp. 203-621-8371
FL Boca Raton, Lawrence Assocs. 407-368-7373
FL Casselberry, Lawrence Assocs. 305-830-6174
FL Oldsmar, Lawrence Assocs. 813-787-2773
GA Norcross, Interep Assocs. 404-449-8680
IL Des Plaines, Electron Mktg. 312-298-2330
IN Indianapolis, STB & Assocs. 317-844-9227
KS Wichita, Baka Corp. 316-682-8411
MD Linthicum, Advanced Technlg. Sls., Inc. 301-789-9360
MA Marlborough, Orion/DSA Grp. 617-480-0516
MA Wakefield, Orion/DSA Grp. 617-245-5220
MI Grand Rapids, DEM Sls., Inc. 616-364-4024
MI St. Clair Shores, DEM Sls., Inc. 313-777-1750
MN Minneapolis, Comstrand 612-788-9234
MO Creve Coeur, Baka Corp. 314-878-4224
NJ Allendale, Eastec Assocs. 201-934-7135
NJ W. Berlin, QED Elctrns. 609-346-9254
NY Pittsford, Noeth-Honsinger 716-586-9002
NC Raleigh, Zucker Assocs. 919-782-8433
OH Dayton, Five Star Elctrns., Inc. 513-299-1718
OH Solon, Five Star Elctrns., Inc. 216-349-1611
OR Beaverton, Blair Hirsh 503-641-1875
PA Spring House, QED Elctrns., Inc. 215-643-9200
TN Greenville, Interep Assocs. 615-639-3491
TX Austin, Impaq Sls. Co. 512-474-1125
TX Carrollton, Impaq Sls. Co. 214-247-3300
TX Houston, Impaq Sls. Co. 713-820-0288
WA Lynwood, Blair Hirsh 206-774-8151
WI Waukesha, Electron Mktg. 414-547-1505
Can Mississauga, Ont., Hi-Tech Sls. Co., Ltd. 416-672-0284
Can Montreal, Que., Hi-Tech Sls. 514-386-4728
Can Surrey, B.C., Enerlec Sls. 604-888-1667

Local Distributors

AL Huntsville, Marshall 205-881-9235
AZ Phoenix, Marshall 602-496-0290
CA Del Mar, Added Value 619-792-0257
CA Irvine, Marshall 714-458-5394
CA Los Angeles, Marshall 818-407-4150
CA Orange, Western Micro 714-637-0200
CA Sacramento, Marshall 916-635-9700
CA San Diego, Marshall 619-578-9606
CA San Diego, Western Micro 619-453-8430
CA San Francisco, Marshall 408-943-4600
CA Saratoga, Western Micro 408-725-1660
CA Tustin, Added Value 714-259-8258
CO Denver, Marshall 303-451-8444
CO Wheat Ridge, Added Value 303-422-1701
CT Orange, Milgray 203-795-0711
CT Wallingford, Marshall 203-265-3822
DC Washington, Milgray 301-621-8169
FL Ft. Lauderdale, Marshall 305-977-4880
FL Orlando, Marshall 305-767-8585
FL Tampa, Marshall 813-573-1399
FL Winter Pk., Milgray 305-647-5747
GA Atlanta, Marshall 404-923-5750
GA Atlanta, Milgray 404-393-9666
IL Chicago, Marshall 312-490-0755
IL Chicago, Milgray 312-350-0490
IN Indianapolis, Marshall 317-297-0483
KS Kansas City, Marshall 913-492-3121
KS Kansas City, Milgray 913-236-8800
KS Wichita, Marshall 316-264-6333
MD Baltimore, Milgray 301-995-6169
MD Gaithersburg, Marshall 301-840-0228
MA Boston, Marshall 617-658-0810
MA Burlington, Milgray 617-657-5900
MA Burlington, Western Micro 617-273-2800
MI Livonia, Marshall 313-525-5850
MN Minneapolis, Marshall 612-559-2255
MO St. Louis, Marshall 314-291-4650
NJ Fairfield, Marshall 201-882-0169
NJ Marlton, Milgray 609-983-5010
NY Farmingdale, Milgray 516-391-3000
NY Hauppauge, Marshall 516-273-1515
NY Johnson City, Marshall 607-798-1611

NY Pittsford, Milgray 716-235-0830
NY Rochester, Marshall 716-235-7620
NC Raleigh, Marshall 919-876-7383
OH Cleveland, Marshall 216-248-1788
OH Cleveland, Milgray 216-447-1520
OH Columbus, Marshall 614-891-7580
OH Dayton, Marshall 513-898-4480
OR Beaverton, Western Micro 503-629-2082
OR Portland, Marshall 503-643-5555
PA Philadelphia, Marshall 609-778-8720
PA Pittsburgh, Marshall 412-963-0441
TX Austin, Added Value 512-459-8519
TX Austin, Marshall 512-837-1991
TX Brownsville, Marshall 512-542-4589
TX Dallas, Added Value 214-404-1144
TX Dallas, Marshall 214-233-5200
TX Dallas, Milgray 214-248-1603
TX El Paso, Marshall 915-593-0706
TX Houston, Marshall 713-895-9200
UT Murray, Marshall 801-261-1888
UT Salt Lake City, Added Value 801-975-9500
UT Salt Lake City, Marshall 801-485-1580
UT Salt Lake City, Milgray 801-272-4999
WA Redmond, Western Micro 206-881-6737
WA Seattle, Marshall 206-641-6800
WI Waukesha, Marshall 414-797-8400
Can Calgary, Alberta, Space Elctrns. 403-235-5325
Can Edmonton, Alberta, Space Elctrns. 403-438-2858
Can Montreal, Que., Marshall 514-848-9112
Can Montreal, Que., Space Elctrns. 514-694-7710
Can Ontario, Marshall 416-674-2161
Can Ontario, Milgray 416-756-4481
Can Ottawa, Ont., Marshall 416-674-2168
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Can Toronto, Ont., Milgray 416-756-4481
Can Toronto, Ont., Space Elctrns. 416-638-4771
Can Vancouver, B.C., Space Elctrns. 604-438-5545
Can Winnipeg, Manitoba, Space Elctrns. 204-339-0554

SHELDAHL, INC., P.O. Box 170, Hwy 3 North, Northfield, MN 55057, Tel: 507-663-8000, TWX: 910-565-2180, FAX: 507-663-8365

SHELLY associates

FAX: 714-669-1081

SHELLY ASSOCIATES, INC., 14281 Chambers Road, Tustin, CA 92680, Tel: 714-669-9850, TELEX: 85-2263; FSC No.: 00303; Empl.: 30; *Sls. Mgr.:* Chuck Feeney; *Dist. Mgr.:* Chuck Feeney ..... **B•1092**

Local Sales Offices & Reps

AZ Tempe, Spectrum Assocs., S.W. 602-966-1788
CA Anaheim, Spectrum Assocs., Inc. 714-630-6977
CA Mountain View, Leddy Assocs. 415-969-6313
CO Broomfield, Connors Co. 303-466-9628
FL Ft. Lauderdale, Hollingsworth & Still, Inc. 800-241-5712
FL Tampa, Hollingsworth & Still, Inc. 800-241-5712
GA Norcross, Hollingsworth & Still, Inc. 404-447-1700
IL Skokie, Electro Tech Mktg. 312-676-3151
IN Ft. Wayne, Scott Elctrns. 219-484-7865
IN Indianapolis, Scott Elctrns. Inc. 317-841-0010
MD Ellicott City, Tech. Sls., Inc. 301-461-2400
MA Norwood, The MacInnis Co. 617-762-8090
MI Ypsilanti, Techrep, Inc. 313-572-1950
MN Hopkins, Steve Forsythe & Assocs. 612-933-8267
MO Florissant, R. R. Burton & Assocs. 314-831-4069
MO Grandview, R. R. Burton & Assocs. 816-763-5385
NJ Boonton, TMA 201-263-2946
NY N. Syracuse, R. F. Roux Co. 315-458-9169
NY Port Washington, TMA 516-883-2432
NC Charlotte, Hollingsworth & Still, Inc. 800-241-5712
NC Kernersville, Hollingsworth & Still, Inc. 800-241-5712
OH Cincinnati, Scott Elctrns. 513-791-2513
OH Cleveland, Scott Elctrns. Inc. 216-473-5050
OH Kettering, Scott Elctrns., Inc. 513-294-0539
OH Reynoldsburg, Scott Elctrns. 614-863-1281
OR Beaverton, Luscombe Engrg. Co. 503-636-6664
PA Boyertown, Tech. Sls., Inc. 800-225-4335
PA Pittsburgh, Scott Elctrns. 412-963-6116
TX Stafford, A & E Sls., Inc. 713-499-3210
WA Bellevue, Luscombe Engrg. Co. 206-223-1541
WI Brookfield, Electro-Tech Mktg. Assocs. 414-785-9554

Local Distributors

AR Ft. Smith, Radio, Inc. 501-646-5200
CA Anaheim, Bisco Inds. Inc. 714-635-0380
CA Fremont, VIC/TAL Sls. 415-651-6420
CA San Jose, Bisco Inds. Inc. 408-435-8980
CT Norwalk, Park Distrs. Inc. 203-853-2010
CT Wallingford, Midstate Elctrns. Co. 203-265-9900
FL Bradenton, Specialty Distbg. 813-756-9571
FL Clearwater, Jenkins Supp. Co., Inc. 813-584-5282
GA Atlanta, A-C Equip. Co. 404-451-2747
IL Franklin Park, Bisco Inds. Inc. 312-451-1230
IN Indianapolis, Mar Elctrns., Inc. 317-633-6699
IA Cedar Rapids, Iowa Radio Supp. Co. 313-393-4510
IA Cedar Rapids, Iowa Radio Supp. Co. 319-393-4510
MA Woburn, Bisco Inds. 617-938-8590
MO Kansas City, Elctrns. Supp. Co., Inc. 816-931-0250
NJ Cranford, Garden State Indl. Elctrns. 201-272-6400
NJ East Brunswick, Brothers Elctrns. 201-238-2200
NJ Fair Lawn, Relay Specialties 201-797-3313
NJ Oakland, Relay Specialties 201-337-1000
NY Elmsford, White Plains Elctrl. 914-592-9555
NY Huntington, Energy Elctrl. Supp. 516-549-2722
NC Raleigh, Svc. Plus Elctrns. 919-850-9550
OH Dayton, Televox, Inc. 513-294-4499
OH Strongsville, Roberts Elctrns. Co., Inc. 216-238-1711
OH Twinsburg, Advacom, Inc. 216-425-8477
OK Tulsa, Radio, Inc. 918-587-9123
PA McKean, Advacom 814-476-7774
TN Chattanooga, Specialty Distbg. Co. 615-267-9531
TX Arlington, Bisco Inds. 817-640-7046
TX Dallas, Wilkinson Brothers Co. 214-941-9963
TX Midland, ESI Supp. 915-694-9657
WI Mequon, Lakeview Elctrns. 414-377-8250

SKC

FAX: 818-764-6845

SHINANO KENSHI CORP. (SKC), 7525 Ethel Ave., Ste. I, N. Hollywood, CA 91605, Tel: 818-764-4266; Empl.: 6; *Sls. Mgr.:* Ken Shimizu ..... **B•1255**

Local Sales Offices & Reps

AL Madison, Benchmark 205-464-0033
CA North Hollywood, Shinano Kenshi Corp. 818-764-4266
CA Santa Clara, Norcomp, Inc. 408-727-7707
CO Denver, Tech Rep Sls. Co. 303-758-7031
CT Bloomfield, SIR Assocs. 203-243-9343
FL Melbourne, Phoenix Comps. 305-723-4414
GA Norcross, Benchmark 404-446-1711
MA Westford, SIR Assocs. 617-692-2500
MI Southfield, Fred Gehrke & Assoc. 313-559-5363
MN Eagan, REL Comp. 612-452-9541
NJ Maple Shade, Bi-Tech 609-667-7374
NJ Oxford, Malin Assocs. 201-689-7398
NC Charlotte, Mackay Smith & Assocs. 704-372-1188
NC Raleigh, Mackay Smith & Assocs. 919-847-2277
OR Portland, Intertech Sls. 503-775-7885
TX Austin, Precision Technlg. Assocs. 512-250-0201
TX Richardson, Precision Technlg. Assoc. 214-234-8071
UT Sandy, Intermountain Technlg. 801-566-5000

Local Distributors

CA N. Hollywood, Digilog Dvcs., Inc. 818-764-9777

Shindengen America, Inc.

FAX: 805-373-3710

SHINDENGEN AMERICA INC., 2649 Townsgate Road, Ste. 200, Westlake Vl, CA 91361, Tel: 805-373-1130; Empl.: 7; *Sls. Mgr.:* Peter Gajewski; *Dist. Mgr.:* Peter Gajewski ..... **D•1961-1963**

Local Sales Offices & Reps

AL Huntsville, 20th Century Mktg., Inc. 205-533-9281
AZ Phoenix, Southwest Tech. Sls. 602-893-1209
CA San Diego, Power Assocs. 619-275-0641
CA Santa Clara, Quorum Tech. Sls. 408-980-0812
CA Simi Valley, Tri-Electro Sls., Inc. 805-527-3317
CO Englewood, BC & Assocs. 303-694-3999
CT Middletown, Gerber Sls. Corp. 203-347-3000
GA Norcross, 20th Century Mktg., Inc. 404-446-1999
IL Rolling Meadows, Eagle Tech. Sls., Inc. 312-991-0700
KS Olathe, C-Tron 319-373-2029
MD Randallstown, Chesapeake Indl. Mktg. 301-922-5997
MA Waltham, Gerber Sls. Corp. 617-890-3334
MI Lathrup Vl., R. C. Nordstrom & Co. 313-559-7373
MN St. Paul, Arkco Sls. 612-777-7454
MO St. Charles, C-Tron, Inc. 314-928-8078
NY N. Bellmore, Aurora Mktg., Inc. 516-221-0764
NY Pittsford, Franklin Sls. Corp. 716-248-8251
NC Cary, 20th Century Mktg., Inc. 919-481-3370
OH Dayton, Thompson & Assocs. 513-435-7733
OR Portland, Crown Elctrns. 503-620-8320
PA Dresher, CMS Mktg. 215-885-4424
TN Knoxville, 20th Century Mktg., Inc. 615-966-2099
TX Dallas, Talo Prods., Inc. 214-644-6010
UT American Fork, BC & Assocs. 801-467-2363
WA Bellevue, Crown Elctrns. 206-643-8100
Can Concord, Votron Elctrns., Inc. 416-669-9870

SHIN-ETSU POLYMER, 34135 7th St., Union City, CA 94587, Tel: 415-475-9000, TWX: 910-338-2229, FAX: 415-475-0613; *Sls. Mgr.:* Doug Hall

SHOGYO INTERNATIONAL CORPORATION

FAX: 516-466-0922

SHOGYO INTERNATIONAL CORP., 287 Northern Blvd., Great Neck, NY 11021, Tel: 516-466-0911, TELEX: 4758024, TWX: 12218 ... **A•2366; B•1154, 1794-1795; C•1550-1552, 1906-1907; D•1050-1051, 1395, 1492, 1967**

SHOKAI FAR EAST, LTD., 280 North Central Ave., Hartsdale, NY 10530, Tel: 914-681-0700, FAX: 914-681-0807; Empl.: 362; *Sls. Mgr.:* Shirlee Serber; *Dist. Mgr.:* Lee Goldberg, V.P. ..... **D•1053**

SHURE BROS., 222 Hartrey Ave., Evanston, IL 60202-3696, Tel: 312-866-2200, TELEX: 4330191, FAX: 312-866-2279; *Sls. Mgr.:* R. T. Murphy, VP & Gen Mgr.

Shurite®

FAX: 203-481-8937

SHURITE METERS, A Prime Technology Co., P.O. Box 185, Twin Lakes Rd., North Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092; Empl.: 15; *Sls. Mgr.:* James Jamieson; *Dist. Mgr.:* Bruce Granoff .... **D•1397**

Local Sales Offices & Reps

CA Burbank, Modco Co. 818-848-2215
CA Sunnyvale, W. W. Posey Co. 408-746-0771
CO Denver, Nelson Co. Inc. 303-295-1017
FL Longboat, R. S. Cushing 813-383-1770
IL Park Ridge, Bob Burns Assocs. 312-823-9360
IN Indianapolis, John Sukup Inc. 317-253-5501
IA Des Moines, The Beams Co. 515-255-1148
MI E. Detroit, Jack M. Thorpe Co. 313-779-6363
NJ Belleville, D. F. Tobias & Co. 201-751-8680
NJ Lawrenceville, DVS Co. 609-896-1112
NY Rochester, H. C. Johnson Agys., Inc. 716-586-0777
NC Raleigh, B. T. Funderburk Inc. 919-782-3493
OH Cincinnati, John Olsen Co. 513-922-8885
RI Lincoln, Adams McGregor Inc. 401-726-1300
TX Dallas, The Crockett Sls. Co. 214-350-3377
WA Seattle, Evergreen Mktg. Grp. 206-633-3160
Can Thornhill, Ont., R. C. Kahnert Sls. Ltd. 416-731-9232

SIDAC ENCLOSURES, Div. of Triac Electronic Systems, Inc., 87-27 Myrtle Ave., Glendale, NY 11385, Tel: 718-441-4728; Empl.: 14; *Sls. Mgr.:* Victor Botnick

SIDEREAL CORP., TransTechnology Corporation, 9600 S.W. Barnes Rd., Portland, OR 97225, Tel: 503-297-5531, TELEX: 36-0640, TWX: 910-464-6139, FAX: 503-292-7730; Empl.: 250; *Sls. Mgr.:* Jeff Gretz

SIECOR CORP., 489 Siecor Park-CO, Hickory, NC 28603-0489, Tel: 704-327-5000, TELEX: 800-510, FAX: 704-327-5973; Empl.: 1200; *Sls. Mgr.:* J. Hicks

SIEMENS COMPONENTS, INC., Optoelectronics Division, 19000 Homestead Rd., Cupertino, CA 95014, Tel: 408-257-7910, TELEX: 352084, TWX: 910-338-0022; FSC No.: 50579; Empl.: 1100; *Sls. Mgr.:* Daniel Rendino; *Dist. Mgr.:* Regina Walls

Local Sales Offices & Reps

CA Cupertino, Siemens Comps., Inc. 408-725-3586
CA Orange, Siemens Comps., Inc. 714-385-1274
CA Woodland Hills, Siemens Comps., Inc. 818-883-4653/4658
GA Norcross, Siemens Comps., Inc. 404-449-3981
IL Rosemont, Siemens Comps., Inc. 312-692-6000
MA Littleton, Siemens Comps., Inc. 617-486-0331
MI Livonia, Siemens Comps., Inc. 313-591-7238
NJ Princeton, Siemens Comps., Inc. 609-987-0083
TX Dallas, Siemens Comps., Inc. 214-620-2294

SIEMENS

FAX: 201-321-3961

SIEMENS COMPONENTS, INC., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830, Tel: 201-321-3400, TWX: 710-998-0588/0529; Empl.: 800; *Sls. Mgr.:* Curt Hozian; *Dist. Mgr.:* Dick Robert ..... **A•1173, 1321; B•1350-1351**

Local Sales Offices & Reps

AL Huntsville, Interep Assocs. 205-533-1730
AZ Phoenix, Westrep 602-997-8899
CA Anaheim, Westrep 714-527-2822
CA Cupertino, Siemens Comps., Inc. 408-725-3566
CA Cupertino, SC Sls. West 408-725-3531
CA Orange, Siemens Comps., Inc. 714-385-1274
CA San Diego, Varigon-San Diego, Inc. ... 619-576-0100
CO Littleton, Lange Sls. 303-795-3600
FL Apopka, G.F. Bohman Assocs. 305-886-1882
GA Norcross, INTEREP 404-449-8680
GA Norcross, Siemens Comps., Inc. 404-449-3981
IL Park Ridge, Metcom Assocs. 312-696-1490
IL Rosemont, Siemens Comps., Inc. 312-629-6000
IN Indainapolis, Elctro Reps., Inc. 317-842-7202
IA Cedar Rapids, Cahill-Schmitz-Cahill .. 319-377-8219
MD Lutherville, D.G. Reps. 301-583-1360
MA Westborough, Anchor Engrg. 617-898-2724
MI Troy, C. B. Jensen & Assocs. 313-643-0506
MN St. Paul, Cahill-Schmitz-Cahill 612-646-7217
NJ Special Prods. Div. 800-222-2203

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NJ Ft. Lee, Necco 201-461-2789
NJ Princeton, Siemens Comps., Inc. 609-987-0083
NM Albuquerque, F-P Sls. 505-345-5553
NY Liverpool, Gen-Tech 315-451-3480
NC Smithfield, ADI, Inc. 919-934-8136
OH Columbus, Siemens Comps., Inc. 614-433-7500
OH Strongsville, Dolfuss-Root & Co., Inc. 216-238-0300
PA Bridgeville, Dolfuss Root & Co. 412-221-4420
TN Greenville, Interep 615-639-3491
TX Arlington, CompTech Sls., Inc. 817-265-6007
TX Austin, CompTech Sls., Inc. 512-331-8922
TX Houston, CompTech Sls., Inc. 713-776-8330
UT Salt Lake City, Lange Sls. 801-487-0843
UT Salt Lake City, Lange Sls., Inc. 801-487-0843
WA Bellevue, Micro Sls. 206-451-0568
PR Rio Piedras, Klamco Elec. 809-752-6169

Local Distributors

AL Huntsville, Hall-Mark 205-837-8700
AZ Phoenix, Hall-Mark 602-437-1200
CA Canoga Park, Hall-Mark 818-716-7300
CA Irvine, Marshall 714-458-5394
CA Milpitas, Marshall Elec. 408-942-4700
CA San Jose, Hall-Mark 408-432-0900
CA Sunnyvale, Permag-Sierra Div. 408-738-1080
CO Thornton, Marshall Elec. 303-451-8444
FL Orlando, Hall-Mark 305-855-4020
GA Norcross, Marshall 404-923-5750
IL Elk Grove, Permag-Central Div. 312-956-1140
IL Rosemont, Advent 312-298-4210
IL Wooddale, Hall-Mark 312-860-3800
IN Indianapolis, Marshall 317-297-0483
MD Columbia, Hall-Mark 301-988-9800
MI Farmington Hills, Advent 313-477-1650
MN Plymouth, Marshall 612-559-2211
NJ Fairfield, Hall-Mark 201-575-4415
NY Rochester, Marshall 716-235-7620
NC Raleigh, Hall-Mark 919-872-0712
OH Dayton, Marshall 513-898-4480
PA McKean, Advacom 814-476-7774
TX Dallas, Hall-Mark 214-553-4300
WA Bellevue, Marshall 206-747-9100

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FAX: 619-438-4987

SIERRACIN/MAGNEDYNE, 2258 Rutherford Rd., Carlsbad, CA 92008, Tel: 619-438-3321, TWX: 910-322-1391; Empl.: 150 ..... **B•1256-1257**

Local Sales Offices & Reps

AZ Mesa, Terry Thatford 602-835-1932
CA Mtn. View, Straube Assocs., Inc. 415-969-6060
CA Pomona, Chuck Schultz 714-629-2809
CT Tolland, Don Fontaine 203-456-4511
FL Deerfield Beach, Electrocomp Assocs. 305-429-0802
FL Palm Harbor, Electrocomp Assocs. ... 813-787-6669
IL Rolling Meadows, KMA Sls. Co. 312-398-5300
MI Troy, Xanthus, Inc. 313-528-2000
MN St. Paul, ARKCO 612-777-7454
NY Melville, Carnes Assocs. 516-694-1600
OH Cleveland, Servo-Mark 216-871-2353
OR Beaverton, Luscombe, Northwest 503-636-6664
PA Morristown, Rivco January 215-631-1414
TX Roanoke, CMR 817-379-6540
WI Milwaukee, KMA Sls. Co. 414-259-1771

SIERRACIN POWER SYSTEMS, See Sierra Power Systems

SIERRA ELEC., See Pass & Seymour, Inc.

SIERRA MONITOR CORP., 1991 Tarob Ct., Milpitas, CA 95035, Tel: 408-262-6611, TELEX: 17-1618; FSC No.: MSGSNDR; Empl.: 23; *Sls. Mgr.:* Robert Dunkle; *Dist. Mgr.:* Gordon Arnold

SIERRA POWER SYSTEMS, See Valor Power Sys. Div., Valor Elctrns.

SIERRA WEST POWER SYSTEMS, 2615 Missouri St., Las Cruces, NM 88001, Tel: 505-522-8828; Empl.: 12

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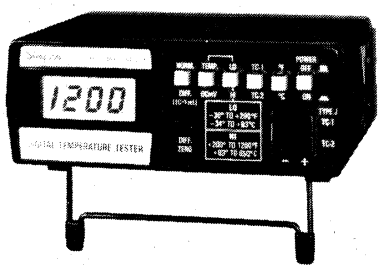

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SKYWAY MAGNETICS, 35372 Hwy 79, Warner Springs, CA 92086, Tel: 619-782-3342; FSC No.: 3612; Empl.: 12; *Sls. Mgr.:* John Grudziadz

SLAUGHTER CO., Moore & Hailey Sts., P.O. Box 1805, Ardmore, OK 73402, Tel: 405-223-4773, TELEX: 697-5577; FSC No.: 05611; *Sls. Mgr.:* T. Medrick ... **D•1325**

SL ELECTRONICS, 300 Harvard Ave., Westville, NJ 08093, Tel: 609-456-7300, TELEX: 844509, TWX: 710-944-0758; Empl.: 60; *Sls. Mgr.:* Dan Holdstein

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SLOAN CO., 7704 San Fernando Rd., Sun Valley, CA 91353-0367, Tel: 213-875-1123, TWX: 910-498-2250; Empl.: 25; *Sls. Mgr.:* Michael Mautner .... **B•1155-1160**

Local Sales Offices & Reps

AL	Huntsville, Remco	205-533-3763
CA	Maywood, M.M.S. (Mgt. Mktg. Sls.)	213-560-5584
CA	Mtn. View, Francisco & Assocs.	415-962-1717
CO	Commerce City, Williams Assoc.	303-289-5647
FL	Pompano Beach, Cole-Tek Assocs.	305-781-8110
IL	Park Ridge, Probe Elctrns.	312-696-2828
MD	Glen Burnie, Macrotech Assoc.	301-437-5588
MN	Minneapolis, Loren Green Assoc. of Minn.	612-571-6666
MO	St. Charles, Microtronics	314-946-8500
NJ	Cherry Hill, Quality Comps.	609-428-6226
NJ	Englewood Cliffs, E. Glass Assocs.	212-586-8440
NY	Rochester, Tech. Comps.	716-342-2406
OH	Cleveland, Allan Scraga	216-662-6080
TX	Dallas, IBL Engrg. & Sls.	214-363-2921
WA	Bellevue, Olson, Ferree & Assocs.	206-883-7792

Local Distributors

AL	Huntsville, Powell Elctrns.	205-529-2731
CA	Anaheim, Deco Elctrns.	714-630-8252
CA	Hawthorne, Electrosonic Comps.	213-970-0997
CA	Hawthorne, Radio Hardware	213-679-3381
CA	San Jose, Powell Elctrns.	408-943-9020
CT	W. Hartford, Signal Inds.	203-236-6005
FL	Ft. Lauderdale, Peerless Radio Corp.	305-973-4141
FL	Ft. Lauderdale, Powell Elctrns.	305-979-5000
FL	Miami, Elctrn. Equip.	305-871-3500
CA	Santa Clara, Master Distrs.	408-496-6151
KS	Wichita, Lee Prods.	316-264-2172
MD	Columbia, Powell Elctrns.	301-621-4070
IL	Northbrook, Mar'Lyn Elctrns.	312-272-2338
MA	Westborough, Powell Elctrns.	617-366-6100
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NJ	Englewood, Powell Elctrns.	201-894-0800
OH	Cleveland, Acorn Inds.	216-289-2531
OH	Solon, Repco	216-248-8900
OK	Tulsa, Altair Co.	918-252-5781
PA	Philadelphia, Powell Elctrns.	215-365-1900
TN	Memphis, GFI Sls.	901-683-6252
NC	Cary, Powell Elctrns.	919-467-1212
TX	Houston, Altair Co.	713-462-3029
TX	Irving, Powell Elctrns.	214-258-6841
TX	Richardson, Altair Co.	214-231-5166

SLOAN TECHNOLOGY, Veeco Instruments Inc., 602 E. Montecito St., Santa Barbara, CA 93103, Tel: 805-963-4431, TWX: 910-334-4901; Empl.: 75; *Sls. Mgr.:* Ben Wride

SL WABER, INC., 300 Harvard Ave., Westville, NJ 08093, Tel: 609-456-5400, 800-257-8384; Empl.: 125; *Sls. Mgr.:* Gary Oswald

SMI CORP., Superior Mfg. & Instr. Corp., 58-75 Queens Midtown Expwy., Maspeth, NY 11378-1220, Tel: 718-476-3000, TWX: 710-582-2626; FSC No.: 96467; Empl.: 150; *Sls. Mgr.:* G. Roger Preisick

H. H. SMITH (DIALIGHT COMPANY), 1913 Atlantic Ave., Manasquan, NJ 08736, Tel: 201-223-9400 ..... **B•1115, 1121-1124, 1692-1693; C•1413, 1415, 1553, 1709**

See Dialight Corp. for sales offices, representatives & distributors.

SMK ELECTRONICS CORPORATION, U.S.A., 1901 Nancita Cir., Placentia, CA 92670, Tel: 714-996-0960, TELEX: 18-3081; FSC No.: 637-7400; Empl.: 64; *Sls. Mgr.:* K. Greenway/T. Klymenko

C. G. SOAR, INC., 434 Windsor Pk. Dr., Dayton, OH 45459, Tel: 513-434-7643; Empl.: 5; *Sls. Mgr.:* Dale K. Mann

Local Sales Offices & Reps

AL	Alabaster, Rohr Wanger Roberts, Inc.	205-879-7361
AZ	Tempe, Barnhill Assocs.	602-820-8800
CA	Santa Clara, Reptek	408-988-2771
CA	Sun Valley, Teqni-Rep	818-768-4223
CO	Englewood, Barnhill Assocs.	303-799-6999
FL	Orlando, Datarep	305-843-5224
GA	Norcross, Rohr Wanger Roberts, Inc.	404-263-9349
IL	Chicago, Promar	312-564-3510
IL	Northbrook, Promar Entprs.	312-564-3510
IN	Mulberry, Maish Sls.	317-296-2322
MD	Silver Spring, Mid-Atlantic Sls.	301-593-7749
MA	Braintree, Anderson Sls.	617-848-9194
MN	Golden Valley, Ambassador Indl. Mrk.	612-542-8437
MO	Liberty, Lectro Rep Inc.	816-781-2522
NJ	Teaneck, Steve Fisher Elctrn. Sls.	201-837-1200
NM	Albuquerque, Barnhill Assocs.	505-299-7658
NY	Syracuse, Paston Hunter Assocs.	315-437-2992
OH	Dayton, Shamrock Elctrn. Sls.	513-258-1227
OK	Tulsa, Barnhill Assocs.	918-743-3249
OR	Portland, Roger Minthorne Co.	503-246-4556
PA	Pittsburgh, Shamrock Elctrn. Sls.	412-343-5877
SC	Rock Hill, Rohr Wanger Roberts Inc.	803-324-5111
TX	Houston, Barnhill Assocs.	713-444-1733
TX	Richardson, Barnhill Assocs.	214-231-2573
TX	San Antonio, Barnhill Assocs.	512-694-5575
UT	Murray, Barnhill Assocs., Inc.	801-262-3000

SOFTWARE DYNAMICS, 2111 W. Crescent Ave-G, Anaheim, CA 92801, Tel: 714-635-4760

SOHIO ENGINEERED MATERIALS CO., See Standard Engineered Materials Co.

SOKOL CRYSTAL PRODS. DIV., 6050 N. 52nd Ave., Glendale, AZ 85301, Tel: 602-934-2108

SOKOL CRYSTAL PRODUCTS, INC., 121 Water St., Mineral Point, WI 53565, Tel: 608-987-3363, FAX: 608-987-3882; FSC No.: 56187; Empl.: 150; *Sls. Mgr.:* Steven M. Sokol

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FAX: 800-626-6269

SOLA, A Unit of General Sign., 1717 Busse Rd., Elk Grove Village, IL 60007, Tel: 312-439-2800, TELEX: 6871106 JOLAE; *Sls. Mgr.:* Fred Lemke ..... **D•1968-1972, 2151-2153**

Local Sales Offices & Reps

AZ	Phoenix, Zeus Elctrns., Inc.	602-263-6022
AR	Little Rock, Erickson Sls., Inc.	501-888-8784
CA	Los Angeles, Sola Factory	714-937-0100,
CA	Pleasanton, Moulthrop Sls., Inc.	415-463-0450
CT	Yalesville, J.M.G., Inc.	203-357-9482
FL	Deerfield Beach, Krutek & Assoc.	305-427-4202
GA	Atlanta, Millar Elctrns.	404-634-3350
IL	Chicago, Sola Factory	312-439-2800,
IN	Indianapolis, Green-Wissler Sls.	317-872-9981
IA	Cedar Rapids, R. W. Kunz & Assocs.	319-396-5386
KS	Kansas City, R. W. Kunz & Assocs.	913-648-3535
LA	Chalmette, Erickson Sls., Inc.	504-271-1976
MI	Farmington Hills, R. C. Merchant	313-476-4600
MN	Bloomington, PWC, Inc.	612-831-9031
NJ	Cherry Hill, Trinkle Sls.	609-795-4200
NJ	East Orange, Willgold Sls.	201-678-7700
NY	Rochester, LMar Assocs.	716-323-1000
NC	Raleigh, C-Tech Sls.	919-847-0202
OH	Columbus, Baehr, Greenleaf & Assocs.	614-486-4046
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OH	Lakewood, Baehr, Greenleaf & Assocs.	216-221-9030
OK	Broken Arrow, Erickson Sls., Inc.	918-455-4276
OR	Portland, Dussault & Assocs.	503-641-8780
TX	Austin, Erickson Sls.	512-244-3068
TX	Dallas, Erickson Sls.	214-739-5833
TX	Houston, Erickson Sls.	713-266-1604
WA	Seattle, Dussault & Assoc.	206-281-4025
WI	Milwaukee, Sola Factory	312-439-2800,

SOLARCOM TECHNOLOGY, INC., P.O. Box 4715, Hayward, CA 94544, Tel: 415-489-3141; Empl.: 9; *Sls. Mgr.:* Rose Ferguson

SOLAR ELECTRONICS CO., A. T. Parker, Inc., 901 N. Highland, Hollywood, CA 90038, Tel: 213-462-0806, TWX: 910-997-1921, FAX: 213-462-3721; FSC No.: 13222; Empl.: 17

SOLAREX CORP., 1335 Piccard Dr., Rockville, MD 20850, Tel: 301-948-0202, TWX: 710-828-9709; *Sls. Mgr.:* Ted Blumenstock

SOLATRON ENTERPRISES, 421 E. Beach Ave., Inglewood, CA 90302, Tel: 213-678-4981; Empl.: 20

SOLDER ABSORBING TECHNOLOGY (SAT), A Spirig Co., 144 Oakland St., Springfield, MA 01108, Tel: 800-628-8862, FAX: 413-788-0490; Empl.: 8; *Sls. Mgr.:* Joyce White

SOLDER REMOVAL, P.O. Box 1678, Covina, CA 91722, Tel: 818-967-3681, TWX: 910-584-1820; FSC No.: 34605

SOLID STATE, INC., 46 Farrand St., Bloomfield, NJ 07003, Tel: 201-429-8700, TWX: 710-994-4780; Empl.: 110; *Sls. Mgr.:* T. King

SOLID STATE DEVICES, 14830 Valley View Ave., La Mirada, CA 90638, Tel: 213-921-9660, TWX: 910-583-4807; FSC No.: 30043; Empl.: 140

SOLID STATE ELECTRONICS CORP., 18646 Parthenia St., Northridge, CA 91324, Tel: 818-993-8257; FSC No.: 11911; Empl.: 15

SOLID STATE RELAYS, 71 Regent, Oak Brook, IL 60521, Tel: 312-932-1660, FAX: 312-887-9522; *Sls. Mgr.:* D. E. Wienke

SOLID STATE SYSTEMS, 1300 Shiloh Rd., N.W., Kennesaw, GA 30144, Tel: 404-423-2200; Empl.: 150; *Sls. Mgr.:* Jason Schloss; *Dist. Mgr.:* J. Schloss

SOLID STATE TESTING, INC., 56 Middlesex Tpke., Burlington, MA 01803, Tel: 617-272-0972, TWX: 710-332-1620, FAX: 617-272-4896; Empl.: 150; *Sls. Mgr.:* James Roberts; *Dist. Mgr.:* James DiGiacomo

SOLITRON DEVICES, 8808 Balboa Ave., San Diego, CA 92123, Tel: 619-278-8780, TWX: 910-335-1221; Empl.: 900

SOLITRON DEVICES, INC., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404, Tel: 305-848-4311, TELEX: 51-3435, TWX: 510-952-7610, FAX: 305-863-5946; Empl.: 800; *Sls. Mgr.:* David Harrison; *Dist. Mgr.:* June Rafol

SOLITRON/MICROWAVE, Solitron Devices, Inc., 1177 Blue Heron Blvd., Solitron Pk., Riviera Bch., FL 33404, Tel: 305-848-4311, TELEX: 51-3435, TWX: 510-952-7610, FAX: 305-848-4311 (ext. 116); FSC No.: 95077; Empl.: 200; *Sls. Mgr.:* Ray Sulzer; *Dist. Mgr.:* Deloris Martinez

SOLTEC CORP., Sol Vista Pk., San Fernando, CA 91340-1597, Tel: 818-365-0800, 800-423-2344, TELEX: 365-7089; Empl.: 80; *Sls. Mgr.:* Gary A. Purser

SONICOR INSTRUMENT CORP., 1365 Marconi Blvd., Copiague, NY 11726, Tel: 516-842-3344, TELEX: 649494; FSC No.: 31605; *Sls. Mgr.:* Arthur Liers; *Dist. Mgr.:* Arthur Liers

SONNENSCHEIN BATTERIES INC., 300 E. Johnson Ave., P.O. Box 339, Cheshire, CT 06410, Tel: 203-271-0091, 800-4-DRYFIT, FAX: 203-271-2179; *Sls. Mgr.:* C. T. Wright, V.P.; *Dist. Mgr.:* Lawrence (Skip) Moran

SONOBOND ULTRASONICS INC., Inductotherm Industries, 200 E. Rosedale Ave., West Chester, PA 19380, Tel: 215-696-4710, 800-323-1269, TELEX: 902497, FAX: 215-692-0674; FSC No.: 15882; Empl.: 43; *Sls. Mgr.:* P. C. Krause

SORENSON CO., Switchcraft, Inc., 5555 N. Elston Ave., Chicago, IL 60630, Tel: 312-775-0843, FAX: 312-775-7432; Empl.: 850; *Sls. Mgr.:* Ed Larrabee

SoLiCo

FAX: 203-527-6047

SORENSON LIGHTED CONTROLS, 75 Locust St., Hartford, CT 06114, Tel: 203-527-3092, 1-800-243-0240, TWX: 710-425-4093; Empl.: 100; *Sls. Mgr.:* Ted Ogorzalek ..... **B•1161**

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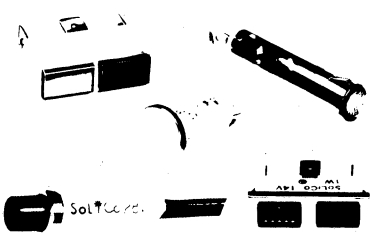

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CA	Mt. View, Del Bucchia & Assoc.	415-965-8045
CA	San Dimas, JPE Assoc.	818-359-4293
CO	Boulder, The Stratford Grp.	303-530-3194
FL	Tampa, Florida Comp. Sls.	813-960-7044
FL	Winter Springs, Florida Comp. Sls.	305-327-2464
GA	Doraville, Advanced Comps. Mktg.	404-448-2464
IL	Wheaton, Chadra-Schilke	312-653-8126
IN	Fort Wayne, Menze Sls.	219-747-5616
KS	Mission, The Mertens Co.	913-432-9323
MD	Glen Burnie, Macrotech Assocs.	301-766-1111
MA	Canton, Comtek Assoc.	617-828-2948
MI	Dearborn, Pitcher-Poulin, Inc.	313-582-5450
MN	Minneapolis, Tech. Comps. Grp.	612-536-9512
MO	Clayton, Mertens Co.	314-993-6600
NJ	Marlton, Naudain Assocs.	609-983-5300
NJ	Union, Pacent Engrg.	201-687-7197
NJ	Wayne, November Elctrn. Sls.	201-696-8683
NY	Great Neck, Pacent Eng. Co.	516-482-4678
NY	Kingston, R. P. Kennedy Co., Inc.	914-876-2700
NY	Rochester, R. P. Kennedy Co., Inc.	716-271-6322
NC	Siler City, Crossroads Elctrns.	919-742-2372
OR	Beaverton, Evergreen Mktg. Grp.	503-643-8020
WA	Seattle, Evergreen Mktg. Grp.	206-633-3160

Local Distributors

AZ	Phoenix, Minarik Elec. Co.	602-233-3000
CA	Costa Mesa, J & J Elctrns.	714-751-7994
CA	Covina, Selecta Switch	818-967-4123
CA	Gardena, California Switch & Signal	212-538-9830
CA	Hayward, KEA Elctrns.	415-887-2900
CA	Los Angeles, Electric Switches	213-660-1310
CA	Los Angeles, Minarik Elec. Co.	213-624-3161
CA	San Diego, Minarik Elec. Co.	619-560-6632
CA	Santa Clara, Minarik Elec. Co.	408-727-0575
CA	Tustin, Western Switches	714-259-8144
CA	Van Nuys, Wes-Garde Comps. Grp.	213-873-4802
CO	Denver, Minarik Elec. Co.	303-329-3525
CT	Hartford, Wes-Garde Comp. Grp.	203-527-7705
FL	Lakeland, Wes-Garde Comp. Grp.	813-644-7564
GA	Tucker, CID, Inc.	404-491-3143
IL	Carol Spring, Wes-Garde Comp. Grp.	312-653-1460
IL	Crystal Lake, Sub-Sem	815-459-4139
IA	Atkins, The Carl Bergquist Co.	319-446-7456
MA	Canton, Comtek Assocs.	617-828-2948
MI	Michigan, Specialties Mfg.	313-771-2700
MN	Minneapolis, Carl Bergquist	612-835-2322
MO	St. Louis, Wes-Garde Comp. Grp.	314-567-7776
NH	Nashua, Wes-Garde Comp. Grp.	603-880-1971
NJ	Mt. Laurel, Wes-Garde Comp. Grp.	609-778-8190
NY	Woodside, Switches Unltd.	718-478-5000
OH	Westerville, Wes-Garde Comps. Grp.	614-885-0319
OR	Portland, Minarik Elec.	503-253-3402
SC	Columbia, Dixie Elctrns.	803-779-5332
TX	Dallas, Wes-Garde Comp. Grp.	214-357-1768
TX	San Antonio, Minarik Elec.	512-822-7097
WI	Mequon, Lake-View Elctrns.	414-377-8250
Can	Edmonton, Deskin Sls.	403-466-2106
Can	Montreal, Deskin Sls.	514-331-2860
Can	Ottawa, Deskin Sls.	613-729-1099
Can	Richmond, Vancouver, Deskin Sls.	604-324-8343
Can	Toronto, Deskin Sls.	416-475-1412
Can	Winnipeg, Deskin Sls.	403-466-2106

SOSHIN ELECTRIC CO., LTD., No. 18-18, 1-Chome Nakamagome, Ota-Ku, Tokyo, Japan, Tel: (03) 775-2111, TELEX: 246-6377, FAX: (03)775-2071; Empl.: 1,000; *Sls. Mgr.:* N. Hiraide, Foreign Trade Dept.

SOUNDCOAT CO., INC., 1 Burt Dr., Deer Park, NY 11729, Tel: 516-242-2200, TELEX: 12-5514, FAX: 516-242-2246; Empl.: 100; *Sls. Mgr.:* Mr. Carl Wolaver

SOURIAU, INC., 28309 N. Avenue Crocker, Valencia, CA 91355, Tel: 805-257-4830, TELEX: 4720328, TWX: 910-336-1553, FAX: 805-257-2383; Empl.: 79; *Sls. Mgr.:* Keith L. Olsen; *Dist. Mgr.:* Sheridan Loungway

SOUTH AMERICAN DEVELOPMENT CORP., Rte. 9G, R.D. 413, Hyde Park, NY 12538, Tel: 914-229-8866, TELEX: 4990035; Empl.: 80; *Sls. Mgr.:* L. Faber

SOUTHCO, INC., 210 N. Brinton Lake Rd., Concordville, PA 19331, Tel: 215-459-4000, TELEX: 83-1485, TWX: 710-760-1715, FAX: 215-459-4012; *Sls. Mgr.:* R. W. Dougherty

SOUTHERN COMPUTER CORP., 141 W. Wieuca Rd., Ste. 300-B, Atlanta, GA 30342, Tel: 404-252-3340, TWX: 910-250-0481 SOU COMPUQ; *Sls. Mgr.:* Ray Manley

SOUTHERN ELECTRONICS, F-Dyne, 726 So. Flower St., Burbank, CA 91502, Tel: 818-845-2458, FAX: 818-845-6348; Empl.: 100; *Sls. Mgr.:* Wayne Melvin

SOUTHWEST TECH PRODS CORP., 219 W. Rhapsody, San Antonio, TX 78216, Tel: 512-344-0242; Empl.: 34

SPACE ELECTRONICS, INC., Box 2166, Meriden, CT 06450, Tel: 203-235-7755; Empl.: 26; *Sls. Mgr.:* Richard Boynton

SPANTA, INC., 795 Franklin Ave., P.O. Box 193, Franklin Lakes, NJ 07417, Tel: 201-848-0033, TELEX: 136011; Empl.: 10; *Sls. Mgr.:* W. Phifer; *Dist. Mgr.:* W. Phifer

SPARKOMATIC, Rte. 6 & 209, Milford, PA 18337, Tel: 717-296-6444, TWX: 510-260-2682; Empl.: 400; *Sls. Mgr.:* Gary Pomes

SPECIALTY CABLE CORPORATION, P.O. Box 50, Wallingford, CT 06492, Tel: 203-265-7126, 800-243-3959, TWX: 510-100-4275, FAX: 203-269-5293; Empl.: 94

SPECIALTY CONNECTOR CO., 2100 Earlywood Dr., Franklin, IN 46131, Tel: 317-738-2800, TELEX: 217084

SPECIALITY ELECTRONICS, INC., 208 E. Rutherford St., Landrum, SC 29356, Tel: 803-457-3824; Empl.: 10; *Sls. Mgr.:* John Galli ..... **C•1555**

SPECO DIV., Components Specialties, Inc., P.O. Box 624, 1172 Rte. 109, Lindenhurst, NY 11757, Tel: 516-957-8700, 800-645-5516, TELEX: 96-7754; FSC No.: 516-957-9142; Empl.: 29; *Sls. Mgr.:* Eric Forman; *Dist. Mgr.:* Bruce Kurtz

SPECTRACOM CORPORATION, 101 Despatch Drive, East Rochester, NY 14445-1484, Tel: 716-381-4827, TELEX: 9103509587

SPECTRAGRAPHICS CORP., 9125 Rehco Rd., San Diego, CA 92121, Tel: 619-450-0611, TELEX: 295439; Empl.: 170; *Sls. Mgr.:* Ray Barger, VP Sls.; *Dist. Mgr.:* Elliot Shev

SPECTRAL DYNAMICS DIVISION, Scientific-Atlanta, Inc., 4255 Ruffin Rd., San Diego, CA 92123-0575, Tel: 619-268-7100, TWX: 910-335-2022; Empl.: 250

SPECTRA LUX CORP., 12840 N.E. 21 St. Pl., Bellevue, WA 98005, Tel: 206-747-0560; FSC No.: 51896; *Sls. Mgr.:* Ron Bustad

SPECTRAN CORP., 50 Hall Road, Sturbridge, MA 01566, Tel: 617-765-0851, TELEX: 709816, FAX: 347-2747; FSC No.: 6V569; Empl.: 175

SPECTRASCAN, INC., 1110A Elkton Drive, Colorado Springs, CO 80907, Tel: 303-599-9254, TWX: 312194 SPECTRASCAN UD; Empl.: 15; *Sls. Mgr.:* John Condren

SPECTRA SONICS, 3750 Airport Rd., Ogden, UT 84405, Tel: 801-392-7531; Empl.: 35

SPECTRA-STRIP, See Amphenol Products

SPECTRO EQUIPMENT, INC., 13821 Progress Pkwy., N. Royalton, OH 44133, Tel: 216-237-8910; Empl.: 25

SPECTROL ELECTRONICS, 17070 East Gale Ave., City of Industry, CA 91745, Tel: 818-964-6565, TWX: 910-584-1314; Empl.: 600; *Sls. Mgr.:* S. Deiling

SPECTRON GLASS & ELECTRONICS, INC., 595 Old Willets Path, P.O. Box 13368, Hauppauge, NY 11788, Tel: 516-582-5600, TELEX: 968296; FSC No.: 57349; *Sls. Mgr.:* Lonnie Bott

SPECTRONICS CORP., 956 Brush Hollow Rd., Westbury, NY 11590, Tel: 516-333-4840, TWX: 510-222-5877, FAX: 516-333-4840; Empl.: 125; *Sls. Mgr.:* Gerard Hubner

SPECTRUM CONTROL, INC., 2185 W. 8th St., Erie, PA 16505, Tel: 814-455-0966, TWX: 510-699-6871, FAX: 814-455-2550; FSC No.: 33095;5733; Empl.: 450; *Sls. Mgr.:* Herb Bostrom; *Dist. Mgr.:* C. Pirro

SPECTRUM SIGNAL PROCESSING INC., 240 H Street, Blaine, WA 98230, Tel: 1-800-663-8986 (US); 604-438-7266 (Can.), FAX: 604-430-0144; Empl.: 14; *Sls. Mgr.:* Judy A. Bishop

Local Sales Offices & Reps

CA	Manhattan Bch., Forth, Inc.	213-372-8493
MA	Waltham, Spectrum Signal Processing	1-800-323-1842,604-890-3400

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a DATUM company

FAX: 805-683-3481

SPECTRUM TECHNOLOGY, INC., DATUM, Incorporated, 300 Lopez Rd., Goleta, CA 93116, Tel: 805-964-7791, TWX: 910-334-1163; FSC No.: 32464; Empl.: 100; *Sls. Mgr.:* Don W. Cope ..... **A•1465-1468**

Local Sales Offices & Reps

AZ	Mesa, Sedco Sls.	602-461-9069
CA	Los Angeles, The Thorson Co.	213-595-0361
CA	San Diego, The Thorson Co.	619-292-8525
CA	San Jose, Frequency Control Assocs.	415-851-8772
CT	Milford, Todino Engrg. Sls.	203-874-6643
FL	Seminole, S.E.S.	813-391-1920
IL	Elgin, R.K. Elctrns.	312-695-8552
MA	Needham, Todino Engrg. Sls.	617-444-7925
NM	Albuquerque, I.M.E.C.	505-883-9010
NY	Melville, Carnes Assocs.	516-694-1600
TX	Dallas, Caton Sls.	214-243-4716
VA	Fairfax, Schibley Assocs.	703-591-3008

Spellman
High Voltage Electronics Corporation

FAX: 516-349-8699

SPELLMAN HIGH VOLTAGE ELCTRNS. CORP., 7 Fairchild Ave., Plainview, NY 11803, Tel: 516-349-8686, TWX: 510-221-2155; Empl.: 150; *Sls. Mgr.:* Tom Stutzbach; *Dist. Mgr.:* Eric Marko ..... **D•1973-1977**

Local Sales Offices & Reps

CA	Costa Mesa, FLW-Southern	714-751-7512
CA	Hayward, FLW-Northern	415-786-9070
FL	Orlando, Gra-Mar, Inc.	305-658-1971
WA	Kirkland, Syntek	206-488-0394
Can	British Columbia, Broman Engrg.	604-254-6311

SPEMCO SWITCHES, 23425 Harper, Box 386, St. Clair Shores, MI 48080, Tel: 800-482-2828, FAX: 313-771-3491; Empl.: 12

SPERRY, A. W. INSTRUMENTS, P.O. Box 9300, Smithtown, NY 11787, Tel: 516-231-7050, 800-645-5398, TELEX: 645104; Empl.: 50; *Sls. Mgr.:* Dennis W. Carroll

SPIRA MANUFACTURING CORP., 12721 Saticoy Street South, North Hollywood, CA 91605, Tel: 818-764-8222, FAX: 818-764-9880; FSC No.: 60050; Empl.: 18; *Sls. Mgr.:* Lisa A Panzich

SPIRICON, INC., 2600 North Main, Logan, UT 84321, Tel: 801-753-3729, TELEX: 296 465 SPIR UR; Empl.: 15; *Sls. Mgr.:* John Gibbs

SPRAGUE ELECTRIC COMPANY, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102, Tel: 617-339-8900, TELEX: 928071, TWX: 7103210021; FSC No.: 56289; Empl.: 10,500; *Sls. Mgr.:* Theodore W. Fischer, VP Sls./Mktg., Passive Comps. Grp.; *Dist. Mgr.:* James O'Sullivan, Sls. Mgr. ..... **A•1694, 1757, 2031; D•1142**

Local Sales Offices & Reps

AL	Huntsville, Electramark Inc.	205-539-7040
AL	Madison, EPI Inc.	205-461-7000,205-883-0520
AZ	Mesa, Sprague Electric Company	602-244-0154, 602-831-6762
AZ	Tucson, Sprague Electric Company	602-746-0955
CA	Burlingame, William J. Purdy Co.	415-347-7701
CA	San Diego, Miner Assocs., Inc.	619-566-9891
CA	Santa Ana, Sprague Electric Company	714-549-9913
CA	Van Nuys, Sprague Electric Company	818-994-6500
CO	Denver, William J. Purdy Co.	303-753-6800
CO	Longmont, Todd & Fry Assocs.	303-776-7331
CT	Guilford, Data Mark Inc.	203-453-0575
CT	Southbury, Sprague Electric Company	203-264-9595
CT	Wallingford, Sprague Electric Company	203-284-8300
FL	Altamonte Springs, Sprague Electric Company	305-831-3636

FL Ft. Lauderdale, Sprague Electric Company 305-491-7411
FL Tampa, Sprague Electric Company ... 813-962-1882
GA Atlanta, Elctm. Mktg. Assocs. 404-448-1215
GA Norcross, Electramark Inc. 404-446-7915
IL Northbrook, D. Dolin Sls. 312-498-6770
IN Indianapolis, Sprague Electric Company 317-253-4247
IA Cedar Rapids, J.R. Sls. 319-393-2232
KS Overland Pk., EPI, Inc. 913-642-9118
KY Lexington, Sprague Elec. Co. 606-224-4230
MD Laurel, Sprague Elec. Co. 301-792-4890
MA burlington, New England Tech. Sls. ... 617-272-0434
MA Framingham, Sprague Electric Company 617-875-3200
MI Ann Arbor, Sprague Electric Company 313-761-2014
MN Minneapolis, HMR, Inc. 612-888-2122
MO St. Louis, EPI, Inc. 314-962-1411
NJ Cherry Hill, Trinkle Sls., Inc. 609-795-4200
NJ Wayne, Sprague Electric Company ... 201-696-8200
NY Central Islip, Sprague Electric Company 516-234-8700
NY Larchmont, Sprague Electric Company 914-834-4439
NY Syracuse, Paston-Hunter Co., Inc. 315-437-2843
NY Syracuse, Sprague Electric Company 315-437-7311
NC Charlotte, Sprague Electric Company 704-527-1306
NC Raleigh, Elctm. Mktg. Assocs. 919-847-8800
OH Dublin, Sprague Electric Company 614-761-1881
OR Beaverton, William J. Purdy Co. 503-641-9373
SC Greenville, Elctm. Mktg. Assocs. 803-233-4637
TX Austin, Sprague Electric Company 512-458-2514
TX Dallas, Sprague Electric Company 214-235-1256
WA Redmond, William J. Purdy Co. 206-882-3144
WA Vancouver, Sprague Electric Company 206-892-0361
WI Milwaukee, D. Dolin Sls. 414-482-1111
Can Downsview, Ont., Sprague Electric of Canada, Ltd. 416-665-6066
Can Markham, Ont., Birde Mktg., inc. 416-477-7722
Can Nepean, Ont., Sprague Elec. of Canada, Ltd. 613-726-0696
Can Ottawa, Ont., Sprague Electric of Canada, Ltd. 613-238-2542

SPRAGUE ELECTRIC COMPANY, Advanced Ceramics Group, 267 Lowell Road, Hudson, NH 03051, Tel: 603-881-7200, FAX: 603-881-3168

See Sprague Electric World Headquarters listing for list of sales offices and reps.

SPRAGUE ELECTRIC COMPANY, The Capacitor Group, 267 Lowell Rd., Hudson, NH 03051, Tel: 603-881-7200

See Sprague Electric World Headquarters listing for list of sales offices and reps.

SPRAGUE ELECTRIC COMPANY, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483, Tel: 619-575-9353, TWX: 619-575-9425, FAX: 619-575-4081 ..... **A•1694, 2031**

See Sprague Electric World Headquarters listing for list of sales offices and reps.

Local Sales Offices & Reps

AL Huntsville, Montgomery Mktg., Inc. 205-830-0498
AZ Tempe, Techni-Source, Inc. 602-730-8093
CA Campbell, Sprague Elec. Co. 408-374-1017
CA Cupertino, Sprague Elec. Co. 408-973-7878
CA Long Bch., Sprague Elec. Co. 213-435-9100
CA Mission Viejo, Sprague Elec. Co. 714-830-1740
CA San Diego, Miner Assocs., Inc. 619-566-9891
CA Santa Ana, Jones & McGeoy Sls., Inc. 714-547-6466,818-244-9884
CA Santa Clara, Criterion Sls. 408-988-6300
CA Van Nuys, Sprague Elec. Co. 818-994-6500
CO Englewood, William J. Purdy Assocs. 303-790-2211
CT Southbury, Sprague Elec. Co. 203-264-9595
CT Wallingford, New England Tech. Sls. Corp. 203-284-8300
DC Cherry Hill, NJ, Trinkle Sls. Inc. 609-795-4200
FL St. Petersburg, Electramark Florida, Inc. 813-894-2299
FL Tampa, Sprague Elec. Co. 813-962-1882
GA Norcross, Montgomery Mktg., Inc. 404-447-6124
GA Norcross, Sprague Elec. Co. 404-263-3715
ID Boise, Bob Sickler Sls. 208-344-9588
IL Rolling Meadows, Sumer, Inc. 312-991-8500
IL St. Louis, MO, EPI Inc. 314-962-1411
IN Indianapolis, Sprague Elec. Co. 317-253-4247
IN Indianapolis, SAI Mktg. Corp. 317-545-1010
IA Cedar Rapids, J.R. Sls. Engrg., Inc. 319-393-2232
KS Overland Pk., EPI Inc. 913-642-9118
KY Jackson, MS, EPI Southwest 601-856-6251
KY Lexington, SAI Mktg. Corp. 606-224-4230
MD Cherry Hill, NJ, Trinkle Sls. Inc. 609-795-4200
MA Burlington, New England Tech. Sls. Corp. 617-272-0434
MI Ann Arbor, Sprague Elec. Co. 313-971-7780
MI Fenton, SAI Mktg. Corp. 313-750-1922
MN Minneapolis, HMR, Inc. 612-888-2122
MS Jackson, EPI Southwest 601-856-6251
MO St. Louis, EPI Inc. 314-962-1411
NE Cedar Rapids, IA, J.R. Sls. Engrg., Inc. 319-393-2232
NH Burlington, MA, New England Tech. Sls. Corp. 617-272-0434
NY Babylon, Astrorep, Inc. 516-422-2500
NY Cherry Hill, Trinkle Sls. Inc. 609-795-4200
NY E. Syracuse, Ossmann Assocs., Inc. 315-437-7052
NY Henrietta, Ossmann Assocs., Inc. 716-359-1200
NY Wayne, Astrorep, Inc. 201-696-8200
NC Charlotte, Sprague Elec. Co. 704-527-1306
NC Raleigh, Montgomery Mktg., Inc. 919-851-0010
OH Columbus, SAI Mktg. Corp. 614-451-0778
OH Dayton, SAI Mktg. Corp. 513-435-3181
OH Shaker Hgts., SAI Mktg. Corp. 216-751-3633
OR Vancouver, WA, Spargue Elec. Co. 503-225-0493
PA Cherry Hill, NJ, Trinkle Sls., Inc. 215-922-2080
SC Raleigh, NC, Montgomery Mktg., Inc. .. 919-851-0010
TN Huntsville, AL, Montgomery Mktg., Inc. 205-830-0498
TN Jackson, MS, EPI Southwest 601-856-6251
TX Austin, Sprague Elec. Co. 512-458-2514
TX Dallas, Sprague Elec. Co. 214-235-1256
TX Richardson, Bonser-Philhower Sls. 214-234-8438
UT Englewood, CO, William J. Purdy Assocs. 303-790-2211
VA Cherry Hill, NJ, Trinkle Sls. Inc. 609-795-4200
WA Boise, ID, Bob Sickler Sls. 208-344-9588
WA Vancouver, Sprague Elec. Co. 206-892-0361
WI Brookfield, Sumer, Inc. 414-784-6641
PR Rio Piedras, Elctm. Sls. Assocs. 809-762-6707
Can Calgary, Alberta, Vitel Elctms. 403-278-5833
Can Kanata, Ont., Vitel Elctms. 613-592-0090
Can La Chine, Que., Vitel Elctms. 514-636-5951
Can Mississauga, Ont., Vitel Elctms. 416-676-9720
Can Toronto, Ont., Sprague Elec. of Canada, Ltd. 416-766-6123

Local Distributors

CA Culver City, Hamilton/Avnet Elctms. .. 213-558-2000
CA El Monte, Marshall Inds., Inc. 818-459-5500
CA Santa Clara, Wyle Labs/EMG 408-727-2500
CA Sunnyvale, Acacia/VWR Elctms. 408-745-7299
CT Milford, Falcon Elctms., Inc. 203-878-5272
FL Tampa, Reptron Elctms., Inc. 813-855-4656
IL Chicago, Newark Elctms. Corp. 312-784-5100
IN Indianapolis, Graham Elctm. Supp., Inc. 317-634-8202
MD Timonium, Zebra Elctms., Inc. 301-252-6576
MA N. Adams, Elctm. Supp. Ctr. 413-664-1086
MA N. Adams, Ico-Rally Corp. 413-664-4951
NY Buffalo, Summit Dists. 716-887-2800
NY Mamoneck, New Yorker Elctms., Inc. 914-698-7600
NY Melville, Arrow Elctms. Distbn. Div. 516-391-1300
NY Port Chester, Zeus Comps., Inc. 914-937-7400
NY Ronkonkoma, Tri-Start Elctms. 516-737-2200
NY Westbury, Schweber Elctms. Corp. 516-334-7555
OK Tulsa, Radio, Inc. 918-587-9123
PA Montgomeryville, Pyttronic Inds., Inc. .. 215-643-2850
PA Philadelphia, Almo Elctms., Inc. 215-698-4003
TX Ft. Worth, TTI, Inc. 817-831-8300
TX Houston, Kent Elctms. 713-780-7770
TX Houston, Sterling Elctms. 713-623-6600
WI Milwaukee, Marsh Elctms., Inc. 414-475-6000
Can Pointe Claire, Montreal, Future Elctms., Inc. 514-694-7710

SPRAGUE®
THE MARK OF RELIABILITY
SEMICONDUCTOR GROUP

FAX: 617-853-5049

SPRAGUE ELECTRIC COMPANY, The Semiconductor Group, 115 Northeast Cutoff, Box 2036, Worcester, MA 01613-2036, Tel: 617-853-5000, TWX: 710-340-6304; *Sls. Mgr.:* Brad Marshall, VP Sls. & Mktg., Semiconductor Grp. ..... **A•1757; D•1142**

See Sprague Electric World Headquarters listing for list of sales offices and reps.

Local Sales Offices & Reps

AL Huntsville, Montgomery Mktg., Inc. 205-830-0498
AZ Tempe, Techni-Source, Inc. 602-730-8093
CA Campbell, Sprague Elec. Co. 408-374-1017
CA Cupertino, Sprague Elec. Co. 408-973-7878
CA Long Bch., Sprague Elec. Co. 213-435-9100
CA Mission Viejo, Sprague Elec. Co. 724-830-1740
CA San Diego, Miner Assocs., Inc. 619-566-9891
CA Santa Ana, Jones & McGeoy Sls., Inc. 714-547-5466,818-244-9884
CA Santa Clara, Criterion Sls. 408-988-6300
CA Van Nuys, Sprague Elec. Co. 818-994-6500
CO Englewood, William J. Purdy Assocs. 303-790-2211
CT Southbury, Sprague Elec. Co. 203-264-9595
CT Wallingford, New England Tech. Sls. Corp. 203-284-8300
DC Cherry Hill, NJ, Trinkle Sls. Inc. 609-795-4200
FL St. Petersburg, Electramark Florida, Inc. 813-894-2299
FL Tampa, Sprague Elec. Co. 813-962-1882
GA Norcross, Montgomery Mktg., Inc. 404-447-6124
GA Norcross, Sprague Elec. Co. 404-263-3715
ID Boise, Bob Sickler Sls. 208-344-9588
IL Rolling Meadows, Sumer, Inc. 312-991-8500
IL St. Louis, MO, EPI Inc. 314-962-1411
IN Indianapolis, Sprague Elec. Co. 317-253-4247
IN Indianapolis, SAI Mktg. Corp. 317-545-1010
IA Cedar Rapids, J.R. Sls. Engrg., Inc. 319-393-2232
KS Overland Pk., EPI Inc. 913-642-9118
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MI Fenton, SAI Mktg. Corp. 313-750-1922
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NH Burlington, MA, New England Tech. Sls. Corp. 617-272-0434
NJ Cherry Hill, Trinkle Sls. Inc. 609-795-4200
NJ Wayne, Astrorep, Inc. 201-696-8200
NY Babylon, Astrorep, Inc. 516-422-2500
NY E. Syracuse, Ossmann Assocs., Inc. 315-437-7052
NY Henrietta, Ossmann Assocs., Inc. 716-359-1200
NC Charlotte, Sprague Elec. Co. 704-527-1306
NC Raleigh, Montgomery Mktg., Inc. 919-851-0010
OH Columbus, SAI Mktg. Corp. 614-451-0778
OH Dayton, SAI Mktg. Corp. 513-435-3181
OH Shaker Hgts., SAI Mktg. Corp. 216-751-3633
OR Vancouver, WA, Sprague Elec. Co. 503-225-0493
PA Cherry Hill, PA, Trinkle Sls. Inc. 215-922-2080
SC Raleigh, NC, Montgomery Mktg., Inc. .. 919-851-0010
TN Huntsville, AL, Montgomery Mktg., Inc. 205-830-0498
TN Jackson, MS, EPI Southwest 601-856-6251
TX Austin, Sprague Elec. Co. 512-458-2514
TX Dallas, Sprague Elec. Co. 214-235-1256
TX Richardson, Bonser-Philhower Sls. 214-234-8438
UT Englewood, CO, William J. Purdy Assocs. 303-790-2211
VA Cherry Hill, NJ, Trinkle Sls. Inc. 609-795-4200
WA Boise, ID, Bob Sickler Sls. 208-344-9588
WA Vancouver, Sprague Elec. Co. 206-892-0361
WI Brookfield, Sumer, Inc. 414-784-6641
PR Rio Piedras, Elctm. Sls. Assocs. 809-762-6707
Can Calgary, Alberta, Vitel Elctms. 403-278-5833
Can Kanata, Ont., Vitel Elctms. 613-592-0090
Can La Chine, Que., Vitel Elctms. 514-636-5951
Can Mississauga, Ont., Vitel Elctms. 416-676-9720
Can Toronto, Ont., Sprague Elec. of Canada, Ltd. 416-766-6123

Local Distributors

CA Culver City, Hamilton/Avnet Elctms. .. 213-558-2000
CA El Monte, Marshall Inds., Inc. 818-459-5500
CA Santa Clara, Wyle Labs/EMG 408-727-2500
CA Sunnyvale, Acacia/VWR Elctms. 408-745-7299
CT Milford, Falcon Elctms., Inc. 203-878-5272
FL Tampa, Reptron Elctms., Inc. 813-855-4656
IL Chicago, Newark Elctms. Corp. 312-784-5100
IN Indianapolis, Graham Elctm. Supp., Inc. 317-634-8202
MD Timonium, Zebra Elctms., Inc. 301-252-6576
MA N. Adams, Elctm. Supp. Ctr. 413-664-1086
MA N. Adams, Ico-Rally Corp. 413-664-4951
NY Buffalo, Summit Dists. 716-887-2800
NY Mamoneck, New Yorker Elctms., Inc. 914-698-7600
NY Melville, Arrow Elctms. Distbn. Div. 516-391-1300
NY Port Chester, Zeus Comps., Inc. 914-937-7400
NY Ronkonkoma, Tri-Start Elctms. 516-737-2200
NY Westbury, Schweber Elctms. Corp. 516-334-7555
OK Tulsa, Radio, Inc. 918-587-9123
PA Montgomeryville, Pyttronic Inds., Inc. .. 215-643-2850
PA Philadelphia, Almo Elctms., Inc. 215-698-4003
TX Ft. Worth, TTI, Inc. 817-831-8300
TX Houston, Kent Elctms. 713-780-7770

TX Houston, Sterling Elctrns. 713-623-6600
WI Milwaukee, Marsh Elctrns., Inc. 414-475-6000
Can Pointe Claire, Montreal, Future Elctrns., Inc. 514-694-7710

SPRAGUE GOODMAN

FAX: 516-746-1396

SPRAGUE-GOODMAN ELCTRNS., INC., 134 Fulton Ave., Garden City Pk., NY 11040, Tel: 516-746-1385, TELEX: 14-4533; FSC No.: 52769; Empl.: 80; *Sls. Mgr.:* Michael Trubowitsch ..... **A•1174-1175**

Local Sales Offices & Reps

AL Huntsville, Interep Assocs. 205-533-1730
AZ Phoenix, Sanford Sls. Assocs. 602-957-3570
CA Cupertino, Dura Elctrn. Sls. 408-255-2084
CA Garden Grove, ELSCO Elctrns. 714-891-4621
CO Denver, West Inc. 303-477-8180
CT Beacon Falls, KSA Connecticut 617-443-5881
FL Clearwater, Beacon Elctrn. Assocs. ... 813-796-2378
GA Norcross, Interep Assocs., Inc. 404-449-8680
IL Chicago, B.N.I. Elctrns. 312-775-1717
IN Ft. Wayne, Denton Mktg., Inc. 219-486-0665
IA Marion, M.S.B. Assocs. 319-377-6261
KS Shawnee Mission, M.S.B. Assocs. 913-432-2131
MD Monkton, Imagitron Sls. 301-374-5600
MA Sudbury, KSA of New England 617-443-5881
MI Southfield, Fred H. Gehrke & Assocs. 313-559-5363
MO St. Charles, M.S.B. Assocs. 314-946-5577
NJ Chatham Township, Richman/Waterview Tech. Sls. 201-635-1839
NY Commack, Richman Sls. Co. 516-543-5532
NY Utica, Upstate Engrg. Sls. 315-797-6721
NC Raleigh, Micro Sls. Inc. 919-881-0007
OH Cincinnati, Stegman Blaine Mktg. 513-729-1969
OR Portland, Harry Levinson 503-245-1902
PA Maple Glen, Imagitron/Pennsylvania .. 800-638-3592
TN Greenville, Interep Tennessee 615-639-3491
TX Seagoville, Delta Comps. 214-287-6333
WA Seattle, Harry Levinson Co. 206-382-1300
PR Rio Piedras, Elctrn. Sls. Assocs. 809-762-6459
Can Toronto, Ont., Norgay Entprs. 416-259-9663

Local Distributors

CA Canoga Pk., Schweber Elctrns. 213-999-4702
CA Chatsworth, TTI, Inc. 818-709-1010
CA Garden Grove, Natl. Elctrns. 714-892-7749
CA Gardena, Schweber Elctrns. 213-327-8409
AL Huntsville, Comp. Dists. 205-883-7501
CA Irvine, Kelex Elctrns. 714-863-1230
CA Irvine, Schweber Elctrns. 714-863-0200
CA Milpitas, Projections Unltd. 408-942-1717
CA Milpitas, TTI, Inc. 408-943-9155
AZ Phoenix, Arizona Comps. 602-269-5655
CA Sacramento, Schweber Elctrns. 916-929-9732
CA San Diego, Neumann Elctrns. 619-695-3005
CA San Diego, Projections Unltd. 619-453-7900
CA San Jose, Schweber Elctrns. 408-946-7171
CA Sunnyvale, Acacia/VWR Elctrns. ..... 408-745-7200 (x 69)
CA Tustin, Projections Unltd. 714-544-2700
CO Englewood, Schweber Elctrns. 303-799-0258
CO Lakewood, Acacia/VWR Elctrns. 303-232-2882
CO Westminster, TTI, Inc. 303-429-6806
FL Altamonte Springs, Schweber Elctrns. 305-331-7555
FL Ft. Lauderdale, Bros. Elctrns. of FL 305-561-6700
FL Ft. Lauderdale, Hammond Elctrns. 305-973-7103
FL Largo, Elctrn. Precepts of FL 813-544-3636
FL Melbourne, Comp. Dists. 305-724-9910
FL Orlando, Hammond Elctrns. 305-849-6060
FL Orlando, TTI, Inc. 305-859-1000
IL Elk Grove VL, Schweber Elctrns. 312-364-3750
IL Skokie, Kellner Elctrns., Inc. 800-323-0460
IN Indianapolis, Pioneer/Indiana ..... 317-849-7300 (x 350)
KS Overland Pk., Schweber Elctrns. 913-492-2922
MD Columbia, TTI, Inc. 301-995-1331
MD Gaithersburg, Schweber Elctrns. 301-840-5900
MA Bedford, Schweber Elctrns. 617-275-5100
MA Wilmington, Marshall Inds. 617-658-0810
MA Woburn, Sterling Elctrns. 617-938-6200
MA Woburn, TTI, Inc. 617-938-8800
MN Eden Prairie, TTI, Inc. 612-944-5080
MO Earth City, Schweber Elctrns. 314-739-0526
NJ E. Brunswick, Varitech Elctrns. Inc. 201-390-4700
NJ Fairfield, Schweber Elctrns. 201-227-7880
NY Buffalo, Summit Dists., Inc. 716-887-2835/2836
NY Mamoroneck, New Yorker Elctrns. 914-698-7600
AZ Phoenix, Schweber Elctrns. 602-997-4874
AZ Phoenix, TTI, Inc. 602-966-1616
NY Rochester, Schweber Elctrns. 716-424-2222
NY Rome, Rome Elctrns. 315-337-5400
NY Ronkonkoma, Tri-Start Elctrns. 516-737-2200
NY Ronkonkoma, TTI, Inc. 516-737-2000
NY Westbury, Schweber Elctrns. ..... 516-334-7555 (x 276)
OH Beachwood, Schweber Elctrns. 216-464-2970
OH Columbus, TTI, Inc. 614-848-5770
OH Dayton, Pioneer/Dayton 513-236-9900
PA Harrisburg, Adtech 717-939-8337
PA Horsham, Schweber Elctrns. 215-441-0600
PA Philadelphia, Almo Elctrns. 215-698-4003
PA Pittsburgh, Schweber Elctrns. 412-782-1600
TX Dallas, Comp. Dists. 214-644-0373
TX Dallas, Schweber Elctrns. 214-661-5010
TX Ft. Worth, TTI, Inc. 800-433-7637
TX Garland, J & S 214-487-8808
VT Charlotte, Kellner Elctrns., Inc. 800-323-0460
WA Redmond, TTI, Inc. 206-882-0291
WA Seattle, Kam Elctrns. 206-382-1300
WI Milwaukee, Marsh Elctrns., Inc. 414-475-6000
WI New Berlin, Schweber Elctrns. 414-784-9020

SPRAGUE SOLID STATE, 3900 Welsh Rd., Willow Grove, PA 19090, Tel: 215-657-8400, TELEX: 476-1101, TWX: 510-661-7267; Empl.: 525

SPRUCE PINE MICA CO., Mtn. Laurel Dr., Spruce Pine, NC 28777, Tel: 704-765-4241, FAX: 704-765-7192; Empl.: 45; *Sls. Mgr.:* Bill Pittman

SPS INC. (MUIRHEAD VACTRIC), 51 Commerce St., Springfield, NJ 07081, Tel: 201-376-1222, TELEX: 13-8275; FSC No.: 0BKV4; Empl.: 60; *Sls. Mgr.:* Bob Conroy

SPS SOFTWARE PRODUCTS & SERVICES, INC., 14 E. 38th Street, 14th Fl., New York, NY 10016, Tel: 212-686-3790, TELEX: 852616, FAX: 212-481-7464; *Sls. Mgr.:* Peter Voletsky

SPUR PRODUCTS CORP., 13649 Beach Ave., Marina Del Rey, CA 90292, Tel: 213-822-7100, FAX: 213-578-0370; Empl.: 19; *Sls. Mgr.:* Ray Lorenz

SQUARE D CO., Executive Plaza, Palatine, IL 60067, Tel: 312-397-2600, TELEX: 247-119; Empl.: 22600; *Sls. Mgr.:* C. N. Thompson, VP; *Dist. Mgr.:* T. W. Wilbor, VP

SR ENGINEERING, BW/IP International, Inc., 13961 Nautilus Dr., Dept. E, Garden Grove, CA 92643, Tel: 714-554-4200, TELEX: 364412INTR-871, FAX: 714-554-1069; FSC No.: 21441; *Sls. Mgr.:* Coleman W. Conrad

Local Sales Offices & Reps

AL Huntsville, Hughes Assocs., Inc. 205-533-9108
AZ Phoenix, The Knight Co. 602-994-1311
CA Hayward, Liaison, Inc. 415-783-1131
CA Los Angeles, The Knight Co. 714-833-8250
MA Hingham, Shain Assocs., Inc. 617-740-2334
FL Orlando, Hughes Assocs., Inc. 305-774-7117
IL La Grange Pk., Bierhaus Sls. Inc. 312-354-5100
IA Cedar Rapids, Howard R. Brown Sls. Co. 319-366-6635
NH Nashua, Shain Assocs., Inc. 603-881-4881
NY Roslyn Hgts., Travco Assocs. 516-621-3223
WA Seattle, Liaison, Inc. 206-767-3870

SRITEK, INC., 8705 Freeway Dr., Macedonia, OH 44056, Tel: 216-468-3380; Empl.: 40; *Sls. Mgr.:* Dennis Vinci

SSAC Inc

FAX: 315-638-0333

SSAC INCORPORATED, P.O. Box 1000, Baldwinsville, NY 13027, Tel: 315-638-1300, TELEX: 64-6221; FSC No.: 16-0985719; Empl.: 250; *Sls. Mgr.:* G. Weeks ... **B•1589**

Local Sales Offices & Reps

AL Decatur, Tenn Tech, Inc. 205-350-0630
AZ Scottsdale, Vikeland Sls. Inc. 602-948-7921
AR Ft. Smith, Electro-Related Prods. 501-452-4030
CA LaHabra, Nolan Corp. 213-694-2145
CA Pleasanton, Sierra Sls. 415-463-2250
CO Englewood, Computech Mktg. 303-773-3981
FL Tampa, Florida Comp. Sls. 813-960-7044
GA Marietta, Tenn Tech, Inc. 404-971-1419
IL Addison, Vikeland Sls. Inc. 312-832-8425
IN Beech Grove, Control Sls. Inc. 317-786-2272
KS Prairie VL, George Pearson Co. 913-362-4442
MD Glen Burnie, Faber-Renoff 301-768-4554
MA Southborough, Motion Engrg. Inc. 617-485-2144
MI Lake Orion, JFCO Inc. 313-693-2053
MN St. Paul, Vikeland Sls. Inc. 612-645-4647
NJ Paramus, Prime Indl. Comps. 201-262-9090
NY Fairport, Batian Sls. Agy. Inc. 716-223-0237
NC Charlotte, P L & E Inc. 704-366-9222
OH Cleveland, JFCO Inc. 216-398-6300
PA Maple Glen, Certified Elctrl. Sls. 215-646-8996
PA Pittsburgh, JFCO Inc. 412-823-5400
TX Lewisville, Elec. Control Assocs. 214-221-3143
VA Midlothian, Daniel E. Boehling & Assocs. 804-794-5879
WA Mukilteo, Krippner & Assocs. 206-743-3579
WI Thiensville, TFL Assocs. 414-242-6800
Can Brampton, Ont., CPM Inds. 416-457-2450

Local Distributors

AZ Tempe, Control Design Supp. 602-829-7981
AR Little Rock, Carlton Bates 501-562-9100
CA Anaheim, Control Design Supp. 714-821-1516
CA S. San Francisco, Steven Engrg. 415-588-9200
CT Southington, Electro Mechanical Drvs. 203-621-7335
FL Lakeland, A. A. Elec. 813-665-6941
GA Atlanta, Georgia Control Cen. 404-876-8833
GA Norcross, A. A. Elec. 404-449-8670
IL Carol Stream, Lectro Comps. 312-690-0520
IL Mt. Prospect, Automation Equip. Co. .. 312-398-7550
IN Indianapolis, Control Design 317-788-4559
IA Marion, Control Design Supp. 319-373-2923
KS Wichita, Delta Elec. Supp. 316-262-3756
MA Hingham, Sager Elctrl. Supp. 617-749-6700
MA W. Springfield, Tectrol Assocs. 413-733-3695
MA Woburn, Control Design 617-932-9404
MI Grand Rapids, E.C. Elctrns. Inc. 616-530-0576
MN Minneapolis, Control Design 612-721-1628
MN Minneapolis, United Elec. Co. 612-338-1915
MO Kansas City, Barr-Thorp Elec. Co. 816-531-8840
MO Maryland Heights, French Gerleman .. 314-569-3122
MO Springfield, SMC Elec. 417-865-2822
MO St. Louis, Control Design Supp. 314-426-3150
NJ E. Rutherford, A. A. Elec. Co. 201-777-5477
NJ Edison, Brownell Instrs. & Controls 201-287-2030
NJ Oakland, Relay Specialties 201-337-1000
NY Baldwinsville, Scibetta Dist. 315-622-3993
NY Hauppauge, Sager Elctrns. 516-348-1300
NY Penfield, Carlen Distrs. 716-381-9050
NY Rochester, Masline Elctrns. 716-546-5373
NY Rome, Rome Elctrns. 315-337-5400
NY Woodside, Switches Unltd. 718-478-5000
NC Charlotte, Brownell Electro Inc. 704-597-1270
NC Charlotte, Control Design Supp. 704-588-4410
NC Shelby, Dixie Ind. Supp. 704-482-5641
OH Toledo, Fee & McCarthy, Inc. 419-535-3163
OK Oklahoma City, Carlton Bates 405-681-4446
OR Clackamas, Amfac Elec. 503-657-3020
PA Harrisburg, Cumberland Elctrns. 717-232-9715
PA Malvern, Control Design Supp. 215-296-0150
TX Dallas, Watson Elec. 214-742-8441
VA Glen Allen, Hermitage Distrs. 804-798-3830
WI New Berlin, Control Design Supp. 414-784-1015
Can Concord, Ont., Trade Elec. Supp. 416-661-7111
Can Dorval, Que., Raytech Controls Inc. ... 514-631-4806
Can Scarborough, Ont., Banke Elctrns. 416-292-5152
Can Woodbridge, Ont., Sonepar 416-747-7800

STACKBIN CORP., Albion Road, P.O. Box 397, Lincoln, RI 02865, Tel: 401-333-1600, 800-346-1018; Empl.: 75; *Sls. Mgr.:* Valerie Baxter

STACKPOLE, CARBON DIV., 201 Stackpole St., St. Marys, PA 15857, Tel: 814-781-1234, TELEX: 914-514, TWX: 510-693-4511; *Sls. Mgr.:* B. E. Speedy

STACKPOLE COMPONENTS CO., See Ark-les Special Products Grp., Div. of Stackpole Switches

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STACO, INC., See Staco Transpower

STACO ENERGY PRODUCTS CO., 301 Gaddis Blvd., Dayton, OH 45403, Tel: 513-253-1191, TELEX: 288-032, FAX: 513-253-1723; FSC No.: 83008; Empl.: 146; *Sls. Mgr.:* Robert Simpson

STACOSWITCH, 1139 Baker St., Costa Mesa, CA 92626, Tel: 714-549-3041, TWX: 910-595-1507; FSC No.: 12522;Multiple; Empl.: 100; *Sls. Mgr.:* D. Sugg

STACO TRANSPOWER, 610 W. 6th St., Mt. Carmel, IL 62863, Tel: 618-262-5555, TELEX: 510-525-2254; FSC No.: 83008; Empl.: 100; *Sls. Mgr.:* K. R. Harris

STAFFALL INC., 7 Woodland St, Providence, RI 02908, Tel: 401-351-8282, TWX: 710-381-6964; Empl.: 25

STAINLESS, INC., 3rd St, N. Wales, PA 19454, Tel: 215-699-4871, TWX: 510-661-8097, FAX: 215-699-9597; Empl.: 80; *Sls. Mgr.:* Jess C. Rodriguez

STANCOR PRODUCTS, Hamilton Standard Controls, 131 Godfrey St, Logansport, IN 46947, Tel: 219-722-2244, TWX: 810-295-0699, FAX: 219-722-5189; FSC No.: 80089; Empl.: 400; *Sls. Mgr.:* Terry D. Smith; *Dist. Mgr.:* Terry D. Smith ..... **A•2393**

STANDARD CONDENSER CORP., 1065 W. Addison St, Chicago, IL 60613, Tel: 312-327-5440; FSC No.: 97419; *Sls. Mgr.:* B. P. McLean

STANDARD CRYSTAL CORPORATION, 9940 E. Baldwin Pl, El Monte, CA 91734, Tel: 818-443-2121, TELEX: 4998755, FAX: 818-443-9049; FSC No.: 30149; *Sls. Mgr.:* Don Groh; *Dist. Mgr.:* Betty Longwell ..... **A•1469**

STANDARD ENERGY, Div. WBH Scientific, Inc., Rte. 32, Greenville, NY 12083, Tel: 518-966-4197, TELEX: 754180; *Sls. Mgr.:* Gary Hanington

STANDARD ENVIRONMENTAL SYSTEMS, INC., 383 Minnisink Rd., Totowa, NJ 07512, Tel: 201-256-2200, TWX: 710-988-5722, FAX: 201-256-2820; Empl.: 50

STANDARD GRIGSBY, INC., Flint Industries, 920 Rathbone Ave., Aurora, IL 60507, Tel: 312-844-4300, TWX: 910-232-3138, FAX: 312-844-4286; Empl.: 350; *Sls. Mgr.:* Jeff Shaw; *Dist. Mgr.:* Jeff Shaw ..... **B•1796-1797**

STANDARD GRIGSBY INC., W. Gunther GMBH, Virnsberger Strasse 51, D 8500 Nurnberg 82, West Germany, Tel: 0911-65521, TELEX: 622351, FAX: 0911/6552-239 ..... **B•1796-1797**

Local Sales Offices & Reps

AL	Huntsville, Elctrn. Mktg. Assocs.	205-536-3044
AZ	Scottsdale, Heath & Assocs.	602-945-9546
CA	Laguna Hills, Jack Fitch & Assocs.	714-951-0196
CA	Milpitas, Maxim Elctrn. Sls.	408-946-6001
CO	Englewood, D. M. Harthun & Assocs.	303-792-5050
CT	Madison, Focus Elctrn. Sls.	203-245-2097
FL	Casselberry, Dyne-A-Mark Corp.	305-629-5557
FL	Clearwater, Dyn-A-Mark Corp.	813-441-4702
FL	Ft. Lauderdale, Dyne-A-Mark Corp.	305-771-6501
GA	Atlanta, Elctrn. Mktg. Assocs.	404-448-1215
IL	Elmhurst, Hill-Gray, Inc.	312-832-4101
IN	Indianapolis, Needler Sls. Co., Inc.	317-255-8056
IA	Cedar Rapids, Rep Assocs.	319-373-0152
KS	Parket, S. W. Wollard	913-898-6556
MD	Baltimore, Hagy Corp.	301-529-3995
MA	Taunton, Focus Elctrn. Sls.	617-824-3840
MI	Madison Hgts., Pine Sls.	313-589-0350
MN	Bloomington, Murnco	612-854-4161
NJ	Manville, Dynorep, Inc.	201-685-0135
NM	Albuquerque, Heath & Assocs.	505-296-8084
NY	Syracuse, Advanced Comps. Inc.	315-699-2671
NC	Raleigh, Elctrn. Mktg. Assocs.	919-847-8800
OH	Cleveland, Finnegan & Co.	216-398-6300
OH	Dayton, Finnegan & Co.	513-890-8322
OR	Beaverton, Micro Sls.	503-645-2841
PA	Feasterville, Knowles Assocs.	215-322-7100
PA	Newton Sq., Hagy Corp.	215-459-0504
PA	Pittsburgh, Finnegan & Co.	412-823-5400
SC	Greenville, Elctrn. Mktg. Assocs.	803-233-4637
TX	Irving, Aid Elctrns.	214-790-4761
WA	Bellevue, Micro Sls.	206-451-0568
WI	Madison, Hill Gray, Inc.	608-246-8155

Local Distributors

CA	Hayward, KEA Elctrns.	415-887-2900
CO	Englewood, NEP Elctrns.	303-799-9898
FL	Oakland Pk., Zelcon, Inc.	305-565-2555
MN	Fridley, Voyager Elctrns. Corp.	612-571-7766
NJ	Mt. Laurel, Wes-Garde Comps. Grp.	609-778-8190
OH	Cincinnati, U.R.I. Elctrns.	513-761-4030
WI	Ocowomowoc, G.W. Elctrns. Ltd.	414-567-9445

STANDARD MICROSYSTEMS, 35 Marcus Blvd., Hauppauge, NY 11788, Tel: 516-273-3100, TWX: 510-227-8898; FSC No.: 53848; Empl.: 700; *Sls. Mgr.:* J. P. Chalmin; *Dist. Mgr.:* Steve Brander

STANDARD OIL ENGINEERED MATERIALS CO., Carborundum, P. O. Box 156, Niagara Falls, NY 14302, Tel: 716-278-2000; Empl.: 2000 ..... **A•2032-2033**

STANDARD REFERENCE LABS, INC., See Koep Precision Standards, Inc.

STANDARD WIRE & CABLE CO., 2345 Alaska Ave., El Segundo, CA 90245, Tel: 213-536-0006, (800)-447-0006/821-5276, TELEX: 65-3423, TWX: 910-340-6758, FAX: 213-643-9218; Empl.: 110; *Sls. Mgr.:* Glenn Davis; *Dist. Mgr.:* Jerry Gaither

STANDEX ELECTRONICS, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, Tel: 513-871-3777, TELEX: 212066, FAX: 513-871-3779; FSC No.: 56402; Empl.: 450; *Sls. Mgr.:* Charles C. Johnson, VP Sls. ..... **A•1287; B•1576, 1798-1799**

Local Sales Offices & Reps

AL	Huntsville, R. W. Mitscher Co.	205-882-6050
AZ	Mesa, Sedco Sls.	602-461-9069
CA	Granada Hills, C & W Comp. Sls.	818-368-4032
CA	Los Altos, Frauman Assocs.	415-941-0660
CO	Longmont, Butler Tech. Sls.	303-651-7703
CT	Beacon Falls, KSA of New England	203-729-6285
FL	Boca Raton, R. W. Mitscher Co.	305-368-3841
GA	Lawrenceville, R. W. Mitscher Co.	404-923-3239
IL	Arlington Hgts., Brainard-Wilson Mktg.	312-437-2700
IN	Greenfield, William Deem & Assocs., Inc.	317-326-2357
MD	Edina, Jay Borman Sls. Co.	612-922-5525
MD	Laurel, R. W. Mitscher Co., Inc.	301-498-6090
MA	Sudbury, KSA of New England	617-443-5881
MI	Farmington Hills, W. R. Hummon & Assocs., Inc.	313-474-0661
NY	Clarence, R. W. Mitscher Co., Inc.	716-759-2350
NY	Red Hook, R. W. Mitscher Co., Inc.	914-758-8375
NY	Rochester, R. W. Mitscher Co., Inc.	716-227-0839
NY	Utica, R. W. Mitscher Co., Inc.	315-738-0383
NC	Raleigh, R. W. Mitscher Co., Inc.	919-848-0941
OH	Dayton, J. C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-241-4880
OR	Portland, Components Technlg.	503-292-1518
PA	Wynnewood, Metz-Benham Assocs., Inc.	215-896-7300
TN	Johnson City, R. W. Mitscher Co., Inc.	615-929-7258
TX	Houston, B & R Elctrn. Sls. Corp.	713-682-5448
TX	Plano, B & R Elctrn. Sls. Corp.	214-985-0028
VA	Richmond, R. W. Mitscher Co., Inc.	804-264-6883
WI	Waukesha, Brainard-Wilson Mktg.	414-797-7940
Can	Toronto, Ont., Anbak Sls. Canada, Ltd.	416-253-0243

STANFORD APPLIED ENGRG. INC., 3520 De La Cruz Blvd., Santa Clara, CA 95054, Tel: 408-988-0700, TELEX: 408-727-6438; Empl.: 500; *Sls. Mgr.:* Sam S. Camperi; *Dist. Mgr.:* Leon Vermont

STANFORD TELECOMMUNICATIONS, INC., 2421 Mission College Blvd., Santa Clara, CA 95054, Tel: 408-748-1010, TWX: 910-339-9531; FSC No.: 61362; Empl.: 650; *Sls. Mgr.:* Patti Laatso

STANGENES INDUSTRIES, INC., 1052 East Meadow Circle, Palo Alto, CA 94303, Tel: 415-493-0814, FAX: 415-855-9926; FSC No.: 62709; Empl.: 56; *Sls. Mgr.:* Magne Stangenes

STANLEY/AC INTERFACE, 17911 Sampson Lane, Costa Mesa, CA 92647, Tel: 714-841-6090, TELEX: 655328; Empl.: 24; *Sls. Mgr.:* Bill Roth; *Dist. Mgr.:* Ray Ponkey

STANLEY ELECTRONICS, INC., 10 Ocean Ave., Copiague, NY 11726, Tel: 516-842-8866; FSC No.: 61544; Empl.: 6; *Sls. Mgr.:* Isabel Goldberg

Local Sales Offices & Reps

CA	San Jose, P & M Elctrns., Inc.	408-578-4878
CA	Tarzana, High Voltage Sls.	213-881-9194
MA	Chelmsford, Encotronics, Inc.	617-256-4207
OH	Dayton, L. D. Bruno Co.	513-434-1847

STANLEY HARDWARE DIV., Stanley Works, 195 Lake St., New Britain, CT 06050, Tel: 800-622-HDWE, 203-225-5111; *Sls. Mgr.:* Jack Gauthier

STANLEY-VIDMAR, Stanley Works, 11 Grammes Rd., Allentown, PA 18103, Tel: 215-797-6600, TELEX: 847-345; Empl.: 5000; *Sls. Mgr.:* Ernie Gitlin, Vic Joliat; *Dist. Mgr.:* Frank Casey

STANPAT PRODS., 366 Main St., Port Washington, NY 11050, Tel: 516-883-8400, FAX: 516-883-6577; Empl.: 25; *Sls. Mgr.:* Mark Barbone

STANTON MAGNETICS, INC., Terminal Dr., Plainview, NY 11803, Tel: 516-349-0235, TWX: 510-221-1845, FAX: 516-349-0230; Empl.: 300; *Sls. Mgr.:* Joseph S. Woodstock, VP Mktg.; *Dist. Mgr.:* Jack O'Donnell, Natl. Sls. Mgr.

STANTRON, Unit of Zero Corporation, 6900-6918 Beck Ave., P. O. Box 9156, N. Hollywood, CA 91605, Tel: 818-841-1825, FAX: 818-841-8892; FSC No.: 06514; Empl.: 125; *Sls. Mgr.:* G. A. Tessier ..... **C•1100**

Local Sales Offices & Reps

AZ	Phoenix, Shefler/Kahn	602-257-9015
CA	Los Angeles, Landa & Assocs.	213-879-0770
CA	Pleasanton, Moulthrop Sls.	415-463-0450
CA	San Diego, Qualtronics	619-695-0118
CA	Santa Ana, Landa & Assocs.	714-543-7805
CO	Golden, J. F. Hurlbut Co.	303-279-7796
CT	Farmington, Ray Perron & Co.	203-673-4825
CT	Farmington, Ray Perron Co.	203-673-4825
CT	New Milford, Ray Perron Co.	203-354-2569
FL	Bradenton, T G & Assocs.	813-753-4158
FL	Long Wood, Southern Mktg. Assocs.	305-682-7317
HI	Honolulu, JC Elctrns.	808-943-8614
IL	Elmhurst, FF/Hill-Gray	312-832-4101
KS	Overland Park, Stone & Assocs.	913-661-0808
MA	Needham, Ray Perron Co.	617-449-6162
MO	Hazelwood, Stone & Assocs.	314-895-4565
NH	Dover, Ray Perron Co.	603-742-2321
NM	Albuquerque, Shefler/Kahn	505-345-3591
NY	Smithtown, T & K Sls.	516-724-3456
NY	Whitney Point, Tae-Rep ...	607-692-3705/772-6952
OH	Cincinnati, Ken Hoffman Co.	513-931-1686
OH	Kettering, Ken Hoffman Co.	513-299-8448
OR	Beaverton, Evergreen Mktg. Grp.	503-643-8020
PA	West Conshocken, Eastern Component Sls. Corp.	215-825-8610
TX	Austin, Barry Sls.	512-837-3616
TX	Houston, Barry Sls.	713-784-5860
TX	Richardson, Barry Sls.	214-234-0255
WA	Seattle, Evergreen Mktg. Grp.	206-633-3160
WI	Madison, FF/Hill-Gray	608-246-8155

FAX: 201-572-5095

STAR MICRONICS, INC., OEM Division, 70-D Ethel Rd. W., Piscataway, NJ 08854, Tel: 201-572-9512, TWX: 910-240-8690; Empl.: 120; *Sls. Mgr.:* John Hurley; *Dist. Mgr.:* Chris Duffy ..... **D•1054-1059, 1104-1105**

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CA Irvine, Star Micronics 714-768-7203,
IL Itasca, Star Micronics 312-773-3717,

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AZ Tempe, Waltronics Sls. 602-967-1020
CA Gardena, Cal Switch 213-770-2330
CA Hayward, Kea Elec., Inc. 415-887-2900
CA Los Angeles, Elec. Switches, Inc. 213-660-1310,
CA San Diego, Tauber Elctrns. 619-274-7242
CA Santa Clara, Waltronics Sls. 408-727-1200
CO Englewood, NEP Elctrns. 303-799-9898
FL Davie, Arco Dist., Inc. 305-473-2550
GA Norcross, AP Sls. Co. 404-263-0421
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MI Grand Rapids, S. F. Elec. Supp., Inc. 616-459-0216
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MO St. Louis, Beckwith Computers & Elec. 314-343-6463,
NJ Sparta, Instrument & Equip. 201-729-4293
NJ Waldwick, Production Supp. & Equip. 201-447-3525
NY Hewlett, Metropolitan Sls. 516-599-7900,
OH Cincinnati, U.R.I. Elctrns. 513-761-4030
OR Portland, United Radio Supp. 503-233-7151
TX Channelview, R. T. Henry Elctrns. 713-452-4451
TX Dallas, Foxfire 214-353-9543
TX Dallas, Wholesale Elec. Supp. 214-969-9400,
WA Bellevue, U.R.S. Elctrns., Inc. 206-451-9393
WI New Berlin, NEP Elctrns. 414-785-9100
EXP Markham, Ont., Birde Mktg. 416-477-7722

STAR PORCELAIN, 71 Muirhead Ave., Trenton, NJ 08638, Tel: 609-392-3154; Empl.: 100; *Sls. Mgr.:* Art Weigold

STAR-TRON CORP., 58 Curtis St., Providence, RI 02909, Tel: 401-274-5090, TELEX: 929490; FSC No.: 32494; Empl.: 50; *Sls. Mgr.:* Anna Coski

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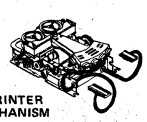
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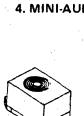

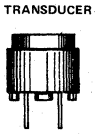
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STATEK CORP., 512 N. Main St., Orange, CA 92668, Tel: 714-639-7810, TELEX: 67-8394, TWX: 910-593-1355; FSC No.: 51791; Empl.: 200; *Sls. Mgr.:* J. Gibson; *Dist. Mgr.:* S. Schaefer ..... **A•1470-1475**

Local Sales Offices & Reps

AL Huntsville, ACM Inc. 205-881-5493
AZ Phoenix, Eltron 602-266-2164
CA Fallbrook, Chilcoate Assocs. 619-728-7678
CA Laguna Hills, H-Tech. Sls. 714-583-1488
CA San Jose, H-Tech. Sls. 408-279-2443
CO Denver, Elcom 303-337-2300
FL Ft. Lauderdale, Mackay Smith & Assocs. 305-467-3888
FL Madeira Beach, MacKay, Smith & Assocs. 813-530-1873
FL Orlando, MacKay, Smith & Assocs. 305-423-4353
GA Doraville, ACM Inc. 404-448-7025
IL Rolling Meadows, Eagle Tech. Sls. 312-991-0700
IN Fort Wayne, M/S Sls. & Assocs. 219-436-3023
IN Indianapolis, M/S Sls. & Assocs. 317-257-8916
IA Des Moines, SPS Assocs. 515-225-0607
KS Olathe, SPS Assocs. 913-764-4460
MD Columbia, Robert Elctrn. Sls. 301-995-1900
MA Woburn, Radian Assocs. 617-933-7386
MI Southfield, Gehrke & Assocs. 313-559-5363
MN Bloomington, Murnco Inc. 612-854-4161
MO Earth City, SPS Assocs. 314-291-0520
NE Panama, SPS Assocs. 913-764-4460
NJ Bellmawr, TAI Corp. 609-933-2600
NJ Manhasset, Win-Cor Elec. Sls. Corp. 516-627-9474
NY Fairport, Net Sls. 716-223-1030
NC Charlotte, Prime Comps. 704-522-1150
NC Raleigh, Prime Comps. 919-850-9866
OH Centerville, Omega Sls. Inc. 513-434-5507
OH Shaker Hgts., Omega Sls. Inc. 216-751-9600
OK Tulsa, Norcom Inc. 918-832-7747
TN Doraville, ACM Inc. 404-448-7025
TX Austin, Norcom 512-451-2757
TX Dallas, Norcom 214-386-4888
TX Houston, Norcom 713-778-0392
UT Salt Lake City, Elcom 801-486-4233
WA Redmond, Halbar Assocs. 206-882-0990
WA Vancouver, Halbar Assocs. 206-696-0170

Local Distributors

CA Orange, Ryno Elctrns. 714-637-0200
CA San Diego, Ryno Elctrns. 619-453-8430
CA Sunnyvale, Target Elctrns. 408-734-5611
CO Englewood, Indl. Elctrns. 303-694-9444
FL Ft. Lauderdale, Reptron Elctrns. 305-735-1112
FL Tampa, Reptron Elctrns. 813-855-4656
GA Norcross, Reptron Elctrns. 404-446-1300
IL Palatine, OHM Elctrns. 312-359-5500
IL Schaumberg, Reptron Elctrns. 312-882-1700
IN Indianapolis, Mar Elctrns., Inc. 317-633-6699
MD Columbia, Aztech Elctrns. 301-995-6800
MA Woburn, First Frequency 617-935-3885
MI Livonia, Reptron Elctrns. 313-525-2700
MN Minnetonka, Reptron Elctrns. 612-938-0000
MO Maryland Hgts., Chelsea Inds. 314-997-7709
NY Buffalo, Summit Distrs. 716-887-2800
NY Mt. Vernon, QAR Indl. Elctrn. Sls. 914-699-2224
OH Solon, Reptron Elctrns. 216-349-1415
OH Worthington, Reptron Elctrns. 614-436-6675
TX Richardson, Ewing Elctrns., Inc. 214-231-6725
WA Kent, Pyramid Elctrns. 206-872-5800

STATE OF THE ART, INC., 2470 Fox Hill Rd., State College, PA 16803-1797, Tel: 814-355-8004, TELEX: 866633; Empl.: 100; *Sls. Mgr.:* Joseph J. Curcio ..... **A•2034-2036**

Local Sales Offices & Reps

AZ Phoenix, Eltron, Inc. 602-266-2164
CA La Miranda, Select Elctrns. 714-739-8891
CA Santa Clara, Meade Assocs. 408-748-1991
CT New Haven, Masten-Wright, Inc. 203-288-1638
FL Altamonte Springs, Micro Mktg., Inc. 305-788-0886
FL Seminole, Micro Mktg. Inc. 813-391-4336
IL Glenview, Crimson Engrg. Sls., Inc. 312-470-0024
MA Newton, Ivornell Assocs., Inc. 617-969-5478
MN Edina, Peterson Sls. & Assocs. 612-944-0030
NY Huntington, Compar NY, Inc. 516-423-5660
NY Lewistown, Watmet, Inc. 716-285-3595
PA Colmar, E.L. Assocs. 215-822-2510
TX Dallas, Merino Sls. Co. 214-233-6002
WA Bellevue, Mars 206-747-3292

Can Niagara Falls, Waters Metal Prods., Ltd. 416-356-4925

Local Distributors

CA Los Alamitos, Semi Dice, Inc. 213-594-4631
NJ Fairfield, CHPS, Inc. 201-882-0997
NY Melville, Semi Dice 516-753-0050
NY Port Chester, Zeus Comps. 914-937-7400

STATIC, INC., Rte. 113 & Mensch Rd., P.O. Box 80, Skippack, PA 19474, Tel: 215-584-9600, TELEX: 846079; Empl.: 50; *Sls. Mgr.:* H. L. Cauffman

THE STAVER COMPANY INCORPORATED

FAX: 516-666-8039

STAVER CO., INC., 41-51 Saxon Ave., Bay Shore, NY 11706, Tel: 516-666-8000, TELEX: 6711657 STAVER; Empl.: 100; *Sls. Mgr.:* Arnold Lazarus .... **B•1093-1097**

Local Sales Offices & Reps

CA Mtn. View, Marquez & Assocs. 415-966-1012
CA Woodland Hill, R.D. Sls. Corp. 818-348-3766
FL Eustis, R. K. Welter & Assocs., Inc. 904-357-3011
IL Lombard, RMP/McBride Corp. 312-932-9090
MI Ann Arbor, Jordan-Elliott Sls. 313-662-4087
MN St. Louis Park, Lestronix 612-926-8466
NH Hancock, Eisenbeis Sls. 603-357-4892
NY East Northport, Levison Sls. Co. 516-266-5020
NY Sewickley, T. H. Stewart Co. 412-741-8665
NC New Hill, Tom G. Santèl 919-362-4091
OH Miamitown, Eastern Sci. Mktg. 513-574-9462
OK Tulsa, Jerry Robison & Assocs. 918-665-3562
OR Beaverton, Quest Mkgt. 503-641-7377
PA Montgomeryville, Eastern Scientific Mktg. 215-368-4570
PA Sewickley, T. H. Stewart Co. 412-741-8665
SC Mauldin, Carl Hart Assocs. 803-288-2323
TX Dallas, Cunningham Comps. 214-669-9706
TX Houston, Cunningham Comps. 713-461-4197
VA Portsmouth, F.B.D. Sls. 804-484-3162
WA Bellevue, Quest Mkgt. 206-747-9424

STEMCO INSTRUMENTS, Colt Industries, P.O. Box 8047, Longview, TX 75607, Tel: 214-643-3236, TWX: 710-730-5236, FAX: 214-643-3339; FSC No.: 07446; Empl.: 100; *Sls. Mgr.:* Bob Halpin

STENNING INSTRMENTS, INC., 671 Enchanted Way, Pacific Palisades, CA 90272, Tel: 213-459-2930; *Sls. Mgr.:* Charles Stenning

STEP ENGINEERING, P.O. Box 3166, Sunnyvale, CA 94088, Tel: 408-733-7837, TWX: 910-339-9506, FAX: 408-773-1073; Empl.: 50; *Sls. Mgr.:* Stan Trumbull

STERLING INSTRUMENTS, 2101 Jericho Turnpike, New Hyde Pk., NY 11040, Tel: 516-328-3300, TWX: 510-223-0642, FAX: 516-526-8827; Empl.: 150

STERLING TRANSFORMER CORP., 510 Driggs Ave., Brooklyn, NY 11211, Tel: 718-782-4200; FSC No.: 97102; Empl.: 45; *Sls. Mgr.:* P. H. Odessey

STETCO, INC., 3344 Schierhorn Ct., Franklin Pk., IL 60131, Tel: 312-671-4208; FSC No.: 52763; Empl.: 20; *Sls. Mgr.:* Saul A. Gusaras

STETRON INTERNATIONAL, INC., 90 Broadway, Buffalo, NY 14203, Tel: 716-854-3443, TWX: 510-100-5547, FAX: 716-854-3448; Empl.: 50; *Sls. Mgr.:* Hugh Kellock; *Dist. Mgr.:* Vern Cunningham

STEVENS-ARNOLD DIV., Computer Prods., Inc., 7 Elkins St., So. Boston, MA 02127, Tel: 617-268-1170, TELEX: 95-1465 STEARCO, TWX: 710-339-0855; FSC No.: 80640; Empl.: 260; *Sls. Mgr.:* John T. Parent ..... **D•1665-1670, 1673-1674**

Refer to Computer Products, Inc., Pompano Beach, FL for sls. offices and reps. and for distrs. listings.

STEVENS PRODUCTS, INC., 128 N. Park St., E. Orange, NJ 07019, Tel: 201-672-2140; Empl.: 50; *Sls. Mgr.:* John Thomson

STEWARD, D. M., MFG. CO., P.O. Box 510, Chattanooga, TN 37401, Tel: 615-867-4100, FAX: 615-867-4102; Empl.: 185; *Sls. Mgr.:* Don Lepard

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STI, Control Components Div., 9520 Black Mountain Rd., San Diego, CA 92126-4507, Tel: 619-566-7680, 800-826-5053, TWX: 910-595-1797; FSC No.: 52797; Empl.: 25; *Sls. Mgr.:* Paul N. Dreiseszun ..... **B•1590-1591**

Local Sales Offices & Reps

CA	Mountain View, Scientific Technlgs. Inc.	800-221-7060
TX	Richardson, Dwain Lawhon	214-231-2289

STIMPSON COMPANY, INC., 900 Sylvan Ave., Bayport, NY 11705-1097, Tel: 516-472-2000, TELEX: ITT 4972370; Empl.: 900; *Sls. Mgr.:* Edward J. Dewalters

STOCK DRIVE PRODUCTS, Div. of Designatronics, Inc., 2101 Jericho Turnpike, New Hyde Pk., NY 11040, Tel: 516-328-0200, 328-3300, TWX: 510-223-0642, FAX: 516-326-8827; Empl.: 228; *Sls. Mgr.:* Murray Ores ..... **B•1259**

Local Sales Offices & Reps

AL	Huntsville, Par Marketing, Inc.	205-859-5702
CA	Chatsworth, Western Comp. Sls.	818-882-6226
CA	San Carlos, SDP West	415-594-0700
CO	Wheatridge, Manufacturers Mktg.	303-425-9569
FL	Clearwater, Tech-Rep Assoc., Inc.	813-576-9900
IL	Downers Grove, Rockford Controls Co.	312-960-2046
MD	Upperco, Imagitron Sls. Co.	301-374-5600
MA	Lowell, Underwood Sls.	617-256-8191
MI	Southfield, R.C. Nordstrom & Co.	313-559-7373
MN	St. Paul, Northstar Motion & Control ..	612-770-5311
NY	Clark Mills, KLM-Garner, Inc.	315-853-6126
NY	New Hyde Park, SDP	516-328-3300
OH	Euclid, Rockford Controls Ohio, Inc.	216-731-5250
TX	Richardson, Zonk & Associates	214-238-7651
WA	Seattle, Northmar Inc.	206-524-5170

Local Distributors

CA	San Carlos, SDP West	415-594-1222

STOELTING CO., 1350 S. Kostner Ave., Chicago, IL 60623, Tel: 312-522-4500, TELEX: 314176; Empl.: 50; *Sls. Mgr.:* Charles W. Scouten

STOLZBERG RESEARCH, INC., 3 Seabrook Court, Stony Brook, NY 11790, Tel: 516-751-4277; Empl.: 4; *Sls. Mgr.:* Bruce Davis; *Dist. Mgr.:* Bruce Davis

STORM PRODUCTS CO., 116 Shore Drive, Hinsdale, IL 60521, Tel: 312-323-9121, TWX: 910-651-0850; FSC No.: 57500; Empl.: 68; *Sls. Mgr.:* John W. Holland

STOW LABS., INC., Kane Ind'l. Dr., Hudson, MA 01749, Tel: 617-562-9347, TELEX: 94-8330; Empl.: 15

STRATEGIC SYS. DIV. POWER SYS. OPERATIONS, GTE Prods. Corp. Sylvania Sys. Grp., 520 Winter St., Waltham, MA 02254, Tel: 617-466-3000, TELEX: 951-953, TWX: 710-290-0376

STRAWBERRY TREE COMPUTERS, 160 S. Wolfe Rd., Sunnyvale, CA 94086, Tel: 408-736-3083

Local Sales Offices & Reps

AL	Adamsville, South Rep	205-674-3056
AZ	Tempe, Trembly Assoc.	602-967-2058
CA	Anaheim, MSC	714-978-0721
CA	Sunnyvale, Zytronix	408-749-1326
CO	Wheat Ridge, Trembly Assoc.	303-421-8900
FL	Ft. Walton Bch., South Rep	904-863-2389
GA	Norcross, South Rep	404-262-6942
IL	Burr Ridge, PVA	312-655-3355
KS	Shawnee, Atech	913-268-9644
MA	Hudson, Graytech	617-562-4393
MN	Minneapolis, Busch Elctrns.	612-934-7922
NV	Las Vegas, Trembly Assoc.	702-739-9770
NM	Albuquerque, Trembly Assoc.	505-266-8616
NY	Oyster Bay, Cascade Control	516-364-9637
NY	Rochester, Bio-Optronics	716-272-1960
OH	Worthington, Roc Assocs.	614-885-1057
UT	Salt Lake City, Trembly Assoc.	801-295-4703

STREET ELECTRONICS CORP., P.O. Box 50220, Santa Barbara, CA 93150, Tel: 805-565-1612; *Dist. Mgr.:* Mark Pfeffer

ST RESEARCH CORPORATION, 8419 Terminal Road, Newington, VA 22122, Tel: 703-550-7000, TWX: 710-832-9818, FAX: 703-550-7470; FSC No.: 50406; Empl.: 160

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STRONGBOX, P.O. Box 84508, Los Angeles, CA 90073, Tel: 213-305-8288; FSC No.: 2T043; Empl.: 3; *Sls. Mgr.:* Larry Martinek ..... **C•1102-1103**

Local Sales Offices & Reps

IN	Indianapolis, TBS Sys.	317-845-0098
PA	Wayne, John J. Lyons Mktg.	215-687-2277

S-D

FAX: 609-589-2619

STRUTHERS-DUNN, INC., Subsidiary of Nytronics, Inc., Lamb's Rd., Pitman, NJ 08071-0901, Tel: 609-589-7500, TWX: 510-686-7510; FSC No.: 78290; Empl.: 580; *Sls. Mgr.:* Clarence Jones; *Dist. Mgr.:* Phil McGarrigan ..... **B•1592-1597**

Local Sales Offices & Reps

AL	Huntsville, Rep, Inc.	205-881-9270
AZ	Scottsdale, BSE, Inc.	602-483-0373
CA	Los Angeles, Wiley Co.	213-666-1611
CA	Palo Alto, Mollard Mktg.	415-961-0456
CO	Denver, Lindberg Co.	303-758-9033
CT	Bloomfield, Zaslow Sls. Co.	203-242-7781
FL	Orlando, Struthers-Dunn Inc.	305-851-5985
GA	Tucker, Rep, Inc.	404-938-4358
IL	Glen Ellyn, Rockford Controls Co.	312-469-6016
IN	Indianapolis, Rockford Controls Co. ...	317-248-2518
IA	Cedar Rapids, Advanced Tech. Sls. ...	319-365-3150
KS	Wichita, Avionics Engrg.	316-264-6201
LA	Lafayette, Kemp Engrg.	318-269-9452
MD	Columbia, L. D. Lowery Inc.	301-381-0225
MI	Southfield, L. H. Dickelman Co.	313-353-8210
MN	Minneapolis, HMR, Inc.	612-888-2122
MO	St. Louis, Advanced Tech. Sls.	314-878-2921
NJ	West Caldwell, Grimm, Siegel Assocs.	201-575-9300
NY	Buffalo, H. C. Zang Agency	716-877-3677
NC	Charlotte, J. Rudisill Assocs.	704-377-6901
OH	Cincinnati, Stegman Blaine Mktg. Co.	513-729-1969
PA	Broomall, L. D. Lowery, Inc.	215-356-5300
PA	Pittsburgh, R. F. Clark Co.	412-242-9500
TX	Bedford, W. Pat Fralia Co.	817-267-3577
TX	Houston, W. Pat Fralia Co	713-772-1572
WA	Bellevue, Eltech, Inc.	206-643-4330
Can	Scarborough, Ont., Renfrew Elec. Co., Ltd.	416-752-4611

ST-SEMICONDUCTORS OF INDIANA, INC., 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402-0609, Tel: 812-332-1435, TWX: 810-351-1384; Empl.: 100; *Sls. Mgr.:* Roscoe Myers

SUCKLE CORP., 733 Davis St., Dept. EM, Scranton, PA 18505, Tel: 717-346-3871, FAX: 717-346-1612; Empl.: 220; *Sls. Mgr.:* M. H. Brenner

SULLINS ELECTRONICS CORP., P.O. Box 189, 801 E. Mission Rd., San Marcos, CA 92069, Tel: 619-744-0125, TWX: 910-322-1472, ESYLNK: 62912413, FAX: 619-744-6081; Empl.: 100; *Sls. Mgr.:* Judy Evans; *Dist. Mgr.:* Ken Flagg ..... **C•1556-1557**

Local Sales Offices & Reps

AZ	Phoenix, O'Donnell Assocs.	602-944-9542
CA	La Canada, K.C.P. Ent.	818-796-1813
CA	San Diego, CK Assocs.	619-279-0420
CA	Santa Clara, Nova-Tronix	408-727-9530
CA	Santa Clara, Nova-Tronix, Inc.	408-727-9530
CO	Wheatridge, Cluff & Assocs.	303-423-9345
FL	Casselbery, Southern Elctrn. Mktg.	305-831-2822
GA	Lithia Springs, Effective Mktg. Force ..	404-948-6023
IL	Elmhurst, Utronix Sls., Inc.	312-834-1100
IN	Indianapolis, John Sukup Inc.	317-253-5501
KS	Shawnee Mission, M-S-B Assoc.	913-432-2131
MD	Laurel, CSDS, Inc.	301-490-3800
MA	Harvard, Cycle Sls.	617-456-6868
MN	Minneapolis, RK Sls. Assocs., Inc.	612-571-1001
NJ	Medford, Comp. Consultants	609-654-5300
NY	Valley Stream, HLJ Comp-Tech	516-599-2999
OH	Centerville, Omega Sls., Inc.	513-434-5507
TX	Allen, Bozman & Assocs.	214-578-1780
WA	Redmond, Elctrn. Mktg. Grp.	206-882-0962
WI	Oconomowoc, Artmor Ltd.	414-367-8789
Can	Scarborough, Ont., R-Tronics	416-299-6676

Local Distributors

AL	Birmingham, American Elctrn. Supp. ..	205-942-4656
AZ	Phoenix, Arizona Comps.	602-269-5655
CA	Burbank, Atwater Elctrns.	818-841-9050
CA	Pasadena, Empire Elctrns.	213-681-2711
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Simi Valley, Lee Johnson Sls.	818-346-5412
CO	Arvada, Denver Beta Wintronic	303-431-7161
CT	Bridgeport, Millenium Elctrn. Sls.	203-372-2037
FL	Winter Park, Deanco	305-671-5100
GA	Marietta, Deanco	404-429-0126
IL	Carol Stream, Lectro Comps.	312-690-0520
IL	Chicago, NEP Elctrns.	312-625-8400
IN	Ft. Wayne, Graham Elctrns.	219-423-3422
IA	Cedar Springs, Barton Digital	319-474-2247
MD	Gaithersburg, Axis Elctrns., Inc.	301-840-9640
MA	Canton, EPC Elctrns. Inc.	617-821-2111
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	Grand Rapids, Caider Elctrns.	616-698-7400
MN	St. Paul, Shelley Ragon Inc.	612-642-2828
MO	Independence, Shelley-Ragon, Inc.	816-254-3410
NH	Hampstead, Astrum Elctrns.	603-329-9640
NJ	Fairfield, Deanco	201-575-7960
NJ	Union, Meridian Supp.	201-687-6220
NM	Albuquerque, Electronic Parts	505-293-6161
NY	Ithaca, Deanco	607-257-4444
NY	Valley Stream, Forejay Assocs.	516-599-2999
NC	Hickory, Southeastern Elctrns., Inc.	919-828-2311
OH	Solon, REH Elctrns.	216-248-1636
OH	Twinsburg, Schuster Elec. Co.	216-425-8134
OR	Portland, Dunn Elctrns.	503-285-0214
PA	McKean, Advacom	814-476-7774
RI	Warwick, Cal-Greg Comps., Inc.	401-884-5101
TN	Knoxville, Indl. Elctrns., Inc.	615-573-7135
TX	Addison, Connec/Tek, Inc.	214-733-4411
TX	Dallas, Cypress Elctrns.	214-869-1435
UT	Salt Lake City, S.L.C. Wintronics	801-483-1882
VA	Virginia Bch., Deanco	804-499-3322
WA	Renton, Carlye	206-251-0700
WI	Oconomowoc, G.W. Elctrns., Ltd.	414-367-6003
Can	Pointe Claire, Que., A. R. Gray & Assocs.	514-694-6378

SUMITRONICS, INC., Sumitomo Corporation, 580 N. Pastoria Ave., Sunnyvale, CA 94086, Tel: 408-737-7683, TELEX: 278869; FSC No.: 408-737-9189; Empl.: 40; *Sls. Mgr.:* Ken Fujii

SUMMAGRAPHICS CORP., 777 State Street Extension, Fairfield, CT 06430, Tel: 203-384-1344, TELEX: 964348; Empl.: 170; *Sls. Mgr.:* John Livesay; *Dist. Mgr.:* Jim Whitney

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FAX: 618-654-2351

SUMMIT ELECTRONICS, Basler Electric, Box 269, Route 143, Highland, IL 62249, Tel: 618-654-2341, 800-645-2074 ..... **D•1979**

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IA	Cedar Rapids, Tech. Elctrns.	319-366-5443
MA	Whitinsville, Power Factor & Assocs.	617-234-6415
MI	Plymouth, Leading Edge Sls. Corp.	313-420-3344
MN	Minneapolis, Electro Serve	612-338-3475
NJ	Upper Montclair, T & K Sls.	201-783-3112
NM	Albuquerque, Trembly Assocs.	505-266-8616
NY	Canandaigua, Mamula Sls.	716-394-5560
NY	Smithtown, T & K Sales	516-724-3456
PA	Exton, Linear Sls.	215-524-8080
TX	Houston, Barry Sls.	713-784-5860
TX	Richardson, Barry Sls.	214-234-0255
UT	N. Salt Lake City, Trembly Assocs.	801-295-4703
VA	Richmond, Glasscock & Assocs.	804-740-0063
WA	Redmond, Elctrn. Mktg. Grp.	206-882-0962
Can	Mississauga, ON, ASG/Wilson Sls.	416-677-8200

SUMMIT ENGINEERING CORP., Box 938, Bozeman, MT 59715, Tel: 406-587-4511, TWX: 910-975-1950; Empl.: 300; *Sls. Mgr.:* Marty Connor

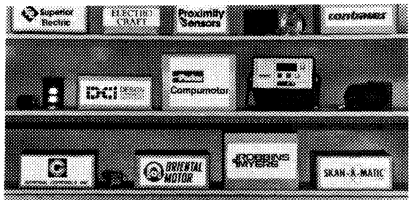
SUMX CORP., Box 14864, Austin, TX 78761, Tel: 512-835-0330, TWX: 910-350-5536, FAX: 512-832-5463; Empl.: 30; *Sls. Mgr.:* Robert K. Hammar

SUNBANK ELECTRONICS, 1740 Commerce Way, Paso Robles, CA 93446, Tel: 805-238-2840, TWX: 910-351-5805; FSC No.: 07418; Empl.: 260; *Sls. Mgr.:* Denis Connolly; *Dist. Mgr.:* Robert Haldeman

SUNDSTRAND DATA CONTROL INC., Sundstrand Corporation, P. O. Box 97001, Redmond, WA 98073-9701, Tel: 206-885-3711, TELEX: RCA 286144; Empl.: 2000

Sun Electronic Systems, Inc.

SUN ELECTRONIC SYSTEMS, INC., 1601 NW 38th Ave., Ft. Lauderdale, FL 33311, Tel: 305-587-5577; Empl.: 10; *Sls. Mgr.:* Ralph Raymond ..... **D•1188**



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CT	New Milford, D & R Controls	203-355-0921
FL	Tampa, State Instrs.	813-933-7676
TX	Austin, Ledbetter-Neal Assocs.	512-835-6642

SUN-FLEX CO., INC., 20 Pimentel Ct., Novato, CA 94947, Tel: 415-883-1221, TELEX: 172-208; *Sls. Mgr.:* David Render; *Dist. Mgr.:* David Render

SUN RESEARCH, INC., Box 210, Old Bay Rd., New Durham, NH 03855, Tel: 603-859-7110, TWX: 510-297-4444; *Sls. Mgr.:* Paul A. Blaisdell

SUNRISE ELECTRONICS, INC.

FAX: 818-914-1583

SUNRISE ELECTRONICS, INC., 524 S. Vermont Ave., Glendora, CA 91740, Tel: 818-914-1926, TWX: 910-584-3847; Empl.: 15; *Sls. Mgr.:* Allan V. Carey ..... **A•1758**

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns.	205-881-5031
AZ	Phoenix, Aztec	602-944-9185
CA	Los Angeles, West Coast Reps.	714-558-6100
CA	San Jose, Reptronics	408-947-0770
CO	Denver, Aztec	303-779-5285
FL	Boca Raton, Beacon Elctrns.	305-392-3500
FL	Clearwater, Beacon Elctrns.	813-796-2378
FL	Maitland, Beacon Elctrns.	305-332-1940
GA	Atlanta, Beacon Elctrns.	404-256-9640
IL	Chicago, Berndt Assocs.	312-283-0713
MA	Boston, Design Automation Sls., Inc.	603-424-7909
MI	Farmington Hills, Carter, McCormic & Peirce	313-477-7700
MN	Minneapolis, Berndt	612-546-2021
MO	St. Louis, Engrg. Svcs. Co.	314-997-1515
NM	Albuquerque, Aztec	505-262-1688
NY	New York City, Beta-Lambda	201-446-1100
NY	Syracuse, Martin P. Andrews	315-637-5291
NC	Raleigh, Beacon Elctrns.	919-787-0330
OH	Cleveland, Carter, McCormic & Peirce	216-779-5100
PA	Pittsburgh, Carter, McCormic & Peirce	412-733-7490
TX	Dallas, Beacon Elctrns.	214-437-1505
UT	Salt Lake, Aztec	801-355-9256
WA	Renton, West Coast Reps	206-235-7042
WI	Milwaukee, Berndt Assocs.	414-545-8400
Can	Montreal, Bytewide	514-636-4121

Distributor

SUNSHINE SCIENTIFIC INSTRUMENTS, 1810 Grant Ave., Philadelphia, PA 19115, Tel: 215-673-5600; *Sls. Mgr.:* Al Stiles 613, 615, 630,687,697,726, 788, 808,824

SUPERIOR CARBON PRODUCTS, INC., Hwy. 35, Superior Place, Walnut Grove, MS 39189, Tel: 601-253-2442, FAX: 601-253-2430; Empl.: 61; *Sls. Mgr.:* Paul Merrill Kling

SUPERIOR ELECTRIC, 383 Middle St., Bristol, CT 06010, Tel: 203-582-9561, TELEX: 962-446, TWX: 710-454-0682; FSC No.: 58474; Empl.: 800; *Sls. Mgr.:* Charles Ritter/James Hayden; *Dist. Mgr.:* A. Nicholson ..... **A•2370-2371; B•1260-1261; C•1558; D•2155**

Local Sales Offices & Reps

AL	Huntsville, Skor, Inc.	205-881-5808
CA	Canoga Pk., FLW, Inc.	818-719-0037
CA	Carlsbad, FLW, Inc.	619-434-5251
CA	Costa Mesa, FLW, Inc.	714-751-7512
CA	Hayward, FLW, Inc.	415-786-9070
CO	Aurora, Power Sys.	303-292-5587
CT	Huntington, Power Tech, Inc.	203-926-0052
FL	Altamonte Springs, Raycom, Inc.	305-682-0032
FL	Ft. Pierce, Skor, Inc.	305-466-1551
FL	Melbourne, Raycom, Inc.	305-259-7988
FL	Orlando, Raycom, Inc.	305-859-5504
FL	Wellborn, Raycom, Inc.	904-963-5023
GA	Atlanta, Skor, Inc.	404-381-7300
IL	Vernon Hills, Mike Malich, Co.	312-438-0870
IN	Indianapolis, Engrg. Prod. Assocs., Inc.	317-353-6867
MD	Gaithersburg, Powell-Pendergraph, Inc.	301-921-4200
MN	Edina, Engrg. Prod. Assocs., Inc.	612-835-9022
MS	Jackson, Doby Assocs.	601-981-1138
MO	St. Louis, Richard Greene Co.	314-994-0222
NJ	Union, Tri-Tech Sls. Assocs., Inc.	201-851-0370
NM	Albuquerque, Fry Gages, Inc.	505-262-1525
NY	E. Syracuse, Ossmann Assocs.	315-437-2332
NY	Henrietta, Ossmann Assocs.	716-359-1200
NC	Charlotte, Davis Godwin Assocs., Inc.	704-392-6181
OR	Portland, Unity Power Sys.	503-620-0373
PA	Willow Grove, Powell-Pendergraph	215-657-0330
TX	Garland, Electrotech Sys.	214-226-8392
TX	Grapevine, Electro Tech Sys.	817-481-1583
TX	Houston, Elctrl. Sls. Assocs.	713-464-3557
TX	Longview, Electro Tech Sys.	214-759-0875
UT	Salt Lake City, TEMSA	801-487-8811
VA	Richmond, Powell-Pendergraph	804-270-1400
WI	Milwaukee, Mike Malich Co.	414-327-6869

SUPERIOR FLUX & MFG. CO., 95 Alpha Pk., Cleveland, OH 44143, Tel: 216-461-3315; Empl.: 10

SUPERTEX, INC., 1225 Bordeaux Dr., P.O. Box 3607, Sunnyvale, CA 94088-3607, Tel: 408-744-0100, TELEX: 6839143 SUPTX, FAX: 408-734-5247; Empl.: 260; *Sls. Mgr.:* Richard Siegel

SUPER VEXTA®

FAX: 213-515-2879

SUPERVEXTA, Div. of Oriental Motor, 2701 Plaza Del Amo, Ste. 702, Torrance, CA 90503-7395, Tel: 213-515-2264, TELEX: 664231; Empl.: 34 ..... **B•1263**

Local Sales Offices & Reps

AZ	Phoenix, Indl. Elctrns. & Controls	602-894-2375
CA	El Toro, Distributed Motion	714-855-9902
CA	San Carlos, Campbell & George	415-594-1994
CA	Santa Clara, Oriental Motor U.S.A. Corp.	408-988-2655
CO	Wheatridge, Control Dvcs.	303-424-9332
FL	Altamonte Springs, Automation Sls. Inc.	305-869-6535
IL	Elk Grove VL, General Controls Inc.	312-595-2152
IL	Rolling Meadows, Oriental Motor U.S.A. Corp.	312-577-0310
IN	Indianapolis, Farrel-Argasta Elec. Co.	317-546-4041
IA	W. Des Moines, Ramco Elec. Co.	515-225-6933
MA	N. Andover, Bagley Intl.	617-688-0062
MI	Troy, Axis Sys.	313-689-7575
MN	Minnetonka, Vericom Corp.	612-933-0520
MO	St. Louis, Neff Power Inc.	314-727-6200
NJ	Clifton, Faber Equip.	201-773-8900
NJ	Fairfield, Oriental Motor U.S.A. Corp.	201-882-0480
NY	Rochester, John M. Forster Co.	716-232-5410
NC	Charlotte, EMCO Inc.	703-372-8281
OH	Cincinnati, Tapco Prods. Inc.	513-683-4481
PA	Broomall, Controlled Drives, Inc.	215-328-9515
TX	Denton, Texonics Inc.	214-260-3403
Can	Mississauga, Ont., Waffle's Elec.	416-672-0822

SUPPORT SYSTEMS INTL. CORP., 150 South Second St., Richmond, CA 94804, Tel: 415-234-9090, TWX: 910-382-8130, FAX: 415-233-8888; Empl.: 105; *Sls. Mgr.:* Richard St. John; *Dist. Mgr.:* Richard St. John

SURGEONICS LTD., 50 Pine St., Hudson Falls, NY 12839, Tel: 518-747-2156, FAX: 518-747-2607; Empl.: 20; *Sls. Mgr.:* R. Diaz

SURON MAAGAN MICHAEL, Kibbutz Maagan-Michael, D.N. Menashe 37805, Israel, Tel: 06-394211, TELEX: 471468 SURON IL, FAX: 063-90296; Empl.: 38; *Sls. Mgr.:* Gershon Peleg

SUSSEX SEMICONDUCTOR, INC., Rte. 206, Branchville, NJ 07826, Tel: 201-948-3633, TELEX: 226000 ETLXUR; Empl.: 12; *Sls. Mgr.:* Mark Iwanski

SWISS JEWEL COMPANY, 406 Lafayette Building, Philadelphia, PA 19106, Tel: 215-925-2867, TELEX: 831-368, FAX: 215-922-3055; Empl.: 5; *Sls. Mgr.:* P. N. Steel, Jr.

SWITCHCRAFT INC.

FAX: 312-792-2129

SWITCHCRAFT, INC., A Raytheon Company, 5555 N. Elston, Chicago, IL 60630, Tel: 312-792-2700, TWX: 910-221-5199; FSC No.: 82389;multiple; Empl.: 1100; *Sls. Mgr.:* Ken Kline; *Dist. Mgr.:* Dennis Warszona ..... **B•1801-1803; C•1559-1563**

Local Sales Offices & Reps

AL	Huntsville, DHR Mktg.	205-533-5165
AZ	Phoenix, Moss Mktg.	602-957-2065
CA	Los Angeles, Wiley Co.	213-666-1611
CA	San Diego, Wiley Co.	619-453-9018
CA	Santa Clara, Ross Mktg. Assoc.	408-988-8111
CO	Denver, Moss Mktg.	303-455-7205
CT	Stamford, Unesco/Genex	203-322-9308
FL	Coral Springs, HAI Elctrns.	305-752-7520
FL	Melbourne, HAI Elctrns.	305-676-1639
FL	Tampa, HAI Elctrns.	813-963-0743
GA	Atlanta, DHR Mktg. Inc.	404-451-9848
IL	Chicago, Switchcraft Inc.	312-792-2700
IN	Indianapolis, Marketing Engrs.	317-872-5665
KS	Overland Park, Thomas L. Dowell & Assoc.	913-648-7373
MA	Waltham, Unesco/Genex	617-890-1535
MI	Farmington Hills, R. C. Merchant & Co.	313-476-4600
MI	St. Joseph, R. C. Merchant & Co.	616-983-7378
MN	Edina, Mel Foster Tech. Sls.	612-941-9790
MS	Jackson, S. L. Welch	601-932-5534
MO	St. Louis, Thomas L. Dowell & Assoc.	314-849-4234
NJ	Cherry Hill, Trinkle Sls.	609-795-4200
NJ	Englewood Cliffs, Masin-Esco	201-569-8868
NM	Albuquerque, Moss Mktg.	505-292-7505
NY	Hauppauge, Masin-Esco	516-273-3500
NY	Rochester, Apex Assocs.	716-254-6050
NC	Raleigh, DHR Mktg., Inc.	919-781-1961
OH	Dayton, J. C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-241-4880
OR	Milwaukee, Comtec	503-654-6626
SC	Greenville, DHR Mktg. Inc.	803-235-3594
TN	Memphis, S. L. Welch & Assocs.	901-365-9575
TX	Austin, J. Y. Schoonmaker Co.	512-327-5274
TX	Dallas, J. Y. Schoonmaker Co.	214-349-1650
TX	Houston, J. Y. Schoonmaker Co.	713-738-2427
UT	Salt Lake City, Moss Mktg.	801-363-5875
WA	Bellevue, Comtec	206-453-1188
WI	Burlington, Switchcraft	414-763-2100
Can	Toronto, Atlas	416-789-7761

SWITCHES UNLIMITED, INC., 34-11 56th St, Woodside, NY 11377, Tel: 718-478-5000, 800-221-0487, FAX: 718-672-6370; Empl.: 15; *Sls. Mgr.:* Douglas King

SWITCHING POWER INC., 3601 Veterans Hwy, Ronkonkoma, NY 11779, Tel: 516-981-7231, TWX: 510-220-1528, FAX: 516-981-7266; Empl.: 200

SSI

FAX: 714-996-2753

SWITCHING SYSTEMS INTERNATIONAL, 500 Porter Way, Placentia, CA 92670, Tel: 714-996-0909; Empl.: 57; *Sls. Mgr.:* Chris Edman ..... **D•1980-1982**

Local Sales Offices & Reps

AZ	Tempe, Holder Hauer	602-242-4025
CA	Los Alamitos, Power Specialists	213-594-9418
CA	Placentia, Switching Sys. Intl.	714-996-0909
CA	San Jose, Nelson Elctrn. Sls.	408-293-2600
CO	Denver, Holder Hauer	303-427-3443
CT	North Haven, Power Conversion Sys.	203-281-7270
GA	Athens, ADI Inc.	404-548-0788
IL	Elmhurst, Utronix	312-834-1100
MD	Randallstown, Beacon North Inc.	301-655-2265
VA	Sterling, Beacon North, Inc.	703-478-2480
MA	Woburn, Power Conversion Sys.	617-938-0839
MI	Ann Arbor, KRW Sls.	313-769-0056
NH	Londonderry, Power Conversion Sys.	603-434-2371
NJ	Marlton, Beacon North Inc.	609-596-9456
NM	Albuquerque, Holder Hauer	505-888-9614
NC	Smithfield, ADI Inc.	919-934-8136
OH	Cleveland, KRW Sls. Inc.	216-871-7521
OH	Columbus, KRW Sls. Inc.	614-885-2598
PA	Pittsburgh, KRW Sls. Inc.	412-828-1490
UT	Salt Lake City, Holder Hauer	801-532-2111

SYLVANIA GTE CONTROL DEVICES, Rte. 35, Standish, ME 04084, Tel: 207-642-4535, TWX: 710-365-0145; Empl.: Over 1,000; *Sls. Mgr.:* M. L. Lyons; *Dist. Mgr.:* M. L. Lyons

SYLVANIA ELECTRONIC COMPONENTS, See Philips ECG, Amperex Electronics Corp., A North American Philips Co.

SYLVANIA MINIATURE LIGHTING, GTE Corporation, W. Main St., Hillsboro, NH 03244, Tel: 603-464-5533, TWX: 710-366-0387, FAX: 603-464-0259; FSC No.: 88204; Empl.: 1011; *Sls. Mgr.:* Frank St. Onge, Natl. Sls. Mgr. ..... **B•1163-1165**

Local Sales Offices & Reps

AZ	Scottsdale, Bill Earl & Assocs.	602-994-3813
AR	Little Rock, Erickson Sls.	501-455-0618
CA	El Toro, English/Damco Sls. Assocs.	714-837-3801
CA	Sunnyvale, W.W. Posey Co.	408-746-0771
CT	No. Haven, Coakley, Boyd & Abbett	203-239-6217, 800-225-8402
FL	Maitland, Hutto, Hawkins Assocs.	305-831-2474
FL	Pompano Beach, Hutto, Hawkins Assocs.	305-979-0330
FL	Tampa, Hutto, Hawkins, Assocs., Inc.	813-251-2970
GA	Atlanta, Millar Elctrns.	404-634-3350
IL	Skokie, I.R.I.	312-647-7755
IN	Ft. Wayne, R.O. Whitesell & Assocs.	219-432-5591
IN	Indianapolis, R.O. Whitesell & Assocs.	317-359-9283
IN	Kokomo, R. O. Whitesell	317-457-9127
IA	Cedar Rapids, R. W. Kunz	319-396-5386
KS	Prairie Village, R.W. Kunz	913-648-3535
KY	Peewee Valley, R.O. Whitesell & Assocs.	502-241-1441
LA	Chalmette, Erickson Sls.	504-271-1976
LA	Covington, Cartwright & Bean	504-892-1780
MA	Needham, Coakley, Boyd & Abbett	617-444-5470
MI	Grand Rapids, R.O. Whitesell & Assocs.	616-942-5420
MI	Southfield, R. O. Whitesell	313-559-5454
MI	St. Joseph, R.O. Whitesell & Assocs.	616-983-7337
MN	Minneapolis, Stoss & Assocs.	612-925-2757
MS	Jackson, Cartwright & Bean	601-981-1170
MO	St. Louis, R.W. Kunz	314-966-4977
NJ	Long Valley, Paul A. Sweeney	201-852-1434
NY	Rochester, Electra Sls.	716-427-7860
NY	Syracuse, Electra Sls.	315-463-1248
NC	Raleigh, Millar Elctrns.	919-828-8840
OH	Cincinnati, R.O. Whitesell & Assocs.	513-521-2290
OH	Cleveland, R.O. Whitesell & Assocs.	216-447-9020
OH	Columbus, R.O. Whitesell & Assocs.	614-888-9396
OH	Dayton, R.O. Whitesell & Assocs.	513-298-9546
OR	Beaverton, Electronic Sources Inc.	503-684-0838
PA	Pittsburgh, R.O. Whitesell & Assocs.	412-963-6161
PA	Trevose, P.S.A. Inc.	215-245-0513
TN	Knoxville, R. O. Whitesell	615-694-9476
TN	Memphis, Cartwright & Bean	901-362-8345
TX	Dallas, Erickson Sales	214-739-5833
TX	Houston, Erickson Sales	713-266-1604
TX	Round Rock, Erickson Sls.	512-244-3068
CO	Wheatridge, Cluff & Assocs.	303-423-9354
WA	Bellevue, Electronic Sources Inc.	206-451-3500
WI	Milwaukee, F.C. DuBois & Assocs.	414-774-3100

SYMBEX CORP., 3M Co., 72 Corwin Dr., Box 938, Painesville, OH 44077, Tel: 216-354-0925, TWX: 810-425-2256; Empl.: 130

SYMBICON, 89 Route 101A, Amherst, NH 03031, Tel: 603-673-8898, TELEX: 272934 SYMB UR; *Sls. Mgr.:* S. Harrington; *Dist. Mgr.:* S. Buzzell

SYM-TEK SYS., INC., 3912 Calle Fortunada, San Diego, CA 92123, Tel: 619-569-6800, TELEX: 249036; Empl.: 250

Local Sales Offices & Reps

AZ	Chandler, Sym-Tek Sys., Inc.	602-786-8809
AZ	Phoenix, Scientific Dvs.	602-957-0401
CA	Huntington Beach, Scientific Dvcs.	714-840-3501
CA	San Diego, Scientific Dvcs.	619-268-9635
CA	San Jose, Scientific Dvs.	408-554-0455
CA	Santa Clara, Sym-Tek Sys., Inc.	408-748-7611
CO	Broomfield, Scientific Dvcs.	303-469-5145
FL	Longwood, Richard Schoonover, Inc.	305-788-3344
FL	Orlando, Sym-Tek Sys., Inc.	306-658-1260
GA	Marietta, MoRe	404-992-5172
IL	Elmhurst, Sector Engrg. Sls.	312-530-7850
IN	Indianapolis, Sector Engrg. Sls.	317-842-1120
MA	Berlin, ATE Entprs., Inc.	617-838-2141
MA	Waltham, Sym-Tek Sys., Inc.	619-899-7170
NJ	Marlton, Javie Bickel, Inc.	609-596-6900
NM	Albuquerque, Scientific Dvcs.	505-883-3668
NY	E. Northport, LSC Assocs., Inc.	516-266-5020
NC	Bellmont, MORE	704-825-9187
OH	Brecksville, WRR Assocs.	216-526-2023
TX	Arlington, Alphatech, Inc.	817-265-8455
TX	Austin, Alphatech, Inc.	512-458-9179
TX	Austin, Sym-Tek Sys., Inc.	512-837-9311
WA	Redmond, Scientific Dvcs.	206-885-0004
WI	Milwaukee, Sector Engrg. Sls.	414-352-8280
Can	Montreal, Interfax Sys., Inc.	514-336-0392

SYMTRON CORP., 2415 E. Charleston Rd., Mountain View, CA 94043, Tel: 415-965-4500, TWX: 910-379-5002; Empl.: 350; *Sls. Mgr.:* Don Atkins

SYNEKTRON
THE MOTION CONTROL COMPANY

FAX: 503-639-5453

SYNEKTRON CORPORATION, 12000 S. W. Garden Place, Portland, OR 97223, Tel: 503-684-3090, TELEX: 517441; Empl.: 60 ..... **B•1264-1265**

SYNTEL DIV., Tegam, Inc., 7230 North Ridge Rd., Madison, OH 44057, Tel: 216-428-7505; Empl.: 15

SYNTEST CORP., 40 Locke Dr., Marlboro, MA 01752-9973, Tel: 508-481-7827, FAX: 508-481-5769; Empl.: 26; *Sls. Mgr.:* Curtis P. Hoffman ..... **D•1106**

Local Sales Offices & Reps

FL	Altamonte Springs, Carter Assocs.	305-260-5566
IL	Arlington Heights, Coombs Assocs.	312-439-9810
MA	Marlboro, Data Reps.	617-481-0333
MI	Rockford, Hal C. Heym Assocs.	616-874-7443
NY	Canandaigua, Mamula Sls.	716-394-5560
NY	White Plains, Channel Corp.	914-694-9234
OH	Centerville, EMA Inc.	513-433-2800
PA	Montgomeryville, Eastern Sci. Mktg.	215-368-4570
WA	Beaverton, Seltech Elctrns.	503-629-9254

Local Distributors

WV	Ravenswood, Valtronics, Inc.	304-273-5356

SYNTRONIC INSTRUMENTS, INC., 100 Industrial Rd., Addison, IL 60101, Tel: 312-543-6444, FAX: 312-543-0287; FSC No.: 99409; Empl.: 125; *Sls. Mgr.:* Paul Evans

SYRACUSE ELCTRNS., P.O. Box 4770, Syracuse, NY 13221, Tel: 315-488-4911, TELEX: 937-232; Empl.: 150

SYRACUSE ELECTRONICS, Pass & Seymour, Inc., P.O. Box 4822, Syracuse, NY 13221, Tel: 315-468-6211, TELEX: 93-7232; *Sls. Mgr.:* Kenneth Hooper

SYSCON INTL., INC., 1108 So. High St., So. Bend, IN 46618-1096, Tel: 219-232-3900, TWX: 810-299-2523, FAX: 219-287-5916; Empl.: 60; *Sls. Mgr.:* Les Barney

SYSTEK, 1027 N. Kellogg St., Kennewick, WA 99336, Tel: 509-735-1200; Empl.: 7

SYSTEMS DATA, INC., 2830 Copley Road, P.O. Box 4297, Akron, OH 44321, Tel: 216-666-0085; Empl.: 12; *Sls. Mgr.:* John C. Hall

SYSTEMS PLUS, 500 Clyde Ave., Mtn. View, CA 94043, Tel: 415-969-7047, TWX: 910-373-2096; Empl.: 20

SYSTEMS RESEARCH LABOROTORIES, Arvin/Calspan, 2800 Indian Ripple Rd., Dayton, OH 45440, Tel: 513-426-6000, TWX: 810-450-2621; FSC No.: 14590; Empl.: 1300

SYSTONICS, INC., Box 121, Winchester, MA 01890, Tel: 617-729-4439, TELEX: 951131 HQBSN; Empl.: 11

SYSTRON-DONNER INERTIAL DIV., 2700 Systron Dr., Concord, CA 94518, Tel: 415-671-6400, TWX: 910-481-9478; Empl.: 370; *Sls. Mgr.:* G. W. Felsing

SYSTRON-DONNER INSTRUMENT DIV., 2727 Systron Dr., Concord, CA 94518, Tel: 415-676-5000, TELEX: 171996, TWX: 910-481-9479; FSC No.: 52542; Empl.: 100; *Sls. Mgr.:* N. J. Susner, Gen. Mgr.

SYSTRON-DONNER MICROWAVE DIV., 14844 Oxnard St., Van Nuys, CA 91409, Tel: 818-786-1760, TWX: 910-495-1786; Empl.: 160; *Sls. Mgr.:* Ashvin K. Sheth

TAB BOOKS, Blue Ridge Summit, PA 17294-0850, Tel: 717-794-2191, TELEX: 820562, TWX: 717-794-2080; Empl.: 185; *Sls. Mgr.:* John P. Bohman

TACHONICS CORPORATION, Grumman Corp., 107 Morgan Ln., Plainsboro, NJ 08536, Tel: 609-275-2550, FAX: 609-275-2591; Empl.: 56; *Sls. Mgr.:* Bill Koehn; *Dist. Mgr.:* Bill Koehn

TADIRAN ELEC. INDS. INC., 40 Seaview Blvd., Port Washington, NY 11050, Tel: 516-621-4980, TWX: 230-697-3370, FAX: 516-621-4517; Empl.: 6300; *Dist. Mgr.:* Avi Timor

TAFA, INC., 146 Pembroke Rd., Concord, NH 03301, Tel: 603-224-9585, TELEX: 94-3424, FAX: 603-225-4342; Empl.: 50; *Sls. Mgr.:* Bob Unger; *Dist. Mgr.:* Leon Grant

TA INSTRUMENT CO., 4625 Alger St., Los Angeles, CA 90039, Tel: 818-242-8855, TWX: 910-497-4780; Empl.: 60

TAIYO YUDEN (USA) INC., 714 W. Algonquin Rd., Arlington Heights, IL 60005-4493, Tel: 312-364-6104, FAX: 312-870-7828; Empl.: 63; *Sls. Mgr.:* Mikio Hasunuma

TALEMA ELECTRONIC INC
301 N. Hwy. 63
Rolla, Missouri 65401
Telephone 314-364-0882
Fax 314-364-6320

FAX: 314-364-6320

TALEMA ELECTRONIC, INC., 301 N. Highway 63, Rolla, MO 65401, Tel: 314-364-0882, TELEX: 442353; Empl.: 27; *Sls. Mgr.:* Fred Tetley ..... **A•2390-2392**

Local Sales Offices & Reps

AL	Huntsville, Naylor Assocs., Inc.	205-881-5955
AZ	Scottsdale, Harris & Croy	602-951-9121
AZ	Tucson, Harris & Croy Mfg. Reps.	602-575-5109
CA	Newark, Jacobson & Assocs.	415-791-2336
CO	Englewood, Dynatech, Inc.	303-773-2830
FL	Boca Rotan, Naylor Assocs., Inc.	305-482-5649
GA	Stone Mountain, Naylor Assocs., Inc.	404-299-9701
IL	Wheaton, Archie Joyner Assocs., Inc.	312-665-6222
IN	Columbus, John H. Weaver Co.	812-372-3625
IN	Indianapolis, John H. Weaver Co.	317-257-7661
KS	Wichita, Buckman & Assocs.	316-267-2052
MD	Durham, Naylor Assocs. Inc.	919-544-6630
MA	Billerica, Dynamic Engrg.	617-667-0111
MA	Chelmsford, Dynamic Engrg.	617-250-0200
MI	Plymouth, Leading Edge Sls.	313-420-3344
MN	Minneapolis, RK Sls. Assocs., Inc.	612-571-1001
MO	St. Charles, Buckman & Assocs.	314-946-6201
NY	Commack, R.C. Engrg. Sls.	516-543-3325
NC	Huntersville, Naylor Assocs. Inc.	704-892-1366
OH	Cincinnati, John O. Olsen Co.	513-922-8885
OH	Cleveland, John O. Olsen Co.	216-662-3454
OH	Garfield Hgts., John O. Olsen Co.	216-662-3454
OR	Beaverton, Luscombe Engrg.	503-636-6664
PA	Rydal, Espy Sls. Co.	215-576-0780
SC	Greenville, Naylor Assocs., Inc.	803-297-9969
TX	Lewisville, Elctrn. Prod. Reps.	214-436-4772
UT	Layton, Dynatech, Inc.	801-546-4837
WA	Bellevue, Whisler Sls.	206-223-1541
Can	Mississauga, Ont., Intrepid Sls. & Mktg. Ent.	416-671-4488

tamura

FAX: 213-638-9956

TAMURA CORPORATION OF AMERICA, 1150 Dominguez St., Carson, CA 90746-3518, Tel: 213-638-1790; *Sls. Mgr.:* Doug Henderson ..... **A•1291-1293, 1695-1697, 2304, 2395-2403; D•1983-1991**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs.	205-533-9108
AZ	Scottsdale, E.D.P. & Assocs.	602-991-6119
CA	Irvine, Groh Assocs.	714-837-9871
CA	Mtn. View, Thorson West	415-964-9300
CO	Golden, J. F. Hurlbut Co.	303-279-7796
CT	Hamden, Datcom Inc.	203-288-7005
FL	Maitland, Hughes Assocs.	305-629-5933
GA	Norcross, Hughes Assocs.	404-662-1587
IL	Mt. Prospect, Interep Inc.	312-577-8899
IN	Kokomo, Schillinger Assocs.	317-455-2708
KS	Kansas City, Delltron Co., Inc.	816-436-6445
MD	Annapolis, Parogem, Inc.	301-269-1898
MA	Waltham, Datcom Inc.	617-891-4600
MI	Grand Rapids, DEM Sls.	616-364-4024
MI	St. Clair Shores, DEM Sls.	313-777-1750
MN	Bloomington, Horizon Technlg. Inc.	612-884-6515
MN	Minneapolis, DeBeck-Hays Assocs.	612-835-3610
MS	Corinth, Hughes Assocs.	601-287-2915
MO	Florissant, Delltron Co., Inc.	314-839-0033
NJ	Lodi, TRC Elec. Inc.	201-779-8282
NC	Cary, Hughes Assocs.	919-467-7029
OH	Cleveland, Comps. Inc.	216-243-9200
OR	Beaverton, Advanced Power Prods.	503-646-0994
PA	Box Spring House, QED Elec. Inc.	215-643-9200
TN	Nashville, Hughes Assocs.	615-871-0908
TX	Richardson, Barry Sls.	214-234-0255
VA	Lynchburg, Parogem, Inc.	804-528-0681
WA	Redmond, Advanced Power Prods.	206-885-0881
WI	Mlwaukee, Interep Inc.	414-774-1100
Can	Pointe Claire, Que., A. R. Gray & Assocs.	514-694-6378

Local Distributors

MA	Lowell, Power Assocs., Inc.	617-459-0700
NJ	Lodi, TRC Elec. Inc.	201-779-8282
OR	Beaverton, Micro Power Elctrn.	503-694-5353

T&W SYSTEMS, INC., See Versacad Corp.

TANE ALARM PRODUCTS, 247-40 Jericho Tpke., Floral Park, NY 11001, Tel: 516-328-3351, FAX: 516-326-9125; Empl.: 5; *Sls. Mgr.:* Tab Hauser; *Dist. Mgr.:* Sam Lurie

TANSITOR ELECTRONICS, West Rd., P.O. Box 230, Bennington, VT 05201, Tel: 802-442-5473, TELEX: 954007, FAX: 802-447-1297; FSC No.: 030266626; Empl.: 308; *Sls. Mgr.:* Dan Perreault; *Dist. Mgr.:* Dave Latchum

TAPECON, INC., 10 Latta Rd., Rochester, NY 14612, Tel: 716-621-8400; Empl.: 80

TAPESWITCH CORP. OF AMERICA, 100 Schmitt Blvd., Farmingdale, NY 11735, Tel: 516-694-6312, TELEX: 144611, FAX: 516-694-6304; Empl.: 100; *Sls. Mgr.:* Thomas Polistina

TAPPAN WIRE & CABLE, 256 Oak Tree Rd., Tappan, NY 10983, Tel: 914-359-9300; FSC No.: 2G330; Empl.: 20; *Sls. Mgr.:* Mike Ressa

TAUBER ELECTRONICS

FAX: 619-274-2220

TAUBER ELCTRNS. INC., 4901 Morena Blvd., Bldg. 314, San Diego, CA 92117, Tel: 619-274-7242; Empl.: 22; *Sls. Mgr.:* Bob Tauber; *Dist. Mgr.:* Pat Hoscoe ..... **D•1493**

Local Sales Offices & Reps

AL	Huntsville, Macro-Marketing	205-883-9630
AZ	Phoenix, MacDonald & Assocs.	602-998-1848
CA	Fullerton, AB Sls.	714-667-0177
CA	Northridge, Tauber & Assocs.	213-416-9000
CA	San Jose, Tauber & Assocs.	408-737-9408
IL	Wheeling, Ed Joyner & Co.	312-520-1200
NV	Reno, Connie Dunning	702-849-0722
OR	Portland, Frank Jackson Assocs.	503-292-2638
WA	Redmond, Frank Jackson Assocs.	206-881-7277

TAURUS COMPUTER PRODUCTS, DY-4 Systems Inc., 110-1140 Morrison Dr., Ottawa, Ont., Canada K2H 8S9, Tel: 613-596-3910, FAX: 613-596-0574; Empl.: 13; *Sls. Mgr.:* David Murray; *Dist. Mgr.:* David Murray

TAURUS CORPORATION, See Signal Research Inc.

TAU-TRON, INC., A Unit of General Signal, 10 Lyberty Way, Westford, MA 01886, Tel: 617-692-5100, TELEX: 750245; Empl.: 300; *Sls. Mgr.:* Tom Lillard, Gen Sls. Mgr.

TAYLOR ELECTRONICS, INC., 401 West Orion, Tempe, AZ 85283, Tel: 602-838-4523; Empl.: 25; *Sls. Mgr.:* Sharon F. Hansen

T-bar INCORPORATED

FAX: 203-929-6408

T-BAR INCORPORATED, Data Switch Corporation, 1 Enterprise Dr., Shelton, CT 06484, Tel: 203-926-1801, TWX: 710-463-3210; Empl.: 140; *Sls. Mgr.:* Gerard F. Ryan ..... **B•1804**

Local Sales Offices & Reps

AZ	Tempe, Can Tec Sls.	602-345-1276
CA	Arcadia, Van Gott & Assocs.	818-445-9728
CA	Palo Alto, Horne Electro Sls.	415-494-6777
FL	Clearwater, Tech-Rep Assocs.	813-577-9370
IL	Barrington, Perhats Assocs.	312-381-6360
MD	Gaithersburg, Carwithen Assocs.	301-921-9545
MA	Westwood, Apex Assocs.	617-326-5042
NY	Rochester, Elctrn. Mktg. Assocs.	716-427-8115
OH	Cleveland, Carter, McCormic & Peirce	216-826-0400
PA	Horsham, Jacobsen Assocs.	215-674-2937
TX	Richardson, McCoy Assocs. Co.	214-864-1838
Can	Quebec, J. G. Weiss Co. Ltd.	514-337-5022

Local Distributors

IL	Chicago, Newark Elctrns.	312-784-5100
CT	Wallingford, Sager Elctrl. Supp. Co.	203-265-4600

T.D.I. BATTERY & CABLE, 2852 Hitchcock Ave., Downers Grove, IL 60515, Tel: 312-971-3460, TWX: 910-695-3222, FAX: 312-971-3903; Empl.: 80; *Sls. Mgr.:* Kurt Padera; *Dist. Mgr.:* Theresa Kanaga

TDJ CO., INC., 1154 Morena Blvd., San Diego, CA 92110, Tel: 619-276-5920; FSC No.: 60382; Empl.: 9; *Sls. Mgr.:* R. Scherr ..... **C•1104-1105**

TDK CORPORATION, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku,, Tokyo, Japan 103, Tel: (03) 278-5111, TELEX: J24270, TWX: J26937, FAX: (03) 278-5330; Empl.: 7,800; *Sls. Mgr.:* Motoyuki Kurihara; *Dist. Mgr.:* Tadashi Enami (TDK Corporation of America) .... **A•1176-1179, 1294, 1322-1327, 1619, 1698-1699; D•1060, 1992**

Local Sales Offices & Reps

AL	Huntsville	205-539-4551
CA	San Jose	408-437-9585
CA	Torrance	213-539-6631
IL	Mt. Prospect	312-803-6100
IN	Indianapolis	317-872-0370
MI	Southfield	313-353-9393
NJ	New Jersey, M & H Intl. Corp.	201-891-8800
NJ	W. Orange	201-736-0023
NY	Pt. Washington	516-625-0100
NC	Greensboro	919-292-0012
TX	Irving	214-506-9800
Can	Ontario, M & H Intl. Corp.	416-676-9401

TEAL ELECTRONICS CORPORATION, 7020 Carroll Rd., San Diego, CA 92121, Tel: 619-458-9522, 800-621-0852 (ext. 590); Empl.: 50; *Sls. Mgr.:* Bill Carpenter, VP Mktg.

TEC, 2727 N. Fairview, Box 5646, Tuscon, AZ 85703, Tel: 602-792-2230, TWX: 910-952-1377, FAX: 602-882-7472; Empl.: 275; *Sls. Mgr.:* Barry Hamilton; *Dist. Mgr.:* Barry Hamilton

TECA, THERMOELECTRIC COOLING AMERICA CORP., 448 N. Halsted St., Chicago, IL 60622, Tel: 312-666-1600, FAX: 312-666-3964; Empl.: 50 ..... **C•1696-1697**

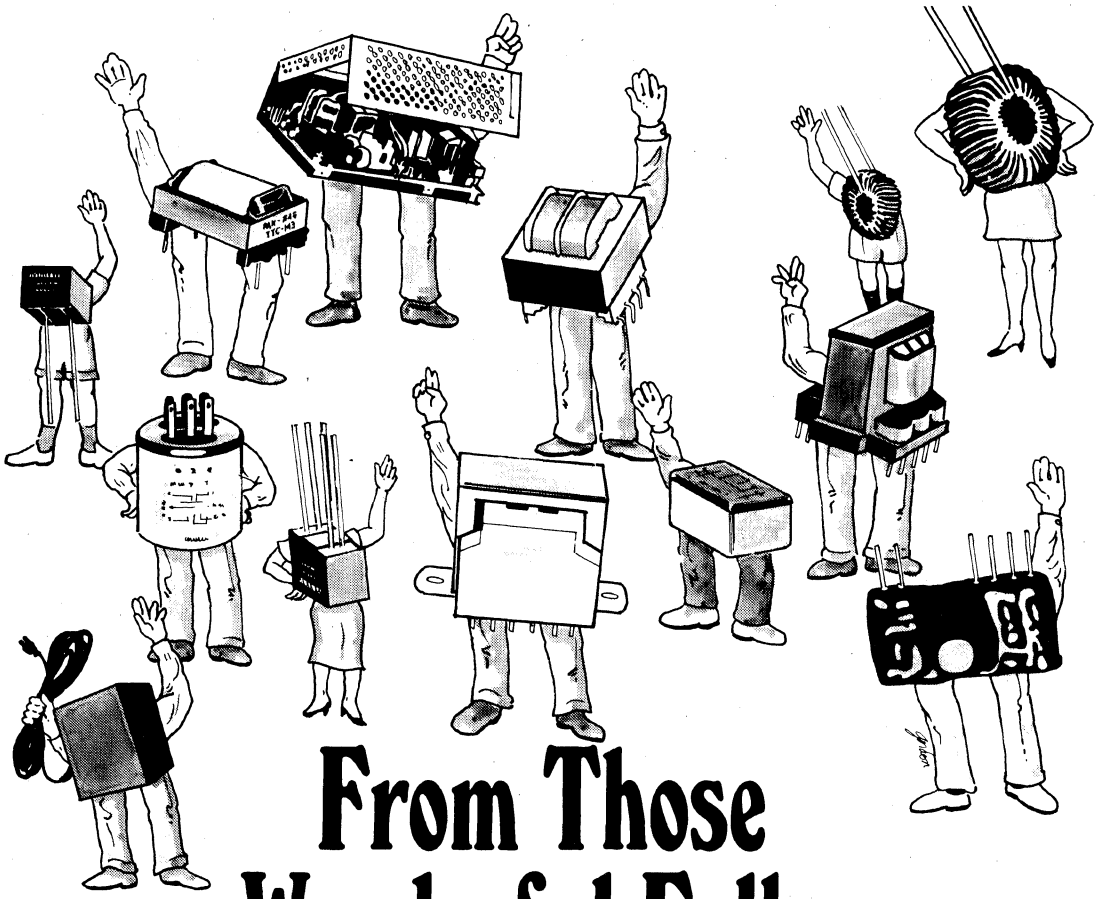
TECCOR ELECTRONICS, INC.

FAX: 214-550-1309

TECCOR ELECTRONICS, INC., 1801 Hurd Dr., Irving, TX 75038, Tel: 214-580-1515, TELEX: 79-1600, TWX: 910-860-5068; Empl.: 1000; *Sls. Mgr.:* Gerry Wiley ..... **A•2146-2149**

Local Sales Offices & Reps

AL	Huntsville, Interep Assocs.	205-533-1730
AL	Mobile, Interep Assocs. Inc.	205-478-1036



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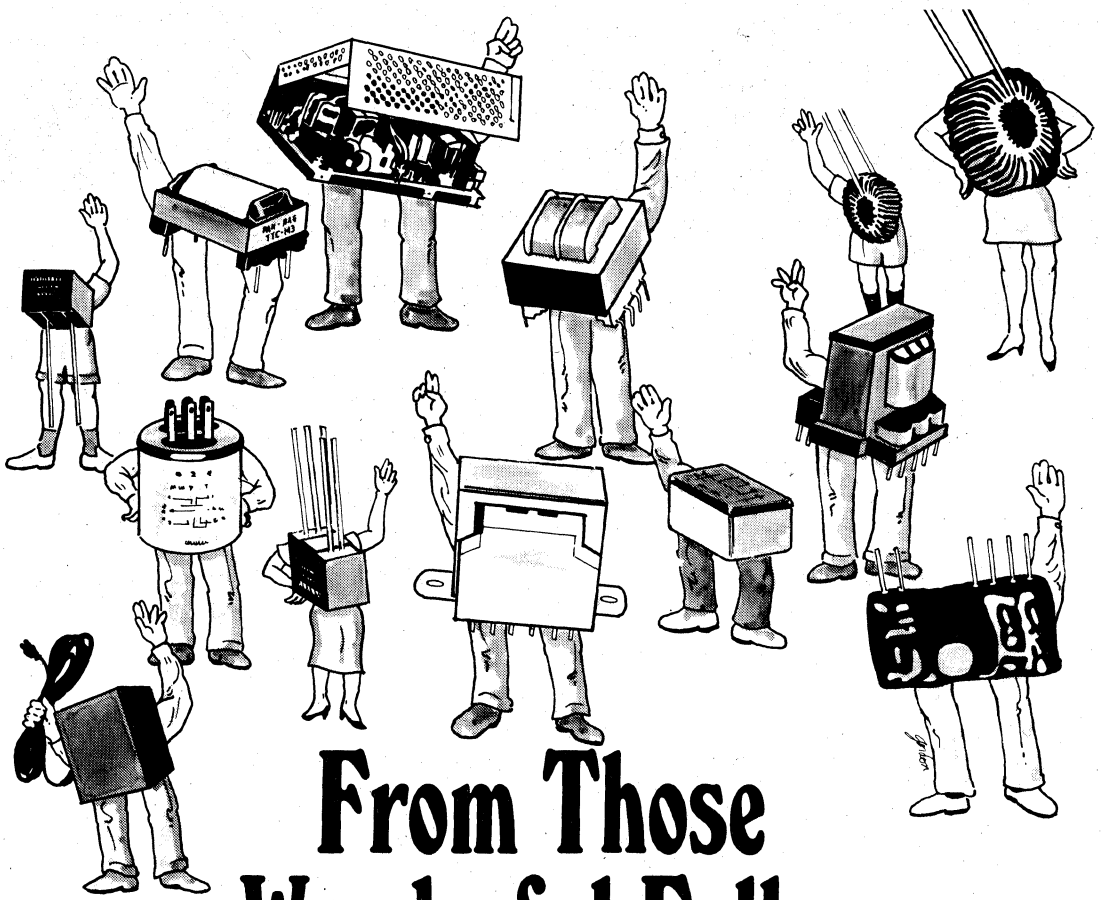

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AZ Tempe, System Sls. of Ariz. 602-829-9338
CA San Diego, O'Donnell Assocs. 619-578-1645
CA San Jose, O'Donnell Assocs. 408-432-1940
CA Torrance, O'Donnell Assocs. 213-539-9664
CO Englewood, Romulus Elctrns. Ltd. 303-770-4888
CT Meriden, Advanced Comp. Sls. (ACS) 203-238-6891
FL Boca Raton, Perrott Assocs. Inc. 305-483-2358
FL Clearwater Beach, Perrott Assocs. 813-443-5214
FL Orlando, Perrott Assocs. 305-298-7748
GA Norcross, Interep Assocs. 404-449-8680
IL Arlington Heights, MSI Micro Sls. 312-956-1000
IN Indianapolis, Elctrn. Rep, Inc. 317-894-1414
IN Mishawaka, Elctrn. Rep, Inc. 219-259-9365
IA Des Plains, SPS Assocs. Ltd. 515-225-0607
KS Olathe, SPS Ltd. 913-764-4460
MA Walpole, JEF Components 617-668-6695
MI Southfield, Rathsburg Assocs. 313-559-9700
MN Minneapolis, Electric Comp. Sls. 612-933-2594
MO Earth City, SPS Assocs. Ltd. 314-291-0520
NJ Mt. Laurel, S-J South Assocs. 609-866-1234
NM Albuquerque, Sys. Sls. of Arizona Inc. 505-889-2901
NM Corrales, Sys. Sls. of Arizona Inc. 505-889-2901
NY Canandaigua, Bensman/Upstate Assocs. 716-396-2498
NY Jamaica, S-J Assocs. Inc. 718-291-3232
NC Raleigh, Godwin Assocs. 919-878-8000
OH Cleveland, Del Steffen & Assocs. 216-461-8333
OH Dayton, Del Steffen & Assocs. 513-293-3145
OH Lexington, Del Steffen & Assocs. 419-884-2313
PA Carnegie, Del Steffen & Assocs. 412-276-7366
TN Greeneville, Interep Assocs. Inc. 615-639-3491
TX Irving, Davis, Don 214-580-1515
UT Salt Lake City, Electrodyne 801-264-8050
VA Falls Church, S-J Chesapeake 703-573-1188
WA Redmond, Quadra Sls. 206-883-3550
WI Wauwatosa, Larsen Assocs. 414-258-0529
Can Concord, Ont., Astec Comps. 416-669-4022
Can St. Laurent, Que., Astec Comps. 514-744-5465

Local Distributors

AL Huntsville, Hammond Elctrns. 205-830-4764
AZ Phoenix, Arizona Comp. Co. 602-269-5655
AZ Tempe, Insight Elctrns. 602-829-1800
CA Agoura, Insight Elctrns. Inc. 818-707-2100
CA Costa Mesa, Insight Elctrns. Inc. 714-556-6890
CA Hayward, Electro Comp. Distrs. 415-783-5800
CA San Diego, Insight Elctrns. 619-587-0471
CA Santee, Mouser Elctrns. 619-449-2220
CA Tustin, Added Value Elec. Dist. Inc. 714-259-8258
CT East Haven, JV Elctrns. 203-469-2321
FL Ft. Lauderdale, Hammond Elctrns. 305-973-7103
GA Norcross, Hammond Elctrns. 404-449-1996
IL Rosemont, Advent Elctrns. 312-298-4210
IN Indianapolis, Advent Elctrns. 317-872-4910
IA Cedar Rapids, Advent Elctrns. 319-363-0221
LA Baton Rouge, Indl. Elctrns. Supp. 504-357-4249
LA Shreveport, Indl. Elctrns. Supp. 318-222-9459
MD Savage, Pyttronic Inds. 301-953-9650
MA Woburn, ACI Elctrns. 617-935-7230
MI Farmington Hills, Advent Elctrns. 313-477-1650
MN Minneapolis, Stark Elctrns. 612-332-1325
MN Thief River Falls, Digi-Key 800-344-4539
NE Lincoln, Scott Elctrns. 402-466-8221
NJ Bloomfield, Solid State Inc. 201-429-8700
NM Albuquerque, Bell Inds. 505-292-2700
NY Buffalo, Summit Distrs. 716-887-2800
NY Plainview, ACI Elctrns. 516-293-6630
NY Rochester, Simcona Elctrns. 716-328-3230
NC Greensboro, Hammond Elctrns. 919-275-6391
OR Portland, Radar Elc. Co. 503-232-3404
PA Export, Advacom Inc. 412-733-5400
PA Mc Kean, Advacom 814-476-7774
PA Montgomeryville, Pyttronic Inds. 215-643-2850
SC Greenville, Hammond Elctrns. 803-233-4121
TX Corpus Christi, Douglas Elctrns. 512-883-5103
TX Dallas, Omni Pro Intl. Inc. 214-233-9368
TX Mansfield, Mouser Elctrns. 817-483-4422
UT West Valley City, Aved-Rocky Mtn. Inc. 801-975-9500
WA Richland, Radar Elec. 509-943-8336
WA Seattle, Radar Elec. Co. 206-282-2511
WA Spokane, Radar Elec. 509-747-3053
WI Milwaukee, Marsh Elctrns. 414-475-6000
Can Burnaby, BC, RAE Indl. Elctrns. Ltd. 604-291-8866
Can Calgary, Alberta, Cardinal Inds. 403-259-6817
Can Edmonton, Alberta, Cardinal IND Elctrns. 403-483-6266
Can London, Ont., CM Peterson Co. 519-434-3204
Can Mississauga, Ont., Prelco Elctrns. 416-678-0401
Can Montreal, Que., Prelco Elec. Ltd. 514-389-8051
Can Saskatoon, Sask., Cardinal Inds. 306-934-3443
Can Willowdale, Ont., Electro Sonic Inc. 416-494-1666

Tech-Etch

FAX: 617-746-9639

TECH-ETCH, INC., 45 Aldrin Rd., Plymouth, MA 02360, Tel: 617-747-0300, TELEX: 989997; Empl.: 280; *Sls. Mgr.:* P. A. Thomas ..... **C•1755**

TECH LABS., INC., 500 10th St., Palisades Pk., NJ 07650, Tel: 201-944-2221, TELEX: 322 532; FSC No.: 83332; Empl.: 31; *Sls. Mgr.:* George Morrow ..... **B•1805**

Local Sales Offices & Reps

CA Granada Hills, C & W Comps. Sls. 818-368-4032
CA Santa Clara, Mollard Mktg. 408-866-5950
GA Atlanta, Grady Duckett Sls. 404-451-3529
IL Glenview, Crimson Engrg. Co. 312-470-0024
KS Lenexa, Midtec Assocs. 913-541-0505
MA Norwood, Comps. Mktg. Svc. 617-762-4339
MI Jackson, N. Scroggs Co. 517-750-1170
MO St. Louis, Midtec Assocs. 314-275-8666
NJ Haddonfield, Gray Assocs. 609-953-9109
NJ Whippany, Ken L. Love Assocs. 201-540-0204
NY Fairport, Net Sls. 716-223-1030
NY Hempstead, Ken L. Love Assocs. 516-681-3155
OH Cincinnati, Patco 513-931-3311
PA Pittsburgh, VerHill Assocs. 412-241-5202
TX Dallas, Southwest Elctrns. 214-690-9881
TX Houston, Southwest Elctrns. 713-729-1670
WA Seattle, SPS Elctrns. 206-323-4140
Can Montreal, Solid State Elctrns. 514-481-3313

TECHLAND BLUELYNX, 112 Main St., Newmarket, NH 03857, Tel: 603-659-6035,800-832-4526, TELEX: 961-134; *Sls. Mgr.:* Janine Filion

TECHMAR CORP., 2232 S. Cotner Ave., Los Angeles, CA 90064, Tel:23-478-0046, 800-TECHMAR, 800-CHASSIS(CA); FSC No.:32597; Empl.:12; *Sls. Mgr.:* Grant Reisfelt ..... **C•1106-1109**

TECHNAR, INC., See TRW Technar, Inc.

TECHNIC, INC., Box 965, Providence, RI 02901, Tel: 401-781-6100, TELEX: 927514; Empl.: 125; *Sls. Mgr.:* Andrew T. Ferris

TECHNICAL DEVICES, 560 Alaska Ave., Torrance, CA 90503, Tel: 213-618-8437; FSC No.: 04772; Empl.: 21; *Sls. Mgr.:* D. Murrin; *Dist. Mgr.:* D. Murrin

TECHNICAL MARKING SYS., See Autoroll Machine Corp.

TECHNICAL MATERIALS, INC., Sub. of Brush Wellman, Inc., 5 Wellington Rd., Lincoln, RI 02865, Tel: 401-333-1700, TWX: 710-384-0600, FAX: 401-333-2848; Empl.: 200; *Sls. Mgr.:* Kenneth Bennett

TECHNICAL PANELS, INC., 9162 La Rosa Dr., Temple City, CA 91780, Tel: 818-285-3105; Empl.: 14; *Sls. Mgr.:* Norman J. Towne

TECHNICAL RESEARCH & MFG., INC., See TRM, Inc.

TECHNIPOWER, A PENRIL CO., P.O. Box 222, Commerce Pk., Danbury, CT 06813, Tel: 203-748-7001, TWX: 710-456-9280; FSC No.: 13850; Empl.: 135; *Sls. Mgr.:* I. Bourgain (Variac); *Dist. Mgr.:* James McCarty ..... **A•2405; D•1993**

Local Sales Offices & Reps

AL Huntsville, Remco 205-533-3763
AZ Scottsdale, Williams Assocs. 602-947-4297
CA Los Alamitos, Power Specialists 213-594-9418
CA Santa Clara, Sourcetronics 408-988-8801
CO Commerce City, Williams Assocs. 303-289-5647
FL Treasure Island, Hi-Tek Sls. 813-360-2816
IL Godfrey, D.B. Entprs. 619-466-2329
IL Medinah, Gentry Technlgs. 312-893-9352
MA Wayland, High Tech Sls. 617-360-2816
MI Jackson, T.P.S. & Assocs. 517-784-3462
MN Burnsville, Electromec Sls., Inc. 612-894-8200
NY Pennsauken, Ar-Jay Tech. 609-663-4260
OR Lake Oswego, Syntek Synergistics Technlgs. 503-636-6793
TX Houston, Scientific Sls. 713-460-9170
TX Richardson, Scientific Sls. Co. 214-231-6541
VA Fairfax, Schibley Assocs. 703-591-3008
WA Kirkland, Syntek Synergistic Technlgs. 206-488-0394
Can Guelph, Ont., Victrix, Ltd. 518-836-1480

Local Distributors

CA Los Angeles, Cal-State Elctrns. 213-933-8187
CA Oakland, N. A. D'Arcy 415-638-7773
IL Chicago, Delta Tech. Prods. Co. 312-478-1134
MA Woburn, Abbott Elctrns. Co. 617-935-2040
MI Dearborn, Indl. Temperature & Control 313-278-2210
MN St. Paul, Gopher Elctrns. Co. 612-483-3322
MO St. Louis, Olive Elctrns., Inc. 314-426-4500
NY Albany, Adirondack Elctrns., Inc. 518-456-0203
NY Farmingdale, Midway Indl. Elctrns. 516-293-6800
NC Charlotte, Jenkins Elec. Co. 704-392-7371
OK Tulsa, Inotek 918-627-1500
PA Philadelphia, PEI/Genesis 215-568-7400
TX Dallas, Inotek 214-243-7000
TX Houston, Inotek 713-688-4494
Can Guelph, Ont., Victrix, Ltd. 519-836-1480

TECHNIQUES, INC., 235 Jackson St., Englewood, NJ 07631, Tel: 201-569-5900; Empl.: 60

TECHNI-TOOL, 5 Apollo Rd., Box 368, Plymouth Meeting, PA 19462, Tel: 215-825-4990, TELEX: 834-763, FAX: 215-828-5623; FSC No.: 30239; Empl.: 80; *Sls. Mgr.:* W. Bezar

Technitrol, Inc.

FAX: 215-426-9105 (ext 102)

TECHNITROL, 1952 E. Allegheny Ave., Philadelphia, PA 19134, Tel: 215-426-9105, TELEX: 834245; FSC No.: 90095; Empl.: 350; *Sls. Mgr.:* G. Shilling ..... **A•1494, 1620-1628, 2407; B•1022-1025**

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A DIVISION OF DATAMAX ELECTRONICS

Local Sales Offices & Reps

AZ	Phoenix, Integrated Sys. & Dev. Sls.	602-971-6250
CA	Torrance, Detomasi & Grupp, Inc.	213-618-8898
CT	New London, Technitrol Sls. Off.	203-442-1141
IL	Wauconda, Cudahy Sls.	312-526-2484
MD	Baltimore, Callas Elctrns.	301-744-7711
NM	Albuquerque, Syntech	505-266-7951
NY	Fairport, TAC Assoc.	716-377-2250
NY	Jericho, J. Square Mktg.	516-935-3200
OH	Akron, Augnat Assocs.	216-239-2499
FL	Seminole, Q-Rep	813-393-6393
PA	Easton, The Kendon Co.	215-253-3100
TX	Dallas, M-Rep	214-484-5711
TX	Houston, M-Rep	713-261-0798
WA	Redmond, General Technlg., Inc.	206-881-6456

TECHNO
SFERNICE, INC.

FAX: 818-781-8647

TECHNO, INC., 7803 Lemona Ave., Van Nuys, CA 91405, Tel: 818-781-1642; FSC No.: 05347; Empl.: 150; *Sls. Mgr.:* Joe Catrambone; *Dist. Mgr.:* Danny Jagirdar ..... **A•1848, 2026, 2099; B•1870-1871**

Local Sales Offices & Reps

AZ	Tempe, Semper Fi Sales, Inc.	602-730-9553
CA	Chatsworth, Raltech	818-700-0933
CA	Del Mar, Chapman & Chapman	619-755-0412
AZ	Tempe, Semper Fi Sls., Inc.	602-730-9553
CA	Glendale, Mission Mktg. Grp.	818-247-9110
IL	Downers Grove, Richmar Elctrns. Corp.	312-968-0118
IA	Hiawatha, Ard Sls.	319-393-6392
CA	Santa Clara, I Squared, Inc.	488-988-3400
CO	Denver, West, Inc.	303-477-8180
MD	Timonium, Zebra Elctrn.	301-252-6576
CT	Bloomfield, F. S. I.	203-243-3122
MA	Lowell, Astrorep of New England	617-459-7399
MI	Jackson, T.P.S. & Assocs.	517-783-1722
MN	Minneapolis, Dunlop Consits.	612-544-1070
FL	St. Petersburg, J.C.J. Assocs.	813-343-2679
NJ	Piscataway, R. P. Luce & Co.	201-752-8750
NY	Chappaqua, Micrel, Inc.	914-238-4961
IN	Ft. Wayne, Denton Mktg.	219-486-0665
NY	New Hyde Pk, R. P. Luce & Co.	516-437-4550
NY	Rochester, Fritz Dasson	716-338-1699
OH	Wooster, T.P.S. & Assocs.	216-264-0971
PA	Wynnewood, Metz-Benham Assocs., Inc.	215-896-7300
TX	Richardson, Pro Comp. Sls. Co.	214-669-1500
UT	Salt Lake City, West, Inc.	801-466-5739
WA	Bellevue, Olson Tech. Sls. Corp.	206-883-7792
WI	Butler, Richmar Elctrns. Corp.	414-781-1730
Can	Manitoba/Winnipeg, Smith-Paterson & Assoc.	204-885-1376
Can	Ont./Mississauga, Sourcer Elctrns.	416-676-0830
Can	Ont./Rexdale, Bestec Elctrns.	416-674-1330

Local Distributors

CA	Chatsworth, Petell/Passive Comp., Inc.	818-341-1745
CA	Chatsworth, Shelley Ragon	818-988-3333
CA	San Diego, Neumann Elec.	619-695-3005
CA	Westlake Village, Distel, Inc.	805-495-9998
CA	Yorba Linda, Zeus Comp.	714-921-9000
CO	Denver, IEC Integrated Elctrn.	303-292-6121
FL	Oviedo, Aztech Elctrn.	305-365-2241
FL	Tampa, Impala Elctrns.	813-885-4747
IL	Hoffman Estates, IEC Integrated Elctrn.	312-843-2040
MD	Columbia, Aztech Elctrns	301-995-6800
MA	Burlington, TLC Elctrns.	617-273-0140
NJ	clifton, J-Mar Electro	201-772-6400
NY	Bohemia, Justin Elec.	516-589-4000
NY	Hauppauge, Jaco, Inc.	516-273-5500
NY	Melville, SAI, Inc.	516-293-2710
NY	N. Syracuse, Andco Elctrns	315-699-2660
NY	Port Chester, Zeus Comp.	914-937-7400
NY	Valley Stream, L & S Elec.	516-561-2474
OH	Cincinnati, Eclipse of Ohio	513-661-7733
OH	Dayton, Televox, Inc.	513-454-1225
OR	Beaverton, IEC Integrated Elctrn.	503-641-1690
TX	Fort Worth, Patco Supply	817-429-8596
TX	Richardson, Jaco, Inc.	214-235-9575
WA	Bellevue, IEC Integrated Elctrns.	206-455-2727

TECHNO, A DSG Company, 2101 Jericho Tunpike, New Hyde Park, NY 11040, Tel: 516-328-3970, TWX: 510-223-0642, FAX: 516-326-8827; Empl.: 85 ..... **B•1266**

TECHNOLOGY DYNAMICS inc.

FAX: 201-385-0702

TECHNOLOGY DYNAMICS INC., 100 School St, Bergenfield, NJ 07621, Tel: 201-385-0500; Empl.: 50; *Sls. Mgr.:* James C. Logan ..... **D•1994**

Local Sales Offices & Reps

CA	Lennox, Dae Joon Elctrns.	213-674-0219
MD	Hagerston, Stinson Assocs., Inc.	301-790-1193
MA	Littleton, Caldwell Assocs.	617-369-2475
NY	Rochester, A.J. Electro Mktg.	716-426-3598
VA	Reston, Stinson Assocs., Inc.	703-620-0088

TECHNOLOGY PRODUCTS, INC., 8900 Eton Ave., Canoga Park, CA 91304, Tel: 213-998-8555; FSC No.: 8K984; *Sls. Mgr.:* N. Lerman

TECHNOLOGY SYSTEMS DIVISION, Krug International, P.O. Box 3036, Overlook Branch, Dayton, OH 45431-0036, Tel: 513-426-2405, TWX: 810-450-2620; FSC No.: 23978; Empl.: 150; *Sls. Mgr.:* William O. Murphy, Reg. Sls. Mgr.

TECHRON

FAX: 1-219-294-8329

TECHRON DIV., Crown Intl., Inc., 1718 W. Mishawaka Rd., Elkhart, IN 46517, Tel: 219-294-8300, TWX: 810-294-2160; FSC No.: 06306; Empl.: 400; *Sls. Mgr.:* Howard King ..... **D•1019-1023**

Local Sales Offices & Reps

CA	Manhattan Bch., Basic Trade, Inc.	714-634-2629
CA	Milpitas, IFM Inc.	408-945-5920
CO	Commerce City, Williams Assocs.	303-289-5647
CT	Woodbridge, Electronic Marketing Assoc.	203-397-1461
FL	Melbourne, Reynolds & Assocs., Inc.	305-259-7000
IL	Chicago, Berndt Assocs.	312-283-0713
IA	Cedar Rapids, MAI Assocs.	319-396-8030
MI	Livonia, Lowell-Wendt Mktg. Co.	313-464-2722
MN	St. Paul, Timewave Technlgy., Inc.	612-451-7575
NJ	Wayne, Ramapo, Inc.	201-839-6767
NY	Syracuse, Labtronics Inc.	315-455-7314
OH	Brecksville, Audio Mktg. Assoc.	216-526-2426
PA	Montogomeryville, Eastern Sci. Mktg.	215-368-4570

TECH SPRAY, INC., Box 949, Amarillo, TX 79105, Tel: 806-372-8523, TELEX: 738450, FAX: 806-372-8750; Empl.: 48; *Sls. Mgr.:* 738450; *Dist. Mgr.:* Jack Swanson

TECHTROL CYCLONETICS, INC., 815 Market St., New Cumberland, PA 17070, Tel: 717-774-2746, TWX: 510-650-7003, FAX: 717-774-6799; FSC No.: 58792; Empl.: 25; *Sls. Mgr.:* James M. Griffith .... **A•1476-1477**

Local Sales Offices & Reps

AL	Huntsville, Gentry Assocs., Inc.	205-837-0692
CA	Buena Pk, West Tech Microwave	714-739-5553
CA	San Jose, MC Microwave, Inc.	408-446-4100
CA	Westlake Vl, West Tech Microwave	818-991-9219
FL	Tampa, Gentry Assocs., Inc.	813-886-0720
GA	Atlanta, Gentry Assocs., Inc.	404-998-2828
MD	Laurel, CSDS, Inc.	301-490-3800
MA	Chelmsford, Matrix Sls. Inc.	617-459-4000
NJ	Teaneck, Sci. Dvcs. East	201-837-1004
PA	Horsham, Penn, Scientific Dvcs.	215-956-0700
TX	Austin, Airep Elctrns.	512-327-0778
TX	Dallas, Airep Elctrns.	214-349-4360
EXP	Palo Alto, CA, Radar Sys., Inc.	415-424-0661

TECKNIT a TWP company
EMI SHIELDING PRODUCTS

FAX: 201-272-2741

TECKNIT (EASTERN FACILITY), 129 Dermody St., Cranford, NJ 07016, Tel: 201-272-5500, TELEX: 6853079 TCKNT; FSC No.: 07700; Empl.: 300; *Sls. Mgr.:* Thomas McCreery ..... **C•1756**

Local Sales Offices & Reps

AL	Huntsville, Dixie Tech. Mktg.	205-830-0808
AZ	Tempe, Elctrn. Dev. & Sls.	602-438-1547
CA	Anaheim, Westrep	714-527-2822
CA	Granada Hills, C & W Comp. Sls.	818-368-4032
CA	San Diego, Westrep	619-566-6580
CA	Santa Barbara, Tecknit (Western Facility)	805-963-5811
CA	Santa Clara, Nova-Tronix	408-727-9530
FL	Boca Raton, Lawrence Assocs. Inc.	305-368-7373
FL	Casselberry, Lawrence Assocs.	305-339-3855
GA	Duluth, Dixie Tech. Mktg., Inc.	404-381-5592
IL	Palatine, Technig. Sls., Inc.	312-991-6600
IA	Marion, Ensco-Rep Inc.	319-377-3026
KS	Wichita, Ensco-Rep Inc.	316-683-1070
MD	Rockville, Mechtronics Sls. Inc.	301-340-2130
MN	St. Paul, Repco	612-642-2828
MO	Maryland Heights, Ensco-Rep, Inc.	314-423-3935
NH	Hudson, EMC Sales	603-889-5751
NJ	Cranford, Tecknit Inter-Connection Prods.	201-272-3850
NY	Binghamton, Empire Tech. Assocs., Inc.	607-772-0651
NY	Great Neck, Trionics Assocs.	516-466-2300
OH	Broadview Hgts., Jay Engrg.	216-838-4840
OH	Dayton, Jay Engrg.	513-253-2151
OR	Beaverton, Quest Mktg.	503-641-7377
PA	Huntingdon Valley, Omega Elctrn. Sls. Inc.	215-947-4135
TX	Austin, Kruvand Assocs.	512-441-6777
TX	Dallas, Kruvand Assocs.	214-437-3355
WA	Bellevue, Quest Mktg.	206-747-9424
WI	Milwaukee, Technig. Sls. Inc.	414-786-5015
Can	Montreal, Que., Norgay Entprs., Ltd.	514-932-3233
Can	Ottawa, Ont., Norgay Entprs., Ltd.	613-723-1858
Can	Toronto, Norgay Entprs. Ltd.	416-259-9663

TECKNIT a TWP company
INTERCONNECTION PRODUCTS

FAX: 201-272-2741

TECKNIT INTERCONNECTION PRODUCTS, 135 Bryant Ave., Cranford, NJ 07016, Tel: 201-272-3850, TELEX: MCI6853079 TCKNT; FSC No.: 07700; Empl.: 40; *Sls. Mgr.:* Robert T. Bjornsen ..... **C•1564**

Local Sales Offices & Reps

AZ	Tempe, E.D.S.	602-438-1547
CA	Grenada Hills, C & W Comp. Sls.	818-368-4032
CA	San Diego, Mesa Engrg.	619-278-8021
CA	Santa Clara, Nova-Tronix	408-727-9530
CO	Longmont, Butler Tech. Sls.	303-651-7703
FL	Maitland, E.I.R., Inc.	305-660-9600
MI	Livonia, Luebbe Sls. Co.	313-477-3131
MN	Eden Prairie, E.I.I. Elctrn. Innovators	612-941-0830
NJ	Union, Meridian Entprs.	201-687-6220
NY	Clarence, R. W. Mitscher Co., Inc.	716-759-2350
TX	Dallas, Blackburn Assocs., Inc.	214-750-8484
WA	Bellevue, Quest Mktg.	206-747-9424
Can	Toronto, Norgay Entprs.	416-259-9663

TECMAR, INC., 6225 Cochran Rd., Solon, OH 44139, Tel: 216-349-0600; Empl.: 600; *Sls. Mgr.:* Tim Mahoney

TECNETICS, See Computer Products, Inc.

TECNETICS, Computer Products/Tecnetics, 6287 Arapahoe Ave., Boulder, CO 80306, Tel: 303-442-3837, FAX: 303-444-9437 ..... **D•1671-1674**

Refer to Computer Products, Inc., Pompano Beach, FL for sales offices, Reps. and Distributors.

TECO CORP., Bay Rd., P. O. Box A, Winnisquam, NH 03289, Tel: 603-524-1998, FAX: 603-524-1899; Empl.: 40-50; *Sls. Mgr.:* Sandra Murphy

TECOM INDUSTRIES, INC., 9324 Topanga Canyon Blvd., Chatsworth, CA 91311, Tel: 818-341-4010, TELEX: 69 8476; FSC No.: 59850001; Empl.: 165

Local Sales Offices & Reps

CA	Mountain View, Disman - Bakner	415-969-3010
CT	Norwalk, Nemarco Assocs.	203-852-9117
FL	Orlando, W. A. Brown Instrs.	305-648-9660
IL	Lake Zurich, Wave Mktg.	312-934-8008
IA	Cedar Rapids, Feller Assocs.	319-364-0566
MD	Severna Pk., Delmarva Engrg.	301-647-8007
MO	Leasburg, EIR Co.	314-895-4100
PA	Lafayette Hill, M. Lader Co.	215-825-3177
TX	Arlington, John Houston Assocs.	817-265-2931
TX	Dallas, Data Mktg. Assocs.	214-661-0300
Can	Ottawa, Ont., Gigatron Assocs.	613-225-4090

TECTROL, INC., 39 Kodiak Cres., Downsview, Ontario, Canada M3J 3E5, Tel: 416-630-8108, FAX: 416-638-0553; Empl.: 320; *Sls. Mgr.:* Len Klebanoff

TED CORP., 11415 Johnson Dr., Shawnee Mission, KS 66203, Tel: 913-631-6211; FSC No.: 05209; Empl.: 48; *Dist. Mgr.:* Carol Smith

TEDEA INC., 8606 Wilbur Ave., Northridge, CA 91324, Tel: 818-349-6116, TELEX: 499-8137, TWX: 910-240-0598; Empl.: 16; *Sls. Mgr.:* Tony Smalarz

TEGAL SCIENTIFIC, INC., Box 5905, Concord, CA 94524, Tel: 415-827-1054, TELEX: 380053, FAX: 415-827-1189; *Sls. Mgr.:* L. Rigali

TEGAM, INC., 7230 N. Ridge Rd., Madison, OH 44057, Tel: 216-428-7505, TELEX: 205188 TEGAM MSON, FAX: 216-428-1068; Empl.: 25; *Sls. Mgr.:* Robert A. Rodella

TEKA INTERCONNECTION SYSTEMS, 45 Salem, Providence, RI 02907, Tel: 401-785-4110, TWX: 710-381-1606, FAX: 401-461-2310; Empl.: 89; *Sls. Mgr.:* John Stiness; *Dist. Mgr.:* John Stiness ..... **C•1565-1567**

Local Sales Offices & Reps

CA	Downey, Management Mktg. & Sls.	213-560-5584
CA	Sunnyvale, W. W. Posey Co.	408-746-0771
CO	Boulder, R.G. Entprs., Inc.	303-447-9211
FL	Tarpon Springs, L.P. Sls.	813-934-4744
IL	St. Charles, May Assocs., Inc.	312-377-2320
MA	Waltham, Newport Tech. Sls.	617-890-7255
MN	Wayzata, Cardinal Sls.	612-475-0041
NJ	Pompton Plains, T. A. Adamo Sls.	201-835-5344
TX	Houston, Mil-Rep Assocs.	713-444-2557
WA	Bothell, A/D Elctms.	206-481-8555

Local Distributors

CA	Hayward, KEA Elctms.	415-887-2900
CA	Irvine, Mann Southwest	714-380-4170
CA	Santa Ana, Norstan Elctms.	800-854-8344
CA	Santa Clara, Cypress Elctms.	408-980-2500
MA	Andover, Aved Elctms.	617-688-3800
MA	Canton, E.P.C., Inc.	617-821-2111
MI	Roseville, Madsion Elctms.	313-778-7640
MN	St. Paul, Shelley-Ragon, Inc.	612-642-2844
NY	Farmingdale, Pride Elctms.	516-293-4020
NY	Ronkonkoma, Conco Elctms.	516-467-8200
NC	Raleigh, Resco Raleigh	919-781-5700
OH	Centerville, I.P.D., Inc.	513-435-2086
TX	Allen, Prime Distbn.	214-231-0170
TX	Dallas, Cypress Elctms.	214-869-1435
WA	Seattle, Shelley Ragon, Inc.	206-241-1980

TEK-COM CORPORATION, 120 Charcot Ave., San Jose, CA 95131, Tel: 408-435-9515, TELEX: 277216; FSC No.: 72242; Empl.: 23; *Sls. Mgr.:* Joseph Gaynor; *Dist. Mgr.:* Robert E. Fasano

TEKNATIONAL INDS., INC., 430 S. Clinton Ave., Rochester, NY 14620-1103, Tel: 716-232-1291, FAX: 716-232-1295; FSC No.: 24227; Empl.: 15; *Sls. Mgr.:* J. D. Hochheimer

TEKTITE CORP., 4657 Platt Rd., Ann Arbor, MI 48108, Tel: 313-971-9379; Empl.: 12; *Sls. Mgr.:* Bob Sinelli

TEKTONE SOUND & SIGNAL, 1331 S. Killian Dr., Lake Park, FL 33403, Tel: 305-844-2383, TELEX: 51-3438, FAX: 305-845-1587; FSC No.: 59-1500771; Empl.: 70; *Sls. Mgr.:* Tom Hendricks; *Dist. Mgr.:* Tom Hendricks

TEKTRONIX, INC., P.O. Box 500, 76/260, Beaverton, OR 97077, Tel: 800-835-9433, TWX: 910-467-8708; FSC No.: 80009; Empl.: 17,000

TEKTRONIX, CAE Systems Divison, 5302 Betsy Ross Drive, Santa Clara, CA 95052, Tel: 408-727-1234, TELEX: 821378, FAX: 408-980-4622; Empl.: 300; *Sls. Mgr.:* John Henrotin

TEKTRONIX, INC., Display Devices Operation, P. O. Box 500, Beaverton, OR 97077, Tel: 503 627 6868

TEKTRONIX, INC., Hybrid Components Operation, P.O. Box 500, Beaverton, OR 97077, Tel: 503-627-4220, TELEX: 151754, TWX: 910-467-8708; *Sls. Mgr.:* Fred Gautreaux; *Dist. Mgr.:* Walter Kalin

TEKTRONIX-SIGNAL ANALYSIS UNIT, 1350 Dell Ave., No. 104, Campbell, CA 95008, Tel: 408-374-6464, FAX: 408-374-6467; *Sls. Mgr.:* Rick Wills

TELCOM INTERNATIONAL, INC., See Hadron, Inc.

TELEBYTE TECHNOLOGY, INC., Remark Datacom Div., 270 East Pulaski Road, Greenlawn, NY 11740, Tel: 516-423-3232, 800-835-3298, TWX: 510-226-0449, FAX: 516-385-8184; Empl.: 48; *Sls. Mgr.:* J. Kramer; *Dist. Mgr.:* R. Nazario

TELECOMMUNICATIONS TECHNIQUES CORP., 444 N. Frederick Ave., Gaithersburg, MD 20877, Tel: 301-258-5011, TELEX: 908736, FAX: 301-921-4331

TELECTRO SYSTEMS CORP., 96-18 43rd Ave., Corona, NY 11368, Tel: 718-651-8900, TWX: 510-601-8607 TELECTRO, FAX: 718-651-4103; FSC No.: 30040; Empl.: 75; *Sls. Mgr.:* H. Sussman

TELEDYNE AEROSPACE SYS., 1007 E. 10th St., Fairmont, MN 56031, Tel: 507-235-3355, 507-235-9712, TWX: 910-565-2120, ESYLNK: 62899301; FSC No.: 24600; Empl.: 230; *Sls. Mgr.:* Robert L. Johnson

TELEDYNE ANSONIA, Solderless Connector Div., One Riverside Dr., Ansonia, CT 06401, Tel: 203-735-9311, TELEX: 963408, ESYLNK: 62877180; FSC No.: 19724

TELEDYNE CAMERA SYS., 131 N. Fifth Ave., Arcadia, CA 91006, Tel: 818-359-6691, TELEX: 675-423; FSC No.: 14440; Empl.: 96; *Sls. Mgr.:* Roy Larson

TELEDYNE CRYSTALONICS, Teledyne Industries, Inc., 147 Sherman St., Cambridge, MA 02140, Tel: 617-491-1670, TWX: 710-320-1196; FSC No.: 12498;Multiple; *Sls. Mgr.:* David Hatfield; *Dist. Mgr.:* W. J. Kilgarriff

TELEDYNE/GEOTECH, 3401 Shiloh Rd., Garland, TX 75041, Tel: 214-271-2561, TELEX: 170584; FSC No.: 99019; Empl.: 175

TELEDYNE GURLEY, 514 Fulton St. P.O. Box 88, Troy, NY 12181, Tel: 518-272-6300, TWX: 710-443-8156; *Sls. Mgr.:* G. S. Gordon

TELEDYNE INET, 2750 W. Lomita Blvd., Torrance, CA 90505, Tel: 213-325-5040, TELEX: 67-7228, FAX: 213-534-2274; Empl.: 700; *Sls. Mgr.:* Fred Tamjidi

TELEDYNE KINETICS, Div. of Teledyne, Inc., 410 S. Cedros Ave., Solana Beach, CA 92075, Tel: 619-755-1181, TELEX: 62877770; Empl.: 100; *Sls. Mgr.:* John Schuler

TELEDYNE MICROELECTRONICS, 12964 Panama St., Los Angeles, CA 90066, Tel: 213-822-8229, 213-870-9831, TWX: 910-343-7436; FSC No.: 16170; Empl.: 1500; *Sls. Mgr.:* W. Kennedy

TELEDYNE MICRONETICS, 7155 Mission Gorge Rd., San Diego, CA 92120, Tel: 619-583-3525, TWX: 910-335-2085; Empl.: 120; *Sls. Mgr.:* S. Amarillas

TELEDYNE MICROWAVE, 1290 Terra Bella Ave., Mountain View, CA 94043, Tel: 415-968-2211, TWX: 910-379-6939; FSC No.: 24022; Empl.: 500

TELEDYNE PHILBRICK, Allied Dr. Rte 128, Dedham, MA 02026, Tel: 617-329-1600, TWX: 710-348-6726; Empl.: 250

TELEDYNE RELAYS

FAX: 213-779-9161

TELEDYNE RELAYS, Teledyne, Inc., 12525 Daphne Ave., Hawthorne, CA 90250, Tel: 213-777-0077, TWX: 910-321-4610; FSC No.: 11532; *Sls. Mgr.:* Tom Garland ..... **B•1598-1608**

Local Sales Offices & Reps

AL	Huntsville, Advanced Comps. Mktg.	205-881-5493
AZ	Scottsdale, Arcom Sls.	602-947-5745
CA	Saratoga, Teledyne Relays	408-996-9944
CO	Englewood, Thorson Rocky Mtn.	303-799-3435
CT	Stratford, G. Rosen Co.	203-375-5456
FL	Clearwater, HHP Assocs., Inc.	813-797-4447
FL	Pompano Beach, HHP Assocs., Inc.	305-971-5750
FL	Winter Pk., HHP Assocs., Inc.	305-740-0320
GA	Doraville, Advanced Comps. Mktg.	404-448-7025
IL	Glen Ellyn, Teledyne Relays	312-858-1090
IN	Kokomo, Schillinger Asso.	317-455-2708
IA	Cedar Rapids, Stan Clothier Co.	319-365-1717
KS	Olathe, C-Tron	913-829-0073
MD	Towson, Arbotek Assocs.	301-825-0775
MA	Marlborough, G. Rosen Co.	617-481-9277
MN	Minneapolis, S. Clothier Co.	612-944-3456
MO	St. Louis, Rothkoph & Assocs.	314-961-4485
NJ	Cranford, Teledyne Relays	201-272-0020
NM	Albuquerque, Reptronix	505-292-1718
NY	Mount Vernon, Friedman-Smith Elctms.	914-664-4866
NY	Syracuse, I.A. Hotze Co.	315-479-6641
OH	Dayton, J.C. Hofstetter Co.	513-296-1010
OH	Medina, J.C. Hofstetter Co.	216-241-4880
OR	Beaverton, B & P Sls.	503-641-3486
PA	Cherry Hill, Vantage Sls.	609-424-6777
PA	Hickory, J. C. Hofstetter Co.	412-356-2305
TX	Austin, Kruvand Assocs.	512-441-6777
TX	Dallas, Kruvand Asso.	214-437-3355
TX	Houston, Kruvand Asso.	713-780-9710
UT	Salt Lake City, Thorson Rocky Mtn.	801-973-7969
WA	Bellevue, B & P Asso.	206-454-6571
Can	Calgary, Alb., Deskin Sls.	403-466-2106
Can	Edmonton, Alb., Deskin Sls.	403-466-2106
Can	Markham, Ont., Deskin Sls.	416-475-1412
Can	Ottawa, Ont., Deskin Sls.	613-729-1099
Can	St. Laurent, Que., Deskin Sls.	514-331-2860
Can	Transcona, Man., Deskin Sls.	403-466-2106
Can	Vancouver, Deskin Sls.	604-324-8343

Local Distributors

AL	Huntsville, Pioneer Elctms.	205-837-9300
AL	Huntsville, Time Elctms.	205-721-1133
AZ	Phoenix, Wyle	602-249-2232
AZ	Tempe, Time-Arizona	602-967-2000
CA	Agoura Hills, Time Elctms.	818-707-2890
CA	Anaheim, Time-Anaheim	714-937-0911
CA	Calabasas, Wyle	818-880-9000
CA	Chatsworth, Time	818-998-7200
CA	Irvine, Wyle Dist. Grp.	714-863-9953
CA	Rancho Cordova, Wyle	916-638-5282
CA	San Diego, Time	619-586-1331
CA	San Diego, Wyle Dist. Grp.	619-565-9171
CA	Santa Clara, Wyle Dist. Grp.	408-727-2500
CA	Sunnyvale, Time-N. Cal.	408-734-9888
CA	Torrance, Time-West	213-320-0880
CO	Englewood, Time-Colorado	303-799-8851
CO	Thornton, Wyle Dist. Grp.	303-457-9953
CT	Cheshire, Time	203-271-3200
CT	Orange, Milgray/Conn.	203-795-0711
FL	Altamonte Springs, Pioneer Elctms.	305-834-9090
FL	Dania, Summit	305-920-6253
FL	Deerfield Beach, Pioneer	305-428-8877

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TELEDYNE ROTOLITE, P.O. Box 398, Owen, WI 54460, Tel: 800-524-0105, TWX: 710-986-3017; *Sls. Mgr.:* J. F. Stickel

TELEDYNE SEMICONDUCTOR, 1300 Terra Bella Ave., PO Box 7267, Mountain View, CA 94039-7267, Tel: 415-968-9241, TWX: 910-379-6494, FAX: 415-967-1590; FSC No.: 15818; Empl.: 200

Local Sales Offices & Reps

CA Agoura, Northern Tech. Sls. 818-991-0091
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Local Distributors

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TELEDYNE SOLID STATE

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TELEDYNE SOLID STATE, A Div. of Teledyne Relays, 12525 Daphne Ave., Hawthorne, CA 90250, Tel: 213-777-0077, TWX: 910-321-4610; FSC No.: 63745; *Sls. Mgr.:* Tom Garland ..... **B•1602-1608**

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GA Doraville, Advanced Comps. Mktg. 404-448-7025
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Can Vancouver, Deskin Sls. 604-324-8343

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AL Huntsville, Pioneer Elctrns. 205-837-9300
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AZ Phoenix, Wyle 602-249-2232
AZ Tempe, Time Elctrns. 602-967-2000
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TELEMECANIQUE, INC., Allied Control, 100 Relay Rd., Plantsville, CT 06479, Tel: 203-621-6771; FSC No.: 5945; Empl.: 1200; *Sls. Mgr.:* Mark Freyermuth

TELEMET, Geotel, Inc., 25 Davids Dr., Hauppauge, NY 11788, Tel: 516-436-7260, TWX: 510-227-9850, FAX: 516-231-7075; Empl.: 35

TELEPACIFIC ELECTRONICS CO., INC., 772 N. Twin Oaks Valley Road, San Marcos, CA 92069, Tel: 619-744-4415, ESYLNK: 888065; Empl.: 25; *Sls. Mgr.:* Vernon P. Cooke

TELEPHONICS CORPORATION/PRD INSTRUMENTS, 770 Park Avenue, Huntington, NY 11743, Tel: 516-549-6415/6102, TWX: 510-222-4494; FSC No.: 78711, 9N770; Empl.: 45; *Sls. Mgr.:* Jeff Price

TELESIS CONTROLS CORP., Box 5000, Chillocothe, OH 45601, Tel: 614-642-5000, TELEX: 24-5451, FAX: 614-642-2037; Empl.: 61; *Sls. Mgr.:* Chuck Bennett

TELE-TECH CORPORATION, P.O. Box 790, Bozeman, MT 59715, Tel: 406-586-0291, ESYLNK: 313-166, FAX: 406-587-0653; FSC No.: 62759; Empl.: 40; *Sls. Mgr.:* Charles Curtis

TELETERMINAL CORP., Greenland, NH 03840, Tel: 603-431-1200; Empl.: 13

TELEVISION EQUIPMENT ASSOCS., Box 393, So. Salem, NY 10590-0393, Tel: 914-763-8893, TELEX: 493 0698; Empl.: 10

TELKOOR ELECTRONICS INDUSTRIES, LTD., 510 Broadhollow Rd., Ste. 307, Melville, NY 11747, Tel: 516-752-0982, TELEX: 961762, FAX: 516-420-1355; FSC No.: S 5417; Empl.: 400; *Sls. Mgr.:* Arik Dotan; *Dist. Mgr.:* Arik Dotan

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TEL LABS, INC., Sfernice, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053, Tel: 603-625-8994, TWX: 710-220-1844, ESYLNK: 332592; FSC No.: 94322;Multiple; Empl.: 100; *Sls. Mgr.:* Robert D. Brown ..... **A•1848, 2030**

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CA Chatsworth, Raltech 818-700-0933
CA Del Mar, Chapman & Chapman 619-755-0412
CA Santa Clara, I-Squared, Inc. 408-988-3400
CO Denver, West, Inc. 303-477-8180
CT Bloomfield, F.S.I. 203-243-3122

FL St. Petersburg, J.C.J. Assocs. 813-343-2679
IL Downers Grove, Richmar Elec. Corp. 312-968-0118
IN Ft. Wayne, Denton Mktg. 219-486-0665
IA Hiawatha, Ard Sls. 319-393-6392
MA Lowell, F.S.I. 617-459-7399
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OH Wooster, T.P.S. & Assocs. 216-264-0971
PA Wynnewood, Metz-Benham Assocs., Inc. 215-896-7300
TX Richardson, Pro-Comp Sls. Co. 214-669-1500
WA Bellevue, Olson Ferree & Assocs. 206-883-7792
WI Butler, Richmar Elec. Corp. 414-781-1730
Can Mississauga, Ont., Source Elctrns., Inc. 416-676-0830

TELMOS, INC., Universal Semiconductor, Inc., 1925 Zanker Rd., San Jose, CA 95112, Tel: 408-436-1906, TWX: 910-338-7617, FAX: 408-436-1125; Empl.: 65; *Sls. Mgr.:* Stephen Pass; *Dist. Mgr.:* Stephen Pass

TELONIC/BERKELEY, Berkeley Inds. Inc., P.O. Box 277, Laguna Beach, CA 92652, Tel: 714-494-9401, FAX: 714-497-7331; FSC No.: 04423; Empl.: 50; *Sls. Mgr.:* Christopher Chrissie

TELPAR, INC., 4137 Billy Mitchell Rd., Box 796, Addison, TX 75001, Tel: 214-233-6631, TELEX: 73-2561, FAX: 214-233-8947; Empl.: 28; *Sls. Mgr.:* Wm. Konrad ... **D•1107**

TEL TEC, INC., 7890 12th Ave. S., Minneapolis, MN 55425, Tel: 612-854-9177, TELEX: 42-301; FSC No.: 57856; Empl.: 5; *Sls. Mgr.:* Dick Lewis; *Dist. Mgr.:* Dick Lewis

TELTONE, 10801-120 Ave. NE, Kirkland, WA 98033, Tel: 206-827-9626, TWX: 910-449-2862; Empl.: 450; *Sls. Mgr.:* D. E. Johnson; *Dist. Mgr.:* Mike Arndt

TELTRON, INC., 2 Riga Lane, Birdsboro, PA 19508, Tel: 215-582-2711, TELEX: 4990805, FAX: 215-582-0851; FSC No.: 28287; Empl.: 20

TEMESCAL/EDWARDS HIGH VACUUM INTL., The BOC Group, Inc., 2850 Seventh St, Berkeley, CA 94710, Tel: 415-841-5720, TWX: 910-366-7366; Empl.: 200

TEMP-FLEX CABLE, INC., 11 Depot Street, S. Grafton, MA 01560, Tel: 617-839-5987, FAX: 617-839-4128; Empl.: 12; *Sls. Mgr.:* P. Raymond Baril

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TEMPO INSTRUMENT, INC., 87 Modular Ave., Commack, NY 11725, Tel: 516-864-3700, TWX: 510-226-3787; FSC No.: 07031; Empl.: 205

TEMPOSONICS, MTS Sys. Corp., 111 East Ames Ct, Plainview, NY 11803, Tel: 516-349-1950, TWX: 510-226-3787; *Sls. Mgr.:* Rudy Leeds

TEMPTRONIC CORPORATION, 55 Chapel St., Newton, MA 02158, Tel: 617-969-2501, TELEX: 200-119 TEMP UR; Empl.: 100; *Sls. Mgr.:* Peter Johnson

TENNELEC, 601 Oak Ridge Tpke., Oak Ridge, TN 37830, Tel: 615-483-8405, TWX: 810-572-1018, FAX: 615-483-5891; Empl.: 96

TNJ Tenney ENGINEERING, INC.

FAX: 201-686-7971

TENNEY ENGINEERING, 109 Springfield Rd., Union, NJ 07083, Tel: 201-686-7870, TWX: 710-985-4725; Empl.: 204 ..... **D•1189**

Local Sales Offices & Reps
CA Chatsworth, Environment Assocs. 818-709-1230
CA Santa Clara, Tenney Engrg., Inc. 408-478-0388
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FL Winter Springs, Equip. Sls. 305-699-4053
IL Des Plaines, Tenney Engrg., Inc. 312-699-3190
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MI Warren, Dietrich & Assoc. 313-751-4990
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NJ Union, Tenney Engrg., Inc. 201-686-7870
NY Fayetteville, M. P. Andrews 315-637-3144
OH Cincinnati, Dietrich & Assoc. 513-984-8924,
OH Independence, Dietrich & Assocs. 216-642-7965,
PA Pittsburgh, Dietrich & Assoc. 412-892-2992
TX Garland, Carey, McMahill & Zerbe Co. 214-681-1414

TENOR COMPANY, 17020 W. Rogers Dr., New Berlin, WI 53151, Tel: 414-782-3800, FAX: 414-782-0005; Empl.: 30; *Sls. Mgr.:* P. Yoblin; *Dist. Mgr.:* P. Yoblin

TENSOLITE COMPANY, Subsidiary of Carlisle Corp., Old Post Rd., Rte. 9A, Buchanan, NY 10511, Tel: 914-737-5600, TWX: 710-573-2341; Empl.: 210; *Sls. Mgr.:* William Dungan; *Dist. Mgr.:* Jack Swindle

TENSOR, Box 14843, Austin, TX 78761, Tel: 512-251-4131, TELEX: ITT 4940124; Empl.: 20

TEN-TEC, INC., Industrial Park, Sevierville, TN 37862, Tel: 615-453-7172, TELEX: 261337 ACTAUR; Empl.: 110; *Sls. Mgr.:* Joe Redwine

TEPRO OF FLORIDA, 2608 Enterprise Rd., Clearwater, FL 33575, Tel: 813-796-1044; FSC No.: 15915; Empl.: 97; *Sls. Mgr.:* Roger C. Mayo; *Dist. Mgr.:* Beverly Mayer

TERADO, 1068 Raymond Ave., St. Paul, MN 55108, Tel: 612-646-2868; Empl.: 12; *Sls. Mgr.:* Don Munson; *Dist. Mgr.:* Fred Munson

TERADYNE CONNECTION SYS., 44 Simon St., Nashua, NH 03060, Tel: 603-889-5156, TWX: 710-228-1431; FSC No.: 31413; Empl.: 1,100; *Sls. Mgr.:* D. Murphy

TERMINAL DATA CORP., 15733 Crabbs Branch Way, Rockville, MD 20855, Tel: 301-921-8282; Empl.: 18

TERMINAL SYS., See A & B Technical Services

TERRA TECHNLG. CORP., 3860 148th Ave. N.E., Redmond, WA 98052, Tel: 206-883-7300, TELEX: 15-2070, FAX: 206-882-1412; *Sls. Mgr.:* Greg Hoyle, Sls. Mgr.

TEST & MEASUREMENT SYSTEMS, INC., 2934 Corvin Drive, Santa Clara, CA 95051, Tel: 408-720-8877, TELEX: 297584 TEAM UR, FAX: 408-720-9643; *Sls. Mgr.:* Bo Bjarno

TEST PROBES, INC., 9178 Brown Deer Rd., San Diego, CA 92121, Tel: 619-459-4197, TELEX: 188946; FSC No.: FK95-3136706; *Sls. Mgr.:* Hal Wardein; *Dist. Mgr.:* Hal Wardein

TESTRONICS, 1601-100 N. Glenville Dr., Richardson, TX 75081, Tel: 214-238-8378, FAX: 214-680-2061; FSC No.: 62236; Empl.: 30

TETRA-ETCH
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FAX: 602-527-0584

TETRA-ETCH, W. L. Gore & Associates, Inc., 1505 North Fourth St, P.O. Box 1389, Flagstaff, AZ 86002, Tel: 602-526-1290

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FAX: 215-539-8005

TETTEX INSTRUMENTS, INC., P.O. Box 281, Fairview Village, PA 19409-0281, Tel: 215-539-6050, TELEX: 753-899 TETTEX; Empl.: 100; *Sls. Mgr.:* George A. Przybys ..... **D•1326-1328**

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MA Burlington, Tri-Com Assocs. 617-272-8163
MA Framingham, Gallagher Assocs., Inc. .. 617-626-2346
MI Grand Rapids, Miltimore Sls. 616-942-9721
MI Grand Rapids, Miltimore Sls., Inc. 616-942-9721
MI Novi, Miltimore Sls. 313-349-0260
MI Novi, Miltimore Sls., Inc. 313-349-0260
MN Minneapolis, Northstar Comps. 612-553-1888
MN Minneapolis, Northstar Comps., Inc. ... 612-553-1888
NJ Medford, Delaware Valley Elctrns. 609-654-6028
NY Endwell, Reagan/Compar Albany, Inc. 607-754-2171
NY Islandia, Schmitt Indl. Mktg. Corp. 516-582-5888
NY Rochester/Buffalo, Reagan/Compar 716-271-2230
NY Syracuse, Reagan/Compar 315-732-3775
OK Tulsa, B & R Elctrns. 918-865-7666
OR Portland, Harry Levinson Co. 503-245-1902
TX Houston, B & R Elctrns. 713-682-5448
TX Plano, B & R Elctrns. 214-985-0028
WA Seattle, Harry Levinson Co. 206-382-1300
Can Islington, Ont., Pipe Thompson Ltd. ... 416-236-2355
Can Montreal, Que., Versatech Electronique, Inc. 514-481-0196

Local Distributors

CA Van Nuys, EW Elctrns. 818-782-9020
FL Ft. Lauderdale, Reptron Elctrns., Inc. .. 305-735-1112
FL Tampa, Reptron Elctrns., Inc. 813-855-4656
GA Norcross, Reptron Elctrns., Inc. 404-446-1300
IL Schaumburg, QPS Elctrns., Inc. 312-884-6620
IL Schaumburg, Reptron Elctrns., Inc. 312-882-1700
IN Indianapolis, MAR Elctrns. 317-633-6699
MI Livonia, Reptron Elctrns., Inc. 313-525-2700
MN Minneapolis, K & H Elctrns. Distbg. Corp. 612-553-1312,800-328-8515
MN Minneapolis, K & H Elctrns. Distr. Co. 612-553-1312
MN Minnetonka, Reptron Elctrns. 612-938-0000
MN Minnetonka, Reptron Elctrns., Inc 612-938-0000
NJ Kenilworth, Ventronics, Inc. 201-272-9262
NJ Whippany, ADI-American Dists., Inc. ... 201-428-0510
NY Buffalo, Summit Dists. 716-887-2800
NY Hempstead, Davis Elctrns. 516-483-9200
OH Worthington, Reptron Elctrns., Inc. 614-436-6675
TX Austin, Southwest Elctrns., Inc. 512-837-8971
TX Dallas, Off the Shelf Comps. 214-247-0052, 800-231-8057
TX Dallas, Southwest Elctrns., Inc. 214-234-3050
TX Ft. Worth, C & W Elctrn. Supp. Co. 817-831-0395
TX Richardson, Comp. Technlg. Corp. 214-437-2211
TX Richardson, Off the Shelf Comps. 214-238-0808, 800-648-5387
TX Stafford, Southwest Elctrns., Inc. 713-240-4000
WI Mequon, Lake-View Elctrns. Corp. 414-377-5590

TODD PRODUCTS CORP.

FAX: 516-231-3473

TODD PRODUCTS CORP., 50 Emjay Blvd., Brentwood, NY 11717, Tel: 516-231-3366, TWX: 510-227-4905; Empl.: 250 ..... **D•1995-2022**

Local Sales Offices & Reps

AL	Huntsville, R. W. Mitscher Co.	205-882-6050
AZ	Scottsdale, Thorson Desert States	602-998-2444
CA	Calabasas, QuadRep Southern	818-887-3711
CA	Irvine, QuadRep Southern	714-261-8141
CA	San Diego, QuadRep Southern	619-560-8330
CA	San Jose, Quantum Coefficient Sys.	408-942-1070
CO	Englewood, Thorson Rocky Mtn. Inc.	303-799-3435
FL	Boca Raton, R.W. Mitscher Co.	305-368-3841
FL	Largo, R. W. Mitscher Co.	813-581-1588
FL	Sanford, R.W. Mitscher Co.	305-322-7141
GA	Lawrenceville, R. W. Mitscher Co.	404-923-3239
IL	Arlington Heights, Coombs Assocs.	312-439-9810
IN	Indinapolis, JFCO	317-576-9363
MD	Glen Burnie, Third Wave Solutions Inc.	301-787-0222
MA	Hingham, Northeast Reps.	617-749-8700
MI	Grand Rapids, JFCO	616-949-1020
MI	Lake Orion, JFCO	313-693-2053
MN	Minneapolis, R. K. Sales Assocs.	612-571-1001
NH	Nashua, Northeast Reps.	603-880-8199
NJ	Princeton, Murtronic Assocs.	609-394-3737
NM	Albuquerque, Thorsen Desert States, Inc.	505-293-8555
NC	Charlotte, R. W. Mitscher Co.	704-366-9131
NY	Melville, Comtronic Assocs.	516-249-0505
NY	Syracuse, T-Squared Elctrns. Co.	315-463-8592
NY	Victor, T-Squared Elctrns. Co.	716-924-9101
NC	Raleigh, R. W. Mitscher Co.	919-848-0941
OH	Cleveland, JFCO	216-398-6300
OH	Dayton, JFCO	513-890-8322
OH	Gahanna, JFCO	614-476-3310
PA	Pittsburgh, JFCO	412-823-5400
TN	Johnson City, R. W. Mitscher Co.	615-929-7258
TX	Houston, AID Elctrns. Inc.	713-955-6204
TX	Irving, AID Elctrs. Inc.	214-790-4761
UT	Salt Lake City, Thorson Rocky Mtn. Inc.	801-973-7969
WI	Milwaukee, Coombs Assocs.	414-351-6123
Can	Surrey, BC, Enerlec Sls. Ltd.	604-888-1667

TODD SYSTEMS, INC., 50 Ash St., Yonkers, NY 10701, Tel: 914-963-3400, FAX: 914-963-3506; Empl.: 45; *Sls. Mgr.:* S. Edwards ..... **A•2408-2411**

Local Distributors

AL	Mobile, Kretzer's Inc.	205-438-5611
CA	San Francisco, Aris Corp.	415-550-8605
CA	San Francisco, Delray Distr.	415-777-4405
CT	Norwalk, Park Distr.	203-853-2010
FL	Miami, Gay Mar, Inc.	305-371-0765
FL	Miami Bch., B. Frank Inc.	305-861-8227
GA	Macon, Giga Corp.	912-745-2897
IL	Skokie, Sargent Welch Inc.	312-677-0600
LA	New Orleans, Bailey Distr.	504-943-2461
MD	Bethesda, Albee Sls.	301-897-8088
MA	Revere, Sozio's	617-547-6900
NJ	Newark, Cotrapex, Inc.	201-589-1416
NJ	Newark, Pinto Trading	201-344-7748
NY	Long Island City, H. L. Dalis, Inc.	212-361-1100
NY	New York, Gelb Sls.	212-475-7940
NY	New York, Rosetta Elec.	212-233-9088
OH	Dayton, K. Elctrns.	513-426-1877
PA	Philadelphia, H & Z Sls.	215-912-2500
TX	Houston, Cross & Co.	713-673-3100
TX	Houston, Western Sls.	713-869-6671
VA	Bailey's Crossroads, Arya Corp.	703-845-0800
WA	Seattle, ForeigN Elctrns.	206-682-2761
WA	Seattle, Pearl Elctrns.	206-622-6200
EXP	NY, New York, Able Intl., Ltd.	212-696-5300

TOKIN AMERICA, INC., 155 Nicholson Ln., 95134, CA 95131, Tel: 408-432-8020, FAX: 408-434-0375; Empl.: 10; *Sls. Mgr.:* Anthony R. Costarella; *Dist. Mgr.:* S. Numata ..... **A•1295, 1329, 1700; B•1926; D•1108**

Local Sales Offices & Reps

AZ	Scottsdale, Mactronix	602-998-1848
CA	Mission Viejo, Angel Assocs.	714-582-8858
CA	Mountain View, Griffith, Nuniey & Hobbs, Inc.	415-961-6740
CA	San Diego, Angel Assocs.	619-581-2211
CA	San Jose, Tokin America, Inc.	408-946-4887
CA	Spring Valley, Griffith, Nuniey & Hobbs, Inc.	209-772-2696
CO	Broomfield, Mactronix	303-469-4350
MN	Minnetonka, JPM & Assoc.	612-593-5460
NJ	Monmouth Junction, S.E.A. Co.	201-329-3636
TX	Austin, Coulomb Elec.	512-258-3002
TX	Dallas, Coulomb Elec.	214-406-1117
TX	El Paso, El Paso Elctrns.	910-855-3900
TX	Houston, Coulomb Elctrns.	713-820-3210
WA	Seattle, LD Elctrns.	206-364-0200
Can	Ontario, Har-Tech Elec.	416-665-7773

TOKO AMERICA, INC., 1250 Feehanville Dr., Mt. Prospect, IL 60056, Tel: 312-297-0070, FAX: 312-699-7864; Empl.: 75; *Sls. Mgr.:* Jim Onodera; *Dist. Mgr.:* John Manders ..... **A•1296-1297, 1629, 1701; D•2023**

Local Sales Offices & Reps

AL	Huntsville, Toko America, Inc.	205-830-0952
CA	Campbell, Kottmeier Assocs.	408-371-8700
CA	Cupertino, Toko America, Inc.	408-996-7575
CA	Irvine, Mission Ridge Mktg.	714-253-4626
CA	San Diego, Varigon-San Diego	619-576-0100
CT	Danbury, Toko America, Inc.	203-748-6871
IL	Mt. Prospect, Toko America, Inc.	312-297-0070
MA	Needham Hgts., The Newscott Co., Inc.	617-444-1923
MA	Newton, Elctrn. Comp. Mktg.	615-828-4243
TN	Rutledge, E.C.M.	615-828-5741

Local Distributors

CA	Orange, Inductor Supp.	714-978-2277
MA	Plainville, J & W Elctrns.	800-227-8529
MN	Thief River Falls, Digi-Key Corp.	800-344-4539

TOKYO ELEC. CO., LTD., 1-1 Nishiki-Cho, Kanda, Chiyoda-Ku, Tokyo, 101, Japan, Tel: (03) 292-1011, TELEX: 0222-3575, TWX: S

TOPAZ®

FAX: 619-569-8427

TOPAZ, INC., 9192 Topaz Way, San Diego, CA 92123-1165, Tel: 619-279-0831, TWX: 910-335-1556; FSC No.: 06049; Empl.: 350; *Sls. Mgr.:* Dan Mathews, Dir. of Sls.; *Dist. Mgr.:* Dan Mathews, Dir. of Sls. ..... **D•2156-2157**

Local Sales Offices & Reps

AL	Birmingham, Sesco	205-988-8304
CA	San Diego, Power West, Inc.	619-299-7007
CA	Torrance, Power West, Inc.	213-328-9411
LA	Baton Rouge, Sesco	504-928-4951
PA	Valley Forge, J. E. Cuesta & Co.	215-935-0400
TX	Austin, Sesco	512-892-2490
WA	Bellevue, Underwood-Hanify Assocs.	206-643-1793

Please refer to Topaz' sales representatives for distributor information.

TOPFLIGHT, 160 East 9th Ave., York, PA 17404, Tel: 717-843-9901, 800-233-9386, TWX: 510-657-4849; Empl.: 250; *Sls. Mgr.:* Bill Ciabattoni

TOPWARD INSTRUMENTS, Div. of Hauman, Inc., 2031 Ringwood Avenue, San Jose, CA 95131, Tel: 408-434-0888, TWX: 510-101-2820, FAX: 408-434-9832; Empl.: 100ò; *Dist. Mgr.:* Thomas C. Trieu

TORAD COIL CO., INC., 283 Linden Rd., Wayne, NJ 07470, Tel: 201-835-6195; *Sls. Mgr.:* Dan Gupta

TORELCO, INC., 14 Paine Ave., P. O. Box 560, Irvington, NJ 07111, Tel: 201-374-8641; Empl.: 20; *Sls. Mgr.:* Stewart H. Cook

TOREMA U.S.A., INC., 6699 Portwest Dr., No. 130, Houston, TX 77024, Tel: 713-861-6643, FAX: 713-861-7344; FSC No.: QB2R8; Empl.: 5; *Sls. Mgr.:* David P. Snelling

Toroid®
SUPERIOR TRANSFORMERS

FAX: 301-464-4657

TOROID CORP. OF MARYLAND, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, Tel: 301-464-2100, TWX: 710-826-0414; *Sls. Mgr.:* Lennart Elmlund ..... **A•1298, 2412-2416**

Local Sales Offices & Reps

CA	San Jose, Texel North	408-272-6836
CA	Seal Beach, Texel	213-596-9411
IL	Wheeling, Ed Joyner & Co.	312-520-1200
MA	Southboro, Sullivan Tech. Sls.	617-485-2215
PA	Huntingdon Valley, Ed Leiby & Assocs.	215-659-8938
VA	Alexandria, Ed Leiby & Assocs.	703-360-9039

TOROTEL PRODUCTS INC.

FAX: 816-763-2278

TOROTEL PRODS. INC., 13402 S. 71 Hwy., Grandview, MO 64030-3199, Tel: 816-761-6314; Empl.: 250; *Sls. Mgr.:* H. Foland ..... **A•1300-1315, 2418-2423**

Local Sales Offices & Reps

AZ	Tempe, Gassner & Clark Co.	602-968-9037
CA	Redwood City, Hickey Ind. Sls.	415-368-3849
CA	Santa Ana, California Elctrn. Mktg.	714-835-2702
FL	Orlando, Perrott Assocs.	305-298-7748
IA	Hiawatha, Gassner & Clark Co.	319-393-5763
MD	Towson, Dickison Sls. Co.	301-823-0923
MA	Weston, John Goode Assocs.	617-235-3900
MO	St. Louis, Abrams & Assocs.	314-569-0447
NY	New Hyde Park, R. P. Luce & Co., Inc.	516-437-4550
NY	Syracuse, Rep, Tech, Inc.	315-437-2845
NC	Raleigh, L & D, Inc.	919-876-5301
OH	New Lebanon, J. N. Bailey & Assocs.	513-687-1325
CO	Boulder, Stratford Grp.	303-530-3194

TOROTRON CORP., 519 South Fifth Ave., Mt. Vernon, NY 10550, Tel: 914-664-2050; Empl.: 14; *Sls. Mgr.:* Miriam Zanger ..... **D•1331**

TORQ CORP., 32 W. Monroe St., Bedford, OH 44146, Tel: 216-232-4100, FAX: 216-232-4104; Empl.: 50; *Sls. Mgr.:* Lee Seabeck

TORWICO ELECTRONICS INC

FAX: 201-363-6234

TORWICO ELCTRNS. INC., 410 Oberlin Ave. South, Lakewood, NJ 08701, Tel: 201-364-1800, TWX: 710-723-8343; Empl.: 200 ..... **A•2424-2425**

Local Sales Offices & Reps

CA	Burlingame, Long and Assocs.	415-342-6544
CA	El Cajon, KCE Corp.	619-588-1198
FL	Orlando, Gra-Mar	305-658-1971
IN	Noblesville, Patco & Assocs.	317-877-5986
IA	Blue Grass, Ensco Rep	319-381-1466
IA	Marion, Ensco Rep	319-377-8551
KS	Countryside, Ensco rep	913-384-0840
KS	Wichita, Ensco Rep	316-683-1070
MD	Riderwood, W. S. Warrington & Assoc.	301-823-8759
MA	Hingham, N.E. Reps.	617-749-8700
MO	Maryland Heights, Ensco Rep	314-423-3935
NJ	Marlton, BGR Assocs.	609-983-1020
NY	Albany, Lynn Assocs.	518-459-1239
NY	Buffalo, Lynn Assocs.	716-631-0054
NY	Great Neck, Trionic	516-466-2300
OH	Akron, Eljay Assoc.	216-666-3774
OR	Portland, Abacus Sls.	503-777-8111
PA	Pittsburgh, Lynn Assocs.	412-935-1466
TX	Irving, Kite Elctrns. Sls. Co.	214-986-0321

TOTAL POWER INTERNATIONAL, INC., 418 Bridge St., Lowell, MA 01850, Tel: 617-453-7272, ESYLNK: 948617, FAX: 617-453-7395; Empl.: 15 ... **D•2024-2026**

Local Sales Offices & Reps

AZ	Tempe, Piper Sls.	602-949-0048
CA	San Diego, Agave	619-488-1920
CA	San Jose, Bytec Sls., Inc.	408-435-8004
CO	Longmont, Piper Sls.	303-433-5337
CT	Avon, Power Mark, Inc.	203-678-0123
FL	Orlando, Gra-Mar	305-656-1971
GA	Lilburn, The Phillip Matthews Corp.	404-381-1662
IL	Schaumburg, Delta Tech. Sls.	312-310-0280
MD	Ellicott City, Techlg. Sls. Assocs.	301-461-7802

MA Framingham, JDS Reps. 617-872-5876
MI Brighton, A.P. Assocs. 313-229-6550
MN Minneapolis, Tecteam Sls. 612-854-6616
NJ Mtn. Lakes, Comps. for Elctrns. 201-334-2921
NJ Pine Hill, Delta Mktg., Inc. 609-784-7718
NM Albuquerque, Piper Sls. 505-828-1300
NY Albany, Lynn Assocs., Inc. 518-459-1239
NY Buffalo, Lynn Assocs., Inc. 716-631-0054
NC King, The Phillip Matthews Corp. 919-983-9790
OH Columbus, Scientific Sys. 614-861-0129
OR Beaverton, Blair Hirsh Co., Inc. 503-641-1875
PA Hatboro, Delta Mktg., Inc. 215-675-0343
PA Penndel, Delta Mktg., Inc. 215-750-1440
PA Wexford, Lynn Assocs. 412-935-1466
TX Dallas, Rem-Air Comp Corp. 214-234-1069
TX Houston, Rem-Air Comps. Corp. 713-729-1670
UT Salt Lake City, Piper Sls. 801-466-9336
WA Lynnwood, Blair Hirsh Co., Inc. 206-774-8151
WI Brookfield, Delta Tech. Sls. 414-781-4775
WI Mequon, Delta Tech. Sls. 414-241-9243

Local Distributors
FL Orlando, GMI Dists. 305-658-1082

TOWER ELECTRONICS, INC., 281 S. Commerce Circle, Fridley, MN 55432, Tel: 612-571-3737; *Sls. Mgr.:* Blase Des Marais

TOYO COMM. EQUIP. CO., LTD., 20-4, Nishi-Shimbashi, 3-Chome Minato-Ku, Tokyo, Japan 105, Tel: 03-459-7320/03-459-7310, TELEX: 02423115 Toyocoj.; FSC No.: 03-436-1434; Empl.: 1800; *Sls. Mgr.:* T. Nagai/S. Nakagome

TRACEWELL ENCLOSURES, INC., 567 Enterprise Dr., Columbus, OH 43081, Tel: 614-846-6175, 800-848-4525, FAX: 614-846-4450; Empl.: 30 ..... **C•1111-1113**

TRACK EQUIPMENT, Div. of Entec Corp., 32 Daniel Webster Hwy., Merrimack, NH 03054, Tel: 603-882-7743; Empl.: 12; *Sls. Mgr.:* Barry D. Moskowitz

TRA-CON, INC., 55 North St., Medford, MA 02155, Tel: 617-391-5550; Empl.: 55; *Sls. Mgr.:* Dan Romanow

TRACOR FLIGHT SYSTEMS, INC., Tracor, Inc., A Westmark Co., 1241 E. Dyer Rd., Santa Ana, CA 92705, Tel: 714-662-0333, TWX: 510-601-1467 FSI HDQT; FSC No.: 6B468; Empl.: 550; *Sls. Mgr.:* A. Mallamo/W. Weiss

TRACOR INSTRUMENTS, 6500 Tracor La., Bldg. 27, Austin, TX 78725, Tel: 512-929-2051, TWX: 910-874-1366, FAX: 512-929-2747; Empl.: 9100; *Sls. Mgr.:* William R. Murphy; *Dist. Mgr.:* Will Hoover

TRACOR PAKTRONICS, Westronics, Inc., 2441 Northeast Pkwy., Ft. Worth, TX 76106, Tel: 817-625-2311, 800-433-2880, TELEX: 629 00631, FAX: 817-625-1068; Empl.: 30; *Sls. Mgr.:* W. C. Preston

FAX: 813-886-2794

TRAK MICROWAVE CORP., 4726 Eisenhower Blvd., Dept. E-8, Tampa, FL 33634, Tel: 813-884-1411, TELEX: 52-827, TWX: 810-876-9140; FSC No.: 12855; *Sls. Mgr.:* Toby Gant ..... **A•1839-1843**

Local Sales Offices & Reps
AZ Mesa, Fetty/Schoenduve 602-241-9009
CA El Segundo, Fetty/Schoenduve 213-322-4991
CA Mountain View, Disman Bakner 415-969-3010
CA San Diego, Fetty/Schoenduve 619-292-5136
CO Parker, Howard Assocs. 303-841-5755
GA Lawrenceville, M. Lader Co. 404-985-8057
IN Ft. Wayne, TX Sls. Indiana 219-489-4447
IA Cedar Rapids, J.R. Sls. Engrg. 319-393-2232
MD Columbia, M. Lader Co. 301-381-1550
MD Conowingo, M. Lader Co. 301-378-3449
MA Andover, Bee Assoc. 617-975-1229
NY Liverpool, R&D Assocs. 315-457-0100
NY New Rochelle, Ascor Elctrns. 914-235-8838
NC Raleigh, M. Lader Co. 919-848-3253
PA Lafayette Hill, M. Lader Co. 215-825-3177
TX Austin, Thorson Co. 512-345-1985
TX Dallas, Thorson Co. 214-233-5744
TX Houston, Thorson Co. 713-558-8205
UT Salt Lake City, Effective Sls. 801-266-9617
WA Seattle, Datacom Assocs. 206-285-2525
Can Nepean, Ont., Norgay Entprs. 613-723-1858
Can Toronto, Ont., Norgay Entprs. 416-259-9663
Can Westmount, Que., Norgay Entprs. 514-932-3233

Local Distributors
CA Mtn. View, Comstock Distrs., Inc. 415-969-3711
IL Des Plaines, Compucon Distr., Inc. 312-827-9444
MA Reading, Compucon Distr., Inc. 617-944-6875
NY Ronkonkoma, Compucon Distr., Inc. 516-499-1211
PA Lafayette Hill, MLC Distrs., Ltd. 215-825-3177

TRAK MICROWAVE LTD., TRAK Microwave Corp., 3/4 Lindsay Court, Dundee Technlg. Pk., Dundee, Scotland DD2 1TY, Tel: 44-382-561509, TELEX: 76266, FAX: 44-382-562643; Empl.: 30

TRAK SYSTEMS, Div. TRAK Microwave Corp., 4722 Eisenhower Blvd., Dept. E-8, Tampa, FL 33634-6391, Tel: 813-884-1411, TELEX: 52-827, TWX: 810-876-9140, FAX: 813-886-2794; FSC No.: 11165; *Sls. Mgr.:* Thomas L. Roberts ..... **D•1179-1183**

Local Sales Offices & Reps
AL Huntsville, Magaro & Assocs. 205-882-0827
AZ Phoenix, J. Smith Assocs. 602-267-0981
CA Mtn. View, Tech Mktg. Assocs. Inc. 415-968-0102
CA San Diego, L. L. Stoakes, Inc. 619-452-1600
CO Parker, Howard Assocs. 303-841-5755
FL Sarasota, Bass Assocs. 813-922-9538
GA Atlanta, Magaro & Assocs. 404-451-8862
IN Ft. Wayne, TX Sls. Indiana 219-489-4447
MD Annapolis, Blackwood Assocs. 301-268-3669
MA Wayland, High-Tech Sls., Inc. 617-653-3838
NM Albuquerque, J. Smith Assocs. 505-345-6501
NC Raleigh, M. Lader Co. 919-848-3253
PA Huntingdon Valley, Rabal Assocs. 215-947-4825
TX Arlington, J. T. Houston Assocs. 817-265-2931
WA Bellevue, Tasco, Inc. 206-453-1414
Can Nepean, Ont., Norgay Entprs. 613-723-1858
Can Toronto, Ont., Norgay Entprs. 416-259-9663
Can Westmount, Que., Norgay Entrps. 514-932-3233

TRANCOR, 108 N. High St., P.O. Box 907, San Saba, TX 76877, Tel: 915-372-6127; Empl.: 6; *Sls. Mgr.:* William F. Mayfield

TRANSAMERICA DELAVAL, INC., See IMO Delaval, Inc., CEC Instruments Div.

TRANSAMERICA DELAVAL, See IMO Delaval, Inc., Gems Sensors Div.

TRANS AMERICAN TRANSFORMER, 142 Peconic Ave., Medford, NY 11763, Tel: 516-654-1880, FAX: 516-654-1936; FSC No.: 61619; Empl.: 30 ..... **A•2426**

TRANSCO PRODUCTS, INC., 1001 Flynn Rd., Camarillo, CA 93011-6003, Tel: 805-987-8007, TELEX: 857579, FAX: 805-484-0830; FSC No.: 82152; Empl.: 400; *Sls. Mgr.:* Jerry Fricke, Dir. of Mktg.

TRANSDUCERS & SYSTEMS

FAX: 203-481-8937

TRANSDUCERS AND SYSTEMS, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092; Empl.: 60; *Sls. Mgr.:* J. L. Jamieson ..... **B•1927**

Local Sales Offices & Reps
CA Huntington Beach, Transducer Sys. ... 714-969-7690
CA Mountain View, Gado Instr. Sls. 415-961-2222
CA Westminster, Transducer Sys. 714-969-7690
IL Des Plaines, Marsland Assocs. 312-298-2620
IN Indianapolis, Marsland Assocs., Inc. ... 317-293-5437
IA Cedar Rapids, Marsland Assocs. 319-365-1908
MI Mt. Clemens, O'Hara Assocs. 313-791-7140
MN Minneapolis, Marsland Assocs. 612-545-4481
MO St. Louis, Marsland Assocs. 314-991-1399
NJ Cherrry Hill, Markey Instrmn. 609-667-3809
NJ Hillsdale, CB Assocs., Inc. 201-644-6230
NY Rochester, TAE-REP 716-586-8710
NY Schenectady, TAE-REP, Inc. 607-692-3705
NY Whitney Point, TAE-REP, Inc. 607-692-3705
OH Dayton, RIXAN Assocs. 513-278-4216
OH Stow, Rixan Assocs., Inc. 216-686-2909
TX Houston, Electric Control Assocs. 713-771-5944
TX Lewisville, Electric Control Assocs. 214-221-3143
WI New Berlin, Marsland Assocs., Inc. 414-786-6611

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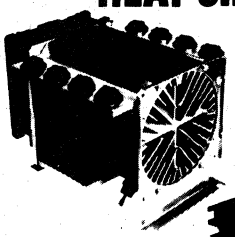

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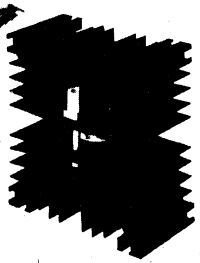

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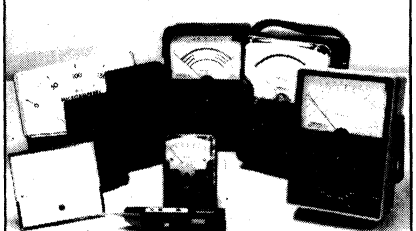

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CA Chatsworth, Raltech 818-700-0933
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CA Glendale, Mission Mktg. Grp. 818-247-9110
CA Santa Clara, I Squared Inc. 408-988-3400
CO Denver, West Inc. 303-477-8180
CT Bloomfield, F. S. I. 203-243-3122
FL St. Petersburg, J.C.J. Assocs. 813-343-2679
IL Downers Grove, Richmar Elctm. 312-968-0118
IN Ft. Wayne, Denton Mktg. 219-486-0665
IA Hiawatha, Ard Sls. 319-393-6392
MA Lowell, F. S. I. 617-459-7399
MI Jackson, T.P.S. & Assocs. 517-783-1722
MN Minneapolis, Dunlop Consits. 612-544-1070
MO St. Louis, S. W. Wollard Co. 314-576-1130
NJ Piscataway, R. P. Luce & Co. 201-752-8750
NY Chappaqua, Micrel, Inc. 914-238-4961
NY New Hyde Pk., R. P. Luce & Co. 516-437-4550
NY Rochester, Fritz Dasson 716-338-1699
OH Wooster, T.P.S. & Assocs. 216-264-0971
PA Wynnewood, Metz-Benham Assocs., Inc. 215-896-7300
TX Richardson, Pro Comp. Sls. Co. 214-669-1500
UT Salt Lake City, West, Inc. 801-292-8787
WA Bellevue, Olson Tech. Sls. Corp. 206-883-7792
WI Butler, Richmar Elctm. 414-781-1730
Can Manitoba/Winnipeg, Smith-Paterson & Assoc. 294-885-1376
Can Ont./Mississauga, Source Elctm. 416-675-6235

Local Distributors
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CA San Diego, Neumann Elec. 619-695-3005
CA San Jose, Zeus Comps. 408-998-5121
CA Westlake Vl., Distel, Inc. 805-495-9998
CO Denver, IEC Integrated Elctm. 303-843-2040
FL Oviedo, Zeus Comp. 305-365-3000
FL Tampa, Impala Elctrns. 813-885-4747
MD Columbia, Aztech Elctrns. 301-995-6800
MD Columbia, Zeus Comps. 301-997-1118
MA Burlington, TLC Elctrns. 617-273-0140
MA Lexington, Zeus Comps. 617-863-8800
NY Bohemia, Justin Elec. 516-589-4000
NY Hauppauge, Jaco, Inc. 516-273-5500
NY Melville, SAI, Inc. 516-293-2710
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OH Cincinnati, G & A Sls. 513-521-8800
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MA Boxford, Lanyi Equip. 617-887-8860

FAX: 415-573-7562

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CT Avon, Tom Maguire Assocs. 203-673-3019
CT Glastonbury, Tom Maguire Assocs. 203-659-1649
MA Norwood, Tom Maguire Assocs. 617-551-0500
MN Minneapolis, Electro-Serv Co. 612-338-3475
NY Clark Mills, KLM Garner 315-853-6126
NY Pittsford, KLM Garner 716-381-8350
NY Plainview, Robert Smith Assocs. 516-681-3155
OR Beaverton, Evergreen Mktg. Corp. 503-643-8020
PA Exton, Linear Sls. 215-524-8080
WA Richmond, Glassock Assocs. 804-740-0063
WA Seattle, Evergreen Mktg. Grp. 206-633-3160
Can Markham, Ont., Stetron Intl., Inc. 416-475-6202

UNGAR, Div. Eldon Inds., Inc., 100 W. Manville St., Compton, CA 90224-6005, Tel: 213-774-5950, TELEX: 4720750 Eldon; FSC No.: 78976; Empl.: 140; *Sls. Mgr.:* Richard Shivers

UNHOLTZ-DICKIE CORP., 6 Brookside Dr., Wallingford, CT 06492, Tel: 203-265-3929, TELEX: 643802, FAX: 203-265-2690; Empl.: 49

UNIBOX, Div. of Amerex, P.O. Box 2815, Riverside, CA 92516, Tel: 714-686-1400; *Sls. Mgr.:* Roger Orton ..... **C•1014**

UNICO, 3725 Nicholson Rd., Franksville, WI 53126-0505, Tel: 414-886-5678, TWX: 910-271-2385, FAX: 414-886-8396; Empl.: 250; *Sls. Mgr.:* Joseph Glover

FAX: 201-674-3803

UNICORP, 291 Cleveland St., Orange, NJ 07050, Tel: 201-674-1700; FSC No.: 04729; Empl.: 82; *Sls. Mgr.:* B. Levine ..... **C•1710-1711**

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UNIMAX SWITCH CORP., See C & K/Unimax, Inc.

UNIMEASURE, INC., 7055 N.W. Grandview Dr., Corvallis, OR 97330, Tel: 503-757-3158

UNION CARBIDE CORPORATION, Industrial Chemicals Div., Crystal Products Dept., 9320 Chesapeake Dr., Ste. 216, San Diego, CA 92123, Tel: 619-279-4500, TELEX: 695-465; Empl.: 125; *Sls. Mgr.:* J. J. Beeman

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CA El Toro, English/Damco Sls. 714-837-3801
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CO Westminster, Straube Assocs. Mountain States, Inc. 303-426-0890
FL Altamonte Springs, Semtronic Assocs., Inc. 305-831-8233
FL Clearwater, Semtronic Assocs., Inc. ... 813-461-4675
FL Ft. Lauderdale, Semtronic Assocs., Inc. 305-731-2484
GA Norcross, R. O. Whitesell 404-449-9190
IL Chicago, M. Gottlieb Assocs. 312-775-1151
IN Fort Wayne, R. O. Whitesell 219-432-5591
IN Indianapolis, R. O. Whitesell 317-359-9283
IN Kokomo, R. O. Whitesell 317-457-9127
KS Shawnee Mission, Lowell Kangas & Assocs., Inc. 913-631-3515
KY Peewee Valley, R. O. Whitesell 502-241-1441
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UT Salt Lake City, Straube Assocs. Mountain States, Inc. 801-263-2640
WA Redmond, Earl & Brown 206-885-5064
WI Brookfield, Twist Co. 414-782-2670
Can Toronto, Renmark Elctrns. 416-494-5445

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AZ Tempe, Elctm. Supp. 602-258-4769
AZ Tempe, Time Elctrns. 602-967-2000
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CA Anaheim, Time Elctrns. 714-937-0911
CA Chatsworth, Passive Comps. 818-341-1745
CA Chatsworth, Time Elctrns. 818-998-7200
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CA San Diego, Elctm. Supp. 619-693-8222
CA San Diego, Time Elctrns. 619-586-1331
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GA Norcross, Reptron Elctrns. 404-446-1300
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CA Santa Clara, Westrep 408-988-8833
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FL Orlando, OPT 305-658-6020
ID Boise, N. R. Schultz 208-377-8686
KS Lenexa, Midtec Assocs. 913-541-0505
MD Columbia, L. D. Lowery 301-381-0225
MD Columbia, L. D. Lowery 301-964-9110
MN Eden Prarie, The Twist Co. 612-941-2040
NM Albuquerque, S.W. Sls. 505-883-1388
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NY Melville, Comtronic Assocs. 516-249-0505
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TX El Paso, S.W. Sls. 915-594-8259
WA Bellevue, N. R. Schultz 206-494-0300
WA Bellevue, N. R. Schultz Co. 206-454-0300
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Can Quebec City, Que., Arrow Elctrns. 418-687-4231
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UNITRACK INDUSTRIES, INC., 1372 Enterprise Dr., Goshen Corp. Pk., P.O. Box 1927, West Chester, PA 19380, Tel: 215-692-0800, TWX: 510-663-0000; *Sls. Mgr.:* Anna Orcutt ..... **C•1114-1117**

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AZ Phoenix, Finn-Pat Co. 602-954-0301
CO Denver, Delltron Co. 303-373-0300
GA Atlanta, Magaro & Assocs. 404-451-8862
IL Des Plaines, Lincoln, Hodges & Assocs. 312-297-3810
IN Ft. Wayne, Aktron Corp. 219-747-3650
MA Northboro, Henik Assocs. 617-393-3127
MI Kentwood, C.A. Geer Co. 616-534-9449
MN St. Paul, Countrymen Assocs. 612-645-9151
MO Blue Springs, Cairns Sls. Co. 816-229-1404
NJ Basking Ridge, Churchill Assocs. 201-204-0744
NY Larchmont, Hingston Walsh Assocs., Inc. 914-834-5781
NY Syracuse, Lenard Co. 315-479-9191
OH Akron, Augnat Assocs. 216-273-1211
PA Norristown, Rivco January 215-631-1414
TX Wylie, Air Quip/Robleyco 214-442-3573
Can Guelph, Ont., Hammond Mfg. Co., Ltd. 519-822-2960

Local Distributors

CA Santa Ana, EL-COM 714-432-6630
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MI Grand Rapids, S-F Elctrn. Supp. Co. .. 616-459-0216
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Dayton, Televox, Inc. 513-294-4499
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PA Erie, Rem Elctrns. Supp. Co., Inc. 814-453-5625
TX Wylie, Air Quip/Robleyco 214-442-3573

UNITRODE CORP., 580 Pleasant St, Watertown, MA 02172, Tel: 617-926-0404, TELEX: 92-2414, TWX: 710-326-6509; Empl.: 2,000; *Sls. Mgr.:* Leslie Wallace; *Dist. Mgr.:* Ron Myers

UNITRODE CORP., Capacitor Div., 11494 Sorrento Valley Road, San Diego, CA 92121, Tel: 619-453-8020

Unitron

FAX: 214-341-2099

UNITRON INC., 10925 Miller Rd., Dept. EE, Dallas, TX 75238, Tel: 214-340-8600, TELEX: 882511; FSC No.: 6130; Empl.: 75; *Sls. Mgr.:* R. L. Beutel ... **D•2158-2160**

Local Sales Offices & Reps

CA	Manhattan Bch., Unitron (Jim Houghten)	213-379-7901
CA	Sunland, Unitron (Jim Crevier)	818-352-7348
KS	Mission, Warren West & Assocs.	913-236-5356
MN	St. Paul, Power Mation	612-645-0781
MO	Ellisville, Maynard & Assocs.	314-256-6899
NC	Charlotte, Bruster Lawing & Assocs.	803-831-1205
SC	Mt. Pleasant, Bruster Lawing & Assocs.	803-884-5748
VA	Midlothian, Bruster Lawing & Assocs.	804-794-3879

UNITRONIX CORP., 50 County Line Rd., Somerville, NJ 08876, Tel: 201-231-9400, TELEX: 833184; Empl.: 35; *Sls. Mgr.:* Frank Zimmer; *Dist. Mgr.:* Joseph Murawski

UNIVERSAL AD-YU/D-F CORP., 2517 E. Norwich St., Milwaukee, WI 53207, Tel: 414-482-4100; FSC No.: 90101; Empl.: 10; *Sls. Mgr.:* Ronald Tessmer

UNIVERSAL DATA SYSTEMS, INC., Motorola Information Systems Group, 5000 Bradford Dr., Huntsville, AL 35805-1953, Tel: 205-721-8000, TELEX: 752602 UDS HTV; Empl.: 800; *Sls. Mgr.:* Ray Kelly; *Dist. Mgr.:* Ron Martin

Local Sales Offices & Reps

AL	Huntsville	205-721-8000
AZ	Meza	602-820-6611
CA	Mission Viejo	714-770-4555
CA	Mountain View	415-969-3323
CA	Van Nuys	818-891-3282
CO	Aurora	303-368-9000
FL	Brandon	813-684-0615
GA	Roswell	404-998-2715
IL	Glenview	312-998-8180
MD	Wheaton	301-942-8558
MA	Framingham	617-875-8868
MI	Livonia	313-522-4750
MN	Apple Valley	612-432-2344
MO	St. Louis	314-434-4919
NJ	East Brunswick	201-238-1515
NY	Uniondale	516-222-0918
NC	Winston-Salem	919-760-4184
OH	Westerville	614-895-3025
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TX	Houston	713-988-5506
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UNIVERSAL VOLTRONICS, 27 Radio Circle Dr., Mt. Kisco, NY 10549, Tel: 914-241-1300, TWX: 710-571-2142; Empl.: 135; *Sls. Mgr.:* Bill Herndon ..... **D•2030**

Local Sales Offices & Reps

CA	Santa Clara, Sourcetronics	408-998-8801
MA	Whitinsville, Power Factor & Assocs.	617-234-6415
MN	Minneapolis, R.J. Sls.	612-866-3661
PA	Audubon, Holmes Assocs.	215-666-0636
VA	Fairfax, Schibley Assocs.	703-591-3008

UPSystems INC.

FAX: 213-634-0621

UPSYSTEMS, INC., 7801 E. Compton Blvd., Paramount, CA 90723, Tel: 213-634-0621, TWX: 910-346-7814; FSC No.: 3698; *Sls. Mgr.:* Dick Williams ..... **D•2161**

URBAN ELECTRONICS, P. O. Box 456, Dover, MA 02030, Tel: 617-329-4068, FAX: 617-235-5936; Empl.: 50; *Sls. Mgr.:* G. Urban

URDC, Acme Electric Corporation, 7915 South 1530 West, Box 10, West Jordan, UT 84084, Tel: 801-561-9385, FAX: 801-562-9004; *Sls. Mgr.:* Glenn Waterman

U S CAPACITOR CORP., See U S Microtek Components

U.S. COMPONENTS, INC., Unitech PLC., 35 Carlough Rd., Bohemia, NY 11716, Tel: 516-589-8080, TWX: 510-228-7886; Empl.: 90; *Sls. Mgr.:* J. Prideaux; *Dist. Mgr.:* J. Prideaux

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FAX: 213-594-6091

U. S. DIGITAL CORP., 12371 Kensington Rd., Los Alamitos, CA 90720, Tel: 213-594-0094 ..... **B•1928**

Local Distributors

NY	Clarks Mills, KLM Garner	315-853-6126

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FAX: 312-867-2211

USD PRODUCTS, Cooper Industries, 7300 W. Wilson Ave., Chicago, IL 60656, Tel: 312-867-4600, TELEX: 910-221-3474; Empl.: 200; *Sls. Mgr.:* Ron Pitchford; *Dist. Mgr.:* John Thielen ..... **B•1352-1353; C•1582-1583**

Local Sales Offices & Reps

AL	Decatur, El Tech, Inc.	205-353-7899
AR	Hot Springs, MYA, Inc.	501-262-1365
CA	Laguna Hills, Western Automation	714-859-6988
CO	Englewood, Harthun Assocs., Inc.	303-792-5050
FL	Stuart, Cahill Assocs., Inc.	305-288-3113
IL	Schaumburg, Tech Tron Sls., Inc.	312-843-7530
IN	Carmel, Fred A. Dorsey & Assocs., Inc.	317-844-4842
KS	Wichita, Thunderbird Tech. Sls., Inc.	316-684-3941
MA	Chelmsford, Marty Flynn Assocs.	617-649-3088
MI	Oak Park, A. Blumenberg Assocs., Inc.	313-968-3230
MN	Arden Hills, R. D. Schwen Engrg.	612-636-3088
MO	Florissant, Mid/West Co.	314-837-3361
NE	Lincoln, MYA-Midwest, Inc.	~~402-475-5296~~
NJ	Florham Park, Varrelman-Gorman Co.	201-822-9616
NY	Rochester, BKT Assocs., Inc.	716-586-5814
NC	Winston-Salem, L. G. White Southern, Inc.	919-725-3612
OH	Rocky River, Hiltebrant Indl. Sls.	216-333-5600
PA	Edgemont, White/Whiddett Co.	215-353-6343
TX	Lewisville, Texoma Tech. Sls., Inc.	214-434-2770
VA	Blacksburg, Candor Co.	703-953-2197
WA	Bothell, Temco Northwest	206-821-5434
WI	Franklin, WD Engrg. Sls., Ltd.	414-529-3772
Can	Mississauga, Ont., Andy Baumen Assocs., Ltd.	416-828-2600

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AZ	Tempe, Control Design	602-829-7981
CA	Anaheim, Control Design	714-821-1516
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CA	San Carlos, Control Design	415-592-4806
FL	Ft. Lauderdale, Bel Thermal Units, Inc.	305-566-0043
FL	Ft. Lauderdale, Control Design Supp.	305-788-3220
GA	Atlanta, Control Design Supp.	404-979-3500
GA	Norcross, A-A Electric	404-449-8670
IL	Genoa, Control Design Supp.	815-784-6515
IL	Wheeling, Connector Concepts	312-541-4020
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IA	Marion, Control Design	319-373-2923
IA	W. Des Moines, Ramco Elec. Supp.	515-225-6933
MA	Boston, Control Design Supp.	617-932-9404
MA	Boston, Controller Svc. & Sls.	617-269-1300
MN	Minneapolis, Control Design	612-721-1628
MO	St. Louis, Control Design	314-426-3150
NH	Manchester, Controller Svc.	603-623-7255
NY	Rochester, R. Baker Elctrns.	716-586-9164
NC	Charlotte, Control Design Supp.	704-588-4410
OH	Cincinnati, Richards Elec. Supp.	513-242-8800
OH	Eastlake, Professional Elctrns.	216-946-3790
OH	Wickliffe, Gateway Megatech	216-944-7039
OK	Tulsa, Altair	918-252-5781
OR	Portland, Tek Elec. Control, Inc.	503-246-5451
PA	Philadelphia, Royal Elec. Supp.	215-221-1200
RI	Providence, Controller Svc. & Sls.	401-781-7100
TN	Nashville, Steinhouse Supp. Co.	615-254-1613
TX	Austin, Altair	512-837-4970
TX	Dallas, Control Design	214-358-1441
WA	Seattle, H. D. Campbell	206-433-1900
WI	Milwaukee, Control Design Supp.	414-784-1015
WI	Milwaukee, Standard Elec.	414-272-8100
Can	Toronto, Ont., GLE, Inc.	416-252-5301

USECO DIV., Litton Inds, 13536 Saticoy St, Van Nuys, CA 91409, Tel: 818-786-9388, FAX: 818-709-4510; FSC No.: 88245; Empl.: 100

U.S. INSTR. RENTALS, 2988 Campus Dr., San Mateo, CA 94403, Tel: 800-824-2873, TELEX: 349301 USIR SMT; Empl.: 500

U. S. LASER CORP., 825 Windham Court North, Wyckoff, NJ 07481, Tel: 201-848-9200; Empl.: 25; *Sls. Mgr.:* John Tobin

U S MICROTEK COMPONENTS CORP., Division of Unitrode Corp., 11144 Penrose St., Sun Valley, CA 91352, Tel: 818-767-6770, TWX: 910-498-4998; FSC No.: 59942; Empl.: 210; *Sls. Mgr.:* Donald F. Hosmer ..... **A•1184**

Local Sales Offices & Reps

AZ	Tempe, Gassner & Clark Co.	602-968-9037
CA	Cupertino, F & F Assocs.	408-446-2349
CA	Granada Hills, C & N Assocs.	818-895-2431
CO	Aurora, Key Specialties	303-690-6106
FL	Margate, EPM Corp.	305-977-0331
FL	Orlando, EPM Corp.	305-425-6149
IL	Elgin, Gassner & Clark	312-695-9540
IA	Marion, MSB Assocs., Inc.	319-377-6261
KS	Shawnee Mission, MSB Assocs., Inc.	913-432-2131
MD	Ellicott City, Thiem Assocs.	301-465-4776
MA	Randolph, Hatch Assocs.	617-963-3306
MO	St. Charles, MSB Assocs., Inc.	314-946-5577
NY	Albany, Reagan/Compar	518-489-7408
NY	Commack, Kaelber & Mack	516-499-2924
OH	Columbus, Baehr, Greenleaf & Assocs.	614-486-4046
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OH	Westlake, Baehr, Greenleaf & Assocs.	216-892-1770
PA	Broomall, Sapinosa Assocs.	215-353-7267
TX	Austin, OM Assocs., Inc.	512-388-1151
TX	Houston, OM Sales Co., Inc.	713-789-4426
TX	Richardson, OM Assocs., Inc.	214-690-6746
WA	Redmond, Gentech	206-881-6456
Can	Oakville, Ont., Haltronics	416-844-2121

U.S. POWER CONVERTING COMPANY/RELCO, Leonard V. Snow & Assocs., 21517 Ocean, Torrance, CA 90503, Tel: 213-316-9984, FAX: 213-374-2387; Empl.: 6; *Sls. Mgr.:* Jonathan Snow; *Dist. Mgr.:* Tom Clark ..... **C•1089; D•1950-1951**

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CA Torrance, U.S. Power Converting/L. Snow & Assocs. 213-316-9984
Can New Dundee, Ont., Ritz Elctrns. 519-696-2616

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CA Redondo Bch., U.S. Power Converting/L. Snow & Assocs. 213-318-9601
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U.S. TERMINALS, 7502 Camargo Rd., Cincinnati, OH 45243, Tel: 513-561-8145, TWX: 810-461-2290; FSC No.: 12615; *Sls. Mgr.:* G.L. Stepp

FAX: 818-287-7350

U.S. TOYO FAN CORP., 4915 Walnut Grove Ave., San Gabriel, CA 91776, Tel: 818-287-5297, TWX: 910-589-1540; Empl.: 20; *Sls. Mgr.:* Bruce Rockwell; *Dist. Mgr.:* Bruce Rockwell ..... **C•1700-1701**

Local Sales Offices & Reps

AL Huntsville, Par Mktg. 205-859-5702
AZ Phoenix, Howe & Howe Sls. 602-264-7971
CA Oceanside, Noo Rep Tech Sls. 619-941-0558
CA San Gabriel, U.S. Toyo Fan Corp. 818-287-5297
CA San Jose, U.S. Toyo Fan Corp. 408-998-2808
CO Lakewood, Christee-Meade 803-232-0287
CT Bethel, Livera-Polk Assocs. Inc. 203-748-4639
FL Goldenrod, Sunland Assocs. 305-365-9533
GA Alpharetta, Par Mktg. 404-442-8858
IL Parcom Inc. 312-228-9046
IL Elk Grove, Parcom Inc. 312-228-9046
KS Lenexa, Midtec Assocs. 913-541-0505
MA Needham, Component Technlg. 617-449-8490
MI Farmington Hills, W. R. Hummon 313-474-0661
MN Osseo, Gaffney Sls. Co. 612-425-5484
MO St. Louis, Midtec Assocs. 314-275-8666
NJ Madison, Livera-Polk Assocs. 201-377-3220
NY Cooperstown, Fitzelle Assocs. 607-547-9333
NY Glen Head, Livera-Polk Assocs. 516-759-9300
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OH Trotwood, Geotronix 513-252-6700
OR Beaverton, LD Elctrns. Inc. 503-568-0511
PA Allison Pk., Geotronix Inc. 412-487-1770
PA Telford, Dalbrook Corp. 215-723-3300
TX Houston, Zonk & Assocs. 713-895-9131
TX Richardson, Zonk Assocs. 214-238-7651
WA Snohomish, LD Elctrns. 206-568-0511
PR Santruce, SISCO 809-726-3137
Can Islington, Ont., Pipe-Thompson Ltd. 416-236-2355

Local Distributors

AZ Phoenix, Aero-Space Southwest 602-269-5655
CA Agoura Hills, Pacesetter Elctrns. 818-991-3984
CA Buena Park, Cypress Elctrns. 714-521-5230
CA Fremont, Terminal Sls. Corp. 415-656-7722
CA Santa Clara, Cypress Elctrns. 408-980-2500
CA Tustin, Added Value Elctrns. Distr. 714-259-8258
CO Arvada, Denver Beta Wintronics 303-431-7161
FL Largo, Lo-Dan Elctrns. 813-586-2851
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NM Albuquerque, Betatron 505-344-2381
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NY Endwell, Pryme-Line Distr. 607-748-5200
OH Richfield, Alpha Distr. Corp. 216-659-7100
OR Beaverton, Hansen Elctrns. 503-642-4455
PA Harrisburg, Cumberland Elctrns. 717-233-5883
TX Dallas, Cypress Elctrns. 214-869-1435
TX Richardson, Zec Sls. 214-669-0895
WA Bothell, Cypress Elctrns. 206-483-1144

UTE MICROWAVE, 3500 Sunset Ave., Asbury Park, NJ 07712, Tel: 201-922-1009, TELEX: 13-2461, FAX: 201-922-0848; FSC No.: 23261; Empl.: 35

UTICA TOOL CO., INC., Cameron Rd., P.O. Box 1807, Orangeburg, SC 29115, Tel: 803-534-7010, TELEX: 57-3498

UTI INSTRUMENTS CO., 497 S. Hillview Dr., Milpitas, CA 95035, Tel: 408-945-1955, TWX: 910-339-9546; Empl.: 80; *Sls. Mgr.:* George Bunyard

UVP, INC., 5100 Walnut Grove Ave., P.O. Box 1501, San Gabriel, CA 91778, Tel: 818-285-3123, TELEX: 371 6381, FAX: 818-285-2940; Empl.: 100; *Sls. Mgr.:* Al Kovalsky

VACO PRODUCTS DIV., 7200 McCormick Blvd., Chicago, IL 60645, Tel: 312-677-9500, TELEX: 72-4431, FAX: 312-677-4476; Empl.: 250; *Sls. Mgr.:* Bill Redmond

VACTRONIC LAB. EQUIP. INC., 160 Wilbur Place, Bohemia, NY 11716, Tel: 516-567-0520, FAX: 516-567-0684; Empl.: 30

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VALHALLA SCIENTIFIC, 9955 Mesa Rim Rd., San Diego, CA 92121, Tel: 619-457-5576, TELEX: 181750 VALHALLA SDG; Empl.: 75; *Sls. Mgr.:* Stephen Merrill ..... **D•1336-1337**

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AL Huntsville, Currie, Peak & Frazier 205-536-1506
AZ Tempe, Barnhill Assocs. 602-820-8800
CA Costa Mesa, Cutlass Elctrns. 714-549-9358
CA San Diego, Mesa Engrg. 619-268-3500
CA San Jose, Scientific Dvcs. 408-554-0455
CA Torrance, Cutlass Elctrns. 213-324-7360
CO Englewood, Barnhill Assocs. 303-799-6999
FL Orlando, Currie, Peak & Frazier 407-855-0843
FL Tampa, Currie, Peak & Frazier 813-968-2480
FL W. Melbourne, Currie, Peak & Frazier 407-724-6795
GA Norcross, Currie, Peak & Frazier 404-449-7662
IL Arlington Hgts., Comtel Midwest Co. .. 312-392-4040
IN Indianapolis, Comtel Midwest Co. 317-253-1681
IA Cedar Rapids, Delltron Co., Inc. 319-393-0058
MD Lanham, Sel-Tronics 301-731-8080
MA Needham, Addelco 617-444-4754
MI Farmington Hills, Carter, McCormic & Peirce (CMP) 313-477-7700
MN Minneapolis, Sector Engrg. 612-593-1809
MO Florissant, Delltron Co., Inc. 314-839-0033
MO Kansas City, Delltron Co., Inc. 816-436-6445
NJ Union, Friedman Assocs., Inc. 201-964-6200
NM Albuquerque, Barnhill Assocs. 505-299-7658
NY Hamburg, Labtronics 716-648-0107
NY Ilion, Labtronics 315-895-7135
NY Kirkwood, Labtronics 607-775-3739
NY Syracuse, Labtronics 315-455-7314
NC Bakersville, Currie, Peak & Frazier 704-688-4371
NC Greensboro, Currie, Peak & Frazier ... 919-373-0380
NC Matthews, Currie, Peak & Frazier 704-846-1702
OH Berea, Carter, McCormic & Peirce (CMP) 216-826-0400
OH Englewood, Carter, McCormic & Peirce (CMP) 513-836-0951
OK Tulsa, Barnhill Assocs. 918-744-6535
OR Portland, Westcon, Inc. 503-283-0132
PA Philadelphia, Robert Meyers Assocs. .. 215-224-1663
PA Pittsburg, Carter, McCormic & Peirce (CMP) 412-826-3800
TX Austin, Barnhill Assocs. 512-451-0217
TX Houston, Barnhill Assocs. 713-444-1733
TX Houston, Barnhill Assocs. 713-580-8007
TX Richardson, Barnhill Assocs. 214-231-2573
TX San Antonio, Barnhill Assocs. 512-694-5575
UT Murray, Barnhill Assocs. 801-262-3000
VA Hampton, Sel-Tronics 804-827-6308
WI Milwaukee, Sector Engrg. 414-352-8280
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VALLEY ELECTROMAGNETICS, P.O. Box 131, Spring Valley, IL 61362, Tel: 815-664-2348, FAX: 815-663-1112; Empl.: 90; *Sls. Mgr.:* A. Petak

VALMARK INDUSTRIES INC., 1376 Borregas Ave., Sunnyvale, CA 94089, Tel: 408-734-4253, FAX: 408-734-0136; Empl.: 60; *Sls. Mgr.:* Roger Coil

VALOR

FAX: 619-458-0875

VALOR ELECTRONICS, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245, Tel: 619-458-1471, TELEX: 653406 VALORSD; FSC No.: 15003; Empl.: 600; *Sls. Mgr.:* Nick Freyling ..... **A•1630-1631; D•2031-2035**

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AL Madison, Benchmark 205-464-0033
AZ Scottsdale, American Mktg., Inc. 602-948-2778
CA Garden Grove, Elsco Elctrns. 714-891-4621
CA San Diego, Elsco Elctrns. 619-292-1771
CA Santa Clara, Fahrner-Miller Assocs. 408-727-9800
CO Denver, Moss Mktg. 303-455-7205
FL Altamonte Springs, Semtronic Assocs. 305-831-8233
FL Clearwater, Semtronic Assocs. 813-461-4675
FL Ft. Lauderdale, Semtronic Assocs. 305-731-2484
GA Norcross, Benchmark 404-446-1711
IL Rolling Meadows, Heartland Tech. Mktg. 312-577-9222
IA Cedar Rapids, Lorenz Sls. 319-377-4666
KS Merriam, Lorenz Sls. 913-384-6556
MD Annapolis, EES 301-269-4235
MA Topsfield, Whitehead Assocs. Inc. 617-887-0050
MI Ypsilanti, Techrep Inc. 313-572-1950
MN Minneapolis, DeBeck-Hays Assocs. Inc. 612-835-3610
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NY Utica, Tech-Mark 315-733-0575
NC Charlotte, Benchmark 704-525-2131
OH Dayton, KW Elctm. Sls. 513-890-2150
OH Shaker Hgts., KW Elctm. Sls. 216-491-9177
PA Allison Pk., KW Elctm. Sls. 412-487-4300
TX Austin, Kruvand 512-441-6777
TX Dallas, Kruvand 214-437-3355
TX Houston, Kruvand 713-956-6741
UT Salt Lake City, Moss Mktg. 801-363-5875
WA Seattle, Northmar Inc. 206-524-5170
WI Broomfield, Heartland Tech. Mktg. 414-796-1128
PR Hato Rey, Semtronic Assocs. 809-766-0700

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AL Huntsville, Hall-Mark Elctrns. Corp. 205-837-8700
AZ Phoenix, Hall-Mark Elctrns. Corp. 602-437-1200
CA Canoga Pk., FLW 818-719-0037,800-225-5359
CA Canoga Pk., Hall-Mark Elctrns. Corp. .. 818-716-7300
CA Carlsbad, FLW 619-434-5251
CA Citrus Hgts., Hall-Mark Elctrns. Corp. .. 916-722-8600
CA Costa Mesa, FLW 714-751-7512,800-225-5359
CA Hayward, FLW 415-786-9070
CA San Diego, Hall-Mark Elctrns. Corp. 619-268-1201
CA San Jose, Hall-Mark Elctrns. Corp. 408-432-0900
CA Torrance, Hall-Mark Elctrns. Corp. 213-217-8400
CA Tustin, Hall-Mark Elctrns. Corp. 714-669-4100
CO Englewood, Hall-Mark Elctrns. Corp. .. 303-790-1662
CT Cheshire, Hall-Mark Elctrns. Corp. 203-271-2844
FL Clearwater, Hall-Mark Elctrns. Corp. 813-530-4543
TX Dallas, TMMI 214-669-0331
TX Ft. Worth, Allied Elec. 817-336-5401
FL Orlando, Hall-Mark Elctrns. Corp. 305-855-4020
FL Pompano Bch., Hall-Mark Elctrns. Corp. 305-971-9280
CA San Jose, Sierra West 408-435-7477
GA Norcross, Hall-Mark Elctrns. Corp. 404-447-8000
IL Woodale, Hall-Mark Elctrns. Corp. 312-860-3800
IN Indianapolis, Hall-Mark Elctrns. Corp. 317-872-8875
KS Lenexa, Hall-Mark Elctrns. Corp. 913-888-4747
MD Columbia, Hall-Mark Elctrns. Corp. 301-988-9800
MA Billerica, Hall-Mark Elctrns. Corp. 617-935-9777
MI Livonia, Hall-Mark Elctrns. Corp. 313-462-1205
MN Eden Prairie, Hall-Mark Elctrns. Corp. 612-941-2600
MO Earth City, Hall-Mark Elctrns. Corp. 314-291-5350
NJ Fairfield, Hall-Mark Elctrns. Corp. 201-575-4415
NJ Mt. Laurel, Hall-Mark Elctrns. Corp. 609-235-1900
NM Albuquerque, Hall-Mark Elctrns. Corp. 505-344-7341
NY Rochester, Hall-Mark Elctrns. Corp. ... 716-244-9290
NY Ronkonkoma, Hall-Mark Elctrns. Corp. 516-737-0600
NC Raleigh, Hall-Mark Elctrns. Corp. 919-872-0712
OH Solon, Hall-Mark Elctrns. Corp. 216-349-4632
OH Worthington, Hall-Mark Elctrns. Corp. 614-888-3313
OK Tulsa, Hall-Mark 918-251-1108
TX Austin, Hall-Mark Elctrns. Corp. 512-258-8848
TX Dallas, Hall-Mark Elctrns. Corp. 214-553-4300
TX Houston, Hall-Mark Elctrns. Corp. 713-781-6100
UT West Valley City, Hall-Mark Elctrns. Corp. 801-972-1008
WI New Berlin, Hall-Mark Elctrns. Corp. .. 414-797-7844

VALOR

FAX: 619-458-0875

VALOR POWER SYSTEMS DIV., Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245, Tel: 619-458-1471; FSC No.: 58999; Empl.: 350; *Sls. Mgr.:* Brad Rogers; *Dist. Mgr.:* Nick Freyling ..... **A•1630-1631; D•2031-2035**

VALPEY-FISHER, 75 South St, Hopkinton, MA 01748, Tel: 617-435-6831, TELEX: 94-8332, FAX: 617-435-5289; FSC No.: 5955; Empl.: 120; *Sls. Mgr.:* Donald Elliott; *Dist. Mgr.:* Saul Rubin

VAMISTOR CORP., 115 Industrial Pk., Sevierville, TN 37862, Tel: 615-453-0001, TWX: 810-570-4931, FAX: 615-453-0003; FSC No.: 56856; Empl.: 49; *Sls. Mgr.:* Richard Harburn; *Dist. Mgr.:* Richard Harburn

Local Sales Offices & Reps

IN Indianapolis, M & L Elctrn. Sls. 317-359-4742
TN Sevierville, Vamistor Corp. 615-453-0001

Local Distributors

CA Chatsworth, Passive Comps., Inc. 818-341-1745
CA Long Bch., El-Comp Sls. 213-421-7316
CT Fairfield, Sound Elctrns. 203-255-7957
FL Tampa, Passive Technlgs., Inc. 813-623-1935
MD Columbia, Jaco Elctrns. 301-995-6620
MD Timonium, Zebra Elctrns., Inc. 301-252-6576
MA Needham, Cronin Elctrns., Inc. 617-449-5000
NJ Moorestown, Marlac Elctrns. 609-234-4200
NY Bohemia, Justin Elctrns. 516-589-4000
NY Hauppauge, Fairmont Elctrns. 516-231-3313
NY Hauppauge, Jaco Elctrns. 800-645-5112
NY Hauppauge, Sherburn Elctrns. 516-231-4300
NY Lynbrook, Patriot Elctrns. 516-579-4000
NY Ronkonkoma, M-Tron Comps. 516-467-5100
NY Valley Stream, L & S Elctrns., Inc. 516-561-2474

VANGUARD ELECTRONICS CO., 1480 W. 178th St., Gardena, CA 90248, Tel: 213-323-4100, FAX: 213-329-8427; FSC No.: 03550; Empl.: 250; *Sls. Mgr.:* T. A. Crawford; *Dist. Mgr.:* T. A. Crawford

VANGUARD RELAY CORP., 333 Strawberry Field Rd., Warwick, RI 02886, Tel: 401-732-0700; *Sls. Mgr.:* Fred Pestana

VANN INSTRUMENTS, 1046 Vassar N.E., Albuquerque, NM 87106, Tel: 505-265-2498; *Sls. Mgr.:* Michael E. Vann

VARIAN ASSOCS., Indl. Equip. Grp., 611 Hansen Way, Palo Alto, CA 94303, Tel: 415-493-4000, TWX: 910-373-1731; Empl.: 1500

VARIAN ASSOCS., Instr. Grp., 220 Humboldt Ct., Sunnyvale, CA 94089, Tel: 408-734-5370, TWX: 910-339-9331

VARIAN ASSOCIATES, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303, Tel: 415-493-4000, TELEX: 910-373-1731; Empl.: 11,000; *Sls. Mgr.:* J. Driscoll

VARIAN CANADA, INC., Microwave Div., 45 River Drive, Georgetown, ON, Canada L7G2J4, Tel: 416-877-0161, TELEX: 069-7502, TWX: 610-492-2641; FSC No.: 02845; Empl.: 350; *Sls. Mgr.:* George C. Plhak

VARITRONIX, See VL Electronics

VARO, INC., Electron Devices Div., 2203 W. Walnut St., Garland, TX 75046, Tel: 214-487-4129, TWX: 910-860-5093, FAX: 214-487-4265; FSC No.: 27777;Multiple; Empl.: 600; *Sls. Mgr.:* Russ Lyons

VARO QUALITY SEMICONDUCTOR, 1000 N. Shiloh Rd., Garland, TX 75040, Tel: 214-487-4300, TELEX: 6829276, FAX: 214-487-0406; Empl.: 550; *Sls. Mgr.:* Charlie Merz; *Dist. Mgr.:* Mike Hawkins

VARTA BATTERIES, INC., 300 Executive Blvd., Elmsford, NY 10523, Tel: 914-592-2500, TELEX: 996-548; *Sls. Mgr.:* Paul Silliman ..... **D•1494**

Local Sales Offices & Reps

AL Athens, EMF 205-233-2947
AZ Scottsdale, Harris & Croy Inc. 602-575-5109
CA Norwalk, Ed Rivers Assocs. 213-868-1471
CA San Mateo, Stewart Fullerton Assocs. 415-570-7666
CO Parker, Parker-Webster Co. 303-841-4888
CT Cheshire, Sci. Comps. 203-272-2963
FL Maitland, EIR, Inc. 305-660-9600
KS Shawnee Mission, Microtronics 913-262-1444
MD Ellicott City, Technlg. Sls. 301-461-7802
MO St. Charles, Livera-Polk 314-946-8500
NJ Madison, Livera-Polk 201-377-3239
NY Glen Head, Livera-Polk 516-759-9300
NC Lillington, EMF 919-893-3650
OH Beachwood, Thompson & Assocs. 216-831-6277
OH Dayton, Thompson & Assocs. 513-435-7733
OH Lexington, Del Steffen & Assocs. 419-884-2313
OR Portland, WMI 503-252-5197
PA Carnegie, Del Steffen & Assocs. 412-276-7366
PA West Chester, TCA Assocs. 215-353-2022
TX Richardson, Comp. Technlg. 214-783-8831
UT Bountiful, Moss Mktg. 801-292-8660
UT Murray, Parker Webster 801-266-9959
WA Redmond, VMI 206-882-2999
Can Downsview, Ont., BD&D Power 416-663-9711
Can Mississauga, Ont., K.C. Sls. & Mktg. 416-826-5435
Can Mississauga, Ont., Nica Power Battery Corp. 416-828-7100

Local Distributors

AZ Phoenix, Specific Energy Corp. 602-433-0288
CA Hayward, Nicad Sys. 415-785-9391
CA La Mirada, Energy Dvcs. 213-921-8775
CA Mtn. View, Energy Sls. 415-969-0600
CA San Francisco, Varta Batteries 415-954-8516
CA San Jose, Rose Elctrns. 408-263-9700
CA Van Nuys, Nesco, Inc. 818-781-0505
CO Englewood, Indl. Elctrns. 303-694-9444
FL Altamonte Springs, TNR Tech., Inc. ... 305-767-2411
GA Lithia Springs, EMF 404-948-6023
GA Marietta, Synergistic Batteries 404-973-2220
HI Honolulu, Pacific Energy Dvcs. 808-737-2021
IL Donwers Grove, Telecommunications Dvcs. 312-971-3460
IL Downers Grove, Jabro Batteries, Inc. 312-964-9358
IL Mt. Prospect, Johnson Assocs. 312-398-5159
IL Schaumburg, Varta Batteries 312-310-4437
MD Beltsville, Mark Elctrns. 301-595-5040
MA Sharon, Adcour 617-784-8123
MI Livonia, LWC Dists., Inc. 313-464-7700
NJ Butler, Access Distrs. 201-492-0808
NJ Clifton, Engrd. Assemblies 201-340-0600
NY Elmsford, Energex Sys. Corp. 914-631-1363
NY Mt. Kisco, Multiplier Inds. 914-699-0990
NC Winston-Salem, Progressive Technlgs. 919-761-1375
OR Aloha, Elctrn. Concept 503-642-9715
TX Spring, Battery Pak Sls. & Svc. 713-367-9393
TX Stafford, S.W. Elctrns. 713-240-4000
WA Redmond, Energy Sls., Inc. 206-883-2343
Can Mississauga, Ont., NICA Power Battery Corp. 416-828-7100

VCH INCORPORATED, Chicago Miniature, 1080 Johnson Drive, Buffalo Grove, IL 60089, Tel: 312-459-3400, TWX: 910-221-5445, FAX: 312-459-2708; FSC No.: 71744; Empl.: 52; *Sls. Mgr.:* Jim Flanagan

VECTOR ELECTRONIC COMPANY

FAX: 818-365-5718

VECTOR ELECTRONIC CO., INC., 12460 Gladstone Ave., Box 4336, Sylmar, CA 91342, Tel: 818-365-9661, TELEX: 269303; FSC No.: 82893; Empl.: 95; *Sls. Mgr.:* Norm Brunell; *Dist. Mgr.:* D. Shelley-W ..... **C•1119, 1736-1737, 1740-1742; D•1115**

For Vector Elctrns.' sales offices and reps. in all other states- 800-423-5659.

Local Sales Offices & Reps

CA Garden Grove, Advanced Digital Grp. 714-735-0579
CA Los Angeles, Advanced Digital Grp. ... 213-598-9645
MD Ellicott, Technlg. Sls. Assocs. 301-461-7802
CA Advanced Digital Grp. 714-897-0319

Local Distributors

AL Huntsville, Allied Elctrns. Inc. 1-800-433-5700
AL Huntsville, Mock Elctrns. Inc. 205-539-2401
AZ Phoenix, Dalis Elctrns. 602-275-2626
AZ Phoenix, Elctrn. Supp. 602-276-1199
AZ Phoenix, Tri-Tek Inc. 602-371-0860
AZ Tucson, Inland Elctrns. 602-294-2628
AR Little Rock, Carlton Bates 501-562-9100
CA Anaheim, R&D Elctrns. 714-773-0240
CA Buena Pk., Cypress Elctrns. 714-521-5230
CA Burbank, Elctrn. City 818-842-5275
CA Canoga Pk., Sandy's Elec. Supp. 818-346-8353
CA Chatsworth, Priority 1 Elctrns. 818-709-5111
CA Costa Mesa, Marvac Elctrns. 714-650-2001
CA Costa Mesa, Powell 714-754-1717
CA Cucamonga, Abletronics 714-987-7606
CA Fremont, Allied Elctrns. 415-770-0590
CA Fullerton, Orvac Elctrns. 714-871-1020
CA Gardena, Cal Switch 213-770-2330
CA Hollywood, Yale Elctrns. 213-465-3186
CA Huntsville, Powell Elctrns. 205-539-2731
CA Inglewood, Newark Elctrns. 213-670-0020
CA Irvine, Priority 1 Elctrns. 714-660-1411
CA Milpitas, Zack Elctrns. 408-942-5432
CA Oakland, Brill Elctrns. 415-834-5888
CA Pasadena, Empire Elctrn. Dist. 213-681-2711
CA Riverside, Elctrn. Supp. 714-787-9220
CA Sacramento, Zack Elctrns. 916-446-3131
CA San Diego, Cypress Elctrns. 619-535-0011
CA San Diego, Elctrn. Supp. 619-693-8222
CA San Diego, Shanks & Wright 619-239-0176
CA San Francisco, Zack Elctrns. 415-626-1444
CA San Jose, Elctrn. Supp. 408-297-3726
CA San Jose, Powell Elctrns. 408-943-9020
CA San Jose, Quement Elctrns. 408-998-5900
CA San Mateo, Newark Elctrns. 415-571-5300
CA Santa Ana, Advanced Computer Prod. 714-558-8813
CA Santa Clara, Cypress Elctrns. 408-980-2500

CA Santee, Mouser Corp. 619-449-2300
CA Sunnyvale, Abacus Elctrns. Co. 408-732-2000
CA Thousand Oaks, Pace Elctrn. 818-889-1209
CA Tustin, Allied Elctrns. Inc. 714-669-4190
CO Colorado Springs, Colorado Springs Walker Elctrns. 303-636-1661
CO Denver, Newark Elctrns. 303-757-3351
CO Englewood, Shelley/Ragon 303-762-0670
CT Bridgeport, Park Dists. 203-366-7200
CT Greenwich, Wise Comps. Inc. 203-531-4880
CT Hamden, Allied Elctrns. 203-248-8900
CT Norwalk, Pioneer Stand. Elctrns. Inc. .. 203-853-1515
CT S. Windsor, Car-Lac Elctrns. 203-282-0631
CT Wallingford, Sager Elec. Supp. Co. 203-265-4600
FL Altamonte Springs, Pioneer-Orlando Techs. 305-834-9090
FL Ft. Lauderdale, Pioneer Technlg. 305-428-8877
FL Ft. Lauderdale, Powell Elctrns. 305-484-8377
FL Ft. Lauderdale, Southeastern Elect. Inc. 305-563-4131
FL Miami, Elctrn. Equip. 305-871-3500
FL Pompano Bch., Peerless Radio Corp. 305-973-4141
GA Atlanta, Jack Spears Elctrns. 404-237-4531
GA Norcross, Allied Elctrns. Inc. 404-377-3555
HI Honolulu, Elctrl. Equip. Ltd. 808-533-3884
ID Boise, Kimball Elctrns. 208-342-3559
ID Spirit Lake, A-I Elctrns. 208-623-3111
IL Chicago, Newark Elctrns. 312-784-5100
IL Chicago/Elgin, Allied Elctrns. 312-697-8200
IL Chicago/Elgin, Newark Elctrns. 312-784-5100
IL Elk Grove Vl., GBL Goold Elctrns. 312-593-3220
IL Niles, Joseph Elctrns. 312-297-4200
IL Palatine, OHM Elctrns. 312-359-5500
IL Peoria, Klaus Radio 309-691-4840
IN Evansville, Hutch & Son Inc. 812-425-7201
IN Ft. Wayne, Bell Inds. 219-423-3422
IN Indianapolis, Bell Inds. 317-875-8200
IN Indianapolis, Meunier Elctrns. 317-635-3511
IA Cedar Rapids, Dee Elctrns., Inc. 319-365-7551
KY Louisville, Peerless Elec. Equip. 502-637-7674
LA New Orleans, Wm. B. Allen Supp. Co. Inc. 504-525-8222
MD Baltimore, ASI Elctrns. 301-265-5100
MD Baltimore, Resco/Baltimore 301-529-0500
MD Bethesda, Empire Elec. Supp. Co. 301-656-3300
MD Columbia, Powell Elctrns. Inc. 301-995-6410
MD Gaithersburg, Pioneer, Inc. 301-792-7500
MD Rockville, Capitol Radio Whlslrs. 301-881-2270
MA Hingham, Sager Elec. Supp. Co. 617-749-6700
MA Lexington, Pioneer Inc. 617-861-9200
MA Lynn, Land Elctrn. Supp. 617-592-2220
MA Milford, Car-Lac Elctrns. 617-478-7797
MA Needham, Cronin Elctrns. 617-449-5000
MA Needham, YDI Elctrns. Corp. 617-449-1005
MA Norwood, Gerber Elctrns. 617-769-6000
MA Woburn, Abbott Elctrns. Inc. 617-935-2040
MI Ann Arbor, Wedemyer Elect. Supp. 313-665-8611
MI Flint, Shand Elctrns. Inc. 313-743-8940
MI Livonia, Chelsa/RS Div. 313-525-1155
MI Oak Pk., Newark Elctrns. 313-967-0600
MI Southfield, Newark Elctrns. 313-557-8227
MN Minneapolis, Newark Elctrns. 612-331-6350
MN Minneapolis, Shelley/Ragon Inc. 612-642-2828
MN St. Paul, Gopher Elctrns. 612-483-3322
MO Kansas City, Elctrns. Supp. 816-931-1321
MO Maryland Hgts., Chelsea Elctrns. 314-426-4500
NE Lincoln, Scott Elec. Supp. 402-466-8221
NE Omaha, Radio Equip. 402-341-7700
NH Salem, Sager Elctrl. 603-898-1348
NJ Camden, GRS Co. 609-964-8560
NJ E. Hanover, State Elctrn. Parts Co. 201-887-2550
NJ Edison, William Elec. Supp. 201-985-3700
NJ Green Brook, Green Brook Elec. Inc. .. 201-968-3500
NJ Kenilworth, Federated Purchaser 201-272-0505
NJ Pennsauken, Resco 609-662-4000
NJ Pine Brook, Pioneer Stand. Elctrn. 201-575-3510
NJ Springfield, Rte. Elctrns., Inc. 201-379-7710
NM Albuquerque, Elctrn. Parts Co. 505-293-6161
NY Binghamton, Pioneer Elctrns. 607-722-9300
NY Bohemia, Car-Lac Elctrns. 516-567-4200, 800-645-1192
NY Buffalo, Summit Dists. Inc. 716-887-2800
NY Commack, Car-Lac Elctrns.;NY Branch Sls. Off. 516-493-0556
NY Elmsford, Laco Indl. Elctrns. 914-592-5058
NY Hauppauge, Broadline Elctrn. Dist. 516-231-4100
NY Hempstead, Davis Elctrns. 516-483-9200
NY L.I. City, H. L. Dalis 718-361-1100
NY Lynbrook, Peerless Radio Dist. Inc. ... 516-593-2121
NY Mineola, Allied Elctrns. Inc. 516-248-2360
NY Rochester, Simcona Elctrns. 716-328-3230
NY Rochester, Summit Dists. Inc. 716-334-8110
NY Ronkonkoma, Arrow Elctrns., Inc. 800-932-7769
NY Schenectady, Grimmer's Elec. Supp. Corp. 518-374-8480
NY Troy, Trojan Elctrns. 518-274-4481
NY Woodbury, Pioneer Stand. Elec. 516-921-8700
NC Raleigh, Allied Elctrns. Inc. 919-876-5845
NC Raleigh, Southeastern Elctrns. 919-828-2311
OH Akron, Akron Elect. Supp. Inc. 216-762-8818
OH Cincinnati, United Radio Inc. 513-761-4030
OH Cleveland, Pioneer Stand. Elec. 216-587-3600
OH Columbus, Hughes Peters Co. 614-294-5351
OH Dayton, Pioneer-Dayton 513-236-9900
OH Dayton, Stotts-Friedman Co. 513-298-5555
OK Tulsa, Radio Inc. 918-587-9123
OR Beaverton, Almac Elctrns. 503-629-8090
OR Beaverton, Norvac Elctrns. 503-644-1025
OR Portland, Radar Elec. Co. 503-232-3404
PA Drexel Hill, Kass Elctrn. Dist. 215-449-2300
PA Harrisburg, Cumberland Elect. Inc. 717-232-9715
PA McKean, Advacom, Inc. 814-476-7774
PA Philadelphia, Powell Elctrns. 215-365-1900
PA Philadelphia, Powell Elctrns. Inc. 215-365-1900
PA Reading, Barbey Elctrns. 215-376-7451
PA Willow Grove, RESCO Elctrns. 215-659-4575
PA York, Elctrn. Comps. For Ind. (ECI) 717-846-5334
SC Columbia, Dixie Elctrns. 803-779-5332
TN Memphis, Bluff City Elctrns. 901-345-9500
TN Nashville, Carlton Bates 615-244-3562
TX Austin, Whlsle. Elctrns. 512-478-4568
TX Dallas, Harrison Equip. Co., Inc. 214-239-2750
TX Dallas, Off-the-Shelf Comps. 214-247-0052
TX Dallas, Whlsle. Elect. Supp. 214-824-3001
TX El Paso, Ideal Indl. Elec. 915-779-6647
TX El Paso, Intl. Elctrns. 915-598-3406
TX Ft. Worth, Allied Elctrns. 817-336-5401
TX Ft. Worth, Whlsle. Elctrns. 817-336-0461
TX Garland, Newark Elctrns. 214-494-5911
TX Houston, Newark Elctrns. 713-782-4800
TX Irving, Powell Elctrns. 214-550-0547
TX Mansfield, Mouser Elctrns. 817-483-4422
TX Richardson, Off-the-Shelf Comps. 214-238-0808
TX Stafford, Harrison Equip. Co. 713-879-2600
UT Salt Lake City, Kimball Elctrns. Inc. 801-328-2075
UT Salt Lake City, Stand. Supp. 801-486-3371
VA Arlington, Arlington Elec. Whlslrs. 703-524-2412
VA Norfolk, Priest Elctrns. 804-855-0105
WA Bellevue, Almac Elctrns. 206-643-9992
WA Seattle, Radar Elec. Co. 206-282-2511
WA Spokane, Almac Elctrns. 509-924-9500
WA Spokane, Radar Elctrns. 509-747-3053
WI Milwaukee, Indl. Elctrns. 414-276-1212
WI Milwaukee, Marsh Elctrns. 414-475-6000

VECTOR ELECTRONIC CO., SOLERWRAP OF CALIFORNIA, INC., 12460 Gladstone Ave., Sylmar, CA 91342, Tel: 818-365-9661, FAX: 818-365-5718; Empl.: 95 ..... **C•1119, 1736-1737, 1740-1742**

VECTRONICS MICROWAVE CORP., 113 Lincoln Blvd., Middlesex, NJ 08846, Tel: 201-356-2377, TELEX: 833560; FSC No.: 32846; Empl.: 51; *Sls. Mgr.:* John G. Vogler

VECTRON LABORATORIES, INC., 166 Glover Ave., Norwalk, CT 06850, Tel: 203-853-4433, TWX: 710-468-3796, FAX: 203-849-1423; FSC No.: 27802; Empl.: 325; *Sls. Mgr.:* Larry Jawitz ..... **A•1480-1485**

Local Sales Offices & Reps

AL Huntsville, Saber Assocs. 800-327-0853
AZ Glendale, Fetty/Schoenduve 602-241-9009
CA El Segundo, Fetty/Schoenduve 213-322-4991
CA Mountain View, Fetty/Schoenduve ... 415-962-8330
CA San Diego, Fetty/Schoenduve 619-292-5136
CO Parker, Techn. Mktg. Assocs. 303-841-3435
CT Cheshire, Meco 800-225-3409
FL Melbourne, Saber Assocs. 800-432-6288
GA Norcross, Saber Assocs. 800-327-0853
IL Bannockburn, Heth, Inc. 312-295-8440
IN Greenwood, Valentine & Assocs. 317-888-2260
IN South Bend, Valentine & Assocs. 219-288-7070
IA Anamosa, WG Controls 319-462-3456
MO Independence, Engrg. Svcs. Co. 816-254-3600
MA Reading, Meco 617-944-6660
MI Detroit, R. P. Urban Assocs. 313-535-2355
MI Grand Rapids, R. P. Urban Assocs. ... 616-245-0511
MN Burnsville, Allied Comp. Reps. 612-435-7876
MO St. Louis, Engrg. Svcs. Co. 314-997-1515
NY Great Neck, F & F Metro 516-482-4080
NM Albuquerque, J. Smith & Assocs. 505-265-3406
NY Great Neck, F & F Metro 516-482-4080
NY Syracuse, T—Squared Elctrns. 315-463-8592
NC Clayton, Saber Assocs. 800-327-0853
OH Englewood, A. Nace Co. 513-836-0931
OH Richfield, A. Nace Co. 216-659-7178
PA Newtown Sq., SWR Tech., Inc. 215-353-6639
TX Dallas, Texas Avionics 214-437-5677
UT Salt Lake City, Techn. Mktg. Assocs. .. 801-943-5609
VA Alexandria, Tech-Reps 703-370-2600
WA Seattle, Datacom 206-285-2525
Can Montreal, Ont., Soquelec, Ltd. 514-482-6427
Can Nepean, Que., Soquelec, Ltd. 613-226-1696

VEECO INSTRUMENTS, INC., 830 Evelyn Ave., Sunnyvale, CA 94086, Tel: 408-733-3700, TWX: 910-339-9263; Empl.: 95; *Sls. Mgr.:* Fred Vanderlinde

VEECO INSTRUMENTS INC., Terminal Dr., Plainview, NY 11803, Tel: 516-349-8300; *Sls. Mgr.:* Robert Kase

VEECO INTEGRATED AUTOMATION, INC., Veeco Instruments Inc., 10480 Markison Rd., Dallas, TX 75238, Tel: 214-349-8482

VEEDER-ROOT, 70 Sargeant St., Hartford, CT 06102, Tel: 203-527-7201, FAX: 203-527-1479; Empl.: 1200; *Sls. Mgr.:* Alan Schoenhut; *Dist. Mgr.:* Alan Schoenhut

Local Sales Offices & Reps

CA N. Hollywood, Veeder-Root 818-503-0313
CA Pleasanton, Veeder-Root 415-846-3500
CT Hartford, Veeder-Root 203-527-7201
IL Chicago, Veeder-Root 312-774-1838
MI Ann Arbor, Veeder-Root 313-971-7555
MI Detroit, Veeder-Root 313-961-2353
MO Kansas City, Veeder-Root Co. 816-761-1717
OH Worthington, Veeder-Root 614-433-0028
PA Willow Grove, Veeder-Root 215-887-0708
SC Greenville, Veeder-Root 803-288-2133
TX Dallas, Veeder-Root 214-252-3360
Can Toronto, Ontario, Veeder-Root of Canada Ltd. 416-239-3094

FAX: 308-324-4985

VEETRONIX, INC., Sub. Reach Electronics, Box 480, Lexington, NE 68850, Tel: 308-324-4600; Empl.: 25; *Sls. Mgr.:* Eddie Howerter ..... **B•1806-1807**

VEGA PRECISION LABS., 800 Follin La., Vienna, VA 22180, Tel: 703-938-6300, TELEX: 89-2521; FSC No.: 23115; Empl.: 350; *Sls. Mgr.:* Joe E. Bennett

VEKTREX ELECTRONIC SYSTEMS, INC., P.O. Box 490, Imperial Bch., CA 92032, Tel: 619-575-8181; Empl.: 5

VELMEX, INC., P. O. Box 38, East Bloomfield, NY 14443, Tel: 716-657-6151, 800-642-6446, FAX: 716-657-6153; Empl.: 30; *Sls. Mgr.:* R. Yurick

VELONEX, 560 Robert Ave., Santa Clara, CA 95050, Tel: 408-727-7370, FAX: 408-727-7370; Empl.: 40; *Sls. Mgr.:* Kevin M. Coffey ..... **D•1340-1341, 1405**

Local Sales Offices & Reps

AZ Phoenix, Scientific Dvcs. 602-957-0401
CA Huntington Bch., Scientific Dvcs. 714-840-3501
CA San Diego, Scientific Dvcs. 619-268-4635
CA San Jose, Scientific Dvcs. 408-554-0455
CO Broomfield, Scientific Dvcs. 303-469-5145
CT Plainview, Addelco Corp. 203-747-9464
FL Melbourne, Saber 800-432-6288
GA Lawrenceville, Saber 800-327-0853
HI Honolulu, Scientific Dvcs. 714-840-3501
IL Schaumburg, K. W. Meyers Co. 312-882-4808
IN Indianapolis, K. W. Meyers Co. 317-783-1030
IA Cedar Rapids, K. W. Meyers Co. 319-363-8987
LA Gurley, Saber 800-327-0853
MA Needham, Addelco Corp. 617-444-4754
MN Minneapolis, R. W. Meyers Co. 612-920-7080
NM Albuquerque, Scientific Dvcs. 505-293-3494
NC Clayton, Saber 919-553-5564
OH Medina, McShane, Inc. 216-725-4568
WA Redmond, Scientific Dvcs. 206-885-0004
WI Brookfield, K. W. Meyers Co. 414-784-3790
Can Downview, Ont., Electrodesign Ltd. 416-665-4405
Can Lachine, Que., Electrodesign Ltd. 514-636-4838
Can Nepean, Ont., Electrodesign Ltd. 613-727-5220
Can Vancouver, BC, Interworld Elec. 604-984-4171

VEMALINE PRODS. DIV., 333 Strawberry Field Rd., P.O. Box 6979, Warwick, RI 02887, Tel: 401-739-7600, FAX: 401-732-6119; FSC No.: 08730; *Sls. Mgr.:* Paul Vamvaketis

VENABLE INDUSTRIES, INC., 3555 Lomita Blvd., Torrance, CA 90505, Tel: 213-539-2522, TELEX: 752421; Empl.: 20; *Sls. Mgr.:* Shelly Scott

VENT RAK, See General Devices

VENUS
SCIENTIFIC, INC.

FAX: 516-752-7976

VENUS SCIENTIFIC, INC., Ferranti, Dundee, 399 Smith St, Farmingdale, NY 11735, Tel: 516-293-4100, TWX: 510-224-6492; Empl.: 450; *Sls. Mgr.:* Peter Jazwinski ..... **D•2036-2037**

Local Sales Offices & Reps

AZ	Scottsdale, Venus Scientific Inc.	602-991-9684
CA	San Luis Obispo, Venus Sci., Inc.	805-528-2882
MA	Norwood, MPS Electronics Inc.	617-769-8700
NY	Hartsdale, Spectrum Sls.	914-472-8600
Can	Nepean, Ont., Subtec Ltd.	613-723-7720

VERMONT AUTOMATION CO., INC., 18 Morse Dr., Essex Junction, VT 05452, Tel: 802-879-7571; Empl.: 7; *Sls. Mgr.:* G. Cox

VERMONT PRECISION RESISTOR, Codeco Corp. of Vermont, West Hill Road, P.O. Box 1207, Stowe, VT 05672-1170, Tel: 802-253-8567, FAX: 802-253-8005; Empl.: 8 ..... **A•2038-2039**

VERMONT RESEARCH CORP., Precision Pk., N. Springfield, VT 05150, Tel: 802-886-2256, TWX: 710-363-6533; Empl.: 100; *Sls. Mgr.:* Richard Simmons

VERNITECH, 300 Marcus Blvd., Deer Pk., NY 11729, Tel: 516-586-5100, TWX: 510-227-6079; FSC No.: 30223; Empl.: 225 ..... **A•2103; B•1030, 1267, 1929**

Local Sales Offices & Reps

AZ	Fountain Hills, Halbar Assocs.	602-837-2464
CA	Glendale, Halbar Assocs.	213-246-8263
CA	Mtn. View, Westech Sls.	415-961-1422
CO	Wheat Ridge, Waugaman Assocs.	303-423-1020
CT	Cheshire, Selmark Assocs.	203-272-8764
FL	Orlando, MacKay Smith & Assocs.	305-423-4353
IL	Palatine, Technlg. Sls.	312-991-6600
MD	Baltimore, R.P. Luce & Co.	301-752-8200
MA	Millis, Selmark Assocs.	617-376-2914
MN	Minneapolis, Boerger & Assocs.	612-560-3435
MO	Bridgeton, Dytronix	314-731-5799
MO	Independence, Dytronix	816-373-6600
NH	Concord, Selmark Assocs.	603-623-5774
NY	Melville, Comtronic Engrg. Sls.	516-249-0505
NY	Syracuse, T-Squared Co.	315-463-8592
OH	Dayton, J. C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-241-4880
PA	Philadelphia, R.P. Luce & Co.	215-884-8365
PA	Pittsburgh, Dietrich & Assocs.	412-892-2992
TX	Bellaire, Seaton Corp.	713-731-2649
TX	Dallas, Seaton Corp.	214-380-0414
UT	Salt Lake City, Waugaman Assocs.	801-261-0802
VA	Powhatan, R.P. Luce & Co.	804-598-4804
WA	Mukilteo, Krippner & Assocs.	206-743-3579

VERNITRON CONTROLS, Vernitron Corporation, 1601 Precision Park La., San Diego, CA 92073, Tel: 619-428-5581, TWX: 910-322-1862, FAX: 619-428-5090; FSC No.: 10112; Empl.: 200; *Sls. Mgr.:* R. Campbell ..... **B•1268**

Local Sales Offices & Reps

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CT	North Haven, Kitchen & Kutchin	203-239-0212
FL	Madeira Beach, Mackay, Smith & Assocs., Inc.	813-393-7144
FL	Orlando, Mackay Smith & Assocs.	305-423-4353
GA	Dunwood, Ken Raby	404-396-5848
IL	Palentine, Technology Sls.	312-991-6600
MA	Burlington, Kitchen & Kutchin	617-229-2660
MO	St. Louis, Rush & West	314-965-3332
NJ	Cherry Hill, Lanson Assocs.	609-424-4670
NY	Jericho, Metro Tech. Sls.	516-935-3330
NY	Syracuse, T-Squared Elctrns., Inc.	315-463-8592
NY	Victor, T-Squared Elctrns., Inc.	716-924-9101
OH	Dayton, Rixan Assocs.	513-222-0011
OK	Tulsa, Norcom, Inc.	918-832-7747
TX	Austin, Norcom, Inc.	512-451-2757
TX	Dallas, Norcom, Inc.	214-386-4888
TX	Houston, Norcom, Inc.	713-778-0392
TX	San Antonio, Norcom, Inc.	512-680-4513
UT	Salt Lake City, Waugaman Assocs.	801-261-0802
VA	Fredericksburg, Vernitron	703-752-4499

VERNITRON ELEC. COMPS., See Beau Prods. Div.

VERNITRON PIEZOELECTRIC DIV., 232 Forbes Rd, Bedford, OH 44146-5478, Tel: 216-232-8600, TWX: 810-427-2274, FAX: 216-232-8731; Empl.: 100; *Sls. Mgr.:* James Honvath ..... **A•1487**

Local Sales Offices & Reps

FL	Orlando, B & M Sls.	305-855-2455
IL	Des Plaines, ESCO Assoc.	312-298-5310

VERSACAD CORPORATION, Prime Computer, Inc., 2124 Main St., Huntington Bch., CA 92648, Tel: 714-960-7720, TWX: 510-101-1759 TWINC UD; Empl.: 85; *Sls. Mgr.:* Glenn Johnson; *Dist. Mgr.:* Glenn Johnson

VERSALOGIC, 3888 Stewart Rd., Eugene, OR 97402, Tel: 503-485-8575, FAX: 503-485-5712

VERTEX COMPUTER CABLE & PRODUCTS, 61 Executive Blvd., Farmingdale, NY 11735, Tel: 516-293-1610, TELEX: 14-3155, TWX: VERTEX FDLE; FSC No.: 6T500; Empl.: 250; *Sls. Mgr.:* M. Scanzano; *Dist. Mgr.:* Penny Shaw

VERTEX INDUSTRIES, INC., P. O. Box 996, 23 Carol St., Clifton, NJ 07014, Tel: 201-472-1331, TWX: 710-989-7021, FAX: 201-472-0814; Empl.: 85; *Sls. Mgr.:* Ron Byer

VERTOX CO., 10022 Imperial Ave. E , Garden Grove, CA 92643, Tel: 714-530-4541, TELEX: 678401 TAB IRIN; FSC No.: 53688; Empl.: 12; *Sls. Mgr.:* Steve Hacker; *Dist. Mgr.:* Steve Hacker

VESTA TECHNOLOGY, INC., 7100 W. 44th Ave. Ste. 101, Wheat Ridge, CO 80033, Tel: 303-422-8088, FAX: 303-422-9800; Empl.: 6

VIABLE SYSTEMS INC., Box 116, Sherborn, MA 01770, Tel: 617-653-7665, TELEX: 922 495 VIABLEUS, FAX: 617-653-7665; Empl.: 30

VIA WEST INC., 534 N. Stone Ave., Tucson, AZ 85705, Tel: 602-623-5716, TELEX: 333089 VIA WEST UD; Empl.: 25; *Sls. Mgr.:* David C. Troupe

VIBRAC, 1 Columbia Dr., Amherst, NH 03031, Tel: 603-882-6777, TELEX: 312698 VIBRAC; Empl.: 50; *Sls. Mgr.:* R. Searle

VIBRA-METRICS, INC., 1014 Sherman Ave., Hamden, CT 06514, Tel: 203-288-6158, 1-800-352-2001, TWX: 710-465-0169, FAX: 203-288-4937; Empl.: 25; *Sls. Mgr.:* Tom Golden ..... **B•1930**

Local Sales Offices & Reps

CA	Canoga Pk., FLW	818-719-0037
CA	Carlsbad, FLW	619-434-5251
CA	Costa Mesa, FLW	714-751-7521
CA	Hayward, FLW	415-786-9070
CO	Parker, Heritage Chem. Co.	303-690-0589
CT	North Haven, International Div.	203-288-1638
CT	Wallingford, Pat Jenks Assocs.	203-265-9939
FL	Ft. Lauderdale, EDC	305-974-2500
IL	Carpentersville, Precision Meas. Prods.	312-426-4446
MA	Danvers, Pat Jenks Assocs.	617-777-5600
MI	Southfield, Comtel Instrs.	313-358-2505
NJ	Martinsville, Blejwas Assocs.	201-221-1440
NJ	Martinsville, Blejwas Assocs.	201-221-1772
NY	Baldwinsville, Oshex Assocs., Inc.	315-635-6027
NC	Raleigh, Lee-Carolinas	919-848-8818
OH	Cleveland, Comtel Instrs.	216-442-0000
OH	Cleveland, Comtel Instrs.	216-442-0444
OH	Dayton, Comtel Instrs.	513-426-5310
OH	Hilliard, Comtel Instrs.	614-876-8305
PA	Philadelphia, MetraSystems	215-247-7347
PA	Pittsburgh, Comtel Instrs.	412-922-5720
TN	Chattanooga, Pump & Vibration Consits.	404-935-5851
TX	Argyle, MilesTek	817-455-7444
TX	Houston, Techsas, Inc.	713-589-2323
UT	W. American Fork, Highland Tech. Mktg.	801-756-2634
UT	West American Fork, Highland Tech. Mktg.	801-756-3744
WI	New Berlin, Comtel -Midwest	414-544-6042
EXP	New Haven, CT, Masten Wright	203-288-1638
Can	Ile Perrot, Que., Dalimar	514-453-0033
Can	N. Vancouver, B.C., Interworld Elctrns.	604-984-4171
Can	Rexdale, Ont., SRP Control Sys. Ltd.	416-746-0117

VIBRATION INSTRUMENTS CO., 1614 Orangethorpe Way, Anaheim, CA 92801, Tel: 714-879-6085, TELEX: 692433; FSC No.: 32102; Empl.: 35; *Sls. Mgr.:* Fritz Egger

VIBRO-METER CORP., 1 Progress Rd., Billerica, MA 01822-5058, Tel: 617-663-7322, TELEX: 948145, TWX: 710-320-1872; FSC No.: 617-667-1944; Empl.: 50; *Sls. Mgr.:* John Snow

VICKERS INSTRUMENTS, INC., Vickers America (Holdings), Inc., 800 W. Cummings Pk., Ste. 1900, Woburn, MA 01801, Tel: 617-932-3800, TELEX: 949913; Empl.: 20; *Sls. Mgr.:* Phill Truckle

VICOM SYSTEMS, INC., 2520 Junction Avenue, San Jose, CA 95134, Tel: 408-946-5660, TELEX: 171-603; Empl.: 65; *Sls. Mgr.:* N. Carlson

VICON INDUSTRIES, INC., 525 Broad Hollow Rd., Melville, NY 11747, Tel: 516-293-2200, TELEX: 144581, FAX: 516-293-2627; Empl.: 284; *Sls. Mgr.:* Carol Ryan; *Dist. Mgr.:* Carol Ryan

VICTOREEN, INC., A Sheller-Globe Corp. Subsidiary, 6000 Cochran Rd., Solon, OH 44139, Tel: 216-248-9300, TWX: 810-421-8287, FAX: 216-248-9301 ..... **A•2040-2045**

Local Sales Offices & Reps

AZ	Tempe, Ele-Comm Assocs.	602-844-0566
MA	Newton, Victoreen, Inc.	617-964-2226
WA	Edmond, EDCO Sls.	206-776-8922

VICTOR ELEC. WIRE & CABLE, 618 Main St., W. Warwick, RI 02893, Tel: 401-821-1700, SALES 401-821-7800, TELEX: 952122, TWX: 710-382-1534, FAX: 401-828-0441; Empl.: 900; *Sls. Mgr.:* E. M. Colasanto

VICTOR WIRE & CABLE CORP., 3601 Holdrege Ave., Los Angeles, CA 90016, Tel: 213-870-9933; Empl.: 30

VICTORY ENGINEERING CORP., Victory Rd., Springfield, NJ 07081, Tel: 201-379-5900, TWX: 710-983-4430; Empl.: 150; *Sls. Mgr.:* J. Bacek

VIDAIRE ELECTRONICS MFG. CORP., 54 Nancy St., W. Babylon, NY 11704, Tel: 516-491-1826; Empl.: 20

VIDCO, 8029 S.W. Cirrus Dr., Beaverton, OR 97005, Tel: 503-641-1804, FAX: 503-641-1806; Empl.: 10; *Sls. Mgr.:* Bradley Cohen

VIDEO AUTOMATION SYSTEMS, Upper Shad Rd., Pound Ridge, NY 10576, Tel: 914-764-4613; Empl.: 5

VIDEO LOGIC CORP., 1294 Lawrence Station Rd., Sunnyvale, CA 94086, Tel: 408-745-0933, TELEX: 35-7400

VIDEO MONITORS, INC., Dotronix, Inc., 3833 N. White Ave., Eau Claire, WI 54703, Tel: 715-834-7785, TELEX: 510-100-1880, FAX: 715-834-5672; Empl.: 190; *Sls. Mgr.:* L. Stewart

VIKING CASES, 10480 Oak St. N.E., St. Petersburg, FL 33702, Tel: 813-577-1216; *Sls. Mgr.:* Jeff Shacter

VIKING CONNETORS CO., Criton Technologies, 21001 Nordhoff St, P.O. Box 2379, Chatsworth, CA 91311, Tel: 818-341-4330, TWX: 910-494-2094; FSC No.: 05574; Empl.: 375; *Sls. Mgr.:* Dale Horton

VIKING ELECTRONICS, Industrial St., Hudson, WI 54016, Tel: 715-386-8861; Empl.: 24; *Sls. Mgr.:* Roy Crist

VIKING INDUSTRIAL PRODUCTS, 729 Farm Rd., Marlboro, MA 01752, Tel: 617-481-4600; Empl.: 20; *Sls. Mgr.:* Aubrey Elms

VIRGINIA PANEL, 1400 New Hope Rd., Waynesboro, VA 22980, Tel: 703-949-8376, FAX: 703-942-2856; Empl.: 225; *Sls. Mgr.:* Jeff Stowers

FAX: 703-985-3848

VIRGINIA PLASTICS CO., P.O. Box 4577, Roanoke, VA 24015-0577, Tel: 703-985-3811, TWX: 710-870-0440; FSC No.: 59608; Empl.: 130; *Sls. Mgr.:* Dee Goode; *Dist. Mgr.:* Sharon Hancock ..... **C•1584-1587, 1908-1909**

Local Sales Offices & Reps

CA	Santa Clara, Penmark Sls. Co.	408-980-1303
CO	Denver, Lindberg Co.	303-758-9033
CT	Middletown, Gerber Sls.	203-347-3000
FL	Lighthouse Pt., Mr. Charles J. Kerns	305-785-6362
IL	Wheaton, Chadra-Schilke	312-653-8126
MD	Gaithersburg, Carwithen Assocs.	301-921-9545
MA	Waltham, Gerber Sls.	617-890-3334
MI	Livonia, Engrg. & Mktg. Svcs. Co.	313-522-9465
MN	Minneapolis, Northstar Comps., Inc.	612-553-1888
NJ	Cranbury, Kay Sls. Assocs.	609-655-3778
NY	Buffalo, NRM Mktg. Grp.	716-634-4300
NY	Skaneateles, NRM Mktg. Grp.	315-685-8991
NY	Spencerport, NRM Mktg. Grp.	716-352-9166
NC	Carrboro, Triangle Comp. Sls.	919-929-3758
NC	Conover, Sonrise Technlgs.	704-464-6633
OK	Bixby, MGR Elctrns.	918-369-5186
OH	Cincinnati, Makin & Assocs.	513-871-2524
OH	Cleveland, Makin & Assocs.	216-248-7370
OH	Columbus, Makin & Assocs.	614-848-5424
OR	Portland, SPS Elctrns.	503-297-6919
PA	Harrison City, NRM Mktg. Grp.	412-327-0858
TX	Austin, MGR Elctrns.	512-250-0926
TX	Dallas, MGR Elctrns., Inc.	214-238-5246
UT	Salt Lake City, Lindberg Co.	801-277-2643
WA	Redmond, SPS Elctrns.	206-323-4140
Can	Toronto, Ont., Tiemkay, Inc.	416-736-1221

Local Distributors

CA	Granada Hills, Acort Inds.	818-368-4474
MN	Minneapolis, K & H Elctrn. Distrbg.	800-328-8515
NH	Manchester, Yankee Elctrn. Supp. Co.	800-221-1738

VIRTIS CO., Rte. 208, Gardiner, NY 12525, Tel: 914-255-5000, TELEX: 926474; Empl.: 92; *Sls. Mgr.:* J. D. Schmidt

VISHAY-MANN SYSTEM, See Vishay Resistive Systems Group

VISHAY

FAX: 215-640-9081

VISHAY RESISTIVE SYSTEMS GROUP, 63 Lincoln Hwy., Malvern, PA 19355, Tel: 215-644-1300, TWX: 510-668-8944; Empl.: 500; *Dist. Mgr.:* Iris Demeritt ..... **A•2046-2051, 2105**

Local Sales Offices & Reps

AL	Huntsville, JWL Assocs.	205-883-1712
AZ	Phoenix, Howe & Howe	602-264-7971
CA	Los Alamitos, Reed Elctrns.	213-598-6676
CA	Redwood City, James S. Heaton Co.	415-367-9000
CA	San Diego, Vishay Res. Sys. Grp.	619-690-5112
CO	Englewood, Comps. Sls. Inc.	303-779-8060
CT	Wallingford, Comp Rep Assocs.	203-269-1145
FL	Altamonte Springs, Semtronic Assocs.	305-831-8233
FL	Clearwater, Semtronic Assocs.	813-461-4675
FL	Ft. Lauderdale, Semtronic Assocs.	305-731-2484
GA	Atlanta, JWL Assocs.	404-320-7643
ID	Boise, N. R. Schultz Co.	208-377-8686
IL	Rolling Meadows, Eagle Tech. Sls.	312-991-0700
IN	Carmel, Shamrock Elctrn. Sls.	317-848-5265
KS	Olathe, Technical Sls. Assocs.	913-829-2800
MD	Lutherville, J. A. Dougherty Sls. Co.	301-321-7890
MA	Westwood, Comp Rep Assocs.	617-329-3454
MI	Plymouth, Jay Mktg. Assocs.	313-459-1200
MO	St. Louis, Technical Sls. Assocs.	314-521-2044
NJ	Flanders, K & R Engrg. Sls. Co.	201-584-5235
NM	Albuquerque, Nelco Electronix	505-293-1399
NY	Rochester, L-Mar Assocs.	716-381-9100
NC	Charlotte, JWL Assocs.	704-541-5750
NC	Raleigh, JWL Assocs.	919-787-4826
OH	Aurora, EMA, Inc.	216-562-6104
OH	Centerville, EMA, Inc.	513-433-2800
OR	Beaverton, N. R. Schultz Co.	503-643-1644
PA	Horsham, TMI	215-441-4300
PA	Malvern, Vishay Resistive Sys. Grp.	215-644-1300
TX	Dallas, Edward F. Aymond Co.	214-826-7620
TX	Houston, Vishay Resistive Sys. Grp.	713-550-0568
UT	Salt Lake City, Harris/CSI	801-974-5155
WA	Bellevue, N. R. Schultz Co.	206-454-0300
PR	Caguas, Comp Rep Assocs.	809-746-6550

Local Distributors

AZ	Tempe, Shelley-Ragon, Inc.	602-894-2058
AZ	Tempe, TTI, Inc.	602-431-1191
CA	Chatsworth, Petell/Passive Comps. Inc.	818-341-1745,805-583-3210
CA	Chatsworth, Petell/Passive Comps. Inc.	818-700-8838
CA	Chatsworth, Shelley-Ragon, Inc.	818-998-3333
CA	Chatsworth, TTI, Inc.	818-709-1010
CA	Milipitas, TTI, Inc.	408-946-5577
CA	San Diego, Shelley-Ragon, Inc.	619-453-7133
CA	San Diego, TTI, Inc.	619-587-4888
CA	San Jose, Shelley-Ragon, Inc.	408-432-0600
CO	Denver, TTI, Inc.	303-429-6806
CO	Englewood, Shelley-Ragon, Inc.	303-762-0670
FL	Orlando, TTI, Inc.	305-859-1000
CT	Stratford, TTI, Inc.	203-375-1400
FL	Tampa, Impala Elctrns., Inc.	813-885-4747, 800-237-7777
FL	Tampa, Shelley-Ragon, Inc.	813-623-6560
GA	Norcross, TTI, Inc.	404-662-0911
ID	Coer d'Alene, A-I Elctrns.	208-765-3280
IL	Lombard, Shelley-Ragon, Inc.	312-629-8833
IL	Palatine, Ohm Elctrns.	312-359-5500
IA	Cedar Rapids, Shelley-Ragon, Inc.	319-373-0525
MD	Baltimore, RESCO/Baltimore	301-529-0500, 800-638-1242
MD	Beltsville, RESCO/Washington	301-937-9100
MA	Wilmington, TTI, Inc.	617-658-4700
MN	Eden Prairie, TTI, Inc.	612-944-5080
MN	St. Paul, Shelley-Ragon, Inc.	612-642-2823
MO	Hazlewood, Shelley-Ragon, Inc.	314-454-0480
MO	Independence, Shelley-Ragon, Inc.	816-254-3410
NJ	Flanders, VKR Svcs., Inc.	201-584-5393, 800-454-9767
NJ	Mt. Laurel, TTI Inc.	609-234-6400
NY	Bohemia, Shelley-Ragon, Inc.	516-567-7751
NY	Farmingdale, Command Elctrns. Corp.	516-293-1212
NY	Hauppauge, Mast Distrs., Inc.	516-273-4422
NY	Ronkonkoma, TTI, Inc.	516-737-2000
NY	Valley Stream, L & S Elctrns.	516-561-2474
OH	Cleveland, Specialized Comps. Sls.	216-464-0405
OH	Dayton, Micro Mil Div.	513-434-8231
OH	Worthington, TTI, Inc.	614-848-5770
PA	Malvern, Vishay Resistive Sys. Grp.	215-644-1300
TX	Fort Worth, TTI, Inc.	817-595-3100
TX	Houston, Texas Comp. Corp.	713-468-3882
TX	Redmond, Shelley-Ragon, Inc.	214-349-2424
WA	Redmond, Shelley-Ragon	206-883-2220
WA	Redmond, TTI, Inc.	206-882-0291
Can	Que., Kaytronics, Inc.	514-745-5800

VISIONARY ELECTRONICS, 141 Parker Avenue, San Francisco, CA 94118, Tel: 415-751-8811

VISION ENGINEERING, INC., 570 Danbury Rd., New Milford, CT 06776, Tel: 203-355-3776, TELEX: 643769; Empl.: 15; *Sls. Mgr.:* John Clery

VISIONICS CORPORATION, 343 Gibraltar Dr., Sunnyvale, CA 94089, Tel: 408-745-1551, TELEX: 346352, FAX: 408-734-9012; *Sls. Mgr.:* Alex Wellins .... **D•1118**

VISTAR CORP., 13740 McCormick Dr., Tampa, FL 33626, Tel: 813-855-6611, TELEX: 522434; Empl.: 25; *Sls. Mgr.:* Ron Rooks; *Dist. Mgr.:* Ron Rooks

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VISUAL COMMUNICATIONS CO., INC., 7920 Arjons Dr., Ste. G, San Diego, CA 92126, Tel: 619-549-6900; Empl.: 9; *Sls. Mgr.:* J. Savage ..... **B•1099-1101**

Local Sales Offices & Reps

AL	Huntsville, Remco	205-553-3763
AZ	Phoenix, Bob Anderson Co.	602-266-2070
CA	Mountain View, Westech Sls.	415-961-1422
CA	San Diego, Harvey King, Inc.	619-587-9300
CA	Torrance, Assoc Reps.	213-328-6708
FL	Boca Raton, Beacon Elctrns.	305-392-3500
GA	Atlanta, Remco	404-447-6937
IL	Elmhurst, Utronix Sls.	312-834-1100
MA	Sharon, Adcour	617-784-8123
MI	Brighton, Michigan Mktg. & Sls.	313-229-6218
MN	Eden Prairie, Bohlig & Assocs.	612-944-8404
NJ	Whippany, Robert Smith Assocs.	201-540-0204
NY	Plainview, Robert Smith Assocs.	516-681-3155
NC	Raleigh, Remco	919-787-2112
OH	Worthington, Dynel Co.	614-436-9452
OR	Portland, Electronic Mktg. Grp.	503-684-5935
PA	Penndel, Rayco Sls.	215-757-1899
VA	Forest, Beacon North	804-239-8486
VA	Sterling, Beacon No.	703-591-1300
WA	Redmond, Elctrn. Mktg. Grp.	206-882-0962
EXP	CT, Litchfield, Intrade	203-567-5901

Local Distributors

AL	Huntsville, Component Distr.	205-883-7501
AZ	Tempe, Anjon Entprs.	602-894-1332
AR	Little Rock, Component Distr.	501-227-6278
CA	Costa Mesa, Orange County Comps.	714-979-3597
CA	Los Angeles, Electric Switch	213-660-1310
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Torrance, WBC Electro Supp.	213-328-6871
CO	Englewood, Industrial Elctrns. Inc.	303-694-9444
FL	Ft. Lauderdale, Component Distr.	305-971-4950
GA	Norcross, Component Distrs.	404-441-3320
MA	Lynn, Land Elctrn. Supp.	617-592-2220
MI	Grand Rapids, S. F. Elctrns. Supp.	616-459-0216
MN	New Brighton, Chris Elctrn. Distr.	612-631-2647
NJ	Bellmawr, Midatlantic Elctrns.	609-931-5303
NY	Elmsford, Ancar Elctrn. Supp.	914-592-7100
NC	Raleigh, Component Distr.	919-834-9465
OH	Aurora, IPD	216-562-8113
OH	Centerville, IPD	513-435-2086
TX	Farmers Bch., Force Elctrns.	214-247-9955
TX	Houston, Force Elctrns.	713-772-8483
VA	Falls Church, Component Distr.	703-241-8227
WA	Redmond, Paccom	206-883-9200
WA	Redmond, Priebe Elctrns.	206-881-2363
EXP	CT, Litchfield, Intrade	203-567-5901

VISUAL INFORMATION INSTITUTE, Box 33, Xenia, OH 45385-0033, Tel: 513-376-4361, TELEX: 501031 VIS INFO INST; FSC No.: 27432; Empl.: 45

VITEC

FAX: 209-739-7634

VITEC ELECTRONIC CORPORATION, 1525A East Acequia, Visalia, CA 93291, Tel: 209-739-1077, TELEX: 4972623 VITEC ..... **A•2435-2439**

Local Sales Offices & Reps

AL	Huntsville, EPi Inc.	205-534-3747
AZ	Tempe, Techni Source Inc.	602-730-8093
CA	San Diego, Miners & Assocs.	619-566-9891
CA	Visalia, Vitec Elctrns. Corp.	209-739-1077
DC	McLean, Jin Sung Hsia	703-734-1739
FL	Longwood, SAM Reps. Inc.	305-869-0097
GA	Atlanta, Elctrns. Mktg. Assocs.	404-448-1215
IL	Addison, Baldwin Sls. Assocs., Inc.	312-279-0352
KS	Overland Pk., EPi Inc.	913-642-9118
MN	Minneapolis, HMR Inc.	612-888-2122
MS	Jackson, EPi Inc.	601-856-6251
MO	St. Louis, EPi Inc.	314-962-1411
NM	Albuquerque, Techni Source Inc.	505-268-4232
NC	Raleigh, Elctrn. Mktg. Assocs.	919-847-8800
OH	Beachwood, Elctrn. Sls. Master Inc.	216-831-9555
SC	Greenville, Elctrn. Mktg. Assocs.	803-233-4637
WA	Seattle, Evergreen Mktg. Inc.	206-633-3160

Local Distributors

CA	Costa Mesa, E.E.P. Corp.	714-549-2275
CA	Irvine, Schweber Elctrns.	714-863-0261
CA	Santa Clara, Wyle Labs.	408-727-2500
CT	Danbury, Hamilton Avnet	203-797-2842
FL	Oakland Pk., Zelcon, Inc.	305-565-2555
GA	Norcross, Hamilton Avnet	404-447-7500
IL	Northbrook, Classic Comps. Supp., Inc.	312-272-9650
IL	Palatine, OHM Elctrns.	312-359-5500
IL	Rosemont, Advent Elctrns.	312-297-6200
IN	Indianapolis, Bell Inds.	317-875-8200
IA	Cedar Rapids, Dee Elctrns., Inc.	319-365-7551
KY	Louisville, Peerless Elctrn. Equip.	502-637-7674
ME	N. Adams, ICO-Rally Corp.	413-664-4951

MI Farmington Hills, Advent Elctrns. 313-477-1650
MI Livonia, RS Elctrns. 313-525-1155
MN N. Adams, Elctrn. Supp. Ctr. 413-664-1086
NJ Kenilworth, Federated Purchaser, Inc. 201-272-0505
NY Binghamton, Pioneer-Standard Elctrns., Inc. 607-722-9300
NY Buffalo, Summit Dists., Inc. 716-884-3450
NY Elmsford, Ancar Elctrns. 914-592-7100
NY Mamorneck, New Yorker Elctrns. 914-698-7600
NY Rome, Rome Elctrns. 315-337-5400
NY Ronkonkoma, M-Tron Comps., Inc. 516-467-5100
NY Westbury, Schweber Elctrns. 516-334-7474
NC Charlotte, Dixie Elctrns. 704-377-5413
NC Winston-Salem, Dixie Elctrns. 919-724-5961
OH Cleveland, Pioneer-Standard Elctrns., Inc. 216-587-3600
OH Dayton, Hamilton Avnet 513-439-6700
OH Dayton, Stotts-Friedman 513-298-5555
OK Tulsa, Radio, Inc. 918-587-9123
PA Bristol, Aim Elctrns. 215-785-3500
PA McKean, Advacom, Inc. 814-476-7774
PA Philadelphia, Almo Elctrns. Corp. 215-698-4000
SC Columbia, Dixie Elctrns. 803-779-5332
WI Milwaukee, Marsh Elctrns. 414-475-6000
WI New Berlin, Classic Comps. Supp. Inc. 414-786-5300
Can Burnaby, BC, RAE Indl. Elctrns. 604-291-8866

VITRAMON N.A., P. O. Box 544, Bridgeport, CT 06601, Tel: 203-268-6261, TWX: 710-450-3640; Empl.: 606; *Sls. Mgr.:* Paul Davis; *Dist. Mgr.:* S. Judt

VIZ METEOROLOGICAL INSTRUMENTS, 335 E. Price St., Philadelphia, PA 19144-5782, Tel: 215-844-2626, TWX: 710-670-2626; FSC No.: 41226; Empl.: 450; *Sls. Mgr.:* V. Scott Zelov; *Dist. Mgr.:* V. Scott Zelov

VIZ TEST EQUIPMENT, Kappa Networks Inc., 175 Commerce Drive, Ft. Washington, PA 19034, Tel: 215-643-6950, 1-800-523-3696, FAX: 215-643-5237; Empl.: 10; *Sls. Mgr.:* F. H. Tribolet; *Dist. Mgr.:* F. Menichello ..... **D•1342-1345**

Local Sales Offices & Reps

AR Little Rock, Leo Barker Co. 501-834-2537
CA Laguna Hills, English/Damco Sls. Assocs. 714-837-3801
CA San Francisco, Tech. Sls. Assocs. 415-467-1434
CO Denver, Mountain Reps. 303-623-0972
FL Ft. Lauderdale, UniRep, Inc. 305-587-7481
GA Roswell, Henry W. Phillips Co., Inc. 404-992-3070
IL Park Ridge, Bob Burns & Assocs., Inc. 312-775-1233
IN Bloomington, Reptronics 812-334-0383
MD Woodbine, DJC Elctrn. Sls. 301-795-7020
MA Milford, Jonel Sls. Assocs. 617-478-4650
MI Royal Oak, Hilltronics, Inc. 313-435-0920
MO Raytown, Marty Tarkski Sls. Co. 816-358-1442
NJ W. Orange, Applied Process Instrs., Inc. 201-325-2511
NY Grand Island, L. J. McTaggart Assocs. 716-773-9222
OR Portland, Joseph V. Belusko Co. 503-222-4279
PA Philadelphia, Instrmn. Specialties 215-742-0898
TX Dallas, Crockett Sls. Co. 214-350-3377
Can Ontario, H. W. Cowan Canada Ltd. 416-773-4331

Local Distributors

AL Birmingham, Forbes Distrs. 205-251-4104
CA Canoga Pk., Rag Elctrns., Inc. 818-998-6500
CA El Monte, Marshall Claude Michael ... 818-442-7204
CA Los Angeles, Metermaster, Inc. 213-685-4340
FL Orlando, Emsco/Hammond 305-849-6060
IL Chicago, Newark Elctrns. 312-784-5100
IL Niles, Joseph Elctrns. 312-297-4200
IN Indianapolis, Meunier Elctrn. Supp. 317-635-3511
MA Needham, You-Do-It Elctrns. 617-449-1005
MI Livonia, RS Elctrns. 313-525-1155
MN St. Louis Pk., Edtronics Co. 612-938-7541
MO St. Louis, Van Sickle Inc. 314-621-5000
NJ Clarksburg, Accutest 609-259-0460
NY Farmingdale, Kelvin Elctrns. 516-249-4646
NY Lindenhurst, RNJ Elctrns. Inc. 516-226-2700
NY New York, Omnitron Elctrns. 212-865-4900
NY Rochester, Transcat 716-458-4801
NC Raleigh, Southeastern Elctrns. 919-828-2311
OH Centerville, MCM Elctrns. 513-434-0031
OH Cleveland, Brodhead-Garrett 216-341-0248
PA Philadelphia, Sunshine Sci. 215-673-5600
TX Ft. Worth, Allied Elctrns. 817-336-5401
VA Richmond, Avec Elctrns. 804-359-6071
WI Milwaukee, E-M Instrs. 414-272-7799

FAX: 213-663-3711

VL ELECTRONICS, INC, 3171 Los Feliz Blvd. Suite 303, Los Angeles, CA 90039, Tel: 213-661-8883, TELEX: 62597050; FSC No.: 95-3896380; Empl.: 6; *Sls. Mgr.:* Christopher Sieh; *Dist. Mgr.:* Christopher Sieh ... **B•1103**

Local Sales Offices & Reps

CA Los Gatos, Luscombe Engrg. Co.-San Francisco 408-370-2020
CA Pasadena, Luscombe Engrg. 213-684-2000
CA San Diego, Luscombe Engrg. Co. 619-549-9699
CO Littleton, MRC 303-794-4684
CO Littleton, T.M.C. 303-723-0643
IN Indianapolis, S.T.B. & Assocs. 317-844-9227
IA Marion, A.E.M. Assocs. 319-377-1129
KS Olathe, A.E.M. Assocs. 913-764-1079
MD Baltimore, Eastern Elctrns. 301-256-4221
MA Canton, New England Elctrn. Sls. 617-828-4835
MO St. Louis, A.E.M. Assocs. 314-731-2246
NY E. Syracuse, Nycom Inc. 315-437-8343
OH Dayton, J. C. Hofstetter Co. 513-296-1010
OH Medina, Hoftstetter 216-241-4880
OR Portland, A/D 503-641-6469
PA Collegeville, H B Sys. 215-489-3256
PA Hickory, J. C. Hoffsetter 412-356-2305
TX Dallas, THT Sls. 214-783-1501
WA Bothell, A/D Elctrns. 206-481-8555
WI Colgate, Rep One 414-628-4016
Can Dorval, Que., Dosh-Dart Import Ltd. ... 514-636-1913
Can Toronto, Ont., Norgay Entprs., Ltd. 416-259-9663

Local Distributors

CA Los Angeles, VL Elctrns Inc. 213-661-8883
NC Raleigh, Eastern Elctrns. 919-876-7591

VLSI TECHNOLOGY, INC., 1109 McKay Dr., San Jose, CA 95131, Tel: 408-434-3000, TELEX: 278807; Empl.: 1,300; *Dist. Mgr.:* Frank Reynolds

VME MICROSYSTEMS INTL. CORP., 12090 South Memorial Pkwy., Huntsville, AL 35803-3308, Tel: 205-880-0444, FAX: 205-882-0859; *Sls. Mgr.:* Carl J. Leary

THE VOICE CONNECTION, 17835 Skypark Circle, Ste. C, Irvine, CA 92714, Tel: 714-261-2366; *Sls. Mgr.:* Sharla Cartwright

VOICE IDENTIFICATION, Box 714, Somerville, NJ 08876, Tel: 201-526-3408; Empl.: 7

FAX: 209-651-0740

VOLTAGE MULTIPLIERS, INC., 8711 W. Roosevelt Ave., Visalia, CA 93291, Tel: 209-651-1402, TELEX: 530484; FSC No.: 60211; Empl.: 85; *Sls. Mgr.:* Karen Spano ..... **A•2151**

FAX: 516-887-9869

VOLTAMPERE CORP., 146 Horton Ave., Lynbrook, NY 11563, Tel: 516-887-9443; FSC No.: 64196; Empl.: 30; *Sls. Mgr.:* Robert Pampin ..... **D•2038**

VOLTARC TUBES, 176 Linwood Ave., Fairfield, CT 06430. Tel: 203-255-2633, TELEX: 96-4337, FAX: 203-259-1194; Empl.: 180; *Sls. Mgr.:* Albert H. Katz

VOLTEX

VOLTEX, 3460 Great Neck Rd., Amityville, NY 11701, Tel: 516-842-2772; Empl.: 55; *Sls. Mgr.:* S. Vogel ..... **D•2039-2041**

Local Sales Offices & Reps

CA Santa Clara, R-C Elctrns. 408-988-0701
CT Washington, Tri-Com Assocs. 203-868-7027
MD Burtonsville, Bekr Inds., Inc. 301-421-1200
MA Burlington, Tri-Com Assocs. 617-272-8163

VOLTRONICS CORPORATION, West St., P.O. Box 476, E. Hanover, NJ 07936, Tel: 201-887-1517, TWX: 710-986-8253, FAX: 201-887-1517; FSC No.: 18736;Multiple; Empl.: 70; *Sls. Mgr.:* Richard J. Newman ..... **A•1185**

Local Sales Offices & Reps

AZ Glendale, Fetty/Schoenduve, Inc. 602-241-9009
CA El Segundo, Fetty/Schoenduve, Inc. .. 213-322-4991
CA Moorpark, Fetty/Schoenduve 805-251-3944
CA Mtn. View, Fetty/Schoenduve, Inc. 415-962-8330
CA San Diego, Fetty/Schoenduve, Inc. ... 619-292-5136
CO Boulder, Herb Bass Assocs. 303-530-7509
FL Lighthouse Pt., R. C. Simon & Co. 305-941-2757
IL Chicago, Technical Sls., Inc. 312-237-7210
KS Parker, S. W. Wollard Co. 913-898-6552
MA Malden, J. K. Assocs. 617-321-2922
MN St. Paul, Countryman Assocs. 612-645-9151
MO Lee's Summit, S. W. Wollard 816-578-4221
NY Melville, RF Elctrn. Sls. Grp. 516-420-8890
OH West Chester, J & B Sls. 513-874-0236
PA Camphill, Quick Response Tech. Sls. 717-936-9696
TX Dallas, Talo Prods., Inc. 214-644-6010
UT Bountiful, Herb Bass Assocs. 801-292-8991
VA Sterling, Beacon North Inc. 703-478-2480
WA Seattle, Datacom 206-285-2525
Can St. Laurent, Que., RF Microwave 514-335-2335

VONCO, INC., 22829 Heslip Drive, Novi, MI 48050, Tel: 313-977-0400, TELEX: 181450; FSC No.: 7J499; *Sls. Mgr.:* Larry Ragsdale

VOTAN, 4487 Technology Dr., Fremont, CA 94538, Tel: 415-490-7600; Empl.: 60; *Sls. Mgr.:* Robert Russo; *Dist. Mgr.:* Ron Williams

VOYAGER TECHNOLOGIES, INC., 2250 Cabot Blvd. W. Bldg. 40M, Langhorne, PA 19047, Tel: 215-750-0270; Empl.: 15; *Sls. Mgr.:* Roger J. Peirce

FAX: 813-347-7520

VRN INTERNATIONAL, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, Tel: 813-347-2181, TELEX: 6815306, TWX: 310-681-5306; FSC No.: 84048; Empl.: 400; *Sls. Mgr.:* R. Fielder; *Dist. Mgr.:* R. Fielder ..... **A•2107-2109; B•1031; D•1061**

Local Sales Offices & Reps

AL Huntsville, R. O. Whitesell & Assoc. ... 205-883-5110
AZ Phoenix, Shefler-Kahn 602-257-9015
CA Burlingame, Wm. J. Purdy Co. 415-347-7701
CA Campbell, Kottmeier Assocs. 408-371-8700
CO Englewood, Omega, Ltd. 303-762-1921
CT Farmington, R. Perron Co. 203-673-4825
FL Orlando, Cartwright & Bean 305-422-4531
IL Downers Grove, Circuit Sls. 312-833-2242
IN Fort Wayne, Ro Whitesell & Assocs. .. 219-432-5591
IN Indianpolis, Ro Whitesell & Assocs. ... 317-359-9283
IN Kokomo, Ro Whitesell & Assocs. 317-457-9127
KS Merriam, MTS 913-236-8557
KY Louisville, Ro Whitesell & Assocs. 502-426-7696
MI Grand Rapids, Ro Whitesell & Assocs. 616-942-5420
MI Southfield, Ro Whitesell & Assocs. 313-559-5454
MI St. Joseph, Ro Whitesell & Assocs. ... 616-983-7337
MN Minneapolis, PSI 612-944-8545
NM Albuquerque, Shefler-Kahn 505-345-3591
NY Great Neck, Mos Assocs. 516-487-3966
NY Syracuse, Pitronics 315-435-7346
OH Cincinnati, Ro Whitesell & Assocs. 513-521-2290
OH Cleveland, Ro Whitesell & Assocs. 216-447-9020

OH Columbus, Ro Whitesell & Assocs. ... 614-888-9396
OH Dayton, Ro Whitesell & Assocs. ... 513-298-9546
OK Tulsa, Comptech ... 918-622-7744
PA Lawrenceville, DVS ... 609-896-1112
PA Pittsburg, Ro Whitesell & Assocs. ... 412-963-6161
TX Arlington, Comptech ... 817-265-6007
UT Salt Lake City, Omega, Ltd. ... 801-277-8061
VA Charlottesville, LD Lowery ... 804-973-6672
Can Rexdale, Ont., Source Elec., Ltd. ... 613-592-5392

Local Distributors

AR Little Rock, Carlton-Bates ... 501-562-9100
CA Chatsworth, TTI ... 818-709-1010
CA San Diego, Shelley-Ragon ... 619-453-7133
CA San Fernando, Petell Elec. ... 213-365-9841
CA San Jose, Future ... 408-945-9100
CA San Jose, Shelley-Ragon ... 408-942-9111
CA Thousand Oaks, Bell Inds. ... 818-340-1940
CO Denver, Denver-Wintronics ... 303-431-7161
CO Lakewood, Acacia ... 303-232-2882
CT Bethel, Future ... 203-847-6442
CT Norwalk, Cobra Comps. ... 203-847-6442
CT Wallingford, Sager Elctrl. Supp. ... 203-265-4600
FL Clearwater, Future ... 813-441-4771
FL Ft. Lauderdale, NRC Elctrns. ... 305-772-4500
FL Orlando, TTI Inc. ... 305-849-1000
FL Tampa, Impala Elctrns. ... 813-885-4747
GA Norcross, TTI ... 404-662-0911
IL Lisle, Components Inc. ... 312-852-7707
IA Cedar Rapids, Dee Elctrns. ... 319-365-7551
MA Woburn, TTI Inc. ... 617-938-8800
MD Columbia, TTI ... 301-995-1331
MD Rockville, M S Elctrns. ... 301-340-6400
MA Framingham, NOW ... 617-872-5876
MA Hingham, Sager Elctrl. Supp. ... 617-749-6700
MA Westboro, Future ... 617-366-2400
MI Farmington Hills, Advent Elctrns. ... 313-477-1650
MN Eden Prarie, TTI ... 612-944-5080
MN Minneapolis, Aero-Space ... 612-884-4725
MO St. Louis, Olive ... 314-426-4500
NJ Berlin, GCI ... 609-768-6767
NJ East Hanover, State Elctrns. ... 201-887-2550
NJ Mt. Laurel, Future ... 609-778-7600
NJ New Brunswick, Brothers Elctrns. ... 201-238-2200
NJ Whippany, Tonar Ind. ... 201-884-1400
NM Albuquerque, Sterling ... 505-884-1900
NY Bohemia, TTI Inc ... 516-567-1500
NY Buffalo, Summit ... 716-887-2800
NY E. Syracuse, Add Elctrns. Corp. ... 315-437-0300
NY Farmingdale, Command Elctrns. Corp. ... 516-293-1212
NY Hauppauge, Fairmont Elec. Sls. ... 516-231-3313
NY Hauppauge, Jaco Elctrns. ... 516-273-5500
NY Huntington Station, Sherburn Elctrns. ... 516-231-4300
NY Liverpool, Future ... 315-451-2371
NY Valley Stream, L & S Elctrns. ... 516-561-2474
NC Charlotte, Elctrns. Mktg. ... 704-394-6195
NC Raleigh, Southeastern ... 919-828-2311
OH Columbus, Elctrns. Mktg. ... 614-299-4161
OH Dayton, Bell Micro-Mil ... 513-434-8231
OK Tulsa, Radio ... 918-587-9123
PA Braddock, Leff ... 412-351-5000
PA Montgomeryville, Pyttronic ... 215-643-2850
PA Philadelphia, PEI Genesis ... 215-568-7400
TX Ft. Worth, TTI Inc. ... 817-831-0441
TX Houston, Sterling ... 713-627-9800
TX Richardson, Altair ... 214-231-5166
UT Salt Lake City, Future ... 801-972-8489
VA Charlottesville, Virginia Radio ... 804-296-4184
WA Bellevue, Future ... 206-881-8199
WA Redmond, Priebe Elec. Inc. ... 206-881-2363
WI Milwaukee, Marsh Elctrns. ... 414-475-6000

VTM MICROWAVES, INC., 4975 W. 80 Ave., Westminster, CO 80030, Tel: 303-426-6866; FSC No.: 52474; Empl.: 15

V-TRON ELECTRONICS CORP., 10 Venus Way, P.O. Box 3297, S. Attleboro, MA 02703, Tel: 617-761-9100, FAX: 617-761-4727; Empl.: 250; *Sls. Mgr.:* Richard E. French

Local Sales Offices & Reps

CT Wallingford, Com-Sale ... 203-269-7964
MA Waltham, Com-Sale ... 617-890-0011
NH Manchester, Com-Sale ... 603-668-1440
NJ Haworth, Kay Sls. Assocs. ... 201-384-3261
TX Fort Worth, Diversified Comps. ... 817-249-5818
VA Portsmouth, FDB Sls. Corp. ... 804-484-3162

VU-DATA, 9180 Brown Deer Rd., San Diego, CA 92121, Tel: 619-452-7670, TWX: 910-335-1586, FAX: 619-452-2543; FSC No.: 34160; Empl.: 15; *Sls. Mgr.:* M. Knapp

WABASH ELECTRICAL COMPONENT GRP., See Kearney/Wabash Electrical Components

WABASH RELAY & ELECTRONICS, Kearney-National Company, First & Webster Streets, P.O. Box 708, Wabash, IN 46992, Tel: 219-563-2191, TWX: 810-290-2722, FAX: 219-563-1652; Empl.: 250; *Sls. Mgr.:* Bob Lunn ... **B•1610-1611**

Local Sales Offices & Reps

AL Huntsville, Hughes Assocs., Inc. ... 205-533-9108
AZ Fountain Hills, Halbar Assocs., INc. ... 602-837-2464
CA Glendale, Halbar ... 818-246-8263
CA San Mateo, Halbar ... 415-349-4700
CO Englewood, Computech ... 303-773-3981
FL Tampa, APM Assocs. ... 813-886-2457
GA Norcross, Hughes Assocs., Inc. ... 404-662-1587
IL Arlington Hgts., M. J. Petersen Assocs. ... 312-577-8200
IN Fort Wayne, M/S Sls. ... 219-436-3023
KS Lenexa, Midtec Assocs. ... 913-541-0505
MD Glen Burnie, Macrotech Assocs., Ltd. ... 301-766-1111
MA Andover, Crawford Assocs. ... 617-470-2122
MN Edina, PWC, Inc. ... 612-831-5999
MS Corinth, Hughes Assocs., Inc. ... 601-287-2915
MO St. Louis, Midtec Assocs. ... 314-275-8666
NJ Watchung, Dolan Assocs. ... 201-753-2671
NC Raleigh, Tingen Tech. Sls. ... 919-878-4440
TN Nashville, Hughes Assocs., Inc. ... 615-871-0908
TX Denton, Stevens Sls. Co. ... 817-382-4735
WA Redmond, Halbar Assocs., Inc. ... 206-882-0990

Local Distributors

CA Fullerton, Pyramid Elctrn. Supp. ... 714-773-0781
CA Santa Clara, Pyramid Elctrn. Supp. ... 408-727-9810
IL Elk Grove Village, Nu-Way Elctrn. Distrs. ... 312-437-7120
PA Philadelphia, Shap Elctrns. Co. ... 215-969-3300
TX Dallas, Aeromerica, Inc. ... 214-484-7508
WA Kent, Pyramid Elctrn. Supp., Inc. ... 206-872-5800

THE WADSWORTH ELECTRIC MANUFACTURING CO., INC., 20 W. 11th St., Covington, KY 41012, Tel: 606-431-0900; *Sls. Mgr.:* J. C. White

WAGO CORP., 9085 N. Deerbrook Trail, Brown Deer, WI 53223, Tel: 414-354-5511, FAX: 414-357-7450; FSC No.: 65996; *Sls. Mgr.:* Michael A. Lane

WAHL INSTRUMENTS, INC., 5750 Hannum Ave., Culver City, CA 90231, Tel: 800-421-2853, TELEX: 66-4406; Empl.: 60

WALDES TRUARC, INC., Member of the Seeger Fastening Sys. Grp., 29-01 Borden Ave., Long Island City, NY 11101-4478, Tel: 718-392-3100, TELEX: 126-829; Empl.: 450

WALKER POWER, INC., Walker Magnetics Group, 10 B Mill St., Warner, NH 03278, Tel: 603-456-3111; Empl.: 70; *Sls. Mgr.:* Paul D. Iverson

FAX: 617-853-3344

WALKER SCIENTIFIC, Rockdale St., Worcester, MA 01606, Tel: 617-852-3674, 617-853-3232, TELEX: 92-0489; Empl.: 83; *Sls. Mgr.:* B. Langley ... **D•1346**

WALL, A. T., CO., 55 Service Ave., Warwick, RI 02886, Tel: 401-739-0740, TWX: 710-382-1535, FAX: 401-732-5784; Empl.: 75; *Sls. Mgr.:* J. G. Matzen; *Dist. Mgr.:* R. Huntsman

WALL-ABLE MFG. CORP., 2201 Landmeier Rd., Elk Grove Vl., IL 60007, Tel: 312-956-8000, TELEX: 312288 WLLABLE, FAX: 312-956-8082; Empl.: 150; *Sls. Mgr.:* Dennis O'Brien ... **C•1588-1589**

Local Sales Offices & Reps

FL Miami, J.R. Assocs. ... 305-593-0621
GA Conyers, J.R. Assocs. ... 404-922-1231
IL Prospect Hgts., AL&W Sls. Co. ... 312-541-9080
IN Indianapolis, D.M. Assocs. ... 317-842-4424
NM Albuquerque, Nelco Electronix ... 505-293-1399
NY Dobbs Ferry, L. J. Valle, Inc. ... 914-693-5072
NC Lewisville, J.R. Assocs. ... 919-945-9574
TN Releigh, J.R. Assocs. ... 615-892-7630
TX Del Rio, C. Sweigart ... 512-774-7748

FAX: 617-685-7691

WALL INDUSTRIES, 5 Watson Brook Rd., Exeter, NH 03833, Tel: 800-321-WALL; Empl.: 50; *Sls. Mgr.:* Dorothy Amato ... **D•2043**

Local Sales Offices & Reps

AZ Scottsdale, Memco Sls. ... 602-952-2254
CA Hayward, Pacific Mktg. ... 415-887-1620
CA Pasadena, A-F Sls. Engrg. ... 213-681-5631
CO Aurora, Butler Tech. Sls. ... 303-343-3787
FL Maitland, Beacon Elctrns. ... 305-647-3496
GA Atlanta, Beacon Elctrns. ... 404-256-9640
IL Chicago, ESA Tech. Mktg. ... 312-554-0120
IN Indianapolis, Elctrn. Mktg. Consits. ... 317-253-1668
MA Chelmsford, Encotronics ... 617-256-4207
MI East Detroit, Elect. Mktg. Consits. ... 317-253-1668
MN Eden Prairie, High Technig. Sls. ... 612-944-7274
MO St. Louis, Reptronics ... 314-576-9816
NJ E. Brunswick, Winch Sls. ... 201-828-4615
NY N. Syracuse, Labtronics ... 315-455-7314
OH Cleveland, E.M.C.I. ... 216-458-8486
PA Huntingdon Valley, Inacker Sls. ... 215-947-5660
TX Austin, Milco Mktg. Inc. ... 512-453-3023
TX Dallas, Milco Mktg. ... 214-783-2716
TX Houston, Milco Mktg. Inc. ... 713-723-5003
WA Kirkland, N.W. Comp. Sls. ... 206-828-4838
WI Madison, ESA Tech. Mktg. ... 312-544-0120
Can Oakville, Ont., Haltronics ... 416-844-2121

WALL LENK CORPORATION, Box 3349, Kinston, NC 28502-3349, Tel: 919-527-4186, FAX: 919-527-4189; Empl.: 60; *Sls. Mgr.:* Richard W. Cooper

WAMCO, INC., 11555-A Coley River Cir., Fountain Valley, CA 92708, Tel: 714-545-5560, TELEX: 678-459, FAX: 714-545-6093; FSC No.: 58774; Empl.: 15; *Sls. Mgr.:* Gordon R. Calvert; *Dist. Mgr.:* Sheila A. Sherman .... **B•1146-1147**

Local Sales Offices & Reps

CA Cupertino, E & F Assocs. ... 408-446-2349
CA Laguna Hills, Cronin & Assocs. ... 714-951-5630
IL Elmhurst, Utronix Sls., Inc. ... 312-834-1100
IN Kokomo, Schillinger Assocs., Inc. ... 219-282-4570
KS Parker, S. W. Wollard Co. ... 913-898-6552
NY Jericho, Metro Tech. Sls., Inc. ... 516-935-3330
NY Massapequa, Richard McGrath, Inc. ... 516-789-0400
OR Beaverton, Rep West ... 503-626-4279

WARD LEONARD ELECTRIC CO., INC., 31 South St., Mt. Vernon, NY 10550, Tel: 914-664-1000, TWX: 710-562-0144; FSC No.: 63743;15109; Empl.: 450; *Dist. Mgr.:* Richard I. Limato

WARREN G-V, UNIT OF SIGNAL CO., 1 Apollo Dr., Whippany, NJ 07981, Tel: 201-386-1200, FAX: 201-386-9331; FSC No.: 93929; Empl.: 200; *Sls. Mgr.:* William Vandertulip

WARREN-KNIGHT INSTRUMENT CO., Warren Industries, Inc., 2045 Bennett Rd., Philadelphia, PA 19116, Tel: 215-464-9300; Empl.: 50; *Sls. Mgr.:* Richard M. Marron

WASATCH HIGH VOLTAGE, P.O. Box 15457, Salt Lake City, UT 84115, Tel: 801-265-9561; Empl.: 32; *Sls. Mgr.:* Jack Reynolds

WATCO, INC., 315 Racetrack Rd., N.E., Ft. Walton, FL 32548, Tel: 904-863-2247, FAX: 904-863-1883; FSC No.: 49232; Empl.: 10; *Sls. Mgr.:* Douglas G. Moreland

WATERS MANUFACTURING, INC. Talley Industries

FAX: 617-358-5649

WATERS MANUFACTURING, INC., Talley Industries, Longfellow Ctr., Wayland, MA 01778, Tel: 617-358-2777, TELEX: 948441; FSC No.: ;Multiple; Empl.: 125; *Sls. Mgr.:* James Dyne ... **A•2110-2111**

Local Sales Offices & Reps

AZ Sun City, Hannah Hill ... 602-933-4623
CA Hayward, Liaisen, Inc. ... 415-783-1131
CA Lomita, Techrep ... 213-539-9070
CO Broomfield, Hannah Hill ... 303-460-0602
CT Bloomfield, Sir Assocs. ... 203-243-9343
FL Melbourne, R-Rep ... 305-725-6993
FL Pompano Beach, R-Rep Co. ... 305-725-6993
IL La Grange Park, Bierhaus Sls ... 312-354-5100
MA Westford, Sir Assocs. ... 617-692-2500
MI Southfield, Fred H. Gehrke & Assoc. .. 313-559-5363
MO Hazelwood, Acorn Elctrns. ... 314-731-2002
NJ Union, S. Simberkoff Assocs. ... 201-687-6363
NY Le Roy, SSAI ... 716-768-7213
OH Dayton, INH Comp. Sls. ... 513-434-8808
TX Dallas, Allied Comps. ... 214-238-0408

WI Milwaukee, Bierhaus Sls. 414-963-0318
Can Rexdale, Ont., Myelco, Inc. 416-674-1636

Local Distributors
CA Lomita, TecRep Comps. 213-539-9070
TX Dallas, Allied Comps. 214-238-0408

WATKINS-JOHNSON CO., 3333 Hillview Ave., Palo Alto, CA 94304, Tel: 415-493-4141, TELEX: 34-8415, TWX: 910-373-1253; FSC No.: 14482; Empl.: 3000

WAVECOM, Sub. of Loral Corp., 9036 Winnetka Ave., Northridge, CA 91324, Tel: 818-882-3010, TELEX: 6502408147; FSC No.: 28979; Empl.: 99

WAVELINE, Box 718, W. Caldwell, NJ 07006, Tel: 201-226-9100, TWX: 710-734-4324; FSC No.: 00443; Empl.: 95; *Sls. Mgr.:* D. Morsillo

WAVETEK, (Western Area Sales Office), 9045 Balboa Avenue, San Diego, CA 92123, Tel: 619-565-9234

WAVETEK, (Central Area Sales Office), 5808 Churchman Bypass, Indianapolis, IN 46203, Tel: 317-782-4619

WAVETEK, Northeast Area Sales Office, One Executive Blvd., Ste. 206, Suffern, NY 10901, Tel: 914-357-5544

WAVETEK, Southeast Area Sales Office, 2085 U.S. 19 North, Ste. 102, Clearwater, FL 34623, Tel: 813-797-1792

WAVETEK DATRON, See Datron Instruments (or call area sales offices)

WAVETEK MICROWAVE, INC., (Formerly Pacific Measurement, Inc.), 488 Tasman Dr., Sunnyvale, CA 94089, Tel: 408-734-5780, FAX: 408-747-1265

For sales offices and representatives, see Wavetek San Diego, Inc.

WAVETEK RF PRODUCTS, INC., (Formerly Wavetek Indiana, Inc.), 5808 Churchman By-Pass, Indianapolis, IN 46203, Tel: 317-787-3332, FAX: 317-788-5999

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AL Huntsville, Southern Mktg. Assocs. 205-534-6020
AZ Phoenix, Tech. Mktg. Specialists 602-582-4800
CA Costa Mesa, Ward/Davis Assocs. 714-556-0955
CA Redondo Bch., Ward/Davis Assocs. .. 213-643-6977
CA San Diego, Ward/Davis Assocs. 619-292-1000
CA Santa Clara, Ward/Davis Assocs. 408-245-3700
CO Denver, Tech. Mktg. Specialists 303-691-5620
CT Wallingford, Pat Jenks Assocs. 203-265-9939
FL Longwood, Southern Mktg. Assocs. ... 305-682-7317
GA Marietta, Southern Mktg. Assocs. 404-565-0603
IL Arlington Hgts., Dytec/Cen., Inc. 312-394-3380
IN Indianapolis, Dytec/Cen., Inc. 317-297-5988
KS Lenexa, Dytec/South, Inc. 913-888-0215
MD Rockville, Creative Mktg. Assocs. 301-251-4100
MA Danvers, Pat Jenks Assocs. 617-777-5600
MI Madison Hgts., WKM Assocs. 313-588-2300
MN Edina, Dytec Instrs., Inc. 612-831-7169
MO Maryland Hgts., Dytec/South, Inc. 314-739-0665
NM Albuquerque, Tech. Mktg. Specialists 505-889-4595
NY Great Neck, RTI 516-829-3770
NY Liverpool, NTS Assocs., Inc. 315-451-1091
NC Greensboro, Southern Mktg. Assocs. 919-854-5588
OH Independence, WKM Assocs., Inc. 216-524-5930
OR Beaverton, Northwest Test & Meas. ... 503-645-9000
PA Southampton, Eastern Instrmn. of PA 215-355-7700
TX Dallas, Data Mktg. Assocs. 214-661-0300
TX Houston, Data Mktg. Assocs. 713-780-2511
WA Redmond, Northwest Test & Meas. ... 206-881-8857
WI Brookfield, Dytec/Central, Inc. 414-792-0320
Can Montreal, Que., Interfax Sys., Inc. 514-336-0392

WAYNE KERR, INC., Wayne Kerr plc, 600 W. Cummings Pk., Woburn, MA 01801, Tel: 617-938-8390, TELEX: 6817257 WKERR WOBN; *Sls. Mgr.:* Pat Prather; *Dist. Mgr.:* Robert Fesmire

WAYNE TRANSFORMER CO., INC., 666 Pacific St., Brooklyn, NY 11217, Tel: 718-783-9007, TELEX: 125327; *Sls. Mgr.:* G. V. Mandell ..... **A•2440**

Local Sales Offices & Reps
NJ Basking Ridge, NuTronix 201-953-0950
NY Long Island, NuTronix 201-953-0950
NY New York, NuTronix 201-953-0950
NY Westchester County, NuTronix 201-953-0950

WEBER, Inmark Corporation-Importer, 147 W. Cedar St., Norwalk, CT 06854, Tel: 203-866-8474, FAX: 1-203-866-0918

WECO®

FAX: 514-694-0956

WECO ELECTRICAL CONNECTORS, INC., 16805 Hymus Blvd., Kirkland, Quebec, Canada H9H 3L4, Tel: 514-694-9136; FSC No.: 5935, 5963, 5940; Empl.: 52; *Sls. Mgr.:* David Asseraf; *Dist. Mgr.:* David Asseraf ..... **C•1590-1600**

Local Sales Offices & Reps
AL Huntsville, B.C.I. Inc. 205-539-4411
CA Newport Bch., SPA Inc. 714-863-1193
CA San Jose, Landia Sls. Grp. 408-280-5695
CO Littleton, Chinook Tech. Sls. 303-933-9007
FL Deerfield Bch., Florida Comp. Sls. 305-429-1758
FL Tampa, Florida Comp. Sls. Inc. 813-960-7044
GA Chamblee, B.C.I. Inc. 404-455-0405
IL Palatine, Key Entprs. Inc. 312-991-2144
IN Indianapolis, MEI (Mktg. Engrs. Inc.) ... 317-872-5665
IA Coralville, Engrg. Prods. 319-354-5344
KS Shawnee Mission, Microtronics Inc. ... 913-262-1444
ME Kittery, Olsen Tech. Sls. Inc. 207-439-0280
MD Belair, LHR Assocs., Inc. 301-877-3405
MA Scituate, Olsen Tech. Sls. Inc. 617-878-9386
MN Edina, Engrg. Prods. Assocs. Inc. 612-835-9022
MO St. Charles, Microtronics Inc. 314-946-8500
NJ Roebling, LHR Assocs., Inc. 609-829-6861
NJ Woodbridge, John Chirico Assocs. Inc. 201-855-9600
NY Buffalo, Sweetco Assocs. Inc. 716-632-0011
NY Johnson City, Sweetco Assocs. Inc. ... 607-729-0827
NY Rochester, Sweetco Assocs. Inc. 716-225-2383
NY Utica, Sweetco Assocs. Inc. 315-797-6721
NC Raleigh, C-Tech 919-782-8100
OH Cleveland, Marlow Assocs. 216-991-6500
OR Portland, SPS Elctrns. 503-297-6919
PA Harrisburg, Beil & Whitaker 717-564-6900
TX Lufkin, Narjen Intl. Sls. 409-634-6101
UT Taylorsville, Chinook Tech. Sls. 801-969-3684
WA Redmond, SPS Elctrns. 206-323-4140
WI Milwaukee, Key Entprs. Inc. 414-453-9462

Local Distributors
AL Mobile, Specialty Distbg. Co. 205-344-0450
AZ Scottsdale, Cypress Elctrns. 602-949-0802
AZ Tempe, Control Design Supp. Inc. 602-829-7981
CA Anaheim, Control Design Supp. Inc. ... 714-821-1516
CA Anaheim, DECO Elctrns. Inc. 714-630-8252
CA Buena Pk., Cypress Elctrns. 213-744-0355, 714-521-5230
CA Fountain Valley, Comp. Ctr. 714-979-0433
CA Fullerton, I.S.I. Mktg. Co. 714-773-0411
CA San Carlos, Control Design Supp. Inc. 415-592-4806
CA San Diego, Cypress Elctrns. 619-535-0011
CA San Diego, Sigma Elctrns. 619-565-2000
CA Santa Clara, Cypress Elctrns. 408-980-2500
CO Wheat Ridge, Cypress Elctrns. 303-431-2622
CT Yalesville, Glynn Elctrns. 203-265-2498
FL Altamonte Springs, Control Design Supp. Inc. 305-788-3220,1-800-432-5895
FL Bradenion, Specialty Distbg. Co., Inc. 813-756-9571,1-800-282-5861
FL Davie, ARCO Dists. Inc. 305-473-2550, 1-800-432-0299
FL Ft. Lauderdale, Specialty Distbg. Co., Inc. 305-561-2544
FL Jacksonville, Specialty Distbg. Co., Inc. 904-356-8426,1-800-824-0714
FL Lakeland, Specialty Distbg. Co., Inc. 813-686-8193, 1-800-282-9080
FL Melbourne, Specialty Distbg. Co., Inc. 305-254-5274
FL Pompano Bch., Control Design Supp. Inc. 305-782-1311
FL Tampa, Specialty Distbg. Co., Inc. 813-870-3315, 1-800-282-7892
GA Albany, Specialty Distbg. Co., Inc. 912-435-1711, 1-800-633-4027
GA Athens, Specialty Distbg. Co., Inc. 404-548-1334, 1-800-443-5553
GA Atlanta, Specialty Distbg. Co., Inc. 404-458-6341, 1-800-392-9898
GA Augusta, Specialty Distbg. Co., Inc. 404-722-1526, 1-800-874-8740
GA Brunswick, Specialty Distbg. Co., Inc. 912-265-1927,1-800-241-3826
GA College Pk., Specialty Distbg. Co., Inc. 404-763-3828
GA Columbus, Specialty Distbg. Co., Inc. .. 404-327-7414
GA Fayettesville, Frankland Inc. 404-461-4026
GA Macon, Specialty Distbg. Co., Inc. 912-743-5421, 1-800-331-5566
GA Marietta, Specialty Distbg. Co., Inc. 404-422-4333
GA Norcross, Specialty Distbg. Co., Inc. 404-448-4004, 1-800-282-4574
GA Savannah, Specialty Distbg. Co. 912-234-1684, 1-800-874-6997
GA Smyrna, ERC Parts Inc. 404-352-1626
GA Stone Mtn., Control Design Supp. Inc. 404-979-3500
GA Valdosia, Specialty Distbg. Co., Inc. 912-242-4910, 1-800-233-8585
IL Carol Stream, Lectro Comps. Inc. 312-690-0520, 1-800-323-2282
IL Genoa, Control Design Supp. Inc. 815-784-6519
IN Indianapolis, Control Design Supp. Inc. 317-788-4614
IA Marion, Control Design Supp. Inc. 319-373-2923
KS Kansas City, Control Design Supp. Inc. 913-362-4248,316-269-0651
MD Gaithersburg, Axis Elctrns. Inc. 301-840-9640, 1-800-492-3190
MD Glen Burnie, Baytronics 301-766-0081
MA Middleboro, Glynn Elctrns. Inc. 617-947-4262, 1-800-642-7002
MA Woburn, Control Design Supp. Inc. 617-932-9404
MN Eden Prairie, Cypress Elctrns. 612-934-2104
MN Minneapolis, Control Design Supp. Inc. 612-721-1628,1-800-328-8222
MO St. Louis, Control Design Supp. Inc. ... 314-426-3160
NH Manchester, Glynn Elctrns. 603-622-8131
NJ S. River, Kon-Tac Inc. 201-254-5100

NY Bohemia, Key Comps. Inc. 516-567-7500
NC Pineville, Control Design Supp. Inc. ... 704-588-4410
OH Akron, Aesco Elctrns. Inc. 216-762-8818/6655
OH Canton, Aesco Elctrns., Inc. 216-494-8572
OH Cleveland, Aesco Elctrns. Inc. 216-621-5835
OH Columbus, Aesco Elctrns. Inc. 614-882-6762
OH WATS, Aesco Elctrns. Inc. 1-800-362-0022
OR Beaverton, Cypress Elctrns. 503-641-2233
OR Portland, Dunn Elctrns. Inc. 503-285-0214
PA Malvern, Control Design Supp. Inc. 215-296-0150
PA Pittsburgh, Aesco Elctrns. Inc. 412-344-1550
PA York, Elctrn. Comps. for Industry 717-846-5334
TN Chattanooga, Specialty Distbg. Co., Inc. 615-624-1040,1-800-443-1581
TX Dallas, Control Design Supp. Inc. 214-358-1441, 1-800-441-0385
TX Dallas, Cypress Elctrns. 214-869-1435
WA Bothell, Cypress Elctrns. 206-483-1144
WA Kirkland, Dunn Elctrns. 206-821-3678
WI New Berlin, Control Design Supp. Inc. 414-784-1015,1-800-242-4395
Can Carsten Elctrns. Ltd., Carsten Elctrns. Ltd. 514-334-8321
Can Concord, Ont., Zierick Canada Corp. .. 416-669-1429
Can Dartmouth, Nova Scotia, Arcom Elctrns. 902-464-1600
Can Drummondville, Que., Mamel Intl. 819-478-3128
Can Islington, Ont., D. T. Shaw Ltd. 416-231-3494
Can Mississauga, Ont., Prelco Ltd. 416-678-0401, 1-800-387-3874
Can Mississauga, Ont., Sayal Elctrns. 416-238-8440
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Can Montreal, Que., Prelco Ltd. 514-389-8051
Can Montreal, Que., Versatech Elctrns. Inc. 514-481-0196
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Can Nepean, Ont., Prelco Ltd. 613-726-1800
Can Oakville, Ont., Cantwell & Co. 416-842-8470
Can Quebec, Que., Crobel Llee Electronique 418-687-1171
Can Quebec, Que., Pro Technique J. M. Emond 418-529-5774
Can Scarborough, Ont., Carsten Elctrns. Ltd. 416-495-9999,1-800-268-3462
Can Scarborough, Ont., Sayal Elctrns. 416-494-8999
Can Sherbrooke, Que., Lumen Inc. 819-566-0966
Can St. Laurent, Que., Zierick Canada Corp. 514-331-7460
Can Ville Laval, Que., Montcalm Electronique 514-663-3102
Can Winnipeg, Manitoba, WES Elctrns. Ltd. 204-632-1260

WECO ELECTRICAL CONNECTORS, INC., Trimex Bldg., Rte. 11, Mooers, NY 12958, Tel: 518-298-4810, FAX: 518-298-5938 ..... **C•1590-1600**

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CA San Jose, Landia Sls. Grp. 408-280-5695
CO Littleton, Chinook Tech Sls. 303-933-9007
DE Roebling, LHR Assocs., Inc. 609-829-6861
FL Tampa, Florida Comp. Sls. Inc. 813-960-7044
GA Chamblee, B.C.I. Inc. 404-455-0405
IL Palatine, Key Entprs. Inc. 312-991-2144
IN Indianapolis, MEI (Mktg. Engrs.) 317-872-5665
IA Coralville, Engrg. Prods. Assocs. 319-354-5344
KS Shawnee Mission, Microtronics Inc. ... 913-262-1444
ME Kittery, Olsen Tech Sls. Inc. 207-439-0280
MD Belair, LHR Assocs. Inc. 301-877-3405
MA Scituate, Olsen Tech Sls. Inc. 617-878-9386
MN Edina, Engrg. Prods. Assocs. 612-835-9022
MO St. Charles, Microtronics Inc. 314-946-8500
NJ Woodbridge, John Chirico Assocs. Inc. 201-855-9600
NY Buffalo, Sweetco Assocs. Inc. 716-632-0011
NY Johnson City, Sweetco Assocs. Inc. ... 607-729-0827
NY Rochester, Sweetco Assocs. Inc. 716-225-2383
NY Utica, Sweetco Assocs. Inc. 315-797-6721
NC Raleigh, C-Tech 919-847-0202
OH Cleveland, Marlow Assocs. 216-991-6500
OR Portland, SPS Elctrns. 503-297-6919
PA Harrisburg, Beil & Whitaker 717-564-6900
TX Lufkin, Narjen Inter Sls. 409-634-6101
UT Taylorsville, Chinook Tech Sls. 801-969-3684
VA Belair, LHR Assocs. Inc. 301-877-3405
WA Redmond, SPS Elctrns. 206-323-4140
WI Milwaukee, Key Entprs. Inc. 414-453-9462

Local Distributors

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AZ Scottsdale, Cypress Elctrns. 602-949-0802
AZ Tempe, Control Design Supp. Inc. 602-829-7981
CA Anaheim, Control Design Supp. Inc. 213-802-1371, 714-821-1516
CA Anaheim, DECO Elctrns. Inc. 714-630-8252
CA Buena Pk., Cypress Elctrns. 213-744-0355
CA Fountain Valley, Comp. Ctr. 714-979-0433
CA Fullerton, I.S.I. Mktg. Co. 714-773-0411
CA San Carlos, Control Design Supp. Inc. 415-592-4806
CA San Carlos, HI-COR Elctrns. Corp. 415-594-9581
CA San Diego, Cypress Elctrns. Inc. 619-535-0011
CA San Diego, Sigma Elctrns. 619-565-2000
CA Santa Clara, Cypress Elctrns. 408-980-2500
CO Wheat Ridge, Cypress Elctrns. 303-431-2622
CT Yalesville, Glynn Elctrns. 203-265-2498
FL Altamonte Springs, Control Design Supp. 305-788-3220,1-800-432-58
FL Bradenton, Specialty Dist. Co. Inc. 813-756-9571, 1-800-282-58
FL Davie, ARCO Dists. Inc. 305-473-2550, 305-940-3295
FL Ft. Lauderdale, Specialty Dist. Co. inc. 305-561-2544
FL Jacksonville, Specialty Dist. Co. Inc. ... 904-356-8426
FL Lakeland, Specialty Dist. Co. Inc. 813-686-8193, 1-800-282-90
FL Melbourne, Specialty Dist. Co. Inc. 305-254-5274
FL Pompano Bch., Control Design Supp. Inc. 305-782-1311
FL Tampa, Specialty Dist. Co. Inc. 813-870-3315, 1-800-282-78
GA Albany, Specialty Dist. Co. Inc. 912-435-1711, 1-800-633-40
GA Athens, Specialty Dist. Co. Inc. 404-548-1334, 1-800-443-55
GA Atlanta, Specialty Dist. Co. Inc. 404-458-6341, 1-800-392-98
GA Augusta, Specialty Dist. Co. Inc. 404-722-1526, 1-800-874-87
GA Brunswick, Specialty Dist. Co. Inc. 912-265-1927, 1-800-241-38
GA College Pk., Specialty Dist. Co. Inc. 404-763-3828
GA Columbus, Specialty Dist. Co. Inc. 404-327-7414
GA Fayetteville, Frankland Inc. 404-461-4026
GA Macon, Specialty Dist. Co. Inc. 912-743-5421, 1-800-331-55
GA Marietta, Specialty Dist. Co. Inc. 404-422-4333
GA Norcross, Specialty Dist. Co. Inc. 404-448-4004
GA Savannah, Specialty Dist. Co. Inc. 912-234-1684
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TX	Hurst, Allied Comps., Inc.	817-589-0456
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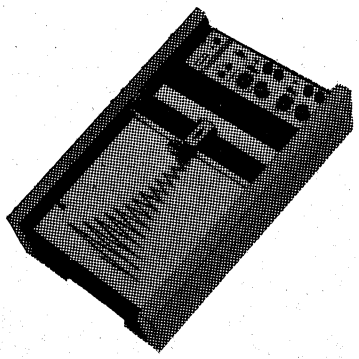

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FAX: 714-855-0895

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WILTRON, 490 Jarvis Dr., Morgan Hill, CA 95037-2809, Tel: 408-778-2000, TELEX: 285227 WILTRON MH, FAX: 408-778-0239; FSC No.: 20944; Empl.: 650; *Sls. Mgr.:* W. Baxter

WINSYSTEMS, INC., P.O. Box 121361, Arlington, TX 76012, Tel: 817-274-7553, FAX: 817-548-1358; FSC No.: 67098

WINTEK CORP., 1801 South St., Lafayette, IN 47904-2993, Tel: 317-742-8428, 800-742-6809, TELEX: 70-9079, FAX: 317-448-4823; Empl.: 16 ..... **D•1116-1117**

WIREBENDERS, INC., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021, Tel: 602-861-1856, FAX: 602-870-9242; FSC No.: 5950;FSCS/CAGE 1DA26; Empl.: 18; *Sls. Mgr.:* Leo Middleton

THE WIREMOLD COMPANY, 60 Woodlawn Street, W. Hartford, CT 06110, Tel: 203-233-6251, TWX: 710-425-6281; Empl.: 900; *Sls. Mgr.:* F. D. Casteel

WIRE-PRO, INC., 23 Front Street, Salem, NJ 08079, Tel: 609-935-7601, 609-935-7651, TWX: 510-680-4750, FAX: 609-935-0102; Empl.: 225; *Sls. Mgr.:* Philip Negrin, Mktg. Mgr.; *Dist. Mgr.:* Philip Negrin

WON TRONICS, Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057, Tel: 213-381-2500, TWX: 910-321-4348; *Sls. Mgr.:* Michael Ronzon

WORKMAN ELCTRN. PRODS., Box 3828, Sarasota, FL 33578, Tel: 813-371-4242, TWX: 810-864-0401; Empl.: 150; *Sls. Mgr.:* Frank Pounds

WORLDNET MARKETING INC., 3187 F Airway Ave., Costa Mesa, CA 92626, Tel: 714-545-7118, TELEX: 3781824, FAX: 714-540-9138; Empl.: 7; *Sls. Mgr.:* Frank Buday; *Dist. Mgr.:* Frank Buday

'WORLD' TEST SYSTEMS, INC., P. O. Drawer 1428, Waynesboro, VA 22980, Tel: 703-949-6753; *Sls. Mgr.:* Buford H. Baber

WOVEN ELECTRONICS, Woven Electronics Corporation, Old Stage Road, Simpsonville, SC 29681, Tel: 803-963-5131, TWX: 810-963-5131, FAX: 803-963-1761; Empl.: 400; *Sls. Mgr.:* Peggy Burnett ..... **C•1910**

Local Sales Offices & Reps

CA	Diamond Bar, Solomon Tech. Sls	714-595-8212
CO	Denver, Spectrum Mktg. Sls. Assocs.	303-480-9991
IL	St. Charles, A. T. Sinker Co.	312-377-6169
MD	Bethesda, Warren Mount Co.	301-657-9312
MN	Bloomington, PWC Inc.	612-831-5999
NH	Merrimack, A. T. Sinker Co.	603-424-8061
NJ	Clinton, A.T. Sinker Co.	201-730-8975

WYLE LABS, See Electronic Enclosures

XCEL CORPORATION, See Digitran and Computron Display Sys. Divs.

XCP, INC., 8 W. Main St., Dryden, NY 13053, Tel: 607-844-9143; *Sls. Mgr.:* Diane Rademacher

XEBEX DATA SYSTEMS, 6610 Buckley Dr., Cambria, CA 93428, Tel: 805-927-5008; Empl.: 4; *Sls. Mgr.:* W. E. Walker

XEDAR CORP., 2500 Central Ave., Boulder, CO 80301, Tel: 303-443-6441; *Sls. Mgr.:* Kathleen Heil

XENON CORP., 20 Commerce Way, Woburn, MA 01801, Tel: 617-938-3594, TELEX: 928204; Empl.: 45; *Sls. Mgr.:* Louis R. Panico

XENOTRONIX INC., 26074 Ave., Hall No. 10, Valencia, CA 91355, Tel: 805-257-4793, FAX: 805-257-1093; *Sls. Mgr.:* Coleen Miller

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XENTEK, INC., 760 Shadow Ridge Dr., Vista, CA 92083, Tel: 619-727-0940, TWX: 910-322-1155; FSC No.: 52360; Empl.: 300 ..... **D•2055**

Local Sales Offices & Reps

AL	Huntsville, The Novus Grp.	205-534-0044
CA	San Jose, Richards Assocs.	408-297-3010
FL	Orlando, Currie Peak & Frazier	305-855-0843
GA	Lilburn, The Novus Grp.	404-381-1015
IL	Itasca, LTD Technlgs., Inc.	312-773-2900
IN	Carmel, Berndt Assocs.	317-844-0114
MD	Hunt Valley, Phoenix Sls.	301-628-2066
MI	Southfield, Fred Gehrke	313-559-5363
MN	Minneapolis, Berndt Assocs.	612-546-2021
MO	Ellisville, Gateway Tech. Sls.	314-391-6543
NH	Nashua, Bell Controls	603-882-6984
NY	Hartsdale, Spectrum Sls.	914-472-8600
NY	Syracuse, M. M. Hare	315-457-6859
NC	Raleigh, The Novus Grp.	919-883-7771
OH	Cincinnati, Tri-State Mktg.	513-761-7993
PA	Jenkintown, Monument Tech. Assocs.	215-884-3737
TX	Dallas, Allied Comps.	214-238-0408
WI	Milwaukee, LTD Technlgs.	414-774-1000

XERCON, INC., P.O. Box 554, Portland, OR 97207, Tel: 503-292-8682; Empl.: 6; *Sls. Mgr.:* G. Osgood

XEROX CORPORATION, Xerox Square, 0-5, Rochester, NY 14644, Tel: 800-832-6979; Empl.: 100,367

XERTEX CORP., See Rosemont Corp., Sensall National Sonics

XICO

FAX: 818-341-3824

XICO, INC., 9737 Eton Ave., Chatsworth, CA 91311, Tel: 818-709-4403, TELEX: 709577, ESYLNK: 62253150; Empl.: 21; *Sls. Mgr.:* Ralph Reccia ..... **D•1109**

XICOR, INC., 851 Buckeye Court, Milpitas, CA 95035, Tel: 408-432-8888, TWX: 910-379-0033, FAX: 408-432-0640; FSC No.: 60395; Empl.: 670; *Sls. Mgr.:* Bruce Mattern; *Dist. Mgr.:* Bruce Mattern

XKD CORPORATION, 101 Cooper Court, Los Gatos, CA 95030, Tel: 408-395-3700, TELEX: 171946, FAX: 408-354-2606; *Sls. Mgr.:* Robert S. Anderson

XSIS ELECTRONICS, INC., 12620 W. 63rd St, Shawnee, KS 66216, Tel: 913-631-0448, TELEX: 437227, FAX: 913-631-1170; FSC No.: 57051; *Sls. Mgr.:* Jerry Dehnert ..... **A•1488-1489**

Local Sales Offices & Reps

AL	Huntsville, Murcota Corp.	205-539-8476
AZ	Phoenix, Western High Tech. Mktg.	602-266-2070
CA	Mission Viejo, Chaparrah Elctrn. Sls.	714-582-2950
CA	Mtn. View, Loeswick's	415-967-5880
CT	Cheshire, Ashworth Assocs.	203-968-0656
IL	Schaumberg, Sieger Assocs.	312-310-8844
KY	Ft. Mitchell, G. W. Thelen Co.	606-341-8181
MD	Ellicott City, VPI, Inc.	301-461-2525
MA	Shrewsbury, Ashworth Assocs.	617-845-9688
MN	Eden Prairie, Aldridge Assocs., Inc.	612-944-8433
NJ	Fairfield, Addem Sls.	201-882-0993
NM	Albuquerque, Western High Tech Mktg.	505-884-2256
NY	E. Syracuse, R. D. Sherman	315-433-1165
NC	Winston-Salem, Murcota Corp.	919-722-9445
PA	Montgomeryville, Rufo Sys. Comps.	215-368-8495
TX	Sherman, Repmaster	214-247-6236
EXP	NY, Great Neck, Ad Auriema	516-487-0700

X-TRON ELECTRONICS, INC., 1869 National Avenue, Hayward, CA 94545, Tel: 415-783-2145; FSC No.: 54166; Empl.: 12; *Sls. Mgr.:* Jackie Medina; *Dist. Mgr.:* Jackie Medina

XYCOM, 750 N. Maple Rd., Saline, MI 48176, Tel: 313-429-4971, TWX: 810-223-8153; Empl.: 225; *Sls. Mgr.:* Dan Lewis; *Dist. Mgr.:* Bill Nemeth

XYLOG CORP., 83 Hobart St., Hackensack, NJ 07601, Tel: 201-489-4040, FAX: 201-489-6745; Empl.: 30; *Sls. Mgr.:* Milton Frank ..... **D•2056**

YAMAICHI ELECTRONICS, 2471 E. Bayshore Rd. 6530, Palo Alto, CA 94303, Tel: 415-493-3756, TWX: 910-373-2060, ESYLNK:; *Sls. Mgr.:* Kathy Fioretti

YELLOW SPRINGS INSTRUMENT CO., Box 279, Yellow Springs, OH 45387, Tel: 513-767-7241, TELEX: 205437; Empl.: 380; *Sls. Mgr.:* M. Mason

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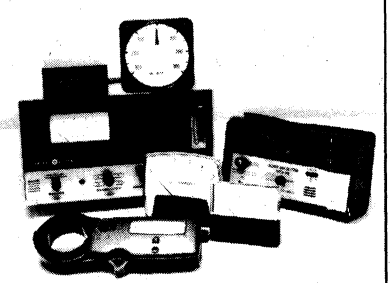

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(302) 652-8585 in Wilmington, DE

Local Sales Offices & Reps

AZ	Mesa, Elec-Com Assocs.	602-844-0566
CA	San Dimas, RDX Corp.	714-599-0985
GA	Atlanta, Craft Assocs.	404-256-0420
IN	Indianapolis, RDP Corp.	317-243-8788
KS	Overland Park, Advanced Indl. Sys.	913-432-8065
MA	Norwell, Bordewieck Engrg.	617-659-4915
MI	Grand Rapids, Smith Instr. Equip.	616-245-1195
MI	Midland, Smith Instr. Equip.	517-496-9250
MI	Warren, Smith Instr. Equip.	313-755-3110
MN	Minneapolis, Trask Engrg.	612-537-2434
MO	Ellisville, Advanced Indl. Sys.	314-391-0366
NJ	Scotch Plains, RJM Sls.	201-322-7880
NY	Syracuse, Labtronics	315-455-7314
OH	Dayton, RDP Assocs.	513-253-6175
TX	Pasadena, Tech-Quip, Inc.	713-473-2891
TX	Plano, Acudata, Inc.	214-424-3567

Local Distributors

CA	Foster City, Therm-X	415-573-3323
CA	San Dimas, RDX Corp.	714-599-0985
GA	Atlanta, Craft Assocs.	404-256-0420
IL	Chicago, Newark Elctrnsâ	312-784-5100
MA	Norwell, Bordewieck Eng. Sls.	617-659-4915
MN	Minneapolis, Trask Engrg.	612-537-2434
NJ	Scotch Plains, RJM Sls.	201-322-7880
NY	Amherst, Terryberry Sls.	716-688-3071
OH	Dayton, RDP Corp.	513-253-6175
TX	Argyle, Milestek Inc.	817-455-7444

YEW CORP., See Yokogawa Corp. of America

YOKOGAWA CORP. OF AMERICA, 200 West Park Drive, Peachtree City, GA 30269, Tel: 404-487-1471, FAX: 404-487-1822; Empl.: 300; *Sls. Mgr.:* Chuck Micallef; *Dist. Mgr.:* Jack Martz

YORK METAL PRODUCTS, INC., 34-20 12th St., Long Island City, NY 11106, Tel: 718-932-3660; Empl.: 45; *Sls. Mgr.:* Harold Miller

YORK TECHNOLOGY, INC., 210 N. Glenoaks Blvd., Ste. C, Burbank, CA 91502, Tel: 818-955-8927, TELEX: 3762780, TWX: 910-968-YORK CA, FAX: 818-955-9728

BATTERY YUASA

FAX: 213-949-5527

YUASA BATTERY (AMERICA), INC., 9728 Alburtis Ave., Santa Fe Springs, CA 90670, Tel: 213-949-4266, TELEX: 696272; Empl.: 5,000; *Sls. Mgr.:* Les Biggins ..... **D•1495**

Local Sales Offices & Reps

AZ	Phoenix, Westrep	602-997-8899
CA	Huntington Bch., West Elctrn Sls.	213-493-5569
CA	San Jose, Novatronix	408-727-9530
CO	Denver, Lindberg Co.	303-758-9033
CT	Horth Haven, Kitchen & Kutchin	203-239-0212
FL	Tampa, Over and Over	813-626-9100
GA	Atlanta, Over and Over	404-449-6205
IL	Arlington Hgts., Brainard-Wilson Mktg.	312-437-2700
IA	Cedar Rapids, R.W. Kunz & Assocs.	319-396-5386
KS	Prairie Vlg., R.W. Kunz & Assocs.	913-648-3535
MA	Burlington, Kitchen & Kutchin	617-229-2660
MN	Minneapolis, Johnson Co.	612-941-8526
MO	St. Louis, R.W. Kunz & Assocs.	314-966-4977
NJ	Berkeley Hgts., Cambridge Allen & Assocs.	201-464-0203
NJ	Carlstadt, Yuasa Battery (Amer.) E. Reg. Off.	201-896-8800
NY	Rochester, Ossman Comps. Sls.	716-359-1200
NY	Syracuse, Ossman Comps. Sls.	315-455-6611
NC	Charlotte, Over and Over	704-542-9111
OH	Columbus, McFadden Sls.	614-459-1280
OK	Tulsa, Barry Sls.	918-749-7775
OR	Portland, Earl & Brown	503-245-2283
TX	Houston, Barry Sls.	713-784-5860
TX	Richardson, Barry Sls.	214-234-0255
UT	Salt Lake City, Lindberg Co.	801-277-2643
WA	Lynwood, Earl & Brown	206-885-5064
WI	Waukesha, Brainard-Wilson Mktg.	414-797-7940
Can	Pointe-Claire, Que., Tech Trek, Ltd.	514-697-3385
Can	Rexdale, Ont., Tech Trek, Ltd.	416-674-1717

Local Distributors

AL	Huntsville, Newark Elctrns.	205-837-9011
AL	Juneau, Juneau Elctrl. Equip.	907-586-2260
AZ	Glendale, Lynntronics	602-931-5981
CA	Buena Pk., Cypress Elctrns.	714-521-5230
CA	Costa Mesa, House of Batteries	714-642-8222
CA	San Diego, Tauber Elctrns.	619-274-7242
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CO	Wheatridge, Cypress Elctrns.	303-431-2622
FL	Miami, Elctrn. Equip.	305-871-3500
GA	Norcross, Applied Power	404-263-0421
HI	Honolulu, Elctrl. Equip.	808-533-3881
IL	Addison, L Comp	312-628-1400
IL	Downers Grove, Jarbo Battery	312-964-9358
IN	Indianapolis, Newark Elctrns.	317-872-7070
KS	Wichita, L Comp	316-265-5100
MD	Beltsville, Mark Elctrns.	301-595-5040
MA	Middleboro, Glynn Elctrns.	617-947-4262
MI	Brighton, Applied Power	313-229-6550
MI	Grand Rapids, Newark Elctrns.	616-214-6681
MN	Minneapolis, Bergquist Co.	612-835-2322
MS	Jackson, Newark Elctrns.	314-291-6200
MO	Kansas City, L Comp	816-221-2400
NH	Salem, Cronin Elctrns.	603-898-4440
NJ	Clifton, Engrd. Assemblies	201-340-0600
NJ	Edison, Newark Elctrns.	201-572-2103
NY	Farmingdale, Battery Expeditors	516-752-0111
NY	FLushing, W & W Assocs.	718-961-2103
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Rochester, Newark Elctrns.	716-473-6600
NC	Raleigh, Engrd. Assemblies	919-790-9700
OH	Columbus, Whitehead Elctrns.	614-224-1186
OH	Solon, Repco Elctrns.	216-248-8900
OR	Portland, Standard Batteries of Portland	503-234-7251
PA	Willow Grove, Resco Elctrns.	215-659-4440
SC	Greenville, Newark Elctrns.	803-228-9610
TX	Allen, Prime Distrbg.	214-231-0170
TX	Dallas, Cypress Elctrns.	214-869-1435
UT	Salt Lake City, Newark Elctrns.	801-484-8611
WA	Redmond, Priebe Elctrns.	206-881-2363
WI	Milwaukee, Newark Elctrns.	414-463-1100
Can	Brampton, Ont., Zentronics	416-451-8445

ZAMBRE CO., INC., 2134 Old Middlefield Way, Mountain View, CA 94043, Tel: 415-968-9176

Z-Communications Inc.

FAX: 305-735-1094

Z COMMUNICATIONS, INC., 5450 N.W. 33rd Ave., Ste. 100, Ft. Lauderdale, FL 33309, Tel: 305-735-1000; FSC No.: 1564A; Empl.: 20; *Sls. Mgr.:* Jonell Stevenson ..... **A•1491-1493**

ZEBRA TECHNOLOGIES CORPORATION, 3455 Commercial Ave., Northbrook, IL 60062, Tel: 312-564-1800, TELEX: 206230; FSC No.: ;;;312-564-4714; Empl.: 110; *Sls. Mgr.:* Kevin O'Donnell

ZEHNTEL, INC., 2625 Shadelands Dr., Walnut Creek, CA 94598, Tel: 415-932-6900, TELEX: 371-6185, TWX: 910-385-6300; Empl.: 500; *Sls. Mgr.:* Dick Noren; *Dist. Mgr.:* Jim Mohr

CARL ZEISS, INC., One Zeiss Drive, Thornwood, NY 10594, Tel: 914-747-1800, TELEX: RCA 221834, TWX: WV64-6928

ZENDEX CORP., 6700 Sierra La., Dublin, CA 94568, Tel: 415-828-3000, TWX: 910-389-4009, FAX: 415-828-1574; Empl.: 42; *Sls. Mgr.:* Woody Bowers

ZENITH CRT & COMPONENTS OPERATIONS, 1000 Milwaukee Ave., Glenview, IL 60025, Tel: 312-391-7733; *Sls. Mgr.:* Norm Berkowitz

ZENITH

FAX: 312-391-7532

ZENITH COMPONENTS GROUP, Zenith Electronics Corp., 1000 Milwaukee Ave., Glenview, IL 60025, Tel: 312-391-7733, TELEX: 254396; *Sls. Mgr.:* George Zimmerer ..... **D•2057-2059**

Local Sales Offices & Reps

AZ	Phoenix, Pinnacle Comp. Sls.	602-994-0441
CA	Calabasas, Centaur Corp.	818-704-1655

CA Irvine, Centaur Corp. 714-261-2123
CA Mtn. View, Taarcom, Inc. 415-960-1550
CA San Diego, Centaur Corp. 619-278-4950
CT Clinton, Selmark Assocs., Inc. 203-573-9088
MA Millis, Selmark Assocs., Inc. 617-376-2914
NH Hopkinton, Selmark Assocs., Inc. 603-746-3299
OK Tulsa, CompTech 918-622-7744
TX Austin, CompTech 512-331-8922
TX Dallas, CompTech 214-751-1181

ZERO CORP., 777 Front St., Burbank, CA 90503, Tel: 818-846-4191, FAX: 818-841-5618; Empl.: 1400; *Sls. Mgr.:* Doug Griffith ..... **C•1100, 1120**

Local Sales Offices & Reps

AZ Phoenix, Howe & Howe Sls., Inc. 602-264-7971
CA Burbank, Zero-West Div. 818-846-4191
CA San Diego, San Diego Sls. Off. 619-271-7221
CO Boulder, Component Prod. Sls. Co. Inc. 303-530-2800
FL Clearwater, Zero-East Div. 813-531-8991
IL Elk Grove Village, Carlson Elctrns. Sls. 312-956-8240
IN Indianapolis, L.M. DeVoe Co. 317-842-3245
IA Cedar Rapids, Carlson Elctrn. Sls. 319-377-6341
MS Jackson, S. L. Welch 601-932-5534
MD Baltimore, Marktron 301-628-1111
MA Monson, Zero-East Div. 413-267-5561
MI Grosse Pointe Park, Greiner Assoc. Inc. 313-499-0188
MN Bloomington, Elctrn. Sls. Agcy. 612-884-8291
MO St. Louis, Cadon Techn. Sls. 314-645-8670
NY Commack, MTR, Inc. 516-462-9580
NM Albuquerque, Fry-Gates 505-262-1525
NY East Syracuse, Fountain Young & Co. 315-437-7733
NC Apex, Wolff Elect. 919-362-5022
OH Columbus, Tom Mulligan & Assocs. 614-457-2242
OR Lake Oswego, RTS, Inc. 503-244-4123
PA Boswell, B.E. Gibson 814-629-6772
PA Huntingdon Valley, Inacker Sls. 215-947-5660
SC Greenville, Sunbelt Sls. 803-877-9088
TX Dallas, Tesco Inc. 214-553-1200
TX Fort Worth, Milco Mktg. 214-783-2716
TX Houston, Milco Mktg. 713-723-5003
UT Salt Lake City, Effective Sls. 801-266-9617
MD Rockville, Marxtron 301-251-8990
WA Vashon, RTS, Inc. 206-285-1363

ZERO CORP., Zero East Div., 288 Main St., Monson, MA 01057, Tel: 413-267-5561, TWX: 710-354-1450; *Sls. Mgr.:* Roger St. Martin ..... **C•1120**

Local Sales Offices & Reps

AL Huntsville, BJR Mfg. Reps. 205-881-3569
CT Monson, Zero-East Div. 413-267-5561
IN Indianapolis, C.C. Electro Sls. 317-355-1508
IN Indianapolis, Leslie M. Devoe Co. 317-842-3245
MD Rockville, Marktron, Inc. 301-251-8990
MA Monson, Zero-East Div. 413-267-5561
MA Palmer, Benoit-Senecal Co. 413-283-8384
MI Grosse Pointe Pk., Greiner Assocs., Inc. 313-499-0188
MS Jackson, S. L. Welch & Assocs. 601-932-5534
NY Commack, MTR, Inc. 516-462-9580
NY Syracuse, Fountain Young Co. 315-437-7733
NC Apex, Wolff Elctrn. Sls., Inc. 919-362-5022
OH Columbus, Tom Mulligan & Assoc. 614-457-2242
PA Boswell, B. E. Gibson 814-629-6772
PA Huntingdon Valley, Inacker Sls. 215-947-5660
SC Greenville, Sunbelt Sls. 803-877-9088
Can Islington, Ont., Pipe-Thompson Ltd. ... 416-236-2355

ZETA LABS., Sub. of CCT Corp., 2811 Orchard Parkway, San Jose, CA 95134, Tel: 408-434-3600, TWX: 910-433-0855; FSC No.: 31260; Empl.: 280; *Sls. Mgr.:* C. W. Frank

ZEUS INDL. PRODS. INC., P.O. Box 298, Raritan, NJ 08869, Tel: 201-526-0800, 800-526-3842, TWX: 710-480-9346, FAX: 201-526-5699; FSC No.: 32039; Empl.: 150; *Sls. Mgr.:* Jeffrey J. Tourville; *Dist. Mgr.:* Michael C. Tourville ..... **C•1718, 1837, 1911**

ZEVATECH, INC., 1580 Old Oakland Rd., Suite C-108, San Jose, CA 95131, Tel: 408-289-1001; Empl.: 70; *Sls. Mgr.:* Bob Black; *Dist. Mgr.:* Bob Black

ZEXCO, 7661 Densmore, 68, Van Nuys, CA 91406, Tel: 818-997-7895

ZIATECH, 3433 Roberto Ct., San Luis Obispo, CA 93401, Tel: 805-541-0488, TELEX: 4992316, FAX: 805-541-5088; Empl.: 55; *Sls. Mgr.:* Jim Eckford

ZIERICK MANUFACTURING CORP., 56 Radio Circle, Mt. Kisco, NY 10549, Tel: 914-666-2911, 800-882-8020, TWX: 710-571-2143; Empl.: 120; *Sls. Mgr.:* L. T. Noyes; *Dist. Mgr.:* Jack Becker ..... **C•1601**

Local Sales Offices & Reps

IL Palatine, Claeson Assocs. 312-359-7230

Local Distributors

CA Fremont, Alatec Prods. 408-279-8895
CA Hayward, Arow Fasteners 415-487-2100
CA Laguna Hills, Yarbrough Timco 714-859-7021
CA Mission Hills, Coast Air 818-898-2288
CA N. Hollywood, Alatec Prods. 818-764-5600
CA San Jose, Bisco Inds. 408-435-8980
CO Denver, Hardware Specialty 303-371-8553
FL Winter Pk., Hardware Specialty 305-677-8500
MA Marlborough, Hardware Specialty 617-481-8622
MA Winchester, Rush Inds. 617-729-5800
MO Bridgeton, Alatec Prods. 314-298-0100
NJ Pine Brook, Alatec Prods. 201-227-8140
NY Long Island City, Hardware Specialty 718-361-9393
NY Peekskill, Lawrence Tufts 914-739-2107
OR Beaverton, Comps. Resources 503-641-8488
WA Redmond, Comps. Resources 206-454-8666
Can Concord, Ont., Zierick Canada Ltd. 416-669-1429

ZIPPERTUBING CO., Box 61129, Los Angeles, CA 90061, Tel: 213-321-3901, TWX: 910-346-6713, FAX: 213-321-3086; Empl.: 120; *Sls. Mgr.:* Terry Plummer

Local Sales Offices & Reps

AZ Phoenix 602-967-8888
FL Deerfield Bch., Sls. Engrg. Concepts .. 305-426-4601
MD Columbia, Pro-Rep 301-381-7460
MA Norwood, Tom Maguire Assocs. 617-551-0500
NJ Wayne 201-256-4980
OH Cleveland, Comps. & Specialty Co. 216-734-0655
TX Carrollton 214-931-7060
WA Mukilteo, Krippner & Assocs. 206-743-3579
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ZIRMEX, See Degussa Electronics, Hybrid Div.

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MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 88/89 EDITION OF EEM

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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
ABS acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CAMAC computer automated measurement and control
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3)
KSR keyboard send /receive

L
LC inductance capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIB microcomputer interface board
MIC microwave IC
MIPS million instructions per second
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

MINIGLOSSARY CAPACITORS

Anode: One of two plates or conductors. In polarized capacitors, the anode should be connected to the positive conductor in the circuit.

Capacitive Reactance: The measure of the opposition of a capacitor to accepting a charge and expressed in ohms. When direct current is applied under stated conditions capacitive reactance becomes a constant but, when alternating current is applied the capacitive reactance varies until an equilibrium is achieved and the capacitor appears to have only direct current present. This condition is commonly used in filter applications or in coupling circuits.

Cathode: One of two plates or conductors. In electrostatic capacitors the cathode is metallic. In electrolytic capacitors the cathode is a liquid, gel or other conductive material which is in intimate contact with a metallic cathodic connection.

Dielectric Constant: The measure of quality of the insulating materials in a capacitor. Dry air has a dielectric constant of one (1). Aluminum oxide used in aluminum electrolytic capacitors has a nominal dielectric constant of ten (10).

Electrolytic: A capacitor with one metallic conductor (generally the anode) and with a liquid or semiconductor cathode. Nonpolarized electrolytic capacitors generally have two equal anodes as well as the liquid cathode. These anodes operate alternately as anode and cathodic connection as alternating current is applied.

Electrostatic: One of two general classes of capacitors in which two or more discrete metallic conductors are present and separated by an insulating dielectric material. Examples include: mica, ceramic, film, and paper types.

Farad: The basic unit of measure in capacitors. A capacitor charged to one volt with a charge of one coulomb (one ampere flowing for one second) has a capacitance of one farad. Capacitors are generally rated at portions of a farad (microfarads or picofarads).

1 farad (F) = 1,000,000 microfarads (μF) 1 microfarad (μF) = 1,000,000 picofarads (pF)

Impedance: All capacitors exhibit impedance. It is a function of capacitor type and internal construction. This can be particularly important in certain applications such as filters for switching power supplies. Capacitors used in these applications often have special multiple tab construction to shorten current paths and to reduce internal resistance.

Leakage Current: Expressed as dcl for electrolytic capacitors, a measure of the intrinsic losses in a charged capacitor. Generally speaking, the lower the dcl, the higher quality the capacitor.

Power Factor: A measure of the overall efficiency of a capacitor. Power factor ratings take all internal losses into consideration in a complex formula. This parameter of certain capacitors is often very important in AC applications such as motor-start and/or motor-run capacitors.

Rated Voltage: The rated working voltage of a capacitor. Generally expressed in DC Volts (Vdcw). This is the voltage at which a capacitor may be safely operated at 25°C continuously within its overall parameters.

Ripple Current: The total amount of alternating and direct current that may be applied to an electrolytic capacitor under stated conditions. In general, the higher the ripple current applied, the shorter the operating life of the capacitor will be. Application of significantly higher than rated ripple currents can shorten the capacitor life dramatically and may even cause catastrophic failure (explosion).

Surge Voltage: The momentary surge voltage which may be applied for a stated length of time without doing permanent damage to the unit.

Temperature: Capacitors are generally rated at 25°C at sea level under specific humidity conditions. Operating temperature ranges are also given, along with derating (reliability) curves for operation at temperatures other than 25°C.

Temperature Coefficient: Expressed as TC in ppm (parts per million) or in percent (%) from the norm of 25°C. This is seldom a straight line and may vary widely for certain types. Most capacitors have positive TC in that the capacitance increases as temperature increases. Some types, however, have negative TC in that the capacitance decreases as temperature increases.

Ceramic Capacitor Codes
(Capacitance Given In pF)

Color	Digit	Multiplier	Tolerance			Temperature Coefficient ppm°C	Significant Figure	Multiplier
			Class 1		Class 2			
			10pF or less	Over 10pF				
Black	0	1	±2.0pF	±20%	±20%	0	0.0	—1
Brown	1	10	±0.1pF	±1%		—33		—10
Red	2	100		±2%		—75	1.0	—100
Orange	3	1000		±3%		—150	1.5	—1000
Yellow	4	10000			+100% —0%	—220	2.0	—10000
Green	5		±0.5pF	±5%	±5%	—330	3.3	+1
Blue	6					—470	4.7	+10
Violet	7					—750	7.5	+100
Gray	8	0.01	±0.25pF		+80% —20%	+150 to —1500		+1000
White	9	0.1	±1.0pF	±10%	±10%	+100 to —750		+10000
Silver								
Gold								

MINIGLOSSARY
BASIC CAPACITOR FORMULAS

I. Capacitance (farads)

English: $C = \frac{.224\,K\,A}{t_D}$

Metric: $C = \frac{.0884\,K\,A}{t_D}$

II. Energy stored in capacitors (Joules, watt-sec)

$E = \frac{1}{2}\,CV^2$

III. Linear charge of a capacitor (Amperes)

$I = C\frac{dV}{dt}$

IV. Total Impedance of a capacitor (ohms)

$Z = \sqrt{R_s^2 + (X_C - X_L)^2}$

Where Rs = ESR

V. Capacitive Reactance (ohms)

$X_C = \frac{1}{2\pi fC}$

VI. Inductive Reactance (ohms)

$X_L = 2\pi fL$

VII. Phase Angles:

Ideal Capacitors: Current leads voltage 90°
Ideal Inductors: Current lags voltage 90°
Ideal Resistors: Current in phase with voltage

VIII. Dissipation Factor

$DF = \tan\delta \text{ (loss angle)} = \frac{ESR}{X_c} = (2\pi fC)\,(ESR)$

IX. Power Factor

PF = Sine δ (loss angle) = Cos φ (phase angle)
PF = DF (when less than 10%)

X. Quality Factor (dimensionless)

$Q = \text{Cotan } \delta \text{ (loss angle)} = \frac{1}{DF}$

XI. Equivalent Series Resistance (ohms)

$ESR = (DF)\,(Xc) = (DF)\,(\frac{1}{2}\pi fC)$

XII. Power Loss (watts)

Power loss $= (2\pi fCV^2)\,(DF)$

XIII. KVA (Kilowatts)

$KVA = 2\pi fCV^2 \times 10^{-3}$

XIV. Temperature Characteristic (ppm/°C)

$TC = \frac{Ct - C_{25}}{C_{25}\,(T_t - 25)} \times 10^6$

XV. Cap Drift (%)

$C.D. = \frac{C_1 - C_2}{C_1} \times 100$

XVI. Reliability of Ceramic Capacitors

$\frac{L_o}{L_t} = \left(\frac{V_t}{V_o}\right)^x \left(\frac{T_t}{T_o}\right)^\tau$

XVII. Capacitors in Series (current the same)

Any number: $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} \text{ --- } + \frac{1}{C_N}$

Two: $C_T = \frac{C_1\,C_2}{C_1 + C_2}$

XVIII. Capacitors in Parallel (voltage the same)

$C_T = C_1 + C_2 \text{ --- } + C_N$

XIX. Aging Rate

A.R. = % Δ C/decade of time

XX. Decibels

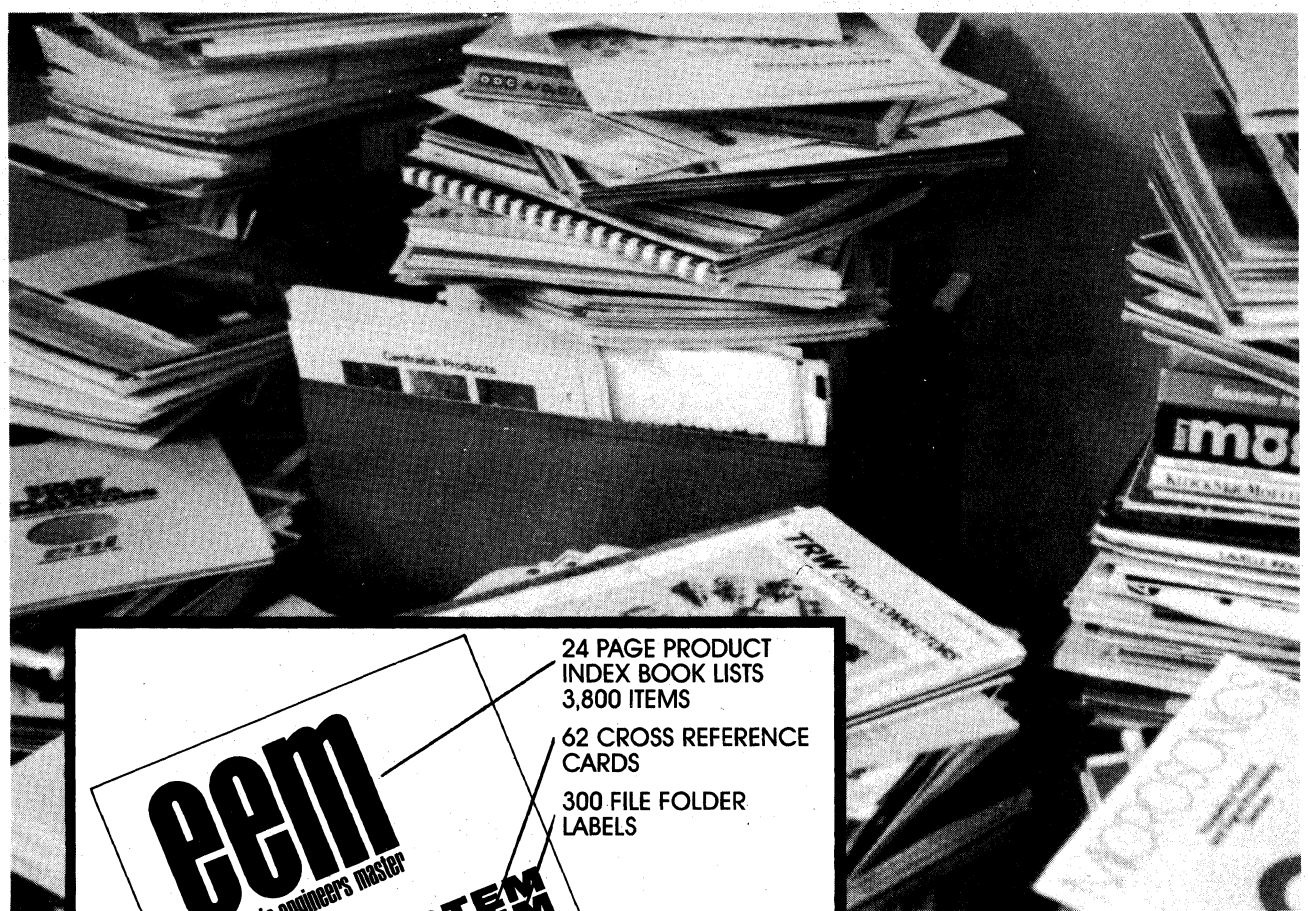
$db = 20 \log \frac{V_1}{V_2}$

Metric prefixes:

Pico	X 10^{-12}
Nano	X 10^{-9}
Micro	X 10^{-6}
Milli	X 10^{-3}
Deci	X 10^{-1}
Deca	X 10
Kilo	X 10^3
Mega	X 10^6
Giga	X 10^9
Tera	X 10^{12}

Symbols:

K = Dielectric Constant
A = Area
t_D = Dielectric thickness
V = Voltage
t = time
R_S = Series Resistance
f = frequency
L = Inductance
δ = Loss angle
φ = Phase angle
x + y = Exponent effect of voltage and temp
L_o = Operating life
L_t = Test life
V_t = Test voltage
V_o = Operating voltage
T_t = Test temperature
T_o = Operating temperature



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eem MINIGLOSSARY CONNECTORS

Connector terminology is often quite confusing. This confusion starts with the very names of connectors. The name of a connector may derive from its shape, application, type of conductor or even method of termination.

Shape—Circular, cylindrical, and rectangular.

Electrical application—High voltage, RF, microwave, input/output, etc.

Mechanical application—Printed circuit, rack & panel, cable, etc.

Conductor type—Coaxial, flat cable, ribbon cable, flex circuit, etc.

Termination method—Wirewrap, soldercup, solderless, etc.

Hardware such as clamps, hoods, and adapters are frequently used to convert cable connectors to rack and panel types. This adds to the name confusion. A very common telephone connector, for example (the "C" type) got its name from the model number of the original maker.

Contact: The part(s) of the connector that actually provides circuit continuity between its two sections—the parts which are normally mated. The back end of the connector should properly be called the *termination.* This is the point where the wires or PC board is attached to the connector.

Contact alignments: Often called *contact float.* Describes the amount of allowable contact movement within the connector body. Permits self-alignment.

Male vs. female: In the U.S. this describes the contact construction. In Europe this term is more often used to describe the outer shell mating action which may be the reverse of the contacts.

Closed entry: A female contact which prevents entry of a male contact larger than a specific size.

Open entry: A female contact designed for a specific size of male contact but which will allow entry of larger male contacts by spring action.

Hermaphrodite: Contacts or connector bodies which are the same configuration. Male/female designations do not apply. Bodies usually have some mechanical means for maintaining polarity.

Hermetic seal: Glass-to-metal seals at terminations. Often used improperly to describe vacuum-tight seals.

Waterproof seal: May or may not be truly *waterproof.* May prevent easy entrance of casual water by means of a rubber or other boot.

Printed circuit connector: Connectors which are used in conjunction with printed circuit boards. There are two distinctly different styles.

Edgeboard. May be called *edge* or *card.* The printed circuit (PC) board edge enters the connector.

Two-piece: One part of the connecting pair is physically attached to the PC board itself. The other part is attached to something else such as a cable or a motherboard.

Readout: Describes the arrangement at the terminating edge of a PC board. May be single or double. A double readout PC board has termination strips on each side not usually interconnected.

Ribbon connectors: A type of connector which allows flat "ribbon" cable to be attached to a round or rectangular connector but also used interchangeably for flat connectors to flat cable.

Ribbon contact connector: Describes the contacts in a rectangular connector which have a self-wiping mating action. Not the same as ribbon connector.

Solderless terminal: Any style of termination which does not require solder for a permanent connection. See *crimp* and *insulation displacement.*

Crimp termination: A stripped wire is inserted into a barrel or trough which is then crimped to the conductor with a suitable tool.

Insulation displacement: Unstripped insulated wire is fitted into a channel containing metal teeth which are forced through the insulation to make contact with the conductor.

Service rating: The maximum rated voltage and/or current which may be applied continuously. May be called *working voltage.* Can be confused with the term used to describe how many times a connector may be mated and separated.

Withstanding voltage: Also called *test voltage.* The voltage a connector must withstand for one minute without breakdown. Applied between connectors and between connectors and shell and any grounding devices of the connector.

eem MINIGLOSSARY POWER SUPPLIES

Ambient reference: Refers to the temperature of the still air surrounding the power supply

Case reference: One of the specs that make up the nominal rating. The temperature of the case with the temperature of the surrounding still air at a stated temperature (usually 25°C).

Crowbar circuit: Protects the load. A protective circuit that applies a short circuit across the output immediately upon overload. (See overvoltage).

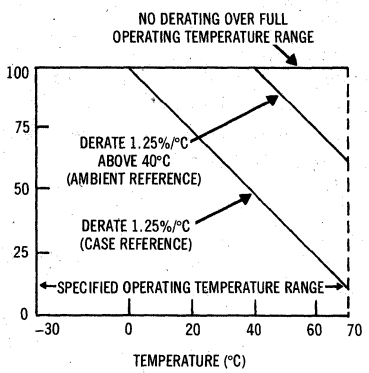


Fig. 1. Power output derating can be referred to ambient or case.

Derating: The degree output is reduced as temperature increases. Usually referenced to ambient case temperature and shown on a graph.

Efficiency: Ratio of the output power to the required input power. Usually expressed as a percentage given nominal environmental temperature.

EMI/RFI: Interference electronic circuitry caused by energy from electromechanical or radio frequency power supplies.

Foldback: Built-in protective circuits that automatically reduce the output voltage and/or current to very low levels in the event of an overload.

Holdover (Holdup): The interval that rated output will continue after input ceases. Usually milliseconds.

Input reflected current: The peak-to-peak alternating current generated by switching transients in DC/DC converters. Should not exceed 1%.

Inrush current limiting: Built-in circuits that monitor high currents through the rectifiers to the capacitors at turn ON. Circuit is usually inhibited as capacitors attain full charge.

Nominal rating: The spec value of the supply at stated conditions of input, output, and temperature.

Overshoot: A transient voltage change occurring during turn ON or OFF or during an abrupt load change.

Overvoltage (Overload) protection: Built-in circuits that protect the load or the supply by shutting it down or providing foldback.

Recovery: The time interval between the termination of an overload and restoration to normal operations.

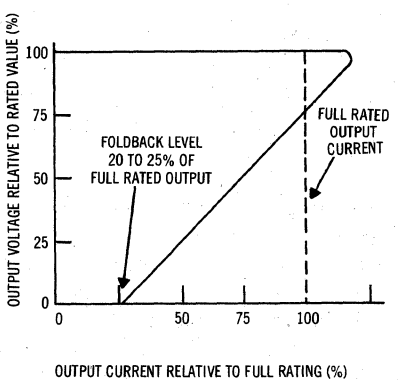


Fig. 2. Current foldback limiting self-resets with removal of fault.

Response: The time interval between a stated step change in input voltage or load current and return of output to normal operating conditions.

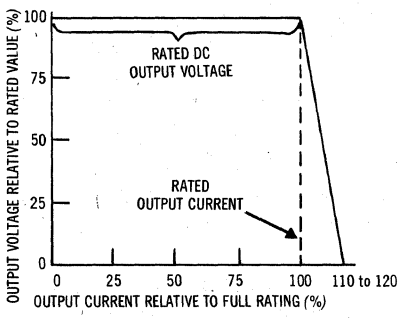


Fig. 3. Current limiting restrictions output current to a valve somewhat greater than full rated output; it resets when fault is removed.

Sensing: Regulation techniques that monitor output voltage and/or current. *Local sensing* refers to the output terminals. *Remote sensing* allows a feedback from the load circuit to the power supply.

Soft start: Allows the supply to start from zero current and/or voltage over a stated period of time during start up to prevent voltage overshoots and current imbalances.

Switchers: Power supplies using switching techniques to achieve high efficiency regulation. These techniques can have attendant EMI/RFI problems.

Tracking: The maintaining of fixed ratios between multiple outlets despite variations in line, load or temperature. Particularly important in supplies with symetrical (+)(−) outputs.

Transient protection: Circuitry designed to protect the supply from high amplitude line transients. Generally expressed in terms of peak voltage and maximum transient time duration.

CHARACTERISTICS OF BATTERIES AND FUEL CELLS

System	Anode	Cathode	Theoretical battery		Practical battery		
			Voltage, V	Capacity, Ah/kg	Typical voltage, V	Capacity[a]	
						Wh/kg	Wh/dm³
Primary:							
Leclanche	Zn	MnO_2	1.6	230	1.2	65	175
Magnesium	Mg	MnO_2	2.0	270	1.5	100	195
Organic cathode	Mg	*m*-DNB	1.8	1,400	1.15	130	180
Alkaline MnO_2	Zn	MnO_2	1.5	230	1.15	65	200
Mercury	Zn	HgO	1.34	185	1.2	80	370
Mercad	Cd	HgO	0.9	165	0.85	45	175
Silver oxide	Zn	AgO	1.85	285	1.5	130	310
Zinc-air	Zn	Air (O_2)	1.6	815	1.1	200	190
Li-organic electrolyte	Li	[b]	2.1-5.4	130-660	1.8-3.2	250	400
Secondary:							
Lead-acid	Pb	PbO_2	2.1	55	2.0	37	70
Edison	Fe	Ni oxides	1.5	195	1.2	29	65
Nickel-cadmium	Cd	Ni oxides	1.35	165	1.2	33	60
Silver-zinc	Zn	AgO	1.85	285	1.5	100	170
Silver-cadmium	Cd	AgO	1.4	230	1.05	55	120
Zinc-nickel oxide	Zn	Ni oxides	1.75	185	1.6	55	110
Zinc-air[c]	Zn	Air (O_2)	1.6	815	1.1	150	155
Cadmium-air[c]	Cd	Air (O_2)	1.2	475	0.8	90	90
Zinc-O_2	Zn	O_2	1.6	610	1.1	130	120
H_2-O_2	H_2	O_2	1.23	3,000	0.8	45	65
Reserve:							
Cuprous chloride	Mg	CuCl	1.5	240	1.4	45	65[d]
Silver-chloride	Mg	AgCl	1.6	170	1.5	60	95[d]
Zinc-silver oxide	Zn	AgO	1.85	285	1.5	30	75[e]
Thermal	Ca	[b]	2.8	240	2.6	10	20[f]
Ammonia-activated	Mg	*m*-DNB	2.2	1,400	1.7	22	60[g]
High-	NA	S	2.1	685	1.8	200	[h]
temperature	Li	S	2.2	1,150	1.8	200	[i]
Solid electrolyte	Ag	Polyiodide	0.66	. . .	0.6	180	75[j]
Fuel cell:							
Hydrogen[c]	H_2	Air	1.23	26,000	0.7		[k]
Hydrazine[c]	N_2H_4	Air	1.5	2,100	0.7	800[b]	[l]
Methanol[c]	CH_2OH	Air	1.3	1,400	0.9	175[b]	185[m]

a Delivered capacity when discharged at normal temperatures (20°C) at normal discharge rates.
b Based on fuel consumption only.
c Weight of air not considered in computation of watt hours.
d Water-activated
e Automatically activated; high rate discharge; 2- to 10-min rate.
f Fused salt; heat-activated; high rate discharge; 2- to 10-min rate.
g Four-minute discharge rate.
h β-alumina electrolyte, 300°C operation.
i Fused salt; 350°C operation.
j Solid $RbAg_4I_5$ electrolyte.
k Several different cathode materials used.
l Fuel consumption is based on source of H_2.
m Based on methanol battery-fuel supply in situ.

WIRE GAUGES— DIAMETER, AREA AND COPPER WEIGHT

	Diameter at 20°C (68°F)		Area at 20°C (68°F)			Weight at 20°C (68°F), bare copper wire		
Size, AWG	mils	mm	mils	c mils	mm	lb/1,000 ft.	lb/mile	kg/km
4/0	460.0	11.68	166,200	211,600	107.2	640.5	3,382	953.2
3/0	409.6	10.40	131,800	167,800	85.01	507.8	2,681	755.7
2/0	364.8	9.266	104,500	133,100	67.43	402.8	2,127	599.5
1/0	324.9	8.252	82,891	105,600	53.49	319.5	1,687	477.6
1	289.3	7.348	85,730	83,690	42.41	253.3	1,338	337.0
2	257.6	6.543	52,120	66,360	33.62	200.9	1,061	298.9
3	229.4	5.827	41,330	52,620	26.67	159.3	841.1	237.1
4	204.3	5.189	32,780	41,740	21.15	126.3	667.1	188.0
5	181.9	4.620	25,990	33,090	16.77	100.2	528.8	149.0
6	162.0	4.115	20,610	26,240	13.30	79.44	419.4	118.2
7	144.3	3.665	16,350	20,820	10.55	63.03	332.8	93.80
8	128.5	3.264	12,970	16,510	8.367	49.98	263.9	74.38
9	114.4	2.906	10,280	13,090	6.631	39.61	209.2	58.95
10	101.9	2.588	8,155	10,380	5.261	31.43	166.0	46.77
11	90.7	2.304	6,460	8,230	4.17	24.90	131	37.1
12	80	2.05	5,130	6,530	3.310	19.8	104	29.4
13	72.0	1.83	4,070	5,180	2.63	15.7	82.9	23.4
14	64.1	1.63	3,230	4,110	2.08	12.4	65.7	18.5
15	57.1	1.45	2,560	3,260	1.650	9.87	52.1	14.7
16	50.8	1.29	2,030	2,580	1.31	7.81	41.2	11.6
17	45.3	1.150	1,610	2,050	1.040	6.21	32.8	9.24
18	40.3	1.02	1,280	1,620	0.823	4.92	26.0	7.32
19	35.9	0.912	1,010	1,290	0.653	3.90	20.6	5.81
20	32.0	0.813	804.0	1,020	0.519	3.10	16.4	4.61
21	28.5	0.724	638.0	812.0	0.412	2.46	13.0	3.66
22	25.3	0.643	503.0	640.0	0.324	1.94	10.2	2.88
23	22.6	0.574	401.0	511.0	0.259	1.55	8.16	2.30
24	20.1	0.511	317.0	404.0	0.205	1.22	6.46	1.82
25	17.9	0.455	252.0	320.0	0.162	0.970	5.12	1.44
26	15.9	0.404	199.0	253.0	0.128	0.765	4.04	1.14
27	14.2	0.361	158.0	202.0	0.102	0.610	3.22	0.908
28	12.6	0.320	125	159.0	0.0804	0.481	2.54	0.715
29	11.3	0.287	100.0	128.0	0.0647	0.387	2.04	0.575
30	10.0	0.254	78.50	100.0	0.0507	0.303	1.60	0.450
31	8.9	0.226	62.20	79.2	0.0401	0.240	1.27	0.357
32	8.0	0.203	50.30	64.0	0.0324	0.194	1.02	0.288
33	7.1	0.180	39.60	50.40	0.0255	0.153	0.806	0.227
34	6.3	0.160	31.20	39.7	0.0201	0.120	0.634	0.179
35	5.6	0.142	24.60	31.4	0.0159	0.0940	0.501	0.141
36	5.0	0.127	19.60	25.00	0.0127	0.0757	0.400	0.113
37	4.50	0.114	15.90	20.20	0.0103	0.0613	0.324	0.0912
38	4.0	0.102	12.60	16.0	0.00811	0.0484	0.256	0.0721
39	3.5	0.0889	9.62	12.2	0.00621	0.0371	0.196	0.0552
40	3.1	0.0787	7.55	9.61	0.00487	0.0291	0.154	0.0433
41	2.8	0.0711	6.16	7.84	0.00397	0.0237	0.125	0.0353
42	2.5	0.0635	4.91	6.25	0.00317	0.0189	0.0999	0.0282
43	2.2	0.0559	3.80	4.84	0.00245	0.0147	0.0774	0.0218
44	2.0	0.0508	3.14	4.00	0.00203	0.0121	0.0639	0.0180
45	1.8	0.0457	2.54	3.24	0.00164	0.00981	0.0519	0.0146
46	1.6	0.0406	2.01	2.56	0.00130	0.00775	0.0409	0.0115
47	1.4	0.0356	1.54	1.96	0.000993	0.00593	0.0313	0.00883
48	1.2	0.0305	1.13	1.44	0.000730	0.00436	0.0230	0.00649
49	1.1	0.0279	0.950	1.21	0.000613	0.00366	0.0193	0.00545
50	1.0	0.0254	0.785	1.00	0.000507	0.00303	0.0160	0.00450

NOMOGRAPH VOLTAGE DROP

NOMOGRAPH OF VOLTAGE DROP ACROSS LOAD SUPPLY LEADS
(as a function of wire size and load current)

THIS NOMOGRAPH CAN BE USED TO FIND:

Maximum current carrying capacity recommended for any standard wire size.*

1) With a straight edge, connect from the wire size on Scale 2 to the point "A" on Scale 3.
2) Read I_{max} on Scale 1.

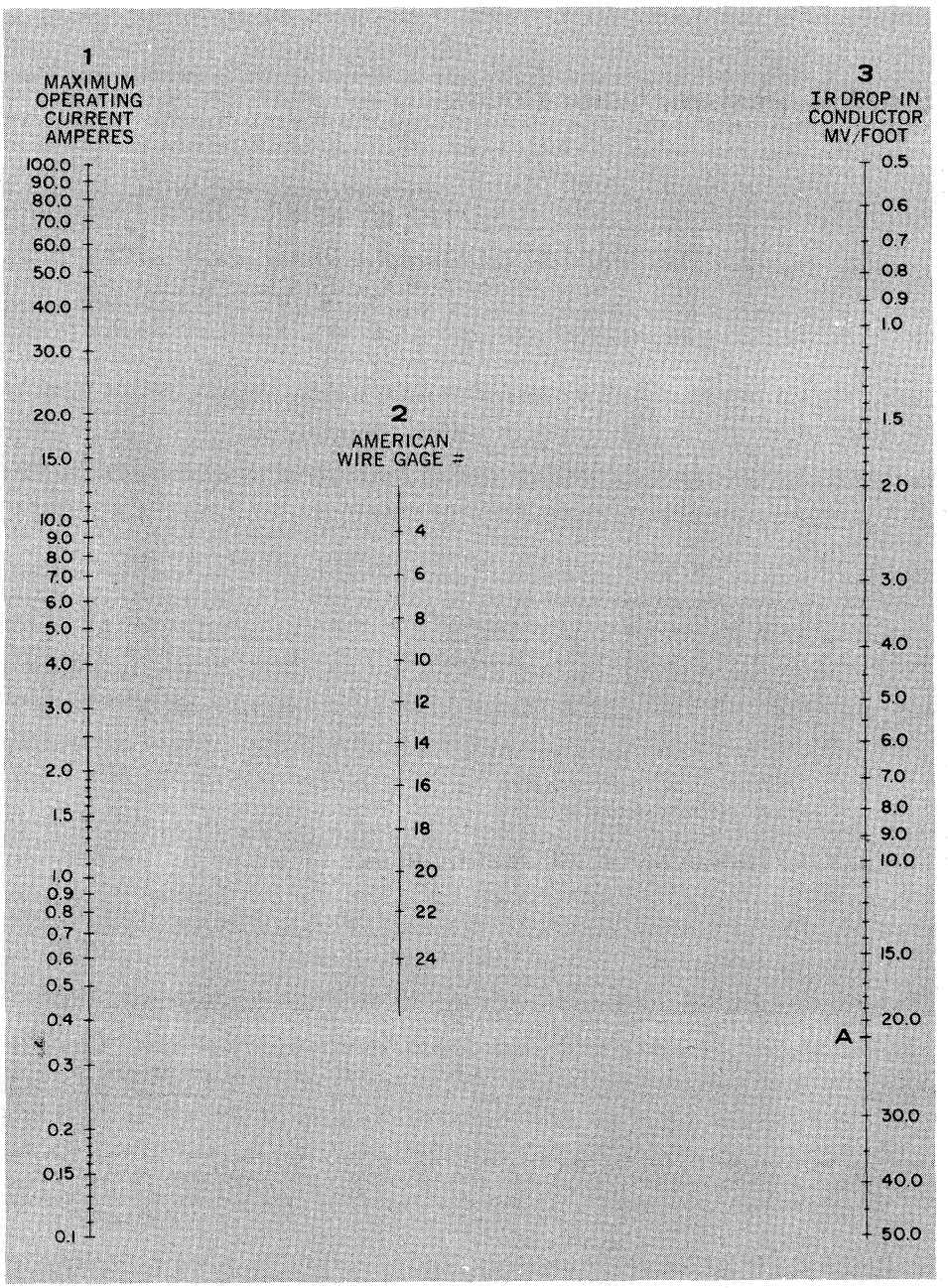
Voltage drop in millivolts per foot for known wire size and operating current.

1) With a straight edge, connect the known current on Scale 1 and the wire size on Scale 2.
2) Read voltage drop on Scale 3.

Wire size required for known operating current and known maximum tolerable voltage drop across supply leads.

1) Determine maximum tolerable drop in millivolts **per foot** of lead (sum of positive and negative leads).
2) Connect the value on Scale 3 (as determined in step 1) to the known current on Scale 1.
3) Read wire size on Scale 2.

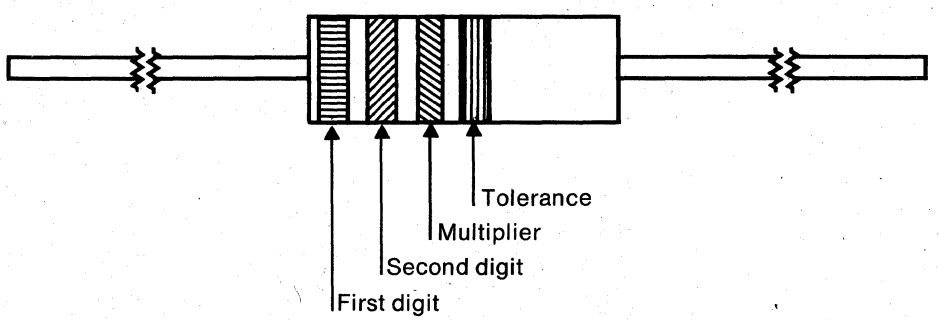
** Based on an arbitrary minimum 500 circular mils per ampere. High-temperature class insulation will safely allow higher currents.*



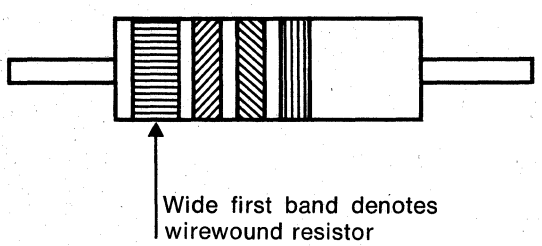
NOTE: A voltage stabilized Power Supply controls the voltage across its output terminals. Hence, the wire conductors used to connect the load must be considered as part of the load. At high load currents, the voltage drop across the supply leads may appreciably degrade stablization at the load. Kepco models equipped with the *remote error sensing* feature can automatically compensate for voltage drops of up to 500 mV across each load supply lead.

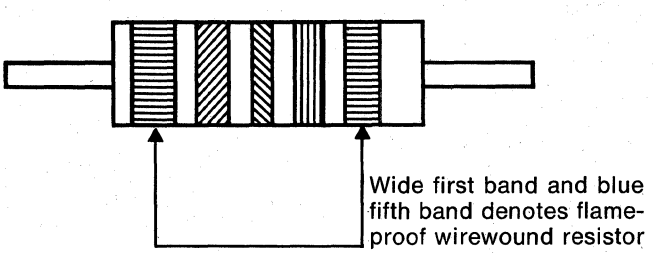
MINIGLOSSARY
RESISTOR COLOR CODES

EIA/MIL Resistor Color Codes



Color code for general-purpose industrial resistors

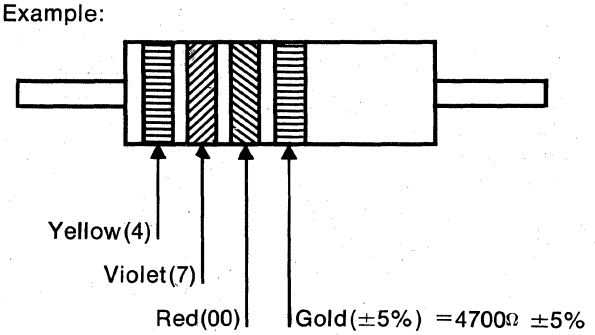




Color code for general-purpose wirewound resistors

Color	Significant digit	Multiplier	Tolerance
Black	0	1	—
Brown	1	10	± 1%
Red	2	100	± 2%
Orange	3	1000	± 3%
Yellow	4	10,000	± 4%
Green	5	100,000	—
Blue	6	1,000,000	—
Violet	7	10,000,000	—
Gray	8	—	—
White	9	—	—
Gold	—	0.1	± 5%
Silver	—	0.01	±10%
No color	—	—	±20%

Example:



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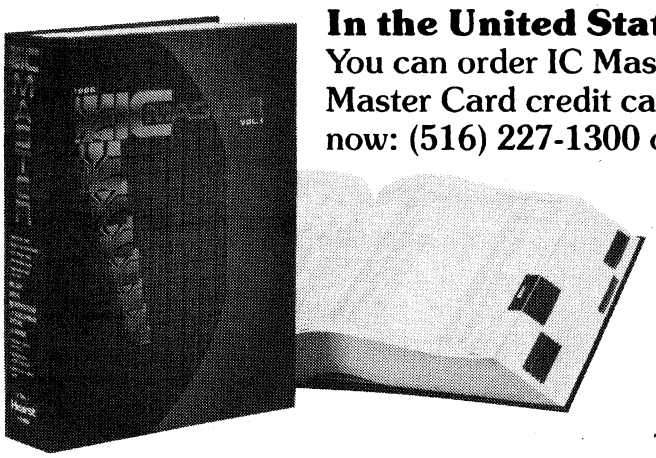

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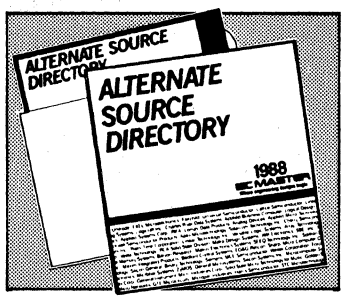

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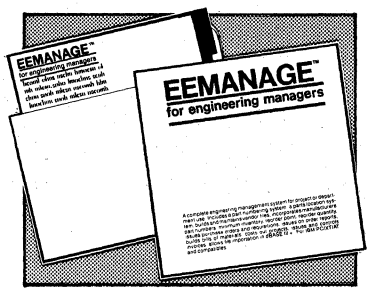

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MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 88/89 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1134, **B**•1098, **C**•1082, **D**•1038
ASCII Code ..... **D**•1073
Batteries, Product Selection Guide ..... **D**•1428
Batteries & Fuel Cells, Characteristics ..... **D**•1454
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1030
Capacitors, Miniglossary ..... **A**•1027
Capacitors, Product Selection Guide .. **A**•1003
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1193
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1760
Connectors, Miniglossary ..... **C**•1374
Connectors, Terminals & Sockets, Product Selection Guide ..... **C**•1127
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide ..... **A**•1331
Delay Lines, Product Selection Guide ..... **A**•1495
Discrete Semiconductors, Product Selection Guide ..... **A**•2113
Displays, Readouts, & CRTs, Product Selection Guide ..... **B**•1033
EBCDIC Code ..... **D**•1162
Encapsulation, Miniglossary ..... **C**•1110
Fans, Blowers, Cooling Equipment & Heat Exchangers, Product Selection Guide ..... **C**•1643
Filters, Product Selection Guide ..... **A**•1633
IC Master ..... **A**•1718
Instruments, Panel Meters, Product Selection Guide ..... **D**•1350
Instruments, Test & Measuring, Product Selection Guide ..... **D**•1190
Interconnection Systems, Product Selection Guide ..... **C**•1719
Keyboards & Keypads, Product Selection Guide ..... **B**•1808
Lamps, Lights, & Inductors, Product Selection Guide ..... **B**•1104
Logofinder & Trademark Directories .... **C**•901
Microwave Components, Product Selection Guide ..... **A**•1761
Military Qualified Products List ..... **B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1181
Opto Semiconductors, Miniglossary .. **B**•1262
Oscilloscopes, Product Selection Guide ..... **D**•1408
Panel Hardware, Product Selection Guide ..... **C**•1603
Potentiometers, Trimmers, Controls & Rheostats, Product Selection Guide ..... **A**•2057
Power Supplies, Miniglossary ..... **D**•1504
Power Supplies, AC, Product Selection Guide ..... **D**•2060
Power Supplies, DC, Product Selection Guide ..... **D**•1497
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide ..... **B**•1297
Relay Contact Forms ..... **B**•1371
Relays, Electromechanical, Miniglossary ..... **B**•1364
Relays, Product Selection Guide ..... **B**•1355
Resistor Color Codes ..... **A**•1911
Resistors, Product Selection Guide .... **A**•1849
Servo Components, Miniglossary ..... **B**•1238, **D**•2176
SI Units, Basic Guide To, ... **A**•1090, **B**•1050, **C**•1092, **D**•1048
Solenoids, Product Selection Guide .... **B**•1612
Switches, Product Selection Guide ..... **B**•1636
Thermal Components, Product Selection Guide ..... **B**•1834
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1842
Thyristors/High Power Diodes, Miniglossary ..... **A**•2145
Trademark & Logofinder Directories .... **C**•901
Transducers & Encoders, Product Selection Guide ..... **B**•1874
Transformers, Product Selection Guide ..... **A**•2153
Voltage Drop Nomograph .. **C**•1912, **D**•2042
Wire & Cable, Product Selection Guide ..... **C**•1763
Wire Guages—Diameter, Area, Copper Weight ..... **C**•1864

CAPACITORS,FIXED, ELECTROSTATIC

CERAMIC

Manufacturer	Starting EEM Page No	General Purposes (Z5U)		Special Purpose (C0G,X7R, NP0, etc.)				Monolithic						
										Encapsulated				
		Axial	Disc/ Radial	Axial	Disc/ Radial	DIP	Chip	Chip	DIP	Axial	Dipped Radial	Molded Radial	Feed Thru	High Voltage/ Power
Robert G. Allen Co.	A•1007	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤		¤
American Tech. Ceramics*	A•1009						¤	¤						¤
Armbar	A•1014						¤							
AVX Corporation	A•1023	¤	¤					¤				¤		
Bradford Electronics	A•1028												¤	¤
Delevan Div.	A•1073						¤	¤						
FL Jennings	A•1085													¤
Illinois Capacitor	A•1086		¤		¤									
International Components	A•1088		¤											
ISL Products Int'l Ltd.	A•1094	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤
Johanson Dielectrics*	A•1098						¤	¤					¤	¤
Kemet*§	A•1100	¤	¤	¤	¤		¤	¤		¤	¤	¤		
Maida Development	A•1103		¤		¤		¤	¤			¤		¤	¤
Mallory Capacitor*§	A•1108	¤	¤	¤	¤	¤	¤	¤						¤
Mepco/Centralab*§	A•1120				¤			¤						¤
Metuchen Capacitors*§	A•1126	¤	¤	¤	¤	¤	¤	¤			¤		¤	¤
Multi Products Intl.	A•1135		¤				¤							
Murata Erie§	A•1136		¤		¤		¤	¤		¤	¤			¤
Radio Materials§	A•1168		¤		¤		¤	¤					¤	¤
TDK	A•1176		¤		¤		¤			¤				¤
Tusonix*	A•1181		¤		¤					¤	¤	¤	¤	¤
U.S. Microtek*	A•1184	¤	¤	¤	¤		¤	¤			¤	¤	¤	¤

* Mil. Spec.
§ Surface Mount

CAPACITORS, FIXED, ELECTROSTATIC

FILM/FOIL (NONMETALLIZED)

Manufacturer	Starting EEM Page No.	Polyester		Polystyrene		Polycarbonate		Polypropylene		Teflon	Paralene		Combi-nations
		Axial	Radial	Axial	Radial	Axial	Radial	Axial	Radial	Axial	Axial	Radial	
Robert G. Allen Co.	A•1007	¤	¤	¤	¤			¤	¤				
American Shizuki	A•1008								¤				
Component Research *	A•1031	¤		¤		¤		¤		¤			¤
Cornell Dubilier*	A•1070	¤	¤			¤	¤	¤	¤				
CSI Capacitors	A•1071		¤						¤				
DEL Electronics*	A•1072							¤	¤				
Electronic Concepts *	A•1076	¤	¤	¤		¤	¤	¤		¤			
Elpac Components*	A•1082	¤	¤	¤	¤	¤	¤	¤	¤	¤			
Illinois Capacitor	A•1086	¤	¤										
International Components	A•1088	¤	¤						¤				
Inter-Technical Group	A•1089		¤				¤	¤	¤				
ISL Products Int'l Ltd.	A-1094	¤	¤	¤	¤	¤	¤	¤	¤				
ITW Paktron	A•1095							¤	¤				
Kemet*§	A•1100										¤	¤	
Mallory Capacitor*§	A•1108		¤	¤				¤	¤				
Matsuo Electronics	A•1114	¤	¤			¤		¤	¤				
Mepco/Centralab*§	A•1120	¤	¤	¤		¤	¤	¤	¤	¤			
Nytronics*	A•1144	¤						¤					
PPD	A•1158	¤						¤					
Seacor	A•1171	¤	¤	¤	¤	¤	¤	¤	¤				
Siemens	A•1173		¤										
Wesco Electrical *	A•1186	¤		¤				¤					

METALLIZED FILM

Manufacturer	Starting EEM Page No.	Polyester		Polysulfone		Polycarbonate			Polypropylene		AC & Motor Run	Teflon Axial	Combi-nations
		Axial	Radial	Axial	Radial	Axial	Radial	Chip	Axial	Radial			
Robert G. Allen Co.	A•1007	¤	¤						¤	¤	¤		
American Shizuki	A•1008	¤	¤			¤	¤		¤	¤	¤		
AT&T	A•1015	¤	¤										
Component Research *	A•1031	¤		¤		¤			¤		¤	¤	¤
Cornell Dubilier*	A•1070	¤	¤			¤	¤		¤	¤	¤		
CSI Capacitors	A•1071												¤
Electronic Concepts *	A•1076	¤	¤	¤		¤	¤		¤	¤			
Elpac Components*	A•1082	¤	¤			¤	¤		¤	¤	¤	¤	¤
Evox, Inc.	A•1084		¤				¤	¤					
Illinois Capacitor	A•1086	¤	¤			¤			¤	¤			
International Components	A•1088	¤											
Inter-Technical Group	A•1089		¤				¤			¤			
ISL Products Int'l Ltd.	A•1094	¤	¤			¤	¤		¤	¤			
ITW Paktron	A•1095		¤										
Johanson Dielectrics*	A•1098		¤						¤				¤
Kemet*§	A•1100					¤							
Maida	A•1103	¤	¤			¤	¤		¤	¤			
Mallory Capacitor*§	A•1108	¤	¤						¤	¤	¤		¤
Matsuo	A•1114		¤			¤			¤	¤			
Mepco/Centralab*§	A•1120	¤	¤			¤	¤			¤			
Nytronics*	A•1144	¤				¤							
PPD	A•1158	¤	¤						¤		¤		
Seacor	A•1171	¤	¤			¤	¤		¤	¤	¤		¤
Siemens	A•1173		¤				¤						
Wesco Electrical*	A•1186	¤	¤			¤			¤				

* Mil. Spec. § Surface Mount

CAPACITORS, FIXED, ELECTROLYTIC

ALUMINUM

Manufacturer	Starting EEM Page No.	Subminiature Tubular				Standard Tubular				Small Can		Lg. Can	Plastic	AC
		Axial Leads		Single End		Axial Leads		Single End		Single	Multi	Storage		Motor
		Polar	Nonpol.	Polar	Nonpol.	Polar	Nonpol.	Polar	Nonpol.	Section	Section	Cptr.Grd	Cases	Start
Robert G. Allen Co.	A•1007	¤	¤	¤	¤	¤	¤	¤	¤	¤		¤		¤
Cornell Dubilier*	A•1070	¤		¤	¤	¤		¤	¤	¤	¤			¤
Del Electronics*	A•1072									¤	¤	¤		
Illlinois Capacitor	A•1086	¤	¤	¤	¤	¤	¤	¤	¤					
ISL Products Int'l Ltd.	A•1094	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤		¤
Maida	A•1103	¤	¤	¤	¤	¤	¤	¤	¤	¤				
Mallory Capacitor*§	A•1108	¤	¤			¤	¤					¤		
Mallory Timers	A•1113									¤		¤		
Mepco/Centralab*§	A•1120													¤
United Chemi-Con	A•1182	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤		

TANTALUM

Manufacturer	Starting EEM Page No.	Solid Electrolyte						Wet Slug		Foil	
		Dipped Radial	Molded Axial	Molded Radial	DIP	Chip	Metal Case	Tubular Case	Large Case	Polar	Nonpolar
Robert G. Allen Co.	A•1007	¤	¤	¤	¤	¤					
AVX Corporation	A•1023	¤	¤			¤					
Cornell Dubilier*	A•1070						¤	¤	¤		
International Components	A•1088	¤									
ISL Products Int'l Ltd.	A•1094	¤	¤	¤	¤	¤					
ITT Components	A•1092	¤				¤					
Kemet *§	A•1100	¤	¤	¤		¤	¤				
KOA Speer§	A•1102			¤		¤					
Mallory Capacitor*§	A•1108	¤	¤	¤		¤		¤	¤		
Matsuo	A•1114	¤	¤	¤	¤	¤	¤	¤	¤		
Mepco/Centralab *§	A•1120					¤	¤	¤	¤	¤	¤
NEC Electronics§	A•1141	¤	¤			¤					

* Mil. Spec.
§ Surface Mount

CAPACITORS, FIXED, ELECTROSTATIC

MICA

Manufacturer	Starting EEM Page No.	Dipped	Chip	Button	Transmitting	Reconstituted
Robert G. Allen Co.	A•1007	¤	¤			
Cornell Dubilier*	A•1070	¤			¤	
ISL Products Int'l Ltd.	A•1094	¤				

PAPER & PAPER/FILM

Manufacturer	Starting EEM Page No.	Paper Foil (Dry)			Paper Foil (Impregnated)		Metallized Paper			Paper/ Film
		Axial	Single End	Herm. Sealed	Energy Store	Motor Run	Axial	Single Ended	Herm. Sealed	(Axial)
DEL Electronics*	A•1072	¤	¤							
Elpac Components*	A•1082									¤
Mallory Capacitor *§	A•1108					¤				
Mepco/Centralab*§	A•1120									¤
Nytronics *	A•1144				¤	¤				

* Mil. Spec.
§ Surface Mount

CAPACITORS, VARIABLE, ELECTROSTATIC

CAPACITORS, VARIABLE

Manufacturer	Starting EEM Page No.	Ceramic				Film	Mica	Air	Gas Filled	Vacuum	Sapphire	Glass
		Tubular		Disc								
		Piston	Other	Single	Multiple							
FL Jennings	A•1085	¤							¤	¤		¤
ISL Products Int'l Ltd.	A•1094		¤	¤	¤	¤	¤					
Johanson Dielectrics*	A•1098			¤	¤			¤				
Johanson Mfg *	A•1099	¤	¤	¤	¤	¤		¤				
Mepco/Centralab*§	A•1120					¤						
Murata/Erie§	A•1136	¤	¤	¤				¤			¤	
Sprague Goodman*§	A•1174	¤	¤	¤	¤	¤	¤	¤			¤	¤
Tusonix*	A•1181			¤	¤							
Voltronics *§	A•1185	¤				¤	¤	¤			¤	¤

* Mil. Spec.
§ Surface Mount

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
ABS acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CAMAC computer automated measurement and control
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3)
KSR keyboard send /receive

L
LC inductance capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIB microcomputer interface board
MIC microwave IC
MIPS million instructions per second
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

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Axial—Wide Temperature
Axial—Low Leakage
Axial—Non-Polarized
Radial—General Purpose
Radial—Low Profile
Radial—High Voltage
Radial—Wide Temperature
Radial—Low Profile (5mm Height Max)
Radial—Low Leakage
Radial—Low Leakage, Wide Temperature
Radial—Super Subminiature, Low Leakage, Tantalum Replacement
Radial—Non-Polarized
Radial—Low ESR for Switching Regulators
Snap-in Terminal
Snap-in Terminal, Low Profile
Snap-in Terminal, Wide Temperature
Snap-in Terminal, Low Profile, Wide Temperature

TANTALUM CAPACITORS
Radial—Resin Dipped
Chip type, Surface Mounted

FILM CAPACITORS
Radial, Inductive Dipped Polyester
Radial, Non-Inductive Dipped Polyester
Axial, Wrap and Fill Polyester, Non-Inductive
Radial, Metalized Polyester, Dipped
Axial, Metalized Polyester, Wrap and Fill, Flat Oval
Axial, Metalized Polyester, Wrap and Fill, Tubular
Radial Metalized Polypropylene, Dipped
Axial Metalized Polypropylene, Wrap and Fill, Flat Oval
Axial Metalized Polypropylene, Wrap and Fill, Tubular
Radial Polypropylene
Axial Polypropylene
Axial Polystyrene, Film Foil

CERAMIC CAPACITORS
Radial Disc, HI-K Type Y5F, Y5P, Z5U, Z5V
Radial Disc, Temperature Compensating Type NPO, SL, N750, N1500
Radial Disc, Semi-Conductive Type Y5S, Y5T, Y5V
Radial, Multi-Layer, Epoxy Dip NPO, X7R, Z5U
Chip Type Multi-Layer NPO, X7R, Y5V, Z5U
Axial Single Layer

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Ceramics
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- *Semiconductive Type*
- *Monolythic*

Tantulum
- *Dipped Type*
- *Molded Types*
- *Solid*
- *Wet Slug*
- *Chip*

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- *Polyester (Mylar)*
- *Metalized Polyester*
- *Polystyrene*
- *Polypropylene*
- *Polycarbonate*
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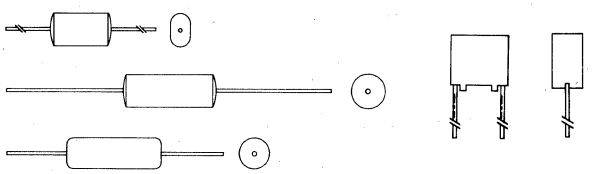
DC CAPACITORS

METALLIZED POLYESTER
(Wrap and fill, molded, box)



APPLICATIONS: Military, airborne, instruments, power supplies, auto-insertion, analog and digital circuitry, decoupling, high volume applications in consumer, automotive and industrial markets.

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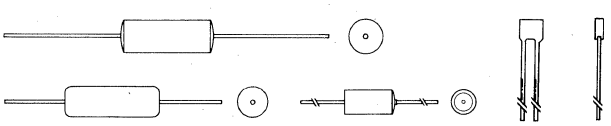
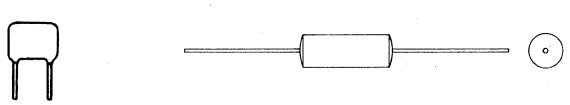
(Wrap and fill, molded, box, hermetically sealed)



APPLICATIONS: Military and space, high volume applications in consumer, automotive and industrial markets.

METALLIZED POLYPROPYLENE
(Conformal coated, wrap and fill)



APPLICATIONS: Instrumentation, switching power supplies, AC/DC/RMS current applications.

FILM AND FOIL POLYPROPYLENE (conformal coated)

APPLICATIONS: Snubbers, CRT monitors, power supplies, RF generators, test equipment, pulse forming, deflection.

ALSO FEATURING THE FOLLOWING TYPES FOR YOUR SPECIFIC APPLICATIONS REQUIRING:

X & Y function: AC types for appliances and DC types for power supplies. UL, CSA, VDE, SEV & TUV approvals.

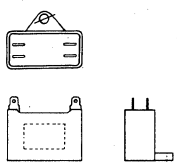
Hermetically sealed: Available in metallized polycarbonate, metallized polyester, and film/foil for applications in instrumentation and high reliability.

SMT: Surface mount capacitors for hybrid and chip-on-board applications (in development; consult factory).

AC CAPACITORS

METALLIZED POLYESTER
(Dry type)

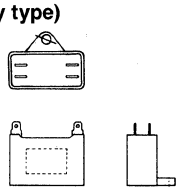
UL810 listed styles available



APPLICATIONS: Motor run, fans/appliances/pumps/business machines, electric tools.

METALLIZED POLYPROPYLENE
(Dry type)

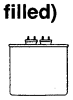
UL810 listed styles available



APPLICATIONS: Motor run, fans/appliances/, electric tools, lighting ballasts.

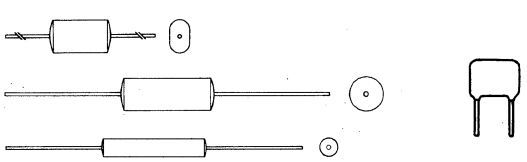
METALLIZED POLYPROPYLENE
(Oil filled)

UL810 listed styles available



APPLICATIONS: HVAC, HID lighting, power factor correction, UPS.

METALLIZED POLYESTER
(Wrap and fill, conformal coated)



APPLICATIONS: Fans/ventilators/air conditioners/business machines, electric tools, power factor correction, small motors, noise filtering.

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american technical ceramics CORP.

ATC Multilayer UHF/Microwave Porcelain & Ceramic Chip Capacitors

ATC 100 Superchips™

HIGH VOLTAGE RATINGS

in the same small package. As the result of a tremendous number of test hours at high DC applied voltage, the ATC 100 Case A (approximately 55 mils sq.) is now available at a rated working voltage of 150 volts. The Dielectric Withstanding Voltage (DWV) is tested at four times the working voltage, or 600 VDC. The actual internal Dielectric Breakdown Voltage (DBV) is at least 1500 VDC. This new rating far exceeds that of any capacitor of equal physical size. These voltages are verified by test data obtained at ATC's Government-approved Hi-rel testing facility, and have been confirmed by various customers.

ULTRA HIGH Q

is characteristic of the ATC 100 capacitors through microwave frequencies, even at high ambient temperatures, and under extremely high currents, permitting reliable operation at high power levels. Output power increases of greater than 20% per stage are reported when ATC 100's, with their negligible I^2R losses, are substituted for conventional capacitors. The reduction of losses also produces greater DC-to-RF conversion efficiency, improvements of 35% being reported. Improvements in Noise Figure are also attainable in receiver applications.

HIGH-POWER

operation through microwave frequencies. Extremely low Equivalent Series Resistance (ESR) and high dielectric strength permit 15 KW pulse operation (900 watts average) at 500 MHz (3000 volts, 17 amps RF) in a 50 ohm system. Other typical applications are 500 watts (CW) at 1 GHz and 1 KW (avg.) at 50 ohms up to 3 GHz.

LOW NOISE FIGURE

in receiving systems is achieved by the very low equivalent series resistance and extremely high Insulation Resistance (I.R.) of the ATC 100's. In an RF preamplifier, their low ESR helped attain a N.F. of 1.4 dB with a 1.2 dB transistor N.F. at 500 MHz. The high Insulation Resistance (ultra-low leakage) of an ATC 100 used as a calibration capacitor at the input of a charge storage amplifier on an X-Ray Spectrometer made possible a threshold sensitivity of 150 eV.

HIGH SELF-RESONANCE

is shown by test data taken on a Hewlett Packard 8542A Network Analyzer covering S-Parameters, VSWR, Reactance, and Insertion Loss over the frequency range of 100 to 3000 MHz. Request **THE RF CAPACITOR HANDBOOK** for actual S-Parameter computer print-outs.

ULTRA-STABLE PERFORMANCE

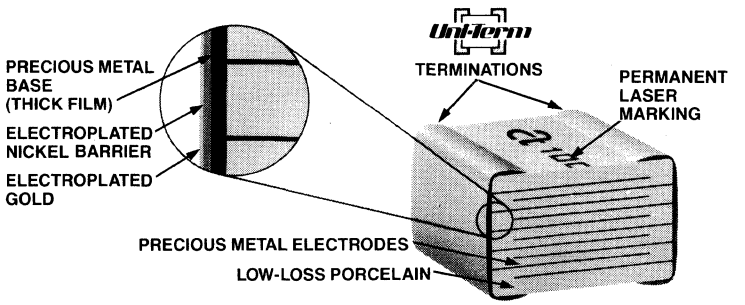
is assured by the self-encapsulating porcelain construction. ATC 100 **Superchips**™ provide absolute retrace, no measureable drift, and complete stability under extremes of voltage, frequency, time and temperature. They are ideal for high-power, high-current, tuning or impedance-matching applications.

ATC performs Evaluation Tests on **every** lot manufactured. This includes cross-section analysis, complete electrical and RF testing and characterization, and mechanical and pull strength testing on a randomly selected sample group.

Structure

SELF-ENCAPSULATING PORCELAIN CONSTRUCTION

Precious metal internal electrodes are molecularly bonded and sealed in a monolith of non-porous porcelain. The ATC 100 **Superchip**™ is a hermetic, microminiature, self-encapsulated, high voltage, porcelain chip capacitor matched to the thermal coefficient of expansion of commonly used substrate materials.



Military Products

American Technical Ceramics is QPL Listed for UHF/Microwave Capacitors in MIL-C-11272/16, /17 and /18 since May 25, 1973, and for established reliability UHF/Microwave Capacitors in MIL-C-55681/4 and /5 since August 3, 1977.

For MIL-C-11272/16, /17 and /18, the QPL List includes styles CY81 through CY89 (ATC 100 Series).

For MIL-C-55681/4 and /5, the QPL List includes BG (90 ± 20 PPM/°C) characteristic (ATC 100 Series), and BP (0 ± 30 PPM/°C) characteristic (ATC 700 Series). Styles CDR 11, 12, 13, 14, and 21 through 25 are available in both the above characteristics.

For MIL-C-55681/4 and /5, the QPL List includes the following terminations:

M – Palladium Silver (CDR 11, CDR 13)

*N – Gold over Nickel over Silver (ATC's UNI-TERM® Termination), (CDR 11, CDR 13)

S – Solder Coated, Final (CDR 12, CDR 14, CDR 23, CDR 25)

T – Silver (CDR 21, CDR 22, CDR 24)

*U – Solder Coated, Nickel Barrier (ATC's BARRIER/CAP® Termination) (CDR 12, CDR 14)

*"N" and "U" are preferred terminations for best solderability, thermocompression bonding, leach and migration resistance, and shelf life for chips and pellets.

ATC has complete Government approved Hi-Rel testing facilities as well as RF production testing capability through 18 GHz.

ATC's Military Product Manual includes a correlation between ATC sizes and lead styles and MIL-C-11272 and MIL-C-55681 sizes and styles.

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ATC Multilayer UHF/Microwave Porcelain & Ceramic Chip Capacitors

ATC 100 UHF/MICROWAVE PORCELAIN Superchip™ CAPACITORS

ELECTRICAL CHARACTERISTICS:

QUALITY FACTOR (Q): greater than 10,000 at 1 MHz.
CAPACITANCE VALUES: Std. values per RETMA 5% table
Case A: 0.1 pF to 100 pF, 150 WVDC
Case B: 0.1 pF to 1000 pF to 500 WVDC
TEMPERATURE COEFFICIENT OF CAPACITANCE (TC):
+90 ±20 PPM/°C (−55°C to +125°C)
INSULATION RESISTANCE (IR):
0.1 pF to 470 pF:
10^6 Megohms min. @ 25°C and rated WVDC.
510 pF to 1000 pF:
10^5 Megohms min. @ 25°C and rated WVDC.
One-tenth of 25°C IR value @125°C.
DIELECTRIC WITHSTANDING VOLTAGE (DWV):
Case A: 400% of rated WVDC for 5 secs., 600 VDC
Case B: 250% of rated WVDC for 5 secs.
TOLERANCES: B (±0.1 pF), C (±0.25 pF), D (±0.5 pF), F (±1%), G (±2%), J (±5%), K (±10%), M (±20%).

MILITARY SPECIFICATIONS:

ATC is QPL Approved for MIL-C-55681, BG Characteristic (+90 ±20 PPM/°C), to Failure Rate Level S, and MIL-C-11272. Meets applicable requirements of MIL-C-123.

ATC 100E HF/VHF/UHF LOW LOSS TRANSMITTER PORCELAIN CAPACITORS

The industry's smallest RF High Power Capacitors

ELECTRICAL CHARACTERICS:

QUALITY FACTOR (Q): greater than 10,000 at 1 MHz.
CAPACITANCE VALUES: Std. values per RETMA 10% table
1.0 pF to 2200 pF to 3600 WVDC
TEMPERATURE COEFFICIENT OF CAPACITANCE (TC):
+90 ±30 PPM/°C (−55°C to +125°C).
INSULATION RESISTANCE (IR): IR at 125°C is one-tenth the IR at 25°C.
DIELECTRIC WITHSTANDING VOLTAGE (DWV): Two times working voltage. (WVDC)
TOLERANCES: C (±0.25 pF), D (±0.5 pF), J (±5%), K (±10%), and M (±20%) standard. Tighter tolerances available upon special request.
MECHANICAL CONFIGURATIONS: Available in leaded styles, body dimensions 0.395 in. (10.03mm) x 0.390 in. (9.91mm) x 0.170 in. (4.32mm) max. Available in Microstrip, Axial Ribbon, and Axial Wire leaded styles, body dimensions 0.415 in. (10.54mm) x 0.390 in. (9.91mm) x 0.170 in. (4.32mm) max.

ATC 175 ULTRA HIGH Q PORCELAIN CAPACITORS

- ***ULTRA HIGH "Q's" UP TO 4X HIGHER THAN BEST INDUSTRY STANDARD (ATC 100).***
- ***MICROWAVE POWER, CURRENT, AND Q RATINGS SPECIFIED AT UHF/MICROWAVE FREQUENCIES FOR ALL CAPACITANCE VALUES. (CONTACT FACTORY.)***
- ***NO DERATING FOR OPERATION UP TO 175°C.***

ELECTRICAL CHARACTERISTICS:

CAPACITANCE VALUES: Std. values per RETMA 5% table
Case B: 1.0 pF to 100 pF to 500 WVDC
TEMPERATURE COEFFICIENT OF CAPACITANCE (TC):
+90 ±30 PPM/°C (−55°C to +175°C).
INSULATION RESISTANCE (IR): 10^6 Megohms min. @ 25°C, and rated WVDC; 10^5 Megohms min. @ 175°C at rated voltage.
DIELECTRIC WITHSTANDING VOLTAGE (DWV): 250% of rated WVDC for 5 seconds.
TOLERANCES: B (±0.1 pF), C (±0.25 pF), D (±0.5 pF), F (±1%), G (±2%), J (±5%), K (±10%), M (±20%).

MILITARY SPECIFICATIONS:

All ATC 175 Capacitors meet applicable requirements of MIL-C-55681, MIL-C-123, and MIL-C-11272.

ATC 700 NPO TEMPERATURE STABLE CERAMIC CAPACITORS

- ***ZERO TC***
- ***NO CAPACITANCE CHANGE WITH VOLTAGE***
- ***HIGHEST PACKAGING DENSITY OF ANY NPO MULTILAYER CAPACITOR***

ELECTRICAL CHARACTERISTICS:

CAPACITANCE VALUES: Std. values per RETMA 5% table
Case A: 0.1 pF to 1000 pF, to 150 WVDC
Case B: 0.1 pF to 5100 pF, to 500 WVDC
TEMPERATURE COEFFICIENT OF CAPACITANCE (TC):
0 ±30 PPM/°C (−55°C to +125°C).
INSULATION RESISTANCE (IR):
0.1 pF to 470 pF:
10^6 Megohms min. @ 25°C and rated WVDC.
510 pF to 5100 pF:
10^5 Megohms min. @ 25°C and rated WVDC.
One-tenth of 25°C IR value @ 125°C.
DIELECTRIC WITHSTANDING VOLTAGE (DWV):
Case A and B: 250% of rated WVDC for 5 sec.
TOLERANCES: B (±0.1 pF), C (±0.25 pF), D (±0.5 pF), F (±1%), G (±2%), J (±5%), K (±10%), M (±20%).

MILITARY SPECIFICATIONS:

ATC is QPL Approved for MIL-C-55681, BP Characteristic (0 ±30 PPM/°C), to Failure Rate Level S. Meets applicable requirements of MIL-C-123.

ATC 200 HIGH PACKAGING DENSITY CERAMIC CAPACITORS

ELECTRICAL CHARACTERICS:

CAPACITANCE VALUES: Std. values per RETMA 10% table
Case A: 510 pF to 0.01 MF, 50 WVDC
Case B: 0.005 MF to 0.1 MF, 50 WVDC
TEMPERATURE COEFFICIENT OF CAPACITANCE (TC):
±15% maximum (−55°C to +125°C).
INSULATION RESISTANCE (IR): 10,000 Megohms minimum
DIELECTRIC WITHSTANDING VOLTAGE (DWV): 300% of WVDC
TOLERANCES: M (±20%), and N (±30%); [K (±10%) available on special order]

MILITARY SPECIFICATIONS:

ATC 200 Capacitors meet applicable portions of MIL-C-55681

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Multilayer Capacitor Mechanical Configurations

american technical ceramics CORP.

ATC SERIES	ATC TERM CODE	QPL MIL-C-11272C	QPL MIL-C-55681	CASE SIZE & TYPE	OUTLINES	BODY DIMENSIONS LENGTH (L)	BODY DIMENSIONS WIDTH (W)	BODY DIMENSIONS THICKNESS (T)	LEAD AND TERMINATION DIMENSIONS AND MATERIALS LENGTH (L)	LEAD AND TERMINATION DIMENSIONS AND MATERIALS WIDTH (W)	LEAD AND TERMINATION DIMENSIONS AND MATERIALS THICKNESS (T)
100	CA	CY81*	CDR11 BG	A Chip	W/T IS A TERMINATION SURFACE	.055 ± .010 (1.4 ± .25)		.055 (1.4) max.	Uni-Term® GOLD OVER NICKEL OVER SILVER (CA)		
700	CA	—	CDR11 BP					***			
200	CA	—									
100	CA	CY83*	CDR13 BG	B Chip		.110 ± .015 (2.79 ± .38)		.100 (2.54) max.			
700	CA	—	CDR13 BP					***			
200	CA	—									
175	C	—						.100 (2.54) max.	Palladium Silver (C) 175 ONLY		
100	P	CY82	CDR12 BG	A Pellet	W/T IS A TERMINATION SURFACE	Same as chip plus twice solder build-up: Solder build-up for size A is: .003 (.076) typ. Solder build-up for size B is: .005 (.127) typ.			barrierCap® Pellets are solder-coated chips with a nickel barrier over the termination. Solder melting temperature is 372 F. 179 C.		
700	P	—	CDR12 BP								
200	P	—									
100	P	CY84	CDR14 BG	B Pellet							
700	P	—	CDR14 BP								
200	P	—									
175	P	—									
100	MS	CY85	CDR21 BG	B Microstrip		.115 (2.92) min. .150 (3.81) max.	.110 ± .015 (2.79 ± .38)	.100 (2.54) max. except 200 Series ***	.250 (6.35) min.	.093 ± .005 (2.36 ± .13)	.004 ± .001 (.102 ± .025)
700	MS	—	CDR21 BP								
200	MS	—									
175	MS	—									
100	AR	CY86	CDR22 BG	B Axial Ribbon							
700	AR	—	CDR22 BP								
200	AR	—									
100	RR	CY88	CDR24 BG	B Radial Ribbon							
700	RR	—	CDR24 BP								
200	RR	—									
100	NAR	—		B Narrow Axial Ribbon		.115 (2.92) min. .155 (3.94) max.	.110 ± .015 (2.79 ± .38)	.100 (2.54) max. except 200 Series ***	.250 (6.35) min.	.050 ± .005 (1.27 ± .13)	.006 ± .003 (.15 ± .08)
700	NAR	—									
200	NAR	—									
100	NMS	—		B Narrow Microstrip							
700	NMS	—									
200	NMS	—									
100	** VNMS	—		B Vertical Narrow MS							
100	RW	CY87	CDR23 BG	B Radial Wire		.115 (2.92) min. .165 (4.19) max.	.110 ± .015 (2.79 ± .38)	.100 (2.54) max. except 200 Series ***	.500 (12.7) min.	#26 AWG. .016 (.375) dia. nominal	
700	RW	—	CDR23 BP								
200	RW	—									
100	AW	CY89	CDR25 BG	B Axial Wire							
700	AW	—	CDR25 BP								
200	AW	—									

* *CY81 and CY83 are Palladium Silver terminated Chips per MIL-C-11272 requirements.*

** *VNMS improves the resonant frequency performance over that of the standard Microstrip. The first important resonance is approximately twice as high in frequecy as with "flat" mounting (NMS). Note that in this configuration, the marking is now on a vertical surface. For details, contact factory.*

*** *T max. for 200 Series depends upon capacity value:*

200 SERIES CAP. VALUE	T MAX. Chips & Pellets	T MAX. Leaded Styles
Case A: 8200 pF to 10,000 pF	.065 (1.65)	.080 (2.03)
Case B: .082 MF to 0.1 MF	.115 (2.92)	.130 (3.30)

ALL DIMENSIONS ARE IN INCHES EXCEPT THOSE IN PARENTHESES WHICH ARE IN MILLIMETERS.

TAPE AND REEL PACKAGING for automated surface mounting available upon request.

ATC PART NUMBER CODE:

ATC 100 B 91 0 F AW 500 X

- Series
- Case Size
- Capacitance
- Indicates number of zeros following digits of capacitance in picofarads.
- Capacitance Tolerances
- Termination Code
- WVDC
- Laser Marking

All leads are high purity silver and are attached with high temperature solder.

LASER MARKED CAPACITORS with ATC's logo, capacity code and tolerance are available for any case size (including chips and pellets). To order, add suffix (X) to code.

ATC has made every effort to have this information as accurate as possible. However, no responsibility is assumed by ATC for its use, nor for any infringements of rights of third parties which may result from its use. ATC reserves the right to revise the content or modify its product line without prior notice.

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ATC Single-Layer Ceramic Capacitors

ATC 111 MILLIMETER WAVELENGTH MICROCAPS®

- Single layer, rugged microminiature capacitors
- For use up to 50 GHz
- Microwave characterized
- Ultra-high Q's

ELECTRICAL CHARACTERISTICS:

OPERATING FREQUENCY: Up to 50 GHz.
CAPACITANCE VALUES: 0.1 to 1800 pF. Std. values per RETMA 5% table.
STANDARD MEASUREMENT FREQUENCY: 1 MHz for 0.1 to 100 pF; 1KHz for values greater than 100 pF.
IR: 10^{11} Ohms min. at 25°C and rated voltage for all dielectrics. The IR is 1/10 of 25°C value at 125°C and rated voltage.
VOLTAGE RATING: 100 WVDC. Consult factory for higher voltage ratings.
DIELECTRIC TEST VOLTAGE: 250% of voltage rating for 5 seconds. Impervious to static discharge failures.

MECHANICAL CHARACTERISTICS:

HERMETICITY: The dielectric is virtually unaffected by moisture and commonly used cleaning solvents.

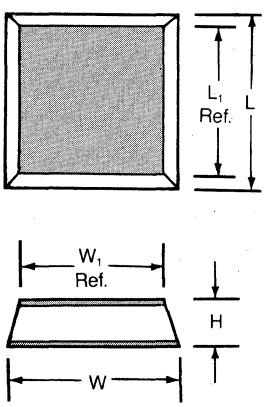
RUGGED CONSTRUCTION: to minimize handling problems and circuit assembly problems.
BOND STRENGTH: Exceeds MIL-STD-883 Method 2011.2 for wire bondability of all terminations and method 2019.1 for die shear strength.
LEADED STYLES: Leaded Microcaps are available in the following styles: Single Lead (L), Double Lead (D), Radial Lead (R), Thru Lead (B) and Vertical Lead (V).Standard Lead Material is high purity Silver. High purity Gold leads are available upon request. Consult factory.

ENVIRONMENTAL CHARACTERISTICS:

OPERATING TEMPERATURE RANGE: −55°C to +125°C (No derating of working voltage).
ATC Microcaps® are designed and manufactured to meet or exceed the requirements of MIL-C-55681 and MIL-C-11272.

CASE SIZE	BODY DIMENSIONS		
	W or L	H*	W_1 or L_1
S	.018 (.457) ± .003 (0.76)	.005 (.127) min. To .011 (.279) max.	.014 (.357)
T	.025 (.637) ± .005 (.127)		.019 (.483)
U	.035 (.889) ± .005 (.127)		.030 (.762)
X	.050 (1.27) ± .010 (.254)		.045 (1.14)
Y	.070 (1.78) ± .010 (.254)		.065 (1.65)
Z	.090 (2.29) ± .010 (.254)		.085 (2.16)

*H depends upon capacity value.
All dimensions shown are in inches except those in parentheses which are in millimeters.



Straight (vertical) sided devices are available upon request. Consult factory.

$$W_2 \approx \frac{W + W_1}{2}$$

NOTE: The above dimensions refer to recommended ATC standard case sizes. However, ATC will manufacture custom sizes to meet your specific circuit requirements.

Request complete product catalog for information on ATC's other Single Layer capacitors:

112 *BI-TRIM*™ Binary Capacitors (1:2:2:4 or 1:2:4:8 configurations)

113 *TWINcap*™ Capacitors (Two Capacitors on one substrate)

115 LOW LOSS RF *MACROcaps*™ (Ultra-high Q's)

ATC 1-083 **3/87**

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ATC Single-Layer Ceramic Capacitors

american technical ceramics CORP.

MICROCAP® ORDERING GUIDE

All T.C.'s are specified over the temperature range −55°C to +125°C with 25°C as the reference temperature.

*TEMPERATURE COMPENSATING

CASE SIZE	STABLE K DIELECTRIC STYLES									MID-K DIELECTRIC STYLES									HIGH K DIELECTRIC STYLES								
	A (14) Q-10* min. @ 1 MHz			BB* (31) Q-600 min. @ 1 MHz			CA (62) & CC* (130) Q-600 min. @ 1 MHz				DB (200) Q-400 min. @ 1 MHz			HC* (350)			EC* (650)			J (1100) DF-2.0% max. @ 1 KHz; Q-20 min. @ 1 MHz			F (2000) DF-2.0% max. @ 1 KHz; Q-25 min. @ 1 MHz			G (5000) DF-2.0% max. @ 1 KHz; Q-30 min. @ 1 MHz		
	CAP. RANGE (pF)	TOL. AVAIL.	T.C.	CAP. RANGE (pF)	TOL. AVAIL.	T.C.	CA CAP. RANGE (pF)	CC CAP. RANGE (pF)	TOL. AVAIL.	T.C.	CAP. RANGE (pF)	TOL. AVAIL.	T.C.	CAP. RANGE (pF)	TOL. AVAIL.	T.C.	CAP. RANGE (pF)	TOL. AVAIL.	T.C.	CAP. RANGE (pF)	TOL. AVAIL.	T.C.	CAP. RANGE (pF)	TOL. AVAIL.	T.C.	CAP. RANGE (pF)	TOL. AVAIL.	T.C.
S .018 ± .018 NOM.	0.08-0.17	B,C,D	+90 −30 PPM C	0.15-0.36	B,C,D	0 ± 30 PPM C	0.37-0.75	0.7-1.8	B,C,D	CA 0 ± 30 PPM C / CC −750 ± 200 PPM C	1.1-2.2	C,D	± 7.5% Max. Change (Non-linear)	1.8-4.2	D	2000 ± 500 PPM C	4.3-10	D	± 10% Max. Change (Non-linear)	6.6-9.9 / 10-15	D / K,M	± 5% 15% Max. Change (Non-linear)	11-26	K,M	± 10% 15% Max. Change (Non-linear)	27-63	M	± 10% 75% Max. Change (Non-linear)
T .025 ± .025 NOM.	0.16-0.36	B,C,D		0.32-0.76	B,C,D		0.75-1.5	1.6-3.9	B,C,D		2.2-4.8	C,D		3.9-8.6	D		8-20	J,K,M		14-32	K,M		23-53	K,M		57-120	M	
U .035 ± .035 NOM.	0.34-0.73	B,C,D		0.71-1.5	B,C,D		1.5-3.1	3.2-7.5	B,C,D		4.6-9.9	C,D		8.1-9.9 / 10-17	D / J,K,M		18-39	K,M		30-65	K,M		50-100	K,M		120-260	M	
X .050 ± .050 NOM.	0.72-1.5	B,C,D		1.5-3.2	B,C,D		3.1-6.5	6.3-17	B,C,D		10-20	J,K,M		17-36	J,K,M		32-85	K,M		65-136	K,M		100-220	K,M		260-540	M	
Y .070 ± .070 NOM.	1.5-3	B,C,D		3.1-6.5	B,C,D		6.5-9.9 / 10-13	14-30	B,C,D / F,G,J,K,M		20-40	G,J,K,M		36-75	J,K,M		75-160	K,M		131-270	K,M		220-450	K,M		530-1000	M	
Z .090 ± .090 NOM.	2.5-5.1	B,C,D		5.2-9.9 / 10-11	B,C,D / F,G,J,K,M		11-21	22-45	F,G,J,K,M		35-68	G,J,K,M		60-120	J,K,M		120-260	K,M		230-450	K,M		370-750	M		890-1800	M	

Higher Dielectric Constant Material Available. Consult Factory.

Terminations

Consult factory for Bulletin 202, Recommended Attachment Techniques for Microcap® Capacitors.

TERM. SUFFIX	TERMINATIONS	RECOMMENDED BONDING TECHNIQUES
TT*	UNIVERSAL (Titanium Tungsten / Nickel / Gold)	• Thermocompression, ultrasonic and thermosonic gold wire and aluminum silicon wire bonding. • Lead / tin soldering. • High temperature, gold content solders, i.e., gold-germanium, gold-silicon, and gold-tin solders. • Conductive epoxy bonding.
AP	Platinum Gold (Thick Film)	• Lead / tin soldering • Conductive epoxy bonding
AC	Gold Over Chromium (Thin Film)	• Thermocompression, ultrasonic and thermosonic gold wire and aluminum silicon wire bonding. • High temperature, gold content solders.

***Preferred**

ATC Part Number Code

ATC 111 U BB 1R0 C 100 TT LA

SERIES

CASE SIZE (See Mechanical Configs.)
Q used for non-standard case sizes.

DIELECTRIC STYLE: Maximum 2 letters; See Capacitance Selection Chart.

CAPACITANCE CODE: 2 Significant Digits
R Decimal Point
Number of Zeros

LEAD STYLE CODE: (Optional)
L – Single Lead
D – Double Leads
R – Radial Leads
B – Thru Lead
V – Vertical Leads
– Unleaded
For Gold leads, add suffix "A".

TERMINATION SUFFIX: 1 to 2 letters Refer to table.

WVDC (in Volts): 3 Significant Digits. 100 WVDC is standard.

CAPACITANCE TOLERANCE CODE								
CODE	B (pF)	C (pF)	D (pF)	F (%)	G (%)	J (%)	K (%)	M (%)
CAP. TOL.	± 0.1	± 0.25	± 0.5	± 1	± 2	± 5	± 10	± 20

The above part number pertains to an ATC 111 Microcap,® Case Size U, Dielectric Style BB, with a Capacitance of 1.0 pF and Tolerance of ± 0.25 pF; Working Voltage is 100, the Termination is Gold over Nickel over Titanium Tungsten, Single Lead, Gold material.

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OLD BRIDGE, NJ 08857
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CERAMIC CHIP CAPACITORS FOR SURFACE MOUNTED TECHNOLOGY

CHIP PACKAGING INFORMATION—CERAMIC

CoPS (Component Placement System) Reeling

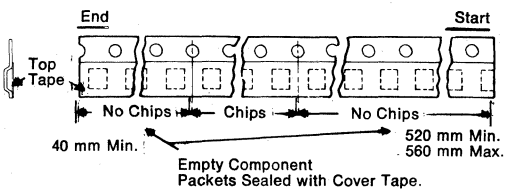
Armbar Industries is offering KEMET's CoPS (Component Placement System), Multilayer Ceramic Chip Capacitors in carrier tape form for automatic placement on printed circuit boards. They are available in nine sizes.

KEMET CoPS capacitors conform to the Electronic Industries Association specification RS-481A for Automated Compoennt Processing and insertion.

FIGURE 1
KEMET CoPS Capacitors are wound on a standard 178.0 mm (7.00") or 330.0 mm (13.0") diameter 8 mm reel. Seven-inch diameter reels contain 2,500 chips and for 13.0" diameter reels, 12,500 chips.

FIGURE 2
Figure 2 shows carrier leader and ending amounts of KEMET Multilayer Ceramic Chips on CoPS reels.

Figure 2 — CoPS Carrier Chips



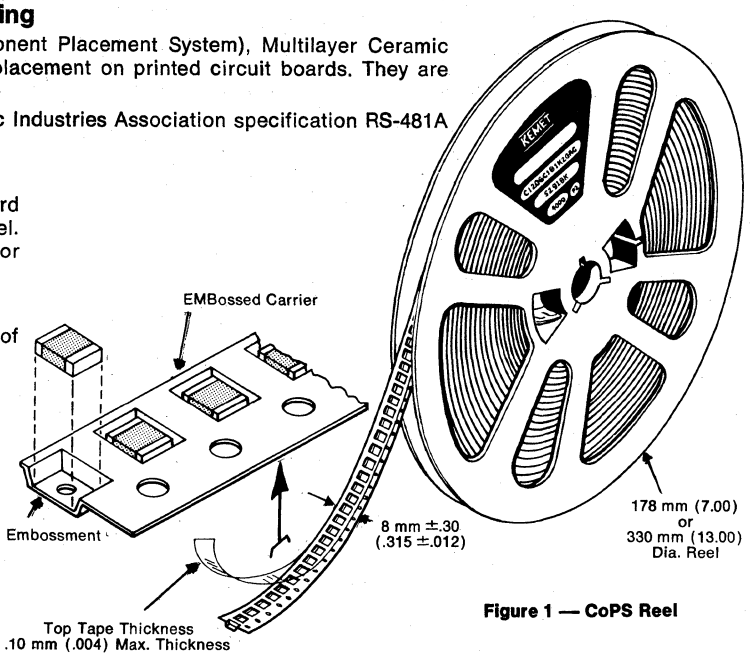


Figure 1 — CoPS Reel

Armbar stocks the following chip sizes and values on reel for immediate shipping.
Additional sizes and value will be made available on reels — consult Armbar for delivery.

NPO DIELECTRIC

CAP pF	SIZE C0805
1.0	C0805C109D5GAC
1.5	C0805C159D5GAC
2.2	C0805C229D5GAC
3.3	C0805C339D5GAC
4.7	C0805C479D5GAC
6.8	C0805C689D5GAC
10.0	C0805C100J5GAC
15.0	C0805C150J5GAC
22.0	C0805C220J5GAC
33.0	C0805C330J5GAC
47.0	C0805C470J5GAC
68.0	C0805C680J5GAC
100.0	C0805C101J5GAC
150.0	C0805C151J5GAC
220.0	C0805C221J5GAC
330.0	C0805C331J5GAC

C1206C

CAP pF	SIZE C1206
1.0	C1206C109D5GAC
4.7	C1206C479D5GAC
10.0	C1206C100J5GAC
15.0	C1206C150J5GAC
22.0	C1206C220J5GAC

C1206C (Cont.)

CAP pF	SIZE C1206
33.0	C1206C330J5GAC
47.0	C1206C470J5GAC
68.0	C1206C680J5GAC
100.0	C1206C101J5GAC
150.0	C1206C151J5GAC
220.0	C1206C221J5GAC
330.0	C1206C331J5GAC
470.0	C1206C471J5GAC
680.0	C1206C681J5GAC
1,000.0	C1206C102J5GAC
1,500.0	C1206C152J5GAC

X7R DIELECTRIC

CAP pF	SIZE C0805
470	C0805C471K5RAC
680	C0805C681K5RAC
1,000	C0805C102K5RAC
1,500	C0805C152K5RAC
2,200	C0805C222K5RAC
3,300	C0805C332K5RAC
4,700	C0805C472K5RAC
6,800	C0805C682K5RAC
10,000	C0805C103K5RAC
15,000	C0805C153K5RAC

C1206

Cap pF	SIZE C1206
1,000	C1206C102K5RAC
2,200	C1206C222K5RAC
3,300	C1206C332K5RAC
4,700	C1206C472K5RAC
6,800	C1206C682K5RAC
10,000	C1206C103K5RAC
15,000	C1206C153K5RAC
22,000	C1206C223K5RAC
33,000	C1206C333K5RAC
47,000	C1206C473K5RAC
68,000	C1206C683K5RAC
100,000	C1206C104K5RAC
100,000	C1206C104M5UAC
150,000	C1206C154M5UAC

Z5U

CAP pF	SIZE C1206
100,000	C1206C104M5UAC
150,000	C1206C154M5UAC

Chip Size	Capacitance Range			Chip Quantities Per Reel*		
	NPO	X7R	Z5U	178 mm Dia. (7 inches)	330 mm Dia. (13 inches)	Tape Width (mm)
C0805	1 — 470 PF	470 — .015 MF	.6800 — .033 MF	2,500	12,500	8
C1005	1 — 1000 PF	680 — 39,000 PF	.018 — .082 MF	2,500	12,500	8
C1206	1 — 2,200 PF	1000 — .1 MF	.033 — .15 MF	2,500	12,500	8
C1210	1000 — 4700 PF	.01 — .15 MF	.047 — .27 MF	2,500	12,500	8
C1805	470 — 2700 PF	.0033 — .1 MF	.033 — .15 MF	2,500	12,500	12
C1808	470 — 4700 PF	.0056 — .18 MF	.068 — .33 MF	2,500	12,500	12
C1812	470 — 10,000 PF	.01 — .33 MF	.082 — .68 MF	1,300	7,500	12
C1825	5600 — 10,000 PF	.12 — .68 MF	.18 — 1.5 MF	1,300	7,500	12
C2225	2200 — 27,000 PF	.27 — .015 MF	.33 — 2.2 MF	1,300	7,500	12

& Minimum shipping quantity is quantity contained on one reel.

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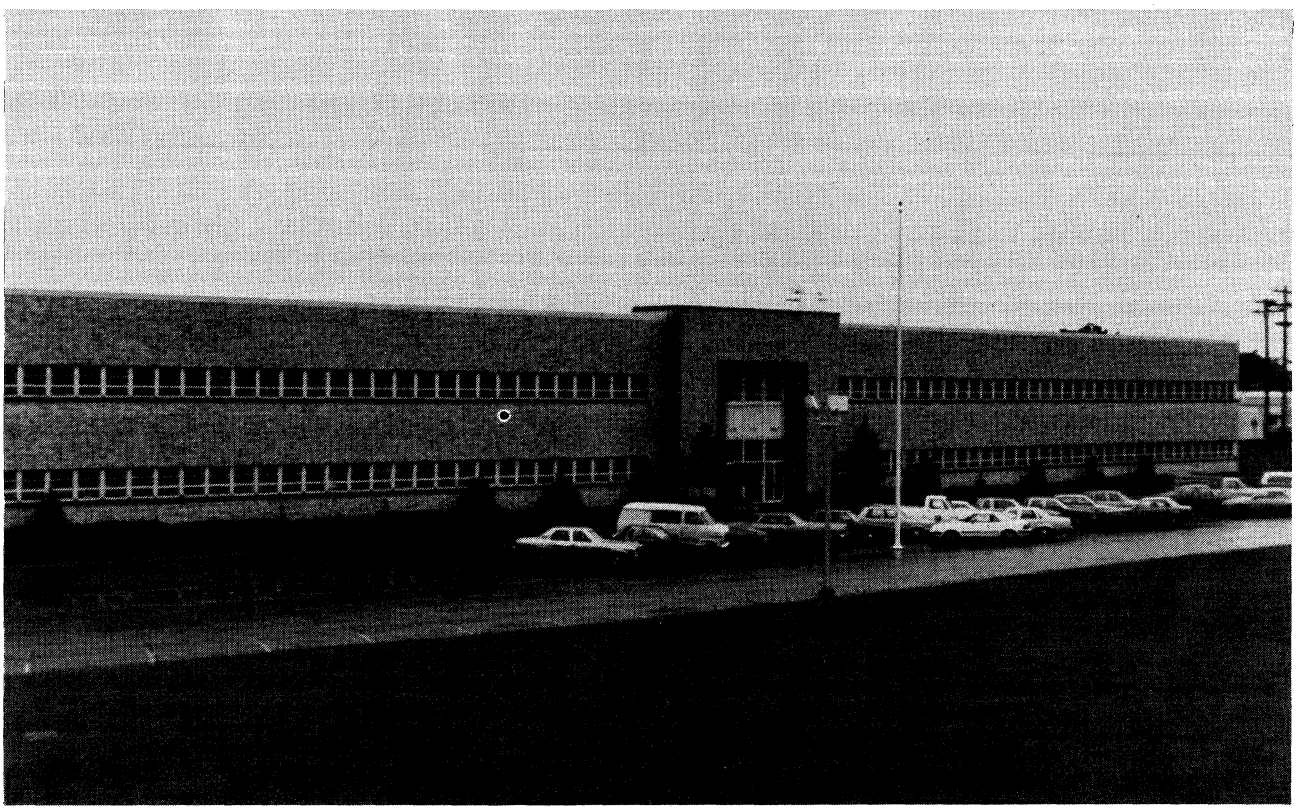
AT&T

CAPACITORS
Wound Film Capacitors



AT&T's Nashville Plant

AT&T wound film capacitors are among the finest in the industry. They offer unsurpassed quality and reliability, proven by the billions of units in widespread use throughout our telephone systems.

Our miniature metallized film designs are characterized by a benign failure-mode operation—to fail open rather than short. The designs include axial, radial, and 2-pin DIP configurations. One of our most prominent models, the 2-pin DIP, is an epoxy-molded, machine-insertable capacitor whose design is so advanced that another leading capacitor vendor has licensed the manufacturing rights from us. This capacitor is particularly well-suited for bypass applications where high-component packing densities are required.

AT&T also manufactures a variety of other high-quality wound film capacitors, including standard-size axial and radial types. Capacitor networks, which are a laser-generated series of capacitor and resistor elements, and CAP-PAKs, which provide custom tailoring for any multicapacitance need, are also available.

A special series of standard reliability capacitors are offered for use in applications with moderate life expectancies. The capacitors, designated as N-Series, are offered in addition to the line of high-reliability products. The addition of a prefix "N" differentiates these units from the high-reliability series (e.g., N75G.10UF vs. 75G.10UF).

Traditional AT&T quality standards are maintained, monitored by the regular performance of rigorous dry life and humidity resistance tests. The units are dimensionally compatible with their high-reliability counterparts, while meeting or exceeding the specifications for similar capacitors produced by various manufacturers.

Our engineering support services accentuate our product offerings. We provide superb applications engineering services and a willingness to develop custom designs to meet the unique needs of our customers. Our engineers at the Nashville plant where AT&T capacitors are manufactured welcome the opportunity to work with our customers to design components that meet their application needs.

For additional information, contact your AT&T Account Manager, or call:
☐ AT&T Microelectronics, Dept. 51AL230230, 555 Union Boulevard, Allentown, PA 18103 **1-800-372-2447** (In Canada, **1-800-553-2448)**

AT&T

CAPACITORS

Standard Metallized Film Capacitors — 739 Type (Tubular)

Specifications

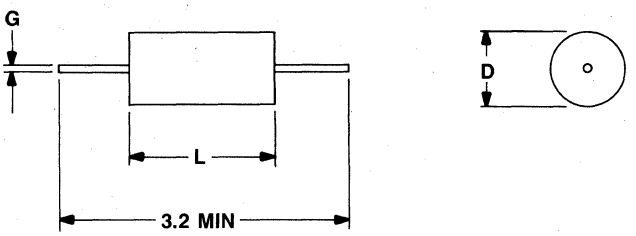
- Temperature range: −40 to +85°C without derating.
- Capacitance: requirements apply at 1 kHz and 25°C.
- Effective series resistance (at 100 kHz): see Table 3.
- Insulation resistance: minimum of 5,000 MΩ • μF at 25°C after 1-minute electrification at 100 Vdc.
- Lead pull: will withstand a tensile force of 5 pounds applied along each lead for 2 seconds.
- Life test: twice rated voltage at 85°C for 250 hours.
- Humidity resistance: rated voltage at 65°C and 85% relative humidity for 144 hours.

Ordering Information

Order by part number as listed in Table 3. The part number consists of the type number (739), letter for capacitance tolerance (C, ±5%; G, ±10%; H, ±20%), and nominal capacitance value in microfarads (μF), followed by the letter "T" to indicate reel taping, when applicable. The 739 Type Capacitors can be furnished with reel taping for the nominal capacitance range of 0.20 to 3.0 μF inclusive.

Outline Diagram

(Dimensions in Inches)



AT&T

CAPACITORS

Standard Metallized Film Capacitors — 739 Type (Tubular)

Table 3. 739 Type Capacitors

Working Voltage Rating: 100 Vdc

Nominal Capacitance (μF)	Part No. Capacitance Tolerance ±5%	±10%	±20%	Maximum Effective Series Resistance (Ω)	D Maximum Diameter (inch)	L Maximum Length (inch)	G Lead Wire Diameter (inch)
0.20	739C.20UF	739G.20UF		1.2	0.30	0.685	0.025
0.22	739C.22UF	739G.22UF	739H.22UF	1.2	0.30	0.685	0.025
0.24	739C.24UF	739G.24UF		1.0	0.30	0.685	0.025
0.27	739C.27UF	739G.27UF	739H.27UF	1.0	0.30	0.685	0.025
0.30	739C.30UF	739G.30UF		0.8	0.30	0.685	0.025
0.33	739C.33UF	739G.33UF	739H.33UF	0.8	0.32	0.685	0.025
0.36	739C.36UF	739G.36UF		0.7	0.33	0.685	0.025
0.39	739C.39UF	739G.39UF	739H.39UF	0.7	0.34	0.685	0.025
0.43	739C.43UF	739G.43UF		0.6	0.36	0.685	0.025
0.47	739C.47UF	739G.47UF	739H.47UF	0.6	0.30	1.00	0.025
0.51	739C.51UF	739G.51UF		0.5	0.30	1.00	0.025
0.56	739C.56UF	739G.56UF	739H.56UF	0.5	0.30	1.00	0.025
0.62	739C.62UF	739G.62UF		0.4	0.30	1.00	0.025
0.68	739C.68UF	739G.68UF	739H.68UF	0.4	0.30	1.00	0.025
0.75	739C.75UF	739G.75UF		0.4	0.30	1.00	0.025
0.82	739C.82UF	739G.82UF	739H.82UF	0.3	0.30	1.00	0.025
0.91	739C.91UF	739G.91UF		0.3	0.30	1.00	0.025
1.0	739C1.0UF	739G1.0UF	739H1.0UF	0.3	0.30	1.00	0.025
1.1	739C1.1UF	739G1.1UF		0.3	0.31	1.00	0.025
1.2	739C1.2UF	739G1.2UF	739H1.2UF	0.3	0.32	1.00	0.025
1.3	739C1.3UF	739G1.3UF		0.3	0.33	1.00	0.025
1.5	739C1.5UF	739G1.5UF	739H1.5UF	0.20	0.35	1.00	0.025
1.6	739C1.6UF	739G1.6UF		0.20	0.36	1.00	0.025
1.8	739C1.8UF	739G1.8UF	739H1.8UF	0.20	0.38	1.00	0.025
2.0	739C2.0UF	739G2.0UF		0.20	0.39	1.00	0.025
2.2	739C2.2UF	739G2.2UF	739H2.2UF	0.20	0.41	1.00	0.025
2.4	739C2.4UF	739G2.4UF		0.20	0.43	1.00	0.032
2.7	739C2.7UF	739G2.7UF	739H2.7UF	0.20	0.46	1.00	0.032
3.0	739C3.0UF	739G3.0UF		0.20	0.48	1.00	0.032
3.3	739C3.3UF	739G3.3UF	739H3.3UF	0.20	0.50	1.00	0.032
3.6	739C3.6UF	739G3.6UF		0.20	0.52	1.00	0.032
3.9	739C3.9UF	739G3.9UF	739H3.9UF	0.20	0.54	1.00	0.032
4.3	739C4.3UF	739G4.3UF		0.20	0.57	1.00	0.032
4.7	739C4.7UF	739G4.7UF	739H4.7UF	0.20	0.59	1.00	0.032
5.1	739C5.1UF	739G5.1UF		0.20	0.61	1.00	0.032

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AT&T

CAPACITORS

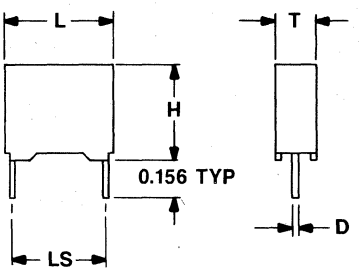
Miniature Metallized Film Capacitors — 754-759 Types (Mini-Box)

Specifications

- Temperature range: −40 to +85°C without derating.
- Capacitance: requirements apply at 1 kHz and 25°C.
- Effective series resistance (at 100 kHz): see Table 1.
- Insulation resistance: minimum of 5,000 MΩ • μF (but need not exceed 30,000 MΩ) at 25°C after 1-minute electrification at 100 Vdc (except 50 Vdc for capacitors with working voltage rating of 50 Vdc).
- Lead pull: will withstand a tensile force of 5 pounds applied along each lead for 5 seconds.
- Life test: twice rated voltage at 85°C for 250 hours.
- Humidity resistance: rated voltage at 65°C and 85% relative humidity for 144 hours.

Outline Diagram

(Dimensions in Inches)



Ordering Information

Order by part number as listed in Table 1. The part number consists of the type number (754—759), letter for capacitance tolerance (C, ±5%; G, ±10%; H, ±20%), and a letter which designates a particular set of values, followed by the letter "T" to indicate reel taping, when applicable. The 754 and 755 Type Capacitors can be furnished with reel taping for all nominal capacitance values. The 757, 758, and 759 Type Capacitors are packaged in 250-unit plastic tubes.

	Maximum Box Dimensions (inch)			Lead Dimensions (inch)	
Type No.	T Thickness	H Height	L Length	D Nominal Diameter	LS Nom. Spacing ±0.016
754	0.145	0.300	0.289	0.025	0.200
755	0.185	0.348	0.289	0.025	0.200
756	0.145	0.260	0.420	0.025	0.300
757	0.165	0.360	0.420	0.025	0.300
758	0.200	0.440	0.420	0.032	0.300
759	0.240	0.480	0.420	0.032	0.300

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AT&T

CAPACITORS

Miniature Metallized Film Capacitors — 754-759 Types (Mini-Box)

Table 1. 754—759 Type Capacitors

Nominal Capacitance (μF)	Maximum Effective Series Resistance (Ω)	Part No.*						
		Leads on 0.2-Inch Centers				Leads on 0.3-Inch Centers		
		Working Voltage Rating				Working Voltage Rating		
		50 Vdc	100 Vdc	200 Vdc	300 Vdc	50 Vdc	100 Vdc	200 Vdc
0.010	6.7			754__A	755__A			756__A
0.012	5.6			754__B				756__B
0.015	4.5			754__C				756__C
0.018	3.7			754__D				756__D
0.022	3.0			754__E	755__E			756__E
0.027	2.5		754__F	755__F				756__F
0.033	2.0		754__G	755__G				756__G
0.039	1.7		754__H	755__H			756__H	757__H
0.047	1.4		754__I				756__I	757__I
0.056	1.2		754__J				756__J	757__J
0.068	1.0	754__K	755__K				756__K	757__K
0.082	0.8	754__L	755__L			756__L	757__L	758__L
0.10	0.7	754__M	755__M			756__M	757__M	758__M
0.12	0.6	754__N				756__N	757__N	759__N
0.15	0.5	754__O				756__O	757__O	759__O
0.18	0.4	755__P				757__P	758__P	
0.22	0.35	755__Q				757__Q	758__Q	
0.27	0.3	755__R				757__R	759__R	
0.33	0.3					757__S	759__S	
0.39	0.25					758__T		
0.47	0.25					758__U		
0.56	0.2					758__V		
0.68	0.2					758__W		
0.82	0.15					759__X		
1.0	0.15					759__Y		

* When ordering, fill in blank with C, G or H to specify capacitance tolerance (C = ±5%, G = ±10%, H = ±20%).

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CAPACITORS

Miniature Metallized Film Capacitors — 761 Type (Mini-Tubular)

Specifications

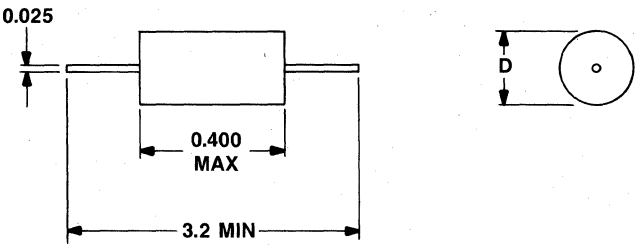
- Temperature range: −40 to +85°C without derating.
- Capacitance: requirements apply at 1 kHz and 25°C.
- Effective series resistance (at 100 kHz): see Table 2.
- Insulation resistance: minimum of 5,000 MΩ • μF (but need not exceed 30,000 MΩ) at 25°C after 1-minute electrification at 100 Vdc (except 50 Vdc for capacitors with working voltage rating of 50 Vdc).
- Lead pull: will withstand a tensile force of 5 pounds applied along each lead for 5 seconds.
- Life test: twice rated voltage at 85°C for 250 hours.
- Humidity resistance: rated voltage at 65°C and 85% relative humidity for 144 hours.

Ordering Information

Order by part number as listed in Table 2. The part number consists of the type number (761), letter for capacitance tolerance (C, ±5%; G, ±10%), and nominal capacitance value in microfarads (μF), followed by the letter "T" to indicate reel taping, when applicable. The 761 Type Capacitors can be furnished with reel taping for all nominal capacitance values.

Outline Diagram

(Dimensions in Inches)



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AT&T

CAPACITORS

Miniature Metallized Film Capacitors — 761 Type (Mini-Tubular)

Table 2. 761 Type Capacitors

Nominal Capacitance (μF)	Part No. Capacitance Tolerance ±5%	Part No. Capacitance Tolerance ±10%	Working Voltage Rating (Vdc)	Maximum Effective Series Resistance (Ω)	D Maximum Diameter (inch)
0.0022	761C.0022UF	761G.0022UF	300	24	0.20
0.0027	761C.0027UF	761G.0027UF	300	24	0.20
0.0033	761C.0033UF	761G.0033UF	300	20	0.20
0.0039	761C.0039UF	761G.0039UF	300	20	0.20
0.0047	761C.0047UF	761G.0047UF	300	19	0.20
0.0056	761C.0056UF	761G.0056UF	300	18	0.20
0.0068	761C.0068UF	761G.0068UF	300	17	0.20
0.0082	761C.0082UF	761G.0082UF	300	16	0.20
0.010	761C.010UF	761G.010UF	300	16	0.20
0.012	761C.012UF	761G.012UF	300	12	0.20
0.015	761C.015UF	761G.015UF	300	12	0.20
0.018	761C.018UF	761G.018UF	300	10	0.20
0.022	761C.022UF	761G.022UF	300	8	0.20
0.027	761C.027UF	761G.027UF	200	8	0.20
0.033	761C.033UF	761G.033UF	200	6	0.20
0.039	761C.039UF	761G.039UF	200	6	0.20
0.047	761C.047UF	761G.047UF	200	5	0.20
0.056	761C.056UF	761G.056UF	200	4	0.20
0.068	761C.068UF	761G.068UF	100	3.5	0.20
0.082	761C.082UF	761G.082UF	100	3	0.20
0.10	761C.10UF	761G.10UF	100	2.5	0.20
0.12	761C.12UF	761G.12UF	100	2	0.20
0.15	761C.15UF	761G.15UF	50	1.6	0.20
0.18	761C.18UF	761G.18UF	50	1.4	0.20
0.22	761C.22UF	761G.22UF	50	1.2	0.21
0.27	761C.27UF	761G.27UF	50	1.0	0.23
0.33	761C.33UF	761G.33UF	50	0.8	0.25
0.39	761C.39UF	761G.39UF	50	0.7	0.28
0.47	761C.47UF	761G.47UF	50	0.6	0.29

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AT&T

CAPACITORS

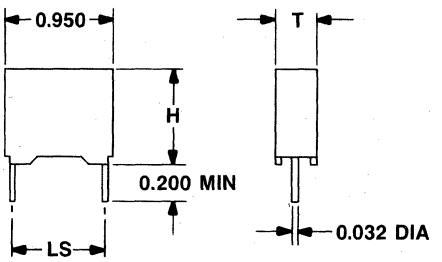
Standard Metallized Film Capacitors — 741 Type (Box)

Specifications

- Temperature range: −40 to +85°C without derating.
- Capacitance: requirements apply at 1 kHz and 25°C.
- Effective series resistance (at 100 kHz): see Table 4.
- Insulation resistance: minimum of 5,000 MΩ • μF at 25°C after 1-minute electrification at 100 Vdc.
- Lead pull: will withstand a tensile force of 5 pounds applied along each lead for 5 seconds.
- Life test: twice rated voltage at 85°C for 250 hours.
- Humidity resistance: rated voltage at 65°C and 85% relative humidity for 144 hours.

Outline Diagram

(Dimensions in Inches)



Ordering Information

Order by part number as listed in Table 4. The part number consists of the type number (741) and letter(s) which designate a particular set of values. The 741 Type Capacitors can be packaged in 250-unit plastic tubes for all nominal capacitance values.

Table 3. 741 Type Capacitors

Nominal Capacitance (μF)	Part No.	Capacitance Tolerance (±%)	Working Voltage Rating (Vdc)	Maximum Effective Series Resistance (Ω)	Maximum Dimensions T Maximum Thickness (inches)	Maximum Dimensions H Maximum Height (inch)	LS Nom. Spacing ±0.016 (inch)
0.147	741J	20	250	1.0	0.187	0.53	0.700
0.147	741W	20	250	1.0	0.187	0.53	0.800
0.51	741E	5	100	0.30	0.25	0.70	0.800
0.51	741A	10	100	0.30	0.25	0.70	0.800
0.55	741H	10	100	0.25	0.187	0.45	0.700
0.825	741K	10	100	0.18	0.187	0.53	0.700
1.0	741B	5	100	0.25	0.25	0.70	0.800
1.0	741F	10	100	0.25	0.25	0.70	0.800
1.47	741L	10	100	0.20	0.30	0.75	0.800
2.15	741C	5	100	0.20	0.30	0.75	0.800
2.15*	741AC	5	100	0.30	0.30	0.75	0.800
2.15	741G	10	100	0.20	0.30	0.75	0.800
2.15	741D	20	100	0.20	0.30	0.75	0.800
2.15*	741AD	20	100	0.30	0.30	0.75	0.800
2.2	741Y	5	100	0.20	0.30	0.75	0.800
2.2	741AA	10	100	0.20	0.30	0.75	0.800
2.2	741AB	20	100	0.20	0.30	0.75	0.800

* These codes have a minimum insulation resistance requirement of 1000 MΩ.

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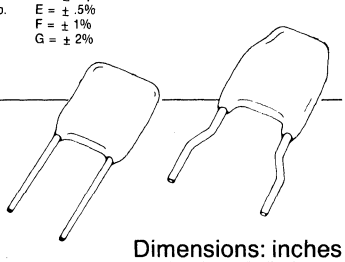
AVX Part Numbering System/How to Order

AVX Leaded MLCs: Example: SR205A561FAA

SR20	5	A	561	F	A	A
AVX Style SR_ _ = Dipped Radials MR_ _ = Molded Radials MA_ _ = Molded Axials MD_ _ = 2-Pin Dips	**Voltage** 5 = 50V 1 = 100V 2 = 200V	**Temperature Coefficient** A = NPO C = X7R E = Z5U	**Capacitance Code** (Example) 561 = 560 pf 56 = sig. figures of cap. 1 = addit. no of zeros	**Capacitance Tolerance** C = ± .25 pf D = ± .5 pf E = ± .5% F = ± 1% G = ± 2%	**Failure Rate** A = Standard	**Leads** A = Standard T = Trimmed

SkyCap

AVX SR Series
Conformally Coated Radial Leaded MLC



Size and Capacitance Specifications
EIA Characteristic

Dimensions: inches

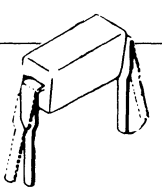
AVX	SR15	SR20	SR21	SR22	SR27	SR30	SR40	SR50
Width	.150	.200	.200	.200	.260	.300	.400	.500
Height	.150	.200	.200	.200	.250	.300	.400	.500
Thickness	.100	.125	.125	.125	.160	.150	.150	.200
Lead Spacing	.100	.100	.200	.250	.300	.200	.200	.400
Lead Diameter	.020	.020	.020	.020	.020	.020	.020	.025

Capacitance Range pf or mfd if 10,000 pf or greater

EIA TC	WVDC	SR15	SR20	SR21	SR22	SR27	SR30	SR40	SR50
NPO	100	1.0-680	1000-4700	1.0-4700	1.0-4700	1.0-4700	6800-.022	.033-.047	.01-.068
	50	1.0-1000	1500-6800	1000-6800	1000-6800	1000-6800	.01-.022	.033-.068	.01-0.1
X7R	100	470-6800	.01-.068	1000-.068	1000-.068	1000-.068	.1-.33	.39-.47	.33-1.0
	50	470-.022	.033-.15	1000-.15	1000-.15	1000-.15	.22-1.0	1.0	1.0-2.7
Z5U	100	.01	.047-.1	.01-.1	.01-.1	.01-.1	.15-.47	.68-1.0	1.0-2.2
	50	.01-.047	.1-.33	.01-.33	.01-.33	.01-.33	.15-1.5	2.2-3.3	1.0-4.7

DipGuard

AVX MD Series
Molded dual-in-line MLC



Size Specifications

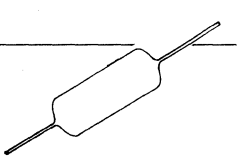
AVX	MD01	MD02	MD03
Length	.260	.260	.260
Height	.135 max	.165 max	.290 max
Height	.165 max	.195 max	.320 max
Thickness	.098 max	.098 max	.098 max

Capacitance Range pf or mfd if 10,000 pf or greater

EIA/TC	WVDC	MD01	MD02	MD03
NPO	100	10-150	—	—
	50	220-3300	4700-.01	—
X7R	100	220-.01	—	—
	50	.15-.1	.15-.22	.33-1.0
Z5U	100	—	—	—
	50	.01-.47	—	.68-1.0

SpinGuard

AVX SA Series – Conformally Coated Axial Leaded MLC



AVX	SA10	SA20	SA30	SA40
(L)	.170	.260	.290	.400
Diameter	.100	.100	.150	.150
Lead Diameter	.019	.019	.019	.019

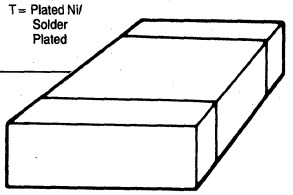
Capacitance Range pf or mfd if 10,000 pf or greater

	WVDC	SA10	SA20	SA30	SA40
NPO	200	1.0-120	—	—	—
	100	150-820	1000-1500	1800-3900	4700-6800
	50	1000	1800	4700	8200-12,000
X7R	200	220-470	—	—	—
	100	560-6800	8200-.018	.022-.047	.056-.1
	50	8200-.022	.027-.047	.056-.1	.12-.33
Z5U	100	.01-.022	033-.047	.068-.1	.15-.22
	50	.01-.1	.1	.15-.33	.47-1.0

AVX Part Numbering System/How to Order

AVX Chip MLC: Example: 08055A101FA1050R

0805	5	A	101	F	A	1	050	R
Chip Size (L" x W") 0805 etc.	**Voltage** 50V = 5 100V = 1 200V = 2	**Dielectric** NPO = A X7R = C Z5U = E	**Capacitance Code** (2 significant digits + no. of zeroes)	**Capacitance Tolerance** D = ± .5 pf F = ± 1% G = ± 2%	**Failure Rate** A = Standard	**Terminations** 1 = Palladium/ Silver 2 = Solder T = Plated Ni/ Solder Plated	**Thickness** Max thickness in mils	**Packaging** R = Reel B = Bulk



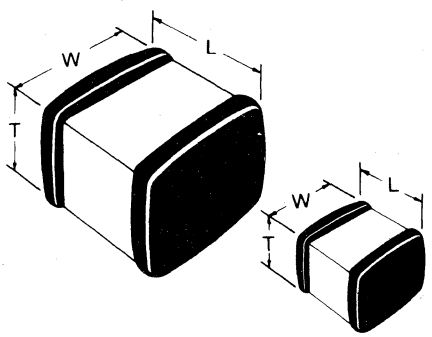
MLC Chips

Dimensions: Inches

SIZE		0805	1206	1210	1812	1825
Length		.080 ± .010	.120 ± .010	.125 ± .010	.175 ± .010	.185 ± .010
Width		.050 ± .010	.060 ± .010	.095 ± .010	.125 ± .010	.250 ± .010
Thickness		.050	.050	.050	.050	.050
Terminal		.020 ± .010	.020 ± .010	.025 ± .010	.025 ± .010	.025 ± .010
Capacitance Range pf or mfd if 10,000 pf or greater						
NPO	100	1.0-680	10-1800	100-3300	330-.047	1800-.012
	50	1.0-1000	10-3300	100-4700	330-.010	1800-.018
X7R	100	100-8200	1000-.012	1000-.027	.010-.047	.033-.10
	50	100-.033	1000-.10	1000-.15	.010-.33	.033-.68
Z5U	50	2700-.068	2700-.18	4700-.33	8200-.68	.027-1.5

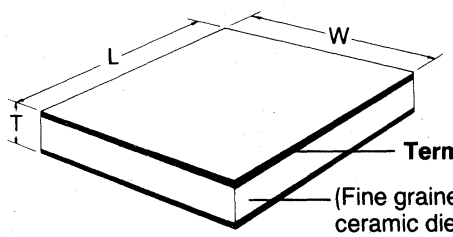
NOTE: for 0504, 1005, 0907, 1505, 1805, 1808, 2321, 2224, contact the factory

Microwave MLCs



Case	Length	Width	Thickness
AQ 11	.055 ± .015 (1.40 ± .381)	.055 ± .015 (1.40 ± .381)	.028/.057 (.711/1.45)
AQ 12	.055 ± .025 (1.40 ± .635)	.055 ± .015 (1.40 ± .381)	.028/.057 (.711/1.45)
AQ 13	.110 ± .020 (2.79 ± .508)	.110 ± .020 (2.79 ± .508)	.058/.102 (1.47/2.59)
AQ 14	.110 + .035 - .020 (2.79 + .889 - .508)	.110 ± .020 (2.79 ± .508)	.058/.102 (1.47/2.59)

Microwave SLCs



Case Size, in. (mm.) Approximate Dimensions:

Case	LW	THK
GH 01	.015 (.381)	.005 (.127)
GH 02	.025 (.635)	.005 (.127)
GH 03	.035 (.889)	.006 (.152)
GH 04	.050 (1.27)	.007 (.178)
GH 05	.070 (1.78)	.008 (.203)
GH 06	.090 (.229)	.010 (.254)

Where to Order:

AVX Corporation, Myrtle Beach, SC 29577 Tel: (803) 448-9411 TWX: 810-661-2252
AVX Corporation, Conway, SC 29526 Tel: (803) 293-4404
AVX Corporation, Olean, NY 14760 Tel: (716) 372-6611 TWX: 510-245-2815
AVX Limited, Aldershot, England Tel: (0252) 312131 Telex: 858473
AVX Asia Limited, Hong Kong Tel: 3-689-171-5 Telex: 49576 AVX AS HX

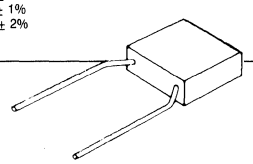
AVX Part Numbering System/How to Order

AVX Leaded MLCs: Example: SR205A561FAA

MROS	5	A	561	F	A	A
AVX Style SR_ _ = Dipped Radials MR_ _ = Molded Radials MA_ _ = Molded Axials MD_ _ = 2-Pin Dips	**Voltage** 5 = 50V 1 = 100V 2 = 200V	**Temperature Coefficient** A = NPO C = X7R E = Z5U	**Capacitance Code** (Example) 561 = 560 pf 56 = sig. figures of cap. 1 = addt. no of zeros	**Capacitance Tolerance** C = ± .25 pf D = ± .5 pf E = ± .5% F = ± 1% G = ± 2%	**Failure Rate** A = Standard	**Leads** A = Standard T = Trimmed

Molded Radials

AVX MR Series
Molded Radial Lead Capacitors



Dimensions: Inches

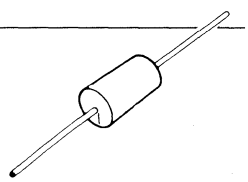
AVX	MR04	MR05	MR06	MR07	MR08
Length	.190	.190	.290	.490	.490
Width	.190	.190	.290	.490	.490
Thickness	.090	.090	.090	.140	.240
Lead Spacing	.100	.200	.200	.400	.400
Lead Diameter	.025	.025	.025	.025	.025

Tolerances ± .254 mm (± .010"). Lead diameter ± .05 mm (± .002")
Capacitance Range – pf or mfd if 10,000 pf or greater

NPO	200 100 150	1-1000 1-4700 1-8200	1-1200 1-4700 1-8200	1500-3900 5600-.015 .010-.18	2200-.015 2200-.068 2200-.10	3900-.027 3900-.12 3900-.27
X7R	200 100 50	100-.015 100-.056 100-.12	100-.015 100-.056 100-.120	.018-.039 .068-.15 .15-1.0	5600-.18 5600-.47 5600-3.3	.01-.33 .01-4.7 .01-5.6
Z5U	100 50	.010-.22 .010-.39	0.10-.22 .010-.39	.27-.68 .47-1.0	.1-2.7 .1-4.7	.18-4.7 .18-10.0

Molded Axials

AVX MA Series
Molded Axial Leaded MLC



Dimensions: Inches

AVX	MA10	MA20	MA30	MA40	MA50	MA60
Length	.160 ± .010	.250 ± .010	.240 ± .010	.390 ± .010	.500 ± .020	.690 ± .020
Diameter	.090 ± .010	.090 ± .010	.130 ± .010	.140 ± .010	.250 ± .015	.350 ± .015
Lead Diameter	.019 ± .002	.019 ± .002	.019 ± .002	.025 ± .002	.025 ± .002	.025 ± .002

Capacitance Range pf or mfd if 10,000 pf or greater

		MA10	MA20	MA30	MA40	MA50	MA60
NPO	200 100 50	1.0-180 1.0-820 1.0-1000	82-330 82-1500 82-1800	120-1200 120-4700 120-5600	180-1800 180-6800 180-.012	1000-8200 1000-.033 1000-.056	3300-.033 3300-.10 3300-.15
X7R	200 100 50	220-1200 220-6800 220-.022	220-2700 220-.018 220-.056	560-6800 560-.047 560-.10	1000-.022 1000-.10 1000-.27	3300-.068 3300-.33 3300-1.0	.01-.33 .01-1.0 .01-3.3
Z5U	200 100 50	1000-4700 1000-.022 1000-.10	330-.012 3300-.047 3300-.12	5600-.027 5600-.1 5600-.47	.01-.068 .01-.22 .01-1.0	.033-.18 .033-.56 .033-2.2	.1-.82 .1-2.7 .1-8.2

Where to Order:

AVX Corporation, Myrtle Beach, SC 29577 Tel: (803) 448-9411 TWX: 810-661-2252
AVX Corporation, Conway, SC 29526 Tel: (803) 293-4404
AVX Corporation, Olean, NY 14760 Tel: (716) 372-6611 TWX: 510-245-2815
AVX Limited, Aldershot, England Tel: (0252) 312131 Telex: 858473
AVX Asia Limited, Hong Kong Tel: 3-689-171-5 Telex: 49576 AVX AS HX

For Military Products...See page B•1009

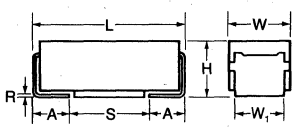
Tantalum Capacitors

AVX Part Numbering System/How to Order

TAJ	B	335	M	016	LI
Type	**Case size**	**Capacitance value** Picofarad code: 1st two digits represent significant figures 3rd digit represents multiplier (number of zeros to follow)	**Tape and reel configuration** (see table on page 9)	**Rated d.c. voltage code**	**Capacitance tolerance** (M = ±20%, K = ±10%)

Solid Tantalum Chip TAJ

Meets or exceeds the requirement of EIA Standard QC 300801/US001



Dimensions mm (inches)

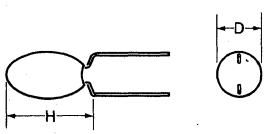
Code	L ± 0.2(0.008) −0.1(0.004)	W ± 0.2(0.008) −0.1(0.004)	H ± 0.2(0.008) −0.1(0.004)	W_1 ± 0.1(0.004)	A ± 0.3(0.012) −0.2(0.008)	S Min
A	3.2(0.126)	1.6(0.063)	1.6(0.063)	1.2(0.047)	0.8(0.031)	1.1(0.043)
B	3.5(0.138)	2.8(0.110)	1.9(0.075)	2.2(0.087)	0.8(0.031)	1.4(0.055)
C	6.0(0.236)	3.2(0.126)	2.6(0.102)	2.2(0.087)	1.3(0.051)	2.9(0.114)
D	7.3(0.287)	4.3(0.169)	2.9(0.114)	2.4(0.094)	1.3(0.051)	4.4(0.173)

Notes: Manufacturing dimensions are mm. Imperial dimensions are for reference only. W_1 dimension applies to the termination width for A dimension only. Stand off (R) is 0.1 ± 0.1 (0.004 ± 0.004)

Capacitance range (Letter denotes case code)*

Capacitance µF	Rated voltage d.c. (V_R) 4V	6.3V	10V	16V	20V	25V	35V	50V
0.1							A	A
0.15							A	B
0.22							A	B
0.33							A	B
0.47						A	B	C
0.68					A		B	C
1.0				A			B	C
1.5			A			B	C	D
2.2		A		B	B		C	D
3.3	A			B		C	C/D	D
4.7			B	C	C	C/D	D	D
6.8		B		C	C/D	D	D	
10	B		C	C/D		D	D	
15		C	C/D		D	D		
22	C	C/D		D	D			
33	C		D	D				
47	D	D	D					
68	D	D						
100	D	D						

Solid Tantalum Resin Dipped TAP



Dimensions mm (inches) max.

Code	H	H_1	D	Code	H	D
A	8.5 (0.33)	7.0 (0.28)	4.5 (0.18)	J	13.0 (0.51)	8.0 (0.31)
B	9.0 (0.35)	7.5 (0.30)	4.5 (0.18)	K	14.0(0.55)	8.5 (0.33)
C	10.0 (0.39)	8.5 (0.33)	5.0 (0.20)	L	14.0 (0.55)	9.0 (0.35)
D	10.5 (0.41)	9.0 (0.35)	5.0 (0.20)	M	14.5 (0.57)	9.0 (0.35)
E	10.5 (0.41)	9.0 (0.35)	5.5 (0.22)	N	16.0 (0.63)	9.0 (0.35)
F	11.5 (0.45)	10.0 (0.39)	6.0 (0.24)	P	17.0 (0.67)	10.0 (0.39)
G	11.5 (0.45)	10.0 (0.39)	6.5 (0.26)	R	18.5 (0.73)	10.0 (0.39)
H	12.0 (0.47)	10.5 (0.41)	7.0 (0.28)			

*H_1 refers to H dimension on S wire only.

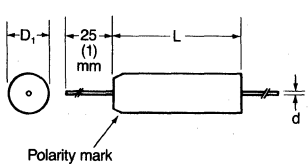
Capacitance range (Letter denotes case code)*

Capacitance µF	Rated voltage d.c. (V_R) 6.3V	10V	16V	20V	25V	35V	50V
0.1						A	A
0.15						A	A
0.22						A	A
0.33						A	A
0.47						A	A
0.68						A	B
1.0				A	A	A	C
1.5			A	A	A	A	D
2.2		A	A	A	A	B	E
3.3	A	A	A	B	B	C	F
4.7	A	A	B	C	C	E	G
6.8	A	B	C	D	D	F	H
10	B	C	D	E	E	F	J
15	C	D	E	F	F	H	K
22	D	E	F	H	H	K	L
33	E	F	F	J	J	M	
47	F	G	J	K	M	N	
68	G	H	L	N	N		
100	H	K	N	N			
150	K	N	N				
220	M	P	R				
330	P	R					

*Values outside this standard range may be available on request without appropriate release or qualification.

AVX reserves the right to supply capacitors to a tighter specification than that ordered.

Solid Tantalum Molded Axial TAR



Dimensions mm (inches) max.

Case Size	L ±0.25(0.01)	D_1 ±0.25(0.01)	d ±0.05(0.02)	Typical Weight g
Q	6.35(0.25)	2.16(0.085)	0.5(0.02)	0.20
R	7.4(0.29)	2.5(0.10)	0.5(0.02)	0.25
S	8.6(0.34)	4.3(0.17)	0.5(0.02)	0.52
W	10.4(0.41)	4.3(0.17)	0.5(0.02)	0.53

Capacitance range (Letter denotes case code)*

Capacitance µF	Rated voltage d.c. (V_R) 6.3V	10V	16V	20V	25V	35V
0.1						Q
0.12						Q
0.15						Q
0.18						Q
0.22						Q
0.27						Q
0.33						Q
0.39						Q
0.47						Q
0.56					Q	R
0.68					Q	R
0.82					Q	R

Capacitance range (Letter denotes case code)*

Capacitance µF	Rated voltage d.c. (V_R) 6.3V	10V	16V	20V	25V	35V
1.0				Q	Q	R
1.2				Q	R	R
1.5			Q	Q	R	R
1.8			Q	R	R	S
2.2		Q	Q	R	R	S
2.7		Q	R	R	R	S
3.3	Q	Q	R	R	R	S
3.9	Q	R	R	R	S	S
4.7	Q	R	R	R	S	S
5.6	R	R	R	S	S	W
6.8	R	R	R	S	S	W
8.2	R	R	S	S	S	W
10	R	R	S	S	S	W
12	R	S	S	W	W	W
15	R	S	S	W	W	
18	S	S	W	W		
22	S	S	W	W		
27	S	W	W			
33	S	W	W			
39	W	W				
47	W	W				
56	W					
68	W					

Items shown in bold type are preferred E6 values.
50V Range available on request.

Available thru Distribution

AVX Corporation, Myrtle Beach, SC 29577 Tel: (803) 448-9411 TWX: 810-661-2252 AVX Corporation, Olean, NY 14760 Tel: (716) 372-6611 TWX: 510-245-2815
AVX Limited, Aldershot, England Tel: (0252) 312131 Telex: 858473 AVX, Hong Kong Tel: 011-852-3-633303 Telex: 49576 AVXASHX

MINIGLOSSARY CAPACITORS

Anode: One of two plates or conductors. In polarized capacitors, the anode should be connected to the positive conductor in the circuit.

Capacitive Reactance: The measure of the opposition of a capacitor to accepting a charge and expressed in ohms. When direct current is applied under stated conditions capacitive reactance becomes a constant but, when alternating current is applied the capacitive reactance varies until an equilibrium is achieved and the capacitor appears to have only direct current present. This condition is commonly used in filter applications or in coupling circuits.

Cathode: One of two plates or conductors. In electrostatic capacitors the cathode is metallic. In electrolytic capacitors the cathode is a liquid, gel or other conductive material which is in intimate contact with a metallic cathodic connection.

Dielectric Constant: The measure of quality of the insulating materials in a capacitor. Dry air has a dielectric constant of one (1). Aluminum oxide used in aluminum electrolytic capacitors has a nominal dielectric constant of ten (10).

Electrolytic: A capacitor with one metallic conductor (generally the anode) and with a liquid or semiconductor cathode. Nonpolarized electrolytic capacitors generally have two equal anodes as well as the liquid cathode. These anodes operate alternately as anode and cathodic connection as alternating current is applied.

Electrostatic: One of two general classes of capacitors in which two or more discrete metallic conductors are present and separated by an insulating dielectric material. Examples include: mica, ceramic, film, and paper types.

Farad: The basic unit of measure in capacitors. A capacitor charged to one volt with a charge of one coulomb (one ampere flowing for one second) has a capacitance of one farad. Capacitors are generally rated at portions of a farad (microfarads or picofarads).

1 farad (F) = 1,000,000 microfarads (μF) 1 microfarad (μF) = 1,000,000 picofarads (pF)

Impedance: All capacitors exhibit impedance. It is a function of capacitor type and internal construction. This can be particularly important in certain applications such as filters for switching power supplies. Capacitors used in these applications often have special multiple tab construction to shorten current paths and to reduce internal resistance.

Leakage Current: Expressed as dcl for electrolytic capacitors, a measure of the intrinsic losses in a charged capacitor. Generally speaking, the lower the dcl, the higher quality the capacitor.

Power Factor: A measure of the overall efficiency of a capacitor. Power factor ratings take all internal losses into consideration in a complex formula. This parameter of certain capacitors is often very important in AC applications such as motor-start and/or motor-run capacitors.

Rated Voltage: The rated working voltage of a capacitor. Generally expressed in DC Volts (Vdcw). This is the voltage at which a capacitor may be safely operated at 25°C continuously within its overall parameters.

Ripple Current: The total amount of alternating and direct current that may be applied to an electrolytic capacitor under stated conditions. In general, the higher the ripple current applied, the shorter the operating life of the capacitor will be. Application of significantly higher than rated ripple currents can shorten the capacitor life dramatically and may even cause catastrophic failure (explosion).

Surge Voltage: The momentary surge voltage which may be applied for a stated length of time without doing permanent damage to the unit.

Temperature: Capacitors are generally rated at 25°C at sea level under specific humidity conditions. Operating temperature ranges are also given, along with derating (reliability) curves for operation at temperatures other than 25°C.

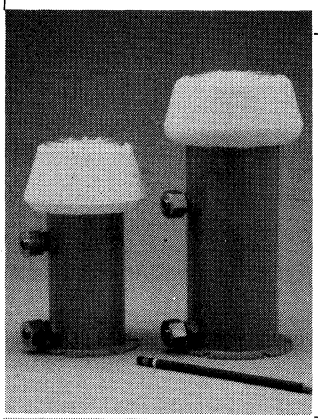
Temperature Coefficient: Expressed as TC in ppm (parts per million) or in percent (%) from the norm of 25°C. This is seldom a straight line and may vary widely for certain types. Most capacitors have positive TC in that the capacitance increases as temperature increases. Some types, however, have negative TC in that the capacitance decreases as temperature increases.

Ceramic Capacitor Codes
(Capacitance Given In pF)

Color	Digit	Multiplier	Tolerance			Temperature Coefficient ppm°C	Significant Figure	Multiplier
			Class 1					
			10pF or less	Over 10pF	Class 2			
Black	0	1	±2.0pF	±20%	±20%	0	0.0	—1
Brown	1	10	±0.1pF	±1%		—33		—10
Red	2	100		±2%		—75	1.0	—100
Orange	3	1000		±3%		—150	1.5	—1000
Yellow	4	10000			+100% —0%	—220	2.0	—10000
Green	5		±0.5pF	±5%	±5%	—330	3.3	+1
Blue	6					—470	4.7	+10
Violet	7					—750	7.5	+100
Gray	8	0.01	±0.25pF		+80% —20%	+150 to —1500		+1000
White	9	0.1	±1.0pF	±10%	±10%	+100 to —750		+10000
Silver								
Gold								

BRADFORD CERAMIC POWER CAPACITORS

PART NUMBERS AND ORDERING INFORMATION



WATER COOLED POWER CAPACITORS

Style	Capacitance Range (pF)	Tolerances (%)	Rated Voltage (kVp)	Rated Power (kVA)	Rated Current (Arms)
TWXF95 x 162	100 - 2500	20-10	14	1000... 1500	150
TWXF95 x 187	1000	20-10	14	1500	150
TWXF95 x 220	5000	20-10	12	1275	150
TWXF110 x 250	5000	20-10	14	2000	200
TWXF135 x 218	4000	20-10	16	2500	250
TWXF135 x 250	5000	20-10	16	2830	250
TWXF135 x 272	6000	20-10	16	2830	250
TWXF135 x 285	5000	20-10	20	3000	250
TWXF165 x 270	7600	20-10	16	3000	300
TWXF165 x 420	10000	20-10	18	2500	250

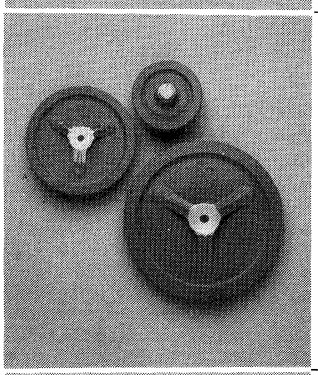


PLATE CAPACITORS WITH SMALL RIM

FP.20 to FP.200	4.7 - 6000	0.5 pF to 20%	2... 8	3... 60	5... 20

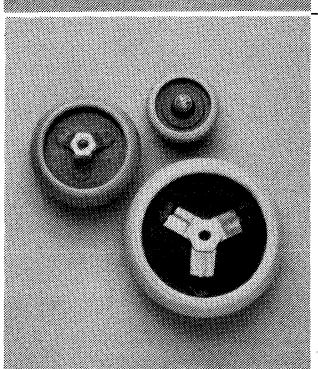
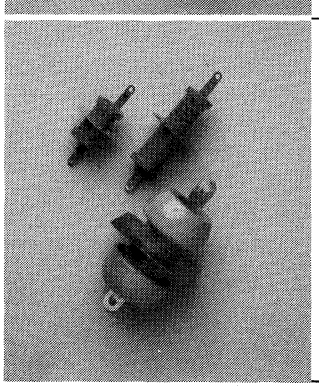


PLATE CAPACITORS WITH CONTOURED RIM

P.20 to P.200	5.6 - 10000	0.5 pF to 20%	5... 15	5... 140	5... 100



FEED-THROUGH CAPACITORS

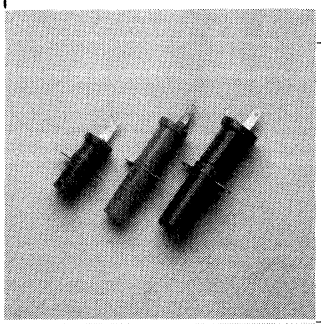
D. 16 x 30 to D. 50 x 180	15 - 2500	20-10-5	3... 20	1.5... 60	5... 50

High Voltage Applications for Bradford ceramic power capacitors include: RF generators for induction heating and dielectric heating • HF transmitters • RF suppression (feed-throughs) • X-Ray equipment • Electrostatic powder spraying • Special design capabilities available.

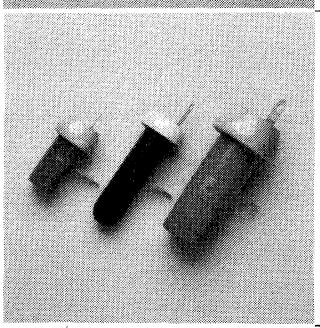
For complete information, contact:
BRADFORD ELECTRONICS, INC., 109 Alfred Street, Biddeford, ME 04005 • Phone (207) 284-5695

BRADFORD CERAMIC POWER CAPACITORS

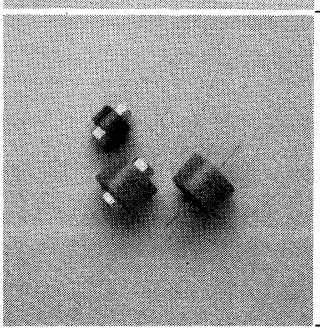
PART NUMBERS AND ORDERING INFORMATION



Style	Capacitance Range (pF)	Tolerances (%)	Rated Voltage (kVp)	Rated Power (kVA)	Rated Current (Arms)
TUBULAR RIMMED CAPACITORS					
R. 12 x 8.5 to R. 45 x 120	3 - 2500	0.5 pF to 20%	2... 11	0.5... 60	4... 50

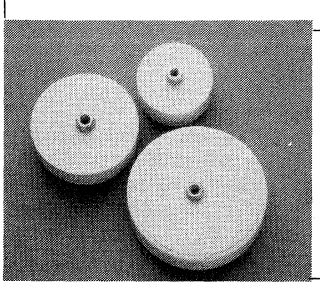


POT CAPACITORS WITH CONTOURED RIM					
T. 20 x 30 to T. 85 x 120	10 - 4000	20-10-5	6... 15	2.5... 50	6... 15



BARREL CAPACITORS					
TO. 16 x 10 to TO. 25 x 16	1.5 - 100	0.5 pF to 20%	5 - 9	0.8... 2.5	5 - 10

HIGH VOLTAGE CERAMIC CAPACITORS



Style	Capacitance Range (pF)	Tolerances (%)	Rated Voltage (kV)	Rated Power (kVA)	Rated Current (Arms)
HIGH VOLTAGE					
HPA/HPD	350 - 5000	20	20	—	6
HPB/HPC	350 - 5000	20	20	—	6
HR	750 - 1500	20	2.8	—	—
	2000 - 5000	+50—20			

For complete information, contact:
BRADFORD ELECTRONICS, INC., 109 Alfred Street, Biddeford, ME 04005 • Phone (207) 284-5695

MINIGLOSSARY
BASIC CAPACITOR FORMULAS

I. Capacitance (farads)

English: $C = \frac{.224\,K\,A}{t_D}$

Metric: $C = \frac{.0884\,K\,A}{t_D}$

II. Energy stored in capacitors (Joules, watt-sec)

$E = \frac{1}{2}\,CV^2$

III. Linear charge of a capacitor (Amperes)

$I = C\frac{dV}{dt}$

IV. Total Impedance of a capacitor (ohms)

$Z = \sqrt{R_s^2 + (X_C - X_L)^2}$

Where Rs = ESR

V. Capacitive Reactance (ohms)

$X_C = \frac{1}{2\pi fC}$

VI. Inductive Reactance (ohms)

$X_L = 2\pi fL$

VII. Phase Angles:

Ideal Capacitors: Current leads voltage 90°
Ideal Inductors: Current lags voltage 90°
Ideal Resistors: Current in phase with voltage

VIII. Dissipation Factor

$DF = \tan\delta\ (\text{loss angle}) = \frac{ESR}{X_c} = (2\pi fC)\ (ESR)$

IX. Power Factor

PF = Sine δ (loss angle) = Cos ϕ (phase angle)
PF = DF (when less than 10%)

X. Quality Factor (dimensionless)

$Q = \text{Cotan}\ \delta\ (\text{loss angle}) = \frac{1}{DF}$

XI. Equivalent Series Resistance (ohms)

$ESR = (DF)\ (Xc) = (DF)\ (\frac{1}{2}\pi fC)$

XII. Power Loss (watts)

Power loss $= (2\pi fCV^2)\ (DF)$

XIII. KVA (Kilowatts)

$KVA = 2\pi fCV^2 \times 10^{-3}$

XIV. Temperature Characteristic (ppm/°C)

$TC = \frac{Ct - C_{25}}{C_{25}\,(T_t - 25)} \times 10^6$

XV. Cap Drift (%)

$C.D. = \frac{C_1 - C_2}{C_1} \times 100$

XVI. Reliability of Ceramic Capacitors

$\frac{L_O}{L_t} = \left(\frac{V_t}{V_O}\right)^x \left(\frac{T_t}{T_O}\right)^\tau$

XVII. Capacitors in Series (current the same)

Any number: $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} \cdots + \frac{1}{C_N}$

Two: $C_T = \frac{C_1\,C_2}{C_1 + C_2}$

XVIII. Capacitors in Parallel (voltage the same)

$C_T = C_1 + C_2 \cdots + C_N$

XIX. Aging Rate

A.R. = % Δ C/decade of time

XX. Decibels

$db = 20 \log \frac{V_1}{V_2}$

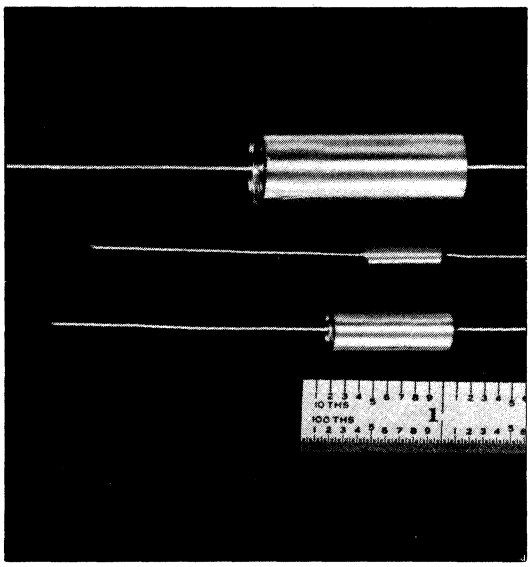
Metric prefixes:

Pico	$\times 10^{-12}$
Nano	$\times 10^{-9}$
Micro	$\times 10^{-6}$
Milli	$\times 10^{-3}$
Deci	$\times 10^{-1}$
Deca	$\times 10$
Kilo	$\times 10^{3}$
Mega	$\times 10^{6}$
Giga	$\times 10^{9}$
Tera	$\times 10^{12}$

Symbols:

K = Dielectric Constant
A = Area
t_D = Dielectric thickness
V = Voltage
t = time
R_S = Series Resistance
f = frequency
L = Inductance
δ = Loss angle
ϕ = Phase angle
x + y = Exponent effect of voltage and temp
L_O = Operating life
L_t = Test life
V_t = Test voltage
V_O = Operating voltage
T_t = Test temperature
T_O = Operating temperature

Component Research High Reliability Film Capacitors



Component Research Company is recognized as the leader in hermetically sealed high reliability plastic film capacitors. These capacitors see large usage in military, aerospace, space, medical and oil well logging industries. Established in 1959, Component Research Company has gained industry wide recognition for outstanding technical expertise, unsurpassed quality and excellent service.

Since the early sixties, Component Research Company capacitors have been used in every U.S. space program. Many of the innovations developed and produced by Component Research have resulted in new military specifications such as MIL-C-83421, MIL-C-39022/9 and MIL-C-87217.

Quality is assured by the strictest adherence to all specification requirements and state-of-the-art manufacturing and testing methods. To this end, Component Research maintains a complete military approved environmental testing laboratory with capabilities for vibration, shock, acceleration, thermal shock, burn-in, moisture resistance, barometric pressure, solderability, resistance to solvents, hermeticity and radiographic testing. This quality system is approved to MIL-Q-9858 and MIL-STD-790. A calibration laboratory complying to MIL-STD-45662 is also maintained.

In addition to the standard line of hermetically sealed film capacitors, Component Research Company designs and manufactures capacitor networks, high current capacitors, feedthrough capacitors and other custom capacitors.

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Component Research CRC

CAPACITOR SELECTION GUIDE

	A12	G12	P12	C15	A19
DIELECTRIC MATERIAL	METALLIZED POLYCARBONATE	METALLIZED POLYCARBONATE	METALLIZED POLYCARBONATE	METALLIZED POLYPROPYLENE	METALLIZED POLYPHENYLENE SULFIDE
CONSTRUCTION	AXIAL LEAD METAL CASE	AXIAL LEAD METAL CASE	AXIAL LEAD METAL CASE	AXIAL LEAD METAL CASE	RADIAL LEAD CERAMIC CASE
MILITARY APPROVAL	MIL-C-83421/1 FAILURE RATE "S"			MIL-C-83421/2 FAILURE RATE "M"	
OPERATING TEMPERATURE	−65°C to 125° WITH DERATING	−65°C TO 125° WITH DERATING	−65°C to 125° WITH DERATING	−65°C to 105° WITH DERATING	−65°C to 125°
STORAGE TEMPERATURE	−65°C to 125°	−65°C to 125°	−65°C to 125°	−65°C to 105°	−65°C to 125°
CAPACITANCE RANGE	.001 TO 27 μF	.001 TO 8.2 μF	.001 TO 27 μF	.056 TO 20 μF	.0005 TO .056 μF
D.C. VOLTAGE RATING	30, 50, 100, 200, 400	30, 50, 100, 200	50, 100, 200, 400	100, 200, 400	50, 100, 200, 300, 400
A.C. VOLTAGE RATING	22, 36, 60, 120, 240	22, 36, 60, 120	36, 60, 120, 240	60, 120, 240	36, 60, 120, 180, 240
INSULATION RESISTANCE @ 25°C	300,000 MEGOHMS × μF	100,000 MEGOHMS × μF	200,000 MEGOHMS × μF	300,000 MEGOHMS × μF	100,000 MEGOHMS × μF
DISSIPATION FACTOR	.15% MAX @ 1 KHz @ 0.1 KHz VALUES > 1 μF	.15% MAX @ 1 KHz @ 0.1 KHz VALUES > 1 μF	.15% MAX @ 1 KHz @ 0.1 KHz VALUES > 1 μF	.07% MAX @ 1 KHz @ 0.1 KHz VALUES > 1 μF	.15% MAX @ 1 KHz
DIELECTRIC ABSORPTION	.1% MAX.	.1% MAX.	.1% MAX.	.02% MAX.	.1% MAX.
RECOMMENDED APPLICATIONS	TIMING CIRCUITS FEEDBACK CIRCUITS FILTERING DECOUPLING	TIMING CIRCUITS FEEDBACK CIRCUITS FILTERING DECOUPLING	A.C. APPLICATIONS FEEDBACK CIRCUITS FILTERING DECOUPLING	POWER SUPPLY FILTERING	TIMING CIRCUITS FEEDBACK CIRCUITS FILTERING DECOUPLING
	J11	H11	J93	A52	B52
DIELECTRIC MATERIAL	METALLIZED TEFLON	METALLIZED TEFLON	POLYSTYRENE	FOIL POLYCARBONATE	FOIL POLYCARBONATE
CONSTRUCTION	AXIAL LEAD METAL CASE	AXIAL LEAD METAL CASE	AXIAL LEAD METAL CASE	AXIAL LEAD METAL CASE	AXIAL LEAD METAL CASE
OPERATING TEMPERATURE	−65°C TO 125°	−65°C TO 200°	−65°C TO 85°	−65°C TO 125° WITH DERATING	−65°C TO 100°
STORAGE TEMPERATURE	−65°C TO 125°	−65°C TO 200°	−65°C TO 85°	−65°C TO 125°	−65°C TO 100°
CAPACITANCE RANGE	.001 TO 2 μF	.001 TO 2 μF	.001 TO 2.7 μF	.001 TO .47 μF	.033 TO .82 μF

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CAPACITOR SELECTION GUIDE

	J11	H11	J93	A52	B52
D.C. VOLTAGE RATING	50, 100, 200	50, 100, 200	50, 100, 200, 400	100, 200, 300, 400	600, 800
A.C. VOLTAGE RATING			36, 60, 120, 240	60, 120, 180, 240	400, 600
INSULATION RESISTANCE @ 25°C	1,000,000 MEGOHMS × μF	100,000 MEGOHMS × μF	1,000,000 MEGOHMS × μF	100,000 MEGOHMS × μF	100,000 MEGOHMS × μF
DISSIPATION FACTOR	.05% MAX @ 1 KHz @ 0.1 KHz VALUES > 1 μF	.1% MAX @ 1 KHz @ 0.1 KHz VALUES > 1 μF	.02% MAX @ 1 KHz @ 0.1 KHz VALUES > 1 μF	.25% MAX @ 10 KHz	.25% MAX @ 10 KHz
DIELECTRIC ABSORPTION	.01% MAX.	.01% MAX.	.02% MAX.	.15% MAX.	.15% MAX.
RECOMMENDED APPLICATIONS	SAMPLE AND HOLD INTEGRATOR CRITICAL TIMING	HIGH TEMPERATURE	SAMPLE AND HOLD HIGH STABILITY TIMING	PULSE CURRENT SNUBBER	PULSE CURRENT SNUBBER HIGH VOLTAGE

	B12	B55	B15
DIELECTRIC MATERIAL	METALLIZED POLYCARBONATE	FOIL POLYPROPYLENE	METALLIZED POLYPROPYLENE
CONSTRUCTION	AXIAL LEAD METAL CASE	AXIAL LEAD METAL CASE	AXIAL LEAD METAL CASE
OPERATING TEMPERATURE	−65°C TO 100°	−65°C TO 85°	−65°C TO 85°
STORAGE TEMPERATURE	−65°C TO 100°	−65°C TO 85°	−65°C TO 85°
CAPACITANCE RANGE	.01 TO 1.2 μF	.033 TO .82 μF	.01 TO 1.2 μF
D.C. VOLTAGE RATING	600, 800	600, 800	600, 800
A.C. VOLTAGE RATING	400, 600	400, 600	400, 600
INSULATION RESISTANCE @ 25°C	100,000 MEGOHMS × μF	100,000 MEGOHMS × μF	100,000 MEGOHMS × μF
DISSIPATION FACTOR	.5% MAX @ 10 KHz	.05% MAX @ 10 KHz	.05% MAX @ 10 KHz
DIELECTRIC ABSORPTION	.15% MAX.	.05% MAX.	.05% MAX.
RECOMMENDED APPLICATIONS	HIGH VOLTAGE FILTERING	PULSE CURRENT SNUBBER HIGH VOLTAGE	HIGH VOLTAGE FILTERING

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Component Research (CRC)

ORDERING INFORMATION

MILITARY APPROVALS

Component Research Company is qualified to the following Military specifications:

- ☐ MIL-C-83421/1
- ☐ MIL-C-83421/2
- ☐ MIL-C-39022/7
- ☐ MIL-C-39022/9
- ☐ MIL-C-39022/10
- ☐ MIL-C-87217/1

SALES INFORMATION

Standard products listed in the catalog may be ordered by contacting our sales office.

PHONE:	(213) 829-3615
TELEFAX:	(213) 829-9584
TWX:	(910) 343-6864
MAIL:	1655 26th Street Santa Monica CA 90404-4090 Attention: Sales

TERMS

Net 30 upon approval by our credit dept. Minimum order is $40, $20 per line item. All shipments are FOB Santa Monica.

PATENT INFORMATION

Component Research capacitors are exclusively manufactured under one or more of the following patents: 3,238,428; 3,260,906; 3,920,063; 3,506,895; 3,539,886; 3,603,849; 4,587,144. Additional patents pending.

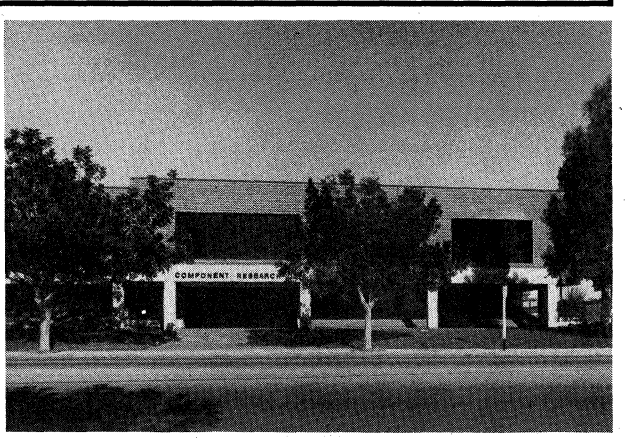
APPLICATIONS ASSISTANCE

Our applications engineers are recognized as the most knowledgeable in the industry. Please call our applications department for any requirement that is not covered in our catalog.

CUSTOM CAPACITORS

Component Research designs and manufactures thousands of custom capacitors for special applications. These custom designs include:

- Capacitor networks
- Capacitor standards
- Feedthrough capacitors
- Matched sets
- Special Temperature Coefficient capacitors
- High temperature capacitors
- Special hermetic packages for high vibration
- High current capacitors tested at high frequencies



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Component Research CRC

VOLTAGE TEMPERATURE SCANNING FOR CAPACITOR FAULTS

SCREENING FOR LOW VOLTAGE MOMENTARY BREAKDOWNS

In recent years some concern has arisen over the use of metallized polycarbonate capacitors in low voltage applications. The cause for this concern is due to a phenomenon existing in these capacitors known as "momentary breakdown." Testing in our laboratories has shown that other metallized dielectrics such as polypropylene, polysulfone, and polyester exhibit this same failure mode, as well. In addition, screening done by Component Research Company on a number of hi-rel ceramic capacitors has shown similar failures.

Programs such as Atlas and Voyager have experienced capacitor failures which have been attributed to momentary breakdown. These costly failures have demonstrated a real need for further investigation into this phenomenon.

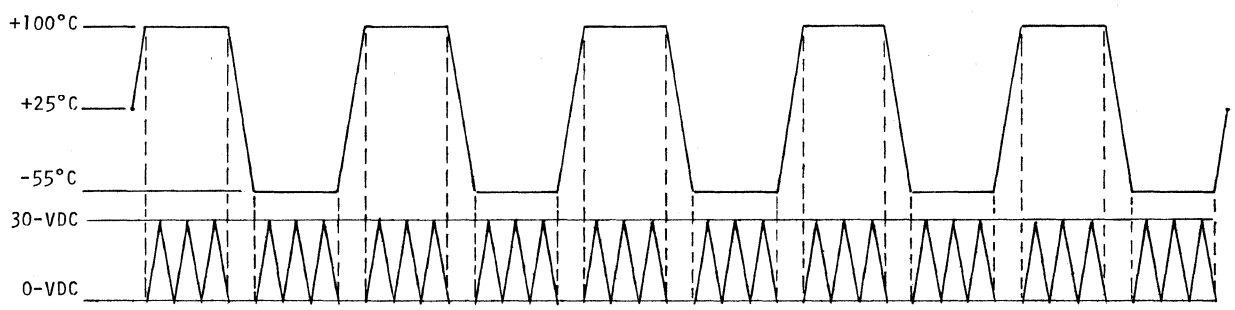
Component Research Company as a manufacturer of established reliability plastic film capacitors has been involved in screening capacitors for momentary breakdown since its involvement in the Viking program in 1973.

Considerable work has been done to develop effective screening methods to eliminate those capacitors that will possibly exhibit momentary breakdown. Component Research Company has developed various screening methods to cull out those capacitors which can exhibit a possibility of momentary breakdown.

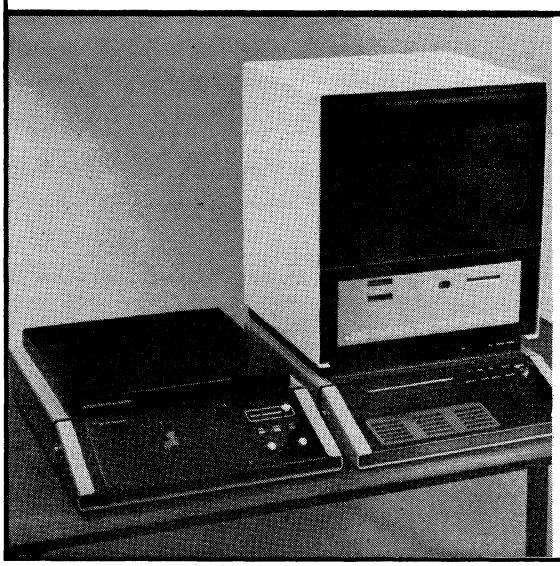
As a result a new military specification, MIL-C-87217, has been established to define screening procedures to be performed for applications in which momentary breakdowns cannot be tolerated.

Please contact our application engineers for assistance in choosing the suitable capacitor and screening procedure for your requirement.

TYPICAL VOLTAGE/TEMPERATURE RAMP SCREENING CYCLE



Stabilize capacitors at at temperature extremes and voltage ramp 3 times 0 to 30VDC and 30 to 0VDC while monitoring for leakage current.



This General Radio model 2230 Component Test System is used in conjunction with CRC specially designed ramp generators, cycling chambers, and interface equipment for voltage/temperature capacitor fault-scanning.

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Component Research

A12 METALLIZED POLYCARBONATE CAPACITOR

PRODUCT FEATURES

1.0 μF 30VDC ACTUAL SIZE CAPACITOR

QUALIFIED TO MIL-C-83421/01 FAILURE RATE S.

HERMETICALLY SEALED, HIGH RELIABILITY SCREENED FOR CRITICAL AEROSPACE APPLICATIONS.

AC RATED FROM 22VRMS TO 240VRMS AT FREQUENCIES FROM 0 TO 400Hz. RATINGS TO 40KHz AT LOWER VOLTAGE RATINGS, −65°C TO +100°C WITH DERATED OPERATION AT 125°C, DC RATED 30VDC TO 400VDC.

100% RELIABILITY SCREENING, INCLUDES BURN-IN, TEMPERATURE CYCLING, FINE LEAK TESTS, AND AC SQUARE WAVE TESTS.

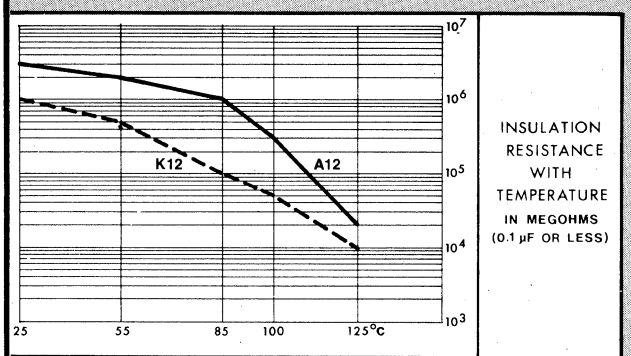
LOW LOSS, RUGGED INTERNAL TERMINATIONS QUALIFIED FOR ALL HI-REL PROGRAMS (CRC PATENTED CONSTRUCTION).

CAPACITORS HAVE BEEN THERMAL SHOCK TESTED FOR 1000 CYCLES FROM −65°C to +125°C, AIR TO AIR AND LIQUID TO LIQUID, SEE THERMAL SHOCK TEST PAGE.

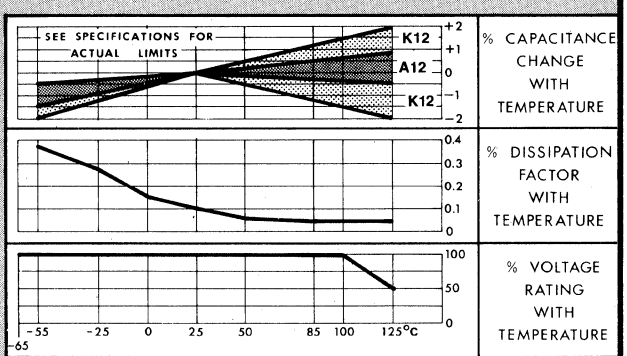
CAPACITORS OF SAME DESIGN AND CONSTRUCTION HAVE BEEN LIFE TESTED TO 40,000 HOURS, SEE 40,000 HOUR LIFE TEST DATA PAGE.

AVAILABLE IN STANDARD TOLERANCES: 0.25%, 0.5%, 1%, 2%, 5%, 10%. OTHER TOLERANCES AVAILABLE ON REQUEST.

TYPICAL CURVES



INSULATION RESISTANCE WITH TEMPERATURE IN MEGOHMS (0.1 μF OR LESS)



% CAPACITANCE CHANGE WITH TEMPERATURE

% DISSIPATION FACTOR WITH TEMPERATURE

% VOLTAGE RATING WITH TEMPERATURE

TYPICAL APPLICATIONS

- CRITICAL TIMING CIRCUITS
- FIXED TUNING CIRCUITS
- FILTERING
- TEMPERATURE COMPENSATION
- COUPLING AND DECOUPLING
- FEEDBACK CIRCUITS
- POWER SUPPLY FILTERING
- GYRO CIRCUITS
- PULSE FORMING NETWORKS
- INTEGRATING CIRCUITS

LIFE TEST DATA CRC TEST REPORT #77TR116

TEST RESULTS FOR SERIES A12 CAPACITORS LIFE TESTED FOR 2000 HOURS AT 100°C AT 140% OF RATED DC VOLTAGE.

THERE WERE NO FAILURES FOR THIS TEST.

LIST OF CAPACITORS SUBMITTED TO LIFE TEST			INSULATION RESISTANCE IN MEGOHMS AT 25°C			% CAPACITANCE CHANGE WITH LIFE			% DISSIPATION FACTOR AT 25°C WITH LIFE		
CRC TYPE	uF VALUE	Q'TY TESTED	POST TEST LIMITS (MIN. I.R.)	TEST RESULTS LOW	TEST RESULTS HIGH	POST TEST LIMITS (MAX. △C)	TEST RESULTS LOW	TEST RESULTS HIGH	POST TEST LIMITS (MAX. D.F.)	TEST RESULTS LOW	TEST RESULTS HIGH
A12A	.1	20	$1x10^6$	$3x10^6$	$4x10^6$	±2.0	0.00	+.40	.25	.07	.08
A12A	.001	20	$1x10^6$	$1x10^7$	$30x10^6$	±2.0	−.38	+.06	.25	.05	.05
A12B	1.0	20	$1x10^5$	$8x10^5$	$1x10^6$	±2.0	−.03	+.18	.25	.04	.05
A12B	.018	20	$1x10^6$	$1.2x10^7$	$2.5x10^7$	±2.0	−.33	−.16	.25	.07	.08
A12C	4.7	20	$2x10^4$	$1.1x10^5$	$5x10^5$	±2.0	−.13	−.06	.25	.04	.05
A12C	.039	20	$1x10^6$	$1.4x10^7$	$2x10^7$	±2.0	−.07	+.05	.25	.08	.08
A12D	.56	30	$1.8x10^5$	$1.6x10^6$	$1.8x10^6$	±2.0	−.03	+.05	.25	.05	.06
A12E	.01	30	$1x10^6$	$4x10^7$	$6.6x10^7$	±2.0	+.02	−.16	.25	.07	.07

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Component Research (CRC)

A12 METALLIZED POLYCARBONATE CAPACITOR

A12 SPECIFICATIONS

CONSTRUCTION	Metallized polycarbonate dielectric, hermetically sealed, extended metal film electrodes, axial leads isolated from case.	
ENVIRONMENTAL	Capacitors meet all environmental requirements and are qualified to MIL-C-83421/1.	
OPERATING TEMPERATURE	−65°C to +100°C	At full rated voltage, derate linearly to 50% of rated voltage at 125°C.
DIELECTRIC ABSORPTION	0.1% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.15% maximum	At 25°C when measured per MIL-C-83421.
AC SQUARE WAVE	100Hz, 60 seconds minimum	At 25°C at a peak to peak voltage of 3 times rated DC voltage, terminal to terminal per MIL-C-83421.
DIELECTRIC STRENGTH	200% rated DC voltage	At 25°C from terminal to terminal and terminal to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT (IN % CAPACITANCE)	−1.0% to +1.2%	From +25°C to +125°C
	−0% to −2.5%	From −55°C to 25°C
CAPACITANCE STABILITY (IN % CAPACITANCE)	±0.25%	When measured at any two corresponding temperature points taken in five successive temperature cycles from −65°C to +125°C.
HERMETIC SEAL	1×10^{-6} atm/cm³/sec.	Maximum leak rate.
INSULATION RESISTANCE	See Insulation Resistance Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1uF, allow an additional minute/uF charge time.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE

FOR VALUES OVER 0.1uF DIVIDE LIMIT SHOWN BY uF TO OBTAIN MINIMUM I.R.
EXAMPLE: A 0.5uF, SERIES A12 CAPACITOR AT 25°C IS 300,000 ÷ 0.5 = 600,000 MEGOHMS.

RANGE	STYLE	25°C	55°C	85°C	100°C	125°C
.001 TO 0.1uF	A12	3,000,000 Megohms	2,000,000 Megohms	1,000,000 Megohms	300,000 Megohms	20,000 Megohms
GREATER THAN 0.1uF	A12	300,000 Megohms-uF	200,000 Megohms-uF	100,000 Megohms-uF	30,000 Megohms-uF	2,000 Megohms-uF

A12 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL A12
1	BURN-IN	48 hrs. minimum at 125°C, at 140% rated DC voltage	4.7.2	No physical damage	100% Test
2	THERMAL AGING	10 cycles minimum from −65°C to +125°C	4.7.3	No physical damage	100% Test
3	SEAL TEST (FINE LEAK)	Helium bomb 45 PSI for 1 hr. minimum, check for helium leak	4.7.5	1×10^{-6} atm/cm³/sec. max.	100% Test
4	SEAL TEST (GROSS LEAK)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
5	AC SQUARE WAVE (TERMINAL TO TERMINAL)	Apply 100Hz at a peak to peak voltage of 3 times DC rated voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
6	DC HI-POT (TERMINAL TO TERMINAL AND TERMINALS TO CASE)	Apply 200% of rated DC voltage for 60 seconds minimum. Do not exceed 800 volts peak to peak.	4.7.6	No shorts	100% Test
7	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage	4.7.7	Per I.R. Table	100% Test
8	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8.	Per part number	100% Test
9	% DISSIPATION FACTOR	At 25°C at 1KHz, values above 1uF measure at 0.1KHz	4.7.9	0.15% max.	100% Test
10	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions, and workmanship	4.7.1	Per specification	1.0% AQL

1. Capacitors are packaged and shipped with Certification of Conformance. 2. Traceability to production and test records by permanent marking of parts with date code lot. 3. Process and inspection data is maintained on file per NHB 5300.4 (1C), MIL-Q-9858 and MIL-STD-790.

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615. TWX: (910) 343-6864

Component Research — CRC

A12 METALLIZED POLYCARBONATE CAPACITOR

uF	CASE DIMENSIONS															
	30 VDC			50 VDC			100 VDC			200 VDC			400 VDC			
	Diam. A	Length B	Length C	Diam. A	Length B	Length C	Diam. A	Length B	Length C	Diam. A	Length B	Length C	Diam. A	Length B	Length C	
.001	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662	
.0012	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662	
.0015	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662	
.0018	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662	
.002	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662	
.0022	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662	
.0027	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.235	.562	.662	
.0033	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.235	.562	.662	
.0039	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.235	.562	.662	
.0047	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.235	.562	.662	
.005	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.235	.562	.662	
.0056	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.235	.562	.662	
.0068	.170	.500	.600	.170	.500	.600	.170	.562	.662	.170	.562	.662	.235	.687	.787	
.0075	.170	.500	.600	.170	.562	.662	.170	.562	.662	.193	.562	.662	.235	.687	.787	
.0082	.170	.500	.600	.170	.562	.662	.170	.562	.662	.193	.562	.662	.235	.687	.787	
.01	.170	.500	.600	.170	.562	.662	.170	.687	.787	.193	.562	.662	.235	.687	.787	
.012	.170	.500	.600	.170	.562	.662	.170	.687	.787	.193	.562	.662	.235	.687	.787	
.015	.170	.500	.600	.170	.562	.662	.170	.687	.787	.235	.562	.662	.235	.813	.913	
.018	.170	.500	.600	.193	.562	.662	.193	.687	.787	.235	.687	.787	.312	.813	.913	
.02	.170	.500	.600	.193	.562	.662	.193	.687	.787	.235	.687	.787	.312	.813	.913	
.022	.170	.500	.600	.193	.562	.662	.193	.687	.787	.235	.687	.787	.312	.813	.913	
.027	.170	.562	.662	.193	.562	.662	.193	.687	.787	.312	.687	.787	.312	.813	.913	
.033	.170	.562	.662	.193	.562	.662	.193	.687	.787	.312	.687	.787	.312	.813	.913	
.039	.170	.562	.662	.170	.687	.787	.235	.687	.787	.312	.687	.787	.312	.813	.913	
.047	.170	.562	.662	.170	.687	.787	.235	.687	.787	.312	.687	.787	.400	.813	.913	
.05	.170	.562	.662	.170	.687	.787	.235	.687	.787	.312	.687	.787	.400	.813	.913	
.056	.170	.562	.662	.193	.687	.787	.235	.687	.787	.312	.813	.913	.400	.813	.913	
.068	.170	.687	.787	.193	.687	.787	.235	.813	.913	.312	.813	.913	.400	.813	.913	
.075	.170	.687	.787	.193	.813	.913	.312	.687	.787	.312	.813	.913	.400	1.063	1.163	
.082	.170	.687	.787	.193	.813	.913	.312	.687	.787	.312	.813	.913	.400	1.063	1.163	
.1	.193	.687	.787	.193	.813	.913	.312	.687	.787	.312	.813	.913	.400	1.063	1.163	
.12	.193	.687	.787	.235	.687	.787	.312	.687	.787	.312	.813	.913	.400	1.063	1.163	
.15	.235	.562	.662	.235	.687	.787	.312	.813	.913	.400	1.063	1.163	.400	1.375	1.475	
.18	.235	.687	.787	.235	.813	.913	.312	.813	.913	.400	1.375	1.475	.500	1.375	1.475	
.2	.235	.687	.787	.235	.813	.913	.312	.813	.913	.400	1.375	1.475	.500	1.375	1.475	
.22	.235	.687	.787	.235	.813	.913	.312	.813	.913	.400	1.375	1.475	.500	1.375	1.475	
.27	.235	.687	.787	.312	.687	.787	.312	1.063	1.163	.500	1.375	1.475	.562	1.375	1.475	
.33	.235	.687	.787	.312	.687	.787	.312	1.063	1.163	.500	1.375	1.475	.562	1.375	1.475	
.39	.235	.687	.787	.312	.813	.913	.400	1.063	1.163	.500	1.375	1.475	.562	1.875	1.975	
.47	.312	.687	.787	.312	.813	.913	.400	1.063	1.163	.500	1.375	1.475	.562	1.875	1.975	
.5	.312	.687	.787	.312	.813	.913	.400	1.063	1.163	.500	1.375	1.475	.562	1.875	1.975	
.56	.312	.687	.787	.400	.813	.913	.400	1.063	1.163	.500	1.375	1.475	.562	1.875	1.975	
.68	.312	.687	.787	.400	.813	.913	.500	1.125	1.225	.562	1.375	1.475	.750	1.875	1.975	
.75	.312	.813	.913	.400	1.063	1.163	.500	1.125	1.225	.562	1.875	1.975	.750	1.875	1.975	
.82	.312	.813	.913	.400	1.063	1.163	.500	1.125	1.225	.562	1.875	1.975	.750	1.875	1.975	
1.0	.312	.813	.913	.400	1.063	1.163	.562	1.125	1.225	.562	1.875	1.975	.750	1.875	1.975	
1.2	.312	.813	.913	.400	1.063	1.163	.562	1.125	1.225	.562	1.875	1.975	1.000	1.875	1.975	
1.5	.400	.813	.913	.400	1.063	1.163	.562	1.375	1.475	.670	1.875	1.975	1.000	2.375	2.475	
1.8	.400	.813	.913	.400	1.063	1.163	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475	
2.0	.400	.813	.913	.500	1.125	1.225	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475	
2.2	.400	.813	.913	.500	1.125	1.225	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475	
2.5	.400	1.063	1.163	.500	1.375	1.475	.670	1.875	1.975	.750	1.875	1.975				
2.7	.400	1.063	1.163	.500	1.375	1.475	.670	1.875	1.975	.750	1.875	1.975				
3.0	.400	1.063	1.163	.500	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975				
3.3	.400	1.063	1.163	.500	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975				
3.9	.400	1.375	1.475	.562	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475				
4.7	.500	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475				
5.0	.500	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475				
5.6	.500	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475				
6.8	.562	1.375	1.475	.670	1.875	1.975	1.000	2.375	2.475							
7.5	.562	1.375	1.475	.670	1.875	1.975	1.000	2.375	2.475							
8.2	.562	1.375	1.475	.670	1.875	1.975	1.000	2.375	2.475							
10.0	.562	1.375	1.475	.670	1.875	1.975	1.000	2.375	2.475							
12.0	.562	1.875	1.975	.750	1.875	1.975										
15.0	.562	1.875	1.975	.750	1.875	1.975										
18.0	.670	1.875	1.975	1.000	1.875	1.975										
20.0	.670	1.875	1.975	1.000	1.875	1.975										
22.0	.670	1.875	1.975	1.000	1.875	1.975										
25.0	.750	1.875	1.975	1.000	2.375	2.475										
27.0	.750	1.875	1.975	1.000	2.375	2.475										

FOR SPECIAL VALUES AND TOLERANCES, PLEASE CONTACT OUR APPLICATION DEPARTMENT.

CASE DIMENSIONS	TOLERANCE LIMITS (INCHES)
"A" Diameter	±.010 Without Sleeving
	+0.02 −0.00 With Mylar Sleeving
"B" Case Length	±0.03 With or Without Sleeving
"C" Bead to Bead Max. Length	The lengths shown in table are maximum and include solder beads. CRC "C" dimensions for A12 and K12 capacitors is 0.1" less than MIL-C-83421/1 requires.

A12 | A | 104 | J | S | W

STYLE

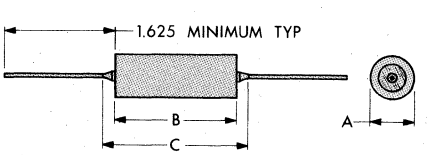
VOLTAGE
A=30VDC
B=50VDC
C=100VDC
D=200VDC
E=400VDC

SLEEVING CODE
S=Mylar sleeve
X=No sleeve

LEAD CODE
W=Tinned copper clad steel: #22 (.025") for .312" case dia & smaller; #20 (.032") for .400" & .500" case dia.
C=Tinned oxygen-free copper: #18 (.040") for .562" case dia. & larger.

CAPACITANCE TOLERANCE
K=10% F=1% B=¼%
J=5% D=½% A=.1%
G=2%

PICOFARAD CODE: First two digits represent significant figures. Last digit represents number of zeros to follow. Example: 104 = 100,000 picofarads.



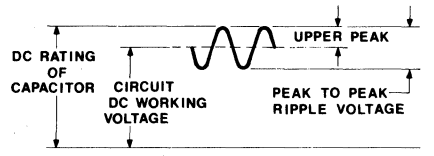
COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615. TWX: (910) 343-6864

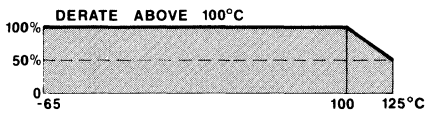
Component Research CRC

A12 METALLIZED POLYCARBONATE CAPACITOR

uF	AC RATINGS														
	30 VDC			50 VDC			100 VDC			200 VDC			400 VDC		
	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps
0.0010	22.00	22.00	0.0060	36.00	36.00	0.0090	60.00	60.00	0.0150	120.00	80.00	0.020	240.00	100.00	0.025
0.0012	22.00	22.00	0.0070	36.00	36.00	0.0110	60.00	60.00	0.0180	120.00	80.00	0.024	240.00	100.00	0.030
0.0015	22.00	22.00	0.0080	36.00	36.00	0.0130	60.00	60.00	0.0220	120.00	80.00	0.030	240.00	98.67	0.037
0.0018	22.00	22.00	0.0100	36.00	36.00	0.0160	60.00	60.00	0.0270	120.00	80.00	0.036	240.00	100.00	0.045
0.0020	22.00	22.00	0.0110	36.00	36.00	0.0180	60.00	60.00	0.0300	120.00	80.00	0.040	240.00	100.00	0.050
0.0022	22.00	22.00	0.0120	36.00	36.00	0.0200	60.00	60.00	0.0330	120.00	80.00	0.044	240.00	100.00	0.055
0.0027	22.00	22.00	0.0150	36.00	36.00	0.0240	60.00	60.00	0.0410	120.00	80.00	0.054	240.00	100.74	0.068
0.0033	22.00	22.00	0.0180	36.00	36.00	0.0300	60.00	60.00	0.0500	120.00	80.00	0.066	240.00	100.61	0.083
0.0039	22.00	22.00	0.0210	36.00	36.00	0.0350	60.00	60.00	0.0580	120.00	80.00	0.078	240.00	99.49	0.097
0.0047	22.00	22.00	0.0260	36.00	36.00	0.0420	60.00	60.00	0.0710	120.00	80.00	0.094	240.00	102.13	0.120
0.0050	22.00	22.00	0.0280	36.00	36.00	0.0450	60.00	60.00	0.0750	120.00	80.00	0.100	240.00	104.00	0.130
0.0056	22.00	22.00	0.0310	36.00	36.00	0.0500	60.00	60.00	0.0840	120.00	78.57	0.110	240.00	100.00	0.140
0.0068	22.00	22.00	0.0370	36.00	36.00	0.0610	60.00	60.00	0.1000	120.00	82.35	0.140	240.00	100.00	0.170
0.0075	22.00	22.00	0.0370	36.00	36.00	0.0610	60.00	60.00	0.1000	120.00	74.67	0.140	240.00	90.67	0.170
0.0082	22.00	22.00	0.0450	36.00	36.00	0.0740	60.00	60.00	0.1200	120.00	78.05	0.160	240.00	102.44	0.210
0.0100	22.00	22.00	0.0550	36.00	36.00	0.0900	60.00	60.00	0.1500	120.00	80.00	0.200	240.00	100.00	0.250
0.0120	22.00	22.00	0.0660	36.00	36.00	0.1100	60.00	60.00	0.1800	120.00	76.67	0.230	240.00	100.00	0.300
0.0150	22.00	22.00	0.0820	36.00	36.00	0.1400	60.00	58.67	0.2200	120.00	77.33	0.290	240.00	93.33	0.350
0.0180	22.00	22.00	0.1000	36.00	36.00	0.1600	60.00	57.78	0.2600	120.00	73.33	0.330	240.00	91.11	0.410
0.0200	22.00	22.00	0.1100	36.00	36.00	0.1800	60.00	56.00	0.2800	120.00	72.00	0.360	240.00	88.00	0.440
0.0220	22.00	22.00	0.1200	36.00	36.00	0.2000	60.00	52.73	0.2900	120.00	67.27	0.370	240.00	85.45	0.470
0.0270	22.00	22.00	0.1500	36.00	36.00	0.2400	60.00	50.37	0.3400	120.00	65.19	0.440	240.00	81.48	0.550
0.0330	22.00	22.00	0.1800	36.00	36.00	0.3000	60.00	49.70	0.4100	120.00	61.82	0.510	240.00	78.79	0.650
0.0390	22.00	22.00	0.2200	36.00	36.00	0.3500	60.00	48.21	0.4700	120.00	60.51	0.590	240.00	74.87	0.730
0.0470	22.00	22.00	0.2600	36.00	36.00	0.4200	60.00	46.81	0.5500	120.00	57.02	0.670	240.00	70.64	0.830
0.0500	22.00	22.00	0.2800	36.00	36.00	0.4500	60.00	46.40	0.5800	120.00	56.00	0.700	240.00	70.40	0.880
0.0560	22.00	22.00	0.3100	36.00	36.00	0.5000	60.00	45.71	0.6400	120.00	55.71	0.780	240.00	67.86	0.950
0.0680	22.00	22.00	0.3700	36.00	34.12	0.5800	60.00	41.76	0.7100	120.00	50.00	0.850	240.00	60.00	1.020
0.0750	22.00	22.00	0.3700	36.00	30.93	0.5800	60.00	37.87	0.7100	120.00	45.33	0.850	240.00	54.40	1.020
0.0820	22.00	22.00	0.4500	36.00	32.20	0.6600	60.00	38.05	0.7800	120.00	43.90	0.900	240.00	50.24	1.030
0.1000	22.00	22.00	0.5500	36.00	30.00	0.7500	60.00	36.00	0.9000	120.00	44.00	1.100	240.00	48.00	1.200
0.1200	22.00	22.00	0.6600	36.00	30.00	0.9000	60.00	35.00	1.0500	120.00	40.00	1.200	240.00	44.67	1.340
0.1500	22.00	22.00	0.8300	36.00	26.13	0.9800	60.00	33.07	1.2400	120.00	35.73	1.340	240.00	40.00	1.500
0.1800	22.00	22.00	1.0000	36.00	25.11	1.1300	60.00	31.11	1.4000	120.00	34.22	1.540	240.00	37.78	1.700
0.2000	22.00	20.00	1.0000	36.00	24.00	1.2000	60.00	30.00	1.5000	120.00	33.00	1.650	240.00	37.00	1.850
0.2200	22.00	18.55	1.0200	36.00	23.09	1.2700	60.00	27.27	1.5000	120.00	32.00	1.760	240.00	35.09	1.930
0.2700	22.00	17.04	1.1500	36.00	18.96	1.2800	60.00	24.00	1.6200	120.00	29.04	1.960	240.00	33.19	2.240
0.3300	22.00	16.00	1.3200	36.00	17.94	1.4800	60.00	23.03	1.9000	120.00	28.00	2.310	240.00	32.12	2.650
0.3900	22.00	14.97	1.4600	36.00	17.03	1.6600	60.00	22.05	2.1500	120.00	26.97	2.630	240.00	32.21	3.140
0.4700	22.00	14.04	1.6500	36.00	15.74	1.8500	60.00	21.02	2.4700	120.00	26.04	3.060	240.00	30.98	3.640
0.5000	22.00	13.52	1.6900	36.00	15.20	1.9000	60.00	20.00	2.5000	120.00	25.04	3.130	240.00	30.00	3.750
0.5600	22.00	12.93	1.8100	36.00	14.36	2.0100	60.00	18.86	2.6400	120.00	22.64	3.170	240.00	28.93	4.050
0.6800	22.00	12.00	2.0400	36.00	14.00	2.3800	60.00	16.00	2.7200	120.00	20.00	3.400	240.00	26.47	4.500
0.7500	22.00	10.88	2.0400	36.00	12.69	2.3800	60.00	14.51	2.7200	120.00	18.13	3.400	240.00	24.00	4.500
0.8200	22.00	10.00	2.0500	36.00	12.00	2.4600	60.00	14.00	2.8700	120.00	18.05	3.700	240.00	23.41	4.800
1.0000	22.00	8.40	2.1000	36.00	10.00	2.5000	60.00	12.00	3.0000	120.00	15.00	3.750	240.00	20.80	5.200
1.2000	22.00	7.17	2.1500	36.00	9.10	2.7300	60.00	10.83	3.2500	120.00	13.50	4.050	240.00	18.33	5.500
1.5000	22.00	5.79	2.1700	36.00	7.73	2.9000	60.00	10.00	3.7500	120.00	12.00	4.500	240.00	16.00	6.000
1.8000	22.00	4.89	2.2000	36.00	6.67	3.0000	60.00	8.33	3.7500	120.00	11.11	5.000	240.00	15.11	6.800
2.0000	22.00	4.40	2.2000	36.00	6.20	3.1000	60.00	8.20	4.1000	120.00	10.00	5.000	240.00	14.00	7.000
2.2000	22.00	4.00	2.2000	36.00	5.82	3.2000	60.00	7.49	4.1200	120.00	9.09	5.000	240.00	12.73	7.000
2.5000	22.00	3.52	2.2000	36.00	5.34	3.3400	60.00	7.04	4.4000	120.00	8.00	5.000			
2.7000	22.00	3.26	2.2000	36.00	4.95	3.3400	60.00	6.52	4.4000	120.00	7.70	5.200			
3.0000	22.00	2.93	2.2000	36.00	4.53	3.4000	60.00	6.01	4.5100	120.00	7.03	5.270			
3.3000	22.00	2.67	2.2000	36.00	4.24	3.5000	60.00	5.52	4.5500	120.00	6.50	5.360			
3.9000	22.00	2.26	2.2000	36.00	3.69	3.6000	60.00	5.03	4.9000	120.00	5.54	5.400			
4.7000	22.00	1.87	2.2000	36.00	3.06	3.6000	60.00	4.26	5.0000	120.00	4.60	5.400			
5.0000	22.00	1.76	2.2000	36.00	2.88	3.6000	60.00	4.00	5.0000	120.00	4.32	5.400			
5.6000	22.00	1.57	2.2000	36.00	2.57	3.6000	60.00	3.57	5.0000	120.00	3.86	5.400			
6.8000	22.00	1.29	2.2000	36.00	2.12	3.6000	60.00	2.94	5.0000						
7.5000	22.00	1.17	2.2000	36.00	1.92	3.6000	60.00	2.67	5.0000						
8.2000	22.00	1.07	2.2000	36.00	1.76	3.6000	60.00	2.44	5.0000						
10.0000	22.00	0.88	2.2000	36.00	1.44	3.6000	60.00	2.00	5.0000						
12.0000	22.00	0.73	2.2000	36.00	1.20	3.6000	60.00	1.67	5.0000						
15.0000	22.00	0.59	2.2000	36.00	0.96	3.6000									
18.0000	22.00	0.49	2.2000	36.00	0.80	3.6000									
20.0000	22.00	0.44	2.2000	36.00	0.72	3.6000									
22.0000	22.00	0.40	2.2000	36.00	0.65	3.6000									
25.0000	22.00	0.35	2.2000	36.00	0.58	3.6000									
27.0000	22.00	0.33	2.2000	36.00	0.53	3.6000									

1. THE COMBINED DC AND AC VOLTAGES SHOULD NOT EXCEED THE DC RATINGS, SEE FIGURE.
2. CAPACITORS MAY BE OPERATED AT HIGHER FREQUENCIES, AT REDUCED RMS VOLTAGE SUCH THAT MAX. AC CURRENT RATINGS ARE NOT EXCEEDED.
3. CAPACITORS CAN HANDLE PULSE CURRENTS UP TO 100 TIMES GREATER THAN THE PEAK CURRENTS CALCULATED FROM THE RATED RMS RATING (PROVIDED SLOW REPETITION RATES ARE USED). IF THERE IS ANY DOUBT, A SKETCH OF THE VOLTAGE AND CURRENT WAVE FORMS WITH TIME BASE SHOULD BE SENT TO CRC FOR ANALYSIS.





COMPONENT RESEARCH CO., INC. ■ 1655 26TH STREET ■ SANTA MONICA, CALIF. 90404 ■ (213) 829-3615. TWX: (910) 343-6864

Component Research CRC

G12 METALLIZED POLYCARBONATE CAPACITOR

PRODUCT FEATURES

2.5 μF 30VDC ACTUAL SIZE CAPACITOR

MINIATURE SIZE TO REPLACE NON-HERMETIC WRAP AND FILL, AND MOLDED CAPACITORS.

HERMETICALLY SEALED, HIGH RELIABILITY SCREENED FOR CRITICAL AEROSPACE APPLICATIONS.

AC RATED FROM 22VRMS TO 120VRMS AT FREQUENCIES UP TO 20KHz, −65°C to 100°C, WITH DERATED OPERATION AT 125°C. DC RATED 30VDC TO 200VDC.

100% RELIABILITY SCREENING, INCLUDES BURN-IN, TEMPERATURE CYCLING, FINE LEAK TESTS, AC SQUARE WAVE TESTS.

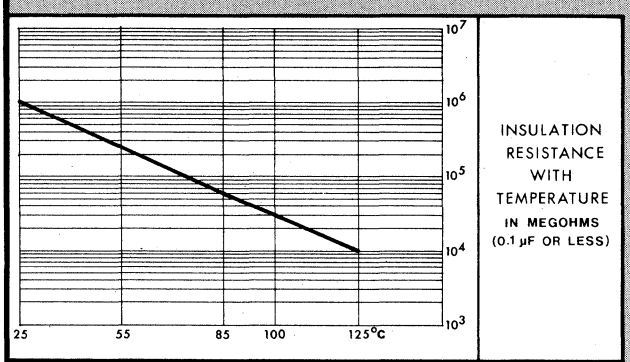
G12 CAPACITORS ARE PRESENTLY DESIGNED INTO MANY NAVY AND AIRFORCE PROGRAMS.

LOW LOSS, RUGGED INTERNAL TERMINATIONS QUALIFIED FOR ALL HI-REL PROGRAMS (CRC PATENTED CONSTRUCTION).

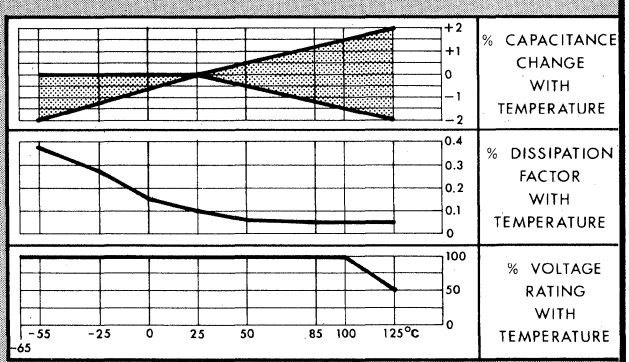
LOWEST PRICED, HIGH RELIABILITY, METALLIZED FILM CAPACITORS FOR HIGH VOLUME PROGRAM USE.

AVAILABLE IN STANDARD CAPACITANCE TOLERANCES, ±1%, ±2%, ±5%, ±10%. OTHER TOLERANCES AVAILABLE ON REQUEST.

TYPICAL CURVES



INSULATION RESISTANCE WITH TEMPERATURE IN MEGOHMS (0.1 μF OR LESS)



TYPICAL APPLICATIONS

- CRITICAL TIMING CIRCUITS
- FIXED TUNING CIRCUITS
- FILTERING
- TEMPERATURE COMPENSATION
- COUPLING AND DECOUPLING
- FEEDBACK CIRCUITS
- POWER SUPPLY FILTERING
- GYRO CIRCUITS
- PULSE FORMING NETWORKS
- INTEGRATING CIRCUITS

LIFE TEST DATA CRC TEST REPORT #78TR129

TEST RESULTS FOR 180 SERIES G12 CAPACITORS LIFE TESTED FOR 2000 HOURS AT 100°C AT 140% OF RATED DC VOLTAGE. THERE WERE NO FAILURES FOR THIS TEST.

LIST OF CAPACITORS LIFE TESTED			INSULATION RESISTANCE IN MEGOHMS AT 25°C			% CAPACITANCE CHANGE WITH LIFE			% DISSIPATION FACTOR AT 25°C WITH LIFE		
CRC TYPE	uF VALUE	Q'TY TESTED	POST TEST LIMITS (MIN. I.R.)	TEST RESULTS LOW	TEST RESULTS HIGH	POST TEST LIMITS (MAX. △C)	TEST RESULTS LOW	TEST RESULTS HIGH	POST TEST LIMITS (MAX. D.F.)	TEST RESULTS LOW	TEST RESULTS HIGH
G12A102	.001	20	$3.3x10^5$	$1.5x10^7$	$3x10^7$	±2	0.000	−.245	.25	.035	.055
G12A153	.015	20	$3.3x10^5$	$1.5x10^7$	$3x10^7$	±2	−.055	−.215	.25	.06	.08
G12B102	.001	20	$3.3x10^5$	$2x10^7$	$5x10^7$	±2	+.005	+.15	.25	.045	.055
G12B684	.68	20	$4.9x10^4$	$1.9x10^6$	$5x10^6$	±2	−.035	−.13	.25	.045	.055
G12C222	.0022	20	$3.3x10^5$	$5x10^7$	$1x10^8$	±2	+.01	−.225	.25	.055	.065
G12C305	3.0	20	$1.1x10^4$	$2.7x10^5$	$8.3x10^5$	±2	0.00	+.07	.25	.04	.045
G12D333	.033	20	$3.3x10^5$	$2x10^7$	$2.8x10^7$	±2	−.005	−.22	.25	.07	.075
G12D564	.56	20	$5.9x10^4$	$1.7x10^6$	$3.4x10^6$	±2	−.06	−.15	.25	.045	.055

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

Component Research CRC

G12 METALLIZED POLYCARBONATE CAPACITOR

G12 SPECIFICATIONS

CONSTRUCTION	Metallized polycarbonate dielectric, hermetically sealed, extended metal film electrodes, axial leads isolated from case.	
ENVIRONMENTAL	Capacitors meet all environmental requirements of MIL-C-83421.	
OPERATING TEMPERATURE	−65°C to +100°C	At full rated voltage, derate linearly to 50% of rated voltage at 125°C.
DIELECTRIC ABSORPTION	0.1% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.15% maximum	At 25°C when measured per MIL-C-83421.
AC SQUARE WAVE	100Hz, 60 seconds minimum	At 25°C at a peak to peak voltage of 2 times rated DC voltage, terminal to terminal per MIL-C-83421.
DIELECTRIC STRENGTH	200% DC volts	At 25°C from terminal to terminal and terminal to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT	±2% 0% to −2%	From 25°C to +125°C. From 25°C to −55°C.
CAPACITANCE STABILITY	±0.25%	When measured at any two corresponding temperature points taken in five successive temperature cycles from −65°C to +125°C.
HERMETIC SEAL	1×10^{-6}atm/cm³/sec.	Maximum leak rate.
INSULATION RESISTANCE	See I.R. Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1uF, allow an additional minute/uF charge time.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE

FOR VALUES OVER 0.1uF DIVIDE LIMIT SHOWN BY uF TO OBTAIN MINIMUM I.R. EXAMPLE: A 0.18uF CAPACITOR AT 25°C IS 100,000 ÷ 0.18 = 555,555 MEGOHMS.

RANGE	25°C	85°C	100°C	125°C
.001 TO 0.1uF	1,000,000 Megohms	60,000 Megohms	30,000 Megohms	10,000 Megohms
GREATER THAN 0.1uF	100,000 Megohms-uF	6,000 Megohms-uF	3,000 Megohms-uF	1,000 Megohms-uF

G12 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	BURN-IN	48 hrs. minimum at 125°C, at 140% rated DC voltage	4.7.2	No physical damage	100% Test
2	THERMAL AGING	10 cycles minimum from −65°C to +125°C	4.7.3	No physical damage	100% Test
3	SEAL TEST (FINE LEAK)	Helium bomb 45 PSI for 1 hr. minimum, check for helium leak	4.7.5	1x10⁻⁶atm/cm³/sec. max.	100% Test
4	SEAL TEST (GROSS LEAK)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
5	AC SQUARE WAVE (TERMINAL TO TERMINAL)	Apply 100Hz at a peak to peak voltage of 2 times DC rated voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
6	DC HI-POT (TERMINAL TO TERMINAL AND TERMINALS TO CASE)	Apply 200% of rated DC voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
7	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage	4.7.7	100,000 megohm-uF, need not exceed 1,000,000 megohms	100% Test
8	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
9	% DISSIPATION FACTOR	At 25°C at 1KHz, values above 1uF measure at 0.1KHz	4.7.9	0.15% max.	100% Test
10	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions, and workmanship	4.7.1	Per specification	1.0% AQL

1. Capacitors are packaged and shipped with Certification of Conformance. 2. Traceability to production and test records by permanent marking of parts with date code lot. 3. Process and inspection data is maintained on file per NHB 5300.4 (1C), MIL-Q-9858 and MIL-STD-790.

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

Component Research (CRC)

G12 METALLIZED POLYCARBONATE CAPACITOR

uF	30 VDC Basic P/N	30 VDC Diam. A	30 VDC Length B	30 VDC Length C	50 VDC Basic P/N	50 VDC Diam. A	50 VDC Length B	50 VDC Length C	100 VDC Basic P/N	100 VDC Diam. A	100 VDC Length B	100 VDC Length C	200 VDC Basic P/N	200 VDC Diam. A	200 VDC Length B	200 VDC Length C
.001	G12A102	.170	.500	.600	G12B102	.170	.500	.600	G12C102	.170	.500	.600	G12D102	.170	.500	.600
.0012	G12A122	.170	.500	.600	G12B122	.170	.500	.600	G12C122	.170	.500	.600	G12D122	.170	.500	.600
.0015	G12A152	.170	.500	.600	G12B152	.170	.500	.600	G12C152	.170	.500	.600	G12D152	.170	.500	.600
.0018	G12A182	.170	.500	.600	G12B182	.170	.500	.600	G12C182	.170	.500	.600	G12D182	.170	.500	.600
.002	G12A202	.170	.500	.600	G12B202	.170	.500	.600	G12C202	.170	.500	.600	G12D202	.170	.500	.600
.0022	G12A222	.170	.500	.600	G12B222	.170	.500	.600	G12C222	.170	.500	.600	G12D222	.170	.500	.600
.0027	G12A272	.170	.500	.600	G12B272	.170	.500	.600	G12C272	.170	.500	.600	G12D272	.170	.500	.600
.0033	G12A332	.170	.500	.600	G12B332	.170	.500	.600	G12C332	.170	.500	.600	G12D332	.170	.500	.600
.0039	G12A392	.170	.500	.600	G12B392	.170	.500	.600	G12C392	.170	.500	.600	G12D392	.170	.500	.600
.0047	G12A472	.170	.500	.600	G12B472	.170	.500	.600	G12C472	.170	.500	.600	G12D472	.170	.500	.600
.005	G12A502	.170	.500	.600	G12B502	.170	.500	.600	G12C502	.170	.500	.600	G12D502	.170	.500	.600
.0056	G12A562	.170	.500	.600	G12B562	.170	.500	.600	G12C562	.170	.500	.600	G12D562	.170	.500	.600
.0068	G12A682	.170	.500	.600	G12B682	.170	.500	.600	G12C682	.170	.500	.600	G12D682	.170	.500	.600
.0075	G12A752	.170	.500	.600	G12B752	.170	.500	.600	G12C752	.170	.500	.600	G12D752	.170	.562	.662
.0082	G12A822	.170	.500	.600	G12B822	.170	.500	.600	G12C822	.170	.500	.600	G12D822	.170	.562	.662
.01	G12A103	.170	.500	.600	G12B103	.170	.500	.600	G12C103	.170	.500	.600	G12D103	.170	.687	.787
.012	G12A123	.170	.500	.600	G12B123	.170	.500	.600	G12C123	.170	.500	.600	G12D123	.170	.687	.787
.015	G12A153	.170	.500	.600	G12B153	.170	.500	.600	G12C153	.170	.500	.600	G12D153	.170	.687	.787
.018	G12A183	.170	.500	.600	G12B183	.170	.500	.600	G12C183	.170	.562	.662	G12D183	.193	.687	.787
.02	G12A203	.170	.500	.600	G12B203	.170	.500	.600	G12C203	.170	.562	.662	G12D203	.193	.687	.787
.022	G12A223	.170	.500	.600	G12B223	.170	.500	.600	G12C223	.170	.562	.662	G12D223	.193	.687	.787
.027	G12A273	.170	.500	.600	G12B273	.170	.500	.600	G12C273	.170	.562	.662	G12D273	.193	.687	.787
.033	G12A333	.170	.500	.600	G12B333	.170	.500	.600	G12C333	.170	.562	.662	G12D333	.193	.687	.787
.039	G12A393	.170	.500	.600	G12B393	.170	.500	.600	G12C393	.170	.562	.662	G12D393	.235	.687	.787
.047	G12A473	.170	.500	.600	G12B473	.170	.500	.600	G12C473	.193	.562	.662	G12D473	.235	.687	.787
.05	G12A503	.170	.500	.600	G12B503	.170	.500	.600	G12C503	.193	.562	.662	G12D503	.235	.687	.787
.056	G12A563	.170	.500	.600	G12B563	.170	.500	.600	G12C563	.193	.562	.662	G12D563	.235	.687	.787
.068	G12A683	.170	.500	.600	G12B683	.170	.562	.662	G12C683	.235	.562	.662	G12D683	.312	.687	.787
.075	G12A753	.170	.500	.600	G12B753	.170	.562	.662	G12C753	.235	.562	.662	G12D753	.312	.687	.787
.082	G12A823	.170	.562	.662	G12B823	.170	.562	.662	G12C823	.235	.562	.662	G12D823	.312	.687	.787
.1	G12A104	.170	.562	.662	G12B104	.193	.562	.662	G12C104	.235	.687	.787	G12D104	.312	.687	.787
.12	G12A124	.170	.562	.662	G12B124	.193	.562	.662	G12C124	.235	.687	.787	G12D124	.312	.687	.787
.15	G12A154	.170	.562	.662	G12B154	.193	.562	.662	G12C154	.235	.687	.787	G12D154	.312	.813	.913
.18	G12A184	.193	.562	.662	G12B184	.235	.562	.662	G12C184	.235	.687	.787	G12D184	.312	.813	.913
.2	G12A204	.193	.562	.662	G12B204	.235	.562	.662	G12C204	.235	.687	.787	G12D204	.312	.813	.913
.22	G12A224	.193	.562	.662	G12B224	.235	.562	.662	G12C224	.235	.687	.787	G12D224	.312	.813	.913
.27	G12A274	.235	.562	.662	G12B274	.235	.687	.787	G12C274	.312	.687	.787	G12D274	.312	1.063	1.163
.33	G12A334	.235	.562	.662	G12B334	.235	.687	.787	G12C334	.312	.813	.913	G12D334	.312	1.063	1.163
.39	G12A394	.235	.687	.787	G12B394	.235	.687	.787	G12C394	.312	.813	.913	G12D394	.400	1.063	1.163
.47	G12A474	.235	.687	.787	G12B474	.312	.687	.787	G12C474	.400	.687	.787	G12D474	.400	1.063	1.163
.5	G12A504	.235	.687	.787	G12B504	.312	.687	.787	G12C504	.400	.687	.787	G12D504	.400	1.063	1.163
.56	G12A564	.235	.687	.787	G12B564	.312	.687	.787	G12C564	.400	.687	.787	G12D564	.400	1.063	1.163
.68	G12A684	.235	.813	.913	G12B684	.312	.687	.787	G12C684	.400	.813	.913	G12D684	.500	1.125	1.225
.75	G12A754	.235	.813	.913	G12B754	.312	.687	.787	G12C754	.400	.813	.913	G12D754	.500	1.125	1.225
.82	G12A824	.235	.813	.913	G12B824	.312	.687	.787	G12C824	.400	.813	.913	G12D824	.500	1.375	1.475
1.0	G12A105	.235	.813	.913	G12B105	.312	.813	.913	G12C105	.400	1.063	1.163	G12D105	.500	1.375	1.475
1.2	G12A125	.312	.813	.913	G12B125	.312	.813	.913	G12C125	.400	1.063	1.163	G12D125	.500	1.375	1.475
1.5	G12A155	.312	.813	.913	G12B155	.400	.813	.913	G12C155	.400	1.375	1.475				
1.8	G12A185	.312	.813	.913	G12B185	.400	.813	.913	G12C185	.400	1.375	1.475				
2.0	G12A205	.312	.813	.913	G12B205	.400	.813	.913	G12C205	.500	1.375	1.475				
2.2	G12A225	.312	.813	.913	G12B225	.400	.813	.913	G12C225	.500	1.375	1.475				
2.5					G12B255	.400	.813	.913	G12C255	.500	1.375	1.475				
2.7					G12B275	.400	1.063	1.163	G12C275	.500	1.375	1.475				
3.0					G12B305	.400	1.063	1.163	G12C305	.500	1.375	1.475				
3.3					G12B335	.400	1.063	1.163	G12C335	.500	1.375	1.475				
3.9					G12B395	.400	1.375	1.475								
4.7					G12B475	.500	1.375	1.475								
5.0					G12B505	.500	1.375	1.475								
5.6					G12B565	.500	1.375	1.475								
6.8					G12B685	.500	1.375	1.475								
7.5					G12B755	.500	1.375	1.475								
8.2					G12B825	.500	1.375	1.475								

FOR VALUES ABOVE 2.2 MICROFARADS, USE TYPE G12B.

FOR SPECIAL VALUES AND TOLERANCES, PLEASE CONTACT OUR APPLICATION DEPARTMENT.

CASE DIMENSIONS	TOLERANCE LIMITS (INCHES)
"A" Diameter	±0.010 Without Sleeving
	+0.02 −0.00 With Mylar Sleeving
"B" Case Length	±0.03 With or Without Sleeving
"C" Bead to Bead Max. Length	The lengths shown in table are maximum and include solder beads

G12 A 104 J S W

STYLE

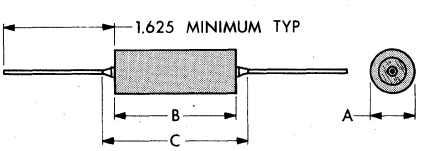
VOLTAGE
A=30VDC
B=50VDC
C=100VDC
D=200VDC

SLEEVING CODE
S=Mylar sleeve
X=No sleeve

LEAD CODE
W=Tinned copper clad steel: #22 (.025″) for .312″ case dia. & smaller; #20 (.032″) for .400″ & .500″ case dia.

CAPACITANCE TOLERANCE
K=10% J=5% G=2% F=1% D=½% B=¼% A=.1%

PICOFARAD CODE: First two digits represent significant figures. Last digit represents number of zeros to follow. Example: 104 = 100,000 picofarads.



COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

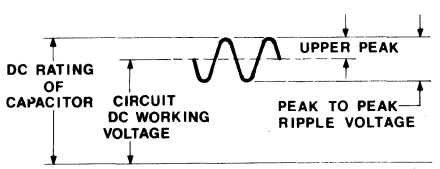
Component Research (CRC)

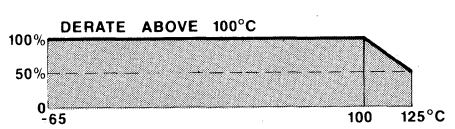
G12 METALLIZED POLYCARBONATE CAPACITOR

uF	AC RATINGS											
	30 VDC			50 VDC			100 VDC			200 VDC		
	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps
.0010	22.0	22.0	.0055	36.0	36.0	.0090	60.0	60.0	.0150	120.0	120.0	.030
.0012	22.0	22.0	.0066	36.0	36.0	.0108	60.0	60.0	.0180	120.0	120.0	.036
.0015	22.0	22.0	.0083	36.0	36.0	.0135	60.0	60.0	.0225	120.0	120.0	.045
.0018	22.0	22.0	.0099	36.0	36.0	.0162	60.0	60.0	.0270	120.0	120.0	.054
.0020	22.0	22.0	.0110	36.0	36.0	.0180	60.0	60.0	.0300	120.0	120.0	.060
.0022	22.0	22.0	.0121	36.0	36.0	.0198	60.0	60.0	.0330	120.0	120.0	.066
.0027	22.0	22.0	.0149	36.0	36.0	.0243	60.0	60.0	.0405	120.0	120.0	.081
.0033	22.0	22.0	.0182	36.0	36.0	.0297	60.0	60.0	.0495	120.0	120.0	.099
.0039	22.0	22.0	.0215	36.0	36.0	.0351	60.0	60.0	.0585	120.0	120.0	.117
.0047	22.0	22.0	.0259	36.0	36.0	.0423	60.0	60.0	.0705	120.0	120.0	.141
.0050	22.0	22.0	.0275	36.0	36.0	.0450	60.0	60.0	.0750	120.0	120.0	.150
.0056	22.0	22.0	.0308	36.0	36.0	.0504	60.0	60.0	.0840	120.0	120.0	.168
.0068	22.0	22.0	.0374	36.0	36.0	.0612	60.0	60.0	.1020	120.0	120.0	.204
.0075	22.0	22.0	.0413	36.0	36.0	.0675	60.0	60.0	.1125	120.0	120.0	.225
.0082	22.0	22.0	.0451	36.0	36.0	.0738	60.0	60.0	.123	120.0	120.0	.246
.010	22.0	22.0	.0550	36.0	36.0	.090	60.0	60.0	.150	120.0	120.0	.30
.012	22.0	22.0	.0660	36.0	36.0	.108	60.0	60.0	.180	120.0	120.0	.36
.015	22.0	22.0	.0825	36.0	36.0	.135	60.0	60.0	.225	120.0	120.0	.45
.018	22.0	22.0	.0990	36.0	36.0	.162	60.0	60.0	.27	120.0	120.0	.54
.020	22.0	22.0	.1100	36.0	26.0	.180	60.0	60.0	.30	120.0	120.0	.60
.022	22.0	22.0	.1210	36.0	36.0	.198	60.0	60.0	.33	120.0	120.0	.66
.027	22.0	22.0	.1485	36.0	36.0	.243	60.0	60.0	.405	120.0	120.0	.81
.033	22.0	22.0	.1815	36.0	36.0	.297	60.0	54.54	.45	120.0	103.03	.85
.039	22.0	22.0	.2145	36.0	31.79	.31	60.0	46.15	.45	120.0	120.0	1.17
.047	22.0	22.0	.2585	36.0	26.38	.31	60.0	60.00	.705	120.0	120.0	1.41
.050	22.0	22.0	.275	36.0	24.80	.31	60.0	60.00	.75	120.0	120.0	1.50
.056	22.0	22.0	.308	36.0	22.14	.31	60.0	60.00	.84	120.0	107.14	1.50
.068	22.0	18.23	.31	36.0	26.47	.45	60.0	60.00	1.02	120.0	120.00	2.04
.075	22.0	16.53	.31	36.0	24.00	.45	60.0	58.66	1.10	120.0	109.33	2.05
.082	22.0	21.95	.45	36.0	21.95	.45	60.0	53.65	1.10	120.0	100.00	2.05
.100	22.0	18.00	.45	36.0	34.00	.85	60.0	60.00	1.50	120.0	82.00	2.05
.12	22.0	15.00	.45	36.0	28.33	.85	60.0	50.00	1.50	120.0	68.33	2.05
.15	22.0	12.00	.45	36.0	22.66	.85	60.0	40.00	1.50	120.0	57.33	2.15
.18	22.0	18.88	.85	36.0	24.44	1.10	60.0	33.33	1.50	120.0	47.77	2.15
.20	22.0	17.00	.85	36.0	22.00	1.10	60.0	30.00	1.50	120.0	43.00	2.15
.22	22.0	15.45	.85	36.0	20.00	1.10	60.0	27.27	1.50	120.0	39.09	2.15
.27	22.0	16.29	1.10	36.0	22.22	1.50	60.0	30.37	2.05	120.0	33.33	2.25
.33	22.0	13.33	1.10	36.0	18.18	1.50	60.0	26.06	2.15	120.0	27.27	2.25
.39	22.0	15.38	1.50	36.0	15.38	1.50	60.0	22.05	2.15	120.0	30.76	3.00
.47	22.0	12.76	1.50	36.0	17.44	2.05	60.0	19.14	2.25	120.0	25.53	3.00
.50	22.0	12.00	1.50	36.0	16.40	2.05	60.0	18.00	2.25	120.0	24.00	3.00
.56	22.0	10.71	1.50	36.0	14.64	2.05	60.0	16.07	2.25	120.0	21.42	3.00
.68	22.0	10.11	1.72	36.0	12.05	2.05	60.0	14.70	2.50	120.0	19.41	3.30
.75	22.0	9.17	1.72	36.0	10.93	2.05	60.0	13.33	2.50	120.0	17.60	3.30
.82	22.0	8.39	1.72	36.0	10.00	2.05	60.0	12.19	2.50	120.0	17.07	3.50
1.0	22.0	6.88	1.72	36.0	8.60	2.15	60.0	12.00	3.00	120.0	14.00	3.50
1.2	22.0	7.16	2.15	36.0	7.16	2.15	60.0	9.99	3.00	120.0	11.66	3.50
1.5	22.0	5.73	2.15	36.0	6.66	2.50	60.0	8.80	3.30			
1.8	22.0	4.77	2.15	36.0	5.55	2.50	60.0	7.33	3.30			
2.0	22.0	4.30	2.15	36.0	5.00	2.50	60.0	7.00	3.50			
2.2	22.0	3.90	2.15	36.0	4.54	2.50	60.0	6.36	3.50			
2.5				36.0	4.00	2.50	60.0	5.60	3.50			
2.7				36.0	4.44	3.00	60.0	5.18	3.50			
3.0				36.0	3.99	3.00	60.0	4.66	3.50			
3.3				36.0	3.63	3.00	60.0	4.24	3.50			
3.9				36.0	3.38	3.30						
4.7				36.0	2.97	3.50						
5.0				36.0	2.80	3.50						
5.6				36.0	2.50	3.50						
6.8				36.0	2.05	3.50						
7.5				36.0	1.86	3.50						
8.2				36.0	1.70	3.50						

FOR VALUES ABOVE 2.2 MICROFARADS, USE TYPE G12B.

1. THE COMBINED DC AND AC VOLTAGES SHOULD NOT EXCEED THE DC RATINGS, SEE FIGURE.
2. CAPACITORS MAY BE OPERATED AT HIGHER FREQUENCIES, AT REDUCED RMS VOLTAGE SUCH THAT MAX. AC CURRENT RATINGS ARE NOT EXCEEDED.
3. CAPACITORS CAN HANDLE PULSE CURRENTS UP TO 100 TIMES GREATER THAN THE PEAK CURRENTS CALCULATED FROM THE RATED RMS RATING (PROVIDED SLOW REPETITION RATES ARE USED). IF THERE IS ANY DOUBT, A SKETCH OF THE VOLTAGE AND CURRENT WAVE FORMS WITH TIME BASE SHOULD BE SENT TO CRC FOR ANALYSIS.





COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615. TWX: (910) 343-6864

Component Research CRC

P12 METALLIZED POLYCARBONATE CAPACITOR

PRODUCT FEATURES:

MINIATURE SIZE - RATED TO 100°C OPERATION.

HERMETICALLY SEALED, HIGH RELIABILITY AC SCREENED FOR AEROSPACE APPLICATIONS.

AC RATED FROM 36VRMS TO 240VRMS AT FREQUENCIES UP TO 20KHz, −65°C TO 100°C WITH 50% DERATED OPERATION AT 125°C.

DC RATED FROM 50VDC TO 400VDC, −65°C TO 100°C WITH 50% DERATED OPERATION AT 125°C.

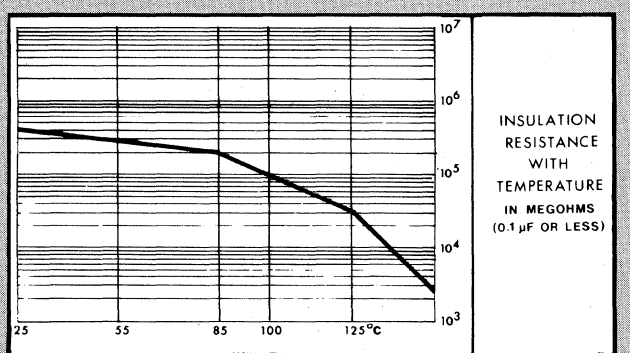
P12 CAPACITORS ARE SCREENED PER MIL-C-83421, AND ARE PRESENTLY DESIGNED INTO MANY MILITARY PROGRAMS.

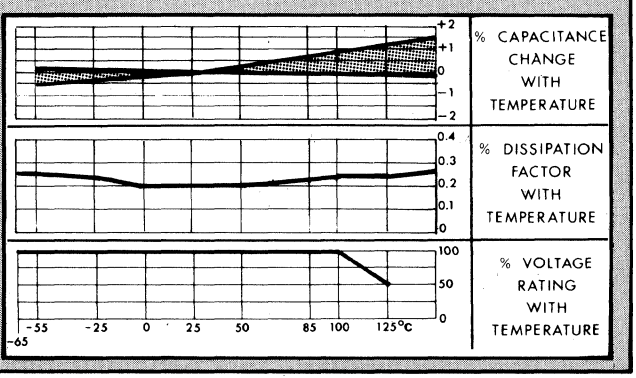
LOW LOSS, RUGGED INTERNAL TERMINATIONS, QUALIFIED FOR ALL HIGH RELIABILITY PROGRAMS (CRC PATENTED CONSTRUCTION).

LOW CAPACITANCE DRIFT AND TC, HIGH INSULATION RESISTANCE.

AVAILABLE IN STANDARD CAPACITANCE TOLERANCES ±1%, ±2%, ±5%, ±10%. OTHER TOLERANCES AVAILABLE ON REQUEST.

TYPICAL CURVES





TYPICAL APPLICATIONS

- CRITICAL TIMING CIRCUITS
- FIXED TUNING CIRCUITS
- FILTERING
- TEMPERATURE COMPENSATION
- COUPLING AND DECOUPLING
- FEEDBACK CIRCUITS
- POWER SUPPLY FILTERING
- GYRO CIRCUITS
- PULSE FORMING NETWORKS
- INTEGRATING CIRCUITS

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

Component Research (CRC)

P12 METALLIZED POLYCARBONATE CAPACITOR

P12 SPECIFICATIONS

CONSTRUCTION	Metallized polycarbonate dielectric, hermetically sealed, extended metal film electrodes axial leads isolated from case.	
ENVIRONMENTAL	Capacitors meet all environmental requirements of MIL-C-83421.	
OPERATING TEMPERATURE	−65°C to +100°C	At full rated voltage, derated linearly to 50% of rated voltage at 125°C.
DIELECTRIC ABSORPTION	0.1% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.15% maximum	At 25°C when measured per MIL-C-83421.
AC SQUARE WAVE	100Hz, 60 seconds minimum	At 25°C at a peak to peak voltage of 2 times rated DC voltage, terminal to terminal per MIL-C-83421.
DIELECTRIC STRENGTH	150% rated DC voltage	At 25°C from terminal to terminal and terminals to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT	+1.5% to −1.0% +0.5% to −1.5	From 25°C to +125°C. From 25°C to −55°C.
CAPACITANCE STABILITY	±0.25%	When measured at any two corresponding temperature points taken in five successive temperature cycles from −65°C to +125°C.
HERMETIC SEAL	1×10^{-6}atm/cm³/sec.	Maximum leak rate.
INSULATION RESISTANCE	See I.R. Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1 uF, allow an additional minute/uF charge time.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE

FOR VALUES OVER 0.5uF DIVIDE LIMIT SHOWN BY uF TO OBTAIN MINIMUM I.R. EXAMPLE: A 0.68uF CAPACITOR AT 25°C IS 200,000 ÷ 0.68 = 294,117 MEGOHMS.

RANGE	25°C	85°C	100°C	125°C
.001 TO 0.5uF	400,000 Megohms	200,000 Megohms	30,000 Megohms	2,500 Megohms
GREATER THAN 0.5uF	200,000 Megohms-uF	100,000 Megohms-uF	15,000 Megohms-uF	1,250 Megohms-uF

P12 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	**BURN-IN**	48 hrs. minimum at 100°C, at 120% rated AC voltage at 400Hz	4.7.2	No physical damage	100% Test
2	**THERMAL AGING**	10 cycles minimum from −65°C to +125°C	4.7.3	No physical damage	100% Test
3	**SEAL TEST (FINE LEAK)**	Helium bomb 45 PSI for 1 hr. minimum, check for helium leak	4.7.5	1×10^{-6}atm/cm³/sec. max.	100% Test
4	**SEAL TEST (GROSS LEAK)**	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
5	**AC SQUARE WAVE (TERMINAL TO TERMINAL)**	Apply 100Hz at a peak to peak voltage of 2 times DC rated voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
6	**DC HI-POT (TERMINAL TO TERMINAL) AND TERMINALS TO CASE)**	Apply 150% of rated DC voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
7	**INSULATION RESISTANCE (TERMINAL TO TERMINAL)**	At 25°C at rated DC voltage	4.7.7	200,000 megohm-uF need not exceed 400,000 megohms	100% Test
8	**% CAPACITANCE TOLERANCE**	At 25°C at 1KHz	4.7.8	Per part number	100% Test
9	**% DISSIPATION FACTOR**	At 25°C at 1KHz, values above 1uF measure at 0.1KHz	4.7.9	0.15% max.	100% Test
10	**VISUAL AND MECHANICAL INSPECTION**	For marking dimensions, and workmanship	4.7.1	Per specification	1.0% AQL

1. Capacitors are packaged and shipped with Certification of Conformance. 2. Traceability to production and test records by permanent making of parts with date code lot. 3. Process and inspection data is maintained on file per NHB 5300.4 (1C), MIL-Q-9858 and MIL-STD-790.

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

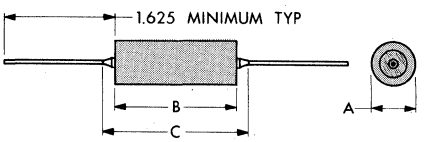
Component Research CRC

P12 METALLIZED POLYCARBONATE CAPACITOR

CASE DIMENSIONS

CAP uF	50 VDC Diam. A	50 VDC Length B	50 VDC Length C	100 VDC Diam. A	100 VDC Length B	100 VDC Length C	200 VDC Diam. A	200 VDC Length B	200 VDC Length C	400 VDC Diam. A	400 VDC Length B	400 VDC Length C
.001	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0012	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0015	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0018	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.002	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0022	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0027	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.687	.787
.0033	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.687	.787
.0039	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.687	.787
.0047	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.687	.787
.005	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.687	.787
.0056	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.687	.787
.0068	.170	.500	.600	.170	.500	.600	.193	.562	.662	.235	.687	.787
.0075	.170	.500	.600	.170	.500	.600	.193	.562	.662	.235	.687	.787
.0082	.170	.500	.600	.170	.500	.600	.193	.562	.662	.235	.687	.787
.01	.170	.500	.600	.170	.562	.662	.193	.687	.787	.312	.687	.787
.012	.170	.500	.600	.170	.562	.662	.193	.687	.787	.312	.687	.787
.015	.170	.500	.600	.170	.562	.662	.193	.687	.787	.312	.687	.787
.018	.170	.562	.662	.193	.562	.662	.235	.687	.787	.312	.813	.913
.02	.170	.562	.662	.193	.562	.662	.235	.687	.787	.312	.813	.913
.022	.170	.562	.662	.193	.562	.662	.235	.687	.787	.312	.813	.913
.027	.170	.562	.662	.193	.562	.662	.235	.687	.787	.312	.813	.913
.033	.170	.562	.662	.193	.562	.662	.235	.687	.787	.312	.813	.913
.039	.170	.562	.662	.193	.562	.662	.235	.687	.787	.312	.813	.913
.047	.193	.562	.662	.193	.687	.787	.312	.687	.787	.400	.813	.913
.05	.193	.562	.662	.193	.687	.787	.312	.687	.787	.400	.813	.913
.056	.193	.562	.662	.193	.687	.787	.312	.687	.787	.400	.813	.913
.068	.193	.562	.662	.193	.687	.787	.312	.687	.787	.400	.813	.913
.075	.193	.687	.787	.235	.687	.787	.312	.813	.913	.400	1.063	1.163
.082	.193	.687	.787	.235	.687	.787	.312	.813	.913	.400	1.063	1.163
.1	.193	.687	.787	.235	.687	.787	.312	.813	.913	.400	1.063	1.163
.12	.193	.687	.787	.235	.687	.787	.312	.813	.913	.400	1.063	1.163
.15	.235	.687	.787	.312	.687	.787	.312	.813	.913	.500	1.125	1.225
.18	.235	.687	.787	.312	.687	.787	.400	.813	.913	.500	1.125	1.225
.20	.235	.687	.787	.312	.687	.787	.400	.813	.913	.500	1.125	1.225
.22	.235	.687	.787	.312	.687	.787	.400	.813	.913	.500	1.125	1.225
.27	.312	.687	.787	.312	.813	.913	.400	1.063	1.163	.562	1.375	1.475
.33	.312	.687	.787	.312	.813	.913	.400	1.063	1.163	.562	1.375	1.475
.39	.312	.687	.787	.312	.813	.913	.400	1.063	1.163	.562	1.375	1.475
.47	.312	.813	.913	.400	.813	.913	.500	1.125	1.225	.670	1.375	1.475
.50	.312	.813	.913	.400	.813	.913	.500	1.125	1.225	.670	1.375	1.475
.56	.312	.813	.913	.400	.813	.913	.500	1.125	1.225	.670	1.375	1.475
.68	.400	.813	.913	.400	1.063	1.163	.562	1.375	1.475	.670	1.375	1.475
.75	.400	.813	.913	.400	1.063	1.163	.562	1.375	1.475	.670	1.375	1.475
.82	.400	.813	.913	.400	1.063	1.163	.562	1.375	1.475	.670	1.375	1.475
1.0	.400	.813	.913	.400	1.063	1.163	.562	1.375	1.475	.750	1.875	1.975
1.2	.400	1.063	1.163	.500	1.125	1.225	.670	1.375	1.475	.750	1.875	1.975
1.5	.400	1.063	1.163	.500	1.125	1.225	.670	1.375	1.475	.750	1.875	1.975
1.8	.500	1.125	1.225	.500	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975
2.0	.500	1.125	1.225	.500	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975
2.2	.500	1.125	1.225	.500	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975
2.5	.562	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475
2.7	.562	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475
3.0	.562	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475
3.3	.562	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475
3.9	.562	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975			
4.7	.670	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975			
5.0	.670	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975			
5.6	.670	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975			
6.8	.670	1.375	1.475	.670	1.875	1.975	1.000	2.375	2.475			
7.5	.670	1.875	1.975	.750	1.875	1.975	1.000	2.375	2.475			
8.2	.670	1.875	1.975	.750	1.875	1.975	1.000	2.375	2.475			
10.0	.670	1.875	1.975	.750	1.875	1.975	1.000	2.375	2.475			
12.0	.750	1.875	1.975	1.000	1.875	1.975						
15.0	.750	1.875	1.975	1.000	1.875	1.975						
18.0	1.000	1.875	1.975	1.000	2.375	2.475						
20.0	1.000	1.875	1.975	1.000	2.375	2.475						
22.0	1.000	1.875	1.975	1.000	2.375	2.475						
25.0	1.000	2.375	2.475									
27.0	1.000	2.375	2.475									

FOR SPECIAL VALUES AND TOLERANCES, PLEASE CONTACT OUR APPLICATION DEPARTMENT.



P12 | B | 104 | J | S | W

STYLE

VOLTAGE
- B = 50VDC
- C = 100VDC
- D = 200VDC
- E = 400VDC

CAPACITANCE TOLERANCE
K = 10% G = 2% D = ½%
J = 5% F = 1% B = ¼%

PICOFARAD CODE: First two digits represent significant figures. Last digit represents number of zeros to follow. Example: 104 = 100,000 picofarads.

SLEEVING CODE
S = Mylar sleeve
X = No sleeve

LEAD CODE
W = Tinned copper clad steel: #22 (.025″) for .312″ case dia. & smaller; #20 (.032″) for .400″ & .500″ case dia.
C = Tinned oxygen-free copper: #18 (.040″) for .562″ case dia. & larger.

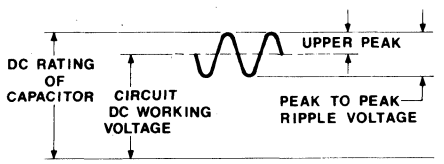
CASE DIMENSIONS	TOLERANCE LIMITS (INCHES)
"A" Diameter	±0.010 Without Sleeving
	+0.02 −0.00 With Mylar Sleeving
"B" Case Length	±0.03 With or Without Sleeving
"C" Bead to Bead Max. Length	The lengths shown in table are maximum and include solder beads

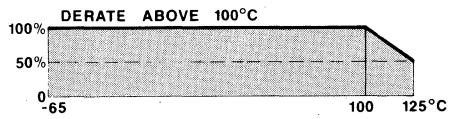
COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

Component Research (CRC)

P12 METALLIZED POLYCARBONATE CAPACITOR

CAP uF	AC RATINGS											
	50 VDC			100 VDC			200 VDC			400 VDC		
	Volts RMS	In KHz Freq.	Amps RMS	Volts RMS	In KHz Freq.	Amps RMS	Volts RMS	In KHz Freq.	Amps RMS	Volts RMS	In KHz Freq.	Amps RMS
.001	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.4
.0012	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.4
.0015	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.4
.0018	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.4
.002	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.4
.0022	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.4
.0027	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.6
.0033	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.6
.0039	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.6
.0047	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.6
.005	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.6
.0056	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.6
.0068	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.40	240.0	40.0	1.0
.0075	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.40	240.0	40.0	1.0
.0082	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.40	240.0	40.0	1.0
.01	36.0	40.00	.14	60.0	40.00	.25	120.0	40.00	.60	240.0	40.0	1.4
.012	36.0	40.00	.14	60.0	40.00	.25	120.0	40.00	.60	240.0	40.0	1.4
.015	36.0	40.00	.14	60.0	40.00	.25	120.0	40.00	.60	240.0	40.0	1.4
.018	36.0	40.00	.25	60.0	40.00	.40	120.0	40.00	1.00	240.0	40.0	1.6
.02	36.0	40.00	.25	60.0	40.00	.40	120.0	40.00	1.00	240.0	40.0	1.6
.022	36.0	40.00	.25	60.0	40.00	.40	120.0	40.00	1.00	240.0	40.0	1.6
.027	36.0	40.00	.25	60.0	40.00	.40	120.0	40.00	1.00	240.0	40.0	1.6
.033	36.0	40.00	.25	60.0	32.00	.40	120.0	40.00	1.00	240.0	32.3	1.6
.039	36.0	32.00	.28	60.0	29.00	.42	120.0	40.00	1.20	240.0	27.4	1.6
.047	36.0	32.00	.34	60.0	28.00	.50	120.0	39.70	1.40	240.0	25.5	1.8
.05	36.0	32.00	.36	60.0	28.00	.53	120.0	37.30	1.40	240.0	24.0	1.8
.056	36.0	31.70	.40	60.0	27.50	.58	120.0	33.30	1.40	240.0	21.4	1.8
.068	36.0	29.00	.45	60.0	27.40	.70	120.0	27.40	1.40	240.0	17.0	1.8
.075	36.0	29.00	.50	60.0	25.00	.70	120.0	27.00	1.50	240.0	17.0	2.0
.082	36.0	28.00	.53	60.0	25.00	.78	120.0	26.00	1.60	240.0	16.3	2.0
.1	36.0	26.60	.60	60.0	25.00	.94	120.0	21.30	1.60	240.0	13.3	2.0
.12	36.0	26.00	.70	60.0	25.00	1.10	120.0	17.80	1.60	240.0	11.1	2.0
.15	36.0	25.00	.85	60.0	24.80	1.40	120.0	16.00	1.80	240.0	11.0	2.4
.18	36.0	24.60	1.00	60.0	20.70	1.40	120.0	13.30	1.80	240.0	11.0	3.0
.20	36.0	22.20	1.00	60.0	18.70	1.40	120.0	12.00	1.80	240.0	10.0	3.0
.22	36.0	20.00	1.00	60.0	16.90	1.40	120.0	11.00	1.80	240.0	10.0	3.0
.27	36.0	20.00	1.20	60.0	15.80	1.60	120.0	10.00	2.00	240.0	10.0	4.2
.33	36.0	16.00	1.20	60.0	13.00	1.60	120.0	8.80	2.20	240.0	8.7	4.3
.39	36.0	14.00	1.20	60.0	11.00	1.60	120.0	8.20	2.40	240.0	7.3	4.3
.47	36.0	14.00	1.50	60.0	10.20	1.80	120.0	8.00	2.80	240.0	6.4	4.5
.50	36.0	13.30	1.50	60.0	9.60	1.80	120.0	8.00	3.00	240.0	6.0	4.5
.56	36.0	11.90	1.50	60.0	8.60	1.80	120.0	7.60	3.20	240.0	5.4	4.5
.68	36.0	11.90	1.80	60.0	7.80	2.00	120.0	7.40	3.80	240.0	5.0	5.0
.75	36.0	10.60	1.80	60.0	7.10	2.00	120.0	7.40	4.20	240.0	4.4	5.0
.82	36.0	9.75	1.80	60.0	6.50	2.00	120.0	7.00	4.30	240.0	4.1	5.0
1.0	36.0	8.00	1.80	60.0	5.80	2.20	120.0	5.70	4.30	240.0	3.3	5.0
1.2	36.0	7.40	2.00	60.0	5.70	2.60	120.0	5.00	4.50	240.0	3.3	6.0
1.5	36.0	5.90	2.00	60.0	5.30	3.00	120.0	4.00	4.50	240.0	2.7	6.0
1.8	36.0	5.70	2.30	60.0	5.10	3.50	120.0	3.70	5.00	240.0	2.4	6.4
2.0	36.0	5.10	2.30	60.0	4.70	3.50	120.0	3.30	5.00	240.0	2.1	6.4
2.2	36.0	4.60	2.30	60.0	4.20	3.50	120.0	3.00	5.00	240.0	2.0	6.4
2.5	36.0	4.60	2.60	60.0	4.80	4.50	120.0	3.20	6.00	240.0	1.9	7.0
2.7	36.0	4.30	2.60	60.0	4.40	4.50	120.0	3.00	6.00	240.0	1.7	7.0
3.0	36.0	3.90	2.60	60.0	4.00	4.50	120.0	2.70	6.00	240.0	1.6	7.0
3.3	36.0	3.50	2.60	60.0	3.60	4.50	120.0	2.40	6.00	240.0	1.4	7.0
3.9	36.0	3.00	2.60	60.0	3.10	4.50	120.0	2.10	6.00			
4.7	36.0	2.80	3.00	60.0	2.80	5.00	120.0	1.80	6.40			
5.0	36.0	2.60	3.00	60.0	2.70	5.00	120.0	1.70	6.40			
5.6	36.0	2.40	3.00	60.0	2.40	5.00	120.0	1.50	6.40			
6.8	36.0	2.00	3.00	60.0	2.00	5.00	120.0	1.30	6.40			
7.5	36.0	2.00	3.50	60.0	2.00	6.00	120.0	1.20	7.00			
8.2	36.0	1.90	3.50	60.0	1.95	6.00	120.0	1.14	7.00			
10.0	36.0	1.60	3.50	60.0	1.60	6.00	120.0	.93	7.00			
12.0	36.0	1.50	4.00	60.0	1.42	6.40						
15.0	36.0	1.20	4.00	60.0	1.14	6.40						
18.0	36.0	1.18	4.80	60.0	.98	6.60						
20.0	36.0	1.10	4.80	60.0	.88	6.60						
22.0	36.0	.97	4.80	60.0	.80	6.60						
25.0	36.0	.96	5.40									
27.0	36.0	.88	5.40									





1. THE COMBINED DC AND AC VOLTAGES SHOULD NOT EXCEED THE DC RATINGS, SEE FIGURE.
2. CAPACITORS MAY BE OPERATED AT HIGHER FREQUENCIES, AT REDUCED RMS VOLTAGE SUCH THAT MAX. AC CURRENT RATINGS ARE NOT EXCEEDED.
3. CAPACITORS CAN HANDLE PULSE CURRENTS UP TO 100 TIMES GREATER THAN THE PEAK CURRENTS CALCULATED FROM THE RATED RMS RATING (PROVIDED SLOW REPETITION RATES ARE USED). IF THERE IS ANY DOUBT, A SKETCH OF THE VOLTAGE AND CURRENT WAVE FORMS WITH TIME BASE SHOULD BE SENT TO CRC FOR ANALYSIS.

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET • SANTA MONICA, CALIF. 90404 • (213) 829-3615. TWX: (910) 343-6864

Component Research (CRC)

C15 METALLIZED POLYPROPYLENE CAPACITOR

C15 SPECIFICATIONS (QUALIFIED TO MIL-C-83421/2)

CONSTRUCTION	Metallized polypropylene dielectric, hermetically sealed, extended metal film electrodes, axial leads isolated from case.	
OPERATING TEMPERATURE	−55°C to +105°C	At voltage and current shown in table.
DIELECTRIC ABSORPTION	0.02% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.07% maximum	At 25°C when measured per MIL-C-83421 at 1KHz.
AC SQUARE WAVE	100Hz, 60 seconds minimum	At 25°C at a peak to peak voltage of 3 times rated DC voltage, terminal to terminal. Do not exceed 800V P/P
DIELECTRIC STRENGTH	200% DC volts	At 25°C from terminal to terminal and terminals to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT	0 to −4% max. 0 to +3% max.	From 25°C to +105°C. From 25°C to −55°C.
CAPACITANCE STABILITY	±0.25% max.	When measured at any two corresponding temperature points taken in five successive temperature cycles from −55°C to +105°C.
HERMETIC SEAL	1×10^{-6} atm/cm³/sec.	Maximum leak rate.
INSULATION RESISTANCE	See I.R. Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1uF, allow an additional minute/uF charge time.
EQUIVALENT SERIES RESISTANCE	Per Table	At 25°C at 100KHz.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE

FOR VALUES OVER 0.1uF DIVIDE LIMIT SHOWN BY uF TO OBTAIN MINIMUM I.R. EXAMPLE: A 0.18uF CAPACITOR AT 25°C IS 300,000 ÷ 0.18 = 1,666,666 MEGOHMS.

RANGE	25°C	85°C	105°C
.001 TO 0.1uF	3,000,000 Megohms	150,000 Megohms	20,000 Megohms
GREATER THAN 0.1uF	300,000 Megohms-uF	15,000 Megohms-uF	2,000 Megohms-uF

C15 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	BURN-IN	24 hours at 85°C at rated current at 40KHz	4.7.2	No physical damage	100% Test
2	THERMAL AGING	10 cycles minimum from −60°C to +105°C	4.7.3	No physical damage	100% Test
3	SEAL TEST (FINE LEAK)	Helium bomb 45 PSI for 1 hr. minimum, check for helium leak	4.7.5	1 x 10^{-6} atm/cm³/sec. max.	100% Test
4	SEAL TEST (GROSS LEAK)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
5	AC SQUARE WAVE (TERMINAL TO TERMINAL)	Apply 100Hz at a peak to peak voltage of 3 times DC rated voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
6	DC HI-POT (TERMINAL TO TERMINAL AND TERMINAL TO CASE)	Apply 200% of rated DC voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
7	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage	4.7.7	300,000 megohms-uF need not exceed 3,000,000 megohms	100% Test
8	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
9	% DISSIPATION FACTOR	At 25°C at 1KHz, values above 1 uF measure at 0.1KHz	4.7.9	0.07% max.	100% Test
10	EQUIVALENT SERIES RESISTANCE	At 25°C at 100KHz	TBD	Per table	100% Test
11	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions, and workmanship	4.7.1	Per specification	1.0% AQL

1. Capacitors are packaged and shipped with Certification of Conformance. 2. Traceability to production and test records by permanent marking of parts with date code lot. 3. Process and inspection data is maintained on file per NHB 5300.4 (1C), MIL-Q-9858 and MIL-STD-790.

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615. TWX: (910) 343-6864

Component Research (CRC)

C 15 METALLIZED POLYPROPYLENE CAPACITOR

CASE DIMENSIONS • AC RATINGS

* PART NO.	uF	RATED VDC	DIAM. A	LENGTH B	E.S.R. (OHMS) MAX. @ 100kHz	RATED VRMS @ 400Hz	25°C MAX. ARMS	35°C MAX. ARMS	45°C MAX. ARMS	55°C MAX. ARMS	65°C MAX. ARMS	75°C MAX. ARMS	85°C MAX. ARMS	95°C MAX. ARMS	105°C MAX. ARMS
C15C474_SC	0.470	100	0.400	0.875	0.025	60	5.3	4.9	4.6	4.2	3.7	3.2	2.6	1.9	0.8
C15C564_SC	0.560	100	0.500	0.875	0.024	60	6.0	5.6	5.2	4.8	4.3	3.7	3.0	2.1	1.0
C15C684_SC	0.680	100	0.500	0.875	0.023	60	6.2	5.8	5.4	4.9	4.4	3.8	3.1	2.2	1.0
C15C824_SC	0.820	100	0.500	0.875	0.022	60	6.3	5.9	5.5	5.0	4.5	3.9	3.2	2.2	1.0
C15C105_SC	1.000	100	0.562	0.906	0.017	60	7.7	7.2	6.7	6.1	5.4	4.7	3.9	2.7	1.2
C15C205_SC	2.000	100	0.670	1.094	0.014	60	10.3	9.7	8.9	8.2	7.3	6.3	5.2	3.7	1.6
C15C305_SC	3.000	100	0.750	1.094	0.013	60	11.4	10.7	9.9	9.0	8.1	7.0	5.7	4.0	1.8
C15C505_SC	5.000	100	0.750	1.406	0.012	60	13.6	12.7	11.8	10.7	9.6	8.3	6.8	4.8	2.1
C15C106_SC	10.000	100	1.000	1.687	0.010	60	15.0	15.0	15.0	14.3	12.8	11.1	9.1	6.4	2.9
C15C206_SC	20.000	100	1.000	2.437	0.009	60	15.0	15.0	15.0	15.0	15.0	14.1	11.5	8.2	3.6
C15D184_SC	0.180	200	0.400	0.875	0.031	120	4.8	4.5	4.1	3.8	3.4	2.9	2.4	1.7	0.8
C15D224_SC	0.220	200	0.500	0.875	0.030	120	5.4	5.1	4.7	4.3	3.8	3.3	2.7	1.9	0.9
C15D274_SC	0.270	200	0.500	0.875	0.029	120	5.5	5.2	4.8	4.4	3.9	3.4	2.8	2.0	0.9
C15D334_SC	0.330	200	0.500	0.875	0.028	120	5.6	5.3	4.9	4.5	4.0	3.5	2.8	2.0	0.9
C15D394_SC	0.390	200	0.562	0.906	0.026	120	6.2	5.8	5.4	4.9	4.4	3.8	3.1	2.2	1.0
C15D474_SC	0.470	200	0.562	1.094	0.025	120	7.0	6.5	6.1	5.5	4.9	4.3	3.5	2.5	1.1
C15D564_SC	0.560	200	0.562	1.094	0.024	120	7.2	6.7	6.2	5.7	5.1	4.4	3.6	2.5	1.1
C15D684_SC	0.680	200	0.670	1.094	0.023	120	8.0	7.5	6.9	6.3	5.7	4.9	4.0	2.8	1.3
C15D824_SC	0.820	200	0.670	1.094	0.022	120	8.2	7.7	7.1	6.5	5.8	5.0	4.1	2.9	1.3
C15D105_SC	1.000	200	0.670	1.094	0.021	120	8.4	7.9	7.3	6.7	6.0	5.2	4.2	3.0	1.3
C15D205_SC	2.000	200	0.750	1.406	0.017	120	11.1	10.4	9.6	8.8	7.8	6.8	5.5	3.9	1.8
C15D305_SC	3.000	200	1.000	1.437	0.015	120	13.9	13.0	12.0	11.0	9.8	8.5	7.0	4.9	2.2
C15D505_SC	5.000	200	1.000	1.687	0.013	120	15.0	15.0	14.2	12.9	11.6	10.0	8.2	5.8	2.6
C15E563_SC	0.056	400	0.400	0.875	0.058	240	3.5	3.3	3.0	2.8	2.5	2.1	1.7	1.2	0.6
C15E683_SC	0.068	400	0.500	0.875	0.046	240	4.4	4.1	3.8	3.5	3.1	2.7	2.2	1.5	0.7
C15E823_SC	0.082	400	0.500	0.875	0.039	240	4.7	4.4	4.1	3.7	3.4	2.9	2.4	1.7	0.7
C15E104_SC	0.100	400	0.500	0.875	0.035	240	5.0	4.7	4.4	4.0	3.6	3.1	2.5	1.8	0.8
C15E124_SC	0.120	400	0.562	0.906	0.033	240	5.5	5.2	4.8	4.4	3.9	3.4	2.8	2.0	0.9
C15E154_SC	0.150	400	0.670	0.906	0.032	240	6.2	5.8	5.3	4.9	4.4	3.8	3.1	2.2	1.0
C15E184_SC	0.180	400	0.670	0.906	0.031	240	6.3	5.9	5.4	5.0	4.4	3.8	3.1	2.2	1.0
C15E224_SC	0.220	400	0.670	1.094	0.030	240	7.0	6.6	6.1	5.6	5.0	4.3	3.5	2.5	1.1
C15E274_SC	0.270	400	0.670	1.094	0.029	240	7.2	6.7	6.2	5.7	5.1	4.4	3.6	2.5	1.1
C15E334_SC	0.330	400	0.670	1.094	0.028	240	7.3	6.8	6.3	5.8	5.2	4.5	3.7	2.6	1.2
C15E394_SC	0.390	400	0.750	1.094	0.026	240	7.9	7.4	6.8	6.2	5.6	4.8	3.9	2.8	1.2
C15E474_SC	0.470	400	0.750	1.094	0.025	240	8.1	7.6	7.0	6.4	5.7	4.9	4.0	2.9	1.3
C15E564_SC	0.560	400	0.750	1.406	0.025	240	9.2	8.6	7.9	7.2	6.5	5.6	4.6	3.2	1.4
C15E684_SC	0.680	400	0.750	1.406	0.024	240	9.4	8.8	8.1	7.4	6.6	5.7	4.7	3.3	1.5
C15E824_SC	0.820	400	0.750	1.656	0.023	240	10.4	9.7	9.0	8.2	7.4	6.4	5.2	3.7	1.6
C15E105_SC	1.000	400	0.750	1.656	0.022	240	10.7	10.0	9.3	8.5	7.6	6.5	5.3	3.8	1.7
C15E205_SC	2.000	400	1.000	1.938	0.017	240	15.0	14.1	13.0	11.9	10.6	9.2	7.5	5.3	2.4

*

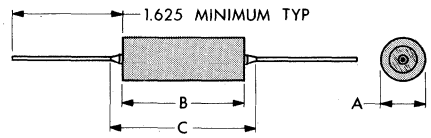
To complete Part Number, select capacitance-tolerance letter from list below, and insert as 8th character.

K = 10% • J = 5% • G = 2% • F = 1%

D = ½% • B = ¼% • A = $^1/_{10}$%

If insulated sleeving is not desired then replace the ninth character "S" with an "X".

CASE DIMENSIONS	TOLERANCE LIMITS (INCHES)
"A" Diameter	±.010 Without Sleeving
	+0.02 −0.00 With Mylar Sleeving
"B" Case Length	+.03 −.09 With or Without Sleeving
"C" Bead to Bead Max. Length	"C" Dimension is 0.2" maximum more than "B" dimension in table



FOR SPECIAL VALUES AND TOLERANCES, PLEASE CONTACT OUR APPLICATIONS DEPARTMENT

COMPONENT RESEARCH CO., INC. ■ 1655 26TH STREET ■ SANTA MONICA, CALIF. 90404 ■ (213) 829-3615. TWX: (910) 343-6864

Component Research CRC

A19 METALLIZED POLYPHENYLENE SULFIDE

A19 SPECIFICATIONS		
CONSTRUCTION	Metallized polyphenylene sulfide dielectric, hermetically sealed, extended metal film electrodes, radial leads isolated from case.	
ENVIRONMENTAL	Capacitors meet all environmental requirements of MIL-C-83421.	
OPERATING TEMPERATURE	−65°C to +125°C.	At full rated voltage,
DIELECTRIC ABSORPTION	0.1% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.15% maximum	At 25°C when measured per MIL-C-83421.
AC SQUARE WAVE	100Hz, 60 seconds minimum	At 25°C at a peak to peak voltage of 3 times rated DC voltage, per MIL-C-83421.
DIELECTRIC STRENGTH	200% DC volts	At 25°C for 60 seconds minimum.
TEMPERATURE COEFFICIENT	±2% 0% to −2%	From 25°C to +125°C. From 25°C to −55°C.
CAPACITANCE STABILITY	±0.25%	When measured at any two corresponding temperature points taken in five successive temperature cycles from −65°C to +125°C.
HERMETIC SEAL	1×10^{-6}atm/cm³/sec.	Maximum leak rate.
INSULATION RESISTANCE	See I.R. Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE	25°C	85°C	100°C	125°C
	1,000,000 Megohms	60,000 Megohms	50,000 Megohms	10,000 Megohms

A19 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	BURN-IN	48 hrs. minimum at 125°C, at 140% rated DC voltage	4.7.2	No physical damage	100% Test
2	THERMAL AGING	10 cycles minimum from −65°C to +125°C	4.7.3	No physical damage	100% Test
3	SEAL TEST (FINE LEAK)	Helium bomb 45 PSI for 1 hr. minimum, check for helium leak	4.7.5	1×10^{-6}atm/cm³/sec. max.	100% Test
4	SEAL TEST (GROSS LEAK)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
5	AC SQUARE WAVE	Apply 100Hz at a peak to peak voltage of 3 times DC rated voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
6	DC HI-POT	Apply 200% of rated DC voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
7	INSULATION RESISTANCE	At 25°C at rated DC voltage	4.7.7	1,000,000 Megohms min.	100% Test
8	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
9	% DISSIPATION FACTOR	At 25°C at 1KHz, values above 1uF measure at 0.1KHz	4.7.9	0.15% max.	100% Test
10	VISUAL AND MECHANICAL INSPECTION	For marking dimensions, and workmanship	4.7.1	Per specification	1.0% AQL

1. Capacitors are packaged and shipped with Certification of Conformance. 2. Traceability to production and test records by permanent marking of parts with date code lot. 3. Process and inspection data is maintained on file per NHB 5300.4 (1C), MIL-Q-9858 and MIL-STD-790.

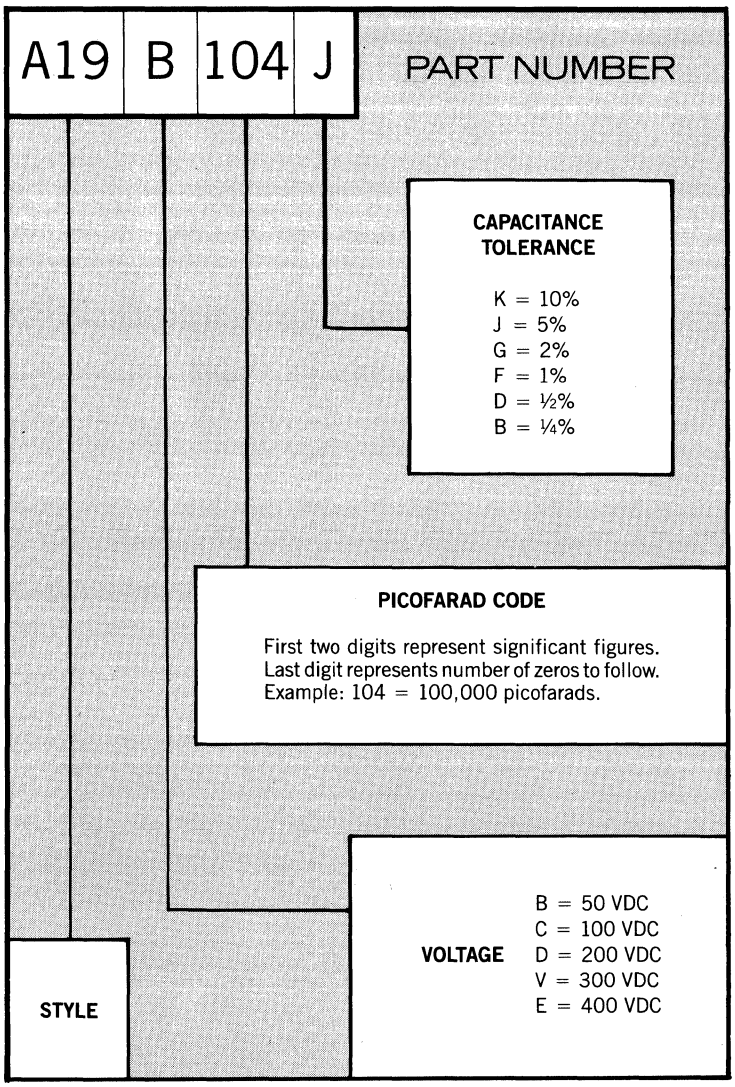
COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

Component Research

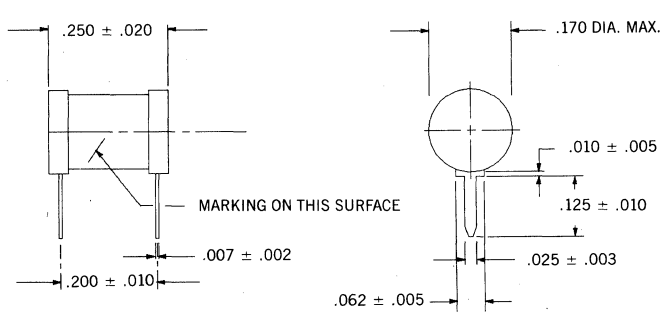
A19 METALLIZED POLYPHENYLENE SULFIDE

CASE DIMENSIONS & AC RATINGS

UF	BASIC PART NO.	D.C. RATING	AC VOLTAGE RATING rms 400 Hz	MAXIMUM rms AMPERES
.0005	A19E501	400	240	0.05
.00056	A19E561	400	240	0.05
.00068	A19E681	400	240	0.05
.00082	A19E821	400	240	0.05
.001	A19E102	400	240	0.05
.0012	A19E122	400	240	0.05
.0015	A19E152	400	240	0.05
.0018	A19V182	300	180	0.05
.002	A19V202	300	180	0.05
.0022	A19V222	300	180	0.05
.0027	A19V272	300	180	0.05
.0033	A19D332	200	120	0.05
.0039	A19D392	200	120	0.05
.0047	A19D472	200	120	0.05
.005	A19D502	200	120	0.05
.0056	A19D562	200	120	0.05
.0068	A19C682	100	60	0.05
.0082	A19C822	100	60	0.05
.01	A19C103	100	60	0.05
.012	A19C123	100	60	0.05
.015	A19C153	100	60	0.05
.018	A19C183	100	60	0.05
.02	A19B203	50	36	0.05
.022	A19B223	50	36	0.05
.027	A19B273	50	36	0.05
.033	A19B333	50	36	0.05
.039	A19B393	50	36	0.05
.047	A19B473	50	36	0.05
.05	A19B503	50	36	0.05
.056	A19B563	50	36	0.05



CASE DIMENSIONS

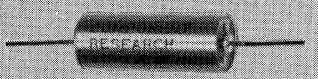


Component Research CRC

J11 METALLIZED TEFLON CAPACITOR

PRODUCT FEATURES

.068 μF 50VDC ACTUAL SIZE CAPACITOR



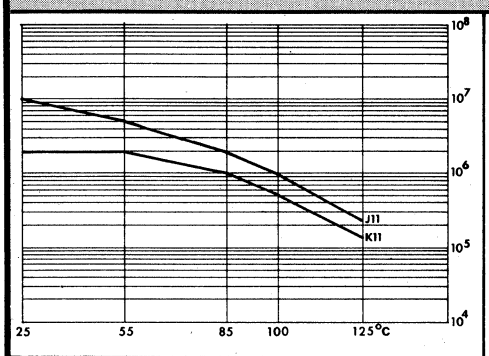
HIGH INSULATION RESISTANCE: 10,000,000 MEGOHMS MINIMUM. (FOR J11 SERIES, ALL VALUES UP TO 0.1uF).

LOW DIELECTRIC ABSORPTION: 0.01% MAXIMUM VOLTAGE RECOVERY.

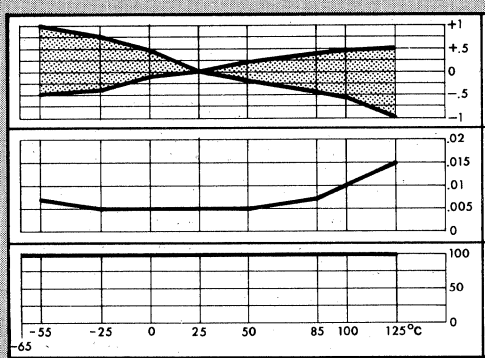
LONG TERM STABILITY: LESS THAN 0.5% CAPACITANCE DRIFT AFTER 2000 HRS. AT 125°C AT RATED VOLTS.

SERIES 11 CAPACITORS HAVE BEEN QUALIFIED FOR USE IN SPACE AND MISSILE SYSTEMS WHERE MAXIMUM RELIABILITY AND LOW DIELECTRIC LOSS ARE ESSENTIAL.

TYPICAL CURVES



INSULATION RESISTANCE WITH TEMPERATURE IN MEGOHMS (0.1 μF OR LESS)



% CAPACITANCE CHANGE WITH TEMPERATURE

% DISSIPATION FACTOR WITH TEMPERATURE

% VOLTAGE RATING WITH TEMPERATURE

TYPICAL APPLICATIONS

- CRITICAL TIMING CIRCUITS
- FIXED TUNING CIRCUITS
- TEMPERATURE COMPENSATION
- COUPLING AND DECOUPLING
- FEEDBACK CIRCUITS
- GYRO CIRCUITS
- INTEGRATING CIRCUITS

LIFE TEST DATA CRC TEST REPORT #XT1303

TEST RESULTS FOR 80 SERIES D11B CAPACITORS LIFE TESTED FOR 2000 HOURS AT 125°C AT 140% OF RATED DC VOLTAGE. THERE WERE NO FAILURES FOR THIS TEST. D11B CAPACITORS ARE THE SAME CONSTRUCTION AND DESIGN as J11 SERIES.

LIST OF CAPACITORS LIFE TESTED			INSULATION RESISTANCE IN MEGOHMS AT 25°C			% CAPACITANCE CHANGE WITH LIFE			% DISSIPATION FACTOR AT 25°C WITH LIFE		
CRC TYPE	uF VALUE	Q'TY TESTED	POST TEST LIMITS (MIN. I.R.)	TEST RESULTS LOW	TEST RESULTS HIGH	POST TEST LIMITS (MAX. △C)	TEST RESULTS LOW	TEST RESULTS HIGH	POST TEST LIMITS (MAX. D.F.)	TEST RESULTS LOW	TEST RESULTS HIGH
D11B	0.1	12	$5x10^5$	$3.9x10^6$	$5x10^7$	±1	−.035	−.35	.2	.01	.065
D11B	0.22	32	$5x10^5$	$2x10^6$	$2.5x10^7$	±1	−.01	+.85	.2	.005	.075
D11B	0.47	11	$5x10^5$	$1x10^6$	$1x10^6$	±1	−.005	+.58	.2	.01	.10
D11B	1.0	6	$2.5x10^5$	$5.2x10^5$	$3.8x10^6$	±1	−.005	+.24	.2	.01	.12
D11B	0.5	20	$5x10^5$	$3.8x10^6$	$5x10^7$	±1	+.02	+.48	.2	.01	.02

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

Component Research CRC

J11 METALLIZED TEFLON CAPACITOR

J11 SPECIFICATIONS

CONSTRUCTION	Metallized teflon dielectric, hermetically sealed, extended metal film electrodes, axial leads isolated from case.	
ENVIRONMENTAL	Capacitors meet all environmetal requirements of MIL-C-83421, except vibration at 20g and shock at 50g.	
OPERATING TEMPERATURE	−65°C to +125°C	At full rated voltage.
DIELECTRIC ABSORPTION	0.01% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.05% maximum	At 25°C when measured per MIL-C-83421.
DIELECTRIC STRENGTH	200% rated voltage	At 25°C from terminal to terminal and terminals to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT	Referenced to 25°C −55°C −25°C 0°C 50°C 85°C 100°C 125°C	 From −0.5% to +1.0% From −0.35% to +0.75% From −0.1% to +0.45% From −0.2% to +0.2% From −0.45% to +0.4% From −0.65% to +0.45% From −1.0% to +0.5%
CAPACITANCE STABILITY	±0.10%	When measured at any two corresponding temperature points taken in five successive temperature cycles from −65°C to +125°C.
HERMETIC SEAL	1 × 10^{-6}atm/cm³/sec.	Maximum leak rate.
INSULATION RESISTANCE	See I.R. Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1uF, allow an additional minute/uF charge time.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE

FOR VALUES OVER 0.1uF DIVIDE LIMIT SHOWN BY uF TO OBTAIN MINIMUM I.R. EXAMPLE: A 0.68uF CAPACITOR AT 25°C IS 1,000,000 ÷ 0.68 = 1,475,000 MEGOHMS.

RANGE	25°	55°C	85°C	100°C	125°C
.001 TO 0.1uF	10,000,000 Megohms	5,000,000 Megohms	2,000,000 Megohms	1,000,000 Megohms	250,000 Megohms
GREATER THAN 0.1uF	1,000,000 Megohms-uF	500,000 Megohms-uF	200,000 Megohms-uF	100,000 Megohms-uF	25,000 Megohms-uF

J11 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	BURN-IN	48 hrs. minimum at 125°C, at 140% rated DC voltage	4.7.2	No physical damage	100% Test
2	THERMAL AGING	10 cycles minimum from −65°C to +125°C	4.7.3	No physical damage	100% Test
3	SEAL TEST (FINE LEAK)	Helium bomb 45 PSI for 1 hr. minimum, check for helium leak	4.7.5	1x10^{-6}atm/cm³/sec. max.	100% Test
4	SEAL TEST (GROSS LEAK)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
5	DC HI-POT (TERMINAL TO TERMINAL AND TERMINALS TO CASE)	Apply 200% of rated DC voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
6	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage	4.7.7	Per I.R. Table	100% Test
7	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
8	% DISSIPATION FACTOR	At 25°C at 1KHz, values above 1uF measure at 0.1KHz	4.7.9	0.05% max.	100% Test
9	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions, and workmanship	4.7.1	Per specification	1.0% AQL

1. Capacitors are packaged and shipped with Certification of Conformance. 2. Traceability to production and test records by permanent marking of parts with date code lot. 3. Process and inspection data is maintained on file per NHB 5300.4 (1C), MIL-Q-9858 and MIL-STD-790.

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615. TWX: (910) 343-6864

Component Research CRC

J11 METALLIZED TEFLON CAPACITOR

uF	CASE DIMENSIONS											
	50 VDC				100 VDC				200 VDC			
	J11	Diam. A	Length B	Length C	J11	Diam. A	Length B	Length C	J11	Diam. A	Length B	Length C
.001	J11B102	.235	.687	.887	J11C102	.235	.687	.887	J11D102	.235	.687	.887
.0012	J11B122	.235	.687	.887	J11C122	.235	.687	.887	J11D122	.235	.687	.887
.0015	J11B152	.235	.687	.887	J11C152	.235	.687	.887	J11D152	.235	.687	.887
.0018	J11B182	.235	.687	.887	J11C182	.235	.687	.887	J11D182	.235	.687	.887
.002	J11B202	.235	.687	.887	J11C202	.235	.687	.887	J11D202	.235	.687	.887
.0022	J11B222	.235	.687	.887	J11C222	.235	.687	.887	J11D222	.235	.687	.887
.0027	J11B272	.235	.687	.887	J11C272	.235	.687	.887	J11D272	.235	.687	.887
.0033	J11B332	.235	.687	.887	J11C332	.235	.687	.887	J11D332	.235	.687	.887
.0039	J11B392	.235	.687	.887	J11C392	.235	.687	.887	J11D392	.235	.687	.887
.0047	J11B472	.235	.687	.887	J11C472	.235	.687	.887	J11D472	.235	.687	.887
.005	J11B502	.235	.687	.887	J11C502	.235	.687	.887	J11D502	.235	.687	.887
.0056	J11B562	.235	.687	.887	J11C562	.235	.687	.887	J11D562	.235	.687	.887
.0068	J11B682	.235	.687	.887	J11C682	.235	.687	.887	J11D682	.235	.687	.887
.0082	J11B822	.235	.687	.887	J11C822	.235	.687	.887	J11D822	.235	.687	.887
.01	J11B103	.235	.687	.887	J11C103	.235	.687	.887	J11D103	.235	.687	.887
.012	J11B123	.235	.687	.887	J11C123	.235	.687	.887	J11D123	.235	.687	.887
.015	J11B153	.312	.687	.887	J11C153	.312	.687	.887	J11D153	.312	.687	.887
.018	J11B183	.312	.687	.887	J11C183	.312	.687	.887	J11D183	.312	.813	1.013
.02	J11B203	.312	.687	.887	J11C203	.312	.687	.887	J11D203	.312	.813	1.013
.022	J11B223	.312	.687	.887	J11C223	.312	.687	.887	J11D223	.312	.813	1.013
.027	J11B273	.312	.687	.887	J11C273	.312	.813	1.013	J11D273	.312	.813	1.013
.033	J11B333	.312	.687	.887	J11C333	.312	.813	1.013	J11D333	.400	.813	1.013
.039	J11B393	.312	.687	.887	J11C393	.400	.813	1.013	J11D393	.400	1.063	1.263
.047	J11B473	.312	.687	.887	J11C473	.400	.813	1.013	J11D473	.400	1.063	1.263
.05	J11B503	.312	.687	.887	J11C503	.400	.813	1.013	J11D503	.400	1.063	1.263
.056	J11B563	.312	.813	1.013	J11C563	.400	.813	1.013	J11D563	.400	1.063	1.263
.068	J11B683	.312	.813	1.013	J11C683	.400	.813	1.013	J11D683	.400	1.063	1.263
.082	J11B823	.312	.937	1.137	J11C823	.400	1.063	1.263	J11D823	.500	1.125	1.325
.1	J11B104	.312	.937	1.137	J11C104	.400	1.063	1.263	J11D104	.500	1.125	1.325
.12	J11B124	.312	1.063	1.263	J11C124	.500	1.125	1.325	J11D124	.500	1.375	1.575
.15	J11B154	.312	1.063	1.263	J11C154	.500	1.125	1.325	J11D154	.562	1.375	1.575
.18	J11B184	.400	1.063	1.263	J11C184	.500	1.125	1.325	J11D184	.562	1.375	1.575
.20	J11B204	.400	1.063	1.263	J11C204	.562	1.125	1.325	J11D204	.562	1.375	1.575
.22	J11B224	.400	1.063	1.263	J11C224	.562	1.125	1.325	J11D224	.562	1.375	1.575
.27	J11B274	.400	1.063	1.263	J11C274	.562	1.125	1.325	J11D274	.670	1.375	1.575
.33	J11B334	.500	1.125	1.325	J11C334	.562	1.125	1.325	J11D334	.670	1.375	1.575
.39	J11B394	.500	1.125	1.325	J11C394	.562	1.375	1.575	J11D394	.562	1.875	2.075
.47	J11B474	.562	1.125	1.325	J11C474	.670	1.375	1.575	J11D474	.670	1.875	2.075
.50	J11B504	.562	1.125	1.325	J11C504	.670	1.375	1.575	J11D504	.670	1.875	2.075
.56	J11B564	.562	1.125	1.325	J11C564	.670	1.375	1.575	J11D564	.670	1.875	2.075
.68	J11B684	.562	1.125	1.325	J11C684	.670	1.875	2.075	J11D684	.750	1.875	2.075
.82	J11B824	.562	1.375	1.575	J11C824	.670	1.875	2.075	J11D824	.750	1.875	2.075
1.0	J11B105	.670	1.375	1.575	J11C105	.670	1.875	2.075	J11D105	.750	1.875	2.075
1.5	J11B155	.670	1.875	2.075	J11C155	.750	1.875	2.075	J11D155	1.00	1.875	2.075
2.0	J11B205	.670	1.875	2.075	J11C205	1.00	1.875	2.075	J11D205	1.00	2.375	2.575

J11 | B | 104 | J | S | A

STYLE

VOLTAGE
B=50VDC
C=100VDC
D=200VDC

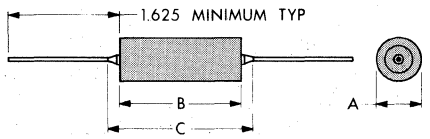
SLEEVING CODE
S=Mylar sleeve
X=No sleeve

CAPACITANCE TOLERANCE
K=10% F=1% B=¼%
J=5% D=½% A=.1%
G=2%

PICOFARAD CODE: First two digits represent significant figures. Last digit represents number of zeros to follow. Example: 104 = 100,000 picofarads.

LEAD CODE
A=Solderable leads: #22 (.025") for .312" case dia. & smaller; #20 (.032") for .400" case dia. & larger.

CASE DIMENSIONS	TOLERANCE LIMITS (INCHES)
"A" Diameter	±0.010 Without Sleeving
	+0.02 −0.00 With Mylar Sleeving
"B" Case Length	±0.03 With or Without Sleeving
"C" Bead to Bead Max. Length	The lengths shown in table are maximum and include solder beads



COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615. TWX: (910) 343-6864

Component Research CRC

H11 METALLIZED TEFLON CAPACITOR

H11 SPECIFICATIONS

CONSTRUCTION	Metallized teflon dielectric, hermetically sealed, extended metal film electrodes, axial leads isolated from case.	
ENVIRONMENTAL	Capacitors meet all environmetal requirements of MIL-C-83421, except vibration at 20g and shock at 50g.	
OPERATING TEMPERATURE	−65°C to +200°C	At full rated voltage.
DIELECTRIC ABSORPTION	0.01% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.05% maximum	At 25°C when measured per MIL-C-83421.
DIELECTRIC STRENGTH	200% rated voltage	At 25°C from terminal to terminal and terminals to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT	Referenced to 25°C −65°C +125°C +200°C	 ±2.0% max. ±3.0% max. ±3.5% max.
CAPACITANCE STABILITY	±0.10%	When measured at any two corresponding temperature points taken in five successive temperature cycles from −65°C to +125°C.
HERMETIC SEAL	1 × 10^{-6}atm/cm³/sec.	Maximum leak rate.
INSULATION RESISTANCE	See I.R. Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1uF, allow an additional minute/uF charge time.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE

FOR VALUES OVER 0.1uF DIVIDE LIMIT SHOWN BY uF TO OBTAIN MINIMUM I.R. EXAMPLE: A 0.68uF CAPACITOR AT 25°C IS 1,000,000 ÷ 0.68 = 1,475,000 MEGOHMS.

RANGE	25°	55°C	85°C	100°C	125°C
.001 TO 0.1uF	10,000,000 Megohms	5,000,000 Megohms	2,000,000 Megohms	1,000,000 Megohms	250,000 Megohms
GREATER THAN 0.1uF	1,000,000 Megohms-uF	500,000 Megohms-uF	200,000 Megohms-uF	100,000 Megohms-uF	25,000 Megohms-uF

H11 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	BURN-IN	48 hrs. minimum at 125°C, at 140% rated DC voltage	4.7.2	No physical damage	100% Test
2	THERMAL AGING	10 cycles minimum from −65°C to +125°C	4.7.3	No physical damage	100% Test
3	SEAL TEST (FINE LEAK)	Helium bomb 45 PSI for 1 hr. minimum, check for helium leak	4.7.5	1x10^{-6}atm/cm³/sec. max.	100% Test
4	SEAL TEST (GROSS LEAK)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
5	DC HI-POT (TERMINAL TO TERMINAL AND TERMINALS TO CASE)	Apply 200% of rated DC voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
6	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage	4.7.7	Per I.R. Table	100% Test
7	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
8	% DISSIPATION FACTOR	At 25°C at 1KHz, values above 1uF measure at 0.1KHz	4.7.9	0.05% max.	100% Test
9	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions, and workmanship	4.7.1	Per specification	1.0% AQL

1. Capacitors are packaged and shipped with Certification of Conformance. 2. Traceability to production and test records by permanent marking of parts with date code lot. 3. Process and inspection data is maintained on file per NHB 5300.4 (1C), MIL-Q-9858 and MIL-STD-790.

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Component Research CRC

H11 METALLIZED TEFLON CAPACITOR

uF	CASE DIMENSIONS											
	50 VDC				100 VDC				200 VDC			
	H11	Diam. A	Length B	Length C	H11	Diam. A	Length B	Length C	H11	Diam. A	Length B	Length C
.001	11B102	.235	.687	.887	11C102	.235	.687	.887	11D102	.235	.687	.887
.0012	11B122	.235	.687	.887	11C122	.235	.687	.887	11D122	.235	.687	.887
.0015	11B152	.235	.687	.887	11C152	.235	.687	.887	11D152	.235	.687	.887
.0018	11B182	.235	.687	.887	11C182	.235	.687	.887	11D182	.235	.687	.887
.002	11B202	.235	.687	.887	11C202	.235	.687	.887	11D202	.235	.687	.887
.0022	11B222	.235	.687	.887	11C222	.235	.687	.887	11D222	.235	.687	.887
.0027	11B272	.235	.687	.887	11C272	.235	.687	.887	11D272	.235	.687	.887
.0033	11B332	.235	.687	.887	11C332	.235	.687	.887	11D332	.235	.687	.887
.0039	11B392	.235	.687	.887	11C392	.235	.687	.887	11D392	.235	.687	.887
.0047	11B472	.235	.687	.887	11C472	.235	.687	.887	11D472	.235	.687	.887
.005	11B502	.235	.687	.887	11C502	.235	.687	.887	11D502	.235	.687	.887
.0056	11B562	.235	.687	.887	11C562	.235	.687	.887	11D562	.235	.687	.887
.0068	11B682	.235	.687	.887	11C682	.235	.687	.887	11D682	.235	.687	.887
.0082	11B822	.235	.687	.887	11C822	.235	.687	.887	11D822	.235	.687	.887
.01	11B103	.235	.687	.887	11C103	.235	.687	.887	11D103	.235	.687	.887
.012	11B123	.235	.687	.887	11C123	.235	.687	.887	11D123	.235	.687	.887
.015	11B153	.312	.687	.887	11C153	.312	.687	.887	11D153	.312	.687	.887
.018	11B183	.312	.687	.887	11C183	.312	.687	.887	11D183	.312	.813	1.013
.02	11B203	.312	.687	.887	11C203	.312	.687	.887	11D203	.312	.813	1.013
.022	11B223	.312	.687	.887	11C223	.312	.687	.887	11D223	.312	.813	1.013
.027	11B273	.312	.687	.887	11C273	.312	.813	1.013	11D273	.312	.813	1.013
.033	11B333	.312	.687	.887	11C333	.312	.813	1.013	11D333	.400	.813	1.013
.039	11B393	.312	.687	.887	11C393	.400	.813	1.013	11D393	.400	1.063	1.263
.047	11B473	.312	.687	.887	11C473	.400	.813	1.013	11D473	.400	1.063	1.263
.05	11B503	.312	.687	.887	11C503	.400	.813	1.013	11D503	.400	1.063	1.263
.056	11B563	.312	.813	1.013	11C563	.400	.813	1.013	11D563	.400	1.063	1.263
.068	11B683	.312	.813	1.013	11C683	.400	.813	1.013	11D683	.400	1.063	1.263
.082	11B823	.312	.937	1.137	11C823	.400	1.063	1.263	11D823	.500	1.125	1.325
.1	11B104	.312	.937	1.137	11C104	.400	1.063	1.263	11D104	.500	1.125	1.325
.12	11B124	.312	1.063	1.263	11C124	.500	1.125	1.325	11D124	.500	1.375	1.575
.15	11B154	.312	1.063	1.263	11C154	.500	1.125	1.325	11D154	.562	1.375	1.575
.18	11B184	.400	1.063	1.263	11C184	.500	1.125	1.325	11D184	.562	1.375	1.575
.20	11B204	.400	1.063	1.263	11C204	.562	1.125	1.325	11D204	.562	1.375	1.575
.22	11B224	.400	1.063	1.263	11C224	.562	1.125	1.325	11D224	.562	1.375	1.575
.27	11B274	.400	1.063	1.263	11C274	.562	1.125	1.325	11D274	.670	1.375	1.575
.33	11B334	.500	1.125	1.325	11C334	.562	1.125	1.325	11D334	.670	1.375	1.575
.39	11B394	.500	1.125	1.325	11C394	.562	1.375	1.575	11D394	.562	1.875	2.075
.47	11B474	.562	1.125	1.325	11C474	.670	1.375	1.575	11D474	.670	1.875	2.075
.50	11B504	.562	1.125	1.325	11C504	.670	1.375	1.575	11D504	.670	1.875	2.075
.56	11B564	.562	1.125	1.325	11C564	.670	1.375	1.575	11D564	.670	1.875	2.075
.68	11B684	.562	1.125	1.325	11C684	.670	1.875	2.075	11D684	.750	1.875	2.075
.82	11B824	.562	1.375	1.575	11C824	.670	1.875	2.075	11D824	.750	1.875	2.075
1.0	11B105	.670	1.375	1.575	11C105	.670	1.875	2.075	11D105	.750	1.875	2.075
1.5	11B155	.670	1.875	2.075	11C155	.750	1.875	2.075	11D155	1.00	1.875	2.075
2.0	11B205	.670	1.875	2.075	11C205	1.00	1.875	2.075	11D205	1.00	2.375	2.575

H11	B	104	J	X	A

STYLE

VOLTAGE
B=50VDC
C=100VDC
D=200VDC

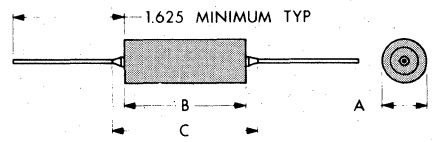
SLEEVING CODE
X=No sleeve

LEAD CODE
A=Solderable leads: #22 (.025") for .312" case dia. & smaller; #20 (.032") for .400" case dia. & larger.

CAPACITANCE TOLERANCE
K=10% F=1%
J=5%
G=2%

PICOFARAD CODE: First two digits represent significant figures. Last digit represents number of zeros to follow. Example: 104 = 100,000 picofarads.

CASE DIMENSIONS	TOLERANCE LIMITS (INCHES)
"A" Diameter	±0.010 Without Sleeving
	+0.02 −0.00 With Mylar Sleeving
"B" Case Length	±0.03
"C" Bead to Bead Max. Length	The lengths shown in table are maximum and include solder beads



COMPONENT RESEARCH CO., INC. • 1655 26TH STREET • SANTA MONICA, CALIF. 90404 • (213) 829-3615. TWX: (910) 343-6864

Component Research CRC

J93 POLYSTYRENE CAPACITOR

PRODUCT FEATURES

.056 μF 50VDC ACTUAL SIZE CAPACITOR

5,000,000 MEGOHM MIN. INSULATION RESISTANCE FOR VALUES 0.1uF AND LESS.

0.02% MAXIMUM DIELECTRIC ABSORPTION.

0.1% MAXIMUM SHELF DRIFT FOR 10 YEARS (OR IN NORMAL USE).

UTILIZES CRC UNIQUE PATENTED, RUGGED, LOW LOSS LEAD TERMINATIONS, QUALIFIED FOR ALL HI-REL PROGRAMS.

HERMETICALLY SEALED, HIGH RELIABILITY SCREENED FOR CRITICAL AEROSPACE PROGRAMS.

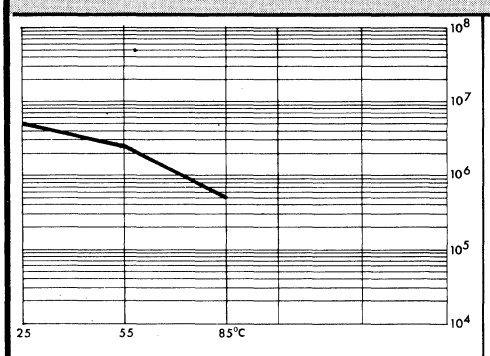
100% RELIABILITY SCREENING, INCLUDES TEMPERATURE CYCLING, FINE LEAK TEST, AC SQUARE WAVE TEST.

SIMILAR GENERIC PARTS HAVE BEEN QUALIFIED FOR TRIDENT PROGRAM.

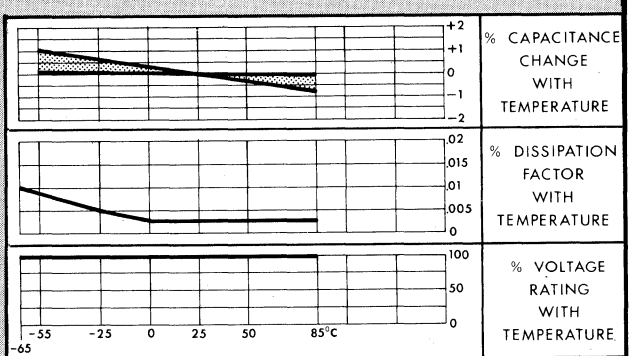
AVAILABLE IN ±0.1% TO ±10% CAPACITANCE TOLERANCE FROM 50VDC TO 400VDC.

AC AND DC RATED.

TYPICAL CURVES



INSULATION RESISTANCE WITH TEMPERATURE IN MEGOHMS (0.1 μF OR LESS)



TYPICAL APPLICATIONS

- CRITICAL TIMING CIRCUITS
- FIXED TUNING CIRCUITS
- FILTERING
- TEMPERATURE COMPENSATION
- COUPLING AND DECOUPLING
- FEEDBACK CIRCUITS
- POWER SUPPLY FILTERING
- GYRO CIRCUITS
- PULSE FORMING NETWORKS
- INTEGRATING CIRCUITS

LIFE TEST DATA CRC TEST REPORT #XT1304

TEST RESULTS FOR 75 SERIES N53 CAPACITORS LIFE TESTED FOR 2000 HOURS AT +85°C AT 140% OF RATED DC VOLTAGE. THERE WERE NO FAILURES FOR THIS TEST. N53 CAPACITORS ARE THE SAME CONSTRUCTION AND DESIGN as J93 SERIES CAPACITORS.

LIST OF CAPACITORS LIFE TESTED			INSULATION RESISTANCE IN MEGOHMS AT 25°C			% CAPACITANCE CHANGE WITH LIFE			% DISSIPATION FACTOR AT 25°C WITH LIFE		
CRC TYPE	uF VALUE	Q'TY TESTED	POST TEST LIMITS (MIN. I.R.)	TEST RESULTS LOW	TEST RESULTS HIGH	POST TEST LIMITS (MAX. △C)	TEST RESULTS LOW	TEST RESULTS HIGH	POST TEST LIMITS (MAX. D.F.)	TEST RESULTS LOW	TEST RESULTS HIGH
N53B	.012	20	$5x10^5$	$2x10^7$	$5x10^7$	0.5	0.00	+.26	.05	.01	.01
N53B	.1	20	$5x10^5$	$1x10^7$	$5x10^7$	0.5	−.03	+.29	.05	.01	.01
N53B	.82	15	$5x10^5$	$5x10^6$	$4x10^7$	0.5	−.02	+.18	.05	.01	.01
N53C	.02	5	$5x10^5$	$3.3x10^7$	$5x10^7$	0.5	−.025	+.245	.05	.01	.01
N53C	.039	5	$5x10^5$	$5.5x10^6$	$1x10^8$	0.5	−.01	+.30	.05	.01	.01
N53C	.068	20	$5x10^5$	$1x10^7$	$2x10^7$	0.5	+.06	+.22	.05	.01	.01

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Component Research CRC

J93 POLYSTYRENE CAPACITOR

J93 SPECIFICATIONS

OPERATING TEMPERATURE	−65°C to 85°C	At full rated voltage.
DIELECTRIC ABSORPTION	0.02% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.02% maximum	At 25°C when measured per MIL-C-83421.
DIELECTRIC STRENGTH	200% rated voltage	At 25°C from terminal to terminal and terminals to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT	−80 ±50 PPM/°C −60 ±50 PPM/°C	For values 0.001uF to 0.0082uF For values 0.01uF to 2.7uF Special polystyrene capacitors can be supplied with a temperature coefficient of −20 to −100 PPM/°C that is linear to ±30 PPM/°C and ±10 PPM/°C. A wide selection is available of large uF values in bathtub and custom cases.
CAPACITANCE STABILITY	0.03% maximum Drift	With five cycles from −25°C to +85°C
HERMETIC SEAL	1×10^{-6}atm/cm³/sec.	Maximum leak rate.
INSULATION RESISTANCE	See I.R. Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1uF, allow an additional minute/uF charge time.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE

FOR VALUES OVER 1.0uF DIVIDE LIMIT SHOWN BY uF TO OBTAIN MINIMUM I.R. EXAMPLE: A 2.0uF CAPACITOR AT 25°C IS 1,000,000 ÷ 2 = 500,000 MEGOHMS.

RANGE	25°C	55°C	85°C
0.001 TO 0.1uF	10,000,000 Megohms	5,000,000 Megohms	1,000,000 Megohms
GREATER THAN 0.1uF	1,000,000 Megohms-uF	500,000 Megohms-uF	100,000 Megohms-uF

J93 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	BURN-IN	48 hrs. min. @ 85°C, 140% rated DC volts	4.7.2	There shall be no physical damage	100% Test
2	THERMAL AGING	From −65°C to +85°C, 5 cycles min.	4.7.3	There shall be no physical damage	100% Test
3	SEAL TEST (FINE LEAK)	Helium bomb 45 PSI for 1 hr. minimum, check for helium leak	4.7.5	1x10⁶atm/cm³/sec. max.	100% Test
4	SEAL TEST (GROSS LEAK)	Place in 85°C hot water for 60 seconds minimum and observe for bubbles	4.7.5	No continuous bubble stream	100% Test
5	AC SQUARE WAVE (TERMINAL TO TERMINAL)	Apply 100Hz square wave at a peak to peak voltage of 3 times DC rated voltage for 60 seconds minimum. Do not exceed 800 volts peak to peak.	4.7.6	No shorts	100% Test
6	DC HI-POT (TERMINAL TO TERMINAL AND TERMINALS TO CASE)	Apply 200% of rated DC voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
7	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage	4.7.7	Per I.R. Table	100% Test
8	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
9	% DISSIPATION FACTOR	At 25°C at 1KHz, values above 1uF measured at 0.1KHz	4.7.9	0.02% max.	100% Test
10	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions, and workmanship as required.	4.7.1	Per specification	1.0% AQL

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Component Research CRC

J93 POLYSTYRENE CAPACITOR

uF	CASE DIMENSIONS															
	50 VDC				100 VDC				200 VDC				400 VDC			
	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C
.001	93B102	.193	.562	.662	93C102	.193	.687	.787	93D102	.235	.687	.787	93E102	.312	.687	.787
.0012	93B122	.193	.562	.662	93C122	.193	.687	.787	93D122	.235	.687	.787	93E122	.312	.687	.787
.0015	93B152	.193	.562	.662	93C152	.193	.687	.787	93D152	.235	.687	.787	93E152	.312	.687	.787
.0018	93B182	.193	.562	.662	93C182	.193	.687	.787	93D182	.235	.687	.787	93E182	.312	.687	.787
.002	93B202	.193	.562	.662	93C202	.193	.687	.787	93D202	.235	.687	.787	93E202	.312	.687	.787
.0022	93B222	.193	.562	.662	93C222	.193	.687	.787	93D222	.235	.687	.787	93E222	.312	.687	.787
.0027	93B272	.193	.562	.662	93C272	.193	.687	.787	93D272	.235	.687	.787	93E272	.312	.687	.787
.0033	93B332	.193	.562	.662	93C332	.193	.687	.787	93D332	.235	.687	.787	93E332	.312	.687	.787
.0039	93B392	.193	.562	.662	93C392	.193	.687	.787	93D392	.235	.687	.787	93E392	.312	.687	.787
.0047	93B472	.193	.562	.662	93C472	.193	.687	.787	93D472	.235	.687	.787	93E472	.312	.687	.787
.005	93B502	.193	.562	.662	93C502	.193	.687	.787	93D502	.235	.687	.787	93E502	.312	.687	.787
.0056	93B562	.193	.562	.662	93C562	.193	.687	.787	93D562	.235	.687	.787	93E562	.312	.687	.787
.0068	93B682	.193	.562	.662	93C682	.193	.687	.787	93D682	.235	.687	.787	93E682	.312	.687	.787
.0075	93B752	.193	.687	.787	93C752	.193	.813	.913	93D752	.235	.813	.913	93E752	.312	.813	.913
.0082	93B822	.193	.687	.787	93C822	.193	.813	.913	93D822	.235	.813	.913	93E812	.312	.813	.913
.01	93B103	.193	.687	.787	93C103	.193	.813	.913	93D103	.235	.813	.913	93E103	.312	.813	.913
.012	93B123	.193	.687	.787	93C123	.193	.813	.913	93D123	.235	.813	.913	93E123	.312	.813	.913
.015	93B153	.235	.687	.787	93C153	.235	.813	.913	93D153	.312	.813	.913	93E153	.400	.813	.913
.018	93B183	.235	.813	.913	93C183	.312	.813	.913	93D183	.400	.813	.913	93E183	.400	1.063	1.163
.02	93B203	.235	.813	.913	93C203	.312	.813	.913	93D203	.400	.813	.913	93E203	.400	1.063	1.163
.022	93B223	.235	.813	.913	93C223	.312	.813	.913	93D223	.400	.813	.913	93E223	.400	1.063	1.163
.027	93B273	.235	.813	.913	93C273	.312	.813	.913	93D273	.400	.813	.913	93E273	.400	1.063	1.163
.033	93B333	.235	.813	.913	93C333	.312	.813	.913	93D333	.400	.813	.913	93E333	.400	1.063	1.163
.039	93B393	.312	.813	.913	93C393	.400	.813	.913	93D393	.400	1.063	1.163	93E393	.500	1.125	1.225
.047	93B473	.312	.813	.913	93C473	.400	.813	.913	93D473	.400	1.063	1.163	93E473	.500	1.125	1.225
.05	93B503	.312	.813	.913	93C503	.400	.813	.913	93D503	.400	1.063	1.163	93E503	.500	1.125	1.225
.056	93B563	.312	.813	.913	93C563	.400	.813	.913	93D563	.400	1.063	1.163	93E563	.500	1.125	1.225
.068	93B683	.400	.813	.913	93C683	.400	1.063	1.163	93D683	.500	1.125	1.225	93E583	.500	1.375	1.475
.075	93B753	.400	.813	.913	93C753	.400	1.063	1.163	93D753	.500	1.125	1.225	93E753	.500	1.375	1.475
.082	93B823	.400	.813	.913	93C823	.400	1.063	1.163	93D823	.500	1.125	1.225	93E823	.500	1.375	1.475
.1	93B104	.400	.813	.913	93C104	.400	1.063	1.163	93D104	.500	1.125	1.225	93E104	.500	1.375	1.475
.12	93B124	.400	.813	.913	93C124	.400	1.063	1.163	93D124	.500	1.125	1.225	93E124	.500	1.375	1.475
.15	93B154	.400	1.063	1.163	93C154	.500	1.125	1.225	93D154	.500	1.375	1.475	93E154	.562	1.375	1.475
.18	93B184	.400	1.063	1.163	93C184	.500	1.125	1.225	93D184	.500	1.375	1.475	93E184	.562	1.375	1.475
.20	93B204	.400	1.063	1.163	93C204	.500	1.125	1.225	93D204	.500	1.375	1.475	93E204	.562	1.375	1.475
.22	93B224	.400	1.063	1.163	93C224	.500	1.125	1.225	93D224	.500	1.375	1.475	93E224	.562	1.375	1.475
.27	93B274	.500	1.125	1.225	93C274	.500	1.375	1.475	93D274	.562	1.375	1.475	93E274	.670	1.375	1.475
.33	93B334	.500	1.125	1.225	93C334	.500	1.375	1.475	93D334	.562	1.375	1.475	93E334	.670	1.375	1.475
.39	93B394	.500	1.375	1.475	93C394	.562	1.375	1.475	93D394	.670	1.375	1.475	93E394	.670	1.875	1.975
.47	93B474	.562	1.375	1.475	93C474	.670	1.375	1.475	93D474	.670	1.875	1.975	93E474	.750	1.875	1.975
.50	93B504	.562	1.375	1.475	93C504	.670	1.375	1.475	93D504	.670	1.875	1.975	93E504	.750	1.875	1.975
.56	93B564	.562	1.375	1.475	93C564	.670	1.375	1.475	93D564	.670	1.875	1.975	93E564	.750	1.875	1.975
.68	93B684	.670	1.375	1.475	93C684	.670	1.875	1.975	93D684	.750	1.875	1.975	93E684	1.000	1.875	1.975
.75	93B754	.670	1.875	1.975	93C754	.750	1.875	1.975	93D754	1.000	1.875	1.975	93E754	1.000	2.375	2.475
.82	93B824	.670	1.875	1.975	93C824	.750	1.875	1.975	93D824	1.000	1.875	1.975	93E824	1.000	2.375	2.475
1.0	93B105	.670	1.875	1.975	93C105	.750	1.875	1.975	93D105	1.000	1.875	1.975	93E105	1.000	2.375	2.475
1.2	93B125	.750	1.875	1.975	93C125	1.000	1.875	1.975								
1.5	93B155	.750	1.875	1.975	93C155	1.000	1.875	1.975								
1.8	93B185	1.000	1.875	1.975	93C185	1.000	2.375	2.475								
2.0	93B205	1.000	1.875	1.975	93C205	1.000	2.375	2.475								
2.2	93B225	1.000	1.875	1.975												
2.5	93B255	1.000	2.375	2.225												
2.7	93B275	1.000	2.375	2.225												

FOR SPECIAL VALUES AND TOLERANCES, PLEASE CONTACT OUR APPLICATION DEPARTMENT.

J93 | B | 104 | J | S | W

STYLE

VOLTAGE
B=50VDC
C=100VDC
D=200VDC
E=400VDC

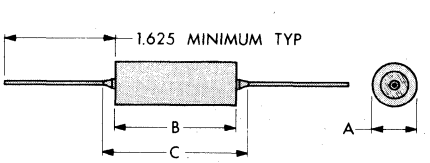
SLEEVING CODE
S=Mylar sleeve
X=No sleeve

LEAD CODE
W=Tinned copper clad steel: #22 (.025") for .312" case dia. & smaller; #20 (.032") for .400" & .500" case dia.
C=Tinned oxygen-free copper: #18 (.040") for .562" case dia. & larger.

CAPACITANCE TOLERANCE
K=10% J=5% G=2% F=1% D=½% B=¼% A=.1%

PICOFARAD CODE: First two digits represent significant figures. Last digit represents number of zeros to follow. Example: 104 = 100,000 picofarads.

CASE DIMENSIONS	TOLERANCE LIMITS (INCHES)
"A" Diameter	±0.010 Without Sleeving
	+0.02 −0.00 With Mylar Sleeving
"B" Case Length	±0.03 With or Without Sleeving
"C" Bead to Bead Max. Length	The lengths shown in table are maximum and include solder beads



COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615. TWX: (910) 343-6864

Component Research CRC

A52 FOIL POLYCARBONATE CAPACITOR

A52 SPECIFICATIONS

CONSTRUCTION	Polycarbonate dielectric, extended foil electrodes, hermetically sealed, leads isolated from case.	
ENVIRONMENTAL	Capacitors meet all environmental requirements of MIL-C-83421 except vibration and shock. Vibration is at 20g's and shock at 50g's.	
OPERATING TEMPERATURE	−65°C to +100°C	At full rated voltage, derate linearly to 50% of rated voltage at 125°C.
DIELECTRIC ABSORPTION	0.1% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.15% maximum	At 25°C when measured per MIL-C-83421.
AC SQUARE WAVE	100Hz, 60 seconds minimum	At 25°C at a peak to peak voltage of 3 times rated DC voltage, terminal to terminal per MIL-C-83421.
DIELECTRIC STRENGTH	200% DC volts	At 25°C from terminal to terminal and terminals to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT	±2% maximum capacitance change	From −55°C to +125°C.
CAPACITANCE STABILITY	±0.25%	When measured at any two corresponding temperature points taken in five successive temperature cycles from −65°C to +125°C.
HERMETIC SEAL	1×10^{-6} atm/cm³/sec.	Maximum leak rate.
INSULATION RESISTANCE	See I.R. Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1uF, allow an additional minute/uF charge time.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE

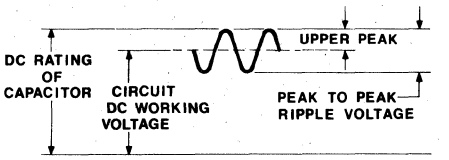
FOR VALUES OVER 0.1uF DIVIDE LIMIT SHOWN BY uF TO OBTAIN MINIMUM I.R. EXAMPLE: A 0.18uF CAPACITOR AT 25°C is 100,000 ÷ 0.18 = 555,000 MEGOHMS.

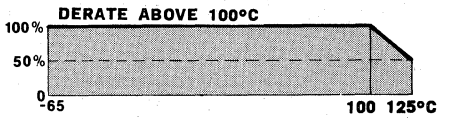
RANGE	25°C	85°C	125°C
.001 TO 0.1uF	1,000,000 Megohms	500,000 Megohms	30,000 Megohms
GREATER THAN 0.1uF	100,000 Megohms-uF	50,000 Megohms-uF	3,000 Megohms-uF

A52 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	BURN-IN	48 hours minimum at 100°C, at 120% rated AC voltage at 400Hz not to exceed 240VRMS	4.7.2	No physical damage	100% Test
2	THERMAL AGING	10 cycles minimum from −65°C to +125°C	4.7.3	No physical damage	100% Test
3	SEAL TEST (GROSS LEAK)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
4	AC SQUARE WAVE (TERMINAL TO TERMINAL)	Apply 100Hz at a peak to peak voltage of 3 times DC rated voltage for 60 sec. min. Do not exceed 800 volts peak to peak.	4.7.6	No shorts	100% Test
5	DC HI-POT (TERMINAL TO TERMINAL) AND TERMINALS TO CASE)	Apply 200% of rated DC voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
6	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage	4.7.7	100,000 megohms-uF, need not exceed 1,000,000 megohms	100% Test
7	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
8	% DISSIPATION FACTOR	At 25°C at 10KHz	4.7.9	.25 maximum	100% Test
9	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions, and workmanship as required.	4.7.1	Per specification	1.0% AQL

1. THE COMBINED DC AND AC VOLTAGES SHOULD NOT EXCEED THE DC RATINGS, SEE FIGURE.
2. CAPACITORS MAY BE OPERATED AT HIGHER FREQUENCIES, AT REDUCED RMS VOLTAGE SUCH THAT MAX. AC CURRENT RATINGS ARE NOT EXCEEDED.
3. TYPE A52 CAPACITORS CAN HANDLE MUCH HIGHER PULSE REPETITION RATES THAN METALLIZED CAPACITORS.





COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

Component Research (CRC)

A52 FOIL POLYCARBONATE CAPACITOR

CASE DIMENSIONS • AC RATINGS

	TYPE A52C 100VDC					TYPE A52D 200VDC					TYPE A52V 300VDC					TYPE A52E 400VDC				
			AC RATINGS					AC RATINGS					AC RATINGS					AC RATINGS		
uF	Dia. A	Length B	Max. RMS Volts 20 KHz	Max. RMS Volts 100 KHz	Max. RMS Amps	Dia. A	Length B	Max. RMS Volts 20 KHz	Max. RMS Volts 100 KHz	Max. RMS Amps	Dia. A	Length B	Max. RMS Volts 20 KHz	Max. RMS Volts 100 KHz	Max. RMS Amps	Dia. A	Length B	Max. RMS Volts 20 KHz	Max. RMS Volts 100 KHz	Max. RMS Amps
.001	.193	.562	60	60	.038	.193	.562	120	120	.075	.193	.562	180	180	.113	.193	.687	240	240	.15
.0012	.193	.562	60	60	.045	.193	.562	120	120	.090	.193	.562	180	180	.135	.193	.687	240	240	.18
.0015	.193	.562	60	60	.056	.193	.562	120	120	.112	.193	.562	180	180	.169	.193	.687	240	240	.22
.0018	.193	.562	60	60	.067	.193	.562	120	120	.135	.193	.562	180	180	.202	.193	.687	240	240	.27
.002	.193	.562	60	60	.075	.193	.562	120	120	.150	.193	.562	180	180	.225	.193	.687	240	240	.30
.0022	.193	.562	60	60	.083	.193	.562	120	120	.165	.193	.562	180	180	.248	.193	.687	240	240	.33
.0027	.193	.562	60	60	.101	.193	.562	120	120	.202	.193	.687	180	180	.304	.193	.687	240	240	.4
.0033	.193	.562	60	60	.124	.193	.562	120	120	.247	.193	.687	180	180	.371	.193	.687	240	240	.5
.0039	.193	.562	60	60	.146	.193	.562	120	120	.293	.193	.687	180	180	.439	.193	.687	240	240	.6
.0047	.193	.562	60	60	.176	.193	.687	120	120	.353	.193	.687	180	180	.529	.235	.687	240	240	.7
.005	.193	.562	60	60	.188	.193	.687	120	120	.375	.193	.687	180	180	.562	.235	.687	240	240	.75
.0056	.193	.562	60	60	.210	.193	.687	120	120	.420	.193	.687	180	180	.623	.235	.687	240	240	.85
.0068	.193	.687	60	60	.255	.193	.687	120	120	.511	.235	.687	180	180	.766	.312	.687	240	240	1.0
.0075	.193	.687	60	60	.282	.235	.687	120	120	.563	.235	.687	180	180	.845	.312	.687	240	240	1.13
.0082	.193	.687	60	60	.308	.235	.687	120	120	.615	.235	.687	180	180	.923	.312	.687	240	240	1.23
.01	.235	.687	60	60	.375	.235	.687	120	120	.750	.312	.687	180	180	1.13	.312	.687	240	224	1.4
.012	.235	.687	60	60	.451	.235	.687	120	120	.902	.312	.687	180	172	1.3	.312	.687	240	200	1.5
.015	.235	.687	60	60	.561	.312	.687	120	120	1.12	.312	.687	180	150	1.4	.312	.813	240	190	1.8
.018	.312	.687	60	60	.674	.312	.687	120	120	1.35	.312	.687	180	134	1.5	.312	.813	240	178	2.0
.02	.312	.687	60	60	.750	.312	.687	120	112	1.4	.312	.813	180	132	1.65	.400	.813	240	168	2.1
.022	.312	.687	60	60	.822	.312	.687	120	110	1.5	.312	.813	180	130	1.8	.400	.813	240	158	2.2
.027	.312	.687	60	60	1.02	.312	.813	120	106	1.8	.312	.813	180	118	2.0	.400	.813	240	148	2.5
.033	.312	.687	60	60	1.22	.312	.813	120	98	2.0	.400	.813	180	108	2.2	.400	1.063	240	130	2.7
.039	.312	.813	60	60	1.46	.400	.813	120	90	2.2	.400	.813	180	98	2.4	.400	1.063	240	117	2.9
.047	.312	.813	60	60	1.76	.400	.813	120	82	2.4	.400	.813	180	85	2.5	.400	1.063	240	102	3.0
.05	.400	.813	60	60	1.88	.400	.813	120	80	2.5	.400	1.063	180	83.2	2.6	.500	1.125	240	102	3.2
.056	.400	.813	60	60	2.07	.400	.813	120	73	2.5	.400	1.063	180	78	2.7	.500	1.125	240	100	3.5
.068	.400	.813	60	53	2.2	.400	1.063	120	65	2.7	.400	1.063	180	67	2.8	.500	1.125	240	96	4.0
.075	.400	.813	60	50	2.4	.400	1.063	120	61	2.9	.400	1.063	180	63	3.0	.500	1.375	240	97	4.6
.082	.400	.813	60	49	2.5	.400	1.063	120	59	3.0	.500	1.125	180	61	3.15	.500	1.375	240	98	5.0
.1	.400	1.063	60	44	2.7	.500	1.125	120	55	3.4	.500	1.125	180	56	3.50	.562	1.375	240	85	5.3
.12	.400	1.063	60	37	2.8	.500	1.125	120	48	3.6	.500	1.125	180	53	4.00	.562	1.375	240	75	5.6
.15	.400	1.063	60	37	2.9	.500	1.125	120	43	4.00	.500	1.375	180	48	4.50	.562	1.375	240	53	6.0
.18	.400	1.063	60	27	3.0	.500	1.375	120	40	4.50	.500	1.375	180	45	5.00					
.2	.500	1.125	60	26	3.3	.500	1.375	120	38	4.75	.562	1.375	180	45	5.63					
.22	.500	1.125	60	25	3.4	.500	1.375	120	37	5.00	.562	1.375	180	45	6.00					
.27	.500	1.125	60	22	3.8	.562	1.375	120	33	5.50										
.33	.500	1.125	60	20	4.13	.562	1.375	120	29	6.00										
.39	.500	1.375	60	20	5.00															
.47	.562	1.375	60	20	6.00															

A52 C 104 J S W

STYLE

VOLTAGE
C=100VDC
D=200VDC
V=300VDC
E=400VDC

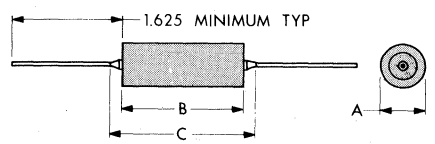
SLEEVING CODE
S=Mylar sleeve
X=No sleeve

LEAD CODE
W=Tinned copper clad steel: #22 (.025″) for .312″ case dia. & smaller; #20 (.032″) for .400″ & .500″ case dia.
C=Tinned oxygen-free copper: #18 (.040″) for .562″ case dia. & larger.

CAPACITANCE TOLERANCE K=10% G=2% J=5% F=1%

PICOFARAD CODE: First two digits represent significant figures. Last digit represents number of zeros to follow. Example: 104 = 100,000 picofarads.

CASE DIMENSIONS	TOLERANCE LIMITS (INCHES)
"A" Diameter	±.010 Without Sleeving +0.02 −0.00 With Mylar Sleeving
"B" Case Length	±0.03 With or Without Sleeving
"C" Bead to Bead Max. Length	"C" Dimension is 0.2″ maximum more than "B" dimension in table



COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

Component Research (CRC)

B52 FOIL POLYCARBONATE CAPACITOR

SPECIFICATIONS & QUALITY CONFORMANCE

400VRMS, 600VRMS, RATED FROM −65°C TO +100°C

Series B52 capacitors are designed for continuous duty operation over the full temperature range from −65°C to +100°C at the rated voltage, current and frequency.

The maximum RMS current or peak current can be exceeded with reduced duty cycle or tone burst operation, provided the peak rated voltages are not exceeded, and provided the heat rise measured at the terminals and within ¼" of the hermetic seals does not exceed 20°C.

Heat rise is measured with the capacitor located in a room temperature environment allowing for non-cooled normal convection. Lead size and distance to the power source must be adequate to prevent undue heat sinking or heat generation during measurement.

HIGH CURRENT HANDLING WITH LOW LOSS

Series B52 capacitors have very low series resistance terminations, measuring in the range of several milliohms at 100KHz, and can handle very high peak current discharge currents. Typically it is estimated that a 1uF capacitor can handle over 3000 amperes of peak current at repetition rates up to 10 pulses per second. Testing is now in process to develop meaningful pulse current limits to be added to future specifications for B52 capacitors.

FREEDOM FROM CORONA INCEPTION AND INTERNAL HOT SPOTS

CRC capacitors use a patented low loss termination which remains reliable after years of operation under severe environmental conditions. Whereas commercial type AC rated capacitors may be adequate for 60Hz and possibly 400Hz long term life, the use of CRC terminations enables these capacitors to operate up to 40KHz without abnormal hot spot conditions of corona inception.

40KHz RATED FOR HIGH CURRENT HANDLING UP TO 100°C

CRC capacitors will operate efficiently up to approximately 400KHz at their maximum current rated conditions. Typically a capacitor that is 1uF and is rated at 10 amps at 40KHz will be handling 40VRMS at 40KHz. This capacitor when operated at 400KHz at 4VRMS will handle approximately 10ARMS current.

CRC has higher frequency, lower loss, higher power capacitors in the planning stage for future applications that seek for higher frequency power sources.

HERMETICALLY SEALED, RUGGED AEROSPACE, MILITARY CONSTRUCTION

CRC true hermetic sealing preserves the high quality performance of Series B52 polycarbonate capacitors and protects the dielectric materials from chemical attack. Merely potting non-hermetic type capacitors is poor insurance against long term loss of dielectric strength and life. It has been found that attack by vapor ingestion of chemicals of non-hermetic polycarbonate capacitors has resulted in failure in life or long term operation.

AVAILABLE WITH 400Hz OR 40KHz BURN-IN OPTIONS

AC burn-in options at additional cost are available for critical applications. The most economical AC burn-in is at rated RMS voltage @ 400Hz at 100°C. Burn-in @ 400KHz at maximum rated current is also available for those applications where long term use at high current is anticipated. Group "A" testing is performed 100%. This testing consists of vital capacitor parameters performed after burn-in to tight specification limits. This ensures the high reliability required to assure our customers of fault free operation under harsh operating conditions.

TYPE B52 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METHOD	TEST LIMIT	INSPECTION LEVEL
1	BURN-IN	16 hrs minimum at 120% rated AC voltage at 400Hz at 100°C	4.7.2 MIL-C-83421	No physical damage	100% Test
2	THERMAL AGING	5 cycles minimum −65°C to 125°C	4.7.3	No physical damage	100% Test
3	SEAL TEST	Gross leak Meth. 112 MIL-STD-202 Cond. B		No continuous bubble stream or oil leaks as required	100% Test
	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage or at 600VDC, whichever is less	4.7.7	100,000 megohms-uF, need not exceed 1,000,000 megohms	100% Test
5	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
6	% DISSIPATION FACTOR	At 25°C at 10KHz	4.7.9	0.25% maximum	100% Test
7	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions and workmanship	4.7.1	Per specification	1.0% AQL

Component Research CRC

B55 FOIL POLYPROPYLENE CAPACITOR

DIMENSIONS & AC RATINGS

	TYPE B55F 400VRMS RATED							TYPE B55P 600VRMS RATED						
	600VDC RATED OR 600 VOLTS PEAK (AC PLUS DC VOLTS)			MAX. AC RATING −55°C TO 85°C				800VDC RATED OR 840 VOLTS PEAK (AC PLUS DC VOLTS)			MAX. AC RATING −55°C TO 85°C			
uF	Part No.	D	L	RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps	Part No.	D	L	RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps
.033	B55F333KXC	.400	1.063	400	400	400	4	B55P333KXC	.500	1.375	600	600	600	6
.039	B55F393KXC	.400	1.063	400	400	400	4	B55P393KXC	.500	1.375	600	600	600	6
.047	B55F473KXC	.500	1.125	400	400	400	5	B55P473KXC	.500	1.375	600	600	511	6
.056	B55F563KXC	.500	1.125	400	400	357	5	B55P563KXC	.500	1.375	600	600	428	6
.068	B55F683KXC	.500	1.125	400	400	294	5	B55P683KXC	.562	1.375	600	600	412	7
.075	B55F753KXC	.500	1.375	400	400	320	6	B55P753KXC	.562	1.375	600	600	373	7
.082	B55F823KXC	.500	1.375	400	400	293	6	B55P823KXC	.562	1.375	600	600	342	7
.092	B55F923KXC	.562	1.375	400	400	305	7	B55P923KXC	.670	1.375	600	600	348	8
.1	B55F104KXC	.562	1.375	400	400	280	7	B55P104KXC	.670	1.375	600	600	360	8
.12	B55F124KXC	.562	1.375	400	400	233	7	B55P124KXX	.670	1.375	600	600	266	8
.15	B55F154KXC	.562	1.375	400	400	187	7	B55P154KXC	.670	1.875	600	600	214	8
.18	B55F184KXC	.670	1.375	400	400	178	8	B55P184KXC	.670	1.875	600	600	200	9
.22	B55F224KXC	.670	1.375	400	400	146	8	B55P224KXC	.670	1.875	600	600	164	9
.27	B55F274KXC	.670	1.875	400	400	133	9	B55P274KXC	.750	1.875	600	600	178	12
.33	B55F334KXC	.670	1.875	400	400	109	9	B55P334KXC	.750	1.875	600	600	145	12
.39	B55F394KXC	.670	1.875	400	400	92.7	9	B55P394KXC	.750	2.375	600	600	144	14
.47	B55F474KXC	.750	1.875	400	400	102.0	12	B55P474KXC	.750	2.375	600	600	119	14
.56	B55F564KXC	.750	1.875	400	400	85.7	12							
.68	B55F684KXC	.750	2.375	400	400	70.6	12							
.75	B55F754KXC	.750	2.375	400	400	74.6	14							
.82	B55F824KXC	.750	2.375	400	400	68.3	14							

ORDERING INFORMATION: All part numbers listed in tables have a capacitance tolerance of ±10% and are supplied with bare metal (unsleeved) cases.

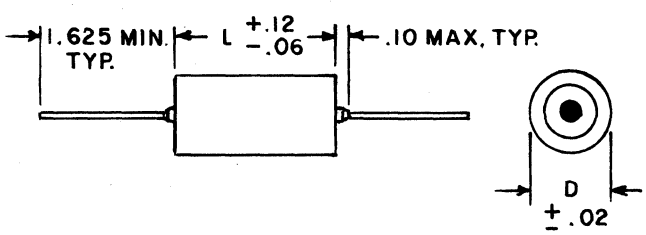
TECHNICAL INFORMATION: These capacitors can be damaged when you solder to the lead wires due to possible overheating that can occur. Place a suitable heat sink on the lead wire between the solder beads on the hermetic seal and the area of wire lead to be soldered.

For initial design, when operating the capacitors at high current levels it is suggested that you monitor the capacitor heat rise on the leads adjacent to the solder beads to verify that it does not exceed 20°C above ambient.

All maximum current ratings shown should result in less than 20°C heat rise with continuous duty operation under normal convection conditions.

Avoid tearing of solder beads when bending wire leads by using a suitable clamping fixture for lead bending.

PART DIMENSIONS AND TOLERANCES



LEAD SIZE
.041 ±.003 (#18AWG) TINNED COPPER FOR CASE DIAMETER .400 & LARGER

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

Component Research CRC

B12 METALLIZED POLYCARBONATE CAPACITOR

SPECIFICATIONS & QUALITY CONFORMANCE

400VRMS, 600VRMS, RATED FROM −65°C TO +100°C

Series B12 capacitors are designed for continous duty operation over the full temperature range from −65°C to +100°C at the ratings for voltage, current and freguency listed in the specifications.

The maximum RMS current or peak current can be exceeded with reduced duty cycle or tone burst operation, provided the peak rated voltages are not exceeded, and provided the heat rise measured at the terminals and within ¼" of the hermetic seals does not exceed 20°C.

Heat rise is measured with the capacitor located in a room temperature environment allowing for non-cooled normal convection. Lead size and distance to the power source must be adequate to prevent undue heat sinking or heat generation during measurement.

HIGH CURRENT HANDLING WITH LOW LOSS

Series B12 capacitors have terminations slightly higher in resistance than Series B52 capacitors and can be used in pulse applications where the peak currents generally do not exceed 100 times B12 RMS current ratings and where the repetition rate is less than 10 pulses per second.

Testing is now in process to develop pulse current limits to be added to future specifications for B12 capacitors. Series B12 capacitors are smaller in size and lighter in weight than Series B52 foil polycarbaronate capacitors.

FREEDOM FROM CORONA INCEPTION AND INTERNAL HOT SPOTS

Commercial type AC rated capacitors may be adequate for 60Hz and possibly 400Hz long term life. CRC capacitors are designed to operate up to 40KHz without abnormal hot spot conditions, without corona inception, with constant controlled low loss terminations which remain reliable after years of use, after operation during severe environmental conditions.

40KHz RATED FOR HIGH CURRENT HANDLING UP TO 100°C

CRC capacitors will operate efficiently up to approximately 400KHz at their maximum current rated conditions. Typically a capacitor that is 1uF and is rated at 10 amps at 40KHz will be handling 40VRMS at 40KHz. This capacitor when operated at 400KHz at 4VRMS will handle approximately 10ARMS current.

CRC has higher frequency, lower loss, higher power capacitors in the planning stage for future applications that seek for higher frequency power sources.

HERMETICALLY SEALED, RUGGED AEROSPACE, MILITARY CONSTRUCTION

CRC true hermetic sealing preserves the high quality performance of Series B12 polycarbonate capacitors and protects the dielectric materials from chemical attack. Merely potting non-hermetic type capacitors is poor insurance against long term loss of dielectric strength and life. It has been found that attack by vapor ingestion of chemicals of non-hermetic polycarbonate capacitors has resulted in failure in life or long term operation.

AVAILABLE WITH 400Hz OR 40KHz BURN-IN OPTIONS

AC burn-in options at additional cost are available for critical applications. Most economical AC burn-in is generally at rated RMS volts at 400Hz at 100°C. 40KHz burn-in at maximum rated current is also available for those applications where long term use at high current is anticipated. 100% Group "A" testing of vital capacitor characteristics is performed after burn-in to generally tightly controlled specifications to assure ourselves and our customers that these capacitors will operate reliably as intended for use.

TYPE B12 QUALITY CONFORMANCE INSPECION

TEST NO.	TEST	TEST CONDITIONS	TEST METHOD	TEST LIMIT	INSPECTION LEVEL
1	BURN-IN	16 hrs minimum at 120% rated AC voltage at 400Hz at 100°C	4.7.2 MIL-C-83421	No physical damage	100% Test
2	THERMAL AGING	5 cycles minimum —65°C to 125°C	4.7.3	No physical damage	100% Test
3	SEAL TEST	Gross leak Meth. 112 MIL-STD-202 Cond. B		No continuous bubble stream or oil leaks as required	100% Test
	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage or at 600VDC, whichever is less	4.7.7	100,000 megohms-uF, need not exceed 1,000,000 megohms	100% Test
5	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
6	% DISSIPATION FACTOR	At 25°C at 10KHz	4.7.9	0.5% maximum	100% Test
7	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions and workmanship	4.7.1	Per specification	1.0% AGL

Component Research (CRC)

B12 METALLIZED POLYCARBONATE CAPACITOR

DIMENSIONS & AC RATINGS

TYPE B12F 400VRMS RATED

uF	600 VDC RATED OR 600 VOLTS PEAK (AC PLUS DC VOLTS) Part No.	D	L	MAX. AC RATING —65°C TO 100°C RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps
.01	B12F103KXW	.312	.813	400	400	400	1.0
.012	B12F123KXW	.312	.813	400	400	400	1.2
.015	B12F153KXW	.312	.813	400	400	400	1.5
.018	B12F183KXW	.312	.813	400	400	355	1.6
.022	B12F223KXC	.400	.813	400	400	309	1.7
.027	B12F273KXC	.400	.813	400	400	252	1.7
.033	B12F333KXC	.400	.813	400	400	218	1.8
.039	B12F393KXC	.400	.813	400	400	205	2.0
.047	B12F473KXC	.400	1.063	400	400	187	2.2
.056	B12F563KXC	.400	1.063	400	400	164	2.3
.068	B12F683KXC	.400	1.063	400	400	159	2.7
.075	B12F753KXC	.400	1.063	400	400	149	2.8
.082	B12F823KXC	.500	1.125	400	400	146	3.0
.092	B12F923KXC	.500	1.125	400	400	140	3.2
.1	B12F104KXC	.500	1.125	400	400	128	3.2
.12	B12F124KXC	.500	1.375	400	400	110	3.3
.15	B12F154KXC	.500	1.375	400	400	110	4.1
.18	B12F184KXC	.562	1.375	400	400	95	4.3
.22	B12F224KXC	.562	1.375	400	400	91	5.0
.27	B12F274KXC	.562	1.375	400	400	74	5.0
.33	B12F334KXC	.670	1.375	400	400	67	5.5
.39	B12F394KXC	.670	1.375	400	400	57	5.5
.47	B12F474KXC	.670	1.875	400	400	47	5.5
.56	B12F564KXC	.670	1.875	400	400	42	5.9
.68	B12F684KXC	.670	1.875	400	400	40	6.8
.75	B12F754KXC	.750	1.875	400	400	40	7.5
.82	B12F824KXC	.750	1.875	400	366	36	7.5
.92	B12F924KXC	.750	2.375	400	370	37	8.5
1.0	B12F105KXC	.750	2.375	400	340	34	8.5
1.2	B12F125KXC	.750	2.375	400	333	33.3	10.0

TYPE B12P 600VRMS RATED

800VDC RATED OR 840 VOLTS PEAK (AC PLUS DC VOLTS) Part No.	D	L	MAX. AC RATING —65°C TO 100°C RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps
B12P103KXC	.400	1.063	600	600	600	1.5
B12P123KXC	.400	1.063	600	600	600	1.8
B12P153KXC	.400	1.063	600	600	600	2.3
B12P183KXC	.400	1.063	600	600	600	2.7
B12P223KXC	.400	1.063	600	600	509	2.8
B12P273KXC	.400	1.063	600	600	414	2.8
B12P333KXC	.400	1.063	600	600	339	2.8
B12P393KXC	.400	1.063	600	600	287	2.8
B12P473KXC	.500	1.125	600	600	272	3.2
B12P563KXC	.500	1.125	600	600	236	3.3
B12P683KXC	.500	1.125	600	600	200	3.4
B12P753KXC	.500	1.375	600	600	200	3.75
B12P823KXC	.500	1.375	600	600	195	4.0
B12P923KXC	.562	1.375	600	600	191	4.4
B12P104KXC	.562	1.375	600	600	180	4.5
B12P124KXC	.562	1.375	600	600	160	4.8
B12P154KXC	.562	1.375	600	600	134	5.0
B12P184KXC	.670	1.375	600	600	120	5.4
B12P224KXC	.670	1.375	600	600	102	5.6
B12P274KXC	.670	1.875	600	600	101	6.8
B12P334KXC	.670	1.875	600	600	82	6.8
B12P394KXC	.670	1.875	600	600	70	6.8
B12P474KXC	.750	1.875	600	600	61	7.2
B12P564KXC	.750	1.875	600	535	53.5	7.5
B12P684KXC	.750	1.875	600	470	47	8.0
B12P754KXC	.750	2.375	600	533	53.3	10.0
B12P824KXC	1.0	2.375	600	488	48.8	11.0

ORDERING INFORMATION: All part numbers listed in tables have a capacitance tolerance of ±10% and are supplied with bare metal (unsleeved) cases.

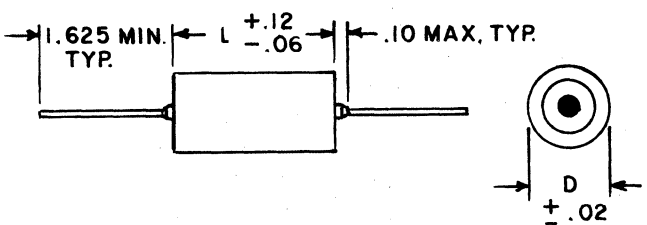
TECHNICAL INFORMATION: These capacitors can be damaged when you solder to the lead wires due to possible overheating that can occur. Place a suitable heat sink on the lead wire between the solder beads on the hermetic seal and the area of wire lead to be soldered.

For initial design, when operating the capacitors at high current levels it is suggested that you monitor the capacitor heat rise on the leads adjacent to the solder beads to verify that it does not exceed 20°C above ambient.

All maximum current ratings shown should result in less than 20°C heat rise with continuous duty operation under normal convection conditions.

Avoid tearing of solder beads when bending wire leads by using a suitable clamping fixture for lead bending.

PART DIMENSIONS AND TOLERANCES



LEAD SIZE

.032 ±.003 (#20AWG) TINNED COPPER-CLAD STEEL FOR CASE DIAMETER .312

.041 ±.003 (#18AWG) TINNED COPPER FOR CASE DIAMETER .400 & LARGER

Component Research (CRC)

B55 FOIL POLYPROPYLENE CAPACITOR

SPECIFICATIONS & QUALITY CONFORMANCE

400VRMS, 600VRMS, RATED FROM −55°C TO +85°C (HIGHER RATINGS AVAILABLE)

Series B55 capacitors are designed for continuous duty operation over the full temperature range from −55°C to +85°C at the rating for voltage, current and frequency listed in the specifications.

The maximum RMS current or peak current can be exceeded with reduced duty cycle or tone burst operation, provided that peak rated voltages are not exceeded, and provided the heat rise measured at the terminals and within ¼" of the hermetic seals does not exceed 20°C.

Heat rise is generally measured with the capacitor located in a room temperature environment allowing for non-cooled normal convection. Lead size and distance to the power source must be adequate to prevent undue heat sinking or generation during measurement.

HIGH CURRENT HANDLING WITH LOW LOSS

Series B55 capacitors have very low series resistance terminations, in the range of several milliohms at 100KHz, and can handle very high peak current discharge currents. Typically it is estimated that a 1uF capacitor can handle over 3000 amperes of peak current at repetition rates up to 10 pulses per second. Testing is now in process to develop meaningful pulse current limits to be added to future specifications for B55 capacitors.

FREEDOM FROM CORONA INCEPTION AND INTERNAL HOT SPOTS

Commercial type AC rated capacitors may be adequate for 60Hz and possibly 400Hz long term life. CRC capacitors are designed to operate up to 40KHz without abnormal hot spot conditions, without corona inception, with constant controlled low loss terminations which remain reliable after years of use, after operation during severe environmental conditions.

40KHz RATED FOR HIGH CURRENT HANDLING UP TO 85°C

CRC capacitors use a patented low loss termination which remains reliable after years of operation under severe environmental conditions. Whereas commercial type AC rated capacitors may be adequate for 60Hz and possibly 400Hz long term life, the use of CRC terminations enables these capacitors to operate up to 40KHz without abnormal hot spot conditions or corona inception.

HERMETICALLY SEALED, RUGGED AEROSPACE, MILITARY CONSTRUCTION

CRC true hermetic sealing preserves the high quality performance of Series B55 foil polypropylene capacitors and protects the dielectric materials from chemical attack. Merely potting non-hermetic type capacitors is poor insurance against long term loss of dielectric strength and life. It has been found that attack by vapor ingestion of chemicals of non-hermetic polypropylene capacitors has resulted in failure in life or long term operation.

AVAILABLE WITH 400Hz OR 40KHz BURN-IN OPTIONS

AC burn-in options at additional cost are available for critical applications. The most economical AC burn-in is at rated RMS voltage @ 400Hz at 85°C. Burn-in @ 40KHz at maximum rated current is also available for those applications where long term use at high current is anticipated. Group "A" testing is performed 100%. This testing consists of vital capacitor parameters performed after burn-in to tight specification limits. This ensures the high reliability required to assure our customers of fault free operation under harsh operating conditions.

TYPE B55 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METHOD	TEST LIMIT	INSPECTION LEVEL
1	BURN-IN	16 hrs. minimum at 120% rated AC voltage at 400Hz at 85°C	4.7.2 MIL-C-83421	No physical damage	100% Test
2	THERMAL AGING	5 cycles minimum −55°C to 85°C	4.7.3	No physical damage	100% Test
3	SEAL TEST	Gross leak Meth. 112 MIL-STD-202 Cond. B		No continuous bubble stream or oil leaks as required	100% Test
4	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage, or at 600VDC. whichever is less	4.7.7	100,000 megohm-uF, need not exceed 1,000,000 megohms	100% Test
5	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
6	% DISSIPATION FACTOR	At 25°C at 10KHz	4.7.9	.05% maximum	100% Test
7	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions and workmanship	4.7.1	Per specification	1.0% AQL

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Component Research CRC

B52 FOIL POLYCARBONATE CAPACITOR

DIMENSIONS & AC RATINGS

	TYPE B52F 400VRMS RATED							TYPE B52P 600VRMS RATED						
	600VDC RATED OR 600 VOLTS PEAK (AC PLUS DC VOLTS)			MAX. AC RATING —65°C TO 100°C				800VDC RATED OR 840 VOLTS PEAK (AC PLUS DC VOLTS)			MAX. AC RATING —65°C TO 100°C			
uF	Part No.	D	L	RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps	Part No.	D	L	RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps
.033	B52F333KXC	.400	1.063	400	400	360	3.0	B52P333KXC	.500	1.375	600	600	600	5.0
.039	B52F393KXC	.400	1.063	400	400	308	3.0	B52P393KXC	.500	1.375	600	600	513	5.0
.047	B52F473KXC	.500	1.125	400	400	306	3.6	B52P473KXC	.500	1.375	600	600	426	5.0
.056	B52F563KXC	.500	1.125	400	400	255	3.6	B52P563KXC	.500	1.375	600	600	357	5.0
.068	B52F683KXC	.500	1.125	400	400	235	4.0	B52P683KXC	.562	1.375	600	600	353	6.0
.075	B52F753KXC	.500	1.375	400	400	235	4.4	B52P753KXC	.562	1.375	600	600	320	6.0
.082	B52F823KXC	.500	1.375	400	400	235	4.8	B52P823KXC	.562	1.375	600	600	293	6.0
.092	B52F923KXC	.562	1.375	400	400	230	5.3	B52P923KXC	.670	1.375	600	600	305	7.0
.1	B52F104KXC	.562	1.375	400	400	220	5.5	B52P104KXC	.670	1.375	600	600	280	7.0
.12	B52F124KXC	.562	1.375	400	400	200	6.0	B52P124KXC	.670	1.375	600	600	233	7.0
.15	B52F154KXC	.562	1.375	400	400	160	6.0	B52P154KXC	.670	1.875	600	600	214	8.0
.18	B52F184KXC	.670	1.375	400	400	155	7.0	B52P184KXC	.670	1.875	600	600	178	8.0
.22	B52F224KXC	.670	1.375	400	400	127	7.0	B52P224KXC	.670	1.875	600	600	146	8.0
.27	B52F274KXC	.670	1.875	400	400	118	8.0	B52P274KXC	.750	1.875	600	600	133	9.0
.33	B52F334KXC	.670	1.875	400	400	97	8.0	B52P334KXC	.750	1.875	600	600	109	9.0
.39	B52F394KXC	.670	1.875	400	400	82	8.0	B52P394KXC	.750	2.375	600	600	103	10.0
.47	B52F474KXC	.750	1.875	400	400	77	9.0	B52P474KXC	.750	2.375	600	600	85.1	10.0
.56	B52F564KXC	.750	1.875	400	400	64	9.0							
.68	B52F684KXC	.750	2.375	400	400	53	9.0							
.75	B52F754KXC	.750	2.375	400	400	53	10.0							
.82	B52F824KXC	.750	2.375	400	400	49	10.0							

ORDERING INFORMATION: All part numbers listed in tables have a capacitance tolerance of ±10% and are supplied with bare metal (unsleeved) cases.

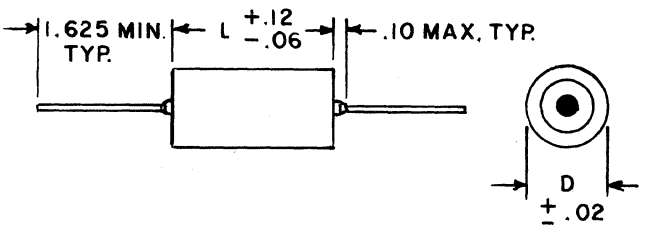
TECHNICAL INFORMATION: These capacitors can be damaged when you solder to the lead wires due to possible overheating that can occur. Place a suitable heat sink on the lead wire between the solder beads on the hermetic seal and the area of wire lead to be soldered.

For initial design, when operating the capacitors at high current levels it is suggested that you monitor the capacitor heat rise on the leads adjacent to the solder beads to verify that it does not exceed 20°C above ambient.

All maximum current ratings shown should result in less than 20°C heat rise with continuous duty operation under normal convection conditions.

Avoid tearing of solder beads when bending wire leads by using a suitable clamping fixture for lead bending.

PART DIMENSIONS AND TOLERANCES



LEAD SIZE
.041 ±.003 (#18AWG) TINNED COPPER FOR CASE DIAMETER .400 & LARGER

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

Component Research CRC

B15 METALLIZED POLYPROPYLENE CAPACITOR

SPECIFICATIONS & QUALITY CONFORMANCE

400VRMS, 600VRMS, RATED −55°C TO +85°C

Series B15 metallized polypropylene capacitors have lower loss than Series B14 metallized polysulfone capacitors and therefore are superior for power resonating applications requiring minimum loss. The B15 capacitors are however limited for use in 85°C or lower temperature applications. CRC can supply special high temperature low loss teflon capacitors for 200°C power resonating applications if required.

When Series B15 specifications are completed, RMS ratings above 600VRMS will be available together with information covering this product line.

LOW LOSS, HIGH Q, LIGHT WEIGHT, HIGH POWER RATED, HERMETICALLY SEALED

The B15 capacitors are lighter in weight than any other hermetically sealed capacitor with equivalent current and voltage ratings at 40KHz. Typically a 5.6uF, 400VRMS, capacitor in a 1.25″ x 3.440″ case weighs approximately 110 grams and is rated to handle 35 amps at 40KHz.

Polypropylene film like many other dielectrics is affected by chemical attack of solvents, epoxies and contamination. True hermetic sealing of CRC's capacitors protects them from outside chemical attack and assures that long term high quality performance can be maintained.

RUGGED LOW LOSS TERMINATIONS FOR 100% DUTY CYCLE OPERATING LIFE

The large amount of power that B15 capacitors can handle is a result of years of development searching for all possible means of reducing capacitor losses and preserving the integrity of CRC's rugged capacitor terminations. When CRC's metallized polypropylene capacitors are subjected to temperature extremes, they surpass commercial type products in their ability to maintain a constant low loss equivalent series resistance and can maintain their low power factor for critical aerospace applications. Where extremely high pulse currents may be encountered Series B55 should be considered.

AC RATED TO 40KHz UP TO 85°C

Series B15 capacitors are rated up to 40KHz and are ideal for power resonating circuits. Due to a negative temperature coefficient of approximately 200 PPM/°C a 10°C temperature increase due to applied power or applied temperature will cause the capacitance to decrease approximately 0.2%.

AVAILABLE WITH AC BURN-IN AND OTHER SCREENING OPTIONS

CRC manufactures larger capacitors of similar construction to the B15 series in rectangular cases for power inverter applications requiring low loss filtering of several hundreds of amperes of ripple at frequencies 20KHz and higher.

Further developments in lowering capacitor losses are currently being completed at CRC and will result in further improved ratings for B15 and other new model capacitors.

TYPE B15 QUALITY CONFORMANCE INSPECTION

NO. TEST	TEST	TEST CONDITIONS	TEST METHOD	TEST LIMIT	INSPECTION LEVEL
1	BURN-IN	16 hrs. minimum at 120% rated AC voltage at 400Hz at 85°C	4.7.2 MIL-C-83421	No physical damage	100% Test
2	THERMAL AGING	5 cycles minimum −55°C to 85°C	4.7.3	No physical damage	100% Test
3	SEAL TEST	Gross leak Meth. 112 MIL-STD-202 Cond. B		No continuous bubble stream or oil leaks as required	100% Test
4	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage, or at 600VDC, whichever is less	4.7.7	100,000 megohm-uF, need not exceed 1,000,000 megohms	100% Test
5	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
6	% DISSIPATION FACTOR	At 25°C at 10KHz	4.7.9	0.05% maximum	100% Test
7	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions and workmanship	4.7.1	Per specification	1.0% AQL

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

Component Research (CRC)

B 15 METALLIZED POLYPROPYLENE CAPACITOR

DIMENSIONS & AC RATINGS

	TYPE B15F 400VRMS RATED							TYPE B15P 600VRMS RATED						
	600VDC RATED OR 600 VOLTS PEAK (AC PLUS DC VOLTS)			MAX. AC RATING —55°C TO 85°C				800VDC RATED OR 840 VOLTS PEAK (AC PLUS DC VOLTS)			MAX. AC RATING —55°C TO 85°C			
uF	Part No.	D	L	RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps	Part No.	D	L	RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps
.01	B15F103KXW	.312	.813	400	400	400	2.5	B15P103KXC	.400	1.063	600	600	600	3.5
.012	B15F123KXW	.312	.813	400	400	400	2.5	B15P123KXC	.400	1.063	600	600	600	3.5
.015	B15F153KXW	.312	.813	400	400	400	2.5	B15P153KXC	.400	1.063	600	600	600	3.5
.018	B15F183KXW	.312	.813	400	400	400	2.5	B15P183KXC	.400	1.063	600	600	600	3.5
.022	B15F223KXC	.400	.813	400	400	400	3.0	B15P223KXC	.400	1.063	600	600	600	3.5
.027	B15F273KXC	.400	.813	400	400	400	3.0	B15P273KXC	.400	1.063	600	600	518	3.5
.033	B15F333KXC	.400	.813	400	400	364	3.0	B15P333KXC	.400	1.063	600	600	424	3.5
.039	B15F393KXC	.400	.813	400	400	308	3.0	B15P393KXC	.400	1.063	600	600	369	3.5
.047	B15F473KXC	.400	1.063	400	400	298	3.5	B15P473KXC	.500	1.125	600	600	340	4
.056	B15F563KXC	.400	1.063	400	400	250	3.5	B15P563KXC	.500	1.125	600	600	286	4
.068	B15F683KXC	.400	1.063	400	400	206	3.5	B15P683KXC	.500	1.125	600	600	235	4
.075	B15F753KXC	.400	1.063	400	400	187	3.5	B15P753KXC	.500	1.375	600	600	267	5
.082	B15F823KXC	.500	1.125	400	400	195	4	B15P823KXC	.500	1.375	600	600	244	5
.092	B15F923KXC	.500	1.125	400	400	174	4	B15P923KXC	.562	1.375	600	600	261	6
.1	B15F104KXC	.500	1.125	400	400	160	4	B15P104KXC	.562	1.375	600	600	240	6
.12	B15F124KXC	.500	1.375	400	400	167	5	B15P124KXC	.562	1.375	600	600	200	6
.15	B15F154KXC	.500	1.375	400	400	134	5	B15P154KXC	.562	1.375	600	600	160	6
.18	B15F184KXC	.562	1.375	400	400	133	6	B15P184KXC	.670	1.375	600	600	155	7
.22	B15F224KXC	.562	1.375	400	400	109	6	B15P224KXC	.670	1.375	600	600	127	7
.27	B15F274KXC	.562	1.375	400	400	88.8	6	B15P274KXC	.670	1.875	600	600	118	8
.33	B15F334KXC	.670	1.375	400	400	84.7	7	B15P334KXC	.670	1.875	600	600	96.8	8
.39	B15F394KXC	.670	1.375	400	400	72.1	7	B15P394KXC	.670	1.875	600	600	82.4	8
.47	B15F474KXC	.670	1.875	400	400	68.1	8	B15P474KXC	.750	1.875	600	600	93.6	11
.56	B15F564KXC	.670	1.875	400	400	57	8	B15P564KXC	.750	1.875	600	600	78.5	11
.68	B15F684KXC	.670	1.875	400	400	47	8	B15P684KXC	.750	1.875	600	600	64.7	11
.75	B15F754KXC	.750	1.875	400	400	58.6	11	B15P754KXC	.750	2.375	600	600	69.3	13
.82	B15P824KXC	.750	1.875	400	400	53.7	11	B15P824KXC	1.0	2.375	600	600	63.4	15
.92	B15F924KXC	.750	2.375	400	400	56.6	13							
1.0	B15F105KXC	.750	2.375	400	400	52	13							
1.2	B15F125KXC	.750	2.375	400	400	43.3	13							

ORDERING INFORMATION: All part numbers listed in tables have a capacitance tolerance of ±10% and are supplied with bare metal (unsleeved) cases.

TECHNICAL INFORMATION: These capacitors can be damaged when you solder to the lead wires due to possible overheating that can occur. Place a suitable heat sink on the lead wire between the solder beads on the hermetic seal and the area of wire lead to be soldered.

For initial design, when operating the capacitors at high current levels it is suggested that you monitor the capacitor heat rise on the leads adjacent to the solder beads to verify that it does not exceed 20°C above ambient.

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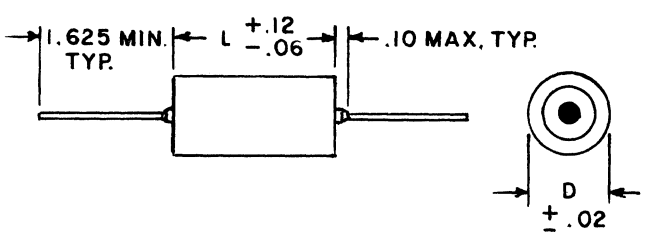
Avoid tearing of solder beads when bending wire leads by using a suitable clamping fixture for lead bending.

PART DIMENSIONS AND TOLERANCES



LEAD SIZE

.032 ±.003 (#20AWG) TINNED COPPER-CLAD STEEL FOR CASE DIAMETER .312

.041 ±.003 (#18AWG) TINNED COPPER FOR CASE DIAMETER .400 & LARGER

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615. TWX: (910) 343-6864

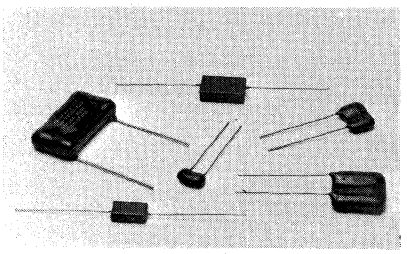
Quality and commitment backed by over 125 years combined experience in the industry makes CDE/SW *the* choice for capacitors.

CDE CORNELL DUBILIER

Mica Capacitors

As the major manufacturer of Mica capacitors **CDE/SW** can supply you with the highest quality and widest selection of Mica capacitors available.

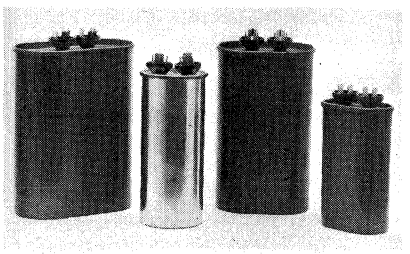
- Dipped Mica Capacitors - Commerical & Military
- Molded Mica Capacitors - Commercial & Military
- Transmitting Type Mica Capacitors - Commercial
- Fixed Terminal Mica Capacitors - Commercial



AC Oil Capacitors

CDE provides the highest quality, longest life A. C. capacitors available for HID lighting and motor run applications.

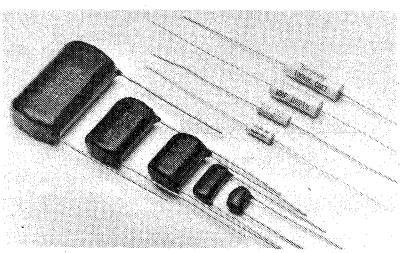
- Soggy Foil™ Construction
- UL Approved
- Built to EIA Standards
- Very High Corona Inception Levels
- Round and Oval Construction



Film Capacitors

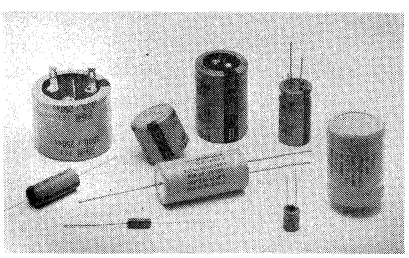
CDE offers a wide range of standard and custom design Film capacitors.

- Miniature Wrapped or Dipped Film/Foil
- Sub-miniature Metallized Film Styles
- High Grade Polyester, Polypropylene or Polycarbonate Film Dielectrics
- High Temperature, Low ESR, Low D. F. Film Capacitors



Aluminum & Tantalum Electrolytic Capacitors

- Computer Grade with Screw Terminals
- Computer Grade with Printed Circuit Leads
- Miniature Axial and Radial Styles
- Sub-miniature/Extended Temperature Styles
- MIL-C-39018 - Screw, Axial and Radial Styles
- Dual Rated Tantalum Foil Capacitors
- Wet Anode Style Tantalum Capacitors



Cornell Dubilier Electronics / **Sangamo Weston Components Division**

1605 E. Rodney French Blvd.
New Bedford, MA 02744
TEL: (617) 996-8561
FAX: (617) 996-3830

P.O. Box 128
Pickens, SC 29671
TEL: (803) 878-6311
FAX: (803) 878-7257

SANGAMO WESTON
Cornell Dubilier
COMPONENTS DIVISION

Capacitors

a division of
CSI Technologies, Inc.

SUMMARY — CAPACITANCE/ VOLTAGE RATINGS

SERIES	TYPE	FEATURE	1nF 10nF 100nF 1uF 10uF 100uF
FT	FILTER	TUBULAR XHV	50 - 250 kV
M	FILTER	XMITTER	0.6-40 kV
CP	FILTER	MIL SPEC	0.6 - 2.5 kV 3.0 - 5.0 kV 6.0 - 12.5 kV
AE	PULSE	RAILS X LOW L	5 - 40 kV
MED	DEFIB	SMALLEST	2.8 - 8 kV
FC	INDUCTOR	LIGHT WEIGHT	.3 mH - 200 mH
WPC	PULSE	RAILS LOW L HIGH E	35 - 100 kV
WM	PULSE	GENERAL PURPOSE FLASHLAMP	2 - 5 kV 7.5 kV 15 kV 25 kV
ES	ENERGY STORAGE	HIGH R.R. WIDE ΔT LOW ESR NON-FLAM.	3300 JOULES 3 - 50 kV 5500 JOULES 4 - 125 kV 8800 JOULES 4 - 125 kV
NB	AC	LOW D.F. BALLAST	1.3 - 4.0 kVAC
CUSTOM	ANY WOUND DIELECTRIC	125° C 5 n H 10 KJ TO 250 kVDC	

Capacitors
a division of
CSI Technologies, Inc.

810 Rancheros Drive, San Marcos, CA 92069-3009, (619) 747-4000, TLX WUI 697832 or RCA 295433

STANLEY ELECTRONICS DIV.

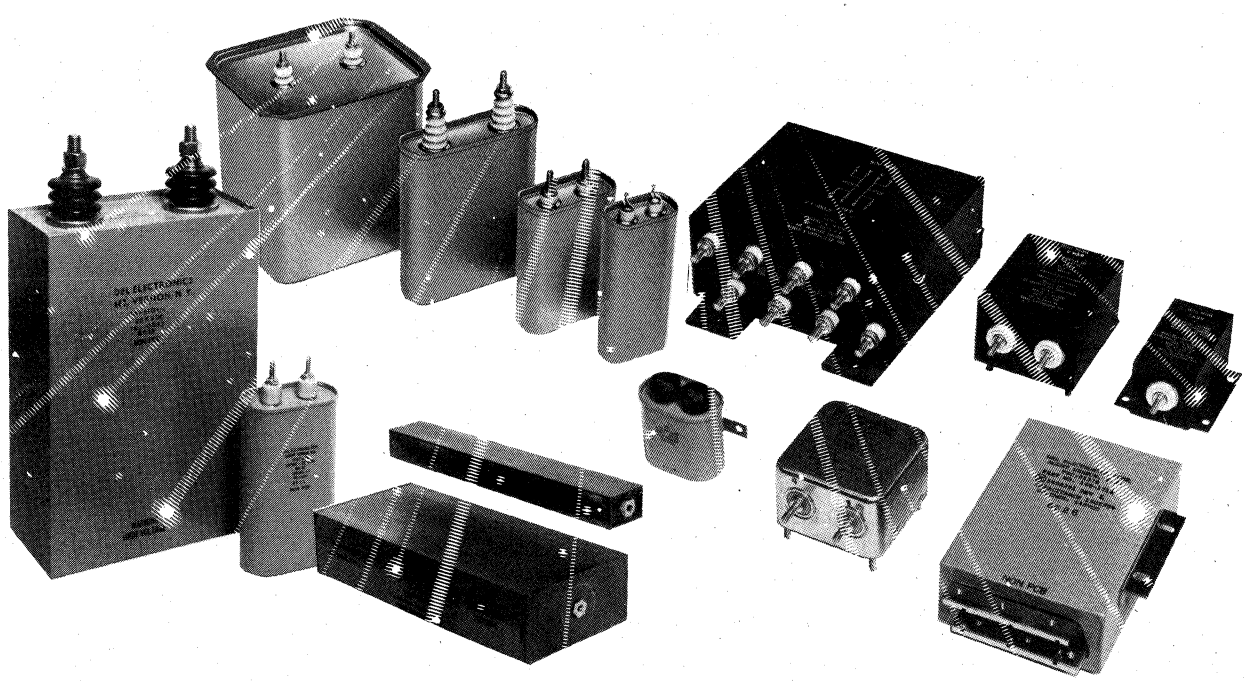
- Reconstituted Mica Capacitors
- Pulse Forming Networks
- Phenolic Round Tube Capacitors
- Phenolic Rectangular Tube Capacitors
- Rectangular Steel Can Capacitors
- Wrap and Fill Capacitors
- Custom Designed Capacitors

DEL

HIGH VOLTAGE CAPACITORS

Custom Design—Mil Specifications

DEL ELECTRONICS will develop custom capacitors for critical applications where size, shape and electrical properties are critical. Polypropylene, Mylar, or Paper dielectrics in combination with mineral or silicone oil are utilized in a wide range of AC, pulse and DC applications. Reconstituted mica capacitors are available for high temperature, small size and low weight requirements.



- Voltage to 200KV
- Current to 200A RMS, 10,000A Pk
- Frequency DC to 100KHz
- Q to 1000
- Low ESR, Low Inductance, High IR

DEL

DEL ELECTRONICS CORP.
250 East Sanford Boulevard
Mount Vernon, NY 10550
Telephone: (914) 699-2000
TWX: 710-562-0130 FAX: (914) 699-4005

MULTILAYER CERAMIC CHIP CAPACITORS
CLASS I COG (NPO) CHARACTERISTICS

Delcap
Division

SIZE		0805	1206	1210	1808	1812	1825	
Length	In (mm)	.080 ± .010 (2.03 ± .25)	.120 ± .010 (3.05 ± .25)	.125 ± .010 (3.18 ± .25)	.180 ± .010 (4.57 ± .25)	.175 ± .010 (4.45 ± .25)	.185 ± .015 (4.57 ± .38)	
Width	In (mm)	.050 ± .010 (1.27 ± .25)	.060 ± .010 (1.52 ± .25)	.095 ± .010 (2.41 ± .25)	.080 ± .010 (2.03 ± .25)	.125 ± .010 (3.18 ± .25)	.250 ± .015 (6.35 ± .38)	
Thickness (max)	In (mm)	.050 (1.27)	.050 (1.27)	.065 (1.65)	.065 (1.65)	.065 (1.65)	.065 (1.65)	
Termination Band	In (mm)	.020 ± .010 (.508 ± .25)	.020 ± .010 (.508 ± .25)	.020 ± .010 (.508 ± .25)	.020 ± .010 (.508 ± .25)	.020 ± .010 (.508 ± .25)	.020 ± .010 (.508 ± .25)	Cap.
VDCW		50 100 200	50 100 200	50 100 200	50 100 200	50 100 200	50 100 200	Code
Cap. (pF)	1.0	1.0						1R0
	1.2							1R2
	1.5							1R5
	1.8							1R8
	2.2							2R2
	2.7							2R7
	3.3							3R3
	3.9							3R9
	4.7							4R7
	5.6							5R6
	6.8							6R8
	8.2							8R2
	10	10						100
	12							120
	15		15					150
	18							180
	22							220
	27		27					270
	33							330
	39							390
	47							470
	56							560
	68				68			680
	82							820
	100			100				101
	120							121
	150							151
	180			180	180			181
	220							221
	270				2700			271
	330							331
	390	390				390		391
	470							471
	560							561
	680	680	680			680		681
	820							821
	1000	1000		4700	5600	5600	1000	102
	1200		1200					122
	1500		1500	3900	3900	6800	1500	152
	1800							182
	2200							222
	2700			2700	2700			272
	3300							332
	3900							392
	4700							472
	5600							562
	6800							682
	8200							822
Cap. (μF)	.010					.010	.012	103
	.012							123
	.015							153
	.018							183
	.022						.022	223
	.027						.027	273
	.033							333
	.039							393

Note: Body dimensions are without solder termination.

Consult Factory for values not shown.

Capacitance Range	1.0 pF – .027 μF
Capacitance Tolerance	± .25 pF ± .5 pF, ± 1%, ± 2% ± 5%, ± 10%
Voltage Rating	50, 100 and 200
Operating Temp. Range	-55°C to +125°C
ΔC Max (Capacitance @ 0 VDC)	0 ± 30 ppm/°C
ΔC Max (Capacitance @ Rated VDC)	0 ± 30 ppm/°C
Dissipation Factor @ 25°C	0.15% Max (0.10% Typical)
Test Conditions @ 25°C	1 MHz≤100pF, 1KHz>100pF (1.0 + .2 Vrms)
Dielectric Withstanding Voltage (Flash)	2.5 x Vdcw for 5±1 sec. current limited to 50mA
Insulation Resistance (I.R.) @ 25°C	100 K megohms (min) or 1000 ohm-farads (min) whichever is less
Insulation Resistance (I.R.) @ 125°C	10 K megohms (min) or 100 ohm-farads (min) whichever is less
Aging Rate % C/Decade Hr	0%
Terminations	• Palladium-Silver • Palladium-Silver/Solder (Sn62) • Nickel barrier layer/Solder (Sn62)

For further information, call your nearest Sales Representative – or call us direct.

270 Quaker Road, East Aurora, NY 14052-0449
Phone (716) 652-3600 Telex 91-293 Fax (716) 652-4814

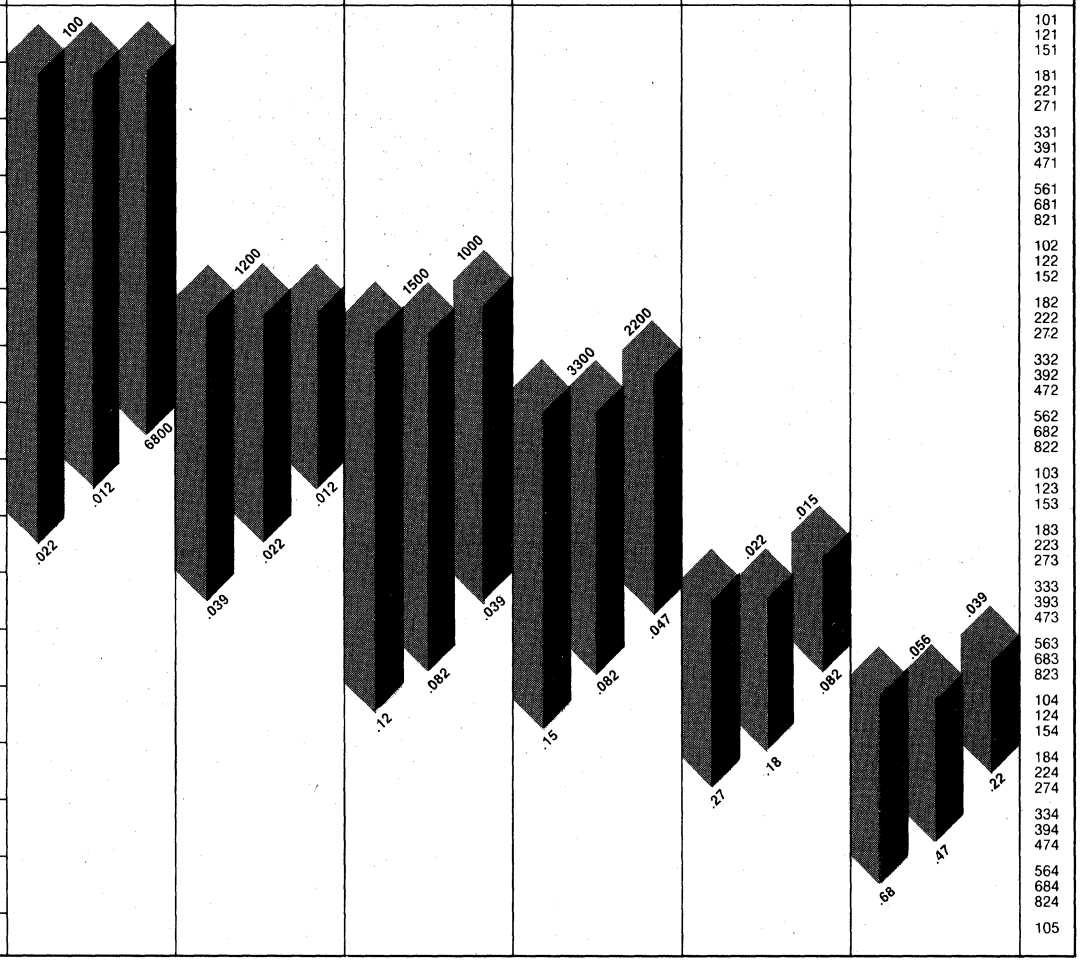
AMERICAN PRECISION INDUSTRIES
Electronic Components Group

....MADE IN AMERICA BY AMERICAN CRAFTSMEN TO AMERICAN STANDARDS OF EXCELLENCE.

MULTILAYER CERAMIC CHIP CAPACITORS
CLASS II X7R CHARACTERISTICS

Delcap Division

SIZE		0805	1206	1210	1808	1812	1825	
Length	In	.080 ± .010	.120 ± .010	.125 ± .010	.180 ± .010	.175 ± .010	.185 ± .015	
	(mm)	(2.03 ± .25)	(3.05 ± .25)	(3.18 ± .25)	(4.57 ± .25)	(4.45 ± .25)	(4.57 ± .38)	
Width	In	.050 ± .010	.060 ± .010	.095 ± .010	.080 ± .010	.125 ± .010	.250 ± .015	
	(mm)	(1.27 ± .25)	(1.52 ± .25)	(2.41 ± .25)	(2.03 ± .25)	(3.18 ± .25)	(6.35 ± .38)	
Thickness (max)	In	.050	.050	.065	.065	.065	.065	
	(mm)	(1.27)	(1.27)	(1.65)	(1.65)	(1.65)	(1.65)	
Termination Band	In	.020 ± .010	.020 ± .010	.020 ± .010	.020 ± .010	.020 ± .010	.020 ± .010	Cap.
	(mm)	(.508 ± .25)	(.508 ± .25)	(.508 ± .25)	(.508 ± .25)	(.508 ± .25)	(.508 ± .25)	
VDCW		50 100 200	50 100 200	50 100 200	50 100 200	50 100 200	50 100 200	Code



Note: Body dimension are without solder termination.

Consult Factory for values not shown.

Capacitance Range	100 pF – .68 μF	Test Conditions @ 25°C	1KHz (1.0 ± .2 Vrms)
Capacitance Tolerance	± .5, ± 10%, ± 20%	Dielectric Withstanding Voltage (Flash)	2.5 x Vdcw for 5±1 sec. current limited to 50mA
Voltage Rating	50, 100 and 200	Insulation Resistance (I.R.) @ 25°C	100 K megohms (min) or 1000 ohm-farads (min) whichever is less
Operating Temp. Range	-55°C to +125°C	Insulation Resistance (I.R.) @ 125°C	10 K megohms (min) or 100 ohm-farads (min) whichever is less
ΔC Max (Capacitance @ 0 VDC)	± 15%	Aging Rate % C/Decade Hr	Less than 1.5%
ΔC Max (Capacitance @ Rated VDC)	N/A	Terminations	• Palladium-Silver • Palladium-Silver/Solder (Sn62) • Nickel barrier layer/Solder (Sn62)
Dissipation Factor @ 25°C	2.5% Max (1.5% Typical)		

All of our products are manufactured in facilities located in the U.S.A.
For further information on our complete line or our capability for producing special components, call your nearest Sales Representative – or call us direct.

270 Quaker Road, East Aurora, NY 14052-0449
Phone (716) 652-3600 Telex 91-293 Fax (716) 652-4814

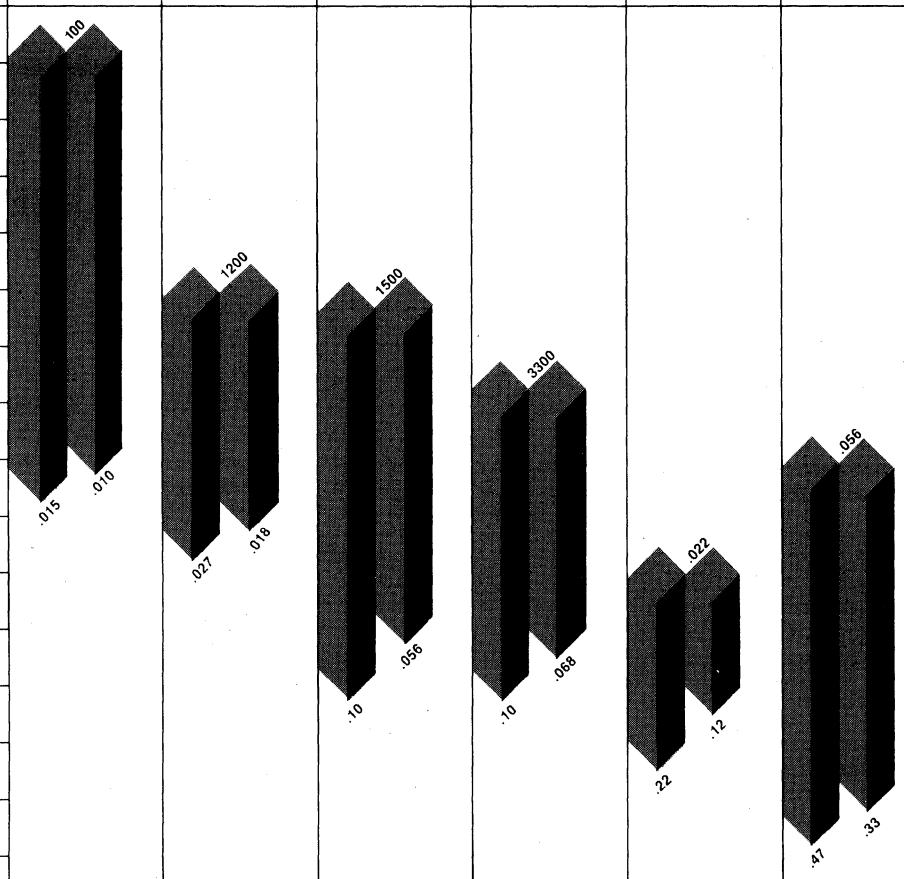
AMERICAN PRECISION INDUSTRIES
Electronic Components Group

....MADE IN AMERICA BY AMERICAN CRAFTSMEN TO AMERICAN STANDARDS OF EXCELLENCE.

MULTILAYER CERAMIC CHIP CAPACITORS
BX DIELECTRIC CHARACTERISTICS

Delcap *Division*

SIZE		0805	1206	1210	1808	1812	1825	
Length	In	.080 ± .010	.120 ± .010	.125 ± .010	.180 ± .010	.175 ± .010	.185 ± .015	
	(mm)	(2.03 ± .25)	(3.05 ± .25)	(3.18 ± .25)	(4.57 ± .25)	(4.45 ± .25)	(4.57 ± .38)	
Width	In	.050 ± .010	.060 ± .010	.095 ± .010	.080 ± .010	.125 ± .010	.250 ± .015	
	(mm)	(1.27 ± .25)	(1.52 ± .25)	(2.41 ± .25)	(2.03 ± .25)	(3.18 ± .25)	(6.35 ± .38)	
Thickness (max)	In	.050	.050	.065	.065	.065	.065	
	(mm)	(1.27)	(1.27)	(1.65)	(1.65)	(1.65)	(1.65)	
Termination Band	In	.020 ± .010	.020 ± .010	.020 ± .010	.020 ± .010	.020 ± .010	.020 ± .010	Cap.
	(mm)	(.508 ± .25)	(.508 ± .25)	(.508 ± .25)	(.508 ± .25)	(.508 ± .25)	(.508 ± .25)	
VDCW		50 100	50 100	50 100	50 100	50 100	50 100	Code
Cap. (pF)	100							101
	120							121
	150							151
	180							181
	220							221
	270							271
	330							331
	390							391
	470							471
	560							561
	680							681
	820							821
	1000							102
	1200							122
	1500							152
	1800							182
	2200							222
	2700							272
	3300							332
	3900							392
	4700							472
	5600							562
	6800							682
	8200							822
Cap. (μF)	.010							103
	.012							123
	.015							153
	.018							183
	.022							223
	.027							273
	.033							333
	.039							393
	.047							473
	.056							563
	.068							683
	.082							823
	.10							104
	.12							124
	.15							154
	.18							184
	.22							224
	.27							274
	.33							334
	.39							394
	.47							474
	.56							564
	.68							684
	.82							824



Note: Body dimensions are without solder termination.

Consult Factory for values not shown.

Capacitance Range	100 pF – .47 μF
Capacitance Tolerance	± .5, ± 10%, ± 20%
Voltage Rating	50 and 100
Operating Temp. Range	-55° C to +125° C
ΔC Max (Capacitance @ 0 VDC)	± 15%
ΔC Max (Capacitance @ Rated VDC)	+ 15%, – 25%
Dissipation Factor @ 25° C	2.5% Max (1.5% Typical)
Test Conditions @ 25° C	1KHz (1.0 ± .2 Vrms)
Dielectric Withstanding Voltage (Flash)	2.5 x Vdcw for 5±1 sec. current limited to 50mA
Insulation Resistance (I.R.) @ 25° C	100 K megohms (min) or 1000 ohm-farads (min) whichever is less
Insulation Resistance (I.R.) @ 125° C	10 K megohms (min) or 100 ohm-farads (min) whichever is less
Aging Rate % C/Decade Hr	Less than 1.5%
Terminations	• Palladium-Silver • Palladium-Silver/Solder (Sn62) • Nickel barrier layer/Solder (Sn62)

All of our products are manufactured in facilities located in the U.S.A.
For further information on our complete line or our capability for producing special components, call your nearest Sales Representative – or call us direct.

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AMERICAN PRECISION INDUSTRIES
Electronic Components Group

....MADE IN AMERICA BY AMERICAN CRAFTSMEN TO AMERICAN STANDARDS OF EXCELLENCE.

ELECTRONIC CONCEPTS INC.

TYPE 5MP SWITCH-MODE POWER SUPPLY CAPACITORS METALLIZED POLYPROPYLENE

Type 5MP capacitors have been developed by Electronic Concepts for use in switching power supplies. These metallized polypropylene capacitors are manufactured by using special techniques in order to achieve the optimum characteristics for high current, high capacitance, low ESR applications.

For filter designs where capacitance of 50 mfd or less is suitable for the circuit, type 5MP affords the opportunity to improve general system design. These unique capacitors also exhibit none of the "roll-off" of capacitance with frequency often associated with electrolytics.

In addition to the features which make type 5MP particularly suitable for switching applications, they are also characterized by low losses. Other advantages of polypropylene are long-term stability, retrace, low dielectric absorbtion, and high insulation resistance.

INTERNAL CONSTRUCTION

Extended foil winding (non-inductive)

ENCLOSURE

Mylar tape outerwrap

ENVIRONMENTAL

These capacitors shall meet or exceed the requirements of MIL-C-55514 for all the following:

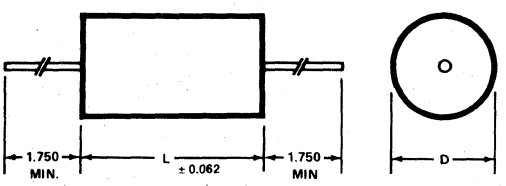
Vibration	(Para. 3.16)
Immersion	(Para. 3.21)
Shock	(Para. 3.17)
Moisture Resistance	(Para. 3.22)
Life	(Para. 3.23)

Electronic Concepts, Inc. is qualified as a supplier for the MIL versions CFR13 and CFR14 capacitors. These capacitors are manufactured to meet the requirements of MIL-C-55514/9. MIL designations are shown in the table above. The last two characters of the MIL designations (CFR13ALB106 - -) specify capacitance tolerance and failure rate respectively (CFR13ALB-106KM).

Capacitance tolerance: M = 20%, K = 10% and J = 5%.

Failure rate level: M, F, R or S

EC Type 5MP12 Military Style CFR13



All dimensions are in inches.

CATALOG NUMBERING SYSTEM

5MP 12 D 106 K

TYPE

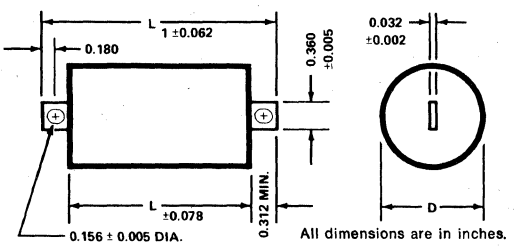
STYLE
Wrap and fill axial leads

VOLTAGE
D = 100 VDC
F = 200 VDC
J = 400 VDC

CAPACITANCE
Expressed in Picofarads, the first two digits are significant figures. The third is the number of zeroes. (e.g., 106 equals 10,000,000 pF).

TOLERANCE
M-20% K-10% J-5%
Closer tolerances upon request

EC Type 5MP16 Military Style CFR14



All dimensions are in inches.

CATALOG NUMBERING SYSTEM

5MP 16 D 106 K

TYPE

STYLE
Wrap and fill lug termination

VOLTAGE
D = 100 VDC
F = 200 VDC
J = 400 VDC

CAPACITANCE
Expressed in Picofarads, the first two digits are significant figures. The third is the number of zeroes. (e.g., 106 equals 10,000,000 pF).

TOLERANCE
M-20% K-10% J-5%
Closer tolerances upon request

OPERATING TEMPERATURE RANGE
−55°C to +105°C without derating.

CAPACITANCE TOLERANCE
Standard tolerance is ±10%. Tolerances of ±20% and ±5% are available.
NOTE: *Capacitance shall be measured at 25°C, and at or referred to a frequency of 1 KHz for all values.*

DIELECTRIC STRENGTH
Capacitors shall withstand a DC potential of twice rated voltage for one minute through a limiting resistance of 100 ohms/volt without damage or breakdown.

DISSIPATION FACTOR
When measured at the frequency specified for capacitance measurement, the dissipation factor shall not exceed 0.1%.

INSULATION RESISTANCE
When measured at the applicable test temperature, and rated voltage, after 2 minutes electrification, the insulation resistance shall equal or exceed the following values:

Megohm X Microfarads	+25°C	+85°C	+105°C
Except the insulation resistance in megohms need not exceed	300,000	30,000	3,000
	500,000	50,000	5,000

CAPACITANCE CHANGE
Temperature coefficient −200 ±50 PPM/°C from 25°C to −55°C. −350 ±50 PPM/°C from 25°C to 105°C.

ELECTRONIC CONCEPTS INC.

TYPE 5MP SWITCH-MODE POWER SUPPLY CAPACITORS METALLIZED POLYPROPYLENE

EC Type 5MP12 Military Style CFR13

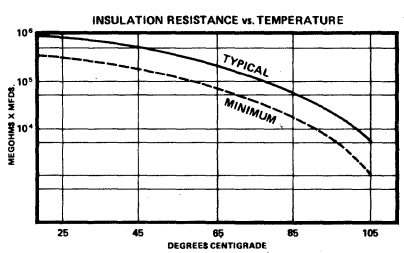
Commercial EC Part Number	Equivalent Military Designation	Capacitance Nominal in MFD	D Diameter	L Length	Lead Dia.	ESR Ohms 20-100 kHz Max	Maximum Ripple Current (AMP RMS) 20-100 kHz Case Temperature +25°C	+35°C	+45°C	+55°C	+65°C	+75°C	+85°C	Resonant Frequency in kHz	I Peak	DVDT
100 VDC																
5MP12D105-	CFR13ALB105--	1.0	.469 ±.062	.750	.032	.015	9.2	8.5	7.8	7.0	6.0	4.9	4.5	1065	407	407
5MP12D205-	CFR13ALB205--	2.0	.534 ±.062	.938	.032	.012	10.8	10.0	9.1	8.2	7.0	5.8	5.3	703	528	264
5MP12D305-	CFR13ALB305--	3.0	.624 ±.093	.938	.040	.011	12.1	11.2	10.3	9.2	8.0	6.5	5.9	574	790	263
5MP12D505-	CFR13ALB505--	5.0	.640 ±.093	1.250	.040	.010	13.8	12.7	11.6	10.4	9.0	7.4	6.7	385	828	166
5MP12D106-	CFR13ALB106--	10.0	.805 ±.093	1.500	.040	.009	15.0	15.0	14.2	12.7	11.0	9.0	8.2	248	1280	128
5MP12D206-	CFR13ALB206--	20.0	.875 ±.125	2.250	.040	.008	15.0	15.0	15.0	15.0	13.6	11.1	10.0	141	1517	76
5MP12D306-	CFR13ALB306--	30.0	1.075 ±.125	2.250	.040	.006	15.0	15.0	15.0	15.0	15.0	12.4	11.4	115	2277	76
5MP12D506-	(Not Available)	50.0	1.375 ±.125	2.250	.040	.004	15.0	15.0	15.0	15.0	15.0	13.6	12.4	89	3795	76
200 VDC																
5MP12F105-	CFR13ALC105--	1.0	.450 ±.062	1.250	.032	.020	7.3	7.3	7.3	7.3	7.2	5.9	5.4	861	250	250
5MP12F205-	CFR13ALC205--	2.0	.605 ±.093	1.250	.032	.015	12.0	12.0	11.3	10.1	8.7	7.1	6.5	609	498	249
5MP12F305-	CFR13ALC305--	3.0	.654 ±.093	1.500	.040	.013	15.0	13.8	12.6	11.3	9.8	8.0	7.3	452	576	192
5MP12F505-	CFR13ALC505--	5.0	.769 ±.093	1.750	.040	.011	15.0	15.0	14.7	13.1	11.4	9.3	8.5	323	782	156
5MP12F106-	CFR13ALC106--	10.0	.905 ±.125	2.250	.040	.009	15.0	15.0	15.0	15.0	13.8	11.3	10.3	200	1139	114
5MP12F206-	CFR13ALC206--	20.0	1.315 ±.125	2.250	.040	.006	15.0	15.0	15.0	15.0	15.0	14.1	12.8	141	2277	114
400 VDC																
5MP12J105-	CFR13ALE105--	1.0	.620 ±.093	1.500	.040	.019	9.5	9.5	9.5	9.5	9.5	7.8	7.1	784	319	319
5MP12J205-	CFR13ALE205--	2.0	.802 ±.093	1.750	.040	.015	15.0	15.0	15.0	13.4	11.6	9.5	8.7	511	521	260
5MP12J305-	CFR13ALE305--	3.0	.961 ±.125	1.750	.040	.012	15.0	15.0	15.0	15.0	13.1	10.7	9.8	417	781	260
5MP12J505-	CFR13ALE505--	5.0	1.067 ±.125	2.250	.040	.010	15.0	15.0	15.0	15.0	15.0	12.5	11.4	283	950	190
5MP12J106-	CFR13ALE106--	10.0	1.543 ±.125	2.250	.040	.006	15.0	15.0	15.0	15.0	15.0	15.0	14.1	200	1898	190

EC Type 5MP16 Military Style CFR14

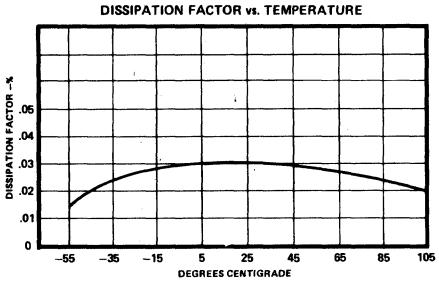
Commercial EC Part Number	Equivalent Military Designation	Capacitance Nominal in MFD	D Diameter	L Length	L_1	ESR Ohms 20-100 kHz Max	Maximum Ripple Current (AMP RMS) 20-100 kHz Case Temperature +25°C	+35°C	+45°C	+55°C	+65°C	+75°C	+85°C	Resonant Frequency in kHz	I Peak	DVDT
100 VDC																
5MP16D105-	CFR14LLB105--	1.0	.469 ±.062	.922	1.640	.015	10.3	9.5	8.7	7.8	6.7	5.5	5.0	949	407	407
5MP16D205-	CFR14LLB205--	2.0	.534 ±.062	1.110	1.828	.012	12.0	11.0	10.0	8.9	7.8	6.3	5.8	617	528	264
5MP16D305-	CFR14LLB305--	3.0	.624 ±.093	1.110	1.828	.011	13.3	12.3	11.2	10.0	8.7	7.1	6.5	504	790	263
5MP16D505-	CFR14LLB505--	5.0	.640 ±.093	1.422	2.140	.010	14.8	13.7	12.5	11.2	9.7	7.9	7.2	347	828	166
5MP16D106-	CFR14LLB106--	10.0	.805 ±.093	1.672	2.390	.009	17.8	16.5	15.0	13.5	11.7	9.5	8.7	227	1280	128
5MP16D206-	CFR14LLB206--	20.0	.875 ±.125	2.422	3.140	.008	21.6	20.0	18.3	16.4	14.2	11.6	10.6	133	1517	76
5MP16D306-	CFR14LLB306--	30.0	1.075 ±.125	2.422	3.140	.006	24.3	22.5	20.5	18.4	15.9	13.0	11.9	108	2277	76
5MP16D506-	(Not Available)	50.0	1.375 ±.125	2.422	3.140	.004	29.6	27.3	25.5	23.6	20.6	20.0	19.7	84	3795	76
200 VDC																
5MP16F105-	CFR14LLC105--	1.0	.450 ±.062	1.422	2.140	.020	7.3	7.3	7.3	7.3	7.3	6.4	5.8	776	250	250
5MP16F205-	CFR14LLC205--	2.0	.605 ±.093	1.422	2.140	.015	14.3	13.3	12.1	10.8	9.4	7.7	7.0	548	498	249
5MP16F305-	CFR14LLC305--	3.0	.654 ±.093	1.672	2.390	.013	15.9	14.7	13.5	12.0	10.4	8.5	7.8	414	576	192
5MP16F505-	CFR14LLC505--	5.0	.769 ±.093	1.922	2.640	.011	18.3	17.0	15.5	13.9	12.0	9.8	8.9	299	782	156
5MP16F106-	CRF14LLC106--	10.0	.905 ±.125	2.422	3.140	.009	22.4	20.7	18.9	16.9	14.6	12.0	10.9	188	1139	114
5MP16F206-	CFR14LLC206--	20.0	1.315 ±.125	2.422	3.140	.006	27.4	25.4	23.2	20.7	17.9	14.7	13.4	133	2277	114
400 VDC																
5MP16J105-	CFR14LLE105--	1.0	.620 ±.093	1.672	2.390	.019	9.5	9.5	9.5	9.5	9.5	8.3	7.5	716	319	319
5MP16J205-	CFR14LLE205--	2.0	.802 ±.093	1.922	2.640	.015	15.0	15.0	15.0	14.2	12.3	10.0	9.1	472	521	260
5MP16J305-	CFR14LLE305--	3.0	.961 ±.125	1.922	2.640	.012	21.1	19.5	17.8	15.9	13.8	11.3	10.3	386	781	260
5MP16J505-	CFR14LLE505--	5.0	1.067 ±.125	2.422	3.140	.010	24.4	22.6	20.6	18.5	16.0	13.1	11.9	265	950	190
5MP16J106-	CFR14LLE106--	10.0	1.543 ±.125	2.422	3.140	.006	30.0	27.8	25.4	22.7	19.7	16.1	14.7	188	1898	190

ELECTRICAL CHARACTERISTICS vs. TEMPERATURE

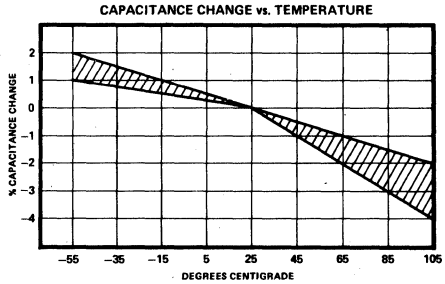
INSULATION RESISTANCE vs. TEMPERATURE



DISSIPATION FACTOR vs. TEMPERATURE



CAPACITANCE CHANGE vs. TEMPERATURE



ELECTRONIC CONCEPTS INC.

P.O. BOX 1278 EATONTOWN, NEW JERSEY 07724 • (201) 542-7880

ELECTRONIC CONCEPTS INC.

TYPE 5MC SWITCH-MODE POWER SUPPLY CAPACITORS METALLIZED POLYCARBONATE

A new innovation pioneered by Electronic Concepts, Inc. leads the way to a new era of miniature metallized polycarbonate film capacitors physically designed to minimize circuit board real estate in switch mode power converters while maintaining a low ESR, excellent ripple capability and high resonant frequency. Electronic Concepts offers, in addition to conventional axial leaded termination, a flat tinned copper tab termination for increased current carrying capability and higher resonant frequency.

To aid the best layout potential, the copper tab terminated version is offered in both high and low profiles for each capacitance/voltage rating.

Excellent electrical characteristics and super miniaturization are offered to switch mode power supply designers with his requirements in mind.

CAPACITANCE In MFD	AXIAL LEADS 5MC22			LOW PROFILE 5MC26			HIGH PROFILE 5MC27			TYPE 5MC29			ESR Milliohms 100 KHz	Ripple Current Max @ 25°	Resonant Frequency KHz 5MC22, 5MC26, 5MC27	Resonant Frequency KHz 5MC29
	T	H	L	T	H	L	T	H	L	T	W	H				
50 VDC																
1.0	.250	.343	.687										18	7.8	1106	
3.0	.406	.593	.687										15	9.8	638	
5.0	.406	.593	.812										13	10.6	460	
10.0	.562	.812	.812	.812	.562	.750	.562	.812	.750	.562	.862	.750	11	12.6	325	390
20.0	.718	.968	.937	.968	.718	.875	.718	.968	.875	.718	.968	.875	10	14.8	215	258
50.0	1.000	1.375	1.062	1.375	1.000	1.000	1.000	1.375	1.000	1.000	1.375	1.000	6	23.5	128	154
75 VDC																
1.0	.281	.375	.812										19	7.9	1028	
3.0	.468	.718	.812							.468	.718	.750	15	10.3	593	712
5.0	.500	.750	.937				.500	.750	.875	.500	.750	.875	13	11.6	431	517
10.0	.718	1.031	.937	1.031	.718	.875	.718	1.031	.875	.718	1.031	.875	12	13.5	305	366
20.0	.937	1.312	1.062	1.312	.937	1.000	.937	1.312	1.000	.937	1.312	1.000	11	16.5	203	244
50.0	1.312	1.687	1.312	1.687	1.312	1.250	1.312	1.687	1.250	1.312	1.687	1.250	6	24.2	116	139
100 VDC																
1.0	.281	.375	.937										20	8.0	963	
3.0	.437	.750	.937							.437	.750	.875	15	10.6	556	667
5.0	.593	.906	.937	.906	.593	.875	.593	.906	.875	.593	.906	.875	13	12.4	431	517
10.0	.781	1.093	1.062	1.093	.781	1.000	.781	1.093	1.000	.781	1.093	1.000	12	14.6	287	344
20.0	.906	1.281	1.312	1.281	.906	1.250	.906	1.281	1.250	.906	1.281	1.250	11	17.1	183	220
50.0	1.437	1.812	1.437	1.812	1.437	1.375	1.437	1.812	1.375	1.437	1.812	1.375	6	23.6	111	133

SPECIFICATIONS

Operating Temperature Range: −55°C to +125°C.

Dissipation Factor: When measured at the frequency specified for capacitance measurements, the dissipation factor shall not exceed 0.3%.

Insulation Resistance: When measured at the applicable test temperature, and rated voltage, the insulation resistance shall equal or exceed the following values:

	25°C	85°C	125°C
Megohm x Microfarads	100,000	7,000	700
Except the insulation resistance in megohms need not exceed	200,000	70,000	7,000

Capacitance Change: The Capacitance change vs. temperature for these capacitors shall not exceed the following:

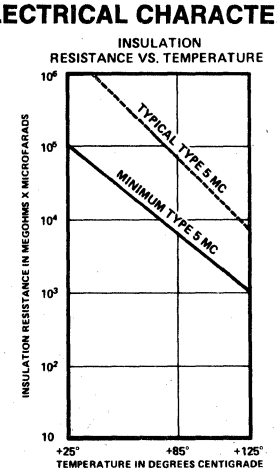
Temperature Degrees C.	−55	+25	+85	+125
Percent Change	−2.5	0	±1.0	±2.0

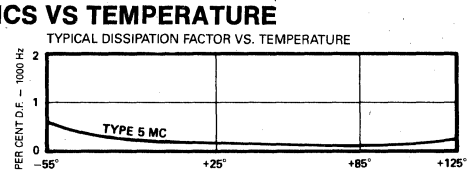
The measurement at each temperature shall be recorded when two successive readings taken at 5-minute intervals indicate no change in capacitance.

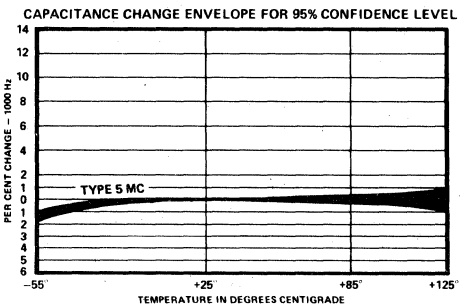
Capacitance Tolerance: Standard Tolerance is ±10%. Tolerances of ±20%, ±5%, ±2% and ±1% are available.

Note: Capacitance shall be measured at 25°C, and at or referred to a frequency of 1 KHz.

ELECTRICAL CHARACTERISTICS VS TEMPERATURE

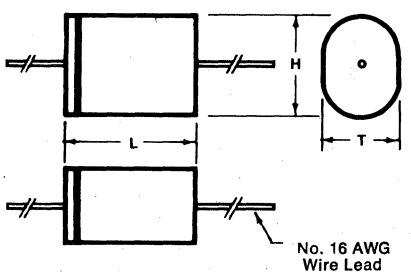






DIMENSIONAL DATA

5MC22



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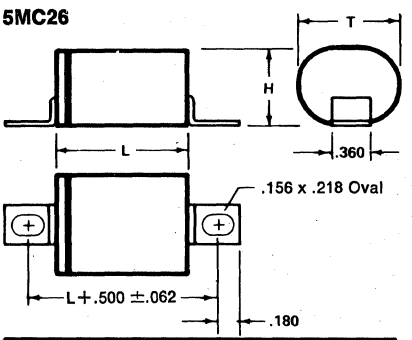

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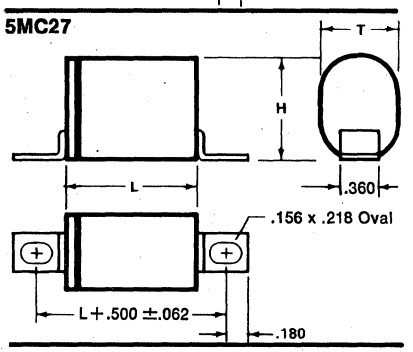

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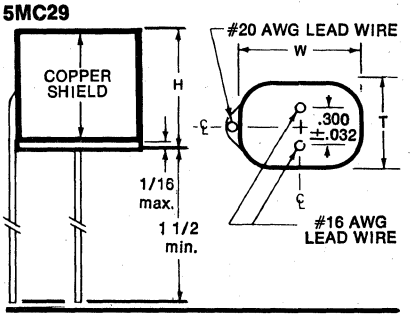


ELECTRONIC CONCEPTS INC.

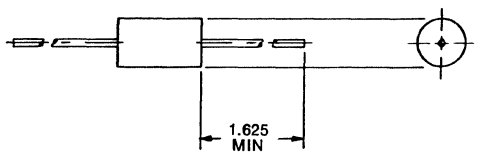
P.O. BOX 1278 EATONTOWN, NEW JERSEY 07724 • (201) 542-7880

ELECTRONIC CONCEPTS INC. ESTABLISHED RELIABILITY CAPACITORS

FIXED, PLASTIC DIELECTRIC, DC, IN NON-METAL CASES PER MIL-C-55514

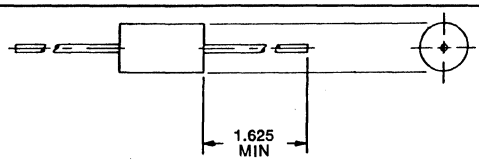
CFR02

ALL DIMENSIONS ARE IN INCHES.



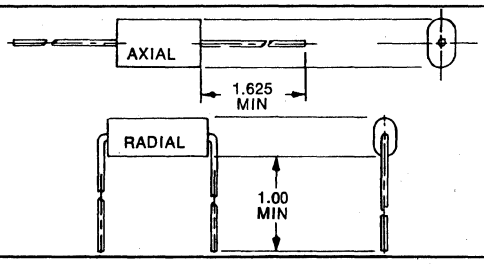
Dielectric: plastic film.
Characteristic "M": polyester film and foil
Characteristic "Q": polycarbonate film and foil
Construction: round configuration, axial leaded.
Capacitance values in MFD:
Characteristic "M": .0068 thru 1.0 100V; .0010 thru 1.0 200V; .0018 thru 1.0 400V; .0010 thru 0.1 600V
Characteristic "Q": .0010 thru 1.0 100V; .0010 thru 1.0 200V
Capacitance tolerance:
"M" ±2%, ±5%, ±10%
"Q" ±1%, ±2%, ±5%, ±10%

CFR05



Dielectric: metallized polycarbonate plastic film. Characteristic "R".
Construction: round configuration, axial leaded.
Capacitance values in MFD:
.0010 thru 50.0 50V .010 thru 10.0 200V
.0010 thru 20.0 100V .010 thru 5.0 400V
Capacitance tolerance: ±1%, ±2%, ±5%, ±10%

CFR06

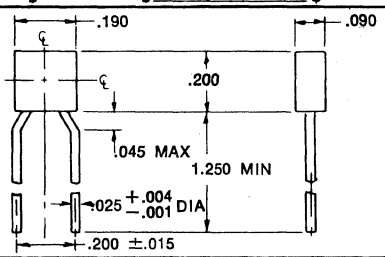


Dielectric: metallized plastic film
Characteristic "R": metallized polycarbonate
"N": metallized polyester
Construction: oval configuration, axial or radial leaded
Capacitance values in MFD:

Characteristic "R"	Characteristic "N"
.0010 thru 50.0 50V	.010 thru 10.0 200V
.0010 thru 20.0 100V	.010 thru 3.3 400V

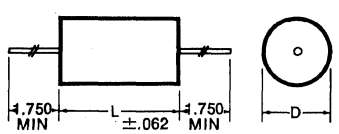
Capacitance tolerance:
"R" ±1%, ±2%, ±5%, ±10%
"N" ±2%, ±5%, ±10%

CFR12



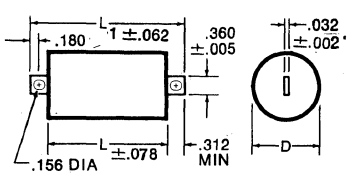
Dielectric: metallized polycarbonate plastic film.
Construction: molded rectangular case, radial leaded.
Capacitance values in MFD:
.0010 thru .0033 250V .010 thru .018 100V
.0039 thru .0056 200V .022 thru .027 75V
.0068 thru .0082 150V .033 thru .082 50V
.10 thru 1.0 available in larger size CFR 16, 50V
See MIL-C-55514/8C for additional information.

CFR13



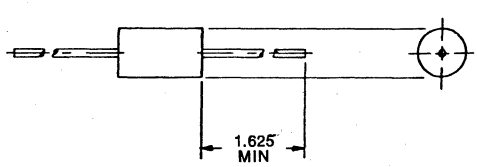
Switch-Mode Power Supply Capacitors.
Dielectric: metallized polypropylene film.
Construction: round configuration, axial leaded.
Capacitance values in MFD:
1.0 thru 30.0 100V
1.0 thru 20.0 200V
1.0 thru 10.0 400V
Capacitance tolerance: ±5%, ±10%, ±20%

CFR14



Switch-Mode Power Supply Capacitors.
Dielectric: metallized polypropylene film.
Construction: round configuration, lug terminal.
Capacitance values in MFD:
1.0 thru 30.0 100V
1.0 thru 20.0 200V
1.0 thru 10.0 400V
Capacitance tolerance: ±5%, ±10%, ±20%

CFR15



Dielectric: polypropylene plastic film.
Construction: round configuration, film foil, axial leaded.
Capacitance values in MFD:
.012 thru 1.0 200V
.0068 thru 1.0 400V
.001 thru 1.0 600V
.0056 thru 0.56 800V
Capacitance tolerance: ±5%, ±10%, ±20%

ELECTRONIC CONCEPTS INC.
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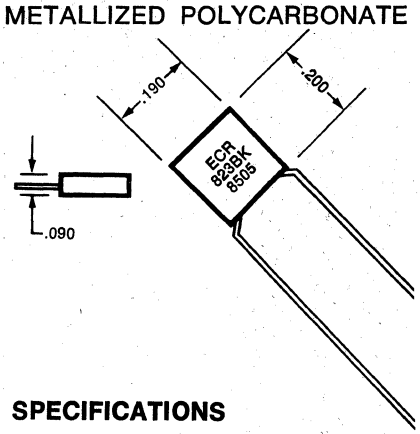
ELECTRONIC CONCEPTS INC. AVIONICAPS®

METALLIZED POLYCARBONATE



TYPE ECR

- NO PIEZOELECTRIC EFFECT
- NOT FREQUENCY SENSITIVE
- NOT VOLTAGE SENSITIVE

A new innovation pioneered by Electronic Concepts leads the way to a new era of smaller metallized film capacitors. Now a combination of excellent electrical characteristics and compactness is offered the equipment designer in a size equal to a ceramic CK05 capacitor.

Besides the superior electrical characteristics Type ECR are self-healing, as is the case with all metallized capacitors.

Additionally, these capacitors do not exhibit any of the drawbacks inherent in all ceramic capacitors.

SPECIFICATIONS

Operating Temperature Range: −55°C to +125°C.

Dissipation Factor: When measured at the frequency specified for capacitance measurements, the dissipation factor shall not exceed 0.3%.

Insulation Resistance: When measured at the applicable test temperature, and rated voltage, the insulation resistance shall equal or exceed the following values:

	25°C	85°C	125°C
Megohm x Microfarads	100,000	7,000	700
Except the insulation resistance in megohms need not exceed	200,000	70,000	7,000

Capacitance Change: The Capacitance change vs. temperature for these capacitors shall not exceed the following:

Temperature Degrees C.	−55	+25	+85	+125
Percent Change	−2.5	0	±1.0	±2.0

The measurement at each temperature shall be recorded when two successive readings taken at 5-minute intervals indicate no change in capacitance.

Capacitance Tolerance: Standard Tolerance is ±10%. Tolerances of ±20%, ±5%, ±2% and ±1% are available.

Note: Capacitance shall be measured at 25°C, and at or referred to a frequency of 1KHz.

VALUE IN MFD	VDC	PHYSICAL SIZE T	H	L	LEAD SPACING LS	SEE FIGURE
.0010	250	.090	.190	.190	.200	1
.0012	250	.090	.190	.190	.200	1
.0015	250	.090	.190	.190	.200	1
.0018	250	.090	.190	.190	.200	1
.0022	250	.090	.190	.190	.200	1
.0027	250	.090	.190	.190	.200	1
.0033	250	.090	.190	.190	.200	1
.0039	200	.090	.190	.190	.200	1
.0047	200	.090	.190	.190	.200	1
.0056	200	.090	.190	.190	.200	1
.0068	150	.090	.190	.190	.200	1
.0082	150	.090	.190	.190	.200	1
.010	100	.090	.190	.190	.200	1
.012	100	.090	.190	.190	.200	1
.015	100	.090	.190	.190	.200	1
.018	100	.090	.190	.190	.200	1
.022	75	.090	.190	.190	.200	1
.027	75	.090	.190	.190	.200	1
.033	50	.090	.190	.190	.200	1
.039	50	.090	.190	.190	.200	1
.047	50	.090	.190	.190	.200	1
.056	50	.090	.190	.190	.200	1
.068	50	.090	.190	.190	.200	1
.082	50	.090	.190	.190	.200	1
.10	50	.095	.245	.295	.200	2
.12	50	.095	.295	.295	.200	2
.15	50	.095	.295	.295	.200	2
.18	50	.095	.295	.295	.200	2
.22	50	.095	.395	.395	.300	2
.27	50	.095	.395	.395	.300	2
.33	50	.095	.395	.395	.300	2
.39	50	.095	.395	.395	.300	2
.47	50	.145	.395	.395	.300	2
.56	50	.145	.395	.395	.300	2
.68	50	.195	.395	.395	.300	2
.82	50	.195	.395	.395	.300	2
1.0	50	.195	.395	.395	.300	2

DIMENSIONAL DATA

Figure 1

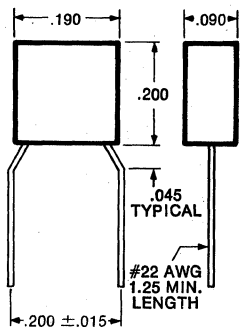
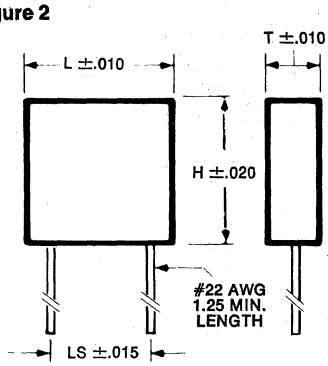
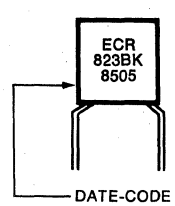


Figure 2

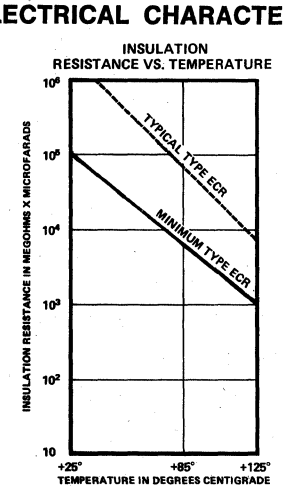


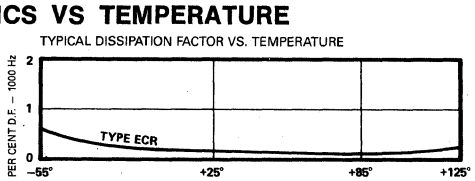
Part Marking

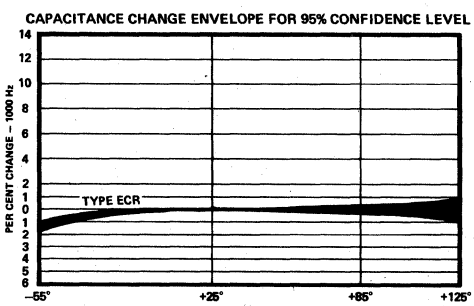


The first two digits represent the year, the second two digits represent the week. ie. 8452 is the 52nd week of 1984, 8512 is the 12th week of 1985.

ELECTRICAL CHARACTERISTICS VS TEMPERATURE



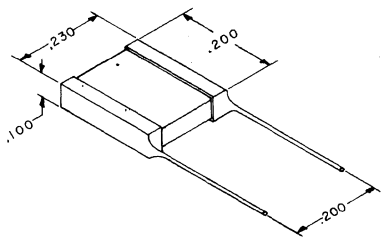




ELECTRONIC CONCEPTS INC.

MINIATURE HERMETICALLY SEALED POLYCARBONATE

TYPE HECR

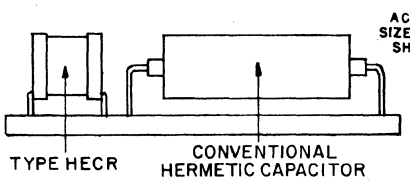


THE FIRST POLYCARBONATE TO OFFER SUBMINIATURE SIZE AND HERMETICITY

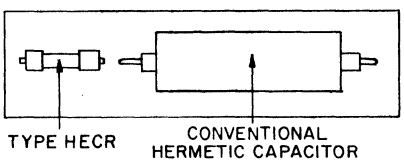
The Avionicap® HECR represents a major improvement in capacitor design that will advance the trend toward miniaturization. This improvement is made possible by a new, patented manufacturing process that enables us to maximize density and actually compress the capacitance of a conventional hermetic capacitor into a subminiature package. Type HECR is the smallest hermetically sealed polycarbonate capacitor on the market today, measuring as compact as .100″ × .200″ × .230″, which is 3.5 times smaller in volume than conventional hermetic polycarbonate capacitors. The HECR represents a competitive edge to the user, because it is the first time both subminiature size and hermeticity are available in a polycarbonate capacitor.

OFFERS GREATER DESIGN LATITUDE WITHOUT COMPROMISE

It is no longer necessary for the designer to compromise because of lack of availability. Before the introduction of the HECR, the choice was between using either a larger than ideal hermetic or a non-hermetic in a small enough size. But now the designer can have both miniature size and hermetics — and as a result, he can miniaturize without compromising performance, reliability or environmental protection requirements.



SIDE VIEW



TOP VIEW

NO LOSS IN ELECTRICAL CHARACTERISTICS AS COMPARED TO CONVENTIONAL HERMETICS

Even though the size of the HECR has been reduced, performance has not been. The HECR still offers excellent stability retrace and insulation resistance, long term capacitance stability, and capacitance as high as 1.0 MFD. There is full hermeticity in accordance with MIL-C-202, method 112. And it meets the environmental and performance standards of MIL-C-83421, as well as other military and commercial standards.

LENDS ITSELF TO END PRODUCT MINIATURIZATION — WITH GREATER PCB DENSITY

Because of its subminiature size the HECR will save valuable printed circuit board surface area and volume, thus allowing for a smaller pc board, and therefore more boards packaged in a specified area. In addition, this capacitor has a rectangular rather than a tubular shape, and is radially rather than axially mounted. As a result the surface area requirement is even further reduced.

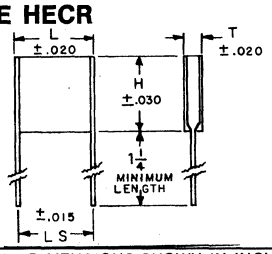
The HECR facilitates miniaturization of the component package and the end product, to reduce system weight and production costs.

NUMERALS INDICATE CASE NUMBERS. SEE ADJACENT TABLE FOR CASE DIMENSIONS

VALUE IN MFD	VDC						VALUE IN MFD	VDC						VALUE IN MFD	VDC					
	30	50	100	150	200	300		30	50	100	150	200	300		30	50	100	150	200	300
.0010						1	.010		1	2			3	.10		3	5	6		
.0012						1	.012		1	2		3	4	.12		3	5			
.0015						1	.015		1	2		3	4	.15		3	6			
.0018						1	.018		1			3	5	.18	3	4	6			
.0022					1	2	.022		1		3	4	5	.22	3	4	6			
.0027					1	2	.027		1		3	4	5	.27	3	4				
.0033				1	2	3	.033	1	2	3	4	5	6	.33	4	5				
.0039				1	2	3	.039	1	2	3	4	5	6	.39	4	5				
.0047				1	2	3	.047	1	2	3		5		.47	5	6				
.0056			1	2		3	.056	2		3	5	6		.56	5	6				
.0068			1	2		3	.068	2	3	4	5	6		.68	5	6				
.0082			1			3	.082	2	3	4	6			.82	6					
														1.00	6					

CASE NO.	CASE DIMENSIONS			
	T	H	L	LS
1	.100	.200	.230	.200
2	.160	.260	.230	.200
3	.160	.260	.330	.300
4	.180	.360	.330	.300
5	.180	.360	.430	.400
6	.210	.480	.430	.400

DIMENSIONAL DATA TYPE HECR



ALL DIMENSIONS SHOWN IN INCHES

ELECTRONIC CONCEPTS INC.
P.O. BOX 1278 EATONTOWN, NEW JERSEY 07724 • (201) 542-7880

ELPAC COMPONENTS 28 YEARS OF EXCELLENCE

FILM CAPACITORS MADE EASY

Elpac's film capacitors offer high quality at competitive prices. They are typically available from 0.0001 to 25 microfarads at voltages from 50 to 1,000 VDC with temperatures up to 125°C (teflon is good up to 200°C). Film capacitors are non-polarized and are noted for their low leakage and capacitance stability over variations in voltage, frequency, and temperature. They also provide excellent volumetric efficiency at higher voltage ratings (over 100 volts), and are applicable to high energy filter applications because of their extremely low DF and exceptionally low ESR (the lowest of all capacitor dielectrics). Film capacitors are typically utilized in test and measurement instruments, telecommunication equipment, industrial control systems, and computers or computer peripherals.
. . . Available in five standard dielectrics.

POLYESTER

This dielectric is the most popular of all film capacitors due to its very low cost. It is available in both metallized and film-and-foil configuration and in values ranging from .001 to 25 microfarads. Polyester capacitors offer capacitance stability over temperature (−55 to +125°C) and a low dissipation factor (DF). In the metallized configuration, they provide the best volumetric efficiency (smallest size) of all film capacitors. Additionally, they are highly reliable due to the self-healing quantities of the metallized dielectric. They are typically used in RF (radio frequency) filtering applications and offer advantages in low frequency (less than 400 Hz) AC circuits where high energy currents are present.

POLYCARBONATE

This dielectric is also popular, especially for applications where it is desirable to maintain a minimum capacitance change over temperature or where lower DF, lower D.A. or high I.R. is important. Polycarbonate capacitors are slightly more expensive than polyester and are available as metallized units in values ranging from 0.001 to 25 microfarads. Their volumetric efficiency approaches that of polyester. They are typically used in timing or frequency determination circuits where precise capacitance tolerance up to a full temperature rating of 125°C is important.

POLYPROPYLENE

This dielectric is available in a metallized or film-and-foil configuration, in values from 0.0001 to 10 microfarads. Polypropylene capacitors exhibit a near linear negative temperature coefficient, excellent insulation resistance and lower DF and dielectric absorption than polycarbonate, but are limited to a maximum temperature of +105°C. They are typically used for high impedance coupling, A-D converters, sample and hold applications and in tuning and timing circuits. They are also utilized in high frequency AC filter applications where their very low DF (and low ESR) yields excellent filtering with minimal self-heating. They are particularly suited for high current, high frequency switching applications such as switching regulator power supplies.

POLYSTYRENE

This dielectric is available from Elpac in film-and-foil configurations only, in values ranging from 0.0001 to 2 microfarads. These capacitors exhibit superior capacitance stability and DF over temperature, but only up to 85°C and in capacitance values less than 2 microfarads. They have broad application to most circuit requirements and in large quantities (greater than 25,000 units) are very inexpensive due to Elpac's off-shore manufacturing facility.

TEFLON

This dielectric is available from Elpac as either metallized or film-and-foil and in values of 0.001 to 1 microfarad. Teflon capacitors are particularly noted for their performance at high temperatures (up to 200°C) and exhibit the best capacitance stability and DF of all film capacitors, over a full temperature range of −55 to +200°C. They are the most expensive of all film capacitor types. They exhibit moderate volumetric efficiency and have typical applications in "down-hole" (petroleum exploration) equipments, military equipments or other high temperature situations.

AC APPLICATIONS

Both polyester and polypropylene film dielectrics are particularly suited to AC circuit applications. At lower frequencies (less than 400 Hz), metallized polyester provides an excellent filter at a small size, especially where high energy currents are present. At current levels greater than approximately 20 amps, a polyester film-and-foil configuration is preferred to improve the current carrying capacity of the conductor and to provide a better cooling path (the foil) for the heat generated by the AC current. For AC applications at frequencies higher than 400 cycles, a metallized polypropylene dielectric will usually be more appropriate since its very low DF (and low ESR) provides excellent filtering with minimal self-heating.

HIGH RELIABILITY

All of the listed film dielectrics can be provided in high reliability configurations for the most demanding applications, including MIL-STD requirements. Some of these applications are best met by a rectangular or tubular hermetic seal configuration with certification of all required Group A and B testing. Additionally, Elpac produces precision capacitors to ±1% or less tolerances, or in matched sets.

CUSTOM EMI/RFI FILTERS

Elpac manufactures a broad range of custom EMI/RFI filters which can be found in most commercial and military aircraft, including the NASA Space Shuttle. In avionics and space applications, it is often necessary to develop custom designs that provide the required EMI protection with a minimum of weight and volume. This is usually accomplished by packaging the required electronic components and circuitry into an enclosure specially configured for optimum space utilization. In most instances, these filters have been designed by the system designer or through a joint effort between the system designer and Elpac.

CUSTOM APPLICATIONS

Elpac offers a highly trained engineering staff and fully equipped test laboratory to provide customer applications assistance as near as your telephone. During the past 28 years, our capacitor specialists have provided such assistance to thousands of customers to solve their capacitor needs in the most efficient and cost effective manner.

HIGH VOLUME, LOW-COST MANUFACTURING

Elpac compliments its Santa Ana, California manufacturing facility with an off-shore manufacturing site to offer all of the above dielectrics (except teflon) in very high quantities at a low unit cost. Best of all, these products are supported by our Santa Ana, California engineering staff and test laboratory to provide local support throughout the United States for all capacitor and filter product lines.

ELPAC COMPONENTS
A DIVISION OF ELPAC ELECTRONICS, INC.
3131 S. STANDARD AVENUE, SANTA ANA, CA 92705
FAX (714) 241-7293 • TEL. (714) 979-4440

ELPAC COMPONENTS 28 YEARS OF EXCELLENCE

FILM CAPACITORS PRODUCT GUIDE

Application:	Z Metallized Polyester	MD Polyester & Foil	C Metallized Polycarbonate	PD Polystyrene Film & Foil	P Metallized Polypropylene	CS Power Cap	PSB Metallized Polypropylene	MPS Metallized Polypropylene	PPN/PPF Polypropylene and Foil	MES Metallized Polyester	MEF/MFF Metallized Polyester	MEC Metallized Polyester
Coupling	Yes	Yes	Yes	Yes	Yes	High Current LOW ESR	AC Rated Low ESR	AC Rated Low ESR	Yes	AC Rated Low ESR	Yes	Yes
By-Pass	Yes	Yes	Yes	Yes	Yes	Switching Regulators	Switching Regulators	Switching Regulators	Yes	Switching Regulators	Yes	Yes
Filtering	Yes	Yes	Yes	Yes	Yes	Pulse Service			Seldom		No	No
Timing	Occasional	Occasional	Yes	Yes	Yes	Critical	Critical	Critical	Yes	Critical	Yes	No
Pulse Discharge	Yes	Yes	Yes	No	Seldom	Filtering	Filtering	Filtering	Seldom	Filtering	Yes	Yes
Arc Suppression	Yes	Yes	Yes	No	Yes	High Frequency	High Frequency	High Frequency	Yes	High Frequency	No	No
Ripple Suppression	Occasional	Yes	Occasional	Seldom	Seldom							
Timing	No	Occasional	Yes	Yes	Yes							
Configuration & Capacitance Range:												
Oval, W&F	.001/25.0	.001/5.0	.001/12.0	.001/1.5	.001/4.0	1 / 50.0	—	—	—	1.0/4.7	—	—
Tubular, W&F	.001/25.0	.001/5.0	.001/12.0	.001/1.5	.001/4.0	—	.47/10.0	1.0/20.0	—	—	—	—
Hermetic, Rect.	.001/8.0	.001/2.0	.001/8.0	.001/1.0	.001/.47	—	—	—	—	—	—	—
Hermetic, Tubular	.001/25.0	.001/5.0	.001/12.0	.001/2.0	.001/3.0	—	—	—	—	—	—	—
Radial Epoxy Case	.001/15.0	.001/3.0	.001/12.0	.001/1.5	.001/2.0	—	—	—	—	—	—	.01/6.8
Axial Epoxy Case	.001/10.0	.001/2.0	.001/12.0	.001/1.0	.001/1.0	—	—	—	—	—	—	—
Dipped Epoxy	—	—	—	—	—	—	—	—	.001/.47	—	.01/10.0	—
Voltage Range (VDC Nominal)	50 to 600	50 to 600	50 to 600	50 to 400	50 to 600	100 to 400	50 to 400	100 to 400	250 to 630	250 to 400	100 to 630	100 to 630
Temperature Range (°C)	−55/+125	−55/+125	−55/+125	−55/+85	−55/+105	−50/+125	−55/+105	−40/+85	−40/+85	−40/+85	−40/+85	−40/+105
Derate Voltage From	50% +85	50% +85	Not Req'd	Not Req'd	Not Req'd	Not Req'd	Not Req'd	Not Req'd	Not Req'd	Not Req'd	Not Req'd	25% +85
Temperature Coefficient over Temp. Range (ppm/°C)	+960	+960	+120	−90	−300	+120	−300	−300	−300	+960	+960	+960
Dissipation Factor (%) @ 1 KHz*	1.0	0.5	0.3	0.1	.01	0.3	0.1	0.1	0.1	1.0	1.0	1.0
Insulation Res.**												
Megohms x Mfds	10,000	50,000	25,000	100,000	50,000	25,000	50,000	100,000	50,000	30,000	10,000	10,000
Need not Exceed	40,000	100,000	50,000	200,000	100,000	50,000	100,000	500,000	100,000	30,000	30,000	30,000
Dielectric Strength (% of rated voltage)**												
Term. to Term.	150	200	150	200	150	150	150	200	200	200	160	160
Terminal to Case	200	200	200	200	200	200	200	200	200	200	160	160

* Except values over 1.0 MFD measured at 60 Hz.
** Measured at rated voltage or 100 VDC, whichever is less, after 2 minutes electrification.
*** Measured at DC potential for 60 seconds through limiting resistance of 100 ohms/volt.

For other voltage and capacitance values, consult factory.

E.M.I. SOLUTIONS MADE EASY

Elpac employs the latest C.A.D. systems to develop electrical and mechanical designs of E.M.I. filters to fit your application. Typical prototype delivery is two weeks. Custom filter designs can be produced to meet the latest U.L. and C.S.A. specifications. Custom military designs meet the requirements of most military Specifications such as: MIL-F-15733, MIL-F-18327, and MIL-STD-461.

TEMPEST & SECURE ROOM FILTERS

Elpac also provides a line of communication, control-line and data filters in stand-alone or panel versions.

ELPAC COMPONENTS
A DIVISION OF ELPAC ELECTRONICS, INC.
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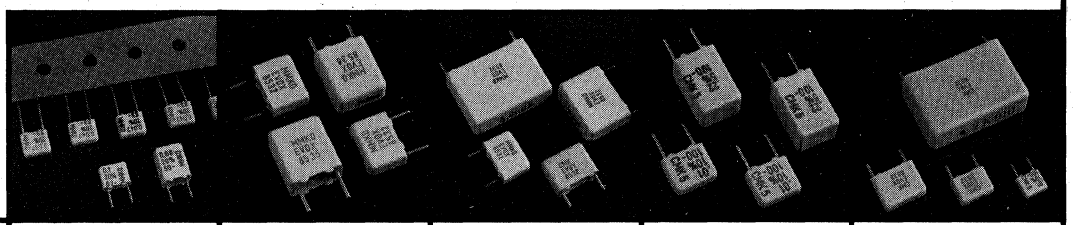
A World Leader in the Design and Manufacture of Metallized Film and Foil Capacitors Since 1947



TYPE	MMK5	MMK7.5/750	MMK	CMK5	CMK
Dielectric	Polyester	Polyester	Polyester	Polycarbonate	Polycarbonate
Electrodes	Metallized	Metallized	Metallized	Metallized	Metallized
Temperature range (°C)	−55 to +100	−55 to +100	−55 to +100	−55 to +125	−55 to +125
Temperature coefficient (ppm/°C)	+400(± 200), nonlinear	+400(± 200), nonlinear	+400(± 200), nonlinear	0(± 100), nonlinear	0(± 100), nonlinear
Dissipation factor (typical) tan δ (%) at 1 kHz, +23°C	0.5	0.5	0.5	0.12	0.12
Pulse rise speed (V/μs)	25.0 to 5.0	40.0 to 6.0	55.0 to 2.0	15.0 to 10.0	30.0 to 2.0
Lead spacing (mm)	5	7.5	10/15/22.5/27.5	5	7.5/10/15/22.5/27.5
Available capacitance tolerance (%, ±)	20, 10, 5	20, 10, 5	20, 10, 5	20, 10, 5, 2.5	20, 10, 5, 2.5
Packing	Available taped for automatic insertion	Available taped for automatic insertion	Available taped for automatic insertion	Available taped for automatic insertion	Available taped for automatic insertion

Rated voltage (V)	MMK5 50	63	100	250	MMK7.5/750 50	63	100	250	400	630	MMK 63	100	250	400	630	1000	CMK5 63	100	CMK 63	100	250	400
47 pF																						
68 pF																						
100 pF																						
150 pF																						
220 pF																						
330 pF																						
470 pF																						
680 pF																						
1000 pF																						
1500 pF																						
2200 pF																						
3300 pF																10						
4700 pF															10							
6800 pF														10								
8200 pF													10									7.5
0.010 μF				5								10						5			7.5	
0.015 μF			5								10					15	5			7.5		10
0.022 μF		5																	7.5		10	
0.033 μF	5																			10		
0.047 μF															15							
0.068 μF														15		22.5						
0.10 μF																						15
0.15 μF													15		22.5							
0.22 μF																27.5					15	
0.33 μF														22.5								22.5
0.47 μF												15			27.5					15		
0.68 μF													22.5								22.5	27.5
1.0 μF											15			27.5						15		
1.5 μF																					27.5	
2.2 μF												22.5								22.5		
3.3 μF													27.5									
4.7 μF											22.5									27.5		
6.8 μF												27.5							22.5			
10.0 μF											27.5											

EVOX, INC. 100 TRI-STATE INTERNATIONAL, SUITE 290, LINCOLNSHIRE, ILLINOIS 60015
TELEPHONE: 312-948-9511 TELEX: 206997 FAX: 312-948-9320

JENNINGS VACUUM/GAS CAPACITORS

Jennings offers over 400 high voltage vacuum capacitors in various models, capacitance values, voltage and current ratings for radio frequency applications. Units are available in both glass and ceramic envelopes. Working voltage ratings are from 2 to 36 KV, at capacitance values to 5000 pfd, and with current ranges to 420 amps RMS (air-cooled) and 1,000 amps (water cooled) — depending upon capacity, frequency, and working voltage.

The examples described represent our most requested models. Please write or call for our comprehensive capacitor catalog that details our complete line.

VACUUM FIXED CAPACITORS

Peak Voltage Kilovolts				Continuous RMS	Nominal Dimensions[3] (Inches)	
Test 60 Hz	RF Working[1] (Peak)	Type	Capacity pF	Amperes[2] (Max.)	Length	Diameter
12	7	CFDS	1000	95	4.6	3.6
15	9	CFDP	1500, 2000	200	3.3	5.6
15	9	CFED	5000	250	13.0	8.2
25	15	CFED	500, 750, 1000	180	3.8	4.6
30	18	CY	1, 2, 3, 5	12	3.3	0.8
30	20	CLF1	150, 200, 250	100	6.5	2.6
30	18	CFED	150, 300	140	3.6	3.4
30	18	CFFM	2500	400	5.8	8.2
35	25	CLF1	6, 12, 25, 50, 75, 100	85	6.5	2.3
35	21	CFFP	2000	360	5.8	8.2
50	30	CFHP	1000	350	6.2	7.2
55	33	CFHP	450	300	5.5	5.6
60	36	CFHD	12, 25, 50, 100, 200, 300	240	5.4	4.6

GAS FIXED CAPACITORS

Peak Voltage Kilovolts					Continuous RMS	Nominal Dimensions[3] (Inches)	
Test 60 Hz	RF + DC	RF Working (1) Peak	Type	Capacity pF	Amperes[2] (Max.)	Length	Diameter
20	18	12	CGF1-1000	1000	215	3.5	4.8
35	30	20	CGF2-1000	1000	270	4.0	6.0
50	40	25	CGF2-500	500	240	5.5	5.7

VACUUM VARIABLE CAPACITORS

Peak Voltage Kilovolts				Continuous RMS	Nominal Dimensions[3] (Inches)	
Test 60 Hz	RF Working[1] (Peak)	Type	Capacity pF	Amperes[2] (Max.)	Length	Diameter
5	3	CACA[4]	5-125	22	4.2	1.3
5	3	CSV1	5-500	45	5.8	2.4
5	5	CMV2	6-500	38	4.7	1.8
5	3	CVCJ	7-1000	70	7.6	3.1
3	3	CMV1	8-1000	40	4.3	1.8
5	3	CVCD	10-1500, 20-2000, 50-3000	100	8.3	4.6
5	5	CMV1	25-4000	70	6.6	3.2
15	9	CADD[4]	3-30	20	4.1	1.3
15	9	CVDD	6.5-50, 10-100	65	6.6	2.4
15	9	CVDD	10-300, 20-500	95	7.5	3.4
15	9	CSVF[4]	12-500	65	7.9	3.5
15	9	CVDD	25-750, 25-1000	150	8.0	4.6
15	9	CVDP	35-1500, 50-2300	160	9.8	5.6
15	9	CVEP	100-2000	200	10.2	7.2
15	9	CVED	100-5000	200	21.3	9.3
20	12	CVEP	25-500, 50-1000, 100-1500	210	10.2	7.2
30	18	CVFNP[5]	10-50	20	5.1	4.0
35	21	CVFP	100-1500, 100-2000	220	14.5	8.2
40	24	CVFP	15-250, 25-450	170	9.6	5.6
40	24	CVFP	20-750, 35-1000	225	11.7	7.2
40	24	CWV2	100-1600 (water cooled)	790	25.0	8.6
50	30	CWV2	25-450, 30-650 (water cooled)	840	17.9	7.6
50	30	CVHP	60-1000	250	14.5	8.0
50	30	CWV1	100-1000 (water cooled)	840	21.6	8.6
55	33	CVHP	10-250, 25-450, 30-650	240	11.9	7.2
60	36	CWV1	100-1600 (water cooled)	1000	23.0	12.6

GAS VARIABLE CAPACITORS

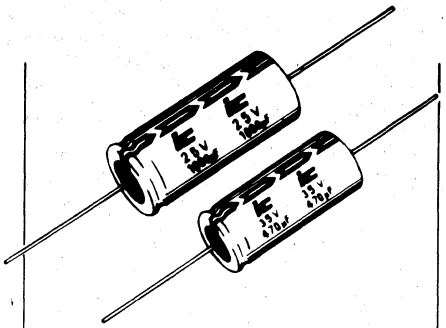
Peak Voltage Kilovolts				Continuous RMS	Nominal Dimensions[3] (Inches)	
Test 60 Hz	RF Working[1]	Type	Capacity pF	Amperes[2] (Max.)	Length	Diameter
5	3	CHV1	1.5-45	18	3.5	0.9
15	9	CHV1	2.5-50	30	6.4	1.4

1 The maximum RF working voltage that can be applied over the 2-32 MHz frequency range while not exceeding the RF current rating.
2 RF current rating is dependent upon capacity, frequency and working voltage. Rating shown is largest unit in series. Write for complete applications data.
3 Dimensions of largest unit in a series. Available with metric thread mounting — on request.
4 Non-magnetic version available.
5 Neutralizing Capacitor.

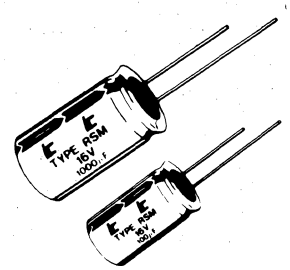
FL JENNINGS
FL INDUSTRIES, INC.
JENNINGS DIVISION
970 McLaughlin Ave., San Jose, CA 95122
(408) 292-4025

TODAY'S SOLUTIONS FOR TOMORROW'S PROBLEMS

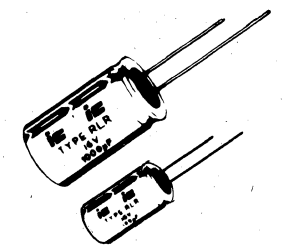
iC CAPACITORS



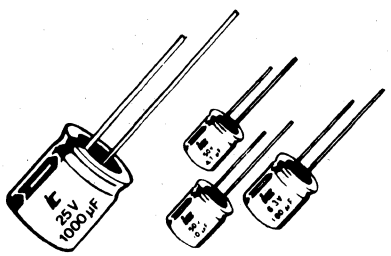
TYPE TTA COMMERCIAL/INDUSTRIAL ELECTROLYTIC CAPACITORS
0.47 Mfd. To 33,000 Mfd.
6.3 WVDC To 500 WVDC
−40°C To +85°C Min.
2000 HOUR +85°C Rating
SOLVENT TOLERANT & EPOXY SEAL Optional
TAPE & REEL Available



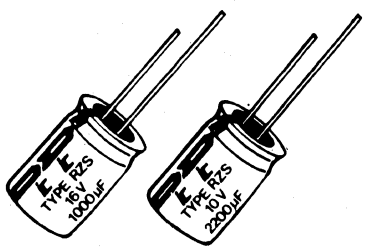
TYPE RSM SUBMINIATURE ELECTROLYTIC CAPACITORS
0.47 Mfd. To 10,000 Mfd.
6.3 WVDC To 450 WVDC
−40°C To +85°C Min.
2000 HOUR +85°C Rating
SOLVENT TOLERANT & EPOXY SEAL Optional
TAPE & REEL Available



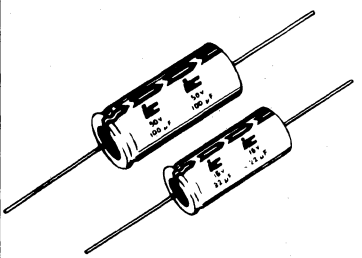
TYPE RLR LOW-LEAKAGE ELECTROLYTIC CAPACITORS
0.1 Mfd. To 2,200 Mfd.
6.3 WVDC To 50 WVDC
−40°C To +85°C Min.
Leakage Current: ≤0.002 CV or 0.4 μA min.
SOLVENT TOLERANT & EPOXY SEAL Optional
TAPE & REEL Available



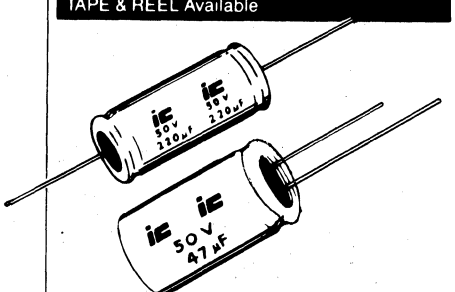
TYPE RSS SUB-SUBMINIATURE LO-PROFILE ELECTROLYTIC CAPACITORS NEW
0.1 Mfd. To 3,300 Mfd.
6.3 WVDC To 50 WVDC
−40°C To +85°C Min.
SOLVENT TOLERANT & EPOXY SEAL Optional
TAPE & REEL Available



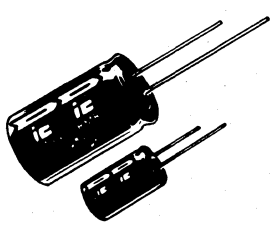
TYPE RZS HIGH FREQUENCY +105°C ELECTROLYTIC CAPACITORS NEW
22 Mfd. To 2,200 Mfd.
6.3 WVDC To 63 WVDC
−55°C To +105°C Min.
Low ESR, Low ESL
SOLVENT TOLERANT SEAL Standard
TAPE & REEL Available



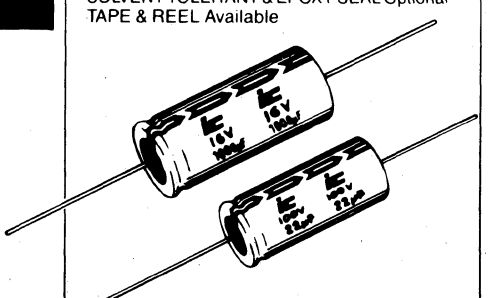
TYPE TLA LOW LEAKAGE ELECTROLYTIC CAPACITORS
0.1 Mfd. To 100 Mfd.
6.3 WVDC To 50 WVDC
−40°C To +85°C Min.
Leakage Current: ≤0.002 CV or 0.4 μA min.
SOLVENT TOLERANT & EPOXY SEAL Optional
TAPE & REEL Available



NON POLARIZED ELECTROLYTICS
TYPE BPA (AXIAL)
TYPE BPR (RADIAL)
0.47 Mfd. To 1,000 Mfd.
10 WVDC To 200 WVDC
−40°C To +85°C Min.
EPOXY END SEAL Optional
TAPE & REEL Available



TYPE RMR SUBMINIATURE +105°C ELECTROLYTIC CAPACITORS
0.47 Mfd. To 10,000 Mfd.
6.3 WVDC To 250 WVDC
−40°C To +105°C Min.
2000 HOUR +105°C Rating
SOLVENT TOLERANT & EPOXY SEAL Optional
TAPE & REEL Available



TYPE THA +125°C OPERATION ELECTROLYTIC CAPACITORS
0.47 Mfd. To 1,000 Mfd.
10 WVDC To 100 WVDC
−40°C To +125°C Min.
EPOXY END SEAL Optional (THA-PX)
TAPE & REEL Available

Please Call for your specialized capacitor requirements.

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ILLINOIS CAPACITOR, INC.®

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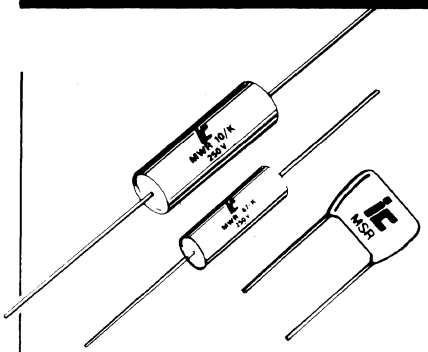
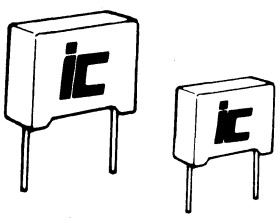
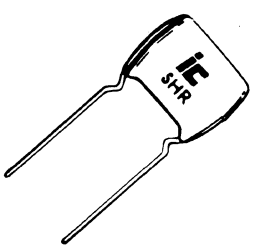
ic CAPACITORS



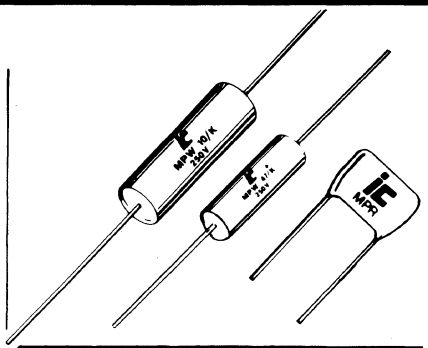
METALLIZED POLYESTER FILM
TYPE MWR (AXIAL) WRAP & FILL
TYPE MSR (RADIAL) EPOXY DIP
SELF-HEALING CONSTRUCTION +125°C
NON-INDUCTIVE WINDING
63 WVDC To 1,000 WVDC
0.001 Mfd. To 22 Mfd.
TOLERANCE: ± 10% (± 5% Opt.)



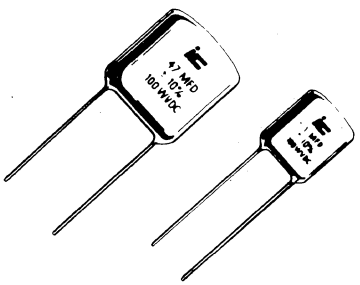
TYPE PMB MINI-CASE
METALLIZED POLYESTER FILM
SELF-HEALING, NON-INDUCTIVE
63 WVDC To 100 WVDC
0.001 Mfd. To .47 Mfd.
Standard Lead Spacing: .200in/5.0mm
TOLERANCE: ± 10% (± 5% Opt.)
NEW



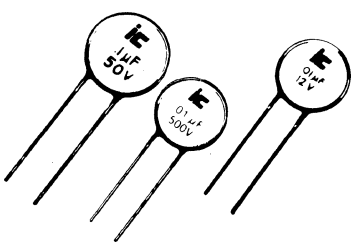
TYPE SHR POLYESTER
FOIL/FILM CAPACITORS
NON-INDUCTIVE WINDING, +125°C
100 WVDC
0.001 Mfd. To .47 Mfd.
Standard Lead Spacing: .375in/9.5mm
TOLERANCE: ± 10% (± 5% Opt.)



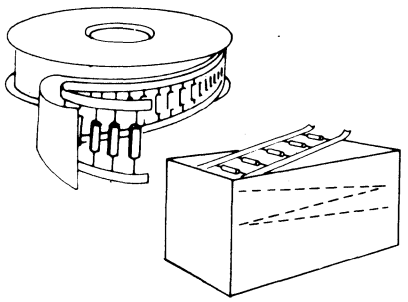
METALLIZED POLYPROPYLENE FILM
TYPE MPW (AXIAL) WRAP & FILL
TYPE MPR (RADIAL) EPOXY DIP
SELF-HEALING, LOW ESR
NON-INDUCTIVE WINDING, +100°C
160 WVDC To 630 WVDC
0.001 Mfd. To 10 Mfd.
TOLERANCE: ± 10% (± 1, 2.5, 5% Opt.)
NEW



TYPE UMR POLYESTER
FILM/FOIL CAPACITORS
INDUCTIVE WINDING
100 WVDC
0.001 Mfd. To .47 Mfd.
TOLERANCE: ± 10% (± 5% Opt.)

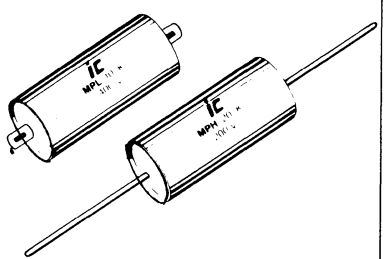


CERAMIC DISC CAPACITORS
TYPE BCR TEMPERATURE STABLE
1pf To 680pf, 50 WVDC, ± 10% (Y5F)
GENERAL PURPOSE TYPES
TYPE GCR: 50 WVDC
0.001 Mfd. To 0.1 Mfd. (Y5T, Y5V)
TYPE GMR: 12 WVDC
0.047 Mfd. To .47 Mfd. (Y5T, Y5V)
TYPE GQR: 500 WVDC
0.001 Mfd. To 0.01 Mfd. (Z5V)

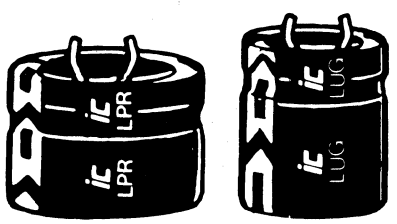


TAPE & REEL CONFIGURATIONS
FOR AUTOMATIC INSERTION OF
AXIAL AND RADIAL LEAD PARTS
(REEL OR AMMO/FLAT)
AVAILABLE ON SPECIAL ORDER

CUT & FORM LEADS
AVAILABLE ON SPECIAL ORDER



HIGH CURRENT (HIGH FREQ.)
METALLIZED POLYPROPYLENE FILM
TYPE MPH (AXIAL LEAD)
TYPE MPL (LUG TERMINAL)
SELF HEALING, LOW ESR
LOW ESL, +105°C RATED
100 WVDC TO 400 WVDC
1 Mfd. TO 30 Mfd.
TOLERANCE ± 10%
NEW



SNAP MOUNT ELECTROLYTICS
TYPE LPR (LOW PROFILE)
TYPE LUG (STANDARD)
HIGH CURRENT, LOW ESR
100 Mfd. To 22,000 Mfd.
10 WVDC To 450 WVDC
-40°C To +85°C
SOLVENT TOLERANT SEAL STANDARD
NEW

The source for Quality, Performance and Delivery

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INTERCAP CAPACITORS by International

COMMERCIAL & INDUSTRIAL ALUMINUM ELECTROLYTIC CAPACITORS — AXIAL & RADIAL LEADS

General Purpose
TDC & PDC, PDS

Temp. Range	−40°C to +85°C
Cap. Range	0.47μF−22,000μF Axial 0.47μF−10,000μF Radial
Cap. Tol.	−10% +75%, −10% +50%, ±20%
Volt. Range	6.3VDC−450VDC
Leakage (Max.)	6.3V−80V .02CxV +4μA 100V−450V .02CxV +100μA

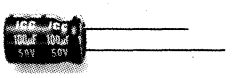
Extended Temperature
TDB & PDB (Close Tolerance)

Temp. Range	−40°C to +105°C
Cap. Range	0.47μF−10,000μF
Cap. Tol.	±20%
Volt. Range	6.3VDC−250VDC
Leakage (Max.)	.01CxV +3μA
Life Test	2,000 hrs. @ 105°C

Low Leakage
TDA-L, PDA-L, PDS-L

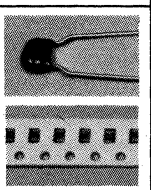
Temp. Range	−40°C to +85°C
Cap. Range	0.1μF−2200μF
Cap. Tol.	±20%, ±10%
Volt. Range	6.3VDC−63VDC
Leakage (Max.)	0.002CxV or 0.4μA whichever is greater

Standard PSS (Subminiature)
PDW & PUB (Solvent Proof)



Temp. Range	−40°C to +105°C	**Cap. Tol.**	±20%
Cap. Range	0.1μF−10,000μF	**Volt. Range**	6.3VDC−250VDC

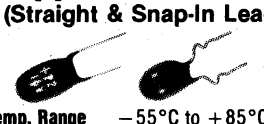
Multilayer Ceramic
MCD & CCM



Both our radial lead MCD Series and leaderless chip CCM Series of multilayer ceramic capacitors are constructed using the latest state-of-the-art techniques and materials. The result is consistently reliable performance for a broad range of applications.

Available: COG, COH, NPO; X7R, BX; Z5U.

Dipped Tantalum
DP (Straight & Snap-In Leads)



Temp. Range	−55°C to +85°C
Cap. Range	0.1μF−330μF
Cap. Tol.	±20%, ±10%
Volt. Range	3.15VDC−50VDC
Leakage (Max.)	.007CxV or .05μA whichever is greater

Ceramic Disc
CD

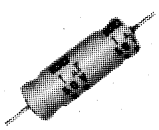
Various lead forms are available in both bulk and tape & reel packaging.

Temperature Compensating
NPO−N750
100V−1000V

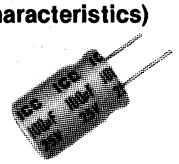
General Purpose
100pF−100,000pF
50V−1000V

Semiconductor
10,000pF−100,000pF
12V−50V

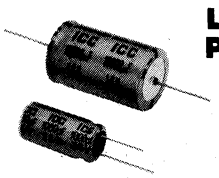
Non-Polar NTD (General Purpose) NTA (Superior Characteristics)



Temp. Range	−25°C to +85°C	**Volt. Range**	16WV−50WV
Cap. Range	0.47μF−470μF	**Leakage (Max.)**	0.06CxV +10μA, 0.1CxV +10μA
Cap. Tol.	−10% +50%, ±30%, ±20%, ±10%		



Low Impedance Radial Lead for Switching Power Supply Output & Regulator Circuits
PZL



Temp. Range	−55°C to +105°C	**Volt. Range**	7.5VDC−100VDC
Cap. Range	2.2μF−8200μF	**Leakage (Max.)**	≤40V = $0.5\sqrt{CxV}\mu A$ >40V = $\sqrt{CxV}\mu A$
Cap. Tol.	−10% +75%		

Series Features Low Impedance, High E.S.R. & Ripple Current Specifications

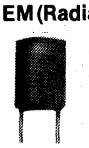
Snap-In Capacitors — Switching Power Supply Input Circuit

PST — Standard Height
PSL — Low Profile Construction
PXT — Extra High Ripple — Standard Height
PXL — High Ripple Low Profile

Specifications	PST	PSL	PXT	PXL
Temp. Range	−40°C to +85°C			
Cap. Range	220μF−22000μF	220μF−22000μF	100μF−820μF	100μF−390μF
Cap. Tol.	±20%	±20%	±20%	±20%
Volt. Range	10VDC−250VDC	10VDC−250VDC	200VDC−250VDC	200VDC−250VDC
Leakage (Max.)	.02CxV or 2000μA whichever is smaller		.02CxV or 3000μA whichever is smaller	

FILM CAPACITORS

Polyester Film
EM (Radial Leads, Welded Construction)



Temp. Range	−55°C to +85°C
Cap. Range	.001μF−0.47μF
Cap. Tol.	±5%, ±10%, ±20%
Volt. Range	100V, 200V, 400V

Metalized Polyester Film
PMG

Polyester Film/Foil
FM
(Radial Leads, Welded Construction)

	PMG	FM
Temp. Range	−55°C to +155°C	−40°C to +85°C
Cap. Range	.01μF−4.7μF	.001μF−0.47μF
Cap. Tol	±10% STD	±10% STD
Volt. Range	250V−630V	100V

Metalized Polyester Film
YM

Polyester Film/Foil
YFT
(Axial Leads, Welded Construction)

	YM	YFT
Temp. Range	−40°C to +85°C	−40°C to +85°C
Cap. Range	.01μF−10μF	.001μF−1.0μF
Cap. Tol.	±10%, ±20%	±10%, ±20%
Volt. Range	250V−630V	100V−1000V

Polypropylene Film
PP (Radial Leads, Welded Construction)

Temp. Range	−40°C to +85°C
Cap. Range	.001μF−0.47μF
Cap. Tol.	±5%, ±10%, ±20%
Volt. Range	250V−630V

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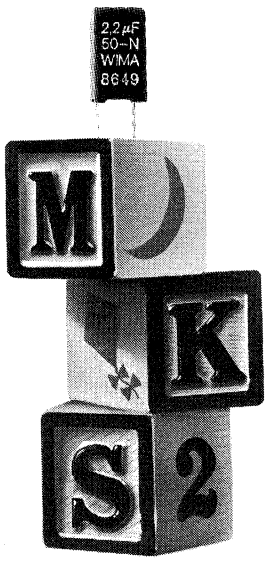
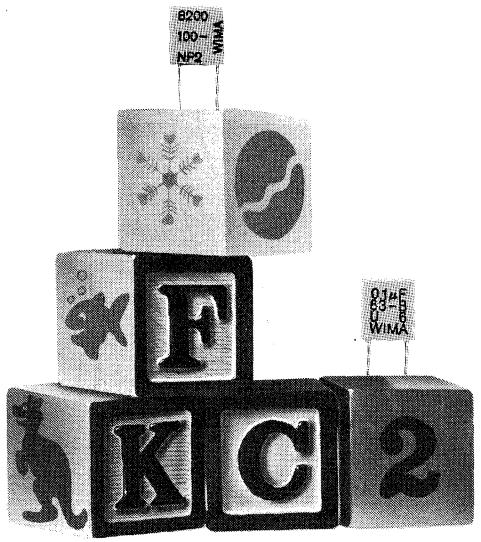
3/88

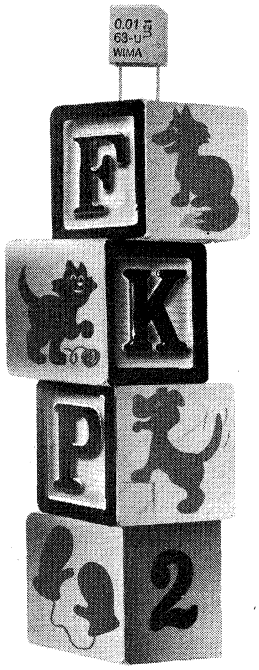
Building the Basics in Products and Services.



Polyester Series
MKS-2, MKS-2i, MKS-20, FKS-2



Polycarbonate Series
FKC-2, MKC-2



Polypropylene Series
FKP-2

Featuring the broadest line of Miniature Specialty Film Capacitors.

Building Basics from WIMA.

Polyester Series

- Pulse duty rated 5 to 300 volts per microsecond
- 2.5 and 5mm lead spacing
- Values from 100 pf to 2.2 mf
- 50, 63 & 100 volt ratings

Polycarbonate Series

- Rated to 125°C
- Long term drift to $< \pm 1\%$
- Values from 100pf to .1 mf
- Tolerance to 2.5%

Polypropylene Series

- Low Dielectric absorption .05% to .1%
- Negative temperature coefficient
- Minimum power factor, i.e. 4×10^{-4} at 1KHz
- Tolerance to 2.5%

Service Basics from ITG.

- Real-time computerized inventory control
- Dedicated buffer stock
- MRP/JIT program services
- Nationwide network of sales representatives and distributors
- Component and design engineering services

WIMA capacitors from ITG are available on tape and reel, and, of course, meet the WIMA 10PPM guarantee.

For more information on CECC quality standards contact...

The Inter-Technical Group Inc.
WIMA Division

P.O. Box 23, One Bridge Street,
Irvington, NY 10533

For the right product for your application, call... (914) 591-8822

QUALITY CAPACITORS... IF THE APPLICATION IS CRITICAL, THE ANSWER IS WIMA®
WIMA is a registered trademark of Wilhelm Westermann, Mannheim, West Germany.

SI UNITS

RELATIVE QUANTITY SYMBOLS

$\neq$	not equal to
$\approx$	approximately equal to
$\propto$	proportional to
$<$	smaller than
$\leq$	smaller than or equal to
$\ll$	much smaller than
$>$	larger than
$\geq$	larger than or equal to
$\gg$	much larger than
$\equiv$	identical to or equivalent
$\uparrow$	increases
$\downarrow$	decreases

PREFIXES FOR SI UNITS

Multiple	Prefix	Symbol
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p

Quantity	Symbol	SI Unit	Symbol	Derivation
acceleration	a	m s^{-2}	—	velocity/time
acceleration due to gravity	g	m s^{-2}	—	velocity/time
amount of substance	n	mole	mol	mole fraction (n) used
amplification factor	μ	*a ratio*	—	—
angle	$\theta_1, \varphi_1, \alpha_1$	—	—	—
angle of incidence	i	degree or radian	°	—
angle of refraction	r	degree or radian	°	—
angle, Bragg	θ	number	—	—
angle, critical	c	degree or radian	°	—
anode slope resistance	R_A	ohm	Ω	$\Delta V_a / \Delta I_a$
area	A	metres squared	m^2	$l \times b$
atomic number	Z	a number	—	number of protons
Avogadro constant	L, N_A	number	—	—
breadth	b	metre	m	fundamental unit
capacitance	C	farad	F	charge/p.d.
charge, electric	Q	coulomb	C	current × time
charge on electron	e	coulomb	C	$1{\cdot}6 \times 10^{-19}$ C
conductance	G	ohm^{-1}	Ω^{-1}	reciprocal of resistance
current, electric	I	ampere	A	fundamental unit
decay constant	λ	*a ratio*	—	—
density	ρ	kg m^{-3}	—	m/V
distance along path	s	metre	m	fundamental unit
efficiency	η	*a ratio*	—	work output/work input
electrochemical equiv.	z	g C^{-1}	—	mass/charge
electromotive force	E	volt	V	energy/charge
electron	e	—	—	—
energy	E	joule	J	N m
energy, kinetic	E_k	joule	J	N m. $E_k = 1/2mv^2$
energy, potential	E_p	joule	J	N m. $E_p = mgh$
Faraday constant	F	coulomb mol^{-1}	C mol^{-1}	96,500 C mol^{-1}
field strength, electric	E	V m^{-1}	—	potential gradient: p.d./dist.
field-strength magnetic	H	ampere-turns	—	current × no. of turns
flux, magnetic	Φ	weber	Wb	e.m.f/rate of change of flux
flux density	B	tesla	T	flux/area
focal length	f	metre	m	—
force	F	newton	N	kg m s^{-2}
free energy	ΔG	joule	J	—
frequency	f	hertz	Hz	oscillations/time
gas constant	r	joule	J	energy
half-life,radioactivity	$t_{1/2}$	second	s	fundamental unit
heat capacity	C	J K^{-1}	—	quantity of heat/temp. rise
heat of reaction	ΔH	joule	J	heat energy
heat capacity, specific	c	J K^{-1} kg^{-1}	—	heat capacity/mass
heat, quantity of	q	joule	J	energy

SI UNITS

Quantity	Symbol	SI Unit	Symbol	Derivation
height	h	metre	m	fundamental unit
image distance	υ	metre	m	fundamental unit
inductance, mutual	M	henry	H	induced e.m.f./rate of change of current
inductance, self	L	henry	H	—
intensity of radiation	I	*a number*	—	—
latent heat	L	joule	J	quantity of heat
latent heat, specific	l	J kg^{-1}	—	quantity of heat
latent heat, molar	L_m	joule mol^{-1}	J	quantity of heat
length	l	metre	m	fundamental unit
magnetizing force	H	ampere-turns	—	—
magnetic moment	m	Wb m	—	torque in unit magnetic field
magnification, linear	m	*a ratio*	—	—
mass	m	kilogramme	kg	fundamental unit
mass number	A	*a number*	—	number of neutrons + protons
molar volume	V_m	(dm^3)	—	volume of 1 mole
molar solution	M	*a ratio*	—	moles/dm^3
moment of force	—	N m	—	force × perp. distance
neutron number	N	*a number*	—	number of neutrons
number	n	—	—	—
number of molecules	N	—	—	—
number turns on coil	n	*a number*	—	—
number order spectrum	p	*a number*	—	—
object distance	u	metre	m	fundamental unit
peak current	I_O	ampere	A	see current
peak e.m.f.	E_O	volt	V	see e.m.f.
period	T	second	s	fundamental unit
permeability	μ	H m^{-1}	—	henry/metre
permeability, vacuum	μ_o	H m^{-1}	—	—
permeability, relative	μ_r	*a ratio*	—	$\mu = \frac{\mu}{\mu_O}$
permittivity	ε	F m^{-1}	—	farad/metre
permittivity, vacuum	ε_o	F m^{-1}	—	farad/metre
permittivity, relative	ε_r	*a ratio*	—	$\varepsilon_r = \frac{\varepsilon}{\varepsilon_o}$
potential, electric	V	volt	V	energy/charge
potential difference	V	volt	V	energy/charge
power	P	watt	W	J s^{-1}
pressure	p	pascal	Pa	N m^{-2}: force/area
radius	r	metre	m	fundamental unit
reactance	X	ohm	Ω	E_O/I_O
refractive index	n	*a ratio*	—	—
resistance	R	ohm	Ω	p.d./current
resistivity, electrical	ρ	ohm-metre	—	resistance × length
relative density	d	*a ratio*	—	ρ_{sub}/ρ_{water}
r.m.s. current	$I_{r.m.s}$	ampere	A	see current
r.m.s. voltage	$V_{r.m.s}$	volt	V	see e.m.f.
slit separation	s	metre	m	fundamental unit
tension	T	newton	N	see force
temperature, Celsius	θ	degree C	°C	from kelvin
temp. interval	θ	degree	° or K	—
temp. absolute	T	kelvin	K	fundamental unit
thickness	d	metre	m	fundamental unit
time	t	second	s	fundamental unit
torque	T	Nm	—	see moment
turns ratio	T	*a ratio*	—	n_{sec}/n_{prim}
(unit of electricity)	—	kW h	—	kilowatt × hour
velocity	u,υ	ms^{-1}	—	distance/time
velocity, angular	ω	$second^{-1}$	s^{-1}	angle/time
velocity, e.m.waves	c	m s^{-1}	—	—
velocity of sound	υ	m s^{-1}	—	—
volume	V	metre cubed	m^3	l × b × h
wavelength	λ	metre	m	fundamental unit
work	w	joule	J	force x distance (Nm)
weight	W	newton	N	kg m s^{-2}or mg

ITT Components
A Unit of ITT Corporation

Epoxy Dipped Solid Tantalum Capacitors

TAP

- Extremely Low Leakage Current
- High Surge Capability
- Small Size
- High Component Density
- Rugged Construction
- Reliability-Long Term Stability
- Outstanding Performance Over Wide Frequency Range
- Wide Temperature Range

Catalog Ordering Information

TAP F 2.2 M 15 — General Specifications

- 15 — Voltage
- M — Tolerance: M ±20%, K ±10%
- 2.2 — Capacity in μF
- F — Lead Style:
  - S = 0.100″ Lead Spacing
  - C = 0.200″ with Shoulder
  - D = 0.125″ Lead Spacing
  - B = 0.250″ Lead Spacing
  - F = Lock-In Leads 0.200″ Spacing
  - E = Tape and Reel

Packed in the following quantities:

Case Size	Quantity (units per bag)	Case Size	Quantity (units per reel)
1—8	1000	1	1500
9—11	500	2—4	1250
12—15	100	5—6	1000
		7—9	750
		10—12	500

Capacitance Range (Number denotes case size)

Capacitance μF	Rated Voltage DC 6.3V	10V	16V	20V	25V	35V	50V
0.1						1	1
0.15						1	1
0.22						1	1
0.33						1	1
0.47						1	1
0.68						1	2
1.0				1	1	1	3
1.5			1	1	1	1	4
2.2		1	1	1	1	2	5
3.3	1	1	1	2	2	3	6
4.7	1	1	2	3	3	5	7
6.8	1	2	3	4	4	6	8
10.0	2	3	4	5	5	6	9
15.0	3	4	5	6	6	8	10
22.0	4	5	6	8	8	10	11
33.0	5	6	6	9	9	12	
47.0	6	7	9	10	12	13	
68.0	7	8	11	13	13		
100.0	8	10	13	13			
150.0	10	13	13				
220.0	12	14	15				
330.0	14	15					

Outline Dimensions (Maximum)

Case Size	Diameter-D Inches	Length-L Inches	Case Size	Diameter-D Inches	Length-L Inches
1	.180	.330	9	.310	.510
2	.180	.350	10	.330	.550
3	.200	.390	11	.350	.550
4	.200	.410	12	.350	.570
5	.220	.410	13	.350	.630
6	.240	.450	14	.390	.670
7	.260	.450	15	.390	.730
8	.280	.47			

TAP-S Standard Case Size 1-8
TAP-B Standard Case Size 1-15
TAP-F Standard Case Size 1-15
TAP-C Case Size 1-15
TAP-D Case Size 1-8
TAP-E Case Size 1-12

Ratings

Capacitance: 0.1 to 330 μF
Tolerance Range: ±20% (±10%)
Voltage: 6 to 50 volts
Temperature Range: Continuous operation between −55°C to +85°C

Maximum Impedance Limits (Ω) at 10 kHz/100 kHz

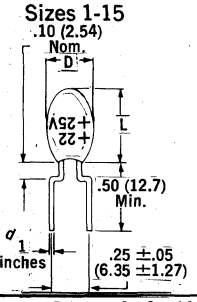
Capacitance μF	Rated Voltage DC 6.3V	10V	16V	20V	25V	35V	50V
0.1						270/26	270/40
0.15						160/21	160/21
0.22						130/17	130/17
0.33						85/15	85/15
0.47						58/13	55/13
0.68						40/10	38/10
1.0						28/8	26/8
1.5				**23/8**	23/8	20/6	18/5
2.2			24/8	18/5	15/6	13/5	12/3.5
3.3		22/10	13.5/6	13/5	13/5	10/4	9/3
4.7	18/10	12/8	11/5	9/5	7.5/4	7/3	6.5/2.5
6.8	10/8	10/6	7/4	6/3.5	5.5/3.1	4.5/2.5	4.2/2
10.0	9/6	9/5	5/3.2	4.5/8	4/2.5	3.2/2	3/1.6
15.0	8/5	4.5/3.7	3.4/2.5	3.8/2.3	2.8/2	2.5/1.6	2.4/1.2
22.0	4/3.7	3/2.7	2.5/2	2.8/1.9	2.5/1.5	2/1.3	2/1
33.0	3.2/3	2.2/2.1	2/1.6	2/1.6	1.8/1.2	1.6/1	
47.0	2/2	2/1.7	1.5/1.3	1.4/1.2	1.2/1	1.2/0.8	
68.0	1.8/1.8	1.61/1.3	1.1/1	1.1/1	1/0.8		
100.0	1.6/1.6	1/1	0.9/0.8	0.9/0.8			
150.0	0.9/0.9	0.9/0.8	0.8/0.6				
220.0	0.9/0.9	0.8/0.6	0.8/0.5				
330.0	0.7/0.7	0.7/0.5					

Maximum Leakage Current in μA

0.1						0.5	0.5
0.15						0.5	0.5
0.22						0.5	0.5
0.33						0.5	0.5
0.47						0.5	0.5
0.68						0.5	0.5
1.0						0.5	0.5
1.5				0.5	0.5	0.5	1.0
2.2			0.5	0.5	0.5	1.0	1.0
3.3		0.5	0.5	0.5	1.0	1.0	1.5
4.7	0.5	0.5	1.0	1.0	1.0	1.5	2.5
6.8	0.5	1.0	1.0	1.5	1.5	2.5	3.5
10.0	1.0	1.0	1.5	2.0	2.5	3.5	5.0
15.0	1.0	1.5	2.5	3.0	4.0	5.0	7.5
22.0	1.5	2.5	3.5	4.5	5.5	7.5	10.0
33.0	2.0	3.5	5.0	7.0	8.5	10.0	
47.0	3.0	4.5	7.5	9.5	10.0	10.0	
68.0	4.5	7.0	10.0	13.5	15.0		
100.0	6.5	10.0	15.0	20.0			
150.0	9.5	15.0	20.0				
220.0	14.0	20.0	20.0				
330.0	20.0	20.0					

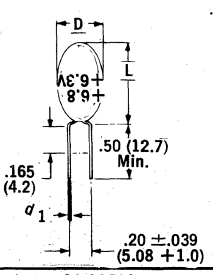
Mechanical Specifications

Tap B Formed Leads Sizes 1-15

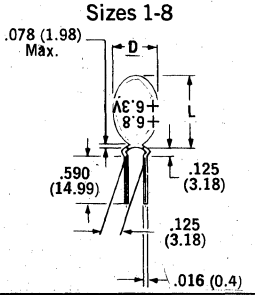


DIMENSIONS in inches (millimeters)

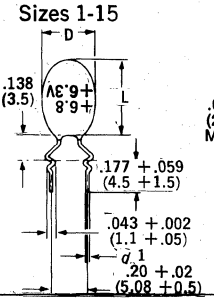
Tap C Formed Leads Sizes 1-15



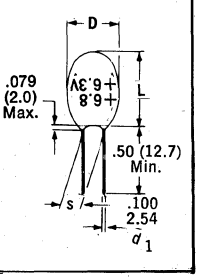
Tap D Formed Leads Sizes 1-8



Tap F Lockin Leads Sizes 1-15



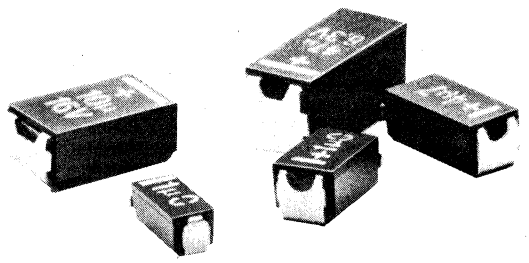
Tap S Straight Leads Sizes 1-8



ITT COMPONENTS • 5 Jenner St. Ste 100 • Irvine CA 92718 • Phone: (714) 727-3001 • TWX: 910-595-1744 • Telex: 69-1389 • FAX: 714-727-2109

ITT Components
A Division of ITT Corporation

Tantalum Capacitors
Solid Tantalum Chip TAJ



DESIGN AND APPLICATION FEATURES

1. A flat top surface for vacuum pick up — compatible with high volume insertion equipment.
2. Regular molded shape — guarantees accurate transfer and placement during insertion.
3. High density packaging on 8 mm and 12 mm blister tape, available on 7″ and 13″ reels.
4. Glue pad on underside of component allows consistent, strong bonding to circuit board prior to soldering.
5. Guaranteed termination dimensions — allows reliable pad design and consistent "fit" to pad — eliminates "tombstoning" or "jumping-bean" effects, and reduces "rotational" effects considerably.
6. Compliant terminations — thermomechanical stresses during operation and mechanical stresses during equipment servicing **not** transferred to component.
7. Rugged construction prevents damage during mounting and ensures compatibility with all systems for soldering (infra-red, solder wave, solder reflow).
8. Resistant to flux removal solvents and solvent systems used with vapor phase soldering.
9. All parts are indelibly laser coded on uppermost surface with videcon-readable polarity mark.

Capacitance Range: 0.1 μF to 100 μF
Capacitance Tolerance: $\pm$20%, $\pm$10%
Temperature Range: $-$55°C to $+$125°C
Environmental Classification: 55/125/56 (IEC 68-2)
Adhesion to Substrate: 5N min. (IEC 384-3)

Dimensions mm (inches)

Case Size	L +0.2 (0.008) −0.1 (0.004)	W +0.2 (0.008)) −0.1 (0.004)	H +0.2 (0.008) −0.1 (0.004)	W_1 ±0.1 (0.004)	A +0.3 (0.012) −0.2 (0.008)	S Min.
A	3.2(0.126)	1.6(0.063)	1.6(0.063)	1.2(0.047)	0.8(0.031)	1.1(0.043)
B	3.5(0.138)	2.8(0.110)	1.9(0.075)	2.2(0.087)	0.8(0.031)	1.4(0.055)
C	6.0(0.236)	3.2(0.126)	2.6(0.102)	2.2(0.087)	1.3(0.051)	2.9(0.114)
D	7.3(0.287)	4.3(0.169)	2.9(0.114)	2.4(0.094)	1.3(0.051)	4.4(0.173)

Notes: Manufacturing dimensions are mm. Imperial dimensions are for reference only. W_1 dimension applies to the termination width for A dimension only. Stand off (R) is 0.1 ±0.1 (0.004 ±0.004).

TAPE AND REEL PACKAGING FOR AUTOMATIC COMPONENT INSERTION.
Supplied as standard (suffix R). Loose products supplied on request (omit suffix).
TAPE SPECIFICATION
Dimensions A_0 and B_0 of the pocket and the tape thickness are dependent on the component size.

Tape Code	8 mm Tape		12 mm Tape	
	mm	inches	mm	inches
P	4 ±0.1	0.157 ±0.004	4 ±0.1	0.157 ±0.004
G	0.75 min.	0.03 min.	0.75 min.	0.03 min.
F	3.5 ±0.5	0.138 ±0.02	5.5 ±0.5	0.22 ±0.02
E	1.75 ±0.1	0.069 ±0.004	1.75 ±0.1	0.069 ±0.004
W	8 ±0.2	0.315 ±0.008	12 ±0.2	0.472 ±0.008
P_2	2 ±0.15	0.079 ±0.006	2 ±0.15	0.079 ±0.006
P_0	4 ±0.1	0.157 ±0.004	4 ±0.1	0.157 ±0.004
D	1.5 ±0.1	0.059 ±0.004	1.5 ±0.1	0.059 ±0.004
D_1	1.0 min.	0.039 min.	1.0 min.	0.039 min.

Tape dimensions comply to IEC 286 (supplement 40/110/80) and EIA RS 481.

PLASTIC TAPE REEL DIMENSIONS
Quantities on reel

Case Size	Tape Width	7″ Reel (178mm)	13″ Reel (330mm)
A	8mm	2000	10,000
B	8mm	2000	8,000
C	12mm	500	2,500
D	12mm	500	2,000

COVER TAPE DIMENSIONS
Thickness: 72μ
Width of Tape:
5.5mm +0.2mm (8mm tape)
9.5mm +0.2mm (12mm tape)
12.5mm +0.2mm (16mm tape)
Tape materials are styrene and butadiene which do not affect component solderability during storage.

ORDERING INFORMATION

TAJ B 33 M 16 R

- TAJ — Tantalum chip
- B — Case size
- 33 — Microfarad code
- M — Capacitance tolerance M — ±20%, K — ±10%
- 16 — Rated voltage code
- R — Tape and reel configuration

RATINGS AND PART NUMBER REFERENCE

ITT Part No.	Case Size	Capacitance μF	Rated Voltage @ 85°C	Max. DC Leakage μA @ 25°C	Max. DF (%) @ 120 Hz @ 25°C	Max. Z (Ω) @ 100 KHz @ 25°C
TAJA3.3(*)4	A	3.3	4	0.5	6	20
TAJB10(*)4	B	10	4	0.5	6	15
TAJC22(*)4	C	22	4	0.9	6	7.5
TAJC33(*)4	C	33	4	1.4	6	7.5
TAJD47(*)4	D	47	4	1.9	6	7.5
TAJD68(*)4	D	68	4	2.7	6	7.5
TAJD100(*)4	D	100	4	4.0	6	2.5
TAJA2.2(*)6	A	2.2	6.3	0.5	6	20
TAJB6.8(*)6	B	6.8	6.3	0.5	6	15
TAJC15(*)6	C	15	6.3	1.0	6	7.5
TAJD22(*)6	D	22	6.3	1.4	6	7.5
TAJD47(*)6	D	47	6.3	3.0	6	7.5
TAJD68(*)6	D	68	6.3	4.3	6	2.5
TAJD100(*)6	D	100	6.3	6.3	6	2.5
TAJA1.5(*)10	A	1.5	10	0.5	6	20
TAJB4.7(*)10	B	4.7	10	0.5	6	15
TAJC10(*)10	C	10	10	1.0	6	7.5
TAJD33(*)10	D	33	10	3.3	6	7.5
TAJD47(*)10	D	47	10	4.7	6	2.5
TAJA1.0(*)16	A	1.0	16	0.5	4	20
TAJB2.2(*)16	B	2.2	16	0.5	6	15
TAJB3.3(*)16	B	3.3	16	0.5	6	15
TAJC4.7(*)16	C	4.7	16	0.8	6	7.5
TAJC6.8(*)16	C	6.8	16	1.1	6	7.5
TAJD10(*)16	D	10	16	1.6	6	7.5
TAJD22(*)16	D	22	16	3.5	6	7.5
TAJD33(*)16	D	33	16	5.3	6	2.5
TAJA0.68(*)20	A	0.68	20	0.5	4	50
TAJB2.2(*)20	B	2.2	20	0.5	6	15
TAJC4.7(*)20	C	4.7	20	1.0	6	7.5
TAJD15(*)20	D	15	20	3.0	6	7.5
TAJD22(*)20	D	22	20	4.4	6	2.5
TAJA0.47(*)25	A	0.47	25	0.5	4	50
TAJB1.5(*)25	B	1.5	25	0.5	6	15
TAJC3.3(*)25	C	3.3	25	0.9	6	7.5
TAJD6.8(*)25	D	6.8	25	1.7	6	7.5
TAJD10(*)25	D	10	25	2.5	6	7.5
TAJD15(*)25	D	15	25	3.8	6	2.5
TAJA0.1(*)35	A	0.1	35	0.5	4	50
TAJA0.15(*)35	A	0.15	35	0.5	4	50
TAJA0.22(*)35	A	0.22	35	0.5	4	50
TAJA0.33(*)35	A	0.33	35	0.5	4	50
TAJB0.47(*)35	B	0.47	35	0.5	4	50
TAJB0.68(*)35	B	0.68	35	0.5	4	50
TAJB1.0(*)35	B	1.0	35	0.5	4	15
TAJC1.5(*)35	C	1.5	35	0.6	6	15
TAJC2.2(*)35	C	2.2	35	0.8	6	7.5
TAJD3.3(*)35	D	3.3	35	1.2	6	7.5
TAJD4.7(*)35	D	4.7	35	1.6	6	7.5
TAJD6.8(*)35	D	6.8	35	2.4	6	7.5
TAJD10(*)35	D	10	35	3.5	6	7.5
TAJA0.1(*)50	A	0.1	50	0.5	4	50
TAJB0.15(*)50	B	0.15	50	0.5	4	50
TAJB0.22(*)50	B	0.22	50	0.5	4	50
TAJB0.33(*)50	B	0.33	50	0.5	4	50
TAJC0.47(*)50	C	0.47	50	0.5	4	50
TAJC0.68(*)50	C	0.68	50	0.5	4	50
TAJC1.0(*)50	C	1.0	50	0.5	4	15
TAJD1.5(*)50	D	1.5	50	0.8	6	7.5
TAJD2.2(*)50	D	2.2	50	1.1	6	7.5
TAJD3.3(*)50	D	3.3	50	1.7	6	7.5
TAJD4.7(*)50	D	4.7	50	2.4	6	7.5

(*) Insert K for ±10% capacitance tolerance and M for ±20%.

CODING INFORMATION
The positive end of body has videcon readable polarity bar marking. Bodies are product coded by indelible laser marking on top surface as follows:

A, B case
Voltage code (see below)
Capacitance in μF

Voltage Code A & B Case	Rated Voltage at 85°C
G	4
J	6.3
A	10
C	16
D	20
E	25
V	35
T	50

C, D case
Capacitance in μF
Rated voltage at 85°C

SPECIFICATION
Surge Voltage

85°C Rated Voltage (VDC)	85°C Surge Voltage (VDC)	125°C Rated Voltage (VDC)	125°C Surge Voltage (VDC)
4	5.2	2.5	3.5
6.3	8	4	5
10	13	6.3	9
16	20	10	12
20	26	13	16
25	33	16	21
35	46	23	28
50	65	33	40

Reverse voltage
The peak reverse voltage applied to the capacitor must not exceed:
0.15 U_R at 20°C
0.10 U_R at 55°C
0.05 U_R at 85°C
0.01 U_R at 125°C
} or 1V whichever is the lesser

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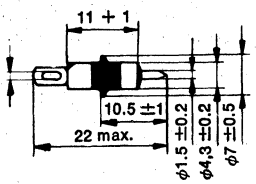
(516) 937-3475/TWX 503242/ISL-INT
FAX (516) 937-3840

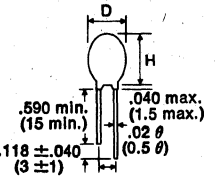
CAPACITORS / SILICON DIODES / CARBON FILM RESISTORS / LEDS / POTENTIOMETERS / TRANSFORMERS ADAPTORS AND POWER SUPPLIES

Ceramic Discs

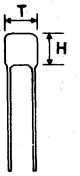
Feed Thru



Dipped Tantalum



Monolythic



DISC CAPACITORS HIGH VOLTAGE TYPES/KV1
From 1 kV to 8 kV—EIA Types (Y5P/25P) (Y5U/25U)

SAFETY TYPE DISC CAPACITORS/KZ
For AC Applications

MONOLITHIC CAPACITORS TO 200V
NPO X7R Z5U

TRAPEZOIDAL CAPACITORS 500V/T7/T12
REDUCED TITANATE DISC/KR1
.001 mFd to .18 mFd 50V for bypass application

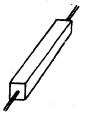
SUBMINIATURE DISC CAPACITORS 500V/K1
All TC's starting at 4mm
P100 ..... N56000
HIK Y5P Z5V

FEED-THROUGH CAPACITORS 500V
3 & 4mm With and Without Pin

FOIL CAPACITORS

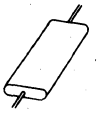
1511 Molded Radial

2710 Molded Axial



1012 Wrap and Fill Round

1011 Oval



1010 Axial

MPE104 Epoxy DIP Radial

Capacitor Type	PS Polystyrene	PE Polyester	PC Polycarbonate	PPR Polypropylene	MPE Metallized Polyester	MPC Metallized Polycarbonate	MPP Metallized Polypropylene
Cap Range	33 pf to .82 μf	.001 to 1 μf	470 pf to .1 μf	.0022 to .1 μf	.01μ to 10 μf	.01 to 10μf	.002 to 1.8 μf
Avail Tol. ±%	10, 5, 2.5	20, 10, 5	20, 10, 5	20, 10, 5	20, 10, 5	20, 10, 5	20, 10, 5
VDC	63V to 1000V	100 to 1000	160, 400	630, 1000, 1500	100 to 1000	100 to 630	400 to 1500
AC Vrms	.4 × Rated DC	63 to 250	100, 200	300, 350, 400	63 to 250	63 to 220	≈ .4 VDC
Pdn Test Voltage	3 × Rated	2 × Rated	2 × Rated	2 × Rated	1.6 × Rated	1.6 × Rated	1.6V Rated
Dielectric Loss @ 1 kHz, 20°C	≤2 × 10^{-4} ≤5 × 10^{-4} Cn <10 μf <Cn	Tan δ ≤60 × 10^{-4}	Tan δ ≤10^{-4}	Tan δ @ 10 kHz ≤5 × 10^{-4}	Tan δ ≤10^{-4}	Tan δ 50 × 10^{-4} Cn <1 μf Tan δ 80 × 10^{-4} Cn >1 μf	≤25 × 10^{-4} C >/μf
Insulation Res.	Ri ≥ 10^{-5} Meg Cn ≤.1 μf Ri Cn ≥10^{-4} Sec cn >.1 μf	Ri ≤30,000 Meg Cn ≤.33 μf Ri Cn = 10,000 Sec Cn >.33 μf	Ri ≥30,000 Meg	Ri ≥30,000 Meg	Ri ≤3750 Meg Cn ≤.33 μf Ri Cn >1250 Cn ≥ .33 μf	Ri ≤3750 Meg Cn ≤.33 μf Ri Cn >1250 Cn ≥ .33 μf	≥20,000 Meg C ≤.33 μf Ri × Cn >6000 Sec C >.33
Operating °C Temp. Range	−40 to +70	−40 to +100	−40 to +100	−40 to +85	−40 to +85	−40 to +85	−25 to +85
Temp. Coefficient	−(125 ±60) × 10^{-6}/°C	≈ 10^{-4}/°C	Less than 5 × 10^{-5}/°C	−200 × 10^{-6}/°C	≈10^{-4}/°C	Less than 5 × 10^{-5}/°C	−200 × 10^{-6}/°C
Pulse Loading	1000V/μsec	1000 v/μsec	1000V/μsec	750V/μsec	1.5 to 24V/μsec*	1.5 to 24V/μsec*	4 to 125V/μsec†
Inductance at Term Length 6 MM	10 nH/Cm Length of cap	20 nH	15 nH	10 nH	20 nH	20 nH	20 H

* Varies with Case Size and Voltage Rating. † Depending on Value and Voltage Rating.

ALUMINUM ELECTROLYTIC CAPACITORS

Application	Type R-Radial T-Axial	Operating Temperature Range	Rated Voltage Range	Leakage Current @ 25°C i_L μa, C mf, V volts (Rated)	Standard Tolerances
General Uses • Filter • By Pass • Radio • TV • Industrial	RS TS	Under 100V: −40°C +85°C Over 100V: −25°C +85°C	6.3V—500V	i_L <.03 CV or 4 μa whichever is greater	−10 +75% <4.7 mf <−10 +50%
Sub Miniature Size Low Leakage • Timing Circuits • Pulse Circuits • Substitutes for Tantalums	SMR SMT	−40°C +85°C	6.3V—50V	i_L <.002 CV or .3 μa whichever is greater	±20%
Epoxy Sealed • Same applications as SM Series, but impervious to chlorinated solvents	LMR LMT	−40°C +85°C	16V—50V	i_L <.002 CV or .3 μa whichever is greater	±20%
Non Polar • General Use • Small Size	NPR NPT	−40°C +85°C	6.3V—100V	i_L <.01 CV +3 μa	±30% −20% & 10% available
Non Polar • Cross Over Networks • High Circulating Currents	BPR BTT	−25°C +85°C	16V—63V	i_L <.03 CV +4 μa	±20%
Military and Telecommunication • Hi Reliability	MTT	−55°C +125°C	3.5—250 VDC	i_L <.01 V $\sqrt{C}$ +2μa	−10 +75% <75V <−10 +50%
Horizontal Deflection • For "S" Correction in Transistor Circuits • Low Cost Substitutes for Film Capacitors	HD	−25°C +85°C	25 VAC	30 μa max	±20%

SEE OUR PAGES IN SECTIONS 5600, 2100, 6000 & 4100

TW Paktron

Chip Film Capacitors

Surfilm® Chip Capacitor Type

ST

Metallized Polyester Multilayer Chip

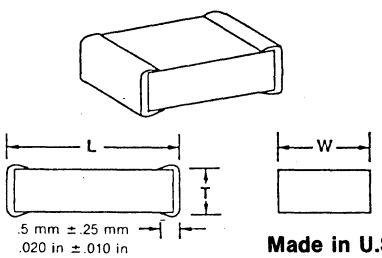
Tolerance: Available in ± 5%, 10%, 20%.

Construction: Non-inductively constructed with metallized polyester dielectric, parallel plate multilayer film.

Marking: capacitance, tolerance, voltage and mfg. on the container.

Reel Packaging: 12 or 16* mm plastic tape.

Termination: Copper tinned with 63/37 SnPb solder. Suitable for IR or vapor phase soldering @ 215°C for 1 minute.



Made in U.S.A.

EXAMPLE: .1 MFD 10% 50 VDC = 104 K 050 ST 1812 T

HOW TO ORDER

PF CODE	TOLERANCE	VOLTAGE	TYPE	STYLE	PACKAGING
	J = ± 5% K = ±10% M = ±20%	050 = 50V	ST	1210 1812 2225 2824 3827	T = Tape & Reel B = Bulk

Capacitance		50 VDC									
		ST 1210		ST 1812		*ST 2225		*ST 2824		*ST 3827	
		L = 3.2 ± 0.2 mm .126 ± .008 in		L = 4.5 ± 0.3 mm .180 ± .012 in		L = 5.6 ± 0.3 mm .220 ± .012 in		L = 7.1 ± 0.3 mm .280 ± .012 in		L = 9.6 ± 0.3 mm .378 ± .012 in	
		W = 2.5 ± 0.2 mm .098 ± .008 in		W = 3.2 ± 0.2 mm .126 ± .008 in		W = 6.35 ± 0.4 mm .250 ± .016 in		W = 6.1 ± 0.4 mm .240 ± .016 in		W = 6.85 ± 0.4 mm .270 ± .016 in	
PF CODE	MFD	T MAX MM	T MAX IN	T MAX MM	T MAX IN	T MAX MM	T MAX IN	T MAX MM	T MAX IN	T MAX MM	T MAX IN
103	.01	1.36	.054	1.32	.052						
153	.015	1.68	.066	1.40	.055						
223	.022	1.62	.064	1.60	.063						
333	.033	2.07	.082	1.63	.064						
473	.047	1.80	.071	1.49	.059						
683	.068	2.29	.090	1.83	.072						
104	.1	3.02	.119	2.35	.093						
154	.15			2.10	.083						
224	.22			2.74	.108	2.10	.083				
334	.33					2.77	.109				
474	.47					3.64	.144	2.94	.116		
684	.68					3.10	.122	3.93	.155		
105	1.0					4.22	.166	3.37	.133	3.62	.143
155	1.5									3.17	.125
225	2.2									4.31	.170

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ITW Paktron

Film Capacitors

Angstor® Capacitor Type

RA

Metallized Polyester Multilayer Film Radial Leads

Tolerance: Available in ± 5, 10, 20%.

Construction: Non-inductively constructed with metallized polyester dielectric. Parallel plate-multilayer film.

Case: Polyester tape.

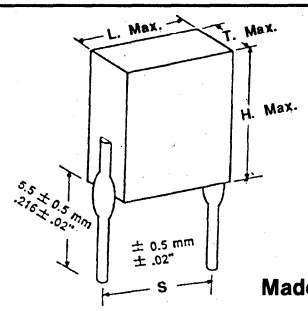
Wire Leads: #22 AWG (.025")

Marking: Parts are continuously marked ITW® and PF code. Capacitance, tolerance, working voltage and manufacturer printed on container.

Reel Packaging: Available for automatic insertion.

Temperature Range: -55°C to 125°C; 55°C to 85°C @ rated voltage and ½ rated voltage @ 125°C.

Self Inductance: ~ 6 nh.



Made in U.S.A.

EXAMPLE:	.1 MFD ± 10% 50 VDC = 104	K	050	RA	2	R
HOW TO ORDER	**PF CODE**	**TOLERANCE** J = ± 5% K = ±10% M = ±20%	**VOLTAGE** 050 = 50V 063 = 63V 100 = 100V	**TYPE** RA	**LEAD SPACING** 2 = 5mm 3 = 7.5mm 4 = 10mm	**REEL PACK** when required

Capacitance		50 VDC & 63 VDC						100 VDC					
		RA 2		RA 3		RA 4		RA 2		RA 3		RA 4	
		S = .197 *5.0mm*		S = .295 *7.5mm*		S = .394 *10mm*		S = .197 *5.0mm*		S = .295 *7.5mm*		S = .394 *10mm*	
		L = .250 *6.3mm*		L = .350 *8.9mm*		L = .450 *11.4mm*		L = .250 *6.3mm*		L = .350 *8.9mm*		L = .450 *11.4mm*	
PF CODE	MFD	T	H	T	H	T	H	T	H	T	H	T	H
102	.001	.100 *2.5mm*	.245 *6.2mm*					.100 *2.5mm*	.245 *6.2mm*				
152	.0015	.100 *2.5mm*	.245 *6.2mm*					.100 *2.5mm*	.245 *6.2mm*				
222	.0022	.100 *2.5mm*	.245 *6.2mm*					.100 *2.5mm*	.245 *6.2mm*				
332	.0033	.100 *2.5mm*	.245 *6.2mm*					.100 *2.5mm*	.245 *6.2mm*				
472	.0047	.100 *2.5mm*	.245 *6.2mm*					.100 *2.5mm*	.245 *6.2mm*				
682	.0068	.100 *2.5mm*	.245 *6.2mm*					.100 *2.5mm*	.245 *6.2mm*				
103	.01	.100 *2.5mm*	.250 *6.3mm*	.100 *2.5mm*	.245 *6.2mm*	.100 *2.5mm*	.245 *6.2mm*	.100 *2.5mm*	.250 *6.3mm*	.100 *2.5mm*	.245 *6.2mm*	.100 *2.5mm*	.245 *6.2mm*
153	.015	.100 *2.5mm*	.250 *6.3mm*	.100 *2.5mm*	.245 *6.2mm*	.100 *2.5mm*	.245 *6.2mm*	.100 *2.5mm*	.250 *6.3mm*	.100 *2.5mm*	.245 *6.2mm*	.100 *2.5mm*	.245 *6.2mm*
223	.022	.115 *2.9mm*	.250 *6.3mm*	.100 *2.5mm*	.245 *6.2mm*	.110 *2.8mm*	.245 *6.2mm*	.115 *2.9mm*	.250 *6.3mm*	.100 *2.5mm*	.245 *6.2mm*	.110 *2.8mm*	.245 *6.2mm*
333	.033	.115 *2.9mm*	.250 *6.3mm*	.110 *2.8mm*	.245 *6.2mm*	.110 *2.8mm*	.240 *6.1mm*	.115 *2.9mm*	.250 *6.3mm*	.110 *2.8mm*	.245 *6.2mm*	.110 2.8mm	.240 6.1mm
473	.047	.100 *2.5mm*	.265 *6.7mm*	.115 *2.9mm*	.245 *6.2mm*	.110 *2.8mm*	.245 *6.2mm*	.100 *2.5mm*	.265 *6.7mm*	.115 *2.9mm*	.245 *6.2mm*	.110 *2.8mm*	.245 *6.2mm*
683	.068	.120 *3.0mm*	.280 *7.1mm*	.140 *3.5mm*	.255 *6.5mm*	.115 *2.9mm*	.250 *6.4mm*	.120 *3.0mm*	.280 *7.1mm*	.140 *3.5mm*	.255 *6.5mm*	.115 *2.9mm*	.250 *6.4mm*
104	.1	.100 *2.5mm*	.255 *6.5mm*	.115 *2.9mm*	.240 *6.1mm*	.115 *2.9mm*	.250 *6.4mm*	.100 *2.5mm*	.255 *6.5mm*	.115 *2.9mm*	.240 *6.1mm*	.115 *2.9mm*	.250 *6.4mm*
154	.15	.100 *2.5mm*	.280 *7.1mm*	.125 *3.2mm*	.260 *6.6mm*	.115 *2.9mm*	.250 *6.4mm*	.170 *4.3mm*	.290 *7.4mm*	.125 *3.2mm*	.260 *6.6mm*	.115 *2.9mm*	.250 *6.4mm*
224	.22	.135 *3.4mm*	.265 *6.7mm*	.155 *3.9mm*	.280 *7.1mm*	.125 *3.2mm*	.260 *6.6mm*	.220 *5.6mm*	.320 *8.1mm*	.155 *3.9mm*	.280 *7.1mm*	.125 *3.2mm*	.260 *6.6mm*
334	.33	.175 *4.4mm*	.275 *7.0mm*	.120 *3.0mm*	.265 *6.7mm*	.125 *3.2mm*	.265 *6.7mm*			.190 *4.8mm*	.285 *7.2mm*	.125 *3.2mm*	.265 *6.7mm*
474	.47	.215 *5.4mm*	.320 *8.1mm*	.150 *3.8mm*	.275 *7.0mm*	.125 *3.2mm*	.250 *6.4mm*			.180 *4.6mm*	.305 *7.7mm*	.145 *3.7mm*	.265 *6.7mm*
684	.68	.185 *4.7mm*	.300 *7.6mm*	.170 *4.3mm*	.305 *7.7mm*	.130 *3.3mm*	.280 *7.1mm*			.235 *6.0mm*	.325 *8.3mm*	.185 *4.7mm*	.290 *7.4mm*
105	1.0	.220 *5.6mm*	.355 *9.0mm*	.225 *5.7mm*	.325 *8.3mm*	.175 *4.4mm*	.285 *7.2mm*					.230 *5.8 mm*	.325 *8.3mm*

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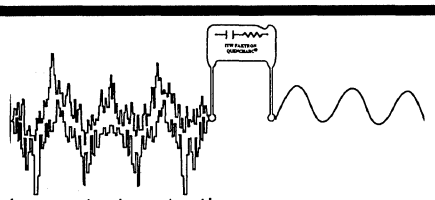
ITW Paktron
Division of Illinois Tool Works, Inc.

ITW Paktron

Arc Suppressor and Snubber Network



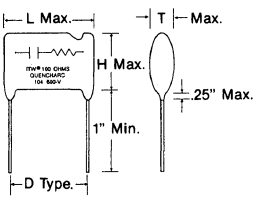
Quencharcs®

Q

Arc Suppressor Snubber Network

- Relay contact protection
- dv/dt suppression on thyristor and triacs.

Tolerance: Capacitor ±20%, Resistor ±10%.
Construction: Metalized polyester capacitor in series with a carbon composition resistor.
Case: Coated with a flame retardant epoxy.
Wire Leads: #20 AWG (.032") capacitor end. Resistor end .025" to 0.045".
Marking: ITW®, resistance, Quencharc®, capacitance, DC voltage.



CAP			RESISTOR		DIMENSIONS			
Mfd ±20%	Voltage	Type	Ohms ±10	Watt	T	H	L	D
.1	50 VDC	QT	3.9 to 100	½	.27	.62	.55	.40
.1	600 VDC 250 VAC	QC	22 to 680	½	.39	.66	1.08	.82
.25	600 VDC 250 VAC	QD	22 to 680	½	.42	.75	1.45	1.20
.5	600 VDC 250 VAC	QE	22 to 150	½	.59	.92	1.45	.120
.5	600 VDC 250 VAC	QE	220 to 330	1	.59	.92	1.54	1.25
.5	600 VDC 250 VAC	QE	470 to 680	2	.59	1.00	1.63	1.29
.5	200 VDC 125 VAC	QA	22 to 680	½	.37	.64	1.08	.82
1.0	200 VDC 125 VAC	QB	22 to 330	½	.39	.66	1.45	1.20
1.0	200 VDC 125 VAC	QB	470 to 680	2	.43	1.00	1.63	1.29
UL Recognized Across-the-Line Application ᴿᵁᴸ UL File No. E33628. NOTE: Type QRL will meet the requirements of UL1414.								
.1	125 VAC	QRL	150 to 680	½	.44	.66	1.08	.82

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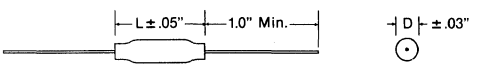
Polypropylene Film Capacitors

Micromatic® Capacitor Type

PP

Polypropylene-Foil Self Cased Axial Leads

Made in U.S.A.



"THE ±1% SOLUTION"

Tolerance: Available in ±1, 2, 2.5, 5, 10%.

VALUE	DIMENSIONS		VOLTAGE	TYPE
PF CODE	D	L	VDC	PP
101	.170	.481	600	481
121	.170	.481	600	481
151	.170	.481	600	481
181	.170	.481	600	481
221	.175	.481	600	481
271	.175	.481	600	481
331	.180	.481	600	481
391	.180	.481	600	481
471	.185	.481	600	481
561	.190	.481	600	481
681	.190	.481	600	481
821	.200	.481	600	481
102	.170	.481	600	481
122	.175	.481	400	481
152	.180	.481	400	481
182	.185	.481	400	481
222	.195	.481	400	481
272	.180	.481	400	481
332	.190	.481	400	481
292	.210	.481	400	481
472	.175	.460	250	460
562	.185	.460	250	460
682	.190	.460	250	460
822	.210	.460	250	460
103	.225	.460	250	460
123	.230	.460	250	460
153	.245	.460	250	460
183	.260	.460	250	460
223	.275	.460	250	460
273	.260	.580	250	580
333	.280	.580	250	580
393	.300	.580	250	580
473	.320	.580	250	580
563	.280	.680	100	680
683	.300	.680	100	680
823	.315	.680	100	680
104	.330	.680	100	680
124	.315	.840	100	840
154	.330	.840	100	840

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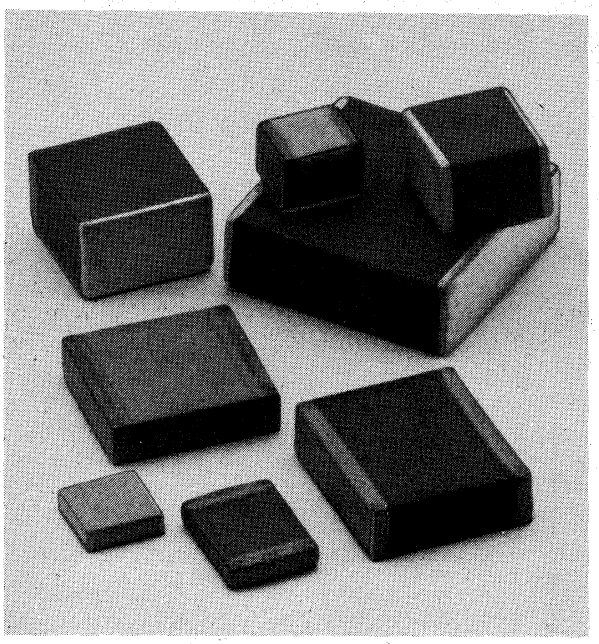

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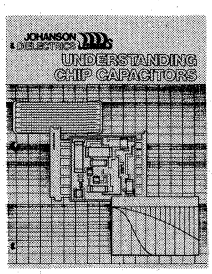

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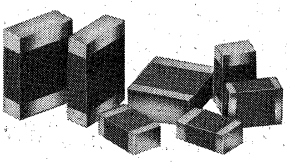
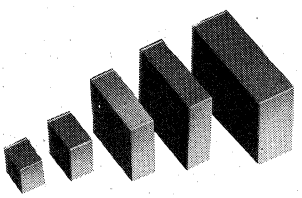
Ultra High Capacitance Chip Capacitors



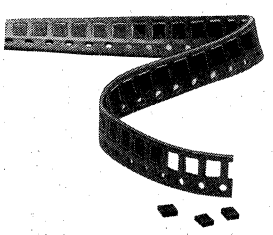
Fourteen configurations are available in four basic dielectrics: NPO/COG, BX/X7R, Z5U, and Y5V characteristics, to meet MIL-C-55681A and EIA 198B specifications. Capacitors feature high volume efficiency of capacitance, and are ideal for hybrid circuit applications.

High Voltage Chip Capacitors



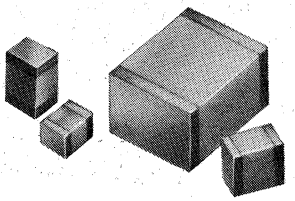
Available in either NPO/COG or BX/X7R dielectric, these units are designed to obtain high voltage values to 4000 VDCW. Typical applications include high voltage power supplies and voltage multiplier circuits.

Multilayer Ceramic Chip Capacitors on Tape & Reel



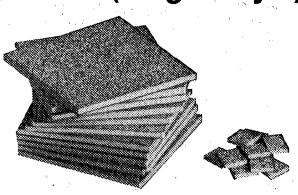
Ceramic chip capacitors designed for automatic placement on ceramic substrates on printed circuit boards in high volume surface mounted applications. Offered in three sizes R15, R18 and S41 they are suited for use with all the popular automatic placement systems. Available in 8mm tape on reel. Larser size units can be provided on 12mm tape on reel.

High Q Microwave Chip Capacitors



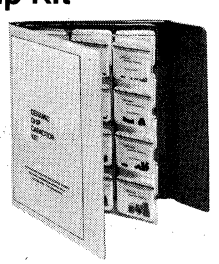
High Q microwave chip capacitors are available in four basic sizes, displaying excellent performance in the VHF, UHF and microwave ranges. The configuration, insertion loss and resonance-free performance make these chips ideal for microstrip and hybrid MIC applications.

Ceramic Capacitor Wafers (Single Layer)

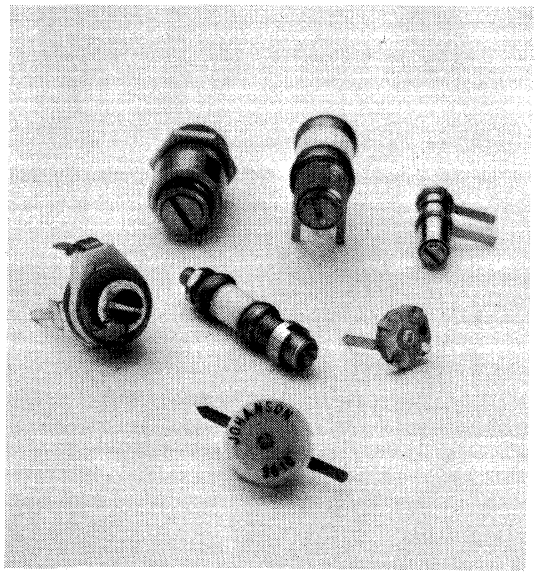


Ideally suited for micromodule and miniature hybrid integrated circuits where low profile requirements preclude the use of conventional multilayer chip capacitors. These units are used as bypass, coupling and filtering elements, (to 18GHz in microwave applications). Custom configurations are also available for high voltage applications to 15 KV.

Chip Kit



Designer kits contain standard size chips in popular capacitance values and dielectric characteristics with palladium silver terminations. Kits are supplied in a special vinyl cover for convenient shelf storage with each chip value individually packaged for easy acesss. Available with NPO/COG dielectric No. S-900, BX/X7R and Y5V dielectric No. S-905 ceramic capacitor wafers (single layer) No. S-910 and High Q S-915.



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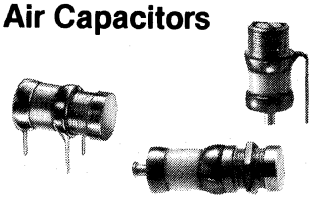
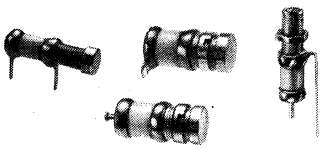
Standard Air Capacitors



- ☐ Capacitance ranges: .8-10pf to 1-30pf
- ☐ Q's to > 10,000
- ☐ Excellent tuning stability and low dynamic noise
- ☐ Patented* self-locking constant torque adjustment mechanism
- ☐ Qualified to MIL-C-14409D, QPL approved
- ☐ Engineering prototype kit JK-500

*U.S. Patent No. Re. 30,406

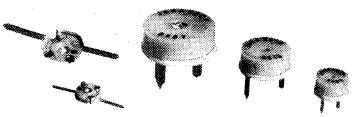
Miniature Air Capacitors



- ☐ Capacitance ranges: .35 - 3.5pf to .8 - 10pf
- ☐ Q's to > 10,000
- ☐ Patented* self-locking constant torque adjustment mechanism
- ☐ Ideal for miniature microwave, VHF and UHF applications
- ☐ Engineering prototype kit JK-500

*U.S. Patent No. Re. 30,406

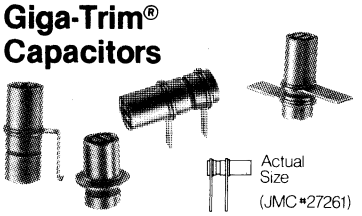
Thin-Trim® /Seal-Trim® Ceramic Capacitors



- ☐ Capacitance ranges: .2 - .6pf to 20-100pf
- ☐ Q's to > 3000 at 100 MHz
- ☐ Ideal for sub-miniature hybrid circuit applications
- ☐ Seal-Trims impervious to all standard PCB cleaning solvents
- ☐ Conform to MIL-C-81 requirements
- ☐ Engineering prototype kits available

U.S. Patent No. 4,179,722

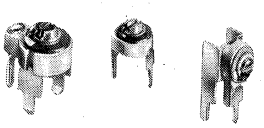
Giga-Trim® Capacitors



- ☐ Capacitance ranges: .3 - 1.2pf to .8 - 8pf
- ☐ Q's over 4000 at 250 MHz
- ☐ Ideal for microwave oscillators and filters
- ☐ Qualified to MIL-C-14409D, QPL approved
- ☐ New Zero TC verisons
- ☐ Engineering prototype kit JK-272

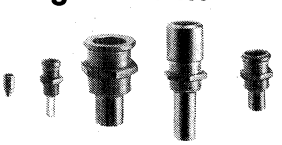
U.S. Patent No. Re. 30,406

Variable Ceramic Capacitors



- ☐ Low cost
- ☐ Broad tuning ranges: 1.7-6pf to 6.0-70pf
- ☐ Top, side and bottom tuning styles available
- ☐ Ideal for crystal oscillators, CATV amplifiers and all varieties of test and communication equipment
- ☐ Engineering prototype kit JK-930

Microwave Tuning Elements

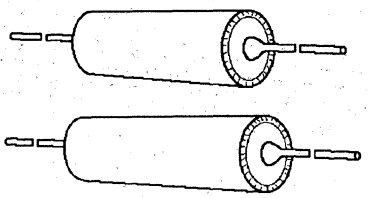


- ☐ Provide a unique money-saving means of introducing a variable reactance into waveguides, cavities, and other microwave structures
- ☐ High resolution
- ☐ Patented* self-locking constant torque adjustment mechanism

*U.S. Patent No. Re. 30,406

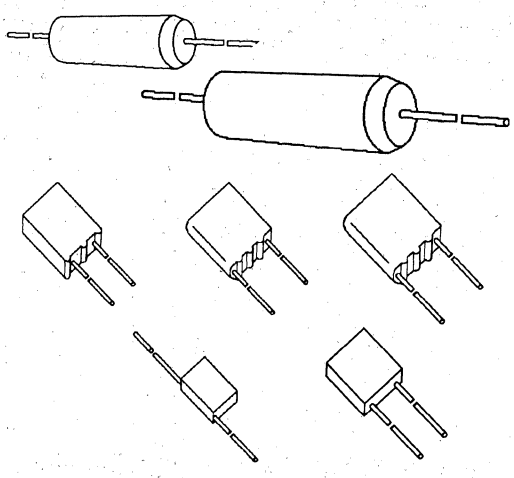
KEMET® Electronics Corporation
P.O. Box 5928, Greenville, SC 29606 • (803) 963-6300

HERMETICALLY SEALED TANTALUM



T110, T212 (CSR13), **T222** (CSR09) **T242** (CSR23), **T252** (CSR33), **T262** (CSR21), **T216** (CSS13), **T256** (CSS33), per MIL-C-39003 are available. Cap. values from .0047-1000.0μF; ±20%, ±10%, and ±5% tol.; 6-125 volts. 4 Case sizes. Higher CV values available in **T140** series. Ultra miniature **T222** cap. values from .0047-22μF. Available on tape and reel.

MOLDED TANTALUM



AXIAL

Miniature molded gold color epoxy. Laser marked. Low impedance at high frequencies. Cap. values from 0.1-330μF; 2-50 volts. 6 Case sizes. **T323** (CX01 & CX05) per MIL-C-49137 available. Available on tape and reel.

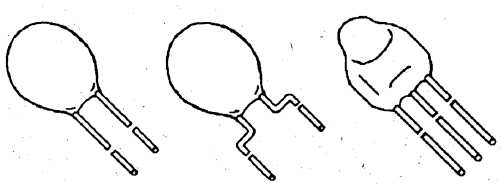
RADIAL

Precision molded gold color epoxy. Laser marked. Rectangular case, plus a radius on positive side of case. Capacitance values from 0.1-330μF; 6-50VDC. 6 Case sizes.

MICRONS

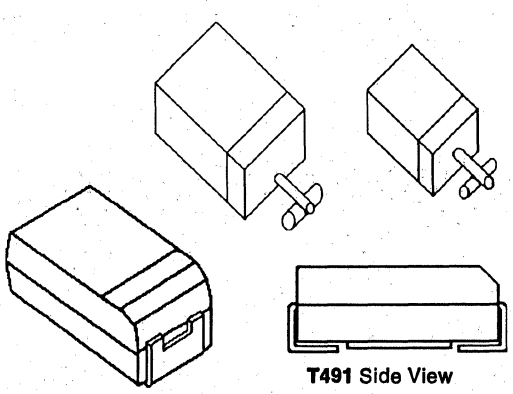
A complete line of micro-miniature solid tantalum capacitors. Microns consist of ultra small anode assemblies encapsulated in epoxy. Capacitance values from .0047-220μF; 2-35 volts.

DIPPED TANTALUM



T35X "Ultra Dip II" miniature dipped solid tantalum capacitors. Gold color epoxy. Laser marked. Compact design plus low DC leakage and DF. Cap. values from 0.1μF; 3-50 volts. 12 Case sizes.
T36X MIL-C-49137 radial dipped capacitors are available in Cap. values from 0.1μF-330.0μF; 6-50 volts.
T39X "Ultra Dip III" Three-Leaded design with anode lead in middle for "fail-safe" insertion. Cap. values from 0.1-680μF; 3-50 volts. Gold color epoxy. Laser marked. 12 Case sizes.

CHIPS TANTALUM



T491 Side View

SOLID TANTALUM CHIP CAPACITORS

T411 and **T421** offer maximum volumetric efficiency and high temperature capability. Economical price. Capacitance values from 0.1-100μF; 4 to 50 volts. 5 Case sizes.

T491 Molded tantalum chip capacitor mounts directly to printed circuit boards. Same world proven solid tantalum anode used in KEMET's leaded devices. Permanently attached to a solder coated lead frame. Assembly precision molded. Outstanding dimensional consistency. Beveled case denotes polarity. Gold color epoxy. Laser marked. Cap. values from 0.1μF-68μF; 6 to 50 volts. Cap tol. ±20% and ±10%. Available on 8mm and 12mm tape on 7" and 13" reels. Bulk packaging available.

These drawings are not to scale and are provided for reference only.

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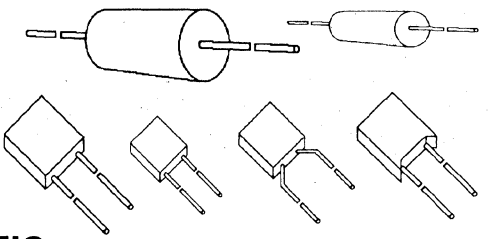
MOLDED MULTILAYER CERAMIC

AXIAL AND RADIAL

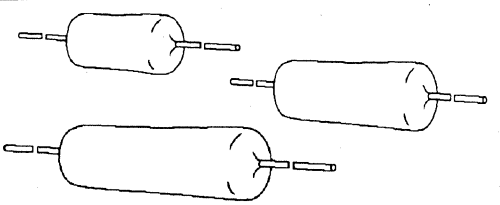
Molded gold color epoxy multilayer ceramic capacitors. Available in Ultra-stable (COG), Stable (X7R) (Military BX or BP) or General Purpose (Z5U) temperature characteristics. Military versions conform to MIL-C-39014, MIL-C-11015 , MIL-C-123 and MIL-C-20 standards. Capacitance values from 1.0pF-1μF; 50, 100 and 200 volts.



CONFORMALLY COATED MULTILAYER CERAMIC

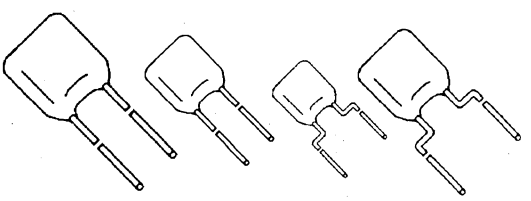
AXIAL

Maximum range, conformally coated capacitors. Available in COG, X7R, and Z5U temperature characteristics. 5 Case sizes include over 138 CV values in capacitance range of 10pF-1.0μF; 50 and 100 volts. Gold color epoxy. Laser marked. Available on tape and reel.



RADIAL

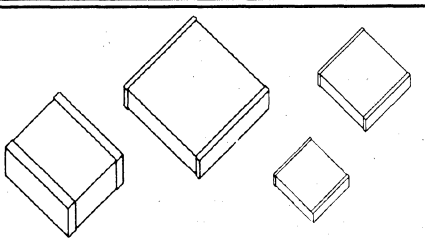
Golden Max dipped multilayer ceramic capacitors. Reliable and economical. Available in COG, X7R, or Z5U temperature characteristics. Gold color epoxy. Laser marked. Capacitance values from 1.0pF-3.3μF; 50, 100, and 200 volts. 6 Case sizes.



CHIPS CERAMIC

MULTILAYER CERAMIC CHIPS

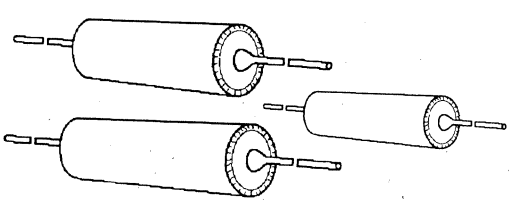
Available in NPO, X7R, or Z5U temperature characteristics. MIL-C-55681 approved. Capacitance values from 1pF-1μF; 50, 100 and 200 volts. 9 Chip sizes. C0805 and C1206 sizes. Available in CoPS (Component Placement System) 8mm or 12mm tape.



FILM

METALLIZED POLYCARBONATE

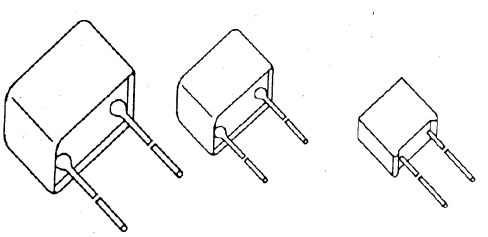
F241-F248 (CRH01-CHR10) meets MIL-C-83421 and MIL-C-39022. Designed for circuits requiring stable performance characteristics over a wide temperature range. Small size. Capacitance values from .001μF-22.0μF; 30 to 600 VDC. **F251** (CHS01-CHS03) meets MIL-C-87217.



FLAT KAPS

Small ultra stable film capacitors. **F310** and **F311** available to MIL-C-55514. **F110** hermetically sealed in metal cases. Capacitance values from .001μF-0.15μF; 50 volts. 6 Case sizes.

F310 - F331 precision molded epoxy. Capacitance values from 0.001μF-0.12μF; 50 volts. 8 Case sizes.



These drawings are not to scale and are provided for reference only.

TANTALUM CHIP CAPACITORS

TYPE **TMC**

KOA SPEER ELECTRONICS, INC.

Type TMC chip capacitors are ideal for compact designs where substrate real estate conservation is a must, or where reduced circuit inductance and improved reliability is required. The TMC can be used for hybrid circuits or surface mount printed circuit board applications.

- **PRECISION MOLDED BODY**
- **HIGH SPEED AUTO-INSERTABLE**
- **EXCELLENT RESISTANCE TO MOISTURE & SOLDER HEAT**

PERFORMANCE CHARACTERISTICS:

Working Temperature Range: −55°C to 125°C
(derate voltage above 85°C: refer to Standard Rating Chart D.V.)

Voltage Range (Vdc): 4V to 35V

Tolerance: ±20%, ±10%

Dissipation Factor: measured at 20°C, 120Hz
0.1 - 1.0μf less than 4.0%
1.5 - 68μf less than 6.0%

D. C. Leakage Current: at rated voltage after 5 minutes
.01CV or 0.5μA whichever is greater
C - capacitance, V - voltage

Load Life: @ 85°C and rated voltage for 2000 hrs.

Capacitance Change - within ±10% of initial value

Dissipation Factor - within 125% of initial value specified

Leakage Current - within initial value specified

Humidity Resistance: testing @ 40°C,
90-95% RH for 500 hrs.

Capacitance Change - within ±5% of initial value

Dissipation Factor - less than initial value specified

Leakage Current - less than initial value specified

Temperature Characteristics:

Capacitance Change
@ −55°C - within ±12% of initial value
+20°C - within ±3% of initial value
+125°C - within 12% of initial value

Leakage Current
@ +20°C - 0.01CV or 0.5μA whichever is greater
+125°C - 0.125CV or 6.25μA

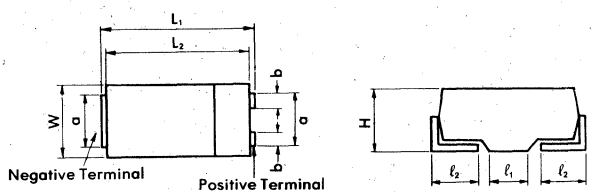
Dissipation Factor
@ −55°C - C≤ 1.0μf
within 4%, C≥ 1.5μf within 6%
+20°C - same as −55°C
+125°C - C≤ 1.0μf within 5%, C≥ 1.5μf within 7%

STANDARD RATINGS TABLE

Cap. (μf)	Code	R.V.	4 (0G)	7 (0J)	10 (1A)	16 (1C)	20 (1D)	25 (1E)	35 (1V)
		S.V.	5	8	13	20	26	32	45
		D.V.	2.5	4	6.3	10	13	16	22
0.1	104								A
0.15	154								A
0.22	224								A
0.33	334								A
0.47	474							A	B
0.68	684						A		B
1.0	105					A			B
1.5	155				A			B	C
2.2	225			A			B	C	C
3.3	335		A			B	C	C	C
4.7	475				B	C	C	C	D
6.8	685			B	C	C	C	D	D
10.0	106		B	C	C	C	D	D	
15.0	156		C	C	C	D	D		
22.0	226		C	C	D	D			
33.0	336		C	D	D				
47.0	476		D	D					
68.0	686		D						

NOTE: R.V. - Rated Voltage
S.V. - Surge Voltage
D.V. - Derated Voltage

CASE DIMENSIONS (mm)



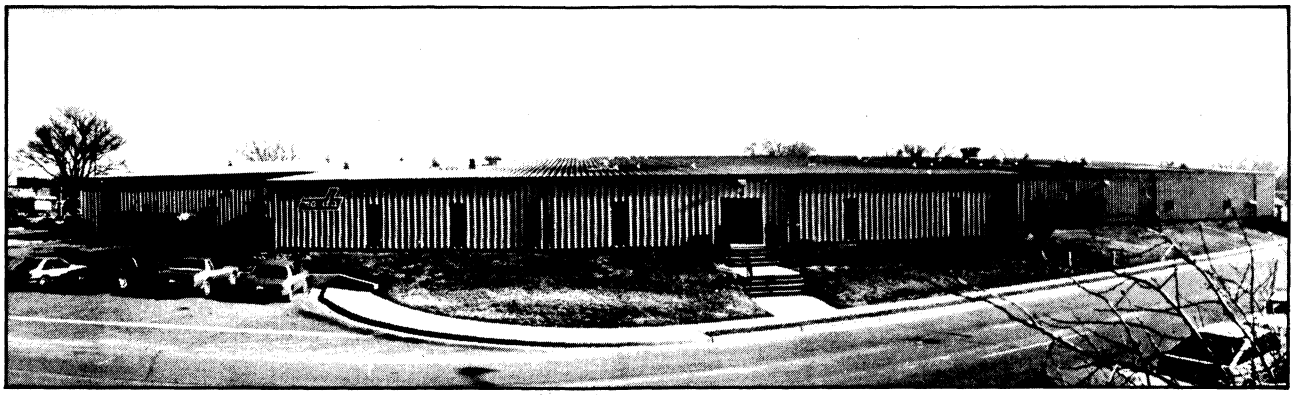
Case	±0.2 L_1	±0.1 L_2	±0.2 W	±0.2 H	±0.2 ℓ_1	±0.3 ℓ_2	±0.2 a	±0.2 b
A	3.2	3.0	1.6	1.6	1.4	0.7	1.0	0.3
B	3.4	3.2	2.6	1.9	1.4	0.8	1.8	0.6
C	5.8	5.6	3.2	2.5	2.4	1.3	2.2	0.7
D	5.8	5.6	4.5	3.1	2.5	1.3	3.1	1.0

KOA SPEER ELECTRONICS, INC.
BOLIVAR DRIVE • P.O. BOX 547 • BRADFORD, PA. 16701 • USA • TEL: (814) 362-5536 • TWX: 510-695-5921 • TLX: 914-404 • FAX: 814-362-8883

CERAMIC CAPACITORS

MAIDA DEVELOPMENT COMPANY

"DOMESTIC CAPACITOR MANUFACTURERS SINCE 1947"



85,000 square foot manufacturing facilities located in Hampton, Virginia

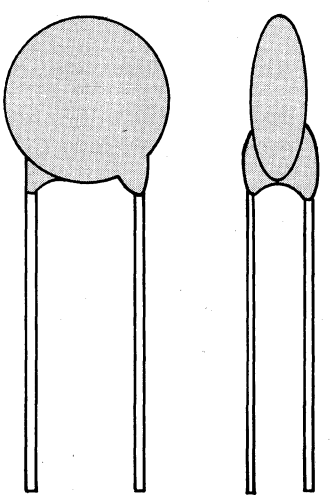
Maida

serving the electronics industry for over thirty-five years.

Maida Development Company, domestically owned and operated, has served the electronics industry with a wide variety of ceramic components. We specialize in custom design and manufacturing, from ceramic powder formulation through finished devices, to meet specific requirements of our customers. Typical capacitor products include (1) high voltage capacitors for power supplies; (2) UL and CSA recognized capacitors for across-the-line, line-by-pass, and antenna coupling uses; (3) reduced titanate capacitors for low-voltage general purpose applications; (4) leadless discs; (5) slot-mounted "trapezoids" for printed circuits; and (6) multilayer capacitors. Our newest product line - zinc oxide varistors (ZOV) is designed for transient voltage suppression and surge energy absorption and many are UL recognized. Our delivery is timely and reliable-with either bulk packaging or tape and reel. We value with pride the repeat business from such customers as GE, Zenith, RCA, IBM, AT&T, Xerox, Sunbeam, GTE, NAP, Kodak, Harris, Allen-Bradley and many others.

CERAMIC DISC CAPACITORS — 500V THRU 6KV

CLASS	T.C.	Maximum Capacitance, *pF*						
		500V	1KV	2KV	3KV	4KV	5KV	6KV
1	P100	81	68	51	36	27	22	18
	NP0	510	430	330	220	180	130	120
	N030	510	430	330	220	180	130	120
	N080	510	430	330	220	180	130	120
	N150	430	360	270	180	140	120	100
	N220	470	390	300	200	150	120	100
	N330	620	510	390	270	200	160	130
	N470	680	620	470	300	240	200	150
	N750	820	680	510	360	270	220	200
	N1500	1300	1200	910	620	500	390	330
	N2200	2000	1800	1300	910	680	560	500
	N3300	3600	3000	2200	1500	1200	1000	820
	N4700	4700	3900	3000	2000	1500	1300	1000
	N5600	6200	5600	4300	2700	2200	1800	1500
2	X5F	12000	10000	8200	5600	3900	3300	2700
	Z5F	15000	12000	8200	6200	4700	3900	3300
	X7R	15000	12000	8200	6200	4700	3900	3300
	Z5U	56000	50000	27000	20000	15000	12000	10000



APPLICATIONS:

CLASS 1. High-Q, temperature compensating, or stable capacitance requirements.

CLASS 2. General Purpose, line by-pass, coupling, etc.

20 LIBBY STREET/P.O. BOX 3529—HAMPTON, VIRGINIA 23663 / (804) 723-0785 / TELEX 82-3443 / FAX (804) 722-1194

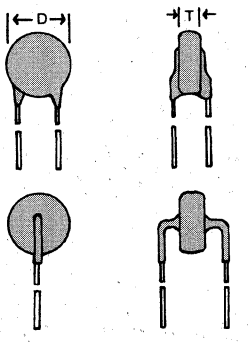
CERAMIC CAPACITORS

MAIDA DEVELOPMENT COMPANY
"DOMESTIC CAPACITOR MANUFACTURERS SINCE 1947"

HIGH VOLTAGE DISCS-10, 12, 15, 20 KVDC-X5R/Z5U

MAX. NOM. CAP. ±20% pF	10KV "T" MAX. 0.360 X5R	10KV "T" MAX. 0.360 Z5U	12KV "T" MAX. 0.400 X5R	12KV "T" MAX. 0.400 Z5U	15KV "T" MAX. 0.460 X5R	15KV "T" MAX. 0.460 Z5U	20KV "T" MAX 0.560 X5R	20KV "T" MAX 0.560 Z5U
100	D68	—	D68	—	D689	—	D689	—
200	D68	—	D68	—	D619	—	D619	—
250	D68	—	D61	—	D619	—	D719	—
500	D71	D68	D62	D61	D629	D619	D649	D719
750	D64	D61	D64	D62	D639	D629	D679	D699
1000	D64	D71	D67	D62	D679	D699	D659	D649
1500	D67	D62	D65	D69	D669	D649	—	D679
2200	D65	D64	D66	D63	—	D679	—	D659
2500	D66	D64	D70	D67	D709	D659	—	D669
3000	—	D63	—	D65	—	D659	—	—
4300	—	D76	—	D66	—	—	—	D709
5600	—	D66	—	—	—	D709	—	—
6800	—	D70	—	D70	—	—	—	—

STYLE	MAX. "D"
D68/D689	0.406
D61/D619	0.469
D71/D719	0.532
D62/D629	0.594
D69/D699	0.659
D64/D649	0.719
D63/D639	0.781
D67/D679	0.840
D65/D659	0.969
D66/D669	1.100
D70/D709	1.350

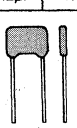


APPLICATIONS:
Voltage Multilpliers, High Voltage Power Supplies

MULTILAYER RADIAL-LEAD DIP CHIPS NPO, X7R, Z5U

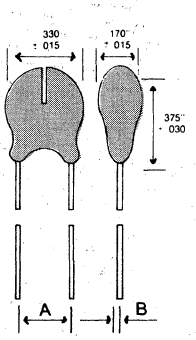
Size, inches L × W × T max.	Maximum Capacitance Value NPO 50V	NPO 100V	X7R 50V	X7R 100V	Z5U 50V	Z5U 100V
.200 × .200 × .125	3300pF	2400pF	.075μF	.056μF	.2μF	.15μF
.300 × .300 × .125	.012μF	9100pF	.27μF	.22μF	.68μF	.51μF
.400 × .400 × .150	.033μF	.022μF	.82μF	.68μF	2.2μF	1.5μF
.500 × .500 × .200	.062μF	.042μF	1.2μF	1.0μF	3.3μF	2.2μF

APPLICATIONS:
High volumetric efficiency in printed circuit boards.



1500 (±300) VDC SPARK GAPS

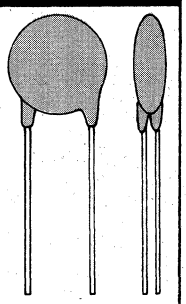
STYLE NO.	A	B
100	.200" ± .015	22 ga.
100-1	.200" ± .015	20 ga.
100-2	.250" ± .015	22 ga.
100-3	.250" ± .015	20 ga.



Rugged flame-retardant epoxy coating.
APPLICATIONS:
Protection of low-voltage circuits from high voltage surges.

UL, CAS, & VDE SAFETY-RECOGNIZED CAPACITORS

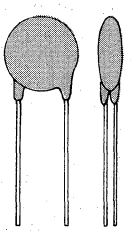
TYPE	APPROVAL UL	CSA	VDE	T.C. EIA	IEC	CAP, pF MAX
UW	125 VAC	125 VAC	250 VAC X1, Y	Z5U	2E4	10,000
HX	—	—	500 VAC X2	—	2E4	30,000
• DP	125 VAC	125 VAC	—	Z5U	—	5,000



APPLICATIONS:
Line-by-pass, antenna coupling, across-the-line
• "Double Protection" in above uses

250 & 500 VOLT AC POWER LINE CAPACITORS

STYLE CODE	MAX. "D" INCHES	MAX CAPACITANCE pF 250VAC	500VAC
60	0.312	1200	680
68	0.375	2500	1200
61	0.470	3600	2000
71	0.530	4300	2200
62	0.590	6800	3600
64	0.720	10000	6200
63	0.780	13000	6800
67	0.840	15000	8200
65	0.970	22000	12000
66	1.10	30000	15000

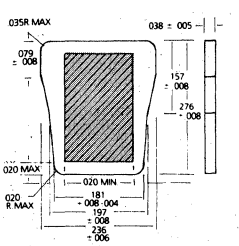


APPLICATIONS:
AC line voltage applications where minimum currents - reactive and resistive - are required.

TOLERANCES AVAILABLE:
±20% or +80 - 20%

500 VOLT TRAPEZOIDS - CLASS 1 and 2

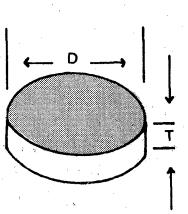
CLASS	T.C.	CAPACITANCE RANGE
1	P100	1.5pF - 3.3pF
	NPO	2.4pF - 18pF
	N030 thru N470	2.7pF - 24pF
	N750	5.6pF - 30pF
	N1500	22pF - 51pF
	N2200 thru N5600	30pF - 130pF
2	X5F	150pF - 220pF
	Z5P/X7R	150pF - 470pF
	Z5U	150pF - 1000pF
	Z5V	200pF - 1900pF



APPLICATIONS:
Solder into slot for minimum lead inductance.

500 VOLT LEADLESS DISCS-CLASS 1

T.C.	CAPACITANCE	"D" NOM.	"T"
NPO	2.2pF - 3.0pF	.250"	.120" max.
N080	3.3pF - 7.5pF	.250"	.062" max.
N150	1.8pF - 5.4pF	.250"	.120" max.
N220	5pF	.250"	.083" max.
N470	18pF	.250"	.032" max.
N750	24pF	.250"	.032" max.
N1500	39pF	.250"	.032" max.
N080	7.5pF	.312"	.062" max.
N150	10pF	.312"	.083" max.
N220	10pF	.312"	.090" max.



APPLICATIONS:
UHF circuits with very low inductance

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LOW VOLTAGE DISC CAPACITORS

MAIDA DEVELOPMENT COMPANY

"DOMESTIC CAPACITOR MANUFACTURERS SINCE 1947"

CLASS 1 TEMPERATURE COMPENSATING TYPE

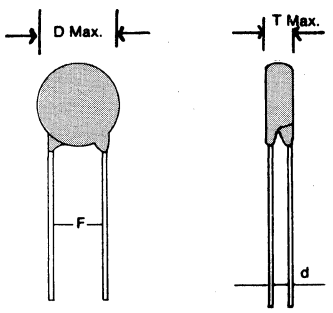
MAXIMUM CAPACITANCE VALUES BY TC TYPE

T.C. / W.V.	CAPACITANCE (pF) NPO	N80	N150	N220	N330	N470	N770	P350 - N1000	DIMENSIONS INCHES (mm) D	T	F	d
50V DC	22	18	16	30	20	22	39	110	.157 (4.0)	.157 (4.0)	.098 (2.5)	.020 (0.5)
	30	30	22	47	39	39	55	130	.197 (5.0)	.118 (3.0)	.098 (2.5)	.020 (0.5)
	56	47	47	91	62	56	100	240	.248 (6.3)	.118 (3.0)	.197 (5.0)	.020 (0.5)
	100	82	91	130	120	130	150	510	.315 (8.0)	.118 (3.0)	.197 (5.0)	.020 (0.5)
	200	130	130	250	200	200	240	680	.394 (10.0)	.118 (3.0)	.197 (5.0)	.020 (0.5)
	—	250	250	370	350	360	390	1000	.492 (12.5)	.118 (3.0)	.197 (5.0)	.020 (0.5)

CLASS 2 GENERAL PURPOSE TYPE

MAX. CAPACITANCE VALUES BY TC TYPE

T.C. / W.V.	CAPACITANCE (pF) Y5P	Y5T	Y5V	DIMENSIONS INCHES (mm) D	T	F	d
50V DC	1200	1200	2200	.155 (4.0)	.157 (4.0)	.098 (2.5)	.020 (0.5)
	1800	1800	4700	.197 (5.0)	.118 (3.0)	.098 (2.5)	.020 (0.5)
	3300	3300	10000	.248 (6.3)	.118 (3.0)	.197 (5.0)	.020 (0.5)
	5600	5600	22000	.315 (8.0)	.118 (3.0)	.197 (5.0)	.020 (0.5)
	8200	8200	40000	.394 (10.0)	.118 (3.0)	.197 (5.0)	.020 (0.5)
	10000	10000	47000	.492 (12.5)	.118 (3.0)	.197 (5.0)	.020 (0.5)

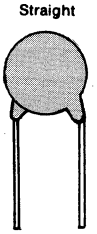


CLASS 3 SEMICONDUCTOR TYPE

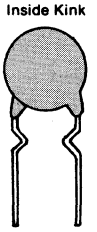
MAX. CAPACITANCE VALUES BY TC TYPES

T.C. / W.V.	CAPACITANCE (pF) Y5P	Y5R	Y5T	Y5U	Y5V	DIMENSIONS INCHES (mm) D	T	F	d
12V DC	—	10000	22000	22000	47000	.197 (5.0)	.118 (3.0)	.098 (2.5)	.020 (0.5)
	—	22000	47000	47000	100000	.248 (6.3)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	—	47000	100000	100000	—	.315 (8.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	—	—	220000	220000	220000	.394 (10.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	—	100000	330000	—	470000	.492 (12.5)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	—	—	470000	—	—	.630 (16.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
25V DC	—	4700	10000	10000 20000	22000	.197 (5.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	10000	15000	22000	—	47000	.248 (6.3)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	—	22000	47000	100000	100000	.315 (8.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	22000	47000	100000	—	22000	.394 (10.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	47000	100000	—	220000	—	.492 (12.5)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	100000	—	—	—	470000	.630 (16.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
50V DC	—	—	—	10000	22000	.197 (5.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	10000	10000	1000	22000	47000	.248 (6.3)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	15000	22000	22000	47000	100000	.315 (8.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	22000	47000	47000	100000	—	.394 (10.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	470000	—	100000	—	—	.492 (12.5)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	100000	100000	—	—	—	.630 (16.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)

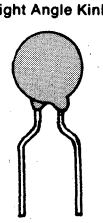
Straight



Inside Kink



Right Angle Kink



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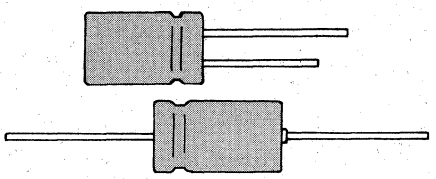
ELECTROLYTIC & FILM CAPACITORS

MAIDA DEVELOPMENT COMPANY

"DOMESTIC CAPACITOR MANUFACTURERS SINCE 1947"

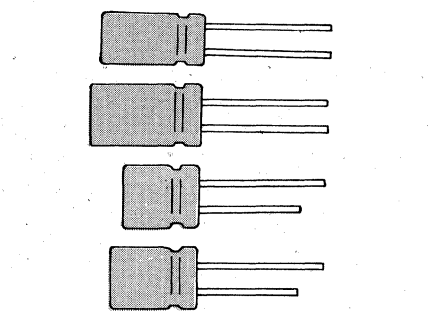
ALUMINUM ELECTROLYTIC CAPACITORS — GENERAL

SERIES	SPECIAL FEATURES	TEMPERATURE RANGE	RATED VOLTAGE RANGE	CAPACITANCE RANGE
SA	Miniature Size	-40°C ~ +85°C	6.3V ~ 100V	0.47μF ~ 10000μF
SE	Ultra miniature size	-40°C ~ +85°C	6.3V ~ 50V	0.1μF ~ 47μF
GA	For high voltage	-25°C ~ +85°C	160V ~ 450V	0.4μF ~ 470μF
SS	Super miniature size	-40°C ~ +85°C	6.3V ~ 63V	0.1μF ~ 470μF
SV	Low profile type	-40°C ~ +85°C	6.3V ~ 50V	0.1μF ~ 4700 F



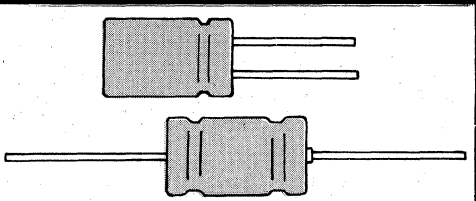
ALUMINUM ELECTROLYTIC CAPACITORS — SPECIAL

SERIES	SPECIAL FEATURES	TEMPERATURE RANGE	RATED VOLTAGE RANGE	CAPACITANCE RANGE
TH	For high stability	-40°C ~ +85°C	16V, 25V, 50V	1.0μF ~ 100μF
LL	For low leakage	-40°C ~ +85°C	6.3V ~ 63V	0.1μF ~ 4700μF
TB	For timer circuit	-40°C ~ +85°C	25V, 50V, 100V	1.0μF ~ 470μF
ZA	For low noise	-40°C ~ +85°C	6.3V ~ 100V	0.47μF ~ 470μF
RA	Wide temp. range	-40°C ~ +105°C	6.3V ~ 100V	0.47μF ~ 10000μF
RB	Wide temp. range	-40°C ~ +125°C	10V ~ 50V	0.47μF ~ 1000μF
RM	For switching regulators	-55°C ~ +105°C	6.3V ~ 63V	1.0μF ~ 1000μF
		-40°C ~ +105°C	100V ~ 160V	1.0μF ~ 47μF
		-25°C ~ +105°C	200V ~ 250V	1.0μF ~ 22μF
RQ	For switching regulators	-55°C ~ +105°C	6.3V ~ 63V	22μF ~ 2200μF
RK	Wide temp. range	-40°C ~ +105°C	6.3V ~ 63V	0.1μF ~ 47μF



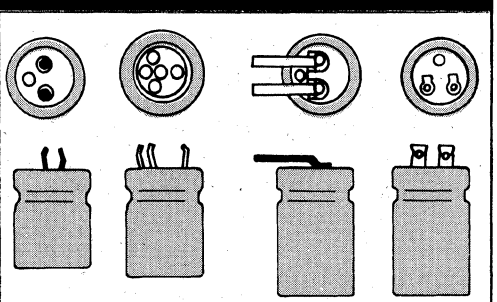
ALUMINUM ELECTROLYTIC CAPACITORS — NON-POLAR

SERIES	SPECIAL FEATURES	TEMPERATURE RANGE	RATED VOLTAGE RANGE	CAPACITANCE RANGE
NP	For reversing polarity circuits	-40°C ~ +85°C	6.3V ~ 100V	1.0μF ~ 6800μF
NF	For horizontal deflection current correction of TV set	-40°C ~ +85°C	25V	1.0μF ~ 10μF
BP	For cross over net-work	-40°C ~ +85°C	50V	1.0μF ~ 100μF
BS	For high output	-40°C ~ +85°C	50V	1.0μF ~ 33μF
NS	For reversing polarity circuits	-40°C ~ +85°C	6.3V ~63V	0.1μF ~ 47μF



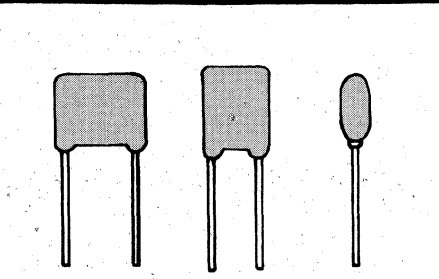
ALUMINUM ELECTROLYTIC CAPACITORS — LARGE

SERIES	SPECIAL FEATURES	TEMPERATURE RANGE	RATED VOLTAGE RANGE	CAPACITANCE RANGE
LN	For general use	-40°C ~ +85°C	16V ~ 450V	33μF ~ 10000μF
HS	Lug snap-in terminal	-40°C ~ +85°C	6.3V ~ 250V	470μF ~ 2200μF
HG	Low profile type	-40°C ~ +85°C	6.3V ~ 250V	470μF ~ 2200μF
SN, SB, SH	Computer grade	-25°C ~ +85°C	10V ~ 250	150μF ~ 15000μF
MS	For motor starting	-25°C ~ +85°C	125V ~ 250V	10μF ~ 400μF
HU	Wide temp. range	-40°C ~ +85°C	10V ~ 160V	330μF ~ 15000μF
HV	Low profile type	-25°C ~ +85°C	200V ~ 250V	
BF	For photo flash	-40°C ~ +85°C	330V	200μF ~ 1000μF



POLYESTER FILM CAPACITORS

SERIES	SPECIAL FEATURES	TEMPERATURE RANGE	RATED VOLTAGE RANGE	CAPACITANCE RANGE
TY	For general use	-40°C ~ +85°C	50V ~ 630V	0.001μF ~ 0.47μF
TX	Non-inductive	-40°C ~ +85°C	50V ~ 400V	0.001μF ~ 0.47μF
TS	Low profile types	-40°C ~ +85°C	50V	0.001μF ~ 0.47μF
TM	Metalized film	-40°C ~ +85°C	100V ~ 630V	0.01μF ~ 3.3μF
PX	Non-inductive polypropylene film	-25°C ~ +85°C	100V ~ 630V	0.001μF ~ 0.47μF
PM	Metalized polypropylene film	-25°C ~ +85°C	200V, 400V	0.1μF ~ 10.0μF
MX	Temperature correction	-40°C ~ +85°C	50V	0.001μF ~ 0.47μF
PY	For general use	-25°C ~ +85°C	100V, 200V	0.001μF ~ 0.1μF
TZ	Low profile type	-40°C ~ +85°C	50/100V	0.001μF ~ 0.47μF



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VARISTORS

MAIDA DEVELOPMENT COMPANY

"DOMESTIC CAPACITOR MANUFACTURERS SINCE 1947"

ZINC OXIDE VARISTORS — TRANSIENT VOLTAGE SURGE SUPPRESSION

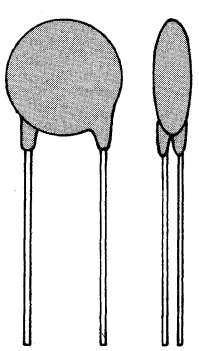
	MDC-ZOV STYLE NUMBER	MODEL SIZE	CROSS REFERENCE — GE-MOV MODEL NUMBER	CONTINUOUS RMS VOLTAGE VAC	CONTINUOUS DC VOLTAGE VDC	TRANSIENT ENERGY (10×1000μS)	VARISTOR PEAK VOLTAGE @1mADC MIN	VARISTOR PEAK VOLTAGE @1mADC MAX	MAC CLAMPING VOLTAGE @ TEST CURRENT (8x20μS) V_c	MAC CLAMPING VOLTAGE @ TEST CURRENT (8x20μS) I_p	CAP @1KHZ ±30%
		(mm)		VOLTS	VOLTS	JOULES	VOLTS	VOLTS	VOLTS	AMPS	pF
	D6921ZOV950RA06	14	V95LA7A	95	127	30	135	164	255	50	1800
	★ D73ZOV131RA03	7	V130LA2	130	175	11	184	224	340	10	250
•	★ D6121ZOV131RA04	10	V130LA5			14		224	340	25	500
•	★ D6921ZOV131RA09	14	V130LA10A			38		224	340	50	1350
•	★ D6521ZOV131RA20	20	V130LA20A			70		224	340	100	2300
•	★ D6521ZOV131RB20	20	V130LA20B			70		220	325	100	2300
	★ D73ZOV141RA03	7	V140LA2	140	180	12	198	242	360	10	230
•	★ D6121ZOV141RA04	10	V140LA5			16		242	360	25	460
•	★ D6921ZOV141RA09	14	V140LA10A			42		242	360	50	1270
	★ D73ZOV151RA03	7	V150LA2	150	200	13	212	259	395	10	220
•	★ D6121ZOV151RA04	10	V150LA5			17		259	395	25	400
•	★ D6921ZOV151RA09	14	V150LA10A			45		259	395	50	1200
•	★ D6521ZOV151RA20	20	V150LA20A			80		268	395	100	2000
•	★ D6521ZOV151RB20	20	V150LA20B			80		243	360	100	2000
	★ D73ZOV251RA21	7	V250LA4	250	330	21	354	432	650	10	130
•	★ D61ZOV251RA40	10	V250LA10A			40		432	650	25	160
•	★ D69ZOV251RA72	14	V250LA20A			72		432	650	50	550
•	★ D65ZOV251RA130	20	V250LA40A			130		432	650	100	920
•	★ D65ZOV251RB130	20	V250LA40B			130		413	620	100	920
	★ D73ZOV271RA23	7	V275LA4	270	360	23	382	466	710	10	120
•	★ D61ZOV271RA043	10	V275LA10A			43		466	710	25	150
•	★ D69ZOV271RA75	14	V275LA20A			75		466	710	50	510
•	★ D65ZOV271RA140	20	V275LA40A			140		466	710	100	850
•	★ D65ZOV271RB140	20	V275LA40B			140		453	680	100	850
	★ D73ZOV301RA25	7	V300LA4	300	405	25	425	518	775	10	110
•	★ D69ZOV321RA90	14	V320LA15A	320	420	90	453	553	850	50	400
•	★ D65ZOV321RA160	20	V320LA40A			160		553	850	100	720
•	★ D65ZOV321RB160	20	V320LA40B			160		540	810	100	720
•	★ D69ZOV421RA90	14	V420LA15A	420	560	90	594	725	1120	50	500
•	★ D65ZOV421RA160	20	V420LA40A			160		725	1120	100	910
•	★ D65ZOV421RB160	20	V420LA40B			160		690	1060	100	910
•	★ D69ZOV481RA105	14	V480LA40A	480	640	105	679	829	1240	50	440
•	★ D69ZOV481RA180	20	V480LA80A			180		829	1240	100	800
•	★ D65ZOV481RB180	20	V480LA80B			180		790	1160	100	800
•	★ D69ZOV511RA110	14	V510LA40A	510	675	110	722	881	1350	50	410
•	★ D65ZOV511RA190	20	V510LA80A			190		881	1350	100	740
•	★ D65ZOV511RB190	20	V510LA80B			190		860	1280	100	740
•	★ D69ZOV581RA120	14	V575LA40A	580	735	120	821	1002	1500	50	370
•	★ D65ZOV581RA220	20	V575LA80A			220		1002	1500	100	670
•	★ D65ZOV581RB220	20	V575LA80B			220		960	1410	100	670
•	★ D69ZOV102RA220	14	V1000LA80A	1000	1200	220	1414	1728	2700	50	210
•	★ D69ZOV102RA360	20	V1000LA160A			360		1728	2700	100	380
•	★ D65ZOV102RB360	20	V1000LA160B			360		1650	2420	100	380

★ UL Recognized Components for Surge Suppression, File E86730

• UL Recognized for Across-The Line Applications, File E38785

Protection for Voltage Sensitive Equipment.
Transient voltage suppression from source such as lightning induced transients, switching surges, ground faults and AC power lines.

APPLICATIONS:
Ground fault interrupters, CATC systems, IC's and microprocessor protection, power supplies, industrial control systems, RFI filters, etc.



"See section 4700, 'Voltage Sensitive Resistors', for comprehensive Listing of Maida Development Company's Zinc Oxide Varistors".

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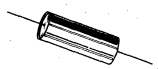
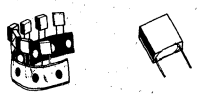
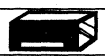
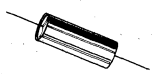
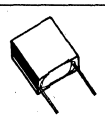
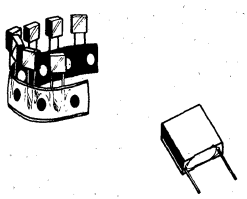
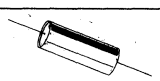
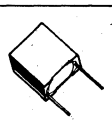
MALLORY ELECTRICAL/ELECTRONIC GROUP
EMHART

MALLORY CAPACITOR COMPANY, EMHART ELECTRICAL ELECTRONIC GROUP
DEPT. EM, P.O. BOX 1284, INDIANAPOLIS, INDIANA 46206 U.S.A.
PHONE: (317) 856-3731 FAX: (317) 856-2500

DC FILM CAPACITORS

			Type	Description	Temp. Range (°C)	Voltage Range (WVDC)	Cap. Range	Standard Tolerance %
POLYESTER	AXIAL		149	Metallized Electrodes	−55 to +100	50 to 63	.001 to .1μF	±5,10,20
			150	Metallized Electrodes	−55 to +125	63 to 1000	.001 to 10μF	±5,10,20
			152	Metal-Foil Electrodes	−55 to +125	100 to 600	100pF to .22μF	±5,10,20
	RADIAL		PVC	Metal-Foil Electrodes	−55 to +125	100 to 2000	.001 to .68μF	±5,10,20
			160	Metallized Electrodes	−55 to +125	63 to 1000	.001 to 10μF	±5,10,20
			108/183	Metallized Electrodes	−55 to +125	50	.01 to .1μF	±10,20
			167/184	Metallized Electrodes	−55 to +125	63 to 630	.001 to 1μF	±5,10,20
			168/185	Metallized Electrodes	−55 to +125	50 to 100	.001 to 1μF	±5,10,20
			166	Metallized Electrodes	−55 to +125	63 to 630	.001 to .15μF	±10,20
	CHIP		198	Metallized Electrodes	−55 to +125	50	.001 to 1.0μF	±5,10,20
POLYPROPYLENE	AXIAL		135	High RMS Current Metallized Electrodes	−55 to −105	100 to 400	1 to 30μF	±5,10,20
			170	Metallized Electrodes	−55 to +105	160 to 630	.001 to 4.7μF	±5,10,20
			172	Metal-Foil Electrodes	−55 to +105	100 to 2000	47pF to .47μF	±5,10,20
	RADIAL		171	Metallized Electrodes	−55 to +105	160 to 630	.001 to 10μF	±5,10,20
			173	Metal-Foil Electrodes	−55 to +105	100 to 2000	100pF to .22μF	±5,10,20
			174	Metal-Foil Electrodes	−55 to +105	630 to 1500	.001 to .33μF	±5,10
			176	Double-Metallized Electrodes	−55 to +105	250 to 400	.01 to 2.2μF	±5,10,20
POLYCARBONATE - AXIAL			LP66N	Metallized Electrodes	−55 to +125	50 to 400	.001 to 22μF	±1,2,5,10
PRECISION CAPACITORS	AXIAL		SX	Metal-Foil Electrodes Polystyrene Dielectric	−40 to +70	33 to 630	.00002 to .1μF	±2.5,5
			145	Foil Electrodes Polypropylene Dielectric	−40 to +105	100 to 200	.0001 to .47μF	±1,2,2.5,5
			148	Metallized Electrodes Polypropylene Dielectric	−55 to +105	160 to 250	.001 to 4.7μF	±1,1.25,2,2.5
	RADIAL		136	Metal-Foil Electrodes Polystyrene Dielectric	−40 to +70	63 to 160	100 to 100,000pF	±.5,2.5
			138	Metal-Foil Electrodes Polystyrene Dielectric	−40 to +70	63 to 1000	100 to 35,000pF	±.5,2.5
			102/112	Metal-Foil Electrodes Polypropylene Dielectric	−55 to +105	63	50 to 5000pF	±.5,2.5
			104/114	Metallized Electrodes Polypropylene Dielectric	−55 to +105	63	5001 to 33,000pF	±.5,2.5
			142	Metal-Foil Electrodes Polypropylene Dielectric	−55 to +105	63	100 to 21,000pF	±.5,2.5
			142	Metallized Electrodes Polypropylene Dielectric	−55 to +105	63	5001 to 432,000pF	±.5,2.5
INTERFERENCE SUPPRESSOR	AXIAL		129X	Metallized Electrodes Polypropylene Dielectric	−55 to +125	250V-AC	.001 to .47μF	±20
			172Y	Metal-Foil Electrodes Polypropylene Dielectric	−55 to +105	250V-AC	.001 to .047μF	±20
	RADIAL		118	Polypropylene & Metallized Polyester	−55 to +100	250V-AC	.0033 to .47μF	+20
			173X	Metal-Foil Electrodes Polypropylene Dielectric	−55 to +105	250V-AC	.001 to .22μF	±20
			173Y	Metal-Foil Electrodes Polypropylene Dielectric	−55 to +105	250V-AC	.001 to .047μF	±20
			158X	Metallized Electrodes Polyester Dielectric	−55 to +125	250V-AC	.01 to 1.0μF	±20
			143	Metallized Electrodes Polyester Dielectric	−55 to +100	250V-DC to 630V-DC	.1 to 1μF	±20

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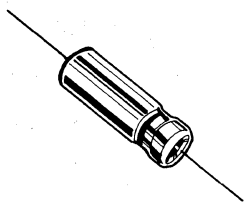
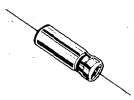
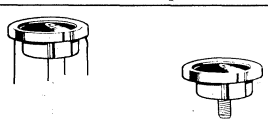
WET SLUG TANTALUM ELECTROLYTIC CAPACITORS

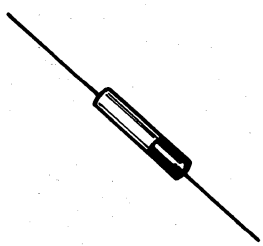
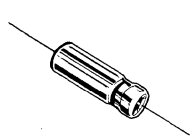
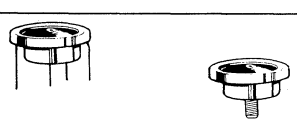
MILITARY—ESTABLISHED RELIABILITY TYPE

		Style	Mil Spec	Type	Description	Features	Temp. Range (°C)	Voltage Range (WVDC)	Cap. Range (μF)	Std. Tol. %
AXIAL		CLR-79	Mil-C-39006/22 "H" Characteristic	TLT	All Tantalum Hermetic Seal Mylar Sleeve High Vibration	Reverse Voltage High Ripple No Silver Migration	−55 to +125	6 to 125	1.7 to 1200	±10,20
		CLR-81	Mil-C-39006/25	TXT	All Tantalum Hermetic Seal Mylar Sleeve High Vibration	Reverse Voltage High Ripple No Silver Migration Extended Cap. Range	−55 to +125	6 to 75	68 to 2200	±10,20
		CLR-65	Mil-C-39006/09	TLX	Hermetic Seal Mylar Sleeve Silver Case	Std. Cap. Range High CV/Case	−55 to +125	6 to 125	1.7 to 1200	±10,20
		CLR-69	Mil-C-39006/21	TXX	Hermetic Seal Mylar Sleeve Silver Case	Ext. Cap. Range Highest CV/Case	−55 to +125	6 to 125	1.7 to 2200	±10,20
MODULE		CLR-10	Mil-C-39006/18	XTM XTK	Metal Can Hermetic Seal Silver Case	Very High Temp. High Cap. & Voltage	−55 to +200	8 to 360	2 to 140	−15 +50,75 ±20
		CLR-14	Mil-C-39006/19	XTH XTL	Metal Can Hermetic Seal Silver Case	Very High Temp. High Cap. & Voltage	−55 to +200	20 to 360	3.5 to 200	−15 +50,75 ±20
		CLR-17	Mil-C-39006/20	XTV	Metal Can Hermetic Seal Silver Case	Very High Temp. High Cap. & Voltage	−55 to +200	30 to 630	18 to 1300	−15 +50,75 ±20

MILITARY—NON-ESTABLISHED RELIABILITY TYPE

		Style	Mil Spec	Type	Description	Features	Temp. Range (°C)	Voltage Range (WVDC)	Cap. Range (μF)	Std. Tol. %
AXIAL		CL-64/65	Mil-C-3965	TLS	Silver Tubular Elastomer Seal	Low DCL High CV/Case	−55 to +125	6 to 125	1.7 to 1200	±10,20
		CL-66/67	Mil-C-3965	TLX	Silver Tubular Hermetic Seal	Rugged Construction Long Life	−55 to +125	6 to 125	1.7 to 1200	±10,20
MOD.		CL-55	Mil-C-3965	TL	Metal Case Glass to Metal Seal	Low DCL Wide Temp. Range	−55 to +125	15 to 150	70 to 2400	±20
BUTTON		CRL-01	Mil-C-83500	W13	Low Profile All Tantalum P.C. Mount	Reverse Voltage High Ripple Long Shelf & Operating Life	−55 to +125	6 to 125	47 to 1200	±10,20
		CRL-02	Mil-C-83560	W13	Low Profile All Tantalum Stud Mount	Reverse Voltage High Ripple High Shock & Vibration	−55 to +125	6 to 125	47 to 1200	±10,20

INDUSTRIAL (NON-MILITARY) TYPE

		Type	Description	Features	Temp. Range (°C)	Voltage Range (WVDC)	Cap. Range (μF)	Std. Tolerance %
MINIATURE AXIAL		CMT	Copper Alloy Case Red Plastic	Low Cost High Capacitance	−55 to +85	6 to 60	1 to 450	±20
		MTP	Silver Tubular Red Plastic	High Capacitance	−55 to +85	6 to 60	3.3 to 470	±20
		MTPH	Silver Tubular Red Plastic	High Reliability	−55 to +85	6 to 60	4.7 to 470	±10,20
		TAP	Silver Tubular Black Plastic	Low ESR	−55 to +85	6 to 90	2 to 330	−15 +20,50,75 ±10 −10 +20
		TNT	Silver Tubular Yellow Plastic	Low DCL	−55 to +85	3 to 50	2 to 80	−15 +75
		TAH	Silver Tubular Green Plastic	Wide Temp. Range Low DCL	−55 to +125	4 to 60	2 to 330	−15 +20,50,75 ±10 −10 +20
STANDARD AXIAL		CTL	Copper Alloy Elastomer Seal	Low Cost, Low DCL Wide Temp. Range	−55 to +125	6 to 125	3.6 to 1200	±10,20
		TLW	Hermetic Seal Kapton Sleeve	High Capacitance High Temperature	−55 to +175	6 to 100	2.5 to 1200	±10,20
		THT	Hermetic Seal Kapton Sleeve	Tantalum Case High Temperature High Ripple	−55 to +200	6 to 125	1.7 to 1200	±10,20
		TLH	Silver Tubular Elastomer Seal	Low DCL Extended Cap. Range	−55 to +125	6 to 125	1.7 to 2200	±10,20
BUTTON		HP (W13)	Low Profile All Tantalum P.C. Mount	Reverse Voltage High Ripple Very High Temp.	−55 to +200	6 to 75	47 to 330	±10,20
		HS (W13)	Low Profile All Tantalum Stud Mount	Reverse Voltage High Ripple Very High Temp. High Shock & Vib.	−55 to +200	6 to 75	47 to 330	±10,20

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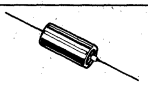
SOLID TANTALUM ELECTROLYTIC CAPACITORS

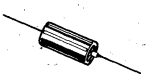
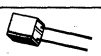
MILITARY—ESTABLISHED RELIABILITY TYPE

		Style	Mil Spec	Type	Features	Temp. Range (°C)	Voltage Range (WVDC)	Cap. Range (μF)	Standard Tolerance %
AXIAL LEAD		CSR13	Mil-C-39003/01	TER	High Reliability	−55 to +125	6 to 100	.0047 to 330	±5, 10, 20
		CSR23	Mil-C-39003/03	TXE	High Reliability	−55 to +125	6 to 100	.0047 to 1000	±5, 10, 20
		CSR33	Mil-C-39003/06	TXR	High Reliability	−55 to +125	6 to 100	.0047 to 1000	±5, 10, 20
		CSR21	Mil-C-39003/09	TFR	High Frequency High Ripple	−55 to +125	6 to 50	22 to 330	±5, 10, 20

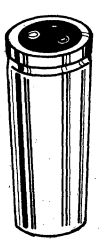
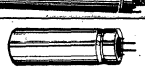
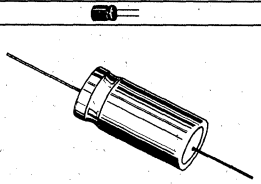
MILITARY—NON-ESTABLISHED RELIABILITY TYPE

		Style	Mil Spec	Type	Features	Temp. Range (°C)	Voltage Range (WVDC)	Cap. Range (μF)	Standard Tolerance %
AXIAL LEAD		CS12 CS13	Mil-C-26655	TAS	Low Leakage Temp. Stable	−55 to +125	6 to 100	.0047 to 330	±5, 10, 20

INDUSTRIAL (NON-MILITARY) TYPE

			Type	Features	Temp. Range (°C)	Voltage Range (WVDC)	Cap. Range (μF)	Standard Tolerance %
TUBULAR	AXIAL		TAS	Low Leakage Temperature Stable	−80 to +125	6 to 100	.0047 to 330	±5, 10, 20
			TXA	Extended Capacitance Range	−80 to +125	6 to 50	1.2 to 1000	± 10, 20
			THF	4.5 Amps Ripple Capability Low ESR	−80 to +125	6 to 50	5.6 to 330	±10, 20
MOLDED	RAD.		TIM	Low Cost Extended Capacitance Temperature Stable	−55 to +85	6 to 50	.10 to 330	±10, 20
	AXIAL		TAC	Low Cost Low Profile	−55 to +85	6 to 50	.10 to 330	±10, 20
	CHIP		TSC	High Density Mounting	−55 to +125	6 to 50	.10 to 220	±10, 20
EPOXY DIPPED	RADIAL		TDC	High Shock & Vibration Auto-Insertable	−55 to +125	6 to 50	.10 to 330	±10, 20
			TDL	Surface Mount Tantalum	−55 to +85	6 to 50	.10 to 68	±10, 20

ALUMINUM ELECTROLYTIC CAPACITORS

			Type	Description	Temp. Range (°C)	Voltage Range (WVDC)	Cap. Range (μF)	Standard Tolerance %
LARGE CAN			CGS	Computer Grade High Capacitance	−40 to +85	10 to 450	75 to 490,000	−10 +75 −10 +50
			CGR	Computer Grade High Ripple Capability	−55 to +85	6.3 to 100	220 to 260,000	−10 +75 −10 +50
			CGO	Computer Grade Power Supply Output Filter	−55 to +85	5 to 55	2,800 to 67,000	−20 +20
			CG	Computer Grade High Reliability	−40 to +85	10 to 450	40 to 160,000	−10 +75 −10 +50
			CGI	Computer Grade Power Supply Input Filter	−40 to +85	200 to 250	260 to 7,400	−10 +50
			HES	Storage Capacitor High Energy Discharge	−40 to +85	400 to 450	300 to 2,100	−0 +50
			LP	Low Profile	−40 to +105	6.3 to 250	82 to 56,000	−10 +30
			SFC	Computer Grade, Stacked Foil Bus Terminals	−40 to +85	6 to 50	6,800 to 100,000	−0 +100
			FP PFP	Twist Prong/PC Mount	−30 to +85	10 to 475	2 to 10,000 1–4 sections	−10 +50 −10 +100 −10 +150
TUBULAR	RADIAL		VPR	High Performance Radial Leads	−55 to +105	6.3 to 100	34 to 18,000	−10 +100 −10 +75 −10 +50
			VTL	Miniature, Radial Leads	−40 to +85	6.3 to 100	.47 to 10,000	−20+20
	AXIAL		TCG	Computer Grade, Long Life Axial Leads	−40 to +85	6 to 450	5 to 12,000	−10 +75 −10 +50
			TCX	Computer Grade High Performance, Axial Leads	−55 to +105	6 to 150	12 to 18,000	−10 +75 −10 +50
			TA	Miniature, Decade Ratings Axial Leads	−40 to +85	6.3 to 100	.10 to 10,000	−20 +20
			TT	Miniature, Axial Leads	−40 to +85	6 to 250	1 to 2,400	−20 +20
			TC	Industrial Grade Axial Leads	−20 to +85	6 to 450	1 to 5,000	−10 +100 −10 +50
	RADIAL		VTH	Miniature, Radial Leads	−40 to +105	6.3 to 250	.1 to 10,000	±20
			VTU	Miniature, Radial Leads	−40 to +125	6.3 to 63V	.47 to 1,000	±20

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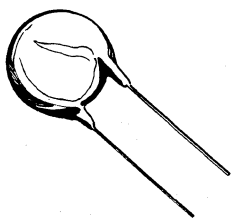
AC CAPACITORS

Type	Description	Temp. Range (°C)	Voltage Range (V-AC)	Cap. Range (μF)	Standard Tolerance (%/μF)
PS	AC Motor Start EIA Type 2 Bakelight Case	-40 to +65	110 to 330	21 to 1326	-0 +20
OPN	Motor Run Paper & Oil, Flat Oval	-55 to +70	236 to 660	1 to 10	±10
MPF	Motor Run Metallized Electrodes Polypropylene Dielectric Self-Healing Round & Flat Oval	-40 to +70	240 to 440	7.5 to 60	±10
MSF	Metallized Paper Electrodes Polypropylene Dielectric Self-Healing Flat Oval	-40 to +70	660	2 to 30	±6

DISC CERAMIC CAPACITORS



Type	Description	Temperature Coefficient	Voltage Range (V-DC)	Cap. Range (μF)	Standard Tolerance (%/μF)
L	Reduced Titanites	Y5R, Y5U, Y5V	12 to 50	.01 to .22μF	-20 +80 ±20
G	General Purpose	Y5P, Y5U, Y5V Z5U, S2L	50 to 1000	1pF to .1μF	± 10, 20 -20 +80
C	Temperature Compensating	NPO, N330 N750, N1500 S2L	50 to 3000	1 to 910pF	±5, 10
S	Temperature/Freq. Stable	Y5E	500 & 1000	100pF to .01μF	±10
H	EIA Class II, High Voltage	Y5P, Y5U	2000 & 3000	220pF to .01μF	±20
U	Across the Line UL & CSA Reorganized	Z5U	150 VAC	1000pF to .01μF	±20

MULTILAYER CERAMIC CAPACITORS

RADIAL

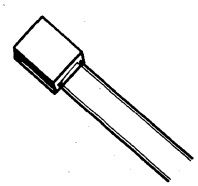
AXIAL

CHIP

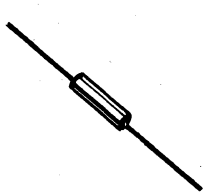
Type	Description	Temperature Coefficient	Voltage Range (V-DC)	Cap. Range (μF)	Standard Tolerance (%/μF)
M	Epoxy Dipped	NPO, X7R, Z5U	50 to 200	1.0pF to 3.3μF	±5, 10, 20
M60	Epoxy Dipped	Y5U	25 to 250	.1μF to 100μF	±20
P	Expoxy Coated	NPO, X7R,Z5U	50 to 200	10pF to 1.0μF	±5, 10, 20
CHP	Chip Capacitor	X7R, C0G (NPO)	50	10pF to .22μF	±5, 10

MONOLITHIC CERAMIC CAPACITORS

RADIAL



AXIAL



Style	Mil Spec	Voltage Range (WVDC)	Cap. Range (μF)	Standard Tolerance %
CK05	Mil-C-11015/18	50-200	10pf to .1μF	±10 ±20
CKR05	Mil-C-39014/01 Failure Rate: M, P, R & S	50-200	10pF to .1μF	±10 ±20
CK06	Mil-C-11015/20	50-200	1,200pF to 1.0μF	±10 ±20
CKR06	Mil-C-39014/02 Failure Rate: M, P, R & S	50-200	1,200pF to 1.0μF	±10 ±20
CKR11	Mil-C-39014/05 Failure Rate: M, P, R & S	50 & 100	10pF to .01μF	±10 ±20
CK12	Mil-C-11015/20	50 & 100	10pF to .01μF	±10 ±20
CKR12	Mil-C-39014/05 Failure Rate: M, P, R & S	50 & 100	.0056μF to .047μF	±10 ±20
CK13	Mil-C-11015/20	50 & 100	.0056μF to .047μF	±10 ±20
CK14	Mil-C-11015/20	50 & 100	.012μF to .27μF	±10 ±20
CKR14	Mil-C-39014/05 Failure Rate: M, P, R & S	50 & 100	.012μF to .27μF	±10 ±20
CK15	Mil-C-11015/20	50 & 100	.056μF to 1.0μF	±10 ±20
CKR15	Mil-C-39014/05 Failure Rate: M, P, R & S	50 & 100	.056μF to 1.0μF	±10 ±20
CK16	Mil-C-11015/20	50 & 100	.47μF to 3.3μF	±10 ±20
CKR16	Mil-C-39014/05 Failure Rate: M, P, R & S	50 & 100	.47μF to 3.3μF	±10 ±20

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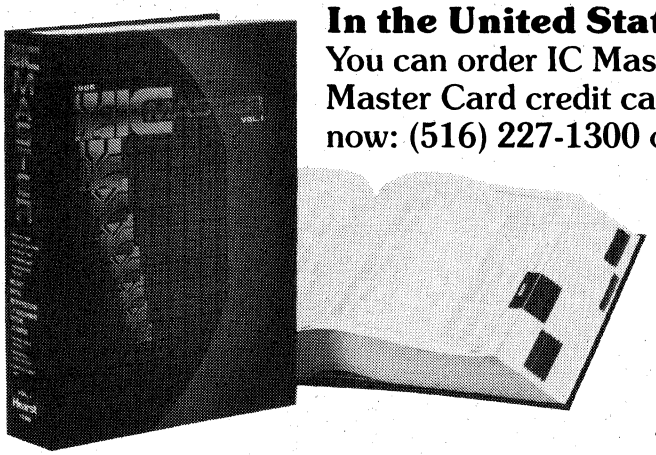

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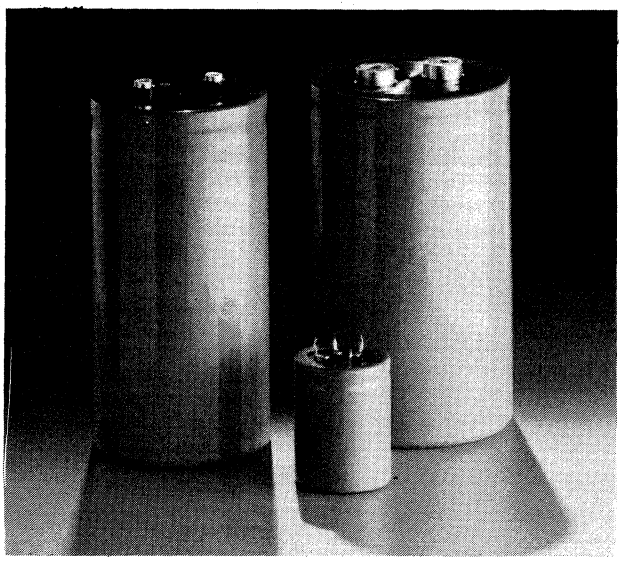
MALLORY

EA EXTREME APPLICATION
ALUMINUM ELECTROLYTIC CAPACITORS



BETTER PERFORMANCE AND RIPPLE CAPABILITY

The EA Capacitor is an extreme application/long life aluminum electrolytic capacitor in a rugged aluminum case with an extensive choice of mounting and terminal configurations. The EA excels in electrical performance and high ripple capability.

With capacitances up to 500,000 uF and ripple capability up to 50 amperes rms, the EA handles extreme application requirements up to 105°C.

Included in the technical bulletin is a complete application guide, typical performance curves, and full performance characteristics. For application assistance and/or more technical information contact Emhart Canada Ltd., Mallory Components Division.

HIGHLIGHTS

CAPACITANCE: 50uF - 500,000uf
VOLTAGE: 15 TO 500 WVdc
TEMPERATURE RANGE:
−40°C TO +105°C
TOLERANCE: −10%, +50% AND
−10%, +20%
CASE SIZE DIAMETERS:
1.000 TO 3.500 INCHES
25.40 TO 88.90mm
CASE SIZE LENGTHS:
2.125 TO 8.625 INCHES
53.98 TO 219.09mm

KEY FEATURES

SAFETY VENT CONSTRUCTION
LONG LIFE/HIGH RIPPLE
LOW ESR/LOW LEAKAGE CURRENT
RAPID DISCHARGE/HIGH CURRENT
LONG SHELF LIFE

APPLICATIONS

U.P.S. SYSTEMS
INVERTERS/P.C.U.s
MOTOR CONTROL
POWER FILTERING & DECOUPLING
STUD WELDING
MAGNETIZERS
HI-RIPPLE POWER SUPPLIES
ENERGY STORAGE APPLICATIONS
PHOTO FLASH

Soon to be released for production 500 WVdc at 85°C up to 3600uF.
Engineering samples available now.

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P.O. Box 210, 1079 Parkinson Road, Woodstock, Ontario N4S 7W8, Canada
Phone: (519) 539-4891, Telex: 064-74132, Fax: (519) 539-6684

EMHART MALLORY

MATSUO® TYPE 202 DIPPED TANTALUM CAPACITORS

Designed to take advantage of high purity tantalum powder resulting in smaller size units and minimum cost, with very low leakage current and excellent stability over both temperature and time, with a very limited distribution. Ideal for by-passing, coupling and timing applications.

SPECIFICATIONS

Capacitance Range: 0.1 to 330 μF
Rated Working Voltage: 3.15 to 50 VDC
Capacitance Tolerance: ±10%
Operating Temperature Range: −55°C to +85°C
DC Leakage Current (Rated Voltage, 5 min. 25°C): 0.01 CV (μA) or 0.5 μA, whichever is greater.
Conform to the test method of Capacitor Flame Test in UL 1414.

SURGE VOLTAGE

DC Rated Voltage at 85°C	3.15	6.3	10	16	20	25	35	50
DC Surge Voltage at 85°C	4.0	8.0	13	20	25	32	44	63

Capacitors shall withstand the surge voltage applied in series with a 100 ohm resistor at the rate of ½ minute on, 5½ minutes off, for 1000 successive test cycles at 85°C. After test, capacitors shall meet the requirements in Table 1.

Table 1

Capacitance Change	Within 5% of initial value
Dissipation Factor	Within initial requirement specified
DC Leakage Current	Within initial requirement specified

ALLOWABLE REVERSE VOLTAGE

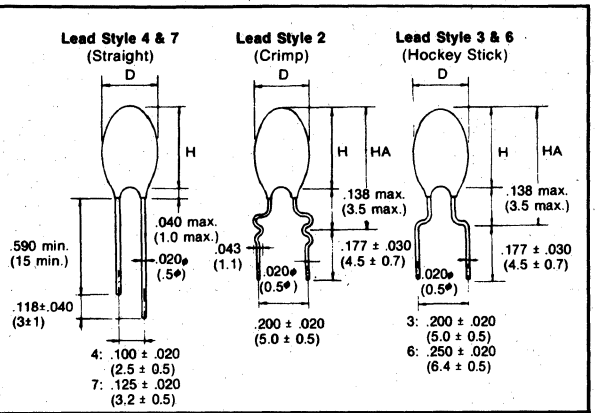
10% of rated voltage or 0.5 V, whichever is greater, at 25°C; 3% of rated voltage or 0.5 V, whichever is greater, at 85°C.

STANDARD RATINGS, SHOWING CASE SIZES

CAP (μF) \ RV (VDC)	3.15	6.3	10	16	20	25	35	50
.10							1	2
.15							1	2
.22							1	2
.33							1	2
.47							1	2
.68							1	2
1.0							1	3
1.5						1	2	4
2.2					1	2	3	5
3.3				1	2	3	4	6
4.7			1	2	3	4	5	
6.8		1	2	3	4	5	6	
10	1	2	3	4	5	6	7	
15	2	3	4	5	6	7	8	
22	3	4	5	6	7	8	9	
33	4	5	6	7	8	9	10	
47	5	6	7	8	9	10		
68	6	7	8	9	10			
100	7	8	9	10				
150	8	9	10					
220	9	10						
330	10							

NOTE: Intermediate non-standard values available. 1000 Pcs. Minimum.

DIMENSIONS: Inch (mm)



CASE SIZE	3.15 VDC — 35 VDC D MAX.	H MAX.	HA MAX.	50 VDC D MAX.	H MAX.	HA MAX.
1	.142(3.6)	.236(6.0)	.374(9.5)	-	-	-
2	.150(3.8)	.256(6.5)	.394(10.0)	.150(3.8)	.276(7.0)	.414(10.5)
3	.157(4.0)	.276(7.0)	.414(10.5)	.157(4.0)	.295(7.5)	.433(11.0)
4	.189(4.8)	.295(7.5)	.433(11.0)	.189(4.8)	.315(8.0)	.453(11.5)
5	.197(5.0)	.315(8.0)	.453(11.5)	.197(5.0)	.335(8.5)	.473(12.0)
6	.217(5.5)	.335(8.5)	.473(12.0)	.217(5.5)	.374(9.5)	.512(13.0)
7	.217(5.5)	.374(9.5)	.512(13.0)			
8	.256(6.5)	.453(11.5)	.591(15.0)			
9	.295(7.5)	.512(13.0)	.650(16.5)			
10	.315(8.0)	.551(14.0)	.689(17.5)			

ORDERING INFORMATION

202 L 3151 106 K 4

TYPE

FAILURE RATE
L: 2%/1000 Hrs.

VOLTAGE RATING

Code	Volts	Code	Volts	Code	Volts
3151	3.15	1602	16	2502	25
6301	6.3	2002	20	3502	35
1002	10			5002	50

CAPACITANCE IN PICOFARADS
First two digits are significant figures.
Third digit is the number of zeros following.

CAPACITANCE TOLERANCE
K = ±10%

LEAD STYLE

Lead Style	Lead Space Inch	mm	Code	Lead Style	Lead Space Inch	mm	Code
Straight .100″	.100	2.5	4	Hockey Stick .250″	.250	6.4	6
Straight .125″	.125	3.2	7	Tape & Reel .200″	.200	5.0	C or F
Crimp .200″	.200	5.0	2	Tape & Reel .100″	.100	2.5	H or J
Hockey Stick .200″	.200	5.0	3	Tape & Ammo Pack .200″	.200	5.0	B

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TYPE 204 (HIGH RELIABILITY) DIPPED TANTALUM CAPACITORS

BLUEDT® 204 Series is designed to maintain high reliability electrical performance characteristics. These high reliability 204 Series capacitors offer small case sizes and are ideal for use in any "Hi-Rel" product such as automotive electronics, telecommunications equipment, or any other industrial product where reliability is a must.

SPECIFICATIONS

Operating Temperature Range: −55°C to +125°C (For operation at 125°C derate voltage linearly to 67% of 85°C voltage rating.)
Rated Voltage: 3.15, 6.3, 10, 16, 20, 25, 35VDC
Capacitance Range: 0.1 to 300μF
Capacitance Tolerance: ±20%(M), ±10%(K), ±5%(J)
DC Leakage Current: 0.008 × CV or 0.4μA, whichever is greater (Rated voltage, 5 min, 25°C)
Dissipation Factor: See Table 1 (at 120Hz)

Surge Voltage

DC Rated Voltage at 85°C	3.15	6.3	10	16	20	25	35
DC Surge Voltage at 85°C	4.0	8.0	13	20	25	32	44

Capacitors shall withstand the surge voltage applied in series with a 100 ohm resistor at the rate of ½ minute on, 5½ minutes off, for 1000 successive test cycles at 85°C. After test, capacitors shall meet the requirements in Table 1.

Table 1

Capacitance Change	Within 5% of initial value
Dissipation Factor	Within initial requirement specified
DC Leakage Current	Within initial requirement specified

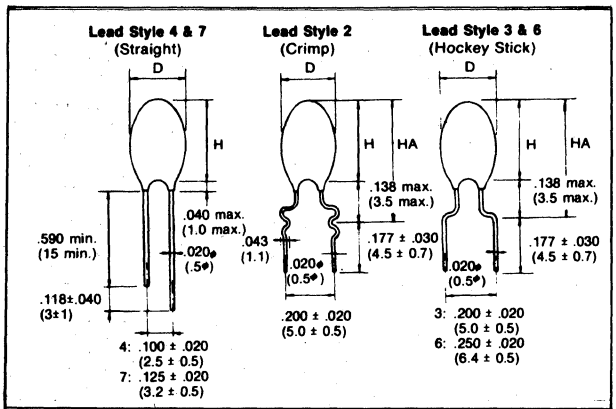
ALLOWABLE REVERSE VOLTAGE

10% of rated voltage or 0.5 V, whichever is greater, at 25°C; 3% of rated voltage or 0.5 V, whichever is greater, at 85°C.

STANDARD RATINGS; SHOWING CASE SIZES

R.V. (VDC) / Cap. (μF)	3.15	6.3	10	16	20	25	35
0.1							1
0.15							1
0.22							1
0.33							1
0.47							1
0.68							1
1.0							1
1.5						1	2
2.2					1	2	3
3.3				1	2	3	4
4.7			1	2	3	4	5
6.8		1	2	3	4	5	6
10	1	2	3	4	5	6	7
15	2	3	4	5	6	7	8
22	3	4	5	6	7	8	9
33	4	5	6	7	8	9	10
47	5	6	7	8	9	10	
68	6	7	8	9	10		
100	7	8	9	10			
150	8	9	10				
220	9	10					
330	10						

DIMENSIONS: Inches (mm)



Case Code	D max.	H max.	P ± .02 (.5)
1	.142 (3.6)	.256 (6.5)	.098 (2.5)
2	.150 (3.8)	.276 (7.0)	.098 (2.5)
3	.157 (4.0)	.296 (7.5)	.098 (2.5)
4	.189 (4.8)	.315 (8.0)	.098 (2.5)
5	.197 (5.0)	.335 (8.5)	.098 (2.5)
6	.217 (5.5)	.374 (9.5)	.098 (2.5)
7	.236 (6.0)	.394 (10.0)	.098 (2.5)
8	.256 (6.5)	.453 (11.5)	.125 (3.2)
9	.295 (7.5)	.512 (13.0)	.197 (5.0)
10	3.15 (8.0)	.551 (14.0)	.197 (5.0)

Packaging Style (available up to Case 8)

Code	Lead Spacing	Polarity	Style
H	.100 ± .020 (2.5 ± 0.5)	⊕ proceeding	Reeled
J		⊖ proceeding	Reeled
G		—	Ammo
C	.200 ± .020 (5.0 ± 0.5)	⊕ proceeding	Reeled
F		⊖ proceeding	Reeled
B		—	Ammo

ORDERING INFORMATION

204 M 3151 106 M 3

TYPE

FAILURE RATE
M: 1%/1000Hr.
N: 0.5%/1000Hr.

VOLTAGE RATING

Code	Vol	Code	Vol	Code	Vol	Code	Vol
3151	3.15	1002	10	2002	20	3502	35
6301	6.3	1602	16	2502	25		

CAPACITANCE IN PICOFARADS
First two digits are significant figures.
Third digit is the number of zeros following.

CAPACITANCE TOLERANCE
M = ±20%
K = ±10%
J = ±5%

LEAD STYLE
SEE DIMENSIONS

TYPE 265 TANTALUM CHIP CAPACITORS

For PCB and Hybrid Applications
Precision Molded Construction

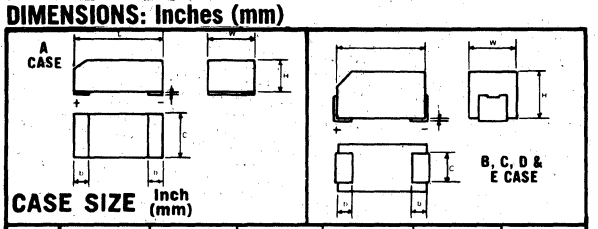
SPECIFICATIONS

Capacitance Range: 0.1 to 100 μF
Rated Working Voltage: 3.15, 6.3, 10, 16, 20, 25 & 35 VDC
Capacitance Tolerance: ±20% (M); ±10% (K)
Operating Temperature Range: −55°C to +125°C
DC Leakage Current (Rated Voltage, 5 min. 25°C): 0.01 CV (μA) or 0.5 μA, whichever is greater.
Conforms to UL 1414.

STANDARD RATINGS, SHOWING CASE SIZES

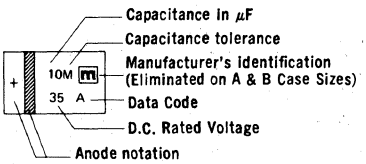
CAP. (μF) \ R.V. (VDC)	3.15	6.3	10	16	20	25	35
.1							A, B
.15							A, B
.22							A, B
.33						A	B
.47					A		B
.68				A		B	C
1.0			A		B		C
1.5		A		B			C
2.2	A		B			C	D
3.3		B			C		D
4.7	B			C		D	E
6.8			C		D		E
10		C		D			E
15	C		D			E	
22			D		E		
33		D		E			
47	D		E				
68		E					
100	E						

DIMENSIONS: Inches (mm)



Case Code	L ±.008 (0.2)	W ±.012 (0.3)	H ±.008 (0.2)	b ±.012 (0.3)	c ±.012 (0.3)	t
A	.180 (4.6)	.100 (2.5)	.070 (1.7)	.030 (0.8)	.100 (2.5)	.006 (0.15)
B	.180 (4.6)	.100 (2.5)	.100 (2.5)	.030 (0.8)	.063 (1.6)	.004 (0.10)
C	.315 (8.0)	.180 (4.6)	.070 (1.7)	.050 (1.3)	.118 (3.0)	.004 (0.10)
D	.315 (8.0)	.180 (4.6)	.100 (2.5)	.050 (1.3)	.118 (3.0)	.004 (0.10)
E	.315 (8.0)	.180 (4.6)	.195 (5.0)	.050 (1.3)	.118 (3.0)	.006 (0.15)

MARKING



ORDERING INFORMATION

265 L 3502 106 M 1

- 265 — MATSUO Type Number
- L — FAILURE RATE LEVEL: L: 2%/1000 h
- 3502 — RATED VOLTAGE

Code	VDC	Code	VDC
3151	3.15	2002	20
6301	6.3	2502	25
1002	10	3502	35
1602	16		

- 106 — CAPACITANCE IN PICOFARADS: First two digits are significant figures. Third digit is the number of zeros following.
- M — CAPACITANCE TOLERANCE: M = ±20%, K = ±10%
- 1 — LEAD STYLE: 1: Case Size B, C, D and E; 8: Case Size A only

TYPE 242 MOLDED TANTALUM CAPACITORS

For High Density Packaging

Impact resistant rectangular molded case. Uniform lead location for automatic insertion. Low impedance at high frequencies. Ideal for noise bypassing in high speed logical circuits. High capacitance in miniature case.

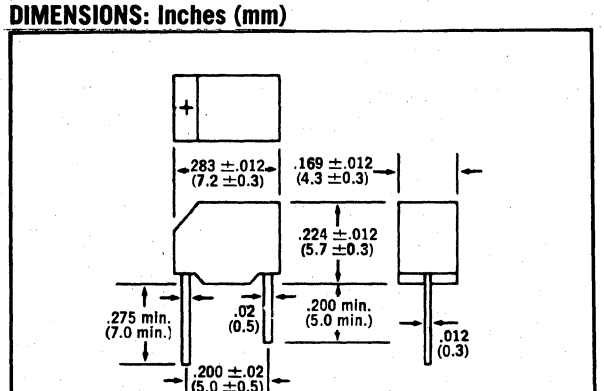
SPECIFICATIONS

Capacitance Range: 0.1 to 47 μF
Rated Working Voltage: 6.3, 10, 16, 20, 25, 35 & 50 VDC
Capacitance Tolerance: ±20% (M); ±10% (K)
Operating Temperature Range: −55°C to +125°C
DC Leakage Current (Rated Voltage, 5 min. 20°C): 0.01 CV (μA) or 0.5 μA, whichever is greater: (85°): 0.5 CV 5.0 μA, whichever is greater.
Conforms to UL 1414.
Available on tape in ammo-pack or reel.

STANDARD RATINGS

CAP. (μF) \ R.V. (VDC)	6.3	10	16	20	25	35	50
0.1						•	•
0.15						•	•
0.22						•	•
0.33						•	•
0.47						•	•
0.68						•	•
1.0						•	•
1.5						•	•
2.2						•	•
3.3						•	•
4.7					•	•	
6.8				•		•	
10			•		•		
15		•		•			
22	•		•				
33		•					
47	•						

DIMENSIONS: Inches (mm)



ORDERING INFORMATION

242 M 1602 106 M 2

- 242 — TYPE
- M — FAILURE RATE LEVEL: M: 1%/1000 Hrs.
- 1602 — VOLTAGE RATING

Code	Volts	Code	Volts
6301	6.3	2502	25
1002	10	3502	35
1602	16	5002	50
2002	20		

- 106 — CAPACITANCE IN PICOFARADS: First two digits are significant figures. Third digit is the number of zeros following.
- M — CAPACITANCE TOLERANCE: M = ±20%, K = ±10%
- 2 — LEAD STYLE

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MATSUO® TYPE 244/245 MOLDED TANTALUM CAPACITORS

TYPE 244

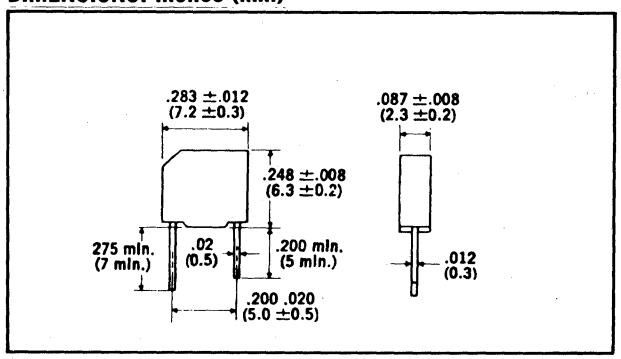
FOR NOISE BYPASSING

Impact resistant rectangular molded case. Eliminating the noise generated at the rise time of pulse in ultra-high speed logical circuits such as TTL and ECL.

SPECIFICATIONS

Operating Temperature Range: −55°C to +125°C (for temperature above 85°C, derate voltage to 67% of R.V.)
Failure Rate Level: M (1%/1000 Hrs.)
Rated Voltage: 16, 35, 50 VDC
Capacitance: 1, 3.3 MFD
Capacitance Tolerance: ±20% (M)
DC Leakage Current (Rated Voltage, 5 min. 25°C): 0.01 CV (μA) or 0.5 μA, whichever is greater.
Conforms to UL 1414
Available on tape in ammo-pack or reel.

DIMENSIONS: Inches (mm)



STANDARD RATING

CATALOG NO.	DC RATED VOLTAGE (VDC)	CAPACITANCE (μF)
244M 1602-335M	16	3.3
244M 3502-105M	35	1.0
244M 5002-105M	50	1.0

TYPE 245

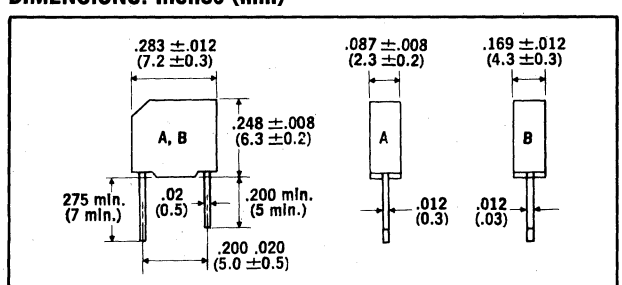
Hybrid Capacitor — Fuse

Eliminates the noise generated at rise time in ultra-high speed logical circuits such as TTL and ECL. Built-in fuse functions either as thermal fuse under small current or as electric fuse under larger currents.

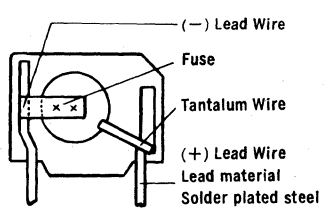
SPECIFICATIONS

Operating Temperature Range: −55°C to +125°C (For temperature above 85°C, derate voltage to 67% of R.V.)
Rated Voltage: 10 VDC to 50 VDC
Capacitance Range: 1.0 to 33 MFD
Capacitance Tolerance: ±20% (M)
DC Leakage Current: (Rated voltage, 5 minutes, 25°C) 0.01 CV (μA) or 0.5 μA whichever is greater.
Conforms to UL 1414.
Circuit Breaking Performance
Built-in fuse functions as a thermal fuse at current of less than 5 amperes. At current of more than 5 amperes, built-in fuse functions by the current flowing through fuse.
Available on tape in ammo-pack or reel.

DIMENSIONS: Inches (mm)



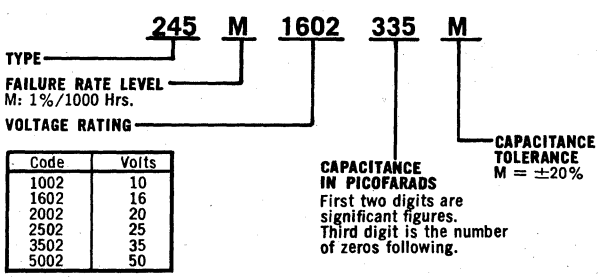
CONSTRUCTION



STANDARD RATINGS, SHOWING CASE SIZES

CAP. (μF) \ R.V. (VDC)	10	16	20	25	35	50
1.0					A	A
2.2					B	B
3.3		A			B	B
4.7				B	B	
6.8			B		B	
10		B		B		
15	B		B			
22		B				
33	B					

ORDERING INFORMATION



Code	Volts
1002	10
1602	16
2002	20
2502	25
3502	35
5002	50

MATSUO ELECTRONICS 2134 Main St., Ste. 200 / Huntington Beach, CA 92648 / Tel. (714) 969-2491 / FAX (714) 960-6492 / TWX 910-596-1828
These specifications are subject to change without notice.

TYPE 267 TANTALUM CHIP CAPACITORS

MATSUO Type 267 is specially designed as a surface mount component for use in hybrid and low profile print circuit board applications. Fully-molded construction provides excellent mechanical protection, superior moisture resistance and high soldering heat resistance.

FEATURES:

- Ultra small dimensions (A case): 3.2 × 1.6mm.
- Dimensions are equivalent to EIA standards and IECQ. (Case A, B, C3 and D3).
- Flame retardant resin molded case.
- Precise dimensions allow for high density package.
- Reeled packaging is compatible with automatic mounting equipment per EIA-481.
- Failure rate: M(1%/1000Hr.).
- Symmetrical construction of positive and negative terminals provides "SELF-ALIGNMENT".
- Soldering: 260°C for 10 sec. by re-flow or dip.

SPECIFICATIONS

Operating Temperature Range: −55°C to +125°C (For operation at 125°C derate voltage linearly to 67% of 85°C voltage rating.)
Rated Voltage: 4, 6.3, 10, 16, 20, 25, 35VDC
Capacitance Tolerance: ±20%(M) ±10%(K)
DC Leakage Current: 0.008 × CV or 0.4μA, Whichever is greater (Rated voltage, 5 minutes, 25°C)
Dissipation Factor: See Table 1 (at 120Hz)

Surge Voltage

DC Rated Voltage at 85°C	4	6.3	10	16	20	25	35
DC Surge Voltage at 85°C	5.0	8.0	13	20	25	32	44

Capacitor shall withstand the surge voltage applied in series with a 1000 ohm resistor at the rate of ½ minute on, 5½ minute off, for 1000 successive test cycles at 85°C.
After test, capacitors shall meet the requirements in Table 1.

Table 1

Capacitance Change	**Within 5% of initial value**
Dissipation Factor	**Within initial requirement specified**
DC Leakage Current	**Within initial requirement specified**

ALLOWABLE REVERSE VOLTAGE

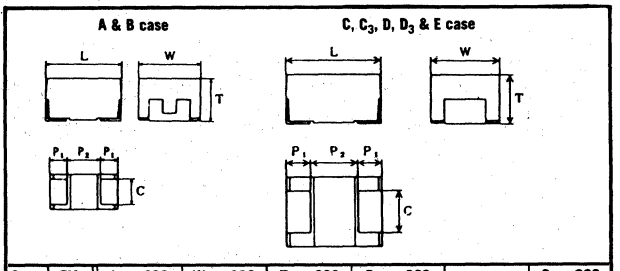
10% of rated voltage or 0.5 V, whichever is greater, at 25°C; 3% of rated voltage or 0.5 V, whichever is greater, at 85°C.

STANDARD RATINGS, SHOWING CASE SIZES

R.V. (VDC) / Cap. (μF)	4	6.3	10	16	20	25	35
0.1							A
0.15							A
0.22							A
0.33							A
0.47						A	B
0.68					A		B
1.0				A	(A)		B
1.5			A	(A)		B	(C, C3)
2.2		A	(A)		B		C, C3
3.3	A	(A)		B	(B)	(C3)	C, (D3)
4.7	(A)		B	(B)	(C3)	C, C3	D, D3
6.8		B	(B)	(C3)	C, C3)		D, D3
10	B	(B)	(C3)	C, C3		D, D3	(E)
15	(B)	(C3)	C	(C, C3)	D, D3		(E)
22	(C3)	C	(C, C3)	D, D3		(E)	
33	C	(C, C3)	D, D3	(D, D3)	(E)		
47	(C, C3)	D, D3	(D, D3)	(E)			
68	D, D3	D, D3	(E)				
100	D, D3	(E)	(E)				
150	(E)	(E)					
220	(E)						

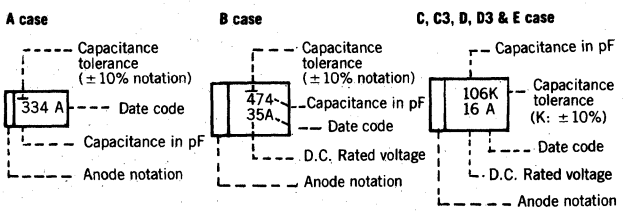
NOTE: ( ) = Designates Extended Range, add ".533" to Part Number.

DIMENSIONS: Inches (mm)

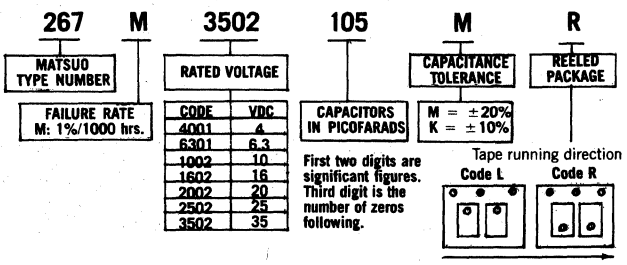


Case Code	EIA. Code	L ±.008 (0.2)	W ±.008 (0.2)	T ±.008 (0.2)	P_1 ±.008 (0.2)	P_2 min.	C ±.006 (0.15)
A	3216	.126 (3.2)	.063 (1.6)	.063 (1.6)	.030 (0.75)	.056 (1.4)	.047 (1.2)
B	3528	.134 (3.4)	.110 (2.8)	.075 (1.9)	.033 (0.85)	.069 (1.5)	.071 (1.8)
C		.220 (5.6)	.130 (3.3)	.091 (2.3)	.051 (1.3)	.110 (2.8)	.087 (2.2)
C_3	6032	.236 (6.0)	.126 (3.2)	.098 (2.5)	.051 (1.3)	.118 (3.0)	.087 (2.2)
D		.220 (5.6)	.181 (4.6)	.126 (3.2)	.051 (1.3)	.110 (2.8)	.126 (3.2)
D_3	7243	.287 (7.3)	.173 (4.4)	.110 (2.8)	.051 (1.3)	.157 (4.0)	.094 (2.4)
E	7257	.287 (7.3)	.228 (5.8)	.138 (3.5)	.051 (1.3)	.157 (4.0)	.138 (3.5)

Marking



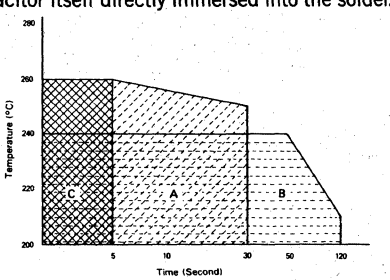
ORDERING INFORMATION



GUIDE TO APPLICATION

Soldering condition

1. Pre-heating:
   Preheating at 130–160°C is recommended to avoid thermal shock in soldering.
2. Soldering:
   Temperature of capacitor body itself should not exceed 260°C.
   2–1 Direct heating (condition A)
   Substrate or PC board placed and floated on the solder bath.
   Substrate or PC board placed on a hot plate.
   Substrate or PC board passed through on the solder bath.
   2–2 Heating in oven (condition B)
   By hot air.
   2–3 Immersion (dipping) (condition C)
   Capacitor itself directly immersed into the solder.



TYPE 501/553/602 FILM CAPACITORS

TYPE 501 POLYESTER

Highly stable resin dipped film capacitor with superior performance.

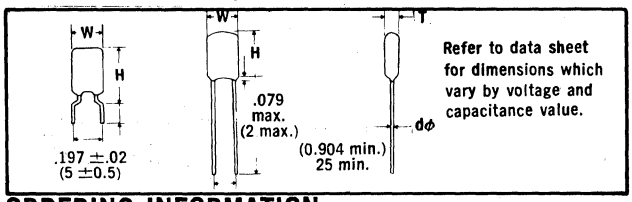
SPECIFICATIONS

Operating Temperature: −40°C ~ +125°C
Maximum Operating Temperature for DC Rated Voltage: +85°C.
DC Rated Voltage: 50, 100, 200 VDC. (For operation at 125°C the voltage is 50% of 85°C ratings).
Capacitance Range: 0.001 ~ 0.22 μF
Capacitance Tolerance: ±5%, ±10%
Failure Rate Levels: P: 0.1%/1000 h. N: 0.5%/1000 h.
Available on tape and reel.

STANDARD RATINGS

50 VOLT	100 VOLT	200 VOLT
.001 to .47 MFD	.001 to .22 MFD	.001 to .1 MFD

DIMENSIONS: Inches (mm)



Refer to data sheet for dimensions which vary by voltage and capacitance value.

ORDERING INFORMATION

501 N 5002 104 K 2

- TYPE: 501
- FAILURE RATE: N: 0.5%/1000 Hrs. P: 0.1%/1000 Hrs.
- RATED VOLTAGE:

Code	Volts
5002	50
1003	100
2003	200

- CAPACITANCE IN PICOFARADS: 104
- CAPACITANCE TOLERANCE: K = ±10%, J = ±5%
- LEAD STYLE: 1: Straight, 2: Hockey stick (50 volt only)

TYPE 553 POLYESTER

Super Miniature metallized polyester film capacitor with high ratio of capacitance/voltage in a small package. Low impedance and high stability. Plastic case.

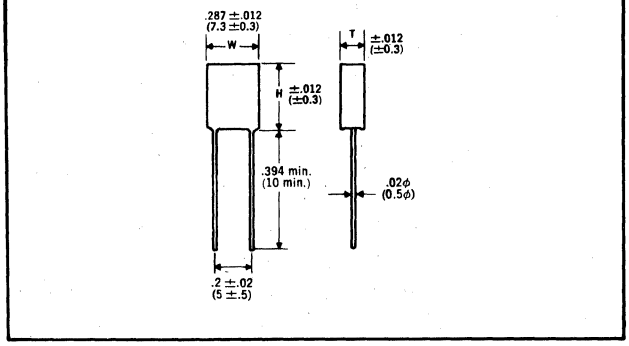
SPECIFICATIONS

Operating Temperature: −40°C ~ +105°C
DC Rated Voltage Range: 50 VDC*, 63 VDC*
Nominal Capacitance Range: .01 μF to 1.0 μF
Capacitance Tolerance: ±5%, ±10%
* For operation at 105°C the voltage shall be derated to 50% of R.V.
Available on tape and reel.

inch (mm)

MFD	VOLTS 50	VOLTS 63	DIMENSIONS H	DIMENSIONS T
0.01		•	.276 (7.0)	.102 (2.6)
0.015		•	.276 (7.0)	.102 (2.6)
0.022		•	.276 (7.0)	.102 (2.6)
0.033		•	.276 (7.0)	.102 (2.6)
0.047		•	.276 (7.0)	.102 (2.6)
0.068		•	.276 (7.0)	.102 (2.6)
0.1		•	.276 (7.0)	.102 (2.6)
0.15		•	.335 (8.5)	.142 (3.6)
0.22		•	.335 (8.5)	.142 (3.6)
0.33		•	.374 (9.5)	.181 (4.6)
0.47		•	.413 (10.5)	.205 (5.2)
0.68	•		.413 (10.5)	.205 (5.2)
1.0	•		.453 (11.5)	.244 (6.2)

DIMENSIONS: Inches (mm)



ORDERING INFORMATION

553 M 6302 104 K

- TYPE: 553
- FAILURE RATE: M: 1%/1000 Hrs.
- RATED VOLTAGE:

Code	VDC
6302	63
5002	50

- CAPACITANCE IN PICOFARADS: 104
- CAPACITANCE TOLERANCE: K = ±10%, J = ±5%

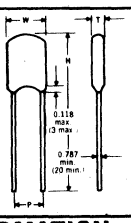
TYPE 602 POLYPROPYLENE

602 capacitors were designed for applications requiring high accuracy, excellent stability, low dielectric absorption, very high insulation resistance and low temperature coefficient. Available on tape and reel.

SPECIFICATIONS

Operating Temperature Range: −40°C to +85°C
D.C. Rated Voltage: 100 VDC
Capacitance Range: 0.001 to 0.22 MFD, E-12 series
Capacitance Tolerance: ±2% (G), ±1% (F), ±5% (J) available on special order
Dielectric Withstanding Voltage: 2 times D.C. rated voltage for 1 minute
Insulation Resistance: 100,000 MΩ at 20°C
10,000 MΩ min. at 85°C
Dissipation Factor: <0.15 MFD 0.1% max.
≥0.15 MFD 0.2% max.
at 20°C, 1000 Hz

DIMENSIONS: Inches (mm)



Refer to data sheet for dimensions which vary by capacitance value.

ORDERING INFORMATION

602 M 1003 103 G 1

- TYPE: 602
- FAILURE RATE: M: 1%/1000 Hrs.
- RATED VOLTAGE: 1003
- CAPACITANCE IN PICOFARADS: 103
- CAPACITANCE TOLERANCE: F = ±1%, G = ±2%, J = ±5%
- LEAD STYLE OR PACKAGING: 1: Straight, 4: Crimp, C: Tape & reel

MATSUO ELECTRONICS 2134 Main St., Ste. 200 / Huntington Beach, CA 92648 / Tel. (714) 969-2491 / FAX (714) 960-6492 / TWX 910-596-1828

These specifications are subject to change without notice.

MEPCO/CENTRALAB

A NORTH AMERICAN PHILIPS COMPANY

TANTALUM SOLID, WET AND CHIP CAPACITORS

5900 Australian Avenue, West Palm Beach, FL 33407 (305) 842-3201 TWX: 510-952-7631 Telex: 820677

MIL SLASH NO.	DESIGNATION		M/E STYLE	DESCRIPTION	CAPACITANCE RANGE	VOLT. RANGE
WET SLUG MIL-C-3965						
/1	CL14	CL16	43XW	Hermetic Seal, Screw Mount, Cylindrical Case	3.5- 200 µf	20-630v
/19	CL17	CL18	43XW	Hermetic Seal, Stud Mount, Cylindrical Case	12-1300 µf	30-630v
/21	CL55		43JW	Hermetic Seal, Rectangular Module	70-2400 µf	15-150v
/4	CL64	CL65	40LW	Elastomer Seal, Axial Lead, Tubular Case	1.7- 560 µf	6-125v
/24	CL66	CL67	40SW	Hermetic Seal, Axial Lead, Tubular Case	1.7- 560 µf	6-125v
MIL-C-39006				Established Reliability		
/18	CLR10		43XW	Extended Range, Cylindrical Case, Solder Lug Terminal	2.0- 140 µf	8-360v
/19	CLR14		43XW	Extended Range, Cylindrical Case, Solder Lug Terminal	3.5- 200 µf	20-630v
/20	CLR17		43XW	Extended Range, Cylindrical Case, Solder Lug Terminal	12-1300 µf	30-630v
/09	CLR65-		40SW	Glass-to-Tantalum Hermetic Seal, Axial Lead Tubular Silver Case	1.7-1200 µf	6-125v
/22	CLR79		40AW	Hermetic Seal, Tantalum Case, Axial Lead, Tubular Case	1.7-1200 µf	6-125v
/25	CLR81		40BW	Extended Range, Hermetic Seal, Axial Lead, T_A Case		
SOLID SLUG MIL-C-26665B						
	CS12	CS13	40SS	Hermetic Seal, Axial Lead, Tubular Case	.0047- 330 µf	6-100v
MIL-C-39003				Established Reliability		
/02	CSR09		40TS	Polar, Miniature Hermetic Seal, Axial Lead, Tubular Case	.047- 18 µf	6- 75v
/01	CSR13		40SS	Polar, Hermetic Seal, Axial Lead, Tubular Case	.0047- 330 µf	6-100v
/09	CSR21		40ZS	Polar, High Frequency Hermetic, Tubular Case, Axial Lead	5.6- 330 µf	6- 50v
/03	CSR23		40XS	Polar, Extended Range Hermetic Seal, Axial Lead, Tubular Case	1.2-1000 µf	6- 50v
/06	CSR33		40YS	Polar, Extended Range,Hermetic Seal,for Low Impedance Application	1.2-1000 µf	6- 50v
/04	CSR91		40NS	Non-Polar, Hermetic Seal, Axial Lead, Tubular Case	.0023- 160 µf	6-100v
SOLID CHIP MIL-C-55365/4				Established Reliability		
	CWR06		49BC	Polar Hybrid Tantalum Chip	.1- 100 µf	4- 50v
WET SLUG						
			40AW	Hermetic, Tantalum Case, Axial Lead, Tubular Case	1.7-1200 µf	6-125v
			40BW	Extended Range, Hermetic Seal, T_A Case, Axial Lead.		
			40CW	Miniature, Polar, Non-Hermetic, Tubular, Axial Lead	3.3- 450 µf	6- 60v
			40EW	Extended Range, Polar, Non-Hermetic, Tubular, Axial	6.8-1800 µf	6-125v
			43JW	Hermetic, Rectangular Module, Spade Lugs	35-22,000 µf	6-150v
			40LW	Polar, Non-Hermetic, Tubular, Axial Lead	1.7-1100 µf	6-125v
			40SW	Hermetic, Polar, Glass to Tantalum Seal, Tubular, Axial	1.7-1200 µf	6-125v
			40TW	Hermetic, Tantalum Case, Tubular, Axial, High Temp. +200°C	1.7-1200 µf	6-125v
			43XW	Hermetic, Cylindrical Case, Stud or Screw Mount	3.5-1300 µf	20-630v
			40YW	Miniature, Non-Acid Electrolyte, Polar, Tubular, Non-Hermetic	0.1- 320 µf	6- 60v
SOLID CHIP						
			49BC	Polar, Hybrid Tantalum Chip, High Reliability	0.1- 100 µf	4- 50v
			49SC	Polar, Hybrid Tantalum Chip, Industrial	0.1- 100 µf	4- 50v
			49UC	Polar, Hybrid, Miniature Industrial Tantalum Chip	0.1- 6.8µf	4- 50v
			49MC	Polar, Hybrid, Commercial Chip, EIA Sizes	0.1- 68µf	4- 50v
SOLID SLUG						
			40CS	Polar, Miniature Non-Hermetic, Tubular Metal Case, Axial Lead	.0047- 68 µf	2- 50v
			40ES	Polar, Non-Hermetic, Tubular Metal Case, Axial Lead	.0047- 330 µf	6-100v
			41GS	Polar, Dipped, Non-Hermetic, Miniature, Radial Lead	0.1- 680 µf	3- 50v
			40MS	Polar, Molded, Non-Hermetic, Axial Lead	0.1- 68 µf	2- 50v
			40NS	Non-Polar, Hermetic, Tubular Case, Axial Lead	.0023- 160 µf	6-100v
			41PS	Polar, Non-Hermetic, Rectangular Plastic Case, Radial Lead	0.1- 220 µf	6- 50v
			40SS	Polar, Standard Hermetic, Tubular Case, Axial Lead	.0047- 330 µf	6-100v
			40TS	Polar, Miniature Hermetic, Tubular Case, Axial Lead	.0047- 39 µf	4-100v
			40XS	Polar, Extended Range, Hermetic Tubular, Axial Lead	0.82-1000 µf	6- 60v
			40YS	Polar, Extended Range, Hermetic, For Low Impedance Applications	1.2-1000 µf	6- 50v
			40ZS	Polar, High Frequency Hermetic, Tubular Case, Axial Lead	5.6- 330 µf	6- 50v

TANTALUM WET FOIL CAPACITORS

6071 St. Andrews Road, Columbia, SC 29212 (803) 772-2500 TWX:810-666-2662 Telex: 805024

MIL SLASH NO.	DESIGNATION		M/E STYLE	DESCRIPTION	CAPACITANCE RANGE	VOLT. RANGE
WET FOIL MIL-C-3965						
/17	CL20	CL21	40AF	Polar, Etched Foil, Tubular Case, Axial Lead	1- 580 µf	15-150v
/18	CL22	CL23	40BF	Non-Polar, Etched Foil, Tubular Case, Axial Lead	0.5- 350 µf	15-150v
/15	CL30	CL31	40AG	Polar, Plain Foil, Tubular Case, Axial Lead	0.27- 300 µf	3-300v
/16	CL32	CL33	40BG	Non-Polar, Plain Foil, Tubular Case, Axial Lead	0.12- 400 µf	3-300v
/9	CL51		43KG	Polar, Plain Foil, KSR, Hermetic Rectangular Module	40- 960 µf	15-150v
/10	CL52		43JG	Non-Polar, Plain Foil, KSR, Hermetic Rectangular Module	20- 600 µf	15-150v
/11	CL53		43KF	Polar, Etched Foil, KSR, Hermetic Rectangular Module	70-3500 µf	15-150v
/12	CL54		43JF	Non-Polar, Etched Foil, KSR, Hermetic Rectangular Module	35-2100 µf	15-150v
/22	CL70	CL71	40RF	Polar, High Etched Foil, Tubular Case, Axial Lead	16- 920 µf	15-150v
/23	CL72	CL73	40SF	Non-Polar, High Etched Foil, Tubular Case, Axial Lead	0.75- 590 µf	15-150v
MIL-C-39006				Established Reliability		
/01	CLR25		40EF	Polar, Etched Foil, Hermetic and Non-Hermetic, Axial Lead	1.0- 580 µf	15-150v
/02	CLR27		40FF	Non-Polar, Etched Foil, Hermetic and Non-Hermetic, Axial Lead	0.5- 350 µf	14-150v
/03	CLR35		40EG	Polar, Plain Foil, Hermetic and Non-Hermetic, Axial Lead	0.35- 160 µf	15-200v
/04	CLR37		40FG	Non-Polar, Plain Foil, Hermetic and Non-Hermetic, Axial Lead	0.15- 100 µf	15-200v
/16	CLR71		40TF	Polar, High Etched Foil, Hermetic and Non-Hermetic Axial Lead	1.6- 920 µf	15-150v
/17	CLR73		40VF	Non-Polar, High Etched Foil, Hermetic and Non-Hermetic, Axial Lead	0.75- 590 µf	15-150v

MEPCO/CENTRALAB
A NORTH AMERICAN PHILIPS COMPANY

ALUMINUM ELECTROLYTIC CAPACITORS

6071 St. Andrews Road, Columbia, SC 29212 (803) 772-2500 TWX: 810-666-2662 Telex: 805024

MEPCO/CENTRALAB Series	Operating Temp.	D.C.V. Range	Capacitance Range (μf)	Standard Cap. Tolerance	Min. Case Size In Inches	Max. Case Size In Inches	Min. Case Size In MM	Max. Case Size In MM	Life*
3070 Miniature Axial	−40 to +85°C	6.3V to 385V	.33 to 10,000	−10 +50% ±20	.177X .394	.827X 1.575	4.5X 10.0	21.0X 40.0	2000 Hrs.
3120 Computer Grade	−40 to +105°C	6V to 300V	110 to 700,000	−10 +50% −10 +75%	1.375X 2.125	3.0X 8.625	34.92X 53.97	76.2X 219.07	2000 Hrs.
3186 Computer Grade	−40 to +85°C	5V to 450V	75 to 650,000	−10 +50% −10 +75%	1.375X 2.125	3.0X 8.625	34.92X 53.97	76.2X 219.07	1000 Hrs.
3188 Computer Grade	−40 to +85°C	3V to 400V	100 to 590,000	−10 +50% −10 +75%	1.375X 2.125	3.0X 8.625	34.92X 53.97	76.2X 219.07	2000 Hrs.
3189 Computer Grade	−40 to +85°C	5V to 75V	3200 to 760,000	−10 +50% −10 +75%	1.375X 3	2.125X 8.625	34.92X 76.20	53.97X 219.07	1000 Hrs.
3190 Computer Grade	−40 to +85°C	3V to 75V	2700 to 650,000	−10 +50% −10 +75%	1.375X 3	2.125X 8.625	34.92X 76.20	53.97X 219.07	2000 Hrs.
3191 Computer Grade	−40 to +85°C	5V to 55V	2800 to 200,000	+20%	1.375X 2.125	2.0X 5.625	34.92X 53.97	50.8X 142.87	2000 Hrs.
3194 Computer Grade	−40 to +105°C	150V to 250V	290 to 11,000	−10 +50%	1.375X 3	2.125X 8.625	34.92X 76.20	53.97X 219.07	2000 Hrs.
3195 Computer Grade	−40 to +85°C	5V to 100V	2800 to 1,200,000	−10 +50% −10 +75%	1.375X 3	2.125X 8.625	34.92X 76.20	53.97X 219.07	1000 Hrs.
3196 Computer Grade	−40 to +85°C	3V to 100V	1600 to 1,000,000	−10 +50% −10 +75%	1.375X 3	2.125X 8.625	34.92X 76.20	53.97X 219.07	2000 Hrs.
		450V	35,000	−10 +75%	1.125	3.625	28.6	92.1	Hrs.
3428 Radial	−55 to +105°C	6.3V to 250V	19 to 17,000	−10 +50% −10 +75%	.750X 1.125	1.0X 3.625	19.1X 28.6	25.4X 92.1	2000 Hrs.
3476 Miniature Radial	−40 to +85°C for 100V or less −25 to +85°C for 160V or greater	6.3V to 450V	0.47 to 10,000	±20%	.197X .433	.709X 1.399	5X 11	18X 40	1000 Hrs.
3477 Miniature Radial	−40 to +85°C	6.3V to 100V	0.1 to 4,700	±20%	.197X .433	.709X 1.399	5X 11	18X 40	1000 Hrs.
3478 Miniature Radial	−40 to +80°C	6.3V to 50V	0.1 to 100	±20%	.197X .55	.394X .591	5X 14	10x 15	1000 Hrs.
3479 Miniature Radial	−40 to +85°C	10V to 100V	470 to 22,000	±20%	.866X 1.181	1.181X 2.008	22X 30	30X 51	1000 Hrs.
3480 Miniature Radial	−55 to +105°C	6.3V to 250V	0.47 to 10,000	±20%	.197X .433	.709X 1.399	5X 11	18X 40	1000 Hrs.
3481 Miniature Radial	−55 to +105°C	10V to 100V	2.2 to 1000	−10 +100%	.315X .453	.492X 1.673	8X 11.5	12.5X 42.5	2000 Hrs.
3482 Miniature Radial	−55 to +105°C	7.5V to 250V	15 to 16,500	−10 +75%	.752X 1.252	1.000X 3.626	19.1X 31.8	25.4X 92.1	2000 Hrs.
3487 Snap-In	−40 to +85°C	6.3V to 250V	22 to 100,000	±20%	.866X 1.0	1.575X 3.15	22X 25	40X 80	1000 Hrs.
3500 A.C. Motor Start	−20 to +65°C	110V to 330V	21 - 1200	±20%	1.44X 2.75	2.56X 4.38	3.66X 6.99	6.50X 17.75	40K to 75K Starts

* **Life:** If capacitors are operated properly, life should exceed 10 yrs. Measured at max. temp. with full applied voltage.

MEPCO/CENTRALAB

A NORTH AMERICAN PHILIPS COMPANY

FILM CAPACITORS

6071 St. Andrews Road, Columbia, SC 29212 (803) 772-2500 TWX: 810-666-2662 Telex: 805024

MEPCO/CENTRALAB SERIES NEW	MEPCO/CENTRALAB SERIES PREVIOUS	12 NC	CONSTRUCTION	ENCLOSURE	LEAD	VOLTAGE VDC/VAC	CAPACITANCE RANGE (μF)	TOLERANCE ±%
POLYESTER								
708D1	61F & AE	—	FILM/FOIL	WRAP & POT	AXIAL	80-200 VDC AVAILABLE TO 600	.001 THRU 1.0 AVAILABLE TO 2.0	5, 10
713D1	C350	347	FILM/FOIL	CONFORMAL	RADIAL	VDC 100, 250, 400, 630 / VAC 50, 80, 125, 200	.001 THRU 1.0	10
701A1	C281A	341	METALIZED	MOLDED	AXIAL	VDC 100, 250, 400 / VAC 63, 160, 220	.01 THRU 6.8	5, 10
708A1	BA	—	METALIZED	WRAP & POT	AXIAL	100-200 VDC	.10 THRU 10.0	5, 10
712A1	—	365-369	METALIZED	EPOXY	RADIAL	VDC 63, 100, 250, 400, 630 / VAC 40, 63, 160, 220, 220	.001 THRU 6.8	5, 10
719A1	C280MA	370, 371 344, 364	METALIZED	POTTED	RADIAL	VDC 63, 100, 250, 400 / VAC 40, 63, 160, 220	.0039 THRU 10.0	5, 10
POLYCARBONATE								
701B1	C281C	341	METALIZED	MOLDED	AXIAL	VDC 100, 250, 400, 630, 1000 / VAC 63, 160, 220, 220, 250	.01 THRU 4.7	5, 10
708B1	74F01	—	METALIZED	WRAP & POT	AXIAL	100-200 VDC	.10 THRU 10.0	5, 10
719B1	C280MC	344	METALIZED	POTTED	RADIAL	100-630 VDC / 63-220 VAC	.01 THRU 6.8	5, 10
POLYSTYRENE								
703C1	—	424-431	FILM/FOIL	CONFORMAL	AXIAL	VDC 63, 160, 250, 630 / VAC 25, 63, 125, 200	51 PF THRU .018	1, 2, 5
704C1	POCO	424-431	FILM/FOIL	WRAPPED	AXIAL	VDC 63, 160, 250, 630 / VAC 25, 63, 125, 200	51PF THRU .039	1, 2, 5
719C1	—	443	FILM/FOIL	POTTED	RADIAL	VDC 63 / VAC 25	100 PF THRU .033	1% ONLY
POLYPROPYLENE								
703E1	—	460-464	FILM/FOIL	CONFORMAL	AXIAL	VDC 63, 160, 250, 400, 630 / VAC 40, 63, 125, 160, 200	47 PF THRU .062	2, 5
719F1	—	376	METALIZED	POTTED	RADIAL	VDC 630, 1000, 1600, 2000 / VAC 300, 400, 500, 600	.001 THRU .27	5,10
711H	—	—	METALIZED	MOLDED (CAN)	TERMINAL	VAC 240, 330, 370	3 THRU 5 MFD	3, 6, 10
POLYESTER & PAPER — CLASS X VDE APPROVED								
719J1	—	330	METALIZED	POTTED	RADIAL	250 VAC	.01 THRU 1.0	10, 20

VARIABLE CAPACITORS

6071 St. Andrews Road, Columbia, SC 29212 (803) 772-2500 TWX: 810-666-2662 Telex: 805024

FILM DIELECTRIC (LEADED)

M/C Part Number	Capacitance Range (pf)	Dielectric Material	Operating Temp. Range
2800C (808	1-5 to 12-120	PTFE Teflon® Polypropylene Polycarbonate Polyethylene	−40°C to +85°C or −40°C to +70°C
2800D (809)	1-3.5 to 7-100	PTFE Teflon® or Polyimide/FEP	−40°C to +125°C

For information on Mepco/Centralab's RESISTORS/MILITARY COMPONENTS, SEE PAGES A-1957-A-1960, B-1014, B-1015

MEPCO/CENTRALAB
A NORTH AMERICAN PHILIPS COMPANY

MILTILAYER CERAMIC CHIP CAPACITORS

4561 COLORADO BLVD., LOS ANGELES, CA 90039 (818) 240-4880 TWX: 910-497-2282 FAX: 818-500-9174

CASE SIZE	DIELECTRIC/CAPACITANCE RANGE			VOLTAGE
	NPO	X7R	Z5U	
0805	1-680pF	120-.047μF	820-.047μF	25, 50, 100, 200
1206	1-2200pF	220-.12μF	1000-.180μF	25, 50, 100, 200
1210	220-3600pF	4700-.180μF	.01-.330μF	25, 50, 100, 200
1808	270-3660pF	4700-.180μF	.012-.330μF	25, 50, 100, 200
1812	680-6800pF	.012-.390μF	.047-.560μF	25, 50, 100, 200
1825	2700-.015μF	.056-.82μF	.39-1.5μF	25, 50, 100, 200
2218	2700-.015μF	.056-.82μF	.39-1.5μF	25, 50, 100, 200
Tolerances Available: C, D, F, G, J, K, M, Z, P				
Packaging: Bulk, tape and reel per EIA RS481				

ELECTRICAL PARAMETERS

TEMPERATURE CHARACTERISTICS:
NPO: 0 ±30ppm/°C, −55°C to +125°C; **X7R:** ±15% △C, −55°C to +125°C; **Z5U:** +22% to −56% △C, +10°C to +85°C.

INSULATION RESISTANCE:
100K megohms or 1000 megohm microfarads, whichever is less at 25°C. Measured after 2 min. with 50 mA limiting current.

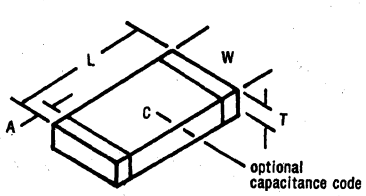
TERMINATIONS AVAILABLE:
Dipped Palladium Silver; Nickel Barrier, 100% Tin; Nickel Barrier, Tin/lead.

DISSIPATION FACTOR:
NPO: .1% maximum @ 25°C, 1.0 VRMS ±.25 VRMS @1 KHz. 1 MHz for values less than 1000 pF; **X7R:** 2.5% maximum @ 25°C, 1.0 VRMS ±.25 VRMS @ 1 KHz; **Z5U;** 4% Maximum @ 25°C, .5 VRMS ±1 VRMS @ 1 KHz.

DIELECTRIC STRENGTH:
NPO, X7R, Z5U: 250% rated voltage with 50mA maximum charging current.

MECHANICAL PARAMETER

INCH / (MILLIMETER) INCH (MILLIMETER)



EIA SIZE CODE	L	W	T MAX.	A MIN./MAX.
0805	.079±.008 (2.03±0.20)	.049±.008 (1.25±0.20)	.050 (1.27)	.010/.030 (0.25/0.76)
1206	.126 ±.008 (3.20 ±0.20)	.063 ±.008 (1.60 ±0.20)	.059 (1.25)	.010/.030 (0.25/0.76)
1210	.126±.008 (3.20±0.20)	.098±.008 (2.51±0.20)	.065 (1.65)	.010/.035 (0.25/0.89)
1812	.177±.012 (4.54±.30)	.126±.008 (3.20±.20)	.065 (1.65)	.010/.035 (0.25/0.89)
1808	.180 ±.015 (4.57 ±0.38)	.080 ±.015 (2.03 ±0.38)	.065 (1.65)	.010/.035 (0.25/0.89)
1825	.177±.012 (4.54±.30)	.252±.016 (6.46±.040)	.065 (1.65)	.010/.035 (0.25/0.89)
2218	.225 ±.020 (5.72 ±0.51)	.175 ±.015 (4.45 ±0.38)	.070 (1.78)	.015/.040 (0.38/1.02)

* With solder coated option all "L" dimension tolerances are to be increased by 010. All "W" and "T" dimension tolerances to be increased by 010.

MEPCO/CENTRALAB

A NORTH AMERICAN PHILIPS COMPANY

7158 MERCHANT AV., EL PASO, TX 79915 (915) 779-3961 TWX: 910-964-1311 FAX: 915-775-0149

MULTILAYER LEADED CAPACITORS

Series	Description	Capacitance Range	Working Voltage Range (VDC)	Operating Temperature Range (°C)	Nominal Size
A	Mono-Axial™; Conformal Coated Axial Leaded	10 pf to 1.0μF	up to 200VDC	−55°C to +125°C	.170″ long × .100″ dia to .400″ long × .150″ dia
G	Mono-Glass™; Glass Encapsulated Axial Leaded	10 pf to .56μF	up to 200VDC	−55°C to +175°C	.170″ long × .100″ dia to .400″ long × .150″ dia
K	Mono-Kap™; Radial Leaded	10 pf to 10μF	up to 200VDC	−55°C to +125°C	.150″ Square × .100″ Thick to .500″ Square × .200″ Thick
P	Mono-Pak™; Dual In-Line Package	10 pf to .33μF	up to 200VDC	−55°C to +125°C	.170″ long × .100″ dia to .400″ long × .150″ dia

CERAMIC DISC CAPACITORS

Series	Description	Capacitance Range	Working Voltage Range (VDC)	Operating Temperature Range (°C)	Nominal Size
D&S	General Purpose and Temperature Stable Class 1, 2 & 3	3.3 pf to .1μF	50VDC to 6KVDC	−55°C to +125°C	.197″ diameter to 1.0″ diameter
D	Temperature Compensating Class 1	1.0 pf to 820pF	50VDC to 6KVDC	−55°C to +125°C	.197″ diameter to 1.0″ diameter
S	Special Application GAP-KAP®	.75 pf to .02μF	up to 3000VDC; up to 6KVDC Arc	−55°C to +85°C	.197″ diameter to 1.0″ diameter
S-UL	UL and CSA listed Across-the-Line Discs	100 pf to .01μF	125VAC and 250VAC	−55°C to +125°C	.330″ diameter to 1.0″ diameter
U	Ultra-Kap® Class IV	.01μF to 2.2μF	3VDC to 100VDC	−55°C to +125°C	.197″ diameter to 1.0″ diameter

PLATE AND TRANSMITTING CAPACITORS

Series	Description	Capacitance Range	Working Voltage Range (VDC)	Operating Temperature Range (°C)	Nominal Size
R	General Purpose and Temperature Stable Plate Caps	.68 pf to .022μF	50VDC and 100VDC	−55°C to +125°C	3.6mm × 6.3mm × 2.5mm to 6.2mm × 11.2mm × 2.5mm
T	RF Rated, Special Application Transmitting Capacitors	3.0 pf to .001μF	5KV, 7.5KV, 15KV and 20KVDC	−55°C to +85°C	.250″ diameter to 2.0″ diameter

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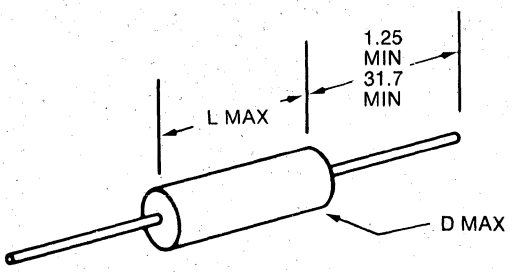
METUCHEN CAPACITORS INC.

NPO, X7R, & Z5U Glass Sealed Axial-Leaded Ceramic Capacitors

RUGGED, RELIABLE, AND IDEAL FOR AUTOMATIC INSERTION



MECHANICAL SPECIFICATIONS

BODY CONSTRUCTION: Glass to metal seal

LEAD MATERIAL: .020 Dia. — Solderable tinned copper

MARKING:

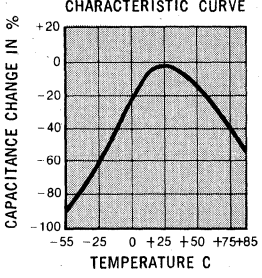
Parts will be marked with the following:

Trademark — Capacitance — Tolerance Letter Designation Voltage (size permitting)

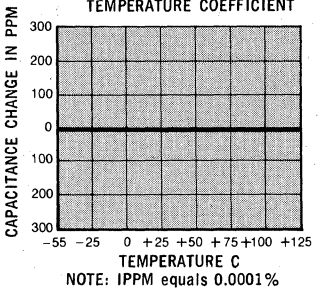
EIA specifications apply regarding Q, TC tol and CAP tol on all units of 10 pF or less

TYPICAL TEMPERATURE CHARACTERISTIC CURVES

Z5U TYPICAL TEMPERATURE CHARACTERISTIC CURVE



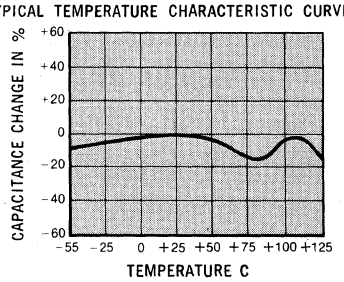
NPO TEMPERATURE COEFFICIENT



NOTE: IPPM equals 0.0001%

TYPICAL TEMPERATURE CHARACTERISTIC CURVE

X7R



HOW TO ORDER

GT07 B CG 101 J

SIZE:

WVDC: (B = 50V)[1] (D = 100V) (F = 200V)

CHARACTERISTIC: (CG = NPO) (BM = X7R) (BN = Z5U)

CAPACITANCE CODE:[2]

TOLERANCE:[3]

1. **WVDC AVAILABLE:** 50 VDC, 100 VDC, 200 VDC
2. 101 = 100 pF i.e., the third digit signifies number of zeroes
3. **MINIMUM AVAILABLE CAPACITANCE TOLERANCES:**
   B = ±.1 pF (10 pF and below) J = ±5% (10 pF and above)
   C = ±.25 pF (10 pF and below) K = 10% (5.6 pF and above)
   D = ±.5 pF (10 pF and below) M = 20% (2.7 pF and above)
   F = ±1% (10 pF and above) Z = +80%, −20% (all values)
   G = 2% (10 pF and above) P = +100%, −0% (GMV — all values)

NPO (COG) CHARACTERISTICS

WORKING VOLTAGE: 50/100/200 VDC
Higher voltages available on request

TEMPERATURE COEFFICIENT: 0 ±30 PPM/°C, −55°C to +125°C (EIA Characteristic COG)

INSULATION RESISTANCE: 100 K megohms or 1000 megohm-microfarads, whichever is less at 25°C, at rated voltage

DIELECTRIC STRENGTH: 250% rated voltage with 50 mA maximum charging current

CAPACITANCE TOLERANCES AVAILABLE: ±1%, ±2%, ±5%, ±10%, ±20%

Meets or exceeds requirements of MIL-C-20

DISSIPATION FACTOR: Min. Q of 1000 at 1 MHz. Meets provisions of EIA standard for capacitance less than 30 pF and greater than 1000 pF

X7R & Z5U characteristics not shown. Please contact factory for sizes.

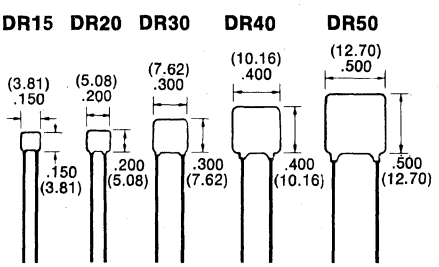
MCI PART NO.	GT07		GT10		GT14		
	In.	mm	In.	mm	In.	mm	
L MAX	.170	4.32	.260	6.60	.400	10.16	
D MAX	.100	2.54	.100	2.54	.150	3.81	
Capacitance in pF	WVDC 100	50	WVDC 100	50	WVDC 100	50	Capacitance Characteristic EIA
1.0							109
1.2							129
1.5							159
1.8							189
2.2							229
2.7							279
3.3							339
3.9							399
4.7							479
5.6							569
6.8							689
8.2							829
10							100
12							120
15							150
18							180
22							220
27							270
33							330
39							390
47							470
56							560
68							680
82							820
100							101
120							121
150							151
180							181
220							221
270							271
330							331
390							391
470							471
560							561
680							681
820							821
1000							102
1200							122
1500							152
1800							182
2200							222
2700							272
3300							332
3900							392
4700							472
5600							562
6800							682
8200							822
10,000							103

Metuchen Capacitors Inc./139 WHITE OAK LANE/P.O. BOX 499/OLD BRIDGE, N.J. 08857/201-679-3366/FAX 201-679-3222

METUCHEN CAPACITORS INC.

Epoxy Coated Sub-Miniature Radial-Leaded Ceramic Capacitors

MCI PART NUMBERS



MAXIMUM PHYSICAL DIMENSIONS

MCI PART NO.	DR15	DR20	DR30	DR40	DR50
S ±.030	.100 (2.54)	.100 (2.54)	.200 (5.08)	.200 (5.08)	.400 (10.16)
D +.004 −.001	.016 (.406)	.020 (.508)	.020 (.508)	.020 (.508)	.025 (.635)
T MAX	.100 (2.54)	.125 (3.18)	.150 (3.81)	.150 (3.81)	.200 (5.08)
AWG#	26	24	24	24	22

S = Lead spacing D = Lead size T = Body thickness mm are in parentheses

MECHANICAL SPECIFICATIONS

BODY CONSTRUCTION: Dipped epoxy

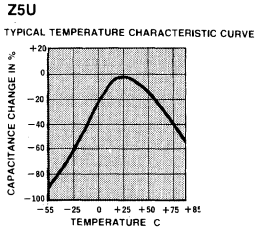
LEAD MATERIAL: Solderable tinned copper

MARKING:
Parts will be marked with the following:
Trademark — Capacitance — Tolerance Letter Designation Voltage (size permitting)

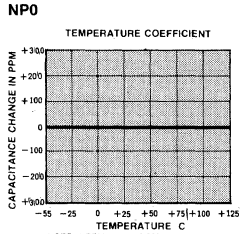
EIA specifications apply regarding Q. TC tol and CAP tol on all units 10 pF or less

TYPICAL TEMPERATURE CHARACTERISTIC CURVES

Z5U

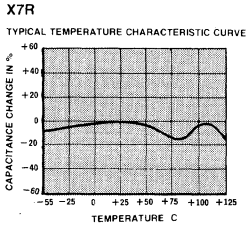


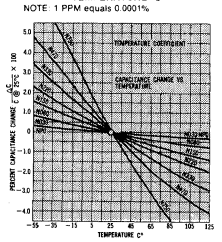
NP0



NOTE: 1 PPM equals 0.0001%

X7R





HOW TO ORDER

DR15 B CG 101 J

SIZE:

WVDC: (B = 50V)[1] (D = 100V)

CHARACTERISTIC: (CG = NPO) (BM = X7R) (BN = Z5U)

CAPACITANCE CODE:[2]

TOLERANCE:[3]

1. **WVDC AVAILABLE:** 50 VDC, 100 VDC, 200 VDC
2. 101 = 100 pF i.e., the third digit signifies number of zeroes
3. **MINIMUM AVAILABLE CAPACITANCE TOLERANCES:**
   B = ±.1 pF (10 pF and below) J = ±5% (10 pF and above)
   C = ±.25 pF (10 pF and below) K = ±10% (5.6 pF and above)
   D = ±.5 pF (10 pF and below) M = ±20% (2.7 pF and above)
   F = ±1% (10 pF and above) Z = +80%, −20% (all values)
   G = ±2% (10 pF and above) P = +100%, −0% (GMV — all values)

Z5U CHARACTERISTICS

CAPACITANCE RANGE: .001 MFD to 4.7 MFD

WORKING VOLTAGE: 50/100/200 VDC
Higher voltages available on request

TEMPERATURE COEFFICIENT: +22%, −56% from +10°C to +85°C (EIA Characteristic Z5U)

DISSIPATION FACTOR: 3% maximum at 1 kHz, 25°C

INSULATION RESISTANCE: 100 K megohms or 500 megohm-microfarad, whichever is less at 25°C, at rated voltage

DIELECTRIC STRENGTH: 250% rated voltage with 50 mA maximum charging current

CAPACITANCE TOLERANCES AVAILABLE: ±20%, +80% −20%, or +100% −0%

MCI offers a complete range of temperature coefficients. Contact factory for sizes and ordering information.

MCI PART NO.	DR15		DR20		DR30		DR40		DR50		Capacitance Characteristic EIA
Capacitance in pF	WVDC 50	100	WVDC 50	100	WVDC 50	100	WVDC 50	100	WVDC 50	100	
1000											102
1200											122
1500											152
1800											182
2200											222
2700											272
3300											332
3900											392
4700											472
5600											562
6800											682
8200											822
10,000											103
12,000											123
15,000											153
18,000											183
22,000											223
27,000											273
33,000											333
39,000											393
47,000											473
56,000											563
68,000											683
82,000											823
100,000											104
120,000											124
150,000											154
180,000											184
220,000											224
270,000											274
330,000											334
390,000											394
470,000											474
560,000											564
680,000											684
820,000											824
1,000,000											105
1,200,000											125
1,500,000											155
1,800,000											185
2,200,000											225
2,700,000											275
3,300,000											335
3,900,000											395
4,700,000											475

Metuchen Capacitors Inc./139 WHITE OAK LANE/P.O. BOX 499/OLD BRIDGE, N.J. 08857/201-679-3366/FAX 201-679-3222

METUCHEN CAPACITORS INC.

Epoxy Coated Sub-Miniature Radial-Leaded Ceramic Capacitors

NPO (COG) CHARACTERISTICS

WORKING VOLTAGE: 50/100/200 VDC
Higher voltages available on request
TEMPERATURE COEFFICIENT: 0 ±30 PPM/°C, −55° to 125°C (EIA Characteristic COG)
DISSIPATION FACTOR: Min. Q of 1000 at 1 MHz. Meets provisions of EIA standard for capacitance less than 30 pF and greater than 1000 pF
INSULATION RESISTANCE: 100 K megohms or 1000 megohm-microfarads, whichever is less at 25°C, at rated voltage
DIELECTRIC STRENGTH: 250% rated voltage with 50 mA maximum charging current
CAPACITANCE TOLERANCES AVAILABLE: ±1%, ±2%, ±5%, ±10%, ±20%
Meets or exceeds requirements of MIL-C-20
MCI offers a complete range of temperature coefficients. Contact factory for sizes and ordering information.

MCI PART NO	DR15			DR20			DR30			DR40			DR50			Cap. Char. EIA
Cap. in pF	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	
1.0	■	■	■													109
1.2	■	■	■													129
1.5	■	■	■													159
1.8	■	■	■													189
2.2	■	■	■													229
2.7	■	■	■													279
3.3	■	■	■													339
3.9	■	■	■													399
4.7	■	■	■													479
5.6	■	■	■													569
6.8	■	■	■													689
8.2	■	■	■													829
10	■	■	■	■	■	■										100
12	■	■	■	■	■	■										120
15	■	■	■	■	■	■										150
18	■	■	■	■	■	■										180
22	■	■	■	■	■	■										220
27	■	■	■	■	■	■										270
33	■	■	■	■	■	■										330
39	■	■	■	■	■	■										390
47	■	■	■	■	■	■										470
56	■	■	■	■	■	■										560
68	■	■	■	■	■	■										680
82	■	■	■	■	■	■										820
100	■	■	■	■	■	■										101
120	■	■	■	■	■	■										121
150	■	■	■	■	■	■										151
180	■	■	■	■	■	■										181
220	■	■	■	■	■	■										221
270	■	■		■	■	■										271
330	■	■		■	■	■										331
390	■	■		■	■	■										391
470	■	■		■	■	■										471
560	■	■		■	■	■										561
680				■	■	■										681
820				■	■	■										821
1000				■	■	■										102
1200				■	■	■	■	■	■							122
1500				■	■	■	■	■	■							152
1800				■	■	■	■	■	■							182
2200				■	■	■	■	■	■							222
2700				■	■		■	■	■							272
3300				■	■		■	■	■	■	■	■				332
3900				■	■		■	■	■	■	■	■				392
4700				■	■		■	■	■	■	■	■				472
5600				■			■	■	■	■	■	■				562
6800							■	■	■	■	■	■				682
8200							■	■	■	■	■	■				822
10,000							■			■	■	■	■	■	■	103
12,000							■			■	■	■	■	■	■	123
15,000							■	■		■	■	■	■	■	■	153
18,000							■	■		■	■	■	■	■	■	183
22,000							■	■		■	■	■	■	■	■	223
27,000							■	■	■	■	■	■	■	■	■	273
33,000							■	■	■	■	■	■	■	■	■	333
39,000							■	■		■	■	■	■	■	■	393
47,000							■	■		■	■	■	■	■	■	473
56,000							■	■	■	■	■	■	■	■	■	563
68,000							■	■	■	■	■	■	■	■	■	683
82,000							■	■	■	■	■	■	■	■	■	823
100,000							■	■	■	■	■	■	■	■	■	104

X7R CHARACTERISTICS

TEMPERATURE COEFFICIENT: ±15% from −55°C to +125°C (EIA Characteristic X7R)
DISSIPATION FACTOR: 2.5% maximum at 1 kHz, 25°C
CAPACITANCE TOLERANCES AVAILABLE: ±5%, ±10%, ±20%, +80% −20%, or +100% −0%
Meets or exceeds requirements of MIL-C-39014
Working Voltage, Insulation Resistance and Dielectric Strength same as NPO Radial
MCI offers a complete range of temperature coefficients. Contact factory for sizes and ordering information.

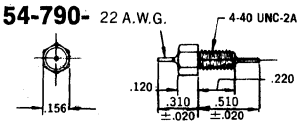
MCI PART NO.	DR15			DR20			DR30			DR40			DR50			Cap. Char. EIA
Cap. in pF	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	
10	■	■	■													100
12	■	■	■													120
15	■	■	■													150
18	■	■	■													180
22	■	■	■													220
27	■	■	■													270
33	■	■	■													330
39	■	■	■													390
47	■	■	■													470
56	■	■	■													560
68	■	■	■													680
82	■	■	■													820
100	■	■	■	■	■	■										101
120	■	■	■	■	■	■										121
150	■	■	■	■	■	■										151
180	■	■	■	■	■	■										181
220	■	■	■	■	■	■										221
270	■	■	■	■	■	■										271
330	■	■	■	■	■	■										331
390	■	■	■	■	■	■										391
470	■	■	■	■	■	■										471
560	■	■	■	■	■	■										561
680	■	■	■	■	■	■										681
820	■	■	■	■	■	■										821
1000	■	■	■	■	■	■	■	■	■							102
1200	■	■	■	■	■	■	■	■	■							122
1500	■	■	■	■	■	■	■	■	■							152
1800	■	■		■	■	■	■	■	■							182
2200	■	■		■	■	■	■	■	■							222
2700	■	■		■	■	■	■	■	■							272
3300	■	■		■	■	■	■	■	■							332
3900	■	■		■	■	■	■	■	■							392
4700	■	■		■	■	■	■	■	■							472
5600	■	■		■	■	■	■	■	■							562
6800	■			■	■	■	■	■	■							682
8200	■			■	■	■	■	■	■							822
10,000	■			■	■	■	■	■	■	■	■	■	■	■	■	103
12,000	■			■	■	■	■	■	■	■	■	■	■	■	■	123
15,000	■			■	■		■	■	■	■	■	■	■	■	■	153
18,000				■	■		■	■	■	■	■	■	■	■	■	183
22,000				■	■		■	■	■	■	■	■	■	■	■	223
27,000				■	■		■	■	■	■	■	■	■	■	■	273
33,000				■	■		■	■	■	■	■	■	■	■	■	333
39,000				■	■		■	■	■	■	■	■	■	■	■	393
47,000				■	■		■	■	■	■	■	■	■	■	■	473
56,000				■	■		■	■	■	■	■	■	■	■	■	563
68,000				■	■		■	■	■	■	■	■	■	■	■	683
82,000				■			■	■	■	■	■	■	■	■	■	823
100,000				■	■		■	■	■	■	■	■	■	■	■	104
120,000				■	■		■	■	■	■	■	■	■	■	■	122
150,000							■	■	■	■	■	■	■	■	■	154
180,000							■	■	■	■	■	■	■	■	■	184
220,000							■	■	■	■	■	■	■	■	■	224
270,000							■	■	■	■	■	■	■	■	■	274
330,000							■	■	■	■	■	■	■	■	■	334
390,000							■	■	■	■	■	■	■	■	■	394
470,000							■	■	■	■	■	■	■	■	■	474
560,000							■	■	■	■	■	■	■	■	■	564
680,000							■	■	■	■	■	■	■	■	■	684
820,000							■	■	■	■	■	■	■	■	■	824
1,000,000							■	■	■	■	■	■	■	■	■	105
1,200,000							■	■	■				■	■	■	125
1,500,000							■	■	■				■	■	■	155
1,800,000							■	■	■				■	■	■	185
2,200,000							■	■	■				■	■	■	225
2,700,000													■	■	■	275
3,300,000													■	■	■	335
3,900,000													■	■	■	395
4,700,000													■	■	■	475

Metuchen Capacitors Inc./139 WHITE OAK LANE/P.O. BOX 499/OLD BRIDGE, N.J. 08857/201-679-3366/FAX 201-679-3222

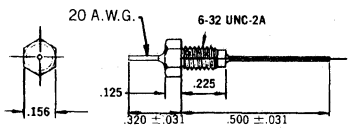
METUCHEN CAPACITORS INC.

Feed-Thru Ceramic Capacitors RESIN SEAL

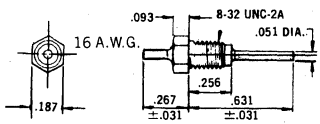
TYPES 54-790-



54-779-



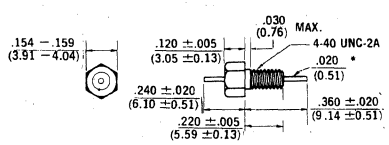
54-713-



Working Voltage +85°C	Working Voltage +125°C	Cap. pF	Ordering Number
200 WVDC	100 WVDC	10	54-790-001-100M
200 WVDC	100 WVDC	100	54-790-001-101M
200 WVDC	100 WVDC	500	54-790-001-501Z
200 WVDC	100 WVDC	1000	54-790-001-102P
200 WVDC	100 WVDC	22,000	54-790-001-223Z
200 WVDC	100 WVDC	10	54-779-001-100M
200 WVDC	100 WVDC	100	54-779-001-101M
200 WVDC	100 WVDC	500	54-779-001-501P
200 WVDC	100 WVDC	1000	54-779-001-102P
200 WVDC	100 WVDC	22,000	54-779-001-223Z
200 WVDC	100 WVDC	10	54-713-001-100M
200 WVDC	100 WVDC	100	54-713-001-101M
200 WVDC	100 WVDC	1000	54-713-001-102Z
200 WVDC	100 WVDC	5000	54-713-001-502P

SERIES SCI 910X/911X/912X

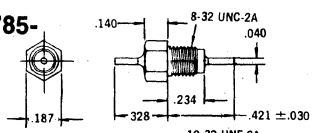
* For 24 gauge tinned copper leads, replace "X" with "0"; for 26 gauge tinned steel leads (.016 Dia.) replace "X" with "2." When steel lead is used, maximum DC current is 5 amps.



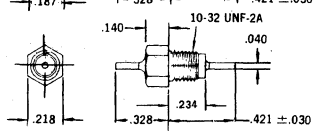
Series	SCI 910X	SCI 911X	SCI 912X
VOLTAGE	50 WVDC	100 WVDC	200 WVDC 115 VAC 60 Hz
DC AMPS. MAX.	10	10	10
CAPACITANCE (GMV)	100 pF 1000 5000	100 pF 1000 5000	100 pF 1000 5000
	.01 μF .027 .05	.01 μF .027 .05	.01 μF

HIGH CAPACITY MULTI-LAYER FEED-THRU CAPACITORS

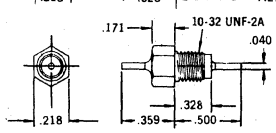
TYPES 54-785-



54-786-013



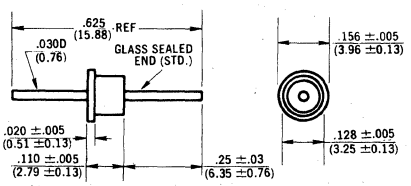
54-786-021 014



Working Voltage @ 125°C	Cap. μF	Ordering Number
100 WVDC	.05	54-785-005-503P
100 WVDC	.3	54-786-013-304Z
50 WVDC	.5	54-786-021-504Z
50 WVDC	1.0	54-786-014-105Z

SERIES SCI 9900/9910/9920

All units are hermetically sealed (glass to metal) on one end, while the other end is epoxy sealed. These units are also available reversed with the hermetic seal at the opposite end. To order, add "R" to the end of the part number; e.g. 9900-502R. Installation: Series 9900 units are designed to be soldered in place. Maximum soldering temperature is +200°C (400°F).



Series	SCI 9900	SCI 9910	SCI 9920
VOLTAGE	50 WVDC	100 WVDC	200 WVDC 115 VAC 60 Hz
DC AMPS. MAX.	5	5	5
CAPACITANCE (GMV)	100 pF 500 1000 1200 2700 5000 .015 μF	100 pF 500 1000 1200 2700 5000	100 pF 500 1000 1200

All Feed-thru Capacitors and RFI Filters stocked by MCI are manufactured in the U.S.A. by **Spectrum Control, Inc...**
The world's leading manufacturer of Electro-Magnetic Components. Distributed for Spectrum Control, Inc.
Metuchen Capacitors Inc./139 WHITE OAK LANE/P.O. BOX 499/OLD BRIDGE, N.J. 08857/201-679-3366/FAX 201-679-3222

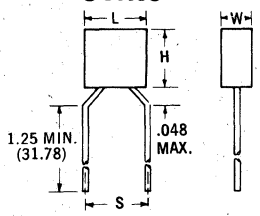
METUCHEN CAPACITORS INC.

NPO Ceramic Capacitors QUALIFIED TO MIL-C-20

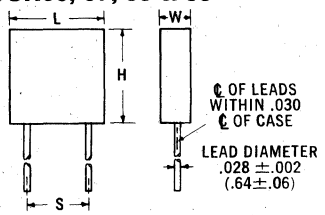
- 0 ±30 ppm/°C Per MIL-C-20
- .1 to 100,000 Pf −55°C +125°C
- Low Dissipation Factor
- Tight Tolerances

RADIAL LEAD CAPACITORS

CCR05



CCR06, 07, 08 & 09



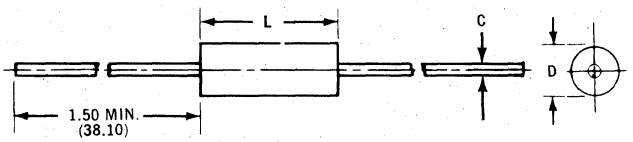
Mil. Equiv.	H & L	W	S
CCR05	.190 ±.010	.090 ±.010	.200 ±.015
CCR09	.190 ±.010	.090 ±.010	.100 ±.015
CCR06	.290 ±.010	.090 ±.010	.200 ±.015
CCR07	.480 ±.020	.140 ±.010	.400 ±.020
CCR08	.480 ±.020	.240 ±.010	.400 ±.020

ER	Slash Sheet	Volt	Cap. Range pF
CCR05 CCR09	35	200 100 50	1-330 360-1800 2200-3300
CCR06	36	200 100 50	360-1800 2000-4700 5100-18,000
CCR07	37	200 100 50	2200-4700 5600-12,000 15,000-100,000
CCR08	38	200 100 50	3900-4700 15,000-18,000 56,000-68,000

All dimensions shown in inches.

AXIAL LEAD CAPACITORS

CCR75, 76, 77, 78 & 79



Mil. Equiv.	L	D	Lead Size
CCR75	.160 ±.010	.090 ±.010	.016
CCR76	.250 ±.010	.090 ±.010	.016
CCR77	.390 ±.010	.140 ±.010	.025
CCR78	.500 ±.020	.250 ±.015	.025
CCR79	.690 ±.020	.350 ±.015	.025

ER	Slash Sheet	Volt	Cap. Range pF
CCR75	27	200 100 50	.1-75 82-240 270-680
CCR76	28	200 100 50	82-130 270-680 750-1000
CCR77	29	200 100 50	150-680 750-2200 2400-5600
CCR78	30	200 100 50	820-3300 3900-12,000 15,000-27,000
CCR79	31	200 100 50	3900-10,000 15,000-39,000 47,000-82,000

Fixed Capacitors, Ceramic Dielectric (Temperature Compensating), Established Reliability

ER **CCR05** **CG** **102** **G** **R**

CG = 0±30ppm/°C

STYLE

05 = Radial .190x.190 75 = Axial .160x.090
09 = Radial .190x.190 76 = Axial .250x.090
06 = Radial .290x.290 77 = Axial .390x.140
07 = Radial .480x.480 78 = Axial .500x.250
08 = Radial .480x.480 79 = Axial .690x.350

CAPACITANCE

Nominal capacitance expressed in picofarads (uF) by three-digit number, first two digits represent significant figures, last digit specifies number of zeroes to follow. When the nominal value is less than 10 pF, the letter 'R' indicates the decimal point and the succeeding digit(s) represent significant figure(s). For example: IRO indicates 1.0 pF; R75 indicates 0.75 pF and OR5 indicates 0.5 pF.

FAILURE RATE LEVEL

M = 1.0%
P = 0.1%
R = 0.01%
S = 0.001%
Expressed in % per 1000 hours

CAPACITANCE TOLERANCE

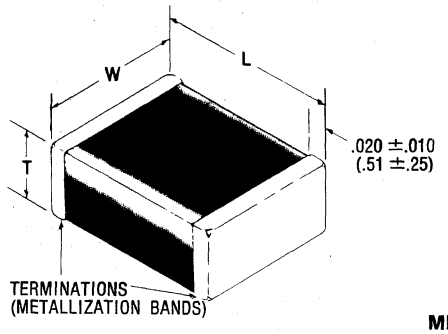
C = ±.25 pF
D = ±.5 pF
F = ±1%
G = ±2%
J = ±5%
K = ±10%

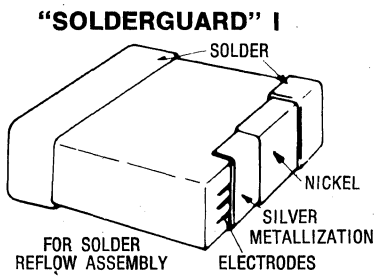
Metuchen Capacitors Inc./139 WHITE OAK LANE/P.O. BOX 499/OLD BRIDGE, N.J. 08857/201-679-3366/FAX 201-679-3222

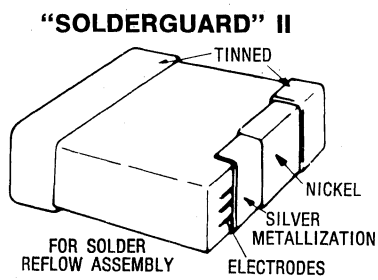
METUCHEN CAPACITORS INC.

Ceramic Chip/MIL-C-55681
ESTABLISHED RELIABILITY

CAPACITOR OUTLINE DRAWINGS







MILITARY DESIGNATION "S" OR "U" **MILITARY DESIGNATION "W" OR "Y"**

DIMENSIONS—MILLIMETERS & (INCHES)

Style	Size Code	L	W	T	
				Min.	Max.
CDR01	C0805	2.03 ±.38 (.080 ±.015)	1.27 ±.38 (.050 ±.015)	.51 (.020)	1.40 (.055)
CDR02	C1805	4.57 ±.38 (.180 ±.015)	1.27 ±.38 (.050 ±.015)	.51 (.020)	1.40 (.055)
CDR03	C1808	4.57 ±.38 (.180 ±.015)	2.03 ±.38 (.080 ±.015)	.51 (.020)	2.03 (.080)
CDR04	C1812	4.57 ±.38 (.180 ±.015)	3.18 ±.38 (.125 ±.015)	.51 (.020)	2.03 (.080)
CDR05	C1825	4.57 +.51 (1.80 +.020) −.38 (−.015)	6.35 +.51 (.250 +.020) −.38 (−.015)	.51 (.020)	2.03 (.080)
CDR06	C2225	5.72 ±.51 (.225 ±.020)	6.35 ±.51 (.250 ±.020)	.51 (.020)	2.03 (.080)
CDR31	C0805	2.00 ±.20 (.078 ±008)	1.25 ±.20 (.049 ±.008)	.50 ±.20 (.020 ±.008)	1.30 ±.20 (.051 ±.008)
CDR32	C1206	3.20 ±.20 (.125 ±.008)	1.60 ±.20 (.062 ±.008)	.50 ±.20 (.020 ±.008)	1.30 ±.20 (.051 ±.008)
CDR33	C1210	3.20 ±.25 (.125 ±.010)	2.50 ±.25 (.098 ±.010)	.50 ±.25 (.020 ±.010)	1.50 ±.25 (.059 ±.010)
CDR34	C1812	4.50 ±.25 (.176 ±.010)	3.20 ±.25 (.125 ±.010)	.50 ±.25 (.020 ±.010)	1.50 ±.25 (.059 ±.010)
CDR35	C1825	4.50 ±.30 (.176 ±.012)	6.40 ±.30 (.250 ±.012)	.50 ±.30 (.020 ±.012)	1.50 ±.30 (.059 ±.012)

ORDERING INFORMATION

CDR01 B P 101 B K S M

STYLE & SIZE CODE
STYLE
C — Ceramic
D — Dielectric, Fixed Chip
R — Established Reliability

RATED TEMPERATURE
−55°C to +125°C

DIELECTRICS
P — 0 ±30 ppm/°C
X — ±15%

CAPACITANCE
Expressed in picofarads (pF)
First 2 digits represent significant figures and the last digit specifies the number of zeros to follow.
Example: 103 — 10,000 picofarads. When nominal value is less than 10 pF, the letter "R" is used to indicate the decimal point.
Example: 1R0 — 1.0 pF; R75 — 0.75 pF; 0R5 — 0.5 pF.

RATED VOLTAGE
A — 50; B — 100

CAPACITANCE TOLERANCE

B	C	D	F	J	K	M
±. 1pF	±.25 pF	±.5 pF	±1%	±5%	±10%	±20%

TERMINATION FINISH
S — Solder Coated, Final (SolderGuard I)
U — Base Metallization Barrier Metal— Solder Coated (SolderGuard I)
W — Base Metallization— Barrier Metal— Tinned (Tin or Tin/Lead Alloy) (SolderGuard II)
Y — Base Metallization Barrier Metal— 100% in coated (SolderGuard II)

FAILURE RATE LEVEL
M — 1.0 (%/1000 hrs.)
P — 0.1
R — 0.01
S — 0.001

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Metuchen Capacitors Inc./139 WHITE OAK LANE/P.O. BOX 499/OLD BRIDGE, N.J. 08857/201-679-3366/FAX 201-679-3222

METUCHEN CAPACITORS INC.

Ceramic Chip/MIL-C-55681
ESTABLISHED RELIABILITY
RATINGS & PART NUMBER REFERENCE

CAP. pF	CAP. TOL.	MIL-C-55681 CDR01-06 CAPACITORS
100 VOLT — C0805 SIZE (MILITARY CDR01)		
10	J,K	CDR01BP100B(2)W(3)
12	J	CDR01BP120BJW(3)
15	J,K	CDR01BP150B(2)W(3)
18	J	CDR01BP180BJW(3)
22	J,K	CDR01BP220B(2)W(3)
27	J	CDR01BP270BJW(3)
33	J,K	CDR01BP330B(2)W(3)
39	J	CDR01BP390BJW(3)
47	J,K	CDR01BP470B(2)W(3)
56	J	CDR01BP560BJW(3)
68	J,K	CDR01BP680B(2)W(3)
82	J	CDR01BP820BJW(3)
100	J,K	CDR01BP101B(2)W(3)
120	J,K	CDR01B(1)121B(2)W(3)
150	J,K	CDR01B(1)151B(2)W(3)
180	J,K	CDR01B(1)181B(2)W(3)
220	K,M	CDR01BX221B(4)W(3)
270	K	CDR01BX271BKW(3)
330	K,M	CDR01BX331B(4)W(3)
390	K	CDR01BX391BKW(3)
470	K,M	CDR01BX471B(4)W(3)
560	K	CDR01BX561BKW(3)
680	K,M	CDR01BX681B(4)W(3)
820	K	CDR01BX821BKW(3)
1,000	K,M	CDR01BX102B(4)W(3)
1,200	K	CDR01BX122BKW(3)
1,500	K,M	CDR01RX152B(4)W(3)
1,800	K	CDR01BX182BKW(3)
2,200	K	CDR01BX222BKW(3)
2,700	K	CDR01BX272BKW(3)
3,300	K	CDR01BX332BKW(3)
50 VOLT — C0805 SIZE (MILITARY CDR01)		
3,900	K	CDR01BX392AKW(3)
4,700	K,M	CDR01BX472A(4)W(3)
100 VOLT — C1805 SIZE (MILITARY CDR02)		
220	J,K	CDR02BP221B(2)W(3)
270	J	CDR02BP271BJW(3)
3,900	K	CDR02BX392BKW(3)
4,700	K,M	CDR02BX472B(4)W(3)
5,600	K	CDR02BX562BKW(3)
6,800	K,M	CDR02BX682B(4)W(3)
8,200	K	CDR02BX822BKW(3)
10,000	K,M	CDR02BX103B(4)W(3)
50 VOLT — C1805 SIZE (MILITARY CDR02)		
12,000	K	CDR02BX123AKW(3)
15,000	K,M	CDR02BX153A(4)W(3)
18,000	K	CDR02BX183AKW(3)
22,000	K,M	CDR02BX223A(4)W(3)
100 VOLT — C1808 SIZE (MILITARY CDR03)		
330	J,K	CDR03BP331B(2)W(3)
390	J	CDR03BP391BJW(3)
470	J,K	CDR03BP471B(2)W(3)
560	J	CDR03BP561BJW(3)
680	J,K	CDR03BP681B(2)W(3)
820	J	CDR03BP821BJW(4)
1,000	J,K	CDR03BP102B(2)W(3)
12,000	K	CDR03BX123BKW(3)
15,000	K,M	CDR03BX153B(4)W(3)
18,000	K	CDR03BX183BKW(3)
22,000	K,M	CDR03BX223B(4)W(3)
27,000	K	CDR03BX273BKW(3)
33,000	K,M	CDR03BX333B(4)W(3)
50 VOLT — C1808 SIZE (MILITARY CDR03)		
39,000	K	CDR03BX393AKW(3)
47,000	K,M	CDR03BX473A(4)W(3)
56,000	K	CDR03BX563AKW(3)
68,000	K,M	CDR03BX683A(4)W(3)

CAP. pF	CAP. TOL.	MIL-C-55681 CDR01-06 CAPACITORS
100 VOLT — C1812 SIZE (MILITARY CDR04)		
1,200	J	CDR04BP122BJW(3)
1,500	J,K	CDR04BP152B(2)W(3)
1,800	J	CDR04BP182BJW(3)
2,200	J,K	CDR04BP222B(2)W(3)
2,700	J	CDR04BP272BJW(3)
3,300	J,K	CDR04BP332B(2)W(3)
39,000	K	CDR03BX393BKW(3)
47,000	K,M	CDR04BX473B(4)W(3)
56,000	K	CDR04BX563BKW(3)
50 VOLT — C1812 SIZE (MILITARY CDR04)		
82,000	K	CDR04BX823AKW(3)
100,000	K,M	CDR04BX104A(4)W(3)
120,000	K	CDR04BX124AKW(3)
150,000	K,M	CDR04BX154A(4)W(3)
180,000	K	CDR04BX184AKW(3)
100 VOLT — C1825 SIZE (MILITARY CDR05)		
3,900	J,K	CDR05BP392B(2)S(3)
4,700	J,K	CDR05BP472B(2)W(3)
5,600	J,K	CDR05BP562B(2)W(3)
68,000	K,M	CDR05BX683B(4)W(3)
82,000	K	CDR05BX823BKW(3)
100,000	K,M	CDR05BX104B(4)W(3)
120,000	K	CDR05BX124BKW(3)
150,000	K,M	CDR05BX154B(4)W(3)
50 VOLT — C1825 SIZE (MILITARY CDR05)		
220,000	K,M	CDR05BX224A(4)W(3)
270,000	K	CDR05BX274AKW(3)
330,000	K,M	CDR02BX335A(4)W(3)
100 VOLT — C2225 SIZE (MILITARY CDR06)		
6,800	J,K	CDR06BP682B(2)W(3)
8,200	J,K	CDR06BP822B(2)W(3)
10,000	J,K	CDR06BP103B(2)W(3)
50 VOLT — C2225 SIZE (MILITARY CDR06)		
390,000	K	CDR06BX394AKW(2)
470,000	K,M	CDR06BX474A(4)W(3)

CAP. pF	CAP. TOL.	CDR31 CAPACITORS PER MIL-C-55681
100 VOLT — BP — C0805 SIZE (MILITARY CDR31)		
1.0	B,C	CDR31BP1R0B(5)W(3)
1.1	B,C	CDR31BP1R1B(5)W(3)
1.2	B,C	CDR31BP1R2B(5)W(3)
1.3	B,C	CDR31BP1R3B(5)W(3)
1.5	B,C	CDR31BP1R5B(5)W(3)
1.6	B,C	CDR31BP1R6B(5)W(3)
1.8	B,C	CDR31BP1R8B(5)W(3)
2.0	B,C	CDR31BP2R0B(5)W(3)
2.2	B,C	CDR31BP2R2B(5)W(3)
2.4	B,C	CDR31BP2R4B(5)W(3)
2.7	B,C,D	CDR31BP2R7B(6)W(3)
3.0	B,C,D	CDR31BP3R0B(6)W(3)
3.3	B,C,D	CDR31BP3R3B(6)W(3)
3.6	B,C,D	CDR31BP3R6B(6)W(3)
3.9	B,C,D	CDR31BP3R9B(6)W(3)
4.3	B,C,D	CDR31BP4R3B(6)W(3)
4.7	B,C,D	CDR31BP4R7B(6)W(3)
5.1	B,C,D	CDR31BP5R1B(6)W(3)
5.6	B,C,D	CDR31BP5R6B(6)W(3)
6.2	B,C,D	CDR31BP6R2B(6)W(3)
6.8	B,C,D	CDR31BP6R8B(6)W(3)
7.5	B,C,D	CDR31BP7R5B(6)W(3)
8.2	B,C,D	CDR31BP8R2B(6)W(3)
9.1	B,C,D	CDR31BP9R1B(6)W(3)
10	F,J,K	CDR31BP100B(7)W(3)
11	F,J,K	CDR31BP110B(7)W(3)
12	F,J,K	CDR31BP120B(7)W(3)
13	F,J,K	CDR31BP130B(7)W(3)

CAP. pF	CAP. TOL.	CDR31 CAPACITORS PER MIL-C-55681
100 VOLT — BP — C0805 SIZE (MILITARY CDR31) (Cont'd)		
15	F,J,K	CDR31BP150B(7)W(3)
16	F,J,K	CDR31BP160B(7)W(3)
18	F,J,K	CDR31BP180B(7)W(3)
20	F,J,K	CDR31BP200B(7)W(3)
22	F,J,K	CDR31BP220B(7)W(3)
24	F,J,K	CDR31BP240B(7)W(3)
27	F,J,K	CDR31BP270B(7)W(3)
30	F,J,K	CDR31BP300B(7)W(3)
33	F,J,K	CDR31BP330B(7)W(3)
36	F,J,K	CDR31BP360B(7)W(3)
39	F,J,K	CDR31BP390B(7)W(3)
43	F,J,K	CDR31BP430B(7)W(3)
47	F,J,K	CDR31BP470B(7)W(3)
51	F,J,K	CDR31BP510B(7)W(3)
56	F,J,K	CDR31BP560B(7)W(3)
62	F,J,K	CDR21BP620B(7)W(3)
68	F,J,K	CDR31BP680B(7)W(3)
75	F,J,K	CDR31BP750B(7)W(3)
82	F,J,K	CDR31BP820B(7)W(3)
91	F,J,K	CDR31BP910B(7)W(3)
100	F,J,K	CDR31BP101B(7)W(3)
110	F,J,K	CDR31BP111B(7)W(3)
120	F,J,K	CDR31BP121B(7)W(3)
130	F,J,K	CDR31BP131B(7)W(3)
150	F,J,K	CDR31BP151B(7)W(3)
160	F,J,K	CDR31BP161B(7)W(3)
180	F,J,K	CDR31BP181B(7)W(3)
200	F,J,K	CDR31BP201B(7)W(3)
220	F,J,K	CDR31BP221B(7)W(3)
240	F,J,K	CDR31BP241B(7)W(3)
270	F,J,K	CDR31BP271B(7)W(3)
300	F,J,K	CDR31BP301B(7)W(3)
330	F,J,K	CDR31BP331B(7)W(3)
360	F,J,K	CDR31BP361B(7)W(3)
390	F,J,K	CDR31BP391B(7)W(3)
430	F,J,K	CDR31BP431B(7)W(3)
470	F,J,K	CDR31BP471B(7)W(3)
50 VOLT — BP — C0805 SIZE (MILITARY CDR31)		
510	F,J,K	CDR31BP511A(7)W(3)
560	F,J,K	CDR31BP561A(7)W(3)
620	F,J,K	CDR31BP631A(7)W(3)
680	F,J,K	CDR31BP681A(7)W(3)
100 VOLT — BX — C0805 SIZE (MILITARY CDR31)		
470	K,M	CDR31BX471B(4)W(3)
560	K,M	CDR31BX561B(4)W(3)
680	K,M	CDR31BX681B(4)W(3)
820	K,M	CDR31BX821B(4)W(3)
1,000	K,M	CDR31BX102B(4)W(3)
1,200	K,M	CDR31BX122B(4)W(3)
1,500	K,M	CDR31BX152B(4)W(3)
1,800	K,M	CDR31BX182B(4)W(3)
2,200	K,M	CDR31BX222B(4)W(3)
2,700	K,M	CDR31BX272B(4)W(3)
3,300	K,M	CDR31BX332B(4)W(3)
3,900	K,M	CDR31BX392B(4)W(3)
4,700	K,M	CDR31BX472B(4)W(3)
50 VOLT — BX — C0805 SIZE (MILITARY CDR31)		
5,600	K,M	CDR31BX562A(4)W(3)
6,800	K,M	CDR31BX682A(4)W(3)
8,200	K,M	CDR31BX822A(4)W(3)
10,000	K,M	CDR31BX103A(4)W(3)
12,000	K,M	CDR31BX123A(4)W(3)
15,000	K,M	CDR31BX153A(4)W(3)
18,000	K,M	CDR31BX183A(4)W(3)

(1) To complete Part Number for Dielectric, insert P or X symbol — J tolerance is not available with the BX Dielectric.
(2) To complete Part Number, insert Capacitance Tolerance Symbol (when applicable): J—±5%; K—±10%.
(3) To complete Part Number, insert Failure Rate Symbol: M—1.0%, P—0.1%; R—0.01%; S—.001%.
(4) To complete Part Number, insert Capacitance Tolerance Symbol (when applicable): K—±10%, M—±20% only.
(5) To complete Part Number, insert Capacitance Tolerance Symbol (when applicable): B—±0.1 pF, C—±0.25 pF.
(6) To complete Part Number, insert Capacitance Tolerance Symbol (when applicable): B—±0.1 pF, C—±0.25 pF, D—±0.5 pF.
(7) To complete Part Number, insert Capacitance Tolerance Symbol (when applicable): F—±1%, J—±5%, K—±10%.

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METUCHEN CAPACITORS INC.

Ceramic Chip/MIL-C-55681
ESTABLISHED RELIABILITY
RATINGS & PART NUMBER REFERENCE

CAP. pF	CAP. TOL.	CDR32 CAPACITORS PER MIL-C-55681
1000 VOLT — BP — C1206 SIZE (MILITARY CDR32)		
1.0	B,C	CDR32BP1R0B/5)W(3)
1.1	B,C	CDR32BP1R1B(5)W(3)
1.2	B,C	CDR32BP1R2B/5)W(3)
1.3	B,C	CDR32BP1R3B(5)W(3)
1.5	B,C	CDR32BP1R5B(5)W(3)
1.6	B,C	CDR32BP1R6B(5)W(3)
1.8	B,C	CDR32BP1R8B(5)W(3)
2.0	B,C	CDR32BP2R0B(5)W(3)
2.2	B,C	CDR32BP2R2B(5)W(3)
2.4	B,C	CRD32BP2R4B(5)W(3)
2.7	B,C,D	CDR32BP2R7B(6)W(3)
3.0	B,C,D	CDR32BP3R0B(6)W(3)
3.3	B,C,D	CDR32BP3R3B(6)W(3)
3.6	B,C,D	CDR32BP3R6B(6)W(3)
3.9	B,C,D	CDR32BP3R9B(6)W(3)
4.3	B,C,D	CDR32BP4R3B(6)W(3)
4.7	B,C,D	CDR32BP4R7B(6)W(3)
5.1	B,C,D	CDR32BP5R1B(6)W(3)
5.6	B,C,D	CDR32BP5R6B(6)W(3)
6.2	B,C,D	CDR32BP6R2B(6)W(3)
6.8	B,C,D	CDR32BP6R8B(6)W(3)
7.5	B,C,D	CDR32BP7R5B(6)W(3)
8.2	B,C,D	CDR32BP8R2B(6)W(3)
9.1	B,C,D	CDR32BP9R1B(6)W(3)
10	F,J,K	CDR32BP100B(7)W(3)
11	F,J,K	CDR32BP110B(7)W(3)
12	F,J,K	CDR32BP120B(7)W(3)
13	F,J,K	CDR32BP130B(7)W(3)
15	F,J,K	CDR32BP150B 7)W(3)
16	F,J,K	CDR32BP160B(7)W(3)
18	F,J,K	CDR32BP180B(7)W(3)
20	F,J,K	CDR32BP200B(7)W(3)
22	F,J,K	CDR32BP220B 7)W(3)
24	F,J,K	CDR32BP240B(7)W(3)
27	F,J,K	CDR32BP270B(7)W(3)
30	F,J,K	CDR32BP300B(7)W(3)
33	F,J,K	CDR32BP330B(7)W(3)
36	F,J,K	CDR32BP360B(7)W(3)
39	F,J,K	CDR32BP390B(7)W(3)
43	F,J,K	CDR32BP430B(7)W(3)
47	F,J,K	CDR32BP470B(7)W(3)
51	F,J,K	CDR32BP510B(7)W(3)
56	F,J,K	CDR32BP560B(7)W(3)
62	F,J,K	CDR32BP620B(7)W(3)
68	F,J,K	CDR32BP680B(7)W(3)
75	F,J,K	CDR32BP750B(7)W(3)
82	F,J,K	CDR32BP820B(7)W(3)
91	F,J,K	CDR32BP910B(7)W(3)
100	F,J, K	CDR32BP101B(7)W(3)
100 VOLT — BP — C1206 SIZE (MILITARY CDR32)		
110	F,J,K	CDR32BP111B(7)W(3)
120	F,J,K	CDR32BP121B(7)W(3)
130	F,J,K	CDR32BP131B(7)W(3)
150	F,J,K	CDR32BP151B(7)W(3)
160	F,J,K	CDR32BP161B(7)W(3)
180	F,J,K	CDR32BP181B(7)W(3)
200	F,J,K	CDR32BP201B(7)W(3)
220	F,J,K	CDR32BP221B(7)W(3)
240	F,J,K	CDR32BP241B(7)W(3)
270	F,J,K	CDR32BP271B(7)W(3)
300	F,J,K	CDR32BP301B(7)W(3)
330	F,J,K	CDR32BP331B(7)W(3)
360	F,J,K	CDR32BP361B(7)W(3)
390	F,J,K	CDR32BP391B(7)W(3)
430	F,J,K	CDR32BP431B(7)W(3)
470	F,J,K	CDR32BP471B(7)W(3)
510	F,J,K	CDR32BP511B(7)W(3)
560	F,J,K	CDR32BP561B(7)W(3)
620	F,J,K	CDR32BP621B(7)W(3)
680	F,J,K	CDR32BP681B(7)W(3)
750	F,J,K	CDR32BP751B(7)W(3)

CAP. pF	CAP. TOL.	CDR32 CAPACITORS PER MIL-C-55681
100 VOLT — BP — C1206 SIZE (MILITARY CDR32) (Cont'd)		
820	F,J,K	CDR32BP821B(7)W(3)
910	F,J,K	CDR32BP911B(7)W(3)
1,000	F,J,K	CDR32BP102B(7)W(3)
50 VOLT — BP — C1206 SIZE (MILITARY CDR32)		
1.100	F,J,K	CDR32BP112A(7)W(3)
1,200	F,J,K	CDR32BP122A(7)W(3)
1,300	F,J,K	CDR32BP132A(7)W(3)
1,500	F,J,K	CDR32BP152A(7)W(3)
1,600	F,J,K	CDR32BP162A(7)W(3)
1,800	F,J,K	CDR32BP182A(7)W(3)
2,000	F,J,K	CDR32BP202A(7)W(3)
2,200	F,J,K	CDR32BP222A(7)W(3)
100 VOLT — BX — C1206 SIZE (MILITARY CDR32)		
4,700	K,M	CDR32BX472B(4)W(3)
5,600	K,M	CDR32BX562B(4)W(3)
6,800	K,M	CDR32BX682B(4)W(3)
8,200	K,M	CDR32BX822B(4)W(3)
10,000	K,M	CDR32BX103B(4)W(3)
12,000	K,M	CDR32BX123B(4)W(3)
15,000	K,M	CDR32BX153B(4)W(3)
50 VOLT — BX — C1206 SIZE (MILITARY CDR32)		
18,000	K,M	CDR32BX183A(4)W(3)
22,000	K,M	CDR32BX223A(4)W(3)
27,000	K,M	CDR32BX273A(4)W(3)
33,000	K,M	CDR32BX333A(4)W(3)
39,000	K,M	CDR32BX393A(4)W(3)

CAP. pF	CAP. TOL.	CDR33, 34, 35 CAPACITORS PER MIL-C-55681
100 VOLT — BP — C1210 SIZE (MILITARY CDR33)		
1,000	F,J,K	CDR33BP102B(7)W(3)
1,100	F,J,K	CDR33BP112B(7)W(3)
1,200	F,J,K	CDR33BP122B(7)W(3)
1,300	F,J,K	CDR33BP132B(7)W(3)
1,500	F,J,K	CDR33BP152B(7)W(3)
1,600	F,J,K	CDR33BP162B(7)W(3)
1,800	F,J,K	CDR33BP182B(7)W(3)
2,000	F,J,K	CDR33BP202B(7)W(3)
2,200	F,J,K	CDR33BP222B(7)W(3)
50 VOLT — BP — C1210 SIZE (MILITARY CDR33)		
2,400	F,J,K	CDR33BP242A(7)W(3)
2,700	F,J,K	CDR33BP272A(7)W(3)
3,000	F,J,K	CDR33BP302A(7)W(3)
3,300	F,J,K	CDR33BP332A(7)W(3)
100 VOLT — BX — C1210 SIZE (MILITARY CDR33)		
15,000	K,M	CDR33BX153B(4)W(3)
18,000	K,M	CDR33BX183B(4)W(3)
22,000	K,M	CDR33BX223B(4)W(3)
27,000	K,M	CDR33BX273B(4)W(3)
50 VOLT — BX — C1210 SIZE (MILITARY CDR33)		
39,000	K,M	CDR33BX393A(4)W(3)
47,000	K,M	CDR33BX473A(4)W(3)
56,000	K,M	CDR33BX563A(4)W(3)
68,000	K,M	CDR33BX683A(4)W(3)
82,000	K,M	CDR33BX823A(4)W(3)
100,000	K,M	CDR33BX104A(4)W(3)
100 VOLT — BP — C1812 SIZE (MILITARY CDR34)		
2,200	F,J,K	CDR34BP222B(7)W(3)
2,400	F,J,K	CDR34BP242B(7)W(3)

CAP. pF	TOL. CAP.	CDR33, 34, 35 CAPACITORS PER MIL-C-55681
100 VOLT — BP — C1812 SIZE (MILITARY CDR34) (Cont'd)		
2,700	F,J,K	CDR34BP272B(7)W(3)
3,000	F,J,K	CDR34BP302B(7)W(3)
3,300	F,J,K	CDR34BP332B(7)W(3)
3,600	F,J,K	CDR34BP362B(7)W(3)
3,900	F,J,K	CDR34BP392B(7)W(3)
4,300	F,J,K	CDR34BP432B(7)W(3)
4,700	F,J,K	CDR34BP472B(7)W(3)
50 VOLT — BP — C1812 SIZE (MILITARY CDR34)		
5,100	F,J,K	CDR34BP512A(7)W(3)
5,600	F,J,K	CDR34BP562A(7)W(3)
6,200	F,J,K	CDR34BP622A(7)W(3)
6,800	F,J,K	CDR34BP682A(7)W(3)
7,500	F,J,K	CDR34B752A(7)W(3)
8,200	F,J,K	CDR34BP822A(7)W(3)
9,100	F,J,K	CDR34BP812A(7)W(3)
10,000	F,J,K	CDR34BP103A(7)W(3)
100 VOLT — BX — C1812 SIZE (MILITARY CDR34)		
27,000	K,M	CDR34BX273B(4)W(3)
33,000	K,M	CDR34BX333B(4)W(3)
39,000	K,M	CDR34BX393B(4)W(3)
47,000	K,M	CDR34BX473B(4)W(3)
56,000	K,M	CDR34BX563B(4)W(3)
50 VOLT — BX — C1812 SIZE (MILITARY CDR34)		
100,000	K,M	CDR34BX104A(4)W(3)
120,000	K,M	CDR34BX124A(4)W(3)
150,000	K,M	CDR34BX154A(4)W(3)
180,000	K,M	CDR34BX184A(4)W(3)
100 VOLT — BP — C1825 SIZE (MILITARY CDR35)		
4,700	K,M	CDR35BP472B(7)W(3)
5,100	K,M	CDR35BP512B(7)W(3)
5,600	F,J,K	CDR35BP562B(7)W(3)
6,200	F,J,K	CDR35BP622B(7)W(3)
6,800	F,J,K	CDR35BP682B(7)W(3)
7,500	F,J,K	CDR35BP752B(7)W(3)
8,200	F,J,K	CDR35BP822B(7)W(3)
9,100	F,J,K	CDR35BP912B(7)W(3)
10,000	F,J,K	CDR35BP103B(7)W(3)
50 VOLT — BP — C1825 SIZE (MILITARY CDR35)		
11,000	F,J,K	CDR35BP113A(7)W(3)
12,000	F,J,K	CDR35BP123A(7)W(3)
13,000	F,J,K	CDR35BP133A(7)W(3)
15,000	F,J,K	CDR35BP153A(7)W(3)
16,000	F,J,K	CDR35BP163A(7)W(3)
18,000	F,J,K	CDR35BP183A(7)W(3)
20,000	F,J,K	CDR35BP203A(7)W(3)
22,000	F,J,K	CDR35BP223A(7)W(3)
100 VOLT — BX — C1812 SIZE (MILITARY CDR35)		
56,000	K,M	CDR35BX563B(4)W(3)
68,000	K,M	CDR35BX683B(4)W(3)
82,000	K,M	CDR35BX823B(4)W(3)
100,000	K,M	CDR35BX104B(4)W(3)
120,000	K,M	CDR35BX124B(4)W(3)
150,000	K,M	CDR35BX154B(4)W(3)
50 VOLT — BX — C1825 SIZE (MILITARY CDR35)		
180,000	K,M	CDR35BX184A(4)W(3)
220,000	K,M	CDR35BX224A(4)W(3)
270,000	K,M	CDR35BX274A(4)W(3)
330,000	K,M	CDR35BX334A(4)W(3)
390,000	K,M	CDR35BX394A(4)W(3)
470,000	K,M	CDR35BX474A(4)W(3)

(1) To complete Part Number for Dielectric, insert P or X symbol — J tolerance is not available with the BX Dielectric.
(2) To complete Part Number, insert Capacitance Tolerance Symbol (when applicable): J—±5%; K—±10%.
(3) To complete Part Number, insert Failure Rate Symbol: M—1.0%, P—0.1%;R—0.01%; S—.001%.
(4) To complete Part Number, insert Capacitance Tolerance Symbol (when applicable): K—±10%, M—±20% only.
(5) To complete Part Number, insert Capacitance Tolerance Symbol (when applicable): B—±0.1 pF, C—±0.25 pF.
(6) To complete Part Number, insert Capacitance Tolerance Symbol (when applicable): B—±0.1 pF, C—±0.25 pF, D—±0.5 pF.
(7) To complete Part Number, insert Capacitance Tolerance Symbol (when applicable): F—±1%, J—±5%, K—±10%.

All Ceramic Chip Capacitors stocked by MCI are manufactured in the U.S.A by KEMET...
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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
ABS acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CAMAC computer automated measurement and control
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3
KSR keyboard send /receive

L
LC inductance capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIB microcomputer interface board
MIC microwave IC
MIPS million instructions per second
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

Multi Products International
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SPECIALISTS IN CERAMIC CAPACITORS

DISC CERAMIC CAPACITORS

SPECIFICATIONS

Temperature Characteristics: Available in characteristics shown in table (below-right) as standard.

Operating Temperature: −55°C to +85°C.

Test Voltage: 2.5 times working voltage for 1 second.

Insulation Resistance:
7500 Megohms or an RC product of 75-ohms F, whichever is less.
RC product of .04-ohms F for 12 VDCW Y5T.
RC product of .1-ohm F for 16 VDCW Y5T.
10,000 Megohms for NPO.

Q (Ratio of Reactance to Equivalent Series Resistance):
Capacitance ≤ 30 pf Q ≥ 400 + 20 x Cpf
Capacitance > 30 pf Q ≥ 1000

Dissipation Factor:
For Z5F, X5R, Z5U, Z5P (@ 1 KC and 25°C) 2.5%
For Z4V, Z5V 5% For Y5U 8.0%
For S2L, S3N 0.6% For NPO, N750, N1500: 0.2%

Encapsulation: Phenolic coated, wax impregnated.

Marking: MP, Value, Tolerance, Voltage.

HOW TO ORDER

Type CF-104Z4

Voltage Rating
Temperature Characteristic
Capacitance
(In picofarads.) The 1st two digits indicate significant digits. The 3rd digit indicates the number of zeroes following. R denotes decimal.
Tolerance
Lead Variation

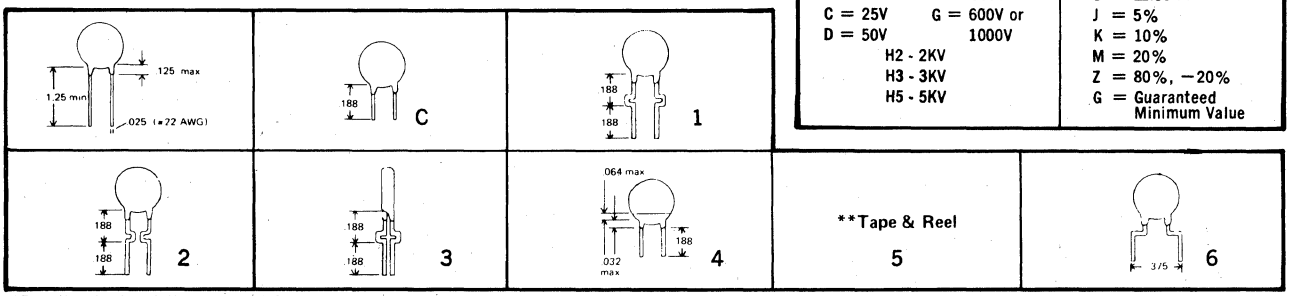
Note: The digit "4" representing lead variation may be 1, 2, 3 or 6 as shown in the diagrams below. The letter "C" and a blank space may also represent lead variations as shown in the diagrams.

TEMPERATURE CHARACTERISTIC			
A = Y5U	F = Z5V	M = P100	S = N470
B = Z5F	G = S2L	N = NPO	T = N750
C = Z5R	H = S3N	P = N150	V = N1500
D = Z5P	J = Z4V	Q = N220	W = N2200
E = Z5U	K = Z5T	R = N330	X = N3300

Other temp. char. available.

VOLTAGE RATING (WDC)	TOLERANCE
A = 12V	C = ±.25 PF
B = 16V	D = ±.50 PF
C = 25V	J = 5%
D = 50V	K = 10%
E = 100V	M = 20%
F = 500V	Z = 80%, −20%
G = 600V or 1000V	G = Guaranteed Minimum Value
H2 - 2KV	
H3 - 3KV	
H5 - 5KV	

*LEAD VARIATIONS



*For other lead variations, consult factory.
**Disc Ceramic Capacitors can be mounted on continuous tape for automatic board insertion. These may be supplied for use in machines such as Matsushita, "Panasert", TDK "Avisert", or Universal 6341. Check the specifications of the particular capacitor(s) required by your application. To order tape and reel packaging, add numeral "5" to part number. Consult factory for details.

MULTILAYER CHIPS

SPECIFICATIONS

- **Temperaure Characteristics: NPO/COG** — 0 ±30ppm/°C, −55°C to +125°C; **BX/X7R** — △C 0 ± 15% Max. over −55°C to +125°C; **Z5U** — △C +22, −56% Max. over +10°C to +85°C
- **Capacitance: NPO/COG** — Measured at 1 Vrms Max., 1MHz ±50KHz, 25°C, below 100PF — 1 Vrms Max., 1KHz ±50Hz, 25°C, above 100PF; **BX/X7R** — Measured at 1KHz ±50Hz, 1.0 ±0.2V, 25°C; **Z5U** — Measured at 1KHz ±50Hz, 0.5V Max., 25°C
- **Dielectric Withstanding Voltage: NPO/COG, BX/X7R, Z5U** — 200% rated voltage for 5 seconds, 50mA Max. charging current, 25°C
- **Insulation Resistance: — NPO/COG** — Greater than 100 G Ω below .01 UF, 25°C, VDCW — Greater than 1000 Ω F above .01 UF, 25°C, VDCW; **BX/X7R** — Greater than 100 G Ω for capacitance below .01 UF, 25°C, VDCW; **Z5U** — Greater than 10,000M Ω for capacitance below .05 UF,25°C, VDCW — Greater than 500 Ω F for capacitance above .05 UF, 25°C, VDCW
- **Dissipation Factor (D.F.): NPO/COG** — 0.1% Max., at 1 Vrms Max., 1KHz, 25°C; **BX/X7R** — .025 (2.5%) Max. at 1KHz ±50Hz, 1.0 ±0.2V, 25°C; **Z5U** — .025 (2.5%) Max., at 1KHz ±50Hz, 0.5V Max., 25°C

ORDERING TERMINOLOGY:

MA — SERIES CODE

R30 — SIZE CODE see chart

CG — TEMPERATURE COEFFICIENT CODE
CG = NPO/COG
XR = X7R
ZU = Z5U

331 — CAPACITANCE CODE
For example:
331 = 330 PF
561 = 560 PF
102 = 1000 PF
223 = 22,000 PF = .022 UF
154 = 150,000 PF = .15 UF
8R2 = 8.2 PF
3R3 = 3.3 PF

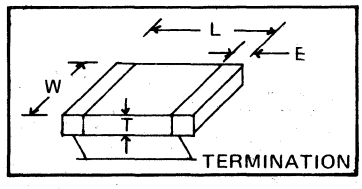
J — TOLERANCE CODE
*B = ±0.1 PF
*C = ±0.25 PF
*D = ±0.5 PF
F = ±1%
G = ±2%
J = ±5%
K = ±10%
M = ±20%
*For Capacitance value below 10 PF only.

S — TERMINATION CODE
S = Silver
G = Gold
P = Palladium — Silver
T = Palladium — Gold

201 — RATED VOLTAGE
6R0 = 6 VDCW
120 = 12 VDCW
250 = 25 VDCW
500 = 50 VDCW
101 = 100 VDCW
201 = 200 VDCW

SIZE CODE

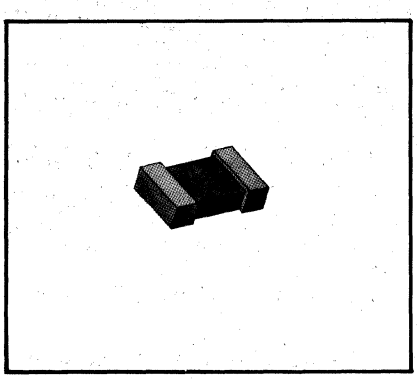
SIZE (in.)	R01	R03	R05	R07	R09	R11	R13	L01	S02	L02	L05	S04	L07
*L	.055	.080	.100	.110	.125	.130	.150	.175	.175	.180	.185	.200	.225
*W	.050	.050	.050	.105	.095	.095	.055	.065	.130	.080	.080	.260	.075
**T (max.)	.050	.050	.050	.070	.070	.070	.060	.070	.070	.060	.070	.070	.070
E	.005	.015	.020	.020	.020	.020	.020	.020	.020	.020	.020	.020	.020



*Tolerance ±0.010, ±7%, whichever is greater, +0.030-0.010 for soldered units.
**For soldered units allow +0.020.

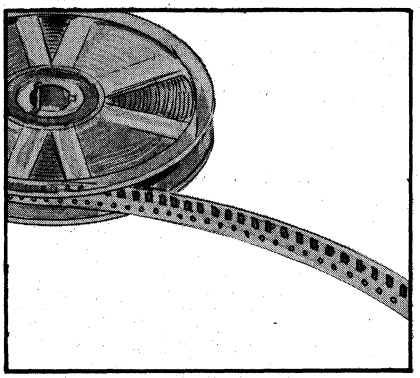
monolithic ceramic capacitors

MURATA ERIE NORTH AMERICA



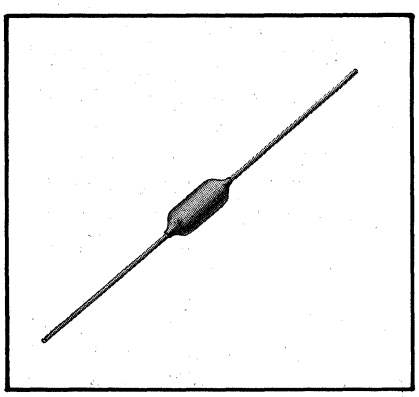
Chips

Capacitance Range:	1pF to 2.2μF
Voltage Ratings:	16, 25, 50, 100 and 200 VDC
Temperature Characteristics:	NPO, X7R, Z5U, Y5V
Dimensions:	.060″ x .030″ to .220″ x .200″



Chips for Tape and Reel

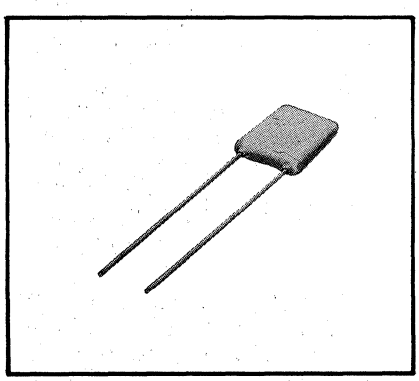
Capacitance Range:	1pF to 2.2μF
Voltage Ratings:	25, 50 & 100 VDC
Temperature Characteristics:	NPO, X7R, Z5U, Y5V
Dimensions:	.060″ x .050″ to .220″ x .200″
Carrier Tape:	Standard 8 & 12 MM



Axial Leaded Conformal Epoxy Coated

Capacitance Range:	1pF to 1μF
Voltage Ratings:	25, 50, 100 and 200 VDC
Temperature Characteristics:	NPO, X7R, Z5U, Y5V
Dimensions:	.170″ x .100″ to .400″ x .150″

Available in standard packaging for auto-insertion



Radial Leaded Conformal Epoxy Coated

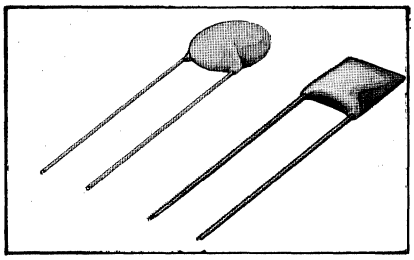
Capacitance Range:	1pF to 5.6μF
Voltage Ratings:	50, 100, 200 and 500 VDC
Temperature Characteristics:	NPO, X7R, Z5U, Y5V
Dimensions:	.138″ x .120″ to .500″ x .500″

Available taped and reeled for auto-insertion

MURATA ERIE NORTH AMERICA 2200 Lake Park Dr., Smyrna, Georgia 30080 Tel: (404) 436-1300 Telex: 26-1301 FAX: 404-436-3030

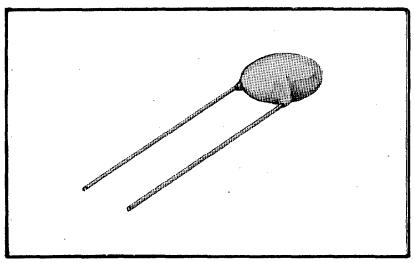
disc ceramic capacitors

MURATA ERIE NORTH AMERICA



Low Voltage DISC/PLATE

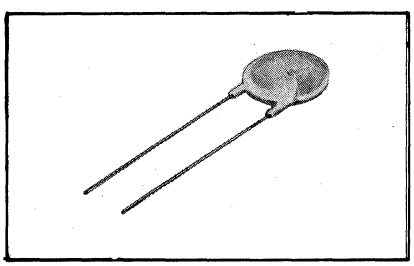
	DISC	PLATE
Capacitance Ranges:	.5pF to .47μF	.5pF to .47μF
Voltage Ratings:	12 VDC to 1000 VDC	50/63 V
Temperature Characteristics:	Y5R, Y5P, Y5U, Y5V, Z5U, Y5F P100 thru N1500	Y5P, Y5U, Z5U, Y5V, Z5V P100 thru N1500
Dimensions:	.157″ to .690″ Dia.	.138″ x .158″ to .472″ x .472″



Medium Voltage

Capacitance Range:	1pF to .02μF
Voltage Ratings:	2,000; 3,000, 6,000 VDC
Temperature Characteristics:	Y5F, Y5P, Y5U, Z5U N750, N1500
Dimensions:	.275″ to .708″ Dia.

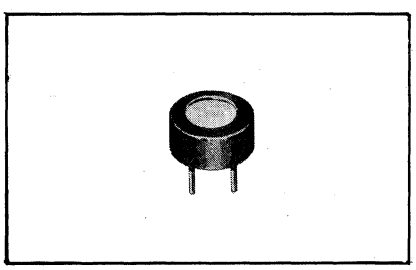
Available in standard packaging for auto-insertion



Safety Recognized UL, CSA, etc.

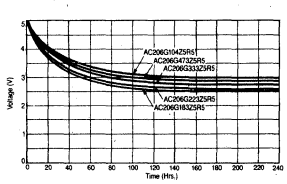
Capacitance Range:	100pF to .01μF
Voltage Ratings:	125, 250, 400 VAC
Temperature Characteristics:	B, F, FZ
Dimensions:	.394″ to .669″ Dia.
Approval Types:	UL, CSA, VDE, SEMKO, BS, SEV

* Many items have multiple safety recognitions.
* Many items are double protection safety recognized.



ACE CAP ELECTRIC DOUBLE LAYER CAPACITOR

SELF-DISCHARGING CHARACTERISTICS



Charging Condition		Discharging Condition	
Applied Voltage	5.0V	Between Terminal	Open
Series Resistance	0 Ω	Environment	25°C max. 70% RH max.
Charging Time	60 min.		

Part Number	Rated Voltage (VDC)	Capacitance (F)	Capacitance Tolerance (%)	Dimension (mm) D	Dimension (mm) H	ESR (Ω)	Leakage Current (mA)
AC206G183Z5R5	5.5	0.018	+80 −20	11	6.5	60 max.	0.05 max.
AC206G223Z5R5	5.5	0.022	+80 −20	11	6.5	60 max.	0.05 max.
AC206G333Z5R5	5.5	0.033	+80 −20	11	6.5	60 max.	0.07 max.
AC206G473Z5R5	5.5	0.047	+80 −20	11	6.5	60 max.	0.07 max.
AC206G104Z5R5	5.5	0.1	+80 −20	12.5	7.0	60 max.	0.15 max.

PLEASE CONTACT OUR FACTORY FOR SPECIAL REQUESTS

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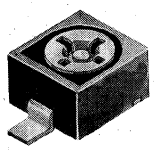
trimming capacitors

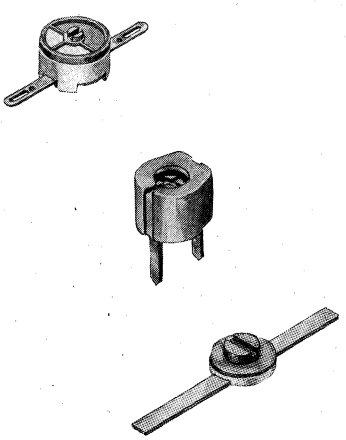
MURATA ERIE NORTH AMERICA



Surface Mounted Ceramic Trimmers

TZB04

Capacitance Ranges:	1.4-3.0pF to 7.0-50pF
Voltage Ratings:	50 and 100 VDC
Temperature Characteristics:	NPO thru N1200
Size:	4.5 (L) x 4.0 (W) x 3.0 (T) (mm)



Ceramic Trimmers

TZ03

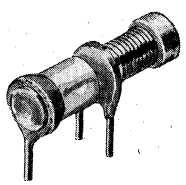
Capacitance Ranges:	1.25pF — 2.3pF to 10pF to 120pF
Voltage Ratings:	50 and 100 VDC
Temperature Characteristics:	NPO thru N1200
Size:	.236 Dia.

DVS3

Capacitance Ranges:	1.5pF — 6pF to 5pF to 35pF
Voltage Ratings:	25 VDC
Temperature Characteristics:	NPO and N750
Size:	.126″ Dia.

DV11

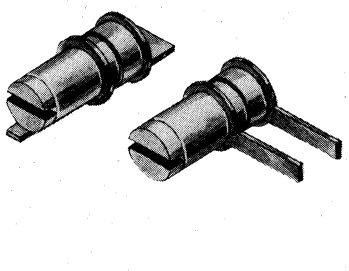
Capacitance Ranges:	2pF — 8pF to 15pF — 60pF
Voltage Ratings:	200 and 350 VDC
Temperature Characteristics:	NPO thru N1500
Size:	.375 Dia.



Air Trimmers

MVM

Capacitance Ranges:	0.8pF — 10pF to 1pF — 20pF
Voltage Ratings:	250 VDC
Temperature Characteristics:	0, ±15 and 0, ±25ppm/°C
Size:	.281, .220 and .145 Dia.



Sapphire Trimmers

GT

Capacitance Ranges:	0.3-1.2 to 1.0-8.0pF
Voltage Ratings:	500 VDC
Temperature Characteristics:	+200 ±100ppm/°C and +350 ±100ppm/°C
Size:	.075 and .118 Dia.

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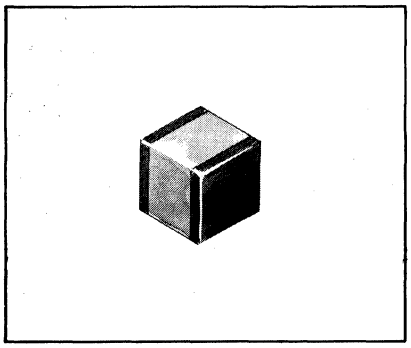
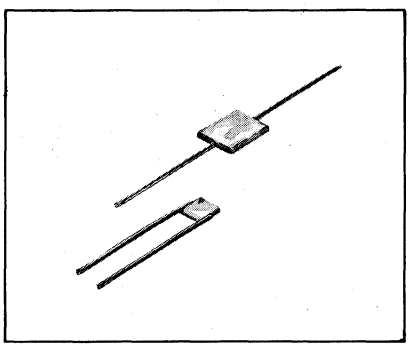
fixed ceramic capacitors for microwave applications

muRata ERIE®
MURATA ERIE NORTH AMERICA



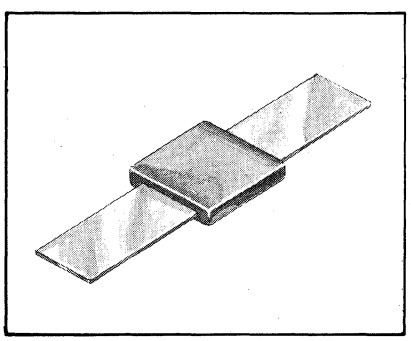
Monolithic Chips—MA Series

Capacitance Ranges:	0.1pF to .1mF
Voltage Ratings:	50, 100, 200, 300, 500 VDC
Tolerances:	B, ±0.1pF thru M, ±20%, thru Z +80 −20%
Q:	10,000 @ 1 MHz
Temperature Characteristics:	P90, ±20ppm/°C, NPO, X7R
Size:	.055″ x .055″ to .110″ x .110″



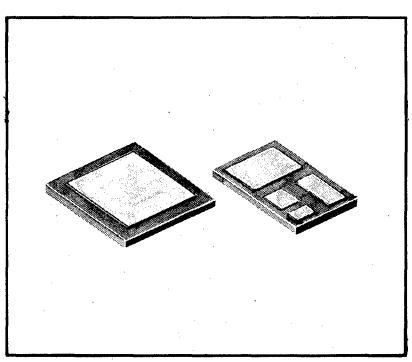
Glass Encapsulated Monolithic—UY Series

	Hi-Q	Hi-K
Temperature Characteristics:	+90, ±20 ppm/°C	±15% over temperature range
Working Voltage:	200 & 300 VDC	50 VDC
Dielectric Test Voltage:	200% of rated voltage	200% of rated voltage
Capacitance Range:	0.5 to 3,000pF	510pF to 1.0 mfd
Tolerance:	C through K depending on Cap. Value	K, M, and Z
Q:	5,000 min., 1 MHz <1,000pF	—
Dissipation Factor:	—	2.5% max. 1 KHz
Insulation Resistance (25°C):	10^6 Megohms min.	1,000 Megohms/mfd or 100,000 Megohms whichever is less



Glass Encapsulated Monolithic RF Power—UFP Series

Capacitance Ranges:	10pF to 3000pF
Voltage Ratings:	300 to 5,400 VDC
Q:	5000 @ 1 MHz
RF Current Ratings:	8 Amperes
Temperature Characteristics:	P90, ±20ppm/°C
Size:	37/64″ x 35/64 to 1 1/16″ x 1 1/16″



Parallel Plate Single Layer Ceramic Capacitors for MIC—CLA Series

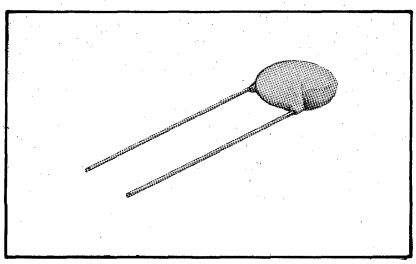
	Single Electrode	Multi Electrodes
Capacitance Ranges:	1-130pF	.1-5.9pF/electrode
Voltage Ratings:	50 VDC	50 VDC
Number of Electrodes:	1	3-5
Q:	≥200	≥200
Temperature Characteristics:	N750, N2200, ±20%	
Size:	.010″ x .010″ to .035″ x .035″	.020″ x .020″ to .035″ x .035″

muRata ERIE®

MURATA ERIE NORTH AMERICA 2200 Lake Park Dr., Smyrna, Georgia 30080 Tel: (404) 436-1300 Telex: 26-1301 FAX: 404-436-3030

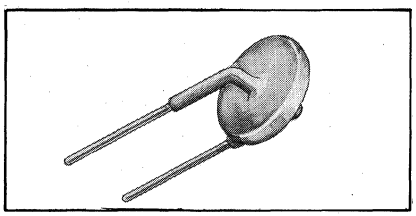
high voltage ceramic capacitors

MURATA ERIE NORTH AMERICA



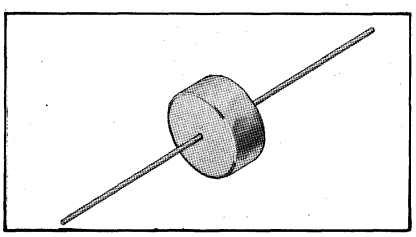
High Voltage—DHR Series

Capacitance Range:	100pF to 2,200pF
Voltage Ratings:	7,500; 10,000; 15,000 VDC
Temperature Characteristics:	Y5P, Z5U, N4700
Dimensions:	.354″ to .870″ Dia.



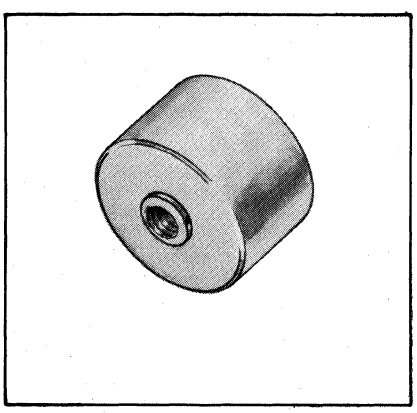
10 and 15 KVDC—DHD Series

Capacitance Ranges:	500pF and 2000pF
Voltage Ratings:	10 and 15 KVDC
Temperature Characteristics:	Y5P
Size:	.295″ x .630″ Dia. to .295″ x .945″ Dia.



10 and 15 KVDC—DHL/DHG Series

Capacitance Ranges:	750pF and 1000pF
Voltage Ratings:	10 and 15 KVDC
Temperature Characteristics:	Y5P
Size:	.39″ x .79″ Dia. to .47″ x .79″ Dia.



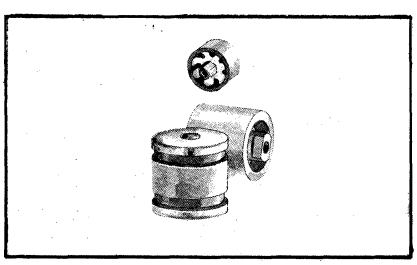
10 to 40 KVDC, DHS Series

For AC and DC Pulse Applications

Capacitance Ranges:	190pF to 8000pF
Voltage Ratings:	10, 15, 20, 30, 40 KVDC
Temperature Characteristics:	N4700
Size:	.63″ x .79″ Dia. to 1.42″ x 2.36″ Dia.

For General Purpose Applications

Capacitance Ranges:	180pF to 9300pF
Voltage Ratings:	10, 15, 20, 30, 40 KVDC
Temperature Characteristics:	Z5V
Size:	.75″ x .79″ Dia. to 1.61″ x 2.36″ Dia.



High Voltage, High Current Ceramic Capacitors—DCC Series

Operating Temperature Range:	−55°C to +85°C
Insulation Resistance:	10^4 megohms min. at 500 VDC
Capacitance Range:	3 to 1000pF
Capacitance Tolerance:	D thru M depending on Cap. Value
Rated Voltage:	5 to 20 KVDC
R.F. Current Rating (30 MHz):	1.4 to 35 Amp
EIA Standard:	NPO, N750, N3300, X5U depending upon Cap. Value

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NEC Electronics Inc.
401 Ellis St., Mountain View, CA 94039 • 415/960-6000

NEC SUPERCAP—DOUBLE LAYER CAPACITORS

NEC Double Layer Capacitors are ideal for IC memory backup. Unlike conventional battery backup, NEC DLCs have a virtually unlimited life. This makes the DLC particularly attractive in applications where replacement would be very inconvenient or difficult.

DLCs may be fully charged and completely discharged indefinitely. They are compact and totally maintenance free. Operating temperature is from −25 to +70°C.

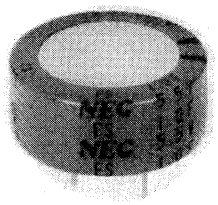
Tests show the FZ0H473Z to be capable of maintaining a 1K CMOS RAM for up to 30 days @ 2 μA.

Typical operating voltage is 5 VDC with a maximum surge of 5.5 VDC. The FA1A series may be operated at 10 VDC.

There are three DLC series. The ultra-compact FS series is best suited for low current applications while the FA and FZ series are suited for higher loads.

These devices are **not** recommended for ripple absorption in DC power supply applications because they exhibit relatively high ESR. They may be arranged in series to achieve higher voltage and are essentially non-polar devices.

For complete specifications, ask for the NEC publication "Electric Double Layer Capacitor" by Sanada and Hosokawa.



Shown Actual Size

Standard Products

FA-Series

Catalog NBR	Cap.	Rated V	Max. W.V.	Max. ESR	Dimensions						
	(Farad)	(V.D.C.)	(V.D.C.)	(Ω at 1 kHz)	(Unit)	D	H max.	P	d_1	d_2	ℓ_1
FA0H473Z	0.047	5	5.5	20	(mm)	16.0	15.5	5	0.6	1.2	5.0
					(inch)	(0.630)	(0.610)	(0.197)	(0.024)	(0.047)	(0.197)
FA0H104Z	0.1	5	5.5	8	(mm)	21.5	15.5	7.5	0.6	1.2	5.5
					(inch)	(0.846)	(0.610)	(0.295)	(0.024)	(0.047)	(0.217)
FA0H224Z	0.22	5	5.5	5	(mm)	28.5	16.5	10	1.0	1.4	9.5
					(inch)	(1.122)	(0.650)	(0.394)	(0.039)	(0.055)	(0.374)
FA0H474Z	0.47	5	5.5	3.5	(mm)	36.5	16.5	15	0.6	1.7	9.5
					(inch)	(1.437)	(0.650)	(0.591)	(0.024)	(0.067)	(0.374)
FA0H105Z	1.0	5	5.5	2.5	(mm)	44.5	18.5	20	1.0	1.4	9.5
					(inch)	(1.752)	(0.728)	(0.787)	(0.039)	(0.055)	(0.374)
FA1A223Z	0.022	10	11	20	(mm)	16.0	25.0	5	0.6	1.2	5.0
					(inch)	(0.630)	(0.984)	(0.197)	(0.024)	(0.047)	(0.197)
FA1A104Z	0.1	10	11	8	(mm)	28.5	25.5	10	1.0	1.4	9.5
					(inch)	(1.122)	(1.004)	(0.394)	(0.039)	(0.055)	(0.374)
FA1A224Z	0.22	10	11	6	(mm)	36.5	27.5	15	1.0	1.4	9.5
					(inch)	(1.437)	(1.083)	(0.591)	(0.039)	(0.055)	(0.374)
FA1A474Z	0.47	10	11	4	(mm)	44.5	28.5	20	1.0	1.4	9.5
					(inch)	(1.752)	(1.122)	(0.787)	(0.039)	(0.055)	(0.374)

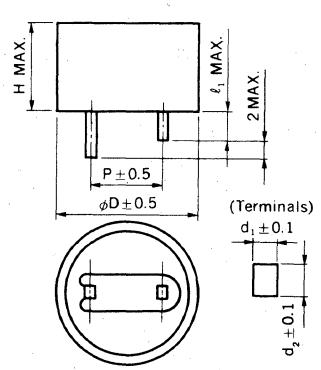
Note 1) Capacitance tolerance: +80%, −20%; 2) Weight is typical.

FZ-Series

Catalog NBR		Cap. V.	Rated W.V.	Max. ESR	Dimensions						
	(Farad)	(V.D.C.)	(V.D.C.)	(Ω at 1 kHz)	(Unit)	D	H max.	P	d_1	d_2	ℓ_1
FZ0H223Z	0.022	5	5.5	50	(mm)	13.0	15	5.1	0.4	1.2	3.9
					(inch)	(0.512)	(0.591)	(0.201)	(0.016)	(0.047)	(0.154)
FZ0H473Z	0.047	5	5.5	40	(mm)	14.5	15	5.1	0.4	1.2	4.2
					(inch)	(0.571)	(0.591)	(0.201)	(0.016)	(0.047)	(0.165)
FZ0H104Z	0.1	5	5.5	45	(mm)	14.5	24	5.1	0.4	1.2	4.6
					(inch)	(0.571)	(0.945)	(0.201)	(0.016)	(0.047)	(0.181)
FZ0H224Z	0.22	5	5.5	25	(mm)	16.5	25	5.1	0.4	1.2	5.2
					(inch)	(0.650)	(0.984)	(0.201)	(0.016)	(0.047)	(0.205)
FZ0H474Z	0.47	5	5.5	13	(mm)	21.5	25	7.6	0.6	1.2	5.9
					(inch)	(0.846)	(0.984)	(0.299)	(0.024)	(0.047)	(0.232)
FZ0H105Z	1.0	5	5.5	7	(mm)	28.5	25	10.2	0.6	1.4	9.5
					(inch)	(1.122)	(0.984)	(0.402)	(0.024)	(0.055)	(0.374)

Note 1) Capacitance tolerance: +80%, −20%; 2) Weight is typical.

DIMENSIONS (Unit: mm)



FS-Series

Catalog NBR	Cap.	Max. W.V.	Max. ESR	Dimensions						
	(Farad)	(V.D.C.)	(Ω at 1 kHz)	(Unit)	D	H max.	P	d_1	d_2	ℓ_1
FS0H473Z	0.047	5.5	50	(mm)	13.0	8.5	5.08	0.4	1.2	2.2
				(inch)	(0.512)	(0.335)	(0.200)	(0.016)	(0.047)	(0.087)
FS0H104Z	0.1	5.5	25	(mm)	16.5	8.5	5.08	0.4	1.2	2.7
				(inch)	(0.650)	(0.335)	(0.200)	(0.016)	(0.047)	(0.106)
FS0H224Z	0.22	5.5	25	(mm)	16.5	13.0	5.08	0.4	1.2	2.7
				(inch)	(0.650)	(0.512)	(0.200)	(0.016)	(0.047)	(0.106)
FS0H474Z	0.47	5.5	13	(mm)	21.5	13.0	7.62	0.6	1.2	3.0
				(inch)	(0.846)	(0.512)	(0.300)	(0.024)	(0.047)	(0.118)
FS0H105Z	1.0	5.5	7	(mm)	28.5	14.0	10.16	0.6	1.4	6.1
				(inch)	(1.122)	(0.551)	(0.400)	(0.024)	(0.055)	(0.240)

Note 1) Capacitance tolerance: +80%, −20%; 2) Weight is typical.

FY-Series

Part Number	Capacitance (Farads)	Rated V (VDC)	Max. WV (VDC)	Max. ESR (Ω at 1 KHz)	Dimensions mm					
					D	Hmax	P	d_1	d_2	ℓ_1
FYH0H223Z	0.022	5	5.5	200	11.5	7.0	5.08	0.4	1.2	2.7
FYH0H473Z	0.047	5	5.5	100	13.0	7.0	5.08	0.4	1.2	2.2
FYH0H104Z	0.10	5	5.5	50	16.5	7.5	5.08	0.4	1.2	2.7
FYH0H224Z	0.22	5	5.5	60	16.5	9.5	5.08	0.4	1.2	2.7
FYH0H474Z	0.47	5	5.5	35	21.5	10.0	7.62	0.6	1.2	3.0
FYH0H105Z	1.0	5	5.5	20	28.5	11.0	10.16	0.6	1.4	6.1
FYD0H473Z	0.047	5	5.5	220	11.5	8.5	5.08	0.4	1.2	2.7
FYD0H104Z	0.1	5	5.5	100	13.0	8.5	5.08	0.4	1.2	2.2
FYD0H224Z	0.22	5	5.5	120	14.5	15.0	5.08	0.4	1.2	2.4
FYD0H474Z	0.47	5	5.5	65	16.5	15.0	5.08	0.4	1.2	2.7
FYD0H105Z	1.0	5	5.5	35	21.5	16.0	7.62	0.6	1.2	3.0

Catalog Numbering System

F— 0H 105 Z

- Z — Capacitance tolerance: $^{+80}_{-20}$%
- 105 — Capacitance; First two digits represent sigificant figures. 3rd digit specifies number of zeros to follow. Microfarad code.
- 0H — Max. DC working voltage OH: 5.5V 1A: 11V
- F — Super capacitor FA: FA-Series FZ: FZ-Series FS: FS-Series FYH: FYD: FY-Series

NEC Electronics Inc.
401 Ellis St., Mountain View, CA 94039 • 415/960-6000

R-SERIES SOLID TANTALUM CAPACITORS

PERFORMANCE CHARACTERISTICS

- Operating temperature range −55 to +125°C with proper voltage derating as shown in following table.

- DC working voltage and surge voltage

Working	@ 85°C	4	6.3	10	16	20	25	35	V
	@125°C	2.5	4	6.3	10	13	16	22	V
Surge	@ 85°C	5.2	8	13	20	26	33	46	V

- Capacitance (at 25°C, 120 Hz)
  Range 0.01 μF to 100 μF
  Tolerance ±20%, ±10%

- Capacitance change with temperature
  Not to exceed −12% at −55°C, +12% at 85°C and +15% at 125°C.

- Dissipation factor (at 25°C, 120Hz)
  0.01 μF to 4.7 μF less than 0.04
  6.8 μF to 68 μF less than 0.06
  100 μF less than 0.08

- DC leakage current (at 25°C)
  0.01CVμA or 0.5μA whichever is greater

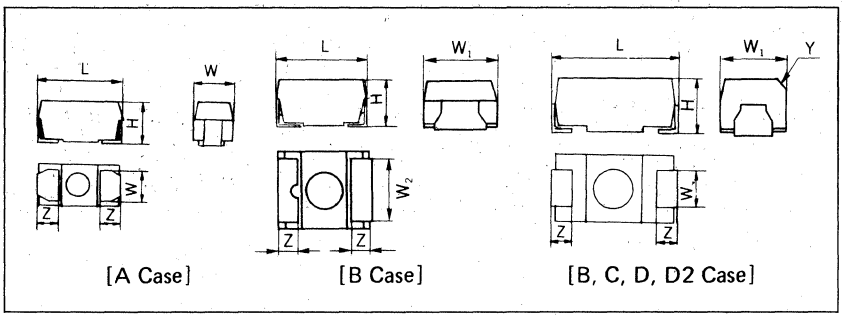
- Humidity (90 ~ 95% RH at 40°C, 500h)
  Capacitance change ±5%
  Dissipation factor 150% of initial requirements
  DC Leakage current initial requirements

- Load life (at 85°C, DC W.V., 1000h)
  Capacitance change ±10%
  Dissipation factor initial requirements
  DC Leakage current initial requirements

- Resistance to soldering heat (solder reflow @260°C, 10 sec. or solder dip @260°C, 5 sec.)
  Capacitance change ±5%
  Leakage current initial requirements
  Disipation factor initial requirements

NEC obtained IEC Qualification Approval on R-series tantalum capacitors, JP154-9, JP154-10 and JP154-11 on Sept. 29, 1987

DIMENSIONS [mm]

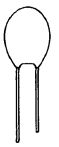
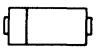


Case Code	L	W_1	W_2	H	Z	Y
A	3.2±0.2	1.6±0.2	1.2±0.1	1.6±0.2	0.8±0.3	
B2	3.5±0.2	2.8±0.2	2.3±0.1	1.9±0.2	0.8±0.3	
B	4.7±0.3	2.6±0.3	1.4±0.1	2.1±0.3	0.8±0.3	0.4C
C	6.0±0.3	3.2±0.3	1.8±0.1	2.5±0.3	1.3±0.3	0.4C
D2	5.8±0.3	4.6±0.3	2.4±0.1	3.2±0.3	1.3±0.3	
D	7.3±0.3	4.3±0.3	2.4±0.1	2.8±0.3	1.3±0.3	0.5C

μF \ VDC	4	6.3	10	16	20	25	35
0.010							A
0.015							A
0.022							A
0.033							A
0.047							A
0.068							A
0.10							A
0.15							A
0.22							A
0.33						A	A
0.47					A	A	B2 B
0.68				A	A		B2 B
1.0			A	A			B2 B
1.5		A	A	A		B2 B	C
2.2	A	A	A	B	B2 B		C
3.3	A	A	B	B2 B		C	C D
4.7	A	B	B2 B	C	C	C	D2 D
6.8	B	B2 B	C	C	C	D2 D	D2 D
10	B2 B	C	C	C D	D2	D2 D	
15	C	C	C D	D2	D2 D		
22	C	C	D2 D	D2 D	D2 D		
33	C	D2 D	D2 D	D2 D			
47	D2 D	D2 D	D2 D				
68	D2 D	D2 D					
100	D2 D						

NEC Electronics Inc.
401 Ellis St., Mountain View, CA 94039 • 415/960-6000

Quick Reference Guide to NEC Tantalum Capacitors

Type / Item	Solid Electrolytic Tantalum						
	A-Series	**C-Series**	**D-Series**	**P-Series**	**Q-Series**	**R-Series**	**U-Series**
Configuration							
	Miniature Molded Axial Polar	**Unencapsulated Chip, Polar**	**Dipped, Polar**	**Subminiature Dipped**	**Dipped, Polar**	**Molded Chip, Polar**	**Subminiature Epoxy End Seal, Axial**
Operating Temperature Range	−55°C to +85°C to +125°C(2/3WV)	−55°C to +85°C	−55°C to +85°C	−55°C to +85°C	−55°C to +85°C to +125°C(2/3WV)	−55°C to +85°C to +125°C(2/3WV)	−55°C to +85°C
DC Working Voltage	4V to 50V	6.3V to 35V	4V to 50V	4V to 35V	6.3V to 35V	4V to 35V	3V to 35V
Capacitance Range	0.01μF to 68μF	0.1μF to 22μF	0.1μF to 330μF	0.01μF to 100μF	0.1μF to 47μF	0.01μF to 100μF	0.01μF to 10μF
Capacitance Tolerance	±20% ±10% ±5%	±20% ±10%	±20% ±10% ±5%	±20% ±10%	±20% ±10%	±20% ±10%	±20% ±10% (Special)
DC Leakage Current	0.01CVμA or 0.5μA whichever is greater	0.02CVμA or 1.0μA whichever is greater	0.01CVμA or 0.5μA whichever is greater	0.01CVμA or 0.5μA whichever is greater	0.005CVμA or 0.3μA whichever is greater	0.01CVμA or 0.5μA whichever is greater	0.005CVμA or 0.5μA whichever is greater
Dissipation Factor	3% 0.1μF to 1.0μF	4% 0.1μF to 1.0μF	4% 0.1μF to 1.0μF	4% 0.01μF to 1.0μF	4% 0.1μF to 1μF	4% 0.1μF to 4.7μF	3% 0.01μF to 1.0μF
	4% 1.2μF to 5.6μF	6% 1.5μF to 22μF	6% 1.5μF to 6.8μF	6% 1.5μF to 68μF	6% 1.5μF to 47μF	6% over to 6.8μF	6% 1.5μF to 4.7μF
	6% 6.8μF to 68μF		8% 10μF to 68μF	8% 10μF to 68μF		8% 100μF	6% 6.8μF to 10μF
	10% 4WV ratings		10% 100μF to 330μF	10% 100μF			

Cross Reference

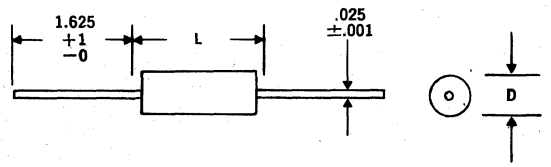
Description	NEC	KEMET	SPRAGUE	AVX	PANASONIC	MEPCO	MALLORY	MATSUO
Epoxy—Dipped Industrial	D-Series (ND)	T350 to T356	199D	TAP	SQ	41DS 41GS	TDC TDL	22IL 202
	Q-Series (NQ)		196D				TDM	
Epoxy—Dipped Subminiature	P-Series (NP)		186D	TAM				
Epoxy—Molded Chip	R-Series (NR)	T491	195D 193D 293D	TAQ TAJ	TE YE	49BC 49MC 49SC		267 268
Unencapsulated Chip	C-Series (NC)	T411 T421						
Subminiature Axial Leads	U-Series (NU)	T322	182D 188D			40CS		
Molded Axials	A-Series (NA)	T322 T310	162D 173D	TAR		40CS 40ES	TAC	

Nytronics Components Group, Inc.
700 ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

MOLDED MYLAR* CAPACITORS TYPE 111

MOLDED IN RUGGED FLAME-RETARDANT MOLDING COMPOUND

TINNED COPPERWELD LEADS



Nytronics Type 111 Capacitors were developed for applications requiring excellent capacitance stability, superior humidity, superior humidity resistance and high insulation resistance. The Capacitor element is non-inductively wound with mylar dielectric and extended foil. Molded construction is ideally suited for automatic insertion. Available either reel packaged or ammo packaged.

CAPACITANCE
Shall be within the specified limits when measured at a frequency of 1 kHz at +25°C.

DISSIPATION FACTOR
Shall not exceed 1% when measured as above.

INSULATION RESISTANCE
Shall be a minimum of 50,000 megohms when measured at +25°C and with rated voltage applied for 2 minutes.

DIELECTRIC STRENGTH
Shall withstand 2.5X rated voltage for one minute.

OPERATING TEMPERATURE
Is −55°C to +85°C at full rated voltage; derated linearly to 50% of rated voltage at 125°C.

LIFE TEST
Is 250 hours at +85°C and 150% of rated voltage or, at +125°C with 85°C rated voltage applied. One failure in twelve allowed.

MOISTURE RESISTANCE
Capacitors shall meet the humidity requirements of MIL-STD-202E, Method 106D, 5 cycles.

CAPACITY TOLERANCE SUFFIX
J = ±5%; K = ±10%; M = ±20%. Other tolerances available on request.

Intermediate Capacitance Values Available.

* Dupont Trade Name

** Available in alternate A-B size. To order prefix number with AB. Example: AB111B123, 100 VDC only.

TYPE 111 MOLDED POLYESTER CAPACITORS

CAPACITANCE µF	CASE SIZE	CATALOG NUMBER
100 VOLTS DC WORKING		
.001	A	111B102K
.0012	A	111B122K
.0015	A	111B152K
.0018	A	111B182K
.0022	A	111B222K
.0027	A	111B272K
.0033	A	111B332K
.0039	A	111B392K
.0047	A	111B472K
.0056	A	111B562K
.0068	A	111B682K
.0082	A	111B822K
.01	A	111B103K
.012**	B or A-B	111B123K
.015**	B or A-B	111B153K
.018**	B or A-B	111B183K
.022**	B or A-B	111B223K
.027**	C or A-B	111B273K
.033**	C or A-B	111B333K
.039	C	111B393K
.047	C	111B473K
200 VOLTS DC WORKING		
.001	A	111C102K
.0012	A	111C122K
.0015	A	111C152K
.0018	A	111C182K
.0022	A	111C222K
.0027	A	111C272K
.0033	A	111C332K
.0039	A	111C392K
.0047	A	111C472K
.0056	A	111C562K
.0068	A	111C682K
.0082	A	111C822K
.01	B	111C103K
.012	B	111C123K
.015	B	111C153K
.018	B	111C183K
.022	B	111C153K
.027	C	111C273K
.033	C	111C333K
400 VOLTS DC WORKING		
.001	A-B	111E102K
.0012	A-B	111E122K
.0015	A-B	111E152K
.0018	A-B	111E182K
.0022	A-B	111E222K
.0027	A-B	111E272K
.0033	A-B	111E332K
.0039	A-B	111E393K
.0047	A-B	111E472K
.0056	C	111E562K
.0068	C	111E682K
600 VOLTS DC WORKING		
.001	A-B	111F102K
.0012	A-B	111F122K
.0015	A-B	111F152K
.0018	A-B	111F182K
.0022	C	111F222K
.0027	C	111F272K
.0033	C	111F332K

CASE SIZE	D MAX	L MAX
A	.188	.440
B	.188	.697
C	.219	.697
A-B	.219	.572

Nytronics Components Group, Inc.
700 ORANGE STREET, DARLINGTON, S. C. 29532
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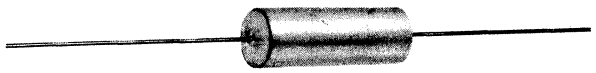
TYPE 107 POLYESTER FILM CAPACITORS

POLYESTER FILM CAPACITORS EXTENDED FOIL/FILM WRAP/EPOXY END FILL STYLE 107 −55°C TO +125°C



ELECTRICAL AND ENVIRONMENTAL CHARACTERISTICS

CAPACITANCE MEASUREMENTS

Capacitors of 1.0 μF or less shall be measured at a frequency of 1000 Hz. Capacitors greater than 1.0 μF shall be measured at 60 Hz. The standard capacitance tolerance is 20%. Other tolerances are available upon request.

Reference: MIL-STD-202, Method 305.

TEMPERATURE CHARACTERISTICS

The maximum change in capacitance from the measured value at +25°C shall be −6% at −55°C, and +15% at +125°C.

DISSIPATION FACTOR

When measured as specified in Paragraph 1, the dissipation factor at +25°C shall not exceed 0.6% for values up to 1.0 μF and shall not exceed 1.0% for greater capacitance values.

INSULATION RESISTANCE

When measured at +25°C, and rated voltage (or 500 VDC, whichever is less), the insulation resistance shall be a minimum of 50,000 megohm-microfarads, but need not exceed 100,000 megohms. The period of electrification shall not exceed two minutes.

Reference: MIL-STD-202, Method 302.

VOLTAGE DERATING

The capacitors may be operated at full rated voltage from −55°C to +85°C, or with linear derating to 50% of rated voltage above +85°C with a maximum temperature of +125°C.

VOLTAGE TEST

When tested at +25°C, the capacitors shall withstand the indicated DC test voltages for a period of one minute:

Terminal to terminal	200% of DC rating
Terminal to case (less than .235 diameter)	200% of DC rating
Terminal to case (greater than .235 diameter)	400% of DC rating or 2,000 VDC, whichever is less

Reference: MIL-STD-202, Method 301.

LIFE TESTING

When tested for 1000 hours at 150% of the appropriate rated voltage for the test temperature, the capacitors shall exhibit no more than one failure in twelve pieces tested. Alternatively, an accelerated +125°C test may be performed at the +85°C voltage rating for a period of 250 hours. A failure is defined as:

a) A capacitance change of more than 10% of its initial value;
b) A dissipation factor greater than that specified in Paragraph 3;
c) An insulation resistance less than ⅓ that specified in Paragraph 4; or
d) A permanent open or short.

VIBRATION

The capacitors will meet or exceed in the vibration requirements of MIL-STD-202, Method 201.

NYTRONICS CATALOG NUMBERING SYSTEM

107 B 103 M

- **107** — Nytronics Style
- **B** — D.C. Voltage Rating: B = 100V; C = 200V; E = 400V; F = 600V
- **103** — Capacitance: In μμf. The first two digits are the significant figures, the third is the number of zeros.
- **M** — Capacitance Tolerance: F = ±1%; P = ±2%; J = ±5%; K = ±10%; M = ±20%

Note: Special capacitance values, voltage ratings and sizes available to customer requirements.

PHYSICAL SIZE TOLERANCES

	100 Volts DC & 200 Volts DC		400 Volts DC	
DIAMETER	Up to .158	+.032 −.000	Up to .218	±.032
	.159 to .200	+.040 −.000	.219 to .500	±.046
	Over .200	+.050 −.000	Over .500	±.062
LENGTH		+1/16 −0		+3/32 −1/16

TINNED COPPERWELD LEADS

No. 22 AWG. (.025) for cases up to .325 Dia.
No. 20 AWG. (.032) for cases .326 thru 1.0 Dia.
No. 18 AWG. (.040) for cases above 1.0 Dia.

Lead Length: 1⅝" Min.

Also available are the following styles with characteristics similar to Type 107.

STANDARD RATINGS

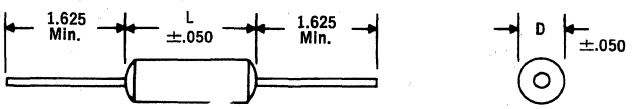
Capacitance μf	Dia. x Length		Cat. No.
100 VOLTS DC WORKING			
.001	.138	3/8	107B102M
.0015	.138	3/8	107B152M
.0022	.138	3/8	107B222M
.0033	.138	3/8	107B332M
.0047	.138	3/8	107B472M
.0068	.138	3/8	107B682M
.0082	.138	3/8	107B822M
.01	.158	3/8	107B103M
.015	.158	21/32	107B153M
.022	.158	21/32	107B223M
.027	.158	21/32	107B273M
.033	.158	21/32	107B333M
.047	.190	21/32	107B473M
.068	.220	21/32	107B683M
.082	.265	21/32	107B823M
.1	.265	11/16	107B104M
.12	.300	3/4	107B124M
.15	.330	3/4	107B154M
.22	.350	15/16	107B224M
.27	.350	1 1/16	107B274M
.33	.385	1 1/16	107B334M
.39	.415	1 1/16	107B394M
.47	.450	1 1/16	107B474M
.56	.490	1 1/16	107B564M
.68	.540	1 1/16	107B684M
.82	.570	1 1/16	107B824M
1.	.590	1 3/16	107B105M
1.5	.670	1 3/16	107B155M
1.8	.730	1 3/16	107B185M
2.0	.700	1 1/2	107B205M
200 VOLTS DC WORKING			
.001	.138	3/8	107C102M
.0015	.138	3/8	107C152M
.0022	.138	3/8	107C222M
.0033	.138	3/8	107C332M
.0047	.138	3/8	107C472M
.0068	.138	3/8	107C682M
.0082	.138	3/8	107C822M
.01	.158	3/8	107C103M
.015	.158	21/32	107C153M
.022	.158	21/32	107C223M
.027	.158	21/32	107C273M
.033	.158	21/32	107C333M
.047	.190	21/32	107C473M
.068	.220	21/32	107C683M
.082	.265	21/32	107C823M
.1	.265	11/16	107C104M
.12	.285	13/16	107C124M
.15	.315	13/16	107C154M
.22	.325	1 1/16	107C224M
.27	.350	1 3/16	107C274M
.33	.390	1 3/16	107C334M
.39	.415	1 3/16	107C394M
.47	.450	1 3/16	107C474M
.56	.490	1 3/16	107C564M
.68	.540	1 3/16	107C684M
.82	.580	1 3/16	107C824M
1.	.590	1 5/16	107C105M
1.5	.680	1 7/16	107C155M
1.8	.740	1 7/16	107C185M
2.0	.750	1 7/16	107C205M
400 VOLTS DC WORKING			
.001	.156	5/8	107E102M
.0015	.156	5/8	107E152M
.0022	.156	5/8	107E222M
.0033	.156	5/8	107E332M
.0047	.187	5/8	107E472M
.0068	.218	5/8	107E682M
.0082	.234	5/8	107E822M
.01	.250	5/8	107E103M
.015	.296	5/8	107E153M
.022	.312	3/4	107E223M
.027	.281	7/8	107E273M
.033	.312	7/8	107E333M
.047	.343	7/8	107E473M
.068	.375	1	107E683M
.082	.406	1	107E823M
.1	.421	1	107E104M
.12	.468	1	107E124M
.15	.468	1 1/4	107E154M
.22	.546	1 3/8	107E224M
.27	.609	1 3/8	107E274M
.33	.593	1 5/8	107E334M
.39	.625	1 5/8	107E394M
.47	.671	1 5/8	107E474M
.56	.718	1 3/4	107E564M
.68	.796	1 3/4	107E684M
.82	.812	1 7/8	107E824M
1.	.812	2	107E105M
1.5	.921	2 1/4	107E155M
1.8	1.015	2 1/4	107E185M
2.0	1.093	2 1/4	107E205M

Special capacitance values, tolerances and sizes are available on request.

Nytronics Components Group, Inc.
700 ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE 184 METALLIZED POLYESTER

SUBMINIATURE CAPACITORS 50, 80, 100 VDC



LEAD WIRE SIZE

AWG	Diameter
#24	.280 & Under
#22	.281-.532
#20	Above .533

CAPACITANCE TOLERANCE SUFFIX

G = ±2%
J = ±5%
K = ±10%
M = ±20%

OUTSTANDING FEATURES

- Excellent Electrical Characteristics
- Subminiature, Space Saving Sizes
- Excellent Moisture Resistance
- Self Healing
- Excellent Shelf Life
- Wide Operating Temperature Range

CAPACITANCE

Shall be measured at +25°C. For capacitance values equal to or less than 1 μF, the test frequency is 1 kHz, above 1 μF use 120 Hz.

DISSIPATION FACTOR

Shall not exceed .75% when measured as above.

INSULATION RESISTANCE

Shall be a minimum of 10,000 megohm X microfarads, need not exceed 30,000 megohms when measured at +25°C and with rated voltage applied for two minutes.

DIELECTRIC STRENGTH

Shall withstand 1.8 times rated voltage for 2 minutes without permanent breakdown.

OPERATING TEMPERATURE

−55°C to +85°C at full rated voltage; derated linearly to 50% of rated voltage at +125°C.

LIFE TEST

250 hours at +85°C and 150% of rated voltage. One failure in 18 allowed.

MOISTURE RESISTANCE

Capacitors shall be subjected to 95% R.H. at +40°C for 500 hours.
Capacitors shall be removed from the humidity chamber on completion. Surface of units shall be wiped dry then exposed to circulating air for four hours. No more than one failure in 12 units tested.

100 VDC

CAP. MFD	CATALOG NUMBER	DIA.	LENGTH
0.01	184B103	.140	.400
0.012	184B123	.140	.400
0.015	184B153	.140	.400
0.018	184B183	.140	.400
0.022	184B223	.140	.400
0.027	184B273	.140	.400
0.033	184B333	.140	.400
0.039	184B393	.140	.400
0.047	184B473	.140	.400
0.056	184B563	.140	.400
0.068	184B683	.140	.400
0.082	184B823	.140	.400
0.10	184B104	.140	.400
0.12	184B124	.150	.400
0.15	184B154	.165	.400
0.18	184B184	.180	.400
0.22	184B224	.195	.400
0.27	184B274	.215	.400
0.33	184B334	.180	.530
0.39	184B394	.205	.530
0.47	184B474	.210	.530
0.56	184B564	.225	.530
0.68	184B684	.250	.530
0.82	184B824	.270	.530
1.00	184B105	.295	.530
1.2	184B125	.265	.680
1.5	184B155	.300	.680
1.8	184B185	.330	.680
2.0	184B205	.345	.680
2.2	184B225	.335	.780
3.0	184B305	.390	.780
3.3	184B335	.410	.780
4.0	184B405	.380	.900
4.7	184B475	.410	.900
5.0	184B505	.425	.900
6.0	184B605	.465	.900
6.8	184B685	.495	.900
8.0	184B805	.535	.900
10.0	184B106	.595	.900

50 VDC*

CAP. MFD	CATALOG NUMBER	DIA.	LENGTH
0.047	184A473	.140	.400
0.056	184A563	.140	.400
0.068	184A683	.140	.400
0.082	184A823	.140	.400
0.10	184A104	.140	.400
0.12	184A124	.140	.400
0.15	184A154	.140	.400
0.18	184A184	.140	.400
0.22	184A224	.140	.400
0.27	184A274	.140	.400
0.33	184A334	.150	.400
0.39	184A394	.160	.400
0.47	184A474	.175	.400
0.56	184A564	.185	.400
0.68	184A684	.205	.400
0.82	184A824	.220	.400
1.00	184A105	.240	.400
1.2	184A125	.200	.530
1.5	184A155	.220	.530
1.8	184A185	.240	.530
2.0	184A205	.255	.530
2.2	184A225	.265	.530
3.0	184A305	.260	.680
3.3	184A335	.270	.680
4.0	184A405	.295	.680
4.7	184A475	.320	.680
5.0	184A505	.330	.680
6.0	184A605	.335	.780
6.8	184A685	.355	.780
8.0	184A805	.385	.780
10.0	184A106	.425	.780
12.0	184A126	.395	.900
15.0	184A156	.440	.900
18.0	184A186	.480	.900
20.0	184A206	.505	.900
25.0	184A256	.520	1.08
30.0	184A306	.565	1.08
35.0	184A356	.610	1.08
50.0	184A506	.730	1.08

80 VDC*

CAP. MFD	CATALOG NUMBER	DIA.	LENGTH
0.047	184Y473	.140	.400
0.056	184Y563	.140	.400
0.068	184Y683	.140	.400
0.082	184Y823	.140	.400
0.10	184Y104	.140	.400
0.12	184Y124	.140	.400
0.15	184Y154	.140	.400
0.18	184Y184	.140	.400
0.22	184Y224	.160	.400
0.27	184Y274	.175	.400
0.33	184Y334	.190	.400
0.39	184Y394	.160	.530
0.47	184Y474	.175	.530
0.56	184Y564	.185	.530
0.68	184Y684	.205	.530
0.82	184Y824	.220	.530
1.00	184Y105	.240	.530
1.2	184Y125	.260	.530
1.5	184Y155	.290	.530
1.8	184Y185	.305	.680
2.0	184Y205	.280	.680
2.2	184Y225	.290	.680
3.0	184Y305	.340	.680
3.3	184Y335	.355	.680
4.0	184Y405	.390	.680
4.7	184Y475	.420	.680
5.0	184Y505	.430	.680
6.0	184Y605	.470	.680
6.8	184Y685	.395	.900
8.0	184Y805	.430	.900
10.0	184Y106	.480	.900
12.0	184Y126	.525	.900
15.0	184Y156	.585	.900
18.0	184Y186	.635	.900

*For values below .047 mfd see 100 VDC.

Nytronics Components Group, Inc.
700 ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE 185 METALLIZED POLYESTER CAPACITORS

POLYESTER TAPE WRAP CASE/EPOXY ENDFILL

Type 185 Capacitors feature extremely small size, light weight, and self clearing metallized construction which virtually eliminates catastrophic failures. Well suited for Voltage Multiplier Circuits in TV Power Supplies and Electrostatic copiers. Also ideal for Potting or Encapsulating in Electronic Sub-Assemblies, Power Supplies, etc.

CAPACITANCE
Measurements shall be made at 1000 Hz for capacitance values thru 1. MFD and at 60 Hz for values over 1. MFD.

CAPACITANCE TOLERANCE
Standard capacitance tolerance is ±20% (M). Closer tolerances available upon request.

DISSIPATION FACTOR
The dissipation factor shall not exceed 1% when measured at 25°C. Measurements shall be made at 1000 Hz for capacitance values thru 1. MFD and at 60 Hz for higher values.

TEST VOLTAGE
Capacitors shall withstand 200% of rated DC voltage for one minute at 25°C, with the charging and discharge current limited to a maximum of 1. Ampere.

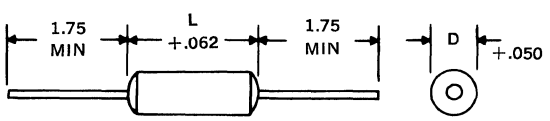
OPERATING TEMPERATURES
−55°C to +125°C.

LIFE TEST
Capacitors shall withstand a life test of 250 hours at 125°C, with 140% of the 125°C rated DC voltage applied. A resistance of one ohm per volt of applied voltage shall be inserted in series with the capacitor.

VOLTAGE DERATING
These capacitors will operate as full DC voltage ratings at 85°C. For operation at temperatures above 85°C, see below.

VIBRATION
Capacitors shall withstand a vibration test per Method 204, Test Condition B of MIL-STD-202 as modified by MIL-C-27287. After test, the I.R. will be equal to or greater than ⅓ of the initial requirement.

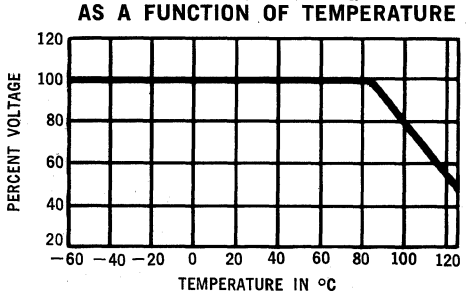
HUMIDITY TEST
These capacitors shall meet the humidity test requirements of MIL-STD-202, Method 103, Test Condition B. After testing the I.R. will be equal to or greater than ⅓ fo the initial requirement.



LEAD GAUGE

Body Length	AWG
.530 & Less	24
.650 thru 1.062	22
1.170 thru 2.00	20
Greater than 2.00	18

VOLTAGE RATING AS A FUNCTION OF TEMPERATURE



LEAD MATERIAL:
Tinned copperweld wire shall withstand mechanical test as specified in Paragraph 3.4 of EIA Standard RS-164A

CAPACITY TOLERANCE SUFFIX

F = ± 1%
P = ± 2%
J = ± 5%
K = ±10%
M = ±20%

CAP MFD	CAT. No.	DIA.	LENGTH
200 VOLTS DC WORKING			
.010	185C103	.150	.400
.012	185C123	.150	.400
.015	185C153	.150	.400
.018	185C183	.160	.400
.022	185C223	.170	.400
.027	185C273	.150	.530
.033	185C333	.150	.530
.039	185C393	.155	.530
.047	185C473	.170	.530
.056	185C563	.180	.530
.068	185C683	.190	.530
.082	185C823	.215	.530
.10	185C104	.230	.530
.12	185C124	.250	.530
.15	185C154	.270	.530
.18	185C184	.240	.680
.22	185C224	.265	.680
.27	185C274	.290	.680
.33	185C334	.320	.680
.39	185C394	.300	.780
.47	185C474	.325	.780
.56	185C564	.350	.780
.68	185C684	.385	.780
.82	185C824	.420	.780
1.0	185C105	.410	.950
1.2	185C125	.390	1.170
1.5	185C155	.430	1.170
1.8	185C185	.470	1.170
2.0	185C205	.490	1.170
3.0	185C305	.600	1.170
4.0	185C405	.610	1.450
5.0	185C505	.600	1.700
6.0	185C605	.670	1.700
8.0	185C805	.710	1.940
10.0	185C106	.790	1.940
400 VOLTS DC WORKING			
.010	185E103	.150	.530
.012	185E123	.150	.530
.015	185E153	.150	.530
.018	185E183	.170	.530
.022	185E222	.180	.530
.027	185E273	.220	.530
.033	185E333	.220	.530
.039	185E393	.230	.530
.047	185E473	.250	.530
.056	185E563	.270	.530
.068	185E683	.240	.680
.082	185E823	.260	.680
.10	185E104	.280	.680
.12	185E124	.260	.780
.15	185E154	.290	.780
18	185E184	.320	.780
.22	185E224	.350	.780
.27	185E274	.390	.780
.33	185E334	.380	.950
.39	185E394	.410	.950
.47	185E474	.450	.950
.56	185E564	.420	1.170
.68	185E684	.460	1.170
.82	185E824	.500	1.170
1.0	185E105	.550	1.170
1.2	185E125	.530	1.450
1.5	185E155	.590	1.450
1.8	185E185	.580	1.700
2.0	185E205	.560	1.940
3.0	185E305	.680	1.940
4.0	185E405	.780	1.940
5.0	185E505	.870	1.940
600 VOLTS DC WORKING			
.010	185F103	.180	.530
.012	185F123	.200	.530
.015	185F153	.220	.530
.018	185F183	.230	.530
.022	185F223	.250	.530
.027	185F273	.230	.680
.033	185F333	.250	.680
.039	185F393	.265	.680
.047	185F473	.250	.780
.056	185F563	.270	.780
.068	185F683	.290	.780
.082	185F823	.330	.780
.10	185F104	.320	.950
.12	185F124	.350	.950
.15	185F154	.390	.950
.18	185F184	.420	.950
.22	185F224	.390	1.170
.27	185F274	.430	1.170
.33	185F334	.470	1.170
.39	185F394	.510	1.170
.47	185F474	.500	1.450
.56	185F564	.540	1.450
.68	185F684	.590	1.450
.82	185F824	.590	1.700
1.0	185F105	.650	1.700
1.2	185F125	.700	1.700
1.5	185F155	.780	1.700
1.8	185F185	.850	1.700
2.0	185F205	.830	1.940

Nytronics Components Group, Inc.
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TYPE 189 POLYESTER CAPACITORS

METALLIZED POLYESTER CAPACITORS TYPE 189 FILM WRAP / EPOXY END FILL −55°C TO +125°C

Type 189 Capacitors features extremely small size, light weight and self clearing metallized construction which virtually eliminates catastrophic failures. Well suited for Voltage Multiplier Circuits in TV power supplies and Electrostatic copiers. Also ideal for Potting or encapsulating in Electronic Sub assemblies, Power supplies, etc.

CAPACITANCE
Measurements shall be made at 1000 cycles per second for capacitance values thru 1. MFD and at 60 cycles per second for values over 1. MFD.

CAPACITANCE TOLERANCE
Standard capacitance tolerance is ±20% (M). Closer tolerances available upon request.

DISSIPATION FACTOR
The dissipation factor shall not exceed 1% when measured at 25°C. Measurements shall be made at 1000 Hz for capacitance values thru 1. MF and at 60 Hz for higher values.

TEST VOLTAGE
Capacitors shall withstand 200% of rated DC voltage for one minute at 25°, with the charging and discharge current limited to a maximum of 1. Ampere.

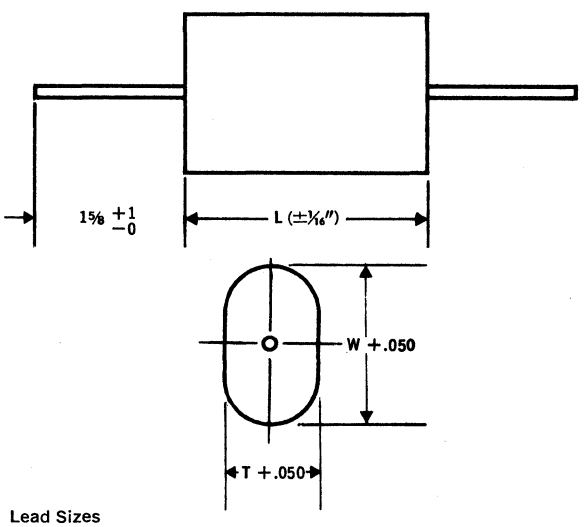
OPERATING TEMPERATURES
−55°C to +125°C.

LIFE TEST
Capacitors shall withstand a life test of 250 hours at 125°C, with 140% of the 125°C rated DC voltage applied. A resistance of one ohm per volt of applied voltage shall be inserted in series with the capacitor.

VOLTAGE DERATING
These capacitors will operate as full DC voltage ratings at 85°C. For operation at temperatures above 85°C, see Figure 4.

VIBRATION
Capacitors shall withstand a vibration test per Method 204, Test condition B of MIL-STD-202B as modified by MIL-C-27287.

HUMIDITY TEST
These capacitors shall meet the humidity test requirements of MIL-STD-202 Method 103B, test condition B. After testing the I.R. will be equal to or greater than ⅓ of the initial requirement.



Lead Sizes

Nom. Body Length	Lead Dia.
Thru .530	.020
.650 thru .970	.025
Above .970	.032

Capacitance	Thickness	Width	Length	Cat. No.
600 VOLTS DC WORKING				
.010	.12	.25	.53	189F103M
.012	.13	.26	.53	189F123M
.015	.15	.28	.53	189F153M
.018	.17	.30	.53	189F183M
.022	.19	.32	.53	189F223M
.027	.21	.34	.53	189F273M
.033	.24	.37	.53	189F333M
.039	.21	.34	.65	189F393M
.047	.24	.37	.65	189F473M
.056	.22	.35	.78	189F563M
.068	.25	.38	.78	189F683M
.082	.27	.40	.78	189F823M
.10	.30	.43	.78	189F104M
.12	.32	.48	.78	189F124M
.15	.36	.52	.78	189F154M
.18	.33	.49	.97	189F184M
.22	.37	.53	.97	189F224M
.27	.36	.52	1.17	189F274M
.33	.40	.56	1.17	189F334M
.39	.44	.60	1.17	189F394M
.47	.49	.65	1.17	189F474M
.56	.41	.57	1.68	189F564M
.68	.45	.61	1.68	189F684M
.82	.51	.67	1.68	189F824M
1.0	.58	.74	1.68	189F105M
1.2	.64	.80	1.68	189F125M
1.5	.73	.89	1.68	189F155M
2.0	.69	.89	2.25	189F205M
2.5	.80	1.00	2.25	189F255M
3.0	.87	1.07	2.25	189F305M

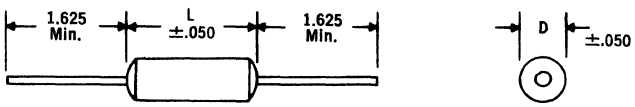
INTERMEDIATE VALUES AVAILABLE.

Capacitance	Thickness	Width	Length	Cat. No.
100 VOLTS DC WORKING				
.010	.10	.20	.40	189B103M
.012	.10	.20	.40	189B123M
.015	.10	.20	.40	189B153M
.018	.10	.20	.40	189B183M
.022	.10	.20	.40	189B223M
.027	.10	.20	.40	189B273M
.033	.10	.20	.40	189B333M
.039	.10	.20	.40	189B393M
.047	.10	.22	.40	189B473M
.056	.11	.24	.40	189B563M
.068	.10	.20	.53	189B683M
.082	.10	.20	.53	189B823M
.10	.10	.20	.53	189B104M
.12	.10	.23	.53	189B124M
.15	.12	.25	.53	189B154M
.18	.14	.27	.53	189B184M
.22	.17	.30	.53	189B224M
.27	.19	.32	.53	189B274M
.33	.21	.34	.53	189B334M
.39	.24	.37	.53	189B394M
.47	.21	.34	.65	189B474M
.56	.23	.36	.65	189B564M
.68	.27	.40	.65	189B684M
.82	.24	.37	.78	189B824M
1.0	.26	.42	.78	189B105M
1.2	.29	.45	.78	189B125M
1.5	.33	.49	.78	189B155M
2.0	.32	.48	.97	189B205M
2.5	.36	.52	.97	189B255M
3.0	.35	.51	1.17	189B305M
3.5	.38	.54	1.17	189B355M
4.0	.41	.57	1.17	189B405M
4.5	.44	.60	1.17	189B455M
5.0	.47	.63	1.17	189B505M
6.0	.52	.68	1.17	189B605M
8.0	.46	.62	1.68	189B805M
10.0	.53	.69	1.68	189B106M
200 VOLTS DC WORKING				
.010	.10	.20	.40	189C103M
.012	.10	.20	.40	189C123M
.015	.10	.20	.40	189C153M
.018	.13	.23	.40	189C183M
.022	.13	.26	.40	189C223M
.027	.10	.20	.53	189C273M
.033	.12	.22	.53	189C333M
.039	.12	.25	.53	189C393M
.047	.13	.26	.53	189C473M
.056	.14	.27	.53	189C563M
.068	.16	.29	.53	189C683M
.082	.18	.31	.53	189C823M
.10	.20	.33	.53	189C104M
.12	.22	.35	.53	189C124M
.15	.26	.39	.53	189C154M
.18	.24	.37	.65	189C184M
.22	.26	.39	.65	189C224M
.27	.24	.37	.78	189C274M
.33	.27	.40	.78	189C334M
.39	.30	.43	.78	189C394M
.47	.33	.46	.78	189C474M
.56	.37	.50	.78	189C564M
.68	.32	.48	.97	189C684M
.82	.35	.51	.97	189C824M
1.0	.35	.51	1.17	189C105M
1.2	.38	.54	1.17	189C125M
1.5	.43	.59	1.17	189C155M
2.0	.52	.68	1.17	189C205M
2.5	.46	.62	1.68	189C255M
3.0	.49	.65	1.68	189C305M
3.5	.54	.70	1.68	189C355M
4.0	.58	.74	1.68	189C405M
4.5	.62	.78	1.68	189C455M
5.0	.64	.84	1.68	189C505M
6.0	.70	.90	1.68	189C605M
8.0	.84	1.04	1.68	189C805M
10.0	.75	.95	2.25	189C106M
400 VOLTS DC WORKING				
.010	.14	.24	.40	189E103M
.012	.10	.23	.53	189E123M
.015	.11	.21	.53	189E153M
.018	.12	.22	.53	189E183M
.022	.12	.25	.53	189E223M
.027	.13	.26	.53	189E273M
.033	.15	.28	.53	189E333M
.039	.17	.30	.53	189E393M
.047	.19	.32	.53	189E473M
.056	.21	.34	.53	189E563M
.068	.23	.36	.53	189E683M
.082	.26	.39	.53	189E823M
.10	.23	.36	.65	189E104M
.12	.25	.38	.65	189E124M
.15	.24	.37	.78	189E154M
.18	.26	.39	.78	189E184M
.22	.30	.43	.78	189E224M
.27	.33	.46	.78	189E274M
.33	.36	.52	.78	189E334M
.39	.33	.49	.97	189E394M
.47	.37	.53	.97	189E474M
.56	.34	.50	1.17	189E564M
.68	.38	.54	1.17	189E684M
.82	.43	.59	1.17	189E824M
1.0	.48	.64	1.17	189E105M
1.2	.54	.70	1.17	189E125M
1.5	.46	.62	1.68	189E155M
2.0	.54	.70	1.68	189E205M
2.5	.60	.80	1.68	189E255M
3.0	.67	.87	1.68	189E305M
3.5	.73	.93	1.68	189E355M
4.0	.78	.98	1.68	189E405M
4.5	.69	.89	2.25	189E455M
5.0	.75	.95	2.25	189E505M

Nytronics Components Group, Inc.
700 ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE 194 METALLIZED POLYCARBONATE

SUBMINIATURE CAPACITORS 50, 80, 100 VDC



LEAD WIRE SIZE

AWG	Diameter
#24	.280 & Under
#22	.281-.532
#20	Above .533

CAPACITANCE TOLERANCE SUFFIX

G = ±2%
J = ±5%
K = ±10%
M = ±20%

OUTSTANDING FEATURES

- Excellent Electrical Characteristics
- Subminiature, Space Saving Sizes
- Excellent Moisture Resistance
- Self Healing
- Excellent Shelf Life
- Wide Operating Temperature Range

CAPACITANCE

Shall be measured at +25°C. For capacitance values equal to or less than 1 μF, the test frequency is 1 kHz, above 1 μF use 120 Hz.

DISSIPATION FACTOR

Shall not exceed .30% when measured as above.

INSULATION RESISTANCE

Shall be a minimum of 50,000 megohm X microfarads, need not exceed 200,000 megohms when measured at +25°C and with rated voltage applied for two minutes.

DIELECTRIC STRENGTH

Shall withstand 1.8 times rated voltage for 2 minutes without permanent breakdown.

OPERATING TEMPERATURE

−55°C to +125°C at full rated voltage.

LIFE TEST

250 hours at +125°C and 150% of rated voltage. One failure in 18 allowed.

MOISTURE RESISTANCE

Capacitors shall be subjected to 95% R.H. at +40°C for 500 hours.
Capacitors shall be removed from the humidity chamber on completion. Surface of units shall be wiped dry then exposed to circulating air for four hours. No more than one failure in 12 units tested.

CAP. MFD	CATALOG NUMBER	DIA.	LENGTH
100 VDC			
0.047	194B473	.140	.400
0.056	194B563	.140	.400
0.068	194B683	.140	.400
0.082	194B823	.140	.530
0.10	194B104	.140	.530
0.12	194B124	.140	.530
0.15	194B154	.160	.530
0.18	194B184	.175	.530
0.22	194B224	.190	.530
0.27	194B274	.210	.530
0.33	194B334	.230	.530
0.39	194B394	.210	.680
0.47	194B474	.230	.680
0.56	194B564	.250	.680
0.68	194B684	.270	.680
0.82	194B824	.295	.680
1.00	194B105	.325	.680
1.2	194B125	.330	.780
1.5	194B155	.365	.780
1.8	194B185	.340	.900
2.0	194B205	.360	.900
2.2	194B225	.375	.900
3.0	194B305	.435	.900
3.3	194B335	.455	.900
4.0	194B405	.430	1.205
4.7	194B475	.465	1.205
5.0	194B505	.475	1.205
6.0	194B605	.520	1.205
6.8	194B685	.555	1.205
8.0	194B805	.600	1.205
9.0	194B905	.635	1.205
10.0	194B106	.670	1.205

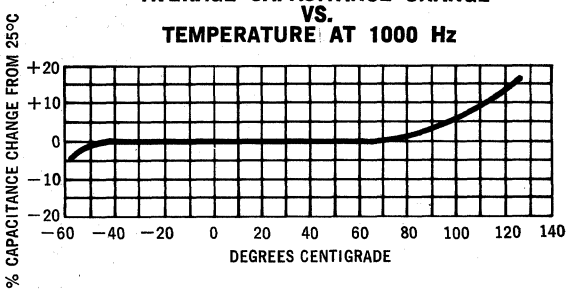
CAP. MFD	CATALOG NUMBER	DIA.	LENGTH
50 VDC			
0.047	194A473	.140	.400
0.056	194A563	.140	.400
0.068	194A683	.140	.400
0.082	194A823	.140	.400
0.10	194A104	.140	.400
0.12	194A124	.160	.400
0.15	194A154	.160	.400
0.18	194A184	.160	.400
0.22	194A224	.170	.400
0.27	194A274	.190	.400
0.33	194A334	.200	.400
0.39	194A394	.170	.530
0.47	194A474	.180	.530
0.56	194A564	.200	.530
0.68	194A684	.220	.530
0.82	194A824	.240	.530
1.00	194A105	.260	.530
1.2	194A125	.240	.680
1.5	194A155	.260	.680
1.8	194A185	.290	.680
2.0	194A205	.305	.680
2.2	194A225	.320	.680
3.0	194A305	.345	.780
3.3	194A335	.360	.780
4.0	194A405	.340	.900
4.7	194A475	.365	.900
5.0	194A505	.375	.900
6.0	194A605	.410	.900
6.8	194A685	.435	.900
8.0	194A805	.430	1.08
9.0	194A905	.460	1.08
10.0	194A106	.480	1.08
12.0	194A126	.530	1.08
15.0	194A156	.550	1.205
20.0	194A206	.630	1.205
25.0	194A256	.710	1.205
30.0	194A306	.770	1.205
80 VDC			
0.047	194Y473	.140	.400
0.056	194Y563	.140	.400
0.068	194Y683	.140	.400
0.082	194Y823	.140	.400
0.10	194Y104	.140	.400
0.12	194Y124	.165	.400
0.15	194Y154	.180	.400
0.18	194Y184	.195	.400
0.22	194Y224	.215	.400
0.27	194Y274	.235	.400
0.33	194Y334	.255	.400
0.39	194Y394	.210	.530
0.47	194Y474	.230	.530
0.56	194Y564	.250	.530
0.68	194Y684	.270	.530
0.82	194Y824	.250	.680
1.00	194Y105	.275	.680
1.2	194Y125	.300	.680
1.5	194Y155	.330	.680
1.8	194Y185	.335	.780
2.0	194Y205	.355	.780
2.2	194Y225	.370	.900
3.0	194Y305	.365	.900
3.3	194Y335	.385	.900
4.0	194Y405	.420	.900
4.7	194Y475	.455	.900
5.0	194Y505	.430	1.08
6.0	194Y605	.470	1.08
6.8	194Y685	.500	1.08
8.0	194Y805	.540	1.08
9.0	194Y905	.570	1.08
10.0	194Y106	.600	1.08
12.0	194Y126	.610	1.205
15.0	194Y156	.685	1.205

Nytronics Components Group, Inc.
700 ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

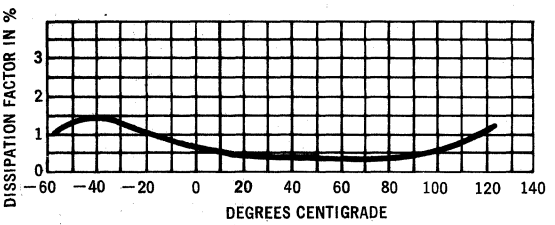
TYPICAL CURVES 184 — 194

TYPICAL TEMPERATURE CHARACTERISTICS FOR METALLIZED POLYESTER CAPACITORS — TYPE 184

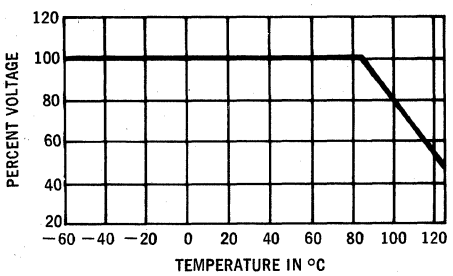
AVERAGE CAPACITANCE CHANGE VS. TEMPERATURE AT 1000 Hz



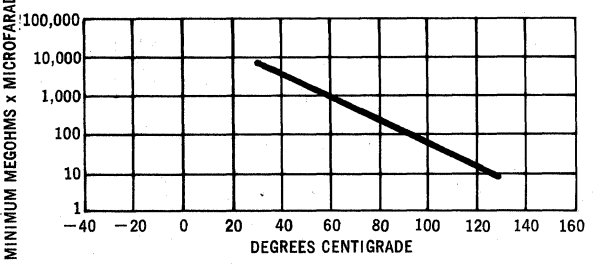
AVERAGE DISSIPATION FACTOR VS. TEMPERATURE AT 1000 Hz



VOLTAGE RATING AS A FUNCTION OF TEMPERATURE

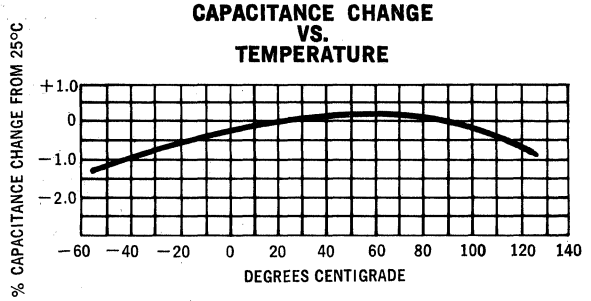


INSULATION RESISTANCE VS. TEMPERATURE

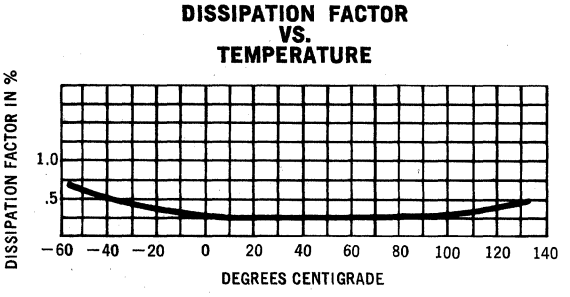


TYPICAL TEMPERATURE CHARACTERISTICS FOR METALLIZED POLYCARBONATE CAPACITORS — TYPE 194

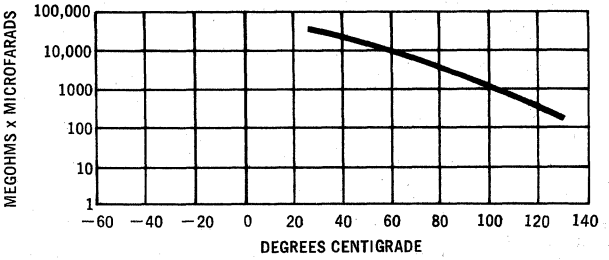
CAPACITANCE CHANGE VS. TEMPERATURE



DISSIPATION FACTOR VS. TEMPERATURE



INSULATION RESISTANCE VS. TEMPERATURE

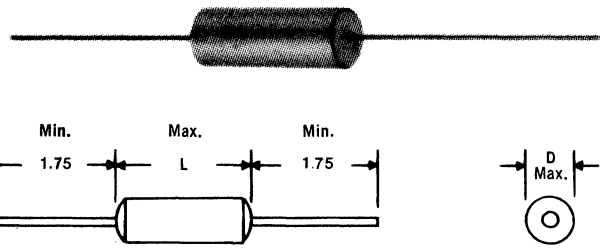


Nytronics Components Group, Inc.
700 ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE 187 POLYPROPYLENE CAPACITORS

TYPE 187 POLYPROPYLENE CAPACITORS

EXTENDED FOIL/FILM WRAP/ EPOXY ENDFILL



ELECTRICAL SPECIFICATIONS

CAPACITANCE
Shall be within the specified limits when measured at 1 kHz at +25°C.

DISSIPATION FACTOR
Shall not exceed .1% when measured as above.

INSULATION RESISTANCE
When measured at +25°C and with rated voltage applied for 2 minutes, shall be a minimum 250,000 megohms/mfd; need not exceed 500,000 megohms.

DIELECTRIC STRENGTH
Shall withstand 200% of rated voltage for 1 minute.

OPERATING TEMPERATURE
−55°C to +105°C at full rated voltage.

LIFE TEST
250 hours, at 105°C with 140% of rated voltage applied. One failure in twelve shall be permitted.

HUMIDITY RESISTANCE
Meets the requirements of MIL-STD-202, Method 103B, Test Condition B. After test the I.R. will be equal to or greater than 1/3 of the initial requirement.

LEAD PULL & BEND TEST
Capacitors will withstand a 5 pound pull test and bend test as described in RS-164.

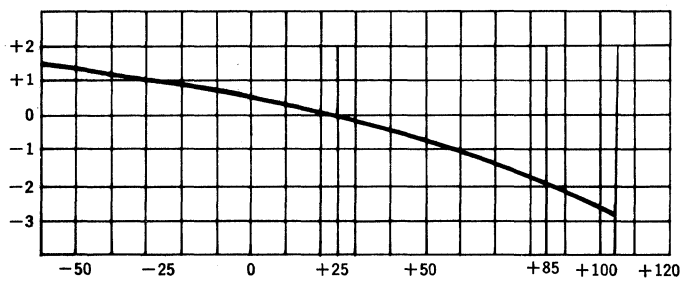
LEAD WIRE SIZE

AWG	DIAMETER MAX.
#22	.40 & Under
#20	.401 Thru 1.0
#18	Above 1.0

CAPACITY TOLERANCE SUFFIX

F = ± 1%
P = ± 2%
J = ± 5%
K = ±10%
M = ±20%

TYPICAL CAPACITANCE CHANGE WITH TEMPERATURE IN PERCENT



TEMPERATURE IN DEGREES CENTIGRADE

Other capacitance values and voltage ratings available upon request.

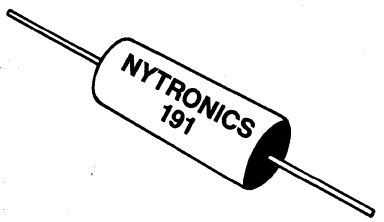
CAPACITY MFD.	100 VDC CATALOG NO.	D MAX.	L MAX.	200 VDC CATALOG NO.	D MAX.	L MAX.	400 VDC CATALOG NO.	D MAX.	L MAX.
.001	187B102___	.218	.625	187C102___	.218	.625	187E102___	.218	.625
.0012	187B122___	.218	.625	187C122___	.218	.625	187E122___	.218	.625
.0015	187B152___	.218	.625	187C152___	.218	.625	187E152___	.218	.625
.0018	187B182___	.218	.625	187C182___	.218	.625	187E182___	.218	.625
.0022	187B222___	.218	.625	187C222___	.218	.625	187E222___	.218	.625
.0027	187B272___	.218	.625	187C272___	.218	.625	187E272___	.218	.625
.0033	187B332___	.218	.625	187C332___	.218	.625	187E332___	.218	.625
.0039	187B392___	.218	.625	187C392___	.218	.625	187E392___	.218	.625
.0047	187B472___	.218	.625	187C472___	.218	.625	187E472___	.218	.625
.0056	187B562___	.218	.625	187C562___	.218	.625	187E562___	.240	.625
.0068	187B682___	.218	.625	187C682___	.218	.625	187E682___	.255	.625
.0082	187B822___	.218	.625	187C822___	.218	.625	187E822___	.235	.687
.01	187B103___	.218	.625	187C103___	.232	.625	187E103___	.255	.687
.012	187B123___	.218	.625	187C123___	.245	.625	187E123___	.280	.687
.015	187B153___	.235	.625	187C153___	.242	.687	187E153___	.310	.687
.018	187B183___	.250	.625	187C183___	.255	.687	187E183___	.340	.687
.022	187B223___	.265	.625	187C223___	.265	.687	187E223___	.360	.687
.027	187B273___	.285	.625	187C273___	.316	.687	187E273___	.395	.687
.033	187B333___	.320	.625	187C333___	.320	.687	187E333___	.370	.812
.039	187B393___	.345	.625	187C393___	.358	.687	187E393___	.395	.812
.047	187B473___	.300	.750	187C473___	.330	.812	187E473___	.435	.812
.056	187B563___	.325	.750	187C563___	.354	.812	187E563___	.465	.812
.068	187B683___	.345	.812	187C683___	.385	.812	187E683___	.450	.937
.082	187B823___	.345	.812	187C823___	.415	.812	187E823___	.480	.937
.1	187B104___	.410	.812	187C104___	.415	.937	187E104___	.530	.937
.12	187B124___	.425	.812	187C124___	.450	.937	187E124___	.495	1.250
.15	187B154___	.425	.937	187C154___	.495	.937	187E154___	.545	1.250
.18	187B184___	.425	.937	187C184___	.530	.937	187E184___	.605	1.250
.22	187B224___	.450	.937	187C224___	.520	1.125	187E224___	.655	1.250
.27	187B274___	.460	1.125	187C274___	.575	1.125	187E274___	.630	1.500
.33	187B334___	.490	1.125	187C334___	.635	1.125	187E334___	.690	1.500
.39	187B394___	.490	1.250	187C394___	.635	1.250	187E394___	.740	1.500
.47	187B474___	.540	1.250	187C474___	.690	1.250	187E474___	.810	1.500
.56	187B564___	.585	1.250	187C564___	.660	1.500	187E564___	.870	1.500
.68	187B684___	.635	1.250	187C684___	.720	1.500	187E684___	.860	1.750
.82	187B824___	.685	1.250	187C824___	.720	1.750	187E824___	.950	1.750
1.	187B105___	.760	1.250	187C105___	.770	1.750	187E105___	1.040	1.750

Nytronics Components Group, Inc.
700 ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE 191 METALLIZED POLYPROPYLENE CAPACITORS

TYPE 191 METALLIZED POLYPROPYLENE CAPACITORS

FOR SWITCHED-MODE POWER SUPPLIES



PERFORMANCE FEATURES:

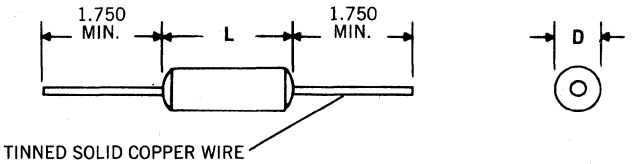
- Operating temperature range −55°C to +105°C
- Flame retardant wrap/fill
- Rated for usage 20 to 100 kHz
- High current capability
- Very low ESR

CAPACITANCE
Shall be within specified tolerance when measured at 1 kHz/25°C.

DISSIPATION FACTOR
Shall be less than .1% when measured as above.

INSULATION RESISTANCE
Shall be greater than 200,000 megohm-microfarads but need not exceed 400,000 megohms at 25°C.

DIELECTRIC STRENGTH
Shall withstand two times rated voltage for two minutes without permanent breakdown.



*CAPACITANCE TOLERANCE SUFFIX
J = ±5%
K = ±10%
M = ±20%

CAPACITANCE MFD	TYPE 191	D +.062	L +.062	LEAD AWG	ESR LIMIT mΩ @ 100 kHz	I MAX 25°C	I MAX 85°C
			100VDC			AMPS	RMS
1.0	B105__*	.469	.750	20	15	8.5	4.2
2.0	B205__	.550	.937	20	12	10.0	5.0
3.0	B305__	.660	.937	18	11	11.0	6.0
5.0	B505__	.670	1.250	18	10	12.0	6.5
			200VDC				
1.0	C105__	.450	1.250	20	17	9.0	4.6
2.0	C205__	.637	1.250	18	15	11.0	5.5
3.0	C305__	.700	1.500	18	13	12.0	6.5
			400VDC				
1.0	E105__	.670	1.500	18	19	9.0	5.5

All dimensions in inches.

Type 191 capacitors are especially designed for input filter, D.C. blocking and output filter applications in high frequency switched-mode power supplies.

Nytronics Components Group, Inc.
700 ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE 192 METALLIZED POLYPROPYLENE CAPACITORS

POLYESTER TAPE WRAP CASE/EPOXY ENDFILL

Type 192 Capacitors feature small size, excellent stability, high insulation resistance, low dissipation factor and good humidity resistance. These properties make them ideal for use in timing and integrating circuitry.

CAPACITANCE
Shall be within specified tolerance when measured at 1 KHz for values thru 1 MFD and at 60 Hz for values above 1 MFD.

DISSIPATION FACTOR
Less than .1% when measured as above at 25°C.

DIELECTRIC STRENGTH
1.5 X rated voltage for one minute through a limiting resistance of 100 ohms/volt.

INSULATION RESISTANCE
Minimum values.

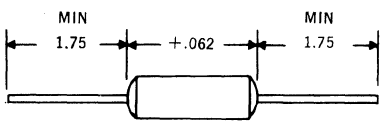
Temperature	+25°C	+85°C	+105°C
Megohms X Microfarads	100,000	5,000	500
Need Not Exceed (Megohms)	200,000	10,000	1000

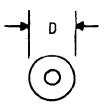
Measured After Two Minutes Electrification At Rated Voltage

TEMPERATURE RANGE
−55°C to +85°C at rated voltage to 105°C with 50% voltage derating.

HUMIDITY
Will meet the test requirements of MIL-STD-202, Method 103B, Test Condition B. After testing the I.R. will be equal to or greater than 1/3 of the initial requirements. One failure in 12 permitted.

LIFE TEST
250 hours at 85°C with 140% of rated voltage applied. A resistance of one ohm per volt shall be inserted in series with each capacitor. One failure in 12 shall be permitted.





D TOLERANCE

.249 and Under	+.032
.250 thru .500	+.046
.501 thru 1.000	+.062

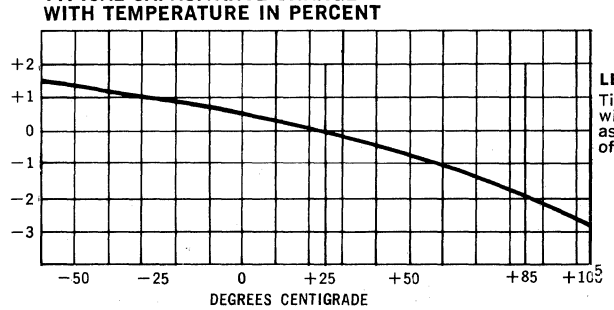
LEAD GAUGE

Body Length	AWG
.530 and Less	24
.650 thru 1.062	22
1.187 thru 2.00	20
Greater Than 2.00	18

CAPACITY TOLERANCE SUFFIX

F = ± 1%
P = ± 2%
J = ± 5%
K = ±10%
M = ±20%

TYPICAL CAPACITANCE CHANGE WITH TEMPERATURE IN PERCENT



LEAD MATERIAL:
Tinned copperweld wire shall withstand mechanical test as specified in Paragraph 3.4 of EIA Standard RS-164A

CAP MFD	CAT No.	DIA.	LENGTH
100 VOLTS DC WORKING			
.010	192B103	.156	.400
.012	192B123	.156	.400
.015	192B153	.156	.400
.018	192B183	.172	.400
.022	192B223	.172	.400
.027	192B273	.188	.400
.033	192B333	.203	.400
.039	192B393	.203	.400
.047	192B473	.219	.400
.056	192B563	.234	.400
.068	192B683	.219	.470
.082	192B823	.234	.470
.10	192B104	.250	.470
.12	192B124	.266	.470
.15	192B154	.250	.530
.18	192B184	.266	.530
.22	192B224	.297	.530
.27	192B274	.328	.530
.33	192B334	.297	.650
.39	192B394	.312	.650
.47	192B474	.344	.650
.56	192B564	.375	.650
.68	192B684	.359	.780
.82	192B824	.391	.780
1.0	192B105	.422	.780
1.2	192B125	.415	.900
1.5	192B155	.453	.900
2.0	192B205	.516	.900
3.0	192B305	.531	1.187
4.0	192B405	.609	1.187
5.0	192B505	.672	1.187
6.0	192B605	.670	1.500
8.0	192B805	.750	1.500
10.0	192B106	.828	1.500
12.0	192B126	.828	1,750
15.0	192B156	.922	1.750
200 VOLTS DC WORKING			
.010	192C103	.160	.400
.012	192C123	.170	.400
.015	192C153	.190	.400
.018	192C183	.165	.470
.022	192C223	.180	.470
.027	192C273	.195	.470
.033	192C333	.210	.470
.039	192C393	.195	.530
.047	192C473	.215	.530
.056	192C563	.230	.530
.068	192C683	.250	.530
.082	192C823	.225	.650
.10	192C104	.245	.650
.12	192C124	.265	.650
.15	192C154	.295	.650
.18	192C184	.285	.780
.22	192C224	.310	.780
.27	192C274	.340	.780
.33	192C334	.370	.780
.39	192C394	.360	.900
.47	192C474	.395	.900
.56	192C564	.425	.900
.68	192C684	.465	.900
.82	192C824	.440	1.187
1.0	192C105	.480	1.187
1.2	192C125	.525	1.187
1.5	192C155	.580	1.187
2.0	192C205	.670	1.187
3.0	192C305	.720	1.500
4.0	192C405	.825	1.500
5.0	192C505	.830	1.750
6.0	192C605	1.000	1.750
8.0	192C805	.960	2.000
10.0	192C106	1.070	2.000
400 VOLTS DC WORKING			
.010	192E103	.205	.400
.012	192E123	.220	.400
.015	192E153	.195	.470
.018	192E183	.210	.470
.022	192E223	.230	.470
.027	192E273	.220	.530
.033	192E333	.240	.530
.039	192E393	.255	.530
.047	192E473	.230	.650
.056	192E563	.245	.650
.068	192E683	.270	.650
.082	192E823	.290	.650
.10	192E104	.285	.780
.12	192E124	.305	.780
.15	192E154	.340	.780
.18	192E184	.370	.780
.22	192E224	.365	.900
.27	192E274	.400	.900
.33	192E334	.440	.900
.39	192E394	.475	.900
.47	192E474	.440	1.187
.56	192E564	.475	1.187
.68	192E684	.525	1.187
.82	192E824	.570	1.187
1.0	192E105	.560	1.500
1.2	192E125	.610	1.500
1.5	192E155	.680	1.500
2.0	192E205	.710	1.750
3.0	192E305	.860	1.750
4.0	192E405	.860	2.250
5.0	192E505	.950	2.250

Nytronics Components Group, Inc.
700 ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

**MIL TYPE CP04 - CP08
MIL-C-25
HERMETICALLY SEALED
CAPACITORS**

HERMETICALLY SEALED CAPACITORS CP04 THRU CP09 TO MIL-C-25

µF	WVDC	CP04A1 — CP05A1 (Uninsulated) (Insulated) Char. K −55°C to +125°C	Size* D. x L.
.001	600	CP04A1KF102K3	.235 x 3/4
.0015	600	CP04A1KF152K3	.235 x 3/4
.0022	600	CP04A1KF222K3	.235 x 3/4
.0033	600	CP04A1KF332K3	.235 x 3/4
.0047	600	CP04A1KF472K3	.235 x 3/4
.0068	600	CP04A1KF682K3	.235 x 3/4
.01	400	CP04A1KE103K3	.235 x 3/4
	600	CP04A1KF103K3	.312 x 7/8
.015	200	CP04A1KC153K3	.235 x 3/4
	600	CP04A1KF153K3	.312 x 7/8
.022	200	CP04A1KF223K3	.235 x 3/4
	600	CP04A1KF223K3	.312 x 7/8
.033	100	CP04A1KB333K3	.235 x 3/4
	400	CP04A1KE333K3	.312 x 7/8
	600	CP04A1KF333K3	.400 x 7/8
.047	200	CP04A1KC473K3	.312 x 7/8
	400	CP04A1KE473K3	.400 x 7/8
	600	CP04A1KF473K3	.400 x 1 1/8
.068	200	CP04A1KC683K3	.312 x 7/8
	400	CP04A1KE683K3	.400 x 1 1/8
	600	CP04A1KF683K3	.400 x 1 3/8
.1	100	CP04A1KB104K3	.312 x 7/8
	200	CP04A1KC104K3	.400 x 7/8
	400	CP04A1KE104K3	.400 x 1 3/8
	600	CP04A1KF104K3	.562 x 1 1/8
.15	100	CP04A1KB154K3	.400 x 7/8
	200	CP04A1KC154K3	.400 x 1 1/8
	400	CP04A1KE154K3	.562 x 1 1/8
	600	CP04A1KF154K3	.562 x 1 3/8
.22	100	CP04A1KB224K3	.400 x 1 3/8
	200	CP04A1KC224K3	.400 x 1 3/8
	400	CP04A1KE224K3	.562 x 1 3/8
	600	CP04A1KF224K3	.562 x 1 7/8
.33	100	CP04A1KB334K3	.400 x 1 3/8
	200	CP04A1KC334K3	.562 x 1 1/8
	400	CP04A1KE334K3	.562 x 1 7/8
	600	CP04A1KF334K3	.670 x 1 7/8
.47	100	CP04A1KB474K3	.562 x 1 1/8
	200	CP04A1KC474K3	.562 x 1 3/8
	400	CP04A1KE474K3	.670 x 1 7/8
	600	CP04A1KF474K3	.750 x 2 1/8
.68	100	CP04A1KB684K3	.562 x 1 3/8
	200	CP04A1KC684K3	.562 x 1 7/8
	400	CP04A1KE684K3	.750 x 2 1/8
	600	CP04A1KF684K3	1.0 x 1 7/8
1.0	100	CP04A1KB105K3	.562 x 1 7/8
	200	CP04A1KC105K3	.670 x 1 7/8
	400	CP04A1KE105K3	1.0 x 1 7/8

µF	WVDC	CP08A1 — CP09A1 (Uninsulated) (Insulated) Char. K −55°C to +125°C	Size* D. x L.
.001	600	CP08A1KF102K3	.235 x 3/4
.0015	600	CP08A1KF152K3	.235 x 3/4
.0022	600	CP08A1KF222K3	.235 x 3/4
.0033	400	CP08A1KE332K3	.235 x 3/4
	600	CP08A1KF332K3	.312 x 7/8
.0047	200	CP08A1KC472K3	.235 x 3/4
	600	CP08A1KF472K3	.312 x 7/8
.0068	200	CP08A1KC682K3	.235 x 3/4
	600	CP08A1KF682K3	.312 x 7/8
.01	100	CP08A1KB103K3	.235 x 3/4
	600	CP08A1KF103K3	.312 x 7/8
.015	100	CP08A1KB153K3	.235 x 3/4
	400	CP08A1KE153K3	.312 x 7/8
	600	CP08A1KF153K3	.400 x 7/8
.022	200	CP08A1KC223K3	.312 x 7/8
	600	CP08A1KF223K3	.400 x 7/8
.033	200	CP08A1KC333K3	.312 x 7/8
	400	CP08A1KE333K3	.400 x 7/8
	600	CP08A1KF333K3	.400 x 1 1/8
.047	100	CP08A1KB473K3	.312 x 7/8
	200	CP08A1KC473K3	.400 x 7/8
	400	CP08A1KE473K3	.400 x 1 1/8
	600	CP08A1KF473K3	.400 x 1 3/8
.068	200	CP08A1KC683K3	.400 x 7/8
	400	CP08A1KE683K3	.400 x 1 3/8
	600	CP08A1KF683K3	.562 x 1/8
.1	100	CP08A7KB104K3	.400 x 7/8
	200	CP08A1KC104K3	.400 x 1 1/8
	400	CP08A1KE104K3	.562 x 1 1/8
	600	CP08A1KF104K3	.562 x 1 3/8
.15	100	CP08A1KB154K3	.400 x 1 1/8
	200	CP08A1KC154K3	.400 x 1 3/8
	400	CP08A1KE154K3	.562 x 1 3/8
	600	CP08A1KF154K3	.562 x 1 5/8
.22	100	CP08A1KB224K3	.400 x 1 3/8
	200	CP08A1KC224K3	.562 x 1 1/8
	400	CP08A1KE224K3	.562 x 1 5/8
	600	CP08A1KF224K3	.670 x 1 5/8
.33	100	CP08A1KB334K3	.562 x 1 1/8
	200	CP08A1KC334K3	.562 x 1 3/8
	400	CP08A1KE334K3	.670 x 1 5/8
	600	CP08A1KF334K3	.750 x 2 1/8
.47	100	CP08A1KB474K3	.562 x 1 3/8
	200	CP08A1KC474K3	.562 x 1 5/8
	400	CP08A1KE474K3	.750 x 2 1/8
	600	CP08A1KF474K3	.750 x 2 3/8
.68	100	CP08A1KB684K3	.562 x 1 5/8
	200	CP08A1KC684K3	.670 x 1 5/8
1.0	100	CP08A1KB105K3	.670 x 1 5/8
	200	CP08A1KC105K3	.750 x 2 1/8

NOTE: The capacitors listed in this table have a capacitance tolerance of ±10%.
* For case grounded reduce L dimension by 1/16". Above listing are ratings listed in Mil-C-25C. Other values are available in Nytronics Commercial Equivalents.
** For CP05 and CP09 add .0625 to Diameter and 1/16" to Length.

NYTRONICS CATALOG NUMBERING SYSTEM

CP 04 A 1 K B 273 K 1

MILITARY TYPE
CAPACITORS
Fixed,
Paper dielectric,
Direct current,
Hermetically sealed in metallic cases

SUBMINIATURE CAPACITORS
CP05 CP09
CP10 CP12
CP11 CP13

TERMINALS
A = axial leads

CIRCUIT
1 =
3 =

CHARACTERISTIC
K = −55°C to +125°C

DC VOLTAGE RATING

CAPACITANCE
In uuf. The first two digits are the significant figures, the third is the number of zeros.

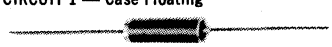
CAPACITANCE TOLERANCE
K = ±10%

VIBRATION GRADE
1 = 10 to 55 cps
3 = 10 to 2000 cps

RATED VOLTAGE DESIGNATIONS
(DC working at 40°C, except for characteristic K which is 85°C)
B = 100 C = 200 E = 400 F = 600 G = 1000

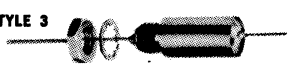
BASIC STYLE

CP04A1/CP08A1
CIRCUIT 1 — Case Floating



CP04A3/CP08A3
CIRCUIT 3 — Case Grounded

STYLE 3



CP11A1/CP13A1
CIRCUIT 1 — Case Floating

CP11A3/CP13A3
CIRCUIT 3 — Case Grounded

STYLE V (Insulated)

CP05A1/CP09A1
CIRCUIT 1 — Case Floating

CP05A3/CP09A3
CIRCUIT 3 — Case Grounded

STYLE 7

CP10A1/CP12A1
CIRCUIT 1 — Case Floating

CP10A3/CP12A3
CIRCUIT 3 — Case Grounded

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(803) 393-5421 — TWX 810-665-2182

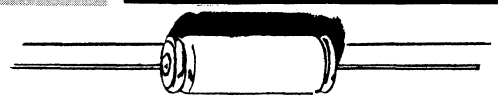
MIL TYPE CP25 - CP29 MIL-C-25 CAPACITORS

MIL-C-25 (LATEST REVISION) CP25 TO CP29

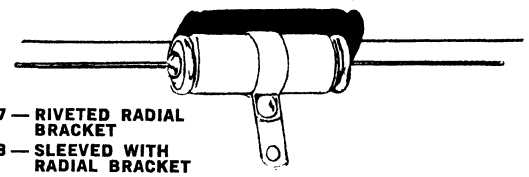
Available in capacitances from .003 thru 0.1 mf and voltages of 1500 VDC.

Type Designation[1]	Rated Voltage	Capacitance μf
CP2-A-EC104-	200	.1
CP2-A-EC254-	200	.25
CP2-A-EC504-	200	.5
CP2-A-EF302-	600	.003
CP2-A-EF602-	600	.006
CP2-A-EF103-	600	.01
CP2-A-EF203-	600	.02
CP2-A-EF503-	600	.05
CP2-A-EF104-	600	.1
CP2-A-EF254-	600	.25
CP2-A-EF504-	600	.5
CP2-A-EG302-	1,000	.003
CP2-A-EG602-	1,000	.006
CP2-A-EG103-	1,000	.01
CP2-A-EG203-	1,000	.02
CP2-A-EG503-	1,000	.05
CP2-A-EG104-	1,000	.1
CP2-A-EG254-	1,000	.25
CP2-A-EH302-	1,500	.003
CP2-A-EH602-	1,500	.006
CP2-A-EH103-	1,500	.01
CP2-A-EH203-	1,500	.02
CP2-A-EH503-	1,500	.05
CP2-A-EH104-	1,500	.1

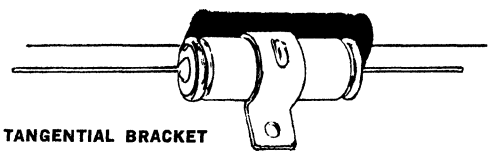
[1] Complete type designation will include additional symbols to complete style designation and to indicate circuit and capacitance tolerance.



CP25 — UNINSULATED BODY
CP26 — INSULATED BODY

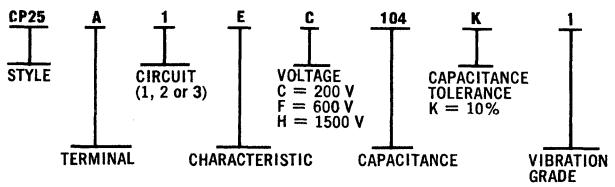


CP27 — RIVETED RADIAL BRACKET
CP28 — SLEEVED WITH RADIAL BRACKET

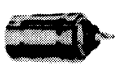


CP29 — TANGENTIAL BRACKET

TYPE - DESIGNATION EXAMPLE (CP25A1EC104K)



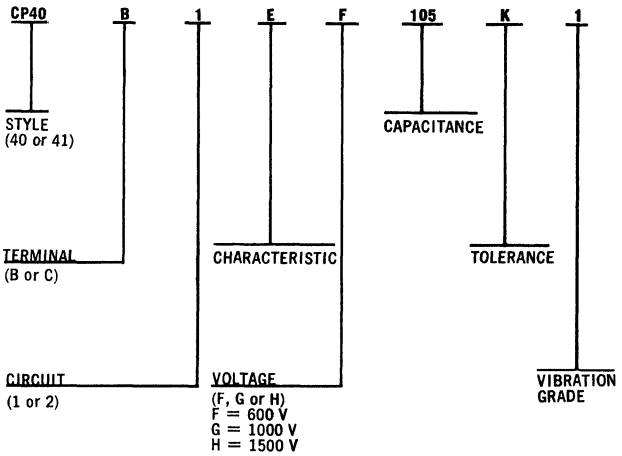
CP40, CP41 (TYPES PCM, PCIM)

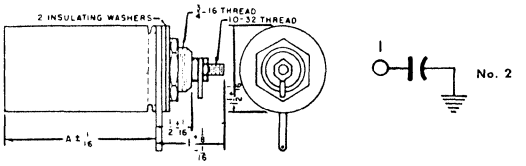


Available in capacitances from .25 mf thru 4.0 mf and voltages of 600 VDC thru 1500 VDC.

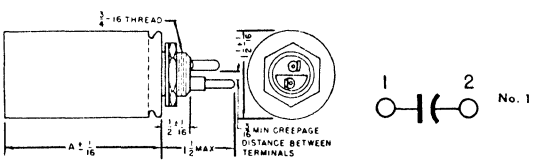
Type Designation 1/	DC Voltage Rating (see fig. 2) Volts	Capacitance μf
CP4----F105K1	600	1
CP4----F205K1	600	2
CP4----F405K1	600	4
CP4----G105K1	1,000	1
CP4----G205K1	1,000	2
CP4----H254K1	1,500 3/	0.25
CP4----H504K1	1,500	0.5
CP4----H105K1	1,500	1

TYPE - DESIGNATION EXAMPLE (CP40B1EF105K)





CIRCUIT DIAGRAM — CP40
Available with (C) or (B) Terminals



CIRCUIT DIAGRAM — CP41
Available only with (B) Terminal

Nytronics Components Group, Inc.
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(803) 393-5421 — TWX 810-665-2182

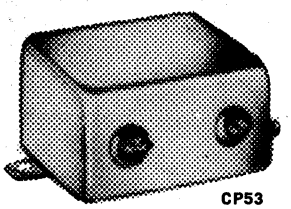
MIL TYPE CP53 - CP55
MIL-C-25
CAPACITORS

CAPACITORS MIL TYPE CP53, CP54, CP55

Section assembled in hermetically sealed tin-coated drawn-shell container. Mineral-oil impregnated and filled. Lug-type terminal seals. Meets requirements of MIL-C-25.

Temperature Rating: −55°C to +85°C.

Standard Tolerance: −10% to +20%.


CP53

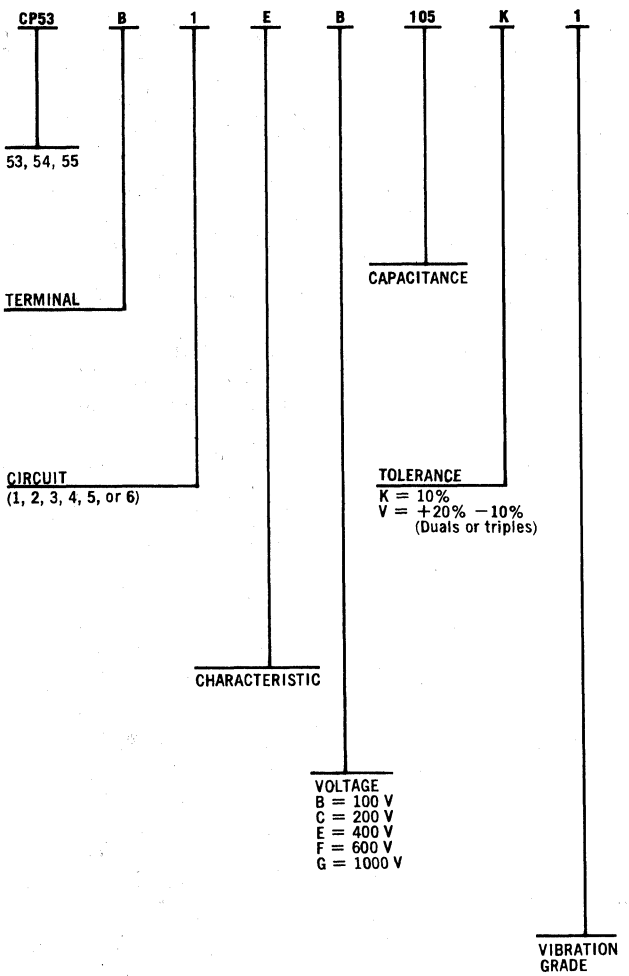
CP53 — Side Terminals
CP54 — Top Terminals
CP55 — Bottom Terminals

PDM VARIATIONS

MIL Type CP53, with terminals on side.
PDMT (CP54) With terminals on top.
PDMB (CP55) With terminals on the bottom.

Type Designation	DC Voltage Rating Volts	Capacitance μf
CP5-B- - B105K1	100	1
CP5-B-EB205K1	100	2
CP5-B- - B405K1	100	4
CP5-B-FC504K1	200	0.5
CP5-B-EC105K1	200	1
CP5-B-EC205K1	200	2
CP5-B-EF254K1	600	0.25
CP5-B- - F504K1	600	0.5
CP5-B- - F105K1	600	1
CP5-B-EF205K1	600	2
CP5-B-EG503K1	1,000	0.05
CP5-B-EG104K1	1,000	0.1
CP5-B- - G254K1	1,000	0.25
CP5-B-EG504K1	1,000	0.5
CP5-B-EG105K1	1,000	1
CP5-B-EF503V1	600	0.05-0.05
CP5-B-EF104V1	600	0.1 -0.1
CP5-B- - F254V1	600	0.25-0.25
CP5-B- - F504V1	600	0.5 -0.5
CP5-B-EF105V1	600	1 -1
CP5-B-EG503V1	1,000	0.05-0.05
CP5-B- - G104V1	1,000	0.1 -0.1
CP5-B-EG254V1	1,000	0.25-0.25
CP5-B-EG504V1	1,000	0.5 -0.5
CP5-B5-E504V1	400	0.5 -0.5 -0.5
CP5-B5-F104V1	600	0.1 -0.1 -0.1
CP5-B5EF254V1	600	0.25-0.25-0.25
CP5-B5EF504V1	600	0.5 -0.5 -0.5
CP5-B5EG503V1	1,000	0.05-0.05-0.05
CP5-B5EG104V1	1,000	0.1 -0.1 -0.1
CP5-B5EG254V1	1,000	0.25-0.25-0.25

TYPE - DESIGNATION EXAMPLE (CP53B1EB105K)

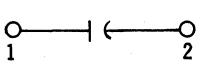


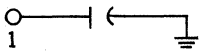
Vibration grade: 1 (10 to 55 Hz, incl.)

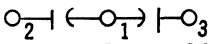
Terminal:

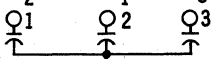
Symbol B ---------- Solder lug (nonremovable).

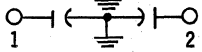
Circuit diagram:

Symbol 1 ----------


Symbol 2 ----------


Symbol 4 ----------


Symbol 5 ----------


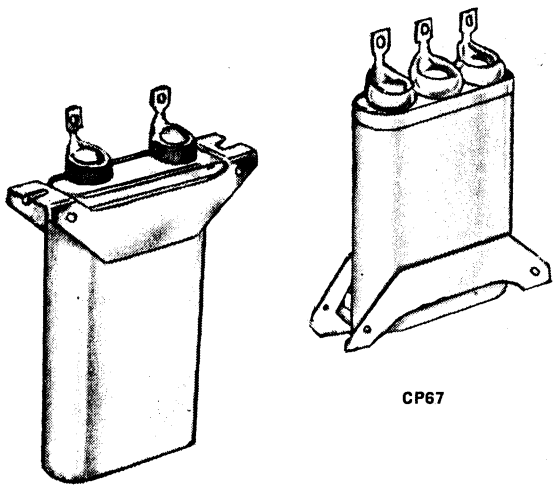
Symbol 6 ----------


Nytronics Components Group, Inc.
700 ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

MIL TYPE CP69, CP67, CP91 MIL-C-25

CAPACITORS MIL TYPE CP67, CP69

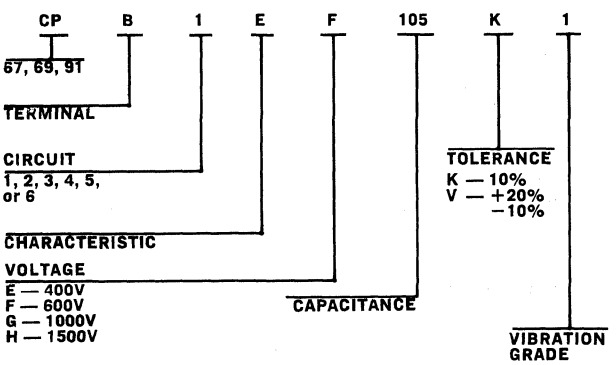
Type Designation	DC Voltage Rating Volts	Capacitance μf
CP6-B-EF503K1	600	0.05
CP6-B-EF104K1	600	0.1
CP6-B-EF254K1	600	0.25
CP6-B-EF504K1	600	0.5
CP6-B- - F105K1	600	1
CP6-B-EG103K1	1,000	0.01
CP6-B-EG203K1	1,000	0.02
CP6-B-EG503K1	1,000	0.05
CP6-B- - G104K1	1,000	0.1
CP6-B-EG254K1	1,000	0.25
CP6-B- - G504K1	1,000	0.5
CP6-B-EF503V1	600	0.05-0.05
CP6-B-EF104V1	600	0.1 -0.1
CP6-B-EF254V1	600	0.25-0.25
CP6-B- - F504K1	600	0.5 -0.5
CP6-B-EG103V1	1,000	0.01-0.01
CP6-B-EG203V1	1,000	0.02-0.02
CP6-B- - G503V1	1,000	0.05-0.05
CP6-B- - G104V1	1,000	0.1 -0.1
CP6-B- - G254V1	1,000	0.25-0.25
CP6-B-5-F503V1	600	0.05-0.05-0.05
CP6-B5EFP04V1	600	0.1 -0.1 -0.1
CP6-B5-F254V1	600	0.25-0.25-0.25
CP6-B5EG103V1	1,000	0.01-0.01-0.01
CP6-B5EG203V1	1,000	0.02-0.02-0.02
CP6-B5EG503V1	1,000	0.05-0.05-0.05
CP6-B5EG104V1	1,000	0.1 -0.1 -0.1



CP67

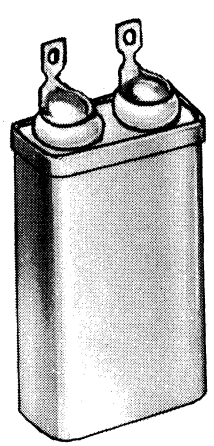
CP69

TYPE DESIGNATION EXAMPLE



CAPACITORS MIL TYPE CP91 SERIES

Type Designation	DC Voltage Rating Volts	Capacitance μf	Capacitance Tolerance
CP91B-E105K1	400	1	K
CP91B-EF503K1	600	0.05	K
CP91B-EF254K1	600	0.25	K
CP91B-EF504K1	600	0.5	K
CP91B-F105K1	600	1	K
CP91B-EG103K1	1,000	0.01	K
CP91B-EG203K1	1,000	0.02	K
CP91B-EG503K1	1,000	0.05	K
CP91B-EG104K1	1,000	0.1	K
CP91B-EG254K1	1,000	0.25	K
CP91B-G504K1	1,000	0.5	K
CP91B6EE503V1	400	0.05-0.05	V
CP91B6EE104V1	400	0.1 -0.1	V
CP91B6EE504V1	400	0.5 -0.5	V
CP91B6EF503V1	600	0.05-0.05	V
CP91B6-F104V1	600	0.1 -01	V
CP91B6EF254V1	600	0.25-0.25	V
CP91B6-F504V1	600	0.5 -0.5	V
CP91B6EG103V1	1,000	0.01-0.01	V
CP91B6EG203V1	1,000	0.02-0.02	V
CP91B6EG503V1	1,000	0.05-0.05	V
CP91B6-G104V1	1,000	0.1 -0.1	V
CP91B6-G254V1	1,000	0.25-0.25	V
CP91B6EH103V1	1,500	0.01-0.01	V
CP91B6EH503V1	1,500	0.05-0.05	V

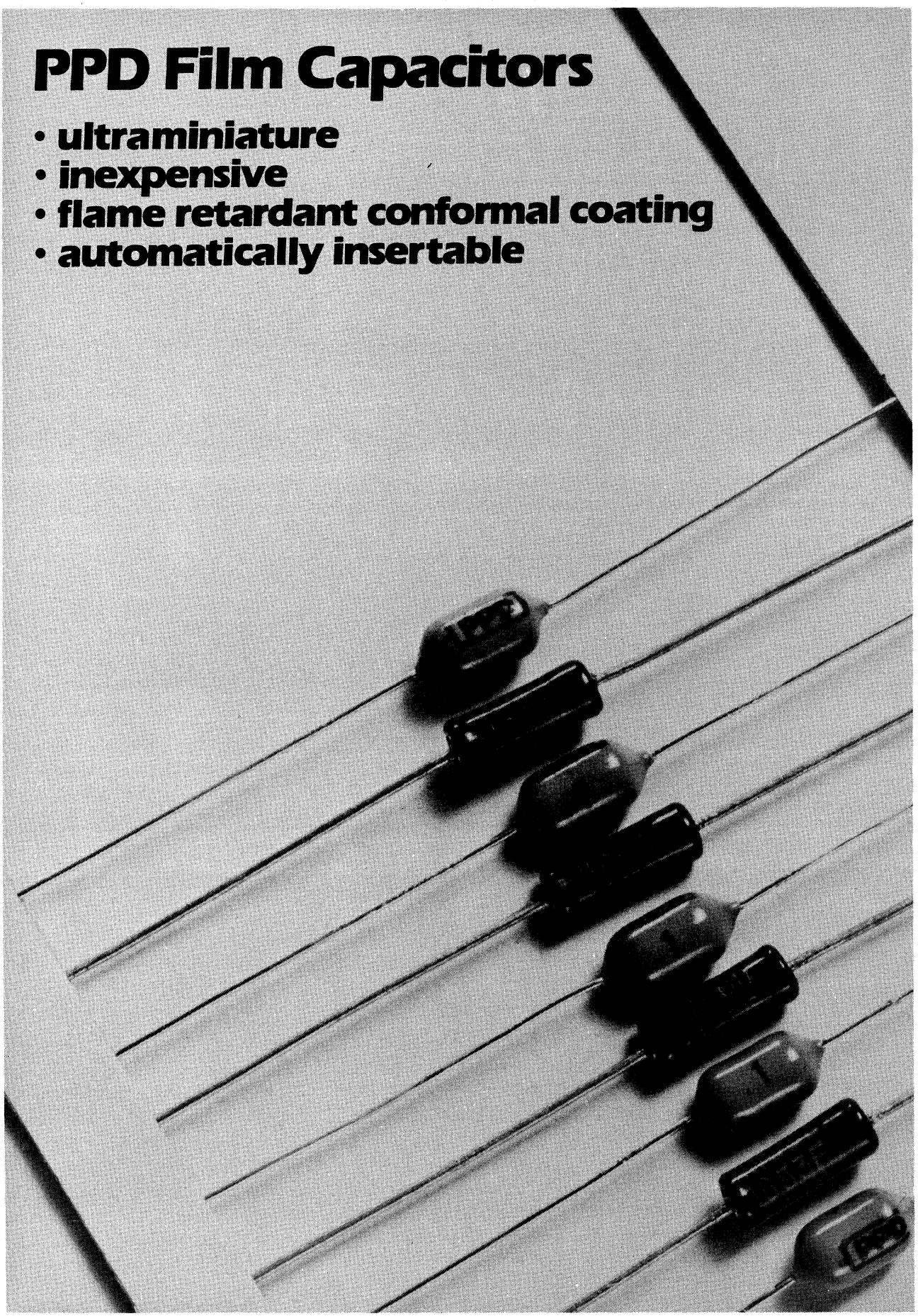


CP91

NOTE: AVAILABLE WITH SPADE-LUG OR FOOTED BRACKET

PPD Film Capacitors

- ultraminiature
- inexpensive
- flame retardant conformal coating
- automatically insertable



PEC 831 Metallized Polyester Film

General Characteristics

The PEC 831 is manufactured using a unique packaging process which allows the production of a compact body size for a given capacitance. This allows the designer to specify an automatically insertable, axial lead capacitor allowing higher circuit board densities than were previously possible. The general characteristics of the PEC 831 make it an ideal choice for general coupling, decoupling and filtering applications. All PPD capacitors are made in the U.S. and are available taped and reeled for automatic insertion.

Physical and Electrical Characteristics.

Capacitance range	1000 pF to 6.8 μF
Capacitance tolerance	±5%, ±10%, ±20%
Voltage Ratings AC ratings are at 60Hz	40VDC/24VAC, 100VDC/63VAC, 200VDC/125VAC, 400VDC/200VAC
Temperature range	−55°C to +125° C. Over 85°C the voltage is derated linearly to 50% at 125°C.
Moisture resistance	After 72 hours at 75°C and 95%RH, the IR shall exceed 30% of the initial requirement.
Dielectric and electrodes	Polyester film vacuum metallized with aluminum.
Coating	Conformally coated with epoxy. Coating material meets UL 94V-0.
Leads	Solder coated copper clad steel wire.
Temperature coefficient	See capacitance vs. temperature curve
Capacity stability	±2% over period of 2 years
Dielectric strength	160% rated DC voltage for 2 seconds.
Life test	140% rated DC voltage at 85°C for 250 hours.
Insulation resistance	C≤.33μF and V>100VDC: 30,000MΩ Min.
2 Min. Electrification, 25°C	C>.33μF and V ≥100VDC: 10,000 MΩ × μF Min.
10 VDC for V<100 VDC	C≤.1μF and V≤100VDC: 10,000 MΩ Min.
100VDC for V≥100VDC	C>.1μF and V<100VDC: 1,000 MΩ × μF Min.
Dissipation Factor	C≤1μF 0.8% max. (0.5% average) at 1KHz C>1μF 1.0% max. (0.6% average) at 1KHz
Self Inductance	10nH/cm along length of body and leads

MAXIMUM PULSE RISE TIME

	V/μs					
	CASE					
VDC	A	B	C	D	E	F
40V	6.2	3.6	1.9	1.5	1.1	0.84
63V	7.3	4.6	2.3	1.8	1.4	1.0
100V	12.1	7.3	3.8	2.9	2.3	1.7
200V	16.2	9.7	5.1	3.9	3.0	2.2
400V	51.0	25.0	11.6	8.6	6.5	4.7

Pulse Current = Cap. (μF) × Pulse Rise Time

CAP. μF	CASE A	B	C	D	E	F
.001	400					
.0012	400					
.0015	400					
.0018	400					
.0022	400					
.0027	400					
.0033	400					
.0039	400					
.0047	400					
.0056	200	400				
.0068	200	400				
.0082	200	400				
.01	200	400				
.012	200	—	400			
.015	200	—	400			
.018	200	—	400			
.022	200	—	—	400		
.027	200	—	—	400		
.033	100	200	—	400		
.039	100	200	—	400		
.047	100	200	—	400		
.056	63	200	—	400		
.068	63	100	200	—	400	
.082	63	100	200	—	400	
.1	63	100	200	—	400	
.12	40	100	—	200	400	
.15	40	63	100	200	400	
.18	40	63	100	200	400	
.22	40	63	—	200	—	400
.27		63	—	200	—	400
.33			63	100	200	400
.39			63	100	200	—
.47				100	200	—
.56				100	200	—
.68				63	200	—
.82				63	200	—
1.0				63	100	200
1.5					100	200
2.2					63	100
3.3					63	—
4.7						63
6.8			VOLTS			63

CASE SIZE

	A	B	C	D	E	F
	D x L	D x L	D x L	D x L	D x L	D x L
IN.	.177×.250	.177×.355	.195×.497	.247×.610	.345×.745	.347×.970
MM.	4.5×6.4	4.5×9.0	5.0×12.6	6.3×15.5	8.8×18.9	8.8×24.6

CAP. μF	VOLTAGE (DC) 40V	63V	100V	200V	400V
.001					A
.0012					A
.0015					A
.0018					A
.0022					A
.0027					A
.0033					A
.0039					A
.0047					A
.0056				A	B
.0068				A	B
.0082				A	B
.01				A	B
.012				A	C
.015				A	C
.018				A	C
.022				A	D
.027				A	D
.033			A	B	D
.039			A	B	D
.047			A	B	D
.056		A	B	B	D
.068		A	B	C	E
.082		A	B	C	E
.1		A	B	C	E
.12	A	B	B	D	E
.15	A	B	C	D	E
.18	A	B	C	D	E
.22	A	B	D	D	F
.27	B	B	D	D	F
.33	C	C	D	E	F
.39	C	C	D	E	
.47	D	D	D	E	
.56	D	D	D	E	
.68	D	D	E	E	
.82	D	D	E	E	
1.0	D	D	E	F	
1.5	E	E	E	F	
2.2	E	E	F		
3.3	E	E			
4.7	F	F			
6.8	F	F			

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PPC 830 Polypropylene Film/Foil

General Characteristics.

The PPC 830 is an axial lead, polypropylene film capacitor that features small size, low price and flame retardant coating. The electrical stability of polypropylene and its characteristic high resistance to moisture allow these units to retain their original capacitance over long periods of time without degradation due to changing environmental conditions. The PPC 830 has the excellent characteristics previously found only in polystyrene capacitors but offers a higher temperature rating and, of course, flame resistance. The low negative TC and very low dissipation factor of the PPC 830 provide for a stable frequency response curve and high Q in resonant and filtering circuit applications. Since the PPC 830 also exhibits high insulation resistance (I.R.) and low dielectric absorption (D.A.), it is a good choice for storage and timing circuit applications. All PPD capacitors are made in the U.S. and are available taped and reeled for automatic insertion.

Physical and Electrical Characteristics

Capacitance range	150pF to .56μF
Capacitance tolerance	±1% thru ±10%
Voltage ratings AC ratings are at 60Hz (higher voltages available upon request)	160VDC/90VAC, 400VDC/160VAC, 630VDC/200VAC
Temperature range	−55°C to 105°C. Over 85°C the voltage is derated linearly to 50% at 105°C.
Humidity range	95% RH max., 85% yearly average
Dielectric	Polypropylene film
Electrodes	Aluminum foil
Coating	Conformally coated with epoxy. Coating material meets UL 94V-0
Leads	Solder coated copper clad steel wire.
Temperature coefficient of capacitance	−150 ± 100 ppm/°C
Capacitance stability	< ± 0.5% drift over period of 2 years
Test voltage/Dielectric strength	2.5 x rated voltage for 2 seconds
Insulation resistance	> 100,000 MΩ after 2 mins. at 100V, 25°C
Life test	140% rated voltage at 105°C for 250 hrs.
Dissipation factor	≤ .07% at 10KHz
Dielectric absorption	< .05%
Self inductance	10nH/cm along length of body and leads
Max pulse rise time	500V/μ sec

	160VDC/90VAC				400VDC/160VAC				630VDC/200VAC			
	mm		in		mm		in		mm		in	
PF	D	L	D	L	D	L	D	L	D	L	D	L
150	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
220	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
330	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
470	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
680	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
735	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
820	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
1000	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
1500	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
2200	4.8	10	.188	.394	4.8	10	.188	.394	5.2	10	.205	.394
3300	4.8	10	.188	.394	4.8	10	.188	.394	6.1	10	.240	.394
4100	4.8	10	.188	.394	5.2	10	.205	.394	6.5	10	.255	.394
4300	4.8	10	.188	.394	5.2	10	.205	.394	6.6	10	.260	.394
4700	4.8	10	.188	.394	5.3	10	.210	.394	5.8	12	.230	.475
4900	5	10	.195	.394	5.5	10	.215	.394	6	12	.235	.475
5600	5	10	.195	.394	5.6	10	.220	.394	6.2	12	.245	.475
6800	5	10	.195	.394	6	10	.235	.394	6.7	12	.265	.475
8200A	6	10	.235	.394	—	—	—	—	—	—	—	—
8200B	5	12	.195	.475	5.6	12	.220	.475	7.1	12	.280	.475
MFD												
.01A	6.2	10	.245	.394	—	—	—	—	—	—	—	—
.01B	5	12	.195	.475	6.4	12	.250	.475	7.7	12	.305	.475
.013	5.5	12	.215	.475	6.9	12	.270	.475	8.5	12	.335	.475
.015	5.7	12	.225	.475	7.1	12	.280	.475	7.9	14.7	.310	.580
.018	6	12	.235	.475	7.5	12	.295	.475	8.3	14.7	.325	.580
.022	6.5	12	.255	.475	8	12	.315	.475	8.8	14.7	.345	.580
.025	6.9	12	.270	.475	7.9	14.7	.310	.580	9.5	14.7	.375	.580
.027	7.1	12	.280	.475	8.1	14.7	.320	.580	9.9	14.7	.390	.580
.033	7.6	12	.300	.475	8.9	14.7	.350	.580	9	18.3	.355	.720
.047	7.9	14.7	.310	.580	10.3	14.7	.405	.580	9.9	18.3	.390	.720
.056	8.8	14.7	.345	.580	11	14.7	.435	.580	10.4	18.3	.410	.720
.060	9	14.7	.355	.580	9.1	18.3	.360	.720	10.8	22	.425	.865
.068	9.4	14.7	.370	.580	10.3	18.3	.405	.720	11.4	22	.450	.865
.082	8.4	18.3	.330	.720	11.4	18.3	.450	.720	12.4	22	.490	.865
.1A	9.1	18.3	.360	.720	11.9	18.3	.470	.720	—	—	—	—
.1B	8.1	22	.320	.865	10.3	22	.405	.865	13.5	22	.530	.865
.15	9.5	22	.375	.865	11.8	22	.465	.865	13.9	25.1	.548	.990
.22	11.4	22	.450	.865	13	22	.510	.865				
.27	12.4	22	.490	.865								
.33	11.9	22	.470	.865								
.47	12.7	25.1	.500	.990								
.56	14	25.1	.550	.990								

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PPC 831 Metallized Polypropylene Film

General Characteristics

The PPC 831 is an axial lead, metallized polypropylene film capacitor featuring small size, high performance, low price and conformal encapsulation with a flame retardant coating.

The physical and electrical characteristics of polypropylene as a dielectric are commendable. Polypropylene is relatively impervious to moisture. It is also extremely stable. The PPC 831 will, therefore, retain its original properties over extended periods of time in a fluctuating environment.

Other noteworthy attributes of the PPC 831 are high insulation resistance (IR) and a low dielectric absorption (DA) factor. Both of these parameters are of critical importance in the selection of a sample-and-hold capacitor in data acquisition applications. The DA of polypropylene is about 10 times less than that of polyester and is significantly less than that of polycarbonate or polystyrene.

Also to be considered are the gently sloping curves for temperature coefficient (TC), dissipation factor (DF) and capacitance variation with frequency. The relatively flat response of the PPC 831 assures dependable, stable performance when incorporated into critical resonant and filtering circuit applications.

Physical and electrical characteristics:

Capacitance	Measured at 1,000 Hz
Capacitance range	1000 pF to 1.0 μF
Capacitance tolerance	1%, 2.5%, 5%, 10%, 20%
Voltage ratings AC ratings at 60 Hz	160 VDC/ 90 VAC, 250 VDC/ 220 VAC, 400 VDC/ 250 VAC, 630 VDC/ 300 VAC
Temperature range	−55°C to 105° C. Over 85°C the voltage is derated linearly to 50% at 105°C.
Dielectric	Aluminum metallized polypropylene film
Coating	Conformally coated with epoxy. Coating material meets UL 94V-0
Leads	Solder coated copper clad steel wire
Dissipation factor Measured at 25°C, 1 KHz	Less than .1%, Figures I & II
Dielectric absorption Per MIL-C-19978	Less than .05%, Figure III

Insulation resistance Rated voltage, 2 min. electrification

	+25°C	+85°C	+105°C
MΩ × μF	100,000	5,000	500
≤MΩ	200,000	10,000	1,000

Life test 1Ω/ Volt in series	1000 hours, 85°C, 140% voltage
Humidity	72 hours, 75°C, 95% R.H. (Ref. EIA RS377, IR shall exceed 30% of minimum)
Dielectric strength 100Ω/ Volt in series	200% rated voltage, 1 min.
Capacitance drift	± .5% over 2 years 20°C to 40°C, 40% to 60% R.H.
Temperature coefficient	Figure IV
Self inductance	10nH/cm along leads and body

MAXIMUM PULSE RISE TIME

	V/μs				
	CASE				
VDC	B	C	D	E	F
160V	8.3	4.6	3.5	2.7	2
250V	15.7	8	5.8	4.3	3.1
400V	21	10.7	7.8	5.8	4.2
630V	43	18.5	13	9.6	6.7

Pulse Current = Cap. (μF) × Pulse Rise Time

CAP. μF	CASE B	C	D	E	F
.001	630				
.0012	630				
.0015	630				
.0018	630				
.0022	630				
.0027	400	630			
.0033	400	630			
.0039	400	630			
.0047	400	630			
.0056	400	630			
.0068	400	630			
.0082	400	—	630		
.01	250	400	630		
.012	250	400	630		
.015	250	400	630		
.018	160	250	630		
.022	160	250	630		
.027	160	250	400	630	
.033	160	—	400	630	
.039	160	—	400	630	
.047	160	—	400	630	
.056		160	250	630	
.068		160	250	400	630
.082		160	250	400	630
.1		160	250	400	630
.12			160	400	630
.15			160	400	630
.18			160	250	400
.22			160	250	400
.27				250	400
.33				160	250
.39				160	250
.47				160	250
.56				160	250
.68				160	—
.82		VOLTS			160
1.0					160

CASE SIZE

	B D x L	C D x L	D D x L	E D x L	F D x L
IN.	.177×.355	.195×.497	.247×.610	.345×.745	.347×.970
MM.	4.5×9.0	5.0×12.6	6.3×15.5	8.8×18.9	8.8×24.6

CAP. μF	VOLTAGE (DC) 160V	250V	400V	630V
.001				B
.0012				B
.0015				B
.0018				B
.0022				B
.0027			B	C
.0033			B	C
.0039			B	C
.0047			B	C
.0056			B	C
.0068			B	C
.0082			B	D
.01		B	C	D
.012		B	C	D
.015		B	C	D
.018	B	C	D	D
.022	B	C	D	D
.027	B	C	D	E
.033	B	D	D	E
.039	B	D	D	E
.047	B	D	D	E
.056	C	D	E	E
.068	C	D	E	F
.082	C	D	E	F
.1	C	D	E	F
.12	D	E	E	F
.15	D	E	E	F
.18	D	E	F	
.22	D	E	F	
.27	E	E	F	
.33	E	F		
.39	E	F		
.47	E	F		
.56	E	F		
.68	E			
.82	F			
1.0	F			

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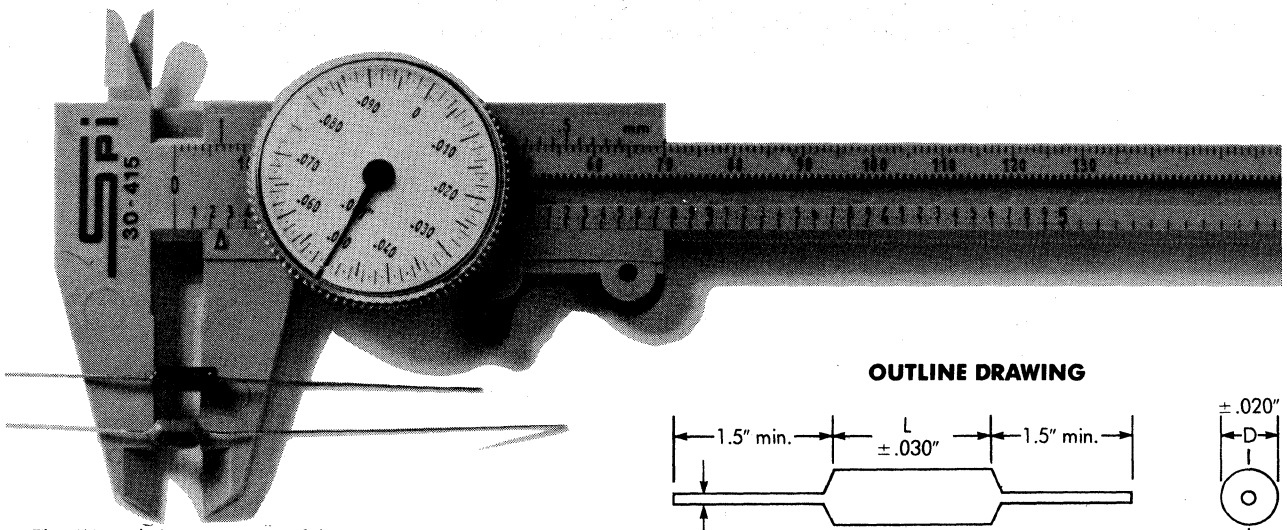
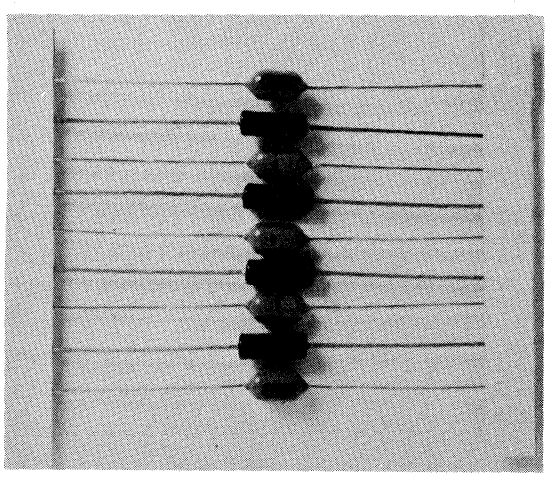


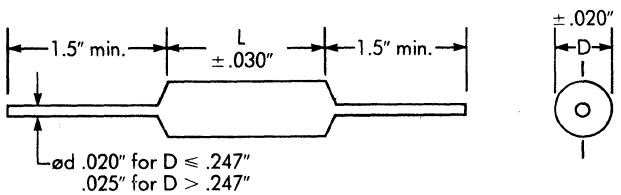
The "A" and "B" case sizes of the PPC 831 and PEC 831 style capacitors are computer designed with today's manufacturing and design criteria firmly in mind — namely, automation.

Until now, the most useful configuration for automated assembly, with respect to general bypassing, filtering and timing requirements, has been the box style capacitor. This is because the corresponding axial style devices are of physical proportions incompatible with automatic insertion equipment. Unfortunately, the box capacitor presents the modern factory with its own unique problems. An expensive radial insertion machine must be obtained. Box insertion requires an additional step in the assembly process which adds both direct and indirect production costs. In comparison, axials insert 3 times faster than radials.

PPD has been studying this situation for some time now. The culmination of this work has been the development of the "A" and "B" case film capacitors. The designer is now presented with the capability of specifying axial lead, automatically insertable, metallized film capacitors in the range of .001 μF to .27 μF. Examination of the dimensions of the "A" and "B" cases will reveal that, in length, they closely approximate the dimensions of RN55 and RN60 style resistors. Both "A" and "B" cases have a .177" ± .020" diameter. They can, therefore, be taped on 0.2" centers. Ultimately, these devices can be sequenced on standard axial lead insertion machinery to provide high volume, low cost production.



OUTLINE DRAWING



CASE SIZE

	A	B	C	D	E	F
	D x L	D x L	D x L	D x L	D x L	D x L
IN.	.177×.250	.177×.355	.195×.497	.247×.610	.345×.745	.347×.970
MM.	4.50×6.35	4.50×9.02	4.95×12.62	6.27×15.49	8.76×18.92	8.81×24.64

PART NUMBERING INFORMATION

PPC 830

PPC830 / 1003 B / 400 / 2.5

- 2.5 — Tolerance
- 400 — Voltage (DC)
- B — A or B where alternate sizes available
- 1003 — Capacitance in pF, 3 significant figures and multiplier, ex. .1uF = 100, 000pF = 1003
- PPC830 — Type: PPC 830

PPC831 and PEC 831

PEC831 / .001 / 250 / 5

- 5 — Tolerance
- 250 — Voltage (VDC)
- .001 — Capacitance in uF
- PEC831 — Type: PEC 831 or PPC 831

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Typical Performance Characteristics

— — — Polypropylene ——— Polyester

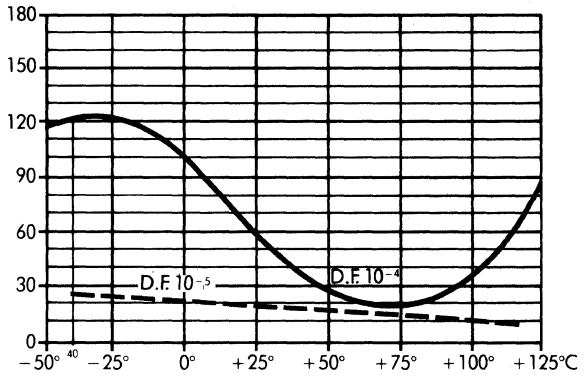

Fig. I *Dissipation factor variation with temperature*

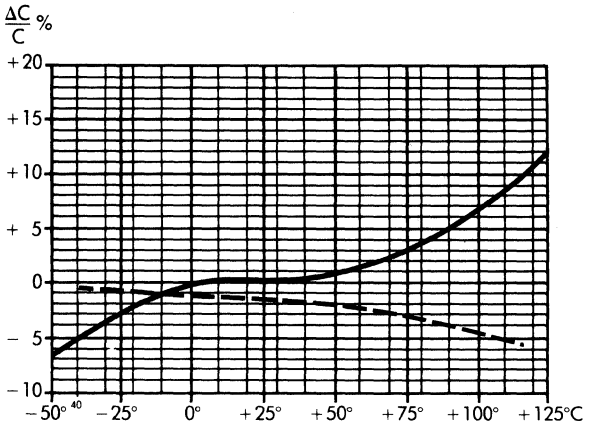

Fig. IV *Capacitance variation with temperature*

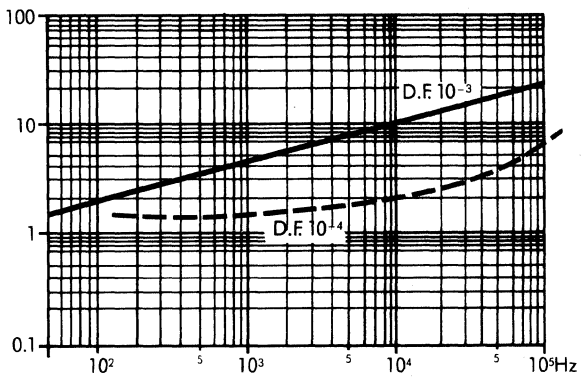

Fig. II *Dissipation factor variation with frequency*

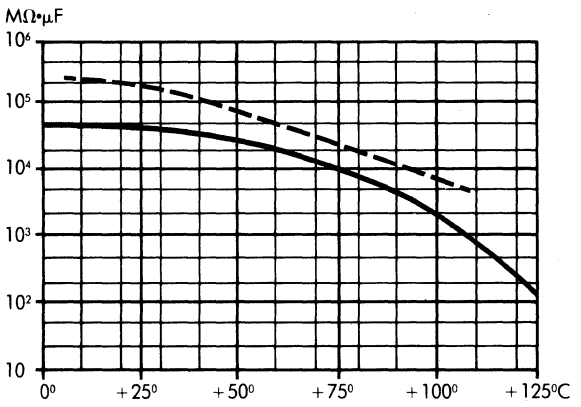

Fig. V *Insulation resistance variation with temperature*

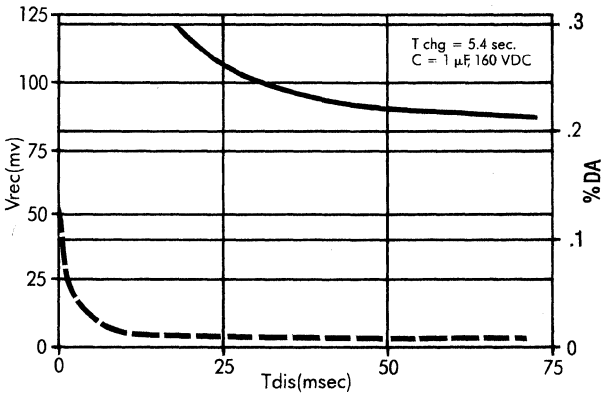

Fig. III *Dielectric absorption*

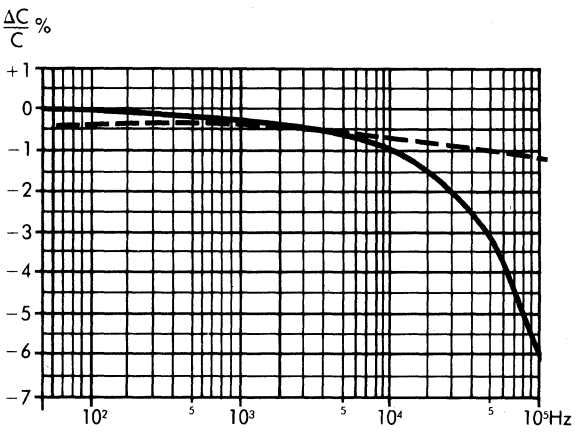

Fig. VI *Capacitance variation with frequency*

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PEB 731 Metallized Polyester "Box" Capacitors

Physical and Electrical Characteristics*

Capacitance range	1000 pF to 1.0μF
Capacitance tolerance	±5%, ±10%, ±20%
Voltage Ratings AC ratings are at 60Hz	50VDC/24VAC, 100VDC/63VAC, 200VDC/125VAC, 400VDC/200VAC
Temperature range	−55°C to +125°C. Over 85°C the voltage is derated linearly to 50% at 125°C
Moisture resistance	After 72 hours at 75°C and 95% RH, the IR shall exceed 30% of the initial requirement
Dielectric and electrodes	Polyester film vacuum metallized with aluminum
Leads	Solder coated copper clad steel wire
Capacity stability	±2% over period of 2 years
Dielectric strength	160% rated DC voltage for 2 seconds
Life test	140% rated DC voltage at 85°C for 250 hours

Dissipation Factor C≤1 μF 0.8% max. (0.5% average) at 1kHz
C>1 μF 1.0% max. (0.6% average) at 1kHz

MAXIMUM PULSE RISE TIME (V/μS)

	Lead Spacing	
Voltage VDC	.200"	.400"
50	4	—
63	8	3
100	10	6
250	—	11
400	—	20
630	—	30

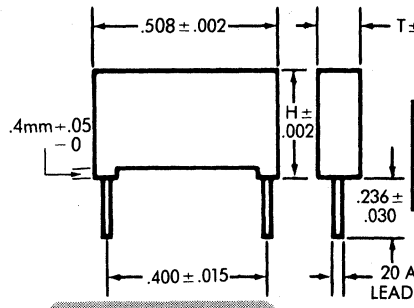
Pulse current = Cap. (μF) × Rise Time (V/μs)

*Additional Information Available on Request

	.400" (10mm) Lead spacing						.200" (5mm) Lead spacing		
CAP	63V DC/ 40V AC Case code	100V DC/ 63V AC Case code	250V DC/ 160V AC Case code	400V DC/ 200V AC Case code	630V DC/ 220V AC Case code	1000V DC/ 250V AC Case code	50V DC Case code	63V DC Case code	100V DC Case code
.001						A			A
.0012						A			A
.0015						A			A
.0018						A			A
.0022						A			A
.0027						A			A
.0033						A			A
.0039					A				A
.0047					A	B			A
.0056					A				A
.0068					A	C			A
.0082					A				A
.01					A				A
.012				A	*B				A
.015				A	*B				A
.018				A	*B				A
.022				A	*C				A
.027				A					A
.033			A	*B				A	
.039			A	*B				A	
.047			A	*C				A	
.056			A					A	
.068			A					A	
.082			A					A	
.1		A	*B/C				A	B	
.12		A	*C				A	B	
.15		A	*C				B	C	
.18		A	*C				B	C	
.22	A	*B					C	*D	
.27	A	*B					C	*D	
.33	A	*C					*D	*E	
.39	A	C					*D	*E	
.47	*B	C					*E	*F	
.68	B						*E	*F	
1.0	C						*F	*F	
1.5	C								

*Additional sizes also available

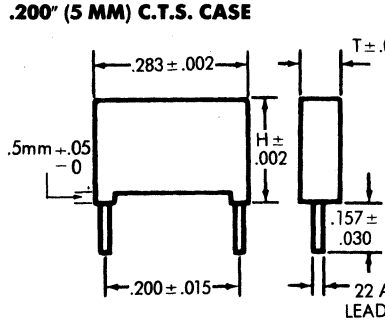
.400" (10 MM) C.T.S. CASE



CASE SIZE

	H	T
A	.354	.157
B	.433	.197
C	.472	.236

.200" (5 MM) C.T.S. CASE



CASE SIZE

	H	T
A	.256	.098
B	.256	.118
C	.295	.138
D	.335	.177
E	.394	.197
F	.433	.236

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SAC 931 Metallized Polypropylene Capacitors For AC Applications

SERIES-WOUND CONSTRUCTION

Engineered to reduce or eliminate corona problems

General Characteristics

The SAC931 is an axial lead, premium quality capacitor, designed for 50-60 Hz applications. Wound with metallized polypropylene, it has multilayer, spray deposited end connections, for low ESR, and reliable operation. The firmly wound series sections are housed with a tough, flame retardant outer wrap, and with epoxy end seals.

Physical and Electrical Characteristics

Capacitance	Measured at 1 KHz
Capacitance range	0.01μF to 3.0μF
Capacitance tolerance	±5%, ±10%, ±20%
AC voltage ratings (50-60Hz)	400, 480, 540, 600V AC
Temperature range	−55 to +85°C
Dielectric	Metallized polypropylene film
Case insulation	Flame retardant outer wrap
Leads	Tinned, copper clad, steel wire
DF at +25°C, 1 KHz	Less than 0.07%

Insulation resistance (100VDC, 2 minute electrification)

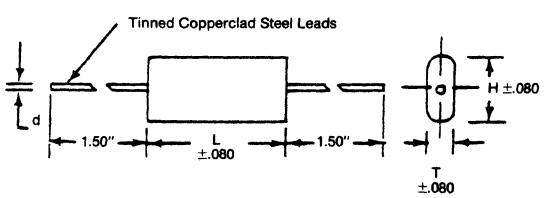
	+25°C	+85°C
MΩ × μF	100000	5000
MΩ	200000	10000

Additional information on request

STANDARD RATINGS

Dimensions in Inches — Voltage Ratings at +85°C

CAP μF	400VAC @ 60 Hz (600VDC)				480VAC @ 60 Hz (800VDC)				540VAC @ 60 Hz (1000VDC)				600VAC @ 60 Hz (1200VDC)			
	T	H	L	d	T	H	L	d	T	H	L	d	T	H	L	d
.01													.167	.311	1.187	.025
.018													.233	.324	1.187	.025
.022									.193	.292	1.187	.025	.250	.349	1.187	.025
.027					.168	.268	1.187	.025	.248	.348	1.187	.025	.278	.377	1.187	.025
.037					.201	.301	1.187	.025	.295	.395	1.187	.025	.328	.427	1.187	.025
.047	.166	.266	1.187	.025	.231	.331	1.187	.025	.336	.436	1.187	.025	.237	.484	1.50	.032
.10	.256	.356	1.187	.025	.352	.452	1.187	.025	.449	.549	1.187	.025	.382	.629	1.50	.032
.18	.230	.477	1.50	.032	.350	.597	1.50	.032	.460	.707	1.50	.032	.545	.792	1.50	.032
.22	.261	.508	1.50	.032	.369	.643	1.50	.032	.519	.766	1.50	.032	.522	.769	1.75	.032
.27	.297	.574	1.50	.032	.447	.694	1.50	.032	.584	.831	1.50	.032	.589	.836	1.75	.032
.33	.335	.600	1.50	.032	.504	.751	1.50	.032	.625	.872	1.50	.032	.663	.910	1.75	.032
.47	.440	.687	1.50	.032	.620	.867	1.50	.032	.714	1.09	1.75	.032	.812	1.06	1.75	.032
.68	.547	.794	1.50	.032	.620	.877	1.75	.032	.814	1.66	1.75	.040	.859	1.11	2.25	.040
1.0	.563	.810	1.75	.032	.763	1.01	1.75	.040	.886	1.13	2.25	.040				
1.5	.714	.961	1.75	.040	.852	1.10	2.25	.040								
2.0	.749	.996	1.75	.040												
2.7	.863	1.11	2.25	.040												
3.0	.912	1.16	2.25	.040												



Order by complete part number

SAC931 / .47 / 400 / K

- K — Capacitance Tolerance (J ± 5%, K ± 10%, M ± 20%)
- 400 — Voltage (VAC) rms @ 50-60 Hz
- .47 — Capacitance in μF
- SAC931 — Type: SAC931

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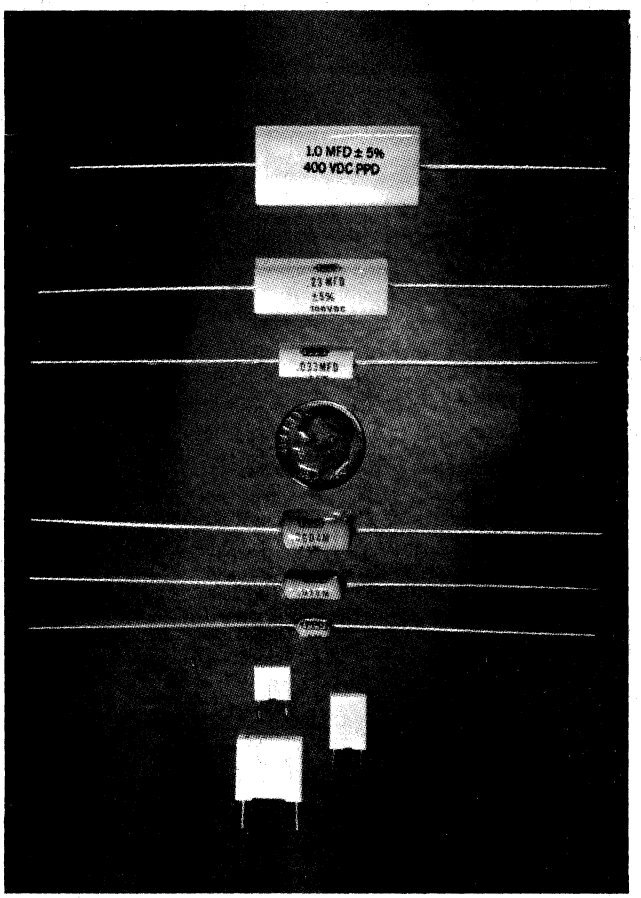

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Tight TC
High IR
Low DF
And more

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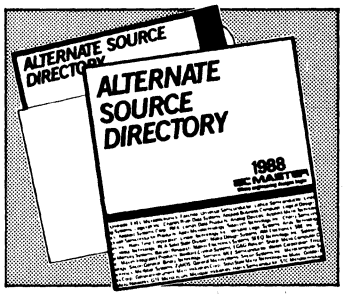

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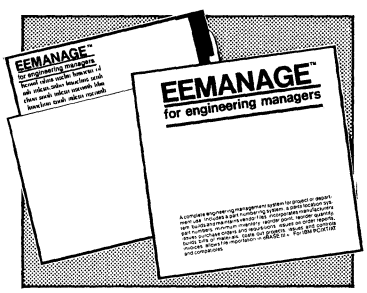

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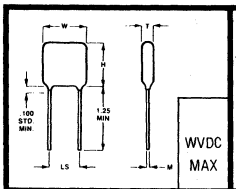
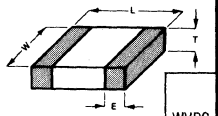
multilayer capacitor guide





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CAP VALUE	10	12	15	18	22	27	33	39	47	56	68	82	100	120	150	180	220	270	330	390	470	560	680	820	1000	1200	1500	1800	2200	2700	3300	3900	4700

		WVDC MAX
0805L	NPO	50V, 100V
SIZE	X7R	50V, 100V
L max. .120	Z5U	50V, 100V
W max. .160		
T max. .100		

		WVDC MAX
0805C	NPO	50V, 100V
SIZE	X7R	50V, 100V
L* .080	Z5U	50V, 100V
W* .050		
T max. .050		
E min. .010		

		WVDC MAX
1005L	NPO	50V, 100V
SIZE	X7R	50V, 100V
L max. .120	Z5U	50V, 100V
W max. .180		
T max. .100		

		WVDC MAX
1005C	NPO	50V, 100V
SIZE	X7R	50V, 100V
L** .098	Z5U	50V, 100V
W* .050		
T max. .050		
E min. .010		

		WVDC MAX
1206L	NPO	50V, 100V
SIZE	X7R	50V, 100V
L max. .130	Z5U	50V, 100V
W max. .210		
T max. .100		

		WVDC MAX
1206C	NPO	50V, 100V
SIZE	X7R	50V, 100V
L† .125	Z5U	50V, 100V
W* .060		
T max. .050		
E min. .010		

		WVDC MAX
1210L	NPO	50V, 100V
SIZE	X7R	50V, 100V
L max. .170	Z5U	50V, 100V
W max. .210		
T max. .100		

		WVDC MAX
1210C	NPO	50V, 100V
SIZE	X7R	50V, 100V
L† .125	Z5U	50V, 100V
W* .100		
T max. .050		
E min. .010		

		WVDC MAX
1505L	NPO	50V, 100V
SIZE	X7R	50V, 100V
L max. .120	Z5U	50V, 100V
W max. .235		
T max. .100		

		WVDC MAX
1505C	NPO	50V, 100V
SIZE	X7R	50V, 100V
L† .150	Z5U	50V, 100V
W* .050		
T max. .050		
E min. .010		

		WVDC MAX
1808L	NPO	50V, 100V
SIZE	X7R	50V, 100V
L max. .150	Z5U	50V, 100V
W max. .260		
T max. .100		

		WVDC MAX
1808C	NPO	50V, 100V
SIZE	X7R	50V, 100V
L† .180	Z5U	50V, 100V
W* .080		
T max. .050		
E min. .010		

		WVDC MAX
1812L	NPO	50V, 100V
SIZE	X7R	50V, 100V
L max. .200	Z5U	50V, 100V
W max. .260		
T max. .100		

		WVDC MAX
1812C	NPO	50V, 100V
SIZE	X7R	50V, 100V
L† .180	Z5U	50V, 100V
W† .125		
T max. .050		
E min. .010		

		WVDC MAX
2225L	NPO	50V, 100V, 250V, 500V
SIZE	X7R	50V, 100V, 250V, 500V
L max. .330	Z5U	50V, 100V, 250V, 500V, 1000
W max. .310		
T max. .100		

		WVDC MAX
2225C	NPO	50V, 100V, 250V, 500V
SIZE	X7R	50V, 100V, 250V, 500V
L† .225	Z5U	50V, 100V, 250V, 500V, 1000V
W†† .250		
T max. .050		
E min. .010		

		WVDC MAX
4040L	NPO	50V, 100V, 250V, 500V
SIZE	X7R	50V, 100V, 250V, 500V
L max. .425	Z5U	50V, 100V, 250V, 500V, 1000
W max. .415		
T max. .200		

		WVDC MAX
4040C	NPO	50V, 100V, 250V, 500V
SIZE	X7R	50V, 100V, 250V, 500V
L† .325	Z5U	50V, 100V, 250V, 500V, 1000V
W* .340		
T max. .100		
E min. .010		

TOLERANCES: * = ±.010, ** = ±.012, † = ±.015, †† = ±.020

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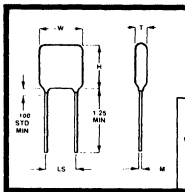

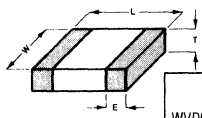

CAP CODE	562	682	822	103	123	153	183	223	273	333	393	473	563	683	823	104	124	184	224	274	334	394	474	564	684	824	105	125	155	185	225	335
CAP VALUE	5600	6800	8200	.01	.012	.015	.018	.022	.027	.033	.039	.047	.056	.068	.082	.100	.120	.180	.220	.270	.330	.390	.470	.560	.680	.820	1.00 mfd	1.20	1.50	1.80	2.20	3.30

		WVDC MAX
0805L	NPO	50V, 100V
SIZE	X7R	50V, 100V
L max. .120	Z5U	50V, 100V
W max. .160		
T max. .100		

		WVDC MAX
0805C	NPO	50V, 100V
SIZE	X7R	50V, 100V
L* .080	Z5U	50V, 100V
W* .050		
T max. .050		
E min. .010		

		WVDC MAX
1005L	NPO	50V, 100V
SIZE	X7R	50V, 100V
L max. .120	Z5U	50V, 100V
W max. .180		
T max. .100		

		WVDC MAX
1005C	NPO	50V, 100V
SIZE	X7R	50V, 100V
L** .098	Z5U	50V, 100V
W* .050		
T max. .050		
E min. .010		

		WVDC MAX
1206L	NPO	50V, 100V
SIZE	X7R	50V, 100V
L max. .130	Z5U	50V, 100V
W max. .210		
T max. .100		

		WVDC MAX
1206C	NPO	50V, 100V
SIZE	X7R	50V, 100V
L† .125	Z5U	50V, 100V
W* .060		
T max. .050		
E min. .010		

		WVDC MAX
1210L	NPO	50V, 100V
SIZE	X7R	50V, 100V
L max. .170	Z5U	50V, 100V
W max. .210		
T max. .100		

		WVDC MAX
1210C	NPO	50V, 100V
SIZE	X7R	50V, 100V
L† .125	Z5U	50V, 100V
W* .100		
T max. .050		
E min. .010		

		WVDC MAX
1505L	NPO	50V, 100V
SIZE	X7R	50V, 100V
L max. .120	Z5U	50V, 100V
W max. .235		
T max. .100		

		WVDC MAX
1505C	NPO	50V, 100V
SIZE	X7R	50V, 100V
L† .150	Z5U	50V, 100V
W* .050		
T max. .050		
E min. .010		

		WVDC MAX
1808L	NPO	50V, 100V
SIZE	X7R	50V, 100V
L max. .150	Z5U	50V, 100V
W max. .260		
T max. .100		

		WVDC MAX
1808C	NPO	50V, 100V
SIZE	X7R	50V, 100V
L† .180	Z5U	50V, 100V
W* .080		
T max. .050		
E min. .010		

		WVDC MAX
1812L	NPO	50V, 100V
SIZE	X7R	50V, 100V
L max. .200	Z5U	50V, 100V
W max. .260		
T max. .100		

		WVDC MAX
1812C	NPO	50V, 100V
SIZE	X7R	50V, 100V
L† .180	Z5U	50V, 100V
W† .125		
T max. .050		
E min. .010		

		WVDC MAX
2225L	NPO	50V, 100V, 250V, 500V
SIZE	X7R	50V, 100V, 250V, 500V
L max. .330	Z5U	50V, 100V, 250V, 500V, 1000V
W max. .310		
T max. .100		

		WVDC MAX
2225C	NPO	50V, 100V, 250V, 500V
SIZE	X7R	50V, 100V, 250V, 500V
L† .225	Z5U	50V, 100V, 250V, 500V, 1000V
W†† .250		
T max. .050		
E min. .010		

		WVDC MAX
4040L	NPO	50V, 100V, 250V, 500V
SIZE	X7R	50V, 100V, 250V, 500V
L max. .425	Z5U	50V, 100V, 250V, 500V, 1000V
W max. .415		
T max. .200		

		WVDC MAX
4040C	NPO	50V, 100V, 250V, 500V
SIZE	X7R	50V, 100V, 250V, 500V
L† .325	Z5U	50V, 100V, 250V, 500V, 1000V
W* .340		
T max. .100		
E min. .010		

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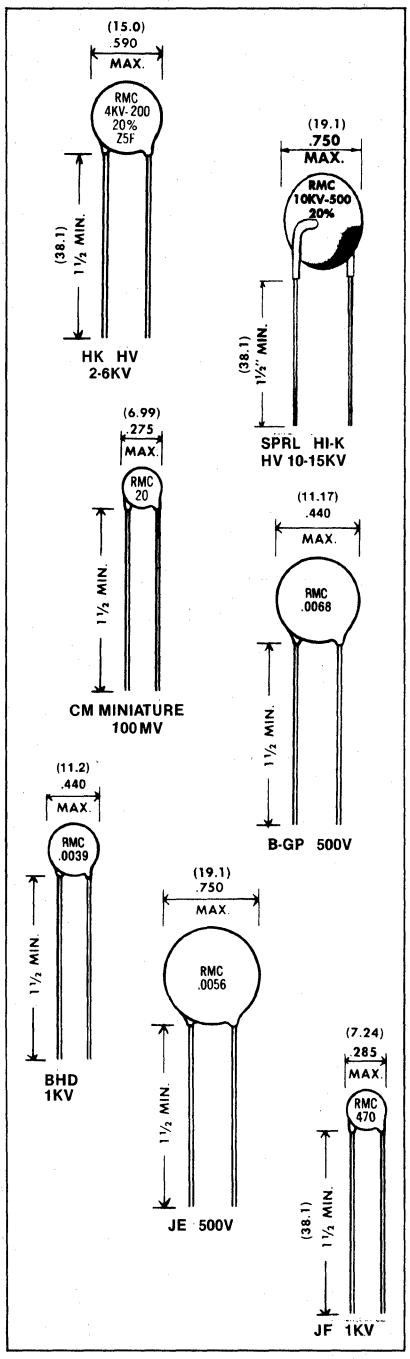
ceramic capacitor guide

CAPACITOR GUIDE

RMC TYPE	CAP. RANGE PICOFARADS 10^0	10^1	10^2	10^3	10^4	10^5	10^6	EIA CLASS	TEMP COEFFICIENT
MLC								1-2	
C								1	P100-N2200
B-GP								2	Z5U, Y5V
BA								2	Z5U, Y5U, X5U
JF								2	Z5F, Y5T, X5T
JL								2	Z5F, Y5F, X5F
JE								2	Z5E, Y5E, X5F
JK								2	Z5F, Y5F, X5F
CM								1	P100, N2200
BT								2	Z5U, Y5V
MAG								3	Z5T, Y5T, X5U
AU								1-2	
TCHV								1	N750, N2200
HKHV								2	Z5F, Z5U
B-HD								2	Z5U, Y5V



APPLICATIONS

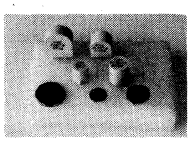
APPLICATIONS	TYPES	DESCRIPTION
Temp. Compensating	MLC, C, CM, AU, TCHV	Predictable linear variation of cap. over wide temp. range for use in HI-Q temp. compensating circuits.
Bypass	MLC, BGP, BA, BHD, BT, AU, HKHV	Audio bypass, filtering, coupling circuits, conservative ratings permit use where intermittant high voltage pulse may occur.
Freq. Stable	MLC, C, JF, JK, CM, AU, TCHV	Minimum variations in cap. & p.f. from low audio to high rf.
Temp. Stable	MLC, JF, JL, JE, JK	Economical replacement for paper or general purpose mica cap. in RC networks & feedback loops.
Miniature	MLC, CM, BT, MAG	Ideal for transistorized applications with 100V rating. Compatible with solid state circuitry.
U.L. & CSA Recognized	AU	UL recognized under std. 1414 for across the line. Also recognized for antenna coupling and line bypass applications.
High Voltage	AU, TCHV, HKHV	High voltage multiplier applications. Excellent temp. & freq., voltage stability. Anti-corona design.
Low Voltage	MLC, CM, BT, MAG	High cap. value over a limited temp. range.

EIA CLASS II CODE

LETTER SYMBOL	LOW TEMP. REQUIREMENT	NUMBER SYMBOL	HIGH TEMP. REQUIREMENT	LETTER SYMBOL	MAX. CAPACITANCE CHANGE OVER TEMP. RATING
				A	±1.0%
Z	+10°C	2	+45°C	B	±1.5
				C	±2.2
		4	+65°C	D	±3.3
				E	±4.7
Y	−30°C	5	+85°C	F	±7.5
				P	±10.0
		6	+105°C	R	±15.0
				S	±22.0
X	−55°C	7	+125°C	T	±22-33
				U	±22-56
				V	±22-82

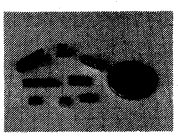
CERAMIC RESONATORS

Economical UNQUARTZ™ design for oscillators, clock generators, bandpass filters, freq. selective emitter bypass units and notch filters. See RMC Catalog No. R2-780-10M.

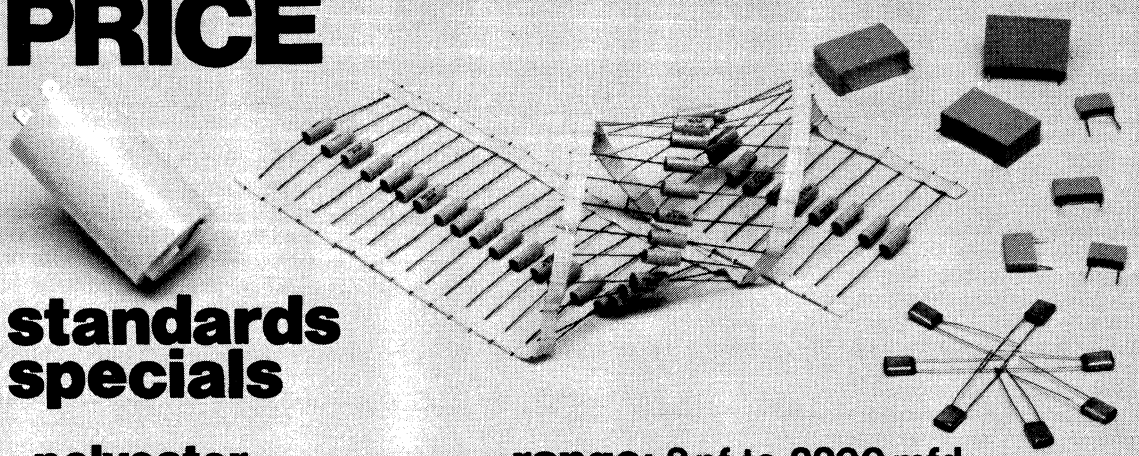


MULTIPLE SECTION CAPACITORS

These microminiature multiple section capacitors are uncased rectangular plate style parts rated for operation from 1KV to 6KV. The capacitors are formed using two to six sets of electrodes on a rectangular ceramic dielectric chip. Typical capacitance values range from 20pF to 70pF per section and MS capacitors can be designed to specific customer requirements.



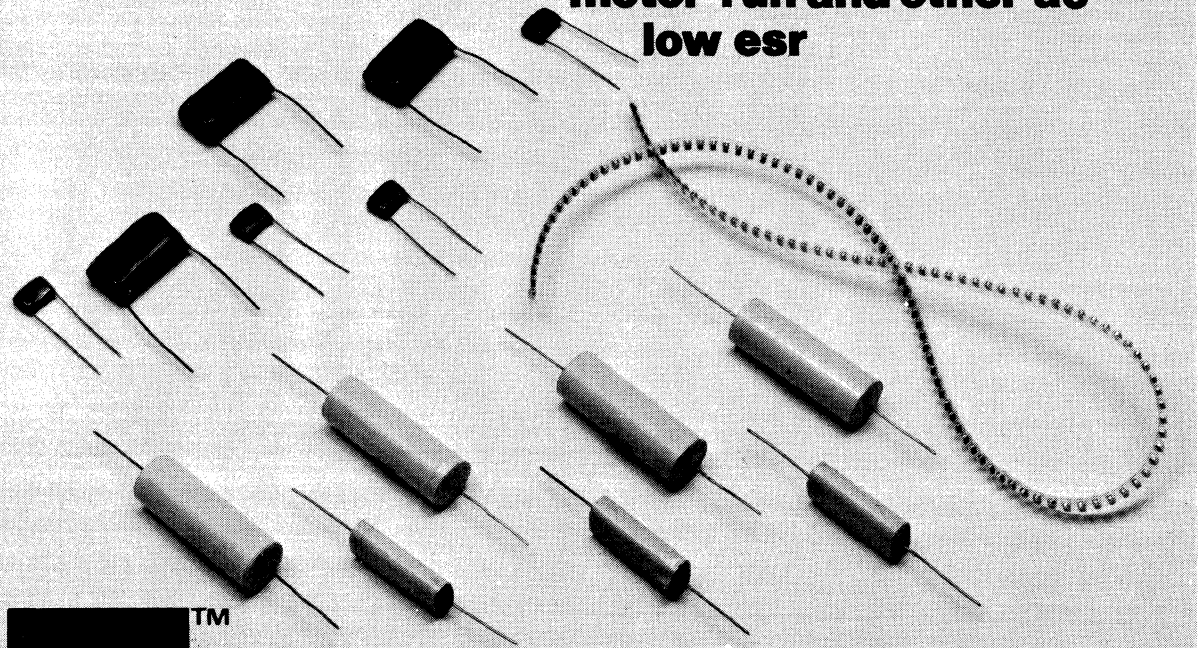
QUALITY
RELIABILITY
PRICE



standards
specials

- polyester
- polycarbonate
- polypropylene
- polystyrene
- tantalum

range: 3 pf to 2200 mfd
voltages: 15 vdc to 15,000 vdc
tolerance: ± 0.25% to ± 20%
approvals: UL, VDE, others
application information
motor run and other ac
low esr



SEACOR INC.
CAPACITORS

123 Woodland Ave. Box 541
Westwood, N.J. 07675
201-666-5600 Telex 135354
Fax: 201-664-8544

MINIGLOSSARY CAPACITORS

Anode: One of two plates or conductors. In polarized capacitors, the anode should be connected to the positive conductor in the circuit.

Capacitive Reactance: The measure of the opposition of a capacitor to accepting a charge and expressed in ohms. When direct current is applied under stated conditions capacitive reactance becomes a constant but, when alternating current is applied the capacitive reactance varies until an equilibrium is achieved and the capacitor appears to have only direct current present. This condition is commonly used in filter applications or in coupling circuits.

Cathode: One of two plates or conductors. In electrostatic capacitors the cathode is metallic. In electrolytic capacitors the cathode is a liquid, gel or other conductive material which is in intimate contact with a metallic cathodic connection.

Dielectric Constant: The measure of quality of the insulating materials in a capacitor. Dry air has a dielectric constant of one (1). Aluminum oxide used in aluminum electrolytic capacitors has a nominal dielectric constant of ten (10).

Electrolytic: A capacitor with one metallic conductor (generally the anode) and with a liquid or semiconductor cathode. Nonpolarized electrolytic capacitors generally have two equal anodes as well as the liquid cathode. These anodes operate alternately as anode and cathodic connection as alternating current is applied.

Electrostatic: One of two general classes of capacitors in which two or more discrete metallic conductors are present and separated by an insulating dielectric material. Examples include: mica, ceramic, film, and paper types.

Farad: The basic unit of measure in capacitors. A capacitor charged to one volt with a charge of one coulomb (one ampere flowing for one second) has a capacitance of one farad. Capacitors are generally rated at portions of a farad (microfarads or picofarads).

1 farad (F) = 1,000,000 microfarads (μF) 1 microfarad (μF) = 1,000,000 picofarads (pF)

Impedance: All capacitors exhibit impedance. It is a function of capacitor type and internal construction. This can be particularly important in certain applications such as filters for switching power supplies. Capacitors used in these applications often have special multiple tab construction to shorten current paths and to reduce internal resistance.

Leakage Current: Expressed as dcl for electrolytic capacitors, a measure of the intrinsic losses in a charged capacitor. Generally speaking, the lower the dcl, the higher quality the capacitor.

Power Factor: A measure of the overall efficiency of a capacitor. Power factor ratings take all internal losses into consideration in a complex formula. This parameter of certain capacitors is often very important in AC applications such as motor-start and/or motor-run capacitors.

Rated Voltage: The rated working voltage of a capacitor. Generally expressed in DC Volts (Vdcw). This is the voltage at which a capacitor may be safely operated at 25°C continuously within its overall parameters.

Ripple Current: The total amount of alternating and direct current that may be applied to an electrolytic capacitor under stated conditions. In general, the higher the ripple current applied, the shorter the operating life of the capacitor will be. Application of significantly higher than rated ripple currents can shorten the capacitor life dramatically and may even cause catastrophic failure (explosion).

Surge Voltage: The momentary surge voltage which may be applied for a stated length of time without doing permanent damage to the unit.

Temperature: Capacitors are generally rated at 25°C at sea level under specific humidity conditions. Operating temperature ranges are also given, along with derating (reliability) curves for operation at temperatures other than 25°C.

Temperature Coefficient: Expressed as TC in ppm (parts per million) or in percent (%) from the norm of 25°C. This is seldom a straight line and may vary widely for certain types. Most capacitors have positive TC in that the capacitance increases as temperature increases. Some types, however, have negative TC in that the capacitance decreases as temperature increases.

Ceramic Capacitor Codes
(Capacitance Given In pF)

Color	Digit	Multiplier	Tolerance			Temperature Coefficient ppm°C	Significant Figure	Multiplier
			Class 1		Class 2			
			10pF or less	Over 10pF				
Black	0	1	±2.0pF	±20%	±20%	0	0.0	—1
Brown	1	10	±0.1pF	±1%		—33		—10
Red	2	100		±2%		—75	1.0	—100
Orange	3	1000		±3%		—150	1.5	—1000
Yellow	4	10000			+100% —0%	—220	2.0	—10000
Green	5		±0.5pF	±5%	±5%	—330	3.3	+1
Blue	6					—470	4.7	+10
Violet	7					—750	7.5	+100
Gray	8	0.01	±0.25pF		+80% —20%	+150 to —1500		+1000
White	9	0.1	±1.0pF	±10%	±10%	+100 to —750		+10000
Silver								
Gold								

SIEMENS

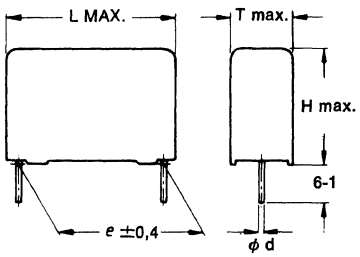
Film Capacitors—1987

• MKT Polyester • MKC Polycarbonate • KP Polypropylene

Self-healing capacitor with polyethyleneterephthalate dielectric. Encapsulated in a flame-retardant rectangular plastic case (in accordance with UL 94 V-O). Epoxy resin sealed for humidity resistance. For improved solderability, the package is provided with spacers. Connections: parallel leads, tinned, plug-in in the lead spacing. Particularly suited for space-saving assembly at high packing density on any pc board.

Quality assessment according to CECC 30 400 for these capacitors will be applied for.

Capacitors with 5 mm and 7.5 mm lead spacing, as well as capacitors with a lead spacing of 7.5/5 mm (leads crimped to a lead spacing of 5 mm) are also available on continuous tape. For taping specifications and ordering code information refer to data sheet B 32 071.



L	Lead spacing "e"	ϕd
7.2	5	0.5
10	7.5	0.6
13	10	0.6
18	15	0.8
27	22.5	0.8
31.5	27.5	0.8

Voltage Ratings	
DC	AC
63V	40V
100V	63V
250V	160V
400V	200V
630V	220V

	MKT							MKC				MKP		
Lead Spacing	Chip SMD	5	7,5	10	15	22,5	27,5	7,5	10	15	22,5	15 22,5 27,5	15 22,5 27,5	22,5 27,5
Ordering Code	B32595	B32529 B32539	B32520 B32530	B32521 B32531	B32522 B32532	B32523 B32533	B32524 B32534	B32550	B32551	B32552	B32553	B32650	B32655	B32656
100 pF														
150 pF														
220 pF														
330 pF														
470 pF														
680 pF														
1000 pF														
1500 pF														
2200 pF														
3300 pF														
4700 pF														
6800 pF														
0,01 µF														
0,015 µF														
0,022 µF														
0,033 µF														
0,047 µF														
0,068 µF														
0,1 µF														
0,15 µF														
0,22 µF														
0,33 µF														
0,47 µF														
0,68 µF														
1,0 µF														
1,5 µF														
2,2 µF														
3,3 µF														
4,7 µF														
6,8 µF														
10 µF														

Special Products Division
186 Wood Avenue South, Iselin, New Jersey 08830 U.S.A. Telephone (201) 906-4300

Siemens Components, Inc.

SPRAGUE GOODMAN

TRIMMER CAPACITORS

METALIZED AND WIREWOUND INDUCTORS

INSULATED TUNING TOOLS

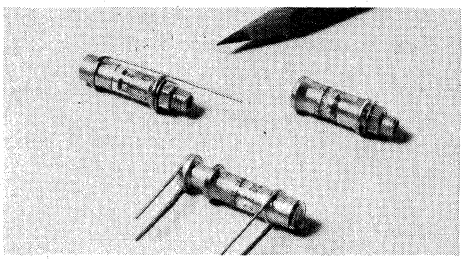
New Surface Mounted Surftrim® and Surfcap® Capacitors, and Surfcoil® Inductors

PISTONCAP®

Features:

- Low loss glass or quartz yields high Q
- Great stability — not affected by changing frequency, voltage, temperature, etc.
- Multi-turn tuning sensitivity • Sealed and unsealed versions
- Zero backlash • Reliable, long life adjust mechanism
- Variety of mounting styles and modifications
- Meets or exceeds applicable portions of MIL-C-14409, and Q.P.L. to many styles

For more information, see bulletins SG-205 and SG-208.

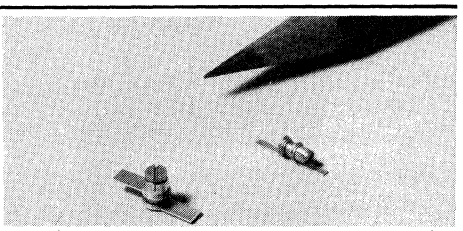


SAPPHIRE PISTONCAPS®

Features:

- Sapphire dielectric
- Very high Q at UHF and GHz frequencies
- Subminiature — smallest PISTONCAP® available
- 6 mounting styles
- Meets or exceeds applicable portions of MIL-C-14409D
- Available in +350 PPM/°C and zero TCC

For more information, see bulletins SG-207.

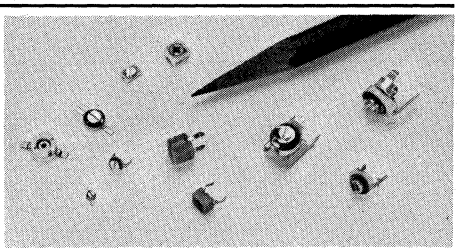


CERAMIC

Features:

- Available in leaded, and new SURFTRIM® surface mount configurations
- Very small size
- Straight line capacitance curve
- Low cost model for industrial and commercial applications
- High Q models available for use up to 2 GHz
- Ideal for Hybrid circuit applications
- Variety of mounting styles

For more information, see bulletin SG-305.

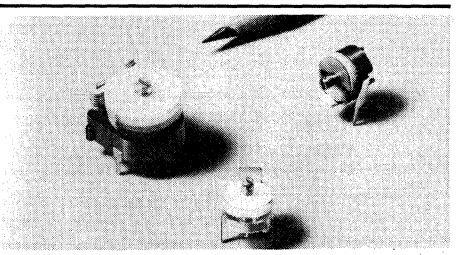


FILMTRIM®

Features:

- PTFE, Polypropylene, Polycarbonate, Polyimide Dielectrics
- Very wide capacitance ranges
- Compact, conserves board space
- Most stable TCC for size and $\triangle C$
- Highly resistant to humidity
- Low cost for commercial/industrial applications
- Most models tune from both sides

For more information, see bulletin SG-402.

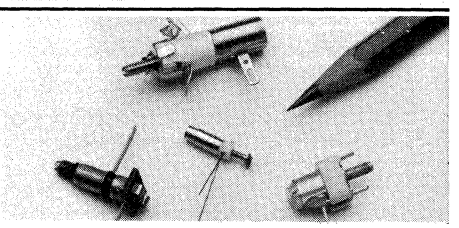


MULTI-TURN PLASTIC

Features:

- Top or bottom adjustment
- Straight line capacitance curve
- Stable and rugged construction
- Excellent characteristics at low cost
- Sensitive multi-turn adjustment
- Available in Polystyrene and PTFE Dielectrics

For more information, see bulletin SG-401.

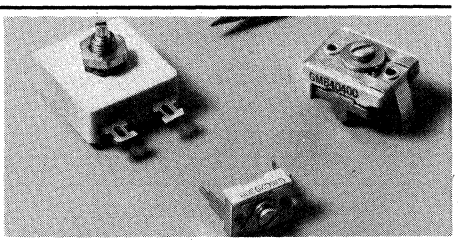


MICA COMPRESSION

Features:

- Very large capacitance ranges
- High Q
- Good R.F. current handling capacity
- Variety of forms and mounting arrangements
- Interchangeable with competitive types

For more information, see bulletin SG-500.



Sprague-Goodman Electronics, Inc.

(An Affiliate of the Sprague Electric Company)

134 FULTON AVE., GARDEN CITY PARK, N.Y. 11040-5395

TEL: 516-746-1385 • TELEX: 14-4533 • TWX: 510-600-2415 • FAX 516-746-1396

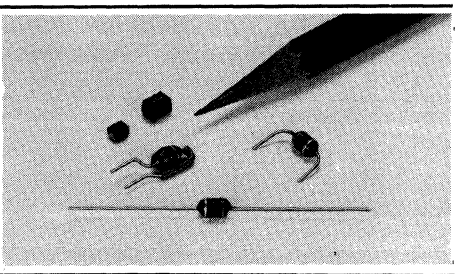
SPRAGUE GOODMAN

TRIMMER CAPACITORS

METALIZED AND WIREWOUND INDUCTORS
INSULATED TUNING TOOLS

New Surface Mounted Surftrim® and Surfcap® Capacitors, and Surfcoil® Inductors

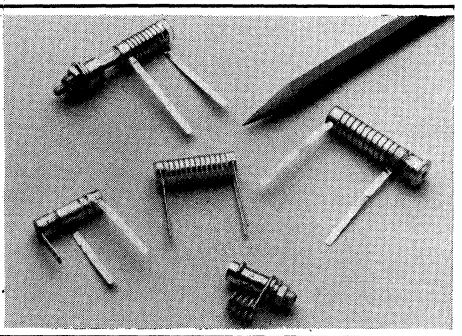
SURFCOIL® AND WIREWOUND INDUCTORS



Features:
- High Q
- High SRF
- Low DC resistance
- Wide range of values
- Surfcoil surface mounting and leaded (axial, radial or vertical) available
- Inductances from 0.22 to 1000 μH

For more information, see bulletins SG-800 and SG-900.

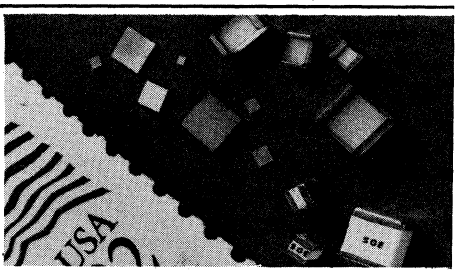
LC TUNERS/STAB-L® METALIZED INDUCTORS



Features:
- Optimum stability of inductance (0 ±10 PPM/°C)
- High Q
- Panel and P.C. mountings
- Simplicity of 1 component inductance/capacitance tuning

For more information, see bulletin SG-700.

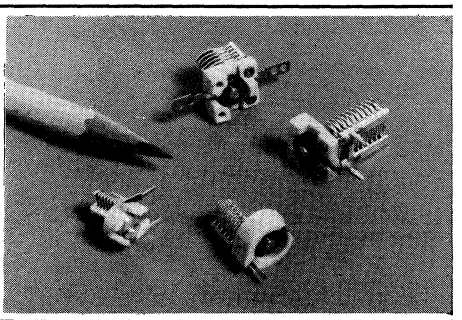
SURFCAP® HIGH FREQUENCY FIXED CAPACITANCE CHIPS



Features:
- 3 basic types: multi-layer; single layer end terminated; single layer face terminated
- High Q
- Low ESL
- Substrate and surface mounted
- Tight tolerance capability
- Full Mil temperature range capability

For more information, see bulletin SG-1000.

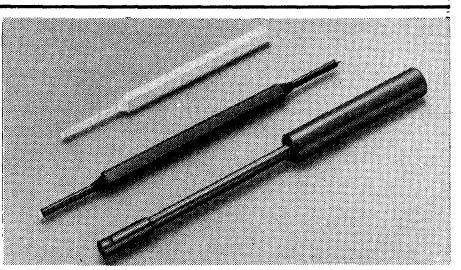
AIRTRIM® AIR DIELECTRIC
PARALLEL PLATE (SINGLE TURN)



Features:
- Rotor and stator machined from solid brass
- Oversized rotor bushing and secure rotor terminal for lowest contact resistance*
- Highest quality spring design for more uniform adjust torque and longer adjust life*
- Solid rivets are shrink fitted for sturdier stator mounting
- Most models are adjustable from both ends
- Full 360° sloted adjust head for secure engagement of tuning tool*

For more information, see bulletin SG-600.
* Standard Series

INSULATED TUNING TOOLS



Features:
- Hardened and plated steel tips
- Tough molded plastic bodies

For more information, see bulletin SG-206.

Sprague-Goodman Electronics, Inc.
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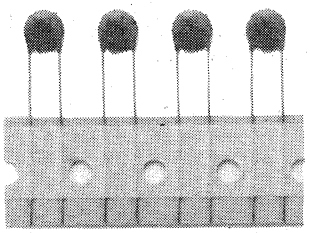
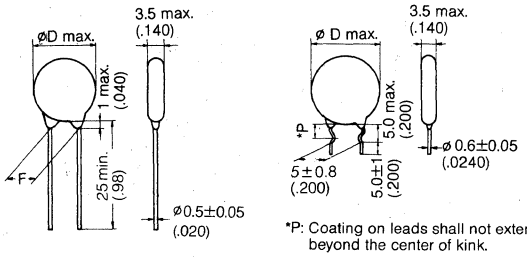
134 FULTON AVE., GARDEN CITY PARK, N.Y. 11040-5395
TEL: 516-746-1385 • TELEX: 14-4533 • TWX: 510-600-2415 • FAX 516-746-1396

CERAMIC CAPACITORS

TDK CORPORATION OF AMERICA HEAD OFFICE 1600 Feehanville Drive, Mount Prospect, IL 60056, U.S.A. Phone: (312) 803-6100 **CHICAGO REGIONAL OFFICE** Phone: (312) 803-6100 **INDIANAPOLIS REGIONAL OFFICE** Phone: (317) 872-0370 **NEW YORK REGIONAL OFFICE** Phone: (516) 625-0100 **LOS ANGELES REGIONAL OFFICE** Phone: (213) 539-6631 **DETROIT DISTRICT OFFICE** Phone: (313) 353-9393 **NEW JERSEY DISTRICT OFFICE** Phone: (201) 736-0023 **HUNTSVILLE DISTRICT OFFICE** Phone: (205) 539-4551 **GREENSBORO DISTRICT OFFICE** Phone: (919) 292-0012 **DALLAS DISTRICT OFFICE** Phone: (214) 506-9800 **SAN FRANCISCO DISTRICT OFFICE** Phone: (408) 437-9585 **TDK CORPORATION,** TOKYO, JAPAN



DIMENSIONS FOR CLASS I AND II



*P: Coating on leads shall not extend beyond the center of kink.

Dimensions in mm (inches)

CERAMIC DISC CAPACITORS-CLASS I, 50V

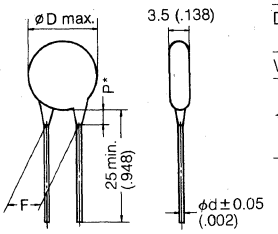
Dimensions mm (inches)		Rated capacitance (pF)			
D	Long lead F	TC*: CH (0±60)	RH (−220±60)	UJ (−750±120)	SL ($^{+350}_{-1000}$)
4 (.15)	2.5±1 (.100)	1 to 27	1 to 27	2 to 51	1 to 100
5 (.20)		33 to 47	33 to 56	56 to 82	120 to 180
6 (.24)		56	68	100, 120	220
6 (.24)	6±1 (.24)	68	82	150	270
7 (.28)		82, 100	100, 120	180, 220	330, 390
8 (.38)		120, 150	150, 180	270	470, 560
9 (.35)		180	220	330, 390	680
10 (.39)		220, 270	270	470	820, 1000
11 (.43)		—	330	560	—

*ppm/°C

CERAMIC DISC CAPACITORS-CLASS II, 50V

Dimensions mm (inches)		Rated capacitance (pF)		
D	Long lead F	T.C. : B (±10%)	D ($^{+20}_{-30}$ %)	F ($^{+30}_{-80}$ %)
4 (.15)	2.5±1	100 to 1000	1000, 1500	1000, 2200, 4700
5 (.20)		1200, 1500, 1800	2200	—
6 (.24)		2200	3300	10000
6 (.24)	5±1	2700	4700	—
7 (.28)		3300, 3900	6800	—
8 (.38)		4700, 5600	10000	22000
9 (.35)		6800	—	—
10 (.39)		8200	—	—
11 (.43)		—	47000	—

CERAMIC SEMI-CONDUCTIVE CAPACITORS-CLASS III, 16V, 25V, 50V



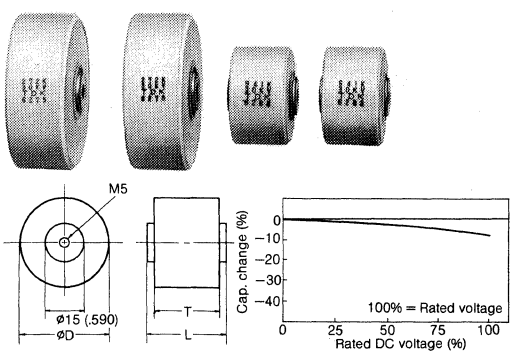
*P: SS45 1.5 max.
SC45 2 max.
Dimensions in mm (inches)

Vdc	Dimensions mm (inches) D	F	Rated capacitance (pF) TC : D ($^{+20}_{-30}$ %)	
16	5.5 (.22)	2.5 (.09)	47000	SS45
	6.9 (.27)	5 (.20)	100000	
	11 (.43)	5 (.20)	220000	
25	4.5 (.18)	2.5 (.09)	1000 to 10000	
	5 (.20)	2.5 (.09)	15000	
	6 (.24)	5 (.20)	22000	
	6.5 (.26)	5 (.20)	33000	
	7.5 (.30)	5 (.20)	47000	
	8.5 (.33)	5 (.20)	68000	
	11 (.43)	5 (.20)	100000	
50	5.5 (.22)	2.5 (.09)	10000	SC45
	7 (.28)	5 (.20)	22000	
	9 (.35)	5 (.20)	47000	
	11 (.43)	5 (.20)	100000	

ULTRA HIGH-VOLTAGE CAPACITORS

Patent numbers –
Japan; JP 52-4440/England; BP 1419284
West Germany; DP P2361, 2308/France; FR7416310
U.S.A.; USP 4058404

Specifications
Operating temperature range . . . . . −30°C to +85°C.
Capacitance . . . . . Within the specified tolerance at 25°C ability 1kHz, 5Vrms.
Withstand voltage . . . . . No breakdown at 1.5 times rated voltage, 5 sec.
tanδ (D.F.) . . . . . 0.1% max. at 25°C, 1 kHz, 5Vrms
Insulation resistance . . . . . 100,000 MΩ min. at 1 kVdc, 60 sec.
Temperature characteristics . . . . Z5T (10°C to 85°C)
AC corona starting voltage . . . . . 0.5 times rated voltage min. (50 Hz, rms)



Dimensions in mm (inches)

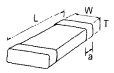
Rated voltage (kVdc)	Part No.	Rated capacitance (pF)	Capacitance tolerance (%)	Dimensions in mm (inches) D	T	L
20	UHV-1	1400	±10	38 (1.50)		
	UHV-2	2500		48 (1.89)	19 (.75)	23 (.91)
	UHV-3	4000		60 (2.36)		
30	UHV-4	940		38 (1.50)		
	UHV-5	1700		48 (1.89)	22 (.87)	26 (1.024)
	UHV-6	2700		60 (2.36)		
40	UHV-7	700		38 (1.50)		
	UHV-8	1300		48 (1.89)	28 (1.10)	32 (1.26)
	UHV-9	2000		60 (2.36)		
50	UHV-10	560		38 (1.50)		
	UHV-11	1000		48 (1.89)	31 (1.22)	35 (1.38)
	UHV-12	1700		60 (2.36)		

MULTILAYER CERAMIC CAPACITORS

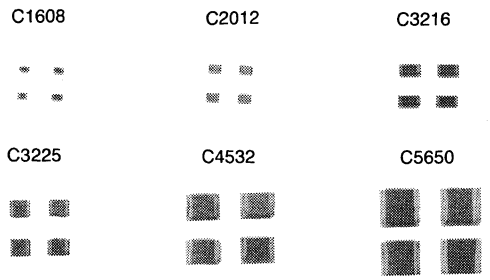
TDK CORPORATION OF AMERICA HEAD OFFICE 1600 Feehanville Drive, Mount Prospect, IL 60056, U.S.A. Phone: (312) 803-6100 **CHICAGO REGIONAL OFFICE** Phone: (312) 803-6100 **INDIANAPOLIS REGIONAL OFFICE** Phone: (317) 872-0370 **NEW YORK REGIONAL OFFICE** Phone: (516) 625-0100 **LOS ANGELES REGIONAL OFFICE** Phone: (213) 539-6631 **DETROIT DISTRICT OFFICE** Phone: (313) 353-9393 **NEW JERSEY DISTRICT OFFICE** Phone: (201) 736-0023 **HUNTSVILLE DISTRICT OFFICE** Phone: (205) 539-4551 **GREENSBORO DISTRICT OFFICE** Phone: (919) 292-0012 **DALLAS DISTRICT OFFICE** Phone: (214) 506-9800 **SAN FRANCISCO DISTRICT OFFICE** Phone: (408) 437-9585 **TDK CORPORATION,** TOKYO, JAPAN

MULTILAYER CERAMIC CHIP CAPACITORS

Shapes and dimensions — Dimensions in mm (inches)



Type	L	W	T max.
C1608	1.6±0.1 (.063)	0.8±0.1 (.031)	0.9 (.035)
C2012	2.0 $^{+0.3}_{-0.1}$ (.079)	1.25±0.2 (.050)	1.45 (.057)
C3216	3.2±0.2 (.126)	1.6±0.15 (.063)	1.3 (.05)
C3225	3.2±0.4 (.126)	2.5±0.3 (.098)	1.9 (.075)
C4532	4.5±0.5 (.177)	3.2±0.4 (.126)	1.9 (.075)
C5650	5.6±0.5 (.220)	5.9±0.5 (.197)	1.9 (.075)

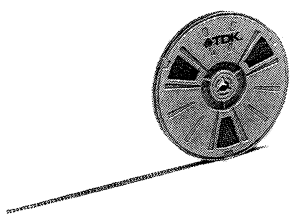


Packaging style

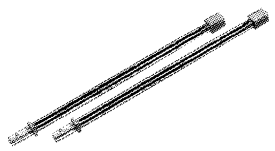
Type	Thickness (mm)	Packaging style		
		Bulk (B)	Magazine (M)	Taping (T)
C1608	0.9 max.	√		√
C2012	0.6±0.15	√	*	√
	0.85±0.15	√		√
	1.25±0.2	√		√
C3216	0.6±0.15	√	√	√
	0.85±0.15	√		√
	1.1±0.2	√	√	√
C3225	1.9 max.	√		*
C4532	1.9 max.	√		*
C5650	1.9 max.	√		

** Please contact TDK for in detail.*

Reel



Magazine



Temperature compensation, 50V

Type	Temperature characteristic	Rated capacitance (pF) T=0.6±0.15 (mm)	T=0.85±0.15 (mm)	T=1.1±0.2 (mm)	T=1.25±0.2 (mm)	T=0.9 (mm) max.	T=1.9 (mm) max.
C1608 (EIA: CC0603)	CH•C0G					0.5 to 220	
	SL					0.5 to 560	
C2012 (EIA: CC0805)	CH•C0G	0.5 to 390	430 to 680		750 to 1100		
	PH	0.5 to 300	300 to 470		510 to 820		
	RH	0.5 to 390	430 to 560		620 to 1000		
	SH	0.5 to 390	430 to 560		620 to 1000		
	TH	0.5 to 510	560 to 680		750 to 1000		
	UJ	0.5 to 560	620 to 1000		1100 to 1300		
	SL	0.5 to 1200	1300 to 1800		2000 to 2700		
C3216 (EIA: 1206)	CH•C0G	0.5 to 1000	1100 to 1800	2000 to 2200			
	PH	0.5 to 560	620 to 1000	1100 to 1500			
	RH	0.5 to 820	910 to 1500	1600 to 2200			
	SH	0.5 to 910	1000 to 1800	2000 to 2700			
	TH	0.5 to 910	1000 to 1800	2000 to 2700			
	UJ	0.5 to 1200	1300 to 2200	2400 to 3300			
	SL	0.5 to 2700	3000 to 4700	5100 to 6800			
C3225 (EIA: CC1210)	CH•C0G						750 to 3300
	SL						3000 to 8200
C4532 (EIA: CC1812)	CH•C0G						2400 to 5600
	SL						9100 to 18000
C5650 (EIA: CC2220)	CH•C0G						5100 to 10000
	SL						20000 to 33000

High dielectric constant, 50V, 25V

Type	Rated voltage (V)	Temperature characteristic	Rated capacitance (pF) T=0.6±0.15 (mm)	T=0.85±0.15 (mm)	T=1.1±0.2 (mm)	T=1.25±0.2 (mm)	T=0.9 (mm) max.	T=1.9 (mm) max.
C1608 (EIA: CC0603)	50	X7R Y5V					220 to 6800 1000, 2200, 4700, 10000, 22000	
C2012 (EIA: CC0805)	50	B	470 to 15000	18000 to 27000	33000, 39000			
		X7R	470 to 15000	18000 to 27000	33000, 39000			
	25	B	12000, 15000	18000 to 27000	33000, 47000			
		X7R	12000, 15000	18000 to 27000	33000, 47000			
	50	F Y5V	4700, 10000 22000	47000, 68000				
	25	F Y5V	22000, 47000	100000				
C3216 (EIA: CC1206)	50	B	470 to 39000	47000 to 68000	82000, 100000			
		X7R	470 to 39000	47000 to 68000	82000, 100000			
	25	B	12000 to 39000	47000 to 68000	82000, 100000			
		X7R	12000 to 39000	47000 to 68000	82000, 100000			
	50	F Y5V	4700, 10000 22000, 47000, 100000		220000			
	25	F Y5V	47000, 100000		220000			
C3225 (EIA: CC1210)	50	X7R						56000 to 150000
		Y5V						220000, 470000
C4532 (EIA: CC1812)	50	X7R						180000, 220000
		Y5V						1000000 (1μF)
C5650 (EIA: CC2220)	50	X7R						270000 to 470000
		Y5V						1500000 (1.5μF)

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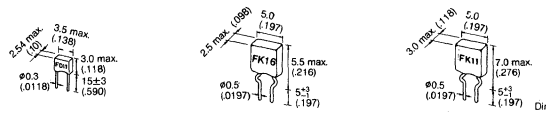
DIPPED RADIAL LEADS-FD11, FK11, FK16, FK20, FK22, FK26, FD23

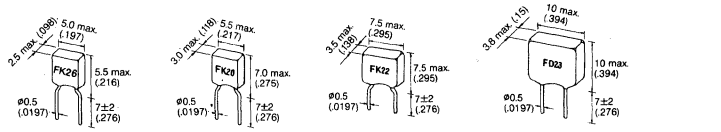
Lead space 2.5 mm (.098)



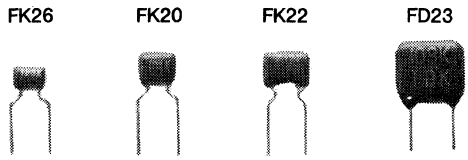
Dimensions in mm (inches)

Type	TC	Capacitance (pF) C0G	SL	X7R·Y5R		Y5V	
	WV	50V(1H)	50V(1H)	50V(1H)	25V(1E)	50V(1H)	25V(1E)
FD11		0.5 to 560	0.5 to 1,800	1,000 to 22,000	27,000 to 39,000	10,000, 15,000, 22,000 33,000, 47,000	68,000, 100,000
FK16		0.5 to 680	0.5 to 2,700	1,000 to 47,000	56,000 to 100,000	10,000, 15,000, 22,000 33,000, 47,000, 68,000 100,000	150,000, 220,000
FK11		750 to 3,300	3,000 to 8,200	56,000 to 150,000	180,000	150,000, 220,000, 330,000 470,000	
Capacitance tolerance		0.5 to 50pF ±0.5pF(D), ±25pF(C) 6 to 10pF ±0.5pF(D), ±1.0pF (F)	Over 10pF ±10%(K), ±5%(J)	±10%(K), ±20%(M)		+80 −20%(Z)	

Lead space 5.0 mm (.197)



Dimensions in mm (inches)

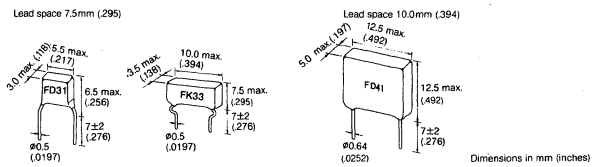


Type	TC	Capacitance (pF) C0G	SL	X7R·Y5R		Y5V	
	WV	50V(1H)	50V(1H)	50V(1H)	25V(1E)	50V(1H)	25V(1E)
FK26		0.5 to 680	0.5 to 2,700	1,000 to 47,000	56,000 to 100,000	10,000, 15,000, 22,000 33,000, 47,000, 68,000 100,000	150,000, 220,000
FK20		750 to 3,300	3,000 to 8,200	56,000 to 150,000	180,000	150,000, 220,000, 330,000 470,000	
FK22		3,600 to 5,600	9,100 to 18,000	180,000 to 270,000	330,000	470,000, 680,000, 1,000,000 (1μF)	1,500,000 (1.5μF)
FD23		6,200 to 27,000	20,000 to 68,000	330,000 to 820,000		1,500,000 to 4,700,000	
Capacitance tolerance		0.5 to 50pF ±0.5pF(D), ±25pF(C) 6 to 10pF ±0.5pF(D), ±1.0pF(F)	Over 10pF ±10%(K), ±5%(J)	±10%(K), ±20%(M)		+80 −20%(Z)	

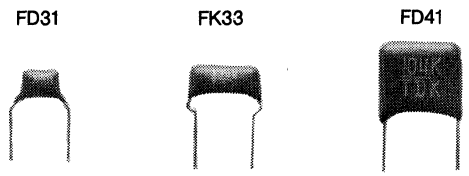
DIPPED RADIAL LEADS-FD31, FK33, FD41

Lead space 7.5mm (.295)

Lead space 10.0mm (.394)

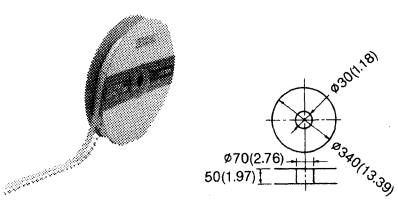


Dimensions in mm (inches)

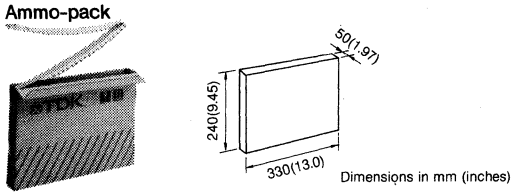


Type	TC	Capacitance (pF) C0G	SL	X7R·Y5R		Y5V	
	WV	50V(1H)	50V(1H)	50V(1H)	25V(1E)	50V(1H)	25V(1E)
FD31		750 to 3,300	3,000 to 8,200	56,000 to 150,000	180,000	100,000, 150,000 220,000, 330,000 470,000	
FK33		3,600 to 5,600	9,100 to 22,000	180,000 to 330,000	390,000	470,000, 680,000 1,000,000 (1μF)	1,500,000 (1.5μF)
FD41		30,000 to 33,000	75,000 to 100,000	1,000,000 to 1,200,000		6,800,000 (6.8μF)	
Capacitance tolerance		±10%(K) ±5%(J)		±20%(M) ±10%(K)		+80 −20%(Z)	

Reel



Ammo-pack



Dimensions in mm (inches)

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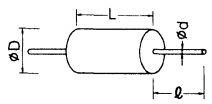
MOLDED AXIAL LEADS-MA12, MA13, MA14



MA12

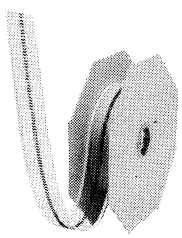
MA13

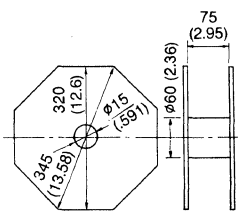
MA14

Type	Dimensions, mm (inches)			
	L	D	d	ℓ
MA12	4.06±0.25 (.16)	2.29±0.25 (.09)	$0.5^{+0.1}_{-0.03}$ (.02)	25 min. (.984)
MA13	6.35±0.25 (.25)	2.29±0.25 (.09)	$0.5^{+0.1}_{-0.03}$ (.02)	25 min. (.984)
MA14	9.91±0.25 (.39)	3.56±0.25 (.14)	$0.64^{+0.1}_{-0.03}$ (.025)	25 min. (.984)

		Capacitance (pF)							
Type	TC	C0G		SL		X7R		Y5V	
	WV	50V(1H)	100V(2A)	50V(1H)	100V(2A)	50V(1H)	100V(2A)	50V(1H)	100V(2A)
MA12		0.5 to 560	0.5 to 390	0.5 to 1,800	0.5 to 1.200	1,000 to 22,000	1,000 to 12,000	10,000, 15,000, 22,000, 33,000 47,000, 68,000, 100,000	10,000 15.000 22,000, 33,000
MA13		620 to 1,500	430 to 1,000	2,000 to 4,700	1,300 to 3,900	27,000 to 100,000	15,000 to 39,000	150,000, 220,000	47,000, 68,000 100,000
MA14		1,600 to 6,800	1,100 to 4,300	5,100 to 18,000	4,300 to 15,000	120,000 to 220,000	47,000 to 150,000	330,000, 470,000 680,000	150,000, 220,000 330,000
Capacitance tolerance		Up to 10pF ±0.5pF(D), ±0.25pF(C)		Over 10pF ±10%(K), ±5%(J)		±20%(M),	±10% (K)	+80% −20%(Z)	

Reel



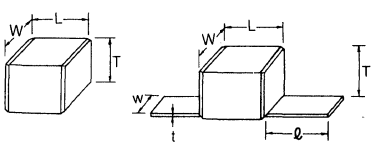


Dimensions in mm (inches)

LOW-LOSS CAPACITORS FOR HIGH FREQUENCIES-FC, FR, HR

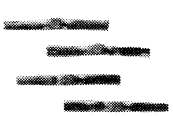
Low-loss capacitors for high frequencies are designed for application in 100 to 1000MHz high-frequency power circuits. They are characterized by an excellent frequency response, a high Q factor, and superior resistance solder heat.

FC1414, FC2828 FR1414, FR2828



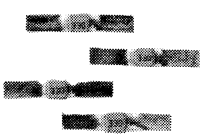
FC1414

FR1414



FC2828

FR2828



Dimensions in mm (inches)

Type	L	W	T	ℓ	w	t	p
FC1414	1.4±0.3 (.055)	1.4±0.3 (.055)	1.6 max (.063)	—	—	—	—
FC2828	$2.8^{+0.5}_{-0.3}$ (.11)	2.8±0.4 (.11)	3.0 max (.12)	—	—	—	—
FR1414	1.4±0.4 (.055)	1.4±0.3 (.055)	1.6 max (.063)	2 min. (.08)	1.3±0.3 (.05)	$0.1^{+0.3}_{-0.01}$ (.004)	—
FR2828	$2.8^{+0.5}_{-0.3}$ (.11)	$2.8^{+0.5}_{-0.3}$ (.11)	3.0 max. (.12)	2 min. (.08)	2.2±0.3 (.09)	$0.1^{+0.3}_{-0.01}$ (.004)	—

Type	Rated voltage	Capacitance (pF) C0G	X7R
FC1414 FR1414	50V (1H)	0.5 to 100	150 to 3,300
FC2828 FR2828	500V (2H)	0.5 to 100	—
	300V (2F)	110 to 180	—
	200V (2D)	200 to 470	—
	100V (2A)	510 to 560	—
	50V (1H)	620 to 1,000	470 to 22,000

Capacitance tolerance	0.5 to 5pF ±0.25pF (C) ±0.5pF (D)	6 to 10pF ±0.5pF (D) ±1.0pF (F)	Over 10pF ±5% (J) ±10% (K)	±10% (K) ±20% (M)

MINIGLOSSARY
BASIC CAPACITOR FORMULAS

I. Capacitance (farads)

English: $C = \frac{.224\,K\,A}{t_D}$

Metric: $C = \frac{.0884\,K\,A}{t_D}$

II. Energy stored in capacitors (Joules, watt-sec)

$E = \frac{1}{2}\,CV^2$

III. Linear charge of a capacitor (Amperes)

$I = C\frac{dV}{dt}$

IV. Total Impedance of a capacitor (ohms)

$Z = \sqrt{R_s^2 + (X_C - X_L)^2}$

Where Rs = ESR

V. Capacitive Reactance (ohms)

$X_C = \frac{1}{2\pi fC}$

VI. Inductive Reactance (ohms)

$X_L = 2\pi fL$

VII. Phase Angles:

Ideal Capacitors: Current leads voltage 90°
Ideal Inductors: Current lags voltage 90°
Ideal Resistors: Current in phase with voltage

VIII. Dissipation Factor

$DF = \tan\delta\ (\text{loss angle}) = \frac{ESR}{X_c} = (2\pi fC)\ (ESR)$

IX. Power Factor

PF = Sine δ (loss angle) = Cos φ (phase angle)
PF = DF (when less than 10%)

X. Quality Factor (dimensionless)

$Q = \text{Cotan}\ \delta\ (\text{loss angle}) = \frac{1}{DF}$

XI. Equivalent Series Resistance (ohms)

$ESR = (DF)\ (Xc) = (DF)\ (\frac{1}{2}\pi fC)$

XII. Power Loss (watts)

Power loss $= (2\pi fCV^2)\ (DF)$

XIII. KVA (Kilowatts)

$KVA = 2\pi fCV^2 \times 10^{-3}$

XIV. Temperature Characteristic (ppm/°C)

$TC = \frac{Ct - C_{25}}{C_{25}\ (T_t - 25)} \times 10^6$

XV. Cap Drift (%)

$C.D. = \frac{C_1 - C_2}{C_1} \times 100$

XVI. Reliability of Ceramic Capacitors

$\frac{L_o}{L_t} = \left(\frac{V_t}{V_o}\right)^x \left(\frac{T_t}{T_o}\right)^\tau$

XVII. Capacitors in Series (current the same)

Any number: $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} \text{---} + \frac{1}{C_N}$

Two: $C_T = \frac{C_1 C_2}{C_1 + C_2}$

XVIII. Capacitors in Parallel (voltage the same)

$C_T = C_1 + C_2 \text{---} + C_N$

XIX. Aging Rate

A.R. = % Δ C/decade of time

XX. Decibels

$db = 20 \log \frac{V_1}{V_2}$

Metric prefixes:

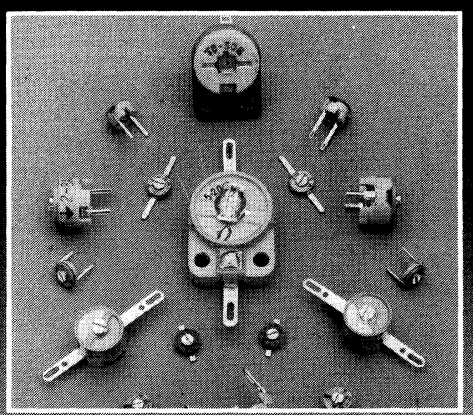
Pico	X 10^{-12}
Nano	X 10^{-9}
Micro	X 10^{-6}
Milli	X 10^{-3}
Deci	X 10^{-1}
Deca	X 10
Kilo	X 10^3
Mega	X 10^6
Giga	X 10^9
Tera	X 10^{12}

Symbols:

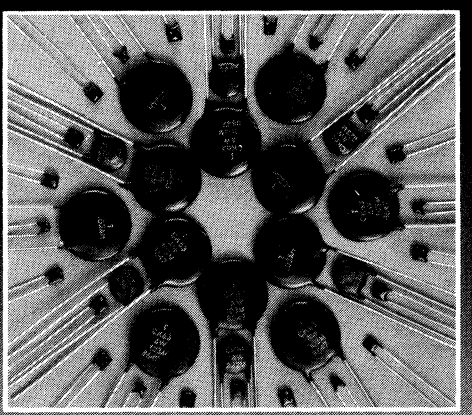
K = Dielectric Constant
A = Area
t_D = Dielectric thickness
V = Voltage
t = time
R_s = Series Resistance
f = frequency
L = Inductance
δ = Loss angle
φ = Phase angle
x + y = Exponent effect of voltage and temp
L_o = Operating life
L_t = Test life
V_t = Test voltage
V_o = Operating voltage
T_t = Test temperature
T_o = Operating temperature

TUSONIX

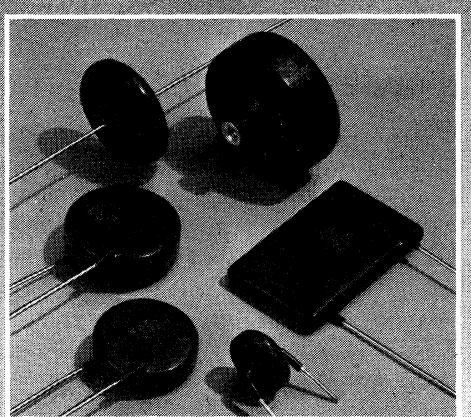
If you're looking for a reliable source for Ceramic Capacitors and Custom Dielectrics



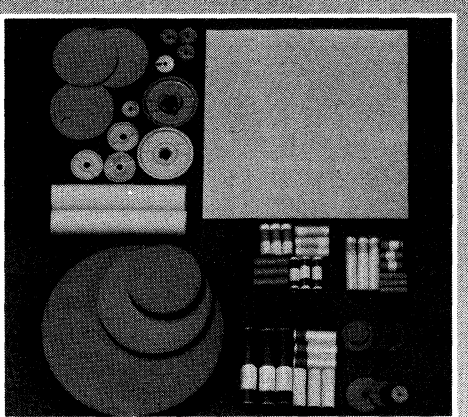
Ceramic Trimmer Capacitors



Single Plate and Disc Ceramic Capacitors



High Voltage Ceramic Capacitors



Custom Ceramic Dielectrics

Tusonix has the product versatility, QPL approvals and delivers what you want, when you want it.

Tusonix should be your first source for reliable fixed and variable capacitors, custom ceramic dielectrics and EMI/RFI ceramic filters. Single plate Weecon ceramic capacitors have long been an industry standard, offering the widest selection of ceramic formulations and miniature package sizes available. Our variable ceramic capacitors are available in an almost endless variety of capacitance ranges and miniature sizes. In addition, Tusonix offers a broad range of ceramic capacitor types, including high voltage, tubular, disc, stand-off and feed-thrus. Tusonix' extensive ceramic technology and manufacturing capabilities enable us to satisfy special dielectric needs with extensive shapes, sizes and technical formulations.

So if you're looking for a consistently reliable source, look to Tusonix first. Please call 602-744-0400.

TUSONIX

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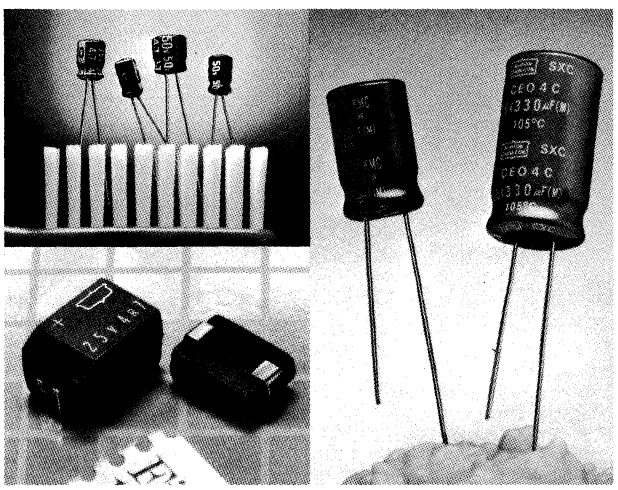
Phone: 602-744-0400 Telex: (RCA) 299-640
FAX: 602-744-6155

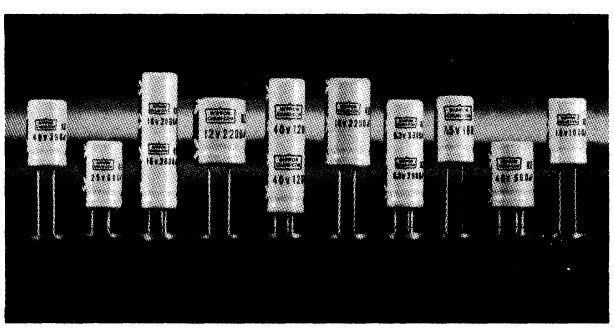
UNITED CHEMI-CON

The LEADER in Aluminum Electrolytic Capacitors for over 50 Years. Today, More Popular Than Ever!

Wider Product Range

The latest technology enables United Chemi-Con to offer a wider choice of capacitors than ever before. High gain foil increases our capacitors' volumetric efficiency. We can build smaller and smaller capacitors without diminishing performance. We also are designing more capacitors that meet special needs, such as low leakage current, without sacrificing other electrical characteristics. And our expanding series of solvent-proof capacitors can be inserted on PC boards along with other components before soldering and cleaning with halogenated solvents. Whatever your needs, we have the capacitors to meet them.



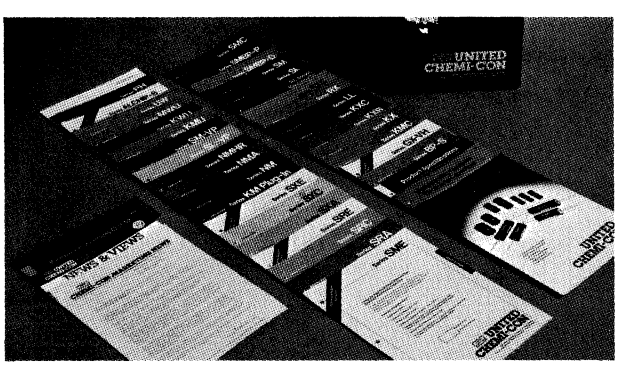


Expanded Facilities

In 1983 United Chemi-Con opened a new 54,000 square foot warehouse in Compton, California. The most advanced computer systems link this warehouse with our Corporate Headquarters in Rosemont, Illinois. In 1984 we opened a Western Region Branch Sales Office in Compton. It provides full-scale services to our Western customers.

Engineering & Technical Support

A team of applications engineers at Corporate Headquarters answers engineering questions, cross-references parts and reviews drawings. They are readily accessible to our customers by telephone. Our product data sheets, newsletters and catalogs set the standard for the industry. Send for our Full Line Catalog detailing the widest variety of aluminum electrolytic capacitors available from any one manufacturer in the world.



UNITED CHEMI-CON

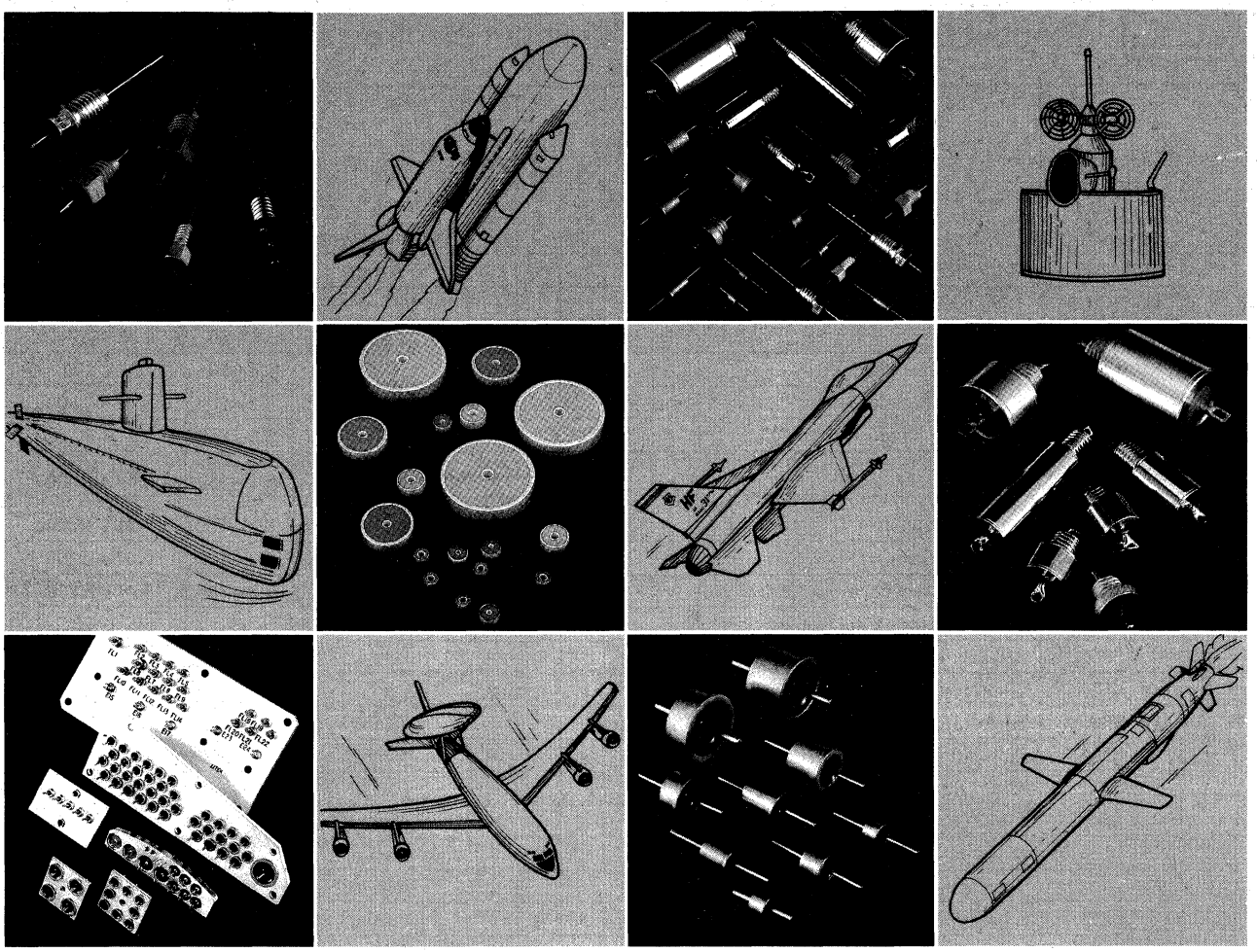
UNITED CHEMI-CON INC.

9801 West Higgins Road, Rosemont, Illinois 60018
312-696-2000 TWX 910-253-2964 TLX 28-3557
Western Region Branch Sales Office:
213-537-7720 TWX 910-997-8025 TLX 66-4707

WORLD LEADER OVER 50 YEARS OF CAPACITOR QUALITY

Product Selection Guide for Aluminum Electrolytic Capacitors

	Series	Features	General	Miniaturization	Long life	Low impedance	Solvent-proof	Terminal type	Rated voltage range (VDC)	Capacitance range (μF)
Miniature	SRE-T	Super Miniature, φ2x5.5lmm		●				Axial	4~50	0.47~4.7
	AL CHIP-S	Chip type		●				—	6.3~50	0.1~22
	AL CHIP-MT	Chip type		●				—	4~50	0.47~4.7
	AL CHIP-MV	Vertical type Chip		●				—	4~50	0.1~100
	SME	General, Miniature	●	●			●	Axial, Radial	6.3~250	0.47~22,000
	KME	General, Miniature (105°C)	●	●	●		●	Axial, Radial	6.3~250	0.47~22,000
	SM, SMC	General	●				SMC ●	Axial, Radial	6.3~450	0.47~10,000
	KM, KMC	General (105°)	●		●		KMC ●	Axial, Radial	6.3~250	0.47~10,000
	SM-BP (D)	Bi-Polar, General	●					Axial, Radial	6.3~100	0.47~2,200
	SM-BP (P)	Bi-Polar, Crossover network	●					Axial, Radial	6.3~100	0.47~2,200
	BP (S)	Bi-Polar, Horizontal Deflection						Radial	25	2.2~10
	SRE	Miniature, Height 5mm		●				Radial	4~50	0.1~100
	KRE	Miniature, Height 5mm (105°)		●	●		●	Radial	4~50	0.1~100
	SRA	Miniature, Height 7mm		●				Radial	4~63	0.1~220
	KMA	Miniature, Height 7mm (105°C)		●	●		●	Radial	4~63	0.1~220
	SR	Short length		●				Radial	6.3~50	0.1~3,300
	SRC	Short length		●			●	Radial	6.3~50	0.1~3,300
	LL	Low leakage						Radial	6.3~100	0.1~4,700
	LR	Low leakage, Epoxy end seal						Radial	6.3~50	0.1~100
	SXE	Low impedance, Miniature (105°C)		●	●	●	●	Radial	6.3~100	1.5~15,000
	SXC	Low impedance (105°C)			●	●	●	Radial	6.3~63	1~2,200
	RXC & RX	Low impedance (105°C)				●	RXC ●	Radial	10~100	2.2~1,000
	RZ	Low ESR (105°C)			●	●	●	Radial, 3 lead	7.5~250	15~16,500
	RZA	Low ESR, 5000 hrs life (105°C)			●	●	●	Radial, 3 lead	6.3~250	56~33,000
	LX	Long life, 5000 hrs life (105°C)			●		●	Radial	10~250	0.47~2,200
	GX	High reliability (130°C)			●			Axial, Radial	10~63	0.47~1,000
Large Sized	SM-VP	3 terminal, large CV value	●					3 lead radial	10~100	470~22,000
	KRF	Miniature, large CV (105°C)		●	●		●	Radial	10~250	68~39,000
	NMA	General		●				Plug-in	10~400	82~15,000
	BKA	General, Low Profile		●				Plug-in	10~400	82~15,000
	SME	General, Miniature	●	●				Plug-in	10~400	82~22,000
	KME	General, Miniature (105°C)	●	●	●			Plug-in	10~400	39~47,000
	KM	General (105°C)						Plug-in	10~400	47~33,000
	NMHR	Miniature, High ripple		●				Plug-in	160~250	100~1,000
	GX-VH	High reliability (130°C)		●	●			Radial	10~250	56~18,000
	MWU	Computer Grade		●				Screw, Terminal	6~450	75~1,600,000
	UW	Computer Grade	●					Screw, Terminal	10~450	80~390,000
	KMU	Computer Grade (105°C)	●		●			Screw, Terminal	10~400	220~390,000
	KWU	Computer Grade (105°C)			●	●		Screw, Terminal	10~100	1000~100,000
Special New Products	FLS	Flat Package	●	●				Radial Leads	10~250	33,000~470
	SB	Memory Back Up		●				Radial	5.5	2200~47,000
	SXJ	Low Impedance (105°C)		●	●	●		Radial	4~16	11~820
	FLK & FLS	Flat Package (105°C)		●	●	●		Radial	10~250	33,000~470
	RW PH	For Inverter, High Ripple For Photo Flash		●	● ●			Screw, Bolt Radial PCB	250~450 200~360	220~15,000 50~1,500



HIGH RELIABILITY EMI FILTERS

US MICROTEK EMI FILTER PRODUCTS

Discoidal Feedthru Style

- SERIES 097D, 127D, 127A, 190B, 190F, 265F, 335E, 340A
  Frequency Range – 300KHz-26GHz.
  Voltage Range – 50-200VDC/125VAC.
  Capacitance Range – .003MFD-1.5MFD.

Solder-In Style

- SERIES ZZ, ZS, YS, XS, WS
  Frequency Range – 50KHz-26GHz.
  Voltage Range – 50-300VDC.
  Capacitance Range – 10pF-1.2MFD.

Bolt Style

- SERIES SA, SB, SH, SP, SN
  Frequency Range – 500KHz-26GHz.
  Voltage Range – 50-200VDC/125VAC, 400Hz.
  Capacitance Range – 25 pF-.2MFD.

Cylindrical Style

- SERIES BL, BK, CK, GK, JD
  Frequency Range – 14KHz-10GHz.
  Voltage Range – 50-400VDC/230VAC, 400Hz.
  Capacitance Range – .01MFD-1.4MFD.

Reliability Screening, to Levels R, B and S.

SERVICES AND CAPABILITIES:

Engineering

- Computer aided design capability.
  Large applications engineering staff available to provide applications solutions. R & D - new product development. Sample/prototype capability.

APPLICATIONS

Military

- Electronic Warfare, Electronic Counter-Measures, Guidance, Communications Command Control, Avionics, Weapon Systems, and EMP/Lightning.

Space

- Satellite, SDI, Space Station, Shuttle, and Reentry Vehicles.

Medical

- Heart Pacemakers, Blood Analyzers, Medication Monitors, and Instrumentation

Industrial Instrumentation

- Spectrum Analyzers, and Network Analyzers.

Other Products:

US Microtek also offers a broad line of Hi Rel MLC capacitors in chip, axial and radial leaded configurations. Specialty products include Hi Voltage, Hi Current, Hi Temperature (175°C, 200°C) and Low ESR devices.

US microtek components
A DIVISION OF UNITRODE CORPORATION

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Precision Trimmer Capacitors

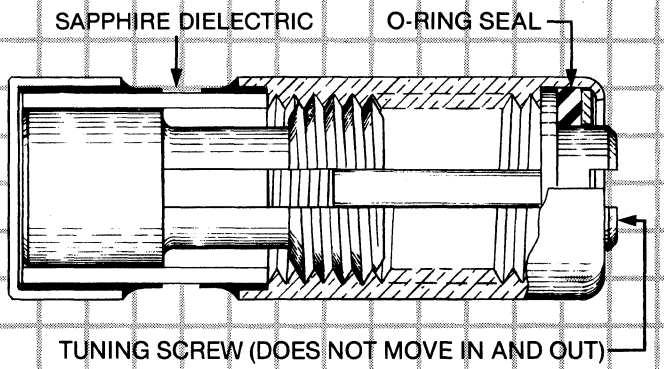
Non-Rotating Piston

24 Years of Fine Tuning

Your critical tuning problems can be solved by this broad line of unique, precise trimmers. Maximum values from 1.2 pF to 300 pF with high Q from 1 MHz to over 10 GHz. Proven applications include crystal filters and oscillators, phase shifters, RF amplifiers, cellular radio, and communication equipment. Over 100 parts are MIL qualified.

Basic to most Voltronics designs are:

- Internal O-ring seal
- Multiturn high resolution
- Non-rotating piston
- Extreme stability
- Long life



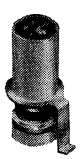
Teflon Film

- Surface mount
- 2.5 & 8.5 pF max C
- Q — 500 & 1000 at 250 MHz
- Usable over 5 GHz
- Smallest precision type

Air

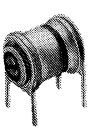
- Sealed (no cap)
- 10 & 14 pF max C
- Q — 5000 at 100 MHz
- Usable over 1.5 GHz
- "A" line — MIL, alumina case
- "E" line, economical, plastic case

Sapphire



- Sealed and meets MIL specs
- 1.2, 2.5, 4.5 & 8 pF max C
- Q — 4-5000 at 250 MHz
- Usable over 10 GHz

Glass & Quartz



- Non-rotating, linear design
- 1.2 to 300 pF max
- Q and frequency dependent on style
- Dozens of MIL styles
- Most range in smallest size

Custom Designs

Let us modify a standard part or design a new one for you.

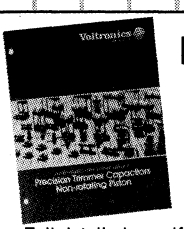
Active present fields are:

- RF high voltage (over 3 KV at 300 MHz)
- Non-magnetic styles for NMR and MRI
- Very long life for continuous use
- Dual trimmers
- Variable capacitor-inductors
- Sealed, surface mount

Engineering Kits

- Separate kits available for each product line
- You select mix of parts
- Inexpensive way to stock design labs
- Typical — Any 28 "E" parts at $75

Free New Catalog



- 22 pages with extensive application notes
- Full detailed specifications
- Latest MIL recommended styles
- Request separate non-magnetic catalog

Voltronics
CORPORATION

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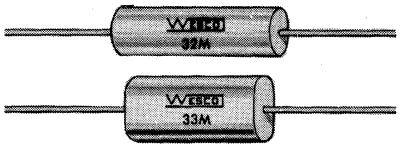
WESCO® POLYESTER FILM-FOIL CAPACITORS



SPECIFICATIONS

DIELECTRIC WITHSTANDING VOLTAGE

200% of rated voltage applied through a minimum limiting resistance of 100 Ohms/Volt. Duration of voltage stress shall be 15 seconds minimum and 1 minute maximum at 25°C.

TEMPERATURE RANGE

−55°C to +85°C with full rated voltage applied. To +125°C with 50% of rated voltage.

INSULATION RESISTANCE

At 25°C after 2 minutes of electrification at rated voltage or 500 VDC, whichever is less, the minimum product of Insulation Resistance and Capacitance shall be 100,000 megohms-microfarads, but need not exceed 100,000 megohms.

DISSIPATION FACTOR

Shall not exceed 0.75% when measured at 25°C and 1000 Hz, ±20 Hz. See characteristic curves for D.F. ratings at other temperatures.

CAPACITANCE AND TOLERANCE

Shall be measured within the tolerance limits specified. Measurements will be made at 25°C and 1000 Hz ±20 Hz.

LIFE TEST

Shall withstand 140% of rated voltage at 85°C for 250 hours. One failure in twelve shall be permitted.

CAPACITANCE STABILITY (DRIFT)

Less than 0.50% when measured in the following manner: three capacitance readings at 25°C, each made prior to and after temperature cycling from room to 80°C, and room to −55°C. The mathematical difference between the two extremes, divided by the intermediate value, and then multiplied by 100, yields the stability expressed in percent.

HUMIDITY RESISTANCE

Meets requirements of Mil-C-27287,, Para. 3.12 when tested in accordance with Mil-STD.-202C, Method 103 B, Condition B.

LEAD PULL AND BEND TEST

Steady pull of 5 pounds applied axially to leads for one minute. Bend test shall consist of one bend from the point of egress, first 90° in one direction, back to the original axial position, and then 90° in the opposite direction with no evidence of breakage.

FEATURES

Wrap and fill construction.

Tubular or oval configuration for optimum space savings.

Extended foil design.

Quality control procedures per Mil-Q-9858.

Will meet or exceed Mil-C-27287.

APPLICATIONS

Computers

Data Processing Equipment

Peripheral Equipment

Aircraft and Missile Systems

Industrial Instrumentation

Navigation and Distance Measuring Equipment

Communications Equipment

Filters

TYPE 32M RATINGS AND DIMENSIONS

Capacity in Mfds.	100 VOLTS B	L	Cat. No. 32M — K-1	200 VOLTS B	L	Cat. No. 32M — K-2	400 VOLTS B	L	Cat. No. 32M — K-4	600 VOLTS B	L	Cat. No. 32M — K-6
.001	.187	.40	1001	.187	.40	1001	.187	.53	1001	.187	.53	1001
.0012	.187	.40	1201	.187	.40	1201	.187	.53	1201	.187	.53	1201
.0015	.187	.40	1501	.187	.40	1501	.187	.53	1501	.187	.53	1501
.0018	.187	.40	1801	.187	.40	1801	.187	.53	1801	.187	.53	1801
.0022	.187	.40	2201	.187	.40	2201	.187	.53	2201	.187	.53	2201
.0027	.187	.40	2701	.187	.40	2701	.187	.53	2701	.203	.53	2701
.0033	.187	.40	3301	.187	.40	3301	.187	.53	3301	.218	.53	3301
.0039	.187	.40	3901	.187	.40	3901	.187	.53	3901	.218	.53	3901
.0047	.187	.40	4701	.187	.40	4701	.187	.53	4701	.187	.65	4701
.0056	.187	.40	5601	.187	.40	5601	.187	.53	5601	.203	.65	5601
.0068	.187	.40	6801	.187	.40	6801	.187	.53	6801	.203	.65	6801
.0082	.187	.40	8201	.187	.40	8201	.203	.53	8201	.218	.65	8201
.01	.187	.40	1002	.203	.40	1002	.218	.53	1002	.234	.65	1002
.012	.187	.40	1202	.234	.40	1202	.234	.53	1202	.265	.65	1202
.015	.203	.40	1502	.250	.40	1502	.265	.53	1502	.281	.65	1502
.018	.218	.40	1802	.203	.53	1802	.218	.65	1802	.265	.78	1802
.022	.234	.40	2202	.218	.53	2202	.250	.65	2202	.281	.78	2202
.027	.265	.40	2702	.234	.53	2702	.234	.78	2702	.312	.78	2702
.033	.218	.53	3302	.218	.65	3302	.265	.78	3302	.296	.90	3302
.039	.187	.65	3902	.234	.65	3902	.281	.78	3902	.328	.90	3902
.047	.203	.65	4702	.250	.65	4702	.312	.78	4702	.359	.90	4702
.056	.218	.65	5602	.281	.65	5602	.296	.90	5602	.375	.90	5602
.068	.250	.65	6802	.312	.65	6802	.328	.90	6802	.421	.90	6802
.082	.265	.65	8202	.296	.78	8202	.343	.90	8202	.375	1.18	8202
.1	.265	.78	1003	.328	.78	1003	.390	.90	1003	.421	1.18	1003
.12	.281	.78	1203	.328	.90	1203	.359	1.18	1203	.453	1.18	1203
.15	.312	.78	1503	.359	.90	1503	.390	1.18	1503	.500	1.18	1503
.18	.312	.90	1803	.359	1.03	1803	.437	1.32	1803	.515	1.32	1803
.22	.343	.90	2203	.390	1.03	2203	.484	1.32	2203	.562	1.32	2203
.27	.343	1.03	2703	.406	1.18	2703	.468	1.56	2703	.562	1.56	2703
.33	.375	1.03	3303	.437	1.18	3303	.515	1.56	3303	.578	1.70	3303
.39	.375	1.18	3903	.468	1.18	3903	.562	1.56	3903	.625	1.70	3903
.47	.406	1.18	4703	.515	1.18	4703	.609	1.56	4703	.687	1.70	4703
.56	.437	1.18	5603	.531	1.32	5603	.640	1.70	5603	.750	1.70	5603
.68	.484	1.18	6803	.515	1.56	6803	.703	1.70	6803	.796	1.82	6803
.82	.531	1.18	8203	.578	1.56	8203	.734	1.82	8203	.828	1.94	8203
1.0	.546	1.32	1004	.593	1.70	1004	.781	1.94	1004	.921	1.94	1004
1.25	.578	1.45	1254	.671	1.70	1254	—	—	—	—	—	—
1.50	.625	1.45	1504	.734	1.70	1504	—	—	—	—	—	—
2.0	.687	1.56	2004	.812	1.82	2004	—	—	—	—	—	—

TYPE 33M RATINGS AND DIMENSIONS

Capacity in Mfds.	100 VOLTS T	W	L	Cat. No. 33M — K1	200 VOLTS T	W	L	Cat. No. 33M — K2	400 VOLTS T	W	L	Cat. No. 33M — K4	600 VOLTS T	W	L	Cat. No. 33M — K6
.001	.125	.234	.40	1001	.125	.234	.40	1001	.109	.203	.53	1001	.109	.203	.53	1001
.0012	.125	.234	.40	1201	.125	.234	.40	1201	.109	.203	.53	1201	.109	.203	.53	1201
.0015	.125	.234	.40	1501	.125	.234	.40	1501	.125	.234	.53	1501	.125	.234	.53	1501
.0018	.125	.234	.40	1801	.125	.234	.40	1801	.125	.234	.53	1801	.125	.234	.53	1801
.0022	.125	.234	.40	2201	.125	.234	.40	2201	.125	.234	.53	2201	.125	.234	.53	2201
.0027	.125	.234	.40	2701	.125	.234	.40	2701	.125	.234	.53	2701	.125	.234	.53	2701
.0033	.125	.234	.40	3301	.125	.234	.40	3301	.125	.234	.53	3301	.140	.281	.53	3301
.0039	.125	.234	.40	3901	.125	.234	.40	3901	.125	.234	.53	3901	.140	.265	.53	3901
.0047	.125	.234	.40	4701	.125	.234	.40	4701	.125	.234	.53	4701	.125	.265	.65	4701
.0056	.125	.234	.40	5601	.125	.234	.40	5601	.125	.234	.53	5601	.125	.250	.65	5601
.0068	.125	.234	.40	6801	.125	.234	.40	6801	.125	.234	.53	6801	.125	.250	.65	6801
.0082	.125	.234	.40	8201	.125	.234	.40	8201	.140	.234	.53	8201	.140	.265	.65	8201
.01	.125	.234	.40	1002	.140	.250	.40	1002	.156	.250	.53	1002	.156	.281	.65	1002
.012	.125	.234	.40	1202	.171	.265	.40	1202	.171	.265	.53	1202	.171	.312	.65	1202
.015	.140	.234	.40	1502	.187	.281	.40	1502	.187	.312	.53	1502	.203	.328	.65	1502
.018	.156	.250	.40	1802	.140	.234	.53	1802	.140	.281	.65	1802	.171	.312	.78	1802
.022	.171	.281	.40	2202	.156	.250	.53	2202	.171	.296	.65	2202	.203	.343	.78	2202
.027	.203	.296	.40	2702	.171	.281	.53	2702	.156	.281	.78	2702	.234	.359	.78	2702
.033	.140	.250	.53	3302	.156	.250	.65	3302	.171	.312	.78	3302	.218	.343	.90	3302
.039	.125	.234	.65	3902	.171	.265	.65	3902	.203	.328	.78	3902	.250	.375	.90	3902
.047	.140	.250	.65	4702	.171	.312	.65	4702	.203	.375	.78	4702	.281	.406	.90	4702
.056	.156	.265	.65	5602	.203	.328	.65	5602	.187	.359	.90	5602	.281	.453	.90	5602
.068	.187	.281	.65	6802	.218	.359	.65	6802	.218	.390	.90	6802	.312	.500	.90	6802
.082	.187	.312	.65	8202	.218	.343	.78	8202	.250	.421	.90	8202	.281	.453	1.18	8202
.1	.187	.312	.78	1003	.234	.375	.78	1003	.281	.453	.90	1003	.312	.500	1.18	1003
.12	.203	.328	.78	1203	.218	.390	.90	1203	.250	.421	1.18	1203	.343	.515	1.18	1203
.15	.234	.359	.78	1503	.250	.421	.90	1503	.281	.484	1.18	1503	.390	.578	1.18	1503
.18	.218	.328	.90	1803	.234	.437	1.03	1803	.312	.515	1.32	1803	.406	.578	1.32	1803
.22	.250	.359	.90	2203	.265	.468	1.03	2203	.359	.562	1.32	2203	.468	.640	1.32	2203
.27	.234	.406	1.03	2703	.281	.484	1.18	2703	.343	.546	1.56	2703	.437	.640	1.56	2703
.33	.265	.437	1.03	3303	.328	.515	1.18	3303	.390	.593	1.56	3303	.468	.671	1.70	3309
.39	.265	.453	1.18	3903	.359	.562	1.18	3903	.437	.640	1.56	3903	.500	.703	1.70	3903
.47	.296	.500	1.18	4703	.406	.593	1.18	4703	.484	.687	1.56	4703	.562	.765	1.70	4703
.56	.328	.531	1.18	5603	.406	.609	1.32	5603	.515	.718	1.70	5603	.625	.828	1.70	5603
.68	.375	.562	1.18	6803	.406	.609	1.56	6803	.578	.781	1.70	6803	.656	.875	1.82	6803
.82	.421	.609	1.18	8203	.453	.656	1.56	8203	.609	.812	1.82	8203	.703	.906	1.94	8203
1.0	.437	.625	1.32	1004	.484	.687	1.70	1004	.656	.859	1.94	1004	.781	.984	1.94	1004
1.25	.453	.656	1.45	1254	.453	.859	1.70	1254	—	—	—	—	—	—	—	—
1.50	.515	.718	1.45	1504	.515	.906	1.70	1504	—	—	—	—	—	—	—	—
2.0	.468	.875	1.56	2004	.578	.984	1.82	2004	—	—	—	—	—	—	—	—

STANDARD LEAD SIZES: #24 AWG TCW: up to and including .203″ Dia., #22 AWG TCW: from .204″ thru .312″ Dia., #20 AWG TCW: /313″ Dia. and over. **CAPACITY TOLERANCE STANDARD** . . . ±10% / OTHER . . . from ±20% to ±1%. Other values as well as voltage ratings are available on request.
MARKING: For marking see metallized polyester data sheet opposite page.

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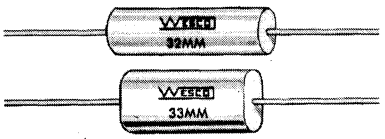
WESCO® ELECTRICAL COMPANY
201 MUNSON ST. • GREENFIELD • MASSACHUSETTS • 01301
TELEPHONE: 413-774-4358 • FAX: 413-774-4562

WESCO® METALIZED POLYESTER CAPACITORS



SPECIFICATIONS

DIELECTRIC WITHSTANDING VOLTAGE

200% of rated voltage applied through a minimum limiting resistance of 100 Ohms/Volt. Duration of voltage stress shall be 15 seconds minimum and 1 minute maximum at 25°C.

TEMPERATURE RANGE

−55°C to +85°C with full rated voltage applied. To +125°C with 50% of rated voltage.

INSULATION RESISTANCE

At 25°C after 2 minutes of electrification at rated voltage or 500 VDC, whichever is less, the minimum product of Insulation Resistance and Capacitance shall be 30,000 megohms-microfarads, but need not exceed 30,000 megohms.

DISSIPATION FACTOR

Shall not exceed 1.0% when measured at 25°C and 1000 Hz, ±20 Hz. See characteristic curves for D.F. ratings at other temperatures.

CAPACITANCE AND TOLERANCE

Shall be measured within the tolerance limits specified. Measurements will be made at 25°C and 1000 Hz, ±20 Hz.

LIFE TEST

Shall withstand 140% of rated voltage at 85°C for 250 hours. One failure in twelve shall be permitted.

CAPACITANCE STABILITY (DRIFT)

Less than 0.3% when measured in the following manner: three capacitance readings at 25°C, each made prior to and after temperature cycling from room to 85°C, and room to −55°C. The mathematical difference between the two extremes, divided by the intermediate value, and then multiplied by 100, yields the stability expressed in percent.

HUMIDITY RESISTANCE

Meets requirements of Mil-C-27287, Para. 3.12 when tested in accordance with Mil-STD.-202C, Method 103 B, Condition B.

LEAD PULL AND BEND TEST

Steady pull of 5 pounds applied axially to leads for one minute. Bend test shall consist of one bend from the point of egress, first 90° in one direction, back to the original axial position, and then 90° in the opposite direction with no evidence of breakage.

FEATURES

Wrap and fill construction
Tubular and oval configuration for optimum space savings
Extended foil design
Miniature size — lightweight
Low dissipation factor
Excellent stability
Quality control procedures per Mil-Q-9858

APPLICATIONS

Data Processing Equipment
Aircraft and Missile Systems
Industrial Instrumentation
Navigation and Distance Measuring Equipment
Communications Equipment
Tachometers
Filters
Peripheral Equipment

32MM RATINGS AND DIMENSIONS

Capacity in Mfds.	25 VDC D	25 VDC L	50 VDC D	50 VDC L	100 VDC D	100 VDC L	200 VDC D	200 VDC L	400 VDC D	400 VDC L	600 VDC D	600 VDC L
.0068	—	—	—	—	—	—	—	—	.218	.53	.312	.53
.0082	—	—	—	—	—	—	—	—	.234	.53	.171	.65
.01	—	—	—	—	—	—	—	—	.265	.53	.250	.65
.012	—	—	—	—	—	—	—	—	.203	.65	.265	.65
.015	—	—	—	—	—	—	—	—	.218	.65	.296	.65
.018	—	—	—	—	—	—	.203	.40	.234	.65	.328	.65
.022	—	—	—	—	—	—	.218	.40	.250	.65	.375	.65
.027	—	—	—	—	.171	.40	.234	.40	.265	.65	.390	.65
.033	—	—	—	—	.187	.40	.265	.40	.296	.65	.437	.65
.039	—	—	—	—	.187	.40	.203	.53	.234	.90	.328	.90
.047	—	—	—	—	.203	.40	.218	.53	.265	.90	.375	.90
.056	—	—	—	—	.218	.40	.234	.53	.265	.90	.390	.90
.068	—	—	—	—	.250	.40	.250	.53	.296	.90	.437	.90
.082	—	—	—	—	.187	.53	.265	.53	.328	.90	.468	.90
.1	—	—	—	—	.203	.53	.281	.53	.343	.90	.515	.90
.12	—	—	—	—	.218	.53	.312	.53	.328	1.18	.453	1.18
.15	—	—	—	—	.234	.53	.343	.53	.343	1.18	.515	1.18
.18	—	—	.187	.40	.250	.53	.296	.65	.375	1.18	.562	1.18
.22	—	—	.203	.40	.234	.65	.328	.65	.406	1.18	.625	1.18
.27	.171	.40	.218	.40	.250	.65	.359	.65	.453	1.18	.687	1.18
.33	.187	.40	.234	.40	.265	.65	.406	.65	.437	1.45	.656	1.45
.39	.203	.40	.250	.40	.281	.65	.437	.65	.468	1.45	.703	1.45
.47	.218	.40	.187	.53	.312	.65	.468	.65	.515	1.45	.781	1.45
.56	.250	.40	.203	.53	.343	.65	.406	.90	.546	1.45	.843	1.45
.68	.171	.53	.218	.53	.375	.65	.437	.90	.609	1.45	.921	1.45
.82	.187	.53	.250	.53	.359	.78	.406	1.18	.593	1.70	.906	1.70
1.00	.203	.53	.218	.65	.390	.78	.437	1.18	.656	1.70	1.000	1.70
1.25	.234	.53	.234	.65	.421	.78	.500	1.18	.734	1.70	1.171	1.70
1.50	.250	.53	.265	.65	.421	.90	.531	1.18	.796	1.70	1.265	1.70
1.80	.218	.65	.281	.65	.453	.90	.593	1.18	.875	1.70	1.375	1.70
2.00	.234	.65	.312	.65	.484	.90	.625	1.18	.921	1.70	1.406	1.70
3.00	.281	.65	.312	.78	.484	1.18	.656	1.45	—	—	—	—
4.00	.343	.65	.375	.78	.562	1.18	.750	1.45	—	—	—	—
5.00	.375	.65	.421	.78	.625	1.18	.765	1.70	—	—	—	—
8.00	.390	.78	.453	.90	.703	1.45	.828	2.06	—	—	—	—
10.00	.390	.90	.453	1.03	.781	1.45	.921	2.06	—	—	—	—
15.00	.468	.90	.546	1.03	—	—	—	—	—	—	—	—
20.00	.546	.90	.593	1.18	—	—	—	—	—	—	—	—
25.00	.500	1.18	.656	1.18	—	—	—	—	—	—	—	—
30.00	.562	1.18	.718	1.18	—	—	—	—	—	—	—	—

LEAD MATERIAL: TINNED COPPER SOLID WIRE. **STANDARD LEAD SIZES:** #24 AWG: Up to and including .203" Dia.; #22 AWG: from .204" thru .312" Dia.; #20 AWG: .313" Dia. and over. **CAPACITY TOLERANCE:** STANDARD . . . ±10%/OTHER . . . from ±20% to ±2%. Other values as well as voltage ratings are available on request. **MARKING:** WESCO Logo, Capacity Tolerance, VDC Rating and Date Code. (Note: On smaller units, Ⓣ trademark will be substituted for WESCO logo.)

33MM RATINGS AND DIMENSIONS

Capacity in Mfds.	25 VDC T	25 VDC W	25 VDC L	50 VDC T	50 VDC W	50 VDC L	100 VDC T	100 VDC W	100 VDC L	200 VDC T	200 VDC W	200 VDC L	400 VDC T	400 VDC W	400 VDC L	600 VDC T	600 VDC W	600 VDC L
.0068	—	—	—	—	—	—	—	—	—	—	—	—	.140	.281	.53	.234	.359	.53
.0082	—	—	—	—	—	—	—	—	—	—	—	—	.156	.296	.53	.078	.218	.65
.01	—	—	—	—	—	—	—	—	—	—	—	—	.187	.312	.53	.171	.296	.65
.012	—	—	—	—	—	—	—	—	—	—	—	—	.125	.250	.65	.140	.281	.65
.015	—	—	—	—	—	—	—	—	—	—	—	—	.140	.265	.65	.203	.343	.65
.018	—	—	—	—	—	—	—	—	—	—	—	—	.156	.281	.65	.218	.421	.65
.022	—	—	—	—	—	—	—	—	—	.140	.281	.40	.171	.312	.65	.250	.437	.65
.027	—	—	—	—	—	—	.109	.203	.40	.156	.296	.40	.203	.328	.65	.281	.484	.65
.033	—	—	—	—	—	—	.125	.218	.40	.187	.312	.40	.218	.359	.65	.312	.531	.65
.039	—	—	—	—	—	—	.125	.234	.40	.125	.250	.53	.156	.296	.90	.218	.421	.90
.047	—	—	—	—	—	—	.140	.250	.40	.140	.265	.53	.171	.312	.90	.250	.437	.90
.056	—	—	—	—	—	—	.156	.265	.40	.156	.281	.53	.187	.328	.90	.265	.468	.90
.068	—	—	—	—	—	—	.187	.281	.40	.171	.296	.53	.218	.343	.90	.312	.515	.90
082	—	—	—	—	—	—	.109	.234	.53	.187	.312	.53	.218	.390	.90	.343	.562	.90
.1	—	—	—	—	—	—	.125	.250	.53	.203	.343	.53	.250	.421	.90	.390	.593	.90
.12	—	—	—	—	—	—	.140	.265	.53	.234	.359	.53	.218	.390	1.18	.343	.546	1.18
.15	—	—	—	—	—	—	.156	.281	.53	.265	.390	.53	.250	.421	1.18	.390	.596	1.18
.18	—	—	—	.125	.218	.40	.187	.312	.53	.234	.359	.65	.281	.453	1.18	.437	.640	1.18
.22	—	—	—	.140	.234	.40	.156	.281	.65	.250	.390	.65	.296	.500	1.18	.500	.687	1.18
.27	.109	.203	.40	.156	.250	.40	.171	.296	.65	.281	.406	.65	.343	.531	1.18	.562	.765	1.18
.33	.125	.218	.40	.187	.265	.40	.187	.312	.65	.281	.484	.65	.312	.515	1.45	.531	.734	1.45
.39	.140	.234	.40	.218	.296	.40	.218	.343	.65	.312	.515	.65	.343	.546	1.45	.578	.781	1.45
.47	.156	.250	.40	.125	.218	.53	.234	.359	.65	.359	.562	.65	.390	.578	1.45	.640	.843	1.45
.56	.187	.265	.40	.156	.250	.53	.250	.406	.65	.281	.484	.90	.437	.625	1.45	.718	.921	1.45
.68	.218	.296	.53	.187	.265	.53	.281	.437	.65	.328	.515	.90	.484	.687	1.45	.796	1.000	1.45
.82	.140	.234	.53	.187	.296	.53	.250	.421	.78	.296	.484	1.18	.468	.671	1.70	.781	.984	1.70
1.0	.156	.250	.53	.156	.250	.65	.281	.453	.78	.328	.531	1.18	.531	.734	1.70	.875	1.078	1.70
1.25	.187	.265	.53	.187	.281	.65	.312	.515	.78	.375	.578	1.18	.609	.812	1.70	1.062	1.265	1.70
1.50	.187	.281	.53	.203	.296	.65	.296	.500	.90	.421	.625	1.18	.671	.875	1.70	1.156	1.359	1.70
1.80	.187	.250	.65	.218	.312	.65	.328	.515	.90	.406	.687	1.18	.750	.953	1.70	1.265	1.484	1.70
2.0	.187	.265	.65	.234	.343	.65	.359	.562	.90	.421	.718	1.18	.796	1.000	1.70	1.281	1.484	1.70
3.0	.218	.312	.65	.234	.359	.78	.375	.578	1.18	.460	.765	1.45	—	—	—	—	—	—
4.0	.265	.359	.65	.281	.406	.78	.406	.703	1.18	.625	.828	1.45	—	—	—	—	—	—
5.0	.296	.406	.65	.328	.453	.78	.453	.750	1.18	.640	.828	1.70	—	—	—	—	—	—
8.0	.312	.437	.78	.375	.500	.90	.531	.828	1.45	.656	.953	2.06	—	—	—	—	—	—
10.0	.312	.437	.90	.375	.500	1.03	.609	.906	1.45	.750	1.046	2.06	—	—	—	—	—	—
15.0	.390	.515	.90	.468	.593	1.03	—	—	—	—	—	—	—	—	—	—	—	—
20.0	.453	.578	.90	.500	.640	1.18	—	—	—	—	—	—	—	—	—	—	—	—
25.0	.437	.562	1.18	.578	.703	1.18	—	—	—	—	—	—	—	—	—	—	—	—
30.0	.468	.593	1.18	.656	.781	1.18	—	—	—	—	—	—	—	—	—	—	—	—

STANDARD LEAD SIZES: Refer to equivalent rating in type 32MM above. **CAPACITY TOLERANCE:** STANDARD . . . ±10%/OTHER . . . from ±20% to ±2%. Other values as well as voltage ratings are available on request. **MARKING:** For marking and lead material see type 32MM above.

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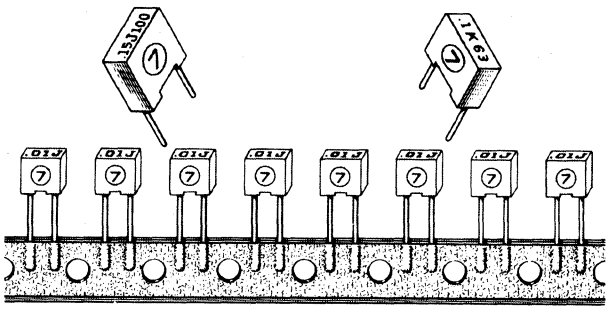
WESCO METALIZED POLYESTER CAPACITORS "BOX" CAPACITORS



SPECIFICATIONS

TEMPERATURE RANGE
−55°C to +85°C. To +100°C with 20% voltage derating.

DIELECTRIC WITHSTANDING VOLTAGE
160% of rated voltage for 2 seconds at 25°C.

DISSIPATION FACTOR
Shall not exceed 1.0% when measured at 25°C at 1KHz ±20Hz.

CAPACITANCE TOLERANCE
Standard: ±5%, ±10%, ±20%. Closer tolerances are also available. Measurements will be made at 25°C and 1KHz ±20Hz.

LIFE TEST
Shall withstand 125% of rated voltage at 85°C for 1000 hours.

HUMIDITY RESISTANCE
Per IEC 68-1 55/100/21

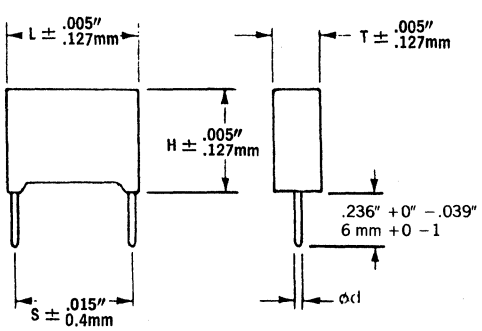
TERMINALS
Tinned solid copper wire. (Minimum lead content 5%.)

MARKING
Capacitance (mfd.), tolerance (J = ±5%, K = ±10%, M = ±20%), voltage (VDC), Wesco trademark ⑦. Due to size limitations, type 68MM will display all of the above except voltage will be defined by letter code. (See How To Order table, this page, for code designation.)

RESISTANCE TO SOLDERING HEAT
During soldering operation, maximum heat of +260°C ±5°C may be applied to leads for no longer than 10 seconds.

HOW TO ORDER
Example: 67mm .1 MFD ±5% 63 VDC 7.5mm Pitch (Lead spacing)

67mm	10 4	J	D	3D
Type	MFD Code	Tolerance J = ± 5% K = ±10% M = ±20%	Voltage (VDC) C = 50 D = 63 E = 100 G = 160 I = 250 M = 400 P = 630	Case Code



TYPE 60MM

Capacity in MFD.	63 VDC 40 VAC Case Code	100 VDC 63 VAC Case Code	250 VDC 160 VAC Case Code	400 VDC 200 VAC Case Code	630 VDC 220 VAC Case Code
.001-.01	—	—	—	—	4B
.022	—	—	—	4B	4F
.047	—	—	4B	4F	6D
.1	—	4B	4D	6D	9B
.22	4B	4D	6B	9B	9F/1.1D
.47	4D	4F/6B	6F/9B	9F	—
1.0	4F/6B	6F	9F	1.1B	—

TYPE 67MM

Capacity in MFD.	63 VDC 40 VAC Case Code	100 VDC 63 VAC Case Code	250 VDC 160 VAC Case Code	400 VDC 200 VAC Case Code	630 VDC 220 VAC Case Code
.001	—	—	—	—	3D
.0033	—	—	—	—	3D
.0047	—	—	—	3D	3F
.01	—	—	3D	3F	3H
.047	—	3D	3F	—	—
.1	3D	3F	3H	—	—
.22	3F	3H	—	—	—
.47	3H	—	—	—	—
1.0	3K	—	—	—	—

TYPE 68MM

Capacity in MFD.	50 VDC 30 VAC Case Code	63 VDC 40 VAC Case Code	100 VDC 63 VAC Case Code
.001–.033	—	—	2A
.047–.068	—	2A	2D
.1	2A	2A	2F
.22	2D	2D	2H
.47	2F	2H	—
1.0	2H	—	—

DIMENSIONS

Case Code	T mm	T in	H mm	H in	L mm	L in	S mm	S in	d mm	d in
2A	2.5	.098	6.5	.256	7.2	.284	5	.197	0.6	.024
2D	3.5	.138	8.5	.335	7.2	.284	5	.197	0.6	.024
2F	4.5	.177	9.5	.374	7.2	.284	5	.197	0.6	.024
2H	6.0	.236	11	.433	7.2	.284	5	.197	0.6	.024
3D	3.5	.138	6.5	.256	10.5	.414	7.5	.295	0.6	.024
3F	4	.158	9	.355	10.5	.414	7.5	.295	0.6	.024
3H	5	.197	11	.433	10.5	.414	7.5	.295	0.6	.024
3K	6	.236	12	.473	10.5	.414	7.5	.295	0.6	.024
4B	4	.158	9	.355	13	.512	10	.394	0.8	.032
4D	5	.197	11	.433	13	.512	10	.394	0.8	.032
4F	6	.236	12	.473	13	.512	10	.394	0.8	.032
6B	5	.197	11	.433	18	.709	15	.591	0.8	.032
6D	6	.236	12	.473	18	.709	15	.591	0.8	.032
6F	7.5	.295	13.5	.532	18	.709	15	.591	0.8	.032
6H	8.5	.335	14.5	.571	18	.709	15	.591	0.8	.032
9B	6	.236	15	.591	26.5	1.044	22.5	.886	0.8	.032
9D	7	.276	16	.630	26.5	1.044	22.5	.886	0.8	.032
9F	8.5	.335	17	.670	26.5	1.044	22.5	.886	0.8	.032
9H	10	.394	18.5	.729	26.5	1.044	22.5	.886	0.8	.032
1.1B	11	.433	20	.788	32	1.26	27.5	1.083	0.8	.032

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WESCO POLYSTYRENE CAPACITORS

SPECIFICATIONS

DIELECTRIC WITHSTANDING VOLTAGE
200% of rated voltage applied through a minimum limiting resistance of 100 Ohms/Volt. Duration of voltage stress shall be 15 seconds minimum and 1 minute maximum at 25°C.

INSULATION RESISTANCE
At 25°C after 2 minutes of electrification at rated voltage or 500 VDC, whichever is less, the minimum product of Insulation Resistance and Capacitance shall be 500,000 megohms-microfarads, but need not exceed 500,000 megohms.

DISSIPATION FACTOR
Shall not exceed .05% when measured at 25°C and 1000 Hz, ± Hz. See characteristic curves for D.F. ratings at other temperatures.

CAPACITANCE AND TOLERANCE
Shall be measured within the tolerance limits specified. Measurements will be made at 25°C and 1000 Hz, ±20 Hz.

LIFE TEST
Shall withstand 140% of rated voltage at 85°C for 250 hours. One failure in twelve shall be permitted.

TEMPERATURE COEFFICIENT
Capacitance shall change linearly over operating temperature range at rate of −105, ±30 parts per million/°C.

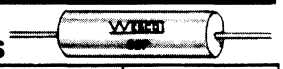
CAPACITANCE STABILITY (DRIFT)
Less than .05% when measured in the following manner: three capacitance readings at 25°C, each made prior to and after temperature cycling from room to 85°C, and room to −55°C. The mathematical difference between the two extremes, divided by the intermediate value, and then multiplied by 100, yields the stability expressed in percent.

HUMIDITY RESISTANCE
Meets requirements of Mil-C-27287, Para. 3.12 when tested in accordance with Mil-STD.-202C, Method 103 B, Condition B.

LEAD PULL AND BEND TEST
Steady pull of 5 pounds applied axially to leads for one minute. Bend test shall consist of one bend from the point of egress, first 90° in one direction, back to the original axial position, and then 90° in the opposite direction with no evidence of breakage.

TEMPERATURE RANGE
−55°C to +85°C with full rated voltage applied.

TYPE 32P RATINGS & DIMENSIONS



Capacity in Mfds.	100 VOLTS D	L	Cat. No. 32P — J-1	200 VOLTS D	L	32P Cat. No. — J-2	400 VOLTS D	L	Cat. No. 32P — J-4
.001	.187	.53	1001	.187	.53	1001	.187	.53	1001
.0012	.187	.53	1201	.187	.53	1201	.187	.53	1201
.0015	.187	.53	1501	.187	.53	1501	.187	.53	1501
.0018	.187	.65	1801	.187	.65	1801	.187	.65	1801
.0022	.187	.65	2201	.187	.65	2201	.187	.65	2201
.0027	.187	.65	2701	.187	.65	2701	.187	.65	2701
.0033	.187	.65	3301	.187	.65	3301	.187	.65	3301
.0039	.187	.65	3901	.187	.65	3901	.187	.65	3901
.0047	.187	.65	4701	.187	.65	4701	.234	.65	4701
.0056	.187	.65	5601	.187	.65	5601	.250	.65	5601
.0068	.187	.65	6801	.187	.65	6801	.234	.78	6801
.0082	.187	.65	8201	.203	.65	8201	.250	.78	8201
.01	.203	.65	1002	.234	.65	1002	.265	.78	1002
.012	.218	.65	1202	.218	.78	1202	.296	.78	1202
.015	.234	.65	1502	.250	.78	1502	.328	.78	1502
.018	.234	.78	1802	.265	.78	1802	.359	.78	1802
.022	.250	.78	2202	.281	.78	2202	.343	.90	2202
.027	.265	.78	2702	.312	.78	2702	.375	.90	2702
.033	.296	.78	3302	.343	.78	3302	.406	.90	3302
.039	.328	.78	3902	.375	.78	3902	.453	.90	3902
.047	.343	.78	4702	.359	.90	4702	437	1.03	4702
.056	.375	.78	5602	.390	.90	5602	.484	1.03	5602
.068	.375	.90	6802	.421	.90	6802	.484	1.18	6802
.082	.406	.90	8202	.421	1.03	8202	.531	1.18	8202
.1	.453	.90	1003	.468	1.03	1003	.578	1.18	1003
.12	.484	.90	1203	.515	1.03	1203	.625	1.18	1203
.15	.500	1.03	1503	.531	1.18	1503	.656	1.32	1503
.18	.531	1.03	1803	.578	1.18	1803	.671	1.45	1803
.22	.546	1.18	2203	.640	1.18	2203	.671	1.70	2203
.27	.609	1.18	2703	.656	1.32	2703	.734	1.70	2703
.33	.625	1.32	3303	.687	1.45	3303	.812	1.70	3303
.39	.671	1.32	3903	.750	1.45	3903	—	—	—
.47	.703	1.45	4703	.734	1.70	4703	—	—	—

LEAD MATERIAL: TINNED COPPER SOLID WIRE. **STANDARD LEAD SIZES:** #24 AWG: Up to and including .203″ Dia.; #22 AWG: from .204″ thru .312″ Dia.; #20 AWG: .313″ Dia. and over. **CAPACITY TOLERANCE:** STANDARD . . . ±5%/ OTHER . . . from ±20% to ±1%. Other values as well as voltage ratings are available on request. **MARKING:** WESCO Logo, Capacity Tolerance, VDC Ratiing and Date Code. (Note: On smaller units, ⓡ trademark will be substituted for WESCO logo.)

METALIZED POLYCARBONATE CAPACITORS

SPECIFICATIONS

DIELECTRIC WITHSTANDING VOLTAGE
200% of rated voltage applied through a minimum limiting resistance of 100 Ohms/Volt. Duration of voltage stress shall be 15 seconds minimum and 1 minute maximum at 25°C.

TEMPERATURE RANGE
−55°C to +85°C with full rated voltage applied. To +125°C with 50% of rated voltage.

INSULATION RESISTANCE
At 25°C after 2 minutes of electrification at rated voltage or 500 VDC, whichever is less, the minimum product of Insulation Resistance and Capacitance shall be 50,000 megohms-microfarads, but need not exceed 50,000 megohms.

DISSIPATION FACTOR
Shall not exceed 0.3% when measured at 25°C and 1000 Hz, ±20 Hz. See characteristic curves for D.F. ratings at other temperatures.

CAPACITANCE AND TOLERANCE
Shall be measured within the tolerance limits specified. Measurements will be made at 25°C and 1000 Hz, ±20 Hz.

LIFE TEST
Shall withstand 140% of rated voltage at 85°C for 250 hours. One failure in twelve shall be permitted.

CAPACITANCE STABILITY (DRIFT)
Less than 0.3% when measured in the following manner: three capacitance readings at 25°C, each made prior to and after temperature cycling from room to 85°C, and room to −55°C. The mathematical difference between the two extremes, divided by the intermediate value, and then multiplied by 100, yields the stability expressed in percent.

HUMIDITY RESISTANCE
Meets requirements of Mil-C-27287, Para. 3.12 when tested in accordance with Mil-STD.-202C, Method 103B, Condition B.

LEAD PULL AND BEND TEST
Steady pull of 5 pounds applied axially to leads for one minute. Bend test shall consist of one bend from the point of egress, first 90° in one direction, back to the original axial position, and then 90 ° in the opposite direction with no evidence of breakage.

TYPE 32MPC RATINGS & DIMENSIONS

Capacity in Mfds.	50 VOLTS D	L	Cat. No. 32MPC — K-05	100 VOLTS D	L	Cat. No. 32MPC — K-1	200 VOLTS D	L	Cat. No. 32MPC — K-2
.012	—	—	—	—	—	—	.171	.40	1202
.015	—	—	—	—	—	—	.187	.40	1502
.018	—	—	—	—	—	—	.203	.40	1802
.022	—	—	—	.156	.40	2202	.218	.40	2202
.027	—	—	—	.171	.40	2702	.234	.40	2702
.033	—	—	—	.171	.40	3302	.250	.40	3302
.039	—	—	—	.187	.40	3902	.187	.53	3902
.047	—	—	—	.203	.40	4702	.203	.53	4702
.056	—	—	—	.218	.40	5602	.218	.53	5602
.068	—	—	—	.234	.40	6802	.234	.53	6802
.082	.156	.40	8202	.187	.53	8202	.265	.53	8202
.1	.171	.40	1003	.203	.53	1003	.234	.65	1003
.12	.187	.40	1203	.218	.53	1203	.250	.65	1203
.15	.203	.40	1503	.234	.53	1503	281	.65	1503
.18	.218	.40	1803	.250	.53	1803	.296	.65	1803
.22	.171	.53	2203	.265	.53	2203	.328	.65	2203
.27	.187	.53	2703	.250	.65	2703	.312	.78	2703
.33	.203	.53	3303	.265	.65	3303	.343	.78	3303
.39	.203	.53	3903	.281	.65	3903	.359	.78	3903
.47	.218	.53	4703	.312	.65	4703	.406	.78	4703
.56	.250	53	5603	.328	.65	5603	.390	.90	5603
.68	.218	.65	6803	.328	.78	6803	.421	.90	6803
.82	.234	.65	8203	.343	.78	8203	.468	.90	8203
1.0	.265	.65	1004	.375	.78	1004	.515	.90	1004
1.25	.296	.65	1254	.421	.78	1254	.484	1.18	1254
1.50	.312	.65	1504	.453	.78	1504	.531	1.18	1504
1.80	.328	.78	1804	.453	.90	1804	.578	1.18	1804
2.0	.343	.78	2004	.468	.90	2004	.609	1.18	2004
3.0	.390	.78	3004	.484	1.18	3004	.656	1.45	3004
4.0	.437	.78	4004	.546	1.18	4004	.750	1.45	4004
5.0	.437	.90	5004	.531	1.45	5004	.734	1.78	5004
8.0	.468	1.18	8004	.593	1.78	8004	.859	2.06	8004
10.0	.515	1.18	1005	.656	1.78	1005	.953	2.06	1005

LEAD MATERIAL: TINNED COPPER SOLID WIRE. **STANDARD LEAD SIZES:** #24 AWG: Up to and including .203″ Dia.; #22 AWG: from .204″ thru .312″ Dia; #20 AWG: .313″ Dia. and over. **CAPACITY TOLERANCE:** STANDARD . . . ±10%/ OTHER . . . from ±20% to ±1%. Other values as well as voltage ratings are available on request. **MARKING:** WESCO Logo, Capacity Tolerance, VDC Rating and Date Code. (Note: On smaller units, ⓡ trademark will be substituted for WESCO logo.)

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WESCO®

METALIZED POLYPROPYLENE CAPACITORS

SPECIFICATIONS

DIELECTRIC WITHSTANDING VOLTAGE
200% of rated voltage applied through a minimum limiting resistance of 100 Ohms/Volt. Duration of voltage stress shall be 15 seconds minimum and 1 minute maximum at 25°C.

INSULATION RESISTANCE
At 25°C after 2 minutes of electrification at rated voltage or 500 VDC, whichever is less, the minimum product of Insulation Resistance and Capacitance shall be 100,000 megohms-microfarads, but need not exceed 100,000 megohms.

DISSIPATION FACTOR
Shall not exceed 0.1% when measured at 25°C and 1000 Hz, ±20 Hz. See characteristic curves for D.F. ratings at other temperatures.

CAPACITANCE AND TOLERANCE
Shall be measured within the tolerance limits specified. Measurements will be made at 25°C and 1000 Hz, ±20 Hz.

LIFE TEST
Shall withstand 140% of rated voltage at 105°C for 250 hours. One failure in twelve shall be permitted.

TEMPERATURE COEFFICIENT
Capacitance shall change linearly over operating temperature range of −55°C to +85°C at rate of −290, ±75 parts per million/°C.

CAPACITANCE STABILITY (DRIFT)
Less than .2% when measured in the following manner: three capacitance readings at 25°C, each made prior to and after temperature cycling from room to 105°C, and room to −55°C. The mathematical difference between the two extremes, divided by the intermediate value, and then multiplied by 100, yields the stability expressed in precent.

HUMIDITY RESISTANCE
Meets requirements of Mil-C-27287, Para. 3.12 when tested in accordance with Mil-STD.-202C, Method 103 B, Condition B.

LEAD PULL AND BEND TEST
Steady pull of 5 pounds applied axially to leads for one minute. Bend test shall consist of one bend from the point of egress, first 90° in one direction, back to the original axial position, and then 90° in the opposite direction with no evidence of breakage.

TEMPERATURE RANGE
−55°C to +105°C with full rated voltage applied.

DIELECTRIC ABSORPTION
Shall not exceed .05% when tested in accordance with Mil-C-19978.

TYPE 32MPL RATINGS AND DIMENSIONS

Capacity in Mfds.	100 VDC D	L	Cat No. 32MPL — K-1	200 VDC D	L	Cat No. 32MPL — K-2	400 VDC D	L	Cat No. 32MPL — K-4
.01	.171	.406	1002	.171	.406	1002	.187	.531	1002
.012	.171	.406	1202	.171	.406	1202	.203	.531	1202
.015	.171	.406	1502	.187	.406	1502	.234	.531	1502
.018	.171	.406	1802	.203	.406	1802	.250	.531	1802
.022	.171	.406	2202	.171	.531	2202	.265	.531	2202
.027	.171	.406	2702	.171	.531	2702	.296	.531	2702
.033	.187	.406	3302	.187	.531	3302	.312	.531	3302
.039	.203	.406	3902	.203	.531	3902	.343	.531	3902
.047	.218	.406	4702	.218	.531	4702	.281	.656	4702
.056	.234	.406	5602	.234	.531	5602	.312	.656	5602
.068	.187	.531	6802	.250	.531	6802	.343	.656	6802
.082	.187	.531	8202	.275	.531	8202	.375	.656	8202
.1	.218	.531	1003	.250	.656	1003	.343	.781	1003
.12	.234	.531	1203	.265	.656	1203	.375	.781	1203
.15	.250	.531	1503	.296	.656	1503	.421	.781	1503
.18	.275	.531	1803	.328	.656	1803	.453	.781	1803
.22	.312	.531	2203	.359	.656	2203	.437	.906	2203
.27	.328	.531	2703	.359	.781	2703	.484	.906	2703
.33	.281	.656	3303	.375	.781	3303	.546	.906	3303
.39	.312	.656	3903	.406	.781	3903	.578	.906	3903
.47	.343	.656	4703	.390	.906	4703	.531	1.187	4703
.56	.375	.656	5603	.437	.906	5603	.578	1.187	5603
.68	.375	.781	6803	.484	.906	6803	.625	1.187	6803
.82	.390	.781	8203	.515	.906	8203	.687	1.187	8203
1.0	.421	.781	1004	.484	1.187	1004	.671	1.437	1004
1.25	.421	.906	1254	.531	1.187	1254	.750	1.437	1254
1.50	.453	.906	1504	.578	1.187	1504	.812	1.437	1504
1.80	.500	.906	1804	.640	1.187	1804	.796	1.687	1804
2.00	.515	.906	2004	.671	1.187	2004	.843	1.687	2004
3.00	.531	1.187	3004	.718	1.437	3004	1.03	1.687	3004
4.00	.609	1.187	4004	.828	1.437	4004	—	—	—
5.00	.671	1.187	5004	.828	1.687	5004	—	—	—
8.00	.750	1.437	8004	.937	2.062	8004	—	—	—
10.00	.843	1.437	1005	1.03	2.062	1005	—	—	—
12.00	.828	1.687	1205	—	—	—	—	—	—
15.00	.921	1.687	1505	—	—	—	—	—	—

LEAD MATERIAL: TINNED COPPER SOLID WIRE. **STANDARD LEAD SIZES:** #24 AWG: Up to and including .203″ Dia.; #22 AWG: from .204″ thru .312″ Dia.; #20 AWG: .313″ Dia. and over. **CAPACITY TOLERANCE:** STANDARD . . . ±10%/ OTHER . . . from ±20% to ±1%. Other values as well as voltage ratings are available on request. **MARKING:** WESCO Logo, Capacity Tolerance, VDC Rating and Date Code. (Note: On smaller units, Ⓦ trademark will be substituted for WESCO logo.)

LIMITED WARRANTY

Seller warrants the products sold shall conform to specifications and be free from defects in material and workmanship furnished by Seller, which develop under normal and intended use. The **sole liability** of Seller, whether based upon breach of warranty or contract or negligence, shall be limited to repair or replacement, at Seller's election, of all such defective or nonconforming products, upon return f.o.b. to Seller's factory, provided Buyer has given Seller notice in writing of such defect or nonconformity within ninety days after delivery by Seller of such items to Buyer.

Seller assumes no liability for 1) incidental, collateral or consequential damages; 2) applications in combination with any electrical or electronic components other than as intended by Seller; 3) damages of any kind incurred by Buyer from modifications made to the products without written consent of Seller.

The foregoing constitutes the sole and exclusive remedy of Buyer and the exclusive liability of Seller and IS IN LIEU OF ANY AND ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, AS TO MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, DESCRIPTION, QUALITY OR PRODUCTIVENESS.

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WESCO® POLYPROPYLENE CAPACITORS

SPECIFICATIONS

DIELECTRIC WITHSTANDING VOLTAGE
200% of rated voltage applied through a minimum limiting resistance of 100 Ohms/Volt. Duration of voltage stress shall be 15 seconds minimum and 1 minute maximum at 25°C.

INSULATION RESISTANCE
At 25°C after 2 minutes of electrification at rated voltage or 500 VDC, whichever is less, the minimum product of Insulation Resistance and Capacitance shall be 250,000 megohms-microfarads, but need not exceed 250,000 megohms.

DISSIPATION FACTOR
Shall not exceed .05% when measured at 25°C and 1000 Hz, ±20 Hz. See characteristic curves for D.F. ratings at other temperatures.

CAPACITANCE AND TOLERANCE
Shall be measured within the tolerance limits specified. Measurements will be made at 25°C and 1000 Hz, ±20 Hz.

LIFE TEST
Shall withstand 140% of rated voltage at 105°C for 250 hours. One failure in twelve shall be permitted.

TEMPERATURE COEFFICIENT
Capacitance shall change linearly over operating temperature range of −55°C to +85°C at rate of −290, ±75 parts per million/°C.

CAPACITANCE STABILITY (DRIFT)
Less than .2% when measured in the following manner: three capacitance readings at 25°C, each made prior to and after temperature cycling from room to 105°C, and room to −55°C. The mathematical difference between the two extremes, divided by the intermediate value, and then multiplied by 100, yields the stability expressed in percent.

HUMIDITY RESISTANCE
Meets requirements of Mil-C-27287, Para 3.12 when tested in accordance with Mil-STD.-202C, Method 103 B, Condition B.

LEAD PULL AND BEND TEST
Steady pull of 5 pounds applied axially to leads for one minute. Bend test shall consist of one bend from the point of egress, first 90° in one direction, back to the original axial position, and then 90° in the opposite direction with no evidence of breakage.

TEMPERATURE RANGE
−55°C to +105°C with full rated voltage applied.

TYPE 32PL RATINGS & DIMENSIONS

Capacity in Mfds.	100 VOLTS D	L	Cat. No. 32PL — K-1	200 VOLTS D	L	Cat. No. 32PL — K-2	400 VOLTS D	L	Cat. No. 32PL — K-4
.0010	.187	.406	1001	.187	.406	1001	.187	.406	1001
.0015	.187	.406	1501	.187	.406	1501	.203	.406	1501
.0022	.187	.406	2201	.187	.406	2201	.234	.406	2201
.0033	.187	.406	3301	.187	.406	3301	.187	.531	3301
.0039	.187	.406	3901	.203	.406	3901	.187	.531	3901
.0047	.187	.406	4701	.187	.531	4701	.203	.531	4701
.0056	.187	.406	5601	.187	.531	5601	.218	.531	5601
.0068	.187	.406	6801	.187	.531	6801	.234	.531	6801
.0082	.187	.406	8201	.187	.531	8201	.203	.656	8201
.0100	.203	.406	1002	.203	.531	1002	.218	.656	1002
.015	.219	.531	1502	.203	.656	1502	.265	.656	1502
.022	.250	.531	2202	.234	.656	2202	.312	.656	2202
.027	.265	.531	2702	.265	.656	2702	.328	.656	2702
.033	.234	.656	3302	.281	.656	3302	.328	.781	3302
.039	.250	.656	3902	.312	.656	3902	.359	.781	3902
.047	.281	.656	4702	.296	.781	4702	.390	.781	4702
.056	.281	.656	5602	.312	.781	5602	.421	.781	5602
.068	.296	.656	6802	.343	.781	6802	.406	.906	6802
.082	.312	.781	8202	.375	.781	8202	.437	.906	8202
.10	.344	.781	1003	.375	.906	1003	.484	.906	1003
.12	.375	.781	1203	.406	.906	1203	.453	1.156	1203
.15	.375	.906	1503	.453	.906	1503	.500	1.156	1503
.18	.406	.906	1803	.484	.906	1803	.546	1.156	1803
.22	.437	.906	2203	.484	1.031	2203	.687	1.156	2203
.27	.437	1.031	2703	.531	1.031	2703	.578	1.406	2703
.33	.500	1.031	3303	.593	1.031	3303	.640	1.406	3303
.39	.531	1.031	3903	.593	1.156	3903	.687	1.406	3903
.47	.531	1.156	4703	.656	1.156	4703	.750	1.406	4703
.56	.578	1.156	5603	.625	1.406	5603	.825	1.406	5603
.68	.625	1.156	6803	.687	1.406	6803	.825	1.656	6803
.82	.625	1.406	8203	.687	1.656	8203	.906	1.656	8203
1.0	.687	1.406	1004	.734	1.656	1004	1.000	1.656	1004

LEAD MATERIAL: TINNED COPPER SOLID WIRE. **STANDARD LEAD SIZES:** #24 AWG: Up to and including .203" Dia.; #22 AWG: from .204" thru .312" Dia.; #20 AWG: .313" Dia. and over. **CAPACITY TOLERANCE:** STANDARD . . . ±5%/ OTHER . . . from ±20% to ±1%. Other values as well as voltage ratings are available on request. **MARKING:** WESCO Logo, Capacity Tolerance, VDC Ratiing and Date Code. (Note: On smaller units, Ⓣ trademark will be substituted for WESCO logo.)

FEATURES

32P
- Wrap and fill construction
- Excellent long-term stability
- Superior "Q" for tuned circuits
- High insulation resistance
- Linear temperature coefficient
- Quality control procedures per Mil-Q-9858
- Extended foil design

32MPC
- Wrap and fill construction
- Micro-miniature — lightweight
- Low dissipation factor
- Zero TC ±50 ppm/°C from +25°C to +55°C
- Extended foil design
- Excellent stability
- Quality control procedures per Mil-Q-9858

32PL & 32MPL
- Wrap and fill construction
- Excellent long-term stability
- Superior "Q" for tuned circuits
- High insulation resistance
- Linear temperature coefficient (−55°C to +85°C)
- Quality control procedures per Mil-Q-9858
- Extended foil design

APPLICATIONS

32P, 32PL & 32MPL
- Computers
- Data Processing Equipment
- Aircraft and Missile Systems
- Industrial Instrumentation
- Navigation and Distance Measuring Equipment
- Communications Equipment
- Timing and Retrace Circuits
- Integrating Networks
- High "Q" Low Loss Filters
- Peripheral Equipment

32MPC
- Data Processing Equipment
- Aircraft and Missile Systems
- Industrial Instrumentation
- Navigation and Distance Measuring Equipment
- Communications Equipment
- Tachometers
- Filters
- Peripheral Equipment

EXPLANATION OF CATALOG NUMBER

32 P 1002 K-1

32 Round, Wrap and Fill, with epoxy seals.

P Polystyrene — Foil, Axial Leads*

1002 In Picofarads — first three digits are significant. Last digit specifies number of zeros, i.e., 1002 = 10,000 pfd. or 0.01 mfd.

K Capacity Tolerance:
K = ±10% H = ±3% F = ±1%
M = ±20% J = ±5% G = ±2%

1 DC Voltage Rating:
05 = 50 VDC 2 = 200 VDC 6 = 600 VDC
1 = 100 VDC 4 = 400 VDC etc.

* For Radial Leads, add letter "R" at end of part number.

J.K ELECTRONICS, INC d/b/a
WESCO® ELECTRICAL COMPANY
201 MUNSON ST. • GREENFIELD • MASSACHUSETTS • 01301
TELEPHONE: 413-774-4358 • FAX: 413-774-4562

Nytronics Components Group, Inc.

Orange Street, Darlington, S.C. 29532

A SIGN FOR OUR TIMES

THIS BANNER IS PROMINENTLY DISPLAYED OVER OUR EMPLOYEE ENTRANCE... AS A DAILY REMINDER OF OUR...

...QUALITY ATTITUDE

...WE STRIVE TO...

MERET

(MEET EVERY REQUIREMENT EVERY TIME)

...ESPECIALLY...

YOUR COMPONENT REQUIREMENTS

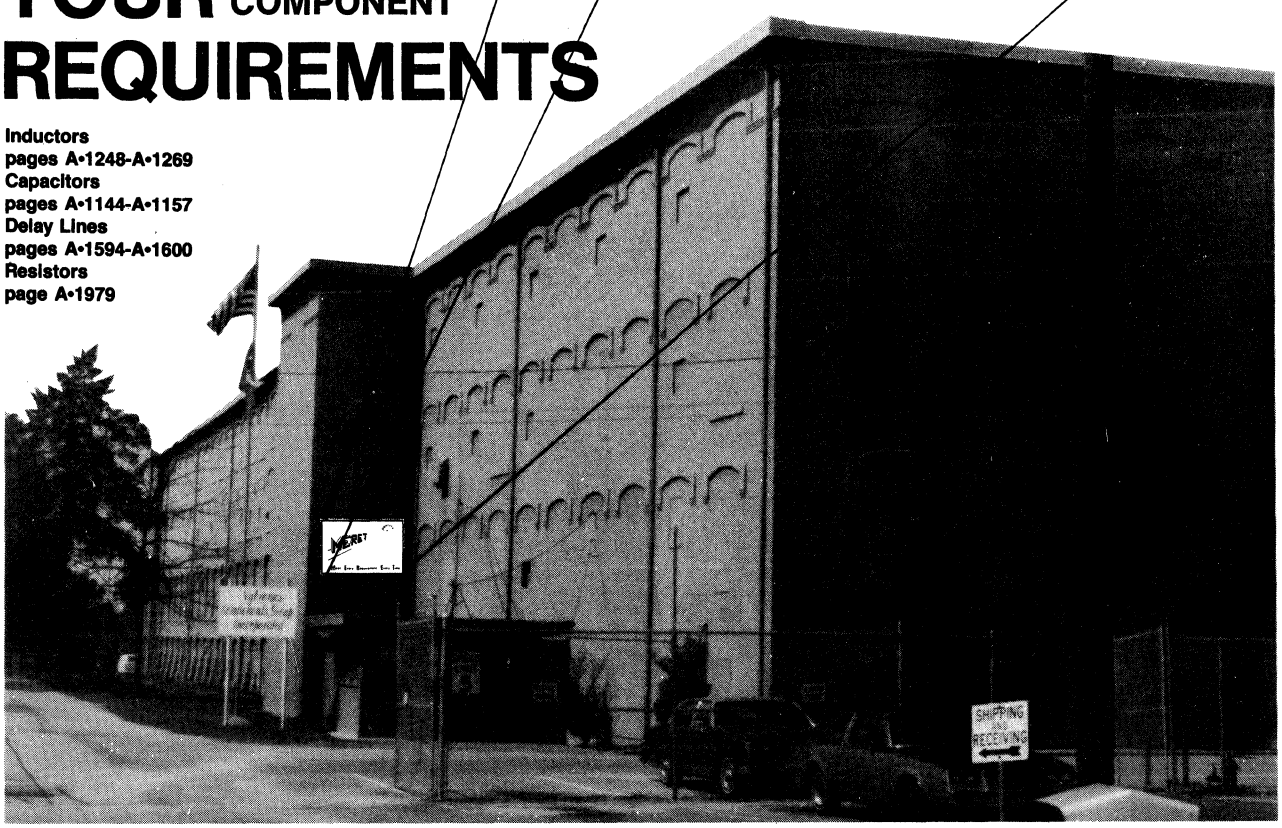
MERET is a Nytronics Components Group, Inc. Service Mark for our quality improvement process, aimed at supplying components which Meet Every Requirement, Every Time.

QUALITY

MERET℠

Meet Every Requirement, Every Time

Inductors
pages A•1248-A•1269
Capacitors
pages A•1144-A•1157
Delay Lines
pages A•1594-A•1600
Resistors
page A•1979



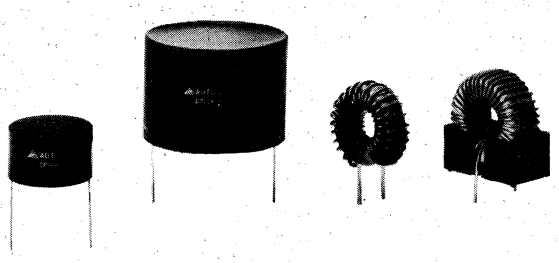
COILS, CHOKES & INDUCTORS

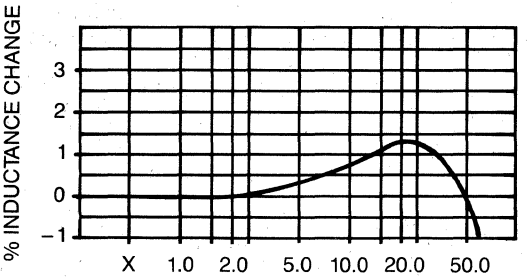
Manufacturer	EEM Page No.	AF	RF	IF	High Q	Shielded	Variable (Adjustable)	Choke/Filter	Chip	Toroidal Inductors	Other Types
Automatic Coil	A•1194	¤*	¤*	¤*	¤*	¤*	¤*	¤*		¤*	
Bell Industries	A•1199		¤*		¤*	¤*	¤*	¤*		¤*	Molded; Subminiature
BH Electronics	A•1206		¤*§							¤*§	
Caddell-Burns	A•1208	¤*	¤*	¤*	¤	¤*	¤*	¤*		¤*	Bobbins Windings
Caddell Coil	A•1223		¤*		¤	¤*	¤*	¤*		¤	
Coilcraft	A•1225		¤§	¤§	¤§	¤	¤	¤§	¤§	¤	
Dale Electronics	A•1232	¤	¤*§		¤	¤		¤	¤§	¤*	
Delevan	A•1241		¤*§			¤*§	¤	¤	¤*§	¤	
EWC	A•1244	¤*	¤*	¤	¤*	¤		¤		¤*	Bobbins Windings
Gowanda	A•1245		¤*		¤*	¤*			¤*	¤*	Bobbins Windings
Microtran	A•1246	¤*			¤*			¤*		¤*	Switch mode power coils* Suppression Coils *
North Hills	A•1247	¤	¤*		¤	¤	¤				Subminiature
Nytronics	A•1248		¤*		¤*	¤*	¤*		¤*§		Molded*
Penn-Tran	A•1269		¤*			¤*	¤*	¤*			
Pico Electronic	A•1270	¤*			¤*	¤*		¤*	¤*		Spike & Power Filtering
Piconics	A•1277		¤*§				¤*§	¤*§	¤*§	¤*§	Spiral §
Power Magnetech	A•1281	¤*§	¤*§	¤*§	¤*§	¤*§	¤*§	¤*§		¤*§	
Renco Electronics	A•1282	¤*	¤	¤	¤	¤*	¤*	¤*	¤	¤*	
Standex	A•1287	¤*	¤*	¤*§	¤§	¤*	¤*	¤*	¤*	¤*	Custom; Molded
Tamura	A•1291	¤	¤			¤		¤		¤	Miniature Encapsulated*
TDK Corp.	A•1294		¤			¤	¤	¤	¤§		
Tokin	A•1295		¤							¤	Bobbins
Toko America	A•1296	¤	¤*	¤		¤	¤	¤	¤§		Subminiature
Toroid	A•1298							¤		¤	Molded
Torotel Prods.	A•1300	¤*	¤*	¤	¤	¤		¤		¤*	
Wilco Corp.	A•1316	¤			¤	¤		¤		¤	Air Coils Pot Core Assemblies

* Mil Spec

§ Surface Mount

Toroid Power Inductors





- High inductance stability
- Low inductance shift with operating voltage
- Predictable swing
- Tolerant to high peak currents
- Single layer design
- Choice of mounting
- Solderable leads

$$X = \frac{V_{OP}}{V_{TEST}\ f_{OP}} \times 10^4$$

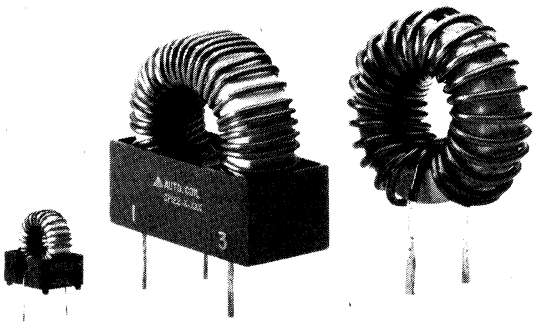
V_{OP} = operating voltage (RMS)
V_{TEST} = indicated test level (RMS)
f_{OP} = operating frequency

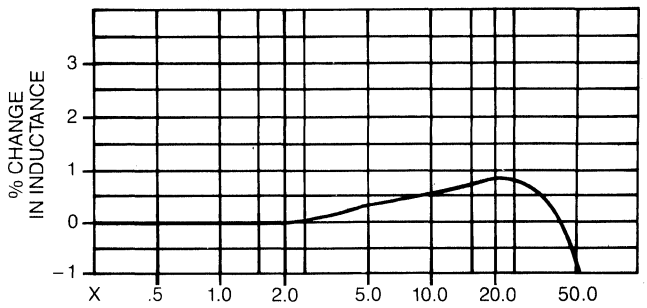
MAX DC CURRENT RATING	INDUCTANCE WITHOUT DC (μH) ± 10%	AC TEST LEVEL 10KHZ RMS	DCR MAX	MAX INDUCTANCE DROP for DC CURRENT INDICATED					INDUCTANCE AT MAX CURRENT	LEAD DIA	SIZE	AUTOMATIC COIL PART NUMBER
				10%	20%	30%	40%	50%				
30.0	2.45	.024	.002	12.8	18.8	23.80	25.0	34.0	1.40	.100	7	xxxxx5-101
30.0	4.35	.036	.002	9.6	14.1	17.7	21.7	25.0	1.7	.100	7	xxxxx5-102
30.0	9.80	.048	.003	6.4	9.4	11.8	14.4	16.83	2.25	.100	7	xxxxx5-103
20.0	11.50	.052	.005	5.9	8.7	10.9	13.36	15.53	3.80	.080	7	xxxxx5-104
10.0	33.0	.084	.010	3.5	5.1	6.4	7.9	9.8	15.50	.057	7	xxxxx5-105
5.0	61.00	.120	.024	2.56	3.78	4.7	5.8	6.73	40.00	.040	7	xxxxx5-106
4.0	100.00	.150	.037	2.0	3.00	3.75	4.6	5.30	64.00	.035	7	xxxxx5-107
3.0	250.00	.240	.058	1.2	1.32	2.25	2.8	3.40	148.00	.032	7	xxxxx5-108
2.0	468.00	.330	.170	.88	1.40	1.65	2.1	2.50	285.00	.025	7	xxxxx5-109
1.0	500.00	.480	.360	.60	.98	1.15	1.5	1.70	720.00	.020	7	xxxxx5-110
1.0	1900.00	.570	.470	.43	.70	.80	1.0	1.23	1150.00	.020	7	xxxxx5-111
30.00	4.00	.058	.002	13.00	28.00	35.00	43.00	50.00	3.10	.100	8	xxxxx5-112
30.00	19.00	.130	.004	8.70	12.80	16.00	19.80	23.00	6.70	.100	8	xxxxx5-113
30.00	26.50	.150	.005	7.36	10.80	13.60	16.70	13.40	7.50	.100	8	xxxxx5-114
20.00	31.00	.163	.007	6.90	10.00	12.60	15.50	18.00	13.60	.080	8	xxxxx5-115
20.00	45.00	.200	.009	5.65	8.30	10.40	12.80	14.80	15.00	.080	8	xxxxx5-116
10.00	90.00	.280	.015	4.00	5.88	7.35	9.00	10.50	50.00	.057	8	xxxxx5-117
5.00	200.00	.420	.042	2.70	4.00	5.00	6.00	7.00	140.00	.040	8	xxxxx5-118
3.00	220.00	.520	.080	2.00	3.20	3.90	4.81	5.60	275.00	.032	8	xxxxx5-119
2.00	530.00	.670	.160	1.70	2.50	3.00	3.80	4.50	450.00	.025	8	xxxxx5-120
1.25	660.00	.750	.270	1.50	2.20	2.80	3.40	3.90	620.00	.020	8	xxxxx5-121
1.25	835.00	.850	.320	1.30	2.00	8.50	3.00	3.50	760.00	.020	8	xxxxx5-122
1.25	1000.00	.930	.340	1.20	1.80	2.50	2.70	3.20	880.00	.020	8	xxxxx5-123
30.00	3.20	.060	.002	25.00	36.80	45.00	56.00	65.00	2.80	.100	9	xxxxx5-124
30.00	8.50	.100	.003	15.30	23.00	29.00	35.00	40.00	5.50	.100	9	xxxxx5-125
30.00	25.00	.167	.005	8.80	13.00	16.00	20.00	23.00	8.80	.100	9	xxxxx5-126
20.00	51.00	.240	.010	6.00	9.00	11.30	14.00	16.00	19.00	.080	9	xxxxx5-127
20.00	73.00	.280	.012	5.00	7.40	9.20	11.30	13.00	24.00	.080	9	xxxxx5-128
10.00	180.00	.400	.021	3.80	5.60	7.00	8.60	10.00	70.00	.057	9	xxxxx5-129
5.00	200.00	.480	.046	3.00	4.50	5.70	6.35	8.10	152.00	.040	9	xxxxx5-130
5.00	.30	.610	.060	2.40	3.60	4.50	5.50	6.40	210.00	.040	9	xxxxx5-131
3.00	520.00	.760	.120	2.00	2.83	3.85	4.40	5.00	400.00	.037	9	xxxxx5-132
2.00	810.00	1.000	.220	1.50	2.30	2.90	3.50	4.00	690.00	.025	9	xxxxx5-133
1.25	1000.00	1.060	.380	1.40	2.03	2.60	3.20	3.65	920.00	.020	9	xxxxx5-134
1.25	1300.00	1.200	.435	1.0	1.80	2.30	2.80	3.20	115.00	.020	9	xxxxx5-135
30.00	4.20	.085	.002	30.00	44.00	55.00	67.00	78.00	3.78	.100	10	xxxxx5-136
30.00	17.00	.150	.005	15.00	22.00	28.00	34.00	33.00	11.60	.100	10	xxxxx5-137
30.00	68.00	.380	.009	7.50	11.00	14.00	17.00	20.00	16.00	.100	10	xxxxx5-138
20.00	96.00	.460	.012	6.20	9.00	11.50	14.20	16.50	36.00	.080	10	xxxxx5-139
10.00	200.00	.670	.026	4.30	6.25	7.80	9.60	11.20	116.00	.057	10	xxxxx5-140
10.00	270.00	.765	.030	3.80	5.60	7.00	8.50	9.90	137.00	.057	10	xxxxx5-141
5.00	430.00	1.030	.076	2.75	4.00	5.00	6.20	7.20	343.0	.040	10	xxxxx5-142
3.00	710.00	1.240	.144	2.28	6.00	7.70	9.50	11.00	632.00	.032	10	xxxxx5-143
3.00	1000.00	1.460	.177	2.00	2.85	3.60	4.40	5.20	770.00	.032	10	xxxxx5-144
2.00	1600.00	1.860	.340	1.50	2.25	2.80	3.45	4.00	1360.00	.025	10	xxxxx5-145
1.25	2000.00	2.100	.600	1.35	2.00	2.50	3.10	3.60	1840.00	.020	10	xxxxx5-146
1.25	2600.00	2.350	.680	1.20	1.77	2.20	2.70	3.20	2314.00	.020	10	xxxxx5-147

CHOOSE STYLE PAGE A•1196 TO COMPLETE PART NUMBER

Automatic Coil Corp.
a DSG company
Dept. E 3545 N.W. 71st Street, Miami, Florida 33147
Telephone: (305) 696-6660, FAX: (305) 696-0626

Toroid Power Inductors





- High inductance stability
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- Predictable swing
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- Single layer design
- Choice of mounting
- Solderable leads

$$X = \frac{V_{OP}}{V_{TEST}\ f_{OP}} \times 10^4$$

V_{OP} = operating voltage (RMS)
V_{TEST} = indicated test level (RMS)
f_{OP} = operating frequency

MAX DC CURRENT RATING	INDUCTANCE WITHOUT DC μH ± 10%	AC TEST LEVEL 10KHZ RMS	DCR MAX	MAX INDUCTANCE DROP for DC CURRENT INDICATED					INDUCTANCE AT MAX CURRENT	LEAD DIA	SIZE	AUTOMATIC COIL PART NUMBER
				10%	20%	30%	40%	50%				
30.0	1.15	.024	.002	25	35	106	134	156	1.1	.100	7	xxxxx4-101
30.0	2.05	.032	.003	19	26.5	35	44	52	1.9	.100	7	xxxxx4-102
30.0	3.20	.040	.004	15.3	21	28	34	40	3.0	.100	7	xxxxx4-103
20.0	7.20	.060	.005	10.2	14.3	18.8	23.5	27.5	68	.080	7	xxxxx4-104
10.0	14.0	.084	.009	7.3	10.2	13.5	16.9	19.7	12.3	.057	7	xxxxx4-105
5.0	29.00	.120	.023	5.1	7.1	9.4	11.8	13.8	27.6	.040	7	xxxxx4-106
4.0	60.00	.170	.025	3.6	5	6.5	8.3	9.6	52	.035	7	xxxxx4-107
3.0	120.00	.240	.084	2.5	3.5	4.6	5.8	6.8	100	032	7	xxxxx4-108
2.0	220.00	.330	.170	1.9	2.6	3.4	4.3	5	190	.025	7	xxxxx4-109
1.0	450.00	480	.360	1.3	1.8	2.4	3.0	3.5	423	.020	7	xxxxx4-110
1.0	900.00	.670	.470	.9	1.3	1.7	2.1	2.4	825	.020	7	xxxxx4-111
30.0	1.20	.046	.002	48	66	88	110	129	1.35	.100	8	xxxxx4-112
30.0	1.90	.058	.002	38.3	53.4	70.5	88.7	104	2.4	.100	8	xxxxx4-113
30.0	4.80	.093	.003	24	33	44	55.4	64.8	4.75	.100	8	xxxxx4-114
30.0	12.80	.150	.005	15.5	21.6	28.5	35.9	42	8.8	.100	8	xxxxx4-115
20.0	24.50	.200	.007	10.6	14.8	20	24.6	28.8	17.5	.080	8	xxxxx4-116
10.0	47.00	.290	.011	7.7	10.7	14	17.7	20.7	41	.064	8	xxxxx4-117
7.5	98.00	.420	.023	5.3	7.4	9.8	12.3	14.4	80	.050	8	xxxxx4-118
5.0	220.00	.630	.056	3.5	4.9	6.5	8.2	9.6	173	.040	8	xxxxx4-119
4.0	475.00	.930	.104	2.4	3.4	4.4	5.5	6.5	350	.035	8	xxxxx4-120
2.0	1000.00	1.340	.300	1.7	2.3	3.1	3.9	4.5	850	.025	8	xxxxx4-121
2.0	1800.00	1.800	.400	1.2	1.7	2.3	2.9	3.3	1350	.025	8	xxxxx4-122
1.5	2700.00	2.200	.623	1.00	1.4	1.8	2.1	3.1	2000	.023	8	xxxxx4-123
30.0	.98	.047	.002	61	85.7	113	142	166	1.26	.100	9	xxxxx4-124
30.0	3.00	.084	.002	35	48.5	64	80.1	94.3	2.76	.100	9	xxxxx4-125
30.0	6.00	.120	.003	24.6	34.3	45.3	57	66.6	5.72	.100	9	xxxxx4-126
30.0	15.50	.180	.005	15.4	21.4	28.3	35.6	44.5	10.3	.100	9	xxxxx4-127
20.0	30.00	.260	.008	11.2	15.6	20.6	26	30.4	21.6	.080	9	xxxxx4-128
10.0	66.00	.400	.016	7.4	10.4	13.7	17.2	20	54	.064	9	xxxxx4-129
7.5	120.00	.520	.033	5.6	7.8	10.3	13	15	98	.050	9	xxxxx4-130
5.0	240.00	.750	.064	3.9	5.4	7.2	9	10.5	195	.040	9	xxxxx4-131
5.0	500.00	1.070	.100	2.7	3.8	5.0	6.3	7.4	350	.040	9	xxxxx4-132
4.0	1000.00	1.530	.180	1.9	2.7	3.5	4.5	5.2	646	.035	9	xxxxx4-133
3.0	2200.00	2.260	.323	1.3	1.8	2.4	3.0	3.5	1300	.032	9	xxxxx4-134
30.0	2.00	.100	.002	59	82	108	136	160	2.13	.100	10	xxxxx4-135
30.0	5.20	.150	.003	37	52	68	86	100	4.9	.100	10	xxxxx4-136
30.0	11.50	.230	.005	24.7	34.5	45	57	67	10.0	.100	10	xxxxx4-137
30.0	23.50	.320	.007	17.5	24.3	32	40.4	47.3	17.0	.100	10	xxxxx4-138
30.0	50.00	.480	.010	11.9	16.5	21.8	27.5	32	26.0	.100	10	xxxxx4-139
20.0	100.00	.660	.013	8.5	11.8	15.6	19.6	23	55.0	.080	10	xxxxx4-140
10.0	245.00	1.050	.030	5.4	7.5	9.9	12.5	14.6	170	.064	10	xxxxx4-141
7.5	500.00	1.500	.065	3.8	5.3	7.0	8.8	10.3	340	.050	10	xxxxx4-142
6.5	1000.00	2.100	.145	2.7	3.8	5.	6.3	7.3	525	.040	10	xxxxx4-143
6.5	2200.00	3.100	.230	1.8	2.5	3.3	4.2	4.9	990	.040	10	xxxxx4-144
4.0	4000.00	4.200	.380	1.3	1.9	2.5	3.1	3.6	1700	.035	10	xxxxx4-145

CHOOSE STYLE PAGE A • 1196 TO COMPLETE PART NUMBER

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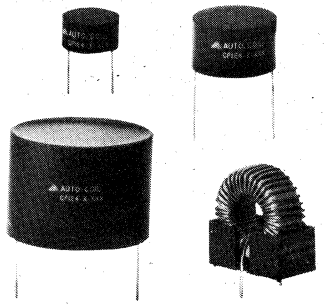
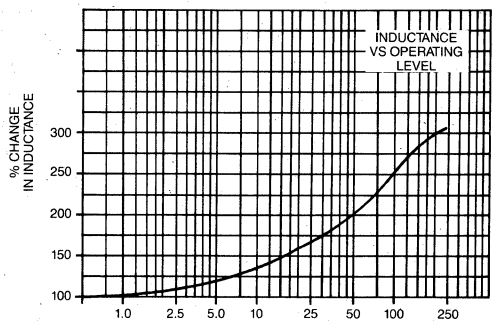
- Single layer design
- Choice of mounting
- Solderable leads

$$X = \frac{V_{OP}}{V_{TEST} \quad f_{OP}} \times 10^4$$

V_{OP} = operating voltage (RMS)
V_{TEST} = indicated test level (RMS)
f_{OP} = operating frequency





MAX CONT DCI	L (μH) WITHOUT D.C. +20-10%	AC TEST LEVEL 10 KHZ RMS	DCR MAX	% INDUCTANCE DROP FOR D.C. CURRENT INDICATED					LEAD DIA	SIZE	AUTO COIL PART NUMBER
				10%	20%	30%	40%	50%			
1.0	20.7	.022	.040	1.24	1.76	2.65	3.53	4.40	.020	1	xxxxx1-101
1.0	32.0	.028	.052	.95	1.35	2.03	2.70	3.40	.020	1	xxxxx1-102
1.0	32.0	.032	.055	1.12	1.60	2.40	3.20	4.00	.020	2	xxxxx1-103
2.0	35.0	.450	.035	1.47	2.10	3.15	4.20	5.25	.025	3	xxxxx1-104
1.0	50.0	.050	.065	1.24	1.76	2.65	3.53	4.40	.020	3	xxxxx1-105
3.0	20.0	.026	.020	1.40	2.00	3.00	4.00	5.00	.032	4	xxxxx1-106
3.0	40.0	.052	.028	1.57	2.25	3.36	4.50	5.60	.032	5	xxxxx1-107
2.0	60.2	.040	.053	1.06	1.50	2.28	3.04	3.80	.025	5	xxxxx1-108
2.0	100.0	.084	.100	1.00	1.45	2.18	2.90	3.64	.020	5	xxxxx1-109
5.0	55.0	.090	.025	2.00	2.90	4.40	5.84	7.30	.040	6	xxxxx1-110
3.0	100.0	.120	.048	1.55	2.20	3.30	4.42	5.52	.032	6	xxxxx1-111
2.0	145.00	.150	.085	1.27	1.82	2.72	3.63	4.54	.025	6	xxxxx1-112
7.5	55.0	.150	.017	3.00	4.28	6.42	8.57	10.70	.051	7	xxxxx1-113
3.0	100.00	.200	.052	2.20	3.12	4.69	6.25	7.80	.032	7	xxxxx1-114
3.0	165.0	.260	.065	1.72	2.45	3.68	4.90	6.14	.032	7	xxxxx1-115
2.0	285.0	.340	.140	1.29	1.84	2.76	3.68	4.60	.025	7	xxxxx1-116
10.0	55.0	.170	.018	3.54	5.00	7.60	10.00	12.65	.064	8	xxxxx1-117
7.5	95.0	.220	.030	2.70	3.85	5.78	7.70	9.60	.051	8	xxxxx1-118
5.0	170.0	.300	.063	2.00	2.86	4.30	5.72	7.15	.040	8	xxxxx1-119
3.0	270.0	.380	.120	1.58	2.27	3.40	4.53	5.67	.032	8	xxxxx1-120
2.0	450.0	.490	.250	1.23	1.75	2.34	3.12	3.90	.025	8	xxxxx1-121

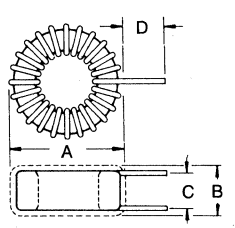
CHOOSE STYLE PAGE BELOW TO COMPLETE PART NUMBER

Reduction of inductance due to DC current can be taken from tables. To find additional inductance change for operating levels and frequency other than listed in tables, solve for X using formula given above.

Use V_{OP} = Actual operating level (RMS)
V_{TEST} = RMS test level indicated at 10KHz
f_{OP} = Actual operating frequency
Refer to corresponding graph to determine inductance change in %.

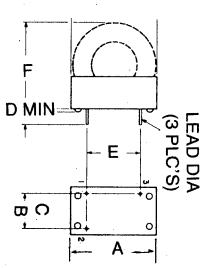
STANDARD STYLES

CPIDIx-xxx



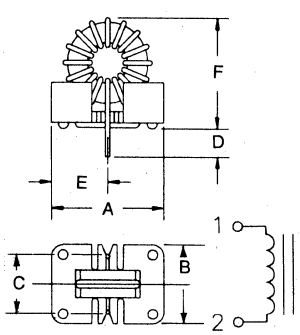
SIZE	A	B	CREF	D±.125
1	.55	.25	.18	.375
2	.64	.28	.20	.375
3	.70	38	.28	375
4	.85	.33	.22	.375
5	.85	.41	.28	.375
6	1.05	.55	.40	.75
7	1.4	.75	.50	.75
8	1.65	.90	.50	.75
9	1.9	1.0	.75	.75
10	2.1	1.1	.625	.75

CPIE2x-xxx



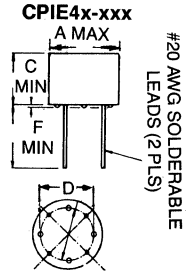
SIZE	A	B	C	D	E	F
1	—	—	—	—	—	—
2	—	—	—	—	—	—
3	—	—	—	—	—	—
4	.9	.5	.25	.5	.6	.95
5	.90	.5	.25	.5	.6	.95
6	1.25	.55	.40	.5	.8	1.35
7	1.65	.95	.75	.5	1.00	1.50
8	1.75	1.00	.75	.5	1.25	1.00
9	1.9	1.13	.9	.5	1.5	2.0
10	2.1	1.13	.9	.5	1.5	2.2

CPIF3x-xxx



SIZE	A	B	C	D	E	F NOM
1	.58	.34	.22	.25	.29	.60
2	.65	.45	.30	.25	.33	.65
3	.83	.45	.30	.25	.415	.65
4	.83	.45	.30	.25	.415	.65
5	.83	.45	.30	.25	.415	.85
6	.95	.60	.45	.25	.475	.95
7	1.25	.75	.500	.25	.625	1.25

CPIE4x-xxx



6-32 INSERT SIZES
SIZES 7 THRU 10

SIZE	A	C	D	F	G
1	.75	.40	.500	.5	.025
2	.75	.400	.500	.5	.025
3	1.00	.500	.75	.5	.036
4	1.0	.500	.75	.5	.032
5	1.00	.500	.75	.5	.032
6	1.25	.800	1.00	.5	.032
7	1.625	1.00	1.25	.5	.040
8	1.75	1.125	1.5	.5	.040
9	2.75	1.375	2.00	.5	.040
10	2.5	1.375	2.25	.5	.040

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- Open construction for max cooling
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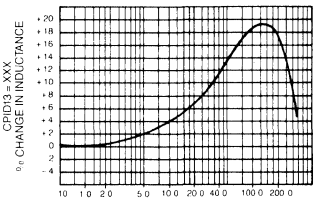

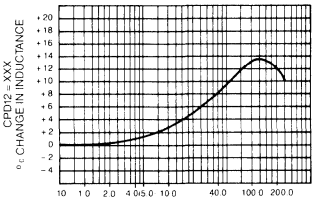

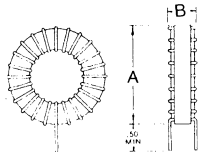

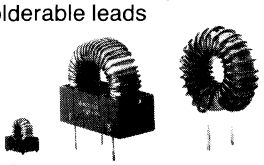

$$X = \frac{V_{OP}}{V_{TEST}\ \ f_{OP}} \times 10^4$$

V_{OP} = operating voltage (RMS)
V_{TEST} = indicated test level (RMS)
f_{OP} = operating frequency

MAX. CONT. DCI RATING	L(μH) WITHOUT D.C. ±-10%	VTEST A.C. TEST LEVEL 10KHZ RMS	DCR	% INDUCTANCE DROP FOR D.C. CURRENT INDICATED				L(μH) AT MAX CURRENT	LEAD DIA	SIZE		AUTOCOIL PART NUMBER
				10%	20%	30%	40%			DIM A	B	
5.0	50	.100	.030	4.6	—	—	—	44.0	.040	1.125	.63	CPID12-101
5.0	80	.125	.037	3.6	—	—	—	68.0	.040	1.125	.63	CPID12-102
5.0	90	.200	.040	5.0	—	—	—	81.0	.040	1.375	.88	CPID12-103
5.0	200	.300	.063	3.4	—	—	—	164.0	.040	1.375	1.25	CPID12-104
5.0	600	.732	.120	3.0	—	—	—	490	.040	1.375	1.375	CPID12-105
10.0	17	.060	.010	7.9	—	—	—	14.5	.050	1.125	.63	CPID12-106
10.0	43	.140	.018	7.3	—	—	—	36.0	.050	1.375	.88	CPID12-107
10.0	100	.300	.031	6.8	—	—	—	84.0	.050	1.375	1.25	CPID12-108
10.0	150	.400	.038	6.4	—	—	—	123.0	.050	1.875	.95	CPID12-109
10.0	300	.800	.065	6.4	—	—	—	246.0	.050	1.875	1.625	CPID12-110
15.0	15	.038	.006	12.0	—	—	—	12.9	.064	1.125	.63	CPID12-111
15.0	27	.110	.010	9.2	—	—	—	22.0	.064	1.375	.88	CPID12-112
15.0	60	.230	.015	8.8	15.0	—	—	48.0	.064	1.375	1.375	CPID12-113
15.0	82	.300	.017	8.5	14.6	—	—	65.0	.064	1.875	.95	CPID12-114
15.0	145	.570	.028	9.0	15.0	—	—	116.0	.064	1.875	1.625	CPID12-115
25.0	6.2	.035	.004	13.0	22.5	—	—	4.8	.080	1.125	.63	CPID12-116
25.0	10.5	.064	.005	14.3	24.5	—	—	8.4	.080	1.125	.88	CPID12-117
25.0	22	.140	.006	14.7	25.0	—	—	17.6	.080	1.375	1.875	CPID12-118
25.0	43	.220	.009	11.9	20.4	—	—	31.0	.080	1.875	.95	CPID12-119
25.0	86	.440	.014	11.9	20.4	—	—	62.0	.080	1.875	1.625	CPID12-120
40.0	2	.020	.002	22.5	38.6	—	—	1.6	.100	1.125	.63	CPID12-121
40.0	4.5	.040	.003	22.5	38.6	—	—	3.5	.100	1.125	1.45	CPID12-122
40.0	6	.040	.003	20.0	33.6	—	—	4.3	.100	1.375	.88	CPID12-123
40.0	12	.100	.005	20.0	33.6	—	—	8.6	.100	1.375	1.875	CPID12-124
40.0	21	.152	.005	17.0	30.0	39.0	—	14.5	.100	1.95	.95	CPID12-125
40.0	60	.360	.008	14.4	25.0	32.9	—	37.2	.100	1.95	1.625	CPID12-126

MAX. CONT. DCI RATING	L(μH) WITHOUT D.C. ± 10%	A.C. TEST LEVEL 10KHZ RMS	DCR	% INDUCTANCE DROP FOR D.C. CURRENT INDICATED					L(μH) AT MAX CURRENT	LEAD DIA	SIZE		AUTOCOIL PART NUMBER
				10%	20%	30%	40%	50%			DIM A	B	
5.0	110.0	.100	.030	2.0	3.75	5.00	—	—	77.0	.040	1.125	.63	CPID13-101
5.0	160.0	.124	.036	1.7	3.20	4.29	—	—	104.0	.040	1.125	.63	CPID13-102
5.0	170.0	.190	.038	2.6	4.58	—	—	—	130.0	.040	1.375	.88	CPID13-103
5.0	360.0	.400	.060	2.5	4.44	—	—	—	270.0	.040	1.375	1.25	CPID13-105
5.0	1000.0	.650	.120	1.5	2.70	3.60	—	6.30	560.0	.040	1.375	1.25	CPID13-106
10.0	36.0	.060	.011	3.82	6.75	9.00	—	—	23.4	.050	1.125	.63	CPID13-107
10.0	90.0	.140	.018	3.56	6.28	8.37	—	—	58.0	.050	1.375	.88	CPID13-108
10.0	212.0	.300	.030	3.30	5.82	7.75	10.00	—	125.0	.050	1.375	1.25	CPID13-109
10.0	300.0	.400	.038	3.16	5.57	7.43	9.66	—	168.0	.050	1.875	.95	CPID13-110
10.0	600.0	.800	.065	3.16	5.57	7.43	9.66	—	330.0	.050	1.875	1.625	CPID13-111
15.0	32.0	.056	.008	4.00	7.10	9.50	12.30	—	16.6	.064	1.125	.63	CPID13-112
15.0	70.0	.121	.011	4.10	7.20	9.60	12.47	—	38.0	.064	1.375	.88	CPID13-113
15.0	125.0	.232	.015	4.28	7.55	10.00	13.10	—	68.0	.064	1.375	1.375	CPID13-114
15.0	160.0	.300	.019	4.28	7.55	10.00	13.10	—	87.0	.064	1.875	.95	CPID13-115
15.0	300.0	.570	.028	4.42	7.80	10.40	13.52	—	171.0	.064	1.875	1.625	CPID13-116
25.0	12.0	.038	.004	6.37	11.25	15.00	19.50	—	6.2	.080	1.125	.63	CPID13-117
25.0	18.0	.006	.004	7.63	13.50	18.00	23.40	—	10.0	.080	1.125	1.125	CPID13-118
25.0	26.5	.075	.005	6.60	11.63	15.50	20.10	—	13.8	.080	1.375	.88	CPID13-119
25.0	45.0	.140	.006	7.14	12.60	16.70	21.80	—	25.2	.080	1.375	1.875	CPID13-120
25.0	80.0	.210	.009	6.03	10.60	14.20	18.40	25.00	40.0	.080	1.95	.95	CPID13-121
25.0	180.0	.440	.014	5.77	10.10	13.58	17.60	23.00	83.0	.080	1.95	1.625	CPID13-122
40.0	4.4	.020	.002	11.00	19.30	25.70	33.40	—	2.3	.100	1.125	.63	CPID13-123
40.0	8.8	.040	.003	11.00	19.30	25.70	33.40	—	4.6	.100	1.125	1.45	CPID13-124
40.0	16.0	.060	.003	8.56	15.00	20.00	26.00	35.00	6.4	.100	1.375	.88	CPID13-125
40.0	25.0	.100	.004	9.50	16.80	22.40	29.00	39.00	11.5	.100	1.375	1.875	CPID13-126
40.0	43.0	.152	.005	8.30	14.60	19.50	25.30	34.00	17.0	.100	1.95	.95	CPID13-127
40.0	120.0	.360	.008	7.00	12.30	16.40	21.40	28.00	37.2	.100	1.95	1.625	CPID13-128

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Resistor Color Codes ..... **A**•1911
Resistors, Product Selection Guide ..... **A**•1849
Servo Components, Miniglossary ..... **B**•1238, **D**•2176
SI Units, Basic Guide To, ... **A**•1090, **B**•1050, **C**•1092, **D**•1048
Solenoids, Product Selection Guide ..... **B**•1612
Switches, Product Selection Guide ..... **B**•1636
Thermal Components, Product Selection Guide ..... **B**•1834
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1842
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Wire & Cable, Product Selection Guide ..... **C**•1763
Wire Guages—Diameter, Area, Copper Weight ..... **C**•1864

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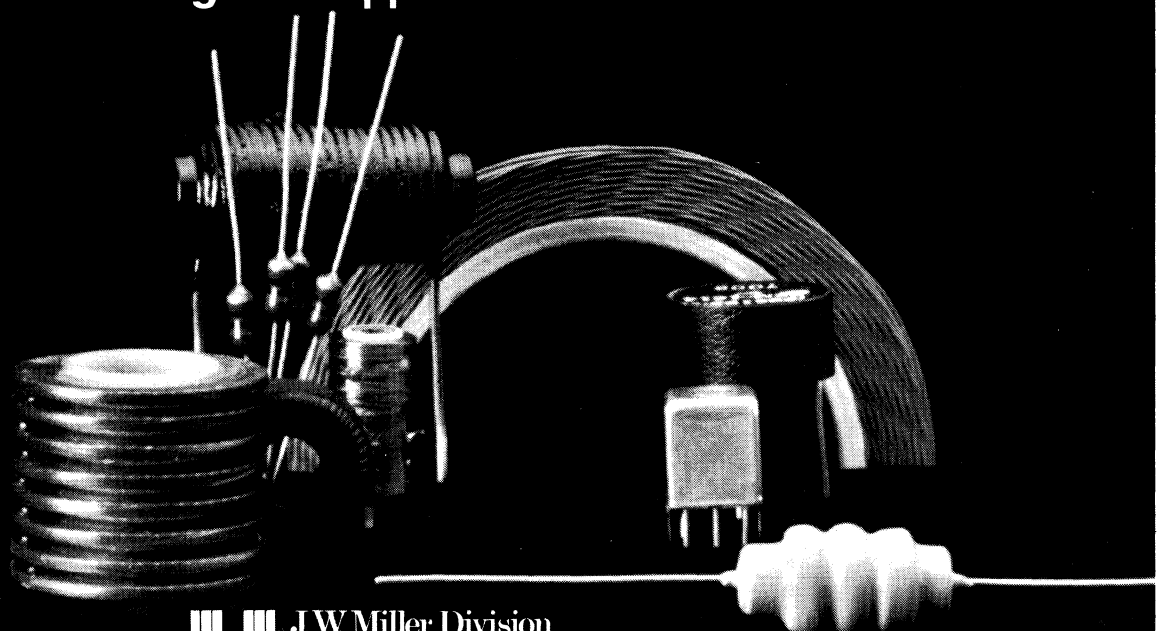
Complete design, manufacture and test facilities for your custom magnetic requirements. ...Call for design and application assistance.



J.W. Miller Division
BELL INDUSTRIES

19070 Reyes Ave. • Rancho Dominguez, CA 90221 • (213) 537-5200/TWX 910-346-6740/FAX 213-631-4217
Since 1924, leading manufacturer of standard and custom inductors.

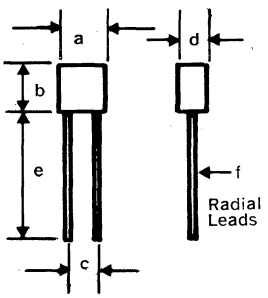
ENCAPSULATED SUBMINIATURE AND MINIATURE TOROIDAL INDUCTORS

Features

- Applications: printed circuits and modules
- Environmental: designed to meet MIL-C-15305, Grade 1, Class B (−55°C to +125°C)
- Moisture and shock resistant, immersion proof
- Powdered iron toroidal core, low external magnetic field
- Identification: part number and inductance value printed in contrasting color

General Specifications (All Series)

Maximum operating temperature: 125°C
Rated temperature rise (at 90°C): 35°C
Dielectric withstanding voltage: 700 v rms
Terminal pull: 5 pounds
Altitude rating: 70,000 feet
Overload current: 1.4 times the rated current



Closer inductance tolerances * available on request.

T1 SERIES

Part Number	Apparent Induc., uH	Max. DC Resist., Ohms	Rated DC Current mA
100066	0.01	0.02	3000
100067	0.012	0.02	3000
100068	0.015	0.02	3000
100069	0.018	0.02	3000
100070	0.022	0.02	3000
100071	0.027	0.02	3000
100072	0.033	0.02	3000
100073	0.039	0.02	3000
100074	0.047	0.02	3000
100075	0.056	0.02	3000
100076	0.068	0.03	2500
100077	0.082	0.04	2200
100078	0.10	0.04	2200
100079	0.12	0.05	2000
100080	0.15	0.06	1800
100081	0.18	0.07	1600
100082	0.22	0.08	1500
100083	0.27	0.10	1400
100084	0.33	0.12	1300
100085	0.39	0.15	1150
100086	0.47	0.20	1000
100087	0.56	0.25	900
100088	0.68	0.30	800
100089	0.82	0.35	750
100090	1.0	0.40	700

a	b	c	d	e	f
.2	.2	.1	.1	1.0	#24

Inductance Tolerances: 0.01 to 0.082 uH, ±20%; 0.10 to 1.0 uH, ±10%.

T2 SERIES

Part Number	Apparent Induc., uH	Max. DC Resist., Ohms	Rated DC Current mA
100092	0.10	0.04	2200
100093	0.12	0.05	2000
100094	0.15	0.06	1800
100095	0.18	0.07	1600
100096	0.22	0.08	1500
100097	0.27	0.10	1400
100098	0.33	0.11	1300
100099	0.39	0.14	1200
100100	0.47	0.17	1100
100101	0.56	0.22	1000
100102	0.68	0.27	900
100103	0.82	0.30	800
100104	1.0	0.35	750
100105	1.2	0.40	700
100106	1.5	0.50	630
100107	1.8	0.70	530
100108	2.2	0.90	470
100109	2.7	1.1	420
100110	3.3	1.3	390
100111	3.9	1.5	360
100112	4.7	1.8	330
100113	5.6	2.0	310
100114	6.8	2.2	300
100115	8.2	2.4	290
100116	10	2.6	280

a	b	c	d	e	f
.2	.2	.1	.1	1.0	#24

Inductance Tolerances: 0.10 to 0.82 uH, ±10%; 1.0 to 10 uH, ±5%.

T3 SERIES

Part Number	Apparent Induc., uH	Max. DC Resist., Ohms	Rated DC Current mA
100117	10	1.1	550
100118	12	1.3	500
100119	15	1.5	450
100120	18	1.9	410
100121	22	2.3	380
100122	27	2.7	350
100123	33	3.3	320
100124	39	3.9	290
100125	47	4.7	260
100126	56	5.6	240
100127	68	6.8	220
100128	82	8.1	200
100129	100	9.7	180
100130	120	12	160
100131	150	14	150
100132	180	17	140
100133	220	20	130
100134	270	24	120
100135	330	19	130
100136	390	22	120
100137	470	27	110
100138	560	32	100
100139	680	19	130
100140	820	23	120
100141	1000	27	110

a	b	c	d	e	f
.27	.27	.2	.15	1.0	#22

Inductance Tolerance: ±5%.

T4 SERIES

Part Number	Apparent Induc., uH	Max. DC Resist., Ohms	Rated DC Current mA
100142	100	6	280
100143	120	7	260
100144	150	8	240
100145	180	10	220
100146	220	12	200
100147	270	14	180
100148	330	17	160
100149	390	20	150
100150	470	24	140
100151	560	28	130
100152	680	33	120
100153	820	39	110
100154	1000	45	100
100155	1200	31	120
100156	1500	37	110
100157	1800	44	100
100158	2200	52	90
100159	2700	61	85
100160	3300	71	80
100161	3900	82	75
100162	4700	93	70
100163	5600	105	65
100164	6800	140	60
100165	8200	160	55

a	b	c	d	e	f
.375	.375	.2	.187	1.0	#22

Inductance Tolerance: ±5%.

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MOLDED SHIELDED MINIATURE R F CHOKES

Part Number	MS Type	Induct. Micro-henries ±10%	D.C. Resist. Max.	Milli-amp Rating Max.
9250-101	75087-1	0.10	.025	1790
9250-121	75087-2	.12	.034	1530
9250-151	75087-3	.15	.037	1470
9250-181	75087-4	.18	.047	1300
9250-221	75087-5	.22	.067	1100
9250-271	75087-6	.27	.11	855
9250-331	75087-7	.33	.13	780
9250-391	75087-8	.39	.18	670
9250-471	75087-9	.47	.25	565
9250-561	75087-10	.56	.33	490
9250-681	75087-11	.68	.45	420
9250-821	75087-12	.82	.59	370
9250-102	75088-1	1.00	.07	1070
9250-122	75088-2	1.20	.10	895
9250-152	75088-3	1.50	.12	815
9250-182	75088-4	1.80	.14	775
9250-222	75088-5	2.20	.19	650
9250-272	75088-6	2.70	.28	535
9250-332	75088-7	3.30	.35	480
9250-392	75088-8	3.90	.40	450
9250-472	75088-9	4.70	.55	380
9250-562	75088-10	5.60	.77	335
9250-682	75088-11	6.80	1.02	280
9250-822	75088-12	8.20	1.32	250
9250-103	75088-13	10.0	1.62	220
9250-123	75088-14	12.0	2.00	200
9250-153	75089-1	15.0	.80	315
9250-183	75089-2	18.0	.89	300
9250-223	75089-3	22.0	.96	290
9250-273	75089-4	27.0	1.19	260
9250-333	75089-5	33.0	1.37	240
9250-393	75089-6	39.0	1.93	205
9250-473	75089-7	47.0	2.11	195
9250-563	75089-8	56.0	2.23	190
9250-683	75089-9	68.0	2.70	170
9250-823	75089-10	82.0	2.44	180
9250-104	75089-11	100.0	3.12	160
9250-124	75089-12	120.0	3.60	150
9250-154	75089-13	150.0	4.10	140
9250-184	75089-14	180.0	4.40	135
9250-224	75089-15	220.0	5.00	125
9250-274	75089-16	270.0	5.80	115
9250-334	75089-17	330.0	6.40	110
9250-394	75089-18	390.0	7.40	105
9250-474	75089-19	470.0	9.50	92
9250-564	75089-20	560.0	10.5	90
9250-684	75089-21	680.0	11.8	80
9250-824	75089-22	820.0	13.0	80
9250-105	75089-23	1,000.0	17.5	70
9250-125	75089-24	1,200.0	22.1	60
9250-155	75089-25	1,500.0	26.5	55
9250-185	75089-26	1,800.0	29.9	50
9250-225	75089-27	2,200.0	33.8	50
9250-275	75089-28	2,700.0	47.3	40
9250-335	75089-29	3,300.0	53.0	40
9250-395	75089-30	3,900.0	73.8	35
9250-475	75089-31	4,700.0	81.6	31
9250-565	75089-32	5,600.0	98.9	28
9250-685	75089-33	6,800.0	111.0	27
9250-825	75089-34	8,200.0	119.0	26
9250-106	75089-35	10,000.0	137.0	24
9250-126	75089-36	12,000.0	143.0	23
9250-156	75089-37	15,000.0	157.0	22
9250-186	75089-38	18,000.0	175.0	21
9250-226	75089-39	22,000.0	274.0	17
9250-276	75089-40	27,000.0	308.0	16
9250-336	75089-41	33,000.0	343.0	15
9250-396	75089-42	39,000.0	376.0	15
9250-476	75089-43	47,000.0	473.0	13
9250-566	75089-44	56,000.0	512.0	13
9250-686	75089-45	68,000.0	580.0	12
9250-826	75089-46	82,000.0	618.0	11
9250-107	75089-47	100,000.0	678.0	11

0.10 thru 0.82 uh — Phenolic Core.
1.00 thru 12 uh — Iron Core.
15 + uh — Ferrite Core.
Mold Size: .162 ±.010 Diameter; .410 ±.020 length.
Leads: AWG #22TCW; 1.438±.188 Length.

Mold Size	Mold Diameter	Mold Length	Lead Size	Lead Length
A	.190±.010	.440±.010	AWG #22	1.44±.188
B	.215±.010	.560±.010	AWG #21	1.44±.188
C	.240±.010	.740±.010	AWG #20	1.44±.188
D	.155±.010	.375±.010	AWG #22	1.44±.188

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MICRO MITE MOLDED RF CHOKES

Miller Part Numer	MS Type	Induct Micro-henries ±5%	D.C. Resist. Max.	Mili-amp Rating Max.	Mold Size
9210-54	90538-01	36	2.50	180	D
9210-56	90538-02	39	2.60	176	D
9210-58	90538-03	43	2.70	172	D
9210-60	90538-04	47	2.75	170	D
9210-62	90538-05	51	2.85	167	D
9210-64	90538-06	56	3.00	164	D
9210-66	90538-07	62	3.15	160	D
9210-68	90538-08	68	3.30	156	D
9210-70	90538-09	75	3.70	147	D
9210-72	90538-10	82	3.90	143	D
9210-74	90538-11	91	4.30	136	D
9210-76	90538-12	100	4.50	133	D
9210-78	90538-13	110	4.90	128	D
9210-80	90538-14	120	5.20	124	D
9210-82	90538-15	130	5.45	121	D
9210-84	90538-16	150	6.05	114	D
9210-86	90538-17	160	6.40	111	D
9210-88	90538-18	180	6.75	108	D
9210-90	90538-19	200	7.10	106	D
9210-92	90538-20	220	7.45	103	D
9210-94	90538-21	240	7.80	101	D
9220-00	90539-01	270	8.2	110	A
9220-02	90539-02	300	8.7	107	A
9220-04	90539-03	330	9.1	105	A
9220-06	90539-04	360	9.6	102	A
9220-08	90539-05	390	10.0	100	A
9220-10	90539-06	430	10.6	97	A
9220-12	90539-07	470	11.1	95	A
9220-14	—	500	11.6	93	A
9220-15	90539-08	510	11.6	92	A
9220-16	90539-09	560	12.3	91	A
9220-18	90539-10	620	13.0	88	A
9220-20	90539-11	680	13.7	85	A
9220-22	90539-12	750	14.4	83	A
9220-24	90539-13	820	15.1	81	A
9220-26	90539-14	910	15.8	79	A
9220-28	90539-15	1000	16.5	78	A
9220-30	90540-01	1100	21.0	78	B
9220-32	90540-02	1200	22.0	76	B
9220-34	90540-03	1300	23.0	75	B
9220-36	90540-04	1500	25.0	72	B
9220-38	90540-05	1600	26.0	70	B
9220-40	90540-06	1800	28.0	68	B
9220-42	90540-07	2000	29.0	67	B
9220-44	90540-08	2200	30.0	66	B
9220-46	90540-09	2400	31.0	64	B
9220-48	90540-10	2700	33.0	62	B
9220-50	90540-11	3000	35.0	61	B
9220-52	90540-12	3300	38.0	58	B
9220-54	90540-13	3600	40.0	57	B
9220-56	90541-01	3900	44.0	61	C
9220-58	90541-02	4300	46.0	59	C
9220-60	90541-03	4700	48.0	58	C
9220-62	90541-04	5000	50.0	57	C
9220-64	90541-05	5600	53.0	56	C
9220-66	90541-06	6200	56.0	54	C
9220-68	90541-07	6800	59.0	52	C
9220-70	90541-08	7500	62.0	51	C
9220-72	90541-09	8200	65.0	50	C
9220-74	90541-10	9100	68.0	49	C
9220-76	90541-11	10000	72.0	47	C

Miller Part Number	MS Type	Induct. Micro-henries*	D.C. Resist. Max.	Milliamp Rating Max.
9310-00	18130-1	.15*	.03	2450
9310-02	18130-2	.22*	.055	1900
9310-04	18130-3	.33*	.09	1400
9310-06	18130-4	.47*	.12	1225
9310-07	18130-5	.56	.135	1220
9310-08	18130-6	.68	.15	1100
9310-10	18130-7	.82	.22	900
9310-12	18130-8	1.00	.29	830
9310-14	18130-9	1.20	.42	650
9310-16	18130-10	1.50	.50	600
9310-18	18130-11	1.80	.65	525
9310-20	18130-12	2.20	.95	435
9310-22	18130-13	2.70	1.20	385
9310-24	18130-14	3.30	2.00	300
9310-26	18130-15	3.90	2.30	280
9310-28	18130-16	4.70	2.60	260
9310-30	18130-17	5.60	.32	750
9310-32	18130-18	6.80	.50	600
9310-34	18130-19	8.20	.60	545
9310-36	18130-20	10.0	.90	445
9310-38	18130-21	12.0	1.10	404
9310-40	18130-22	15.0	1.40	370
9310-42	18130-23	18.0	2.25	280
9310-44	18130-24	22.0	2.50	265
9310-46	—	24.0	2.50	265
9310-48	18130-25	27.0	2.60	260
9310-50	—	30.0	2.80	255
9310-52	18130-26	33.0	3.00	250

Mold Size: .156 ±.010 Diameter; .375 ±.010 Lgth.
Leads: AWG #22 TCW; 1.437 ±.188 Lgth.

MICRO-MINIATURE MOLDED RF CHOKES

We are pleased to offer the following series of molded RF chokes. They represent what we believe to be the smallest package for the current rating specified. Color Coding is per MIL-C-15305.

Miller Part No.	MS Type	Inductance Micro-henries ±10%	Max. D.C. Resis-tance	Milli-amp Rating Max.
9230-94	75083-1	.10	.07	1100
9230-96	75083-2	.12	08	1100
9230-00	75083-3	.15	.10	1100
9230-02	75083-4	.18	.12	1010
9230-04	75083-5	.22	.14	935
9230-06	75083-6	.27	.16	875
9230-08	75083-7	.33	.20	780
9230-10	75083-8	.39	.30	640
9230-12	75083-9	.47	.35	590
9230-14	75083-10	.56	.50	495
9230-16	75083-11	.68	.60	450
9230-18	75083-12	.82	.85	380
9230-20	75083-13	1.00	1.00	350
9230-22	75084-1	1.20	.18	825
9230-24	75084-2	1.50	.22	745
9230-26	75084-3	1.80	.30	640
9230-28	75084-4	2.20	.40	550
9230-30	75084-5	2.70	.50	495
9230-32	75084-6	3.30	.85	380
9230-34	75084-7	3.90	1.00	350
9230-36	75084-8	4.70	1.20	320
9230-38	75084-9	5.60	1.80	260
9230-40	75084-10	6.80	2.00	245
9230-42	75084-11	8.20	2.70	210
9230-44	75084-12	10.00	3.70	180
9230-46	75084-13	12.00	2.70	210
9230-48	75084-14	15.00	2.80	205
9230-50	75084-15	18.00	3.10	195
9230-52	75084-16	22:00	3.30	190
9230-54	75084-17	27.00	3.50	185
9230-56	75085-1	33.00	3.40	187
9230-58	75085-2	39.00	3.60	180
9230-60	75085-3	47.00	4.50	165
9230-62	75085-4	56.00	5.70	145
9230-64	75085-5	68.00	6.70	135
9230-66	75085-6	82.00	7.30	130
9230-68	75085-7	100.00	8.00	125
9230-70	75085-8	120.00	13.00	97
9230-72	75085-9	150.00	15.00	85
9230-74	75085-10	180.00	17.00	79
9230-76	75085-11	220.00	21.00	73
9230-78	75085-12	270.00	25.00	65
9230-80	75085-13	330.00	28.00	62
9230-82	75085-14	390.00	35.00	55
9230-84	75085-15	470.00	42.00	50
9230-86	75085-16	560.00	46.00	48
9230-88	75085-17	680.00	60.00	42
9230-90	75085-18	820.00	65.00	40
9230-92	75085-19	1000.00	72.00	38

Mold Size: .095 ±.010 Diameter; .250 ±.010 Length.
Leads: AWG #24 TCW; 1.500 ±.188 Length.

Molded Choke Series 9210, 9230, and 9310 also are available in equivalent epoxy conformal coated . . . manufactured to the same high standards.

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SERIES S, M, L MOLDED R.F. CHOKES

Series	Lengths	Diameter	Lead Size	Lead Length
S	.44 max.	.188 max.	#22 AWG	1.3 min.
M	.60 max.	.25 max.	#21 AWG	1.3 min.
L	.90 max.	.31 max.	#21 AWG	1.3 min.

Inductance Tolerance: 0.1 to 22 uH, ±10% on Q-meter

Physical and Environmental Characteristics
Operating temperature −55° to +125°C
Terminal strength—meets five pound pull test per MIL-C-15305
All Series meet requirements of MIL-C-15395, Grae 1, Class B
Inductance Tolerance: 0.1 to 22 uH, ±10% on Q-meter/
27 uH to 10,000, ±5% kHz bridge

SERIES S

Part Number	-L-Micro-Henries	Max DC Res. Ohms	Max I mA
100170	0.10	0.02	4000
100171	0.12	0.025	3500
100172	0.15	0.03	3000
100173	0.18	0.03	3000
100174	0.22	0.03	3000
100175	0.27	0.04	2700
100176	0.33	0.05	2500
100177	0.39	0.08	2000
100178	0.47	0.08	2000
100179	0.56	0.10	1700
100180	0.68	0.12	1500
100181	0.82	0.18	1300
100182	1.0	0.24	1100
100183	1.2	0.35	1000
100184	1.5	0.43	850
100185	1.8	0.65	720
100186	2.2	0.80	610
100187	2.7	0.12	1600
100188	3.3	0.15	1400
100189	3.9	0.23	1200
100190	4.7	0.30	1000
100191	5.6	0.45	900
100192	6.8	0.55	800
100193	8.2	0.65	720
100194	10.0	0.73	650
100195	12.0	1.1	590
100196	15.0	1.4	500
100197	18.0	1.6	460
100198	22.0	1.8	430

SERIES S

Part Number	-L-Micro-Henries	Max DC Res. Ohms	Max I mA
100199	27.0	2.7	360
100200	33.0	3.5	300
100201	39.0	3.8	290
100202	47.0	4.0	275
100203	56.0	4.4	265
100204	68.0	4.7	250
100205	82.0	5.3	235
100206	100.0	6.0	220

SERIES M

Part Number	-L-Micro-Henries	Max DC Res. Ohms	Max I mA
100207	1.0	0.04	2700
100208	1.2	0.04	2700
100209	1.5	0.04	2700
100210	1.8	0.05	2500
100211	2.2	0.05	2500
100212	2.7	0.05	2500
100213	3.3	0.05	2500
100214	3.9	0.07	2100
100215	4.7	0.09	1800
100216	5.6	0.14	1550
100217	6.8	0.17	1300
100218	8.2	0.25	1150
100219	10.0	0.32	1000
100220	12.0	0.47	870
100221	15.0	0.62	730
100222	18.0	0.72	660
100223	22.0	0.8	600
100224	27.0	1.2	520
100225	33.0	1.5	450

SERIES M

Part Number	-L-Micro-Henries	Max DC Res. Ohms	Max I mA
100226	39.0	2.3	380
100227	47.0	3.0	300
100228	56.0	4.2	270
100229	68.0	5.2	250
100230	82.0	6.2	220
100231	100.0	7.0	200
100232	120.0	7.5	200
100233	150.0	8.0	190
100234	180.0	9.0	185
100235	220.0	10.0	180
100236	270.0	11.0	172
100237	330.0	12.0	165
100238	390.0	13.0	157
100239	470.0	14.0	150
100240	560.0	16.0	145
100241	680.0	17.0	140
100242	820.0	19.0	132
100243	1000.0	21.0	125

SERIES L

Part Number	-L-Micro-Henries	Max DC Res. Ohms	Max I mA
100244	10.0	0.15	1800
100245	12.0	0.23	1600
100246	15.0	0.3	1300
100247	18.0	0.4	1150
100248	22.0	0.5	1000
100249	27.0	0.6	900
100250	33.0	0.7	850
100251	39.0	1.1	720
100252	47.0	1.3	620

SERIES L

Part Number	-L-Micro-Henries	Max DC Res. Ohms	Max I mA
100253	56.0	1.8	540
100254	68.0	2.4	450
100255	82.0	2.8	425
100256	100.0	3.2	400
100257	120.0	4.8	360
100258	150.0	6.4	280
100259	180.0	9.5	240
100260	220.0	12.0	200
100261	270.0	13.0	195
100262	330.0	14.0	190
100263	390.0	15.5	180
100264	470.0	17.0	170
100265	560.0	18.5	165
100266	680.0	20.0	155
100267	820.0	22.0	150
100268	1000.0	24.0	145
100269	1200.0	27.0	137
100270	1500.0	29.0	130
100271	1800.0	32.0	125
100272	2200.0	35.0	120
100273	2700.0	40.0	112
100274	3300.0	45.0	105
100275	3900.0	49.0	100
100276	4700.0	53.0	95
100277	5600.0	60.0	90
100278	6800.0	67.0	85
100279	8200.0	75.0	82
100280	10000.0	80.0	80

SUB-MINIATURE RF CHOKES

An extremely versatile series of iron core R.F. chokes designed to meet the industries' demand for high reliability, ultra-miniature components. The coils are ideally suited to network and filter design, delay lines and computer applications. The coils are impregnated with a moisture resistant lacquer and on special order they can be fungus-proofed per JAN-T-152 using varnish per MIL-V-173A. They can also be encapsulated in epoxy resin to conform to Grade 1, Class B of MIL-C-15305. Note: L measured on 260A Q Meter except 120 thru 500 mH which are measured on 1 kHz Bridge.

Miller Part No.	Inductance Nominal*	D.C. Resistance Max.	Milliamp Rating Max.	Max. Winding Diam.	Form Length ±1/32
70F107AP	.10 uh★	.013	3922	.156	5/16
70F157AP	.15 uh★	.025	2828	.141	5/16
70F227AP	.22 uh★	.038	2294	.141	5/16
70F337AP	.33 uh★	.070	1690	.125	5/16
70F477AP	.47 uh★	.125	1264	.125	5/16
70F687AP	.68 uh★	.200	1000	.125	5/16
70F757AP	.75 uh★	.264	870	.125	5/16
70F827AP	.82 uh★	.290	830	.125	5/16
70F106AI	1.0 uh	.048	2041	.165	1/4
70F126AI	1.2 uh	.072	1666	.160	1/4
70F156AI	1.5 uh	.096	1443	.160	1/4
70F186AI	1.8 uh	.096	1443	.160	1/4
70F226AI	2.2 uh	.156	1132	.160	1/4
70F276AI	2.7 uh	.168	1091	.160	1/4
70F336AI	3.3 uh	.240	912	.150	1/4
70F396AI	3.9 uh	.264	870	.150	1/4
70F476AI	4.7 uh	.457	661	.150	1/4
70F566AI	5.6 uh	.492	637	.150	1/4
70F686AI	6.8 uh	.624	566	.150	1/4
70F756AI	7.5 uh	.624	566	.150	1/4
70F826AI	8.2 uh	.744	518	.150	1/4
70F916AI	9.1 uh	1.44	288	.160	1/4
70F105AI	10 uh	1.56	277	.160	1/4
70F125AI	12 uh	1.68	267	.160	1/4
70F155AI	15 uh	1.92	250	.165	1/4
70F185AI	18 uh	2.28	229	.165	1/4
70F225AI	22 uh	2.28	229	.165	1/4
70F255AI	25 uh	2.64	213	.170	1/4
70F275AI	27 uh	2.64	213	.170	1/4
70F335AI	33 uh	2.76	208	.170	1/4
70F395AI	39 uh	3.36	188	.175	1/4
70F475AI	47 uh	3.36	188	.175	1/4
70F565AI	56 uh	3.84	176	.180	1/4
70F685AI	68 uh	4.20	169	.180	1/4
70F755AI	75 uh	4.56	162	.185	1/4
70F825AI	82 uh	4.80	158	.185	1/4
70F915AI	91 uh	4.92	156	.185	1/4
70F104AI	100 uh	7.68	139	.165	1/4
70F124AI	120 uh	8.16	135	.165	1/4
70F154AI	150 uh	8.16	135	.165	1/4
70F184AI	180 uh	8.16	135	.170	1/4
70F204AI	200 uh	10.3	120	.170	1/4
70F224AI	220 uh	11.5	114	.170	1/4
70F254AI	250 uh	12.1	111	.170	1/4
70F274AI	270 uh	13.2	106	.175	1/4
70F304AI	300 uh	13.2	106	.175	1/4
70F334AI	330 uh	13.9	103	.175	1/4
70F354AI	350 uh	14.4	102	.180	1/4
70F394AI	390 uh	15.8	97	.180	1/4

Miller Part No.	Inductance Nominal*	D.C. Resistance Max.	Milliamp Rating Max.	Max. Winding Diam.	Form Length ±1/32
70F474AI	470 uh	16.3	95	.185	1/4
70F504AI	500 uh	18.0	91	.195	1/4
70F564AI	560 uh	19.2	88	.195	1/4
70F684AI	680 uh	19.8	87	.200	1/4
70F754AI	750 uh	22.9	80	.210	1/4
70F824AI	820 uh	22.9	80	.210	1/4
70F914AI	910 uh	24.0	79	.220	1/4
70F103AI	1.00 mh	24.0	79	.225	1/4
70F123AI	1.20 mh	33.6	66	.220	1/4
70F153AI	1.50 mh	37.2	63	.225	1/4
70F183AI	1.80 mh	42.0	59	.235	1/4
70F223AI	2.20 mh	45.6	57	.240	1/4
70F253AI	2.50 mh	45.6	57	.260	3/8
70F273AI	2.70 mh	45.6	57	.260	3/8
70F333AI	3.30 mh	51.6	53	.260	3/8
70F393AI	3.90 mh	57.6	51	.275	3/8
70F473AI	4.70 mh	64.8	48	.285	3/8
70F563AI	5.60 mh	69.6	46	.300	3/8
70F683AI	6.80 mh	78.0	43	.310	3/8
70F753AI	7.50 mh	85.2	41	.310	3/8
70F823AI	8.20 mh	92.4	40	.330	3/8
70F913AI	9.10 mh	98.4	39	.330	3/8
70F102AI	10.0 mh	101	38	.335	3/8
70F122AI	12 mh	100	50	.300	1/2
70F152AI	15 mh	113	47	.300	1/2
70F182AI	18 mh	128	44	.325	1/2
70F222AI	22 mh	144	41	.330	1/2
70F252AF	25 mh	115	46	.340	5/8
70F272AF	27 mh	120	45	.353	5/8
70F332AF	33 mh	134	43	.353	5/8
70F392AF	39 mh	147	41	.370	5/8
70F472AF	47 mh	168	38	.384	5/8
70F502AF	50 mh	175	37	.400	5/8
70F562AF	56 mh	189	36	.400	5/8
70F682AF	68 mh	215	34	.415	5/8
70F752AF	75 mh	222	33	.430	5/8
70F822AF	82 mh	238	32	.430	5/8
70F912AF	91 mh	250	31	.430	5/8
70F101AF	100 mh	278	29	.446	5/8
70F121AF	120 mh	288	48	.485	7/8
70F151AF	150 mh	328	44	.505	7/8
70F181AF	180 mh	374	41	.525	7/8
70F221AF	220 mh	424	39	.540	7/8
70F251AF	250 mh	468	37	.555	7/8
70F271AF	270 mh	490	36	.570	7/8
70F331AF	330 mh	540	34	.580	7/8
70F391AF	390 mh	617	33	.600	7/8
70F471AF	470 mh	704	30	.615	7/8
70F501AF	500 mh	736	30	.635	7/8

* Tolerance 0.1 to 1.0 uh ±20%, 1.1 to 15 uh ±10%, over 15 uh ±5%. ★ Measured with leads 1/4" long from Q Meter binding posts.

J. W. MILLER DIVISION, BELL INDUSTRIES / DEPT. EM, 19070 Reyes Ave., Rancho Dominguez, CA 90221 / (213) 537-5200 / FAX (213) 631-4217

PHENOLIC CORE 3-SECTION WINDINGS

Dimensions of core: 3/16" diameter x 3/4" long. Leads are 1½" long.

Miller Part No.	Inductance Nominal	D.C. Resistance Max.	Milliamp Rating Max.	Diam. over Winding
4642	.10 mh ±5%	5.4	160	.406
4644	.15 mh ±5%	6.5	160	.406
4646	.24 mh ±5%	8.5	160	.438
4648	.39 mh ±5%	11	160	.500
4649	.55 mh ±5%	13	160	.500
4650	.62 mh ±5%	15	160	.531
4651	.75 mh ±5%	16	160	.531
4652	1.0 mh ±5%	19	160	.563

IRON CORE 3-SECTION WINDINGS

Dimensions of core: 7/32" diameter x 7/8" long. Leads are 1½" long.

Miller Part No.	Inductance @ 1000 Hertz	D.C. Resistance Max.	Milliamp Rating Max.	Diam. over Winding
4662	1.0 mh ±5%	8.6	160	.469
4664	1.5 mh ±5%	11	160	.469
4666	2.4 mh ±5%	15	160	.531
4668	3.9 mh ±5%	20	160	.563
4669	5.5 mh ±5%	25	160	.594
4670	6.2 mh ±5%	37	100	.531
4671	8.2 mh ±5%	46	100	.563
4672	10 mh ±5%	50	100	.594

FERRITE CORE 3-SECTION WINDINGS

Dimensions of core: 1/4" diameter x 7/8" long. Leads are 1½" long.

Miller Part No.	Inductance @ 1000 Hertz	D.C. Resistance Max.	Milliamp Rating Max.	Diam. over Winding
6302	2.5 mh ±5%	9.0	160	.469
6304	5.0 mh ±5%	14	160	.531
6306	10 mh ±5%	31	160	.531
6308	25 mh ±5%	82	65	.531
6310	50 mh ±5%	127	65	.625

PHENOLIC CORE SINGLE WINDINGS LAYER

Dimensions of core 3/16" diameter x 3/4" long. Leads are 1½" long.

Miller Part No.	Inductance Nominal*	D.C. Resistance Max.	Milliamp Rating Max.	Diam. over Winding
4602	1.0 uh	.050	2000	.270
4604	1.5 uh	.093	1800	.270
4606	2.4 uh	.190	1500	.270
4608	3.9 uh	.450	1000	.270
4609	5.5 uh	.670	850	.270
4610	6.2 uh	.830	700	.270
4611	8.2 uh	1.20	600	.270
4612	10.0 uh	1.50	500	.270

* Tolerance 1.0 uh ±20%, 1.1 to 10 uh ±10%.

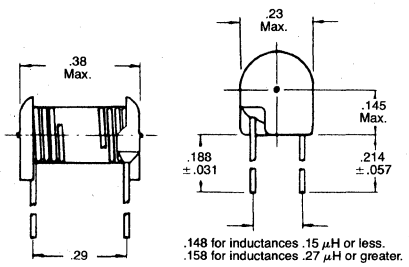
IRON CORE SINGLE LAYER WINDINGS

Dimensions of core: 7/32" diameter x 7/8" long. Leads are 1½" long.

Miller Part No.	Inductance Nominal	D.C. Resistance Max.	Milliamp Rating Max.	Diam. over Winding
4622	10 uh ±5%	.11	1500	.29
4624	15 uh ±5%	.17	1000	.29
4626	24 uh ±5%	.34	800	.29
4628	39 uh ±5%	.65	600	.29
4629	55 uh ±5%	1.0	500	.29
4630	62 uh ±5%	1.2	475	.29
4631	82 uh ±5%	1.9	450	.29
4632	100 uh ±5%	3.0	400	.29

75F SERIES FIXED RF COILS

.148 for inductances .15 μH or less
.158 for inductances .27 μH or greater
For equipment operating in the 50-450 MHz range. The 75F Series of inductors have unsurpassed stability and uniformity of electrical parameters. Polypropylene is molded around an accurately positioned winding.



.148 for inductances .15 μH or less.
.158 for inductances .27 μH or greater.

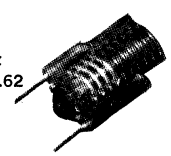
PART NUMBER	L +/− 10% UH	Q REF.	TEST FREQ. MHZ	TURNS	A DIM	WIRE SIZE
75F238MPC	.032	105	50	2½	.148	22 TINNED CU.
75F328MPC	.039	95	40	3½	.148	22 TINNED CU.
75F518MPC	.049	104	40	4½	.148	22 TINNED CU.
75F117MPC	.108	90	25	8½	.148	22 SINGLE POLY
75F157MPC	.142	90	25	10½	.148	22 HEAVY POLY
75F277MPC	.275	92	25	14½	.153	24 SINGLE POLY
75F397MPC	.364	93	25	15½	.158	26 SYBOND #2
75F477MPC	.49	89	25	17½	.159	27 SINGLE POLY
75F597MPC	.57	92	25	19½	.159	27 SINGLE POLY

NOTE: ALL TESTING IS DONE ON A HP 4342A Q-METER.

ADJUSTABLE RF COILS

Ideal for Communications Applications in the 30-250 MHz Range

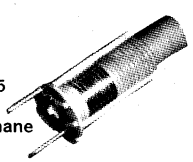
48A SERIES



Frequency range: 30-250 MHz
Form length:.73 OD at base: .62
Lead spacing: .408
Wire size: AWG 20 TCW
Core: 10-32 x 3/8 Carbonyl J
For equipment operating in the 30-250 MHz range. These coils have unsurpassed stability and uniformity of electrical parameters. Polypropylene is molded around an accurately positioned winding.

Miller Part No.	L uH Min.	L uH Nom.	L uH Max.	Q Min.	I,dc Max. A	No Turns
48A518MPC	.046	.051	.055	100	2	1½
48A778MPC	.071	.077	.082	100	2	2½
48A117MPC	.099	.111	.122	100	2	3½
48A147MPC	.118	.138	.157	100	2	4½
48A187MPC	.15	.179	.207	100	2	5½
48A227MPC	.181	.215	.278	100	2	6½
48A257MPC	.209	.246	.283	100	2	7½
48A287MPC	.241	.284	.316	100	2	8½
48A317MPC	.27	.311	.351	100	2	9½

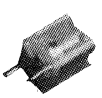
49A SERIES



Form length: 1.05
OD at base: .46 Coil OD: .285
Lead spacing: .324
Wire size: AWG 22 polyurethane coated, with tinned leads
Core: 10-32 x 3/8 Carbonyl J
For equipment operating in the 10-250 MHz range. These coils have unsurpassed stability and uniformity of electrical parameters. Polypropylene is molded around an accurately positioned winding.

Miller Part No.	L uH Min.	L uH Nom.	L uH Max.	Q Min.	I,dc Max. A	No. Turns
49A678MPC	.06	.067	.074	100	1.5	2⅓
49A127MPC	.1	.116	.132	100	1.5	3⅓
49A167MPC	.134	.164	.194	100	1.5	4⅓
49A217MPC	.17	.214	.258	100	1.5	5⅓
49A347MPC	.25	.338	.415	100	1.5	7⅓
49A537MPC	.393	.525	.657	70	1.5	10⅓
49A757MPC	.6	.75	.9	70	1.5	14⅓
49A997MPC	.81	.99	1.16	70	1.5	18⅓
49A126MPC	.96	1.15	1.34	70	1.5	21⅓
49A146MPC	1.18	1.36	1.53	70	1.5	24⅓

ADJUSTABLE RF COILS



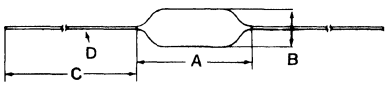
Ideal for communications applications in the 30-250 MHz range.

Miller Part No.	L Min. uH	Q Min. at L Min.	L Max. uH	Q Min. at L Max.	Test Freq. MHz
SHIELDED					
4901-S	.037	90	.039	85	80
4902-S	.059	100	.071	95	75
4903-S	.086	105	.107	90	75
4904-S	.117	90	.159	90	50
4905-S	.150	90	.208	80	45
4906-S	.184	85	.262	70	45
4907-S	.188	85	.311	65	45
4908-S	.258	85	.363	60	45
4909-S	.296	85	.417	55	45
4910-S	.335	80	.454	50	45
UNSHIELDED					
4901	.041	113	.050	136	80
4902	.070	155	.100	139	75
4903	.103	147	.152	133	75
4904	.148	146	.252	162	50
4905	.193	138	.337	142	45
4906	.238	137	.417	122	45
4907	.286	135	.508	105	45
4908	.339	126	.600	89	45
4909	.390	132	.691	76	45
4910	.460	128	.788	72	45

J. W. MILLER DIVISION, BELL INDUSTRIES / DEPT. EM, 19070 Reyes Ave., Rancho Dominguez, CA 90221 / (213) 537-5200 / FAX (213) 631-4217

HIGH QUALITY COMMERCIAL CONFORMAL COATED INDUCTORS

Operating temperature: −20°C to −100°C
Working voltage: 250 VDC maximum
Terminal pull: 5 lbs. per EIA RS 186C, Method 208
Solderability: Per MIL-STD-202, Method 208
Humidity: Per EIA RS 186, Method 2
Material: Coating-epoxy
Leads-tinned copper (AWG 22 TC)
Core material: Ferrite



	A	B	C (Nom.)	D
		77F DIMENSIONS		
Max.	.410	.157	1.0	.025
		78F DIMENSIONS		
Max.	.280	.110	1.0	.020

Type 77

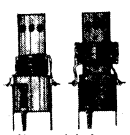
Part Number	L ± 10% µH	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc Max. Ohms	I,dc Max. mA
77F1R0K	1.0	45	25.2	157	0.17	920
77F1R2K	1.2	50	7.96	144	0.21	880
77F1R5K	1.5	50	7.96	131	0.23	830
77F1R8K	1.8	55	7.96	121	0.25	790
77F2R2K	2.2	55	7.96	110	0.28	750
77F2R7K	2.7	60	7.96	100	0.30	720
77F3R3K	3.3	65	7.96	94	0.34	670
77F3R9K	3.9	65	7.96	86	0.37	640
77F4R7K	4.7	70	7.96	80	0.39	620
77F5R6K	5.6	70	7.96	74	0.43	590
77F6R8K	6.8	75	7.96	68	0.48	550
77F8R2K	8.2	80	7.96	53	0.52	530
77F100K	10	85	7.96	45	0.58	500
77F120K	12	75	2.52	34	0.63	480
77F150K	15	70	2.52	20	0.72	460
77F180K	18	65	2.52	14	0.77	430
77F220K	22	60	2.52	9.9	0.84	410
77F270K	27	55	2.52	7.6	0.94	390
	L ±5% µH					
77F330J	33	55	2.52	6.3	1.03	370
77F390J	39	50	2.52	6.3	1.12	350
77F470J	47	45	2.52	6.3	1.22	340
77F560J	56	40	2.52	6.2	1.34	320
77F680J	68	40	2.52	5.7	1.47	305
77F820J	82	35	2.52	5.3	1.62	290
77F101J	100	30	2.52	4.8	1.80	275
77F121J	120	70	0.796	3.8	3.70	185
77F151J	150	70	0.796	3.5	4.20	175
77F181J	180	70	0.796	3.3	4.60	165
77F221J	220	70	0.796	3.0	5.10	155
77F271J	270	65	0.796	2.8	5.80	145
77F331J	330	65	0.796	2.6	6.40	137
77F391J	390	65	0.796	2.4	7.00	133
77F471J	470	60	0.796	2.25	7.70	126
77F561J	560	60	0.796	2.1	8.50	120
77F681J	680	55	0.796	1.95	9.40	113
77F821J	820	55	0.796	1.85	10.5	105
77F102J	1000	50	0.796	1.40	14.0	100

Type 78

Part Number	L ± 20% µH	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc Max. Ohms	I,dc Max. mA
78FR10M	0.10	40	25	400	0.06	500
78FR12M	0.12	40	25	400	0.06	500
78FR15M	0.15	40	25	400	0.07	500
78FR18M	0.18	40	25	400	0.08	450

Type 78

Part Number	L ± 10% µH	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc Max. Ohms	I,dc Max. mA
78FR22K	0.22	40	25	380	0.08	1025
78FR27K	0.27	40	25	360	0.08	950
78FR33K	0.33	40	25	350	0.08	815
78FR39K	0.39	40	25	320	0.09	700
78FR47K	0.47	40	25	300	0.10	650
78FR56K	0.56	40	25	280	0.11	545
78FR68K	0.68	40	25	250	0.12	495
78FR82K	0.82	40	25	200	0.12	415
78F1R0K	1.0	40	25	180	0.15	385
78F1R2K	1.2	40	7.9	165	0.18	590
78F1R5K	1.5	45	7.9	150	0.20	535
78F1R8K	1.8	50	7.9	125	0.25	455
78F2R2K	2.2	50	7.9	110	0.28	395
78F2R7K	2.7	50	7.9	95	0.30	355
	L ± 5% µH					
78F3R3J	3.3	50	7.9	70	0.34	270
78F3R3J	3.9	45	7.9	65	0.32	250
78F3R9J	4.7	45	7.9	50	0.35	230
78F4R7J	5.6	45	7.9	40	0.40	185
78F5R6J	6.8	40	7.9	30	0.45	175
78F6R8J	8.2	40	7.9	28	0.55	155
78F8R2J	10	40	2.5	22	0.72	130
78F100J	12	45	2.5	20	0.80	155
78F120J	15	50	2.5	16	0.88	150
78F150J	18	50	2.5	15	1.00	145
78F180J	22	50	2.5	13	1.20	140
78F220J	27	50	2.5	11	1.35	135
78F270J	33	50	2.5	10	1.50	193
78F330J	39	50	2.5	9.5	1.70	185
78F390J	47	60	2.5	8.5	2.30	167
78F470J	56	60	2.5	7.5	2.60	150
78F560J	68	60	2.5	6.5	2.90	137
78F680J	82	60	2.5	6.0	3.20	132
78F820J	100	60	2.5	5.5	3.50	125
78F101J	120	60	0.79	5.4	3.80	100
78F121J	150	60	0.79	4.7	4.40	90
78F151J	180	60	0.79	4.3	5.00	84
78F181J	220	60	0.79	4.0	5.70	76
78F221J	270	60	0.79	3.7	6.50	70
78F271J	330	60	0.79	3.4	9.50	65
78F391J	390	60	0.79	2.8	10.50	60
78F471J	470	60	0.79	2.5	11.60	53
78F561J	560	60	0.79	2.3	13.00	51
78F681J	680	60	0.79	2.0	18.00	45
78F821J	820	60	0.79	1.5	23.00	43
78F102J	1000	60	0.79	1.2	26.00	41



VERTICAL MOUNTED PRINTED CIRCUIT VELVETORK ADJUSTABLE RF COILS

Dimensions (form only) Over Collar 3/8" Dia. x 3/4" long.
The coil form is Polyester impregnated Alpha Cellulose tubing with internally bonded resilient ribs which provide both thread and torque control. Coils may be adjusted from either end of form.

Miller Part No.	Inductance Min.	Inductance Max.	R Ohms Max.	Max. Current Ma.	Dia. over Winding
23A107RPC	.095 uH	.125 uH	.02	4100	.40
23A157RPC	.130 uH	.170 uH	.02	1600	.37
23A227RPC	.185 uH	.265 uH	.02	1600	.37
23A337RPC	.285 uH	.410 uH	.03	1000	.37
23A477RPC	.420 uH	.580 uH	.03	2500	.37
23A687RPC	.540 uH	.850 uH	.03	1600	.37
23A827RPC	.640 uH	1.00 uH	.03	1600	.37
23A106RPC	.760 uH	1.25 uH	.04	1600	.37
23A156RPC	1.20 uH	1.87 uH	.06	1000	.37
23A226RPC	1.65 uH	2.75 uH	.14	400	.37
23A336RPC	2.40 uH	4.10 uH	.17	400	.37
23A476RPC	3.40 uH	5.80 uH	.24	400	.37
23A686RPC	4.60 uH	8.50 uH	.39	250	.37
23A826RPC	5.60 uH	10.00 uH	.64	160	.37
23A105RPC	7.10 uH	12.50 uH	.77	160	.37
23A155RPC	10.00 uH	18.70 uH	1.68	100	.37
23A225RPC	14.80 uH	27.50 uH	1.91	100	.37
23A335RPC	22.00 uH	41.00 uH	2.34	100	.37
23A475RPC	31.00 uH	58.00 uH	2.72	100	.40
23A685RPC	43.50 uH	85.00 uH	3.30	100	.40
23A825RPC	61.00 uH	100.00 uH	3.89	100	.40
23A104RPC	76.00 uH	125.00 uH	4.39	100	.40
23A154RPC	105.00 uH	187.00 uH	5.46	100	.40
23A224RPC	160.00 uH	275.00 uH	6.70	100	.44
23A334RPC	240.00 uH	410.00 uH	8.30	100	.44
23A474RPC	360.00 uH	580.00 uH	10.50	100	.48
23A684RPC	530.00 uH	850.00 uH	12.90	100	.48
23A824RPC	700.00 uH	1.00 mH	14.90	100	.53
23A103RPC	910.00 uH	1.25 mH	17.10	100	.58
23A153RPC	990.00 uH	1.87 mH	28.20	65	.45
23A223RPC	1.60 mH	2.75 mH	34.80	65	.45
23A333RPC	2.40 mH	4.10 mH	42.90	65	.48
23A473RPC	3.40 mH	5.80 mH	51.60	65	.48
23A683RPC	5.15 mH	8.50 mH	63.60	65	.55
23A823RPC	7.40 mH	10.00 mH	75.60	65	.55
23A102RPC	9.80 mH	12.50 mH	87.30	65	.55
23A152RPC	12.00 mH	18.70 mH	111.00	65	.60
23A222RPC	12.10 mH	27.50 mH	197.00	33	.60
23A332RPC	18.20 mH	41.00 mH	244.00	33	.60
23A472RPC	27.50 mH	58.00 mH	302.00	33	.60
23A682RPC	40.00 mH	85.00 mH	378.00	33	.58
23A822RPC	50.00 mH	100.00 mH	423.00	33	.58
23A101RPC	62.00 mH	125.00 mH	468.00	33	.60

SHIELDED SUBMINIATURE ADJUSTABLE RF COILS

Dimensions: 1/2" sq., x 5/8" high.
These compact adjustable coils offer a minimum two-to-one inductance range with relatively small changes in Q. The tuning adjustment is accessible from either the top or bottom of the coil assembly. Magnetic shielding is achieved through the use of cup cores while the metal shield offers effective electrostatic shielding. Printed circuit terminals on base and shield.

Miller Part No.	Inductance Min.	Inductance Max.	R Ohms Max.	Max. Current Ma.
9050	1.5 uH	3.0 uH	.66	80
9051	3.0 uH	7.0 uH	.85	125
9052	7.0 uH	14.0 uH	1.38	80
9053	14.0 uH	28.0 uH	2.10	80
9054	28.0 uH	60.0 uH	3.00	100
9055	60.0 uH	120.0 uH	4.00	100
9056	120.0 uH	280.0 uH	5.75	80
9057	280.0 uH	650.0 uH	12.00	80
9058	650.0 uH	1.3 mH	15.00	100
9059	1.3 mH	3.0 mH	23.00	100
9059-1	1.8 mH	2.2 mH	10.00	141
9060	3.0 mH	10.0 mH	76.00	30
9061	8.0 mH	20.0 mH	110.00	30
9062	15.0 mH	40.0 mH	150.00	30
9063	20.0 mH	60.0 mH	175.00	25

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HEAVY DUTY HASH CHOKES

Part No.	µH ±20%	Ohms Max.	Amps	Dimensions
5218	3.35	.010	20	17/32" × 15/16"
5219	4.90	.016	15	1/2" × 1 1/4"
5220	8.80	.021	10	1/2" × 1 1/4"
5230	4.00	.012	8	5/16" × 29/32"
5240	40.00	.082	3	9/16" × 1 1/4"
5248	68.00	.054	5	17/32" × 1 1/4"
5250	100.00	.216	2	5/16" × 1 1/4"
5252	125.00	.080	3.5	1/2" × 1 1/4"
5254	250.00	.170	2.5	7/16" × 1 1/4"
5256	500.00	.260	2.0	9/16" × 1 1/4"
5258	1000.00	.550	1.0	1/2" × 1 1/4"
*5300	100.00	.087	2.5	3/4" × 1 1/32"

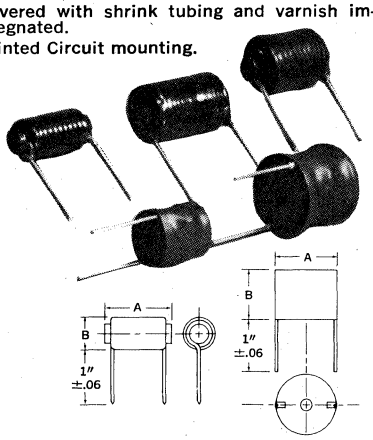
*Dual Choke: Electrical measurements per section

HIGH CURRENT FILTER CHOKES

Chokes are ideal for all EMI/RFI filtering applications. They are also suitable for energy storage inductors in switching power supplies.

Covered with shrink tubing and varnish impregnated.

Printed Circuit mounting.



5500 SERIES
HIGH SATURATION FLUX DENSITY FERRITE RODS

* Inductance measured @ 1 kHz with 0 Amps D.C. current.
Typical inductance change is less than 5% maximum rated current.

Leads: 1" long. Tinned within 1/8" of body.

Miller Part No.	* L uH ±10%	R,dc Max. Ohms	I,dc Max. Amps	Dim. A Max.	Dim. B Max.
5501	5	.013	10	.88	.63
5502	10	.017	9	1.12	.63
5503	27	.030	7	.88	.81
5504	50	.045	5.6	1.12	.81
5505	100	.061	4.9	1.12	.81
5506	150	.069	4.6	1.38	.81
5507	250	.089	4	1.62	.81
5508	5	.009	14	.88	.64
5509	10	.012	12	1.12	.64
5510	27	.022	9	.88	.88
5511	50	.028	8	1.12	.88
5512	68	.034	7.3	1.12	.88
5513	100	.038	6.8	1.38	.88
5514	150	.046	6.3	1.62	.88
5515	5	.006	19	1.12	.69
5516	10	.008	16	1.38	.69
5517	27	.014	12.5	1.12	.94
5518	50	.020	10.5	1.38	.94
5519	68	.023	10	1.38	.94
5520	100	.027	10	1.62	.94
5521	5	.004	23	1.38	.72
5522	10	.006	20	1.69	.72
5523	27	.010	15	1.38	1
5524	50	.013	15	1.62	1

5600 SERIES
HIGH SATURATION FLUX DENSITY FERRITE BOBBINS

* Inductance measured @ 1 kHz with 0 Amps D.C. current.

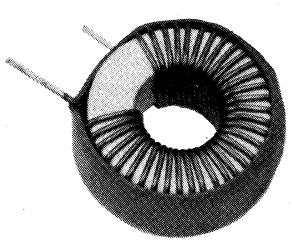
Typical inductance change is less than 5% @ twice rated current.

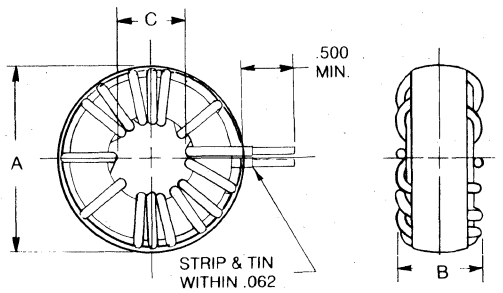
Miller Part No.	* L uH ±10%	R,dc Max. Ohms	I,dc Max. Amps	Dim. A Max.	Dim. B Max.
5601	5	.007	15	.83	.91
5602	10	.008	14	.83	.91
5603	25	.023	8	.83	.91
5604	50	.034	6.6	.83	.91
5605	100	.072	4.5	.83	.91
5606	250	.173	2.9	.83	.91
5607	500	.378	2	.83	.91
5608	1,000	.801	1.3	.83	.91
5609	2,500	2.04	.85	.83	.91
5610	5	.005	20	1.22	1.11
5611	10	.006	17	1.22	1.11
5612	25	.009	14	1.22	1.11
5613	50	.017	10	1.22	1.11
5614	100	.034	7	1.22	1.11
5615	250	.083	4.6	1.22	1.11
5616	500	.129	3.7	1.22	1.11
5617	1,000	.279	2.5	1.22	1.11
5618	2,500	.690	1.6	1.22	1.11
5619	50	.012	14	1.50	1.11
5620	100	.025	9.8	1.50	1.11
5621	250	.059	6.4	1.50	1.11
5622	500	.090	5	1.50	1.11
5623	1,000	.195	3.5	1.50	1.11
5624	2,500	.499	2.2	1.50	1.11
5625	5,000	1.08	1.5	1.50	1.11
5626	100	.018	14	1.50	1.50
5627	250	.040	9	1.50	1.50
5628	500	.085	6.5	1.50	1.50
5629	1,000	.183	4.4	1.50	1.50
5630	2,500	.464	2.8	1.50	1.50
5631	5,000	.714	2.2	1.50	1.50
5632	10,000	1.55	1.5	1.50	1.50

HIGH CURRENT TOROIDS

5700 SERIES

Chokes are ideal for all EMI/RFI filtering applications. They are also suitable for energy storage inductors in switching power supplies. Can be covered with shrink tubing and varnish impregnated. Printed Circuit mounting.





OUTLINE STYLE	MAX. A	MAX. B	MIN. C
1	.875	.437	.187
2	1.125	.562	.312
3	1.250	.625	.375
4	1.812	.750	.750
5	2.125	.937	.625

Miller Number	L at OADC µHy + 15%	Rated DC Amps	Min. Ind. µHy at Rated DC	DC Res. Ohms Max.	Outline Style	Lead Dia. Nom
5701	10	11.00	5	.003	1	.064
5702	25	5.50	12	.012	1	.040
5703	125	2.75	70	.12	1	.020
5704	275	2.00	150	.24	1	.016
5705	450	1.50	250	.49	1	.012
5706	25	9.00	15	.012	2	.064
5707	75	5.00	40	.03	2	.036
5708	400	2.25	225	.33	2	.018
5709	800	1.75	475	.64	2	.015
5710	1000	1.50	575	.98	2	.012
5711	50	9.50	25	.012	3	.064
5712	150	4.75	85	.046	3	.036
5713	700	2.26	400	.42	3	.018

Miller Number	L at OADC µHy + 15%	Rated DC Amps	Min. Ind. µHy at Rated DC	DC Res. Ohms Max.	Outline Style	Lead Dia. Nom
5714	1250	1.75	750	.85	3	.015
5715	1600	1.50	950	1.27	3	.012
5716	125	7.75	65	.032	4	.064
5717	500	4.00	275	.15	4	.032
5718	1100	2.50	650	.33	4	.025
5719	2250	1.75	1350	.92	4	.018
5720	4500	1.25	2700	2.64	4	.012
5721	250	8.00	125	.041	5	.062
5722	900	3.75	500	.175	5	.032
5723	1800	2.50	1000	.55	5	.023
5724	4000	1.75	2100	1.16	5	.018
5725	8000	1.00	4500	3.34	5	.012

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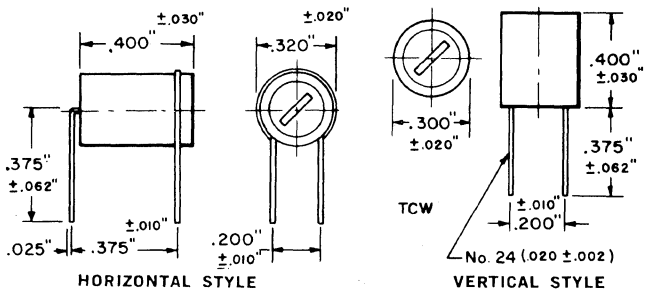
VLS SERIES VARIABLE INDUCTORS (SHIELDED)

May be mounted either Vertically or Horizontally
Printed Circuit: Mil-C-15305
Tunable Range: .10 uH .12 uH ±5% — All others ±10%
Operating Temperature: −55°C to +125°C
Leads: No. 24 TCW



Part No.	Nom. L uH	DCR 25°C, Max. Ohms	Max. I mA	Part No.	Nom. L uH	DCR 25°C, Max. Ohms	Max. I mA
VLSR10	.10	0.030	2500	VLS121	120.00	2.38	316
VLSR12	.12	0.030	2500	VLS151	150.00	2.52	306
VLSR15	.15	0.030	2500	VLS181	180.00	2.88	288
VLSR18	.18	0.035	2400	VLS221	220.00	3.18	273
VLSR22	.22	0.038	2300	VLS271	270.00	3.50	260
VLSR27	.27	0.040	2200	VLS331	330.00	4.80	222
VLSR33	.33	0.040	2200	VLS391	390.00	5.44	209
VLSR39	.39	0.045	2100	VLS471	470.00	5.90	201
VLSR47	.47	0.045	2100	VLS561	560.00	6.30	194
VLSR56	.56	0.050	2000	VLS681	680.00	7.20	181
VLSR68	.68	0.055	1900	VLS821	820.00	8.00	172
VLSR82	.82	0.060	1800	VLS102	1,000.00	12.00	141
VLS1R0	1.00	0.070	1700	VLS122	1,200.00	13.50	132
VLS1R2	1.20	0.085	1670	VLS152	1,500.00	16.50	119
VLS1R5	1.50	0.100	1540	VLS182	1,800.00	18.00	114
VLS1R8	1.80	0.110	1470	VLS222	2,200.00	20.50	107
VLS2R2	2.20	0.120	1410	VLS272	2,700.00	22.50	102
VLS2R7	2.70	0.125	1380	VLS332	3,300.00	42.00	76
VLS3R3	3.30	0.165	1200	VLS392	3,900.00	47.50	71
VLS3R9	3.90	0.180	1135	VLS472	4,700.00	53.00	67
VLS4R7	4.70	0.245	985	VLS562	5,600.00	62.50	65
VLS5R6	5.60	0.265	950	VLS682	6,800.00	69.50	58
VLS6R8	6.80	0.330	853	VLS822	8,200.00	75.00	56
VLS8R2	8.20	0.460	720	VLS103	10,000.00	100.00	49
VLS100	10.00	0.640	620	VLS123	12,000.00	64.00	60
VLS120	12.00	0.800	545	VLS153	15,000.00	84.00	52
VLS150	15.00	0.865	520	VLS183	18,000.00	93.00	50
VLS180	18.00	0.940	504	VLS223	22,000.00	104.00	45
VLS220	22.00	1.03	460	VLS273	27,000.00	173.00	35
VLS270	27.00	1.18	418	VLS333	33,000.00	187.00	32
VLS330	33.00	1.30	398	VLS393	39,000.00	220.00	30
VLS390	39.00	1.41	385	VLS473	47,000.00	253.00	28
VLS470	47.00	1.61	350	VLS563	56,000.00	285.00	26
VLS560	56.00	2.08	330	VLS683	68,000.00	311.00	24
VLS680	68.00	2.20	320	VLS823	82,000.00	385.00	22
VLS820	82.00	2.42	300	VLS104	100,000.00	420.00	20
VLS101	100.00	2.15	333				

I.F. COMPONENTS SUB MINIATURE

The transformers in this series represent the state of the art, as it relates to a commercial product. In both the 455 kc. and 10.7 Mc. groups there are a complete set of I.F. transformers as well as Ratio Detector and Discriminator transformers.

Dimensions: 8849, 8850, 8851, 8805, 8806, 8807 — 25/32" x 7/16" x 1/2" high • 8852, 8853 * 8854 — 13/32" sq. x 5/8" high • 8810, 8811, 8812 & 8813 — 9/32" sq. x 15/32" high.

Cat. No.	Specs	Description
	10.7 Mc. Transistor Transformers	
8849	500 kc. P P	10.7 Mc. Ratio Detector
8850	300 kc. P P	10.7 MC. Discriminator
8851-A	6 db 300 kc.	10.7 Mc. Double Tuned IF
8852	100 K-300	10.7 Mc. Single Tuned IF
8853	20 K-500	10.7 Mc. Single Tuned IF
8854	25 K-500	10.7 Mc. Single Tuned IF
	455 Kc. Transistor Transformers	
8805	20 kc. P P	455 kc. Ratio Detector
8806	20 kc. P P	455 kc. Discriminator
8807	6 db 15 kc	455 kc. Double Tuned IF
8810	50 K-500	455 kc. Single Tuned IF
8811	30 K-500	455 kc. Single Tuned IF
8812	20 K-5 K	455 kc. Single Tuned IF
8813	Oscillator (455 kc. IF) (Tuning Cap. 78 to 110 pf. Max.)	

ADJUSTABLE R.F. COILS 9100 SERIES SHIELDED

These ultra compact adjustable coils offer a good inductance range with relatively small changes in Q. Tuning is accessible from either top or bottom of the assembly. Magnetic shielding is achieved by the use of cup cores while the copper shield offers effective electro static shielding. Printed circuit terminals on base and shield.

Applications between 10 kHz and 200 MHz
Dimensions: .440" Sq. x .550" High.

Part No.	L Min. uH	L Max. uH	Max. DC Ohms	Max. Current
9101	.099	.134	0.01	4.85 A
9102	.129	.192	0.01	4.43 A
9103	.165	.258	0.02	3.97 A
9104	.246	.418	0.02	3.83 A
9105	.366	.627	0.02	3.43 A
9106	.588	.950	0.90	516.00 mA
9107	.830	1.54	1.02	485.00 mA
9108	1.44	2.94	1.38	417.00 mA
9109	2.52	5.70	1.76	368.00 mA
9110	5.35	13.49	2.92	286.00 mA
9111	12.50	29.45	4.72	225.00 mA
9112	26.25	71.25	6.97	185.00 mA
9113	64.57	163.00	9.98	155.00 mA
9114	147.00	430.00	16.32	121.00 mA
9115	422.00	1.10	27.84 mH	92.00 mA
9116	1.05	3.74mH	41.06 mH	76.00 mA
9117	3.36	11.12mH	78.92 mH	55.00 mA

BH Electronics

Data Communication Chokes

- **Intended for the rejection of RFI and EMI picked up by twisted pair Especially designed for use in baluns, telephone systems, drop lines, media filters and other high frequency data communication applications**
- **Custom designs in a wide variety of packages are available.**
- **1000 VDC isolation winding to winding and winding to core.**
- **PC Mount**
- **Surface Mount available**

Listed below are eight typical designs. As previously manufactured parts they are available at low cost with minimal lead time. Samples are available upon request.

Part No.	Turns Ratio	Sine Wave OCL ±25% @ 100Khz	Ciw Max. Any winding	DCR Max.	Schematic	Figure
500-1164	1:1	33 μH	20 pF	.05Ω	2	2
500-1165	1:1:1:1	27 μH	20 pF	.05Ω	1	2
500-1179	1:1:1:1	53 μH	30 pF	.1Ω	1	1
500-1266	1:1	15 mH	260 pF	1.0Ω	2	1
500-1267	1:1	125 μH	150 pF	.5Ω	2	1
500-1291	1:1	53 μH	30 pF	.1Ω	2	1
500-1299	1:1	475 μH	11 pF	.2Ω	3	3
500-1433	1:1	750 μH	15 pF	.25Ω	3	3

Custom Versions Available Upon Request

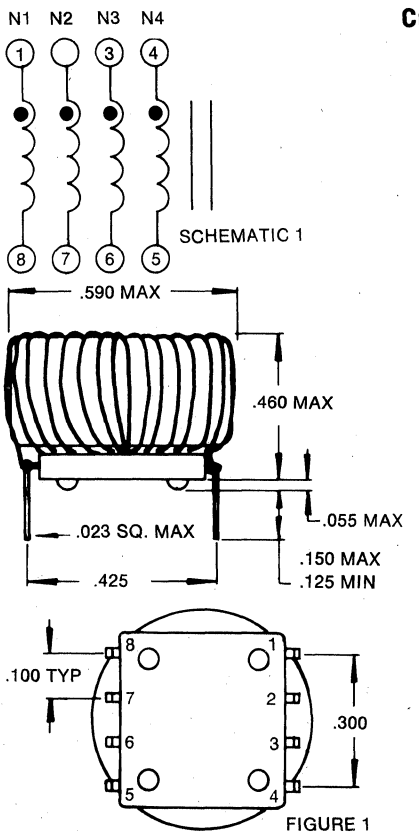


FIGURE 1

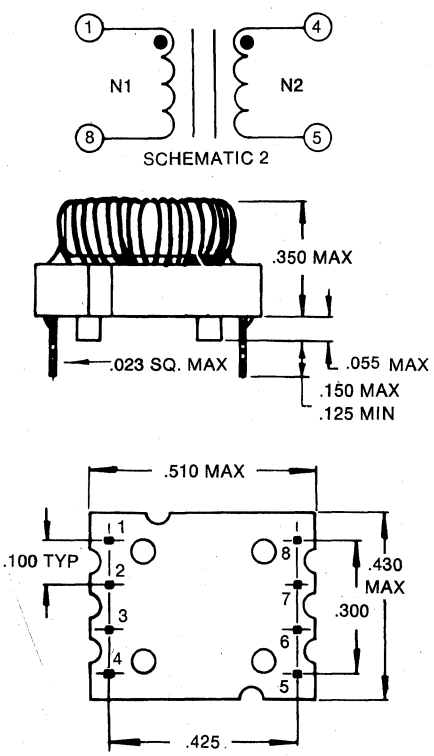


FIGURE 2

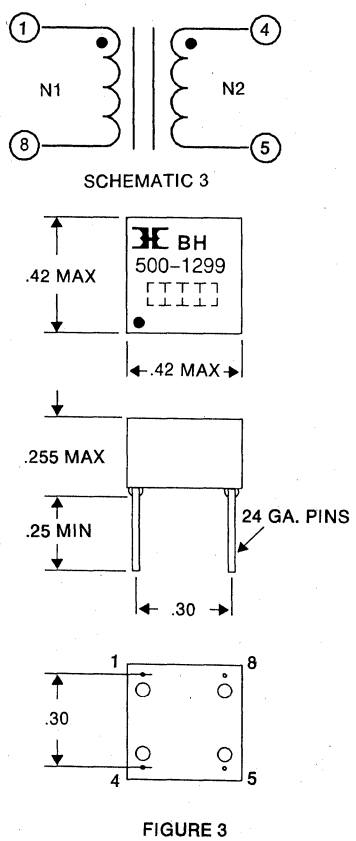


FIGURE 3

Header style may vary, pins 2, 3, 6 & 7 removed on some versions

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BH Electronics

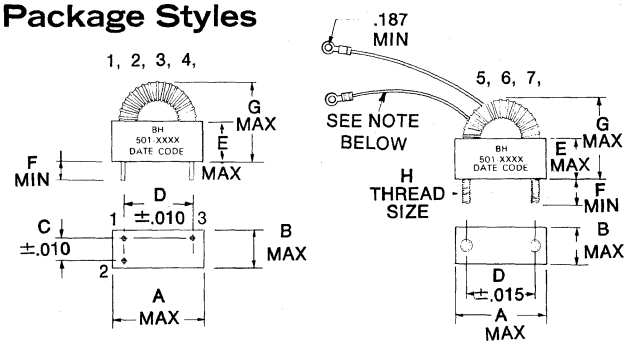
Toroid Inductors for Switching Power Supplies

- **Current Range, 1 AMP To 50 AMPS**
- **Cost Effective Design**
- **Wide Range of Inductance**
- **Maximum Temperature Rise, 40°C Above Ambient**
- **PC Mount**

Electrical Characteristics at 25°C

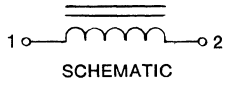
BH Part Number	Rated DC Current (Amps)	Minimum Inductance At Rated DC μh	Minimum Inductance At Zero DC μh	DC Resistance Maximum Ω	Min. Energy Storage ½ LI²	Package Style	Lead Dia. Inches ±.004
501-1001	1.0	725	1400	.75	366	1	.025
501-1002	2.5	115	230	.12	366	1	.025
501-1003	2.5	370	740	.23	1166	2	.025
501-1004	4.1	40	80	.045	361	1	.032
501-1005	4.1	140	280	.086	1185	2	.032
501-1006	4.1	360	720	.177	3034	3	.032
501-1007	6.5	15	30	.018	359	1	.040
501-1008	6.5	50	100	.035	1162	2	.040
501-1009	6.5	140	280	.070	3000	3	.040
501-1010	6.5	290	580	.098	6190	4	.040
501-1011	10.0	7	14	.0075	350	1	.051
501-1012	10.0	20	40	.014	1150	2	.051
501-1013	10.0	60	120	.028	3000	3	.051
501-1014	10.0	120	240	.040	6200	4	.051
501-1015	20.0	6	12	.004	1200	5	NA
501-1016	20.0	15	30	.0072	3200	6	NA
501-1017	20.0	30	60	.010	6400	7	NA
501-1018	40.0	3.5	7.0	.0017	2800	6	NA
501-1019	40.0	7	14	.0024	5920	7	NA
501-1020	50.0	4.5	9	.0016	5875	7	NA

Package Styles

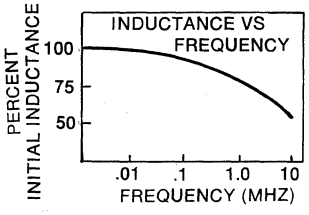


Style 1-4

Style 5-7



Typical Inductance Characteristics



Style	A	B	C	D	E	F	G	H
1	1.05 26,67	.55 13,97	.400 10,16	.800 20,32	.55 13,97	.20 5,08	1.10 27,94	N/A
2	1.45 36,83	.80 20,32	.600 15,24	.900 22,86	.58 14,73	.20 5,08	1.40 35,56	N/A
3	2.00 50,80	.95 24,13	.700 17,78	1.20 30,48	.75 19,05	.20 5,08	1.90 48,26	N/A
4	2.16 54,86	1.12 28,45	.900 22,86	1.50 38,10	1.05 26,67	.20 5,08	2.20 55,88	N/A

Style	A	B	C	D	E	F	G	H
5	1.45 36,83	.80 20,32	N/A	.900 22,86	.58 14,73	.25 6,35	1.40 15,56	6/32
6	2.00 50,80	.95 24,13	N/A	1.20 30,48	.75 19,05	.25 6,35	1.90 48,26	8/32
7	2.16 54,86	1.12 28,45	N/A	1.50 38,10	1.05 26,67	.25 6,35	2.20 55,88	10/32

NOTE: Style 5, 6, 7 Leads Cut to 6" Length/Custom Lengths Available Upon Request

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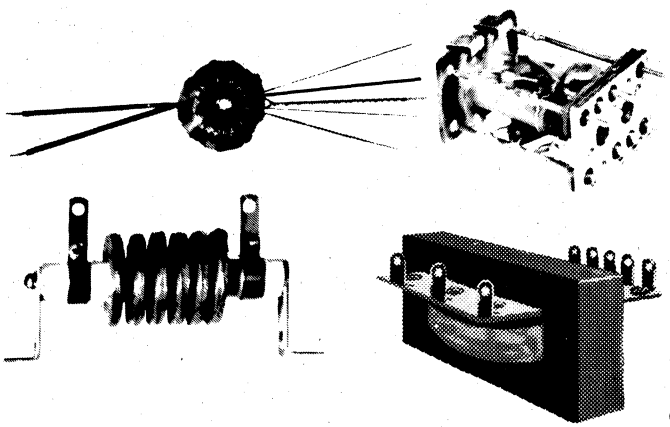


FERRITE POT CORE INDUCTORS & TRANSFORMERS

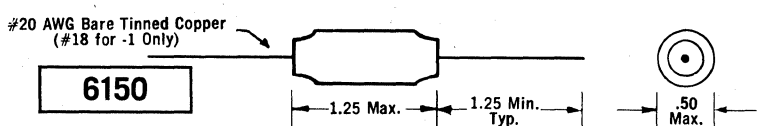
Caddell-Burns has complete facilities for winding and assembling all types of pot core assemblies, both fixed and variable. Write or phone in your specifications.

MODIFIED STOCK COILS

Any of the coils shown on these pages can be wound to intermediate inductance values or modified to meet customer requirements, often at no additional cost.

HIGH CURRENT CHOKES

TYPE 6150 10-100μH
Recommended mounting pitch — 1.50″



NOTES:

1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
2. Current rating (Rated IDC) is based on .75 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
4. Dielectric Withstanding Voltage — 1000 VRMS.
5. Operating Temperature Range — −55°C to +85°C.
6. Materials:
   Coil Form — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Jacket — PVC shrink tube.

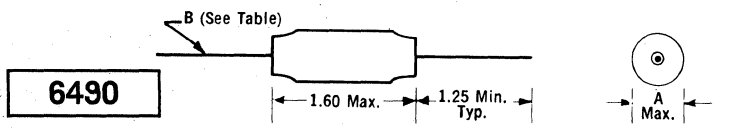
STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance*	Min. Q	Test Freq. MHz	Max. DCR Ohms	Min. SRF MHz	Rated I_{DC} Amps	I_{NCR} I Amps
6150-1	10μH	30	2.5	.018	10	6.40	21
6150-2	20	18	2.5	.036	7.2	4.50	15
6150-3	30	12	2.5	.063	5.0	3.40	13
6150-4	40	12	2.5	.096	4.3	2.75	12
6150-5	50	10	2.5	.110	3.7	2.60	10
6150-6	75	8	2.5	.200	3.2	1.90	9
6150-7	100	26	.79	.400	2.2	1.30	7.8

*(−10, +20%)

HIGH CURRENT CHOKES

TYPE 6490 10μH-1.0mH 10% Tolerance
Recommended mounting pitch — 1.75″



NOTES:

1. Inductance measured on General Radio 1650B Impedance Bridge at 1 kHz.
2. Current rating (Rated IDC) is based on 1.0 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
4. Dielectric Withstanding Voltage — 1000 VRMS.
5. Operating Temperature Range — −55°C to +85°C.
6. Materials:
   Coil Form — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Jacket — PVC shrink tube.
   Lead Wires — Bare tinned copper.

STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated I_{DC} Amps	I_{NCR} I Amps	A Dia. In.	B Lead Size AWG
6490-1	10μH	.010	12.0	10.0	20	.65	14
6490-2	20	.017	9.0	7.7	16	.62	16
6490-3	30	.031	6.0	5.7	12	.61	18
6490-4	40	.050	5.0	4.5	11	.60	20
6490-5	50	.068	4.5	3.8	10	.59	20
6490-6	75	.13	3.4	2.8	9.0	.58	20
6490-7	100	.056	1.5	4.2	7.0	.79	18
6490-8	250	.14	0.90	2.7	4.5	.75	20
6490-9	500	.30	0.60	1.8	3.3	.72	20
6490-10	750	.56	0.45	1.3	2.6	.68	20
6490-11	1.0mH.	.80	0.35	1.1	2.3	.66	20

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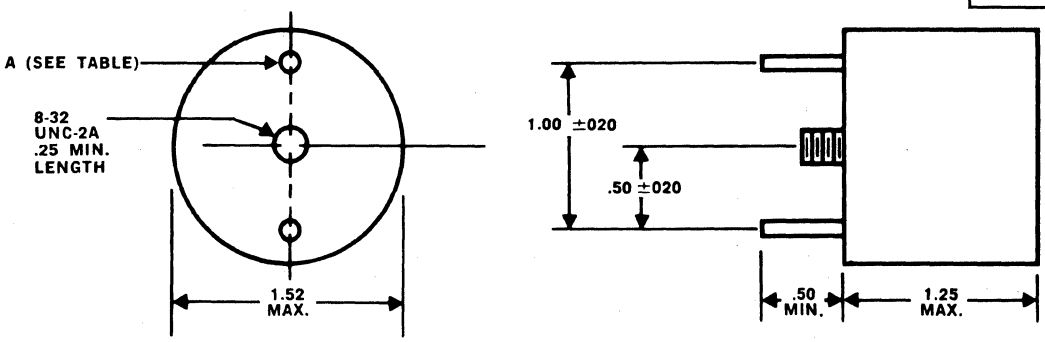
HIGH CURRENT CHOKES

TYPE 7000 10μH — 10 mH — 10% Tolerance

7000



NOTES:

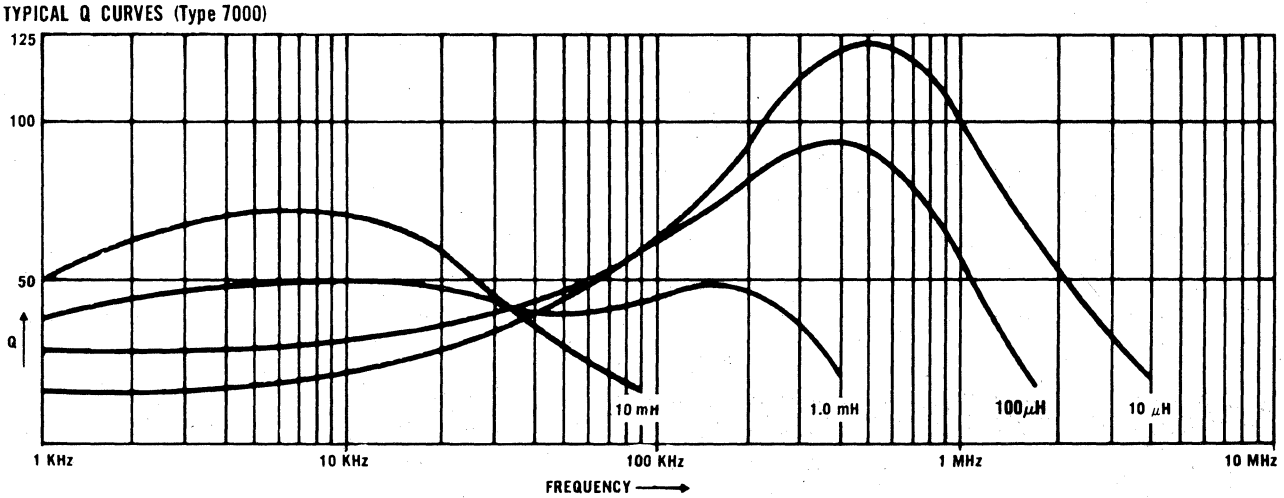
1. Inductance measured on General Radio 1650 B Impedance Bridge at 1 KHz.
2. Current Rating (Rated IDC) is based on 3.0 watts power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental Current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero-DC) value.
4. Dielectric withstanding voltage (winding to case and mounting stud) — 500 VRMS.
5. Operating temperature range: −55°C to +105°C.
6. Materials:
   Coil Form — Ferrite.
   Magnet Wire — per FED. SPEC. J-W-001177/9 (MIL-W-583 Type B).
   Leads — Bare tinned copper.
   Mounting Stud — 18-8 stainless steel.
   Case — epoxy encapsulated.
7. Marking — Printed with Caddell-Burns Part Number.

STANDARD VALUES: (other values available on special order)

Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC Amps (2)	INCR I Amps (3)	A Lead Size AWG
7000-01	10 μH	.004	9.0	27	65	10
7000-02	12	.004	7.2	27	58	10
7000-03	15	.005	5.2	24	52	10
7000-04	18	.006	4.4	22	44	11
7000-05	22	.007	3.8	21	41	11
7000-06	27	.008	3.5	19	38	12
7000-07	33	.011	2.8	17	33	13
7000-08	39	.012	2.7	16	31	13
7000-09	47	.013	2.5	15	28	13
7000-10	56	.014	2.4	14	26	13
7000-11	68	.017	2.1	13	23	13
7000-12	82	.019	2.0	13	21	13
7000-13	100	.022	1.8	12	19	13
7000-14	120	.027	1.4	11	17	14
7000-15	150	.030	1.3	10	15	14
7000-16	180	.039	1.1	8.8	14	15
7000-17	220	.054	.90	7.5	13	16
7000-18	270	.060	.85	7.1	12	16
7000-19	330	.070	.75	6.5	11	16

Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC Amps (2)	INCR I Amps (3)	A Lead Size AWG
7000-20	390 μH	.090	.65	5.8	10	17
7000-21	470	.10	.62	5.5	8.8	17
7000-22	560	.11	.56	5.2	8.0	17
7000-23	680	.14	.51	4.6	7.5	18
7000-24	820	.17	.49	4.2	6.7	18
7000-25	1.0 mH	.22	.43	3.7	6.0	19
7000-26	1.2	.25	.37	3.5	5.4	19
7000-27	1.5	.29	.36	3.2	4.8	19
7000-28	1.8	.32	.33	3.1	4.4	19
7000-29	2.2	.44	.31	2.6	4.0	20
7000-30	2.7	.50	.27	2.4	3.6	20
7000-31	3.3	.69	.23	2.1	3.2	21
7000-32	3.9	.75	.21	2.0	3.0	21
7000-33	4.7	1.0	.20	1.7	2.8	22
7000-34	5.6	1.1	.18	1.6	2.6	22
7000-35	6.8	1.3	.17	1.5	2.3	22
7000-36	8.2	1.6	.14	1.4	2.1	23
7000-37	10	1.8	.13	1.3	1.9	23

TYPICAL Q CURVES (Type 7000)



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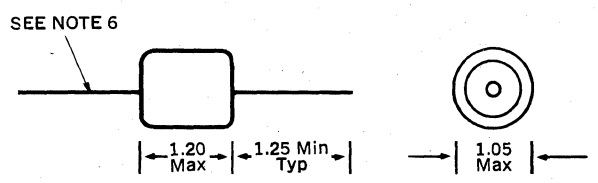
HIGH CURRENT CHOKES

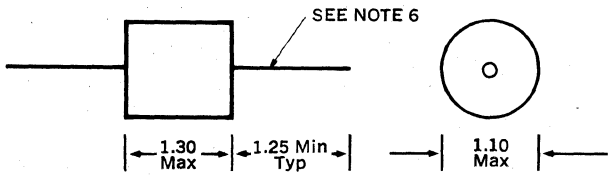
TYPE 7140

7140 10 μH-100 mH. 10% Tolerance
Recommended Mounting Pitch—1.50"



TYPE 7150 (EPOXY ENCAPSULATED VERSION)

7150



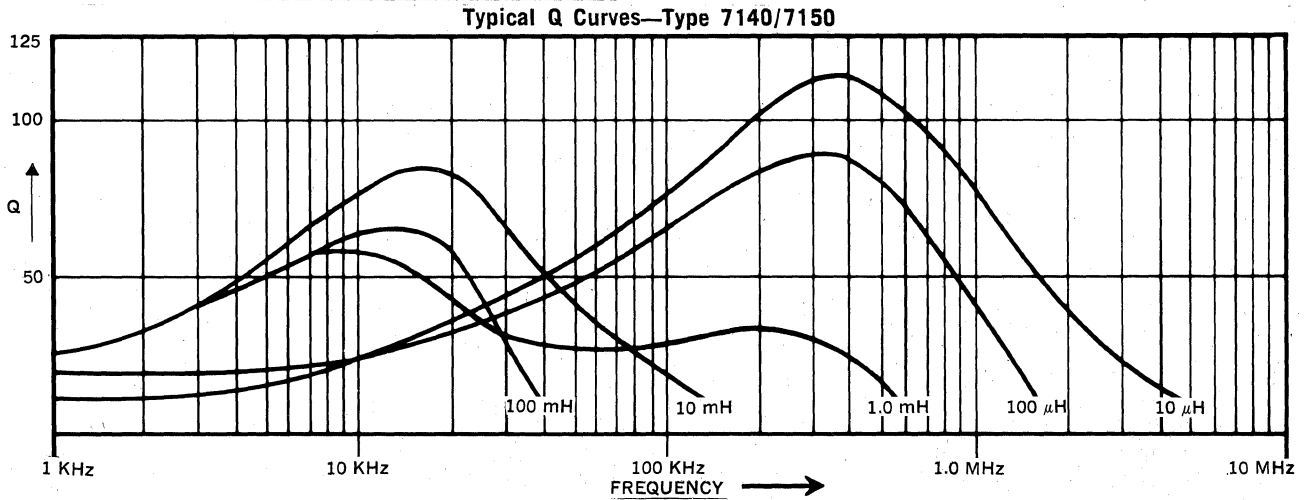
NOTES: (FOR BOTH TYPES)
1. Inductance measured on Cambridge Technology type 520 L/C Meter at 1 KHz.
2. Current rating (Rated IDC) is based on 1.5 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental Current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero-DC) value because of saturation.
4. Dielectric Withstanding Voltage—1000 VRMS.
5. Operating temperature range −55° to +105°C.
6. Leads are bare tinned copper: -01 thru -10, #14 AWG; -11, #15 AWG; -12 thru -49, #16 AWG.
7. Marking—Printed with Caddell-Burns Part Number.
8. Materials: (See below)
   TYPE 7140
   Coil Form: Ferrite
   Magnet Wire: Per FED SPEC J-W-001177/9
   Jacket: Flame Retardant PVC shrink tube UL Type FR-1 Per MIL-I-23053
   TYPE 7150
   Coil Form: Ferrite
   Magnet Wire: Per FED SPEC J-W-001177/9
   Cover and Coating: Epoxy encapsulated

STANDARD VALUES: (Electrical characteristics are identical for both types. Other values are available on special order.)

DASH NO.	Nominal Inductance	DCR ±20% Ohms	Min. SRF MHz	Rated IDC Amps	INCR I Amps
-01	10 μH	0.0060	8.8	16	43
-02	12	0.0065	8.0	15	39
-03	15	0.0070	7.4	15	36
-04	18	0.0080	5.4	14	32
-05	22	0.0085	3.9	13	29
-06	27	0.0090	3.3	13	26
-07	33	0.010	3.1	12	24
-08	39	0.011	2.7	12	21
-09	47	0.012	2.6	11	20
-10	56	0.013	2.3	11	18
-11	68	0.017	2.1	9.4	16
-12	82	0.023	1.8	8.1	15
-13	100	0.025	1.6	7.7	14
-14	120	0.028	1.5	7.3	12
-15	150	0.032	1.4	6.8	11
-16	180	0.042	1.2	6.0	10
-17	220	0.048	1.1	5.6	9.2
-18	270	0.055	1.0	5.2	8.0
-19	330	0.072	0.96	4.6	7.4
-20	390	0.079	0.84	4.4	6.8
-21	470	0.11	0.72	3.7	6.2
-22	560	0.12	0.64	3.5	5.7
-23	680	0.14	0.62	3.3	5.1
-24	820	0.18	0.60	2.9	4.7
-25	1.0 mH	0.20	0.52	2.7	4.2

DASH NO.	Nominal Inductance	DCR ±20% Ohms	Min. SRF MHz	Rated IDC Amps	INCR I Amps
-26	1.2 mH	0.23	0.48	2.6	3.8
-27	1.5	0.31	0.40	2.2	3.4
-28	1.8	0.35	0.37	2.1	3.1
-29	2.2	0.46	0.32	1.8	2.8
-30	2.7	0.54	0.30	1.7	2.6
-31	3.3	0.72	0.27	1.4	2.3
-32	3.9	0.79	0.25	1.4	2.1
-33	4.7	0.90	0.24	1.3	1.9
-34	5.6	1.2	0.20	1.1	1.8
-35	6.8	1.3	0.19	1.1	1.6
-36	8.2	1.7	0.16	0.94	1.5
-37	10	2.0	0.15	0.87	1.3
-38	12	2.7	0.12	0.75	1.2
-39	15	3.1	0.11	0.70	1.1
-40	18	3.5	0.10	0.65	1.0
-41	22	4.7	0.096	0.56	0.90
-42	27	5.3	0.088	0.53	0.81
-43	33	7.1	0.076	0.46	0.74
-44	39	7.9	0.070	0.44	0.68
-45	47	11	0.067	0.37	0.62
-46	56	12	0.062	0.35	0.57
-47	68	14	0.054	0.33	0.51
-48	82	18	0.051	0.29	0.46
-49	100	21	0.042	0.27	0.42

Typical Q Curves—Type 7140/7150



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258 East Second Street
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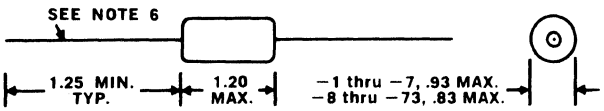
HIGH CURRENT CHOKES

6950

TYPE 6950 10μH - 10H — 10% Tolerance
Recommended mounting pitch — 1.40"



NOTES:

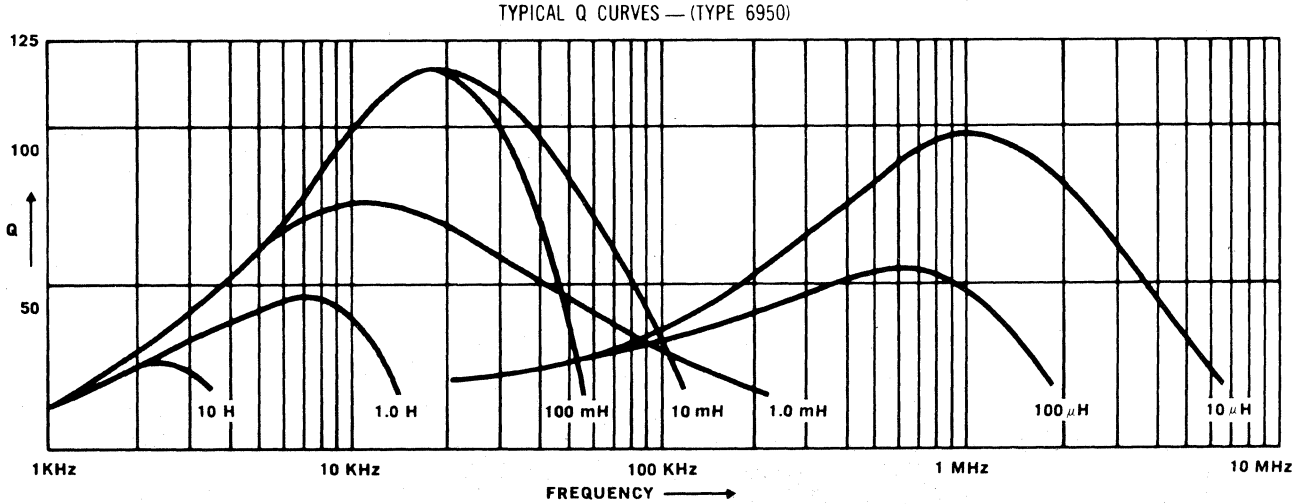
1. Inductance measured on General Radio 1650B Impedance Bridge at 1 KHz.
2. Current rating (Rated IDC) is based on 1.0 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero-DC) value.
4. Dielectric withstanding voltage — 1000 VRMS.
5. Operating temperature range: −55° to +105°C.
6. Leads are bare tinned copper: −1 thru −7, #14 AWG; −8 and −9, #16 AWG; −10 thru −14, #18 AWG; −15 thru −17, #19 AWG; −18 thru −73, #20 AWG.
7. Materials:
   Coil Form — Ferrite
   Magnet Wire — Per FED. SPEC. J-W-001177/9 (MIL-W-583 Type B)
   Jacket — PVC Shrink Tube — FLAME RETARDANT UL TYPE FR-1 PER MIL-I-23053
8. Marking — Printed with Caddell-Burns Part Number.

STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma (2)	INCR I ma (3)
6950-01	10 μH	.007	12	12,000	35,000
-02	12	.008	8.0	11,200	32,600
-03	15	.009	6.0	10,500	28,400
-04	18	.010	5.7	10,000	25,900
-05	22	.011	5.3	9500	23,800
-06	27	.012	5.0	9100	21,000
-07	33	.013	4.5	8800	18,700
-08	39	.020	3.4	7100	17,600
-09	47	.022	3.2	6700	16,300
-10	56	.034	2.6	5400	14,700
-11	68	.038	2.4	5100	13,300
-12	82	.042	2.2	4900	12,400
-13	100	.048	1.9	4600	11,100
-14	120	.054	1.7	4300	10,100
-15	150	.073	1.5	3700	9100
-16	180	.082	1.3	3500	8300
-17	220	.091	1.2	3300	7500
-18	270	.12	1.1	2900	6800
-19	330	.13	1.0	2800	6100
-20	390	.18	.92	2400	5600
-21	470	.20	.84	2200	5100
-22	560	.26	.78	2000	4700
-23	680	.30	.69	1800	4300
-24	820	.40	.56	1600	3900
-25	1.0 mH	.45	.54	1500	3500
-26	1.2	.50	.50	1400	3200
-27	1.5	.70	.45	1200	2900
-28	1.8	.80	.43	1100	2600
-29	2.2	1.1	.42	950	2400
-30	2.7	1.2	.40	910	2100
-31	3.3	1.6	.28	790	1900
-32	3.9	1.8	.26	750	1800
-33	4.7	2.4	.23	650	1600
-34	5.6	2.6	.21	620	1500
-35	6.8	3.0	.20	580	1300
-36	8.2	4.0	.19	500	1200
-37	10	4.6	.18	470	1100

Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma (2)	INCR I ma (3)
6950-38	12 mH	6.1	.16	400	1000
-39	15	7.1	.15	380	910
-40	18	9.6	.14	320	830
-41	22	11	.12	300	750
-42	27	13	.095	280	680
-43	33	15	.085	260	610
-44	39	21	.077	220	560
-45	47	24	.067	200	510
-46	56	33	.065	180	470
-47	68	36	.062	170	430
-48	82	41	.057	160	390
-49	100	55	.051	140	350
-50	120	60	.048	130	320
-51	150	84	.040	110	290
-52	180	94	.033	100	260
-53	220	110	.032	95	240
-54	270	127	.030	88	210
-55	330	165	.027	78	190
-56	390	220	.023	67	180
-57	470	240	.021	65	160
-58	560	330	.020	55	150
-59	680	360	.017	53	130
-60	820	400	.016	50	120
-61	1.0 H	570	.014	42	110
-62	1.2	650	.013	40	100
-63	1.5	740	.012	37	90
-64	1.8	1000	.011	32	83
-65	2.2	1100	.010	30	75
-66	2.7	1500	.0090	26	68
-67	3.3	1700	.0085	24	61
-68	3.9	2200	.0080	21	56
-69	4.7	2500	.0073	20	51
-70	5.6	3500	.0062	17	47
-71	6.8	4000	.0058	16	43
-72	8.2	4800	.0050	15	39
-73	10	5400	.0042	14	35

TYPICAL Q CURVES — (TYPE 6950)



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258 East Second Street
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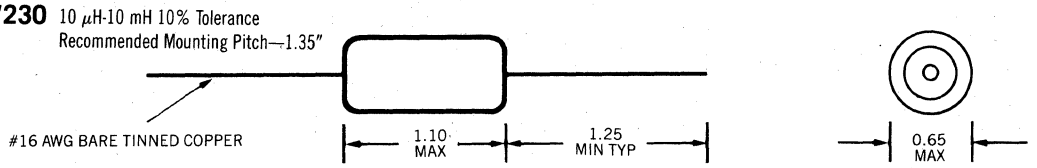
Area Code 516 746-2310

HIGH CURRENT CHOKES

7230

TYPE 7230 10 μH-10 mH 10% Tolerance
Recommended Mounting Pitch—1.35"



NOTES:

1. Inductance measured on Cambridge Technology type 520 L/C Meter at 1 KHz.
2. The current rating (Rated IDC) is based on 0.75 watt power dissipation (I^2R) for an approximate 20°C temperature rise. Depending on the application, these units may be operated at higher currents.
   The core material for the 7230 series has been chosen for optimum current handling capability. Because this material has a relatively low volume resistivity, the core will appear as a shunt resistance on the order of 1 Kilohm, which may have to be taken into account when determining total power dissipation; e.g., if the induced voltage across the coil is 10 volts, there will be a V^2/R loss on the order of 0.10 watt, in addition to the I^2R losses associated with the winding.
3. The incremental current (INCR I) is the approximate current at which the inductance will be decreased by 5% from its initial (zero-DC) value because of saturation. If the current is increased beyond INCR I, the inductance will continue to decrease as shown by the saturation curve below.
4. Dielectric Withstanding Voltage: 1000 VRMS.
5. Operating Temperature Range: −55° to +105°C.
6. Marking: Printed with Caddell-Burns Part Number.
7. Materials:

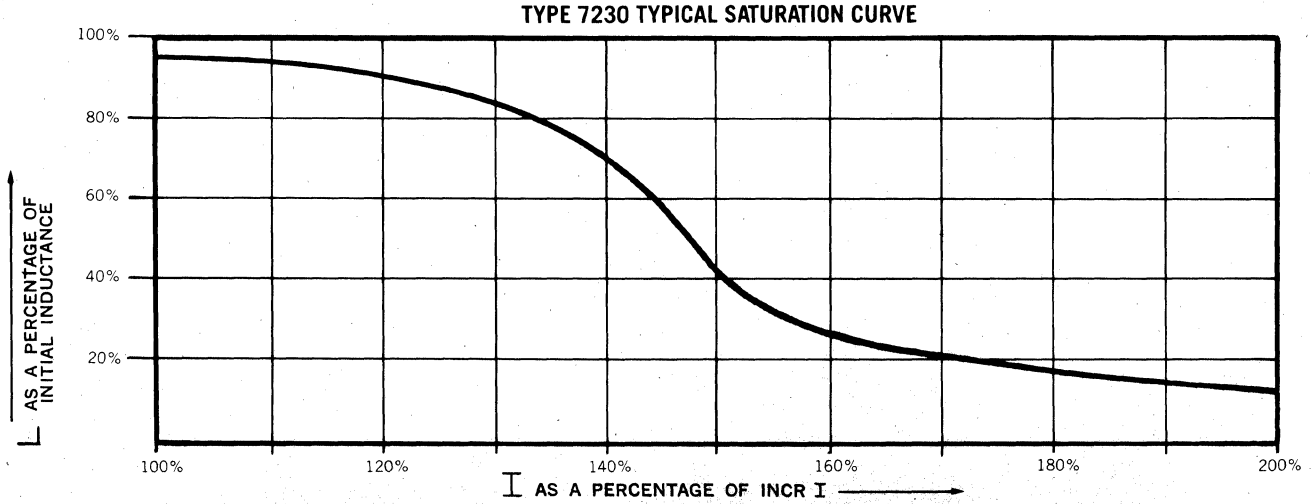
   Coil Form: Ferrite
   Magnet Wire: Per FED SPEC J-W-001177/9
   Jacket: Flame Retardant PVC shrink tube UL Type FR-1 per MIL-I-23053

STANDARD VALUES: (Other values available on special order)

DASH NO.	Nominal Inductance	DCR ±20% Ohms	Min. SRF MHz	Rated IDC Amps	INCR I Amps
-01	10 μH	0.0065	5.4	11	23
-02	12	0.0070	4.7	10	22
-03	15	0.0080	4.2	9.7	19
-04	18	0.011	3.8	8.3	18
-05	22	0.016	3.4	6.9	16
-06	27	0.021	3.1	6.0	14
-07	33	0.023	2.8	5.7	13
-08	39	0.025	2.5	5.5	12
-09	47	0.028	2.2	5.2	11
-10	56	0.031	2.0	4.9	10
-11	68	0.043	1.8	4.2	9.0
-12	82	0.047	1.6	4.0	8.3
-13	100	0.063	1.5	3.5	7.6
-14	120	0.086	1.4	3.0	6.8
-15	150	0.097	1.2	2.8	6.1
-16	180	0.11	1.1	2.6	5.6
-17	220	0.12	0.95	2.5	5.1
-18	270	0.17	0.85	2.1	4.6
-19	330	0.19	0.77	2.0	4.1

DASH NO.	Nominal Inductance	DCR ±20% Ohms	Min. SRF MHz	Rated IDC Amps	INCR I Amps
-20	390 μH	0.21	0.70	1.9	3.8
-21	470	0.29	0.63	1.6	3.5
-22	560	0.32	0.56	1.5	3.2
-23	680	0.43	0.51	1.3	2.9
-24	820	0.47	0.45	1.3	2.6
-25	1.0 mH	0.54	0.41	1.2	2.4
-26	1.2	0.71	0.36	1.0	2.2
-27	1.5	1.0	0.33	0.87	1.9
-28	1.8	1.1	0.30	0.83	1.8
-29	2.2	1.3	0.27	0.76	1.6
-30	2.7	1.7	0.24	0.66	1.4
-31	3.3	2.3	0.22	0.57	1.3
-32	3.9	2.5	0.20	0.55	1.2
-33	4.7	2.8	0.18	0.52	1.1
-34	5.6	3.1	0.16	0.49	1.0
-35	6.8	4.2	0.14	0.42	0.91
-36	8.2	4.7	0.13	0.40	0.83
-37	10	5.3	0.12	0.38	0.75

TYPE 7230 TYPICAL SATURATION CURVE



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258 East Second Street
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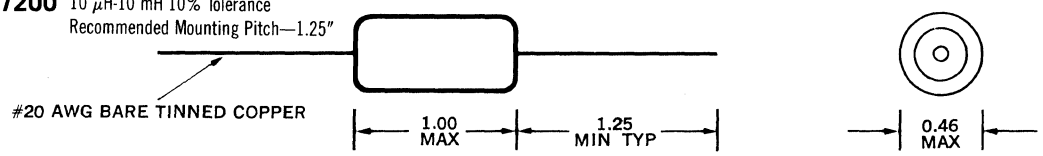
HIGH CURRENT CHOKES

7200

TYPE 7200 10 μH-10 mH 10% Tolerance
Recommended Mounting Pitch—1.25"



NOTES:

1. Inductance measured on Cambridge Technology type 520 L/C Meter at 1 KHz.
2. The current rating (Rated IDC) is based on 0.5 watt power dissipation (I^2R) for an approximate 20°C temperature rise. Depending on the application, these units may be operated at higher currents.

   The core material for the 7200 series has been chosen for optimum current handling capability. Because this material has a relatively low volume resistivity, the core will appear as a shunt resistance on the order of 1 Kilohm, which may have to be taken into account when determining total power dissipation; e.g., if the induced voltage across the coil is 10 volts, there will be a V^2/R loss on the order of 0.10 watt, in addition to the I^2R losses associated with the winding.
3. The incremental current (INCR I) is the approximate current at which the inductance will be decreased by 5% from its initial (zero-DC) value because of saturation. If the current is increased beyond INCR I, the inductance will continue to decrease as shown by the saturation curve below.
4. Dielectric Withstanding Voltage: 1000 VRMS.
5. Operating Temperature Range: −55° to +105°C.
6. Marking: Printed with Caddell-Burns Part Number.
7. Materials:

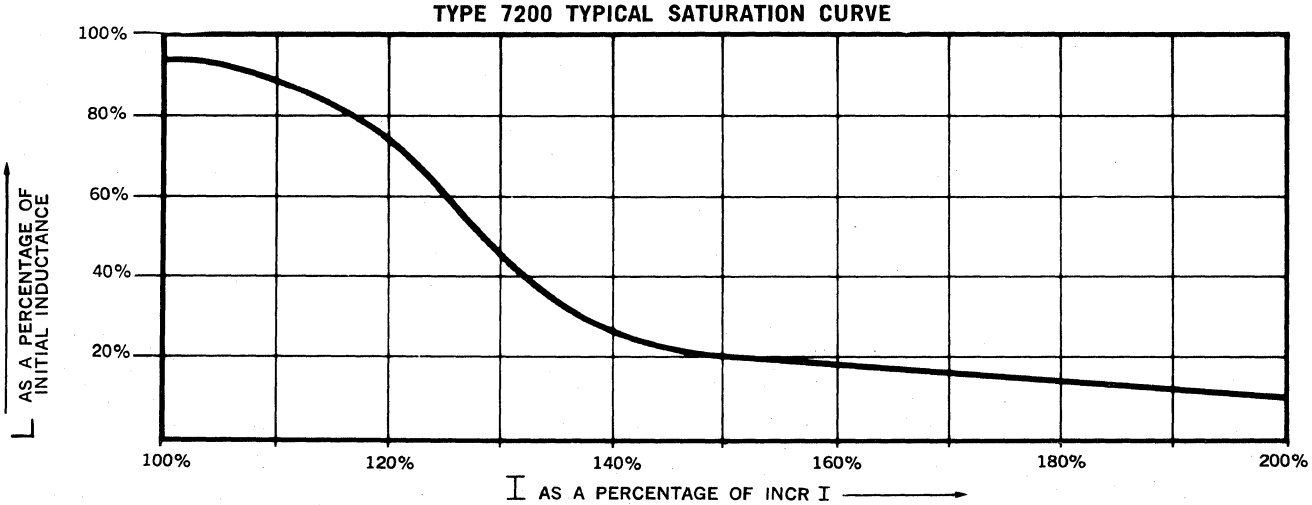
   Coil Form: Ferrite
   Magnet Wire: Per FED SPEC J-W-001177/9
   Jacket: Flame Retardant PVC shrink tube UL Type FR-1 per MIL-I-23053

STANDARD VALUES: (Other values available on special order)

DASH NO.	Nominal Inductance	DCR ±20% Ohms	Min. SRF MHz	Rated IDC Amps	INCR I Amps
-01	10 μH	0.010	6.0	7.1	9.4
-02	12	0.012	4.8	6.5	8.3
-03	15	0.014	4.0	6.0	7.5
-04	18	0.015	3.3	5.8	7.1
-05	22	0.017	2.9	5.4	6.3
-06	27	0.018	2.5	5.3	5.8
-07	33	0.021	2.2	4.9	5.2
-08	39	0.023	2.0	4.7	4.7
-09	47	0.026	1.7	4.4	4.3
-10	56	0.030	1.5	4.1	3.8
-11	68	0.040	1.3	3.5	3.5
-12	82	0.053	1.2	3.1	3.2
-13	100	0.059	1.1	2.9	2.9
-14	120	0.068	1.0	2.7	2.6
-15	150	0.078	0.90	2.5	2.4
-16	180	0.089	0.82	2.4	2.2
-17	220	0.12	0.74	2.0	1.9
-18	270	0.16	0.68	1.8	1.8
-19	330	0.18	0.61	1.7	1.6

DASH NO.	Nominal Inductance	DCR ±20% Ohms	Min. SRF MHz	Rated IDC Amps	INCR I Amps
-20	390 μH	0.20	0.56	1.6	1.5
-21	470	0.26	0.51	1.4	1.3
-22	560	0.29	0.47	1.3	1.2
-23	680	0.39	0.43	1.1	1.1
-24	820	0.44	0.39	1.1	1.0
-25	1.0 mH	0.59	0.36	0.92	0.92
-26	1.2	0.66	0.33	0.87	0.84
-27	1.5	0.77	0.31	0.81	0.75
-28	1.8	0.87	0.29	0.76	0.68
-29	2.2	1.2	0.27	0.65	0.62
-30	2.7	1.6	0.25	0.56	0.56
-31	3.3	1.8	0.23	0.53	0.51
-32	3.9	2.0	0.22	0.50	0.47
-33	4.7	2.6	0.20	0.44	0.42
-34	5.6	2.9	0.19	0.42	0.39
-35	6.8	3.4	0.18	0.38	0.35
-36	8.2	4.4	0.17	0.34	0.32
-37	10	6.0	0.16	0.29	0.29

TYPE 7200 TYPICAL SATURATION CURVE



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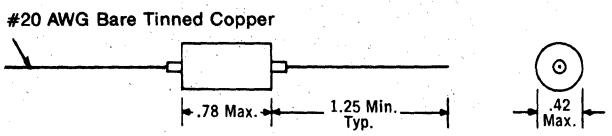
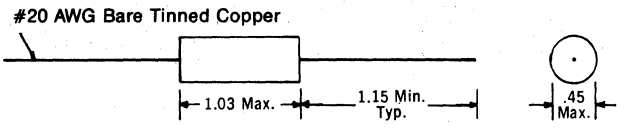
HIGH CURRENT CHOKES

TYPE 6860 | **6860** | 10 μH-1.0 mH. 10% Tolerance
Recommended Mounting Pitch—1.25" | **6870** | **TYPE 6870 (EPOXY ENCAPSULATED VERSION)**





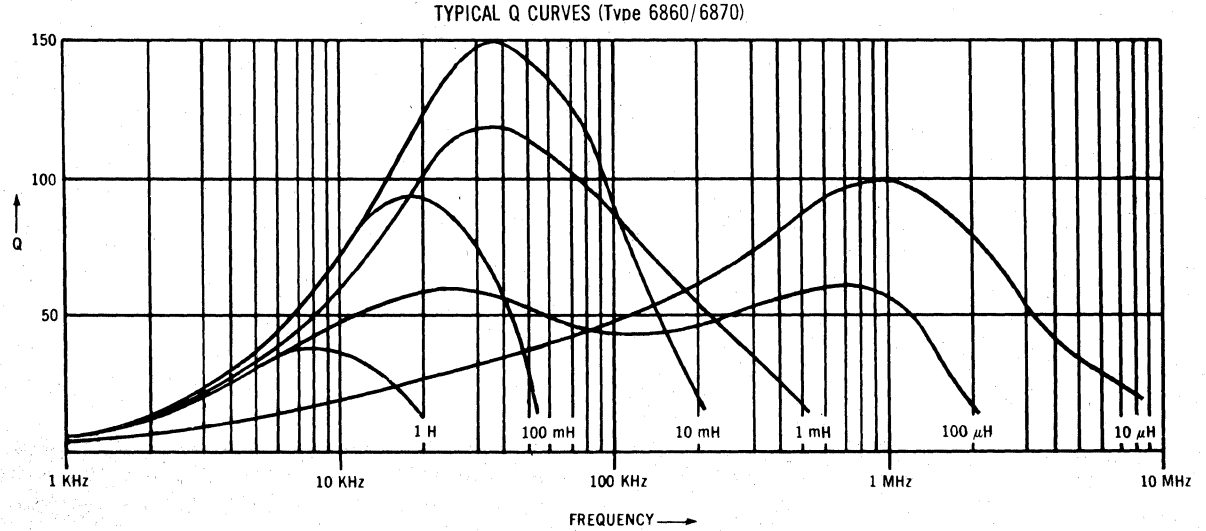
NOTES: (FOR BOTH TYPES)
1. Inductance (Ls) measured on General Radio 1650B Impedance Bridge at 1 KHz.
2. Current rating (Rated IDC) is based on 0.5 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero-DC) value.
4. Dielectric Withstanding Voltage — 1000 VRMS.
5. Operating temperature range — 55° to + 105°C.
6. Materials:
   Coil Form: Ferrite.
   Cover: TYPE 6860 - Polyester alpha-cellulose.
   Coating: Polyurethane per MIL-1-46058.
   TYPE 6870- Cover & Coating: Epoxy encapsulated.
   Magnet Wire: Per FED SPEC J-W-001177/9 (MIL-W-583 Type B)

STANDARD VALUES: (Electrical characteristics are identical for both types. Other values are available on special order.)

Dash No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma	INCR I ma
—01	10 μH	.023	45	4600	3200
—02	12	.025	40	4500	2900
—03	15	.030	32	4100	2600
—04	18	.032	21	3900	2400
—05	22	.035	12	3700	2200
—06	27	.038	8.5	3600	2000
—07	33	.043	5.8	3400	1800
—08	39	.047	3.5	3200	1700
—09	47	.054	3.2	3000	1500
—10	56	.060	2.9	2900	1400
—11	68	.068	2.7	2700	1200
—12	82	.073	2.5	2600	1100
—13	100	.098	2.3	2300	1000
—14	120	.14	2.1	1900	930
—15	150	.18	1.9	1700	830
—16	180	.20	1.5	1600	760
—17	220	.28	1.3	1400	680
—18	270	.31	1.3	1300	620
—19	330	.35	1.2	1200	560
—20	390	.38	1.1	1100	510
—21	470	.44	1.0	1050	460
—22	560	.48	.90	1000	430
—23	680	.63	.80	890	390
—24	820	.87	.72	760	350
—25	1.0 mH	.96	.65	720	320
—26	1.2	1.3	.62	620	290
—27	1.5	1.4	.58	600	260
—28	1.8	1.7	.53	540	240
—29	2.2	2.3	.44	470	220
—30	2.7	2.6	.39	440	190
—31	3.3	3.5	.36	380	180

Dash No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma	INCR I ma
—32	3.9 mH	3.8	.34	360	160
—33	4.7	4.3	.32	340	150
—34	5.6	5.6	.26	300	140
—35	6.8	6.3	.24	280	120
—36	8.2	8.6	.21	240	110
—37	10	9.7	.20	220	100
—38	12	11	.19	210	92
—39	15	15	.17	180	84
—40	18	20	.14	160	75
—41	22	24	.13	140	68
—42	27	26	.12	130	62
—43	33	35	.10	120	56
—44	39	38	.95	110	51
—45	47	50	.80	100	47
—46	56	55	.72	95	43
—47	68	76	.66	81	39
—48	82	86	.62	76	35
—49	100	99	.57	71	32
—50	120	110	.52	67	29
—51	150	200	.47	50	26
—52	180	220	.43	48	24
—53	220	300	.38	41	22
—54	270	320	.35	40	20
—55	330	420	.32	35	18
—56	390	480	.29	32	16
—57	470	670	.26	27	15
—58	560	730	.24	26	14
—59	680	870	.19	24	12
—60	820	950	.18	23	11
—61	1.0 H	1100	.17	21	10

TYPICAL Q CURVES (Type 6860/6870)



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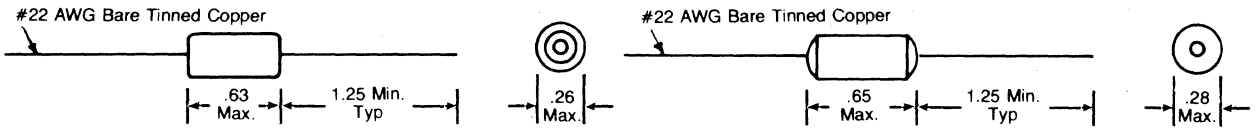
Area Code 516 746-2310

MINIATURE HIGH CURRENT CHOKES

TYPE 7070 | **7070** | 1.0μH-100mH. 10% Tolerance | Recommended Mounting Pitch—.80" | **7080** | **TYPE 7080 (EPOXY ENCAPSULATED VERSION)**



NOTES: (FOR BOTH TYPES)

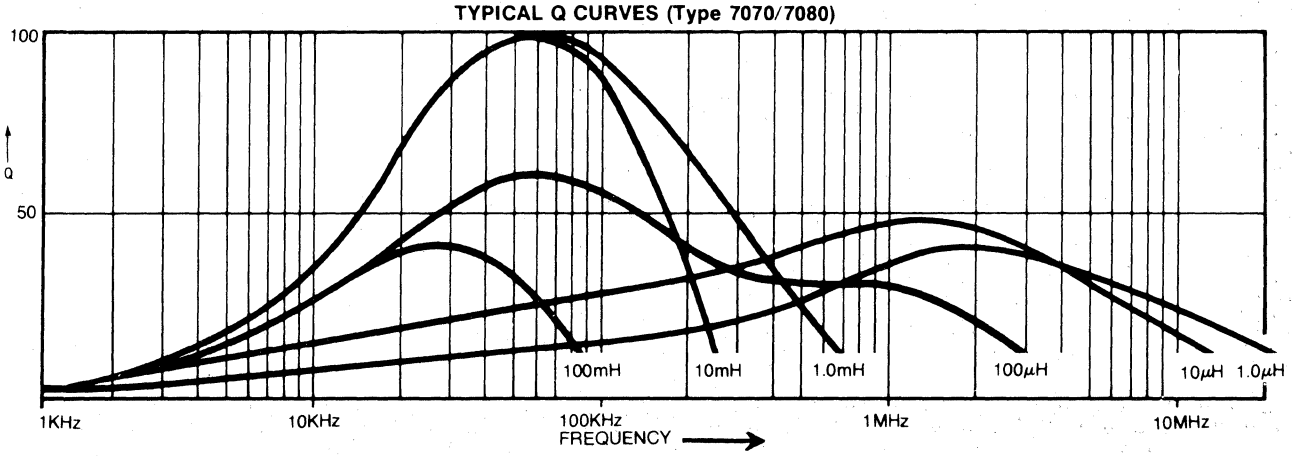
1. INDUCTANCE:
   For 1.0μH thru 8.2μH; effective inductance measured on Boonton 260A Q-meter at 7.9 MHz in accordance with MIL-C-15305.
   For 10μH thru 100mH; inductance (Ls) measured on General Radio 1650B Impedance Bridge at 1 KHz.
2. Current rating (Rated IDC) is based on 0.25 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero-DC) value.
4. Dielectric Withstanding Voltage — 1000 VRMS.
5. Operating temperature range −55° to +105°C.
6. Materials:
   Coil Form: Ferrite
   Cover: TYPE 7070 - PVC shrink tube-flame retardant UL type FR-1 per MIL-I-23053
   TYPE 7080 - Epoxy encapsulated.
   Magnet Wire: Per FED SPEC J-W-001177/9 (MIL-W-583 Type B)

STANDARD VALUES: (Electrical characteristics are identical for both types. Other values are available on special order.)

DASH NO.	NOMINAL INDUCTANCE	MAX.DCR OHMS	MIN.SRF MHz	RATED IDC ma	INCR I ma
-01	1.0μH	.010	155	5,000	6,400
-02	1.2	.011	148	4,800	6,000
-03	1.5	.012	128	4,600	5,000
-04	1.8	.013	120	4,400	4,500
-05	2.2	.014	108	4,200	4,100
-06	2.7	.015	100	4,100	3,600
-07	3.3	.016	96	4,000	3,200
-08	3.9	.017	90	3,800	3,000
-09	4.7	.022	85	3,400	2,700
-10	5.6	.028	76	3,000	2,500
-11	6.8	.031	70	2,800	2,300
-12	8.2	.035	51	2,700	2,000
-13	10	.038	35	2,600	1,900
-14	12	.043	21	2,400	1,700
-15	15	.049	14	2,300	1,500
-16	18	.054	10	2,200	1,400
-17	22	.059	8.0	2,100	1,300
-18	27	.070	6.5	1,900	1,100
-19	33	.077	6.1	1,800	1,000
-20	39	.084	5.7	1,700	940
-21	47	.093	5.1	1,600	870
-22	56	.12	4.3	1,500	790
-23	68	.13	3.6	1,400	710
-24	82	.16	3.2	1,300	650
-25	100	.24	3.0	1,000	590
-26	120	.32	2.7	880	540
-27	150	.43	2.1	760	480
-28	180	.48	1.7	720	440
-29	220	.55	1.6	670	400
-30	270	.62	1.5	640	360

DASH NO.	NOMINAL INDUCTANCE	MAX.DCR OHMS	MIN.SRF MHz	RATED IDC ma	INCR I ma
-31	330μH	.72	1.4	590	320
-32	390	.79	1.3	560	300
-33	470	.88	1.2	530	270
-34	560	1.2	1.1	460	250
-35	680	1.5	1.0	410	230
-36	820	1.7	.96	380	210
-37	1.0mH	1.9	.88	360	190
-38	1.2	2.4	.78	320	170
-39	1.5	2.8	.64	300	150
-40	1.8	3.1	.60	280	140
-41	2.2	4.5	.54	240	120
-42	2.7	5.8	.44	210	110
-43	3.3	8.1	.43	180	100
-44	3.9	8.9	.40	170	95
-45	4.7	10	.38	160	86
-46	5.6	11	.35	150	79
-47	6.8	15	.29	130	72
-48	8.2	17	.26	120	65
-49	10	22	.24	110	59
-50	12	26	.23	100	54
-51	15	34	.19	86	48
-52	18	39	.17	80	44
-53	22	54	.16	68	40
-54	27	62	.15	64	36
-55	33	82	.12	55	32
-56	39	93	.11	52	30
-57	47	120	.096	46	27
-58	56	130	.092	44	25
-59	68	190	.088	36	23
-60	82	210	.080	35	21
-61	100	270	.074	30	19

TYPICAL Q CURVES (Type 7070/7080)



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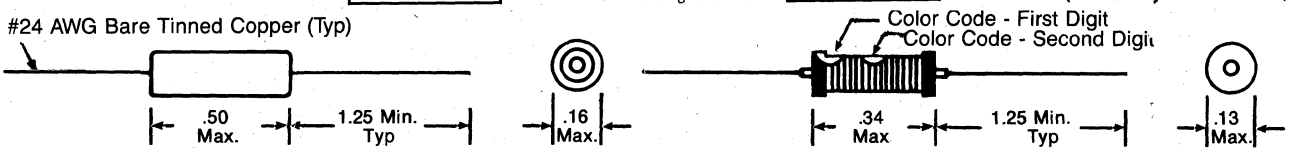
MINIATURE HIGH CURRENT CHOKES

TYPE 7120 — **7120** — 1.0μH-10mH. 10% Tolerance — Recommended Mounting Pitch—.60" — **7130** — **TYPE 7130** (conformally coated version)



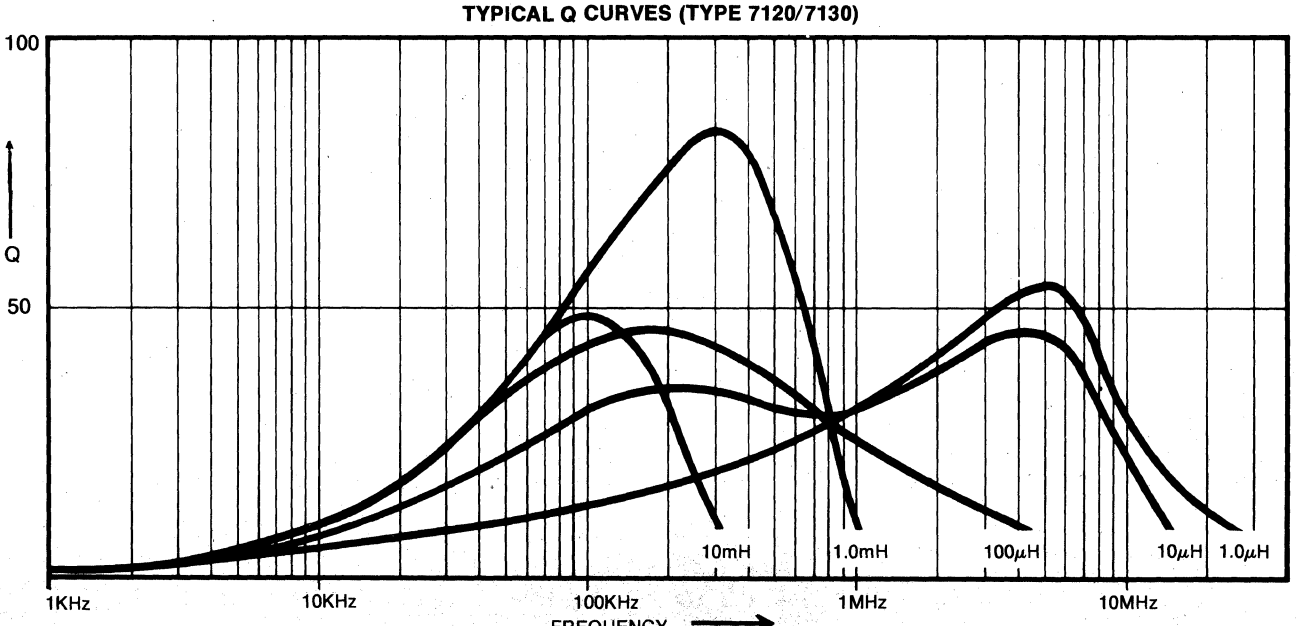
NOTES: (FOR BOTH TYPES)
1. Inductance:
   For 1.0μH thru 8.2μH; effective inductance measured on Boonton 260A Q-meter at 7.9 MHz in accordance with MIL-C-15305. For 10μH thru 10mH, inductance (Ls) measured on General Radio 1650 B Impedance Bridge at 1 KHz.
2. Current Rating (Rated 1 DC) is based on 0.2 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR 1) is the minimum current at which the inductance will be decreased by 5% from its initial (zero - DC) value because of saturation.
4. Dielectric Withstanding Voltage:
   Type 7120 - 1000 VRMS
   Type 7130 - 100 VRMS
5. Operating temperature range -55° to +105°C.
6. Materials:
   Coil Form: Ferrite
   Cover: Type 7120 - PVC shrink tube - flame retardant UL type FR-1 per MIL-I-23053
   Type 7130 - conformally coated with Polyurethane per MIL-I-46058
   Magnet Wire: Per FED SPEC J-W-001177/9
   (MIL-W-583 Type B)
7. Marking:
   Type 7120 - Printed with part number
   Type 7130 - Color coded per dash number using standard EIA color code.

STANDARD VALUES (Electrical Characteristics are identical for both types. Other values are available on special order.)

DASH NO.	NOMINAL INDUCTANCE	MAX. DCR OHMS	MIN.SRF MHz	RATED IDC ma	INCR I ma
-01	1.0μH	.018	190	3300	3000
-02	1.2	.019	170	3200	2700
-03	1.5	.020	160	3100	2500
-04	1.8	.023	150	2900	2100
-05	2.2	.031	130	2600	2000
-06	2.7	.033	120	2500	1900
-07	3.3	.054	110	1900	1700
-08	3.9	.060	100	1800	1500
-09	4.7	.068	86	1700	1400
-10	5.6	.074	64	1600	1300
-11	6.8	.080	44	1600	1200
-12	8.2	.087	32	1500	1100
-13	10	.095	25	1500	970
-14	12	.11	17	1400	880
-15	15	.15	13	1200	790
-16	18	.16	10	1100	710
-17	22	.19	8.4	1000	640
-18	27	.22	8.0	950	580
-19	33	.24	7.6	910	530
-20	39	.26	7.1	880	480
-21	47	.35	6.0	760	430
-22	56	.47	5.8	650	400
-23	68	.53	4.3	610	370
-24	82	.60	4.1	580	330
-25	100	.67	3.9	550	300

DASH NO.	NOMINAL INDUCTANCE	MAX. DCR OHMS	MIN.SRF MHz	RATED IDC ma	INCR I ma
-26	120μH	.90	3.6	470	270
-27	150	1.2	3.2	410	250
-28	180	1.4	2.8	380	220
-29	220	1.9	2.3	320	200
-30	270	2.1	2.1	310	180
-31	330	2.4	1.9	290	170
-32	390	3.0	1.7	260	150
-33	470	3.4	1.4	240	140
-34	560	4.7	1.3	210	130
-35	680	6.4	1.2	180	110
-36	820	7.1	1.1	170	100
-37	1.0mH	7.9	1.0	160	95
-38	1.2	9.0	.94	150	87
-39	1.5	12	.76	130	78
-40	1.8	14	.72	120	71
-41	2.2	19	.64	100	64
-42	2.7	25	56	90	58
-43	3.3	29	53	83	52
-44	3.9	34	48	77	48
-45	4.7	37	.45	74	44
-46	5.6	50	.40	63	40
-47	6.8	58	.36	59	36
-48	8.2	68	.29	54	33
-49	10	75	.27	52	30

TYPICAL Q CURVES (TYPE 7120/7130)



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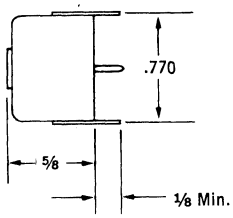
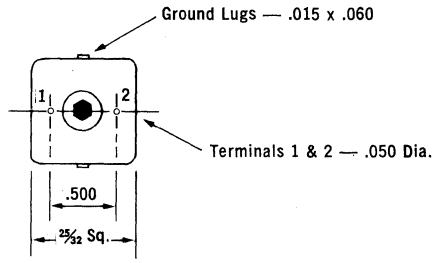
SHIELDED HIGH CURRENT VARIABLE INDUCTORS

TYPE 7170 10 μH-100 mH

7170





NOTES:

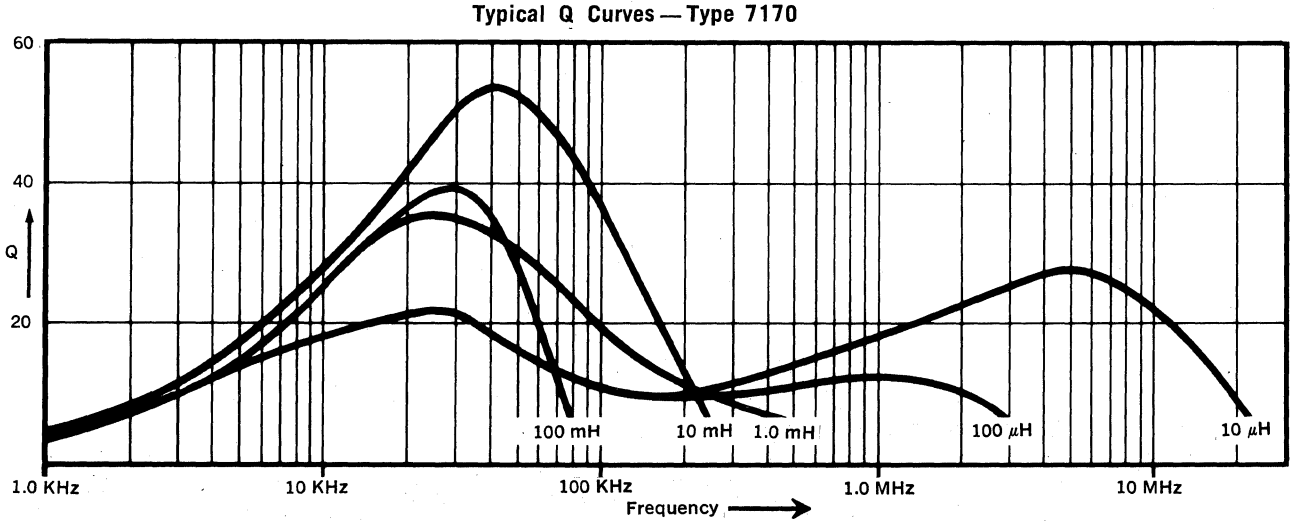
1. Tuning core extends ¼" max. from bottom @ L min. Provide 5/16 dia. hole in P.C. board.
2. Inductance measured on Cambridge Technology type 520 L/C Meter @ 1 KHz.
3. Current rating (Rated IDC) is based on 0.5 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at higher currents.
4. Incremental Current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero-DC) value because of saturation (INCR I and SRF are measured with inductors set to nominal inductance).
5. Dielectric Withstanding Voltage (winding to shield) — 500 VRMS.
6. Operating temperature range −55°C to +105°C.
7. Marking — Printed with Caddell-Burns Part Number.
8. Materials:
   Shield — aluminum, plain finish
   Core — ferrite
   Terminals — tin-plated brass
   Magnet Wire — per Fed. Spec. J-W-001177/9.

STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Minimum Range L Min.	Minimum Range L Max.	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma	INCR I ma
7170-01	10 μH	6.8 μH	12 μH	0.040	20.0	3500	8400
-02	12	8.2	15	0.043	14.0	3400	7700
-03	15	10.0	18	0.047	9.2	3300	7100
-04	18	12.0	22	0.053	6.8	3100	6100
-05	22	15.0	27	0.059	6.0	2900	5500
-06	27	18.0	33	0.067	5.6	2700	5200
-07	33	22.0	39	0.072	5.2	2600	4800
-08	39	27.0	47	0.079	4.5	2500	4400
-09	47	33.0	56	0.087	4.3	2400	4000
-10	56	39.0	68	0.096	4.1	2300	3700
-11	68	47.0	82	0.10	3.7	2200	3400
-12	82	56.0	100	0.15	3.5	1800	3000
-13	100	68.0	120	0.19	2.7	1600	2800
-14	120	82.0	150	0.23	2.4	1500	2600
-15	150	100.0	180	0.29	2.0	1300	2200
-16	180	120.0	220	0.32	1.8	1300	2000
-17	220	150.0	270	0.37	1.7	1200	1800
-18	270	180.0	330	0.42	1.6	1100	1600
-19	330	220.0	390	0.56	1.5	940	1500
-20	390	270.0	470	0.63	1.4	890	1400
-21	470	330.0	560	0.84	1.3	770	1300
-22	560	390.0	680	0.97	1.1	720	1100
-23	680	470.0	820	1.1	1.0	670	1000
-24	820	560.0	1000	1.4	0.77	600	930

Part No.	Nominal Inductance	Minimum Range L Min.	Minimum Range L Max.	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma	INCR I ma
7170-25	1.0 mH	.68 mH	1.2 mH	1.6	0.80	560	860
-26	1.2	.82	1.5	2.2	0.68	480	760
-27	1.5	1.0	1.8	2.5	0.63	450	690
-28	1.8	1.2	2.2	2.8	0.58	420	640
-29	2.2	1.5	2.7	3.8	0.52	360	570
-30	2.7	1.8	3.3	4.2	0.48	350	520
-31	3.3	2.2	3.9	5.4	0.39	300	480
-32	3.9	2.7	4.7	6.2	0.37	280	440
-33	4.7	3.3	5.6	8.7	0.35	240	390
-34	5.6	3.9	6.8	9.7	0.33	230	360
-35	6.8	4.7	8.2	11.0	0.31	210	330
-36	8.2	5.6	10.0	14.0	0.25	190	290
-37	10.0	6.8	12.0	16.0	0.23	180	270
-38	12.0	8.2	15.0	22.0	0.21	150	240
-39	15.0	10.0	18.0	24.0	0.19	140	220
-40	18.0	12.0	22.0	35.0	0.16	120	200
-41	22.0	15.0	27.0	46.0	0.13	100	180
-42	27.0	18.0	33.0	52.0	0.12	98	160
-43	33.0	22.0	39.0	68.0	0.096	86	150
-44	39.0	27.0	47.0	75.0	0.086	82	140
-45	47.0	33.0	56.0	87.0	0.084	76	120
-46	56.0	39.0	68.0	96.0	0.081	72	110
-47	68.0	47.0	82.0	130.0	0.079	62	100
-48	82.0	56.0	100.0	150.0	0.077	58	93
-49	100.0	68.0	120.0	200.0	0.063	50	83

Typical Q Curves — Type 7170



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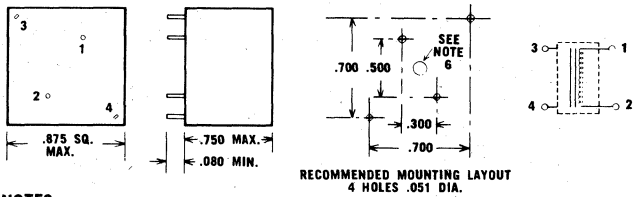
SHIELDED HIGH CURRENT CHOKES



TYPE 6900 10 μH — 82μH — 10% Tolerance
100 μH — 1.0 H — 5% Tolerance

6900

SPECIAL FEATURES

SHIELDED — Magnetically shielded with ground lugs to minimize external field.

ENCAPSULATED — with epoxy for maximum ruggedness and moisture protection.

VARIABLE — with optional trimmer. See note 6.

STABLE — typical temperature coefficient of +76 ±28 ppm/°C from −30° to +70°C.

NOTES:

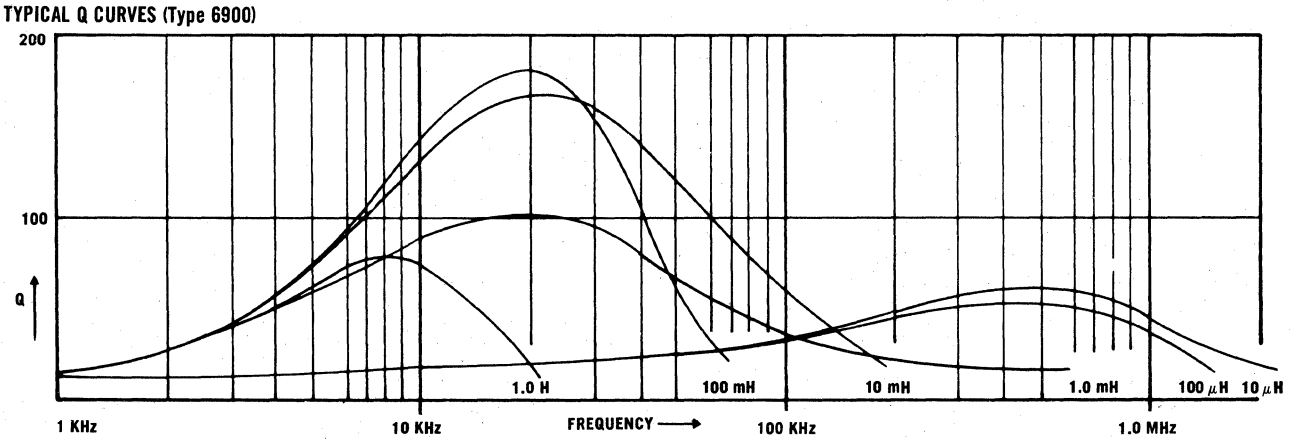
1. Inductance measured on General Radio 1650 B Impedance Bridge at 1 KHz.
2. Current rating (Rated IDC) is based on 1.0 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from the initial (zero-DC) value.
4. Dielectric Withstanding Voltage — 1000 VRMS.
5. Operating temperature range −55° to +105°C.
6. These units are available with an optional trimmer which, when fully inserted, will increase the inductance by at least 20%. Order by adding suffix "V" to dash numbers, e.g.: 6900 -25V is continuously variable from 1.0 mH ±5% to 1.2 mH +10% −5%. If bottom access to trimmer is desired, provide a 3/16" dia. center hole as shown in the recommended mounting layout.
7. Materials:
   Core — Ferrite.
   Case — Epoxy encapsulated.
   Magnet Wire — per FED SPEC J-W-001177/9 (MIL-W-583 Type B)
   Terminals (1-2) — -01 thru -08 #18 AWG TINNED COPPER
   -09 thru -14 #20 AWG TINNED COPPER
   -15 and -16 #21 AWG TINNED COPPER
   -17 #22 AWG TINNED COPPER
   -18 thru -61 .024 dia. TINNED PH. BRONZE
   Ground Lugs (3-4) — .016 x .028 STEEL, NICKEL PLATE WITH GOLD FLASH.
8. Marking — Rubber stamped with Caddell-Burns part number.

STANDARD VALUES: (other values available on special order)

Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma	INCR I ma
6900-01	10 μH	.010	19	10,000	10,500
6900-02	12	.011	13	9,500	9,500
6900-03	15	.012	8.0	9,100	8,000
6900-04	18	.013	6.6	8,700	7,400
6900-05	22	.014	5.3	8,400	6,900
6900-06	27	.016	4.9	7,900	6,000
6900-07	33	.018	4.5	7,400	5,400
6900-08	39	.020	4.0	7,000	5,100
6900-09	47	.031	3.6	5,700	4,600
6900-10	56	.034	3.4	5,400	4,200
6900-11	68	.040	3.2	5,000	3,800
6900-12	82	.042	2.9	4,900	3,500
6900-13	100	.047	2.7	4,600	3,200
6900-14	120	.053	2.4	4,300	2,900
6900-15	150	.071	2.1	3,800	2,600
6900-16	180	.080	1.9	3,500	2,300
6900-17	220	.11	1.7	3,000	2,100
6900-18	270	.15	1.5	2,600	1,900
6900-19	330	.17	1.4	2,400	1,700
6900-20	390	.19	1.2	2,300	1,600
6900-21	470	.24	1.1	2,000	1,500
6900-22	560	.28	.90	1,900	1,300
6900-23	680	.31	.80	1,800	1,200
6900-24	820	.34	.70	1,700	1,100
6900-25	1.0 mH	.46	.61	1,500	1,000
6900-26	1.2	.52	.57	1,400	910
6900-27	1.5	.72	.54	1,200	820
6900-28	1.8	.79	.52	1,100	740
6900-29	2.2	.89	.50	1,000	670
6900-30	2.7	1.2	.44	900	610

Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma	INCR I ma
6900-31	3.3 mH	1.3	.38	880	550
6900-32	3.9	1.9	.35	730	510
6900-33	4.7	2.1	.32	690	460
6900-34	5.6	2.6	.29	620	420
6900-35	6.8	3.1	.26	570	380
6900-36	8.2	3.4	.23	540	350
6900-37	10	4.6	.20	470	310
6900-38	12	5.1	.18	440	290
6900-39	15	5.8	.17	420	260
6900-40	18	7.8	.16	360	240
6900-41	22	9.0	.15	330	210
6900-42	27	12	.13	290	190
6900-43	33	13	.12	280	170
6900-44	39	18	.11	240	160
6900-45	47	20	.10	220	150
6900-46	56	27	.085	190	130
6900-47	68	31	.070	180	120
6900-48	82	34	.065	170	110
6900-49	100	45	.060	150	100
6900-50	120	51	.055	140	91
6900-51	150	58	.050	130	82
6900-52	180	77	.045	110	75
6900-53	220	88	.040	105	67
6900-54	270	120	.036	91	61
6900-55	330	130	.032	88	55
6900-56	390	150	.030	82	51
6900-57	470	200	.028	71	46
6900-58	560	280	.026	60	42
6900-59	680	310	.024	57	38
6900-60	820	350	.020	53	35
6900-61	1.0 H	470	.016	46	31

TYPICAL Q CURVES (Type 6900)



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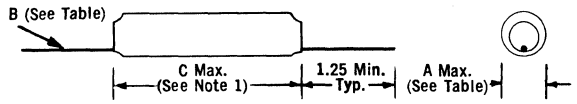
Area Code 516 746-2310

HIGH CURRENT/HIGH VOLTAGE CHOKES

suitable for any high-current application — especially those requiring high-voltage transient suppression.

TYPE 6309 11-360μH 10% Tolerance
20-50KV minimum breakdown voltage

6309



NOTES:
1. Minimum Breakdown Voltage ratings and dimensions are as follows:

	Min. Breakdown	C Max. Length In.	Rec. Mtg. Pitch In.
-1 thru -5	20KV	2.8	3.0
-6 thru -10	35KV	4.2	4.4
-11 thru -15	50KV	5.8	6.0

2. Inductance measured on General Radio 1650 Impedance Bridge at 1 KHz.
3. Current rating (Rated IDC) is based on power dissipation of 1.5 watt for -1 thru -5, 2.5 watt for -6 thru -10, and 3.5 watt for -11 thru -15; for approx. 20°C temperature rise. Depending on application, these units may be operated at up to twice the rated current.
4. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
5. Dielectric Withstanding Voltage — 1000 VRMS.
6. Materials:
   Coil Form — Ferrite. Jacket — PVC shrink tube.
   Magnet Wire — Type B per MIL-W-583.
   Lead Wires — Bare tinned copper.

STANDARD VALUES: (Other values available on special order.)

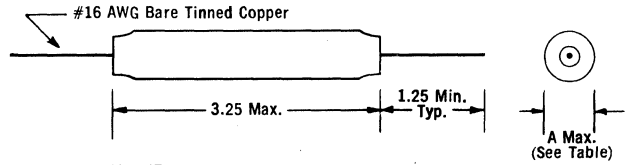
Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated I_{DC} Amps	INCR I Amps	A Dia. In.	B Lead Size AWG
6309-1	11μH	.005	40	18	11	.62	10
6309-2	18	.007	33	15	9.0	.59	12
6309-3	31	.013	27	11	7.0	.56	14
6309-4	46	.023	22	8.0	6.0	.52	16
6309-5	79	.042	15	6.0	4.5	.49	18
6309-6	32	.008	25	18	4.0	.62	10
6309-7	48	.012	20	15	3.2	.59	12
6309-8	80	.019	15	12	2.7	.56	14
6309-9	120	.036	13	8.3	2.2	.52	16
6309-10	190	.068	11	6.0	1.7	.49	18
6309-11	60	.010	15	19	2.2	.62	10
6309-12	90	.014	13	16	1.8	.59	12
6309-13	146	.025	10	12	1.4	.56	14
6309-14	225	.050	8	8.4	1.2	.52	16
6309-15	360	.100	7	6.0	.95	.49	18

HIGH CURRENT/HIGH VOLTAGE CHOKES

suitable for any high-current application — especially those requiring high-voltage transient suppression.

TYPE 6400 80μH-2.0mH 10% Tolerance
Recommended mounting pitch — 3.50"
25kV minimum breakdown voltage

6400



NOTES:
1. Inductance measured on General Radio 1650B Impedance Bridge at 1 KHz.
2. Current rating (Rated IDC) is based on 2.0 watt power dissipation for approx. 20°C temperature rise. Depending on application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
4. Dielectric Withstanding Voltage — 1000 VRMS.
5. Operating Temperature Range — −55°C to +85°C.
6. Materials:
   Coil Form — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Jacket — PVC shrink tube.

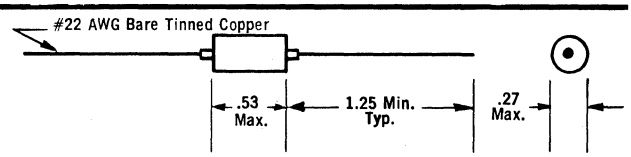
STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated I_{DC} Amps	INCR I Amps	A Dia.
6400-1	80μH	.034	12	7.7	7.5	.70
6400-2	130	.065	11	5.5	5.6	.68
6400-3	220	.13	9.0	3.9	4.3	.67
6400-4	350	.25	7.0	2.8	3.6	.66
6400-5	560	.49	5.0	2.0	2.9	.65
6400-6	780	.87	4.5	1.5	2.5	.64
6400-7	1.4mH	1.9	3.2	1.0	1.8	.63
6400-8	2.0	3.6	2.6	.75	1.4	.62

SHIELDED CHOKES

TYPE 1670 250μH-100mH 10% or 25% Tolerance (GMV also available).
Recommended mounting pitch — .80"

1670



NOTES:
1. These units are especially suited for filtering applications where small size, low DC resistance and magnetic shielding are required. They are not recommended for applications requiring extremely high stability.
2. Inductance (LP) is measured at 1.0 KHz on a General Radio 1650-B impedance bridge. These units are available in either 10% or 25% inductance tolerance.
3. The test voltage specified in column 3 is the RMS voltage across the test unit during inductance measurement.
4. Current rating (Rated IDC) is based on 0.3 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
5. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
6. Dielectric Withstanding Voltage — 100 VRMS.
7. Materials:
   Coil Form and Shield — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Coating — Polyurethane per MIL-I-46058.

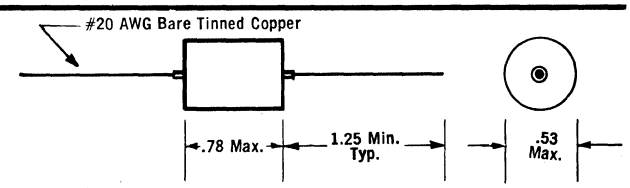
STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Test Volts See Note 3	Max. DCR Ohms	Min. SRF MHz	Rated I_{DC} ma See Note 4	INCR I ma See Note 5
1670-1	250μH	.007	0.17	1.5	1330	60
1670-2	500	.014	0.39	1.1	880	44
1670-3	1.0mH	.028	0.80	0.90	610	30
1670-4	2.5	.07	1.8	0.40	400	20
1670-5	5.0	.14	3.1	0.30	310	13
1670-6	10	.15	6.3	0.20	220	9.4
1670-7	25	.30	13	0.14	150	6.0
1670-8	50	.40	28	0.10	100	4.3
1670-9	100	.24	54	0.70	75	3.0

SHIELDED CHOKES

TYPE 1662 5.0mH-1.0H 10% or 25% Tolerance (GMV also available).
Recommended mounting pitch — 1.20"

1662



NOTES:
1. These units are especially suited for filtering applications where small size, low DC resistance and magnetic shielding are required. They are not recommended for applications requiring extremely high stability.
2. Inductance (Lp) is measured at 1.0 KHz on a General Radio 1650-B impedance bridge. These units are available in either 10% or 25% inductance tolerance.
3. The test voltage specified in column 3 is the RMS voltage across the test unit during inductance measurement.
4. Current rating (Rated IDC) is based on 0.5 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
5. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
6. Dielectric Withstanding Voltage — 100 VRMS.
7. Materials:
   Coil Form and Shield — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Coating — Polyurethane per MIL-I-46058.

STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Test Volts See Note 3	Max. DCR Ohms	Min. SRF MHz	Rated I_{DC} ma See Note 4	INCR I ma See Note 5
1662-1	5.0mH	.14	.83	.28	770	20
1662-2	10	.16	2.4	.20	450	13
1662-3	25	.32	5.2	.11	310	8.0
1662-4	50	.42	12	.080	200	5.0
1662-5	100	.24	30	.050	130	4.0
1662-6	250	.40	65	.035	88	2.3
1662-7	500	.46	130	.024	62	1.6
1662-8	1.0H	.25	200	.015	50	1.2

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QUALITY COILS SINCE 1946

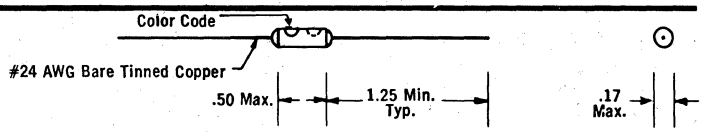
CADDELL-BURNS

258 East Second Street
Mineola, New York 11501-3508
Area Code 516 746-2310

MINIATURE SHIELDED CHOKES

TYPES 6375/6376 1.0μH-5.0mH 10% Tolerance
Recommended mounting pitch—.70″

6375 / 6376



NOTES:
1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
2. Current rating (Rated IDC) is based on 0.25 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
4. Dielectric Withstanding Voltage — 1000 VRMS.
5. Operating Temperature Range — −55°C to +105°C.
6. Materials:
   Coil Form and Shield — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Construction — Epoxy encapsulated.
   Coating — Polyurethane per MIL-I-46058.

Marking — Color coded per dash number using standard EIA color as follows: 6375 — one color dot; 6376 — two color dots. e.g.: 6375-1 — one brown dot; 6376-1 — two brown dots, etc.

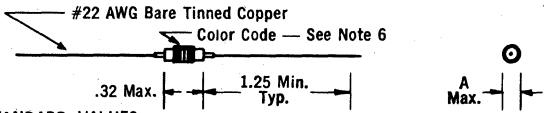
STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Min. Q	Test Freq. MHz	Max. DCR Ohms	Min. SRF MHz	Rated I_{DC} ma See Note 2	Incr I ma See Note 3
6375-1	1.0μH	55	7.9	.05	200	2200	2700
6375-2	2.5	45	7.9	.08	115	1700	1600
6375-3	5.0	35	7.9	.12	90	1400	1000
6375-4	10	65	2.5	.42	55	770	750
6375-5	25	55	2.5	.80	35	560	450
6375-6	50	60	2.5	1.5	27	400	300
6375-7	100	70	2.5	3.1	20	280	200
6376-1	100	50	.79	.60	6.0	640	50
6376-2	250	55	.79	.92	2.6	520	32
6376-3	500	50	.79	2.0	1.9	350	22
6376-4	1.0mH	45	.25	4.7	0.8	230	15
6376-5	2.5	45	.25	7.5	0.5	180	10
6377-6	5.0	45	.25	17	0.4	120	7.0

MINIATURE CHOKES

660

TYPE 660 0.1-2μH 10% Tolerance
Recommended mounting pitch—.70″



NOTES:
1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
2. Current rating (Rated IDC) is based on 0.2 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Dielectric Withstanding Voltage — 100 VRMS.
4. Operating Temperature Range — −55°C to +105°C.
5. Materials:
   Coil Form — Mineral filled phenolic.
   Magnet Wire — Type B per MIL-W-583.
   Coating — Polyurethane per MIL-I-46058.
6. Marking — Color coded per dash number using standard EIA color code.

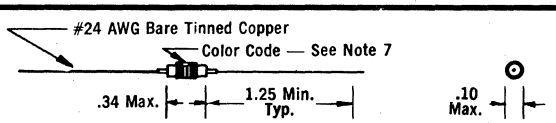
STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Min. Q	Test Freq. MHz	Max. DCR Ohms	Min. SRF MHz	Rated I_{DC} Amps See Note 2	A Dia.
660-1	0.1μH	60	25	.014	420	3.8	.15
660-2	0.2	60	25	.034	380	2.4	.14
660-3	0.3	55	25	.060	340	1.8	.13
660-4	0.4	55	25	.074	310	1.6	.13
660-5	0.5	55	25	.12	280	1.3	.13
660-6	0.75	45	25	.23	240	0.9	.13
660-7	1.0	50	25	.39	200	0.7	.13
660-8	1.5	30	7.9	.76	160	0.5	.12
660-9	2.0	30	7.9	.96	140	0.4	.12

MINIATURE CHOKES

620

TYPE 620 1.0-100μH 10% Tolerance
Recommended mounting pitch—.60″



NOTES:
1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
2. Current rating (Rated IDC) is based on 0.2 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
4. Dielectric Withstanding Voltage — 100 VRMS.
5. Operating Temperature Range — −55°C to +105°C.
6. Materials:
   Coil Form — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Coating — Polyurethane per MIL-I-46058.
7. Marking — Color coded per dash number using standard EIA color code.

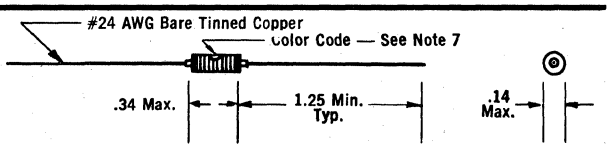
STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Min. Q	Test Freq. MHz	Max. DCR Ohms	Min. SRF MHz	Rated I_{DC} ma See Note 2	Incr I ma See Note 3
620-1	1.0μH	50	7.9	.11	190	1300	4400
620-2	2.5	50	7.9	.18	120	1000	2600
620-3	5.0	45	7.9	.24	90	900	1800
620-4	7.5	40	7.9	.33	70	800	1350
620-5	10	40	2.5	.39	64	700	1100
620-6	15	60	2.5	.74	54	500	950
620-7	20	55	2.5	.96	46	450	780
620-8	25	60	2.5	1.2	40	400	680
620-9	50	85	2.5	3.6	28	270	490
620-10	75	90	2.5	6.3	22	170	410
620-11	100	80	2.5	8.6	20	150	320

MINIATURE CHOKES

659

TYPE 659 250μH-10.0mH 10% Tolerance
Recommended mounting pitch—.60″



NOTES:
1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified in accordance with MIL-C-15305.
2. Current rating (Rated IDC) is based on 0.2 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased 5% from its initial (zero — DC) value.
4. Dielectric Withstanding Voltage — 100 VRMS.
5. Operating Temperature Range — −55°C to +105°C.
6. Materials:
   Coil Form — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Coating — Polyurethane per MIL-I-46058.
7. Marking — Color coded per dash number using standard EIA color code.

STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Min. Q	Test Freq. MHz	Max. DCR Ohms	Min. SRF MHz	Rated I_{DC} ma See Note 2	Incr I ma See Note 3
659-1	250μH	40	.79	2.0	3.2	315	165
659-2	500	35	.79	3.9	1.5	225	120
659-3	1.0mH	60	.25	9.5	1.1	145	78
659-4	2.5	55	.25	24	0.6	90	50
659-5	5.0	50	.25	50	0.5	63	37
659-6	10	40	.079	75	0.3	51	30

QUALITY COILS SINCE 1946

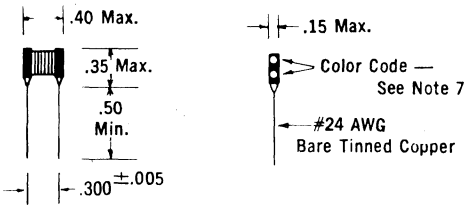
CADDELL-BURNS

258 East Second Street
Mineola, New York 11501-3508
Area Code 516 746-2310

PRINTED CIRCUIT CHOKES

TYPE 6550 1.0μH-10mH 10% Tolerance

6550



STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Min. Q	Test Freq. MHz	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma See Note 2	INCR I ma See Note 3
6550-1	1.0μH	90	7.9	.015	180	3600	7000
6550-2	2.5	85	7.9	.03	110	2500	4100
6550-3	5.0	90	7.9	.06	75	1800	2900
6550-4	7.5	95	7.9	.11	70	1300	2500
6550-5	10	90	7.9	.19	55	1020	2100
6550-6	25	80	2.5	.50	18	630	1300
6550-7	50	70	2.5	1.1	11	420	1000
6550-8	75	45	2.5	1.2	5.5	400	860
6550-9	100	85	.79	1.5	2.8	365	700
6550-10	250	55	.79	2.7	1.6	270	450
6550-11	500	35	.79	3.3	1.3	240	340
6550-12	750	30	.79	4.2	1.2	215	280
6550-13	1.0mH	80	.25	8.6	1.0	150	210
6550-14	2.5	75	.25	16	.53	110	140
6550-15	5.0	45	.25	31	.45	80	100
6550-16	7.5	25	.25	50	.32	63	80
6550-17	10	50	.079	70	.26	53	70

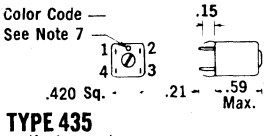
NOTES:
1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
2. Current rating (Rated IDC) is based on 0.2 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
4. Dielectric Withstanding Voltage — 100 VRMS.
5. Operating Temperature Range — −55°C to +105°C.
6. Materials:
   Coil Form — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Coating — Polyurethane per MIL-I-46058.
7. Marking — color coded per dash number using standard EIA color code.

MINIATURE SHIELDED VARIABLE INDUCTORS

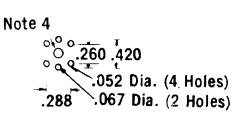
TYPES 435/6344 .25-70μH

SCHEMATIC

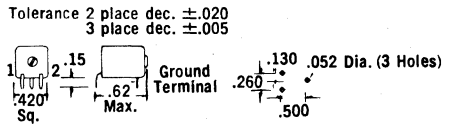
435



TYPE 435
vertical mount



Recommended Mounting Layout



TYPE 6344
horizontal mount

Recommended Mounting Layout

6344

NOTES:
1. For vertical mount, order as 435-1 . . . etc. For horizontal mount, order as 6344-1 . . . etc.
2. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
3. Self-resonant frequencies are measured at maximum inductance.
4. Unit can be tuned from top or bottom with 1/8" insulated screwdriver (part no. C-B 2102). For type 435 only, provide .156 dia. hole if bottom access to tuning core is desired.
5. Current rating is based on .15 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
6. Materials:
   Terminals — Tin-plated brass. Core — Ferrite.
   Coil Form and Base — Molded nylon. Shield Can — Cadmium-plated brass.
7. Marking — Marked with Caddell-Burns Part No. on side of can, and color-coded per dash number on bottom between two active terminals.

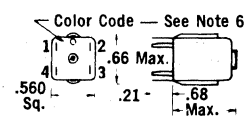
STANDARD VALUES: (Other values available on special order.)

Part No.	Minimum Range L Min.	Minimum Range L Max.	Minimum Q @ L Min.	Minimum Q @ L Max.	Test Freq. MHz	Min. SRF MHz Note 3	Max. DCR Ohms	Current Rating ma
435/6344-1	.25μH	.50μH	75	50	25	200	.03	2200
435/6344-2	.48	1.0	70	45	25	150	.08	1300
435/6344-3	.90	2.1	70	45	25/7.9	110	.17	930
435/6344-4	1.7	3.9	50	55	7.9	80	.60	500
435/6344-5	3.5	8.5	50	45	7.9	55	1.2	350
435/6344-6	7.5	17	60	40	7.9/2.5	40	2.3	250
435/6344-7	16.5	35	50	50	2.5	11	1.9	280
435/6344-8	33	70	45	45	2.5	8	2.9	220

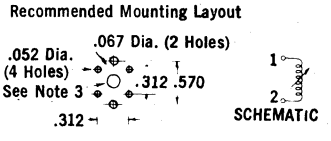
MINIATURE SHIELDED VARIABLE INDUCTORS

434

TYPE 434 .55-64μH
Tol: 2 Place Dec. ±.020
3 Place Dec. ±.005



Recommended Mounting Layout



NOTES:
1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
2. Self-resonant frequencies are measured at maximum inductance.
3. Provide .187 dia. hole if bottom access to tuning core is desired. Unit can be tuned from top or bottom with standard .060 square tuning tool (Part No. C-B2102).
4. Current rating is based on .2 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
5. Materials:
   Terminals — Tin-plated brass.
   Coil Form and Base — Molded nylon.
   Core — Moisture proofed powdered iron.
   Shield Can — Aluminum plain finish.
6. Marking — Marked with Caddell-Burns No. on side of can; and color-coded per dash number on bottom between two active terminals.

STANDARD VALUES: (Other values available on special order.)

Part No.	Minimum Range L Min.	Minimum Range L Max.	Minimum Q @ L Min.	Minimum Q @ L Max.	Test Freq. MHz	Min. SRF MHz Note 2	Max. DCR Ohms	Current Rating ma
434-1	.55μH	.90μH	90	85	25	160	.06	1800
434-2	.90	1.4	90	70	25/7.9	130	.12	1200
434-3	1.4	2.4	60	70	7.9	100	.25	890
434-4	2.2	4.1	60	80	7.9	80	.60	570
434-5	3.9	7.7	55	55	7.9	52	1.0	440
434-6	7.5	11	35	70	7.9/2.5	21	1.2	400
434-7	11	17	55	75	2.5	16	1.4	370
434-8	18	27	55	75	2.5	14	1.8	330
434-9	27	42	55	70	2.5	13	2.4	280
434-10	42	64	55	65	2.5	11	3.1	250

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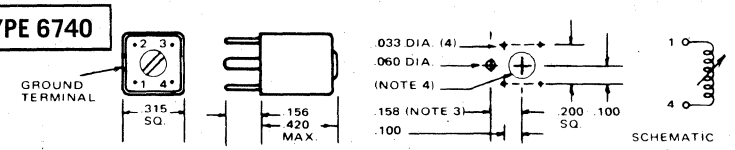
SUBMINIATURE SHIELDED VARIABLE INDUCTORS

TYPE 6740



NOTES:

1. Effective inductance and Q measured on Boonton 260A Q-meter in accordance with MIL-C-15305.
2. Self-resonant frequencies are measured at nominal inductance.
3. Ground terminal may be bent as required to fit existing layouts.
4. Provide .156 DIA. hole if bottom access to tuning core is desired. Tuning range on −38 thru −61 may be extended by allowing core to extend 1/16" below mounting surface (when Lmin≈½Lnom).
5. Current rating is based on ¼ watt power dissipation.
6. MATERIALS–
   Terminals: tin plated copper.
   Terminal Base: molded phenolic.
   Coil Form: polyester fiberglass.
   Core: moisture-proofed powdered iron or ferrite.
   Shield Can: tin plated copper.
   Impregnation: varnish per MIL-V-173.

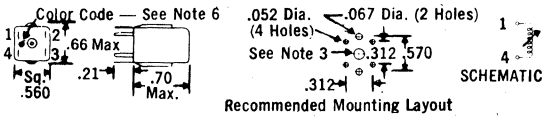
STANDARD VALUES (INTERMEDIATE AND SPECIAL VALUES AVAILABLE ON SPECIAL ORDER)

Dash No.	Nominal Inductance	Minimum Range LMIN	Minimum Range LMAX	Min Q @ LNOM	Test Freq. MHz	Max DCR OHMS	Min SRF MHz Note 2	Max IDC mA Note 5
-01	10uH	08uH	12uH	80	25	.02	250	3500
-03	15	12	18	85	25	.03	250	2800
-05	22	18	27	85	25	.04	250	2500
-07	33	27	39	90	25	.05	250	2200
-09	47	39	56	90	25	.13	230	1350
-11	68	56	82	90	25	.17	200	1200
-13	1.0	82	1.2	90	25	.31	160	850
-15	1.5	1.0	1.8	60	7.9	.33	125	850
-17	2.2	1.5	2.7	65	7.9	.72	110	550
-19	3.3	2.2	3.9	65	7.9	1.3	95	425
-21	4.7	3.3	5.6	60	7.9	1.5	80	400
-23	6.8	4.7	8.2	60	7.9	1.8	62	350
-25	10	6.8	12.	60	7.9	2.2	45	325
-27	15	10	18	72	2.5	1.5	12	400
-29	22	15	27	67	2.5	1.8	9.5	350
-31	33	22	39	65	2.5	2.1	7.8	325
-33	47	33	56	57	2.5	2.6	6.6	300
-35	68	47	82	47	2.5	3.0	5.3	275
-37	100	68	120	45	2.5	3.5	5.0	250
-39	150	100	180	70	.79	3.6	3.4	250
-41	220	150	270	65	.79	6.0	2.8	200
-43	330	220	390	60	.79	7.9	2.3	150
-45	470	330	560	40	.79	11	1.9	125
-47	680	470	820	35	.79	13	1.7	125
-49	1.0mH	68mH	1.2mH	32	.79	17	1.5	100
-51	1.5	1.0	1.8	37	25	32	86	85
-53	2.2	1.5	2.7	37	25	41	72	75
-55	3.3	2.2	3.9	40	25	51	69	65
-57	4.7	3.3	5.6	27	25	80	47	55
-59	6.8	4.7	8.2	25	25	90	39	50
-61	10	6.8	12	25	25	110	37	45

MINIATURE SHIELDED VARIABLE INDUCTORS

TYPE 6380

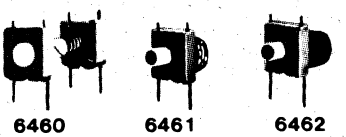
.08-370μH
Tol: 2 Place Dec. ±.020
3 Place Dec. ±.005



NOTES:
1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
2. Self-resonant frequencies are measured at maximum inductance.
3. Provide .187 dia. hole if bottom access to tuning core is desired. Unit can be tuned from top or bottom with standard .060 square tuning tool (Part No. C-B2102).
4. Current rating is based on .2 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
5. Materials:
   Terminals — Tin-plated brass.
   Coil Form and Base — Molded nylon.
   Core — Moisture-proofed powered iron or ferrite.
   Shield Can — Aluminum plain finish.
6. Marking — Marked with Caddell-Burns Part No. on side of can; and color-coded per dash number on bottom between two active terminals.

STANDARD VALUES: (Other values available on special order.)

Part No.	Minimum Range L Min.	Minimum Range L Max.	Minimum Q @ L Min.	Minimum Q @ L Max.	Test Freq. MHz	Min. SRF MHz Note 2	Max. DCR Ohms	Current Rating ma
6380-1	.08μH	.11μH	65	75	25	300	.012	4000
6380-2	.10	.17	75	85	25	280	.014	3700
6380-3	.13	.23	75	90	25	260	.015	3600
6380-4	.17	.28	80	90	25	230	.016	3500
6380-5	.25	.44	90	95	25	180	.024	2800
6380-6	.29	.53	90	95	25	170	.026	2700
6380-7	.48	.84	90	90	25	140	.058	1800
6380-8	.71	2.5	90	85	25/7.9	80	.10	1400
6380-9	1.8	5.7	70	110	7.9	50	.50	630
6380-10	4.5	14	55	120	7.9/2.5	18	.85	480
6380-11	12	40	60	115	2.5	10	1.6	350
6380-12	30	99	55	80	2.5	5.6	2.4	280
6380-13	73	190	55	115	2.5/.79	4.8	3.8	220
6380-14	148	370	75	120	.79	3.5	5.6	180



LOW-COST PRINTED-CIRCUIT VARIABLE INDUCTORS

TYPE 6460

Variable R.F. Inductors
Four Printed Circuit Terminals, Mounting—.5" x .8" Centers
Size 5/8" x 5/8" x .985 Long
Polyester Cellulose Coil Form

Stock No.	Inductance Range Microhenries Min.	Max.	Q'	Q''	Nom. D.C. Res. Ohms	Wire Size AWG
6460-1	06	09	80	105	008	22
6460-2	09	16	100	130	010	22
6460-3	15	29	120	140	011	22
6460-4	19	40	130	145	012	22
6460-5	32	68	80	105	08	20/44
6460-6	60	1.35	80	125	11	20/44
6460-7	1.14	2.5	90	135	15	20/44
6460-8	2.0	4.0	100	140	21	20/44
6460-9	3.1	5.6	110	120	26	20/44
6460-10	4.5	8.1	48	85	29	20/44
6460-11	7.0	11.4	43	150	37	20/44
6460-12	9.7	16.4	80	140	47	20/44
6460-13	15.6	26.2	90	155	61	20/44
6460-14	19.2	44	80	110	1.80	7/44
6460-15	41	95	80	90	2.56	7/44
6460-16	70	183	65	100	3.24	7/44
6460-17	180	525	90	98	5.76	7/44
6460-18	445	1040	94	105	9.32	7/44

Note Inductance & Q at various frequencies can be altered by changing type of core used (see parts section for cores available) Dash No 1 thru 15 uses Powdered Iron Core 302—250—6R Dash No 16 thru 18 uses Ferrite Core 303—250—6R

TYPE 6461

Variable R.F. Coil Series
Size 5/8" x 5/8" x .625 Long
0.5" P.C. Mounting

Stock No.	Inductance Range Microhenries Min.	Max.	Q'	Q''	Nom. D.C. Res. Ohms	Wire Size AWG
6461-1	09	12	58	66	007	22
6461-2	1	14	102	128	009	22
6461-3	14	22	128	150	01	22
6461-4	18	33	134	155	011	22
6461-5	23	44	140	154	013	22
6461-6	37	68	87	105	102	7/41
6461-7	58	1.1	87	100	136	7/41
6461-8	1.1	2.2	72	115	2	7/41
6461-9	2	4.4	80	112	29	7/41
6461-10	3.3	8	96	140	77	7/44
6461-11	7	13.6	70	130	1.02	7/44
6461-12	12.4	25.5	85	134	1.42	7/44
6461-13	22.5	49	90	127	1.93	7/44
6461-14	47	100	86	97	2.8	7/44
6461-15	99	174	75	142	4.2	7/44
6461-16	170	332	95	146	6.0	7/44
6461-17	322	570	102	140	8.5	7/44
6461-18	525	910	97	125	10.4	7/44

TYPE 6462

Variable R.F. Coil with Powdered Iron Shield
Size 5/8" x 5/8" x .730 Long
0.5" P.C. Mounting

Stock No.	Inductance Range Microhenries Min.	Max.	Q'	Q''	Nom. D.C. Res. Ohms	Wire Size AWG
6462-1	08	10	84	89	007	22
6462-2	4	8	82	100	11	7/41
6462-3	6	13	85	105	14	7/41
6462-4	11	26	71	115	20	7/41
6462-5	21	51	85	145	55	7/44
6462-6	34	86	96	145	75	7/44
6462-7	80	169	70	150	1.14	7/44
6462-8	162	395	94	142	1.52	7/44
6462-9	34	84	86	110	2.21	7/44
6462-10	57	124	80	145	2.74	7/44
6462-11	67	141	80	148	3.16	7/44

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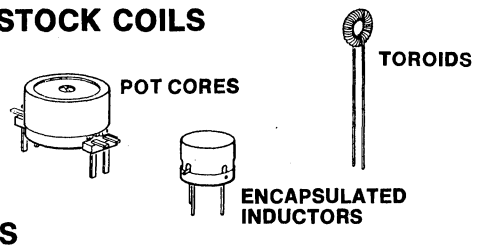
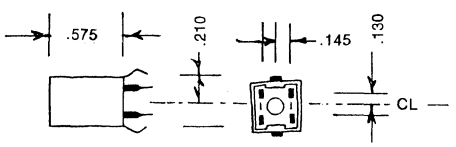
- Toroids
- Printed Circuit Coils
- Pot Core Inductors
- High Current Chokes
- Miniatures
- Ferrites

STOCK COILS



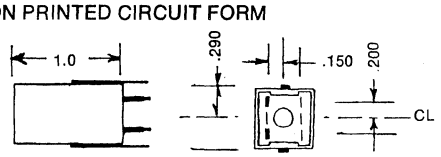
SHIELDED VARIABLE INDUCTORS

NYLON SHIELDED FORM



VSI **.33-36 uh**

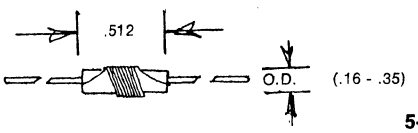
NYLON PRINTED CIRCUIT FORM



VS2 **2.2-4000 uh**

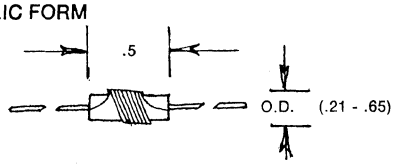
CHOKES

POWDERED IRON FORM



CPI **5-500 uh**

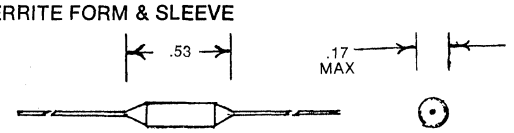
PHENOLIC FORM



CQI **5-2500 uh**

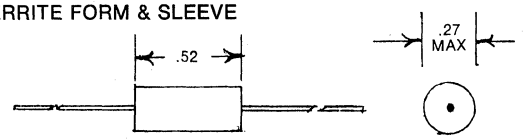
MINIATURE SHIELDED CHOKES

FERRITE FORM & SLEEVE



CF3 **1-1000 uh**

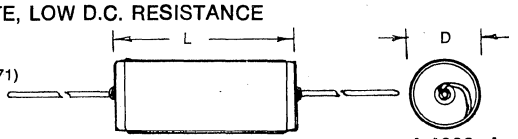
FERRITE FORM & SLEEVE



CF4 **100 uh-100 MH**

HIGH CURRENT CHOKES

FERRITE, LOW D.C. RESISTANCE



CFI **1-1000 uh**

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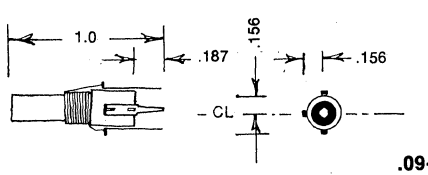
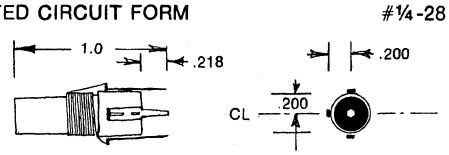
VARIABLE COILS

PRINTED CIRCUIT FORM #10-32 CORE



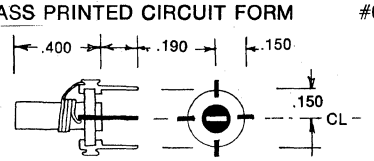
VP1 **.09-780 uh**

PRINTED CIRCUIT FORM #¼-28 CORE



VP2 **.10-1000 uh**

FIBERGLASS PRINTED CIRCUIT FORM #6-32 CORE



VP3 **.095-11 uh**

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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
ABS acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CAMAC computer automated measurement and control
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3
KSR keyboard send /receive

L
LC inductance capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIB microcomputer interface board
MIC microwave IC
MIPS million instructions per second
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

Coilcraft

312/639-6400
Telex 216378
Dept. E, 1102 Silver Lake Road
Cary, IL 60013

TO ORDER CALL 800/322-2645 In Illinois 312/639-6400

Coilcraft has built its reputation on providing high quality coils at low, factory-direct prices.

We're the only coil manufacturer who can give you technical information, Designer's Kits of standard parts, custom samples, start-up lots, or full production quantites — all with a single phone call.

Most orders are shipped overnight from a one million piece inventory of standard parts.

Need high volume production quantities? We can give you world prices, and the assurance of two plants offshore and a third in Mexico — all supported by two more Coilcraft plants and our engineering staff here in the USA.

Ordering information

To order stock items shown, call 800/322-2645 between 8 AM and 4 PM CST (in Illinois 312/639-6400).

Or write to Coilcraft, Dept. E, 1102 Silver Lake Road, Cary, IL 60013.

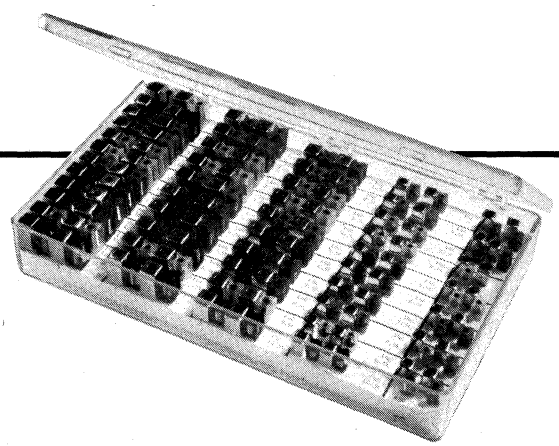
All orders must specify a purchase order number. There is no minimum quantity. Most orders are filled from stock and shipped via UPS unless otherwise specified.

Custom orders

In addition to the standard parts shown here, Coilcraft can custom-build a wide range of inductive devices to meet your precise requirements. For more information, please call our Sales Department at 312/639-2361.

Other Coilcraft inductive devices

- Wide band RF transformers
- LAN transformers
- T-1 carrier transformers
- Magnetics for switching power supplies
  - Chokes
  - Transformers
  - Mag amp toroids
  - Current sensors
- CRT magnetic components
- Data line EMI filters
- LC resonators
- 60 Hz current sensors



DESIGNER'S KITS

These handy, low cost Designer's Kits put a wide range of component values at your fingertips. They're perfect for prototyping and can save you hours of hunting around for the right part.

And when you're ready for production quantities, we can have them to you as early as the next day!

To order call 800/322-2645.

TUNEABLE INDUCTORS

"Slot Ten" 10 mm inductors
0.7 μH-1143 μH
18 shielded, 18 unshielded
(3 of each)
Kit M100 $60

"Unicoil" 7/10 mm inductors
.0435 μH-1.5 μH
49 shielded, 49 unshielded
(3 of each)
Kit M102 $60

SURFACE MOUNT INDUCTORS

Fixed inductors
4 nH-33 μH
48 values (10 of each)
Kit C100 $125

Tuneable inductors
100 nH-10 μH
11 values (45 total)
Kit C101 $50

FIXED INDUCTORS

Axial lead chokes
0.1 μH-1000 μH
25 values (5 of each)
Kit F101 $50

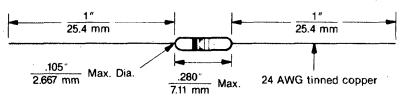
"132 Series" coils
31.5 nH-720 nH
20 values (6 of each)
Kit F100 $50

Coilcraft Dept. E, 1102 Silver Lake Road, Cary, IL 60013 • TLX 216378 • 800/322-2645

FIXED INDUCTORS

AXIAL INDUCTORS

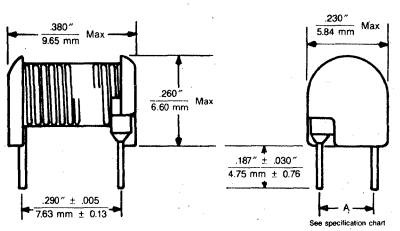
Save 20% — 50% compared to expensive molded chokes. These conformally coated coils provide equivalent electrical performance, equal or greater humidity resistance, low temperature coefficients, and greater mechanical reliability. Cross-reference to Dale IR 2/IM 2, Miller 9230, Nytronics DD/MD 75083, 4, 5, Delevan 1025, Jeffers 09. Coilcraft **Designer's Kit F101** contains samples of 25 values. To order, please contact Coilcraft.



Part Number	L µH ±10%	Q Min.	Test Freq. MHz	DCR Max. Ohms	F_O Min. MHz	Max. Current mA
70-1	**.10**	**40**	**25**	**.07**	**680**	**1410**
70-2	**.12**	**40**	**25**	**.08**	**640**	**1320**
70-3	**.15**	**38**	**25**	**.10**	**600**	**1180**
70-4	**.18**	**35**	**25**	**.12**	**550**	**1050**
70-5	**.22**	**33**	**25**	**.14**	**510**	**980**
70-6	**.27**	**33**	**25**	**.16**	**460**	**985**
70-7	**.33**	**30**	**25**	**.22**	**410**	**730**
70-8	**.39**	**30**	**25**	**.30**	**365**	**690**
70-9	**.47**	**30**	**25**	**.35**	**330**	**600**
70-10	**.56**	**30**	**25**	**.50**	**310**	**510**
70-11	**.68**	**28**	**25**	**.60**	**280**	**430**
70-12	**.82**	**28**	**25**	**.85**	**260**	**405**
70-13	**1.0**	**25**	**25**	**1.00**	**240**	**330**
70-14	**1.2**	**30**	**7.9**	**.18**	**150**	**800**
70-15	**1.5**	**30**	**7.9**	**.22**	**140**	**750**
70-16	**1.8**	**30**	**7.9**	**.30**	**125**	**605**
70-17	**2.2**	**30**	**7.9**	**.40**	**115**	**500**
70-18	**2.7**	**40**	**7.9**	**.50**	**100**	**490**
70-19	**3.3**	**45**	**7.9**	**.85**	**90**	**375**
70-20	**3.9**	**45**	**7.9**	**1.00**	**80**	**355**
70-21	**4.7**	**45**	**7.9**	**1.20**	**75**	**310**
70-22	**5.6**	**50**	**7.9**	**1.8**	**65**	**260**
70-23	**6.8**	**50**	**7.9**	**2.0**	**60**	**250**
70-24	**8.2**	**55**	**7.9**	**2.7**	**55**	**210**
70-25	**10**	**55**	**7.9**	**3.7**	**50**	**200**
70-26	12	45	2.5	2.7	40	210
70-27	**15**	**45**	**2.5**	**2.8**	**35**	**205**
70-28	18	50	2.5	3.1	30	195
70-29	**22**	**50**	**2.5**	**3.3**	**25**	**190**
70-30	27	50	2.5	3.6	20	185
70-31	**33**	**45**	**2.5**	**3.4**	**24**	**187**
70-32	39	45	2.5	3.6	22	180
70-33	**47**	**45**	**2.5**	**4.5**	**20**	**165**
70-34	56	45	2.5	5.7	18	145
70-35	**68**	**50**	**2.5**	**6.7**	**15**	**135**
70-36	82	50	2.5	7.3	14	130
70-37	**100**	**50**	**2.5**	**8.0**	**13**	**125**
70-38	120	30	.79	13	12	100
70-39	**150**	**30**	**.79**	**15**	**11**	**90**
70-40	180	30	.79	17	10	85
70-41	**220**	**30**	**.79**	**21**	**9**	**75**
70-42	270	30	.79	25	8	70
70-43	**330**	**30**	**.79**	**28**	**7**	**65**
70-44	390	30	.79	35	6.5	60
70-45	**470**	**30**	**.79**	**42**	**6**	**55**
70-46	560	30	.79	46	5	50
70-47	**680**	**30**	**.79**	**60**	**4**	**45**
70-48	820	30	.79	65	3.8	43
70-49	**1000**	**30**	**.79**	**72**	**3.4**	**40**

132 SERIES

Very high Q and 5% tolerance make these coils an attractive alternative to axial inductors. Precision insert molding assures constant winding pitch and long-term stability. Coilcraft **Designer's Kit F100** contains samples of each value. To order, please contact Coilcraft.



Part Number	Color	Turns	Dim A	L nH ±5%	Q Min
132-01	Brown	1½	.148 inches/3.76 mm	31.5	60 @ 50 MHz
132-02	Red	2½	.148 inches/3.76 mm	36.5	64 @ 50 MHz
132-03	Orange	3½	.148 inches/3.76 mm	44.0	68 @ 50 MHz
132-04	Yellow	4½	.148 inches/3.76 mm	53.5	72 @ 50 MHz
132-05	Green	5½	.148 inches/3.76 mm	64.0	75 @ 50 MHz
132-06	Blue	6½	.148 inches/3.76 mm	79.0	80 @ 50 MHz
132-07	Violet	7½	.148 inches/3.76 mm	99.0	66 @ 25 MHz
132-08	Gray	8½	.148 inches/3.76 mm	117	68 @ 25 MHz
132-09	White	9½	.148 inches/3.76 mm	138	68 @ 25 MHz
132-10	Black	10½	.148 inches/3.76 mm	158	68 @ 25 MHz
132-11	Brown	11½	.148 inches/3.76 mm	197	66 @ 25 MHz
132-12	Red	12½	.153 inches/3.89 mm	235	72 @ 25 MHz
132-13	Orange	13½	.153 inches/3.89 mm	260	70 @ 25 MHz
132-14	Yellow	14½	.153 inches/3.89 mm	290	70 @ 25 MHz
132-15	Green	15½	.154 inches/3.91 mm	345	72 @ 25 MHz
132-16	Blue	16½	.156 inches/3.96 mm	410	72 @ 25 MHz
132-17	Violet	17½	.156 inches/3.96 mm	475	66 @ 25 MHz
132-18	Gray	18½	.156 inches/3.96 mm	550	66 @ 25 MHz
132-19	White	19½	.156 inches/3.96 mm	600	68 @ 25 MHz
132-20	Black	20½	.160 inches/4.06 mm	720	66 @ 25 MHz

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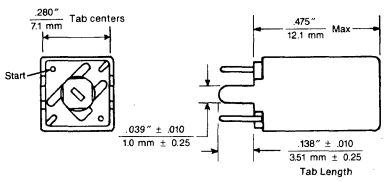
TUNEABLE RF COILS

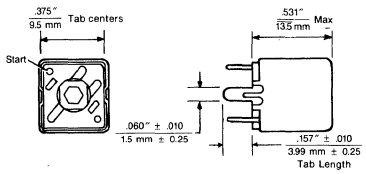
These Coilcraft variable inductors are precision molded in plastic to assure constant winding pitch and a consistent relationship to the printed circuit board. They're ideal for applications requiring low inductance and are more economical than any similar coil. Typical applications include RF coils, IF coils, oscillators, chokes, and helical resonators. Coilcraft **Designer's Kit M102** contains 49 shielded and 49 unshielded coils (2 each). To order, please contact Coilcraft.

- Compact 10mm or 7mm size
- Molded-in windings assure tight tolerances
- Highly resistant to humidity, temperature, shock and vibration
- Threaded cores allow precise tuning
- Custom values and unshielded parts with higher values also available

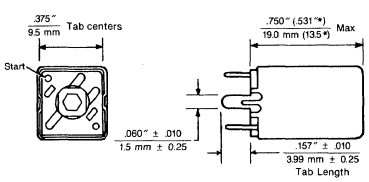
146/150 "UNICOIL"



142 "UNICOIL"



143/144 "UNICOIL"



Part Number	Color	Turns	No Core μH	L Min μH	L Nom μH	L Max μH	Min Q @ L Nom
150-01J08S	Brown	1½	.0425	.0435	.0445	.0455	72 @ 50 MHz
150-02J08S	Red	2½	.054	.056	.060	.064	80 @ 50 MHz
150-03J08S	Orange	3½	.068	.071	.076	.081	84 @ 50 MHz
150-04J08S	Yellow	4½	.0825	.086	.095	.104	85 @ 50 MHz
150-05J08S	Green	5½	.0955	.107	.115	.123	84 @ 50 MHz
150-06J08S	Blue	6½	.109	.125	.134	.143	82 @ 50 MHz
150-07J08S	Violet	7½	.123	.150	.156	.162	80 @ 50 MHz
146-01J08S	Brown	1½	.044	.045	.046	.047	76 @ 50 MHz
146-02J08S	Red	2½	.059	.062	.065	.068	78 @ 50 MHz
146-03J08S	Orange	3½	.075	.080	.085	.090	78 @ 50 MHz
146-04J08S	Yellow	4½	.095	.100	.110	.120	78 @ 50 MHz
146-05J08S	Green	5½	.115	.120	.135	.150	76 @ 50 MHz
146-06J08S	Blue	6½	.136	.142	.163	.184	72 @ 50 MHz
146-07J08S	Violet	7½	.155	.172	.194	.216	68 @ 50 MHz
146-08J08S	Gray	8½	.176	.200	.224	.248	66 @ 50 MHz
146-09J08S	White	9½	.202	.234	.260	.284	60 @ 50 MHz
146-10J08S	Black	10½	.224	.260	.288	.315	56 @ 50 MHz
144-01J12S	Brown	1½	.050	.052	.053	.054	—
144-02J12S	Red	2½	.067	.070	.074	.078	—
144-03J12S	Orange	3½	.088	.092	.099	.106	—
144-04J12S	Yellow	4½	.106	.111	.122	.133	—
144-05J12S	Green	5½	.126	.132	.149	.165	—
144-06J12S	Blue	6½	.147	.154	.175	.196	106 @ 40 MHz
144-07J12S	Violet	7½	.168	.176	.200	.223	104 @ 40 MHz
144-08J12S	Gray	8½	.190	.202	.226	.250	108 @ 40 MHz
144-09J12S	White	9½	.210	.239	.256	.274	108 @ 40 MHz
144-10J12S	Black	10½	.232	.270	.282	.295	106 @ 40 MHz
142-01J08S	Brown	1½	.058	.058	.0595	.061	—
142-02J08S	Red	2½	.081	.084	.086	.089	—
142-03J08S	Orange	3½	.110	.115	.120	.121	—
142-04J08S	Yellow	4½	.140	.147	.156	.160	88 @ 40 MHz
142-05J08S	Green	5½	.174	.182	.197	.205	94 @ 40 MHz
142-06J08S	Blue	6½	.210	.220	.240	.248	92 @ 40 MHz
142-07J08S	Violet	7½	.247	.259	.280	.290	90 @ 40 MHz
142-08J08S	Gray	8½	.284	.299	.322	.337	86 @ 40 MHz
142-09J08S	White	9½	.319	.338	.363	.377	88 @ 40 MHz
142-10J08S	Black	10½	.357	.382	.410	.422	82 @ 40 MHz
143-09J12S	White	9½	.300	.315	.369	.423	80 @ 40 MHz
143-10J12S	Black	10½	.338	.355	.416	.477	82 @ 40 MHz
143-11J12S	Brown	11½	.377	.396	.468	.540	78 @ 40 MHz
143-12J12S	Red	12½	.412	.433	.509	.585	80 @ 40 MHz
143-13J12S	Orange	13½	.452	.475	.556	.637	80 @ 40 MHz
143-14J12S	Yellow	14½	.490	.515	.604	.693	78 @ 40 MHz
143-15J12S	Green	15½	.522	.583	.660	.738	80 @ 40 MHz
143-16J12S	Blue	16½	.575	.638	.720	.801	76 @ 40 MHz
143-17J12S	Violet	17½	.612	.693	.770	.846	76 @ 40 MHz
143-18J12S	Gray	18½	.650	.754	.814	.874	82 @ 40 MHz
143-19J12S	White	19½	.675	.792	.846	.900	80 @ 40 MHz
143-20J12S	Black	20½	.715	.847	.896	.945	74 @ 40 MHz

Coilcraft
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"SLOT 10" 10mm TUNEABLE RF COILS

These veratile Coilcraft variable inductors operate over a wide range of frequencies. Standard inductance values are available from less than 1 μH to over 1 mH. Custom values can also be provided upon request.

Coilcraft "Slot Ten" RF coils come in an international 10mm package. Their precision-molded slotted bobbins assure tight tolerances and high stability.

A variety of magnetic and electrostatic shielding options are offered. "Slot Ten" coils are tuned by means of ferrite or powdered iron tuning cores with a hex hole for easy, positive adjustment.

Coilcraft **Designer's Kit M100** contains 18 shielded and 18 unshielded coils (3 each) plus extra cores and sleeves to create all of the standard values shown. To order, please contact Coilcraft.

SELECTION GUIDE

Coilcraft "Slot Ten" coils come in five different styles. Consult this table for the inductance range, relative Q, and shielding options of each style. Then use the appropriate specification chart to pick a specific part number.

Style	L (μH)	Electrostatic Shield	Magnetic Shield	Recommended Frequency	Tuning Core	Relative Q	Relative Cost
Style 1	.8 — 624	No	No	Higher	Iron	Hi	Low
Style 2	.8 — 927	No	No	Higher	Ferrite	Hi	Low
Style 3	.7 — 450	Yes	No	Higher	Iron	Low	Med
Style 4	.8 — 624	Yes	Yes (Iron)	Lower	Iron	Med	Hi
Style 5	.9 — 1143	Yes	Yes (Ferrite)	Lower	Ferrite	Med	Hi

1 All readings taken on H.P. 4342-A Q Meter.
2 L min is achieved at maximum extension of the core toward PC board. Complete tuning range is reached within the boundaries of the coil form.
3 All specifications are recommended at standard "Q" meter frequency as a simple way to assure the quality of our parts. L and Q readings will vary with frequency change.
4 Unshielded parts are coated with lacquer to protect the winding.
5 Shielded parts have a sleeve insert to protect the winding.

STYLE 1
Unshielded with carbonyl E core

Part Number	Color	L min (μH)	L max (μH)	L nom (μH)	Min Q @ L nom	Test Frequency
SLOT TEN-1-01	Brown	.800	1.2	1.0	48	7.9 MHz
SLOT TEN-1-02	Red	1.2	1.8	1.5	50	7.9 MHz
SLOT TEN-1-03	Orange	1.76	2.64	2.2	56	7.9 MHz
SLOT TEN-1-04	Yellow	2.56	3.84	3.2	54	7.9 MHz
SLOT TEN-1-05	Green	3.6	5.4	4.5	54	7.9 MHz
SLOT TEN-1-06	Blue	5.2	7.8	6.5	51	7.9 MHz
SLOT TEN-1-07	Violet	7.6	11.4	9.5	48	7.9 MHz
SLOT TEN-1-08	Grey	11.2	16.8	14.0	38	2.5 MHz
SLOT TEN-1-09	White	16.0	24.0	20.0	38	2.5 MHz
SLOT TEN-1-10	Black*	22.4	33.6	28.0	38	2.5 MHz
SLOT TEN-1-11	Brown*	32.0	48.0	40.0	38	2.5 MHz
SLOT TEN 1-12	Red*	46.4	69.6	58.0	47	2.5 MHz
SLOT TEN-1-13	Orange*	67.2	100.2	84.0	48	2.5 MHz
SLOT TEN-1-14	Yellow*	96	144	120.0	40	790 KHz
SLOT TEN-1-15	Green*	137.6	206.4	172.0	34	790 KHz
SLOT TEN-1-16	Blue*	200	300	250.0	39	790 KHz
SLOT TEN-1-17	Violet*	280	432	360.0	30	790 KHz
SLOT TEN-1-18	Grey*	416	624	520.0	35	790 KHz

STYLE 2
Unshielded with ferrite core

Part Number	Color	L min (μH)	L max (μH)	L nom (μH)	Min Q @ L nom	Test Frequency
SLOT TEN-2-01	Brown	.80	1.7	1.2	47	7.9 MHz
SLOT TEN-2-02	Red	1.25	2.75	2.0	48	7.9 MHz
SLOT TEN-2-03	Orange	1.75	4.0	2.9	48	7.9 MHz
SLOT TEN-2-04	Yellow	2.4	5.4	3.9	47	7.9 MHz
SLOT TEN-2-05	Green	3.5	7.8	5.6	47	7.9 MHz
SLOT TEN-2-06	Blue	4.7	10.6	7.6	46.4	7.9 MHz
SLOT TEN-2-07	Violet	7.4	15.6	11.5	38	2.5 MHz
SLOT TEN-2-08	Grey	11	25	18.2	40	2.5 MHz
SLOT TEN-2-09	White	16	35	25.3	40	2.5 MHz
SLOT TEN-2-10	Black*	22	50	36.5	40	2.5 MHz
SLOT TEN-2-11	Brown*	33	72	52.5	39	2.5 MHz
SLOT TEN-2-12	Red*	46	103	74.8	51	2.5 MHz
SLOT TEN-2-13	Orange*	66	136	100	40	790 KHz
SLOT TEN-2-14	Yellow*	95	198	146	44	790 KHz
SLOT TEN-2-15	Green*	136	297	216	40	790 KHz
SLOT TEN-2-16	Blue*	198	426	312	45	790 KHz
SLOT TEN-2-17	Violet*	286	630	530	33	790 KHz
SLOT TEN-2-18	Grey*	418	927	790	38	790 KHz

* Coils 10 thru 18 have a brown color dot on bottom of coil base.

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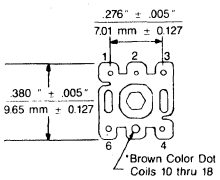
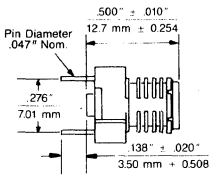
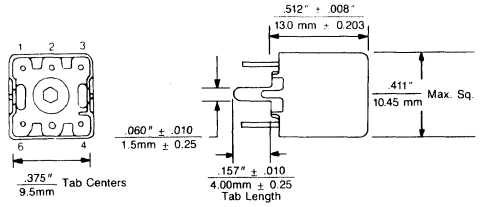
UNSHIELDED (Styles 1 and 2)

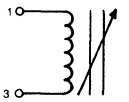




WITH SHIELD CAN (Styles 3, 4, and 5)



SCHEMATIC



STYLE 3
Shielded with carbonyl E core and plastic sleeve

STYLE 4
Shielded with carbonyl E core and sleeve

STYLE 5
Shielded with ferrite core and sleeve

Part Number	Color	L min (μH)	L max (μH)	L nom (μH)	Min Q @ L nom	Test Frequency
SLOT TEN-3-01	Brown	.70	.94	.82	65	25 MHz
SLOT TEN-3-02	Red	1.05	1.41	1.23	37	7.9 MHz
SLOT TEN-3-03	Orange	1.5	2.0	1.75	40	7.9 MHz
SLOT TEN-3-04	Yellow	2.04	2.76	2.4	40	7.9 MHz
SLOT TEN-3-05	Green	2.9	3.9	3.4	39	7.9 MHz
SLOT TEN-3-06	Blue	4.25	5.75	5.0	38	7.9 MHz
SLOT TEN-3-07	Violet	6	8.2	7.1	35	7.9 MHz
SLOT TEN-3-08	Grey	9.4	12.6	11.0	25	2.5 MHz
SLOT TEN-3-09	White	12.8	17.2	15.0	25	2.5 MHz
SLOT TEN-3-10	Black*	18.7	25.3	22.0	26	2.5 MHz
SLOT TEN-3-11	Brown*	26.4	35.6	31.0	25	2.5 MHz
SLOT TEN-3-12	Red*	37.4	50.6	44	29	2.5 MHz
SLOT TEN-3-13	Orange*	52.7	71.3	62	30	2.5 MHz
SLOT TEN-3-14	Yellow*	79	105	92	28	2.5 MHz
SLOT TEN-3-15	Green*	108.8	147.2	128	18	790 KHz
SLOT TEN-3-16	Blue*	155	208	182	20	790 KHz
SLOT TEN-3-17	Violet*	230	310	270	16	790 KHz
SLOT TEN-3-18	Grey*	336	450	390	18	790 KHz
SLOT TEN-4-01	Brown	.80	1.2	1.0	44	7.9 MHz
SLOT TEN-4-02	Red	1.2	1.8	1.5	45	7.9 MHz
SLOT TEN-4-03	Orange	1.76	2.64	2.2	48	7.9 MHz
SLOT TEN-4-04	Yellow	2.56	3.84	3.2	48	7.9 MHz
SLOT TEN-4-05	Green	3.6	5.4	4.5	46	7.9 MHz
SLOT TEN-4-06	Blue	5.2	7.8	6.5	43	7.9 MHz
SLOT TEN-4-07	Violet	7.6	11.4	9.5	40	7.9 MHz
SLOT TEN-4-08	Grey	11.2	16.8	14	32	2.5 MHz
SLOT TEN-4-09	White	16.0	24.0	20	33	2.5 MHz
SLOT TEN-4-10	Black*	22.4	33.6	28	32	2.5 MHz
SLOT TEN-4-11	Brown*	32.0	48.0	40	32	2.5 MHz
SLOT TEN-4-12	Red*	46.4	69.6	58	40	2.5 MHz
SLOT TEN-4-13	Orange*	67.2	100.8	85	40	2.5 MHz
SLOT TEN-4-14	Yellow*	96	144	120	33	790 KHz
SLOT TEN-4-15	Green*	137.6	206.4	172	28	790 KHz
SLOT TEN-4-16	Blue*	200.0	300.0	250	32	790 KHz
SLOT TEN-4-17	Violet*	288	432	360	26	790 KHz
SLOT TEN-4-18	Grey*	416	624	520	29	790 KHz
SLOT TEN-5-01	Brown	.86	2.0	1.4	43	7.9 MHz
SLOT TEN-5-02	Red	1.27	3.25	2.25	44	7.9 MHz
SLOT TEN-5-03	Orange	1.83	4.6	3.25	41	7.9 MHz
SLOT TEN-5-04	Yellow	2.48	6.4	4.5	40	7.9 MHz
SLOT TEN-5-05	Green	3.58	9.3	6.5	40	7.9 MHz
SLOT TEN-5-06	Blue	5.0	12.7	8.8	38	7.9 MHz
SLOT TEN-5-07	Violet	7.7	18.4	13.0	30	2.5 MHz
SLOT TEN-5-08	Grey	12.0	30.0	20.9	35	2.5 MHz
SLOT TEN-5-09	White	16	42	29.4	34	2.5 MHz
SLOT TEN-5-10	Black*	25	60	42.3	32	2.5 MHz
SLOT TEN-5-11	Brown*	36	90	62.8	30	2.5 MHz
SLOT TEN-5-12	Red*	48	126	87.2	42	2.5 MHz
SLOT TEN-5-13	Orange*	72	163	116	35	790 KHz
SLOT TEN-5-14	Yellow*	102	238	168	36	790 KHz
SLOT TEN-5-15	Green*	147	360	252	36	790 KHz
SLOT TEN-5-16	Blue*	215	522	312	45	790 KHz
SLOT TEN-5-17	Violet*	303	765	530	33	790 KHz
SLOT TEN-5-18	Grey*	440	1143	790	38	790 KHz

* Coils 10 tru 18 have a brown color dot on bottom of coil base.

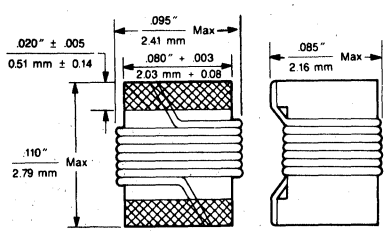
Coilcraft
Dept. E, 1102 Silver Lake Road, Cary, IL 60013 • TLX 216378 • 800/322-2645

SURFACE MOUNT INDUCTORS

Coilcraft surface mount inductors offer the designer a quality part at an extremely low cost — even at relatively low volumes They're compatible with automatic placement equipment and vapor phase, reflow or wave soldering methods as well as most ultrasonic or vapor degreasing techniques. Coilcraft **Designer's Kit C100** contains samples of each of the parts shown. To order, contact Coilcraft.

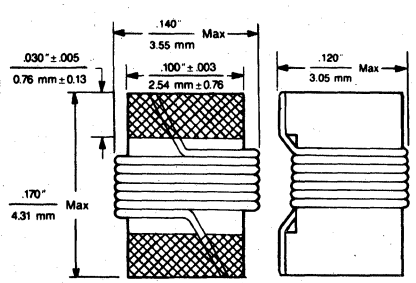
- Ceramic bodies, platinum palladium silver metalized terminations
- Conformal coated to withstand 155°C continuous, 260°C for 10 seconds
- Options: tape and reel, nickel barrier, 100% testing, custom values, tighter tolerance

1008CS SERIES



Part Number	Inductance	Q Min	Test Frequency MHz	Self Resonance MHz Min	R_{DC} Max Ohms
1008CS-100	10nH ±20%	50	50	1100	.080
1008CS-120	12	50	50	1100	.090
1008CS-150	15	50	50	1100	.100
1008CS-180	18	50	50	1100	.110
1008CS-220	22	50	50	1100	.120
1008CS-270	27	50	50	1100	.130
1008CS-330	33	50	50	1100	.140
1008CS-390	39	50	50	1100	.150
1008CS-470	47	50	50	1100	.160
1008CS-560	56nH ±10%	50	50	980	.180
1008CS-680	68	50	50	900	.200
1008CS-820	82	50	50	860	.220
1008CS-101	100	25	25	>900	.56
1008CS-121	120	25	25	>900	.63
1008CS-151	150	25	25	850	.70
1008CS-181	180	25	25	700	.77
1008CS-221	220	28	25	600	.84
1008CS-271	270	28	25	550	.91
1008CS-331	330	30	25	500	1.05
1008CS-391	390	30	25	465	1.12
1008CS-471	470	30	25	425	1.19
1008CS-561	560	30	25	415	1.33
1008CS-621	620	30	25	375	1.40
1008CS-681	680	30	25	340	1.47
1008CS-751	750	33	25	330	1.54
1008CS-821	820	33	25	325	1.61
1008CS-911	910	33	25	305	1.68
1008CS-102	1000	33	25	290	1.75
1008CS-122	1.2 µH ±10%	20	7.9	200	2.0
1008CS-152	1.5	20	7.9	165	2.3
1008CS-182	1.8	20	7.9	150	2.6
1008CS-222	2.2	20	7.9	140	2.8
1008CS-272	2.7	20	7.9	110	3.2
1008CS-332	3.3	20	7.9	90	3.4
1008CS-392	3.9	20	7.9	70	3.6
1008CS-472	4.7	20	7.9	60	4.0
1611CS-562	5.6	26	7.9	95	6.0
1611CS-682	6.8	26	7.9	85	6.6
1611CS-822	8.2	26	7.9	75	7.5
1611CS-103	10	24	7.9	65	8.1
1611CS-123	12	16	2.5	48	8.9
1611CS-153	15	16	2.5	40	10.2
1611CS-183	18	18	2.5	33	11.0
1611CS-223	22	20	2.5	28	12.0
1611CS-273	27	20	2.5	23	13.1
1611CS-333	33	20	2.5	20	13.5

1611CS SERIES



Complete Selection of

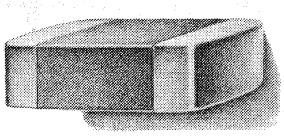
Inductors, Chokes & Coils

Molded & Molded/ Shielded Inductors
Inductance Range: .10 μH thru 100,000 μH
MIL-C-15305, latest revision, including:

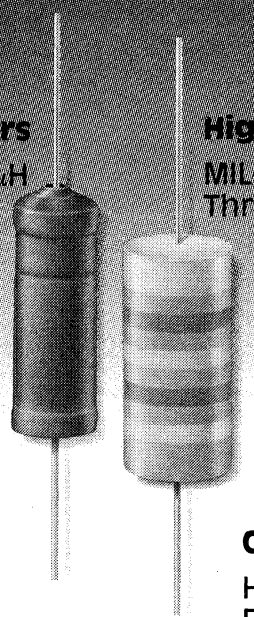
MS 75083	MS 75084	MS 75085
MS 18130	MS 14046	MS 90538
MS 75008	MS 75101	MS 90539
MS 90537	MS 75087	MS 75088
		MS 75089

High Reliability
MIL-C-39010, /01 thru /10
Through S-Level Failure Rate

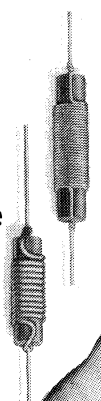
EMI/ RFI Filters
Line
Noise



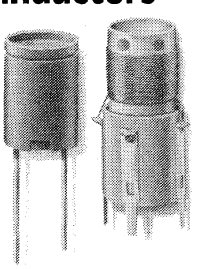
Chip Inductors
Surface Mounted
Fixed
Variable
Shielded



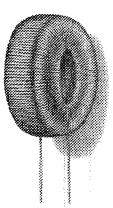
Chokes
High Current
Power Line
Common Mode
Filter



Variable Inductors
10 mm
7 mm
Molded
Shielded

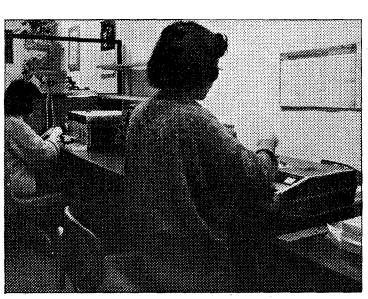


Toroids
PC Mounted
Self-Leaded
Potted
Custom

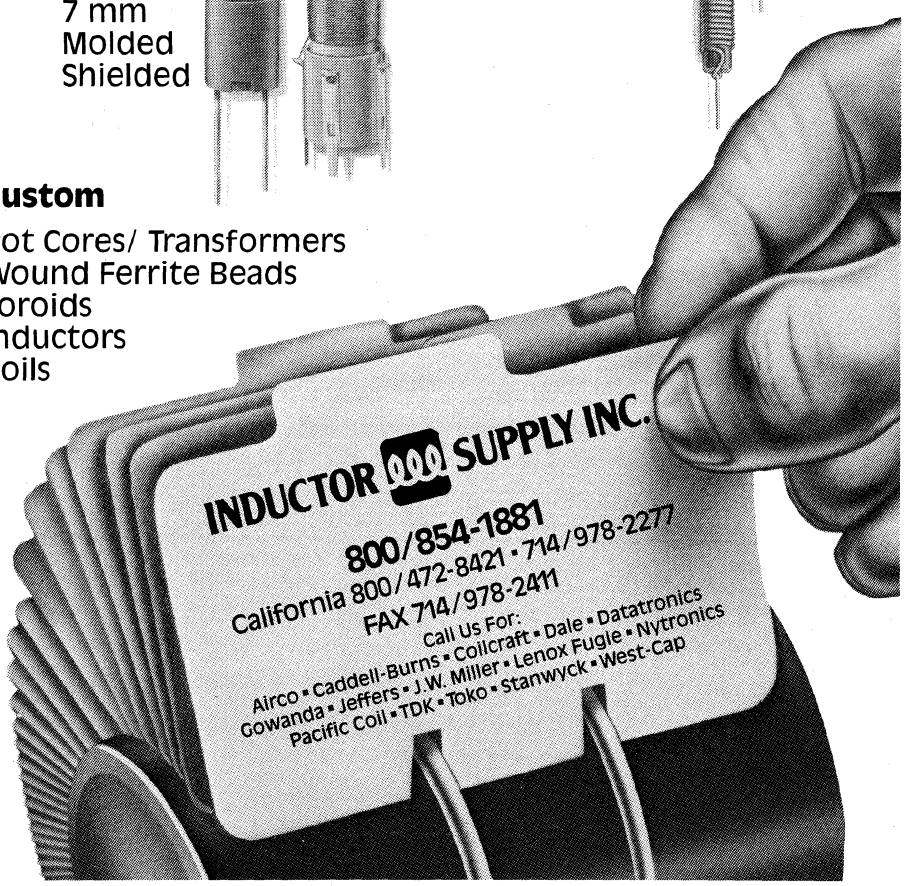


Transformers
RF
IF
Power
Toroids
Balun
Pulse
Trigger

Custom
Pot Cores/ Transformers
Wound Ferrite Beads
Toroids
Inductors
Coils

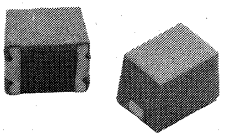


All incoming and outgoing shipments are sample-tested.



DALE®

MOLDED CHIP INDUCTOR



MODEL IMC-1812

FEATURES

- Molded construction provides superior strength and moisture resistance
- Precision performance, excellent reliability, sturdy construction
- Compatible with vapor phase and infra-red reflow soldering
- Solid phosphor bronze, tin plated terminals. No leaching!
- Special inductance tolerances available (±10%, ±5% and ±3%) upon request
- Printed marking
- Wide inductance range in small package
- Tape and reel packaging for automatic handling
- Component shape designed to accommodate automatic machine placement

ELECTRICAL SPECIFICATIONS

Inductance Range: .01μH to 1000μH

Standard Tolerances: ±20% for .01μH to .39μH
±10% for .47μH to 1000μH

Temperature Range: −20°C to 105°C

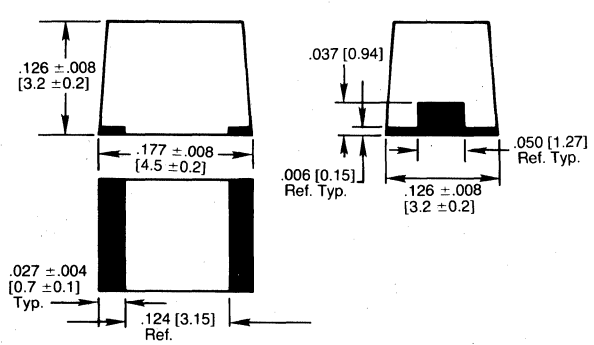
Coilform Material: Ceramic for .01μH to .82μH
Ferrite for 1.0μH to 1000μH

TEST EQUIPMENT

- H/P 4342A Q meter with Dale test fixture or equivalent
- H/P 4191A RF Impedance Analyzer (for SRF measurements)
- Wheatstone Bridge

DIMENSIONAL SPECIFICATIONS

[Numbers in brackets indicate millimeters]



ORDERING INFORMATION

IMC-1812	10 μh	±10%
1.	2.	3.

1. Basic model
2. Inductance value (μh)
3. Inductance tolerance

IMC-1812 ELECTRICAL SPECIFICATIONS

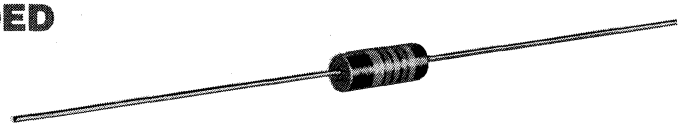
INDUCT (μH) & TOL.	Q MIN.	TEST FREQ. L & Q (Mhz)	SELF-RESONANT FRE. MIN. (Mhz)	DC RESISTANCE MAX. (Ω)	COILFORM MATERIAL
.010 ±20%	50	50.0	1000.	.20	
.012 ±20%	50	50.0	1000.	.20	
.018 ±20%	50	50.0	1000.	.20	
.022 ±20%	50	50.0	1000.	.20	
.027 ±20%	50	50.0	1000.	.20	
.033 ±20%	50	50.0	1000.	.30	
.039 ±20%	50	50.0	1000.	.30	
.047 ±20%	50	50.0	1000.	.30	
.056 ±20%	40	50.0	900.	.35	
.068 ±20%	40	50.0	800.	.35	
.082 ±20%	40	50.0	700.	.40	
.10 ±20%	30	25.2	650.	.32	Ceramic
.12 ±20%	30	25.2	600.	.30	
.15 ±20%	30	25.2	500.	.30	
.18 ±20%	30	25.2	400.	.35	
.22 ±20%	30	25.2	350.	.40	
.27 ±20%	30	25.2	300.	.45	
.33 ±20%	30	25.2	250.	.55	
.39 ±20%	30	25.2	220.	.70	
.47 ±10%	30	25.2	190.	.80	
.56 ±10%	30	25.2	170.	1.20	
.68 ±10%	30	25.2	150.	1.40	
.82 ±10%	30	25.2	140.	1.60	
1.0 ±10%	50	7.96	100.	.50	
1.2 ±10%	50	7.96	80.	.55	
1.5 ±10%	50	7.96	70.	.60	
1.8 ±10%	50	7.96	60.	.65	
2.2 ±10%	50	7.96	55.	.70	
2.7 ±10%	50	7.96	50.	.75	
3.3 ±10%	50	7.96	45.	.80	
3.9 ±10%	50	7.96	40.	.90	
4.7 ±10%	50	7.96	35.	1.00	
5.6 ±10%	50	7.96	33.	1.10	
6.8 ±10%	50	7.96	27.	1.20	
8.2 ±10%	50	7.96	25.	1.40	
10. ±10%	50	7.96	20.	1.60	
12. ±10%	50	2.52	18.	2.00	
15. ±10%	50	2.52	17.	2.50	
18. ±10%	50	2.52	15.	2.80	
22. ±10%	50	2.52	13.	3.20	Ferrite
27. ±10%	50	2.52	12.	3.60	
33. ±10%	50	2.52	11.	4.00	
39. ±10%	50	2.52	11.	4.50	
47. ±10%	50	2.52	10.	5.00	
56. ±10%	50	2.52	9.0	5.50	
68. ±10%	50	2.52	9.0	6.00	
82. ±10%	50	2.52	8.0	7.00	
100. ±10%	50	2.52	8.0	8.00	
120. ±10%	40	.79	6.0	8.00	
150. ±10%	40	.79	5.0	9.00	
180. ±10%	40	.79	5.0	9.50	
220. ±10%	40	.79	4.0	10.0	
270. ±10%	40	.79	4.0	12.0	
330. ±10%	40	.79	3.5	14.0	
390. ±10%	40	.79	3.0	16.0	
470. ±10%	40	.79	3.0	26.0	
560. ±10%	30	.79	3.0	30.0	
680. ±10%	30	.79	3.0	30.0	
820. ±10%	30	.79	2.5	35.0	
1000. ±10%	30	.79	2.5	40.0	

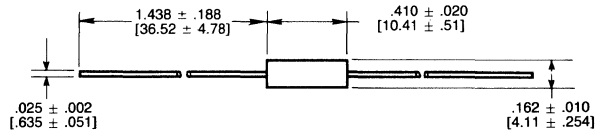
For complete information, write or phone
DALE ELECTRONICS, INC., East Highway 50, Yankton, South Dakota 57078 · Phone 605-665-9301

DALE®

MOLDED SHIELDED INDUCTORS

MODEL IMS-5, MIL-C-15305





FEATURES

- Epoxy molded construction provides superior moisture protection
- Meets requirements of MIL-C-15305
- Precision performance, excellent reliability, sturdy construction
- Wide inductance range in small package
- Flame retardant coating
- Electromagnetic shield — finest shield available
- Standard inductance tolerance ±10% (Special inductance tolerances available on request)

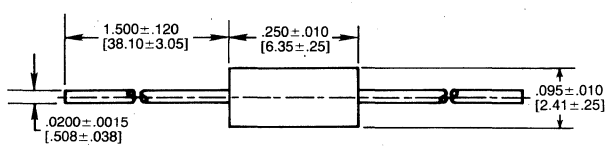
INDUCTANCE RANGE & MIL STANDARD

INDUCTANCE RANGE		CLASSIFICATION		MILITARY STANDARD
FROM	TO	GRADE	CLASS	
.10μH	.82μH	1	A	MS75087
1.0μH	12.0μH	1	A	MS75088
15.0μH	100,000μH	1	A	MS75089

NOTE: Listing of Military Standard does not imply qualification. Contact factory for latest government QPL information.

Ind. ±10% (μH)	Q. Min.	Test Freq. (Mhz)	Ind. ±10% (μH)	Q. Min.	Test Freq. (Mhz)	Ind. ±10% (μH)	Q. Min.	Test Freq. (Mhz)	Ind. ±10% (μH)	Q. Min.	Test Freq. (Mhz)
.10	50	25	3.90	44	7.9	120.0	55	.79	3,900.0	45	.25
.12	51	25	4.70	44	7.9	150.0	55	.79	4,700.0	45	.25
.15	51	25	5.60	44	7.9	180.0	55	.79	5,600.0	44	.25
.18	50	25	6.80	50	7.9	220.0	55	.79	6,800.0	40	.25
.22	49	25	8.20	50	7.9	270.0	55	.79	8,200.0	40	.25
.27	47	25	10.0	50	7.9	330.0	55	.79	10,000.0	40	.25
.33	46	25	12.0	55	2.5	390.0	60	.79	12,000.0	30	.079
.39	44	25	15.0	45	2.5	470.0	60	.79	15,000.0	30	.079
.47	44	25	18.0	45	2.5	560.0	60	.79	18,000.0	30	.079
.56	43	25	22.0	45	2.5	680.0	60	.79	22,000.0	27	.079
.68	42	25	27.0	45	2.5	820.0	60	.79	27,000.0	27	.079
.82	40	25	33.0	45	2.5	1,000.0	60	.79	33,000.0	27	.079
1.00	44	25	39.0	50	2.5	1,200.0	45	.25	39,000.0	27	.079
1.20	44	7.9	47.0	50	2.5	1,500.0	45	.25	47,000.0	23	.079
1.50	44	7.9	56.0	50	2.5	1,800.0	45	.25	56,000.0	23	.079
1.80	44	7.9	68.0	50	2.5	2,200.0	45	.25	68,000.0	23	.079
2.20	44	7.9	82.0	50	2.5	2,700.0	45	.25	82,000.0	21	.079
2.70	44	7.9	100.0	50	2.5	3,300.0	45	.25	100,000.0	18	.079
3.30	44	7.9									

MODEL IMS-2, Miniature



FEATURES

- Epoxy molded construction provides superior moisture protection
- Designed to meet requirements of MIL-C-15305 and applicable military standards listed below
- Precision performance, excellent reliability, sturdy construction
- Small package for a shielded inductor
- Flame retardant coating
- Electromagnetic shield
- Standard inductance tolerance ±10% (Special inductance tolerances available on request)

INDUCTANCE RANGE & MIL STANDARD

INDUCTANCE RANGE		CLASSIFICATION		MILITARY STANDARD
FROM	TO	GRADE	CLASS	
.10μH	100μH	1	A	MS21426
120μH	560μH	1	A	MS21427

NOTE: Listing of Military Standard does not imply qualification. Contact factory for latest government QPL information.

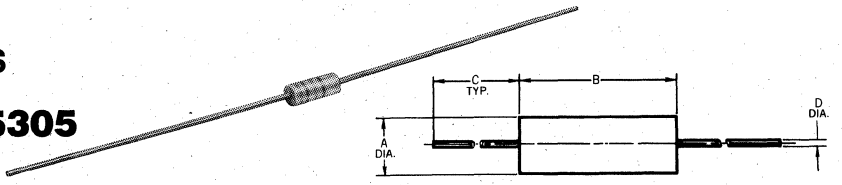
Ind. ±10% (μH)	Q. Min.	Test Freq. (Mhz)	Ind. ±10% (μH)	Q. Min.	Test Freq. (Mhz)	Inc. ±10% (μH)	Q. Min.	Test Freq. (Mhz)	Ind. ±10% (μH)	Q. Min.	Test Freq. (Mhz)
.10	54	25.	1.0	37	25.	10.	57	7.9	100.	40	2.5
.12	52	25.	1.2	40	7.9	12.	36	2.5	120.	31	.79
.15	50	25.	1.5	41	7.9	15.	38	2.5	150.	33	.79
.18	49	25.	1.8	43	7.9	18.	40	2.5	180.	33	.79
.22	47	25.	2.2	45	7.9	22.	40	2.5	220.	35	.79
.27	46	25.	2.7	48	7.9	27.	40	2.5	270.	37	.79
.33	44	25.	3.3	49	7.9	33.	41	2.5	330.	40	.79
.39	42	25.	3.9	50	7.9	39.	42	2.5	390.	38	.79
.47	41	25.	4.7	53	7.9	47.	44	2.5	470.	36	.79
.56	41	25.	5.6	54	7.9	56.	44	2.5	560.	36	.79
.68	39	25.	6.8	55	7.9	68.	45	2.5			
.82	38	25.	8.2	55	7.9	82.	45	2.5			

For complete information, write or phone
DALE ELECTRONICS, INC., East Highway 50, Yankton, South Dakota 57078. Phone 605-665-9301

DALE®

MOLDED INDUCTORS

MODELS IM, MIL-C-15305



FEATURES

- Epoxy molded construction provides moisture protection
- Designed to meet requirements of MIL-C-15305 and applicable military standards listed below
- Precision performance, excellent reliability, sturdy construction
- Wide inductance range in small package
- Flame retardant coating
- Wide range of tolerances: ±1%, ±3%, ±5%, ±10%, ±20%

INDUCTANCE RANGE & MIL STANDARD

Model No.	INDUCTANCE RANGE Mil. Range shown in bold face		CLASSIFICATION		Military Standard
	From	To	Grade	Class	
IM-1	.10 µH	1000 µH	—	—	—
IM-2	**.10 µH**	**1.00 µH**	1	B	MS75083
	1.2 µH	**27 µH**	1	A	MS75084
	33 µH	**1000 µH**	1	A	MS75085
IM-4	**.15 µH**	**4.7 µH**	1	B	MS18130
	5.6 µH	**33 µH**	1	A	MS14046
	36 µH	**240 µH**	1	A	MS90538
	270 µH	1800 µH	—	—	—
IM-6	**.10 µH**	**2.7 µH**	1	B	MS75008
	3.3 µH	**27 µH**	1	A	MS75101
	33 µH	220 µH	—	—	—
	270 µH	**1000 µH**	1	A	MS90539
IM-8	**1100 µH**	**3600 µH**	1	A	MS90540
IM-9	**68 µH**	**150 µH**	1	A	MS14047
IM-10	**3900 µH**	**10,000 µH**	1	A	MS90541

NOTE: Listing of Military Standard does not imply qualification. Contact factory for latest government QPL information.

DIMENSIONS

[Numbers in brackets indicate millimeters]

Model No.		A	B	C	D
IM-1	MAX.	.086 [2.18]	.210 [5.33]	1.62 [41.15]	.0215 [0.546]
	MIN.	.070 [1.78]	.190 [4.83]	1.38 [35.05]	.0185 [0.470]
IM-2	MAX.	.105 [2.67]	.260 [6.60]	1.626 [41.30]	.0215 [0.546]
	MIN.	0.85 [2.16]	.240 [6.10]	1.250 [31.75]	.0185 [0.470]
IM-4	MAX.	.165 [4.19]	.385 [9.78]	1.625 [41.28]	.027 [0.686]
	MIN.	.145 [3.68]	.365 [9.27]	1.250 [31.75]	.023 [0.584]
IM-6	MAX.	.200 [5.08]	.450 [11.4]	1.625 [41.28]	.027 [0.686]
	MIN.	.180 [4.57]	.430 [10.9]	1.250 [31.75]	.023 [0.584]
IM-8	MAX.	.225 [5.72]	.570 [14.5]	1.625 [41.28]	.030 [0.762]
	MIN.	.205 [5.21]	.550 [14.0]	1.250 [31.75]	.026 [0.660]
IM-9	MAX.	.260 [6.60]	.570 [14.48]	1.625 [41.28]	.027 [0.69]
	MIN.	.240 [6.10]	.550 [13.97]	1.250 [31.75]	.023 [0.58]
IM-10	MAX.	.250 [6.35]	.750 [19.0]	1.625 [41.28]	.034 [0.864]
	MIN.	.230 [5.84]	.730 [18.5]	1.250 [31.75]	.030 [0.762]

MODEL NO. IM-1

	Ind. & Tol. (µH)	Q Min.	Test Freq. L&Q (Mhz)
PHENOLIC CORE	.10	35	25.0
	.12	35	25.0
	.15	35	25.0
	.18	35	25.0
	.22	30	25.0
	.27	30	25.0
	.33	25	25.0
	.39	25	25.0
	.47	25	25.0
IRON CORE	.56	40	25.0
	.68	40	25.0
	.82	40	25.0
	1.0	40	25.0
	1.2	35	7.9
	1.5	40	7.9
	1.8	40	7.9
	2.2	45	7.9
	2.7	45	7.9
	3.3	45	7.9
	3.9	50	7.9
	4.7	55	7.9
	5.6	55	7.9
	6.8	55	7.9
	8.2	45	7.9
	10.	45	7.9
	12.	40	2.5
	15.	40	2.5
	18.	40	2.5
	22.	45	2.5
	27.	45	2.5
	33.	45	2.5
	39.	45	2.5
	47.	45	2.5
	56.	45	2.5
	68.	45	2.5
	82.	45	2.5
	100.	45	2.5
FERRITE CORE	120.	35	.79
	150.	35	.79
	180.	35	.79
	220.	35	.79
	270.	35	.79
	330.	35	.79
	390.	35	.79
	470.	35	.79
	560.	35	.79
	680.	35	.79
	820.	35	.79
	1000.	35	.79

MODEL NO. IM-2

	Ind. & Tol. (µH)	Q Min.	Test Freq. L&Q (Mhz)
PHENOLIC CORE	.10 ±10%	40	25.0
	.12 ±10%	40	25.0
	.15 ±10%	38	25.0
	.18 ±10%	35	25.0
	.22 ±10%	33	25.0
	.27 ±10%	33	25.0
	.33 ±10%	30	25.0
	.39 ±10%	30	25.0
	.47 ±10%	30	25.0
	.56 ±10%	30	25.0
	.68 ±10%	28	25.0
	.82 ±10%	28	25.0
	1.00 ±10%	25	25.0
IRON CORE	1.20 ±10%	25	7.9
	1.50 ±10%	28	7.9
	1.80 ±10%	30	7.9
	2.20 ±10%	30	7.9
	2.70 ±10%	37	7.9
	3.30 ±10%	45	7.9
	3.90 ±10%	45	7.9
	4.70 ±10%	45	7.9
	5.60 ±10%	50	7.9
	6.80 ±10%	50	7.9
	8.20 ±10%	55	7.9
	10.0 ±10%	55	7.9
	12.0 ±10%	45	2.5
	15.0 ±10%	40	2.5
	18.0 ±10%	50	2.5
	22.0 ±10%	50	2.5
	27.0 ±10%	50	2.5
FERRITE CORE	33.0 ±10%	45	2.5
	39.0 ±10%	45	2.5
	47.0 ±10%	45	2.5
	56.0 ±10%	45	2.5
	68.0 ±10%	50	2.5
	82.0 ±10%	50	2.5
	100. ±10%	50	2.5
	120. ±10%	30	.79
	150. ±10%	30	.79
	180. ±10%	30	.79
	220. ±10%	30	.79
	270. ±10%	30	.79
	330. ±10%	30	.79
	390. ±10%	30	.79
	470. ±10%	30	.79
	560. ±10%	30	.79
	680. ±10%	30	.79
	820. ±10%	30	.79
	1000. ±10%	30	.79

MODEL NO. IM-4

	Ind. & Tol. (µH)	Q Min.	Test Freq. L&Q (Mhz)
PHENOLIC CORE	.15 ±20%	50	25.0
	.22 ±20%	50	25.0
	.33 ±20%	45	25.0
	.47 ±20%	45	25.0
	.56 ±20%	50	25.0
	.68 ±10%	50	25.0
	.82 ±10%	50	25.0
	1.00 ±10%	50	25.0
	1.20 ±10%	33	7.9
	1.50 ±10%	33	7.9
	1.80 ±10%	33	7.9
	2.20 ±10%	33	7.9
	2.70 ±10%	33	7.9
	3.30 ±10%	33	7.9
	3.90 ±10%	33	7.9
	4.70 ±10%	33	7.9
IRON CORE	5.60 ±10%	45	7.9
	6.80 ±10%	50	7.9
	8.20 ±10%	50	7.9
	10. ±10%	55	7.9
	12. ±10%	65	2.5
	15. ±10%	65	2.5
	18. ±10%	75	2.5
	22. ±10%	75	2.5
	27. ±10%	60	2.5
	33. ±10%	65	2.5
	36. ± 5%	60	2.5
	39. ± 5%	60	2.5
	43. ± 5%	60	2.5
	47. ± 5%	55	2.5
	51. ± 5%	55	2.5
	56. ± 5%	55	2.5
	62. ± 5%	55	2.5
	68. ± 5%	55	2.5
	75. ± 5%	55	2.5
	82. ± 5%	50	2.5
	91. ± 5%	50	2.5
	100. ± 5%	50	2.5
	110. ± 5%	60	.79
	120. ± 5%	65	.79
	130. ± 5%	65	.79
	150. ± 5%	65	.79
	160. ± 5%	65	.79
	180. ± 5%	65	.79
	200. ± 5%	65	.79
	220. ± 5%	65	.79
	240. ± 5%	65	.79
	270. ± 5%	65	.79
	300. ± 5%	65	.79
	330. ± 5%	65	.79

	Ind. & Tol (µH)	Q Min.	Test Freq. L&Q (Mhz)
IRON CORE (continued)	360. ± 5%	65	.79
	390. ± 5%	65	.79
	430. ± 5%	65	.79
	470. ± 5%	65	.79
	510. ± 5%	65	.79
	560. ± 5%	65	.79
	620. ± 5%	65	.79
	680. ± 5%	55	.79
	750. ± 5%	55	.79
	820. ± 5%	55	.79
	910. ± 5%	55	.79
	1000. ± 5%	55	.79
	1100. ± 5%	30	.25
	1200. ± 5%	30	.25
	1300. ± 5%	30	.25
	1500. ± 5%	30	.25
	1600. ± 5%	30	.25
	1800. ± 5%	30	.25

MODEL NO. IM-6

	Ind. & Tol. (µH)	Q Min.	Test Freq. L&Q (Mhz)
PHENOLIC CORE	.10 ±10%	55	25.0
	.12 ±10%	55	25.0
	.15 ±10%	55	25.0
	.18 ±10%	55	25.0
	.22 ±10%	50	25.0
	.27 ±10%	50	25.0
	.33 ±10%	50	25.0
	.39 ±10%	50	25.0
	.47 ±10%	50	25.0
	.56 ±10%	50	25.0
	.68 ±10%	45	25.0
	.82 ±10%	40	25.0
	1.00 ±10%	40	25.0
	1.20 ±10%	30	7.9
	1.50 ±10%	30	7.9
	1.80 ±10%	30	7.9
	2.20 ±10%	30	7.9
	2.70 ±10%	30	7.9
IRON CORE	3.30 ±10%	30	7.9
	3.90 ±10%	30	7.9
	4.70 ±10%	30	7.9
	5.60 ±10%	30	7.9
	6.80 ±10%	30	7.9
	8.20 ±10%	30	7.9
	10.0 ±10%	30	7.9
	12.0 ±10%	50	2.5
	15.0 ±10%	55	2.5
	18.0 ±10%	60	2.5
	22.0 ±10%	60	2.5
	27.0 ±10%	65	2.5

	Ind. & Tol. (µH)	Q Min.	Test Freq. L&Q (Mhz)
IRON CORE	33.0 ±10%	75	2.5
	39.0 ±10%	75	2.5
	47.0 ±10%	75	2.5
	56.0 ±10%	75	2.5
	68.0 ±10%	75	2.5
	82.0 ±10%	75	2.5
	100. ±10%	65	2.5
	120. ±10%	65	.79
	150. ±10%	65	.79
	180. ±10%	65	.79
	220. ±10%	65	.79
	270. ± 5%	65	.79
	300. ± 5%	65	.79
	330. ± 5%	65	.79
	360. ± 5%	65	.79
	390. ± 5%	65	.79
	430. ± 5%	65	.79
	470. ± 5%	65	.79
	510. ± 5%	65	.79
	560. ± 5%	65	.79
	620. ± 5%	60	.79
	680. ± 5%	60	.79
	750. ± 5%	60	.79
	820. ± 5%	60	.79
	910. ± 5%	60	.79
	1000. ± 5%	60	.79

MODEL NO. IM-8

	Ind. & Tol. (µH)	Q Min.	Test Freq. L&Q (Mhz)
IRON CORE	1100. ± 5%	60	.25
	1200. ± 5%	60	.25
	1300. ± 5%	60	.25
	1500. ± 5%	65	.25
	1600. ± 5%	65	.25
	1800. ± 5%	65	.25
	2000. ± 5%	65	.25
	2200. ± 5%	70	.25
	2400. ± 5%	70	.25
	2700. ± 5%	70	.25
	3000. ± 5%	70	.25
	3300. ± 5%	70	.25
	3600. ± 5%	70	.25

MODEL NO. IM-9

	Ind. & Tol. (µH)	Q Min.	Test Freq. L&Q (Mhz)
IRON CORE	68. ±10%	70	2.5
	82. ±10%	65	2.5
	100. ±10%	65	2.5
	120. ±10%	75	.79
	150. ±10%	75	.79

MODEL NO. IM-10

	Ind. & Tol. (µH)	Q Min.	Test Freq. L&Q (Mhz)
IRON CORE	3900. ± 5%	80	.25
	4300. ± 5%	80	.25
	4700. ± 5%	80	.25
	5000. ± 5%	80	.25
	5600. ± 5%	80	.25
	6200. ± 5%	80	.25
	6800. ± 5%	80	.25
	7500. ± 5%	80	.25
	8200. ± 5%	80	.25
	9100. ± 5%	80	.25
	10,000. ± 5%	80	.25

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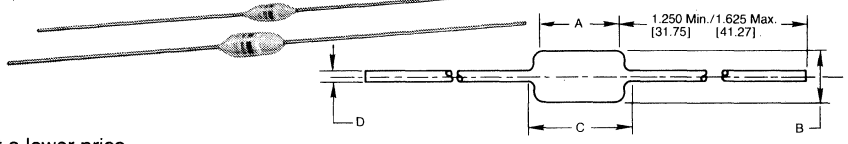
DALE® EPOXY CONFORMAL COATED INDUCTORS



MODELS IR-2 and IR-4

FEATURES

- Equivalent in quality to molded chokes at a lower price
- Epoxy coating is more durable than lacquer coated models, yet is priced comparably
- Uniform coating is excellent for automatic insertion
- Excellent environmental characteristics
- Flame-retardant coating • Color band identification
- Wide range of tolerances: ±1%, ±3%, ±5%, ±10%, ±20%
- Wide temperature range (−55°C to +105°C)

[Numbers in brackets indicate millimeters]

MODEL	A (Max)	B (Max)	C (Max)	D
IR-2	.260 [6.60]	.120 [3.05]	.330 [8.38]	.0200 ± .0015 [.508 ± .038]
IR-4	.385 [9.78]	.180 [4.57]	.440 [11.18]	.025 ± .002 [.635 ± .051]

MODEL NO. IR-2

Ind. (μh)	Tol.	Q Min.	Test Freq. L & Q (Mhz)	Ind. (μh)	Tol.	Q. Min.	Test Freq. L & Q (Mhz)
.10	±10%	40	25.0	12.0	±10%	45	2.5
.12	±10%	40	25.0	15.0	±10%	40	2.5
.15	±10%	38	25.0	18.0	±10%	50	2.5
.18	±10%	35	25.0	22.0	±10%	50	2.5
.22	±10%	33	25.0	27.0	±10%	50	2.5
.27	±10%	33	25.0	33.0	±10%	45	2.5
.33	±10%	30	25.0	39.0	±10%	45	2.5
.39	±10%	30	25.0	47.0	±10%	45	2.5
.47	±10%	30	25.0	56.0	±10%	45	2.5
.56	±10%	30	25.0	68.0	±10%	50	2.5
.68	±10%	28	25.0	82.0	±10%	50	2.5
.82	±10%	28	25.0	100.0	±10%	50	2.5
1.00	±10%	25	25.0	120.	±10%	30	.79
1.20	±10%	25	7.9	150.	±10%	30	.79
1.50	±10%	28	7.9	180.	±10%	30	.79
1.80	±10%	30	7.9	220.	±10%	30	.79
2.20	±10%	30	7.9	270.	±10%	30	.79
2.70	±10%	37	7.9	330.	±10%	30	.79
3.30	±10%	45	7.9	390.	±10%	30	.79
3.90	±10%	45	7.9	470.	±10%	30	.79
4.70	±10%	45	7.9	560.	±10%	30	.79
5.60	±10%	50	7.9	680.	±10%	30	.79
6.80	±10%	50	7.9	820.	±10%	30	.79
8.20	±10%	55	7.9	1000.	±10%	30	.79
10.0	±10%	55	7.9				

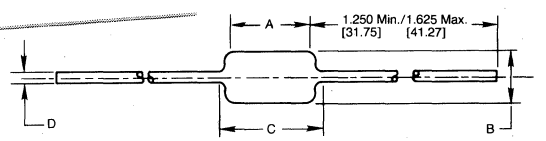
MODEL NO. IR-4

Ind. (μh)	Tol.	Q. Min.	Test Freq. L & Q (Mhz)	Ind. (μh)	Tol.	Q. Min.	Test Freq. L & Q (Mhz)
.15	±20%	50	25.0	75.0	± 5%	55	2.5
.22	±20%	50	25.0	82.0	± 5%	50	2.5
.33	±20%	45	25.0	91.0	± 5%	50	2.5
.47	±20%	45	25.0	100.0	± 5%	50	2.5
.56	±10%	50	25.0	110.0	± 5%	60	.79
.68	±10%	50	25.0	120.0	± 5%	65	.79
.82	±10%	50	25.0	130.0	± 5%	65	.79
1.00	±10%	50	25.0	150.0	± 5%	65	.79
1.20	±10%	33	7.9	160.0	± 5%	65	.79
1.50	±10%	33	7.9	180.0	± 5%	65	.79
1.80	±10%	33	7.9	200.0	± 5%	65	.79
2.20	±10%	33	7.9	220.0	± 5%	65	.79
2.70	±10%	33	7.9	240.0	± 5%	65	.79
3.30	±10%	33	7.9	270.0	± 5%	65	.79
3.90	±10%	33	7.9	300.	± 5%	65	.79
4.70	±10%	33	7.9	330.	± 5%	65	.79
5.60	±10%	45	7.9	360.	± 5%	65	.79
6.80	±10%	50	7.9	390.	± 5%	65	.79
8.20	±10%	50	7.9	430.	± 5%	65	.79
10.0	±10%	55	7.9	470.	± 5%	65	.79
12.0	±10%	65	2.5	510.	± 5%	65	.79
15.0	±10%	65	2.5	560.	± 5%	65	.79
18.0	±10%	75	2.5	620.	± 5%	65	.79
22.0	±10%	75	2.5	680.	± 5%	55	.79
27.0	±10%	60	2.5	750.	± 5%	55	.79
33.0	±10%	65	2.5	820.	± 5%	55	.79
36.0	± 5%	60	2.5	910.	± 5%	55	.79
39.0	± 5%	60	2.5	1000.	± 5%	55	.79
43.0	± 5%	60	2.5	1100.	± 5%	30	.25
47.0	± 5%	55	2.5	1200.	± 5%	30	.25
51.0	± 5%	55	2.5	1300.	± 5%	30	.25
56.0	± 5%	55	2.5	1500.	± 5%	30	.25
62.0	± 5%	55	2.5	1600.	± 5%	30	.25
68.0	± 5%	55	2.5	1800.	± 5%	30	.25

MODELS IRF-1 and IRF-3

FEATURES

- Superior electrical specifications
  High Q & SRF, Low DC resistance, High rated DC current
- Available in bulk, ammo and reel pack per EIA RS-296
- Flame-retardant coating • Color band identification
- Wide inductance range: .10μh to 1000μh
- Uniform coating is excellent for automatic insertion



[Numbers in brackets indicate millimeters]

Dale Type	Dim. A (Max.)	Dim B. (Max.)	Dim. C (Max.)	Dim. D
IRF-1	.260 [6.60]	.110 [2.79]	.330 [8.38]	.0200 ± .0015 [.508 ± .038]
IRF-3	.385 [9.78]	.165 [4.19]	.410 [10.41]	.025 ± .002 [.635 ± .051]

MODEL NO. IRF-1

Ind. (μh)	Tol.	Q Min.	Test Freq. L & Q (Mhz)	Ind. (μh)	Tol.	Q. Min.	Test Freq. L & Q (Mhz)
.10	± 20%	40	25.0	10.	± 10%	50	7.9
.12	± 20%	40	25.0	12.	± 10%	50	2.5
.15	± 20%	40	25.0	15.	± 10%	50	2.5
.18	± 20%	40	25.0	18.	± 10%	50	2.5
.22	± 20%	40	25.0	22.	± 10%	50	2.5
.27	± 20%	40	25.0	27.	± 10%	50	2.5
.33	± 20%	40	25.0	33.	± 10%	50	2.5
.39	± 20%	40	25.0	39.	± 10%	50	2.5
.47	± 20%	40	25.0	47.	± 10%	60	2.5
.56	± 20%	40	25.0	56.	± 10%	60	2.5
.68	± 20%	40	25.0	68.	± 10%	60	2.5
.82	± 20%	40	25.0	82.	± 10%	60	2.5
1.0	± 10%	50	25.0	100.	± 10%	60	2.5
1.2	± 10%	50	7.9	120.	± 10%	60	.79
1.5	± 10%	50	7.9	150.	± 10%	60	.79
1.8	± 10%	50	7.9	180.	± 10%	60	.79
2.2	± 10%	50	7.9	220.	± 10%	60	.79
2.7	± 10%	50	7.9	270.	± 10%	60	.79
3.3	± 10%	50	7.9	330.	± 10%	60	.79
3.9	± 10%	50	7.9	390.	± 10%	60	.79
4.7	± 10%	50	7.9	470.	± 10%	60	.79
5.6	± 10%	50	7.9	560.	± 10%	60	.79
6.8	± 10%	50	7.9	680.	± 10%	60	.79
8.2	± 10%	50	7.9	820.	± 10%	60	.79
				1000.	± 10%	60	.79

MODEL NO. IRF-3

Ind. (μh)	Tol.	Q. Min.	Test Freq. L & Q (Mhz)	Ind. (μh)	Tol.	Q Min.	Test Freq. L & Q (Mhz)
.22	± 20%	55	25.0	18.	± 10%	65	2.5
.27	± 20%	55	25.0	22.	± 10%	60	2.5
.33	± 20%	55	25.0	27.	± 10%	55	2.5
.39	± 20%	55	25.0	33.	± 10%	55	2.5
.47	± 20%	55	25.0	39.	± 10%	50	2.5
.56	± 20%	55	25.0	47.	± 10%	45	2.5
.68	± 20%	55	25.0	56.	± 10%	40	2.5
.82	± 20%	55	25.0	68.	± 10%	40	2.5
1.0	± 10%	55	25.0	82.	± 10%	35	2.5
1.2	± 10%	50	7.9	100.	± 10%	30	2.5
1.5	± 10%	50	7.9	120.	± 10%	70	.79
1.8	± 10%	55	7.9	150.	± 10%	70	.79
2.2	± 10%	55	7.9	180.	± 10%	70	.79
2.7	± 10%	60	7.9	220.	± 10%	70	.79
3.3	± 10%	65	7.9	270.	± 10%	70	.79
3.9	± 10%	65	7.9	330.	± 10%	70	.79
4.7	± 10%	70	7.9	390.	± 10%	65	.79
5.6	± 10%	70	7.9	470.	± 10%	65	.79
6.8	± 10%	75	7.9	560.	± 10%	65	.79
8.2	± 10%	80	7.9	680.	± 10%	65	.79
10.	± 10%	85	7.9	820.	± 10%	65	.79
12.	± 10%	75	2.5	1000.	± 10%	65	.79
15.	± 10%	70	2.5				

For complete information, write or phone
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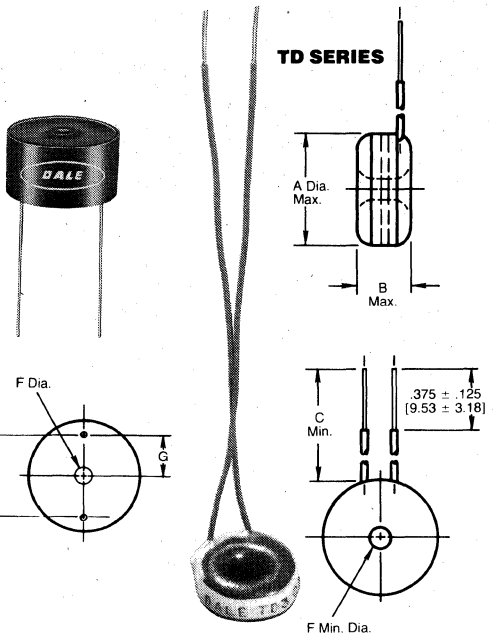
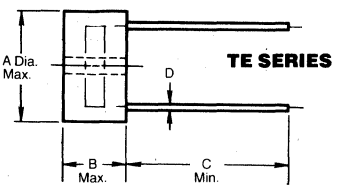
TOROIDAL FILTER INDUCTORS

MODELS TE & TD



FEATURES

- Choice of encapsulated (TE) or dipped (TD) styles
- TE style designed to meet the requirements of MIL-T-27, Type TF5S20ZZ. TD style combines low cost with excellent performance in commercial applications.
- High Q and wide selection of Q vs frequency ranges in one small package. Large number of standard inductance values.



SPECIFICATIONS

ELECTRICAL

Tolerance:
TE-2, TD-2 = ±1% > 2mH, ±2% = 0.05mH to 2.0mH
TE-3, TD-3 = ±1% > 2mH, ±2% 154μH to 2.0mH, ±5% < 150μH
TE-4, TD-4 = ±1% > 2mH, ±2% < 2mH
TE-5, TD-5 = ±1% > 2mH, ±2% < 2mH

Insulation Resistance: 1000 Megohms minimum

Dielectric Strength: 1000 Volts minimum (TE)
500 Volts minimum (TD)

MECHANICAL

Terminal Strength: 2 lb. pull test (TE)

Vibration: Per MIL-T-27 (TE)

Shock: Per MIL-T-27 (TE)

Weight: TE-2 = 2 grams TD-2 = 1.6 grams typ.
TE-3 = 5.1 grams TD-3 = 4.9 grams typ.
TE-4 = 20 grams TD-4 = 17 grams typ.
TE-5 = 53 grams TD-5 = 52 grams typ.

MATERIAL

Encapsulant: Epoxy (TE)

Coating: Vinyl (TD), non-flammable, abrasion and moisture resistant. Resists most cleaning agents. (Consult factory for chemicals which may be used.)

Standard Terminals: Tinned copper (TE); Stranded, tinned copper, Teflon insulated (TD)

Gauge: TE-2 = 24AWG TD-2 = 30AWG
TE-3 = 22AWG TD-3 = 26AWG
TE-4 = 20AWG TD-4 = 24AWG
TE-5 = 20AWG TD-5 = 24AWG

DIMENSIONS [Numbers in brackets indicate millimeters]

TYPE	A	B	C	D	E	F	G
TE-2	.437 [11.10]	.270 [6.86]	1.00 [25.40]	.020 [0.51]	.300 [7.62]	—	—
TD-2	.437 [11.10]	.250 [6.35]	2.00 [50.80]	—	—	—	—
TE-3	.685 [14.86]	.385 [9.78]	1.00 [25.40]	.025 [0.64]	.500 [12.70]	.093 [2.36]	.250 [6.35]
TD-3	.685 [14.86]	.320 [8.13]	3.0 [76.20]	—	—	.125 [3.18]	—
TE-4	1.062 [26.97]	.500 [12.70]	1.00 [25.40]	.032 [0.81]	.900 [22.86]	.120 [3.05]	.450 [11.43]
TD-4	1.062 [26.97]	.437 [11.10]	4.0 [101.6]	—	—	.220 [5.59]	—
TE-5	1.32 [33.53]	.725 [18.42]	1.00 [25.40]	.032 [0.81]	1.00 [25.40]	.144 [3.66]	.50 [12.70]
TD-5	1.32 [33.53]	.688 [17.48]	6.00 [142.4]	—	—	.220 [5.59]	—

INDUCTANCE RANGES

T.C. AVAIL.	TE-2 TD-2	TE-3 TD-3	TE-4 TD-4	TE-5 TD-5
Q0	50μH to 10mH	50μH to 15mH	150μH to 20mH	1mH to 100mH
Q3	470μH to 120mH	500μH to 1H	1mH to 2H	5mH to 2H
Q4	1mH to 250mH	1mH to 4H	2mH to 7.5H	10mH to 20H

TEMPERATURE COEFFICIENT CODE (APPLIES TO CORE ONLY)

DALE TYPES				T.C. CODE	TEMPERATURE COEFFICIENT	TEMPERATURE RANGE	T.C. AVAILABILITY		
TE-2 TD-2	TE-3 TD-3	TE-4 TD-4	TE-5 TD-5				Q0	Q3	Q4
X	X	X	X	TA	0 ± 1%	−55°C to +125°C		X	X
		X	X	TB	0 ± 0.1%	+13°C to +35°C		X	X
X	X	X	X	TD	0 ± 0.1%	0°C to +55°C		X	X
		X	X	TE	0 ± 0.15%	0°C to +55°C			X
	X	X	X	TL*	+40 to +110 PPM/°C +85 to +185 PPM/°C	−55°C to +25°C +25°C to +85°C			X
X	X	X	X	TM	0 ± 0.25%	−65°C to +125°C		X	X
X	X	X	X	TR	50 PPM/°C (Typical)	−65°C to +125°C	X		
X	X	X	X	TW	0 ± 0.25%	−55°C to +85°C		X	X

*Inverse of typical Temperature Coefficient of polystyrene capacitor.

For complete information, write or phone
DALE ELECTRONICS, INC., East Highway 50, Yankton, South Dakota 57078 • Phone 605-665-9301

DC RESISTANCE AND SELF RESONANT FREQUENCIES
(Typical Values)

TE-2, TD-2

INDUCTANCE (mH)	DC RESISTANCE (Ohms)			SELF-RESONANT FREQUENCIES (MHz)		
	Q0	Q3	Q4	Q0	Q3	Q4
0.050	1.9	—	—	10	—	—
0.100	2.7	—	—	7	—	—
0.330	7.7	—	—	3.1	—	—
0.470	9.3	2.3	—	2.5	2.4	—
1.00	26	4.2	2.3	1.4	1.2	2.0
3.30	79	9.7	5.4	.70	.79	.95
10.0	251	31	18	.34	.40	.43
33.0	—	118	54	—	.18	.21
100	—	408	227	—	.06	.10
250	—	—	450	—	—	.05

TE-3, TD-3

INDUCTANCE	DC RESISTANCE (Ohms)			SELF-RESONANT FREQUENCIES (MHz)		
	Q0	Q3	Q4	Q0	Q3	Q4
50.0 μH	.68	—	—	7.6	—	—
100. μH	1.0	—	—	5.1	—	—
330. μH	3.3	—	—	2.9	—	—
1.00 mH	6.9	1.5	.82	1.4	1.1	1.0
3.30 mH	24	4.1	2.3	.79	.57	.55
10.0 mH	84	14	5.9	.40	.29	.25
15.0 mH	106	17	9.1	.34	.24	.21
33.0 mH	—	40	18	—	.14	.12
100. mH	—	138	58	—	.080	.077
330. mH	—	555	220	—	.040	.038
1.0 H	—	1500	670	—	.021	.019
4.00 H	—	—	2700	—	—	.009

TE-4, TD-4

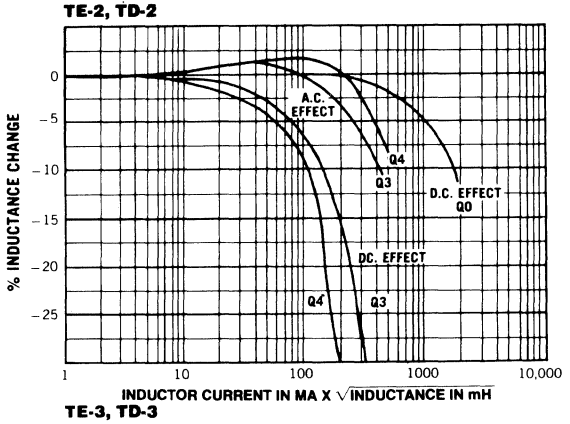
INDUCTANCE	DC RESISTANCE (Ohms)			SELF-RESONANT FREQUENCIES (MHz)		
	Q0	Q3	Q4	Q0	Q3	Q4
150. μH	.54	—	—	2.6	—	—
1.00 mH	2.8	.70	—	1.0	.75	—
2.00 mH	5.5	1.4	.78	.64	.54	.45
10.0 mH	27	4.9	2.5	.24	.21	.18
20.0 mH	54	9.6	5.0	.18	.15	.13
100. mH	—	56	23	—	.059	.051
1.00 H	—	570	260	—	.016	.014
2.00 H	—	1200	520	—	.013	.011
7.5 H	—	—	2000	—	—	.004

TE-5, TD-5

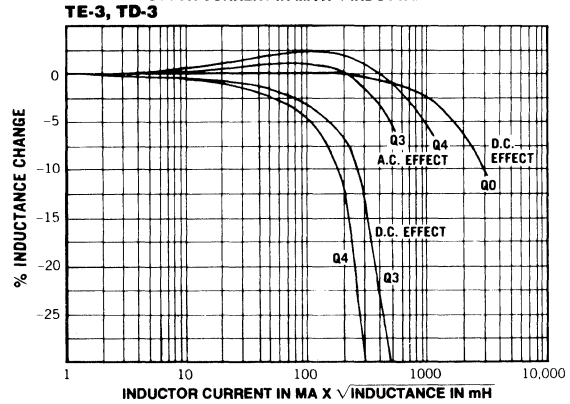
INDUCTANCE	DC RESISTANCE (Ohms)			SELF-RESONANT FREQUENCIES (MHz)		
	Q0	Q3	Q4	Q0	Q3	Q4
1.00 mH	1.8	—	—	.80	—	—
3.30 mH	5.2	—	—	.44	—	—
5.00 mH	6.5	1.8	—	.33	.32	—
10.00 mH	13	2.4	1.7	.21	.20	.15
33.00 mH	49	8.8	3.9	.12	.11	.086
100.00 mH	133	27	11	.061	.057	.044
330.00 mH	—	80	44	—	.032	.024
1.00 H	—	222	121	—	.016	.012
2.00 H	—	475	217	—	.012	.008
10.00 H	—	—	1300	—	—	.003
20.00 H	—	—	2400	—	—	.002

INDUCTANCE VS D.C. BIAS
INDUCTANCE VS A.C. EXCITATION

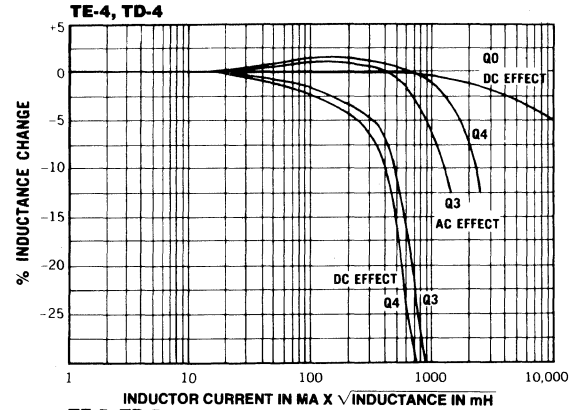
TE-2, TD-2



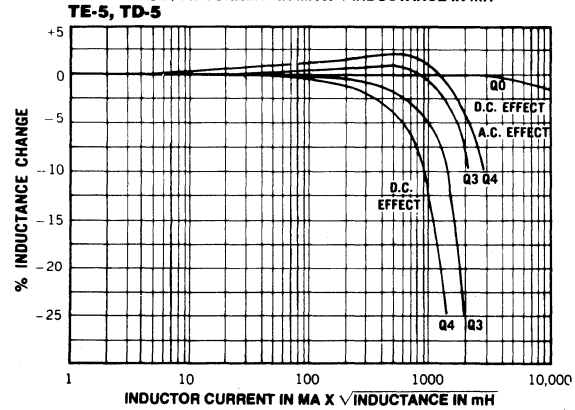
TE-3, TD-3



TE-4, TD-4



TE-5, TD-5



SAMPLE PART NUMBER

TE-X TD-X	Q0	TR	5mH	1.0
DALE SIZE	Q TYPE	T.C. CODE	INDUCTANCE in μH, mH or H	% TOLERANCE

For complete information, write or phone
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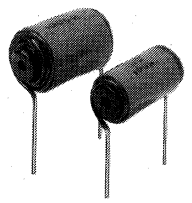
HIGH CURRENT FILTER INDUCTORS

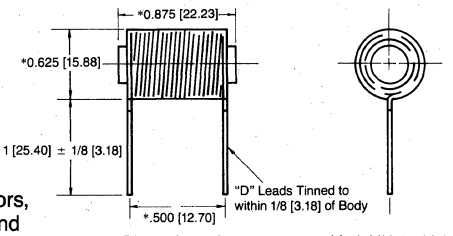
MODEL | FEATURES | DIMENSIONS

IH



FEATURES
- Printed circuit mounting
- Pre-tinned leads

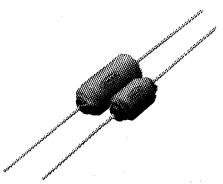
TYPICAL APPLICATIONS
Noise filtering for switching regulators, power amplifiers, power supplies and SCR or Triac control circuits.



SCHEMATIC

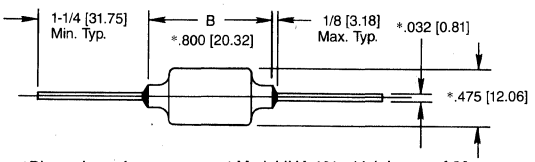
*Dimensions shown represent Model IH-3 which is one of 24 available models with current ratings from 5 to 24 amps. For complete information, contact factory or write for a Magnetic Components Catalog.

IHA



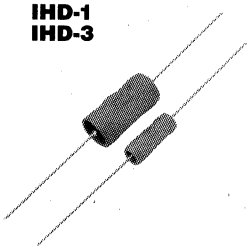
FEATURES
- Printed circuit mounting
- Pre-tinned leads
- Low cost construction
- For use with switching power supplies
- Protected by polyolefin sleeve

SCHEMATIC

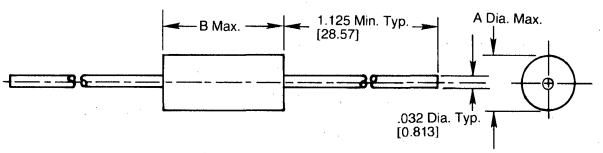


*Dimensions shown represent Model IHA-101 which is one of 20 models available with current ratings from 1.4 to 9.3 amps.

IHD-1 IHD-3

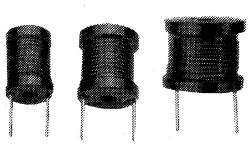


FEATURES
- Printed circuit mounting (axial leads)
- Protected by polyolefin sleeve
- Pre-tinned leads
- High saturation bobbin used allowing high inductance with low DC resistance
- Inductance: Measured at 1 KHz with no DC current
- Temperature Range: −55°C to +105°C

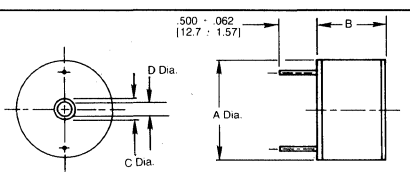


MODEL	A (Max.)	B (Max.)
IHD-1	.250 [6.35]	.650 [16.51]
IHD-3	.453 [11.51]	.900 [22.86]

IHB

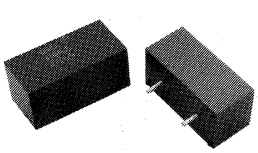


FEATURES
- Printed circuit mounting
- Wide range of inductance and current ratings
- Pre-tinned leads
- Optional insulating covering and printing available at additional cost
- Inductance: Measured at 1 KHz with no DC current
- Temperature Range: −55°C to +130°C

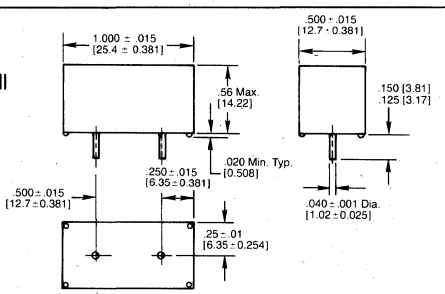


MODEL NO.	A (Max.)	B (Max.)	C (Max.)	D (Max.)
IHB-1	.660 [16.76]	.840 [21.34]	.162 [4.11]	.115 [2.92]
IHB-2	.825 [20.95]	.840 [21.34]	.162 [4.11]	.115 [2.92]
IHB-3	1.100 [27.94]	.840 [21.34]	.162 [4.11]	.115 [2.92]
IHB-4	1.600 [40.64]	1.030 [26.16]	.250 [6.35]	.175 [4.44]
IHB-5	1.600 [40.64]	1.450 [36.83]	.250 [6.35]	.175 [4.44]
IHB-6	2.000 [50.80]	1.500 [38.10]	.330 [8.38]	.160 [4.06]

IHM-2



FEATURES
- Totally encapsulated using a potted flame-resistant shell
- Pre-tinned leads • Printed circuit mounting
- Designed to meet MIL-T-27 specifications
- Inductance: Measured at 1 KHz with no DC current
- Insulation Strength: 10 Megohms minimum
- Temperature Rating: Continuous operation at temperatures between −55°C and +125°C



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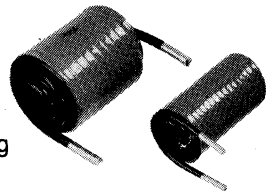
HIGH CURRENT FILTER INDUCTORS

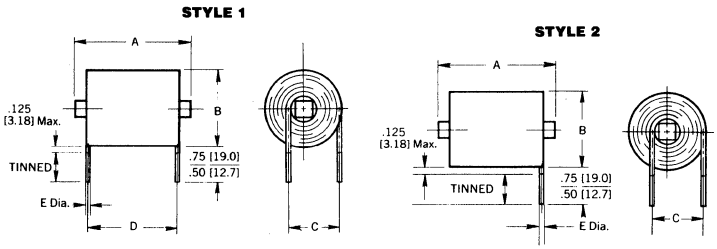
MODEL IHV



FEATURES

- Printed circuit mounting
- Low cost construction
- Designed for use with switching power supplies
- Pre-tinned leads
- Epoxy coated for durability and reliability

[Numbers in brackets indicate millimeters]



MECHANICAL SPECIFICATIONS

MODEL	STYLE	A (Max.)	B ±.050 [1.27]	C ±.062 [1.57]	D ±.062 [1.57]	E (Dia.)	TYPICAL WEIGHT (Grams)
IHV-15-500	1	2.45 [62.2]	1.45 [36.8]	.98 [24.9]	1.95 [49.6]	.082 [2.08]	305
IHV-20-200	2	2.45 [62.2]	1.45 [36.8]	.98 [24.9]	—	.102 [2.59]	310
IHV-28-60	2	2.45 [62.2]	1.02 [25.9]	.77 [19.6]	—	.102 [2.59]	160
IHV-30-150	2	2.45 [62.2]	1.65 [41.9]	1.08 [27.4]	—	.129 [3.28]	470
IHV-40-39	2	2.45 [62.2]	1.15 [29.2]	.82 [20.8]	—	.129 [3.28]	210
IHV-45-92	2	2.55 [64.8]	1.92 [48.8]	1.21 [30.7]	—	.162 [4.11]	650
IHV-50-50	1	2.55 [64.8]	1.57 [39.9]	1.05 [26.7]	2.10 [53.3]	.162 [4.11]	420
IHV-60-24	2	2.45 [62.2]	1.27 [32.3]	.89 [22.6]	—	.162 [4.11]	270

ELECTRICAL SPECIFICATIONS

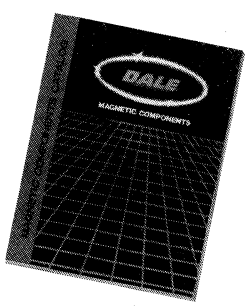
MODEL	INDUCTANCE* ±10%	CURRENT (Max.)	DC RESISTANCE (Max.)	SELF-RESONANT FREQUENCY (Min.)
IHV-15-500	500 μh	15 amps	.050Ω	0.8 MHz
IHV-20-200	200 μh	20 amps	.021Ω	1.2 MHz
IHV-28-60	60 μh	28 amps	.0085Ω	1.9 MHz
IHV-30-150	150 μh	30 amps	.013Ω	2.1 MHz
IHV-40-39	39 μh	40 amps	.0048Ω	2.5 MHz
IHV-45-92	92 μh	45 amps	.0075Ω	2.9 MHz
IHV-50-50	50 μh	50 amps	.0045Ω	3.1 MHz
IHV-60-24	24 μh	60 amps	.0025Ω	5.7 MHz

*Will not decrease more than 10% at rated current.

GET INFORMATION ON DALE'S COMPLETE MAGNETICS LINE

These pages show only a portion of Dale's greatly expanded magnetics line. We can help you accelerate product development and production with a wide range of standard and custom components including filter inductors, toroids, bobbins, air cores, E-cores, pot cores, slug cores, laminated inductors and switch mode magnetics. Surface mounted versions can be provided for many of these devices.

For complete technical information, WRITE FOR THE NEW DALE MAGNETICS CATALOG or get immediate assistance by contacting the factory or your local Dale representative.



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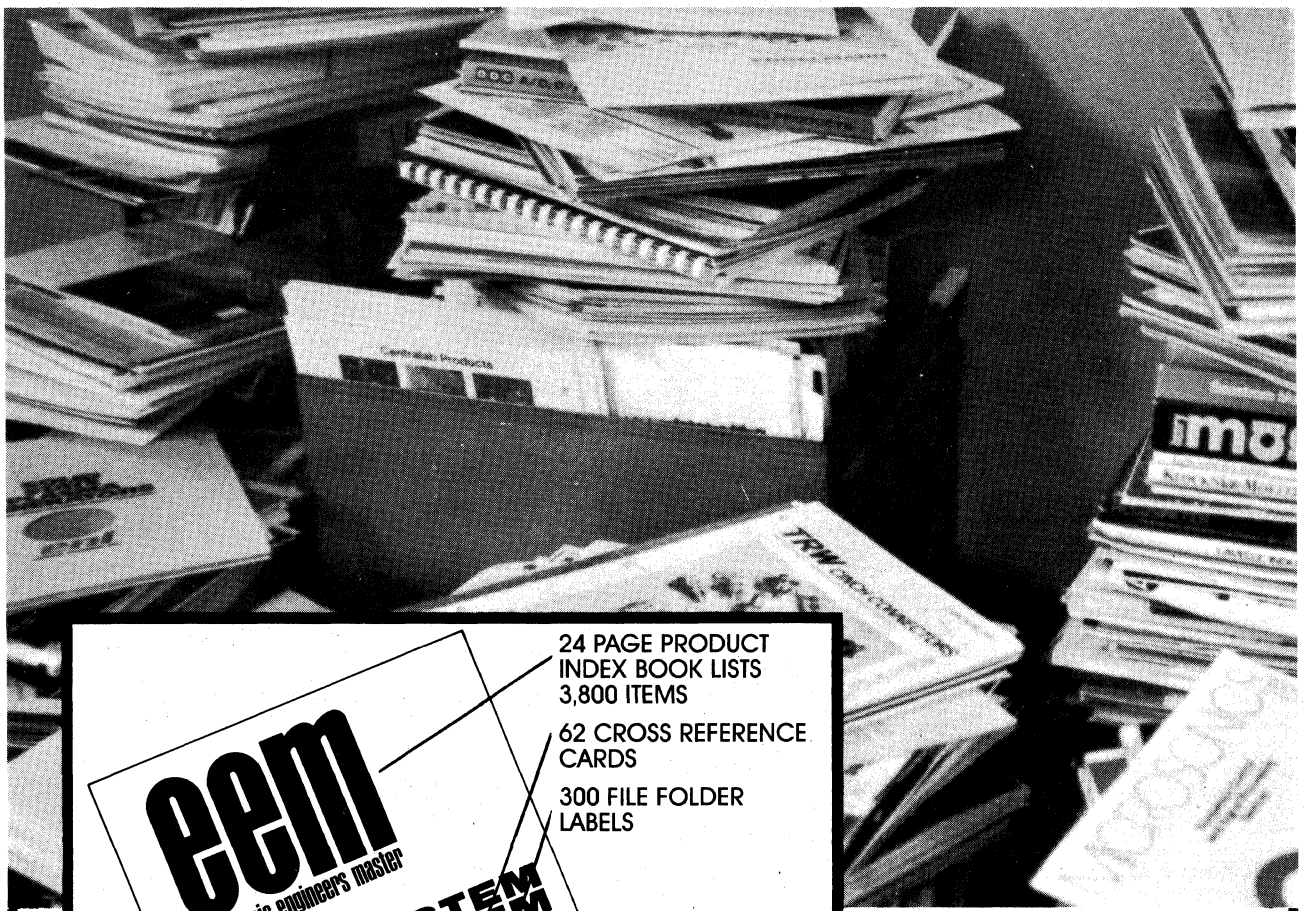

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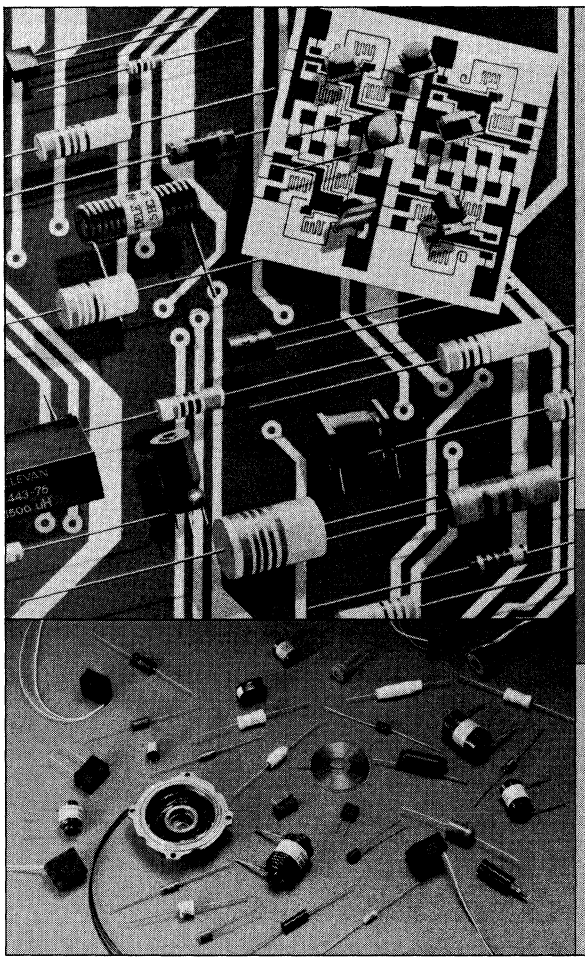
For over three decades, we have set the standards for inductor design and manufacture. Our experience in supplying high reliability components to the military and the industrial/ commercial markets is reflected in the same standards of quality for the products of all our Electronic Components Group Divisions.



Delevan Division Coils & Inductive Components

A wide variety of standard products are available for both traditional thru-the-hole mounting as well as to meet the needs of today's newer surface mountable technology.

Molded RF unshielded coils are available in a range from 0.022μH through 150,000μH. Coils which are electromagnetically shielded to reduce magnetic coupling between components are available in a range from 0.1μH to 10,000μH. Newly qualified MIL-SPEC coils 39010/-8, 9, 10. 0.10μH-1000μH. Special values, sizes, and tighter tolerances are available on a custom design basis. Coils can also be supplied unmolded or with reel tape packaging.

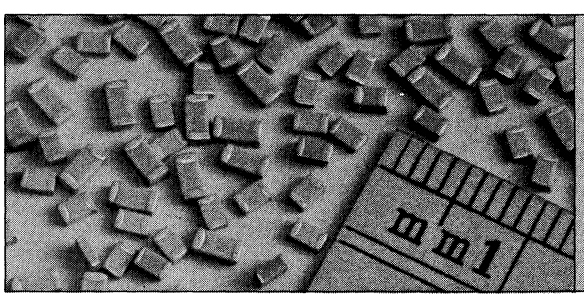
Surface Mountable Components

Unshielded surface mountable inductors are available from 0.10μH to 1000μH. Shielded parts are available from 0.10μH to 560μH. Parts are available with laser marking when required.

SPECIALIZING IN CLOSE TOLERANCE COMPONENTS 1% 3% 5%

Also • Toroids • Variable RF Coils • Micro-i® Chip Inductors • Power Chokes • Pot Cores • Custom Molded & Potted Coils to your design specifications

See additional pages (Section 1800) for an overview of our entire inductor line.



Delcap Division Multilayer Ceramic Chip Capacitors

Surface Mountable. Meets or exceeds applicable portions of RS-198 and MIL-C-55681 class 1-COG (NPO) from 1.0pFd thru .027μFd. Class II X 7R from 100pFd thru .68μFd. BX Dielectric 100pF – .47μF. Designed for dependable performance in all RF applications. Nickel barrier layer optional.

See Section 1500 for product details.

All of our products are manufactured in facilities located in the U.S.A.
For further information on our complete line or our capability for producing special components, call your nearest Sales Representative – or call us direct.

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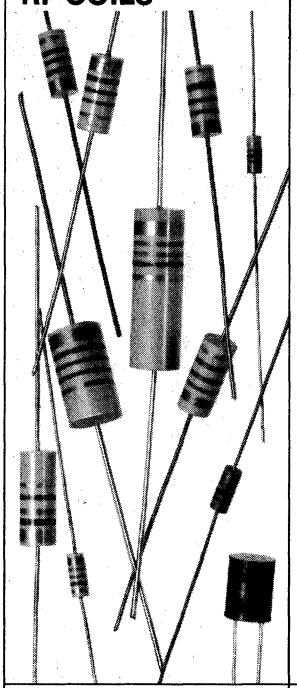
COILS & INDUCTIVE COMPONENTS

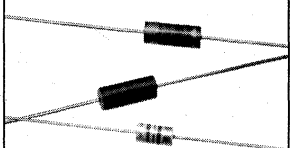
Delevan
Division

MOLDED RF COILS



Series	Mil. Spec.		Range (μH)	Size (Inches) Nom.	Wgt. (Grams) Max.
0819	*	—	0.10-1000	DIA.: .078; LN.: .200 LEAD AWG #24	.22
1025	MS-75083 MS-75084 MS-75085	LT4K 339-351 LT10K 061-077 LT10K 078-096	0.10-1000	DIA.: .095; LN.: .250 LEAD AWG #24	.3
	Newly Qualified Mil. Spec. 39010/-8, 9, 10 Level M				
1026	*	—	0.022-0.082	DIA.: .095; LN.: .250 LEAD AWG #24	.3
1537	MS-14046 MS-18130 MS-90538	LT10K 128-137 LT4K 074-089 LT10K 001-021	0.15-240.0	DIA.: .156; LN.: .375 LEAD AWG #22	.9
1840	MS-75008 MS-75101	LT4K 027-039 LT10K 169-180	0.15-27.0	DIA.: .187; LN.: .437 LEAD AWG #22	.95
2150	MS-14052 MS-90542	LT10K 158-168 LT4K 315-327	.047-39.0	DIA.: .220; LN.: .560 LEAD AWG #22	1.5
2500	MS-90539 MS-90540 MS-90541	LT10K 022-036 LT10K 037-049 LT10K 050-060	270-10,000	(mold size) (A) DIA.: .190; LN.: .440 LEAD AWG #22 (B) DIA.: .215; LN.: .560 LEAD AWG #21 (C) DIA.: .240; LN.: .740 LEAD AWG #20	.95 1.5 2.5
2534	(RADIAL LEADS)		0.10-150.0 (MH)	HGT.: .345; DIA.: .25 LEAD AWG #24	1.0
2890	MS-75103 MS-91189	LT10K 181-190 LT4K 002-016	1.2-120.0	DIA.: .280; LN.: .900 LEAD AWG #21	3.9
3500	MS-14047 MS-14048 MS-75052	LT10K 138-142 LT10K 143-147 LT4K 052-053	47-10,000	(mold size) (A) DIA.: .250; LN.: .560 LEAD AWG #22 (B) DIA.: .310; LN.: .560 LEAD AWG #21 (C) DIA.: .375; LN.: .625 LEAD AWG #21 (D) DIA.: .468; LN.: .687 LEAD AWG #21	2.0 2.8 4.0 6.4

SHIELDED RF COILS

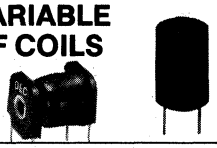


Series	Mil. Spec.		Range (μH)	Size (Inches) Nom.	Wgt. (Grams)	Coupling
0925	MS-21426 MS-21427	LT10K LT10K	.10μH – 560μH	DIA.: .095; LN.: .250 LEAD AWG #24	.25	3% max.
1325	*	—	0.10-560.0	DIA.: .133; LN.: .250 LEAD AWG #24	.390	3% max.
1537-700	*	—	0.10-10,000	DIA.: .156; LN.: .375 LEAD AWG #22	.9	2% max. Ferrite Sleeve 4% max. Iron Sleeve
1641	MS-75087 MS-75088 MS-75089	LT10K 191-202 LT10K 203-216 LT10K 217-251	0.10-10,000	DIA.: .162; LN.: .410 LEAD AWG #22	1.0	3% max.

TOROIDAL INDUCTORS

Series	Mil. Spec.		Range (μH)	Size (Inches)	Wgt. (Grams)
2020	MS-21422	LT4K 496-520	0.10-10.0	min./max. HGT. .200-.230 LN. .190-.210 WDTH. .090-.110 LEAD AWG #24	.5

VARIABLE RF COILS



Series	Mil. Spec.	Range (μH)	Size (Inches) Nom.	Core & Shield Material	Wgt. (Grams)
9405	*	0.10-10,000	HGT.: .500 DIA.: .380 LEAD AWG #24	Ferrite	4.0
9406	*	0.10-10,000	LN.: .500 HGT.: .375 WDTH.: .375	Ferrite	4.0

HIGH CURRENT FILTER CHOKES

Series	Mil. Spec.	Range (μH)	Size	Core Material	Wgt. (Grams)
HC	*	RANGE 3-15 AMPS RATED CURRENT IN AN INDUCTANCE RANGE OF 5-250 μH	Size varies with inductance (see catalog)	Ferrite	Weight varies with size (see catalog)

**Derating is required at elevated ambient temperatures

POWER CHOKES

Series	Mil. Spec.	Range (μH)	Size Nom.	Core Material	Wgt. (Grams)
3443	*	1.0-15,000**	.870 x .515 x .600 Height LEAD AWG #18	Ferrite	12.0

*Note: Inductors are made in accordance with the basic requirements of MIL-C-15305

For further information on our complete line or our capability for producing special components, call your nearest Sales Representative – or call us direct.

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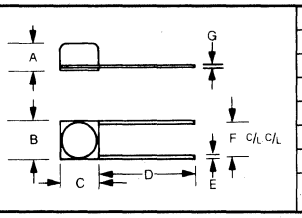
MICRO-i® COILS & CHIP INDUCTORS

Micro-i inductors are available in an inductance range of from .010μH to 1000μH in various low profile packages for use on thick film hybrid packages. Parts are available with ribbon leads, reflow solder pads or in a wire bondable pad configuration. Tighter tolerances and special platings are available for specialized applications.

Delevan Division

SERIES 100 MICRO-i® COILS

(MIL. SPEC. MS-21367) LT10K 367-383
RANGE μH .015-10.0
MECHANICAL CONFIGURATION 1) Units are epoxy encapsulated 2) Leads are tin-plated Beryllium Copper (Gold-plated leads available on special order)
WEIGHT MAX. (Grams) .03 CORE MATERIAL - Iron

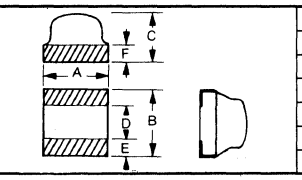


Dim.	Inches
A	.065 max.
B	.110 max.
C	.110 max.
D	.210 min.
E	.012 ± .002 Typ.
F	.095 ± .015 (at egress)
G	.022 + .001 − .000

SERIES 103 MICRO-i® CHIP INDUCTORS

(MIL. SPEC. MIL-C-83446/4C) 01-49 Surface Mountable
RANGE .010μH - 27.0μH WEIGHT MAX. (Grams) .03
MECHANICAL CONFIGURATION 1) Units are epoxy encapsulated 2) Contact areas for reflow soldering are gold-plated per MIL-G-45204 Type 1 - Grade A 3) Internal connections are thermal compression bonded
CORE MATERIAL .010μH - .100μH Phenolic .12μH - 27.0μH Ferrite

NOTES: 1) Designed specifically for reflow soldering and other high temperature processes. 2) Will withstand 260°C for 2 minutes without degradation. 3) Solder coating is optional.



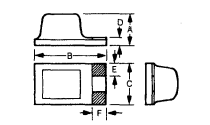
Dim.	Inches
A	.100 ± .010
B	.100 ± .010
C	.075 max.
D	.050 min.
E	.015 min. Typ.
F	.020 max. Typ.

SERIES 105 MICRO-i® SURFACE MOUNTABLE CHIP INDUCTORS

Meets test methods of (MIL. SPEC. MIL-C-83446)
RANGE .12μH - 10.0μH WEIGHT MAX. (Grams) .05
MECHANICAL CONFIGURATION 1) Units are epoxy encapsulated 2) Contact areas are gold plated per MIL-G-45204 Type 1 - Grade A 3) Internal connections are Thermal Compression Bonded
CORE MATERIAL - Iron (Designed to meet the same criteria as #103, but with a powdered iron core for improved stability)

SERIES 106 MICRO-i® WIRE BONDABLE CHIP INDUCTORS

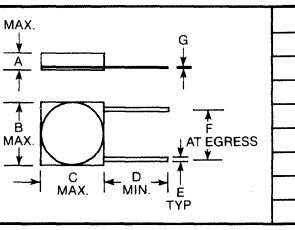
RANGE .10μH - 47.0μH TERMINATION AREAS Gold plated per MIL-G-45204, Type III; Grade A
Internal Connections are Thermal Compression Bonded
CORE MATERIAL - Iron



Dim.	Inches	Dim.	Inches
A	.075 max.	D	.015 Ref.
B	.155 max.	E	.030 ± .005
C	.110 max.	F	.025 min.

SERIES 150 & 250 MICRO-i® COILS

(MIL. SPEC. SERIES 150 MS-21368) LT10K (Reference only)
(MIL. SPEC. SERIES 250 MS-21369) LT10K (Reference only)
RANGE 12.0 μH - 1000μH WEIGHT MAX. (Grams) Series 150 .05, Series 250 .18
MECHANICAL CONFIGURATION 1) Units are epoxy encapsulated 2) Leads are tin-plated Beryllium Copper (Gold plated leads available on special order)
CURRENT RATING AT 90°C 15°C Rise
CORE MATERIAL Iron



	SERIES 150	SERIES 250
Dim.	Inches	Inches
A	.065 max.	.065 max.
B	.160 max.	.260 max.
C	.160 max.	.260 max.
D	.210 min.	.210 min.
E	.012 ± .002	.012 ± .002
F	.100 ± .010	.200 ± .010
G	.002 + .001-.000	.002 + .001-.000

DELEVAN SURFACE MOUNTABLE INDUCTORS

Expertise gained in over two decades of surface mounted inductor development and production has enabled us to produce a new generation of coil packaging to meet the critical demands of present day assembly methods and for designs where space and weight are critical...at a price comparable with conventional wire leaded components.

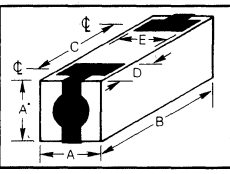
They are compatible with all state-of-the art attachments and soldering methods. Standard metalized ends are copper coated with 60/40 solder.

They are molded in thermally stable flame retardant epoxy resin. High temperature solder is used for internal joints to insure maximum stability during assembly and attachment operations.

Their square outline package with symmetrical orientation is ideal for automatic indexing and assembly methods. Their parallel flat surfaces are well adapted to all methods of vacuum or key jaw pickup and indexing. They are also available with 4 opposing contacts if required. Standard identification by laser marking of inductance and tolerance.

SERIES 0820 Compact Design (Unshielded) Surface Mountable. Patent applied for

.10μH - 1000μH
(Wgt. .22 grams (max.))
Core Material .10-.47μH Phenolic .56-100.μH Iron 120-1000μH Ferrite
Molded Epoxy



Dimensions A* and B include measurements over end caps.

Dim.	Inches	Millimeters
A	.075 - .095	1.91 - 2.41
A*	.095 - .115	2.41 - 2.92
B	.230 - .255	5.84 - 6.48
C	.130 - .160	3.30 - 4.06
D	.040 - .060	1.02 - 1.52
E	.078 ± .003	1.98 ± .076

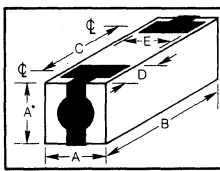
SERIES 1330 (Unshielded) Surface Mountable Patent applied for

(Dwg. & Dimension same for 1330 & 1331)
.10μH - 1000μH Wgt. Max. 3 grams
Core Material .10μH - 1.00μH Phenolic .120μH - 27.0μH Iron 33μH - 1000μH Ferrite

SERIES 1331 (Shielded) Surface Mountable, shielded to reduce magnetic coupling between components

.10μH - 560μH Wgt. .3 grams
Coupling 3% max.

Core Material	Core	Sleeve
.10μH - 100μH	Iron	Iron
120.μH - 560.μH	Ferrite	Ferrite



Dimensions A* and B include measurements over end caps.

Dim.	Inches	Millimeters
A	.105 - .125	2.67 - 3.18
A*	.125 - .145	3.18 - 3.68
B	.300 - .320	7.62 - 8.13
C	.230 - .260	5.84 - 6.60
D	.020 - .040	.51 - 1.02
E	.075 - .095	1.91 - 2.41

Our inductors are made in accordance with the basic requirements of MIL-C-15305 & MIL-C-83446. Coils can be supplied in bulk, reel tape, or plastic tubes.

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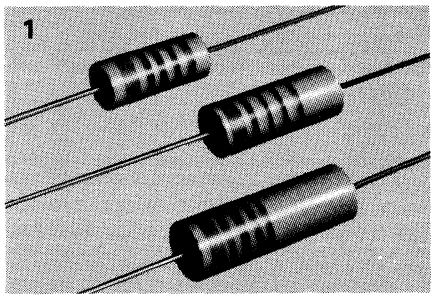
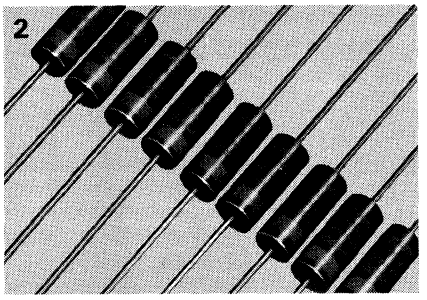
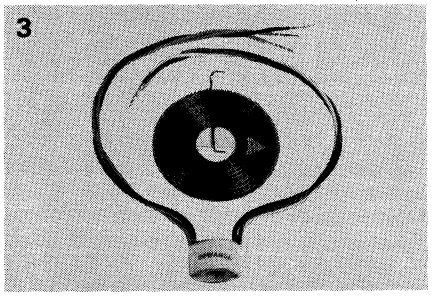
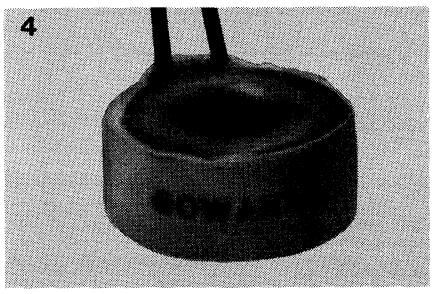
GOWANDA

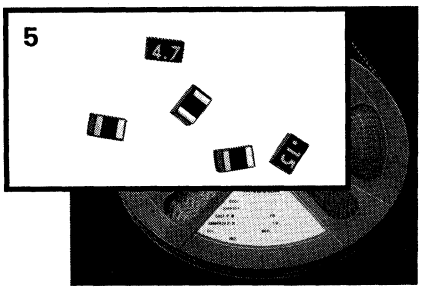
RF Chokes, Power Magnetics and Custom Coil Winding to Match Every Need

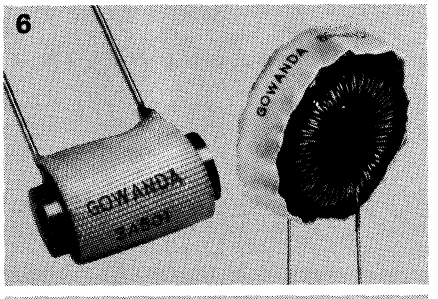


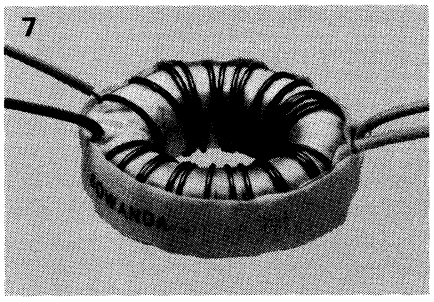


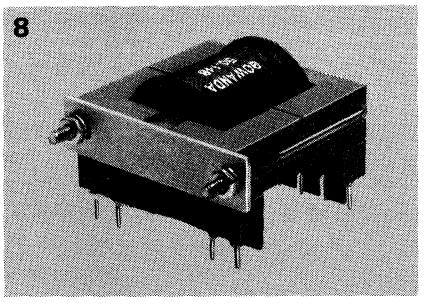


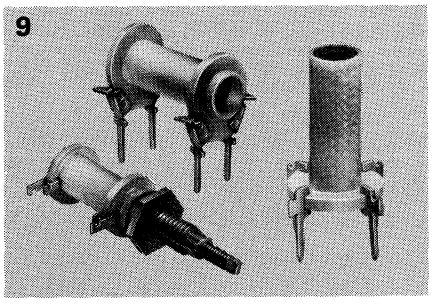












1. RF MOLDED CHOKES
Manufactured to MIL-C-15305 standards. Inductance values .10 μH to 10,000 μH. Standard series for both Q-meter and LCR bridge testing.

2. RF SHIELDED CHOKES
Manufactured to MIL-C-15305 standards. Inductance values .10 μH to 10,000 μH.

3. CUSTOM COIL WINDING
Capabilities for winding your specials--Toroids, Bobbins, self-supporting. Equipped to handle a wide range of wire sizes and coil configurations.

4. TOROIDAL INDUCTORS
Vinyl coated, non-flammable. Abrasion and moisture resistant. High Q and wide selection of Q vs. frequency ranges. Standard inductance TOL ± 2%. Other tolerances available. Custom designs available.

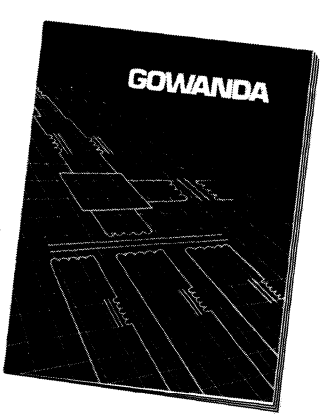
5. SURFACE MOUNT INDUCTORS AND TRANSFORMERS
Standard and custom inductors to meet your electrical, mechanical and packaging requirements. Custom transformers to your requirements.

6. POWER SUPPLY CHOKES
High current filter chokes with printed circuit mounting and pre-tinned leads. Inductance values 1.0 μH to 15.0 mH. Current rating .8 to 35 amps.

7. COMMON MODE INDUCTORS
Custom designed to your requirements. Open, partially or fully encapsulated in both toroidal or bobbin wound forms in the entire range of physical or performance specifications.

8. SWITCHING FREQUENCY TRANSFORMERS
Switching frequency power output transformers and base drive and gate drive transformers custom designed or manufactured to your requirements.

9. TUNABLE COILFORMS
Wide range of printed circuit and chasis mount designs. Winding provided to your specifications.



For complete information, specificiations and rating data, write or call for the new GOWANDA CATALOG No. 285.

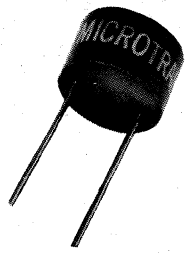
GOWANDA

ELECTRONICS CORP. P.O. Box 111
NO. 1 INDUSTRIAL PLACE GOWANDA, NY 14070
PHONE 716-532-2234 • TWX 710-529-1211

TOROIDAL INDUCTORS

MICROTRAN company, inc.

For SMPS inductors and additional magnetic products, see Transformer Section 5600

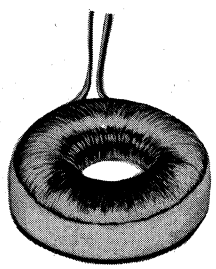


QE-M Molded

QE SERIES

Ultra miniaturized with low height design. Exceptionally high "Q" and wide frequency range. Frequency range of QEL Series 1 to 300 kHz; QEM, 3 to 500 kHz. Accuracy, ±2%. Molded in epoxy resin with .020″ x 2″ gold-plated nickel alloy leads. Size, .450″ dia. x .285″.

QEL-M SERIES				QEM-M SERIES			
Part No.	Inductance	Typ. DCR	Typ. Dist. Cap., pF	Part No.	Inductance	Typ. DCR	Typ. Dist. Cap., pF
QEL1-M	1 mH	2.1	25	QEM05-M	0.5 mH	2.1	20
QEL2-M	2	3.6	30	QEM1-M	1	3.8	30
QEL5-M	5	7.3	35	QEM2-M	2	6.2	35
QEL10-M	10	15.8	45	QEM5-M	5	15.9	45
QEL15-M	15	20	45	QEM10-M	10	19	50
QEL25-M	25	32	50	QEM15-M	15	42	55
QEL50-M	50	69	50	QEM25-M	25	88	60
QEL100-M	100	185	70	QEM50-M	50	193	70



QG-F, QI-F, QK-F, QPL-F, QTL-F Open Frame

QG SERIES

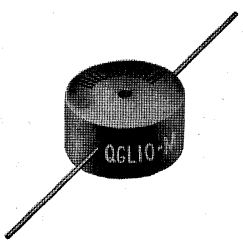
Frequency range of QGL Series, to 20 kHz; QGM Series, 2 to 100 kHz. Accuracy, ±2%. **QG-F:** Open frame, microcrystalline wax dipped with 4″ #28 plastic leads. Size, ⅝″ dia. x 3/32″. **QG-M:** Molded in high temperature epoxy resin with .020″ x 2″ gold plated nickel alloy leads. Leads may be bent downward for plug-in printed circuit use. Size, ⅞″ dia. x ⅜″.

QGL SERIES				QGM SERIES			
QGL5-	5 mH	2.5	30	QGM1-	1 mH	1.4	22
QGL10-	10	5	33	QGM2-	2	2.5	25
QGL15-	15	8	34	QGM5-	5	6	28
QGL30-	30	17	37	QGM10-	10	12	31
QGL50-	50	28	40	QGM15-	15	18	32
QGL100-	100	50	42	QGM25-	25	30	35
QGL250-	250	130	46	QGM50-	50	52	37
QGL500-	500	290	48	QGM100-	100	115	39
QGL1000-	1.0 H	530	51				
QGL1500-	1.5	825	53				

QI SERIES

Frequency range to 20 kHz; accuracy, ±2%. **QIL-M:** Molded in high temperature epoxy with silver plated turret lugs. Size, 1¾″ dia. x ½″. **QIL-H:** Hermetically sealed in metal case with Teflon terminals. Size, 1 1/16″ x ½″ x 1 7/32″. **QIL-F:** Open frame. Microcrystalline wax dipped with 4″ #28 plastic leads. Size, 1″ dia. x 13/32″.

QIL SERIES							
QIL3-	3 mH	.73	36	QIL150-	150 mH	34	50
QIL5-	5	1.1	38	QIL250-	250	55	53
QIL10-	10	2.1	40	QIL500-	500	95	55
QIL15-	15	3.3	42	QIL1000-	1.0 H	210	57
QIL25-	25	5.3	45	QIL1500-	1.5	335	59
QIL50-	50	11	47	QIL2500-	2.5	550	61
QIL100-	100	22	49				

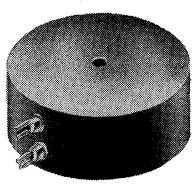


QG-M Molded

QK SERIES

Frequency range of QKL Series, to 10 kHz; QKM Series, 5 to 50 kHz. Accuracy, ±2%. **QK-F:** Open frame, microcrystalline wax dipped; 4″ #28 plastic leads. Size, 1¼″ dia. x ⅝″. **QK-H:** Hermetically sealed with Teflon terminals. Size, 1 15/32″ x 25/32″ x 1 47/64″. **QK-M:** Molded in high temperature epoxy resin, silver plated turret lugs. Size, 1⅜″ dia. x ¾″; #8 clearance hole.

QKL SERIES							
QKL5-	5 mH	.62	60	QKL250-	250 mH	28	87
QKL10-	10	1.1	66	QKL500-	500	63	91
QKL15-	15	1.7	68	QKL1000-	1.0 H	110	96
QKL25-	25	2.8	72	QKL1500-	1.5	175	98
QKL50-	50	6	76	QKL2500-	2.5	275	103
QKL100-	100	11	81	QKL5000-	5	645	106
QKL150-	150	17	83	QKL10,000-	10	1175	112
QKM SERIES							
QKM2-	2 mH	.45	52	QKM100-	100 mH	25	79
QKM5-	5	1.1	58	QKM250-	250	65	87
QKM10-	10	2.5	62	QKM500-	500	115	92
QKM25-	25	6.5	70	QKM1000-	1.0 H	250	97
QKM50-	50	11	74				

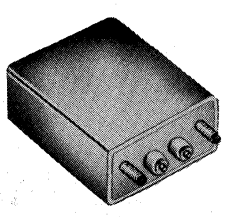


QI-M, QK-M, QPL-M, QTL-M Molded

QP SERIES

Frequency range to 10 kHz; accuracy, ±2%. **QPL-F:** Open frame, microcrystalline wax dipped; 4″ #24 leads. Size, 1 3/16″ x ⅞″. **QPL-H:** Hermetically sealed with Teflon terminals. Size, 1 3/16″ x 1 1/16″ x 2 3/32″. **QPL-M:** Molded in high temperature epoxy resin; silver plated turret lugs. Size, 2″ dia. x 1″.

QPL SERIES							
QPL25-	25 mH	1.5	100	QPL2500-	2.5 H	150	133
QPL50-	50	2.5	105	QPL5000-	5.0	350	138
QPL100-	100	6	110	QPL7500-	7.5	525	140
QPL250-	250	15	115	QPL10,000-	10	600	142
QPL500-	500	25	120	QPL15,000-	15	900	146
QPL1000-	1.0 H	60	125	QPL25,000-	25	1500	150
QPL1500-	1.5	90	130				



QI-H, QK-H 2 studs, QPL-H, QTL-H 4 studs Hermetic

QT SERIES

Frequency range to 15 kHz; accuracy, ±2%. **QTL-F:** Open frame, microcrystalline wax dipped; 4″ #24 leads. Size, 2 7/16″ dia. x 1″. **QTL-H:** Hermetically sealed with Teflon terminals. Size, 2 1/16″ x 1 1/16″ x 2 13/16″. **QTL-M:** Molded in epoxy resin. Size, 2⅞″ x 1⅜″.

QTL SERIES							
QTL25-	25 mH	0.85	127	QTL1500-	1.5 H	40	177
QTL50-	50	1.5	136	QTL2500-	2.5	70	184
QTL100-	100	2.8	144	QTL5000-	5	140	192
QTL150-	150	3.9	149	QTL10,000-	10	270	200
QTL250-	250	7	156	QTL15,000-	15	430	205
QTL500-	500	15	164	QTL25,000-	25	850	212
QTL1000-	1.0 H	27	173	QTL50,000-	50	1500	221

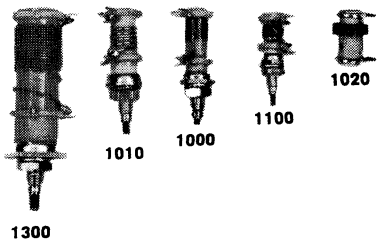
145 E. MINEOLA AVE., BOX 236, VALLEY STREAM, NY 11582-0236 • 516-561-6050 • TWX 510-225-8412 • FAX 516-561-1117

HIGH-PERFORMANCE COILS: ADJUSTABLE AND FIXED

10 kHz to 200 MHz

North Hills Electronics, Inc.
1 ALEXANDER PLACE, GLEN COVE, NEW YORK 11542-3796
TELEPHONE: (516) 671-5700• TELEX: 46-6886

MIL-I-10 COILS (Ceramic forms)



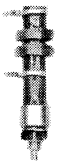
Series No.	Dimensions (Inches) Dia.	Length	Mtg. Hole Dia. (Inches)
1000	.50	.88	.196
1020	.50	.63	.050,.500 Apart
1100	.33	.63	.166
1300	.70	1.80	.252
1010	.43	.88	.196

Part No.	Range Microhenries	Average Q
Miniature 1000 Series		
1000-A	1.0- 1.6	70 @ 7.9 MHz
1000-B	1.6- 2.7	80 @ 7.9 MHz
1000-C	2.7- 4.5	85 @ 7.9 MHz
1000-D	4.5- 8.5	85 @ 7.9 MHz
1000-E	8.5-14.5	75 @ 2.5 MHz
1000-F	14.5-22	65 @ 2.5 MHz
1000-G	22-29	65 @ 2.5 MHz
1000-H	29-55	85 @ 2.5 MHz
1000-I	55-110	80 @ 2.5 MHz
1000-J	110-185	85 @ .79 MHz
1000-K	185-305	85 @ .79 MHz
1000-L	305-515	85 @ .79 MHz
1000-M	515-820	85 @ .79 MHz
1000-N	820-1100	75 @ .79 MHz
RF Printed Circuit Coils		
1020-A	0.41- 0.53	75 @ 25 MHz
1020-B	8.95- 1.15	65 @ 7.9 MHz
1020-C	1.87- 2.50	65 @ 7.9 MHz
1020-D	4.0 - 5.4	70 @ 7.9 MHz
1020-E	7.5 -12.5	70 @ 2.5 MHz
1020-F	20 -29	80 @ 2.5 MHz
1020-G	33 -61	80 @ 2.5 MHz
1020-H	80 -120	60 @ 0.79 MHz
1020-I	170 -260	70 @ 0.79 MHz
Subminiature 1100 Series		
1100-A	0.9- 1.4	60 @ 7.9 MHz
1100-B	1.4- 1.9	70 @ 7.9 MHz
1100-C	1.9- 2.6	65 @ 7.9 MHz
1100-D	2.6- 3.7	65 @ 7.9 MHz
1100-E	3.7- 5.5	65 @ 7.9 MHz
1100-F	5.5- 7.4	60 @ 7.9 MHz
1100-G	7.4-12.5	70 @ 7.9 MHz
1100-H	12.5-18.0	65 @ 2.5 MHz
1100-I	18.0-28.0	70 @ 2.5 MHz
1100-J	28.0-38.0	70 @ 2.5 MHz
1100-K	38.0-55.0	70 @ 2.5 MHz
Transmitter 1300 Series		
1300-A		For use from 90-200 MHz
1300-B		For use from 40-90 MHz
1300-C		For use from 20-40 MHz
1300-D	0.7- 1.0	170 @ 25 MHz
1300-E	1.1- 1.6	130 @ 7.9 MHz
1300-F	1.7- 2.5	140 @ 7.9 MHz
1300-G	2.7- 4.1	140 @ 7.9 MHz
1300-H	4.4- 6.5	140 @ 7.9 MHz
1300-I	6.8-10.0	140 @ 7.9 MHz
1300-J	11.5-17.0	110 @ 2.5 MHz
1300-K	19.0-29.0	95 @ 2.5 MHz
1300-L	31.0-45.0	100 @ 2.5 MHz
1300-M	49.0-75.0	100 @ 2.5 MHz
HF Coils, Variable Approx. ±15%		
1010-A	0.118	115 @ 50 MHz
1010-B	0.225	125 @ 25 MHz
1010-C	0.315	130 @ 25 MHz

WIDE ADJUSTMENT RANGE COILS

120 Series
Mica-filled form

PCS-120 Series
Phenolic form



PC-120 Series
Phenolic form

Dimensions:

Series No.	O.D.	Length	Mtg. Hole Dia.	Spacing
120	.75″	1.30″	.196″	NA
PCS-120	.75″	1.30″	.196″	NA
PC-120	.50″	1.25″	.05	.70″

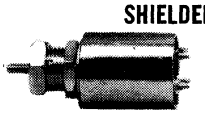
Part No.	Range Microhenries	Average Q
120-A	2-3	70 @ 7.9 MHz
120-B	3-5	80 @ 7.9 MHz
120-C	5-9	85 @ 7.9 MHz
120-D	9-18	65 @ 2.5 MHz
120-E	18-36	70 @ 2.5 MHz
120-F	36-64	65 @ 2.5 MHz
120-G	64-105	85 @ 2.5 MHz
120-H	105-200	80 @ .79 MHz
120-I	200-500	75 @ .79 MHz
120-J	500-1000	85 @ .79 MHz
120-K	1000-2000	50 @ .25 MHz

SUBMINIATURE 600 SERIES

- Variable ±10%
- Shielded
- 0.3″ O.D. x 0.4″ H
- .020″ Leads .20″ Apart

Part No.	Nominal Microhenries	Average Q
600U1X0	1.0	120 @ 7.9 MHz
600U1X5	1.5	120 @ 7.9 MHz
600U2X2	2.2	120 @ 7.9 MHz
600U3X3	3.3	130 @ 7.9 MHz
600U4X7	4.7	125 @ 7.9 MHz
600U6X8	6.8	140 @ 7.9 MHz
600U10X	10	135 @ 7.9 MHz
600U15X	15	130 @ 2.5 MHz
600U22X	22	135 @ 2.5 MHz
600U33X	33	130 @ 2.5 MHz
600U47X	47	130 @ 2.5 MHz
600U68X	68	120 @ 2.5 MHz
600MX10	100	100 @ 2.5 MHz
600MX15	150	125 @ .79 MHz
600MX22	220	130 @ .79 MHz
600MX33	330	125 @ .79 MHz
600MX47	470	120 @ .79 MHz
600MX68	680	100 @ .79 MHz
600M1X0	1000	100 @ .79 MHz

SHIELDED COILS



- Shielded
- Encapsulated

900 Series: .44″ Diameter
1500 Series: .63″ Diameter

Part No.	Range Microhenries	Average Q
900-A	0.5- 0.8	80 @ 25 MHz
900-B	0.8- 1.3	70 @ 18 MHz
900-C	1.3- 2.0	60 @ 15 MHz
900-D	2.0- 4.0	70 @ 8 MHz
900-E	4.0- 7.0	70 @ 5 MHz
900-F	7.0-12.0	70 @ 4 MHz
900-G	12.0-20.0	70 @ 3 MHz
900-H	20.0-35.0	70 @ 2.5 MHz
900-I	35.0-60.0	70 @ 2.0 MHz
900-J	60.0-100.0	70 @ 1.0 MHz
1500-A	.100- .175	80 @ 790 kHz
1500-B	.175- .300	80 @ 790 kHz
1500-C	.300- .500	80 @ 790 kHz
1500-D	.500- .800	75 @ 790 kHz
1500-E	.800-1.15	55 @ 500 kHz
1500-F	1.15-1.50	55 @ 250 kHz
1500-G	1.50-2.30	55 @ 250 kHz
1500-H	2.30-3.50	50 @ 250 kHz
1500-I	3.50-7.50	40 @ 250 kHz

HIGH Q RF COILS: FIXED

- .75″ O.D. x .63″ H
- Hermetically sealed
- Complete shielding
- For printed circuitry
- For standard circuitry

Part No.	Nominal Microhenries	Average Q
1219-A	0.47 ±5%	90 @ 20 MHz
1219-B	1.0 ±5%	100 @ 10 MHz
1219-C	2,2 ±5%	130 @ 8 MHz
1219-D	4.7 ±5%	130 @ 5 MHz
1219-E	10 ±5%	130 @ 3 MHz
1219-F	22 ±3%	185 @ 1.7 MHz
1219-G	47 ±3%	185 @ 1 MHz
1219-H	100 ±3%	200 @ 0.8 MHz
1219-I	220 ±3%	225 @ 0.7 MHz
1219-J	470 ±3%	250 @ 0.6 MHz
1219-K	1000 ±3%	300 @ 0.5 MHz
1219-L	2200 ±3%	300 @ 0.25 MHz

HIGH Q RF COILS: ADJUSTABLE

- Adjustable ±10%
- 1.18″ O.D. x .93″ H

801, 802 Series
1.18″ O.D. x .93″ H

Part No.	Nominal Millihenries	Peak Q
801M1X0	1.0	100 @ 10 kHz
801M1X5	1.5	100 @ 10 kHz
801M2X2	2.2	100 @ 10 kHz
801M3X3	3.3	100 @ 10 kHz
801M4X7	4.7	100 @ 10 kHz
801M6X8	6.8	100 @ 10 kHz
801M10X	10	200 @ 20 kHz
801M15X	15	200 @ 20 kHz
801M22X	22	200 @ 20 kHz
801M33X	33	200 @ 20 kHz
801M47X	47	200 @ 20 kHz
801M68X	68	200 @ 20 kHz
801HX10	100	300 @ 30 kHz
801HX15	150	300 @ 30 kHz
801HX22	220	300 @ 30 kHz
801HX33	330	250 @ 20 kHz
801HX47	470	250 @ 20 kHz
801HX68	680	250 @ 20 kHz
801H1X0	1000	150 @ 15 kHz
802M1X0	1.0	400 @ 100 kHz
802M1X5	1.5	400 @ 100 kHz
802M2X2	2.2	400 @ 100 kHz
802M3X3	3.3	400 @ 100 kHz
802M4X7	4.7	400 @ 100 kHz
802M6X8	6.8	400 @ 100 kHz
802M10X	10	400 @ 70 kHz
802M15X	15	400 @ 70 kHz
802M22X	22	400 @ 70 kHz
802M33X	33	400 @ 70 kHz
802M47X	47	400 @ 40 kHz

Nytronics Components Group, Inc.
700 ORANGE STREET, DARLINGTON, S. C. 29532
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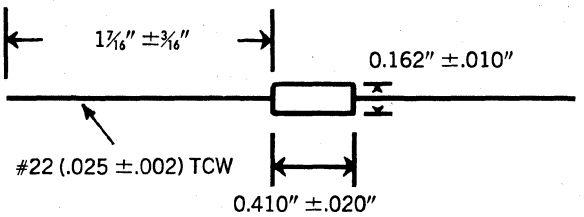
M39010/1, /2, /3 INDUCTORS

ESTABLISHED RELIABILITY

MIL-C-39010 (LATEST REVISION)



Magnetically Shielded

MIL-C-39010-1 (Phenolic Core - Iron Sleeve)

MIL-C-39010-2 (Iron Core - Iron Sleeve)

MIL-C-39010-3 (Ferrite Core - Ferrite Sleeve)

ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% and ±5% over the entire inductance range. Intermediate values per the MS slash sheet are available.

ELECTRICAL CHARACTERISTICS

Dielectric Strength: 1500 volts RMS at sea level.

Self-Resonant Frequency: Measured per MIL-C-39010.

Q: Measured on a Q-Meter.

Maximum Current: Based on temperature rise not to exceed 15°C at 90°C ambient.

DENSITY CHARACTERISTICS

Volume: 0.0076 cubic inches. **Weight:** 1.0 grams maximum.

Shielding: At the coupling test frequency two units assembled side by side exhibit less than 3% coupling.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +105°C.

Terminal Strength: Meets five pound pull test; five 360° rotations in alternate directions.

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-39010. High frequency 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 100G, 6 MS.

Marking:

EXAMPLE: M39010 /01 A1ROKS } - Military part number.
83125 - Manufacturer's source code.
J8711A - "JAN" marking, date code, and lot symbol.

M39010	Dash Number	L µH	Q min	MHz	Min. SRF MHz	Max. DCR Ω	Max. I mA	Incr.† I mA
/1	AR10K*	0.10	50	25	250	0.025	1790	
	AR12K*	0.12	50	25	250	0.034	1530	
	AR15K*	0.15	50	25	250	0.037	1470	
	AR18K*	0.18	50	25	250	0.047	1300	
	AR22K*	0.22	49	25	250	0.067	1100	
	AR27K*	0.27	47	25	250	0.11	855	
	AR33K*	0.33	46	25	250	0.13	780	
	AR39K*	0.39	44	25	250	0.18	670	
	AR47K*	0.47	44	25	235	0.25	565	
	AR56K*	0.56	43	25	210	0.33	490	
	AR68K*	0.68	42	25	190	0.45	420	
	AR82K*	0.82	40	25	180	0.59	370	
/2	A1R0K*	1.0	44	25	140	0.070	1070	
	A1R2K*	1.2	44	7.9	130	0.10	895	
	A1R5K*	1.5	44	7.9	115	0.12	815	
	A1R8K*	1.8	44	7.9	105	0.14	775	
	A2R2K*	2.2	44	7.9	100	0.19	650	
	A2R7K*	2.7	44	7.9	92	0.28	535	
	A3R3K*	3.3	44	7.9	85	0.35	480	
	A3R9K*	3.9	44	7.9	75	0.40	450	
	A4R7K*	4.7	44	7.9	70	0.55	380	
	A5R6K*	5.6	44	7.9	65	0.72	335	
	A6R8K*	6.8	50	7.9	55	1.02	280	
	A8R2K*	8.2	50	7.9	50	1.32	245	
	A100K*	10	50	7.9	46	1.62	220	
	A120K*	12	55	2.5	44	2.00	200	
/3	A150K*	15	45	2.5	49	0.80	315	250
	A180K*	18	45	2.5	45	0.89	300	235
	A220K*	22	45	2.5	41	0.96	290	220
	A270K*	27	45	2.5	38	1.19	260	200
	A330K*	33	45	2.5	34	1.37	240	190
	A390K*	39	50	2.5	29	1.93	205	180
	A470K*	47	50	2.5	27	2.11	195	175
	A560K*	56	50	2.5	25	2.23	190	160
	A680K*	68	50	2.5	21	2.70	170	150
	A820K*	82	50	2.5	10.5	2.44	180	140

M39010	Dash Number	L µH	Q min	MHz	Min. SRF MHz	Max. DCR Ω	Max. I mA	Incr.† I mA
/3	A101K*	100	50	2.5	10.0	3.12	160	120
	A121K*	120	55	0.79	9.7	3.60	150	95
	A151K*	150	55	0.79	8.5	4.10	140	90
	A181K*	180	55	0.79	8.0	4.40	135	85
	A221K*	220	55	0.79	7.5	5.00	125	80
	A271K*	270	55	0.79	7.0	5.80	115	70
	A331K*	330	55	0.79	6.5	6.40	110	65
	A391K*	390	60	0.79	6.2	7.40	105	60
	A471K*	470	60	0.79	5.7	9.50	92	58
	A561K*	560	60	0.79	4.7	10.5	90	55
	A681K*	680	60	0.79	4.5	11.8	80	50
	A821K*	820	60	0.79	4.2	13.0	80	45
	A102K*	1000	60	0.79	3.8	17.5	70	40
	A122K*	1200	45	0.25	1.5	22.1	60	35
	A152K*	1500	45	0.25	1.2	26.5	55	33
	A182K*	1800	45	0.25	1.0	29.9	50	30
	A222K*	2200	45	0.25	0.97	33.8	50	27
	A272K*	2700	45	0.25	0.92	47.3	40	25
	A332K*	3300	45	0.25	0.84	53.0	40	22
	A392K*	3900	45	0.25	0.80	73.8	35	20
	A472K*	4700	45	0.25	0.74	81.6	31	19
	A562K*	5600	44	0.25	0.73	98.9	28	17
	A682K*	6800	40	0.25	0.66	111.0	27	16
	A822K*	8200	40	0.25	0.54	119.0	26	15
	A103K*	10,000	40	0.25	0.47	137.0	24	14
	A123K*	12,000	30	0.079	0.33	143.0	23	13
	A153K*	15,000	30	0.079	0.29	157.0	22	12
	A183K*	18,000	30	0.079	0.28	175.0	21	10
	A223K*	22,000	27	0.079	0.25	274.0	17	9
	A273K*	27,000	27	0.079	0.21	308.0	16	8
	A333K*	33,000	27	0.079	0.19	343.0	15	7.5
	A393K*	39,000	27	0.079	0.17	376.0	15	6.0
	A473K*	47,000	23	0.079	0.16	473.0	13	5.5
	A563K*	56,000	23	0.079	0.14	512.0	13	5.0
	A683K*	68,000	23	0.079	0.13	580.0	12	4.0
	A823K*	82,000	21	0.079	0.12	618.0	11	3.5
	A104K*	100,000	18	0.079	0.11	678.0	11	3.0

† INCREMENTAL CURRENT: The D.C. current required to cause a 5% reduction in the nominal inductance value.

* Complete dash number will include an additional letter symbol to indicate failure rate level.

MIL-C-39010/1 - /2 - /3 FAILURE RATE "S" .001%/1000 HRS.

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M39010/4, /5, /6, /7 INDUCTORS

ESTABLISHED RELIABILITY

MIL-C-39010 (LATEST REVISION)

MIL-C-39010-4 (Phenolic Core)
MIL-C-39010-5 (Iron Core)
MIL-C-39010-6 (Phenolic Core)
MIL-C-39010-7 (Iron Core)

ELECTRICAL CHARACTERISTICS

Inductance Tolerance: 0.15 to 0.47uH ±20%; 0.56uH and up ±10%. ±5% and intermediate values per MS slash sheet are available.

Dielectric Strength: 1500 Volts RMS at sea level.

Self-Resonant Frequency: Measured per MIL-C-39010.

Rating: Maximum current based on: 35°C rise in 90° ambient for phenolic, 15°C rise in 90° ambient for iron.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

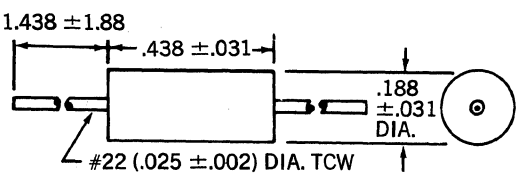
Operating Temperature: −55°C to +125°C phenolic core, −55°C to +105°C iron.

Terminal Strength: Meets five pound pull test; five 360° rotations in alternate directions per MIL-C-39010.

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-39010 (latest revision), 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 100G, 6 MS.

Marking:

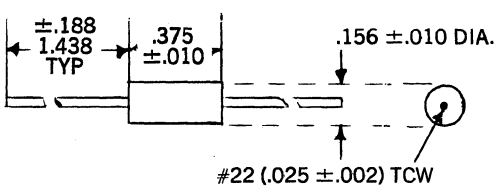
EXAMPLE: M39010 /04 A1ROKS } - Military part number.
83125 - Manufacturer's source code.
J8711A - "JAN" marking, date code, and lot symbol.



ALL DIMENSIONS IN INCHES

Weight: 0.950 gram maximum.

M39010	Dash Number	Inductance µH	Q min	Test frequency MHz	Self-resonant frequency Min. MHz	DC resistance Max. (25°C) ohms	Rated dc current mA
/4	BR15L*	0.15	55	25.0	510	0.030	2,900
	BR22L*	0.22	50	25.0	415	0.035	2,700
	BR33L*	0.33	50	25.0	350	0.065	2,000
	BR47L*	0.47	50	25.0	300	0.085	1,700
	BR56K*	0.56	50	25.0	270	0.125	1,450
	BR68K*	0.68	45	25.0	250	0.150	1,300
	BR82K*	0.82	40	25.0	210	0.205	1,100
	B1R0K*	1.00	40	25.0	200	0.290	930
	B1R2K*	1.20	30	7.9	180	0.400	785
	B1R5K*	1.50	30	7.9	170	0.485	720
	B1R8K*	1.80	30	7.9	150	0.740	580
	B2R2K*	2.20	30	7.9	140	0.970	505
	B2R7K*	2.70	30	7.9	120	1.20	460
/5	A3R3K*	3.30	30	7.9	70	0.140	945
	A3R9K*	3.90	30	7.9	65	0.155	370
	A4R7K*	4.70	30	7.9	60	0.210	745
	A5R6K*	5.60	30	7.9	50	0.280	645
	A6R8K*	6.80	30	7.9	50	0.375	560
	A8R2K*	8.20	30	7.9	48	0.440	520
	A100K*	10.0	30	7.9	42	0.605	440
	A120K*	12.0	50	2.5	36	1.05	335
	A150K*	15.0	55	2.5	30	1.20	310
	A180K*	18.0	60	2.5	30	1.95	245
	A220K*	22.0	60	2.5	24	2.20	230
	A270K*	27.0	65	2.5	22	2.75	205



Weight: 0.90 gram maximum.

M39010	Dash Number	Inductance µH	Q min	Test frequency MHz	Self-resonant frequency Min. MHz	DC resistance Max. (25°C) ohms	Rated dc current mA
/6	BR15L*	0.15	50	25.0	525	0.030	2,450
	BR22L*	0.22	50	25.0	450	0.055	1,810
	BR33L*	0.33	45	25.0	360	0.090	1,400
	BR47L*	0.47	45	25.0	310	0.12	1,225
	BR56K*	0.56	50	25.0	280	0.135	1,150
	BR68K*	0.68	50	25.0	250	0.150	1,100
	BR82K*	0.82	50	25.0	220	0.220	900
	B1R0K*	1.00	50	25.0	200	0.290	785
	B1R2K*	1.20	33	7.9	180	0.420	650
	B1R5K*	1.50	33	7.9	160	0.500	600
	B1R8K*	1.80	33	7.9	150	0.650	525
	B2R2K*	2.20	33	7.9	135	0.950	435
	B2R7K*	2.70	33	7.9	120	1.20	385
	B3R3K*	3.30	33	7.9	110	2.00	300
	B3R9K*	3.90	33	7.9	100	2.30	280
	B4R7K*	4.70	33	7.9	90	2.60	260
/7	A5R6K*	5.6	45	7.9	60	0.32	495
	A6R8K*	6.8	50	7.9	55	0.50	395
	A8R2K*	8.2	50	7.9	50	0.60	360
	A100K*	10	55	7.9	45	0.90	290
	A120K*	12	65	2.5	42	1.10	265
	A150K*	15	65	2.5	40	1.40	240
	A180K*	18	75	2.5	34	2.25	185
	A220K*	22	75	2.5	30	2.50	175
	A270K*	27	60	2.5	25	2.60	170
	A330K*	33	65	2.5	19	3.00	165

* Complete dash number will include an additional letter symbol to indicate failure rate level.

MIL-C-39010/4 - /5 - /6 - /7 FAILURE RATE "S" .001%/1000 HRS.

Nytronics Components Group, Inc.
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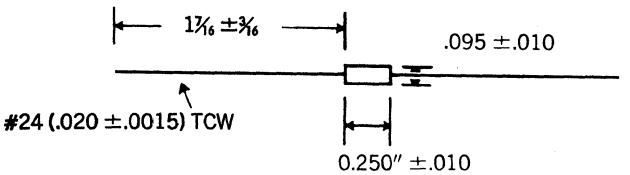
M39010/8, /9, /10 INDUCTORS

ESTABLISHED RELIABILITY

MIL-C-39010
(LATEST REVISION)



MIL-C-39010-8 (Phenolic Core)
MIL-C-39010-9 (Iron Core)
MIL-C-39010-10 (Ferrite Core)

ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% and ±5% over the entire range. Intermediate values per MS slash sheet are available.

Dielectric Strength: 1000 volts RMS at sea level.

Self-Resonant Frequency: Measured per MIL-C-39010.

Rating: Maximum current based on: 35°C rise in 90° ambient for phenolic, 15°C rise in 90° ambient for iron, and for ferrite core inductors.

DENSITY CHARACTERISTICS

Volume: 0.002 cubic inches; **Weight:** 0.30 grams.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +125°C phenolic core, −55°C to +105°C iron and ferrite core.

Terminal Strength: Meets five pound pull test; five 360° rotations in alternate direction.

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-39010 (latest revision), 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 100G, 6 MS.

Marking:

EXAMPLE: M39010 /08 A1ROKS } - Military part number.
83125 - Manufacturer's source code.
J8711A - "JAN" marking, date code, and lot symbol.

M39010	Dash Number	Inductance μH	Q min	Test frequency MHz	Self-resonant frequency Min MHz	DC resistance Max. (25°C) ohms	Rated dc current mA
/8	BR10K*	.10	40	25.0	680	.08	1350
	BR12K*	.12	40	25.0	640	.09	1270
	BR15K*	.15	38	25.0	600	.10	1200
	BR18K*	.18	35	25.0	550	.12	1105
	BR22K*	.22	33	25.0	510	.14	1025
	BR27K*	.27	33	25.0	430	.16	960
	BR33K*	.33	30	25.0	410	.22	815
	BR39K*	.39	30	25.0	365	.30	700
	BR47K*	.47	30	25.0	330	.35	650
	BR56K*	.56	30	25.0	300	.50	545
	BR68K*	.68	28	25.0	275	.60	495
	BR82K*	.82	28	25.0	250	.85	415
	B1R0K*	1.00	25	25.0	230	1.00	385
/9	A1R2K*	1.2	25	7.9	150	.18	590
	A1R5K*	1.5	28	7.9	140	.22	535
	A1R8K*	1.8	30	7.9	125	.30	455
	A2R2K*	2.2	30	7.9	115	.40	395
	A2R7K*	2.7	37	7.9	100	.55	335
	A3R3K*	3.3	45	7.9	90	.85	270
	A3R9K*	3.9	45	7.9	80	1.00	250
	A4R7K*	4.7	45	7.9	75	1.20	230
	A5R6K*	5.6	50	7.9	65	1.80	185
	A6R8K*	6.8	50	7.9	60	2.00	175
	A8R2K*	8.2	55	7.9	55	2.70	155
	A100K*	10	55	7.9	50	3.70	130
	A120K*	12	45	2.5	40	2.70	155
	A150K*	15	40	2.5	35	2.80	150
	A180K*	18	50	2.5	30	3.10	145
	A220K*	22	50	2.5	25	3.30	140
	A270K*	27	50	2.5	20	3.50	135

M39010	Dash Number	Inductance μH	Q min	Test frequency MHz	Self-resonant frequency Min MHz	DC resistance Max. (25°C) ohms	Rated dc current mA
/10	A330K*	33	45	2.5	24	3.4	130
	A390K*	39	45	2.5	22	3.6	125
	A470K*	47	45	2.5	20	4.5	110
	A560K*	56	45	2.5	18	5.7	100
	A680K*	68	50	2.5	15	6.7	92
	A820K*	82	50	2.5	14	7.3	88
	A101K*	100	50	2.5	13	8	84
	A121K*	120	30	.79	12	13	66
	A151K*	150	30	.79	11	15	61
	A181K*	180	30	.79	10	17	57
	A221K*	220	30	.79	9	21	52
	A271K*	270	30	.79	8	25	47
	A331K*	330	30	.79	7	28	45
	A391K*	390	30	.79	6.5	35	40
	A471K*	470	30	.79	6	42	36
	A561K*	560	30	.79	5	46	35
	A681K*	680	30	.79	4	60	30
	A821K*	820	30	.79	3.8	65	29
	A102K*	1000	30	.79	3.4	72	28

* Complete dash number will include an additional letter symbol to indicate failure rate level.

MIL-C-39010/8 - /9 - /10 FAILURE RATE "S" .001%/1000 HRS.

Nytronics Components Group, Inc.
700 ORANGE STREET, DARLINGTON, S. C. 29532
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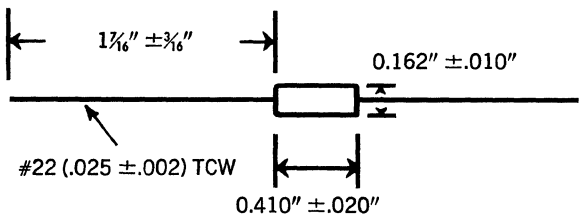
TYPE SWD
MS75087, 75088 & 75089
INDUCTORS

MS-INDUCTOR SERIES 75087, 75088, 75089 MOLDED SHIELDED INDUCTOR

GRADE 1 CLASS A

Ultra-Reliable Molded Shielded Miniature Inductor.
Inductance Range: 0.1uH to 100,000uH.

The **MS-INDUCTOR SERIES** are R.F. Inductors specifically designed to meet the demanding requirements of MIL-C-15305 (latest revision). The MS-INDUCTOR Series epoxy molded envelope and shielding offers the design engineer reliability, electrical performance, and minimum coupling in high density packaging.



ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% over the entire inductance range.
Dielectric Strength: 1000 volts RMS at sea level.
Self-Resonant Frequency: Measured per MIL-C-15305 (latest revision).
Q: Measured on a Q-Meter.
Maximum Current: Based on temperature rise not to exceed 15°C at 90°C ambient.

DENSITY CHARACTERISTICS

Volume: 0.0076 cubic inches **Weight:** 0.75 grams maximum
Shielding: At the test frequency, two units assembled side by side exhibit less than 3% coupling.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +105°C.

Terminal Strength: Meets five pound pull test; five 360° rotations in alternate directions per MIL-C-15305 (latest revision).

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision), Grade 1, Class B. High frequency 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 100G, 6 MS.

Marking: Color coded per MIL-C-15305 (latest revision).

Material	MS No.	NCG P/N	L uH	Q min		Min. SRF MHz	Max. DCR Ω	Max. I mA	Incr.† I mA
					MHz				
PHENOLIC	MS75087-1	SWD	0.10	50	25	250	0.025	1790	>2900
	MS75087-2	SWD	0.12	51	25	250	0.034	1530	>2800
	MS75087-3	SWD	0.15	51	25	250	0.037	1470	>2750
	MS75087-4	SWD	0.18	50	25	250	0.047	1300	>2200
	MS75087-5	SWD	0.22	49	25	250	0.067	1100	>1700
	MS75087-6	SWD	0.27	47	25	250	0.11	855	>1500
	MS75087-7	SWD	0.33	46	25	250	0.13	780	>1300
	MS75087-8	SWD	0.39	44	25	250	0.18	670	>1100
	MS75087-9	SWD	0.47	44	25	235	0.25	565	>1000
	MS75087-10	SWD	0.56	43	25	210	0.33	490	> 900
	MS75087-11	SWD	0.68	42	25	190	0.45	420	> 750
	MS75087-12	SWD	0.82	40	25	180	0.59	370	> 600
IRON	MS75088-1	SWD	1.0	44	25	140	0.070	1070	>1900
	MS75088-2	SWD	1.2	44	7.9	130	0.093	895	>1600
	MS75088-3	SWD	1.5	44	7.9	115	0.12	815	>1300
	MS75088-4	SWD	1.8	44	7.9	105	0.14	775	>1200
	MS75088-5	SWD	2.2	44	7.9	100	0.19	650	>1100
	MS75088-6	SWD	2.7	44	7.9	92	0.28	535	> 950
	MS75088-7	SWD	3.3	44	7.9	85	0.35	480	> 800
	MS75088-8	SWD	3.9	44	7.9	75	0.40	450	> 750
	MS75088-9	SWD	4.7	44	7.9	70	0.55	380	> 650
	MS75088-10	SWD	5.6	44	7.9	65	0.72	335	> 550
	MS75088-11	SWD	6.8	50	7.9	55	1.02	280	> 500
	MS75088-12	SWD	8.2	50	7.9	50	1.32	250	> 475
	MS75088-13	SWD	10	50	7.9	46	1.62	220	> 450
	MS75088-14	SWD	12	55	2.5	44	2.00	200	> 400
FERRITE	MS75089-1	SWD	15	45	2.5	49	0.80	315	250
	MS75089-2	SWD	18	45	2.5	45	0.89	300	235
	MS75089-3	SWD	22	45	2.5	41	0.96	290	220
	MS75089-4	SWD	27	45	2.5	38	1.19	260	200
	MS75089-5	SWD	33	50	2.5	34	1.37	240	190
	MS75089-6	SWD	39	50	2.5	29	1.93	205	180
	MS75089-7	SWD	47	50	2.5	27	2.11	195	175
	MS75089-8	SWD	56	50	2.5	25	2.23	190	160
	MS75089-9	SWD	68	50	2.5	21	2.70	170	150
	MS75089-10	SWD	82	50	2.5	10.5	2.44	180	140

Material	MS No.	NCG P/N	L uH	Q min		Min. SRF MHz	Max. DCR Ω	Max. I mA	Incr.† I mA
					MHz				
FERRITE	MS75089-11	SWD	100	50	2.5	10.0	3.12	160	120
	MS75089-12	SWD	120	55	0.79	9.7	3.60	150	95
	MS75089-13	SWD	150	55	0.79	8.5	4.10	140	90
	MS75089-14	SWD	180	55	0.79	8.0	4.40	135	85
	MS75089-15	SWD	220	55	0.79	7.5	5.00	125	80
	MS75089-16	SWD	270	55	0.79	7.0	5.80	115	70
	MS75089-17	SWD	330	55	0.79	6.5	6.40	110	65
	MS75089-18	SWD	390	60	0.79	6.2	7.40	105	60
	MS75089-19	SWD	470	60	0.79	5.7	9.50	92	58
	MS75089-20	SWD	560	60	0.79	4.7	10.5	90	55
	MS75089-21	SWD	680	60	0.79	4.5	11.8	80	50
	MS75089-22	SWD	820	60	0.79	4.2	13.0	80	45
	MS75089-23	SWD	1000	60	0.79	3.8	17.5	70	40
	MS75089-24	SWD	1200	45	0.25	1.5	22.1	60	35
	MS75089-25	SWD	1500	45	0.25	1.2	26.5	55	33
	MS75089-26	SWD	1800	45	0.25	1.0	29.9	50	30
	MS75089-27	SWD	2200	45	0.25	0.97	33.8	50	27
	MS75089-28	SWD	2700	45	0.25	0.92	47.3	40	25
	MS75089-29	SWD	3300	45	0.25	0.84	53.0	40	22
	MS75089-30	SWD	3900	45	0.25	0.80	73.8	35	20
	MS75089-31	SWD	4700	45	0.25	0.74	81.6	31	19
	MS75089-32	SWD	5600	44	0.25	0.73	98.9	28	17
	MS75089-33	SWD	6800	40	0.25	0.66	111.0	27	16
	MS75089-34	SWD	8200	40	0.25	0.54	119.0	26	15
	MS75089-35	SWD	10,000	40	0.25	0.47	137.0	24	14
	MS75089-36	SWD	12,000	30	0.079	0.33	143.0	23	13
	MS75089-37	SWD	15,000	30	0.079	0.29	157.0	22	12
	MS75089-38	SWD	18,000	30	0.079	0.28	175.0	21	10
	MS75089-39	SWD	22,000	27	0.079	0.25	274.0	17	9
	MS75089-40	SWD	27,000	27	0.079	0.21	308.0	16	8
	MS75089-41	SWD	33,000	27	0.079	0.19	343.0	15	7.5
	MS75089-42	SWD	39,000	27	0.079	0.17	376.0	15	6.0
	MS75089-43	SWD	47,000	23	0.079	0.16	473.0	13	5.5
	MS75089-44	SWD	56,000	23	0.079	0.14	512.0	13	5.0
	MS75089-45	SWD	68,000	23	0.079	0.13	580.0	12	4.0
	MS75089-46	SWD	82,000	21	0.079	0.12	618.0	11	3.5
	MS75089-47	SWD	100,000	18	0.079	0.11	678.0	11	3.0

† INCREMENTAL CURRENT: The D.C. current required to cause a 5% reduction in the nominal inductance value.
MS No. Electricals as shown.

Nytronics Components Group, Inc.
700 ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

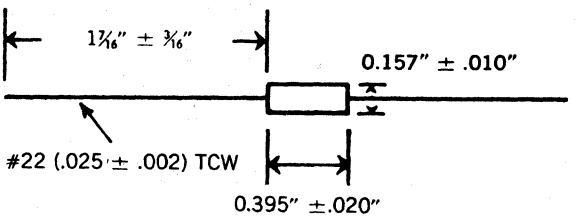
**TYPE SWD
MS90537
INDUCTORS**

MS-INDUCTOR SERIES
90537
MOLDED SHIELDED INDUCTOR

(Manufactured per MS-90537)

**Ultra-Reliable Molded Shielded Miniature Inductor.
Inductance Range: 0.1uH to 100,000uH.**

The **MS-INDUCTOR SERIES** are R.F. Inductors specifically designed to meet the demanding requirements of MIL-C-15305 (latest revision). The MS-INDUCTOR Series epoxy molded envelope and shielding offers the design engineer reliability, electrical performance, and minimum coupling in high density packaging.



GRADE 1 CLASS B

ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% over the entire inductance range.
Dielectric Strength: 700 volts RMS at sea level.
Self-Resonant Frequency: Measured per MIL-C-15305 (latest revision).
Q: Measured on Q-Meter.
Maximum Current: Based on temperature rise not to exceed 35°C at 90°C ambient.

DENSITY CHARACTERISTICS

Volume: 0.0076 cubic inches **Weight:** 0.75 grams maximum
Shielding: At the test frequency, two units assembled side by side exhibit less than 3% coupling.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: —55°C to +125°C.

Terminal Strength: Meets five pound pull test; five 360° rotations in alternate directions per MIL-C-15305 (latest revision).

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305D, Grade 1, Class B. High frequency 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. **Shock:** 100G, 6 MS.

Marking: Color coded per MIL-C-15305 (latest revision).

Material	MS Catalog No.	NCG P/N	L µH	Q Min.	MHz	Min. SRF MHz	Max. DCR Ω	Max. I mA	Incr.** I mA
PHENOLIC	90537-1	SWD	0.10	50	25	250	0.025	2900	>2900
	90537-2	SWD	0.12	51	25	250	0.034	2800	>2800
	90537-3	SWD	0.15	51	25	250	0.037	2750	>2750
	90537-4	SWD	0.18	50	25	250	0.047	2200	>2200
	90537-5	SWD	0.22	49	25	250	0.067	1700	>1700
	90537-6	SWD	0.27	47	25	250	0.11	1500	>1500
	90537-7	SWD	0.33	46	25	250	0.13	1300	>1300
	90537-8	SWD	0.39	44	25	250	0.18	1100	>1100
	90537-9	SWD	0.47	44	25	235	0.25	1000	>1000
	90537-10	SWD	0.56	43	25	210	0.33	900	>900
	90537-11	SWD	0.68	42	25	190	0.45	750	>750
	90537-12	SWD	0.82	40	25	180	0.59	600	>600
IRON	90537-13	SWD	1.0	47	25	140	0.070	1900	>1900
	90537-14	SWD	1.2	46	7.9	130	0.093	1600	>1600
	90537-15	SWD	1.5	45	7.9	115	0.12	1300	>1300
	90537-16	SWD	1.8	43	7.9	105	0.14	1200	>1200
	90537-17	SWD	2.2	45	7.9	100	0.19	1100	>1100
	90537-18	SWD	2.7	46	7.9	92	0.28	950	>950
	90537-19	SWD	3.3	44	7.9	85	0.35	800	>800
	90537-20	SWD	3.9	44	7.9	75	0.40	750	>750
	90537-21	SWD	4.7	44	7.9	70	0.55	650	>650
	90537-22	SWD	5.6	47	7.9	65	0.72	550	>550
	90537-23	SWD	6.8	50	7.9	55	1.02	500	>500
	90537-24	SWD	8.2	50	7.9	50	1.32	475	>475
	90537-25	SWD	10	49	7.9	46	1.62	450	>450
	90537-26	SWD	12	55	2.5	44	2.00	400	>400
FERRITE	90537-27	SWD	15	44	2.5	49	0.80	620	250
	90537-28	SWD	18	45	2.5	45	0.89	610	235
	90537-29	SWD	22	46	2.5	41	0.96	600	220
	90537-30	SWD	27	49	2.5	38	1.19	500	200
	90537-31	SWD	33	45	2.5	34	1.37	490	190
	90537-32	SWD	39	53	2.5	29	1.93	410	180
	90537-33	SWD	47	52	2.5	27	2.11	400	175
	90537-34	SWD	56	49	2.5	25	2.23	380	160
	90537-35	SWD	68	51	2.5	21	2.70	370	150
	90537-36	SWD	82	45	2.5	10.5	2.44	360	140

Material	MS Catalog No.	NCG P/N	L µH	Q Min.	MHz	Min. SRF MHz	Max. DCR Ω	Max. I mA	Incr.** I mA
FERRITE	90537-37	SWD	100	52	2.5	10.0	3.12	325	120
	90537-38	SWD	120	57	.79	9.7	3.60	290	95
	90537-39	SWD	150	56	.79	8.5	4.10	275	90
	90537-40	SWD	180	60	.70	8.0	4.40	260	85
	90537-41	SWD	220	58	.79	7.5	5.00	250	80
	90537-42	SWD	270	60	.79	7.0	5.80	240	70
	90537-43	SWD	330	54	.79	6.5	6.40	225	65
	90537-44	SWD	390	67	.79	6.2	7.40	200	60
	90537-45	SWD	470	60	.79	5.7	9.50	180	58
	90537-46	SWD	560	60	.79	4.7	10.5	174	55
	90537-47	SWD	680	60	.79	4.5	11.8	168	50
	90537-48	SWD	820	57	.79	4.2	13.0	152	45
	90537-49	SWD	1000	65	.79	3.8	17.5	135	40
	90537-50	SWD	1200	45	.25	1.5	22.1	115	35
	90537-51	SWD	1500	49	.25	1.2	26.5	110	33
	90537-52	SWD	1800	47	.25	1.0	29.9	105	30
	90537-53	SWD	2200	50	.25	0.97	33.8	99	27
	90537-54	SWD	2700	47	.25	0.92	47.3	83	25
	90537-55	SWD	3300	43	.25	0.84	53.0	80	22
	90537-56	SWD	3900	43	.25	0.80	73.8	67	20
	90537-57	SWD	4700	44	.25	0.74	81.6	63	19
	90537-58	SWD	5600	45	.25	0.73	98.9	56	17
	90537-59	SWD	6800	43	.25	0.66	111.0	54	16
	90537-60	SWD	8200	42	.25	0.54	119.0	52	15
	90537-61	SWD	10,000	39	.25	0.47	137.0	49	14
	90537-62	SWD	12,000	31	.079	0.33	143.0	46	13
	90537-63	SWD	15,000	31	.079	0.29	157.0	45	12
	90537-64	SWD	18,000	31	.079	0.28	175.0	41	10
	90537-65	SWD	22,000	27	.079	0.25	274.0	33	9
	90537-66	SWD	27,000	27	.079	0.21	308.0	31	8
	90537-67	SWD	33,000	27	.079	0.19	343.0	30	7.5
	90537-68	SWD	39,000	27	.079	0.17	376.0	27	6.0
	90537-69	SWD	47,000	23	.079	0.16	473.0	26	5.5
	90537-70	SWD	56,000	23	.079	0.14	512.0	25	5.0
	90537-71	SWD	68,000	23	.079	0.13	580.0	24	4.0
	90537-72	SWD	82,000	21	.079	0.12	618.0	23	3.5
	90537-73	SWD	100,000	18	.079	0.11	678.0	22	3.0

**INCREMENTAL CURRENT — The D.C. current required to cause a 5% reduction in the nominal inductance value.
NCG and MS Part No. electricals as shown.

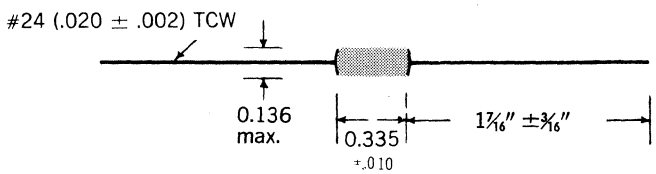
Nytronics Components Group, Inc.
700 ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE SWWD
MS21399, 21400 & 21401
INDUCTORS

SUPER WEE-WEE-DUCTOR

An Ultra-Reliable molded shielded inductor. Subminiature size for high density circuits. Great Inductance-to-size ratio. .10 uH to 10,000 uH. 0.136" diameter x 0.335" length. 61 stock values.

The **SUPER WEE-WEE-DUCTOR,** a shielded miniaturized inductor, provides a greater inductance-to-size ratio in a molded epoxy envelope. Use of unique "T" lead construction on all values from 15 uH to 10,000 uH assures exceptional reliability in ranges where fine wire sizes are used. This MS inductor series is designed to meet the stringent requirements of MIL-C-15305 (latest revision). This provides the design engineer with utmost reliability, electrical performance, and minimum coupling in high density packaging.



GRADE 1 CLASS A

ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% (Q-Meter) at specified frequency.
Dielectric Strength: 700 volts RMS at sea level.
Self-Resonant Frequency: Measured with full length leads on Q-Meter.
Q: Measured on Q-Meter at specified frequency.
Rating: maximum based on ⅓ watt dissipation.

DENSITY CHARACTERISTICS

Volume: 0.0041 cubic inches.
Weight: 0.50 grams maximum.
Shielding: Less than 3% coupling with two units mounted side by side at 1000 cycles.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +105°C.
Terminal Strength: Meets five pounds pull test; five 360° rotations in alternate directions per MIL-C-15305 (latest revision).
Moisture, Vibration and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision). High Frequency: 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 100G, 6 MS.
Marking: Color coded per MIL-C-15305 (latest revision).

SUPER WEE-WEE-DUCTOR STANDARD VALUES

Material	MS No.	NCG Part No.	L µH	Q Min.	Test Freq. MHz	min. SRF MHz	Max. DCR Ω	Max. I mA	Incr.* I mA
PHENOLIC	MS21399-1	SW-W-D- 0.10	0.10	42	25	480	.087	1650	>1650
	MS21399-2	SW-W-D- 0.12	0.12	42	25	460	.090	1630	>1630
	MS21399-3	SW-W-D- 0.15	0.15	42	25	400	.098	1550	>1550
	MS21399-4	SW-W-D- 0.18	0.18	42	25	360	.117	1420	>1420
	MS21399-5	SW-W-D- 0.22	0.22	42	25	340	.141	1330	>1330
	MS21399-6	SW-W-D- 0.27	0.27	42	25	320	.157	1230	>1230
	MS21399-7	SW-W-D- 0.33	0.33	42	25	295	.178	1140	>1140
	MS21399-8	SW-W-D- 0.39	0.39	42	25	275	.208	1060	>1060
	MS21399-9	SW-W-D- 0.47	0.47	41	25	250	.257	960	> 960
	MS21399-10	SW-W-D- 0.56	0.56	39	25	238	.283	915	> 915
	MS21399-11	SW-W-D- 0.68	0.68	36	25	224	.337	840	> 840
	MS21399-12	SW-W-D- 0.82	0.82	35	25	205	.470	720	> 720
IRON	MS21400-1	SW-W-D- 1.0	1.0	38	25	135	.170	1180	>1180
	MS21400-2	SW-W-D- 1.2	1.2	38	7.9	124	.190	1150	>1150
	MS21400-3	SW-W-D- 1.5	1.5	38	7.9	114	.212	1050	>1050
	MS21400-4	SW-W-D- 1.8	1.8	38	7.9	105	.242	990	> 990
	MS21400-5	SW-W-D- 2.2	2.2	38	7.9	95	.263	950	> 950
	MS21400-6	SW-W-D- 2.7	2.7	38	7.9	85	.320	880	> 880
	MS21400-7	SW-W-D- 3.3	3.3	38	7.9	78	.345	820	> 820
	MS21400-8	SW-W-D- 3.9	3.9	42	7.9	74	.411	755	> 755
	MS21400-9	SW-W-D- 4.7	4.7	42	7.9	68	.562	650	> 650
	MS21400-10	SW-W-D- 5.6	5.6	42	7.9	62	.742	565	> 565
	MS21400-11	SW-W-D- 6.8	6.8	45	7.9	55	1.00	485	> 485
	MS21400-12	SW-W-D- 8.2	8.2	47	7.9	51	1.20	440	> 440
	MS21400-13	SW-W-D- 10	10	51	7.9	45	1.84	355	> 335
	MS21400-14	SW-W-D- 12	12	51	2.5	41	2.60	300	> 300
FERRITE "T" LEAD	MS21401-1	SW-W-D- 15	15	45	2.5	48	.635	610	200
	MS21401-2	SW-W-D- 18	18	45	2.5	44	.728	570	175
	MS21401-3	SW-W-D- 22	22	45	2.5	37	.825	530	160
	MS21401-4	SW-W-D- 27	27	45	2.5	32	.950	500	155
	MS21401-5	SW-W-D- 33	33	46	2.5	30	1.26	430	150
	MS21401-6	SW-W-D- 39	39	46	2.5	27	1.42	405	145
	MS21401-7	SW-W-D- 47	47	46	2.5	23	1.72	370	140
	MS21401-8	SW-W-D- 56	56	48	2.5	21	2.03	340	130
	MS21401-9	SW-W-D- 68	68	48	2.5	18.5	2.29	320	120
	MS21401-10	SW-W-D- 82	82	46	2.5	17.0	2.55	305	115
	MS21401-11	SW-W-D- 100	100	46	2.5	15.5	2.92	280	100
	MS21401-12	SW-W-D- 120	120	53	0.79	14.5	3.30	235	80
	MS21401-13	SW-W-D- 150	150	53	0.79	13.0	4.30	215	68
	MS21401-14	SW-W-D- 180	180	53	0.79	11.5	5.40	200	64
	MS21401-15	SW-W-D- 220	220	55	0.79	10.0	6.65	150	60
	MS21401-16	SW-W-D- 270	270	57	0.79	9.50	7.60	140	58
	MS21401-17	SW-W-D- 330	330	57	0.79	8.50	8.50	130	56
	MS21401-18	SW-W-D- 390	390	57	0.79	8.00	10.0	120	54
	MS21401-19	SW-W-D- 470	470	57	0.79	7.20	13.5	100	52
	MS21401-20	SW-W-D- 560	560	61	0.79	6.40	14.5	95	50
	MS21401-21	SW-W-D- 680	680	61	0.79	5.80	16.0	90	48
	MS21401-22	SW-W-D- 820	820	58	0.79	5.30	19.0	85	47
	MS21401-23	SW-W-D- 1000	1000	58	0.79	4.80	21.5	80	45
	MS21401-24	SW-W-D- 1200	1200	55	0.25	2.90	23	100	40
	MS21401-25	SW-W-D- 1500	1500	55	0.25	2.80	30	90	35
	MS21401-26	SW-W-D- 1800	1800	55	0.25	2.60	33	86	32
	MS21401-27	SW-W-D- 2200	2200	55	0.25	2.55	40	78	30
	MS21401-28	SW-W-D- 2700	2700	55	0.25	2.40	43	74	28
	MS21401-29	SW-W-D- 3300	3300	55	0.25	2.00	58	65	26
	MS21401-30	SW-W-D- 3900	3900	55	0.25	1.95	76	56	23
	MS21401-31	SW-W-D- 4700	4700	55	0.25	1.85	85	53	20
	MS21401-32	SW-W-D- 5600	5600	55	0.25	1.75	100	48	18
	MS21401-33	SW-W-D- 6800	6800	50	0.25	1.58	127	43	15
	MS21401-34	SW-W-D- 8200	8200	50	0.25	1.55	150	40	12
	MS21401-35	SW-W-D-10,000	10,000	50	0.25	1.45	190	37	10

*INCREMENTAL CURRENT — The D.C. current to cause a 5% reduction in the nominal inductance value.

Nytronics Components Group, Inc.
700 ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE WD INDUCTORS

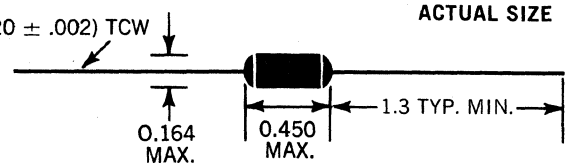
WEE-DUCTOR

Miniature Shielded Inductor with high inductance-to-size ratio. 0.10uH to 180,000uH in 76 values

The **WEE-DUCTOR** was the first miniature shielded inductor that Nytronics standardized for stock delivery. This encapsulated non-flammable shielded unit in a 0.164" diameter by 0.450" long envelope offers the design engineer extremely high inductance for density packaging.

GRADE 2 CLASS B

ACTUAL SIZE



ELECTRICAL CHARACTERISTICS

Inductance Tolerance: 0.1uH to 22uH ±10% (Q-Meter); 27uH to 1,000uH ±5% (1KC Bridge); 1,200uH to 56,000uH ±10% (1KC Bridge) 68,000uH to 180,000uH ±20% (1KC Bridge) measured at point on leads ¼ inch from body.

Dielectric Strength: 700 volts RMS at sea level.

Self-Resonant Frequency: Minimum SRF measured with full length leads on Grid DIP Meter.

Q: Measured on Q-Meter.

Maximum Current: Based on temperature rise not to exceed 40°C at 85°C ambient.

DENSITY CHARACTERISTICS

Volume: 0.0087 cubic inches **Weight:** 0.75 grams maximum
Shielding: Less than 3% coupling with two units measured side by side at 1000 cycles.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: —55°C to +125°C.
Terminal Strength: Meets five pound pull test; five 360° rotations in alternate directions per MIL-C-15305B.
Marking: Printed with pertinent data.

Note: L & Q are not always tested at the same frequency.

NCG Part No.	L µH	Q Min.	MHz	Min. SRF MHz	Max. DCR Ω	Max. I mA	Incr.* I mA	Material
WEE- 0.10	0.10	63	25	487	0.020	4000	4000	PHENOLIC
WEE- 0.12	0.12	61	25	442	0.029	3350	3350	
WEE- 0.15	0.15	59	25	402	0.032	3000	3000	
WEE- 0.18	0.18	57	25	366	0.040	2850	2850	
WEE- 0.22	0.22	56	25	331	0.045	2700	2700	
WEE- 0.27	0.27	50	25	298	0.08	2000	2000	
WEE- 0.33	0.33	48	25	270	0.09	1900	1900	
WEE- 0.39	0.39	48	25	248	0.16	1420	1420	
WEE- 0.47	0.47	48	25	226	0.17	1400	1400	
WEE- 0.56	0.56	45	25	206	0.36	960	960	
WEE- 0.68	0.68	45	25	188	0.37	940	940	
WEE- 0.82	0.82	41	25	171	0.46	870	870	
WEE- 1.0	1.0	42	7.9	131	0.062	2300	2300	IRON
WEE- 1.2	1.2	43	7.9	120	0.067	2200	2200	
WEE- 1.5	1.5	41	7.9	108	0.16	1420	1420	
WEE- 1.8	1.8	42	7.9	99	0.17	1370	1370	
WEE- 2.2	2.2	42	7.9	90	0.19	1300	1300	
WEE- 2.7	2.7	41	7.9	86	0.20	1270	1270	
WEE- 3.3	3.3	40	7.9	73	0.31	1030	1030	
WEE- 3.9	3.9	40	7.9	68	0.33	1000	1000	
WEE- 4.7	4.7	40	7.9	61	0.58	750	750	
WEE- 5.6	5.6	40	7.9	56	0.64	710	710	
WEE- 6.8	6.8	40	7.9	51	0.68	680	680	
WEE- 8.2	8.2	45	7.9	46	1.3	500	500	
WEE- 10	10	46	2.5	42	1.4	480	480	
WEE- 12	12	47	2.5	38	1.5	460	460	
WEE- 15	15	47	2.5	34	1.7	440	440	
WEE- 18	18	45	2.5	43	0.88	610	235	FERRITE
WEE- 22	22	47	2.5	38	0.95	590	220	
WEE- 27	27	42	2.5	35	1.15	530	200	
WEE- 33	33	43	2.5	32	1.2	520	193	
WEE- 39	39	45	2.5	30	1.6	450	183	
WEE- 47	47	46	2.5	26	1.8	420	177	
WEE- 56	56	40	2.5	24	2.2	390	170	
WEE- 68	68	40	2.5	22	2.3	375	165	
WEE- 82	82	42	2.5	14	2.4	360	160	
WEE-100	100	63	.79	12	2.6	345	157	
WEE-120	120	62	.79	11	2.9	330	145	

NCG Part No.	L µH	Q Min.	MHz	Min. SRF MHz	Max. DCR Ω	Max. I mA	Incr.* I mA	Material
WEE- 150	150	63	.79	10	3.3	315	126	FERRITE
WEE- 180	180	60	.79	9.2	3.6	300	110	
WEE- 220	220	57	.79	8.8	4.1	280	105	
WEE- 270	270	52	.79	8.0	4.8	260	91	
WEE- 330	330	50	.79	7.2	5.6	240	87	
WEE- 390	390	43	.79	6.8	6.2	230	72	
WEE- 470	470	66	.79	6.4	10.0	180	67	
WEE- 560	560	64	.79	6.0	11.5	170	65	
WEE- 680	680	71	.79	5.2	12.0	160	60	
WEE- 820	820	67	.79	4.8	13.8	150	55	
WEE- 1000	1000	62	.79	4.5	16.0	140	52	
WEE- 1200	1200	52	.250	1.3	18.2	135	50	
WEE- 1500	1500	51	.250	1.2	23.7	118	48	
WEE- 1800	1800	51	.250	1.1	30.2	105	42	
WEE- 2200	2200	50	.250	1.0	33.7	99	37	
WEE- 2700	2700	51	.250	.94	43.1	87	33	
WEE- 3300	3300	52	.250	.84	48.7	82	30	
WEE- 3900	3900	48	.250	.77	62.7	72	29	
WEE- 4700	4700	48	.250	.67	70.5	68	28	
WEE- 5600	5600	48	.250	.65	104	56	24	
WEE- 6800	6800	45	.250	.59	118	53	20	
WEE- 8200	8200	38	.250	.46	146	47	18	
WEE- 10,000	10,000	36	.079	.38	76.6	66	15	
WEE- 12,000	12,000	36	.079	.30	109	55	14	
WEE- 15,000	15,000	38	.079	.26	119	52	13	
WEE- 18,000	18,000	38	.079	.24	138	49	13	
WEE- 22,000	22,000	32	.079	.23	219	39	12	
WEE- 27,000	27,000	32	.079	.22	259	35	12	
WEE- 33,000	33,000	32	.079	.20	296	33	11	
WEE- 39,000	39,000	30	.079	.17	395	29	10	
WEE- 47,000	47,000	25	.079	.16	452	27	9	
WEE- 56,000	56,000	25	.079	.15	499	26	8	
WEE- 68,000	68,000	20	.079	.12	395	29	1.1	
WEE- 82,000	82,000	20	.079	.10	452	27	1.1	
WEE-100,000	100,000	20	.079	.09	499	26	1.1	
WEE-120,000	120,000	20	.070	.08	540	23	1.1	
WEE-150,000	150,000	20	.060	.07	750	20	1.0	
WEE-180,000	180,000	20	.050	.07	880	18	0.8	

* INCREMENTAL CURRENT — The D.C. current to cause a 5% reduction in the nominal inductance value.

Nytronics Components Group, Inc.
700 ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

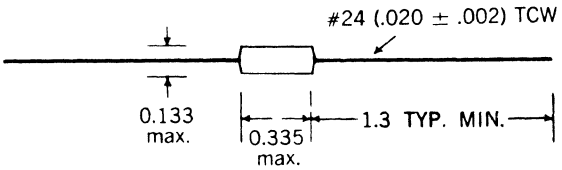
TYPE WWD INDUCTORS

WEE-WEE-DUCTOR SERIES

GRADE 2 CLASS B

The **WEE-WEE-DUCTOR** offers the Design Engineer a subminiature shielded inductor to solve special problems in density circuit application. This shielded inductor has great inductance-to-size ratio.

0.10 to 1,000uH
0.133" diameter x 0.335" length
49 stock values



ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% (Q-Meter).

Dielectric Strength: 700 volts RMS at sea level.

Self-Resonant Frequency: Minimum SRF measured with full length leads on Grid-Dip Meter.

Rating: I maximum based on ⅓ watt dissipation.

DENSITY CHARACTERISTICS

Volume: 0.0041 cubic inches.

Weight: 0.50 grams maximum.

Shielding: Less than 3% coupling with two units mounted side by side at 1000 cycles.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +125°C.

Terminal Strength: Meets five pound pull test; five 360° rotations in alternate directions per MIL-C-15305 (latest revision).

Marking: Color coded per MIL-C-15305 (latest revision)

WEE-WEE-DUCTOR STANDARD VALUES

NCG Part No.	L µH	Q Min.		Min. SRF MHz	Max. DCR Ω	Max. I mA	Incr.* I mA	Material
WEE-WEE- 0.10	0.10	42	25	>400	.112	1720	>1720	PHENOLIC
WEE-WEE- 0.12	0.12	42	25	>400	.126	1630	>1630	
WEE-WEE- 0.15	0.15	42	25	>400	.138	1550	>1550	
WEE-WEE- 0.18	0.18	42	25	366	.165	1420	>1420	
WEE-WEE- 0.22	0.22	42	25	331	.198	1330	>1330	
WEE-WEE- 0.27	0.27	42	25	298	.220	1230	>1230	
WEE-WEE- 0.33	0.33	42	25	288	.258	1140	>1140	
WEE-WEE- 0.39	0.39	42	25	271	.292	1060	>1060	
WEE-WEE- 0.47	0.47	41	25	247	.360	960	> 960	
WEE-WEE- 0.56	0.56	39	25	236	.397	915	> 915	
WEE-WEE- 0.68	0.68	36	25	216	.472	840	> 840	
WEE-WEE- 0.82	0.82	35	25	200	.638	720	> 720	
WEE-WEE- 1.0	1.0	42	25	136	.208	1260	>1260	IRON
WEE-WEE- 1.2	1.2	38	7.9	120	.225	1210	>1210	
WEE-WEE- 1.5	1.5	38	7.9	111	.265	1120	>1120	
WEE-WEE- 1.8	1.8	38	7.9	103	.285	1080	>1080	
WEE-WEE- 2.2	2.2	36	7.9	94	.330	1000	>1000	
WEE-WEE- 2.7	2.7	38	7.9	85	.381	935	> 935	
WEE-WEE- 3.3	3.3	38	7.9	78	.432	875	> 875	
WEE-WEE- 3.9	3.9	40	7.9	73	.576	755	> 755	
WEE-WEE- 4.7	4.7	42	7.9	66	.787	650	> 650	
WEE-WEE- 5.6	5.6	42	7.9	62	1.04	565	> 565	
WEE-WEE- 6.8	6.8	45	7.9	54	1.40	485	> 485	
WEE-WEE- 8.2	8.2	47	7.9	50	1.68	440	> 440	
WEE-WEE- 10	10	51	7.9	44	2.58	355	> 355	
WEE-WEE- 12	12	51	2.5	39	3.65	300	> 300	
WEE-WEE- 15	15	45	2.5	44	.862	620	200	FERRITE
WEE-WEE- 18	18	43	2.5	40	1.02	570	175	
WEE-WEE- 22	22	42	2.5	36	1.12	545	160	
WEE-WEE- 27	27	37	2.5	33	1.28	510	155	
WEE-WEE- 33	33	46	2.5	30	1.70	440	150	
WEE-WEE- 39	39	38	2.5	26	1.99	405	145	
WEE-WEE- 47	47	42	2.5	23	2.41	370	140	
WEE-WEE- 56	56	41	2.5	22	2.85	340	130	
WEE-WEE- 68	68	46	2.5	18	3.21	320	120	
WEE-WEE- 82	82	46	2.5	17	3.57	305	115	
WEE-WEE- 100	100	43	2.5	15	4.10	280	100	
WEE-WEE- 120	120	50	0.79	13	5.97	235	80	
WEE-WEE- 150	150	49	0.79	12	7.05	215	68	
WEE-WEE- 180	180	56	0.79	11	8.12	200	64	
WEE-WEE- 220	220	53	0.79	10	14.8	150	60	
WEE-WEE- 270	270	57	0.79	9	16.8	140	58	
WEE-WEE- 330	330	57	0.79	8.5	18.6	130	56	
WEE-WEE- 390	390	57	0.79	8	21.1	120	54	
WEE-WEE- 470	470	50	0.79	7	32.2	100	52	
WEE-WEE- 560	560	50	0.79	6	36.4	95	50	
WEE-WEE- 680	580	56	0.79	5.5	41.1	90	48	
WEE-WEE- 820	820	49	0.79	5	45.0	85	47	
WEE-WEE-1000	1000	49	0.79	4.5	52.0	80	45	

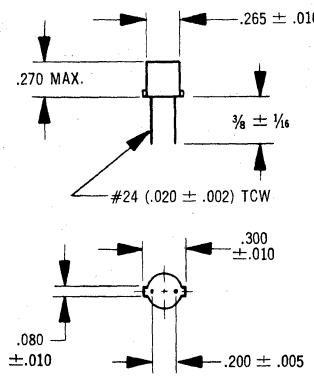
* INCREMENTAL CURRENT — The D.C. current to cause a 5% reduction in the nominal inductance value.

Nytronics Components Group, Inc.
700 ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE PC INDUCTORS

The PEE-CEE is designed to meet MIL-C-15305 (latest revision), Grade 1, Class B. Printed board mounting is facilitated by 0.200 grid spacing and unit has shielded construction to allow maximum density packaging. Standardized in 73 stock values.

Subminiature Shielded **Radial Lead Fixed Inductor**
High Q Values **0.10 to 100,000uH**
Unitized Epoxy-Molded Construction



All dimensions in inches

ELECTRICAL CHARACTERISTICS

Inductance: ±10% over entire range as measured per MIL-C-15305 (latest revision).

Q and SRF Values: Minimum not less than 80% of specified value

Dielectric Strength: 840 Volts R.M.S. at sea level.

Working Voltage: 300 Volts D.C.

Maximum Current: Based on temperature rise not to exceed 35°C at 90°C ambient.

Incremental Current: Defined as the DC current required to cause a five percent reduction in the nominal inductance value.

DENSITY CHARACTERISTICS

Weight: 1.5 grams maximum

Volume: .015 cubic inches

Shielding: 3% coupling maximum when two units are tested side by side.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +125°C.

Moisture, Vibration, and Shock Resistance: Meet requirements of MIL-C-15305 (latest revision). Low frequency 10 to 55 cps @ .06" maximum total excursion at rate of 1 linear sweep per minute for 2 hours repeated for each of three mutually perpendicular planes. Shock: 100G, 6 MS (body mounted)

Marking: Manufacturer data printed.

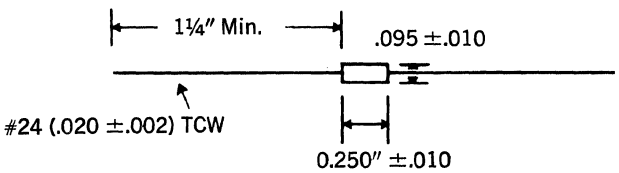
Terminal Pull: Three pounds.

NCG Part No.	L	Test Freq.	Q nom.	SRF nom.	D. C. R. Max.	Max. I	Incr. I
	μh	MHz		MHz	ohms	m.a.	m.a.
PC 0.10	.10	25	70	>250	0.030	2500	2500
PC 0.12	.12	25	70	>250	0.030	2500	2500
PC 0.15	.15	25	70	>250	0.030	2500	2500
PC 0.18	.18	25	70	>250	0.035	2400	2400
PC 0.22	.22	25	70	>250	0.038	2300	2300
PC 0.27	.27	25	80	>250	0.040	2200	2200
PC 0.33	.33	25	80	>250	0.040	2200	2200
PC 0.39	.39	25	80	250	0.045	2100	2100
PC 0.47	.47	25	80	230	0.045	2100	2100
PC 0.56	.56	25	80	220	0.050	2000	2000
PC 0.68	.68	25	80	190	0.055	1900	1900
PC 0.82	.82	25	85	180	0.060	1800	1800
PC 1.00	1.00	25	85	160	0.070	1700	1700
PC 1.2	1.2	7.9	90	170	0.085	1670	1670
PC 1.5	1.5	7.9	100	155	0.100	1540	1540
PC 1.8	1.8	7.9	115	135	0.110	1470	1470
PC 2.2	2.2	7.9	110	120	0.120	1410	1410
PC 2.7	2.7	7.9	110	104	0.125	1380	1380
PC 3.3	3.3	7.9	90	93.0	0.165	1200	1200
PC 3.9	3.9	7.9	90	87.0	0.180	1135	1135
PC 4.7	4.7	7.9	95	79.0	0.245	985	985
PC 5.6	5.6	7.9	95	72.0	0.265	950	950
PC 6.8	6.8	7.9	85	63.0	0.330	853	853
PC 8.2	8.2	7.9	95	60.0	0.460	720	720
PC 10	10	7.9	90	54.0	0.640	620	620
PC 12	12	2.5	120	37.0	0.800	545	545
PC 15	15	2.5	120	28.8	0.865	520	520
PC 18	18	2.5	115	23.8	0.940	504	504
PC 22	22	2.5	125	21.3	1.03	460	460
PC 27	27	2.5	115	20.6	1.18	418	418
PC 33	33	2.5	120	18.6	1.30	398	398
PC 39	39	2.5	120	17.7	1.41	385	385
PC 47	47	2.5	110	14.9	1.61	350	350
PC 56	56	2.5	115	13.9	2.08	330	330
PC 68	68	2.5	105	12.9	2.20	320	320
PC 82	82	2.5	105	11.7	2.42	300	300
PC 100	100	2.5	95	10.5	2.15	333	333
PC 120	120	0.790	95	5.60	2.38	316	190
PC 150	150	0.790	90	5.20	2.52	306	175
PC 180	180	0.790	95	4.90	2.88	288	150
PC 220	220	0.790	95	4.60	3.18	273	125
PC 270	270	0.790	100	4.20	3.50	260	120
PC 330	330	0.790	100	3.55	4.80	222	110
PC 390	390	0.790	100	3.45	5.44	209	105
PC 470	470	0.790	100	3.20	5.90	201	100
PC 560	560	0.790	95	2.90	6.30	194	90
PC 680	680	0.790	100	2.70	7.20	181	80
PC 820	820	0.790	90	2.50	8.00	172	70
PC 1,000	1,000	0 790	100	2.35	12.0	141	65
PC 1,200	1,200	0.250	95	2.20	13.5	132	60
PC 1,500	1,500	0.250	90	1.90	16.5	119	55
PC 1,800	1,800	0.250	100	1.80	18.0	114	47
PC 2,200	2,200	0.250	100	1.70	20.5	107	43
PC 2,700	2,700	0.250	95	1.50	22.5	102	39
PC 3,300	3,300	0.250	90	1.40	42.0	76	36
PC 3,900	3,900	0.250	85	1.27	47.5	71	35
PC 4,700	4,700	0.250	85	1.24	53.0	67	34
PC 5,600	5,600	0.250	85	0.93	62.5	65	31
PC 6,800	6,800	0.250	75	0.79	69.5	58	27
PC 8,200	8,200	0.250	80	0.75	75.0	56	26
PC 10,000	10,000	0.250	70	0.70	100.0	49	24
PC 12,000	12,000	0.079	70	.50	64	60	40
PC 15,000	15,000	0.079	70	.38	84	52	34
PC 18,000	18,000	0.079	70	.36	93	50	30
PC 22,000	22,000	0.079	70	.32	104	45	28
PC 27,000	27,000	0.079	70	.30	173	35	26
PC 33,000	33,000	0.079	70	.27	187	32	24
PC 39,000	39,000	0.079	70	.26	220	30	22
PC 47,000	47,000	0.079	70	.25	253	28	20
PC 56,000	56,000	0.079	70	.24	285	26	19
PC 68,000	68,000	0.079	60	.20	311	24	18
PC 82,000	82,000	0.079	60	.19	385	22	16
PC 100,000	100,000	0.079	60	.17	420	20	15

Nytronics Components Group, Inc.
700 ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE SDD INDUCTORS

SDD
MOLDED SHIELDED INDUCTOR
GRADE 1 CLASS A



ALL DIMENSIONS IN INCHES

The **SDD INDUCTOR SERIES** are R.F. Inductors specifically designed to meet the demanding requirements of MIL-C-15305 (latest revision). The SDD INDUCTOR Series epoxy molded envelope and shielding offers the design engineer reliability, electrical performance, and minimum coupling in high density packaging.

ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% over the entire inductance range.

Dielectric Strength: 300 volts RMS at sea level.

Self-Resonant Frequency: Measured per MIL-C-15305 (latest revision).

Q: Measured on a Q-Meter.

Maximum Current: Based on temperature rise not to exceed 15°C at 90°C ambient.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +105°C.

Terminal Strength: Meets three pound pull test; five 360° rotations in alternate directions per MIL-C-15305 (latest revision).

Moisture, Vibration, and Shock Resistance: Meets requirements or MIL-C-15305 (latest revision), 10 cps to 2000 cps @ 15 G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 50G, 11 MS.

Marking: Color coded per MIL-C-15305 (latest revision).

DENSITY CHARACTERISTICS

Volume: 0.002 cubic inches **Weight:** 0.35 grams

NCG Part No.	L	Q. Min		Min. SRF	Max. DCR	Max. I	Incr. † I
	μH		MHz	MHz	Ohms	mA	mA
SDD- 0.10	0.10	40	25	400	.10	1500	*
SDD- 0.12	0.12	40	25	384	.11	1400	*
SDD- 0.15	0.15	40	25	360	.12	1300	*
SDD- 0.18	0.18	40	25	344	.13	1200	*
SDD- 0.22	0.22	40	25	312	.15	1100	*
SDD- 0.27	0.27	40	25	272	.16	1000	*
SDD- 0.33	0.33	40	25	248	.18	950	*
SDD- 0.39	0.39	40	25	224	.19	900	*
SDD- 0.47	0.47	40	25	200	.21	800	*
SDD- 0.56	0.56	40	25	176	.25	750	*
SDD- 0.68	0.68	35	25	160	.27	700	*
SDD- 0.82	0.82	35	25	144	.36	600	*
SDD- 1.00	1.00	35	25	132	.40	525	*
SDD- 1.20	1.20	35	7.9	120	.73	425	*
SDD- 1.50	1.50	35	7.9	104	.86	400	*
SDD- 1.80	1.80	35	7.9	96	.95	350	*
SDD- 2.20	2.20	35	7.9	88	1.30	320	*
SDD- 2.70	2.70	35	7.9	80	1.80	275	*
SDD- 3.30	3.30	35	7.9	56	1.70	290	*
SDD- 3.90	3.90	35	7.9	52	1.80	275	*
SDD- 4.70	4.70	35	7.9	46	2.60	225	*
SDD- 5.60	5.60	35	7.9	43	2.90	210	*
SDD- 6.80	6.80	35	7.9	40	3.30	200	*
SDD- 8.20	8.20	35	7.9	38	4.50	170	*
SDD- 10.0	10.0	35	7.9	36	4.80	165	*
SDD- 12.0	12.0	35	2.5	32	3.00	250	230
SDD- 15.0	15.0	35	2.5	29	3.40	230	180
SDD- 18.0	18.0	35	2.5	25	3.80	195	150
SDD- 22.0	22.0	35	2.5	22	4.90	170	135
SDD- 27.0	27.0	35	2.5	20	5.80	160	115
SDD- 33.0	33.0	35	2.5	18	6.50	150	105
SDD- 39.0	39.0	35	2.5	17	7.90	140	100
SDD- 47.0	47.0	35	2.5	17	9.30	135	95
SDD- 56.0	56.0	35	2.5	15	11	130	90
SDD- 68.0	68.0	35	2.5	14	12	120	83
SDD- 82.0	82.0	35	2.5	13	14	95	65
SDD- 100	100	35	2.5	11	16	90	70
SDD- 120	120	35	.79	7.6	10	115	40
SDD- 150	150	35	.79	7.0	12	105	35
SDD- 180	180	35	.79	6.5	15	90	32
SDD- 220	220	35	.79	6.2	20	80	30
SDD- 270	270	35	.79	5.8	23	75	27
SDD- 330	330	35	.79	5.4	26	70	25
SDD- 390	390	35	.79	4.8	35	65	23
SDD- 470	470	35	.79	4.5	37	60	21
SDD- 560	560	35	.79	4.0	40	58	20
SDD- 680	680	35	.79	3.4	48	54	18
SDD- 820	820	35	.79	3.0	54	47	17
SDD-1000	1000	35	.79	2.8	65	43	15

* GREATER THAN MAX. CURRENT.

† INCREMENTAL CURRENT: The D.C. current required to cause a 5% reduction in the nominal inductance value.

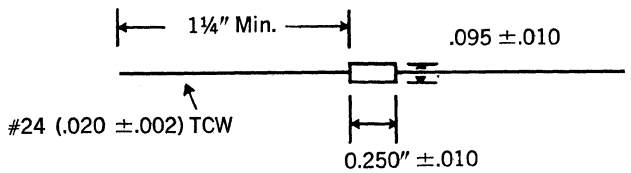
Nytronics Components Group, Inc.
700 ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE DD INDUCTORS

DECI-DUCTOR

New Subminiature Inductor 0.10uH to 1000uH Range
0.100" diameter by 0.250" length 49 STANDARD VALUES

The **DECI-DUCTOR** offers the design engineer epoxy-molded reliability and uniformity in a subminiature R.F. Inductor. This Nytronics R.F. Inductor line is designed to meet all the environmental specifications of MIL-C-15305 (latest revision).



GRADE 1 CLASS B

ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% over entire range.
Dielectric Strength: 700 volts RMS at sea level.
Self-Resonant Frequency: Measured per MIL-C-15305 (latest revision).
Rating: Maximum Current based on 35°C rise in 90°C ambient.

DENSITY CHARACTERISTICS

Volume: 0.002 cubic inches **Weight:** 0.35 grams

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: —55°C to +125°C

Terminal Strength: Meets three pound pull test; five 360° rotations in alternate directions per MIL-C-15305 (latest revision).

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision), 10 cps to 2000 cps @ 15 G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 50G, 11 MS.

Marking: Color coded per MIL-C-15305 (latest revision).

	NCG Part No.	L uH	Q Min.	MHz	Min. SRF MHz	Max. DCR Ohms	Max I. mA
PHENOLIC	DD-0.10	0.10	40	25	690	0.07	2000
	DD-0.12	0.12	40	25	650	0.08	1900
	DD-0.15	0.15	38	25	600	0.09	1750
	DD-0.18	0.18	38	25	550	0.10	1600
	DD-0.22	0.22	35	25	510	0.11	1550
	DD-0.27	0.27	35	25	470	0.15	1350
	DD-0.33	0.33	32	25	410	0.21	1150
	DD-0.39	0.39	32	25	370	0.29	970
	DD-0.47	0.47	32	25	340	0.35	820
	DD-0.56	0.56	32	25	310	0.48	700
	DD-0.68	0.68	33	25	280	0.65	600
	DD-0.82	0.82	30	25	255	0.82	500
	DD-1.00	1.00	30	25	240	1.10	475
IRON	DD-1.20	1.20	30	7.9	155	0.16	1200
	DD-1.50	1.50	32	7.9	140	0.20	1100
	DD-1.80	1.80	35	7.9	130	0.32	900
	DD-2.20	2.20	35	7.9	120	0.37	760
	DD-2.70	2.70	37	7.9	105	0.49	700
	DD-3.30	3.30	45	7.9	95	0.67	575
	DD-3.90	3.90	45	7.9	87	0.95	500
	DD-4.70	4.70	45	7.9	80	1.10	475
	DD-5.60	5.60	52	7.9	75	1.60	380
	DD-6.80	6.80	52	7.9	65	1.80	350
	DD-8.20	8.20	60	7.9	62	2.40	300
	DD-10.0	10.0	60	7.9	52	3.40	265
	DD-12.0	12.0	45	2.5	42	2.40	300
	DD-15.0	15.0	47	2.5	36	2.70	275
	DD-18.0	18.0	50	2.5	32	3.00	260
	DD-22.0	22.0	50	2.5	28	3.30	250
	DD-27.0	27.0	50	2.5	25	3.80	240
FERRITE	DD-33.0	33.0	50	2.5	30	3.80	260
	DD-39.0	39.0	50	2.5	26	4.10	240
	DD-47.0	47.0	50	2.5	24	4.40	210
	DD-56.0	56.0	50	2.5	22	5.70	205
	DD-68.0	68.0	52	2.5	19	6.50	180
	DD-82.0	82.0	52	2.5	17	7.30	175
	DD-100	100	50	2.5	15	8.20	165
	DD-120	120	28	0.79	14	14	110
	DD-150	150	28	0.79	13	16	105
	DD-180	180	28	0.79	12	18	100
	DD-220	220	26	0.79	11	25	90
	DD-270	270	26	0.79	10	33	75
	DD-330	330	26	0.79	9.0	37	70
	DD-390	390	25	0.79	8.0	51	60
	DD-470	470	27	0.79	7.0	56	58
	DD-560	560	27	0.79	6.5	61	55
	DD-680	680	28	0.79	6.0	70	50
	DD-820	820	28	0.79	5.5	91	45
	DD-1000	1000	28	0.79	5.2	102	40

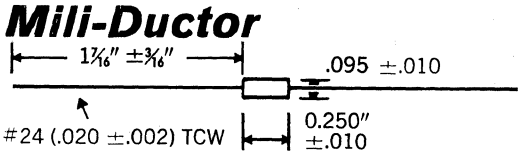
Nytronics Components Group, Inc.
700 ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE MD INDUCTORS

—MS INDUCTOR SERIES 75083, 75084, 75085 MOLDED INDUCTOR/0.100 uH to 1000 uH

Markings: Color coded per MIL-C-15305 (Latest Rev.)

The MS Inductor Series are RF Inductors specifically designed to meet the demanding requirements of MIL-C-15305 (latest revision). This MS Series is Epoxy Molded enveloped features reliability and uniformity in a Subminiature Inductor.



ELECTRICAL CHARACTERISTICS
Inductance Tolerance: ±10% over entire range.
Dielectric Strength: 1000 volts RMS at sea level.
Self-Resonant Frequency: Measured per MIL-C-15305 (latest revision).
Rating: Maximum current based on; 35°C rise in 90° ambient for phenolic, 15°C rise in 90° ambient for iron and ferrite core inductors.

DENSITY CHARACTERISTICS
Volume: 0.002 cubic inches; **Weight:** 0.30 grams.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS
Operating Temperature: —55°C to +125°C phenolic core, —55°C to +105°C iron and ferrite core.
Terminal Strength: Meets five pound pull test; five 360° rotations in alternate directions per MIL-C-15305 (latest revision).
Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision), 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 100G, 6 MS.

MS No.	NCG Part No.	Inductance uh	Q Min.	Test Frequency (L & Q) MHz	Self-resonant Frequency, Min. MHz	DC Resistance Max. Ohms	Rated DC Current MA	Material
MS75083-1	MD	.10	40	25.0	680	.08	1350	PHENOLIC
MS75083-2	MD	.12	40	25.0	640	.09	1270	
MS75083-3	MD	.15	38	25.0	600	.10	1200	
MS75083-4	MD	.18	35	25.0	550	.12	1105	
MS75083-5	MD	.22	33	25.0	510	.14	1025	
MS75083-6	MD	.27	33	25.0	430	.16	960	
MS75083-7	MD	.33	30	25.0	410	.22	815	
MS75083-8	MD	.39	30	25.0	365	.30	700	
MS75083-9	MD	.47	30	25.0	330	.35	650	
MS75083-10	MD	.56	30	25.0	300	.50	545	
MS75083-11	MD	.68	28	25.0	275	.60	495	
MS75083-12	MD	.82	28	25.0	250	.85	415	
MS75083-13	MD	1.00	25	25.0	230	1.00	385	
MS75084-1	MD	1.2	25	7.9	150	.18	590	IRON
MS75084-2	MD	1.5	28	7.9	140	.22	535	
MS75084-3	MD	1.8	30	7.9	125	.30	455	
MS75084-4	MD	2.2	30	7.9	115	.40	395	
MS75084-5	MD	2.7	37	7.9	100	.55	355	
MS75084-6	MD	3.3	45	7.9	90	.85	270	
MS75084-7	MD	3.9	45	7.9	80	1.00	250	
MS75084-8	MD	4.7	45	7.9	75	1.20	230	
MS75084-9	MD	5.6	50	7.9	65	1.80	185	
MS75084-10	MD	6.8	50	7.9	60	2.00	175	
MS75084-11	MD	8.2	55	7.9	55	2.70	155	
MS75084-12	MD	10	55	7.9	50	3.70	130	
MS75084-13	MD	12	45	2.5	40	2.70	155	
MS75084-14	MD	15	40	2.5	35	2.80	150	
MS75084-15	MD	18	50	2.5	30	3.10	145	
MS75084-16	MD	22	50	2.5	25	3.30	140	
MS75084-17	MD	27	50	2.5	20	3.50	135	
MS75085-1	MD	33	45	2.5	24	3.4	130	FERRITE
MS75085-2	MD	39	45	2.5	22	3.6	125	
MS75085-3	MD	47	45	2.5	20	4.5	110	
MS75085-4	MD	56	45	2.5	18	5.7	100	
MS75085-5	MD	68	50	2.5	15	6.7	92	
MS75085-6	MD	82	50	2.5	14	7.3	88	
MS75085-7	MD	100	50	2.5	13	8	84	
MS75085-8	MD	120	30	.79	12	13	66	
MS75085-9	MD	150	30	.79	11	15	61	
MS75085-10	MD	180	30	.79	10	17	57	
MS75085-11	MD	220	30	.79	9	21	52	
MS75085-12	MD	270	30	.79	8	25	47	
MS75085-13	MD	330	30	.79	7	28	45	
MS75085-14	MD	390	30	.79	6.5	35	40	
MS75085-15	MD	470	30	.79	6	42	36	
MS75085-16	MD	560	30	.79	5	46	35	
MS75085-17	MD	680	30	.79	4	60	30	
MS75085-18	MD	820	30	.79	3.8	65	29	
MS75085-19	MD	1000	30	.79	3.4	72	28	

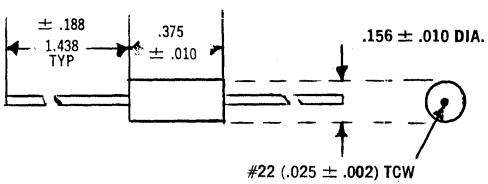
Nytronics Components Group, Inc.
700 ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

**TYPE RFC-SS
MS18130, 14046 & 90538
INDUCTORS**

RFC-SS SERIES

Molded inductors specifically designed to meet MIL-C-15305 (latest revision). Inductance from 0.15 to 240uH.

GRADE 1 CLASS B (0.15-4.7)
CLASS A (5.6-240)



ELECTRICAL CHARACTERISTICS

Inductance Tolerance: 0.15 to 33 uH ±10%
36 to 240 uH ±5%
Measured on Q meter per MIL-C-15305 (latest revision).

Dielectric Strength: 1000 volts RMS @ sea level

Rated Current: Based on max. temp. rise of 35°C (ambient 90°C) for RFC-SS-0.15 to -4.7
15°C (ambient 90°C) for RFC-SS-5.6 to -240

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: Max. 125°C for RFC-SS-0.15 to -4.7
Max. 105°C for RFC-SS-5.6 to -240

Terminal Strength: Meets five pound pull test per MIL-C-15305 (latest revision).

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision), high frequency 10 cps

Marking: Color banded.

MS NO.	NCG* PART NO.	L uH	Q Min.	@ MHz	Min. SRF MHz	Max. DCR Ω	Rated DC Cur. mA	Material
MS18130-1	RFC-SS- .15	0.15	50	25	525	0.03	2450	PHENOLIC
MS18130-2	RFC-SS- .22	0.22	50	25	450	0.05	1900	
MS18130-3	RFC-SS- .33	0.33	45	25	360	0.09	1400	
MS18130-4	RFC-SS- .47	0.47	45	25	310	0.12	1225	
MS18130-5	RFC-SS- .56	0.56	50	25	280	0.13	1220	
MS18130-6	RFC-SS- .68	0.68	50	25	250	0.15	1100	
MS18130-7	RFC-SS- .82	0.82	50	25	220	0.22	900	
MS18130-8	RFC-SS- 1.00	1.00	50	25	200	0.29	830	
MS18130-9	RFC-SS- 1.20	1.20	33	7.9	180	0.42	650	
MS18130-10	RFC-SS- 1.50	1.5	33	7.9	160	0.50	600	
MS18130-11	RFC-SS- 1.80	1.8	33	7.9	150	0.65	525	
MS18130-12	RFC-SS- 2.2	2.2	33	7.9	135	0.95	435	
MS18130-13	RFC-SS- 2.7	2.7	33	7.9	120	1.20	385	
MS18130-14	RFC-SS- 3.3	3.3	33	7.9	110	2.00	300	
MS18130-15	RFC-SS- 3.9	3.9	33	7.9	100	2.30	280	
MS18130-16	RFC-SS- 4.7	4.7	33	7.9	90	2.60	260	
MS14046-1	RFC-SS- 5.6	5.6	45	7.9	60	0.32	750	IRON
MS14046-2	RFC-SS- 6.8	6.8	50	7.9	55	0.50	600	
MS14046-3	RFC-SS- 8.2	8.2	50	7.9	50	0.60	545	
MS14046-4	RFC-SS- 10	10.0	55	7.9	45	0.90	445	
MS14046-5	RFC-SS- 12	12	65	2.5	42	1.10	404	
MS14046-6	RFC-SS- 15	15	65	2.5	40	1.40	370	
MS14046-7	RFC-SS- 18	18	75	2.5	34	2.25	280	
MS14046-8	RFC-SS- 22	22	75	2.5	30	2.50	265	
MS14046-9	RFC-SS- 27	27	60	2.5	25	2.60	260	
MS14046-10	RFC-SS- 33	33	65	2.5	19	3.00	250	
MS90538-1	RFC-SS- 36	36	60	2.5	15.5	2.50	180	
MS90538-2	RFC-SS- 39	39	60	2.5	14.5	2.60	176	
MS90538-3	RFC-SS- 43	43	60	2.5	13.7	2.70	172	
MS90538-4	RFC-SS- 47	47	55	2.5	13.0	2.75	170	
MS90538-5	RFC-SS- 51	51	55	2.5	12.7	2.85	167	
MS90538-6	RFC-SS- 56	56	55	2.5	12.0	3.00	164	
MS90538-7	RFC-SS- 62	62	55	2.5	11.5	3.15	160	
MS90538-8	RFC-SS- 68	68	55	2.5	11.0	3.30	156	
MS90538-9	RFC-SS- 75	75	55	2.5	10.5	3.70	147	
MS90538-10	RFC-SS- 82	82	50	2.5	10.3	3.9	143	
MS90538-11	RFC-SS- 91	91	50	2.5	10.0	4.3	136	
MS90538-12	RFC-SS-100	100	50	2.5	9.5	4.5	133	
MS90538-13	RFC-SS-110	110	60	0.79	8.9	4.9	128	
MS90538-14	RFC-SS-120	120	65	0.79	8.7	5.2	124	
MS90538-15	RFC-SS-130	130	65	0.79	8.5	5.45	121	
MS90538-16	RFC-SS-150	150	65	0.79	8.0	6.05	114	
MS90538-17	RFS-SS-160	160	65	0.79	7.5	6.40	111	
MS90538-18	RFC-SS-180	180	65	0.79	7.0	6.75	108	
MS90538-19	RFC-SS-200	200	65	0.79	6.5	7.10	106	
MS90538-20	RFC-SS-220	220	65	0.79	6.2	7.45	103	
MS90538-21	RFC-SS-240	240	65	0.79	5.9	7.8	101	

* NCG Part No. electricals and tolerances as shown,
MS No. electricals and tolerances per actual MS sheet.

Nytronics Components Group, Inc.
700 ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

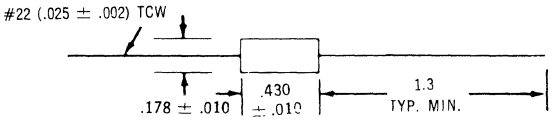
TYPE RFC-S MS21389 & 21390 INDUCTORS

RFC-S SERIES

Proven reliability molded inductors specifically designed to meet MIL-C-15305 (latest revision). Inductance 0.1 to 1000uH.

GRADE 1 CLASS B

ACTUAL SIZE



ELECTRICAL CHARACTERISTICS

Inductance Tolerance: 0.1 uH to 22uH ±10% on Q-Meter
27uH to 100uH ±5%
1,000 cps bridge
120uH to 1000uH ±5% on Q-Meter
Note: L & Q are not always tested at the same frequency. Inductance values that are tested on Q-Meter, are tested at standard test frequencies.

Dielectric Strength: 700 volts RMS at sea level.

Self-Resonant Frequency: Minimum SRF measured with full length leads on Grid-Dip Meter.

Q: Measured on Q-Meter.

Rating: ⅓ watt dissipation for series S

DENSITY CHARACTERISTICS

Volume: 0.012 cu. in.

Weight: 0.90 grams

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +125°C.

Terminal Strength: Meets five pound pull test per MIL-C-15305 (latest revision).

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305 Grade 1, Class B. High frequency 10 cps to 2000 cps @ 30G ±10% maximum for 12 logarithmic swings, each of 20 minute duration repeated for each of three mutually perpendicular planes.

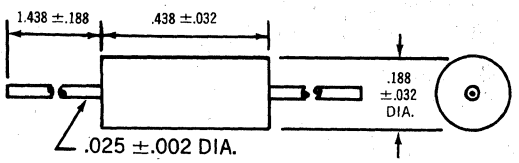
MS NO.	NCG PART NO.*	L uH	Q min		min. SRF MHz	Max. DCR Ω	max. I mA	MATERIAL
				MHz				
MS21389-1	RFC-S- 0.10	0.10	85	50	400	.02	4000	PHENOLIC
MS21389-2	RFC-S- 0.12	0.12	85	50	400	.025	3500	
MS21389-3	RFC-S- 0.15	0.15	85	50	400	.03	3000	
MS21389-4	RFC-S- 0.18	0.18	75	50	400	.03	3000	
MS21389-5	RFC-S- 0.22	0.22	75	50	400	.03	3000	
MS21389-6	RFC-S- 0.27	0.27	70	45	376	.04	2700	
MS21389-7	RFC-S- 0.33	0.33	70	40	352	.05	2500	
MS21389-8	RFC-S- 0.39	0.39	65	40	320	.08	2000	
MS21389-9	RFC-S- 0.47	0.47	60	25	288	.08	2000	
MS21389-10	RFC-S- 0.56	0.56	55	25	264	.10	1700	
MS21389-11	RFC-S- 0.68	0.68	55	25	240	.12	1500	
MS21389-12	RFC-S- 0.82	0.82	50	25	220	.18	1300	
MS21389-13	RFC-S- 1.0	1.0	50	20	200	.24	1100	
MS21389-14	RFC-S- 1.2	1.2	45	20	176	.35	1000	
MS21389-15	RFC-S- 1.5	1.5	45	15	160	.43	850	
MS21389-16	RFC-S- 1.8	1.8	45	15	144	.65	720	
MS21389-17	RFC-S- 2.2	2.2	45	15	132	.80	610	
MS21390-1	RFC-S- 2.7	2.7	55	10	88	.12	1600	IRON
MS21390-2	RFC-S- 3.3	3.3	55	10	80	.15	1400	
MS21390-3	RFC-S- 3.9	3.9	60	10	76	.23	1200	
MS21390-4	RFC-S- 4.7	4.7	70	7.9	72	.30	1000	
MS21390-5	RFC-S- 5.6	5.6	65	7.9	64	.45	900	
MS21390-6	RFC-S- 6.8	6.8	65	7.9	56	.55	800	
MS21390-7	RFC-S- 8.2	8.2	60	7.9	52	.65	720	
MS21390-8	RFC-S- 10	10	60	5	48	.73	650	
MS21390-9	RFC-S- 12	12	65	5	42	1.1	590	
MS21390-10	RFC-S- 15	15	80	2.5	38	1.4	500	
MS21390-11	RFC-S- 18	18	75	2.5	34	1.6	460	
MS21390-12	RFC-S- 22	22	75	2.5	32	1.8	430	
MS21390-13	RFC-S- 27	27	75	2.5	29	2.7	360	
MS21390-14	RFC-S- 33	33	85	2.5	26	3.5	300	
MS21390-15	RFC-S- 39	39	80	2.5	21	3.8	290	
MS21390-16	RFC-S- 47	47	80	2.5	18	4.0	275	
MS21390-17	RFC-S- 56	56	75	2.5	15	4.4	265	
MS21390-18	RFC-S- 68	68	75	2.5	13	4.7	250	
MS21390-19	RFC-S- 82	82	75	2.5	10	5.3	235	
MS21390-20	RFC-S- 100	100	75	1.5	8	6.0	220	
MS21390-21	RFC-S- 120	120	65	0.79	5.7	5.0	170	
MS21390-22	RFC-S- 150	150	65	0.79	5.4	5.8	164	
MS21390-23	RFC-S- 180	180	65	0.79	5.0	6.6	158	
MS21390-24	RFC-S- 220	220	65	0.79	4.7	7.4	155	
MS21390-25	RFC-S- 270	270	65	0.79	4.5	8.0	150	
MS21390-26	RFC-S- 300	300	65	0.79	4.2	8.6	145	
MS21390-27	RFC-S- 330	330	65	0.79	4.0	8.9	142	
MS21390-28	RFC-S- 360	360	65	0.79	3.8	9.6	137	
MS21390-29	RFC-S- 390	390	65	0.79	3.6	9.9	135	
MS21390-30	RFC-S- 430	430	65	0.79	3.4	10.4	131	
MS21390-31	RFC-S- 470	470	65	0.79	3.2	10.9	128	
MS21390-32	RFC-S- 510	510	65	0.79	3.0	11.6	124	
MS21390-33	RFC-S- 560	560	65	0.79	2.9	11.8	123	
MS21390-34	RFC-S- 620	620	60	0.79	2.8	12.5	120	
MS21390-35	RFC-S- 680	680	60	0.79	2.7	13.5	115	
MS21390-36	RFC-S- 750	750	60	0.79	2.6	14.0	113	
MS21390-37	RFC-S- 820	820	60	0.79	2.5	15.0	110	
MS21390-38	RFC-S- 910	910	60	0.79	2.4	15.5	107	
MS21390-39	RFC-S-1000	1000	60	0.79	2.2	16.5	104	

* NCG Part No. electricals and tolerances as shown, MS No. electricals and tolerances per actual MS sheet.

Nytronics Components Group, Inc.
700 ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

**TYPE RFC-S
MS75008, 75101 & 90539
INDUCTORS**

MS-INDUCTOR SERIES 75008-75101-90539 MOLDED INDUCTOR



ALL DIMENSIONS IN INCHES

Proven reliability molded inductors designed to meet MIL-C-15305 (latest revision).
Inductance 0.15 to 1000 uH.

ELECTRICAL CHARACTERISTICS

Inductance Tolerance: 0.15 to 0.47 uH ±20%; 0.56-27 uH ±10%; 270-1000 uH ±5%.
Dielectric Strength: 1000 Volts RMS at sea level
Max. Temp. Rise: 35°C (Class B devices)
15°C (Class A devices)

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +125°C. (.15 thru 2.7 μH) −55°C to +105°C (3.3 μH thru 1000 μH).
Terminal Strength: Meets five pound pull test per MIL-C-15305 (latest revision).
Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision). High frequency 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings, each of 20 minute duration repeated for each of three mutually perpendicular planes.
Volume: S Type — 0.012 cu. in.
Weight: S Type — 0.90 grams
Marking: Color banded per MIL-C-15305 (latest revision).

	MS No.	NCG Part No.*	Inductance uH	Q Min.	Test Frequency MHz	Self-Resonant Frequency, Min. MHz	DC Resistance Maximum Ohms	Rated DC Current mA	Material
GRADE 1, CLASS B	MS75008-21	RFC-S	0.15 ±20%	55	25.0	510	0.030	3,000	PHENOLIC
	MS75008-22	RFC-S	0.22 ±20%	50	25.0	415	0.035	2,800	
	MS75008-23	RFC-S	0.33 ±20%	50	25.0	350	0.065	2,000	
	MS75008-24	RFC-S	0.47 ±20%	50	25.0	300	0.085	1,700	
	MS75008-25	RFC-S	0.56 ±10%	50	25.0	270	0.125	1,450	
	MS75008-26	RFC-S	0.68 ±10%	45	25.0	250	0.150	1,300	
	MS75008-27	RFC-S	0.82 ±10%	40	25.0	210	0.205	1,100	
	MS75008-28	RFC-S	1.00 ±10%	40	25.0	200	0.290	930	
	MS75008-29	RFC-S	1.20 ±10%	30	7.9	180	0.400	785	
	MS75008-30	RFC-S	1.50 ±10%	30	7.9	170	0.485	700	
	MS75008-31	RFC-S	1.80 ±10%	30	7.9	150	0.740	580	
	MS75008-32	RFC-S	2.20 ±10%	30	7.9	140	0.970	505	
	MS75008-33	RFC-S	2.70 ±10%	30	7.9	120	1.20	460	
GRADE 1, CLASS A	MS75101-1	RFC-S	3.30 ±10%	30	7.9	70	0.140	1,350	IRON
	MS75101-2	RFC-S	3.90 ±10%	30	7.9	65	0.155	1,250	
	MS75101-3	RFC-S	4.70 ±10%	30	7.9	60	0.210	1,100	
	MS75101-4	RFC-S	5.60 ±10%	30	7.9	50	0.280	935	
	MS75101-5	RFC-S	6.80 ±10%	30	7.9	50	0.375	810	
	MS75101-6	RFC-S	8.20 ±10%	30	7.9	48	0.440	750	
	MS75101-7	RFC-S	10.00 ±10%	30	7.9	42	0.605	640	
	MS75101-8	RFC-S	12.00 ±10%	50	2.5	36	1.05	490	
	MS75101-9	RFC-S	15.00 ±10%	55	2.5	30	1.20	460	
	MS75101-10	RFC-S	18.00 ±10%	60	2.5	30	1.95	360	
	MS75101-11	RFC-S	22.00 ±10%	60	2.5	24	2.20	335	
	MS75101-12	RFC-S	27.00 ±10%	65	2.5	22	2.75	300	
	MS90539-01	RFC-S	270 ±5%	65	.79	5.6	8.2	110	IRON
	MS90539-02	RFC-S	300 ±5%	65	.79	5.3	8.7	107	
	MS90539-03	RFC-S	330 ±5%	65	.79	5.0	9.1	105	
	MS90539-04	RFC-S	360 ±5%	65	.79	4.7	9.6	102	
	MS90539-05	RFC-S	390 ±5%	65	.79	4.5	10.0	100	
	MS90539-06	RFC-S	430 ±5%	65	.79	4.3	10.6	97	
	MS90539-07	RFC-S	470 ±5%	65	.79	4.0	11.1	95	
	MS90539-08	RFC-S	510 ±5%	65	.79	3.8	11.6	93	
	MS90539-09	RFC-S	560 ±5%	65	.79	3.6	12.3	91	
	MS90539-10	RFC-S	620 ±5%	60	.79	3.5	13.0	88	
	MS90539-11	RFC-S	680 ±5%	60	.79	3.4	13.7	85	
	MS90539-12	RFC-S	750 ±5%	60	.79	3.3	14.4	83	
	MS90539-13	RFC-S	820 ±5%	60	.79	3.1	15.1	81	
	MS90539-14	RFC-S	910 ±5%	60	.79	2.9	15.8	79	
	MS90539-15	RFC-S	1000 ±5%	60	.79	2.8	16.5	78	

MS No. electricals as shown.
NCG Part No. is reference only, see page 19 for RFC-S electricals.

Nytronics Components Group, Inc.
700 ORANGE STREET, DARLINGTON, S. C. 29532
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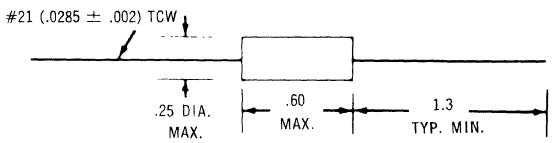
**TYPE RFC-M
MS21388
INDUCTORS**

RFC-M SERIES

Proven reliability molded inductors specifically designed to meet MIL-C-15305 (latest revision). Inductance 1.0 to 2200uH.

GRADE 1 CLASS B

ACTUAL SIZE



ELECTRICAL CHARACTERISTICS

Inductance Tolerance: 1.0 to 22uH ± 10% on Q-Meter
27uH to 2200 ± 5%
1,000 cps bridge
Note: L & Q are not always tested at the same frequency. Inductance Values tested on Q-Meter, are tested at standard test frequencies.

Dielectric Strength: 700 volts RMS at sea level.

Self-Resonant Frequency: Minimum SRF measured with full length leads on Grid-Dip Meter.

Q: Measured on Q-Meter.

Rating: ⅓ watt dissipation for series M

DENSITY CHARACTERISTICS

Volume: 0.029 cu. in.

Weight: 2.00 grams

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +125°C.

Terminal Strength: Meets five pound pull test per MIL-C-15305.

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision). High frequency 10 cps to 2000 cps @ 30G ±10% maximum for 12 logarithmic swings, each of 20 minute duration repeated for each of three mutually perpendicular planes.

MS NO.	NCG PART NO.*	L	Q Min.		Min. SRF	Max. DCR	Max. I	MATERIAL
		uH		MHz	MHz	Ω	mA	
MS21388-1	RFC-M- 1.0	1.0	100	15	136	.04	2700	IRON
MS21388-2	RFC-M- 1.2	1.2	100	15	124	.04	2700	
MS21388-3	RFC-M- 1.5	1.5	100	10	112	.04	2700	
MS21388-4	RFC-M- 1.8	1.8	95	10	100	.05	2500	
MS21388-5	RFC-M- 2.2	2.2	95	10	88	.05	2500	
MS21388-6	RFC-M- 2.7	2.7	68	7.9	76	.05	2500	
MS21388-7	RFC-M- 3.3	3.3	60	7.9	72	.05	2500	
MS21388-8	RFC-M- 3.9	3.9	60	7.9	70	.07	2100	
MS21388-9	RFC-M- 4.7	4.7	60	7.9	60	.09	1800	
MS21388-10	RFC-M- 5.6	5.6	65	7.9	56	.14	1550	
MS21388-11	RFC-M- 6.8	6.8	70	7.9	52	.17	1300	
MS21388-12	RFC-M- 8.2	8.2	65	7.9	46	.25	1150	
MS21388-13	RFC-M- 10	10	65	5	40	.32	1000	
MS21388-14	RFC-M- 12	12	65	5	36	.47	870	
MS21388-15	RFC-M- 15	15	75	4	32	.62	730	
MS21388-16	RFC-M- 18	18	65	4	30	.72	660	
MS21388-17	RFC-M- 22	22	65	2.5	28	.8	600	
MS21388-18	RFC-M- 27	27	65	2.5	25	1.2	520	
MS21388-19	RFC-M- 33	33	80	2.5	22	1.5	450	
MS21388-20	RFC-M- 39	39	80	2.5	20	2.3	380	
MS21388-21	RFC-M- 47	47	100	2.5	19	3.0	300	
MS21388-22	RFC-M- 56	56	100	2.5	18	4.2	270	
MS21388-23	RFC-M- 68	68	100	2.5	16	5.2	250	
MS21388-24	RFC-M- 82	82	100	2.5	14	6.2	220	
MS21388-25	RFC-M- 100	100	100	1.5	13	7	200	
MS21388-26	RFC-M- 120	120	95	1.5	11	7.5	200	
MS21388-27	RFC-M- 150	150	90	1.0	9	8	190	
MS21388-28	RFC-M- 180	180	85	1.0	7	9	185	
MS21388-29	RFC-M- 220	220	85	1.0	5.5	10	180	
MS21388-30	RFC-M- 270	270	80	1.0	4.5	11	172	
MS21388-31	RFC-M- 330	330	80	.8	3.5	12	165	
MS21388-32	RFC-M- 390	390	75	.8	3.0	13	157	
MS21388-33	RFC-M- 470	470	75	.8	2.8	14	150	
MS21388-34	RFC-M- 560	560	65	.8	2.5	16	145	
MS21388-35	RFC-M- 680	680	65	.8	2.2	17	140	
MS21388-36	RFC-M- 820	820	65	.8	2.0	19	132	
MS21388-37	RFC-M-1000	1000	70	.5	1.8	21	125	
MS21388-38	RFC-M-1200	1200	60	.25	2.2	22	120	
MS21388-39	RFC-M-2200	2200	70	.25	1.6	30	100	

* NCG Part No. electricals and tolerances as shown.
MS No. electricals and tolerances per actual MS sheet.

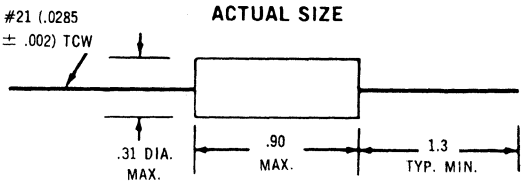
Nytronics Components Group, Inc.
700 ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

**TYPE RFC-L
MS21380
INDUCTORS**

RFC-L SERIES

Proven reliability molded inductors specifically designed to meet MIL-C-15305 (latest revision). Inductance 1.0 to 10,000uH.

GRADE 1 CLASS B



ELECTRICAL CHARACTERISTICS

Inductance Tolerance: 1.0uH to 22uH ±10% on Q-Meter
27uH to 10,000uH ±5%
1,000 cps bridge
Note: L & Q are not always tested at the same frequency. Inductance Values tested on Q-Meter are tested at standard test frequencies.

Dielectric Strength: 700 volts RMS at sea level.

Self-Resonant Frequency: Minimum SRF measured with full length leads on Grid-Dip Meter.

Q: Measured on Q-Meter.

Rating: ½ watt dissipation for L series.

DENSITY CHARACTERISTICS

Volume: 0.068 cu. in.

Weight: 4.10 grams

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +125°C.

Terminal Strength: Meets five pound pull test per MIL-C-15305 (latest revision).

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision). High frequency 10 cps to 2000 cps @ 30G ±10% maximum for 12 logarithmic swings, each of 20 minute duration repeated for each of three mutually perpendicular planes.

MS NO.	NCG PART NO.*	L	Q min		Min. SRF	Max. DCR	max. I	MAT.
		μH		MHz	MHz	Ω	mA	
MS21380-1	RFC-L- 1.0	1.0	130	15	136	.03	4000	IRON
MS21380-2	RFC-L- 1.2	1.2	130	15	124	.03	4000	
MS21380-3	RFC-L- 1.5	1.5	130	10	112	.03	4000	
MS21380-4	RFC-L- 1.8	1.8	130	10	100	.03	4000	
MS21380-5	RFC-L- 2.2	2.2	130	10	92	.04	3500	
MS21380-6	RFC-L- 2.7	2.7	100	10	82	.04	3500	
MS21380-7	RFC-L- 3.3	3.3	100	7.9	72	.04	3500	
MS21380-8	RFC-L- 3.9	3.9	80	7.9	68	.05	3100	
MS21380-9	RFC-L- 4.7	4.7	75	7.9	64	.05	3100	
MS21380-10	RFC-L- 5.6	5.6	65	7.9	58	.06	3000	
MS21380-11	RFC-L- 6.8	6.8	65	7.9	52	.06	3000	
MS21380-12	RFC-L- 8.2	8.2	65	7.9	46	.11	2400	
MS21380-13	RFC-L- 10	10	75	5	40	.15	1800	
MS21380-14	RFC-L- 12	12	75	5	36	.23	1600	
MS21380-15	RFC-L- 15	15	75	5	32	.3	1300	
MS21380-16	RFC-L- 18	18	75	5	29	.4	1150	
MS21380-17	RFC-L- 22	22	75	2.5	26	.5	1000	
MS21380-18	RFC-L- 27	27	70	2.5	24	.6	900	
MS21380-19	RFC-L- 33	33	70	2.5	22	.7	850	
MS21380-20	RFC-L- 39	39	70	2.5	21	1.1	720	
MS21380-21	RFC-L- 47	47	75	2.5	20	1.3	620	
MS21380-22	RFC-L- 56	56	80	2.5	18	1.8	540	
MS21380-23	RFC-L- 68	68	100	2.5	16	2.4	450	
MS21380-24	RFC-L- 82	82	100	2.5	14	2.8	425	
MS21380-25	RFC-L- 100	100	100	1.5	13	3.2	400	
MS21380-26	RFC-L- 120	120	100	1.5	12	4.8	360	
MS21380-27	RFC-L- 150	150	100	1.0	11	6.4	280	
MS21380-28	RFC-L- 180	180	95	1.0	10	9.5	240	
MS21380-29	RFC-L- 220	220	95	1.0	9	12	200	
MS21380-30	RFC-L- 270	270	70	1.0	7	13	195	
MS21380-31	RFC-L- 330	330	65	.79	6	14	190	
MS21380-32	RFC-L- 390	390	65	.79	5	15.5	180	
MS21380-33	RFC-L- 470	470	60	.79	4	17	170	
MS21380-34	RFC-L- 560	560	75	.5	3	18.5	165	
MS21380-35	RFC-L- 680	680	75	.5	2.5	20	155	
MS21380-36	RFC-L- 820	820	75	.5	2.0	22	150	
MS21380-37	RFC-L- 1000	1000	75	.5	1.9	24	145	
MS21380-38	RFC-L- 1200	1200	75	.5	1.7	27	137	
MS21380-39	RFC-L- 1500	1500	75	.4	1.5	29	130	
MS21380-40	RFC-L- 1800	1800	65	.4	1.4	32	125	
MS21380-41	RFC-L- 2200	2200	65	.25	1.2	35	120	
MS21380-42	RFC-L- 2700	2700	65	.25	1.0	40	112	
MS21380-43	RFC-L- 3300	3300	65	.25	.95	45	105	
MS21380-44	RFC-L- 3900	3900	65	.25	.80	49	100	
MS21380-45	RFC-L- 4700	4700	65	.25	.75	53	95	
MS21380-46	RFC-L- 5600	5600	65	.25	.70	60	90	
MS21380-47	RFC-L- 6800	6800	65	.25	.60	67	85	
MS21380-48	RFC-L- 8200	8200	65	.25	.50	75	82	
MS21380-49	RFC-L-10000	10000	65	.15	.45	80	80	

MS91189-14 THRU -28, VALUES 1.2 THRU 18uH (ON PHENOLIC CORES) ARE AVAILABLE, AND MS75103-1 THRU -10, VALUES 22 THRU 120uH (ON IRON CORES) ARE ALSO AVAILABLE.

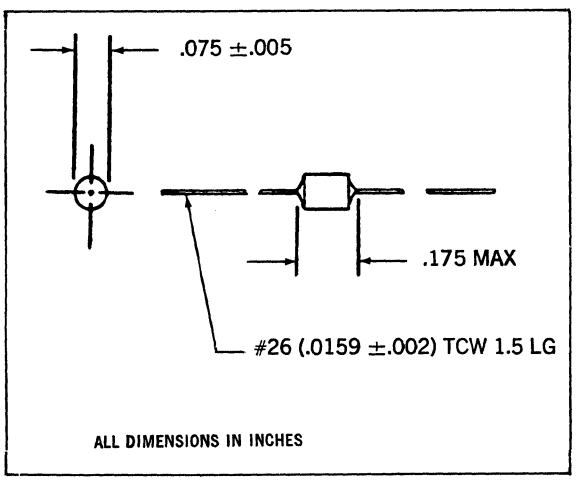
* NCG Part No. electricals and tolerances as shown.
MS No. electricals and tolerances per actual MS sheet.

Nytronics Components Group, Inc.
700 ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE PD INDUCTORS

Pee Dee Ductor Series

Marking: EIA color coded



The Pee Dee Ductor is a microminiature, axial-leaded RF inductor for hybrid circuit applications.

This reliable, high performance inductor has a standard inductance tolerance of ±10%.

GRADE 2 CLASS A

ELECTRICAL CHARACTERISTICS:

Inductance Tolerance: ±10% (Std).

L,Q,F, values: Measurements per MIL-C-15305. (latest revision).

Dielectric Strength: 300 Volts RMS @ Sea Level.

DENSITY CHARACTERISTICS:

Volume: .0007 Cubic Inches

Weight: 0.12 Grams

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS:

Terminal pull: 3 lbs. minimum.

ELECTRICAL DATA

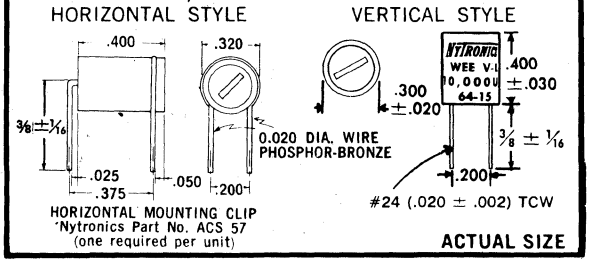
NCG Part No.	L uH	Q (Min.)	Test Freq. MHz	SRF Min. MHz	DCR Max. Ohms	Rated Current mA
PD-0.10	0.10	40	25	400	0.2	600
PD-0.12	0.12	40	25	360	0.2	600
PD-0.15	0.15	40	25	320	0.25	575
PD-0.18	0.18	40	25	304	0.25	575
PD-0.22	0.22	40	25	288	0.30	565
PD-0.27	0.27	40	25	240	0.30	565
PD-0.33	0.33	40	25	224	0.35	560
PD-0.39	0.39	40	25	208	0.37	550
PD-0.47	0.47	40	25	200	0.39	535
PD-0.56	0.56	40	25	192	0.40	525
PD-0.68	0.68	35	25	176	0.45	500
PD-0.82	0.82	35	25	144	0.50	480
PD-1.0	1.0	35	25	136	0.60	450
PD-1.2	1.2	35	7.9	120	0.70	425
PD-1.5	1.5	35	7.9	104	0.80	400
PD-1.8	1.8	35	7.9	96	0.90	350
PD-2.2	2.2	35	7.9	88	1.3	320
PD-2.7	2.7	35	7.9	84	1.8	275
PD-3.3	3.3	35	7.9	80	1.1	340
PD-3.9	3.9	35	7.9	72	1.4	310
PD-4.7	4.7	35	7.9	68	1.6	290
PD-5.6	5.6	35	7.9	56	1.8	275
PD-6.8	6.8	35	7.9	52	2.0	250
PD-8.2	8.2	35	7.9	50	2.2	245
PD-10	10	35	7.9	48	3.0	210
PD-12	12	35	2.5	28	2.0	250
PD-15	15	35	2.5	24	2.2	245
PD-18	18	35	2.5	20	2.5	230
PD-22	22	35	2.5	18	2.7	220
PD-27	27	35	2.5	17	3.8	195
PD-33	33	35	2.5	16	4.5	170
PD-39	39	35	2.5	13	6.0	150
PD-47	47	35	2.5	11	6.5	145
PD-56	56	35	2.5	10	7.8	135
PD-68	68	35	2.5	8	8.6	130
PD-82	82	35	2.5	7.2	9.8	120
PD-100	100	35	2.5	6.4	11.5	110
PD-120	120	28	.79	5.6	15.0	90
PD-150	150	28	.79	4.8	16.5	88
PD-180	180	25	.79	4.4	22	75
PD-220	220	24	.79	4.2	31	62
PD-270	270	24	.79	4.0	38	56
PD-330	330	24	.79	3.8	42	53
PD-390	390	24	.79	2.9	58	47
PD-470	470	24	.79	2.7	60	45
PD-560	560	24	.79	2.6	65	43
PD-680	680	22	.79	2.4	90	36
PD-820	820	23	.79	2.0	95	34
PD-1000	1000	21	.79	1.6	130	30

Nytronics Components Group, Inc.
700 ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE WEE-VL MS21381 & 21402 VARIABLE INDUCTORS

WEE V-L

NOW MIL APPROVED MIL-C-15305 (latest revision) — MS21381 & MS21402
Subminiature Shielded Adjustable Inductor
High Q Values
Vertical or Horizontal* Mounting
Unitized Epoxy-Molded Construction (MIL Style)
0.400" by 0.300"
0.10 to 100,000uH



The **WEE V-L** is designed to accommodate close inductance adjustments in high-density circuits that demand exceptional stability and high "Q" in the smallest size available.
The **WEE V-L** is qualified MIL-C-15305 (latest revision). Printed board mounting is facilitated by 0.200 grid spacing and unit has shield construction to allow maximum density packaging. Standardized in 73 stock values.

ELECTRICAL CHARACTERISTICS

Adjustable Inductance Range:	Tunable range ±5% on 0.10uH thru 1.0uH and ±10% on 1.2uH thru 100,000uH.
Dielectric Strength:	840 Volts R.M.S. at sea level.
Working Voltage:	300 Volts D.C.
Maximum Current:	Based on temperature rise not to exceed 15°C at 90°C ambient.
Incremental Current:	Defined as the DC current required to cause a five percent reduction in the nominal inductance value.

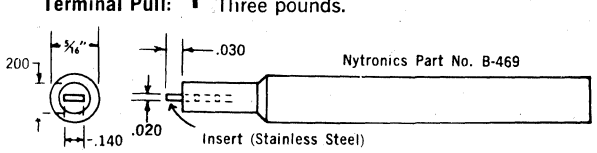
DENSITY CHARACTERISTICS

Weight:	1.5 grams maximum
Volume:	.0346 cubic inches
Shielding:	3% coupling maximum when two units are tested side by side.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Use Nytronics Tuning Tool No. B-469 or equal.

Torque:	0.40 to 6.0 inch-oz.
Operating Temperature:	−55°C to +105°C.
Moisture, Vibration, and Shock Resistance:	Meet requirements of MIL-C-15305 (latest revision).
Marking:	Manufacturer data printed.
Terminal Pull:	Three pounds.



MS GRADE 1 CLASS A
WVL GRADE 3 CLASS A

MS No.	NCG Part No.**		L nom. uH	f MHz	Q Min.	SRF Min. MHz	Max. DCR ohms	Max. I m.a.	Incr. I m.a.
MS21381-1	WEE V-L	0.10	.10	25	56	200	0.030	1510	NA
MS21381-2	WEE V-L	0.12	.12	25	56	200	0.030	1450	NA
MS21381-3	WEE V-L	0.15	.15	25	56	200	0.030	1400	NA
MS21381-4	WEE V-L	0.18	.18	25	56	200	0.035	1370	NA
MS21381-5	WEE V-L	0.22	.22	25	56	200	0.038	1340	NA
MS21381-6	WEE V-L	0.27	.27	25	64	200	0.040	1300	NA
MS21381-7	WEE V-L	0.33	.33	25	64	200	0.040	1260	NA
MS21381-8	WEE V-L	0.39	.39	25	64	200	0.045	1240	NA
MS21381-9	WEE V-L	0.47	.47	25	64	184	0.045	1200	NA
MS21381-10	WEE V-L	0.56	.56	25	64	176	0.050	1160	NA
MS21381-11	WEE V-L	0.68	.68	25	64	150	0.055	1100	NA
MS21381-12	WEE V-L	0.82	.82	25	68	144	0.060	1040	NA
MS21381-13	WEE V-L	1.00	1.00	25	68	128	0.070	986	NA
MS21381-14	WEE V-L	1.2	1.2	7.9	72	136	0.085	968	NA
MS21381-15	WEE V-L	1.5	1.5	7.9	80	124	0.100	893	NA
MS21381-16	WEE V-L	1.8	1.8	7.9	92	108	0.110	853	NA
MS21381-17	WEE V-L	2.2	2.2	7.9	88	96	0.120	817	NA
MS21381-18	WEE V-L	2.7	2.7	7.9	88	83	0.125	800	NA
MS21381-19	WEE V-L	3.3	3.3	7.9	77	74	0.165	696	NA
MS21381-20	WEE V-L	3.9	3.9	7.9	72	70	0.180	659	NA
MS21381-21	WEE V-L	4.7	4.7	7.9	76	63	0.245	571	NA
MS21381-22	WEE V-L	5.6	5.6	7.9	76	58	0.265	550	NA
MS21381-23	WEE V-L	6.8	6.8	7.9	68	50	0.330	493	NA
MS21381-24	WEE V-L	8.2	8.2	7.9	76	48	0.460	417	NA
MS21381-25	WEE V-L	10	10	7.9	72	43	0.640	359	NA
MS21381-26	WEE V-L	12	12	2.5	96	30	0.800	316	NA
MS21381-27	WEE V-L	15	15	2.5	96	23	0.865	301	NA
MS21381-28	WEE V-L	18	18	2.5	92	19	0.940	292	NA
MS21381-29	WEE V-L	22	22	2.5	100	17	1.03	267	NA
MS21381-30	WEE V-L	27	27	2.5	92	16	1.18	243	NA
MS21381-31	WEE V-L	33	33	2.5	96	15	1.30	231	NA
MS21381-32	WEE V-L	39	39	2.5	96	14	1.41	223	NA
MS21381-33	WEE V-L	47	47	2.5	88	12	1.61	203	NA
MS21381-34	WEE V-L	56	56	2.5	92	11	2.08	191	NA
MS21381-35	WEE V-L	68	68	2.5	84	10	2.20	185	NA
MS21381-36	WEE V-L	82	82	2.5	84	9	2.42	174	NA
MS21402-1	WEE V-L	100	100	2.5	76	8.4	2.15	333	333
MS21402-2	WEE V-L	120	120	0.790	76	4.5	2.38	316	190
MS21402-3	WEE V-L	150	150	0.790	72	4.0	2.52	306	175
MS21402-4	WEE V-L	180	180	0.790	76	3.9	2.88	288	150
MS21402-5	WEE V-L	220	220	0.790	76	3.7	3.18	273	125
MS21402-6	WEE V-L	270	270	0.790	80	3.4	3.50	260	120
MS21402-7	WEE V-L	330	330	0.790	80	2.8	4.80	222	110
MS21402-8	WEE V-L	390	390	0.790	80	2.7	5.44	209	105
MS21402-9	WEE V-L	470	470	0.790	80	2.6	5.90	201	100
MS21402 10	WEE V-L	560	560	0.790	76	2.3	6.30	194	90
MS21402-11	WEE V-L	680	680	0.790	80	2.2	7.20	181	80
MS21402-12	WEE V-L	820	820	0.790	72	2.0	8.00	172	70
MS21402-13	WEE V-L	1,000	1,000	0.790	80	1.9	12.0	141	65
MS21402-14	WEE V-L	1,200	1,200	0.250	76	1.8	13.5	132	60
MS21402-15	WEE V-L	1,500	1,500	0.250	72	1.5	16.5	119	55
MS21402-16	WEE V-L	1,800	1,800	0.250	80	1.4	18.0	114	47
MS21402-17	WEE V-L	2,200	2,200	0.250	80	1.3	20.5	107	43
MS21402-18	WEE V-L	2,700	2,700	0.250	76	1.2	22.5	102	39
MS21402-19	WEE V-L	3,300	3,300	0.250	72	1.1	42.0	76	36
MS21402-20	WEE V-L	3,900	3,900	0.250	68	1.0	47.5	71	35
MS21402-21	WEE V-L	4,700	4,700	0.250	68	.99	53.0	67	34
MS21402-22	WEE V-L	5,600	5,600	0.250	68	.74	62.5	65	31
MS21402-23	WEE V-L	6,800	6,800	0.250	60	.63	69.5	58	27
MS21402-24	WEE V-L	8,200	8,200	0.250	64	.60	75.0	56	26
MS21402-25	WEE V-L	10,000	10,000	0.250	56	.70	100.0	49	24
MS21402-26	WEE V-L	12,000	12,000	0.079	56	.40	64	60	40
MS21402-27	WEE V-L	15,000	15,000	0.079	56	.30	84	52	34
MS21402-28	WEE V-L	18,000	18,000	0.079	56	.29	93	50	30
MS21402-29	WEE V-L	22,000	22,000	0.079	56	.26	104	45	28
MS21402-30	WEE V-L	27,000	27,000	0.079	56	.24	173	35	26
MS21402-31	WEE V-L	33,000	33,000	0.079	56	.22	187	32	24
MS21402-32	WEE V-L	39,000	39,000	0.079	56	.21	220	30	22
MS21402-33	WEE V-L	47,000	47,000	0.079	56	.20	253	28	20
MS21402-34	WEE V-L	56,000	56,000	0.079	56	.19	285	26	19
MS21402-35	WEE V-L	68,000	68,000	0.079	48	.16	311	24	18
MS21402-36	WEE V-L	82,000	82,000	0.079	48	.15	385	22	16
MS21402-37	WEE V-L	100,000	100,000	0.079	48	.14	420	20	15

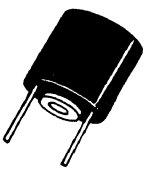
*For horizontal mounting use Nytronics mounting clip No. ACS-57 or order with prefix H (i.e. H WEE V-L 0.10).

**NCG Part No. cannot be used as the MS No.
MS Part No. electrical as shown MS No. electricals and tolerances per actual MS sheet.
NOTE: MS 21381 -74 thru -85 are available.

Nytronics Components Group, Inc.
700 ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

VARIABLE INDUCTOR TYPE VIN

VARIABLE INDUCTOR, NEW (VIN)



- Standard inductance values from 0.1μH to 4700μH.
- Epoxy-encapsulated windings.
- Excellent tuning torque control.

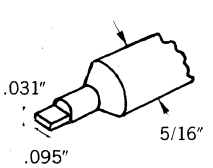
NCG PART NO.	L NOM.	MIN. Q AT L NOM.		MIN. SRF L NOM.	MAX. DCR	MAX. I
	μH		MHz	MHz	Ω	mA
VIN 0.10	0.10	68	25	400	.01	3500
VIN 0.15	0.15	80	25	340	.01	2600
VIN 0.22	0.22	80	25	290	.02	2500
VIN 0.33	0.33	80	25	267	.02	2500
VIN 0.47	0.47	75	25	220	.05	2200
VIN 0.68	0.68	75	25	190	.07	1850
VIN 1.0	1.0	72	25	160	.13	1350
VIN 1.5	1.5	56	7.9	130	.24	1000
VIN 2.2	2.2	58	7.9	100	.30	890
VIN 3.3	3.3	64	7.9	85	.45	730
VIN 4.7	4.7	60	7.9	75	.80	550
VIN 6.8	6.8	64	7.9	60	1.10	460
VIN 10	10.0	66	7.9	50	1.90	355
VIN 15	15.0	52	2.5	38	3.20	270
VIN 22	22.0	44	2.5	12	3.40	265
VIN 33	33.0	40	2.5	12	3.60	255
VIN 47	47.0	40	2.5	10.5	4.50	230
VIN 68	68.0	40	2.5	9.5	5.50	210
VIN 100	100.	40	2.5	8.5	6.70	190
VIN 150	150.	40	.79	2.4	11.0	150
VIN 220	220.	40	.79	2.2	13.0	135
VIN 330	330.	38	.79	1.8	16.0	120
VIN 470	470.	36	.79	1.5	18.0	115
VIN 680	680.	27	.79	1.2	21.0	105
VIN 1000	1000.	27	.79	1.1	38.0	80
VIN 1500	1500.	32	.25	0.9	54.0	65
VIN 2200	2200.	35	.25	0.8	66.0	60
VIN 3300	3300.	37	.25	0.7	85.0	54
VIN 4700	4700.	38	.25	0.6	99.0	49

ELECTRICAL CHARACTERISTICS

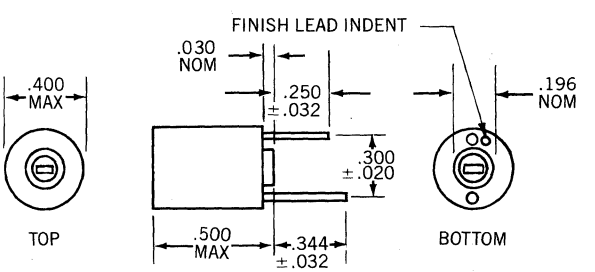
Inductance Tuning Range:	0.1μH ±10% 0.15-0.47μH ±15% 0.68-4700μH ±20%
Q:	Measured at L NOM (L & Q measured on a Q-meter)
SRF:	Grid dip meter

PHYSICAL & ENVIRONMENTAL CHARACTERISTICS

Volume:	.063 cubic inches
Weight:	2.0 grams
Torque:	0.75-5.0 inch-ounces
Operating Temperature:	−55°C to +105°C
Terminal Strength:	Meets 5 pound pull test
Core Material:	Iron
Marking:	NYT NYTRONICS XXX NOM. L (μH) 88XX Date Code



TYPICAL ALIGNING TOOL B-305



LEADS: .025 ±.002 DIA. T.C.W.

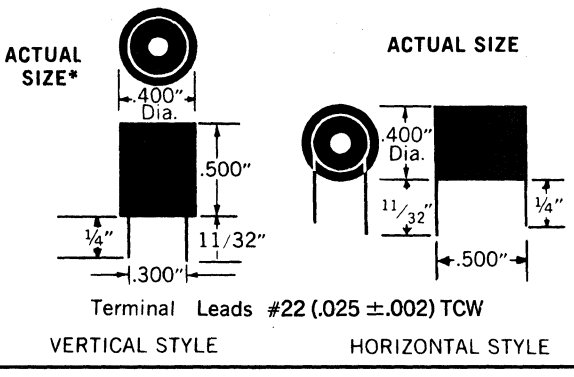
Nytronics Components Group, Inc.
700 ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE VIV - VIH VARIABLE INDUCTORS

VIV-VIH

Miniature with inductance range of 0.10 to 4700uH in 29 values.
Encapsulated in epoxy resin for reliability.

*ALL DIMENSIONS ARE ±1/32 INCH



The **VARIABLE INDUCTOR** offers high reliability and exceptional stability over extreme temperature variations. This small lightweight unit is furnished in vertical and horizontal styles to facilitate mounting on printed circuit boards.

NCG PART NOS.		L nom.	Min. Q at L Nom.		Min. SRF, L Nom.	Max. DCR	Max. I
VIV	VIH	μH		MHz	MHz	Ω	mA
VIV-0.10	VIH-0.10	0.10	68	25.	400	0.02	3500
VIV-0.15	VIH-0.15	0.15	80	25.	400	0.035	2600
VIV-0.22	VIH-0.22	0.22	80	25.	400	0.04	2500
VIV-0.33	VIH-0.33	0.33	80	25.	267	0.04	2500
VIV-0.47	VIH-0.47	0.47	80	25.	228	0.05	2200
VIV-0.68	VIH-0.68	0.68	80	25.	190	0.07	1850
VIV-1.00	VIH-1.00	1.00	72	25.	164	0.13	1350
VIV-1.50	VIH-1.50	1.50	56	7.9	134	0.24	1000
VIV-2.20	VIH-2.20	2.20	58	7.9	108	0.30	890
VIV-3.30	VIH-3.30	3.30	64	7.9	90	0.45	730
VIV-4.70	VIH-4.70	4.70	60	7.9	80	0.80	550
VIV-6.80	VIH-6.80	6.80	64	7.9	64	1.1	460
VIV-10.0	VIH-10.0	10.0	66	7.9	54	1.9	355
VIV-15.0	VIH-15.0	15.0	52	2.5	43	3.2	270
VIV-22.0	VIH-22.0	22.0	44	2.5	14	3.4	265
VIV-33.0	VIH-33.0	33.0	43	2.5	12	3.6	255
VIV-47.0	VIH-47.0	47.0	41	2.5	10.5	4.5	230
VIV-68.0	VIH-68.0	68.0	44	2.5	9.5	5.5	210
VIV-100	VIH-100	100.0	40	2.5	8.5	6.7	190
VIV-150	VIH-150	150.	40	.79	2.4	11.0	150
VIV-220	VIH-220	220.	40	.79	2.2	13.0	135
VIV-330	VIH-330	330.	38	.79	1.8	16.0	120
VIV-470	VIH-470	470.	36	.79	1.5	18.0	115
VIV-680	VIH-680	680.	34	.79	1.4	21.0	105
VIV-1000	VIH-1000	1000.	32	.79	1.1	38.0	80
VIV-1500	VIH-1500	1500.	32	.25	.9	54.0	65
VIV-2200	VIH-2200	2200.	35	.25	.8	66.0	60
VIV-3300	VIH-3300	3300.	37	.25	.7	85.0	54
VIV-4700	VIH-4700	4700.	38	.25	.6	99.0	49

GRADE 2 CLASS B

ELECTRICAL CHARACTERISTICS

Inductance Range: 0.33 to 4700uH Tunable Range ±20%
0.15 to 0.22uH Tunable Range ±15%
0.1 Tunable Range ±10%
All measurements at 25°C on Q-Meter

Self-Resonant Frequency: Minimum SRF measured with Grid-Dip Meter.

DENSITY CHARACTERISTICS

Volume: 0.063 cubic inches
Weight: 2.6 grams

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Torque: 0.75 to 5.0 inch-ounces
Use Nytronics Tuning Tool No. B-305 or equal.

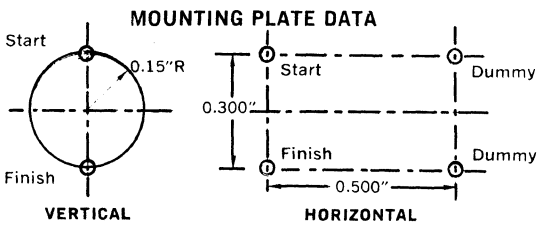
Operating Temperature: −55°C to +125°C

Terminal Strength: Meets five pound pull tests.

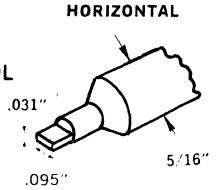
Core Material: Iron

Marking: Manufactured data printed.

MOUNTING PLATE DATA



TYPICAL ALIGNING TOOL
B-305



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(803) 393-5421 — TWX 810-665-2182

POWER CHOKES
PL SERIES

HIGH CURRENT CHOKES PL SERIES

Inductance: Measured on general radio 1657 LRC bridge at 1 kHz.

Current (rated IDC): Based on 0.5 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current..

Incremental Current (INCR I): The minimum current at which the inductance will be decreased by 5% from its initial (zero DC) value.

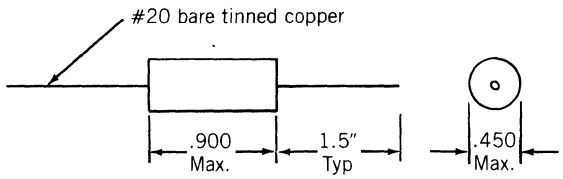
Dielectric Withstanding Voltage: 1000 VRMS

Operating Temperature Range: −55°C to 105°C

Materials: Coil form — ferrite
Cover — flame retardant heat-shrink tubing
Magnet wire — per MIL-W-583 Type B

Marking: Printed with part number.

10μH TO 100mH, 20% TOLERANCE
RECOMMENDED MOUNTING PITCH: 1.25"



STANDARD VALUES (OTHER VALUES ARE AVAILABLE ON SPECIAL ORDER)

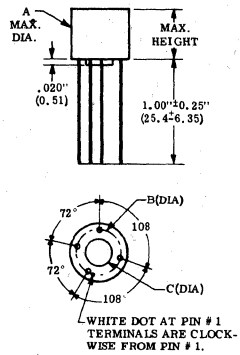
PART NUMBER	NOMINAL INDUCTANCE	MAXIMUM DCR (Ω)	MINIMUM SRF (MHz)	RATED IDC (mA)	INCR I (mA)
PL 10	10μH	.023	45	4600	3200
PL 15	15μH	.030	32	4100	2600
PL 22	22μH	.035	12	3700	2200
PL 33	33μH	.043	5.8	3400	1800
PL 47	47μH	.054	3.2	3000	1500
PL 68	68μH	.068	2.7	2700	1200
PL 100	100μH	.100	2.3	2300	1000
PL 150	150μH	.18	1.9	1700	830
PL 220	220μH	.28	1.3	1400	680
PL 330	330μH	.35	1.2	1200	560
PL 470	470μH	.44	1.0	1050	460
PL 680	680μH	.63	.80	890	390
PL 1000	1mH	.96	.50	720	320
PL 1500	1.5mH	1.4	.43	600	260
PL 2200	2.2mH	2.3	.39	470	220
PL 3300	3.3mH	3.5	.34	380	180
PL 4700	4.7mH	4.3	.32	340	150
PL 6800	6.8mH	6.3	.24	280	120
PL 10,000	10mH	9.7	.20	220	100
PL 15,000	15mH	15	.17	180	84
PL 22,000	22mH	24	.13	140	68
PL 33,000	33mH	35	.11	120	56
PL 47,000	47mH	50	.10	100	47
PL 68,000	68mH	76	.09	81	39
PL 100,000	100mH	99	.08	71	32

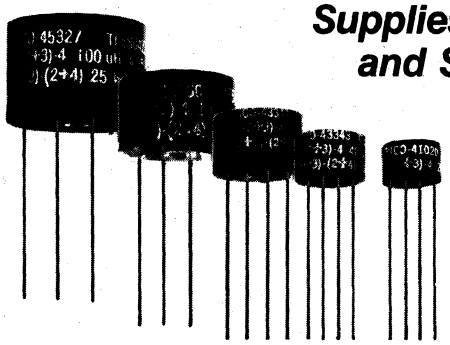
PICO's Miniaturized Power Inductors

These Inductors are ideal for Noise, Spike and Power Filtering Applications in Power Supplies, DC-DC Converters and Switching Regulators

Size	Max. Height	A Max. Dia.	B Bolt Circle	C Stand-Off
1	.280 (7.11)	.410 (10.41)	.260 (6.6)	.160 (4.06)
2	.340 (8.63)	.500 (12.7)	.350 (8.89)	.250 (6.35)
3	.415 (10.54)	.630 (16.0)	.440 (11.17)	.340 (8.64)

ALL DIMENSIONS ARE IN INCHES, ( ) = MM



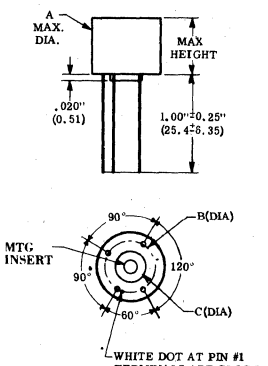


- **Minimum possible size**
- **Meets MIL-T-27D (TF5S04ZZ)**
- **Special high frequency core material to insure low losses**
- **All units have split windings**
- **Large selection of sizes available**
- **All units are magnetically shielded**

These units can be manufactured and tested to MIL-T-27/356. Contact Factory for price and delivery information and appropriate part numbers (MIL-T-27/356-01 thru MIL-T-27/356-63).

Size	Max. Height	A Max. Dia.	B Bolt Circle	C Stand-Off	Mtg. Insert
4	.500 (12.7)	.800 (20.32)	.560 (14.22)	.460 (11.68)	—
5	.650 (16.51)	.950 (24.13)	.670 (17.0)	.570 (14.48)	6-32 UNC 8 Threads Deep

ALL DIMENSIONS ARE IN INCHES, ( ) = MM



All inductors have split windings—ratings shown in table are for series connection. Parallel connection will have ¼ inductance at twice the DC current and ¼ the DC resistance, ie. parallel connection of PICO-41020 will have 5 millihenry at .12 Amps DC with DC resistance of 13.5 Ohms

INDUCTANCE	I_{DC} (AMPS)	R_{DC} (OHMS)	SIZE	MODEL NUMBER	*** PRICE 1-9
20 MILLI-HENRY	.06	54	1	41020	14.72
	.10	29	2	42105	14.72
	.14	20	3	43103	14.72
	.22	12.4	4	44500	17.62
	.29	10.2	5	45107	17.62
15 MILLI-HENRY	.07	40.5	1	41040	14.72
	.12	22	2	42125	14.72
	.16	15	3	43123	14.72
	.25	9.3	4	44520	17.62
	.33	7.7	5	45127	17.62
10 MILLI-HENRY	.08	27	1	41060	14.72
	.14	14.6	2	42145	14.72
	.20	10	3	43143	14.72
	.31	6.2	4	44560	17.62
	.40	5.1	5	45147	17.62
7.5 MILLI-HENRY	.10	20.3	1	41080	14.72
	.17	11	2	42165	14.72
	.24	7.5	3	43163	14.72
	.38	4.7	4	44580	17.62
	.49	3.8	5	45167	17.62
5 MILLI-HENRY	.12	13.5	1	41100	14.72
	.21	7.3	2	42185	14.72
	.30	5	3	43183	14.72
	.47	3.1	4	44600	17.62
	.6	2.6	5	45187	17.62
3 MILLI-HENRY	.16	8.1	1	41120	14.72
	.27	4.4	2	42205	14.72
	.38	3	3	43203	14.72
	.6	1.9	4	44620	17.62
	.78	1.5	5	45207	17.62

INDUCTANCE	I_{DC} (AMPS)	R_{DC} (OHMS)	SIZE	MODEL NUMBER	*** PRICE 1-9
2 MILLI-HENRY	.19	5.4	1	41140	14.72
	.33	2.9	2	42225	14.72
	.47	2	3	43223	14.76
	.74	1.3	4	44640	17.62
	.95	1	5	45227	17.62
1 MILLI-HENRY	.27	2.7	1	41160	14.72
	.47	1.5	2	42245	14.72
	.66	1	3	43243	14.72
	1	.62	4	44660	17.62
	1.3	.5	5	45247	17.62
750 MICRO-HENRY	.31	2	1	41180	14.72
	.54	1	2	42265	14.72
	.76	.75	3	43263	14.72
	1.2	.47	4	44680	17.62
	1.6	.38	5	45267	17.62
500 MICRO-HENRY	.38	1.3	1	41200	14.72
	.66	.66	2	42285	14.72
	.93	.5	3	43283	14.72
	1.47	.31	4	44700	17.62
	1.9	.25	5	45287	17.62
250 MICRO-HENRY	.53	.66	1	41220	14.72
	.93	.33	2	42305	14.72
	1.3	.25	3	43303	14.72
	2.08	.16	4	44720	17.62
	2.7	.13	5	45307	17.62
100 MICRO-HENRY	0.78	.300	1	41240	14.72
	1.35	.170	2	42325	14.72
	1.95	.110	3	43323	14.72
	3.08	.070	4	44740	17.62
	3.88	.060	5	45327	17.62
40 MICRO-HENRY	1.18	.141	1	41260	14.72
	2.03	.070	2	42345	14.72
	2.68	.060	3	43343	14.72

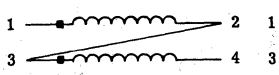
*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

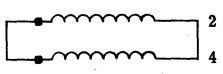
SPECIFICATIONS:

- All units meet MIL-T-27D and are type TF5S04ZZ
- Inductance measured at 0.1 VRMS-10 kHz
- Temperature rise at rated D.C. current is less than 30°C
- Maximum ambient is 100°C
- Unit has magnetic shield

TERMINAL ARRANGEMENT SERIES CONNECTION



PARALLEL CONNECTION



For immediate engineering assistance or to place an order—

Call Toll Free 800-431-1064

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552
914-699-5514 • TWX 7105620113

Delivery— stock to one week

PICO's POWER INDUCTORS

THESE PICO UNITS CAN HANDLE LARGE TRANSIENT DC CURRENTS

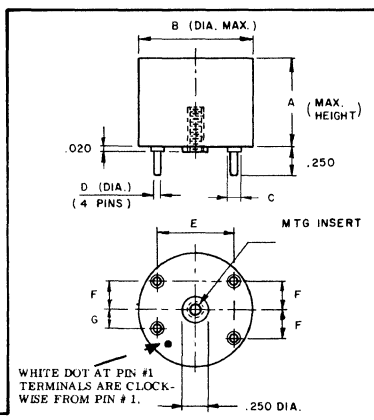
They are ideal for Noise, Spike and Power Filtering Applications in Power Supplies, DC-DC Converters and Switching Regulators

FOR MULTIPLE OUTPUT REGULATORS WE CAN SUPPLY ALL NECESSARY INDUCTANCE VALUES ON ONE CORE This technique provides minimum possible size and gives excellent dynamic and DC cross-regulation . . . Contact factory for these special inductors.

- **Handle large transient DC currents**
- **Minimum possible size**
- **Meets MIL-T-27D (TF5S04ZZ)**
- **Special high frequency core material to insure low losses**
- **All units have split windings**
- **Large selection of sizes available**
- **All units are magnetically shielded**

All inductors have split windings—ratings shown in table are for series connection. Parallel connection will have ¼ inductance at twice the DC current and ¼ the DC resistance, ie. parallel connection of PICO-69010 will have 32.5 microhenry with DC resistance of .015 Ohms at 6 Amps DC current (10% drop in L)

Delivery— stock to one week



Size	A Max. Height	B Max. Dia.	C	D Terminal Dia.	E	F	G	Mtg. Insert	Wt. Nominal (Grams)
A	.560	.960	.100	.070	.600	.200	.100	4–40 UNC 5 Threads Deep	23
B	.635	1.215	.100	.070	.800	.250	.150	4–40 UNC 5 Threads Deep	44
C	.720	1.330	.125	.094	.900	.250	.150	6–32 UNC 8 Threads Deep	60

SIZE A

LODC MICROHY (μH)	IDC FOR 10% DROP in L AMPS	IDC FOR 20% DROP in L AMPS	IDC FOR 30% DROP in L AMPS	RDC OHMS	SRF MHz	PICO PART NUMBER	PRICE (1–9)
130	3.0	4.5	5.5	.060	1.7	69010	22.95
210	2.5	3.5	4.5	.11	1.4	69020	22.95
260	2.2	3.2	3.9	.14	1.25	69030	22.95
315	2.0	2.9	3.5	.17	1.14	69040	22.95
525	1.6	2.2	2.7	.28	0.9	69050	22.95
790	1.2	1.8	2.2	.42	0.7	69060	22.95
1050	1	1.6	1.9	.56	0.6	69070	22.95
1300	.95	1.4	1.7	.7	0.4	69080	22.95

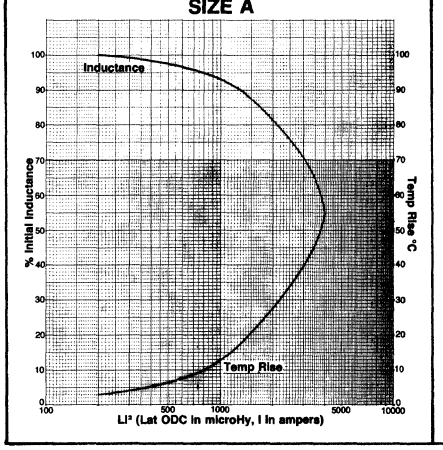
SIZE B

228	3.5	5.2	6.8	.070	1.1	69105	25.25
323	2.7	4.0	5.0	.105	0.9	69115	25.25
460	2.5	3.7	4.8	.15	0.8	69125	25.25
787	1.9	2.8	3.7	.26	0.6	69135	25.25
1050	1.6	2.4	3.2	.34	0.5	69145	25.25
1310	1.5	2.2	2.8	.43	0.45	69155	25.25
1600	1.3	2.0	2.6	.52	0.4	69165	25.25
1840	1.2	1.8	2.4	.60	0.38	69175	25.25
2100	1.1	1.7	2.2	.70	0.33	69185	25.25

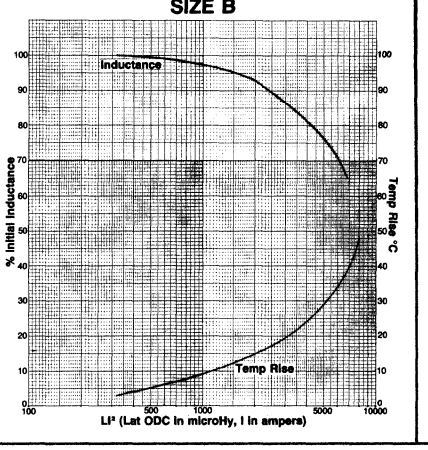
SIZE C

165	5.0	7.0	9.5	.040	1.4	69205	27.75
191	4.7	7.0	8.8	.050	1.3	69215	27.75
262	4.0	5.6	7.5	.07	1.1	69225	27.75
390	3.3	4.6	6.2	.10	0.9	69235	27.75
525	2.8	4.0	5.3	.14	0.8	69245	27.75
790	2.3	3.2	4.3	.20	0.6	69255	27.75
1050	2.0	2.8	3.8	.27	0.55	69265	27.75
1310	1.8	2.5	3.4	.34	0.5	69275	27.75
1580	1.6	2.3	3.0	.41	0.45	69285	27.75
1838	1.5	2.1	2.8	.48	0.4	69295	27.75

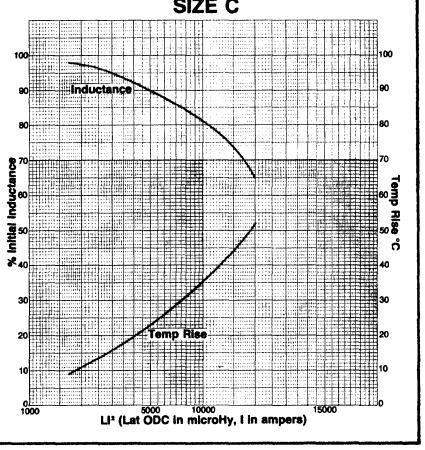
SIZE A



SIZE B

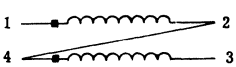


SIZE C

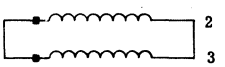


TERMINAL ARRANGEMENT

SERIES CONNECTION



PARALLEL CONNECTION



*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

PICO Electronics, Inc.

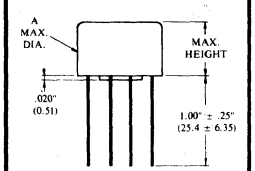
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • 914-699-5514 • TWX 7105620113

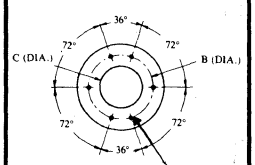
PICO's EMI Common Mode Suppression Inductors

- **Minimum possible size**
- **130°C operation (Ambient + Temp. Rise)**
- **Windings Balance ± 1%**
- **Dielectric Strength .... 1500 Volts RMS**
- **All units are magnetically shielded**

These Inductors are well suited for use in Switching Regulators, DC to DC Power Supplies and all types of Electrical Equipment where the elimination of line transmitted Electromagnetic Interference is important. Electrical equipment will generate noise due to switching operations of transistors, SCR's, relays, triacs, etc. By using these Inductors, noise being fed back to the power line is minimized to an acceptable level and this noise will not interfere with other equipment operating on the same power line.

Size	Max. Height	A Max. Dia.	B Bolt Circle	C Stand-Off
1	280 (7.11)	410 (10.41)	260 (6.6)	160 (4.06)
2	340 (8.63)	500 (12.7)	350 (8.89)	250 (6.35)
3	415 (10.54)	630 (16.0)	440 (11.17)	340 (8.64)

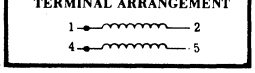




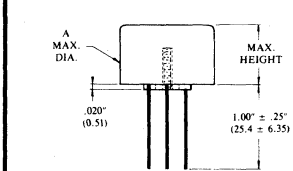
WHITE DOT AT PIN #1 TERMINALS ARE CLOCK-WISE FROM PIN #1.
PINS 3 and 6 HAVE NO CONNECTION (MECHANICAL SUPPORT ONLY).

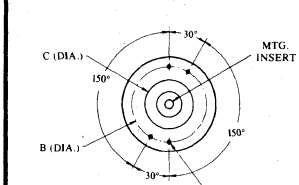
Dimensions are in inches (MM)

TERMINAL ARRANGEMENT



Size	Max. Height	A Max. Dia	B Bolt Circle	C Stand-Off	Mtg Insert
4	500 (12.7)	800 (20.32)	560 (14.22)	460 (11.68)	2-56 UNC .6 Threads Deep
5	650 (16.51)	950 (24.13)	670 (17.0)	570 (14.48)	6-32 UNC .8 Threads Deep
6	745 (18.92)	1.125 (28.57)	800 (20.32)	700 (17.78)	6-32 UNC .8 Threads Deep

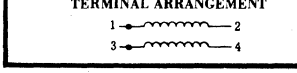




WHITE DOT AT PIN #1 TERMINALS ARE CLOCK-WISE FROM PIN #1.

Dimensions are in inches (MM)

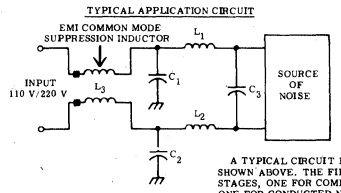
TERMINAL ARRANGEMENT



SPECIFICATIONS

- **All units meet MIL-T-27D and are type TF5S04ZZ**
- **Inductance measured at 0.1VRMS-10kHz**
- **Unit has magnetic shield**
- **Dielectric Strength .... 1500 Volts RMS**
- **Windings Balanced ± 1%**
- **Maximum ambient plus temp. rise limited to 130°C (ie maximum ambient of part no. 46283 would be 105°C if IRMS is 1.29 AMPS)**

TYPICAL APPLICATION CIRCUIT



A TYPICAL CIRCUIT FOR THE ELIMINATION OF NOISE IS SHOWN ABOVE. THE FILTER CONTAINS TWO STAGES, ONE FOR COMMON MODE NOISE (L_3, C_1, C_2) AND ONE FOR CONDUCTED NOISE (L_1, L_2, AND C_3).

INDUCTANCE	IRMS (AMPS) TEMP. RISE 60°C	TEMP. RISE 40°C	TEMP. RISE 25°C	RDC. (OHMS) EACH WDG.	APPROX. LEAKAGE INDUCTANCE (MICRO-HENRY)	SIZE	MODEL NUMBER	PRICE 1-9
75 MICRO-HENRY	1.95	1.57	1.29	.051	3.5	1	46283	16.45
	2.57	2.20	1.90	.033	3.5	2	47291	16.45
	4.43	3.79	3.23	.015	4	3	48381	16.45
185 MICRO-HENRY	1.25	1.00	.959	.125	5	1	46263	16.45
	1.61	1.39	1.19	.083	5	2	47271	16.45
	2.80	2.39	2.04	.038	4.5	3	48361	16.45
	4.58	3.83	3.06	.019	4.5	4	49461	19.45
375 MICRO-HENRY	.862	.691	.572	.263	9	1	46243	16.45
	1.14	.986	.851	.163	8	2	47251	16.45
	1.98	1.70	1.44	.075	8	3	48341	16.45
	3.23	2.70	2.16	.037	7.5	4	49441	19.45
	4.70	4.18	3.04	.021	6.5	5	50241	19.75
550 MICRO-HENRY	.711	.568	.472	.31	10.3	1	46223	16.45
	.924	.792	.686	.20	8.9	2	47231	16.45
	1.62	1.38	1.18	.09	8.4	3	48321	16.45
	2.64	2.20	1.77	.045	7.7	4	49421	19.45
	3.80	3.39	2.46	.026	7.5	5	50221	19.75
750 MICRO-HENRY	.619	.495	.410	.41	13.8	1	46203	16.45
	.814	.694	.601	.26	11.9	2	47211	16.45
	1.40	1.20	1.02	.12	11.3	3	48301	16.45
	2.29	1.91	1.53	.06	10.3	4	49401	19.45
	3.33	2.96	2.15	.034	10.0	5	50201	19.75
	5.10	4.23	3.77	.022	9.4	6	51303	21.67
1.5 MILLI-HENRY	.437	.349	.290	.82	27.5	1	46183	16.45
	.575	.491	.425	.52	23.8	2	47191	16.45
	.986	.847	.722	.24	22.5	3	48281	16.45
	1.61	1.36	1.08	.12	20.6	4	49381	19.45
	2.31	2.06	1.50	.07	20	5	50181	19.75
	3.78	3.14	2.80	.04	18.8	6	51283	21.67
3 MILLI-HENRY	.308	.246	.204	1.65	55	1	46163	16.45
	.405	.345	.299	1.05	47.5	2	47171	16.45
	.708	.605	.516	.47	45.0	3	48261	16.45
	1.14	.959	.766	.24	41.3	4	49361	19.45
	1.64	1.45	1.06	.14	40.0	5	50161	19.75
	2.53	2.09	1.86	.09	37.5	6	51263	21.67
6.75 MILLI-HENRY	.205	.165	.136	3.71	123.8	1	46143	16.45
	.270	.231	.200	2.36	106.9	2	47151	16.45
	.468	.401	.342	1.07	101.3	3	48241	16.45
	.769	.643	.516	.53	92.8	4	49341	19.45
	1.10	.977	.711	.31	90.0	5	50141	19.75
	1.69	1.41	1.25	.20	84.4	6	51243	21.67
12 MILLI-HENRY	.154	.123	.101	6.6	220	1	46123	16.45
	.202	.172	.150	4.2	190	2	47131	16.45
	.352	.299	.255	1.9	180	3	48221	16.45
	.572	.480	.378	.95	165	4	49321	19.45
	.827	.730	.528	.55	160	5	50121	19.75
	1.28	1.06	.942	.35	150	6	51223	21.67

For immediate engineering assistance or to place an order— ***Call Toll Free 800-431-1064***

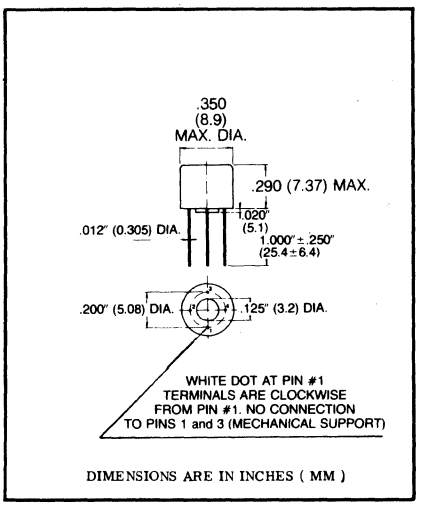
Delivery— stock to one week

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • 914-699-5514 • TWX 7105620113

PICO's ultra-miniature HIGH "Q" INDUCTORS

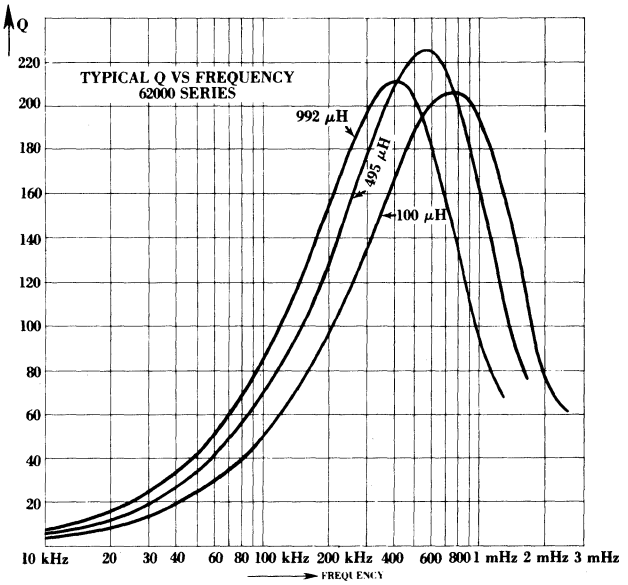
- ± 2% inductance stability vs temperature
- Smallest possible size
- Extreme resistance to thermal shock
- Meets Mil-T-27D (TF5R20ZZ)
- All units [illegible]
- Non-standard inductance values available at 10% higher cost than nearest standard inductor.



Delivery— stock to one week

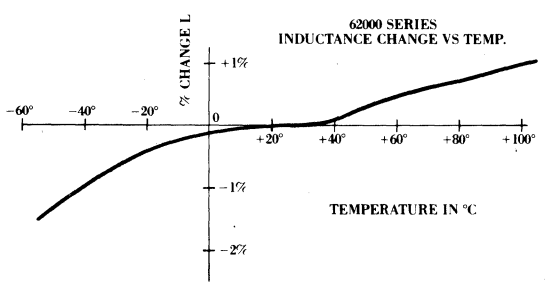
"62000" SERIES

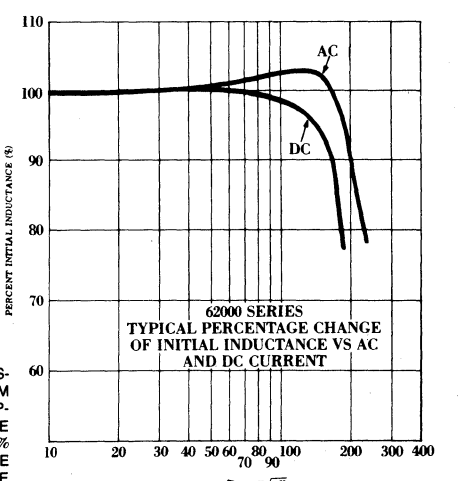
PART NUMBER	INDUCTANCE (MICRO-HENRYS)	D.C. RESISTANCE (OHMS)	APPROXIMATE SELF RESONANT FREQUENCY (MHz)	MAXIMUM DC CURRENT (mA)	MINIMUM Q	PRICE (1-9)
62112	2500	18	1.15	80	130 at (400 kHz)	21.71
62132	1500	10	1.5	100	130 at (400 kHz)	21.71
62152	992	7	1.8	125	160 at (400 kHz)	21.71
62172	900	6.5	1.9	130	160 at (400 kHz)	21.71
62192	800	6.0	2.1	140	160 at (400 kHz)	21.71
62212	742	5.7	2.3	150	150 at (500 kHz)	21.71
62232	702	5.5	2.5	155	150 at (500 kHz)	21.71
62252	600	5.0	2.7	160	160 at (500 kHz)	21.71
62272	495	4.5	3	170	160 at (500 kHz)	21.71
62292	400	3.7	3.3	185	160 at (500 kHz)	21.71
62312	298	2.8	3.8	215	170 at (500 kHz)	21.71
62332	248	2.3	4.2	235	170 at (500 kHz)	21.71
62352	196	1.8	4.75	265	160 at (500 kHz)	21.71
62372	150	1.4	5.5	300	160 at (500 kHz)	21.71
62392	100	1.2	6.8	330	140 at (500 kHz)	21.71



SPECIFICATIONS:

- INDUCTANCE TOLERANCE ±4% AT 0.1V-100KHZ
- INDUCTANCE STABILITY VS TEMPERATURE ±2% -55°C TO 105°C
- MEETS MIL-T-27D TF5R20ZZ
- WEIGHT 2 GRAMS
- THERMAL SHOCK 100 CYCLES, METHOD 107D MIL-STD 202E TEST CONDITION A3
- UNIT HAS MAGNETIC SHIELD





ALL INDUCTORS ARE MEASURED AT 0 DC. THE MAXIMUM DC LISTINGS ARE FOR APPROXIMATELY 30°C HEAT RISE AND APPROXIMATELY 2% DROP IN INDUCTANCE. THE CHANGE OF INDUCTANCE WITH AC OR DC CURRENTS IS ILLUSTRATED BY THE CURVES. THE EXCITATION IS PLOTTED IN mA ×√mHy. FOR EXAMPLE THE 0.495 mH INDUCTOR (62272) WITH 170 mA DC FLOWING WILL HAVE AN EXCITATION OF mA ×√mHy = 120, AND THE INDUCTANCE WILL DROP FROM 495 uH to 485 uH. IF THE 170 mA WAS AC, THE INDUCTANCE WOULD BE 510 uH.

For immediate engineering assistance or to place an order—
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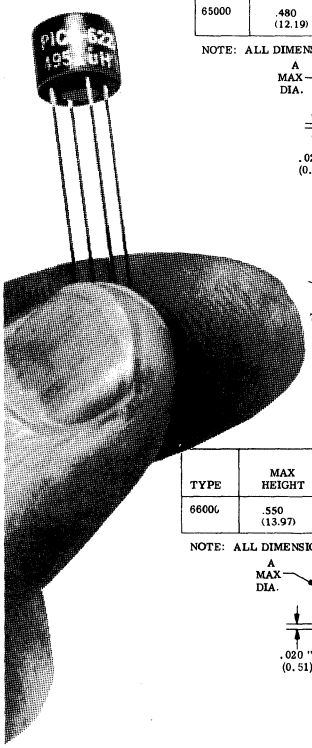
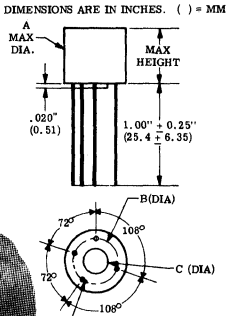
PICO's miniature HIGH "Q" INDUCTORS

- ± 1% inductance stability vs temperature
- Smallest possible size
- Extreme resistance to thermal shock
- Meets Mil-T-27D (TF5R20ZZ)
- All units are magnetically shielded

TYPE	MAX HEIGHT	A MAX DIA.	B BOLT CIRCLE	C STAND-OFF
63000	.325 (7.87)	.430 (10.69)	.260 (6.6)	.160 (4.06)
64000	.360 (8.89)	.530 (13.5)	.350 (8.89)	.250 (6.35)
65000	.480 (12.19)	.670 (17.0)	.440 (11.17)	.340 (8.64)

NOTE: ALL DIMENSIONS ARE IN INCHES. ( ) = MM

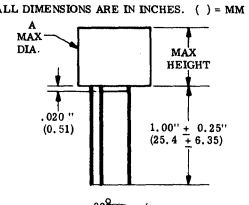


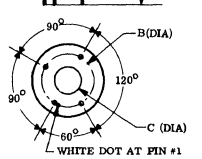


WHITE DOT AT PIN #1 TERMINALS ARE CLOCK-WISE FROM PIN #1. NO CONNECTION TO PIN #1 AND #3 (MECHANICAL SUPPORT)

TYPE	MAX HEIGHT	A MAX DIA	B BOLT CIRCLE	C STAND-OFF
66000	.550 (13.97)	.840 (21.34)	.560 (14.22)	.460 (11.68)

NOTE: ALL DIMENSIONS ARE IN INCHES. ( ) = MM





WHITE DOT AT PIN #1 TERMINALS ARE CLOCK-WISE FROM PIN #1. NO CONNECTION TO PIN #2 AND #4 (MECHANICAL SUPPORT)

ALL INDUCTORS ARE MEASURED AT 0 DC. THE MAXIMUM DC LISTINGS ARE FOR APPROXIMATELY 5% DROP IN INDUCTANCE AND NEGLIGIBLE HEAT RISE. THE CHANGE OF INDUCTANCE WITH AC OR DC CURRENTS IS ILLUSTRATED BY THE CURVES SHOWN FOR EACH INDUCTOR TYPE. THE EXCITATION IS PLOTTED IN mA X $\sqrt{mH}$. FOR EXAMPLE THE 10 mH INDUCTOR (64314) WITH 79 mA DC FLOWING WILL HAVE AN EXCITATION OF mA X $\sqrt{mH}$ = 79 X $\sqrt{10}$ = 250 AND THE INDUCTANCE WILL DROP FROM 10 mH TO 9mH. IF THE 79 mA WAS AC THE INDUCTANCE WOULD BE 9.65 mH.

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"63000" SERIES

PART NUMBER	INDUCTANCE	D.C. RESISTANCE (OHMS)	APPROXIMATE SELF RESONANT FREQUENCY (KHz)	MAXIMUM DC CURRENT (mA)	MINIMUM Q	*** PRICE (1-9)
63120	1 Hy	1840	47	5.7	30 at (15 kHz)	24.42
63140	750 mH	1380	54	6.6	30 at (15 kHz)	23.57
63160	500 mH	920	66	8	30 at (15 kHz)	22.20
63180	200 mH	368	105	12.5	60 at (25 kHz)	22.20
63200	100 mH	185	148	18	60 at (25 kHz)	22.20
63220	75 mH	140	172	20.8	100 at (50 kHz)	22.20
63240	50 mH	90	210	25.5	100 at (50 kHz)	22.20
63260	30 mH	55	270	33	100 at (50 kHz)	22.20
63280	20 mH	37	332	40	100 at (50 kHz)	22.20
63300	15 mH	28	383	46	100 at (50 kHz)	22.20
63320	10 mH	18.5	470	57	100 at (50 kHz)	22.20
63340	5 mH	10	665	80	100 at (50 kHz)	22.20
63360	1 mH	2	1480	180	100 at (50 kHz)	24.42

"64000" SERIES

PART NUMBER	INDUCTANCE	D.C. RESISTANCE (OHMS)	APPROXIMATE SELF RESONANT F REQUENCY (KHz)	MAXIMUM DC CURRENT (mA)	MINIMUM Q	*** PRICE (1-9)
64114	5 Hy	3000	17	2.8	15 at (4 kHz)	26.58
64134	3 Hy	1800	22	3.6	30 at (6 kHz)	25.63
64154	2 Hy	1200	27	4.4	30 at (6 kHz)	24.42
64174	1 Hy	600	38	6.3	30 at (6 kHz)	22.20
64194	750 mH	450	44	7.3	30 at (6 kHz)	22.20
64214	500 mH	300	54	9	30 at (6 kHz)	22.20
64234	250 mH	150	76	13	65 at (15 kHz)	22.20
64254	100 mH	60	120	20	65 at (15 kHz)	22.20
64274	75 mH	45	139	23	120 at (25 kHz)	22.20
64294	50 mH	30	170	28	120 at (25 kHz)	22.20
64314	10 mH	6	380	63	200 at (50 kHz)	22.20
64334	5 mH	3	537	89	200 at (50 kHz)	22.20
64354	1 mH	.6	1200	200	200 at (50 kHz)	24.42

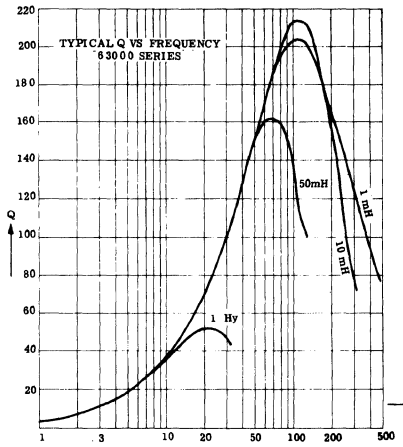
"65000" SERIES

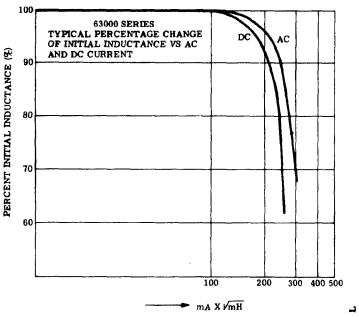
PART NUMBER	INDUCTANCE	D.C. RESISTANCE (OHMS)	APPROXIMATE SELF RESONANT FREQUENCY (kHz)	MAXIMUM DC CURRENT (mA)	MINIMUM Q	*** PRICE (1-9)
65413	10 Hy	3800	11.7	2.8	28 at (4 kHz)	26.58
65433	5 Hy	1900	16.5	3.9	28 at (4 kHz)	25.63
65453	3 Hy	1140	21	5.1	28 at (4 kHz)	24.42
65473	2 Hy	760	26	6.3	56 at (6 kHz)	24.42
65493	1 Hy	380	37	8.8	56 at (6 kHz)	22.20
65513	500 mH	190	52	12.5	56 at (6 kHz)	22.20
65533	250 mH	95	74	17.7	140 at (15 kHz)	22.20
65553	100 mH	38	117	28	140 at (15 kHz)	22.20
65573	50 mH	19	165	39.6	240 at (25 kHz)	22.20
65593	10 mH	3.8	370	88.5	240 at (25 kHz)	22.20

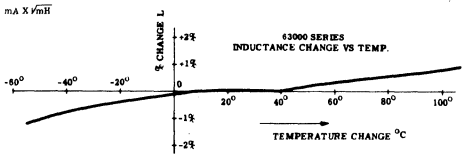
"66000" SERIES

PART NUMBER	INDUCTANCE	D.C. RESISTANCE (OHMS)	APPROXIMATE SELF RESONANT FREQUENCY (kHz)	MAXIMUM DC CURRENT (mA)	MINIMUM Q	*** PRICE (1-9)
66218	10 Hy	2200	11	4.2	40 at (4 kHz)	26.58
66238	5 Hy	1100	15.7	6	40 at (4 kHz)	25.63
66258	3 Hy	660	20	7.7	70 at (6 kHz)	25.63
66278	2 Hy	440	25	9.4	70 at (6 kHz)	22.20
66298	1 Hy	220	35	13	70 at (6 kHz)	22.20
66318	500 mH	110	49	18.8	70 at (6 kHz)	22.20
66338	250 mH	55	70	26.6	200 at (15 kHz)	22.20
66358	100 mH	22	110	42	200 at (15 kHz)	22.20
66378	50 mH	11	156	59	200 at (15 kHz)	22.20
66398	10 mH	2.2	350	133	200 at (15 kHz)	22.20

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

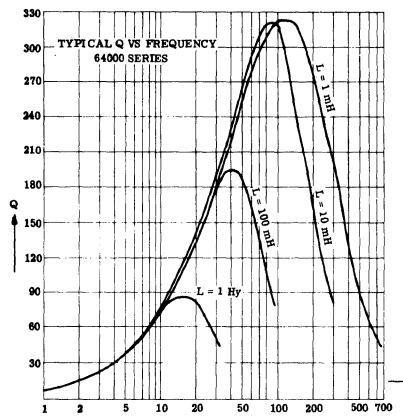


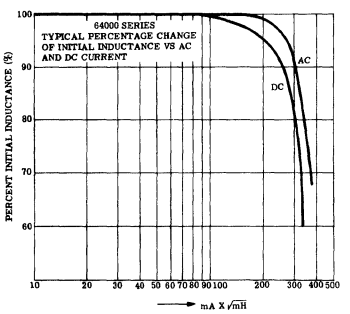


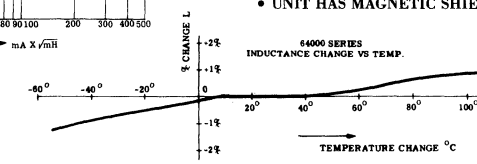


SPECIFICATIONS: **"63000" SERIES**

- INDUCTANCE TOLERANCE
  ±3% AT .1V - 4 kHZ.
- INDUCTANCE STABILITY VS TEMP.
  ± 1% - 30°C TO + 105°C
  + 1%
  - 2% - 55°C TO + 105°C
- MEETS MIL -T-27D (MIL TYPE TF5R20ZZ)
- WEIGHT 3.5 GRAMS
- THERMAL SHOCK:
  100 CYCLES, METHOD 107D, MIL-STD 202E, TEST CONDITION A-3
- UNIT HAS MAGNETIC SHIELD

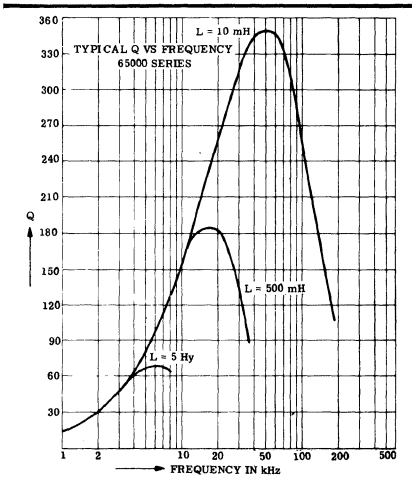


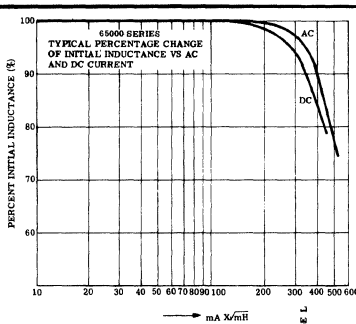


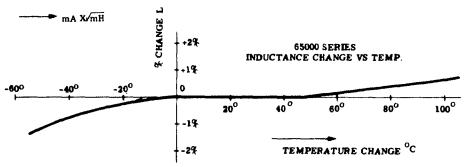


SPECIFICATIONS: **"64000" SERIES**

- INDUCTANCE TOLERANCE
  +3% AT .1V - 2 kHz
- INDUCTANCE STABILITY VS TEMP.
  ± 1% - 30°C TO + 105°C
  + 1%
  - 2% - 55°C TO + 105°C
- MEETS MIL -T-27D (MIL TYPE TF5R20ZZ)
- WEIGHT 6 GRAMS
- THERMAL SHOCK:
  100 CYCLES, METHOD 107D, MIL-STD 202E, TEST CONDITION A-3
- UNIT HAS MAGNETIC SHIELD

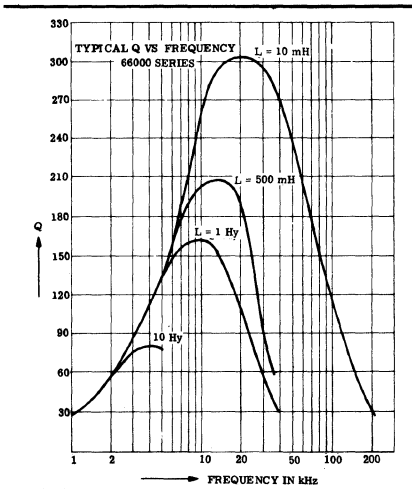


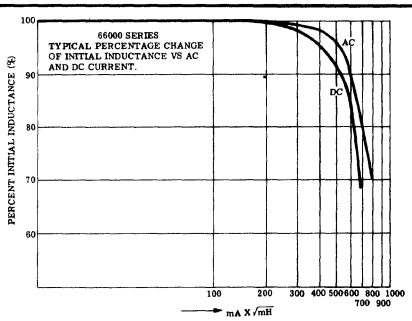


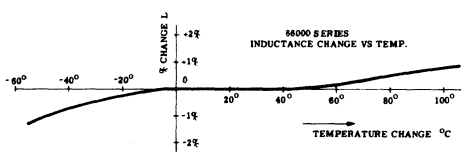


SPECIFICATIONS: **"65000" SERIES**

- INDUCTANCE TOLERANCE
  ±3% AT .1V - 1 kHz
- INDUCTANCE STABILITY VS TEMP.
  ± 1% - 30°C TO + 105°C
  + 1%
  - 2% - 55°C TO + 105°C
- MEETS MIL -T-27D (MIL TYPE TF5R20ZZ)
- WEIGHT 12 GRAMS
- THERMAL SHOCK:
  100 CYCLES, METHOD 107D, MIL-STD 202E, TEST CONDITION A-3
- UNIT HAS MAGNETIC SHIELD







SPECIFICATIONS: **"66000" SERIES**

- INDUCTANCE TOLERANCE
  ±3% AT .1V - 1 kHz
- INDUCTANCE STABILITY VS TEMP.
  ± 1% - 30°C TO + 105°C
  + 1%
  - 2% - 55°C TO + 105°C
- MEETS MIL -T-27D (MIL TYPE TF5R20ZZ)
- WEIGHT 22 GRAMS
- THERMAL SHOCK:
  100 CYCLES, METHOD 107D, MIL-STD 202E, TEST CONDITION A-3
- UNIT HAS MAGNETIC SHIELD

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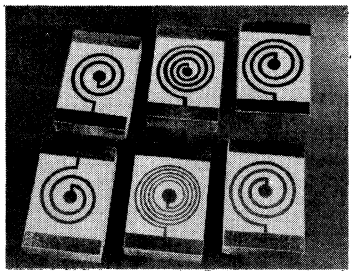
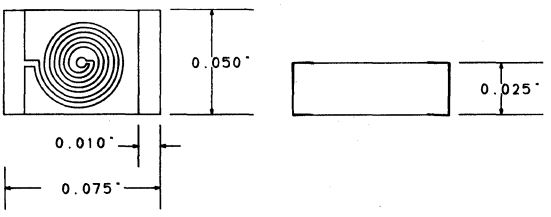
A complete family of SMD spiral chip inductors are available from two turns to fourteen turns. The product has excellent uniformity and is easily installed with standard chip handling techniques. Reflow solderable types are totally compatible with surface mount assembly techniques and because of the wide selection of values, can be selected to meet critical close tolerance requirements. It should be noted that because of stray effects differences in interconnection geometry and sensitivity to measurement techniques, the electrical values shown here may not represent values in a specific application.

The chip and wire bondable types can be used as tunable devices by selecting different points at which the leads are bonded to the inductor. Additional bonding pads are optionally available. Custom geometry spiral inductors can be tooled for a nominal charge.





Surface Mounted Device/Spiral Chip Inductor — Preliminary Data

PART #	TURNS	INDUCTANCE NH	Q MAX	SERIES RESONANCE Min GHz	PARALLEL RESONANCE Min GHz	DCR MAX OHM
SPR 20	2	3	4	14	9	2
SPR 25	2½	4	3.9	14	8	2
SPR 30	3	6	3.7	13	8	2
SPR 35	3½	7	3.6	13	7	2.5
SPR 40	4	9	3.5	12	7	3
SPR 45	4½	11	3.4	12	6	4
SPR 50	5	14	3.3	10	6	5
SPR 55	5½	16	3.2	9	5	6
SPR 60	6	19	3.1	9	4.7	8
SPR 65	6½	23	3.1	8	4.4	10
SPR 70	7	27	3.0	8	4.1	12
SPR 75	7½	31	2.9	7	3.9	14
SPR 80	8	36	2.9	7	3.7	16
SPR 85	8½	40	2.8	6	3.5	18
SPR 90	9	47	2.8	6	3.3	20
SPR 95	9½	52	2.7	5	3.1	21
SPR 100	10	59	2.7	5	2.9	23
SPR 105	10½	65	2.6	4	2.7	25
SPR 110	11	73	2.6	4	2.6	27
SPR 115	11½	80	2.5	3	2.5	29
SPR 120	12	89	2.5	3	2.4	31
SPR 125	12½	97	2.4	2	2.3	34
SPR 130	13	107	2.4	2	2.2	37
SPR 135	13½	116	2.3	1	2.1	40
SPR 140	14	130	2.3	1	2	43

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PICONICS

Micro Inductor Products and Application

The principal application for Piconics' Inductors has traditionally been in linear hybrid amplifier, micro-strip and stripline circuits. These designs have been used in a wide range of systems from the Space Shuttle Program to commercial microwave applications. Major use is in military systems where excellence and tight quality controls are required.

Piconics' components feature excellent stability, high Q and controlled characteristics. They are packaged in various configurations with a wide range of lead materials. Internal connections are welded to avoid the problems associated with high temperature soldering. Encapsulation is mechanically interlocked to strengthen all surface (shear) bonds. The materials and methods used at Piconics are compatible with normal requirements in hybrid circuit manufacturing.

Piconics' custom design capability has led to the development of unique products. Should your inductor requirements be outside the parameters of our standard listings, contact Piconics directly for a prompt quotation to your needs.

Leaded Inductor Selection Table — Tunable/Fixed **MIL-C-15305**

Series	Length	Width	Height	Inductance	Case	Adjustment	QPL
B	.325-.475	.110	.150	.020μH to 1mH	Molded	Screw (side)	Yes
G	.150-.300	.090	.105	.018μH to 1mH	Conformal Coating	Slide	In Process
ST	.200	.100	.275	.020μH to 1mH	Molded	Screw (top)	Yes
TT	.285	.110	.325-.450	.020μH to 1mH	Molded	Screw (top)	Yes

Series	Length	Width	Height	Inductance	NOTES	QPL
C	.200	.090	.105	.010μH to 1mH	Conformal Coating	In Process
D	.200	.085 or .095	.085 or .095	.010μH to 1mH	Molded Case	In Process
JA	.110 or .180	.060 or .075	.060 or .075	.045μH to 1mH	Epoxy Coated, Open Frame Case, Self-Leaded	In Process
JC	.180	.085	.085	.045μH to 1mH	Bonded, Open Frame Case Self-Leaded	In Process

Chip Inductor Selection Table — Tunable/Fixed **MIL-C-83446**

Series	Length	Width	Height	Inductance	Case	Adjustment	QPL
PGV	.160	.125	.330	.012μH to 1mH	Molded	Screw (top)	Yes
PSV	.320	.165	.130	.012μH to 1mH	Molded	Screw (side)	Yes
PV	.150-.300	.140	.065 or .095	.012μH to 1mH	Conformal Coating	Slide	Yes
PVW	.150-.300	.140	.065 or .095	.010μH to 1mH	Conformal Coating	Slide	Yes

Series	Length	Width	Height	Inductance	NOTES	QPL
P	.180	.140	.065 or .095	.010μH to 1mH	Conformal Coating	Yes
PA	.100	.100	.100	.010μH to 1mH	Molded Epoxy - Minimum Area Profile	Yes
PG	.160	.125	.130	.010μH to 1mH	Molded Diallyl Phthalate (DAP) Solder Fillet, Interlock Substrate Easily handled by automatic equipment	Yes
PK	.160	.125	.130	.010μH to 1mH	Molded Epoxy Case, Solder Fillet Interlock Substrate Easily handled by automatic equipment	Yes
PW	.180	.140	.065 or .095	.010μH to 1mH	Conformal Coating Bonding Pad Completes Connection	Yes

Leaded Inductor Selection Table — Fixed

Series	Length	Width	Height	Inductance	NOTES	QPL
M	.004-.170	.024	.024	6.3nH to 684nH	BONDED, SELF-LEADED AIR CORE HIGH FREQUENCY CHOKE, CONSTRUCTED OF 47AWG COPPER WIRE, INSULATED.	In Process
MG	.004-.170	.024	.024	6.3nH to 684nH	BONDED, SELF-LEADED AIR CORE HIGH FREQUENCY CHOKE, CONSTRUCTED OF 47AWG GOLD WIRE, INSULATED.	In Process
S	.200	.100	.100	5nH to 330nH	EPOXY CONFORMAL COATING SELF-LEADED TINNED AIR CORE HIGH FREQUENCY CHOKE.	In Process

Chip/Spiral Inductor Selection Table — Tunable/Fixed

Series	Length	Width	Ht/Th	Inductance	NOTES	QPL
MC	.100 or .160	.095 or .125	.045 or .060	6.3nH to 684nH	CHIP MOUNTED COIL	In Process
SP	.045	.045	.010	5.5nH to 100nH	QUARTZ AND 99.6% ALUMINA SUBSTRATE MATERIALS. $3^1/_2$, $4^1/_2$, $5^1/_2$, $8^1/_2$, TURNS AVAILABLE ON .045″ X .045″ OR .050″ X .075″. $11^1/_2$, $18^1/_2$, $22^1/_2$ TURNS ONLY ON .050″ X .075″ VALUES ABOVE 50nh AVAILABLE ON .050″ X .075″	No
	.050	.075	.010			

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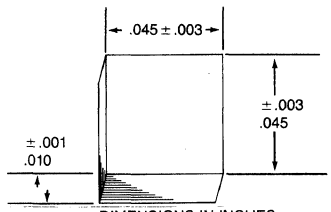
PICONICS

SP SERIES/M/MG SERIES MC SERIES

SP Series Spiral Chip Inductor

This style inductor may be used where low inductance values are required and gold wire bonding is the method for making interconnections. When used as an r.f. choke, attach center pad to r.f. and outside pad to power supply. Custom designs available. Other ceramic materials having various dielectric constants are available.



DIMENSIONS IN INCHES

NOTES:

(1) Self-resonant frequency may be increased by mounting inductor on an insulating standoff. These Stand-offs can be provided by Piconics.
(2) Inductors to 25 turns in this geometry are available on special order.
(3) Attachment is generally made using non-conductive epoxy such as EPO-TEK H-61 or EPO-TEK H-20.
(4) Thermosonic wire bonding using 1 mil gold wire is recommended for lead attachment to this style inductor. Gold ribbon may also be used.
(5) Resonances shown in the tables are the lowest self resonances encountered. Typical values are higher.
(6) Measurements are very dependent on fixturing and frequency.
(7) Quartz typically gives higher SRF and Q's than ceramic due to lower Dielectric Constant.
(8) Bonding area typically .005" in diameter.
(9) Other thicknesses available upon request.

SP Series on Quartz

Part No.	Turns (2)	@200MHz Inductance (L) nH (6)	Q Min (7)	Series Resonance Min GHz (1-5-7)	Parallel Resonance Min GHz (5)	DCR MAX OHM
SP3P5-Q	3 1/2	7	3.5	17	9	2.5
SP4P5-Q	4 1/2	11	3.4	15	9	4
SP5P5-Q	5 1/2	15.7	3.2	11	7	6
SP8P5-Q	8 1/2	45	2.8	8	5	20
SP11P5-Q	11 1/2	80	2.5	3.5	3.5	28

SP Series on Ceramic

Part No.	Turns (2)	@200MHz Inductance (l) nH (6)	Q Min (7)	Series Resonance Min GHz (5)	Parallel Resonance Min GHz (5)	DCR MAX OHM
SP3P5-A	3 1/2	7	3.5	13	5	2.5
SP4P5-A	4 1/2	11	3.4	12	7	4
SP5P5-A	5 1/2	15.7	3.2	9	5	6
SP8P5-A	8 1/2	45	2.8	6	3.5	20
SP11P5-A	11 1/2	80	2.5	3	2.5	28

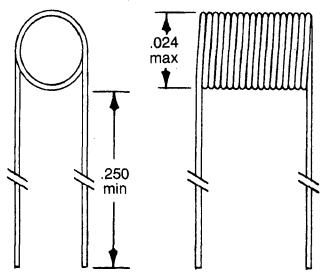
Microwave Components — M/MG Series

Piconics' M series is a microminiature broadband air core choke with a high self-resonant frequency, suitable for microwave applications.

Piconics' M series chokes provide inductance values from 6.3nH to 684nH, operating frequencies from 100 MHz, and self-resonant frequencies from 1 GHz to 28GHz.

Constructed of 47 AWG insulated copper wire rated at 130°C. Piconics' M series chokes are available from 2 to 100 turns for standard models. Special models can also be provided.

Applications include oscillators, mixers, switches, stripline devices, broadband modulators, power supplies, filters and frequency multipliers.



PHYSICAL CHARACTERISTICS

- Air Core
- Self-Leaded
- Solder Strippable Leads (SS)
- Recommended operating and storage Temperature Range: −55°C to +125°C

OPTIONS AVAILABLE

- Axial Leads
- Tinned Leads (We recommend pre-tinning of leads prior to circuit insertion)
- Gold Plated Leads, M xxx 47GP
- Gold Coils, MG xxx 47SS, (99.99% Pure), bare or insulated.
- Higher temperature class insulation available upon request.

ELECTRICAL CHARACTERISTICS

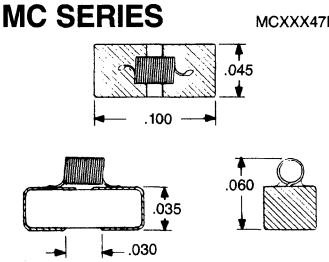
Piconics' Part Number	Length Nom. Inches	L nH ± 10%	Test Freq. MHz	Q Min	SRF Min GHz	DC Res. Ohms Max	Idc Max MA
M2T47SS	.004	6.3	200	36	28	0.14	100
M3T47SS	.005	9.6	200	34	25	0.18	100
M5T47SS	.010	30	200	32	15	0.26	100
M8T47SS	.014	35	100	24	14	0.33	100
M10T47SS	.017	47	100	24	13	0.43	100
M15T47SS	.026	72	100	24	11	0.55	100
M20T47SS	.034	113	100	18	8	0.78	100
M25T47SS	.043	147	25	16	6	0.90	100
M30T47SS	.050	178	25	18	6	1.1	100
M35T47SS	.060	213	25	18	5	1.3	100
M40T47SS	.068	234	25	16	4	1.4	100
M45T47SS	.077	282	25	18	3	1.6	100
M50T47SS	.085	320	25	18	3	1.8	100
M55T47SS	.095	343	25	18	2	1.9	100
M60T47SS	.102	388	25	18	2	2.0	100
M65T47SS	.112	406	25	17	2	2.2	100
M70T47SS	.120	442	25	18	1	2.3	100
M75T47SS	.128	470	25	18	1	2.5	100
M80T47SS	.136	533	25	18	1	2.7	100
M85T47SS	.145	552	25	18	1	2.9	100
M90T47SS	.153	618	25	18	1	3.0	100
M95T47SS	.162	651	25	18	1	3.2	100
M100T47SS	.170	684	25	18	1	3.4	100

The number of turns required are counted between the leads.

NOTE: Electrical characteristics are measured at a point on the leads .100" from the body of the coil.

MC SERIES

MCXXX47PW



FEATURES

- Minimum Height
- Surface Mountable
- Ease of Handling

ABSOLUTE MAXIMUM RATINGS

- Operating Temperature range: −55°C to +125°C
- Storage Temperature range: −55°C to +125°C
- Temperature rise (at 90°C): 35°C
- Maximum Operating Temperature: 125°C
- DC MA MAX: 100

PHYSICAL CHARACTERISTICS

- Air Core
- Alumina Substrate Base
- Gold Plated Contacts over Nickel
- Weight: 0.1 gram maximum

OPTIONS AVAILABLE

- Optional wire sizes available.
- Tinned terminations available.

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The New

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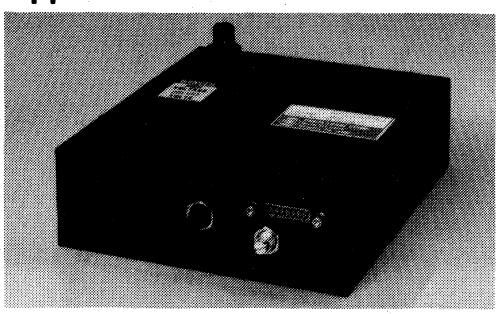
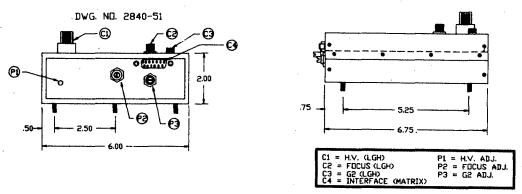
30 Watt High Voltage Power Supply For Military and Airborne Applications MIL HVS 2825





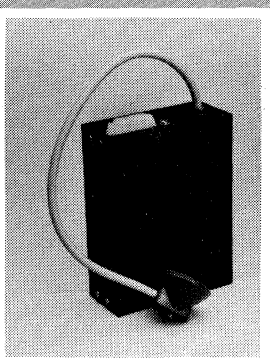
Performance Specifications

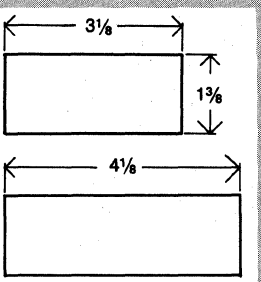
Input	28VDC ± 2 Volts
Anode Voltage	25KV (less than ± 1%)
Anode Current	0-1.2 MA
Ripple (P-P)	7.5 Volts (P-P) @ 1.2 MA
Temperature Coefficient	100 PPM/°C
Line Regulation	.05%
Focus Voltage	5-8 KV
G2 Voltage	200-1000 VDC
G1 Voltage	−150 VDC
Operation Temperature	−55° to 70°C

High Voltage Power Supplies

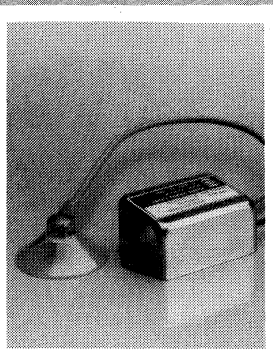
Engineers know us for quality and innovation in the design and manufacture of deflection components for CRT Displays and television cameras. High Voltage Power Supplies are part of the new Penn-Tran's team of deflection components, exactingly designed, manufactured and backed by our 41 years as a pioneer in the field.

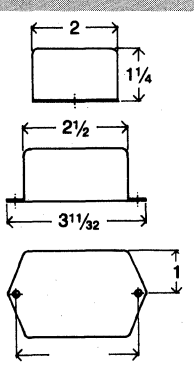
These power supplies are suitable for multiple customer-specified applications, or we will design a prototype to suit your application. For more of the Penn-Tran team, see our stator yokes in EEM Section 1800. UL listed file.



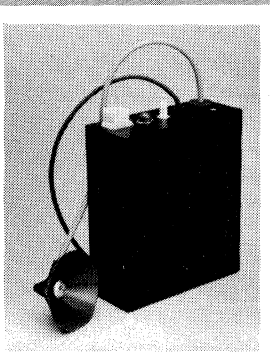


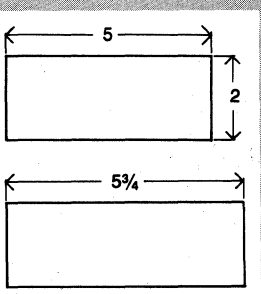
10 Watt -	B+	HV(KV)	SEC	SEC	SEC
HVS 2610	26	10	400	−100	
HVS 2617	26	17	1000	−110	





3 Watt -	B+	HV(KV)	SEC	SEC
HVS 1509	15	9.0	400	−100
HVS 1512	15	12.0	400	−100





30 Watt –	B+	HV(KV)	SEC(KV)	SEC	SEC
HVS 2825	28	25	(5.0-8.0)	(200-1000)	−150
HVS 3625	36	25	(5.5-8.5)	(200-700)	−200

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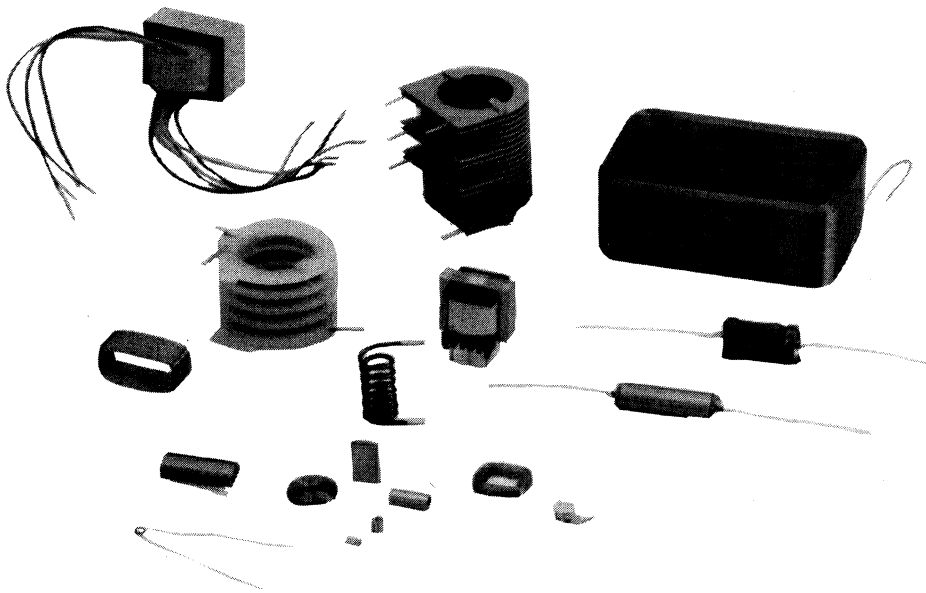

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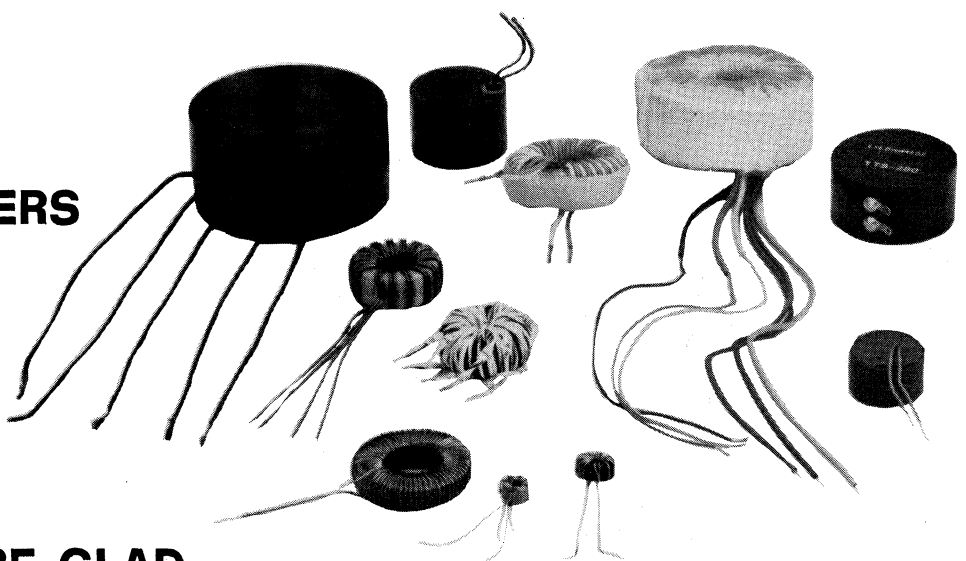

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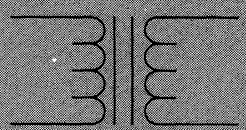

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"CONSISTENT SERVICE ... START TO FINISH"

Renco offers more than 1700 standard models of chokes and transformers for applications ranging from switching power supplies to fuel injection systems. And what we don't supply as a standard catalog item, we can create. Our standard product lines include:

POWER-LINE CHOKES . . . over 400 standard values, despite their compact size, they can handle high currents.

SHIELDED INDUCTORS . . . over 200 standard values, low-cost miniature units for audio filters, tone controls and other applications.

FLAT COILS . . . over 50 standard values, twice the inductance and Q of axial lead inductors.

LOW-COST CHOKES . . . over 50 standard values, heavy duty general-purpose ferrite core inductors.

SWINGDUCTORS . . . over 200 standard values, cost-effective swinging chokes to improve power-supply efficiency.

COMMON-MODE CHOKES . . . over 400 standard values, low-cost means to meet UL, FCC, CSA, and VDE requirements.

MIL-SPEC INDUCTORS . . . over 350 standard values, encapsulated power-line chokes meeting MIL-T-270.

POWER, DRIVER, INTERSTAGE, AND INVERTER TRANSFORMERS . . . over 300 types, with pot core, toroidal, EP, EC, PQ, ETD and RM configurations.

CUSTOM DESIGNS

But even with our broad line of standard products, there will always be "specials". We've been in this business exclusively for over 30 years, so we can say with confidence, "If you can describe it, we can make it". And we send out samples in one day in most cases, or perhaps as long as ten days, if you've got a far-out design. There's no charge, by the way, for samples; we believe we'll earn your business as we learn about your needs. If our samples meet your requirements, you'll find our custom products are available at standard prices.

TECHNICAL SUPPORT

You can count on our technical backup if you encounter circuit or systems problems involving coils or transformers. We'll return phone calls promptly, and even fly an application specialist to your plant if necessary . . . and that's a fact.

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Our prices are competitive and our product quality and reliability are excellent due to our years of design/production experience coupled with the latest automated assembly equipment, robotic workstations, and specialized ATE test setups. And we won't keep you waiting . . . we meet our scheduled delivery dates.

So think Renco when you think coils and tranformers. We'll make sure you made the right decisions.

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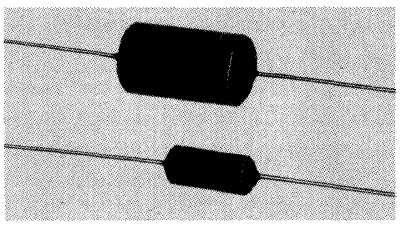
"CONSISTENT SERVICE . . . START TO FINISH"

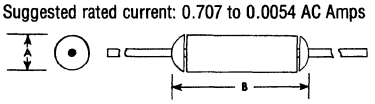
Shielded Inductors RL1123/RL1124



Low cost, miniature shielded coils, extremely useful in compact audio filters, tone control circuits, amplifiers, and wherever high inductance coils are needed. Excellent, low cost alternatives to fixed pot cores.

Series RL1123: (96 values)
Inductance: 1.0 μH to 47.0 H
Max DCR: 0.0066 to 5170.0 Ohms
Suggested rated current: 1.5 to 0.0054 AC Amps

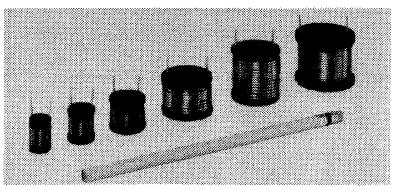
Series RL1124: (80 values)
Inductance: 1.0 μH to 4.7 H
Max DCR: 0.011 to 1700.0 Ohms
Suggested rated current: 0.707 to 0.0054 AC Amps



		RL1123	RL1124
DIM. (IN)	A	.500 max.	.260 max.
	B	.950 max.	.700 max.

WEIGHT: RL1123 . . . 15 gm max, approx.
RL1124 . . . 5 gm max, approx.
LEADS: No. 20 tinned copper 1-1/4' long min.

Power Line Chokes RL1256/1283/1284



Available in 406 standard values. High saturation flux density material makes these coils ideal wherever high current choke values in a small physical size are needed.

Series RL1256-1: (34 values)
Inductance: 1.0 to 560.0 μH
Max DCR: 0.003 to 0.696 Ohms
Saturation current: 87.0 to 2.9 DC Amps
Suggested Rated current: 9.0 to 0.8 AC Amps
Dimension "E": 0.406 to 0.550

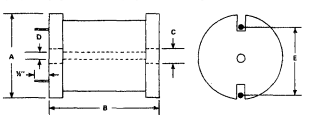
Series RL1256-2: (41 values)
Inductance: 1.0 to 2200.0 μH
Max DCR: 0.003 to 1.54 Ohms
Saturation current: 108.0 to 2.90 DC Amps
Suggested rated current: 11.4 to 0.8 AC Amps
Dimension "E": 0.590 to 0.671

Series RL1256-3: (45 values)
Inductance: 1.0 to 4700.0 μH
Max DCR: 0.003 to 1.86 Ohms
Saturation current: 116.0 to 1.7 DC Amps
Suggested rated current: 21.0 to 1.0 AC Amps
Dimension "E": 0.750 to 0.800

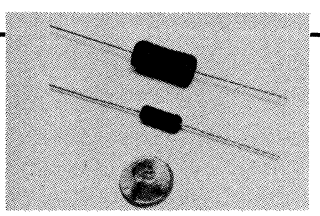
Series RL1256-4: (48 values)
Inductance: 1.8 to 15000.0 μH
Max DCR: 0.002 to 3.39 Ohms
Saturation current: 150.0 to 1.5 DC Amps
Suggested rated current: 27.0 to 1.3 AC Amps
Dimension "E": 1.11 to 1.187

Series RL1256-5: (48 values)
Inductance: 1.8 to 15000.0 μH
Max DCR: 0.002 to 2.17 Ohms
Saturation current: 155.0 to 1.5 DC Amps
Suggested rated current: 35.0 to 2.0 AC Amps
Dimension "E": 1.11 to 1.28

Series RL1256-6: (49 values)
Inductance: 4.7 to 47000.0 μH
Max DCR: 0.002 to 6.19 Ohms
Saturation current: 149.9 to 1.2 DC Amps
Suggested rated current: 35.0 to 1.4 AC Amps
Dimension "E": 1.31 to 1.53



DIM. (IN)	A	B	C	D
RL1256-1	0.660	0.84	0.195	Clearance Hole For 4/40 Screw
RL1256-2	0.825	0.84	0.195	
RL1256-3	1.1	0.84	0.195	
RL1256-4	1.6	1.03	0.290	Clearance Hole For 8/32 Screw
RL1256-5	1.6	1.45	0.290	
RL1256-6	2.0	1.50	0.320	

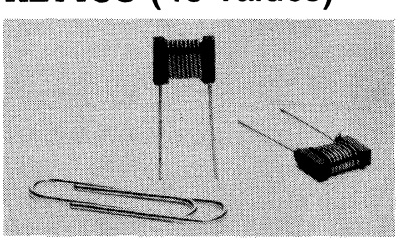


Series RL1283: (54 values)
Inductance: 3.9 to 100000.0 μH
Max DCR: 0.007 to 89.7 Ohms
Saturation current: 15.5 to 0.081 DC Amps
Suggested rated current: 4.0 to 0.065 AC Amps

Series RL1284: (45 values)
Inductance: 3.9 to 18000.0 μH
Max DCR: 0.008 to 48.3 Ohms
Saturation current: 7.3 to 0.091 DC Amps
Suggested rated current: 1.28 to 0.039 AC Amps

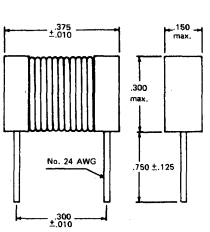
DIM. (IN) **RL-1283 (A)** 0.453 max. **(B)** 0.900 max.
RL-1284 (A) 0.260 max. **(B)** 0.650 max.

Flat Coils RL1160 (45 values)

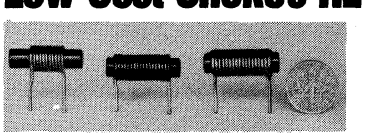


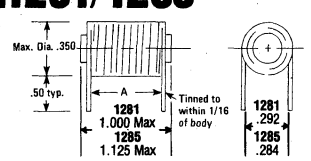
Unique flat coil configuration ideally suited to high density PCBs. Twice the inductance and Q values than axial lead inductors occupying the same space. Wide range of inductance and Q values for use at radio as well as audio frequencies.

Inductance:
1.0 to 4700.0 μH
Frequency:
7.9 MHz to 250.0 KHz
Min Q: 37.0 to 63.0
Max DCR:
0.010 to 29.9 Ohms
Saturation current:
7.0 to 0.11 DC Amps
Suggested rated current: 2.25 to 0.027 AC Amps



Low Cost Chokes RL1281/1285





Heavy duty, general purpose inductors use ferrite cores and offer a wide range of inductance values. Their compact size and pretinned leads make them easy to use in printed circuit boards.

Series RL1281: (23 values)
Max current: 4 Amps
Inductance (±15%)*: 0.22 to 12.50 μH
Max DCR: 0.003 to 0.025 Ohms
Dimension "A": 0.187 to 0.875

Series RL1285: (19 values)
Max current: 6 Amps
Inductance (±15%)*: 0.22 to 10.20 μH
Max DCR: 0.002 to 0.015 Ohms
Dimension "A": 0.125 to 0.883

*Measured at 1 KHz

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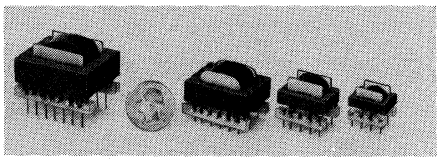
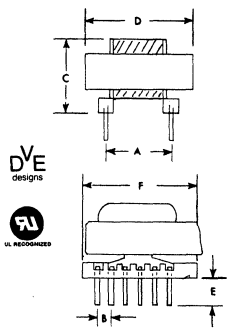
Custom Power Supply Transformers-Ferrite Core



This series gives switching power supplies the custom-designed transformers they deserve — at standard prices. We have large stocks of research-selected ferrite "E" cores, and glass-filled nylon bobbins, with which we can quickly meet the specification for your power, driver, interstage, and inverter transformers. Prototypes usually shipped within 10 days.

Wound on custom engineered equipment that ensures conformance to requirements.



DVE designs

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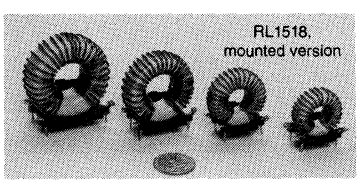
DIM. (IN)	A	B	C	D	E	F
RL1287-1	0.515	0.200	0.660	0.650	0.175	0.780
RL1287-2	0.630	0.200	0.830	0.770	0.175	1.030
RL1287-3	0.800	0.200	0.915	1.140	0.175	1.375
RL1287-4	1.000	0.200	1.050	1.325	0.375	1.700
RL1287-5	1.100	0.300	1.300	1.700	0.185	1.000
RL1287-6	1.300	0.300	1.500	2.000	0.250	2.300

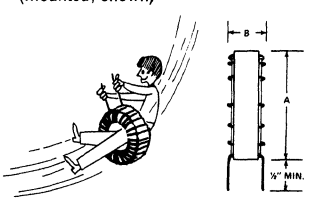
NUMBER OF TERMINALS — SIZE 0.025 SQ.		
RL1287-1 (#8)	RL1287-2 (#10)	RL1287-3 (#12)
RL1287-4 (1#14)	RL1287-5 (#12)	RL1287-6 (#12)

Swingductor™ RL1386 /RL1518

(unmounted) (mounted, shown)

185 values each version





Designed for applications requiring a known inductance change with changing current loads (as in power supplies). Although similar in appearance to conventional toroids, the special core material allows a "controlled saturation," so that a specific inductance value is repeatable at a specific current. The core material is effective up to 1 MHz. As a result of toroidal design, the Swingductor™ produces a closed magnetic field, resulting in low EMI. All are supplied with pretinned leads for easy PC board installation.

DIM. (IN)	"A" (MAX. DIA.)	"B" (MAX. WIDTH)
RL1386-1	1.10	0.500
RL1386-2	1.45	0.874
RL1386-3	1.80	0.900
RL1386-4	2.00	1.100
RL1386-5	2.60	1.500

FREE SAMPLES just for the asking.

Think you could use any of the chokes described on pages A•1282-A•1285? Then call our TOLL-FREE engineering Hot-Line (800-645-5828 outside of New York State; in New York State call 516-586-5566) and tell us your specs—and we'll send you a free sample. If your specs hit squarely on one of our 1428 standard values, we'll ship the same day.

If your specs do not exactly match any of our standards—give us a call and we'll make up a free custom sample in our special prototype and sampling laboratory. So unless you need something exceptionally complex, we'll ship your sample within 10 days.

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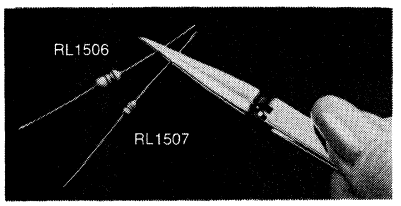
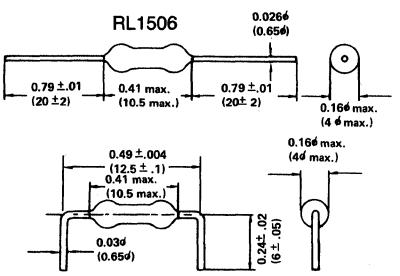
Mini Inductor RL1506
Sub Mini Inductor RL1507



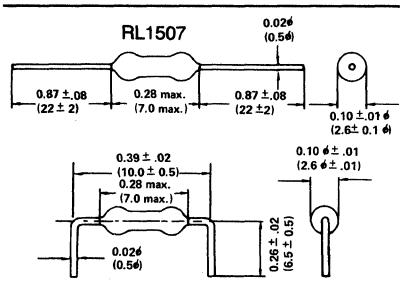
These rugged coils exhibit high Q and very low distributed capacity, all concentrated into an amazingly small package. Ideal where weight, space, Hi Q, and auto insertion are involved. Temperature range −25° to +85°C. Coils identified with industry standard color code.

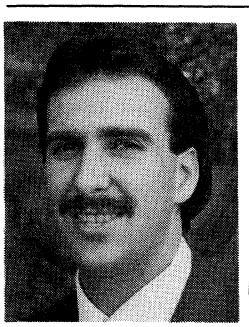
OUTER DIMENSIONS
Dimensions of Single Product
Temperature Range: −25°C to +85°C
Dimensions in inches (mm)

RL1506



RL1507





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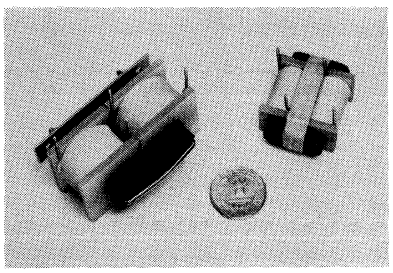
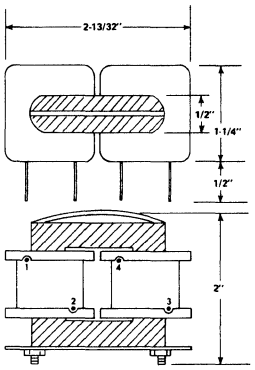
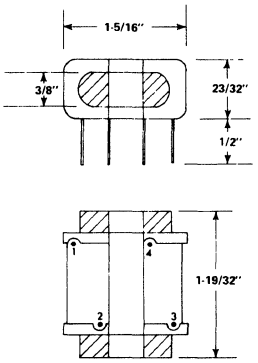
Common Mode Chokes RL1328/1329



Placed at the inputs of electrical equipment, these chokes help meet U.S. and international requirements for safety and EMI. These low priced Common Mode Chokes are available in a wide range of standard inductances, with current ratings to 35 Amps.



Series RL1328: (120 values)
Inductance: 47.0 to 39000.0 μH
Max DCR: 0.002 to 0.555 Ohms
Max leakage inductance:
4.0 to 3080.0 μH
Max interwinding capacitance:
2.0 to 9.4 pF
Hipot winding to winding and winding to core: 5000 VAC
Suggested rated current:
3 to 35 AC Amps



Series RL1329: (86 values)
Inductance: 6.8 to 22000.0 μH
Max DCR: 0.0028 to 0.555 Ohms
Max leakage inductance:
1.5 to 1430.0 μH
Max interwinding capacitance:
1.0 to 10.7 pF
Hipot winding to winding and winding to core: 5000 VAC
Suggested rated current:
2 to 22 AC Amps

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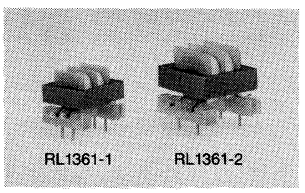
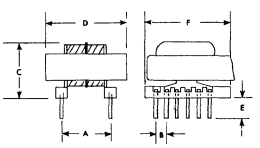
Common Mode Chokes RL1361-1/RL1361-2

Placed at the inputs of electrical equipment, these chokes help meet U.S. and international requirements for safety and EMI. Low-priced, they're available in a wide range of inductances and current ratings from 100mA to 5.5Amps. PC mounting. Low profile. Varnish impregnated. MTL Used Class B 130°C. MIL spec and encapsulation available.

STYLE NUMBER	TYPICAL DIMENSIONS						TERMINAL	
	A	B	C	D	E	F	SIZE	NO.
RL-1361-1	.515	.200	.622	.750	.175	.850	.025 SQ.	8
RL-1361-2	.630	.200	.797	.850	.175	1.100	.025 SQ.	10





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As for pot core assemblies, we've manufactured millions since 1955, and are thoroughly experienced with all standard cores and hardware, including Ferroxcube, Siemens, TDK, Magnetics Inc., Indiana General, etc. We stock all the popular bobbins, including printed circuit types.

Let us assist you in your upcoming designs. Our fully independent sample and prototype department can usually ship a prototype within 10 days.

Send us your specifications and designs for your pot cores, coils, inductors, or transformers, and we'll respond promptly with very competitive prices. We have a reputation for keeping our delivery promises.

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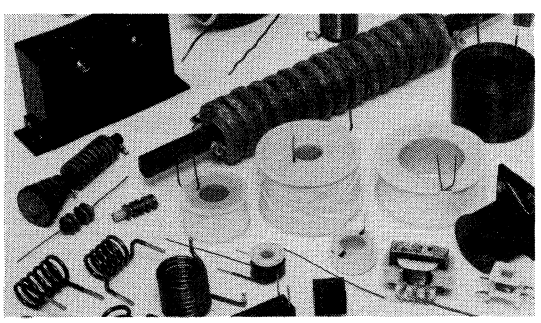

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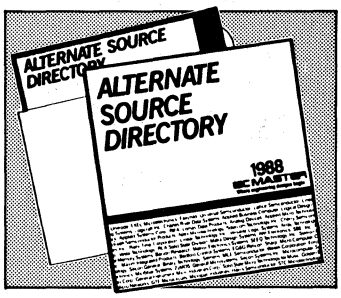

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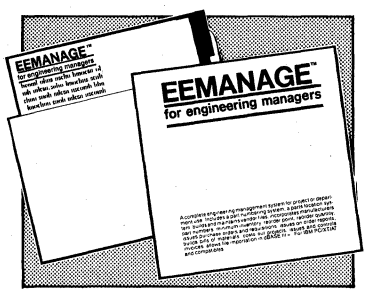

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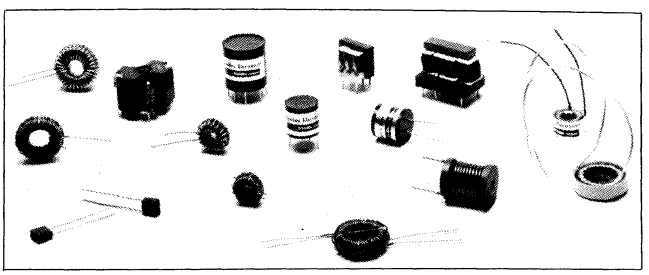
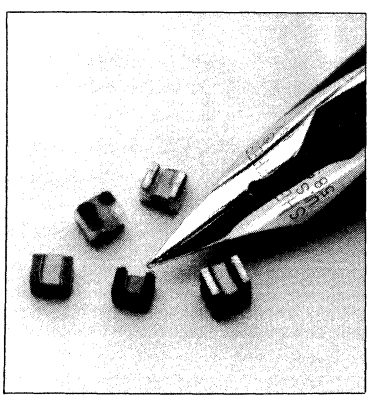
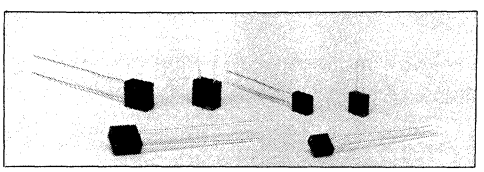


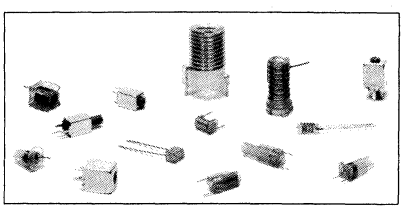




Standard Standex "MT" Series Miniature Toroidal Inductors meet all of the requirements of MIL-C-15305, MS21422, MS21423 and MS21424. Inductances range from .01μh to 1000μh.

Microcoil™ Surface Mounted Inductors range from 50 to 22,000 nH and may be supplied uncoated, epoxy coated, potted, bulk packaged, or "Tape and Reel." The "Q" on these components is higher than components of similar size.

Insert molded variable and fixed Inductors and helical coils are used in most radio frequency applications. Standard 7mm and 10 mm packages are available along with numerous other variable and fixed, vertical and horizontal configurations.



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Standex quality procedures are based on the specifications of MIL-I-45208. Statistical process control is utilized to monitor and control variables in processing during manufacturing.

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a Standex company

eem SI UNITS

RELATIVE QUANTITY SYMBOLS

$\neq$	not equal to
$\approx$	approximately equal to
$\propto$	proportional to
$<$	smaller than
$\leq$	smaller than or equal to
$\ll$	much smaller than
$>$	larger than
$\geq$	larger than or equal to
$\gg$	much larger than
$\equiv$	identical to or equivalent
$\uparrow$	increases
$\downarrow$	decreases

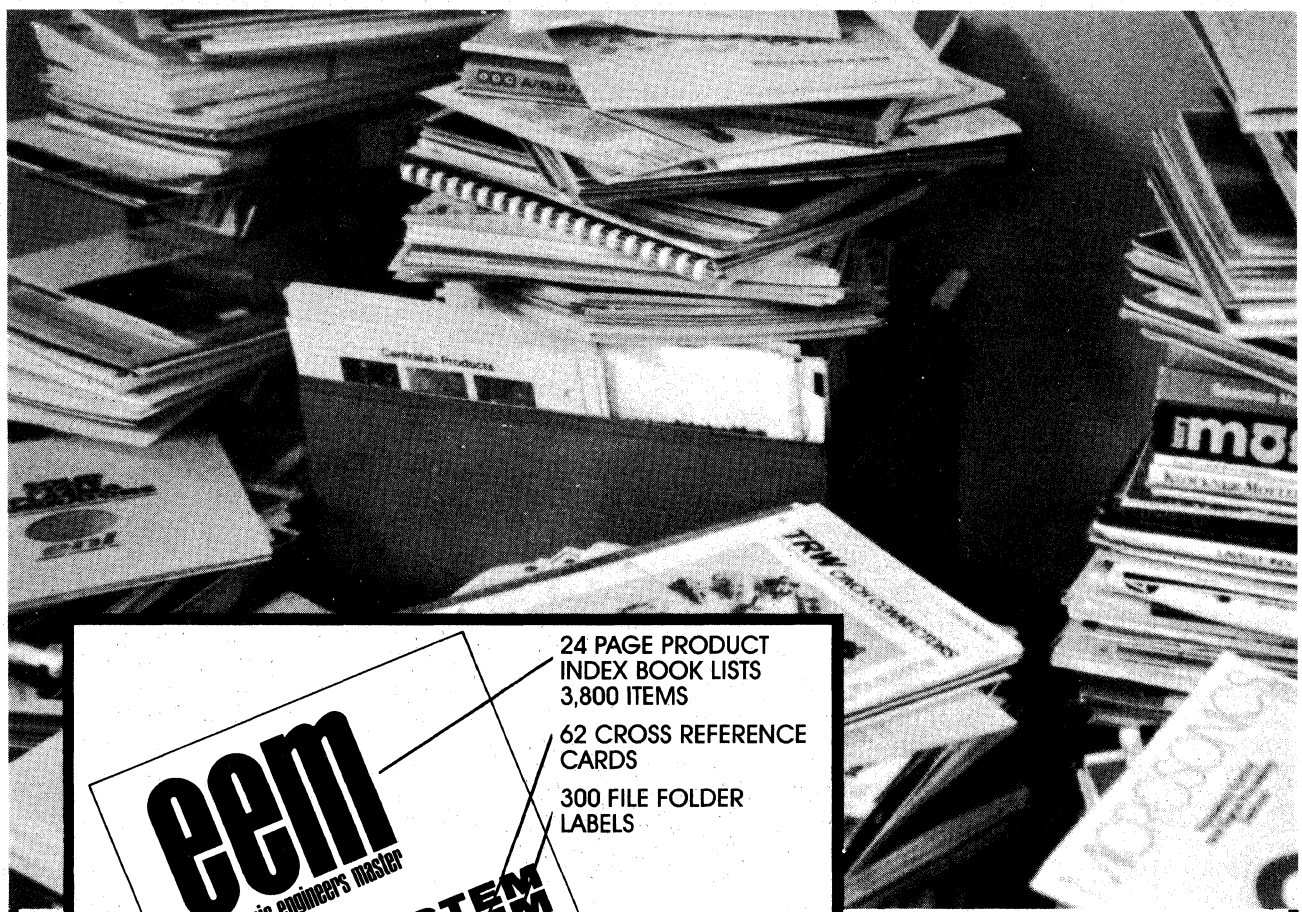
PREFIXES FOR SI UNITS

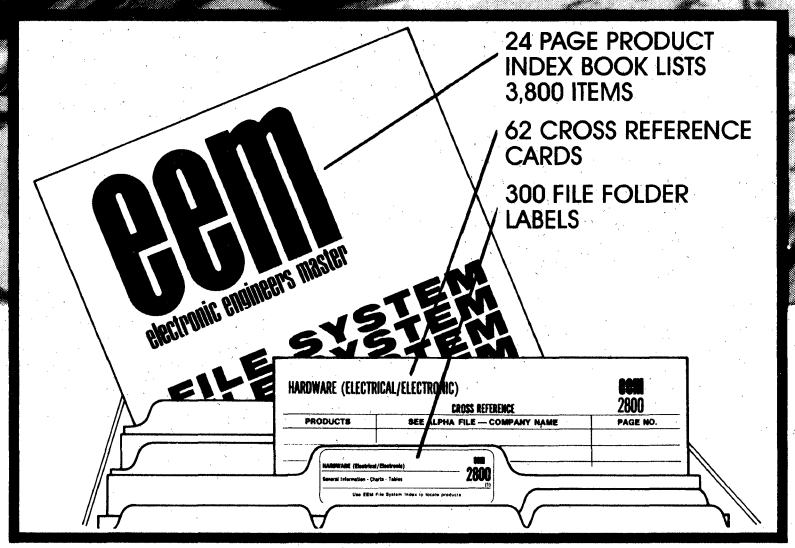
Multiple	Prefix	Symbol
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p

Quantity	Symbol	SI Unit	Symbol	Derivation
acceleration	a	m s^{-2}	—	velocity/time
acceleration due to gravity	g	m s^{-2}	—	velocity/time
amount of substance	n	mole	mol	mole fraction (n) used
amplification factor	μ	*a ratio*	—	—
angle	$\theta_1, \varphi_1, \alpha_1$	—	—	—
angle of incidence	i	degree or radian	°	—
angle of refraction	r	degree or radian	°	—
angle, Bragg	θ	number	—	—
angle, critical	c	degree or radian	°	—
anode slope resistance	R_A	ohm	Ω	$\Delta V_a / \Delta I_a$
area	A	metres squared	m^2	$l \times b$
atomic number	Z	a number	—	number of protons
Avogadro constant	L, N_A	number	—	—
breadth	b	metre	m	fundamental unit
capacitance	C	farad	F	charge/p.d.
charge, electric	Q	coulomb	C	current × time
charge on electron	e	coulomb	C	$1{\cdot}6 \times 10^{-19}$ C
conductance	G	ohm^{-1}	Ω^{-1}	reciprocal of resistance
current, electric	I	ampere	A	fundamental unit
decay constant	λ	*a ratio*	—	—
density	ρ	kg m^{-3}	—	m/V
distance along path	s	metre	m	fundamental unit
efficiency	η	*a ratio*	—	work output/work input
electrochemical equiv.	z	g C^{-1}	—	mass/charge
electromotive force	E	volt	V	energy/charge
electron	e	—	—	—
energy	E	joule	J	N m
energy, kinetic	E_k	joule	J	N m. $E_k = 1/2mv^2$
energy, potential	E_p	joule	J	N m. $E_p = mgh$
Faraday constant	F	coulomb mol^{-1}	C mol^{-1}	96,500 C mol^{-1}
field strength, electric	E	V m^{-1}	—	potential gradient: p.d./dist.
field-strength magnetic	H	ampere-turns	—	current × no. of turns
flux, magnetic	Φ	weber	Wb	e.m.f/rate of change of flux
flux density	B	tesla	T	flux/area
focal length	f	metre	m	—
force	F	newton	N	kg m s^{-2}
free energy	ΔG	joule	J	—
frequency	f	hertz	Hz	oscillations/time
gas constant	r	joule	J	energy
half-life,radioactivity	$t_{1/2}$	second	s	fundamental unit
heat capacity	C	J K^{-1}	—	quantity of heat/temp. rise
heat of reaction	ΔH	joule	J	heat energy
heat capacity, specific	c	J K^{-1} kg^{-1}	—	heat capacity/mass
heat, quantity of	q	joule	J	energy

SI UNITS

Quantity	Symbol	SI Unit	Symbol	Derivation
height	h	metre	m	fundamental unit
image distance	υ	metre	m	fundamental unit
inductance, mutual	M	henry	H	induced e.m.f./rate of change of current
inductance, self	L	henry	H	—
intensity of radiation	I	*a number*	—	—
latent heat	L	joule	J	quantity of heat
latent heat, specific	l	J kg^{-1}	—	quantity of heat
latent heat, molar	L_m	joule mol^{-1}	J	quantity of heat
length	l	metre	m	fundamental unit
magnetizing force	H	ampere-turns	—	—
magnetic moment	m	Wb m	—	torque in unit magnetic field
magnification, linear	m	*a ratio*	—	—
mass	m	kilogramme	kg	fundamental unit
mass number	A	*a number*	—	number of neutrons + protons
molar volume	V_m	(dm^3)	—	volume of 1 mole
molar solution	M	*a ratio*	—	moles/dm^3
moment of force	—	N m	—	force × perp. distance
neutron number	N	*a number*	—	number of neutrons
number	n	—	—	—
number of molecules	N	—	—	—
number turns on coil	n	*a number*	—	—
number order spectrum	p	*a number*	—	—
object distance	u	metre	m	fundamental unit
peak current	I_o	ampere	A	see current
peak e.m.f.	E_o	volt	V	see e.m.f.
period	T	second	s	fundamental unit
permeability	μ	H m^{-1}	—	henry/metre
permeability, vacuum	μ_o	H m^{-1}	—	—
permeability, relative	μ_r	*a ratio*	—	$\mu = \frac{\mu}{\mu_o}$
permittivity	ε	F m^{-1}	—	farad/metre
permittivity, vacuum	ε_o	F m^{-1}	—	farad/metre
permittivity, relative	ε_r	*a ratio*	—	$\varepsilon_r = \frac{\varepsilon}{\varepsilon_o}$
potential, electric	V	volt	V	energy/charge
potential difference	V	volt	V	energy/charge
power	P	watt	W	J s^{-1}
pressure	p	pascal	Pa	N m^{-2}: force/area
radius	r	metre	m	fundamental unit
reactance	X	ohm	Ω	E_O/I_O
refractive index	n	*a ratio*	—	—
resistance	R	ohm	Ω	p.d./current
resistivity, electrical	ρ	ohm-metre	—	resistance × length
relative density	d	*a ratio*	—	ρ_{sub}/ρ_{water}
r.m.s. current	$I_{r.m.s}$	ampere	A	see current
r.m.s. voltage	$V_{r.m.s}$	volt	V	see e.m.f.
slit separation	s	metre	m	fundamental unit
tension	T	newton	N	see force
temperature, Celsius	θ	degree C	°C	from kelvin
temp. interval	θ	degree	° or K	—
temp. absolute	T	kelvin	K	fundamental unit
thickness	d	metre	m	fundamental unit
time	t	second	s	fundamental unit
torque	T	Nm	—	see moment
turns ratio	T	*a ratio*	—	n_{sec}/n_{prim}
(unit of electricity)	—	kW h	—	kilowatt × hour
velocity	u,υ	ms^{-1}	—	distance/time
velocity, angular	ω	$second^{-1}$	s^{-1}	angle/time
velocity, e.m.waves	c	m s^{-1}	—	—
velocity of sound	υ	m s^{-1}	—	—
volume	V	metre cubed	m^3	l × b × h
wavelength	λ	metre	m	fundamental unit
work	w	joule	J	force x distance (Nm)
weight	W	newton	N	kg m s^{-2}or mg





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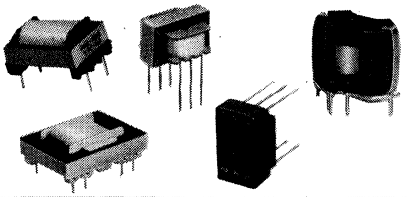
PRODUCT LINE SUMMARY

TRANSFORMERS & INDUCTORS FOR TELEPHONE INTERCONNECT. The TTC SERIES meets the high performance requirements of telephone central office, modem, facsimile, and voice communication applications. These **FCC PART 68** coupling, direct connect, hybrid transformers and holding coils **COMPLY WITH UL & MEET FCC PART 68** requirements.

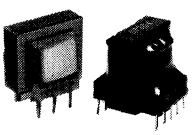
FOR DETAILS SEE A•2396, 2397

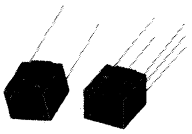


TELECOMMUNICATION TRANSFORMERS for DATA, DIGITAL, LOCAL-AREA-NETWORK & T-1 CARRIER circuit applications. These wide-band & pulse transformers feature low loss & low distortion performance characteristics. Miniature size, & low profiles are achieved with high-perm cores. Many models **MEET FCC PART 68** isolation requirements.

THE ATT SERIES **AUDIO TRANSFORMERS** are a low cost, volume produced series of transformers for impedance matching, isolation & sound distribution applications. The DP SERIES **ENCAPSULATED AUDIO TRANSFORMERS** are cost effective for severe environments & are tested to **MIL-T-27;** several items **MEET FCC PART 68** requirements

FOR DETAILS SEE A•2399



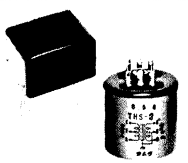


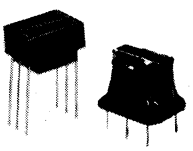
MINIATURE ENCAPSULATED TRANSFORMERS AND INDUCTORS are the smallest (0.31" x 0.41" x 0.465") audio magnetic components available with **1000V R M S HIPOT.** Several models **MEET FCC PART 68 & 1500V R M S HIPOT.** The MET SERIES transformers & MEI SERIES inductors are manufactured to **MEET MIL-T-27** as type TF5S21ZZ.

FOR DETAILS SEE A•2398

PROFESSIONAL AUDIO TRANSFORMER SERIES of high performance audio transformers are widely used in communications, broadcasting, recording & measuring apparatus. These transformers are available with electrostatic and MU-metal shields; lead, solder lug, or PC pin terminations; & open or metal case construction.

FOR DETAILS CONTACT FACTORY





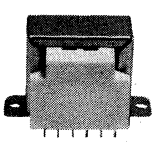
SCR—TRIAC TRIGGER & PULSE—ISOLATION TRANSFORMERS. The STT SERIES is designed for low cost source isolation with **2600V R M S HIPOT** for SCR & TRIAC control circuits. The PHT & G SERIES PULSE TRANSFORMERS offer a wide range of characteristics. Encapsulated for protection against severe environments.

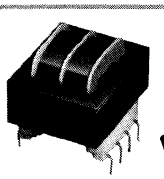
FOR DETAILS SEE A•2399

The PEP **INTERNATIONAL SERIES POWER TRANSFORMERS** have physical barriers between primary & secondary windings. The PEP SERIES incorporates a double protection insulation system and passes **4000V R M S HIPOT.**

UL 1411 RECOGNIZED—FILE NO. E 98949
MEETS CSA, IEC 65 & VDE SAFETY STANDARDS

FOR DETAILS SEE A•2400





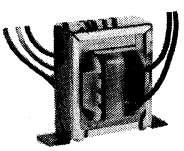
3 FLANGE BOBBIN POWER TRANSFORMERS—80 MODELS IN STOCK. The 3F SERIES POWER TRANSFORMERS are drop-in compatible to all competitors & tube packed for auto-insertion.

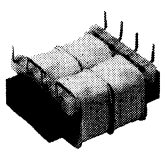
UL1585 CLASS II & III—FILE NO. E 95844
UL GENERAL PURPOSE TRANSFORMER—E 91239
UL CLASS B INSULATION SYSTEM

FOR DETAILS SEE A•2401

CUSTOM OEM POWER & AUDIO TRANSFORMERS—UL RECOGNIZED under **UL1411** and Tamura FILE NO. E 59673. These designed-to-customer performance transformers also **COMPLY WITH CSA, IEC-65, MITI-JIS, & VDE** SAFETY STANDARDS. This series offers many different construction styles and OUTPOWER RATINGS FROM 0.7VA TO 400VA.

FOR DETAILS CONTACT FACTORY



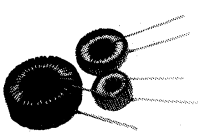


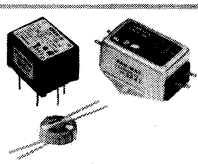
LOW PROFILE—3 FLANGE BOBBIN PC POWER TRANSFORMERS. The 3FL SERIES power transformers are designed and manufactured to comply with **UL** requirements and utilize a **UL CLASS B INSULATION SYSTEM.** Available in 5 power ranges: 2VA, 6VA, 12VA, 24VA & 48VA. These transformers have max. heights above the PC board of 0.65" to 1.375".

FOR DETAILS SEE A•2401

NOISE FILTERING & POWER INDUCTORS for switch-mode power, regulator, control & filtering circuit applications. **SKP SERIES INDUCTORS** for **EMI/RFI** noise absorbing use. **SKL SERIES INDUCTORS** have **SWINGING L** with varying DC. **SKC SERIES INDUCTORS** are wound on gapped toroidal cores & have current ratings from 5 to 50A DC

FOR DETAILS SEE A•1293





EMI/RFI AC LINE FILTERS & COMMON MODE INDUCTORS. This series MEETS **FCC PART 15 & VDE-0871 CLASS A & B** requirements; UL1283 RECOGNIZED under E 92559; CSA CERTIFIED to C22.2 #8; & TUV CERTIFIED to VDE0565, Teil 3. *FOR DETAILS SEE A•1292, 1712, 1713*

DC-DC CONVERTERS NON-ISOLATION, SINGLE-IN-LINE PACKAGE for POLARITY REVERSING & VOLTAGE BOOSTING use. This series of DC-DC converters is encapsulated for environmental protection & available with single or dual outputs. In four package sizes, they have output power ratings of 0.2, 0.3, 0.5, & 1.0 WATT.

FOR DETAILS SEE D•1986, 1987

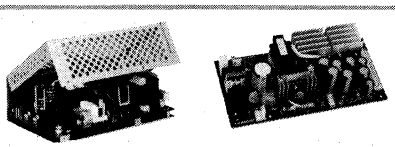
ISOLATION SERIES DC-DC CONVERTERS mount on a PC board. These COST EFFECTIVE, LOW PROFILE, SMALL SIZE power modules are ENCAPSULATED SURFACE-MOUNT HIGH-DENSITY HYBRID packaged to guarantee LONG LIFE & HIGH RELIABILITY. Most models in this series of DC-DC converter modules include a NOISE FILTER INDUCTOR & OVERCURRENT PROTECTION.

FOR DETAILS SEE D•1986, 1987

DIRECT PLUG-IN AC-DC REGULATED & UNREGULATED POWER SOURCES comply to WORLDWIDE safety agency requirements. This series is available in a variety of output ratings & terminations. Custom logo & multiple listings available. *FOR DETAILS SEE A•2402 and D•1988*

PLUG-IN POWER SOURCES are available in CORD-CORD DESK TOP, UL-CSA PLUG & EUROPEAN PLUG configurations with a variety of output terminations. Includes barrel plug & screw terminal styles. A wide range of output ratings including AC-AC, AC-DC regulated, & AC-DC unregulated models, & OEM CUSTOM designs are available.

The OLYMPIAN SERIES **SWITCHING POWER SUPPLIES** are the highest **WATTS/INCH³ VDE** certified units available. The series is **UL & CSA** approved. The Olympian series features WORLDWIDE AC INPUT with VDE0871 & VDE0875 filtering, SURFACE-MOUNT HYBRID TECHNOLOGY, OVP, ENABLE/INHIBIT, POWER FAIL, **& 80,000 HOURS MTBF.** *FOR DETAILS SEE A•1984, 1985, 1989*



OPEN FRAME POWER SUPPLIES—These LINEAR & SWITCHMODE SERIES meet all international safety and emission standards. They are available in multiple and single output models with WORLDWIDE AC INPUT. **HIGH MTBF** components are used throughout these power supplies for high performance and long operating life.

FOR DETAILS SEE D•1989, 1990, 1991

TAMURA QUALITY CIRCLES THE ELECTRON WORLD

TAMURA CORPORATION OF AMERICA

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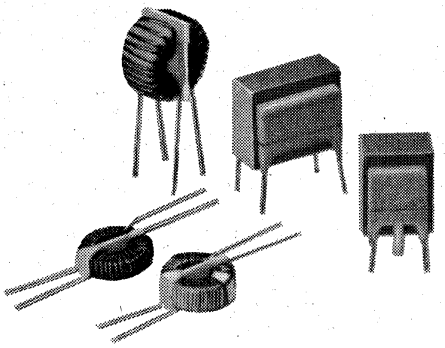
COMMON MODE COILS FOR A.C. LINE & R.F.I. FILTER CIRCUITS



PART NUMBER	AMPS (AC)	"L" (mH)	D.C.R. (OHMS)	FIGURE NUMBER	LEAD DIA.
CMT-01102	1	2	0.25	1	0.40
CMT-01104	1	4	0.35	1	0.40
CMT-01202	2	2	0.15	1	0.55
CMT-01301	3	1	0.10	1	0.70
CMT-02105	1	5	0.40	2	0.40
CMT-02107	1	7	0.50	2	0.40
CMT-02203	2	3	0.20	2	0.55
CMT-02302	3	2	0.10	2	0.70
CMT-03110	1	10	0.55	3	0.40
CMT-03305	3	5	0.15	3	0.70
CMT-03502	5	2	0.04	3	0.95
CMT-03801	8	1	0.02	3	1.20
CME-04103	1	3	0.45	4	0.40
CME-04105	1	5	0.55	4	0.40
CME-04202	2	1.5	0.18	4	0.55
CME-04203	2	2.5	0.22	4	0.55
CME-05107	1	7	0.70	5	0.40
CME-05110	1	10	0.80	5	0.40
CME-05205	2	5	0.30	5	0.55
CME-05303	3	3	0.15	5	0.70

SPECIFICATIONS

- WORKING VOLTAGE: 250VAC
- DIELECTRIC VOLTAGE: 1500VAC
- INSULATION RESISTANCE: 100 Megohms, 500VDC
- TEMPERATURE RISE: 30°C Max.
- OPERATING TEMP. RANGE: -25°C to +85°C

SCHEMATIC DIAGRAM

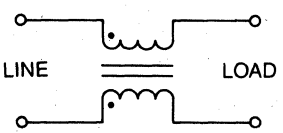


FIG. 1, 2 & 3

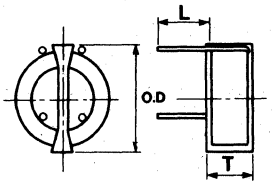


FIG.	O.D.	T	L ±3
1	28	12.5	20
2	28	14.5	20
3	32	22	20

(mm)

FIG. 4 & 5

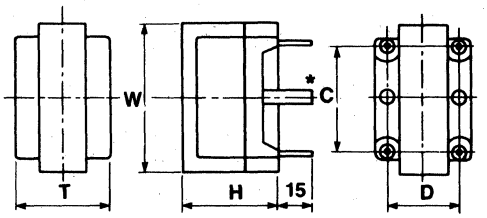


FIG.	W	T	H	C	D
4	28.5	22.5	30	16	17
5	35.5	22.5	30	28	17

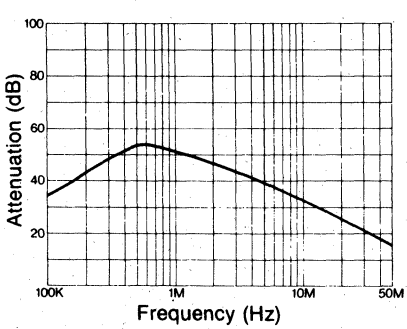
(mm)

*FIG. 4 ONLY (3 mm Dia.)

TYPICAL PERFORMANCE CHARACTERISTICS

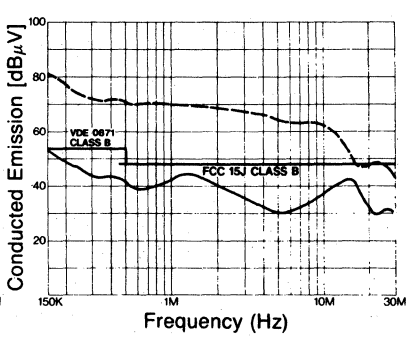
STATIC CHARACTERISTIC

CMT-02105 IN CIRCUIT 1

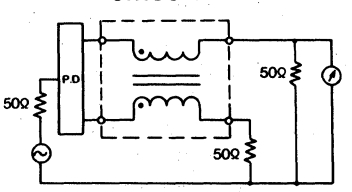


DYNAMIC CHARACTERISTICS

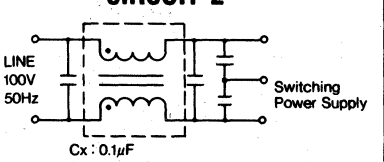
CMT-02105 IN CIRCUIT 2



MEASURING CIRCUIT 1



MEASURING CIRCUIT 2



TAMURA QUALITY CIRCLES THE ELECTRON WORLD
TAMURA CORPORATION OF AMERICA
1150 DOMINGUEZ ST. □ CARSON, CA 90746-3518 □ 213/638-1790 □ FAX: 2136389956

INDUCTORS FOR SWITCH-MODE POWER REGULATOR, CONTROL AND NOISE FILTERING CIRCUITS

The **SKC SERIES INDUCTORS** are designed on gapped toroidal tape wound cores for DC switching power supply, regulator and energy storage circuits — DC current ratings **5 to 50 AMPS DC.**

The **SKL SERIES INDUCTORS** are designed on functional gapped toroidal tape wound cores for power circuits requiring high inductance at low DC currents and nominal inductance at rated DC amps.

The **SKP SERIES INDUCTORS** are designed on powered iron toroidal cores for RFI and EMI filtering and other noise absorbing applications. Also, **SKP SERIES INDUCTORS** are most useful in DC circuit applications, available in a wide range of "L" values and DC current ratings to **40 AMPS DC.**

SKC SERIES POWER INDUCTORS FOR DC SWITCH-MODE CIRCUITS

PART NUMBER	AMPS (DC)	"L" (μH)	DCR (OHMS)	DIMENSIONS (inch/mm)	
				OD (max.)	HT (max.)
SKC-101	5 to 10	30	0.009	1.26/32	.71/18
SKC-102	5 to 10	50	0.011	1.26/32	.71/18
SKC-103	5 to 10	100	0.017	1.26/32	.71/18
SKC-104	5 to 10	150	0.023	1.26/32	.71/18
SKC-105	5 to 10	200	0.024	1.46/37	.79/20
SKC-106	5 to 7.5	400	0.048	1.46/37	.79/20
SKC-107	5 to 7.5	600	0.056	1.73/44	1.02/26
SKC-108	5 to 7.5	800	0.044	2.13/54	.98/25
SKC-109	5 to 6	1200	0.081	2.17/55	1.02/26
SKC-110	5 to 6	1800	0.099	2.17/55	1.02/26
SKC-201	10 to 15	30	0.005	1.26/32	.71/18
SKC-202	10 to 15	50	0.007	1.46/37	.79/20
SKC-203	10 to 15	100	0.012	1.46/37	.79/20
SKC-204	10 to 15	150	0.014	1.73/44	1.02/26
SKC-205	10 to 15	200	0.011	2.13/54	.98/25
SKC-206	10 to 12	400	0.024	2.17/55	1.02/26
SKC-207	10 to 12	600	0.032	2.20/56	1.06/27
SKC-208	10 to 12	800	0.032	2.20/56	1.30/33
SKC-301	15 to 25	30	0.004	1.46/37	.79/20
SKC-302	15 to 25	50	0.006	1.54/39	.83/21
SKC-303	15 to 25	100	0.006	2.13/54	.98/25
SKC-304	15 to 20	150	0.009	2.17/55	1.02/26
SKC-305	15 to 20	200	0.011	2.17/55	1.02/26
SKC-306	15 to 20	400	0.016	2.20/56	1.30/33
SKC-401	20 to 30	30	0.004	1.61/41	.91/23
SKC-402	20 to 30	50	0.005	1.81/46	.98/25
SKC-403	20 to 28	100	0.006	2.17/55	1.02/26
SKC-404	20 to 25	150	0.008	2.20/56	1.06/27
SKC-405	20 to 25	200	0.008	2.20/56	1.30/33
SKC-501	25 to 35	30	0.003	1.77/45	.95/24
SKC-502	25 to 35	50	0.003	2.17/55	1.02/26
SKC-503	25 to 35	100	0.004	2.17/55	1.30/33
SKC-504	25 to 30	150	0.006	2.24/57	1.34/34
SKC-601	30 to 40	30	0.002	2.13/54	.98/25
SKC-602	30 to 40	50	0.003	2.17/55	1.02/26
SKC-603	30 to 35	100	0.004	2.20/56	1.30/33
SKC-801	40 to 50	30	0.002	2.17/55	1.30/33
SKC-802	40 to 50	50	0.002	2.24/57	1.34/34

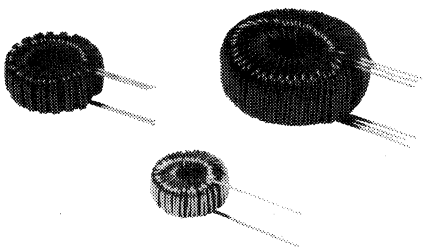
SKL SERIES POWER INDUCTORS WITH HIGH "L" AT LOW DC

PART NUMBER	AMPS (DC)	"L" (μH)		DCR (OHMS)	DIMENSIONS (inch/mm)	
		with DC	0 DC		OD (max.)	HT (max.)
SKL-103	5	100	450	0.017	1.26/32	.71/18
SKL-105	5	200	1000	0.025	1.26/32	.71/18
SKL-203	10	100	500	0.011	1.69/43	.91/23
SKL-205	10	200	1000	0.015	2.13/54	1.15/29
SKL-303	15	100	500	0.008	2.17/55	1.02/26
SKL-305	15	200	1000	0.011	2.20/56	1.06/27
SKL-403	20	100	500	0.008	2.17/55	1.02/26
SKL-404	20	150	750	0.009	2.20/56	1.06/27
SKL-502	25	50	250	0.006	2.17/55	1.02/26
SKL-503	25	100	600	0.007	2.24/57	1.34/34

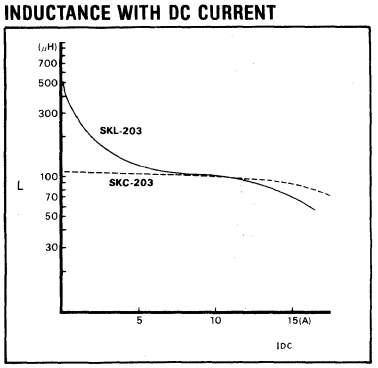
SKP SERIES NOISE ABSORBING INDUCTORS

PART NUMBER	AMPS		"L" (μH)	DCR (OHMS)	DIMENSIONS (inch/mm)	
	(AC)	(DC)			OD (max.)	HT (max.)
SKP1-30	2	1	30	0.039	.62/16	.31/8
SKP1-40	2	1	55	0.050	.62/16	.31/8
SKP1-50	2	1	80	0.061	.62/16	.33/8.5
SKP2-30	2	1	50	0.051	.62/16	.43/11
SKP2-40	2	1	90	0.066	.62/16	.43/11
SKP2-50	2	1	130	0.082	.62/16	.45/11.5
SKP3-30	3	2	40	0.028	.83/21	.43/11
SKP3-40	3	2	80	0.037	.83/21	.43/11
SKP3-50	3	3	120	0.045	.85/21.5	.45/11.5
SKP4-40	5	3	65	0.023	.98/25	.47/12
SKP4-50	5	3	100	0.028	1.02/26	.47/12
SKP5-40	5	3	100	0.033	1.08/27.5	.55/14
SKP5-50	5	3	150	0.041	1.10/28	.59/15

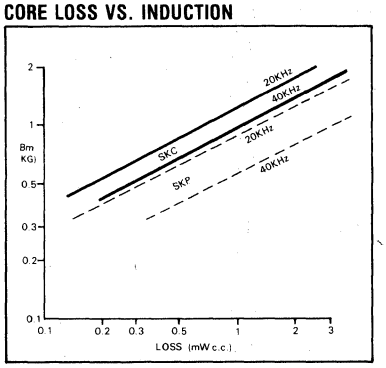
NOTE: SKP SERIES "L" with DC is approximately 50% of value shown.



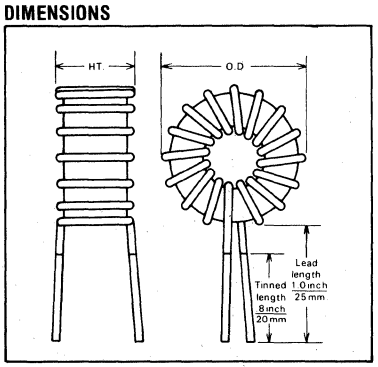
INDUCTANCE WITH DC CURRENT



CORE LOSS VS. INDUCTION



DIMENSIONS



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MULTILAYER CHIP INDUCTORS, TRANSFORMERS, IFT, LC TRAPS

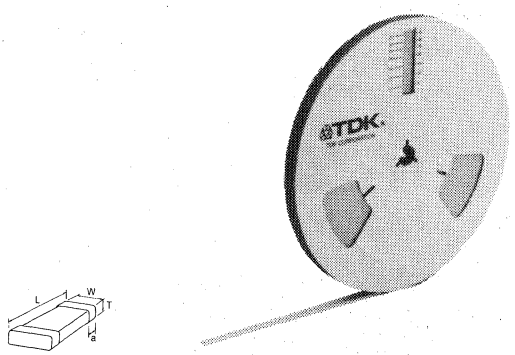
TDK

TDK CORPORATION OF AMERICA HEAD OFFICE 1600 Feehanville Drive, Mount Prospect, IL 60056, U.S.A. Phone: (312) 803-6100 **CHICAGO REGIONAL OFFICE** Phone: (312) 803-6100 **INDIANAPOLIS REGIONAL OFFICE** Phone: (317) 872-0370 **NEW YORK REGIONAL OFFICE** Phone: (516) 625-0100 **LOS ANGELES REGIONAL OFFICE** Phone: (213) 539-6631 **DETROIT DISTRICT OFFICE** Phone: (313) 353-9393 **NEW JERSEY DISTRICT OFFICE** Phone: (201) 736-0023 **HUNTSVILLE DISTRICT OFFICE** Phone: (205) 539-4551 **GREENSBORO DISTRICT OFFICE** Phone: (919) 292-0012 **DALLAS DISTRICT OFFICE** Phone: (214) 506-9800 **SAN FRANCISCO DISTRICT OFFICE** Phone: (408) 437-9585 **TDK CORPORATION,** TOKYO, JAPAN

MULTILAYER CHIP INDUCTORS (MLF SERIES)

TDK Multilayer Chip Inductors use magnetic materials and multilayer technology in producing epoch-making inductors which do not use any windings. TDK multilayer chip inductors use ferrite paste and electric conductor paste alternately layered in a completely monolithic structure. Inductor is obtained using a sintered closed magnetic circuit such as toroidal and a magnetic shield.

- No crosstalk between inductors due to magnetic shield. Perfect for high density installation.
- Unified automatic chip mounting shape with no directionality.



Dimensions in mm (inches)

Type	L	W	T	a
MLF3216	3.2±0.2 (.126)	1.6±0.2 (.063)	0.6±0.2 (.024)	1.1±0.3 (.043)	0.5±0.3 (.02)
MLF3225	3.2±0.2 (.126)	2.5±0.2 (.098)	1.1±0.3 (.043)	2.5±0.3 (.098)	0.5±0.3 (.02)

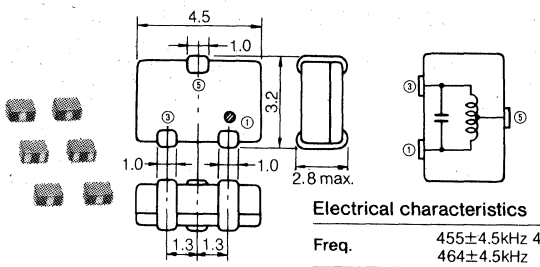
Type	Material	Thickness (mm)	Inductance (μH)	Tolerance (%)*	Q min.	Rated current (mA)
MLF3216	D	0.6	0.047 to 0.33	M or K	30 at 25MHz	100
		1.1	0.39 to 0.82		35 at 25MHz	100
	A	0.6	1 to 1.2	M or K	40 at 10MHz	100
		1.1	1.5 to 4.7		45 at 10MHz	50
	E	1.1	5.6 to 10	M or K	55 at 4MHz	25
		1.1	12		65 at 2MHz	15
	C	1.1	15 to 33	M or K	45 at 1MHz	5
MLF3225	C	1.1	39 to 56	M or K	45 at 0.4MHz	5
	E	2.5	68	M or K	65 at 2MHz	10
			100		65 at 1MHz	10
	C	2.5	120 to 220	M or K	45 at 0.2MHz	5

K: ±10%, M: ±20%

MULTILAYER CHIP IFT FOR AM RADIO (MIA4532 SERIES)

TDK 4532 type multilayer chip IFT for AM radios can be taped for automated mounting processes. These are the first multilayer chip IFT in the world in which a non regulated portion (ferrite) and capacitor (dielectric material) are sintered into layers simultaneously.

- Usable in automatic surface mounting. (12mm wide tape).
- Compact, thin design.
- Closed magnetic circuit configuration eliminates crosstak. Usable in high density applications.



Dimensions in mm

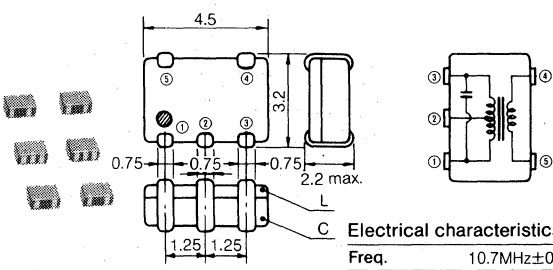
Electrical characteristics

Freq.	455±4.5kHz 459±4.5kHz 464±4.5kHz
Q	40 min.

MULTILAYER CHIP IFT FOR FM RADIO (MIF 4532 SERIES)

TDK 4532 type multilayer chip IFT for FM radios are the smallest in the world and can be used for automatic mounting. These are the first multilayer chip IFT in the world in which a non regulated portion (ferrite) and capacitor (dielectric material) are sintered simultaneously.

- Usable in automatic surface mounting. (12mm wide tape).
- Compact, thin design.
- Closed magnetic circuit configuration eliminates crosstalk. Usable in high density applications.



Dimensions in mm

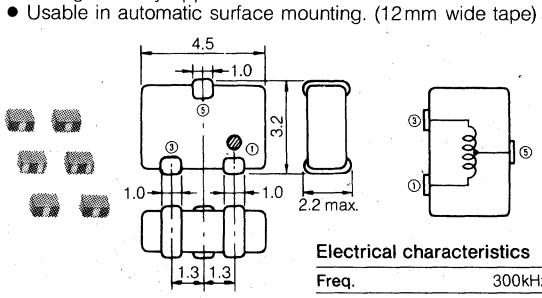
Electrical characteristics

Freq.	10.7MHz±0.16MHz
Q	40 min.

MULTILAYER CHIP TRANSFORMERS (MTT4532 SERIES)

TDK Multilayer chip transformers are magnetic shielded type and of totally monolithic construction. Magnetic material processing and multilayer technologies totally eliminate winding.

- Volume is reduced 1/5 compared to conventional chips, for compact, thin design.
- Closed magnetic circuit configuration for low leakage flux. Perfect for high density applications.
- Usable in automatic surface mounting. (12mm wide tape)



Dimensions in mm

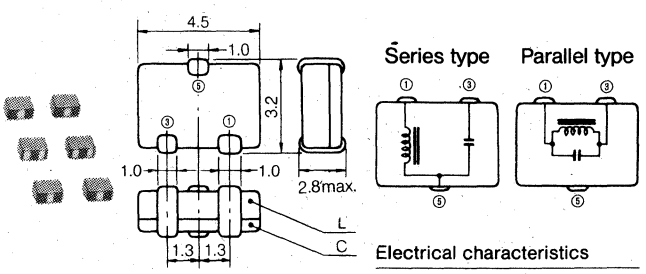
Electrical characteristics

Freq.	300kHz to 1MHz
Inductance ①–③	10 to 200μH

MULTILAYER CHIP LC TRAPS (MXT4532 SERIES)

TDK multilayer LC chip traps are the first of their kind in the world. Ferrite material and dielectric ceramic material are sintered into monolithic configuration simultaneously.

- Ultracompact, lightweight configuration allows use in automatic surface mounting systems. (12mm wide tape).
- 700kHz to 10MHz applicable frequency range.



Dimensions in mm

Electrical characteristics

f_r	f_r±2%
Attenuation	20dB min.

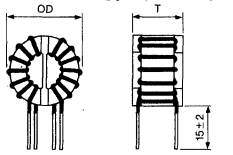
EMC COMPONENTS Tokin
Tokin America Inc.
155 Nicholson Lane, San Jose, California 95134, U.S.A.
Tel: 408-432-8020 Fax: 408-434-0375
Chicago Branch
Presidents Place I, Suite 200N, 9600 W. Bryn Mawr, Chicago, IL 60631
Tel: 312-380-0030 Fax: 312-693-8834

EMC COILS

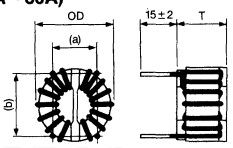
(mm)

	Model	Rated Current AC/DC (A)	Inductance Min. (mH)	DC Resistance Max. (mΩ)*	Wire size (φ)	O.D. Max.	H Max.	T Max.	a	b
SC Coils									*Line at one side	
	SC-02-101	2	1	100	0.6	23.0	—	13.0	10	13
	SC-02-100	2	1	100	0.6	23.0	—	18.5	10	19
	SC-02-200	2	2	110	0.6	23.0	—	18.5	10	19
	SC-02-300	2	3	100	0.6	25.0	—	20.0	10	17
	SC-02-500	2	5	100	0.6	27.0	—	20.0	10	17
	SC-02-800	2	8	150	0.6	34.0	—	23.0	18	16
	SC-05-100	5	1	50	0.8	25.0	—	18.5	10	19
	SC-05-200	5	2	70	0.8	32.0	—	22.0	18	21
	SC-05-500	4	5	80	0.8	34.0	—	23.0	18	21
	SC-05-800	4	8	80	0.8	34.0	—	23.0	18	21
	SC-10-100	10	1	20	1.3	34.0	—	22.0	22	21
	SC-10-200	10	2	28	1.3	47.0	—	27.0	30	30
	SC-15-100	15	1	12	1.8	49.0	—	27.0	35	35
	SC-20-100	20	1	8	2.3	60.0	—	30.0	40	40
	SC-30-100	30	1	6	2.6	62.0	—	35.0	55	20
SC Coils with terminal base										
J Type	SC-02-10J	2	1	100	0.6	25.0	27.0	20.0	10	15
J Type	SC-02-20J	2	2	110	0.6	25.0	27.0	20.0	10	15
J Type	SC-02-30J	2	3	110	0.6	25.0	27.0	20.0	10	15
J Type	SC-02-50J	2	5	120	0.6	25.0	27.0	20.0	10	15
J Type	SC-05-10J	5	1	50	0.8	25.0	27.0	20.0	10	15
J Type	SC-05-20J	5	2	70	0.8	34.0	33.0	23.0	18	16
J Type	SC-05-30J	5	3	70	0.8	34.0	33.0	23.0	18	16
J Type	SC-05-50J	4	5	80	0.8	34.0	33.0	23.0	18	16
J Type	SC-05-80J	4	8	90	0.8	34.0	33.0	23.0	18	16
J Type	SC-10-10J	10	1	20	1.3	35.0	33.0	23.0	12	17
J Type	SC-10-20J	10	2	22	1.4	42.0	44.0	29.0	18	22
J Type	SC-12-15J	12	1.5	18	1.5	42.0	44.0	29.0	18	22
J Type	SC-15-10J	15	1	12	1.7	44.0	44.0	30.0	18	22
J Type	SC-18-05J	18	0.5	7	1.8	44.0	44.0	30.0	18	22
*JV Type	SC-02-300JV	2	44^{+50}_{-30}%	300	0.6	35.0	40.0	25.0	18	16
*JV Type	SC-04-200JV	4	29^{+50}_{-30}%	100	0.8	35.0	40.0	25.0	18	16
*JV Type	SC-05-100JV	5	15^{+50}_{-30}%	100	0.9	35.0	40.0	25.0	18	16
JS Type	SC-02-08JS	2	0.8	80	0.6	26.0	12.0	29.0	10	25
JS Type	SC-02-10JS	2	1.0	100	0.6	26.0	12.0	29.0	10	25
JS Type	SC-02-15JS	2	1.5	120	0.6	26.0	12.0	29.0	10	25
JS Type	SC-02-20JS	2	2.0	120	0.6	26.0	12.0	29.0	10	25
JS Type	SC-03-08JS	3	0.8	60	0.65	26.0	12.0	29.0	10	25
JS Type	SC-03-10JS	3	1.0	80	0.65	26.0	13.0	29.0	10	25
SC Coils for high frequencies									*Recognized by VDE.	
	SC-02-D100	2	1	70	0.5	23.0	—	13.0	10	13
	SC-03-D050	3	0.5	40	0.6	23.0	—	13.0	10	13
	SC-04-D050	4	0.5	25	0.7	25.0	—	19.0	10	19
	SC-05-D030	5	0.3	20	0.8	25.0	—	19.0	10	19
SC Coils small types										
G Type	SC-01-06G	1	0.6	60						
G Type	SC-01-10G	1	1.0	70						
G Type	SC-01-20G	1	2.0	100						
G Type	SC-01-30G	1	3.0	120						
G Type	SC-01-50G	1	5.0	150						
G Type	SC-02-06G	2	0.6	50						
G Type	SC-02-10G	2	1.0	50						
G Type	SC-02-20G	2	2.0	70						
G Type	SC-02-30G	2	3.0	85						
G Type	SC-03-06G	3	0.6	30						
G Type	SC-03-10G	3	1.0	35						
GS Type	SC-01-10GS	1	1.0	130						
GS Type	SC-01-20GS	1	2.0	180						
GS Type	SC-02-10GS	2	1.0	80						
GS Type	SC-03-05GS	3	0.5	45						

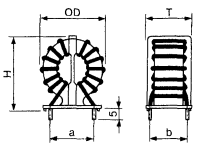
SC Coil vertical type (1A ~ 5A)



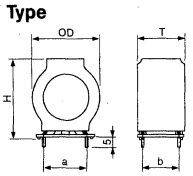
SC Coil horizontal type (10A ~ 30A)



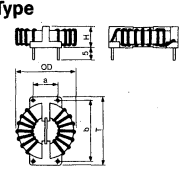
SC-J Type



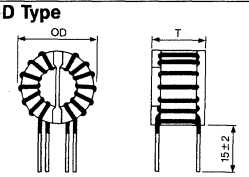
SC-JV Type



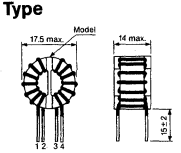
SC-JS Type



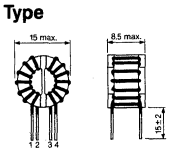
SC-D Type

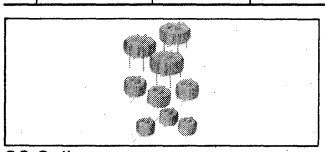


SC-G Type

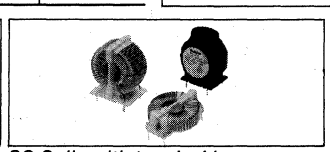


SC-GS Type

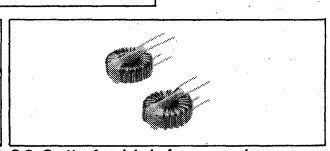




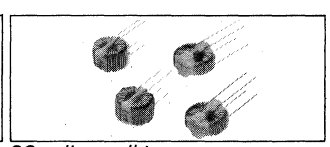
SC Coils



SC Coils with terminal base



SC Coils for high frequencies



SC coils small types

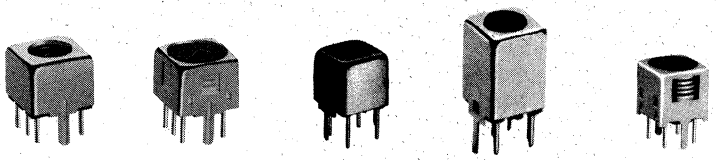
TOKO AMERICA COILS

Toko is the **WORLD'S LARGEST MANUFACTURER OF SMALL COILS**, offering types for virtually any application. Thousands of individual part numbers are available, in addition to custom types.

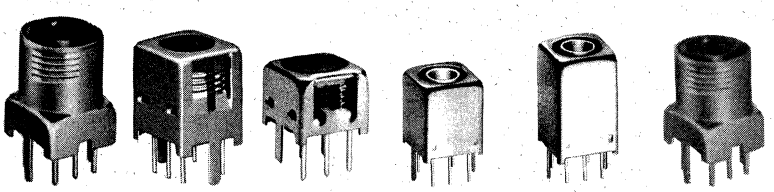
Many offer internal capacitors to form complete tuned circuits, saving you design time, board space and cost.

SUBMINIATURE ADJUSTABLE COILS

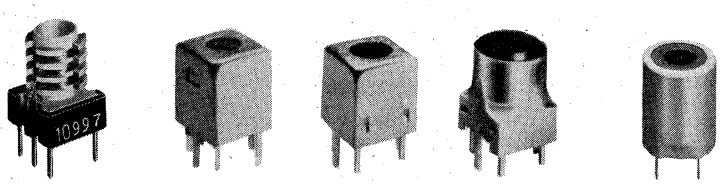
Toko Subminiature Adjustable Coils are well suited for a variety of RF and I-F applications in communications equipment, remote control, military and other uses requiring receiver, transmitter or oscillator circuitry. Each is shielded and slug tunable.



Type	4 K (4mm)	4 P (4mm)	5 K (5mm)	5 A (5mm)	5 P (5mm)
Freq. Range	10 MHz~150 MHz	200 kHz~15 MHz	30 MHz - 150 MHz	30 MHz - 150 MHz	200 kHz - 15 MHz
L Values	0.02 μH~1μH	1μH~700 μH	.08 μH ~ 1 μH	.03 μH~.3 μH	1 μH~1mH
Q Value (min)	60 at 100 MHz	80 at 10.7 MHz	45	40	40~55
Int. Cap. Values Available	None	None	None	None	18 pF~47 pF, 180 pF, 470, 1500 pF



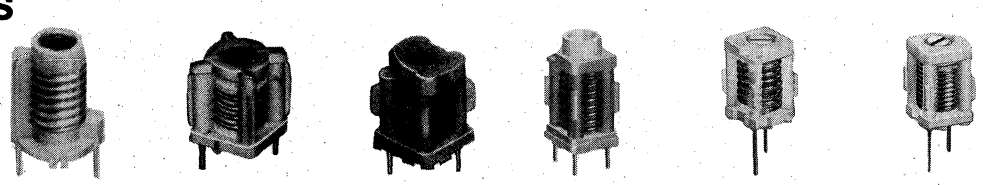
Type	7 PA (7mm)	7 PL (7mm)	7 PS (7mm)	7 KL (7mm)	7 KM (7mm)	7 P (7mm)
Freq. Range	10 kHz - 200 kHz	200 kHz - 20 mHz	200 kHz - 1.5 mHz	2 MHz~120 MHz	2 MHz~120MHz	200 kHz - 20 MHz
L Values	500 μH - 25 mH	1 μH - 500μH	10μH - 1.5mH	.1 μH~50 μH	.1 μH~80 μH	1 μH~2.6 mH
Q Value (min)	60	40-82	50-65	20	35-50	60~144
Int. Cap. Values Available	None	5-390 pF, 430 pF	150-390 pF	5 pF~100 pF	5 pF~100 pF	5 pF~100 pF, 150, 180 pF, 430 pF



Type	10 NSF (10mm)	10 EZ (10mm)	10 K (10mm)	10 PA (10mm)	12 VXA (12mm)
Freq. Range	400 kHz - 120 MHz	200 kHz - 15 MHz	2 MHz - 120 MHz	10 kHz - 200 kHz	10 kHz~200 kHz
L Values	0.5 μH - 120 μH	50 μH~2 mH	1 μH~55 μH	1 mH~56 mH	1 mH~68 mH
Q Value (min)	15-70	50-144	45-80	70~80	80
Int. Cap. Values Available	None	5 pF~100 pF, 180 pF, 430 pF	5 pF~100 pF	None	None

MOLDED COILS

ALL AVAILABLE WITH SHIELDED CASE



Type	S18 (10mm)	MC 120 (10mm)	MC 122 (7mm)	MC 138 (7.4mm)	MC 139 (5.5mm)	MC 141 (5.5mm)
Freq. Range	30 MHz~200 MHz	30 MHz - 150 MHz	30 MHz - 250 MHz	30 MHz - 250 MHz	30 MHz~250 MHz	30 MHz~150 MHz
L Values	0.03 μH~0.4 μH	.04 μH~.44 μH	.03 μH~.38 μH	.03 μH~0.02 μH	.02 μH~.15 μH	.02 μH~.23 μH
Q Values (min)	65-160	80-190	60-120	70-80	45-120	35-55
Winding	No Tap	1 Tap Available	No Tap	1 Tap Available	No Tap	No Tap

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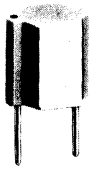
Eastern Office / Danbury Corp. Center, 107 Mill Plain Road, Danbury, CT 06811 / Tel 203/748-6871 / FAX 203/797-1223
S. Eastern Office / Executive Plaza, 555 Sparkman Drive, Suite 820-C, Huntsville, AL 35816 / Tel. 205/830-0952 / FAX 205/830-5399

TOKO AMERICA COILS

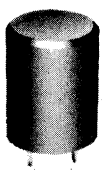
FIXED COILS

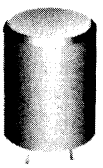
Toko manufactures a large variety of high grade miniature, sub-miniature and SMT coils. These coils are designed for use in a wide variety of electronic equipment. Coils are available over a wide range of inductances and sizes.

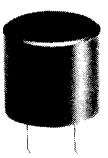
Toko can help you with your coil specifications. If you do not find the coil that meets your needs, please contact us. We are interested in custom designs, and offer the quality, delivery and pricing you need.

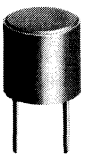


Type	7 BS	8 RBS HC
Freq. Range	1.5 kHz - 12.5 MHz	2 MHz - 70 MHz
L Values	1μH - 1 mH	1 μH~470 μH
Q Values (min)	40	20-50









Type	8 RBS (8ϕ) LC	8 RB	10 RB (10ϕ)	10 RBM	10 RBH	6 RA	FL 4 (AXIAL)
Freq. Range	600 kHz - 6 MHz	400 kHz - 6 MHz	10 kHz - 200 kHz	10 kHz - 200 kHz	10 kHz - 200 kHz	100 MHz - 700 MHz	200 kHz - 150 MHz
L Values	100 μH~15 mH	5.6 μH~33 mH	1 mH~120 mH	560 μH - 200 H	150 mH - 1.5 H	0.18 μH~1.1 μH	10 μH - 1 mH
Q Values (min)	60-80	80-100	70~100	40-70	50-90	N/A	20-50

SMT CHIP COILS

Toko SMT Chip Coils are ultra-miniature in size, low profile and available in both fixed and adjustable varieties. They are machine insertable for mounting with reflow or solder dipping. Toko SMT coils are ideal for applications requiring high packaging density and automated assembly.

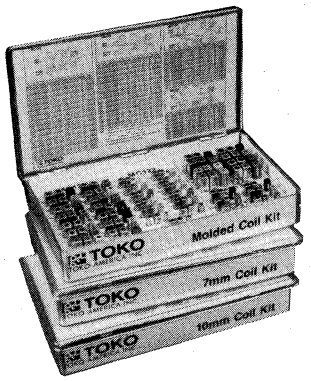
Type	32 CS	43 CS	43 FS	5 CT (5°)	5 CD (adjustable) (5°)	5 CDL (5°)	5 CBL (5°)
Freq. Range	200 kHz - 150 MHz	200 kHz - 150 MHz	200 kHz - 150 MHz	10 kHz - 100 kHz	200 kHz - 15 MHz	200 kHz~15 MHz	30-200 MHz
L Values	0.01 μH~220 μH	0.1 μH~1 mH	0.1 μH~1 mH	50 μH~7.5 mH	1 μH~500 μH	1 μH~300 μH	0.03 μH~1.2 μH
Q Value (min)	12-30	50	17-50	25-110	25-40	50	40-55
Int. Cap. Values	None	None	None	None	5 pF~750 pF	None	None
Mounting	dip soldering	dip soldering	reflow soldering	reflow soldering	reflow soldering	Reflow	Reflow

NEW COIL EXPERIMENTING/ PROTOTYPING KITS

Prototyping kits that take the guess work out of your design needs are available from Toko at a nominal cost.

7mm Adjustable	— contain over 100 parts	$49
10mm Adjustable	— contain over 130 parts	$49
Molded Coils	— contain over 120 parts	$49
NEW SMD Fixed Coils	— call for details	

(Prices subject to change without notice.)



Think of all the benefits of having these kits in your design lab. Compare our kits to other manufacturers . . . We offer a spectrum of part numbers and inductance ranges, at a lower price . . . AND OF COURSE . . . **SUPERIOR TOKO QUALITY AND PERFORMANCE!** Try us in your prototype . . . You'll buy us for your production. — **GO AHEAD, GIVE IT A TRY!**

FREE: Send for our new coil and filter catalog, filled with over 120 pages of product specifications, features and part numbers.

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DC FILTER CHOKES OF TOROIDAL DESIGN

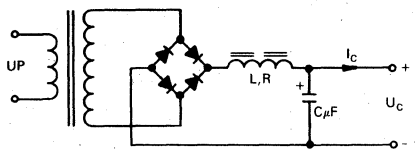
CUSTOM MADE FOR 50 OR 60 HZ RECTIFIERS

TOROID CORPORATION OF MARYLAND has developed a new concept for low frequency chokes based on its in-depth knowledge of toroidal design.

Our chokes are smaller in size, have less weight, run quieter, and have smaller losses than ordinary chokes. The low strayfield also permits mounting of our chokes flush to the chassis.

In many rectifier applications, our chokes are used as a better alternative to capacitor filtering. One typical application is ordinary rectifier circuits with high voltage requirements for which capacitors are both bulky and expensive. Another application is reversible DC motor controls where a filter choke reduces the motor losses and improves the motor torque.

Rectifier with choke filtering.



A rectifier with choke filtering needs only a small capacitor, or no capacitor at all. An added advantage of choke filtering is that the VA rating of the rectifier transformer is reduced from about 1.5 times the DC power (for capacitor filtered rectifiers) to about 1.1 times the DC power (for choke filtered rectifiers). This reduction in transformer size and cost can be subtracted from the size and cost added by the filter choke.

Our low frequency chokes are also used in AC circuits as balancing transformers for current splitting and current combining, and as ballast reactors.

The table and instructions below make it easy to select the right DC filter choke directly from the desired DC voltage and DC current.

DC FILTER CHOKES WITH CUSTOM MADE WINDINGS

Core No.	Size OD × H	Weight Lbs.	Idc max Amp.	Pdc max (W) 50 Hz	Pdc max (W) 60 Hz	½•L•I² Ws	Pcu W
L-30	2.8" × 1.3"	1.0	7.0	60	72	.094	4.8
L-50	3.2" × 1.4"	1.4	6.5	90	110	.14	5.5
L-80	3.7" × 1.4"	1.8	7.7	190	230	.31	11.9
L-120	3.7" × 1.8"	2.5	7.7	270	320	.43	14.1
L-225	4.5" × 1.6"	4.0	7.0	420	500	.66	18.2
L-330	5.1" × 1.7"	4.9	25.0	540	650	.85	17.0
L-500	5.5" × 2.3"	7.4	27.0	920	1,100	1.45	23.5
L-800	6.3" × 2.3"	11.4	25.0	1,400	1,650	2.20	31.0
L-1200	6.3" × 3.2"	16.1	25.0	2,200	2,600	3.70	38.7

Worksheet

To select the proper choke size:

1. Take the desired DC voltage at no load, and add 2V.
2. Multiply the resulting DC voltage by your rated DC current to get the DC Power (Pdc).
3. Go to column 5 for 50 Hz rectifiers or to column 6 for 60 Hz rectifiers (Pdc max). Find a choke size that has the same or larger DC Power than calculated above in step 2.
4. Go to column 4 (Idc max). Check that the current listed here is equal to or larger than your rated current. If not, select a choke size that will support your rated DC current.

Vdc (no load) + 2 = _____ V

Pdc = _____ W

Pdc max = _____ W Core No. _____

Idc max = _____ A Idc rated = _____ A

*If Idc rated > Idc max, then choose new core:

Core No. _____

After you have selected a size for your choke:

5. Calculate the DC voltage drop over the choke by dividing Pcu in the last column (for the size you have selected) by your rated current. (The DC resistance in the choke is Pcu divided by the square of the rated current.)
6. You can calculate the inductance of the choke as follows:
   Divide Ws from column 7 (for the choke size you have selected) by the square of your rated current. Multiply the result by 2, and you have the inductance in Henry.

Vdc choke = _____ V

R choke (dc) = _____ Ω

L choke = _____ H

NOTE: If Pdc max. from column 5 or 6 for the selected choke is much larger than the DC Power (Pdc) from step 2, both the DC voltage drop (step 5) and the inductance (step 6) can be reduced by using fewer turns of heavier wire. The max. reduction is proportional to the square of (Pdc/Pdc max.)

Data are subject to change without prior notice.

FOR POWER TRANSFORMERS OF TOROIDAL DESIGN, BOTH OFF-THE-SHELF STANDARD AND CUSTOM DESIGN PLEASE CONSULT SECTION 5600 PAGES A•2412–A•2416 OR CALL THE FACTORY IN BOWIE, MARYLAND.

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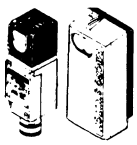
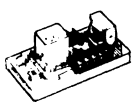
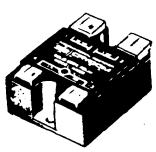
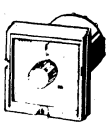

PHOTOELECTRICS

RELAYS


LIQUID LEVEL CONTROLS


SOLID STATE RELAYS

TERMINAL BLOCKS


TEMPERATURE CONTROLS

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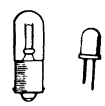
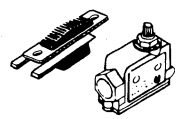
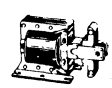

LAMPS & LEDS


SWITCHES

RELAYS

INDICATOR LIGHTS


SOLENOIDS

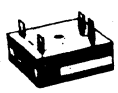
SOCKETS

PUSHBUTTON SWITCHES

TIMERS

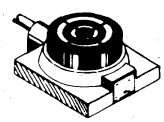
PADDLE SWITCHES

TRANSFORMERS


TIMERS

COUNTERS

FANS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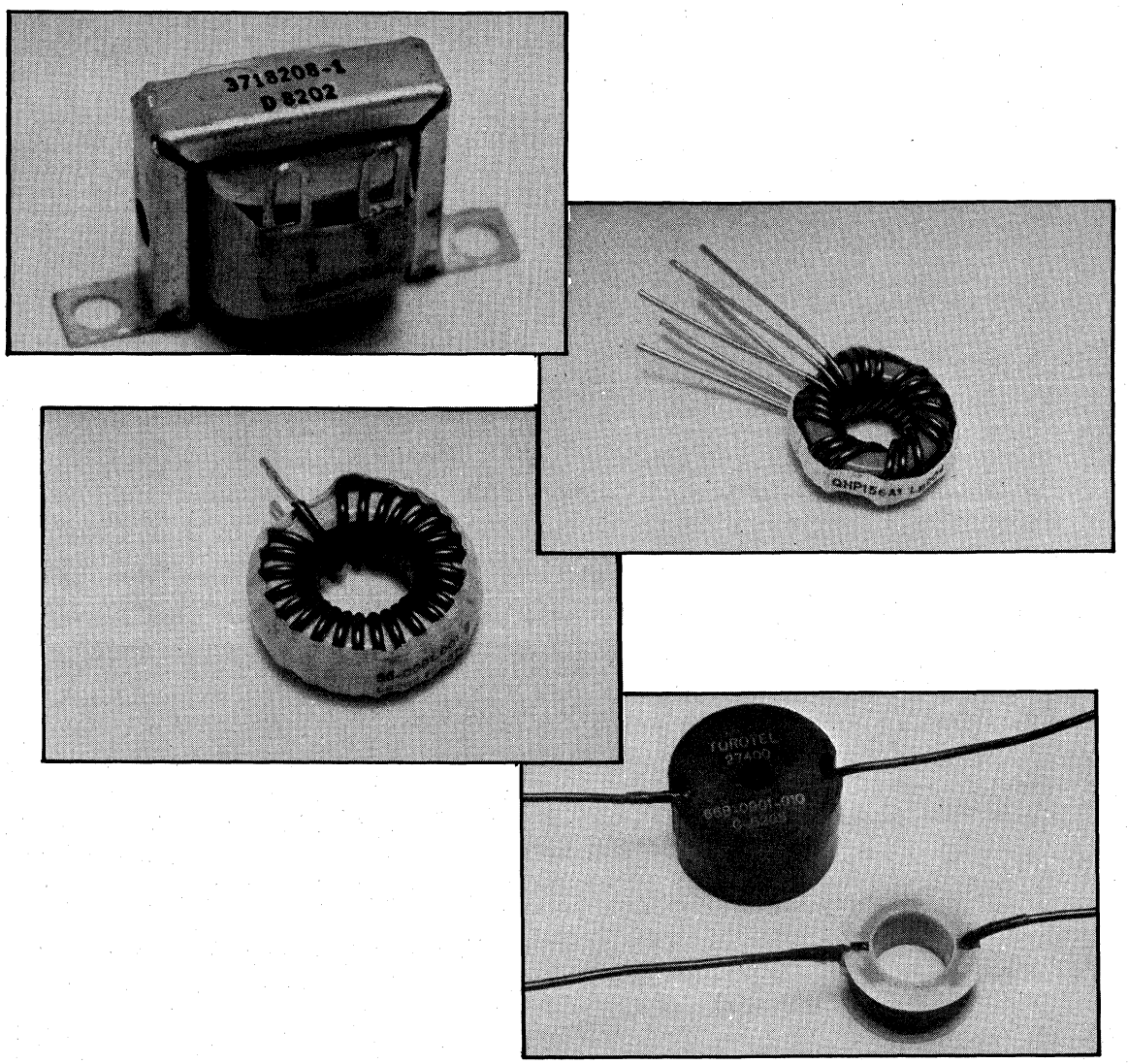

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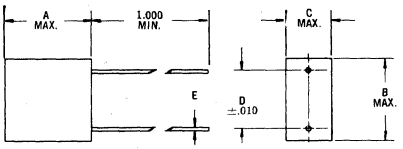
INDUCTORS

See MIL-C-15305 MINI-L QPL Listing

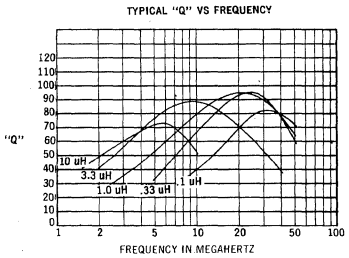
ENCAPSULATED RF INDUCTORS



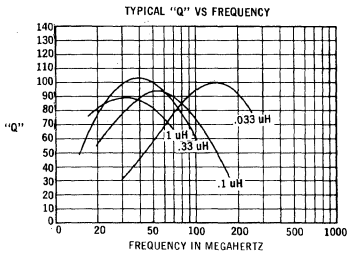
Type	A	B	C	D	E	Wt.
TA-TF	.225	.210	.110	.100	.020	.01 oz.
TB	.300	.280	.160	.200	.025	.02 oz.
TD	.390	.390	.197	.200	.025	.04 oz.

Designed to meet the requirements of MIL-C-15305, Grade 1, Class B (−55°C to +125°C). The rated temperature rise is 35°C above an ambient of 90°C. Overload current should not exceed 1.4 times the rated current. Dielectric withstanding voltage is 700 volts rms. The powdered iron cores used in these items possess excellent temperature stability and result in an inductor with low external magnetic field. This allows mounting in close proximity to each other and to other circuit components without ill effects.

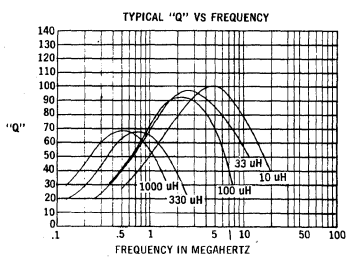
TA



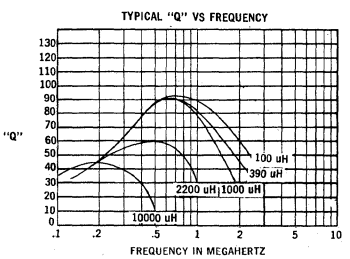
TF



TB



TD



TA SERIES

Frequency Range: 1 to 50 MHz.

Inductance Tolerances: Less than 1.0 uH, ±10%. Greater than or equal to 1.0 uH, ±5%. Closer tolerances available by special request.

Inductance TC: +50 PPM/°C maximum.

Maximum Power Dissipation: 0.2 watt.

Leads: 1 inch minimum AWG 24 tinned copper wire. Weldable gold plated Dumet leads are available.

Method of Measurement: Apparent inductance measured on HP4342A "Q" meter with leads connected ¼ inch from inductor body directly to "Q" meter terminals. Residual "Q" meter inductance of 0.01 uH should be subtracted from reading.

MIL-C-15305, Grade 1, Class B.

See MIL-C-15305 for Qualified Parts.

Part No.	Apparent Inductance (uH)	Minimum "Q"	Test Frequency (MHz)	Minimum SRF (MHz)	Maximum DCR (ohms)	DC Current (mA)
TA-1	0.10	60	25	450	0.04	2230
TA-2	0.12	60	25	410	0.05	2000
TA-3	0.15	65	25	350	0.06	1825
TA-4	0.18	65	25	325	0.07	1675
TA-5	0.22	65	25	300	0.08	1550
TA-6	0.27	65	25	280	0.09	1475
TA-7	0.33	65	25	260	0.10	1400
TA-8	0.39	70	25	240	0.11	1325
TA-9	0.47	70	25	220	0.15	1125
TA-10	0.56	70	25	200	0.20	1000
TA-11	0.68	70	25	180	0.25	900
TA-12	0.82	70	25	165	0.30	810
TA-13	1.0	70	25	150	0.35	750
TA-14	1.2	65	7.9	130	0.25	875
TA-15	1.5	65	7.9	120	0.30	800
TA-16	1.8	65	7.9	110	0.50	600
TA-17	2.2	65	7.9	100	0.75	500
TA-18	2.7	65	7.9	90	0.90	450
TA-19	3.3	65	7.9	70	1.0	425
TA-20	3.9	65	7.9	60	1.2	400
TA-21	4.7	60	7.9	50	1.5	350
TA-22	5.6	60	7.9	45	1.7	325
TA-23	6.8	60	7.9	40	2.0	300
TA-24	8.2	60	7.9	37	2.4	290
TA-25	10.0	60	7.9	35	2.6	280

TB SERIES

Recommended Frequency Range: 50 KHz to 35 MHz.

Inductance Tolerance: ±5%. Closer tolerances available by special request.

Inductance TC: From +60 PPM/°C maximum to +300 PPM/°C maximum, depending upon inductance value.

Maximum Power Dissipation: .33 watt.

Leads: 1 inch minimum AWG 22 tinned copper wire. Weldable gold plated Dumet leads are available.

Method of Measurement: Apparent inductance measured on HP4342A "Q" meter with leads connected ¼ inch from inductor body directly to "Q" meter terminals. Residual "Q" meter inductance of 0.01 uH should be subtracted from reading.

See MIL-C-15305 for Qualified Parts.

Part No.	Apparent Inductance (uH)	Minimum "Q"	Test Frequency (MHz)	Minimum SRF (MHz)	Maximum DCR (ohms)	DC Current (mA)
TB-1	10	75	2.5	35	1.1	550
TB-2	12	75	2.5	31	1.3	500
TB-3	15	75	2.5	27	1.5	460
TB-4	18	80	2.5	25	1.9	410
TB-5	22	80	2.5	22	2.2	380
TB-6	27	80	2.5	20	2.6	350
TB-7	33	80	2.5	18	3.3	320
TB-8	39	80	2.5	16	3.8	290
TB-9	47	80	2.5	14	4.6	260
TB-10	56	80	2.5	12	5.6	240
TB-11	68	80	2.5	11	6.7	220
TB-12	82	80	2.5	10	8.1	200
TB-13	100	80	2.5	9.1	9.6	180
TB-14	120	50	0.79	8.2	10.0	175
TB-15	150	50	0.79	7.5	11.0	160
TB-16	180	50	0.79	6.5	12.0	155
TB-17	220	50	0.79	5.6	13.0	150
TB-18	270	55	0.79	5.0	17.0	125
TB-19	330	55	0.79	4.5	19.0	130
TB-20	390	55	0.79	4.0	21.0	120
TB-21	470	55	0.79	3.5	22.0	115
TB-22	560	55	0.79	3.0	24.0	110
TB-23	680	55	0.79	2.8	19.0	130
TB-24	820	50	0.79	2.5	23.0	120
TB-25	1000	50	0.79	2.2	26.0	110

TF SERIES

Frequency Range: 15 to 300 MHz.

Inductance Tolerances: Less than 0.1 uH, ±20%. Greater than or equal to 0.1 uH, ±10%. Closer tolerances available by special request.

Inductance TC: +200 PPM/°C maximum.

Maximum Power Dissipation: 0.2 watt.

Leads: 1 inch minimum AWG 24 tinned copper wire. Weldable gold plated Dumet leads are available.

Method of Measurement: Apparent inductance measured on Boonton 190-A "Q" meter with leads connected ¼ inch from inductor body directly to "Q" meter terminals. Residual "Q" meter inductance of 0.0026 uH should be subtracted from value calculated from C and F readings.

MIL-C-15305, Grade 1, Class B.

Part No.	Apparent Inductance (uH)	Minimum "Q"	Test Frequency (MHz)	Minimum SRF (MHz)	Maximum DCR (ohms)	DC Current (mA)
TF-1	0.01	60	150	1000	0.02	3100
TF-2	0.012	60	150	1000	0.02	3100
TF-3	0.015	60	150	1000	0.02	3100
TF-4	0.018	60	150	1000	0.02	3100
TF-5	0.022	60	100	900	0.02	3100
TF-6	0.027	60	100	800	0.02	3100
TF-7	0.033	60	100	750	0.02	3100
TF-8	0.039	60	100	700	0.02	3100
TF-9	0.047	60	100	650	0.02	3100
TF-10	0.056	60	100	600	0.02	3100
TF-11	0.068	60	100	550	0.03	2500
TF-12	0.082	60	100	500	0.03	2500
TF-13	0.10	70	50	450	0.04	2200
TF-14	0.12	70	50	400	0.05	2000
TF-15	0.15	70	50	350	0.06	1800
TF-16	0.18	70	50	320	0.07	1650
TF-17	0.22	70	50	300	0.08	1500
TF-18	0.27	70	50	280	0.10	1400
TF-19	0.33	70	50	260	0.12	1300
TF-20	0.39	60	50	240	0.15	1150
TF-21	0.47	60	50	220	0.20	1000
TF-22	0.56	60	50	200	0.25	900
TF-23	0.68	60	50	180	0.30	800
TF-24	0.82	60	50	160	0.35	750
TF-25	1.0	60	50	150	0.40	700

TD SERIES

Recommended Frequency Range: 50 KHz to 10 MHz.

Inductance Tolerance: ±5%. Closer tolerances available by special request.

Inductance TC: From +60 PPM/°C maximum to +300 PPM/°C maximum, depending upon inductance value.

Maximum Power Dissipation: .50 watt.

Leads: 1 inch minimum AWG 22 tinned copper wire. Weldable gold plated Dumet leads are available.

Method of Measurement: Apparent inductance measured on HP4342A "Q" meter with leads connected ¼ inch from inductor body directly to "Q" meter terminals.

Part No.	Apparent Inductance (uH)	Minimum "Q"	Test Frequency (KHz)	Minimum SRF (MHz)	Maximum DCR (ohms)	DC Current (mA)
TD-1	100	75	790	8.4	6	280
TD-2	120	75	790	7.5	7	260
TD-3	150	75	790	6.8	8	240
TD-4	180	75	790	6.1	10	220
TD-5	220	80	790	5.4	12	200
TD-6	270	80	790	4.7	14	180
TD-7	330	80	790	4.2	17	165
TD-8	390	80	790	3.8	20	150
TD-9	470	75	790	3.4	24	140
TD-10	560	75	790	3.1	28	130
TD-11	680	75	790	2.8	33	120
TD-12	820	75	790	2.5	40	110
TD-13	1000	75	790	2.2	46	100
TD-14	1200	45	250	1.9	30	120
TD-15	1500	45	250	1.6	35	110
TD-16	1800	50	250	1.4	40	105
TD-17	2200	50	250	1.3	50	95
TD-18	2700	50	250	1.2	60	85
TD-19	3300	50	250	1.1	70	80
TD-20	3900	50	250	1.0	80	75
TD-21	4700	50	250	0.9	90	70
TD-22	5600	45	250	0.8	100	65
TD-23	6800	40	250	0.7	140	60
TD-24	8200	40	250	0.6	160	55
TD-25	10,000	40	250	0.6	175	50

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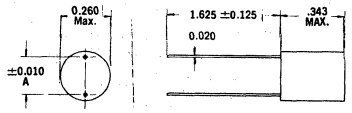
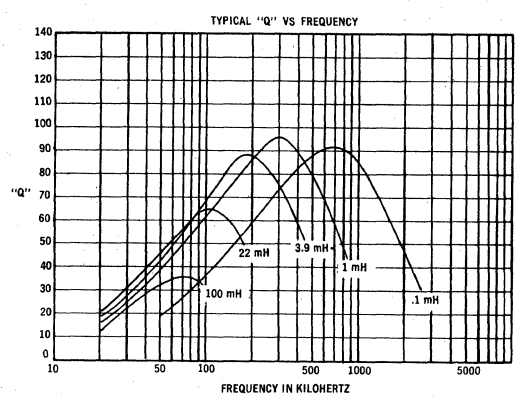
INDUCTORS

MINI-L ENCAPSULATED INDUCTORS
TE/TJ SERIES



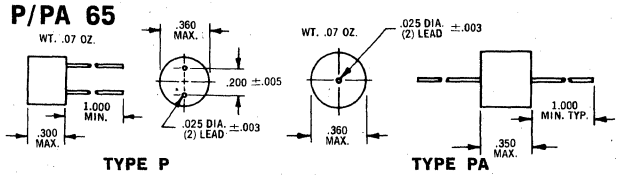
Series	A	WT.
TE	.200	.03 oz.
TJ	.100	.03 oz.

Recommended Frequency Range: 25 KHz to 2.5 MHz.
Inductance Tolerances: ±10% @ 1 KHz.
Maximum Power Dissipation: .33 watt.
Leads: 1.625 ±.125 AWG #24 tinned copper leads. Add suffix "D" to Part Number for Weldable Gold Plated Dumet leads.
Method of Measurement: Inductance at 1 KHz measured on General Radio inductance bridge Type 1632A with leads connected directly to bridge. "Q" at test frequency, measured on HP4342A "Q" meter with leads connected directly to meter terminals.
MIL-C-15305, Grade 1, Class B.

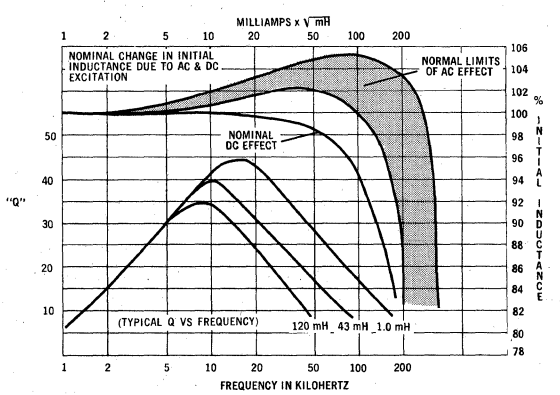


Part Number		Inductance Ref. @ 1 KHz (mH)	Minimum "Q"	"Q" Test Frequency (KHz)	Minimum SRF (MHz)	Maximum DCR* (ohms)	DC Current (mA)
TJ-1	TE-1	0.10	80	790	4.5	1.8	450
TJ-2	TE-2	0.12	80	790	3.9	2.1	425
TJ-3	TE-3	0.15	75	790	3.6	2.3	400
TJ-4	TE-4	0.18	75	790	3.3	2.7	380
TJ-5	TE-5	0.22	75	790	3.0	2.9	360
TJ-6	TE-6	0.27	75	790	2.7	3.2	320
TJ-7	TE-7	0.33	70	790	2.5	3.6	300
TJ-8	TE-8	0.39	70	790	2.3	4.0	275
TJ-9	TE-9	0.47	65	790	2.1	4.4	265
TJ-10	TE-10	0.56	60	790	2.0	4.7	250
TJ-11	TE-11	0.68	55	790	1.8	5.4	240
TJ-12	TE-12	0.82	50	790	1.6	5.8	225
TJ-13	TE-13	1.00	80	250	1.5	8.7	190
TJ-14	TE-14	1.20	75	250	1.4	9.5	180
TJ-15	TE-15	1.50	75	250	1.2	11.6	160
TJ-16	TE-16	1.80	75	250	1.1	15.8	140
TJ-17	TE-17	2.20	75	250	0.95	17.3	130
TJ-18	TE-18	2.70	70	250	0.87	18.9	125
TJ-19	TE-19	3.30	70	250	0.80	25.2	110
TJ-20	TE-20	3.90	70	250	0.75	27.2	105
TJ-21	TE-21	4.70	65	250	0.70	31.5	100
TJ-22	TE-22	5.60	65	250	0.60	42.0	85
TJ-23	TE-23	6.80	60	250	0.55	52.5	75
TJ-24	TE-24	8.20	55	250	0.50	63.0	65
TJ-25	TE-25	10.0	45	250	0.45	89.2	55
TJ-26	TE-26	12.0	40	79	0.40	105.0	50
TJ-27	TE-27	15.0	40	79	0.35	121.0	45
TJ-28	TE-28	18.0	40	79	0.33	136.0	40
TJ-29	TE-29	22.0	40	79	0.30	147.0	35
TJ-30	TE-30	27.0	40	79	0.26	241.0	30
TJ-31	TE-31	33.0	35	79	0.24	325.0	28
TJ-32	TE-32	39.0	35	79	0.22	367.0	25
TJ-33	TE-33	47.0	35	79	0.20	420.0	23
TJ-34	TE-34	56.0	30	79	0.18	483.0	20
TJ-35	TE-35	68.0	25	79	0.16	630.0	18
TJ-36	TE-36	82.0	20	79	0.14	893.0	16
TJ-37	TE-37	100.0	20	79	0.12	1100	15
TJ-38	TE-38	120.0	10	50	0.10	1200	14
TJ-39	TE-39	150.0	10	50	0.095	1360	13
TJ-40	TE-40	180.0	10	40	0.080	1520	11
TJ-41	TE-41	220.0	10	40	0.070	1890	10

P/PA 65



MIL-T-27 Grade 5, Class S.
Frequency Range: 1 to 50 KHz
WHEN ORDERING, ADD CASE PREFIX (TYPE) TO PART NUMBER.
EXAMPLE: PA65 — XX
CASE TYPE — PART NUMBER



CORE NO. 65

Inductance ±2% (mH)	Part Number	Typical DCR* (ohms)	Typical Distributed Capacity (pf)
1.00	65-1	.934	12
1.25	65-2	1.310	12
1.50	65-3	1.430	12
1.75	65-4	1.550	14
2.00	65-5	2.020	14
2.40	65-6	2.200	14
2.50	65-7	2.250	14
3.00	65-8	3.010	16
3.60	65-9	3.300	16
4.30	65-10	3.600	16
5.00	65-11	4.260	18
6.00	65-12	4.680	18
7.20	65-13	5.120	18
7.50	65-14	7.000	20
8.00	65-15	7.700	22
8.60	65-16	8.000	22
10.00	65-17	10.300	24
12.00	65-18	11.300	24
12.50	65-19	11.600	24
15.00	65-20	16.500	26
17.50	65-21	17.800	26
20.00	65-22	19.000	28
24.00	65-23	28.500	28
25.00	65-24	29.100	30
30.00	65-25	31.900	30
36.00	65-26	34.900	32
43.00	65-27	42.100	32
50.00	65-28	48.000	34
60.00	65-29	52.600	34
72.00	65-30	61.500	36
75.00	65-31	78.700	36
86.00	65-32	84.200	36
100.00	65-33	90.800	38
120.00	65-34	115.000	40

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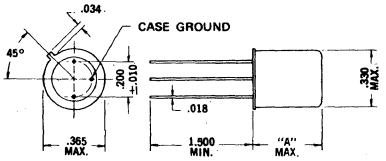
INDUCTORS

MINI-L HERMETICALLY SEALED RF INDUCTORS
TG, TH SERIES



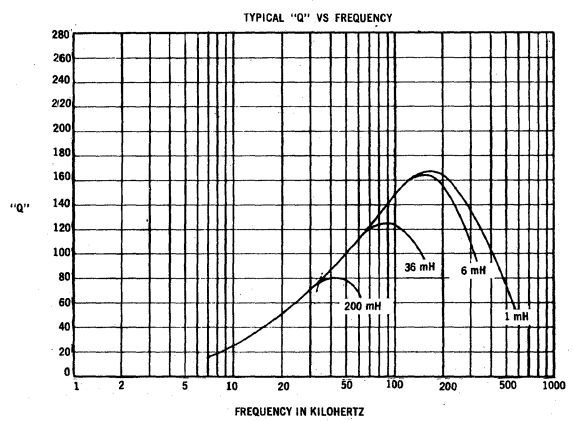
Series	A max.	Weight
TG	.390	.06 oz.
TH	.350	.07 oz.

The TG and TH series offer high "Q" inductors in a TO-5 transistor can configuration. High density packaging can be accomplished with little regard to coupling between adjacent circuitry since construction of these units results in a low external magnetic and electrostatic field.

TG SERIES

Recommended Frequency Range: 10 KHz to 500 KHz.
Inductance Tolerance: ±5%.
Inductance Stability: Less than ±2% from −20°C to +130°C.
Method of Test: Inductance is measured on a General Radio inductance bridge, Type 1632A with leads connected directly to bridge. "Q" is measured on HP4342A "Q" meter with leads connected directly to the "Q" meter terminals.
MIL-T-27, Grade 4, Class S.
Temperature Range: −55°C to +130°C.
Insulation Resistance: 10,000 Megohms minimum at 100 volts DC.
Dielectric Withstanding Voltage: 100 volts rms.

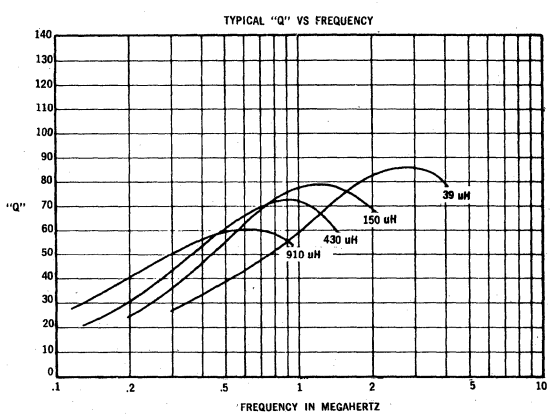
Part Number	Inductance (mH)	Inductance Test Frequency (KHz)	"Q" Minimum	"Q" Test Frequency (KHz)	Maximum DCR* (ohms)	Minimum SRF (KHz)	DC Current (mA)
TG-1	1.0	10	120	200	3.3	1500	123
TG-2	1.2	10	120	200	3.6	1300	118
TG-3	1.5	10	120	200	4.8	1160	102
TG-4	1.75	10	120	200	5.2	1080	98
TG-5	2.0	10	120	200	5.7	1000	94
TG-6	2.4	10	120	200	7.9	920	80
TG-7	3.0	10	120	150	8.9	820	75
TG-8	3.6	10	120	150	9.8	730	71
TG-9	4.3	10	120	150	13.7	660	60
TG-10	5.0	10	120	150	14.7	600	58
TG-11	6.0	10	120	150	20.0	540	50
TG-12	7.2	10	120	100	21.8	480	48
TG-13	8.6	10	100	100	24.0	430	45
TG-14	10.0	10	100	100	32.4	400	39
TG-15	12.0	10	100	100	34.8	360	38
TG-16	15.0	10	100	100	39.1	320	36
TG-17	17.5	10	85	70	55.0	300	30
TG-18	20.0	10	85	70	60.0	280	29
TG-19	24.0	10	85	70	64.7	250	28
TG-20	30.0	10	85	70	86.3	220	24
TG-21	36.0	10	85	70	95.8	195	23
TG-22	43.0	10	85	70	132	185	19
TG-23	50.0	10	85	70	143	165	18
TG-24	60.0	10	75	50	155	145	18
TG-25	72.0	10	75	50	172	130	17
TG-26	86.0	10	75	50	233	125	15
TG-27	100	10	75	50	252	115	14
TG-28	120	5	75	50	290	105	13
TG-29	150	5	50	40	323	95	13
TG-30	175	5	50	40	350	85	12
TG-31	200	5	50	40	477	80	10
TG-32	240	5	50	40	693	71	10
TG-33	300	5	50	40	735	63	8
TG-34	360	5	30	30	1005	57	7
TG-35	430	5	30	30	1100	51	6.5
TG-36	500	5	30	20	1200	48	6.5



TH SERIES

Recommended Frequency Range: 100 KHz to 10 MHz.
Inductance Tolerances: 10 uH through 33 uH, ±10%, 39 uH through 130 uH, ±5%, greater than and including 150 uH, ±3%.
Inductance Stability: Less than or equal to ±2% from −20°C to +85°C.
Method of Test: Inductance and "Q" are measured on HP4342A "Q" meter with leads connected directly to the "Q" meter terminals.
MIL-C-15305, Grade 1, Class C.
Temperature Range: −55°C to +130°C.
Insulation Resistance: 10,000 Megohms minimum at 100 volts DC.
Dielectric Withstanding Voltage: 100 volts rms.

Part Number	Inductance (uH)	Inductance Test Frequency (KHz)	"Q" Minimum	"Q" Test Frequency (KHz)	Maximum DCR* (ohms)	Minimum SRF (MHz)	DC Current (mA)
TH-7	10	1000	75	2500	2.4	35.0	102
TH-8	12	1000	75	2500	2.5	30.0	100
TH-9	15	1000	75	2500	2.6	25.0	98
TH-10	18	1000	75	2500	2.7	23.0	96
TH-11	22	1000	75	2500	2.8	20.0	94
TH-12	27	1000	75	2500	2.9	17.0	93
TH-13	33	1000	75	2500	3.0	14.0	91
TH-14	39	500	70	2500	3.1	11.0	90
TH-15	47	500	70	2500	3.2	10.0	88
TH-16	56	500	70	2500	3.3	9.5	87
TH-17	68	500	70	2500	3.4	9.0	85
TH-18	82	500	70	2500	4.5	8.0	74
TH-19	100	500	70	1500	5.1	7.5	70
TH-20	110	500	70	1500	6.0	7.0	64
TH-21	120	500	70	1500	6.2	6.5	63
TH-22	130	500	70	1500	6.4	6.0	62
TH-23	150	500	70	1500	6.6	5.5	61
TH-24	160	500	60	790	8.6	5.3	54
TH-25	180	500	60	790	9.0	5.0	52
TH-26	200	500	60	790	9.5	4.5	51
TH-27	220	250	60	790	10.0	4.0	50
TH-28	240	250	60	790	10.6	3.8	48
TH-29	270	250	60	790	11.2	3.6	48
TH-30	300	250	60	790	14.2	3.4	42
TH-31	330	250	60	790	14.6	3.2	41
TH-32	360	250	60	790	15.0	3.0	41
TH-33	390	250	60	790	15.6	2.9	40
TH-34	430	250	60	790	16.4	2.8	39
TH-35	470	250	60	790	20.4	2.7	35
TH-36	510	250	60	790	21.8	2.6	34
TH-37	560	250	60	790	23.6	2.5	32
TH-38	620	250	60	790	24.6	2.3	32
TH-39	680	250	50	790	25.8	2.1	31
TH-40	750	250	50	790	26.8	1.9	31
TH-41	820	250	50	790	38.4	1.7	25
TH-42	910	250	50	790	40.8	1.5	24
TH-43	1000	250	50	790	42.6	1.4	24



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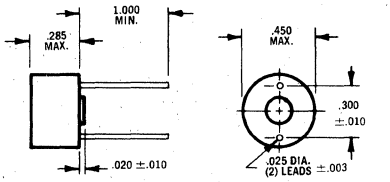
INDUCTORS

MINIATURE TOROIDS

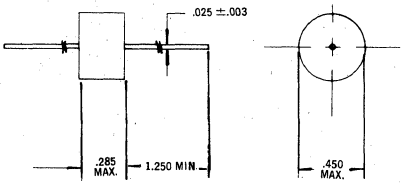
TYPE P/PF
Epoxy Encapsulated
MIL-T-27 Grade 5, Glass S
AVAILABLE FOR CORES
03, 13, 29, 82, 72 & 52



WT. .08 oz.

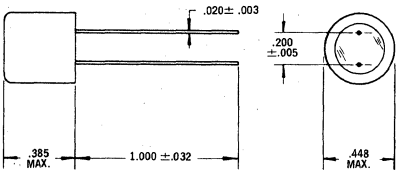
P	PF
NO FOOT	WITH FOOT

TYPICAL TYPE PA
Axial Lead Epoxy Encapsulated
AVAILABLE FOR CORES
03, 13, 29, 82, 72 & 52



WT. .08 oz.

TYPE M
Metal Cased
MIL-T-27 Grade 4, Class R
AVAILABLE FOR CORES
03, 13, 29, 82, 72 & 52



WT. .15 oz.

CORE NO. 03
Recommended Frequency: Up to 100 KHz.
Maximum Inductance: 250 mH.
Special Core Stabilization Available: D, W, M, L.

CORE NO. 13
Recommended Frequency: 10 KHz to 200 KHz.
Maximum Inductance: 100 mH.
Special Core Stabilization Available: D, W, M, L.

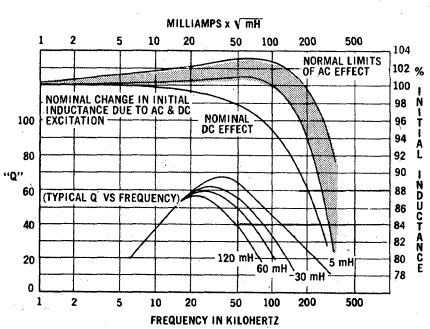
CORE NO. 29
Recommended Frequency: 50 KHz to 5 MHz.
Maximum Inductance: 15 mH.
Only Core Stabilization Available: ±90 PPM/°C

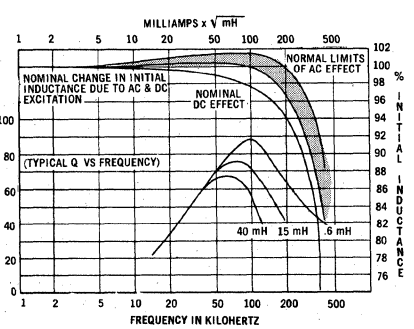
When ordering add the prefix P, PA, PF, or M to the Part Number for the case type desired.

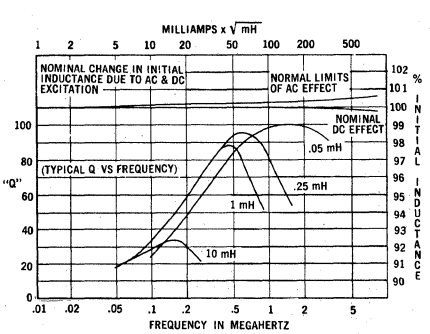
Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
1.00	03-1	1.5	14
1.25	03-2	1.7	14
1.50	03-3	2.4	18
1.75	03-4	2.6	20
2.00	03-5	2.7	20
2.40	03-6	3.7	22
2.50	03-7	3.8	22
3.00	03-8	4.0	24
3.60	03-9	5.7	24
4.30	03-10	6.2	24
5.00	03-11	6.7	26
6.00	03-12	9.3	26
7.20	03-13	10.0	26
7.50	03-14	10.5	28
8.00	03-15	13.5	28
8.60	03-16	14.0	28
10.00	03-17	15.0	30
12.00	03-18	15.5	32
12.50	03-19	16.0	34
15.00	03-20	23.0	36
17.50	03-21	25.0	38
20.00	03-22	26.0	40
24.00	03-23	35.0	42
30.00	03-24	50.0	44
36.00	03-25	58.0	46
43.00	03-26	64.0	48
50.00	03-27	69.0	50
60.00	03-28	78.0	52
72.00	03-29	106.0	54
75.00	03-30	108.0	56
86.00	03-31	140.0	58
100.00	03-32	150.0	60
120.00	03-33	155.0	62
150.00	03-34	228.0	64
175.00	03-35	246.0	66
178.00	03-36	248.0	66
200.00	03-37	333.0	68
250.00	03-38	373.0	70

Inductance ±1% (mH)	Part Number	Typical DCR* (ohms)	Typical Distributed Capacity (pf)
.50	13-1	1.5	14
.60	13-2	1.6	14
.72	13-3	2.4	14
.86	13-4	2.6	14
1.00	13-5	2.8	16
1.25	13-6	3.9	16
1.50	13-7	4.1	18
1.75	13-8	5.7	18
2.00	13-9	6.1	20
2.40	13-10	6.7	22
2.50	13-11	6.8	24
3.00	13-12	9.5	24
3.60	13-13	10.5	26
4.30	13-14	14.7	28
5.00	13-15	15.5	30
6.00	13-16	16.0	30
7.20	13-17	24.0	32
8.60	13-18	26.0	34
10.00	13-19	27.0	36
12.00	13-20	39.0	38
15.00	13-21	41.0	40
17.50	13-22	59.0	40
20.00	13-23	63.0	42
24.00	13-24	67.0	42
25.00	13-25	68.0	44
30.00	13-26	100.0	44
36.00	13-27	103.0	46
40.00	13-28	108.0	46
43.00	13-29	142.0	48
50.00	13-30	154.0	48
60.00	13-31	168.0	50
72.00	13-32	228.0	50
86.00	13-33	250.0	52
100.00	13-34	340.0	52

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
.050	29-1	1.2	10
.060	29-2	1.6	10
.072	29-3	1.8	10
.075	29-4	1.8	12
.086	29-5	1.9	12
.100	29-6	2.1	12
.120	29-7	2.3	12
.125	29-8	3.0	12
.150	29-9	3.3	12
.175	29-10	3.5	14
.200	29-11	4.5	14
.240	29-12	4.9	14
.250	29-13	5.0	14
.300	29-14	7.0	14
.360	29-15	7.7	14
.400	29-16	8.1	16
.430	29-17	10.5	16
.500	29-18	12.3	16
.600	29-19	13.5	16
.720	29-20	16.2	16
.750	29-21	16.5	18
.860	29-22	17.7	18
1.000	29-23	19.1	18
1.200	29-24	25.9	20
1.250	29-25	26.4	20
1.500	29-26	29.0	22
1.750	29-27	37.6	22
2.000	29-28	40.3	24
2.400	29-29	44.0	24
2.500	29-30	45.0	26
3.000	29-31	64.0	28
3.600	29-32	69.0	28
4.000	29-33	73.0	30
4.300	29-34	76.0	32
5.000	29-35	102.0	34
6.000	29-36	112.0	34
7.200	29-37	122.0	36
7.500	29-38	125.0	38
8.600	29-39	162.0	40
10.000	29-40	175.0	42







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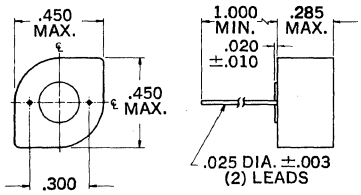
INDUCTORS

TOROTEL PRODUCTS INC./ 13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 FAX 816-763-2278

MINIATURE TOROIDS

TYPE PE/PEF
Epoxy Encapsulated
MIL-T-27 Grade 5, Class S
AVAILABLE FOR CORES
03, 13, 29, 82, 72, 52

PE	PEF
NO FOOT	WITH FOOT



WHEN ORDERING, ADD CASE PREFIX (TYPE) TO PART NUMBER.

EXAMPLE P 03-1

CASE TYPE — PART NUMBER

CORE NO. 82

Recommended Frequency: Up to 50 KHz.
Maximum Inductance: 250 mH.
Special Core Stabilization: D, W, M, L.

When ordering add the prefix P, PA, PF, or M, to the part number for the case type desired.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
1.00	82-1	1.23	12
1.25	82-2	1.38	14
1.50	82-3	1.85	14
1.75	82-4	2.00	16
2.00	82-5	2.34	16
2.40	82-6	2.56	18
2.50	82-7	2.62	18
3.00	82-8	3.87	18
3.60	82-9	4.25	20
4.30	82-10	4.63	22
5.00	82-11	6.29	22
6.00	82-12	6.91	24
7.20	82-13	7.55	24
7.50	82-14	9.27	26
8.00	82-15	9.57	26
8.60	82-16	9.93	28
10.00	82-17	10.70	28
12.00	82-18	14.20	30
15.00	82-19	15.90	30
17.50	82-20	22.10	32
20.00	82-21	23.60	34
24.00	82-22	25.90	36
30.00	82-23	36.50	36
36.00	82-24	40.00	38
43.00	82-25	43.70	38
50.00	82-26	56.70	40
60.00	82-27	62.10	40
72.00	82-28	68.10	42
86.00	82-29	96.80	44
100.00	82-30	104.00	44
120.00	82-31	149.00	46
150.00	82-32	206.00	48
175.00	82-33	223.00	48
200.00	82-34	305.00	50
250.00	82-35	341.00	50

CORE NO. 72

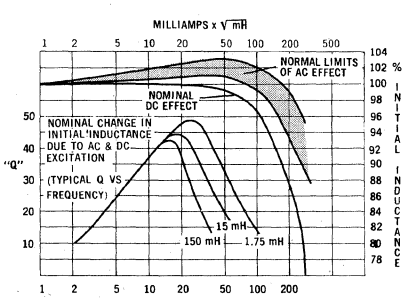
Recommended Frequency: Up to 30 KHz.
Maximum Inductance: 360 mH.
Special Core Stabilization: D, W, M, L.

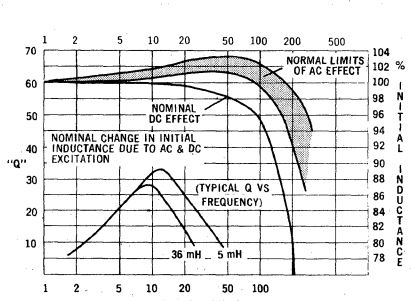
Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
1.25	72-1	1.23	12
1.50	72-2	1.34	14
1.75	72-3	1.78	14
2.00	72-4	1.90	16
2.40	72-5	2.28	16
2.50	72-6	2.34	18
3.00	72-7	2.55	18
3.60	72-8	3.78	18
4.30	72-9	4.14	20
5.00	72-10	4.45	22
6.00	72-11	6.15	22
7.20	72-12	6.75	24
7.50	72-13	6.88	24
8.00	72-14	7.09	26
8.60	72-15	8.86	26
10.00	72-16	9.54	28
12.00	72-17	10.50	28
15.00	72-18	14.20	30
17.50	72-19	15.30	30
20.00	72-20	16.40	32
24.00	72-21	23.10	34
30.00	72-22	25.80	36
36.00	72-23	35.70	36
43.00	72-24	39.00	38
50.00	72-25	42.00	38
60.00	72-26	55.40	40
72.00	72-27	60.70	40
86.00	72-28	66.40	42
100.00	72-29	71.60	44
120.00	72-30	102.00	44
150.00	72-31	148.00	46
175.00	72-32	160.00	48
200.00	72-33	213.00	48
250.00	72-34	304.00	50
300.00	72-35	333.00	52
360.00	72-36	365.00	54

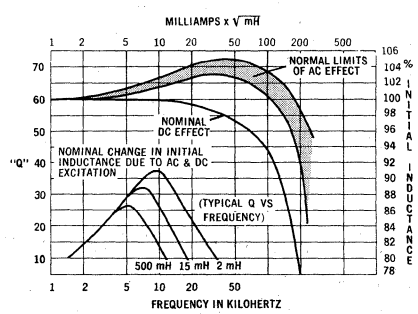
CORE NO. 52

Recommended Frequency: Up to 15 KHz.
Maximum Inductance: 500 mH.
Special Core Stabilization: L.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
2.0	52-1	1.27	12
2.4	52-2	1.39	14
2.5	52-3	1.74	14
3.0	52-4	1.91	16
3.6	52-5	2.28	16
4.3	52-6	2.49	18
5.0	52-7	2.70	18
6.0	52-8	4.00	18
7.2	52-9	4.38	20
7.5	52-10	4.47	22
8.0	52-11	4.61	22
8.6	52-12	6.02	24
10.0	52-13	6.50	24
12.0	52-14	7.11	26
15.0	52-15	9.57	26
17.5	52-16	10.30	28
20.0	52-17	11.10	28
24.0	52-18	14.70	30
30.0	52-19	16.40	30
36.0	52-20	23.20	32
43.0	52-21	25.30	34
50.0	52-22	27.30	36
60.0	52-23	37.70	36
72.0	52-24	41.30	38
86.0	52-25	54.30	38
100.0	52-26	58.60	40
120.0	52-27	64.20	40
150.0	52-28	71.70	42
175.0	52-29	101.00	44
200.0	52-30	140.00	44
250.0	52-31	156.00	46
300.0	52-32	213.00	48
360.0	52-33	233.00	48
400.0	52-34	315.00	50
430.0	52-35	326.00	52
500.0	52-36	352.00	54







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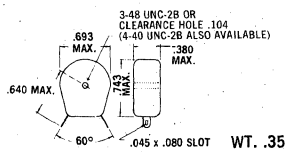
INDUCTORS

MINIATURE INDUCTORS

Mechanical Tolerance: ±.015 unless otherwise indicated.

TYPE P — Compression Molded AVAILABLE FOR CORES 50, 51, 53, 55, 56 & 57



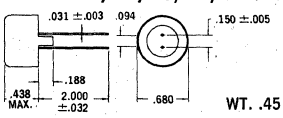
WT. .35 oz.

CORE NO. 50

Recommended Frequency: Up to 50 KHz.
Maximum Inductance: 4.5 H.
Special Core Stabilization Available: D, L, M, W.

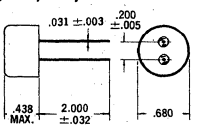
Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
1.0	50-1	.6	30
2.5	50-2	1.4	31
5.0	50-3	2.8	31
6.0	50-40	3.3	32
7.2	50-41	3.9	32
7.5	50-4	4.1	32
8.6	50-42	4.7	33
10.0	50-5	5.4	33
12.0	50-43	6.5	33
12.5	50-6	6.6	33
15.0	50-7	7.5	34
17.5	50-44	9.4	34
20.0	50-8	10.7	34
24.0	50-45	12.9	34
25.0	50-9	13.5	34
30.0	50-10	16.1	35
36.0	50-46	19.4	35
40.0	50-11	21.5	35
43.0	50-47	23.1	36
50.0	50-12	27.3	36
60.0	50-48	32.6	36
72.0	50-49	38.9	37
75.0	50-13	41.0	37
86.0	50-50	47.0	38
100.0	50-14	54.0	38
120.0	50-51	66.0	38
125.0	50-15	68.0	39
150.0	50-16	81.0	39
175.0	50-53	95.0	40
200.0	50-17	108.0	40
240.0	50-54	130.0	41
250.0	50-52	135.0	41
300.0	50-18	161.0	42
360.0	50-55	194.0	42
400.0	50-19	215.0	43
430.0	50-56	231.0	43
500.0	50-20	268.0	44
600.0	50-57	321.0	44
720.0	50-58	387.0	45
750.0	50-21	403.0	45
860.0	50-59	461.0	46
1.00 H	50-22	536.0	46
1.20 H	50-60	643.0	47
1.25 H	50-61	672.0	47
1.50 H	50-62	804.0	48
1.75 H	50-63	938.0	48
2.00 H	50-64	1103.0	49
2.40 H	50-67	1286.0	50
2.50 H	50-66	1339.0	50
3.00 H	50-65	1607.0	51

TYPE M — Metal Cased - AVAILABLE FOR CORES 50, 51, 53, 55, 56 & 57



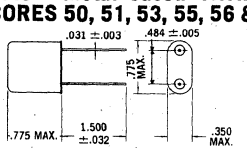
WT. .45 oz.

TYPE MG — Metal Cased - Grid Spacing AVAILABLE FOR CORES 50, 51, 53, 55, 56 & 57



WT. .45 oz.

TYPE MC — Metal Cased - AVAILABLE FOR CORES 50, 51, 53, 55, 56 & 57



WT. .45 oz.

CORE NO. 51

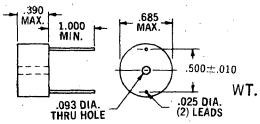
Recommended Frequency: 10 KHz to 200 KHz.
Maximum Inductance: 1 H.
Special Core Stabilization Available: D, M, W, L.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
1.00	51-1	1.2	25
1.20	51-2	1.3	25
1.50	51-3	1.7	26
1.75	51-4	1.9	26
2.00	51-5	2.5	26
2.40	51-6	2.7	26
3.00	51-7	3.3	27
3.60	51-8	4.4	27
4.30	51-9	4.7	27
5.00	51-10	5.5	28
6.00	51-11	6.6	28
7.20	51-12	7.8	28
8.60	51-13	9.4	28
10.00	51-14	10.9	28
12.00	51-15	13.1	28
15.00	51-16	16.3	29
17.50	51-17	18.9	29
20.00	51-18	21.7	29
24.00	51-19	26.0	29
30.00	51-20	33.0	29
36.00	51-21	39.0	29
43.00	51-22	47.0	29
50.00	51-23	55.0	30
60.00	51-24	66.0	30
72.00	51-25	78.0	30
86.00	51-26	94.0	30
100.00	51-27	109.0	31
120.00	51-28	130.0	31
150.00	51-29	162.0	31
175.00	51-30	189.0	31
200.00	51-31	217.0	32
240.00	51-32	260.0	32
300.00	51-33	325.0	33
360.00	51-34	389.0	33
430.00	51-35	466.0	34
500.00	51-36	546.0	35

WHEN ORDERING, ADD CASE PREFIX (TYPE) TO PART NUMBER.†
EXAMPLE: U 55-1
CASE TYPE — PART NUMBER

† Add "C" to part number of molded inductor if clearance hole is desired.

TYPE PT — Printed Circuit AVAILABLE FOR CORES 50, 51, 53, 56 & 57

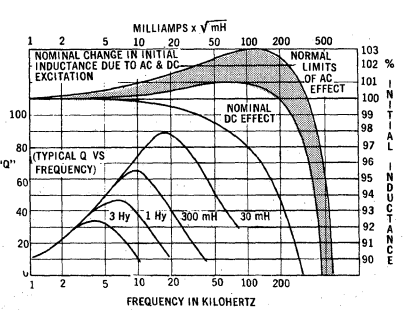


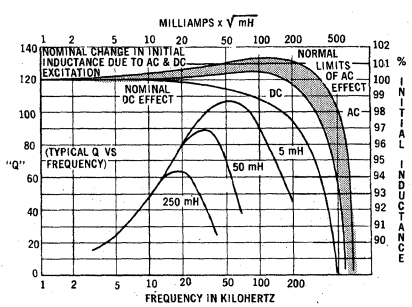
WT. .35 OZ.

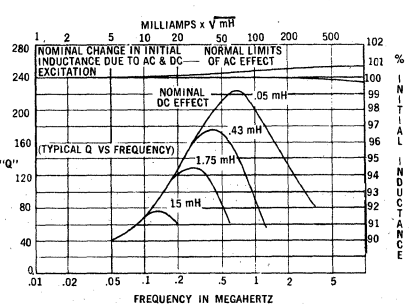
CORE NO. 53 - AVAILABLE

Recommended Frequency: 50 KHz to 2 MHz.
Maximum Inductance: 20 mH.
Only Core Stabilization Available: ±90 PPM/°C

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
0.050	53-1	.42	6
0.060	53-2	.50	6
0.072	53-3	.60	6
0.075	53-4	.61	6
0.086	53-5	.72	6
0.100	53-6	.78	6
0.120	53-7	.89	6
0.125	53-8	.94	6
0.150	53-9	1.17	7
0.175	53-10	1.26	7
0.200	53-11	1.72	7
0.240	53-12	2.02	7
0.250	53-13	2.08	8
0.300	53-14	2.28	8
0.360	53-15	2.44	8
0.400	53-16	3.20	8
0.430	53-17	3.30	8
0.500	53-18	4.80	8
0.600	53-19	5.60	8
0.720	53-20	5.90	8
0.750	53-21	7.40	8
0.860	53-22	7.50	8
1.000	53-23	10.10	8
1.200	53-24	11.30	8
1.250	53-25	11.40	8
1.500	53-26	12.50	8
1.750	53-27	13.50	9
2.000	53-28	18.20	9
2.400	53-29	19.90	9
2.500	53-30	20.80	9
3.000	53-31	23.10	9
3.600	53-32	23.20	9
4.000	53-33	25.90	9
4.300	53-34	27.10	9
5.000	53-35	36.00	9
6.000	53-36	39.00	9
7.200	53-37	51.00	9
7.500	53-38	52.00	9
8.600	53-39	57.00	9
10.000	53-40	64.00	9
12.000	53-41	86.00	9
12.500	53-42	94.00	9
15.000	53-43	104.00	9





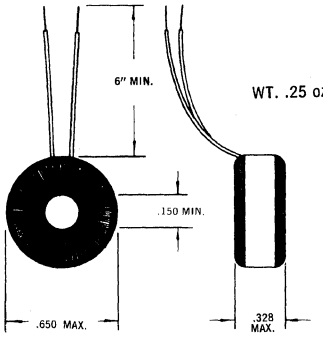


INDUCTORS

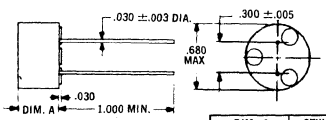
TOROTEL PRODUCTS INC./ 13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 FAX 816-763-2278

MINIATURE INDUCTORS

TYPE U — Uncased - AVAILABLE FOR CORES 50, 51, 53, 55, 56, 57



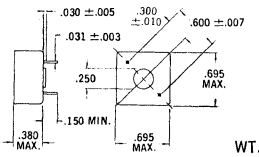
TYPE PS/PST/PW/PWT — Epoxy Encapsulated - AVAILABLE FOR CORES 50, 51, 53, 55, 56, 57



WT. .35 oz.

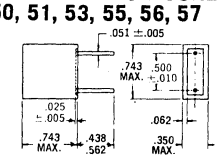
DIM. A		STYLE
.435	.390	
PS	PST	FEET
PW	PWT	NO FEET

TYPE S — Epoxy Encapsulated AVAILABLE FOR CORES 50, 51, 53, 55, 56, 57



WT. .35 oz.

TYPE PC — Epoxy Encapsulated AVAILABLE FOR CORES 50, 51, 53, 55, 56, 57

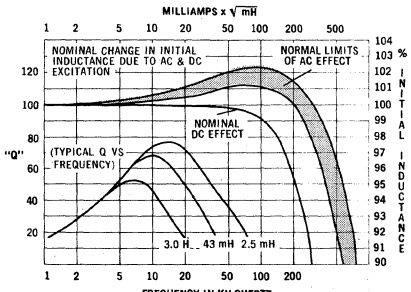


WT. .35 oz.

CORE NO. 55

Recommended Frequency: Up to 50 KHz.
Maximum Inductance: 5 H.
Special Core Stabilization: D, W, M, L.

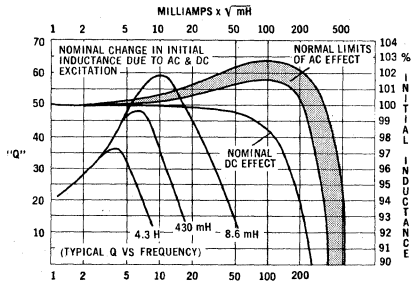
Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
1.20	55-1	0.50	30
1.50	55-2	0.71	30
1.75	55-3	0.77	32
2.00	55-4	0.82	32
2.40	55-5	1.13	32
3.00	55-6	1.26	34
3.60	55-7	1.38	34
4.30	55-8	1.51	34
5.00	55-9	1.63	34
6.00	55-10	2.32	34
7.20	55-11	3.20	36
8.60	55-12	3.51	36
10.00	55-13	4.68	36
12.00	55-14	5.11	36
15.00	55-15	5.72	36
17.50	55-16	7.60	38
20.00	55-17	8.12	38
24.00	55-18	8.89	38
30.00	55-19	12.30	38
36.00	55-20	13.40	40
43.00	55-21	18.20	40
50.00	55-22	19.60	40
60.00	55-23	27.00	42
72.00	55-24	29.60	42
86.00	55-25	40.70	42
100.00	55-26	43.90	42
120.00	55-27	48.10	44
150.00	55-28	71.50	44
175.00	55-29	77.30	44
200.00	55-30	82.60	46
240.00	55-31	117.00	46
300.00	55-32	131.00	46
360.00	55-33	143.00	48
430.00	55-34	196.00	48
500.00	55-35	211.00	48
600.00	55-36	292.00	50
720.00	55-37	320.00	50
860.00	55-38	350.00	52
1.00 H	55-39	475.00	52
1.20 H	55-40	520.00	54
1.50 H	55-41	735.00	54
1.75 H	55-42	794.00	54
2.00 H	55-43	1080.00	56
2.40 H	55-44	1180.00	56
3.00 H	55-45	1320.00	56



CORE NO. 56

Recommended Frequency: Up to 40 KHz.
Maximum Inductance: 7 H.
Special Core Stabilization: D, W, M, L.

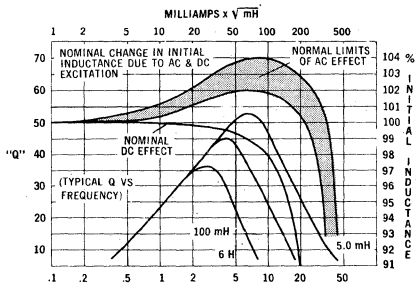
Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
1.50	56-1	0.50	36
1.75	56-2	0.54	36
2.00	56-3	0.58	36
2.40	56-4	0.80	36
3.00	56-5	0.90	38
3.60	56-6	1.23	38
4.30	56-7	1.35	38
5.00	56-8	1.46	38
6.00	56-9	1.60	38
7.20	56-10	2.27	40
8.60	56-11	3.13	40
10.00	56-12	3.38	40
12.00	56-13	3.70	42
15.00	56-14	5.11	42
17.50	56-15	5.53	42
20.00	56-16	5.90	44
24.00	56-17	7.95	44
30.00	56-18	8.89	44
36.00	56-19	12.00	46
43.00	56-20	13.10	46
50.00	56-21	14.10	46
60.00	56-22	19.20	46
72.00	56-23	26.40	48
86.00	56-24	28.90	48
100.00	56-25	31.20	48
120.00	56-26	43.00	50
150.00	56-27	48.10	50
175.00	56-28	51.90	52
200.00	56-29	73.90	52
240.00	56-30	80.90	54
300.00	56-31	117.00	54
360.00	56-32	128.00	54
430.00	56-33	140.00	56
500.00	56-34	189.00	56
600.00	56-35	207.00	58
720.00	56-36	286.00	58
860.00	56-37	313.00	60
1.00 H	56-38	337.00	60
1.20 H	56-39	369.00	62
1.50 H	56-40	520.00	62
1.75 H	56-41	710.00	64
2.00 H	56-42	759.00	64
2.40 H	56-43	832.00	66
3.00 H	56-44	1180.00	66
3.60 H	56-45	1290.00	66



CORE NO. 57

Recommended Frequency: Up to 20 KHz.
Maximum Inductance: 10 H.
Special Core Stabilization: L.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
2.0	57-1	0.48	40
2.4	57-2	0.52	40
3.0	57-3	0.74	42
3.6	57-4	0.81	42
4.3	57-5	1.11	42
5.0	57-6	1.19	44
6.0	57-7	1.31	44
7.2	57-8	1.43	44
8.6	57-9	1.56	46
10.0	57-10	2.19	46
12.0	57-11	2.40	46
15.0	57-12	3.40	46
17.5	57-13	3.66	48
20.0	57-14	4.84	48
24.0	57-15	5.30	50
30.0	57-16	7.29	50
36.0	57-17	7.99	52
43.0	57-18	8.73	52
50.0	57-19	11.60	54
60.0	57-20	12.70	54
72.0	57-21	13.90	56
86.0	57-22	18.80	56
100.0	57-23	20.30	56
120.0	57-24	28.00	58
150.0	57-25	31.30	58
175.0	57-26	42.60	60
200.0	57-27	45.50	62
240.0	57-28	49.80	62
300.0	57-29	74.10	64
360.0	57-30	81.20	64
430.0	57-31	115.00	64
500.0	57-32	124.00	66
600.0	57-33	136.00	66
720.0	57-34	186.00	66
860.0	57-35	203.00	68
1.00 H	57-36	219.00	68
1.20 H	57-37	303.00	70
1.50 H	57-38	338.00	72
1.75 H	57-39	366.00	72
2.00 H	57-40	492.00	74
2.40 H	57-41	682.00	74
3.00 H	57-42	762.00	74
3.60 H	57-43	835.00	76
4.30 H	57-44	1160.00	76
5.00 H	57-45	1250.00	76



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INDUCTORS

TOROIDAL INDUCTORS

Studs are available on the "M" Series on special request.

Mechanical Tolerance: ±.015 unless otherwise indicated.

WHEN ORDERING, ADD CASE PREFIX (TYPE) TO PART NUMBER.
EXAMPLE: PS 90-1
CASE TYPE — PART NUMBER

CORE NO. 90

Recommended Frequency: Up to 50 KHz.
Maximum Inductance: 9 H.
Special Core Stabilization: D, L, M, W.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
3.0	90-1	1.10	34
3.6	90-2	1.20	35
4.0	90-3	1.61	35
4.3	90-4	1.67	36
5.0	90-5	1.80	36
6.0	90-6	1.97	36
7.2	90-7	2.70	37
7.5	90-8	2.75	37
8.6	90-9	2.95	37
10.0	90-10	3.82	38
12.0	90-11	4.19	38
12.5	90-12	4.28	38
15.0	90-13	4.68	38
17.5	90-14	6.15	39
20.0	90-15	6.57	39
24.0	90-16	9.18	39
25.0	90-17	9.36	39
30.0	90-18	10.30	40
36.0	90-19	11.30	40
40.0	90-20	15.10	40
43.0	90-21	15.70	41
50.0	90-22	16.90	41
60.0	90-23	18.50	42
72.0	90-24	25.40	42
75.0	90-25	25.90	43
86.0	90-26	27.70	43
100.0	90-27	29.90	44
120.0	90-28	42.30	45
125.0	90-29	43.10	45
150.0	90-30	47.20	46
175.0	90-31	63.00	46
200.0	90-32	67.50	47
240.0	90-33	74.00	47
250.0	90-34	75.50	48
300.0	90-35	104.00	48
360.0	90-36	114.00	49
400.0	90-37	120.00	49
430.0	90-38	165.00	50
500.0	90-39	178.00	50
600.0	90-40	195.00	50
720.0	90-41	264.00	51
750.0	90-42	270.00	51
860.0	90-43	288.00	52
1.00 H	90-44	312.00	52
1.20 H	90-45	480.00	53
1.25 H	90-46	490.00	53
1.50 H	90-47	610.00	54
1.75 H	90-48	659.00	54
2.00 H	90-49	705.00	55
2.40 H	90-50	772.00	55
2.50 H	90-51	788.00	56
3.00 H	90-52	1090.00	56
3.60 H	90-53	1190.00	57
4.00 H	90-54	1522.00	57
5.00 H	90-55	1705.00	58
6.00 H	90-56	2420.00	58

CORE NO. 89

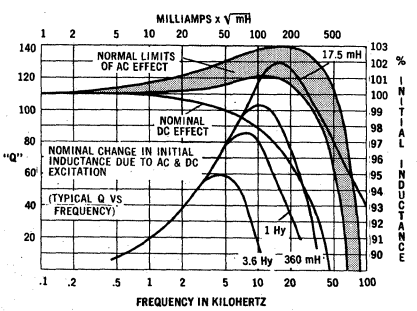
Recommended Frequency: Up to 200 KHz.
Maximum Inductance: 1.5 H.
Special Core Stabilization: D, L, M, W

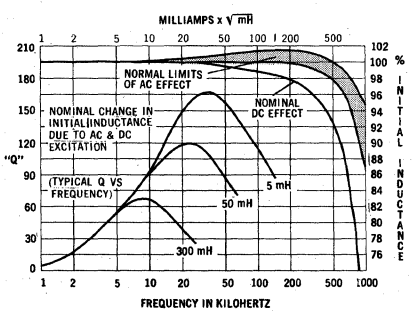
Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
1.50	89-1	1.12	27
1.75	89-2	1.20	27
2.00	89-3	1.63	28
2.40	89-4	1.89	28
3.00	89-5	2.00	29
3.60	89-6	2.74	29
4.30	89-7	2.98	30
5.00	89-8	3.87	31
6.00	89-9	4.24	31
7.20	89-10	4.65	32
8.60	89-11	6.18	32
10.00	89-12	6.67	33
12.00	89-13	9.30	33
15.00	89-14	10.40	34
17.50	89-15	11.20	34
20.00	89-16	15.20	35
24.00	89-17	16.70	35
30.00	89-18	18.70	36
36.00	89-19	25.80	36
43.00	89-20	28.20	37
50.00	89-21	30.40	37
60.00	89-22	42.80	38
72.00	89-23	46.80	38
86.00	89-24	62.50	39
100.00	89-25	68.50	39
120.00	89-26	74.90	40
150.00	89-27	105.00	41
175.00	89-28	114.00	42
200.00	89-29	122.00	43
240.00	89-30	177.00	44
300.00	89-31	197.00	45
360.00	89-32	268.00	46
430.00	89-33	292.00	47
500.00	89-34	315.00	48
600.00	89-35	422.00	49

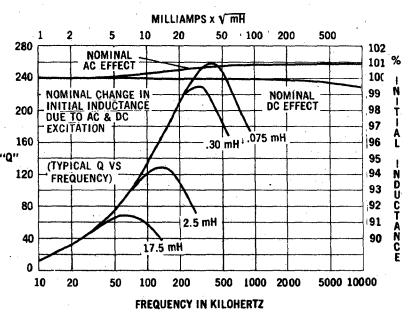
CORE NO. 68

Recommended Frequency: 50 KHz to 2 MHz.
Maximum Inductance: 30 mH.
Only Core Stabilization Available: ±90 PPM/°C.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
0.075	68-1	0.40	9
0.086	68-2	0.54	9
0.100	68-3	0.59	9
0.120	68-4	0.64	9
0.125	68-5	0.65	10
0.150	68-6	0.83	10
0.175	68-7	0.90	10
0.200	68-8	0.96	10
0.240	68-9	1.31	10
0.250	68-10	1.34	10
0.300	68-11	1.47	10
0.360	68-12	1.95	10
0.400	68-13	2.06	10
0.430	68-14	2.14	10
0.500	68-15	2.30	10
0.600	68-16	3.25	11
0.720	68-17	3.56	11
0.750	68-18	3.64	11
0.860	68-19	3.90	11
1.000	68-20	5.02	11
1.200	68-21	5.50	11
1.250	68-22	5.62	11
1.500	68-23	6.15	11
1.750	68-24	8.53	11
2.000	68-25	9.10	11
2.400	68-26	9.98	12
2.500	68-27	10.20	12
3.000	68-28	14.10	12
3.600	68-29	15.50	12
4.000	68-30	16.30	12
4.300	68-31	16.90	12
5.000	68-32	23.40	12
6.000	68-33	25.60	13
7.200	68-34	33.40	13
7.500	68-35	34.00	13
8.600	68-36	36.40	13
10.000	68-37	39.30	13
12.000	68-38	55.50	14
12.500	68-39	56.70	14
15.000	68-40	75.80	15
17.500	68-41	81.80	15







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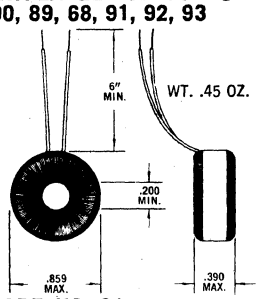
INDUCTORS

TOROTEL PRODUCTS INC./ 13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 FAX 816-763-2278

TOROIDAL INDUCTORS

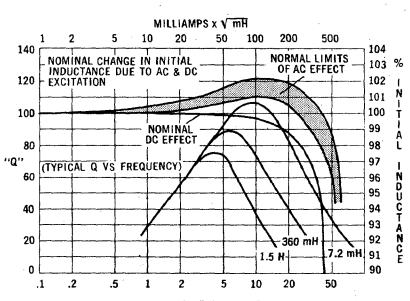
TYPE U — Uncased AVAILABLE FOR CORES 90, 89, 68, 91, 92, 93



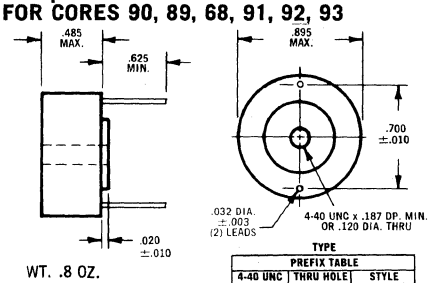
CORE NO. 91

Recommended Frequency: Up to 30 KHz.
Maximum Inductance: 11 H.
Special Core Stabilization: D, W, M, L.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
3.0	91-1	0.96	36
3.6	91-2	1.05	36
4.3	91-3	1.14	36
5.0	91-4	1.23	36
6.0	91-5	1.73	38
7.2	91-6	1.90	38
8.6	91-7	2.60	38
10.0	91-8	2.80	38
12.0	91-9	3.07	38
15.0	91-10	4.02	40
17.5	91-11	4.34	40
20.0	91-12	4.64	40
24.0	91-13	6.50	42
30.0	91-14	7.26	42
36.0	91-15	10.00	42
43.0	91-16	10.90	44
50.0	91-17	11.80	44
60.0	91-18	16.30	46
72.0	91-19	17.90	46
86.0	91-20	19.50	46
100.0	91-21	26.60	46
120.0	91-22	29.10	48
150.0	91-23	41.30	48
175.0	91-24	44.60	48
200.0	91-25	47.70	50
240.0	91-26	52.20	50
300.0	91-27	73.10	52
360.0	91-28	80.10	52
430.0	91-29	110.00	54
500.0	91-30	119.00	54
600.0	91-31	170.00	54
720.0	91-32	186.00	56
860.0	91-33	204.00	56
1.00 H	91-34	278.00	58
1.20 H	91-35	305.00	58
1.50 H	91-36	423.00	58
1.75 H	91-37	457.00	60
2.00 H	91-38	489.00	60
2.40 H	91-39	680.00	62
3.00 H	91-40	760.00	62
3.60 H	91-41	833.00	62
4.30 H	91-42	1130.00	64
5.00 H	91-43	1570.00	64
6.00 H	91-44	1720.00	66



TYPE PS/PF/PFC/PSC — Epoxy Encapsulated - AVAILABLE FOR CORES 90, 89, 68, 91, 92, 93

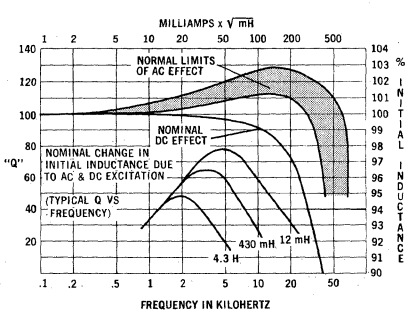


TYPE PREFIX TABLE		
4-40 UNC	THRU HOLE	STYLE
PS	PSC	NO FOOT
PF	PFC	WITH FOOT

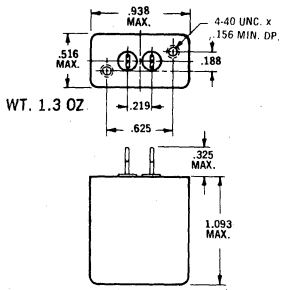
CORE NO. 92

Recommended Frequency: Up to 20 KHz.
Maximum Inductance: 14 H.
Special Core Stabilization: D, W, M, L.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
3.6	92-1	0.93	40
4.3	92-2	1.02	42
5.0	92-3	1.10	42
6.0	92-4	1.20	44
7.2	92-5	1.70	44
8.6	92-6	1.85	44
10.0	92-7	2.51	46
12.0	92-8	2.74	46
15.0	92-9	3.07	46
17.5	92-10	3.88	48
20.0	92-11	4.15	48
24.0	92-12	4.55	50
30.0	92-13	6.50	50
36.0	92-14	7.12	52
43.0	92-15	9.76	52
50.0	92-16	10.50	54
60.0	92-17	11.50	54
72.0	92-18	16.00	54
86.0	92-19	17.50	56
100.0	92-20	18.80	56
120.0	92-21	26.10	56
150.0	92-22	29.10	58
175.0	92-23	39.90	58
200.0	92-24	42.70	60
240.0	92-25	46.70	60
300.0	92-26	52.20	62
360.0	92-27	71.60	62
430.0	92-28	78.30	64
500.0	92-29	106.00	64
600.0	92-30	116.00	64
720.0	92-31	167.00	66
860.0	92-32	182.00	66
1.00 H	92-33	196.00	68
1.20 H	92-34	273.00	68
1.50 H	92-35	305.00	70
1.75 H	92-36	409.00	72
2.00 H	92-37	437.00	72
2.40 H	92-38	479.00	74
3.00 H	92-39	680.00	74
3.60 H	92-40	745.00	74
4.30 H	92-41	814.00	76
5.00 H	92-42	1090.00	76
6.00 H	92-43	1540.00	78
7.20 H	92-44	1690.00	80



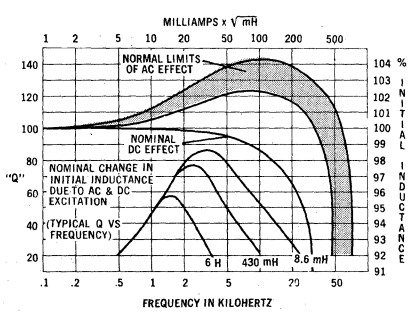
TYPE M — Metal Cased - AVAILABLE FOR CORES 90, 89, 68, 91, 92, 93



CORE NO. 93

Recommended Frequency: Up to 10 KHz.
Maximum Inductance: 20 H.
Special Core Stabilization: L.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
5.0	93-1	0.90	46
6.0	93-2	0.98	46
7.2	93-3	1.08	46
8.6	93-4	1.18	48
10.0	93-5	1.63	48
12.0	93-6	1.78	50
15.0	93-7	2.50	52
17.5	93-8	2.70	52
20.0	93-9	2.89	54
24.0	93-10	3.70	54
30.0	93-11	4.14	54
36.0	93-12	4.54	56
43.0	93-13	6.35	56
50.0	93-14	6.84	58
60.0	93-15	9.41	58
72.0	93-16	10.30	60
86.0	93-17	11.30	62
100.0	93-18	15.40	62
120.0	93-19	16.80	62
150.0	93-20	18.80	64
175.0	93-21	25.70	64
200.0	93-22	27.40	66
240.0	93-23	30.00	66
300.0	93-24	42.60	68
360.0	93-25	46.70	68
430.0	93-26	51.00	68
500.0	93-27	68.80	70
600.0	93-28	75.40	70
720.0	93-29	104.00	72
860.0	93-30	114.00	72
1.00 H	93-31	160.00	74
1.20 H	93-32	175.00	74
1.50 H	93-33	186.00	76
1.75 H	93-34	269.00	76
2.00 H	93-35	287.00	76
2.40 H	93-36	315.00	78
3.00 H	93-37	436.00	80
3.60 H	93-38	478.00	82
4.30 H	93-39	664.00	82
5.00 H	93-40	716.00	84
6.00 H	93-41	784.00	86
7.20 H	93-42	1070.00	86
8.60 H	93-43	1170.00	88
10.00 H	93-44	1620.00	90



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INDUCTORS

TOROIDAL INDUCTORS

Studs are available on the "M" Series on special request.

Mechanical Tolerance: ±.015 unless otherwise indicated.

WHEN ORDERING, ADD CASE PREFIX (TYPE) TO PART NUMBER.†

EXAMPLE: U 24-1

CASE TYPE — PART NUMBER

† Add "C" to Part Number of molded inductor if clearance hole is desired.

CORE NO. 06

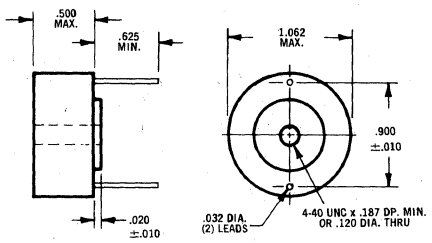
Recommended Frequency: Up to 30 KHz

Maximum Inductance: 7.2 H.

Special Core Stabilization Available: B, D, L, M, W.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
5.0	06-1	1.05	40
6.0	06-40	1.26	42
7.2	06-41	1.51	43
7.5	06-2	1.58	43
8.6	06-42	1.80	43
10.0	06-3	2.10	44
12.0	06-43	2.52	44
12.5	06-4	2.63	44
15.0	06-5	3.15	44
17.5	06-44	3.67	45
20.0	06-6	4.20	45
24.0	06-45	5.04	45
25.0	06-7	5.25	46
30.0	06-8	6.30	46
36.0	06-46	7.56	47
40.0	06-9	8.40	48
43.0	06-47	9.03	48
50.0	06-10	10.50	48
60.0	06-48	12.60	49
72.0	06-49	15.10	49
75.0	06-11	15.80	49
86.0	06-50	18.00	49
100.0	06-12	21.00	50
120.0	06-51	25.20	50
125.0	06-13	26.30	51
150.0	06-14	31.50	51
175.0	06-53	36.80	51
200.0	06-15	42.00	52
240.0	06-54	50.40	52
250.0	06-52	52.50	52
300.0	06-16	63.00	53
360.0	06-55	75.60	53
400.0	06-17	84.00	54
430.0	06-56	90.30	54
500.0	06-18	105.00	55
600.0	06-57	126.00	55
720.0	06-58	151.00	55
750.0	06-19	158.00	56
860.0	06-59	180.00	56
1.00 H	06-20	210.00	57
1.20 H	06-60	252.00	57
1.25 H	06-21	263.00	57
1.50 H	06-22	315.00	58
1.75 H	06-61	368.00	58
2.00 H	06-23	420.00	58
2.40 H	06-62	504.00	59
2.50 H	06-69	525.00	59
3.00 H	06-24	630.00	59
3.60 H	06-70	756.00	60
4.30 H	06-71	840.00	60
5.00 H	06-72	903.00	61
6.00 H	06-73	1260.00	62
7.20 H	06-74	1512.00	62

TYPE PS/PF/PFC/PSC — P.C. Mount AVAILABLE FOR CORES 06, 48, 74, 24, 23, 21



WT.-1.0 oz.

TYPE PREFIX TABLE		
4-40 UNC	THRU HOLE	STYLE
PS	PSC	NO FOOT
PF	PFC	WITH FOOT

CORE NO. 48

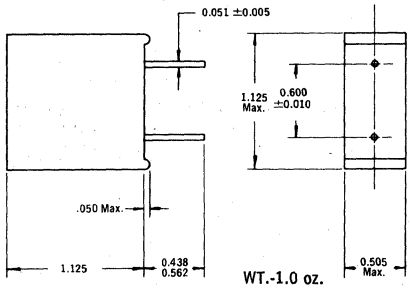
Recommended Frequency: Up to 100 KHz.

Maximum Inductance: 1 H.

Special Core Stabilization Available: B, D, M, W, L.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
2.0	48-1	0.84	30
2.4	48-2	1.01	31
3.0	48-3	1.26	31
3.6	48-4	1.51	32
4.3	48-5	1.80	32
5.0	48-6	2.10	33
6.0	48-7	2.50	33
7.2	48-8	3.02	34
8.6	48-9	3.61	34
10.0	48-10	4.20	35
12.0	48-11	5.05	35
15.0	48-12	6.30	36
17.5	48-13	7.35	36
20.0	48-14	8.40	37
24.0	48-15	10.10	37
30.0	48-16	12.60	38
36.0	48-17	15.10	39
43.0	48-18	18.00	39
50.0	48-19	21.00	40
60.0	48-20	25.20	41
72.0	48-21	30.20	42
86.0	48-22	36.10	43
100.0	48-23	42.00	44
120.0	48-24	50.40	45
150.0	48-25	63.00	46
175.0	48-26	73.50	47
200.0	48-27	84.00	48
240.0	48-28	101.00	49
300.0	48-29	126.00	50
360.0	48-30	151.00	51
430.0	48-31	180.00	52
500.0	48-32	210.00	53
600.0	48-33	252.00	54

TYPE PC — P.C. Mount - AVAILABLE FOR CORES 06, 48, 74, 24, 23, 21



WT.-1.0 oz.

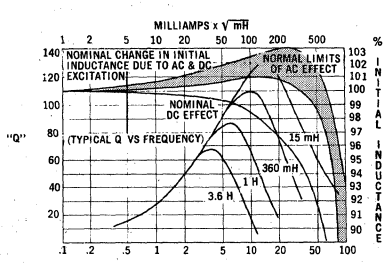
CORE NO. 74

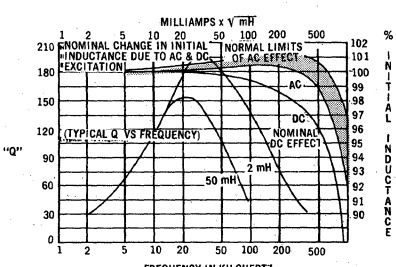
Recommended Frequency: 25 KHz to 1 MHz.

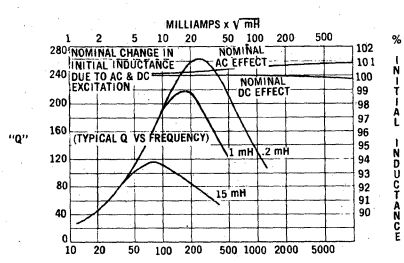
Maximum Inductance: 30 mH.

Only Core Stabilization Available: H.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
0.100	74-1	0.31	18
0.120	74-2	0.36	18
0.125	74-3	0.39	19
0.150	74-4	0.46	19
0.175	74-5	0.55	20
0.200	74-6	0.62	20
0.240	74-7	0.74	20
0.250	74-8	0.77	21
0.300	74-9	0.92	21
0.360	74-10	1.11	21
0.400	74-11	1.23	21
0.430	74-12	1.33	22
0.500	74-13	1.54	22
0.600	74-14	1.85	22
0.720	74-15	2.21	23
0.750	74-16	2.31	23
0.860	74-17	2.65	23
1.000	74-18	3.08	23
1.200	74-19	3.60	24
1.250	74-20	3.80	24
1.500	74-21	4.60	24
1.750	74-22	5.50	25
2.000	74-23	6.20	25
2.400	74-24	7.40	25
2.500	74-25	7.70	26
3.000	74-26	9.20	26
3.600	74-27	11.10	27
4.000	74-28	12.30	27
4.300	74-29	13.30	28
5.000	74-30	15.40	28
6.000	74-31	18.50	29
7.200	74-32	22.10	29
7.500	74-33	23.10	30
8.600	74-34	26.50	30
10.000	74-35	30.80	31
12.000	74-36	36.90	32
12.250	74-37	38.50	33
15.000	74-38	46.20	33
17.500	74-39	53.90	34
20.000	74-40	61.60	35







INDUCTORS

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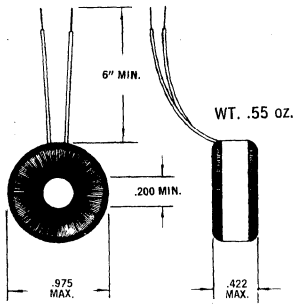
TOROIDAL INDUCTORS

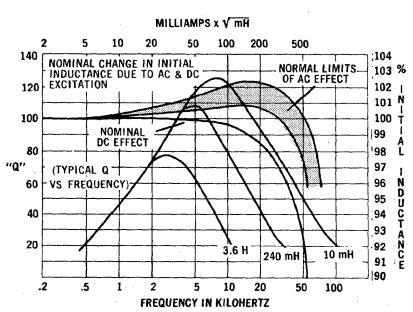
TYPE U — Uncased - AVAILABLE FOR CORES 06, 48, 74, 24, 23, 21



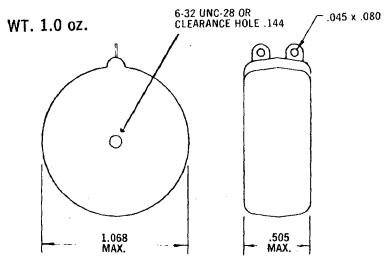
CORE NO. 24

Recommended Frequency: Up to 20 KHz
Maximum Inductance: 12 H.
Special Core Stabilization: D, W, M, L.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
6.0	24-1	0.88	40
7.2	24-2	0.97	40
8.6	24-3	1.33	42
10.0	24-4	1.44	42
12.0	24-5	1.80	42
15.0	24-6	2.01	44
17.5	24-7	2.74	44
20.0	24-8	2.93	44
24.0	24-9	3.21	44
30.0	24-10	5.20	46
36.0	24-11	5.70	46
43.0	24-12	6.23	46
50.0	24-13	8.31	46
60.0	24-14	9.10	48
72.0	24-15	9.97	48
86.0	24-16	13.50	48
100.0	24-17	14.50	50
120.0	24-18	20.00	50
150.0	24-19	22.40	50
175.0	24-20	30.80	52
200.0	24-21	32.90	52
240.0	24-22	36.10	52
300.0	24-23	52.50	54
360.0	24-24	57.50	54
430.0	24-25	62.90	56
500.0	24-26	87.00	56
600.0	24-27	95.30	56
720.0	24-28	104.00	58
860.0	24-29	142.00	58
1.00 H	24-30	153.00	58
1.20 H	24-31	212.00	60
1.50 H	24-32	237.00	62
1.75 H	24-33	256.00	62
2.00 H	24-34	345.00	64
2.40 H	24-35	376.00	64
3.00 H	24-36	522.00	64
3.60 H	24-37	572.00	66
4.30 H	24-38	768.00	66
5.00 H	24-39	861.00	68
6.00 H	24-40	1150.00	68
7.20 H	24-41	1260.00	68
8.60 H	24-42	1740.00	70



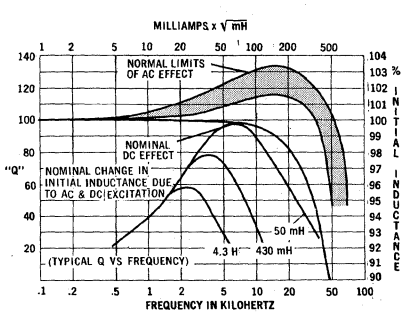
TYPE P — Compression Molded AVAILABLE FOR CORES 06, 48, 74, 24, 23, 21



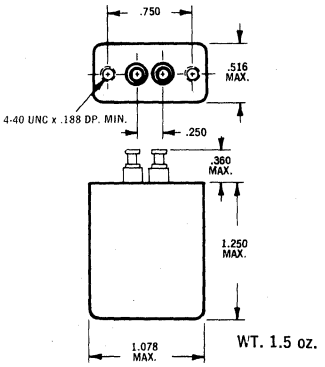
CORE NO. 23

Recommended Frequency Up to 15 KHz.
Maximum Inductance: 15 H.
Special Core Stabilization: D, W, M, L.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
7.2	23-1	0.86	44
8.6	23-2	0.94	44
10.0	22-3	1.29	44
12.0	23-4	1.41	46
15.0	23-5	1.80	46
17.5	23-6	1.95	46
20.0	23-7	2.08	46
24.0	23-8	2.87	48
30.0	23-9	3.21	48
36.0	23-10	5.09	48
43.0	23-11	5.56	48
50.0	23-12	6.00	48
60.0	23-13	8.13	50
72.0	23-14	8.91	50
86.0	23-15	9.73	50
100.0	23-16	13.00	52
120.0	23-17	14.20	52
150.0	23-18	20.00	54
175.0	23-19	21.60	54
200.0	23-20	23.10	54
240.0	23-21	32.20	56
300.0	23-22	36.00	56
360.0	23-23	51.40	58
430.0	23-24	56.20	58
500.0	23-25	60.60	60
600.0	23-26	85.20	60
720.0	23-27	93.30	62
860.0	23-28	102.00	64
1.00 H	23-29	137.00	64
1.20 H	23-30	150.00	66
1.50 H	23-31	211.00	66
1.75 H	23-32	228.00	68
2.00 H	23-33	244.00	68
2.40 H	23-34	336.00	68
3.00 H	23-35	376.00	70
3.60 H	23-36	511.00	72
4.30 H	23-37	559.00	74
5.00 H	23-38	602.00	74
6.00 H	23-39	842.00	76
7.20 H	23-40	1130.00	78
8.60 H	23-41	1230.00	80
10.00 H	23-42	1680.00	82



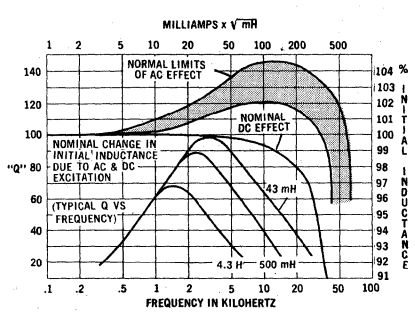
TYPE M — Metal Cased - AVAILABLE FOR CORES 06, 48, 74, 24, 23, 21



CORE NO. 21

Recommended Frequency: Up to 5 KHz.
Maximum Inductance: 20 H.
Special Core Stabilization: L.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
10.0	21-1	0.83	50
12.0	21-2	0.91	52
15.0	21-3	1.29	52
17.5	21-4	1.39	54
20.0	21-5	1.70	54
24.0	21-6	1.86	54
30.0	21-7	2.08	56
36.0	21-8	2.87	56
43.0	21-9	3.14	58
50.0	21-10	4.91	58
60.0	21-11	5.38	60
72.0	21-12	5.89	60
86.0	21-13	7.96	62
100.0	21-14	8.58	62
120.0	21-15	9.40	64
150.0	21-16	13.00	64
175.0	21-17	14.00	64
200.0	21-18	15.00	66
240.0	21-19	20.70	66
300.0	21-20	23.20	66
360.0	21-21	32.30	68
430.0	21-22	35.20	68
500.0	21-23	38.00	70
600.0	21-24	54.30	70
720.0	21-25	59.40	72
860.0	21-26	83.40	74
1.00 H	21-27	90.00	74
1.20 H	21-28	98.50	76
1.50 H	21-29	137.00	76
1.75 H	21-30	148.00	76
2.00 H	21-31	199.00	78
2.40 H	21-32	219.00	78
3.00 H	21-33	244.00	80
3.60 H	21-34	337.00	80
4.30 H	21-35	368.00	82
5.00 H	21-36	492.00	84
6.00 H	21-37	540.00	84
7.20 H	21-38	591.00	86
8.60 H	21-39	825.00	86
10.00 H	21-40	1090.00	88
12.00 H	21-41	1190.00	88
15.00 H	21-42	1680.00	90



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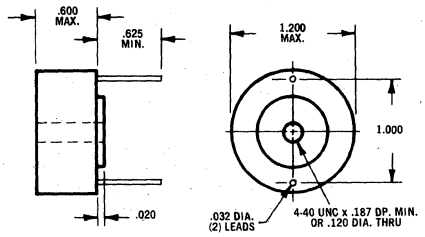
INDUCTORS

TOROIDAL INDUCTORS

TYPE PS/PF/PFC/PSC — Epoxy Encapsulated - AVAILABLE FOR CORES 59, 10, 08, 07, 05

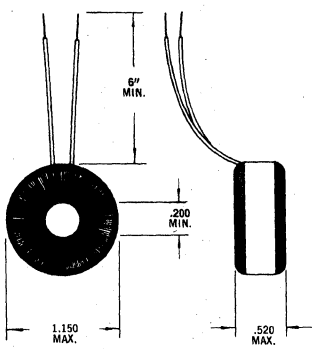


WT. 1.5 oz

TYPE PREFIX TABLE

4-40 UNC	THRU HOLE	STYLE
PS	PSC	NO FOOT
PF	PFC	WITH FOOT

TYPE U — Uncased - AVAILABLE FOR CORES 59, 10, 08, 07, 05



WT. .82 oz.

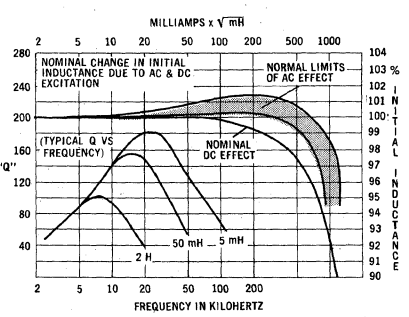
Mech. Tol. = ±.010 unless indicated.

WHEN ORDERING, ADD CASE PREFIX (TYPE) TO PART NUMBER.
EXAMPLE: U 59-1
CASE TYPE — PART NUMBER

CORE NO. 59

Recommended Frequency: Up to 50 KHz.
Maximum Inductance: 5 H.
Special Core Stabilization: D, W, M, L.

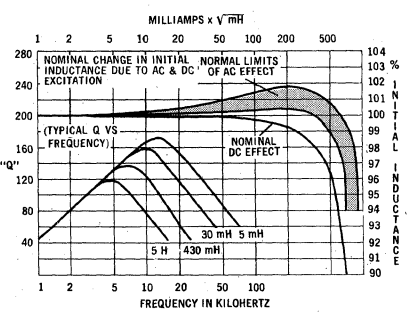
Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
3.0	59-1	0.85	50
3.6	59-2	1.17	54
4.3	59-3	1.27	56
5.0	59-4	1.67	60
6.0	59-5	1.83	64
7.2	59-6	2.00	66
8.6	59-7	2.75	68
10.0	59-8	2.97	70
12.0	59-9	3.25	74
15.0	59-10	4.45	76
17.5	59-11	4.80	78
20.0	59-12	6.64	80
24.0	59-13	7.27	82
30.0	59-14	8.13	84
36.0	59-15	11.30	84
43.0	59-16	12.30	86
50.0	59-17	13.30	88
60.0	59-18	18.50	90
72.0	59-19	20.30	92
86.0	59-20	22.20	94
100.0	59-21	30.70	96
120.0	59-22	33.60	98
150.0	59-23	48.30	100
175.0	59-24	52.10	102
200.0	59-25	55.70	104
240.0	59-26	76.90	104
300.0	59-27	86.00	106
360.0	59-28	119.00	106
430.0	59-29	130.00	108
500.0	59-30	140.00	110
600.0	59-31	188.00	112
720.0	59-32	205.00	114
860.0	59-33	225.00	116
1.00 H	59-34	306.00	118
1.20 H	59-35	335.00	120
1.50 H	59-36	472.00	124
1.75 H	59-37	510.00	126
2.00 H	59-38	709.00	130
2.40 H	59-39	777.00	136
3.00 H	59-40	868.00	140
3.60 H	59-41	1200.00	150



CORE NO. 10

Recommended Frequency: Up to 25 KHz.
Maximum Inductance: 12 H.
Special Core Stabilization: D, W, M, L.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
5.0	10-1	0.76	50
6.0	10-2	0.83	54
7.2	10-3	1.14	56
8.6	10-4	1.25	60
10.0	10-5	1.34	64
12.0	10-6	1.79	66
15.0	10-7	2.00	68
17.5	10-8	2.71	70
20.0	10-9	2.90	74
24.0	10-10	3.17	76
30.0	10-11	4.34	78
36.0	10-12	4.75	80
43.0	10-13	6.72	82
50.0	10-14	7.25	84
60.0	10-15	7.94	84
72.0	10-16	11.00	86
86.0	10-17	12.00	88
100.0	10-18	13.00	90
120.0	10-19	18.10	92
150.0	10-20	20.20	94
175.0	10-21	21.80	96
200.0	10-22	30.00	98
240.0	10-23	32.90	100
300.0	10-24	47.20	102
360.0	10-25	51.70	104
430.0	10-26	56.50	104
500.0	10-27	76.70	106
600.0	10-28	84.10	106
720.0	10-29	116.00	108
860.0	10-30	127.00	110
1.00 H	10-31	137.00	112
1.20 H	10-32	183.00	114
1.50 H	10-33	205.00	116
1.75 H	10-34	221.00	118
2.00 H	10-35	299.00	120
2.40 H	10-36	328.00	124
3.00 H	10-37	366.00	126
3.60 H	10-38	506.00	130
4.30 H	10-39	719.00	136
5.00 H	10-40	775.00	140
6.00 H	10-41	849.00	150
7.20 H	10-42	1170.00	156
8.60 H	10-43	1610.00	160



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INDUCTORS

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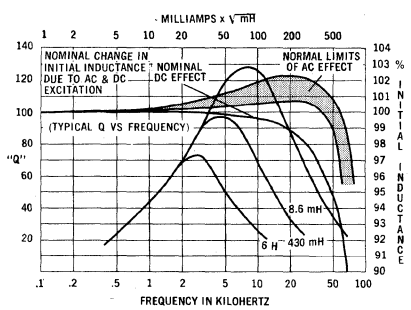
TOROIDAL INDUCTORS

CORE NO. 08

Recommended Frequency: Up to 20 KHz.
Maximum Inductance: 16 H.
Special Core Stabilization: D, W, M, L.

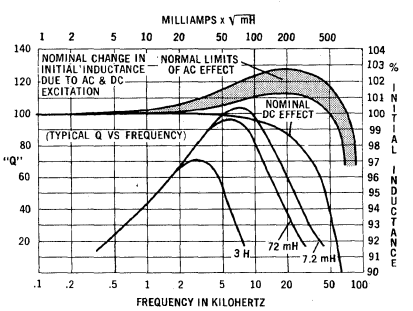
Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
7.2	08-1	0.80	60
8.6	08-2	0.88	64
10.0	08-3	1.19	66
12.0	08-4	1.30	68
15.0	08-5	1.77	70
17.5	08-6	1.91	74
20.0	08-7	2.04	76
24.0	08-8	2.81	80
30.0	08-9	3.14	84
36.0	08-10	4.21	86
43.0	08-11	4.60	88
50.0	08-12	4.96	90
60.0	08-13	7.03	94
72.0	08-14	7.70	96
86.0	08-15	8.42	96
100.0	08-16	11.50	98
120.0	08-17	12.60	100
150.0	08-18	14.00	104
175.0	08-19	19.30	106
200.0	08-20	20.70	106
240.0	08-21	29.10	108
300.0	08-22	32.50	110
360.0	08-23	45.70	112
430.0	08-24	50.00	114
500.0	08-25	53.90	116
600.0	08-26	74.40	118
720.0	08-27	81.50	120
860.0	08-28	89.00	124
1.00 H	08-29	121.00	126
1.20 H	08-30	133.00	128
1.50 H	08-31	148.00	130
1.75 H	08-32	196.00	134
2.00 H	08-33	209.00	136
2.40 H	08-34	229.00	140
3.00 H	08-35	324.00	144
3.60 H	08-36	355.00	146
4.30 H	08-37	489.00	150
5.00 H	08-38	527.00	154
6.00 H	08-39	751.00	160
7.20 H	08-40	823.00	166
8.60 H	08-41	938.00	168
10.00 H	08-42	1220.00	170



CORE NO. 07

Recommended Frequency: Up to 15 KHz.
Maximum Inductance: 18 H.
Special Core Stabilization: D, W, M, L.

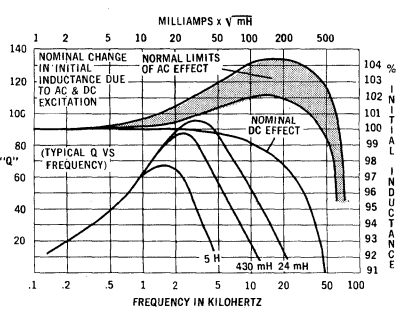
Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
10.0	07-1	0.85	60
12.0	07-2	1.17	64
15.0	07-3	1.30	66
17.5	07-4	1.71	68
20.0	07-5	1.83	70
24.0	07-6	2.00	74
30.0	07-7	2.81	76
36.0	07-8	3.08	80
43.0	07-9	3.36	84
50.0	07-10	4.43	86
60.0	07-11	4.85	88
72.0	07-12	6.88	90
86.0	07-13	7.52	94
100.0	07-14	8.11	96
120.0	07-15	11.20	96
150.0	07-16	12.60	98
175.0	07-17	13.60	100
200.0	07-18	18.50	104
240.0	07-19	20.20	106
300.0	07-20	29.00	106
360.0	07-21	31.80	108
430.0	07-22	44.70	110
500.0	07-23	48.10	112
600.0	07-24	52.70	114
720.0	07-25	57.80	116
860.0	07-26	79.60	118
1.00 H	07-27	85.80	120
1.20 H	07-28	119.00	124
1.50 H	07-29	132.00	126
1.75 H	07-30	143.00	128
2.00 H	07-31	187.00	130
2.40 H	07-32	205.00	134
3.00 H	07-33	229.00	136
3.60 H	07-34	317.00	140
4.30 H	07-35	347.00	144
5.00 H	07-36	471.00	146
6.00 H	07-37	516.00	150
7.20 H	07-38	735.00	154
8.60 H	07-39	803.00	160
10.00 H	07-40	866.00	166
12.00 H	07-41	1200.00	170



CORE NO. 05

Recommended Frequency: Up to 5 KHz.
Maximum Inductance: 25 H.
Special Core Stabilization: L.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
15.0	05-1	0.85	70
17.5	05-2	1.15	74
20.0	05-3	1.23	76
24.0	05-4	1.34	80
30.0	05-5	1.83	84
36.0	05-6	2.00	86
43.0	05-7	2.74	88
50.0	05-8	2.96	90
60.0	05-9	3.24	92
72.0	05-10	4.34	94
86.0	05-11	4.74	96
100.0	05-12	6.62	100
120.0	05-13	7.25	104
150.0	05-14	8.11	106
175.0	05-15	11.10	108
200.0	05-16	11.80	110
240.0	05-17	13.00	112
300.0	05-18	18.50	114
360.0	05-19	20.20	116
430.0	05-20	22.10	118
500.0	05-21	30.60	120
600.0	05-22	33.50	124
720.0	05-23	47.20	126
860.0	05-24	51.60	130
1.00 H	05-25	55.60	134
1.20 H	05-26	76.70	136
1.50 H	05-27	85.80	138
1.75 H	05-28	117.00	140
2.00 H	05-29	125.00	144
2.40 H	05-30	137.00	146
3.00 H	05-31	187.00	150
3.60 H	05-32	205.00	154
4.30 H	05-33	224.00	156
5.00 H	05-34	305.00	160
6.00 H	05-35	334.00	164
7.20 H	05-36	366.00	166
8.60 H	05-37	504.00	168
10.00 H	05-38	707.00	170
12.00 H	05-39	775.00	174
15.00 H	05-40	866.00	180
17.50 H	05-41	1180.00	186
20.00 H	05-42	1590.00	190



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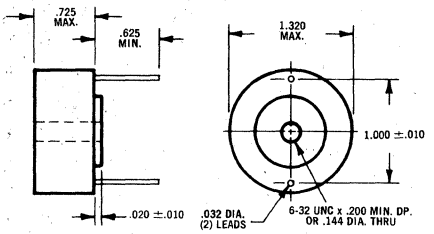
INDUCTORS

TOROIDAL INDUCTORS

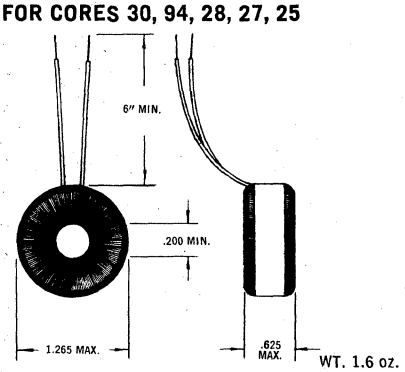
TYPE PS/PF/PSC/PFC — Epoxy Encapsulated - AVAILABLE FOR CORES 30, 94, 28, 27, 25



WT. 2.5 oz.

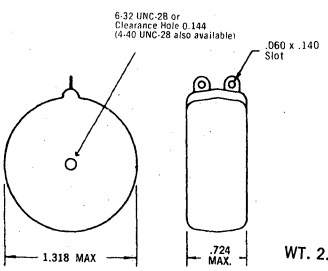
TYPE PREFIX TABLE		
4 6-32 UNC THRU HOLE		STYLE
PS	PSC	NO FOOT
PF	PFC	WITH FOOT

TYPE U — Uncased - AVAILABLE FOR CORES 30, 94, 28, 27, 25



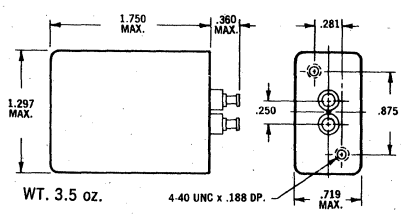
WT. 1.6 oz.

TYPE P — Compression Molded AVAILABLE FOR CORES 30, 94, 28, 27, 25



WT. 2.5 oz.

TYPE M — Metal Cased



WT. 3.5 oz.

Mechanical Tolerance: ±.015 unless otherwise indicated.

Studs are available on the "M" Series on special request.

CORE NO. 30

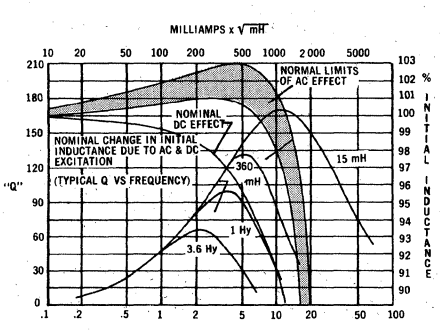
Recommended Frequency: Up to 20 KHz.
Maximum Inductance: 17.5 H.
Special Core Stabilization Available: B, D, L, M, W.

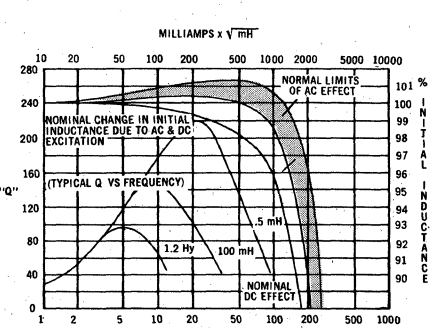
Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
5.0	30-1	0.53	63
6.0	30-40	0.63	64
7.2	30-41	0.76	65
7.5	30-2	0.79	66
8.6	30-42	0.90	67
10.0	30-3	1.05	68
12.0	30-43	1.26	69
12.5	30-4	1.31	69
15.0	30-5	1.58	70
17.5	30-44	1.84	71
20.0	30-6	2.10	72
24.0	30-45	2.52	73
25.0	30-7	2.63	73
30.0	30-8	3.15	75
36.0	30-46	3.78	76
40.0	30-9	4.20	77
43.0	30-47	4.52	78
50.0	30-10	5.25	79
60.0	30-48	6.30	80
72.0	30-49	7.56	81
75.0	30-11	7.86	81
86.0	30-50	9.03	82
100.0	30-12	10.50	83
120.0	30-51	12.60	84
125.0	30-13	13.10	84
150.0	30-14	15.80	85
175.0	30-53	18.40	86
200.0	30-15	21.00	87
240.0	30-54	25.20	88
250.0	30-52	26.30	88
300.0	30-16	31.50	89
360.0	30-55	37.80	90
400.0	30-17	42.00	91
430.0	30-56	45.20	91
500.0	30-18	52.50	92
600.0	30-57	63.00	93
720.0	30-58	75.60	94
750.0	30-19	78.70	96
860.0	30-59	90.30	97
1.00 H	30-20	105.00	98
1.20 H	30-60	126.00	99
1.25 H	30-21	131.30	99
1.50 H	30-22	157.50	100
1.75 H	30-61	183.80	101
2.00 H	30-23	210.00	102
2.40 H	30 62	252.00	103
2.50 H	30-69	262.50	103
3.00 H	30-24	315.00	104
3.60 H	30-63	378.00	106
4.00 H	30-25	420.00	107
4.30 H	30-64	451.50	108
5.00 H	30-26	525.00	109
6.00 H	30-65	630.00	110
7.20 H	30-66	756.00	111
7.50 H	30-27	787.50	112
8.60 H	30-67	903.00	113
10.00 H	30-28	1050.00	114
12.00 H	30-68	1260.00	115
12.50 H	30-29	1312.50	116
15.00 H	30-30	1575.00	117
17.50 H	30-31	1837.50	118

CORE NO. 94

Recommended Frequency: Up to 75 KHz.
Maximum Inductance: 1 H.
Special Core Stabilization Available: B, D, M, W, L.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
5.0	94-1	1.05	32
6.0	94-2	1.26	32
7.2	94-3	1.51	33
7.5	94-4	1.58	34
8.6	94-5	1.80	35
10.0	94-6	2.10	35
12.0	94-7	2.52	36
12.5	94-8	2.63	37
15.0	94-9	3.15	38
17.5	94-10	3.67	39
20.0	94-11	4.20	40
24.0	94-12	5.04	41
25.0	94-13	5.25	41
30.0	94-14	6.30	42
36.0	94-15	7.56	43
40.0	94-16	8.40	44
43.0	94-17	9.03	44
50.0	94-18	10.50	45
60.0	94-19	12.60	46
72.0	94-20	15.10	46
75.0	94-21	15.80	47
86.0	94-22	18.00	47
100.0	94-23	21.00	48
120.0	94-24	25.20	49
125.0	94-25	26.30	49
150.0	94-26	31.50	50
175.0	94-27	36.80	51
200.0	94-28	42.00	52
240.0	94-29	50.40	53
250.0	94-30	52.50	54
300.0	94-31	63.00	54
360.0	94-32	75.60	56
400.0	94-33	84.00	57
430.0	94-34	90.00	57
500.0	94-35	105.00	57
600.0	94-36	126.00	58
720.0	94-37	151.00	58
750.0	94-38	158.00	59
860.0	94-39	181.00	59





CALL TOROTEL PRODUCTS FOR YOUR COMPETITIVELY PRICED CUSTOM MAGNETICS REQUIREMENTS

INDUCTORS

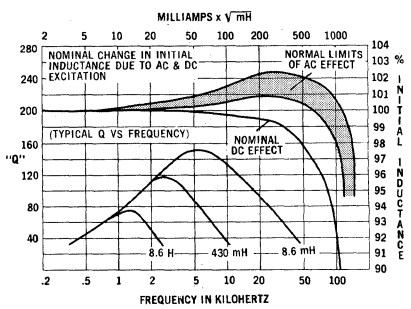
TOROTEL PRODUCTS INC./ 13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 FAX 816-763-2278

TOROIDAL INDUCTORS

CORE NO. 28

Recommended Frequency: Up to 35 KHz.
Maximum Inductance: 25 H.
Special Core Stabilization: D, W, M, L.

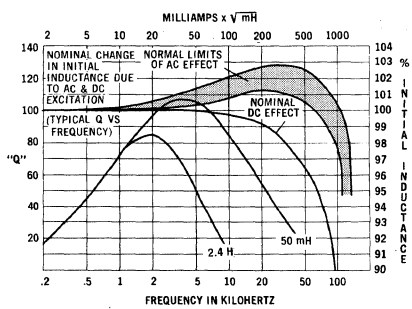
Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
7.2	28-1	0.64	60
8.6	28-2	0.70	64
10.0	28-3	0.97	66
12.0	28-4	1.06	68
15.0	28-5	1.19	70
17.5	28-6	1.66	74
20.0	28-7	1.78	76
24.0	28-8	1.95	78
30.0	28-9	2.57	80
36.0	28-10	2.82	84
43.0	28-11	3.86	86
50.0	28-12	4.16	88
60.0	28-13	4.55	90
72.0	28-14	6.33	94
86.0	28-15	6.91	96
100.0	28-16	9.36	98
120.0	28-17	10.30	100
150.0	28-18	11.50	102
175.0	28-19	16.20	104
200.0	28-20	17.30	106
240.0	28-21	18.90	108
300.0	28-22	26.50	110
360.0	28-23	29.00	114
430.0	28-24	31.70	116
500.0	28-25	42.10	118
600.0	28-26	46.20	120
720.0	28-27	64.50	124
860.0	28-28	70.50	126
1.00 H	28-29	93.90	128
1.20 H	28-30	103.00	130
1.50 H	28-31	115.00	134
1.75 H	28-32	154.00	136
2.00 H	28-33	164.00	140
2.40 H	28-34	229.00	144
3.00 H	28-35	256.00	146
3.60 H	28-36	281.00	148
4.30 H	28-37	388.00	150
5.00 H	28-38	419.00	152
6.00 H	28-39	510.00	154
7.20 H	28-40	624.00	156
8.60 H	28-41	682.00	158
10.00 H	28-42	930.00	160
12.00 H	28-43	1020.00	164
15.00 H	28-44	1440.00	166
17.50 H	28-45	1550.00	168
20.00 H	28-46	1660.00	170



CORE NO. 27

Recommended Frequency: Up to 20 KHz.
Maximum Inductance: 30 H.
Special Core Stabilization: D, W, M, L.

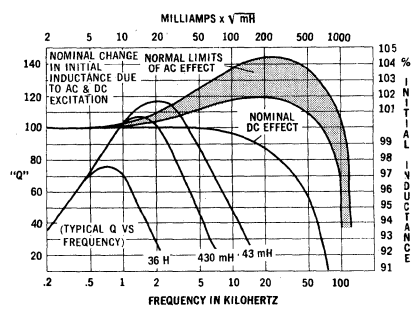
Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
8.6	27-1	0.63	60
10.0	27-2	0.68	64
12.0	27-3	0.95	66
15.0	27-4	1.06	68
17.5	27-5	1.15	70
20.0	27-6	1.59	74
24.0	27-7	1.74	76
30.0	27-8	1.95	78
36.0	27-9	2.52	80
43.0	27-10	2.76	84
50.0	27-11	2.97	86
60.0	27-12	4.07	88
72.0	27-13	4.46	90
86.0	27-14	6.18	94
100.0	27-15	6.67	96
120.0	27-16	7.30	98
150.0	27-17	10.30	100
175.0	27-18	11.10	102
200.0	27-19	15.50	104
240.0	27-20	16.90	106
300.0	27-21	18.90	108
360.0	27-22	26.00	110
430.0	27-23	28.40	114
500.0	27-24	37.70	116
600.0	27-25	41.30	118
720.0	27-26	45.30	120
860.0	27-27	63.10	124
1.00 H	27-28	68.00	126
1.20 H	27-29	74.50	128
1.50 H	27-30	103.00	130
1.75 H	27-31	111.00	134
2.00 H	27-32	147.00	136
2.40 H	27-33	161.00	140
3.00 H	27-34	229.00	144
3.60 H	27-35	251.00	146
4.30 H	27-36	274.00	148
5.00 H	27-37	374.00	150
6.00 H	27-38	410.00	152
7.20 H	27-39	559.00	154
8.60 H	27-40	611.00	156
10.00 H	27-41	659.00	158
12.00 H	27-42	912.00	160
15.00 H	27-43	1020.00	164
17.50 H	27-44	1390.00	166
20.00 H	27-45	1490.00	168
24.00 H	27-46	1630.00	170



CORE NO. 25

Recommended Frequency: Up to 5 KHz.
Maximum Inductance: 40 H.
Special Core Stabilization: L.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
12.0	25-1	0.60	80
15.0	25-2	0.67	84
17.5	25-3	0.94	86
20.0	25-4	1.00	88
24.0	25-5	1.10	90
30.0	25-6	1.59	94
36.0	25-7	1.74	96
43.0	25-8	1.91	98
50.0	25-9	2.42	100
60.0	25-10	2.66	104
72.0	25-11	2.91	106
86.0	25-12	3.98	108
100.0	25-13	4.29	110
120.0	25-14	5.96	112
150.0	25-15	6.67	114
175.0	25-16	7.20	116
200.0	25-17	9.67	118
240.0	25-18	10.60	120
300.0	25-19	15.50	124
360.0	25-20	16.90	126
430.0	25-21	18.50	128
500.0	25-22	25.00	130
600.0	25-23	27.40	132
720.0	25-24	30.00	134
860.0	25-25	40.40	136
1.00 H	25-26	43.50	138
1.20 H	25-27	60.80	140
1.50 H	25-28	68.00	144
1.75 H	25-29	73.40	146
2.00 H	25-30	97.00	150
2.40 H	25-31	106.00	154
3.00 H	25-32	147.00	156
3.60 H	25-33	161.00	158
4.30 H	25-34	224.00	160
5.00 H	25-35	241.00	166
6.00 H	25-36	264.00	168
7.20 H	25-37	367.00	170
8.60 H	25-38	401.00	174
10.00 H	25-39	432.00	176
12.00 H	25-40	589.00	178
15.00 H	25-41	658.00	180
17.50 H	25-42	900.00	184
20.00 H	25-43	970.00	186
24.00 H	25-44	1060.00	190
30.00 H	25-45	1490.00	196
36.00 H	25-46	1630.00	200



WHEN ORDERING, ADD CASE PREFIX (TYPE) TO PART NUMBER.†

EXAMPLE: U 30-1

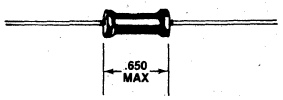
CASE TYPE — PART NUMBER

† Add "C" to part number of molded inductor if clearance hole is desired.

CALL TOROTEL PRODUCTS FOR YOUR COMPETITIVELY PRICED CUSTOM MAGNETICS REQUIREMENTS

"SFB" SERIES • SMALL FERRITE Bobbin Coils

- Leads No. 20 Tinned Copper 1.5" long
- Coils Finished with Polyolifin Shrink Tube
- Nonstandard Values Available
- Saturation Current Lowers Inductance 5%

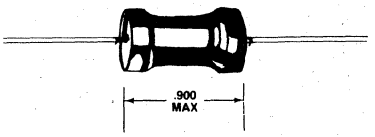


WILCO PART#	L uh ±15%	R.D.C. OHMS MAX.	Saturation Current (DC AMPS)	I AMPS Suggested Rating	DIA. NOM.	TEST FREQ.
SFB 39G	3.9	.019	7.3	1.28	.260	1 kHz
SFB 47G	4.7	.022	6.3	1.28	.260	1 kHz
SFB 56G	5.6	.024	5.6	1.28	.260	1 kHz
SFB 68G	6.8	.026	5.3	1.28	.260	1 kHz
SFB 82G	8.2	.028	4.5	1.28	.260	1 kHz
SFB 100	10	.033	4.1	1.28	.260	1 kHz
SFB 120	12	.037	3.6	1.28	.260	1 kHz
SFB 150	15	.040	3.3	1.28	.260	1 kHz
SFB 180	18	.044	3.0	1.28	.260	1 kHz
SFB 220	22	.050	2.7	1.28	.260	1 kHz
SFB 270	27	.058	2.5	1.28	.260	1 kHz
SFB 330	33	.075	2.2	1.008	.260	1 kHz
SFB 390	39	.094	2.0	.804	.260	1 kHz
SFB 470	47	.109	1.8	.804	.260	1 kHz
SFB 560	56	.140	1.7	.804	.260	1 kHz
SFB 680	68	.131	1.5	.804	.260	1 kHz
SFB 820	82	.152	1.4	.804	.260	1 kHz
SFB 101	100	.208	1.2	.632	.260	1 kHz
SFB 121	120	.283	1.1	.508	.260	1 kHz
SFB 151	150	.340	1.0	.508	.260	1 kHz
SFB 181	180	.362	.95	.508	.260	1 kHz
SFB 221	220	.430	.86	.508	.260	1 kHz
SFB 271	270	.557	.77	.400	.260	1 kHz

WILCO PART#	L uh ±15%	R.D.C. OHMS MAX.	Saturation Current (DC AMPS)	I AMPS Suggested Rating	DIA. NOM.	TEST FREQ.
SFB 331	330	.665	.70	.400	.260	1 kHz
SFB 391	390	.712	.64	.400	.260	1 kHz
SFB 471	470	1.15	.59	.315	.260	1 kHz
SFB 561	560	1.27	.54	.315	.260	1 kHz
SFB 681	680	1.61	.49	.250	.260	1 kHz
SFB 821	820	1.96	.44	.200	.260	1 kHz
SFB 102	1000	2.30	.40	.200	.260	1 kHz
SFB 122	1200	2.65	.35	.200	.260	1 kHz
SFB 152	1500	3.45	.33	.158	.260	1 kHz
SFB 182	1800	4.03	.29	.158	.260	1 kHz
SFB 222	2200	4.48	.27	.158	.260	1 kHz
SFB 272	2700	5.40	.24	.125	.260	1 kHz
SFB 332	3300	6.56	.22	.125	.260	1 kHz
SFB 392	3900	8.63	.20	.100	.260	1 kHz
SFB 472	4700	9.66	.18	.100	.260	1 kHz
SFB 562	5600	13.9	.166	.082	.260	1 kHz
SFB 682	6800	16.3	.151	.082	.260	1 kHz
SFB 822	8200	20.8	.138	.065	.260	1 kHz
SFB 103	10000	26.4	.125	.050	.260	1 kHz
SFB 123	12000	29.9	.114	.050	.260	1 kHz
SFB 153	15000	42.5	.098	.039	.260	1 kHz
SFB 183	18000	48.3	.091	.039	.260	1 kHz

"LFB" SERIES • LARGE FERRITE Bobbin Coils

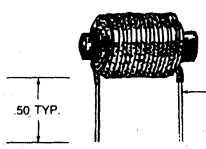
- Leads No. 20 Tinned Copper 1.5" long
- Coils Finished with Polyolifin Shrink Tube
- Nonstandard Values Available
- Saturation Current Lowers Inductance 5%



WILCO PART#	L uh ±15%	R.D.C. OHMS MAX.	Saturation Current (DC AMPS)	I AMPS Suggested Rating	DIA. NOM.	TEST FREQ.
LFB 39G	3.9	.007	15.5	4.0	.450	1 kHz
LFB 47G	4.7	.008	13.9	4.0	.450	1 kHz
LFB 56G	5.6	.009	12.6	4.0	.450	1 kHz
LFB 68G	6.8	.011	11.5	4.0	.450	1 kHz
LFB 82G	8.2	.013	9.89	4.0	.450	1 kHz
LFB 100	10	.017	8.70	4.0	.450	1 kHz
LFB 120	12	.019	8.21	4.0	.450	1 kHz
LFB 150	15	.022	7.34	4.0	.450	1 kHz
LFB 180	18	.023	6.64	4.0	.450	1 kHz
LFB 220	22	.026	6.07	4.0	.450	1 kHz
LFB 270	27	.027	5.36	4.0	.450	1 kHz
LFB 330	33	.032	4.82	4.0	.450	1 kHz
LFB 390	39	.033	4.36	4.0	.450	1 kHz
LFB 470	47	.035	3.98	4.0	.450	1 kHz
LFB 560	56	.037	3.66	3.2	.450	1 kHz
LFB 680	68	.047	3.31	2.5	.450	1 kHz
LFB 820	82	.060	3.10	2.0	.450	1 kHz
LFB 101	100	.080	2.79	1.6	.450	1 kHz
LFB 121	120	.090	2.54	1.6	.450	1 kHz
LFB 151	150	.107	2.22	1.6	.450	1 kHz
LFB 181	180	.123	1.98	1.6	.450	1 kHz
LFB 221	220	.150	1.89	1.6	.450	1 kHz
LFB 271	270	.162	1.63	1.6	.450	1 kHz
LFB 331	330	.183	1.51	1.6	.450	1 kHz
LFB 391	390	.212	1.39	1.6	.450	1 kHz
LFB 471	470	.281	1.24	1.2	.450	1 kHz
LFB 561	560	.380	1.17	1.0	.450	1 kHz

WILCO PART#	L uh ±15%	R.D.C. OHMS MAX.	Saturation Current (DC AMPS)	I AMPS Suggested Rating	DIA. NOM.	TEST FREQ.
LFB 681	680	.420	1.05	1.0	.450	1 kHz
LFB 821	820	.548	.97	0.8	.450	1 kHz
LFB 102	1000	.655	.87	0.8	.450	1 kHz
LFB 122	1200	.884	.79	0.6	.450	1 kHz
LFB 152	1500	1.04	.70	0.6	.450	1 kHz
LFB 182	1800	1.18	.64	0.6	.450	1 kHz
LFB 222	2200	1.56	.58	0.5	.450	1 kHz
LFB 272	2700	2.06	.53	0.4	.450	1 kHz
LFB 332	3300	2.53	.47	0.4	.450	1 kHz
LFB 392	3900	2.75	.43	0.4	.450	1 kHz
LFB 472	4700	3.19	.39	0.4	.450	1 kHz
LFB 562	5600	3.92	.359	.315	.450	1 kHz
LFB 682	6800	5.69	.322	.250	.450	1 kHz
LFB 822	8200	6.32	.293	.250	.450	1 kHz
LFB 103	10000	7.30	.266	.250	.450	1 kHz
LFB 123	12000	9.21	.241	.200	.450	1 kHz
LFB 153	15000	10.5	.214	.200	.450	1 kHz
LFB 183	18000	14.8	.198	.158	.450	1 kHz
LFB 223	22000	21.8	.180	.125	.450	1 kHz
LFB 273	27000	22.7	.162	.125	.450	1 kHz
LFB 333	33000	25.7	.146	.125	.450	1 kHz
LFB 393	39000	31.8	.135	.100	.450	1 kHz
LFB 473	47000	36.1	.122	.100	.450	1 kHz
LFB 563	56000	40.9	.112	100	.450	1 kHz
LFB 683	68000	57.3	.101	082	.450	1 kHz
LFB 823	82000	79.3	.090	065	.450	1 kHz
LFB 104	100000	89.7	.081	065	.450	1 kHz

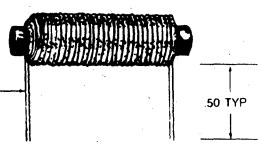
"HCS" SERIES



RADIAL LEAD HASH CHOKES
WOUND ON .250 x 1.00
FERRITE RODS

WILCO Part #	L uh	R.D.C. Ohms Max	Rated Current Suggested Max (amps)	Lead Spacing Typ	Lead Dia. Nom	Body Dia. Max
HCS 100	10	.016	10.00	.260	.050	.590
HCS 200	20	.017	11.00	.560	.050	.590
HCS 300	30	.021	11.00	.610	.050	.590
HCS 500	50	.043	7.00	.625	.039	.550
HCS 101	100	.086	6.00	.750	.030	.550
HCS 151	150	.107	5.00	.565	.030	.600
HCS 201	200	.140	4.00	.620	.030	.600
HCS 251	250	.184	4.00	.750	.030	.600

"HCL" SERIES



RADIAL LEAD HASH CHOKES
WOUND ON .250 x 1.50
FERRITE RODS

WILCO Part #	L uh	R.D.C. Ohms Max	Rated Current Suggested Max (amps)	Lead Spacing Typ	Lead Dia. Nom	Body Dia. Max
HCL 101	100	.061	8.00	1.143	.050	.590
HCL 201	200	.110	6.00	1.103	.039	.550
HCL 301	300	.140	5.00	1.145	.030	.550
HCL 401	400	.167	4.00	.775	.030	600
HCL 501	500	.192	4.00	.880	.030	600
HCL 601	600	.237	4.00	1.080	.030	600
HCL 701	700	.257	4.00	1.115	.030	600
HCL 801	800	.291	4.00	1.285	.030	600

L = ± 15% @ 1KHz Measured with zero D.C. current

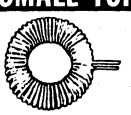
OPTIONS AVAILABLE:

- Intermediate values
- Shrink tube sleeving
- Formed leads
- Tight "L" tolerances

Compact size and pretinned leads for fast & easy PCB insertion in:

- Filters for switching regulators
- SCR/TRIAC control circuits
- Power supplies
- Hash filters
- RF circuits

" ITS" SERIES • SMALL TOROIDAL INDUCTORS



• ACTUAL SIZE •

- The Toroidal core design produces a closed magnetic field resulting in low EMI.

TYPICAL APPLICATIONS:

- Switching Power Supplies
- Output Chokes
- Hash Filters
- EMI/RFI Filtering

WILCO PART NUMBER	L UH ±15%	MAX RDC (OHMS)	RATED DC AMPS	OD (NOM)	ID (NOM)	H (NOM)	LEAD LENGTH (NOM)
ITS10G	1	.004	10	.58	.25	.262	.5
ITS12G	1.2	.004	10	.58	.25	.262	.5
ITS15G	1.5	.005	10	.58	.25	.262	.5
ITS18G	1.8	.005	10	.58	.25	.262	.5
ITS22G	2.2	.007	10	.58	.25	.262	.5
ITS27G	2.7	.007	10	.58	.25	.262	.5
ITS33G	3.3	.008	10	.58	.25	.262	.5
ITS39G	3.9	.009	10	.58	.25	.262	.5
ITS47G	4.7	.01	10	.60	.22	.28	.5
ITS56G	5.6	.011	9	.60	.22	.28	.5
ITS68G	6.8	.012	9	.60	.22	.28	.5
ITS82G	8.2	.013	9	.60	.22	.28	.5
ITS100	10	.014	9	.60	.22	.28	.5
ITS120	12	.018	8	.60	.22	.28	.5
ITS150	15	.02	8	.60	.22	.28	.5
ITS180	18	.025	7	.60	.22	.28	.5
ITS220	22	.029	7	.60	.22	.28	.5
ITS270	27	.035	5.5	.60	.22	.28	.5
ITS330	33	.04	5.5	.60	.22	.28	.5
ITS390	39	.06	5.5	.60	.22	.28	.5
ITS470	47	.095	5	.60	.22	.28	.5
ITS560	56	.120	5	.56	.23	.24	.5
ITS680	68	.125	4	.56	.23	.24	.5
ITS820	82	.200	3.5	.56	.23	.24	.5
ITS101	100	250	3.5	.56	.23	.24	.5
ITS121	120	.31	3	.56	.23	.24	.5
ITS151	150	.42	3	.56	.23	.24	.5
ITS181	180	.49	3	.56	.23	.24	.5
ITS221	220	.62	2	.56	.23	.24	.5
ITS271	270	.71	2	.56	.23	.24	.5
ITS331	330	.85	1.5	.56	.23	.24	.5
ITS391	390	1	1.5	.56	.23	.24	.5
ITS471	470	1.2	1.5	.56	.23	.24	.5
ITS561	560	1.5	1.5	.56	.23	.24	.5
ITS681	680	1.7	1	.56	.23	.24	.5
ITS821	820	1.9	1	.56	.23	.24	.5
ITS102	1000	2.1	1	.56	.23	.24	.5

- Inductance measured@ 1khz with zero DC current
- Toroids are self leaded for PCB insertion

Options Available: • Intermediate Values • Custom Mounts • Encapsulation

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"DC" SERIES • POWER LINE INDUCTORS

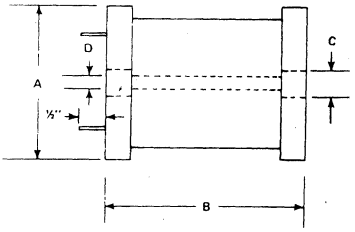
The use of high saturation flux density ferrite drum cores make these inductors ideal for use in switching power supply applications.

MAXIMUM PHYSICAL DIMENSIONS:				
	A	B	C	D
DC1	.660	.840	.195	Clearance Hole
DC2	.825	.840	.195	For 4/40
DC3	1.1	.840	.195	Screw

DC1

Typical Applications Are:

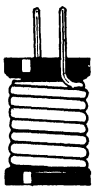
- Power Supplies
- Switching Regulators
- SCR and Triac Controls
- RFI Suppression
- Filters



NOTES:

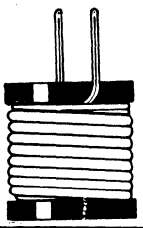
- Saturation current lowers inductance 5%.
- Inductance ±10% measured at 1 KHz.
- Leads for PC mounting tinned to within 1/16" of body.
- Non-listed values available on request.
- Coils finished with sleeving (Polyolefin shrink tube).
- Center hole for mechanical mounting.
- RDC measured @ 20°C.
- Values below 10uH ±20%.

WILCO Part#	Inductance at O DC (MH)	Max. DCR (Ohms)	Saturation Current (DC Amps)	Rated Current (AC Amps)
DC1-10G	1.0	.003	87.0	9.0
DC1-12G	1.2	.003	66.0	9.0
DC1-15G	1.5	.004	56.0	9.0
DC1-18G	1.8	.004	56.0	9.0
DC1-22G	2.2	.005	47.0	9.0
DC1-27G	2.7	.005	47.0	9.0
DC1-33G	3.3	.005	40.0	9.0
DC1-39G	3.9	.006	36.0	9.0
DC1-47G	4.7	.007	32.0	9.0
DC1-56G	5.6	.007	29.0	9.0
DC1-68G	6.8	.008	26.0	9.0
DC1-82G	8.2	.009	24.5	9.0
DC1-100	10.0	.010	21.2	9.0
DC1-120	12.0	.011	19.0	9.0
DC1-150	15.0	.015	17.5	7.2
DC1-180	18.0	.016	16.5	7.2
DC1-220	22.0	.020	15.6	5.5
DC1-270	27.0	.030	14.4	4.5
DC1-330	33.0	.040	13.2	4.0
DC1-390	39.0	.046	11.8	4.0
DC1-470	47.0	.062	11.0	2.8
DC1-560	56.0	.069	10.0	2.8
DC1-680	68.0	.077	8.9	2.8
DC1-820	82.0	.083	8.2	2.8
DC1-101	100.0	.095	7.5	2.8
DC1-121	120.0	.127	5.8	2.0
DC1-151	150.0	.181	5.6	1.6
DC1-181	180.0	.217	5.1	1.6
DC1-221	220.0	.240	4.3	1.6
DC1-271	270.0	.300	4.1	1.6
DC1-331	330.0	.336	3.8	1.3
DC1-391	390.0	.460	3.3	1.0
DC1-471	470.0	.636	3.2	0.8
DC1-561	560.0	.696	2.9	0.8



DC2

WILCO Part#	Inductance at O DC (MH)	Max. DCR (Ohms)	Saturation Current (DC Amps)	Rated Current (AC Amps)
DC2-10G	1.0	.003	108.0	11.4
DC2-12G	1.2	.003	108.0	11.4
DC2-15G	1.5	.003	83.0	11.4
DC2-18G	1.8	.003	68.0	11.4
DC2-22G	2.2	.004	68.0	11.4
DC2-27G	2.7	.005	58.0	11.4
DC2-33G	3.3	.005	58.0	11.4
DC2-39G	3.9	.005	50.0	11.4
DC2-47G	4.7	.005	50.0	11.4
DC2-56G	5.6	.006	44.0	11.4
DC2-68G	6.8	.007	39.0	11.4
DC2-82G	8.2	.007	36.0	11.4
DC2-100	10.0	.009	30.0	11.4
DC2-120	12.0	.009	27.0	11.4
DC2-150	15.0	.013	25.0	9.4
DC2-180	18.0	.018	22.0	7.2
DC2-220	22.0	.019	21.0	7.2
DC2-270	27.0	.026	20.5	5.5
DC2-330	33.0	.029	18.6	5.5
DC2-390	39.0	.030	17.0	5.5
DC2-470	47.0	.035	15.1	5.5
DC2-560	56.0	.039	13.6	5.5
DC2-680	68.0	.053	12.7	4.8
DC2-820	82.0	.060	11.3	4.8
DC2-101	100.0	.080	10.4	4.0
DC2-121	120.0	.090	9.4	4.0
DC2-151	150.0	.980	8.6	4.0
DC2-181	180.0	.110	7.8	4.0
DC2-221	220.0	.150	7.0	2.8
DC2-271	270.0	.213	6.3	2.0
DC2-331	330.0	.305	5.2	1.6
DC2-391	390.0	.320	4.9	1.6
DC2-471	470.0	.355	4.5	1.6
DC2-561	560.0	.388	4.1	1.6
DC2-681	680.0	.430	3.7	1.6
DC2-821	820.0	.590	3.4	1.3
DC2-102	1000.0	.818	3.1	1.0
DC2-122	1200.0	1.14	2.7	0.8
DC2-152	1500.0	1.26	2.4	0.8
DC2-182	1800.0	1.39	2.2	0.8
DC2-222	2200.0	1.54	2.0	0.8



DC3

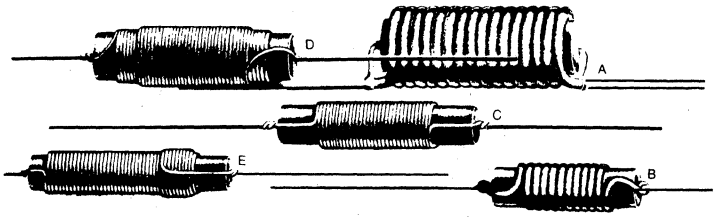
WILCO Part#	Inductance at O DC (MH)	Max. DCR (Ohms)	Saturation Current (DC Amps)	Rated Current (AC Amps)
DC3-10G	1.0	.003	116.0	21.0
DC3-12G	1.2	.003	116.0	21.0
DC3-15G	1.5	.003	116.0	21.0
DC3-18G	1.8	.003	90.0	21.0
DC3-22G	2.2	.003	90.0	21.0
DC3-27G	2.7	.003	74.0	21.0
DC3-33G	3.3	.003	74.0	21.0
DC3-39G	3.9	.003	62.0	21.0
DC3-47G	4.7	.003	54.0	21.0
DC3-56G	5.6	.003	54.0	21.0
DC3-68G	6.8	.004	47.0	21.0
DC3-82G	8.2	.004	42.0	21.0
DC3-100	10.0	.006	38.0	17.0
DC3-120	12.0	.008	35.0	13.5
DC3-150	15.0	.009	32.0	13.5
DC3-180	18.0	.010	29.0	13.5
DC3-220	22.0	.011	25.0	13.5
DC3-270	27.0	.012	23.0	13.5
DC3-330	33.0	.017	20.0	13.5
DC3-390	39.0	.022	19.0	11.4
DC3-470	47.0	.024	19.1	9.0
DC3-560	56.0	.026	17.5	9.0
DC3-680	68.0	.029	15.6	9.0
DC3-820	82.0	.032	14.0	9.0
DC3-101	100.0	.034	13.2	9.0
DC3-121	120.0	.046	12.1	7.2
DC3-151	150.0	.064	10.8	5.5
DC3-181	180.0	.072	9.7	5.5
DC3-221	220.0	.080	8.7	5.5
DC3-271	270.0	.110	7.9	4.5
DC3-331	330.0	.122	7.1	4.5
DC3-391	390.0	.169	6.7	4.0
DC3-471	470.0	.187	6.0	4.0
DC3-561	560.0	.205	5.5	4.0
DC3-681	680.0	.256	5.0	2.8
DC3-821	820.0	.288	4.5	2.8
DC3-102	1000.0	.426	4.1	2.0
DC3-122	1200.0	.462	3.7	2.0
DC3-152	1500.0	.518	3.4	2.0
DC3-182	1800.0	.705	2.8	1.6
DC3-222	2200.0	1.02	2.5	1.3
DC3-272	2700.0	1.14	2.3	1.3
DC3-332	3300.0	1.27	2.0	1.3
DC3-392	3900.0	1.67	1.8	1.0
DC3-472	4700.0	1.86	1.7	1.0

"W" SERIES Single Layer Solenoid Type Choke Coils

All choke coils in this series are wound on .156x½ size forms. Leads are of No. 20 tinned wire. Values from 1 uh to 18 uh are wound on phenolic forms. Values from 22 uh to 100 uh are wound on iron core forms. Tolerances are ± 20% for W10G through W22G: ± 10% from W27G through W101. All units are impregnated with thermosetting varnish and are EIA color coded.

WILCO PART #	L uh	Q NOM.	S.R.F. NOM. (MHz)	R.D.C. OHMs NOM.	COLOR CODE	I (MA) MAX	DIA. NOM.	TEST FREQ (MHz)
W 10 G	1.0	45	238	.11	Br Blk Gld	1965	.179	7.90
W 12 G	1.2	45	218	.12	Br Rd Gld	1882	.179	"
W 15 G	1.5	45	200	.14	Br Gr Gld	1742	.179	"
W 18 G	1.8	45	180	.24	Br Gry Gld	1330	.175	"
W 22 G	2.2	45	165	.26	Rd Rd Gld	1278	.175	"
W 27 G	2.7	45	149	.34	Rd Vi Gld	1118	.175	"
W 33 G	3.3	45	136	.52	Or Or Gld	904	.172	"
W 39 G	3.9	45	127	.61	Or Wh Gld	835	.172	"
W 47 G	4.7	50	114	.80	Yel Vi Gld	729	.170	"
W 56 G	5.6	50	104	1.15	Gr Blu Gld	608	.170	"
W 68 G	6.8	50	94.8	1.35	Blu Gry Gld	561	.169	"
W 82 G	8.2	50	86.1	1.75	Gry Rd Gld	493	.168	"
W 100	10	50	78.5	2.50	Br Blk Blk	412	.167	"
W 120	12	30	71.6	2.90	Br Rd Blk	383	.166	2.50
W 150	15	30	63.9	5.10	Br Gr Blk	288	.165	"
W 180	18	30	57.5	6.60	Br Gry Blk	254	.164	"
W 220	22	85	36.1	1.10	Rd Rd Blk	622	.170	"
W 270	27	80	33.2	1.22	Rd Vi Blk	590	.169	"
W 330	33	80	30.6	1.38	Or Or Blk	555	.169	"
W 390	39	90	26.6	2.04	Or Wh Blk	456	.167	"
W 470	47	90	24.9	2.32	Yel Vi Blk	428	.167	"
W 560	56	90	23.6	2.50	Grn Blu Blk	412	.167	"
W 680	68	90	21.6	3.00	Blu Gry Blk	376	.166	"
W 820	82	100	19.0	4.70	Gry Rd Blk	300	.165	"
W 101	100	100	17.8	5.40	Br Blk Br	280	.165	"

"LF" SERIES • HIGH CURRENT HASH CHOKES



WILCO Part #	Inductance ±20% (μH)	DC Resistance Max. (Ω)	DC Current Max. (Amps)	Coil Diameter	Lead Wire Size	Lead Lengths Min.	Body Length Min.	Refer To Figure	Core Material
MEASURED ON Q-METER AT 7.9 MHz									
LF 335G	3.35	.01	20	.6	12 AWG	1.25	1.25	A	IRON
LF 49G	4.9	.016	15	.6	14 AWG	1.25	1.25	A	IRON
LF 88G	8.8	.021	10	.56	16 AWG	1.25	1.25	A	IRON
LF 40G	4	.012	8	.38	20 AWG	1.25	1.00	B	FERRITE
MEASURED ON 1KHz BRIDGE									
LF 400	40	.082	3	.31	20 AWG	1.25	1.25	C	FERRITE
LF 680	68	.054	5	.56	20 AWG	1.25	1.25	D	"
LF 101	100	.216	2	.38	20 AWG	1.25	1.25	E	"
LF 125	125	.08	3.5	.5	20 AWG	1.25	1.25	D	"
LF 251	250	.17	2.5	.44	20 AWG	1.25	1.25	D	"
LF 501	500	.26	2	.56	20 AWG	1.25	1.25	D	"
LF 102	1000	.55	1	.5	20 AWG	1.25	1.25	D	"

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"ML" SERIES MINIATURE LAYER Choke Coils

All choke coils in this series are wound on .095x¼ size forms. Leads are of No.21 tinned wire. Values from .68 uh to 5.6 uh are wound on phenolic forms. Values from 6.8 uh to 33 uh are wound on iron core forms. Tolerances are ± 15% for ML10S through ML82S: ± 10% from ML10G through ML270. All units are impregnated with thermosetting varnish and are EIA color coded.

• ¼ WATT RESISTOR SIZE CHOKES •

WILCO PART # ML Series	L uh	Q NOM.	S.R.F. NOM. (MHz)	R.D.C. OHMs NOM.	I (MA) MAX.	DIA. NOM.	TEST FREQ. (MHz)
ML 10S	.10	45	750+	.06	1824	.107	25
ML 12S	.12	47	"	.07	1824	.109	"
ML 15S	.15	48	712	.08	1824	.111	"
ML 18S	.18	44	607	.09	1379	.107	"
ML 22S	.22	46	541	.09	1490	.111	"
ML 27S	.27	44	475	.13	1154	.107	"
ML 33S	.33	44	428	.14	1054	.107	"
ML 39S	.39	45	410	.16	975	.107	"
ML 47S	.47	43	387	.21	912	.107	"
ML 56S	.56	44	365	.24	1012	.111	"
ML 68S	.68	46.9	308	.25	942	.109	"
ML 82S	.82	45.6	279	.32	816	.109	"
ML 10G	1.0	30.3	253	.33	635	.106	7.9
ML 12G	1.2	30.1	234	.42	563	"	"
ML 15G	1.5	31.3	208	.58	479	.104	"
ML 18G	1.8	31.0	187	.68	443	"	"
ML 22G	2.2	32.1	169	1.17	337	.102	"
ML 27G	2.7	32.3	153	1.42	306	"	"
ML 33G	3.3	33.3	137	2.68	223	.100	"
ML 39G	3.9	34.4	126	2.92	214	"	"
ML 47G	4.7	33.5	114	3.44	197	"	"
ML 56G	5.6	32.1	106	3.92	184	"	"
ML 68G	6.8	42.7	54.0	.43	557	.104	"
ML 82G	8.2	40.8	49.6	.56	488	"	"
ML 100	10	39.1	48.6	.72	430	"	"
ML 120	12	62.5	40.3	1.18	336	.102	2.5
ML 150	15	64.5	36.5	1.43	300	"	"
ML 220	22	63.2	29.2	3.11	207	.100	"
ML 270	27	64.8	27.0	3.54	194	"	"

"MP" SERIES • MULTI-PI Choke Coils

These Coils use 3-Pi Universal windings to insure low distributed capacity and High "Q".

WILCO PART NO.	L±5% uH	Q (MIN)	TEST FREQ. MHz	S.R.F. MIN. MHz	RDC OHMS (MAX)	I MA (MAX)	COIL DIA.	CORE LENGTH	CORE MATERIAL
MP101	100	49	.79	11	5.4	160	.41	.75	Phenolic
MP151	150	53	.79	8.8	6.5	160	.41	.75	Phenolic
MP241	240	56	.79	7.2	8.5	160	.44	.75	Phenolic
MP391	390	57	.79	5.6	11	160	.5	.75	Phenolic
MP551	550	58	.79	4.8	13	160	.5	.75	Phenolic
MP621	620	59	.79	4.5	15	160	.53	.75	Phenolic
MP751	750	56	.79	4	16	160	.53	.75	Phenolic
MP102	1000	83	.25	2.6	8.6	160	.47	.875	Powdered Iron
MP152	1500	82	.25	2.1	11	160	.47	.875	Powdered Iron
MP242	2400	80	.25	1.7	15	160	.53	.875	Powdered Iron
MP392	3900	73	.25	1.4	20	160	.56	.875	Powdered Iron
MP552	5500	69	.25	1.1	25	160	.59	.875	Powdered Iron
MP622	6200	89	.25	1	37	100	.53	.875	Powdered Iron
MP822	8200	83	.25	.94	46	100	.56	.875	Powdered Iron
MP103	10000	108	.079	.71	31	100	.53	.875	Ferrite
MP253	25000	102	.079	.47	82	65	.53	.875	Ferrite
MP503	50000	113	.079	.33	127	65	.63	.875	Ferrite

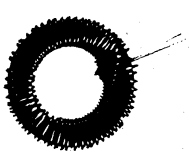
Leads: 1.5 inch. AWG 20 TCW
Coils finished with Thermosetting Varnish

WILCO

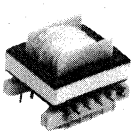
■ Inductors ■ Chokes ■ Coils

QUICK DELIVERY AT COMPETITIVE PRICES

■ **Toroidal Inductors--**
Designed specifically for:
Switching Power Supplies
High Current Filters



■ **"EE" Core Transformers--**
Core configurations, size range, and ferrite mix provide one of the most cost effective designs available.



■ **Ferrite Drum Cores--**
Designed for:
High Current Applications
Power Line Chokes

■ **Pot Core Assemblies--**
High degree of repeatability, high Q's, stable inductance, and tunability

Wilco has the answers to your inductor needs.

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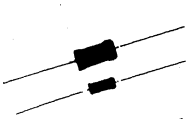

■ **High Current Ferrite Bobbin Chokes--**
A wide range of inductances in a small package.

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High L and High Q

■ **Hash Chokes--**
Power Line Filters

■ **Air Coils--**
High Frequency Applications

■ **Single Layer Wound--**
Varnish or Conformal Coated

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FERRITE CORES FOR POWER SUPPLY

These cores are suitable for the transformers and choke coils used in a wide variety of electronic equipment, such as mainframe computers, peripherals, applied systems, etc. FDK offers a broad selection of cores with standardized materials and shapes to meet the higher-frequency needs of the next-generation technology.

Applications

(1) For switching power supplies
- Main transformers
- Drive transformers
- Current transformers
- Choke coils

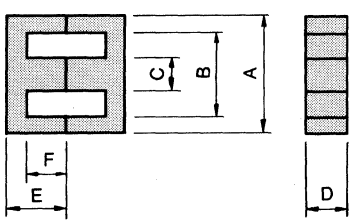
(2) For EMI filters
- Common mode coils
- Differential mode coils

Standard material characteristics

Property	Symbol	Condition	Unit	H49B	H63	H45A	H63B	H24B	H24Z	H63A
Initial permeability	μiac	0.1MHz		1600±20%	2500±20%	2400±20%	2000±20%	4000±20%	7000±25%	1250±20%
Saturation magnetic flux density	Bs (10 Oe)	20°C	Gauss	5300	5200	4800	5000	4400	4000	4700
		60°C		4800	4700	4300	4500	—	—	4400
		100°C		4300	4200	3800	4000	—	—	4000
Residual magnetic flux density	Br	20°C	Gauss	1800	1200	1200	1500	1500	900	3100
Coercivity	Hc	20°C	Oe	0.16	0.16	0.16	0.16	0.13	0.13	0.25
Relative loss factor	tanδ/μiac	0.1MHz	×10⁻⁶	<8	<4	<5	<5	<15	<7 @10kHz	—
Power loss (2000 Gauss, 25 kHz)		20°C	kW/m³	200	100	150	130	—	—	500 kHz, 500 Gauss, 60°C: 250
		60°C		140	70	100	90			500 kHz, 500 Gauss, 100°C: 200
		100°C		100	75	100	70			500 kHz, 1000 Gauss, 60°C: 1500
Power loss (2000 Gauss, 100 kHz)		20°C	kW/m³	920	660	980	640			500 kHz, 1000 Gauss, 100°C: 1200
		60°C		700	415	640	440			
		100°C		510	530	660	410			
Temperature coefficient	αμγ	20 to 80°C	×10⁻⁶	8	8	8	8	−0.5 to 2.5	−0.5 to 2.5	—
Curie temperature	Tc	—	°C	>230	>230	>200	>200	>145	>125	>270
Resistivity	ρ	—	Ω-cm	100	100	100	100	20	3	1000
Density	d	—	g/cm³	4.8	4.8	4.8	4.8	4.8	4.9	4.7
Temp. at minimum power loss	LMP	—	°C	90	70	80	100	—	—	100

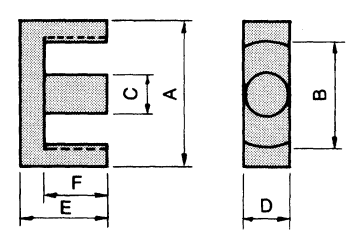
Note: 1) The values were obtained with toroidal cores (FR 25φ/15φ/5).
2) The values were obtained at 23±2°C unless otherwise specified.
3) Initial permeability was measured at 10 kHz, 0.8 A/m.

EE cores



Shape code	Core factor Σℓ/A (cm⁻¹)	Effective length ℓe (cm)	Effective area Ae (cm²)	Effective volume Ve (cm³)	Dimensions (mm) A	B	C	D	E	F
EE12.6/13	22.8	2.96	0.13	0.38	12.6 ±0.5	8.9 min.	3.7 $^{+0}_{-0.3}$	3.7 $^{+0}_{-0.3}$	6.5 $^{+0}_{-0.2}$	4.5 $^{+0.3}_{-0}$
EE13/11	13.0	2.73	0.21	0.57	13.0 ±0.5	9.8 ±0.3	3.8 ±0.15	6.5 ±0.2	5.6 $^{+0.3}_{-0}$	4.1 $^{+0.3}_{-0}$
EE16/14K	18.0	3.52	0.19	0.66	16.0 ±0.3	11.7 min.	4.0 $^{+0}_{-0.4}$	5.0 $^{+0}_{-0.4}$	7.1 $^{+0.2}_{-0}$	5.1 $^{+0.25}_{-0}$
EE19/16K	17.0	3.96	0.23	0.92	19.1 ±0.3	14.2 min.	4.7 $^{+0}_{-0.3}$	5.2 $^{+0}_{-0.4}$	7.8 $^{+0.3}_{-0}$	5.5 $^{+0.2}_{-0}$
EE19.3/16Z	17.4	4.01	0.23	0.92	19.3 ±0.3	14.1 min.	4.76±0.15	4.76±0.15	8.1 ±0.2	5.72±0.15
EE22/18K	9.75	3.97	0.41	1.62	22.0 ±0.3	12.8 min.	6.0 $^{+0}_{-0.5}$	6.0 $^{+0}_{-0.5}$	9.2 $^{+0.3}_{-0}$	5.2 $^{+0.3}_{-0}$
EE25/19Z	12.0	4.79	0.40	1.92	25.4 ±0.5	18.5 min.	6.35±0.2	6.35±0.25	9.53±0.25	6.35±0.25
EE30/26K	5.28	5.78	1.09	6.33	30.0 ±0.5	19.5 min	11.0 $^{+0}_{-0.6}$	11.0 $^{+0}_{-0.6}$	13.0 $^{+0.3}_{-0}$	8.0 $^{+0.3}_{-0}$
EE40/34K	6.05	7.73	1.28	9.86	40.0 ±0.5	27.4 min.	11.0 $^{+0}_{-0.6}$	11.0 $^{+0}_{-0.6}$	16.7 $^{+0.6}_{-0}$	10.0 $^{+0.5}_{-0}$
EE42/42A-15W	5.42	9.70	1.79	17.36	42.0 $^{+1.0}_{-0.7}$	29.5 min.	12.2 $^{+0}_{-0.5}$	15.2 $^{+0}_{-0.5}$	21.2 $^{+0}_{-0.4}$	14.8 $^{+0.7}_{-0}$
EE42/42A-20W	4.22	9.70	2.30	22.31	42.0 $^{+1.0}_{-0.7}$	29.5 min.	12.2 $^{+0}_{-0.5}$	20.0 $^{+0}_{-0.8}$	21.2 $^{+0}_{-0.4}$	14.8 $^{+0.7}_{-0}$
EE42/42G	3.70	9.80	2.65	26.00	42.85±0.5	30.4 min.	11.89±0.3	22.2 ±0.3	21.3 ±0.3	15.35±0.3
EE50/42K	4.25	9.61	2.26	21.70	50.0 ±0.7	34.2 min.	15.0 $^{+0}_{-0.8}$	15.0 $^{+0}_{-0.8}$	21.0 $^{+0.5}_{-0}$	12.5 $^{+0.5}_{-0}$
EE55/55A	3.51	12.40	3.53	43.70	55.0 $^{+1.2}_{-0.9}$	37.5 min.	17.2 $^{+0}_{-0.5}$	21.0 $^{+0}_{-0.6}$	27.8 $^{+0}_{-0.6}$	18.5 $^{+0.8}_{-0}$
EE56/48	3.09	10.65	3.45	36.77	56.57±0.6	37.9 min	18.8 ±0.25	18.8 ±0.25	23.6 ±0.25	14.5 ±0.2
EE60/44K	4.50	11.0	2.45	27.10	60.0 ±0.8	43.8 min.	16.0 $^{+0}_{-0.8}$	16.0 $^{+0}_{-0.8}$	22.0 $^{+0.8}_{-0}$	13.8 $^{+0.5}_{-0}$

EER cores



Shape code	Core factor Σℓ/A (cm⁻¹)	Effective length ℓe (cm)	Effective area Ae (cm²)	Effective volume Ve (cm³)	Dimensions (mm) A	B	C	D	E	F
EER19/24	18.8	5.23	0.28	1.45	19.2 ±0.4	13.6 min.	5.6 $^{+0.2}_{-0.3}$	5.6 $^{+0.2}_{-0.4}$	12.1 ±0.2	8.9 ±0.2
EER26/33	16.90	7.43	0.44	3.27	26.2 ±0.4	19.6 min.	7.2 ±0.3	7.2 ±0.3	16.3 ±0.3	12.8 ±0.3
EER34/35	8.12	7.90	0.97	7.68	35.0 $^{+0}_{-1.6}$	25.6 $^{+1.4}_{-0}$	11.1 $^{+0}_{-0.6}$	11.1 $^{+0}_{-0.6}$	17.3 ±0.2	11.8 $^{+0.6}_{-0}$
EER35/41	8.12	9.01	1.11	10.00	35.0 ±0.5	25.6 min.	11.3 ±0.3	11.3 ±0.3	20.7 ±0.3	14.7 ±0.3
EER39/40	7.38	9.22	1.25	11.50	40.0 $^{+0}_{-1.6}$	29.3 $^{+1.6}_{-0}$	12.8 $^{+0}_{-0.6}$	12.8 $^{+0}_{-0.6}$	19.8 ±0.2	14.2 $^{+0.8}_{-0}$
EER39/44	7.61	10.12	1.33	13.50	39.0 ±0.5	28.6 min.	12.8 ±0.3	12.8 ±0.3	22.0 ±0.3	17.0 ±0.3
EER42/42	5.26	9.63	1.83	17.64	42.0 ±0.5	31.0 ±0.5	15.2 ±0.3	15.2 ±0.3	21.2 ±0.3	15.2 ±0.3
EER44/45	5.95	10.36	1.75	18.09	45.0 $^{+0}_{-2.0}$	32.5 $^{+1.6}_{-0}$	15.2 $^{+0}_{-0.6}$	15.2 $^{+0}_{-0.6}$	22.3 ±0.2	16.1 $^{+0.8}_{-0}$
EER49/49	5.40	11.40	2.11	24.05	49.8 $^{+0}_{-2.2}$	36.1 $^{+1.8}_{-0}$	16.7 $^{+0}_{-0.6}$	16.7 $^{+0}_{-0.6}$	24.7 ±0.2	17.7 $^{+0.8}_{-0}$
EER49/62	6.21	14.60	2.35	34.30	49.0 ±0.6	36.4 min.	17.2 ±0.2	17.2 ±0.3	31.2 ±0.3	22.7 ±0.3
EER55/57	3.69	12.50	3.40	42.60	55.0 ±0.5	42.0 ±0.5	20.6 ±0.3	24.7 ±0.3	28.4 ±0.4	19.0 ±0.3

Other shapes of cores, for example EI, PM, EP, ER, Drum, are also available.

All specifications are subject to change without notice.

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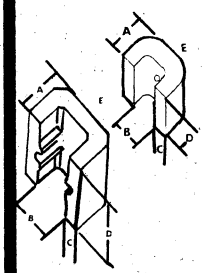
JOBMASTER MAGNETS

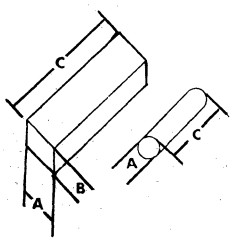
STOCK JOBMASTER MAGNETS



POWER MAGNET

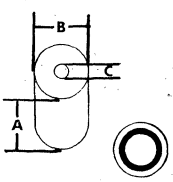
Cat No	A mm	A ins	B mm	B ins	C mm	C ins	D mm	D ins	E mm	E ins	Weight gr	Weight oz
811	19	¾	14.2	9/16	7.9	5/16	19	¾	4	5/32	71	2½
812	25.4	1	19	¾	9.5	⅜	25.4	1	4.7	3/16	142	5
813	28.6	1⅛	22.2	⅞	11.1	7/16	28.6	1⅛	4.7	3/16	226	8
814	35	1⅜	35	1⅜	11	7/16	44.5	1¾	8	5/16	368	13
815	41	1⅝	41	1⅝	14.3	9/16	57	2¼	8	5/16	709	25
816	54	2⅛	47.6	1⅞	16	⅝	82.5	3¼	9.5	⅜	1446	51

Hole centres 814 31 75 mm 1¼" 815 38 mm 1½" 816 43 mm 1 11/16"



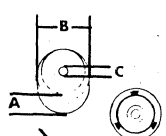
BAR MAGNET

Cat No	A mm	A ins	B mm	B ins	C mm	C ins	Weight gr	Weight oz
805	6	¼ diameter			20	13/16	4	15
806	8	5/16 diameter			25	1	8	30
807	10	⅜ diameter			30	1⅛	16	58
844	10	⅜	5	3/16	20	13/16	11	38
845	12.5	½	5	3/16	40	1 9/16	21	75
846	15	⅝	5	3/16	60	2⅜	56	2
842	15	⅜	10	⅜	50	2	70	2½
843	15	⅝	10	⅜	75	3	100	3½



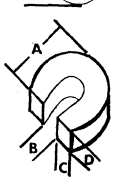
POT MAGNET

Cat No	A mm	A ins	B mm	B ins	C	Weight gr	Weight oz
831	15.8	⅝	17.5	11/16	Tapped Hole	28	1
832	19.0	¾	20.6	13/16	OBA/6 SI	47	1¾
833	25.4	1	27	1 1/16	or 10 NF	100	3½
834	30.1	1 3/16	35	1⅜		198	7



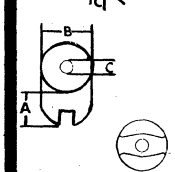
SHALLOW POT MAGNET

Cat No	A mm	A ins	B mm	B ins	C mm	C ins	Weight gr	Weight oz
826	8	5/16	19	¾	3.5	9/64	14	½
827	9.5	⅜	28.6	1⅛	4.7	3/16	50	1¾
828	11.1	7/16	38	1½	4.7	3/16	100	3½



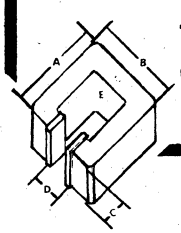
POCKET MAGNET

Cat No	A mm	A ins	B mm	B ins	C mm	C ins	D mm	D ins	Weight gr	Weight oz
802	25.4	1	6.35	¼	7.9	5/16	7.9	5/16	28.3	1



BUTTON MAGNET

Cat No	A mm	A ins	B mm	B ins	C mm	C ins	Weight gr	Weight oz
821	9.5	⅜	12.7	½	4.4	11/64	10	⅓
822	12.7	½	19	¾	4.8	3/16	28	1
823	15.9	⅝	25.4	1	4.8	3/16	56	2
824	25.4	1	31.7	1¼	6.4	¼	113	4



MAJOR MAGNET

Cat No	A mm	A ins	B mm	B ins	C mm	C ins	D mm	D ins	E mm	E ins	Weight gr	Weight oz
862	111	4⅜	103	4 1/16	52	2 1/16	40	1 9/16	6.3	¼	2835	100

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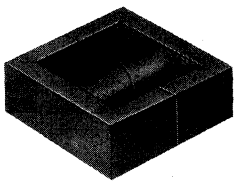
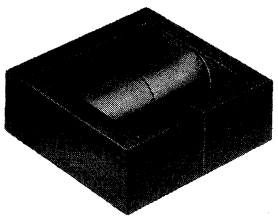
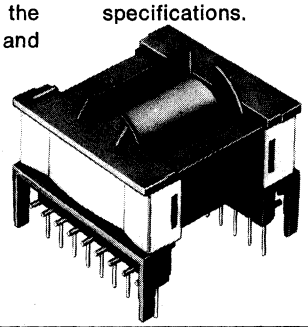
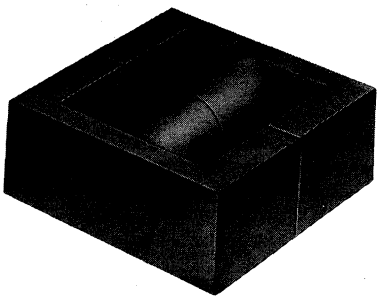

Preferred Application			Standard Materials										Special Materials			
			Resonant Circuit Inductors			Broadband Transformers				Power Transformers				Resonant Circuit Inductors Transformers, Chokes			Proximity Switches and Small Parts
Material			K 1	M 33	N 48	N 26	N 30	T 35	T 38	N 47	N 27	N 67	N 41	U 60	U 17	K 12	N 22
Color code			violet	white	—	—	—	—		—	—	—	—	pink	grey	yellow	red
Initial permeability μ			80 ±20%	750[1] ±20%	2000 ±20%	2300 ±20%	4300 ±20%	6000 ±20%	10,000 ±30%	1400 ±20%	2000 ±20%	2300 ±25%	3000 ±20%	8 ±20%	10 ±20%	26 ±25%	1900 ±25%
Optimum	f_{min}	MHz	1,5	0,2	0,001	—	—	—	—		—	—	—	100	10	3	0,001
frequency range	f_{max}	MHz	12	1,0	0,1	—	—	—	—	1,0	0,15	0,3	0,15	1000	220	40	0,2
Sat. flux density B		Gauss	3600	4500	3900	3900	3800	3800	3800	4300	5100	5050	5100	1100	—	1450	3900

SWITCH MODE POWER SUPPLY APPLICATIONS

Siemens is expanding its offering to the SMPS industry! We now offer ETD, EC, IEC, PM and RM cores in power materials; N47, N27, N67 and N41.

ETD29	E187	E55	EC41	PM74X59	RM7
ETD34	E24/25	E75	EC52	PM87X70	RM8
ETD39	E30	E625	EC70	PM114X93	RM10
ETD44	E42/15	E375	PM50X39	RM5	RM12
ETD49	E42/20	EC35	PM62X49	RM6	RM14—many others . . .

We can gap the cores to meet your design criteria!
N41 (of high permeability, for applications with biasing) and N47 (for frequencies greater than 200 KHz)were added to the ferrite material N27 proven for applications in power electronics. And N67 will fill the gap between 100 KHz and 300 KHz with appreciably lower losses.

TELECOMMUNICATIONS APPLICATIONS

Recognized for our consistent quality, on-time delivery and excellent service, Siemens also offers a complete line of cores, hardware, and tuning cores. We are the one-stop for all your ferrite needs.

- Pot Cores from 3 mm to 114 mm dia.
- RM3 to RM14
- EP7 to EP20
- Touch Tone Cores
- Toroids

SPECIAL APPLICATIONS

In addition to our standard catalog offering we also manufacture many custom shapes, plus a complete line of assorted hardware to complete your design. These include:

- Single & Multi Section Bobbins
- Bobbins for Printed Circuit and Surface Mount Applications
- Mounting Clips and Yokes for Chassis and Printed Circuit Mount
- Multipin Header Assembly
- Trimmer Screws and Nuts

Our customer service group, nation-wide representatives and distributors are available to answer any questions you may have regarding price, availability and technical questions.

Special Products Division
186 Wood Avenue South, Iselin, New Jersey 08830 U.S.A. Telephone (201) 906-4300

Siemens Components, Inc.

FERRITE MATERIALS

TDK®

TDK CORPORATION OF AMERICA HEAD OFFICE 1600 Feehanville Drive, Mount Prospect, IL 60056, U.S.A. Phone: (312) 803-6100 **CHICAGO REGIONAL OFFICE** Phone: (312) 803-6100 **INDIANAPOLIS REGIONAL OFFICE** Phone: (317) 872-0370 **NEW YORK REGIONAL OFFICE** Phone: (516) 625-0100 **LOS ANGELES REGIONAL OFFICE** Phone: (213) 539-6631 **DETROIT DISTRICT OFFICE** Phone (313) 353-9393 **NEW JERSEY DISTRICT OFFICE** Phone: (201) 736-0023 **HUNTSVILLE DISTRICT OFFICE** Phone: (205) 539-4551 **GREENSBORO DISTRICT OFFICE** Phone: (919) 292-0012 **DALLAS DISTRICT OFFICE** Phone: (214) 506-9800 **SAN FRANCISCO DISTRICT OFFICE** Phone: (408) 437-9585 **TDK CORPORATION,** TOKYO, JAPAN

For yoke cores, U cores and E cores (H series materials)

Characteristics*1	μiac	tanδ/μiac*2	$\alpha\mu$r	Tc	Bms	Brms	Hcms	ϱ	d
Material	—	$\times10^{-6}$	$\times10^{-6}$/°C (+20°C to +60°C)	°C	G {mT}	G {mT}	Oe {A/m}	Ω·cm	g·cm^3
H_3T	1900±25%	8 (0.1 MHz)	8	>200	5000 {500} (15.0 Oe {1194 A/m})	1900 {190}	0.25 {20}	30	4.8
H_4M	320±25%	52 (0.1 MHz)	40	>150	2100 {210} (1.5 Oe {1194 A/m})	1500 {150}	0.5 {40}	10^7	4.4

**1 Measured with toroidal cores at room temperature. *2 Average values.*

For high frequency inductors

Characteristics	Practical frequency	μiac	tanδ/μiac	$\alpha\mu$r*	Bms	Tc	ϱ*	d*
Material	MHz	—	$\times10^{-6}$	$\times10^{-6}$/°C (+20°C to +60°C)	G	°C	Ω·cm	g/cm^3
L_4	0.1 to 1.5	400±25%	<30 (0.1 MHz)	3 to 9	3300 (20 Oe)	>150	10^7	5.0
L_4N	0.1 to 1.5	300±25%	<45 (0.1 MHz)	−3 to −1	2600 (20 Oe)	>150	10^7	5.1
L_5	0.1 to 1.5	750±25%	<15 (0.1 MHz)	1 to 3	3100 (20 Oe)	>120	10^7	4.9
L_5N	0.1 to 1.5	500±25%	<50 (0.1 MHz)	−1 to 1	2900 (20 Oe)	>100	10^7	5.1
L_5T	0.1 to 1.5	500±25%	<30 (0.1 MHz)	−4 to −1	3000 (20 Oe)	>120	10^7	4.9
L_6	0.01 to 0.5	1500±25%	<10 (0.01 MHz)	1 to 3	2800 (20 Oe)	>100	10^7	4.8
L_6E	0.01 to 0.5	1200±25%	<10 (0.01 MHz)	6 to 10	2900 (20 Oe)	>100	10^7	4.9
L_6H	0.05 to 0.5	1000±25%	<10 (0.05 MHz)	3 to 7	3500 (20 Oe)	>150	10^7	5.0
L_7M	0.01 to 0.5	1500±25%	<10 (0.01 MHz)	1 to 3	3700 (20 Oe)	>150	10^2	4.8
L_8H	0.05 to 1.5	650±25%	<15 (0.05 MHz)	10 to 20	4200 (50 Oe)	>200	10^7	5.1
L_9	0.1 to 1.5	210±25%	<40 (0.1 MHz)	0 to 2	2500 (20 Oe)	>150	10^7	4.8
L_9H	0.05 to 3	200±25%	<35 (0.05 MHz)	20 to 30	5000 (150 Oe)	>300	10^7	5.2
D_1B	0.3 to 7.0	200±25%	<350 (0.3 MHz)	15 to 35	3100 (20 Oe)	>180	10^6	5.1
D_1C	0.3 to 7.0	230±25%	<350 (0.3 MHz)	30 to 70	3500 (20 Oe)	>200	10^6	5.2
D_1F	0.1 to 2.0	400±25%	<400 (0.1 MHz)	15 to 25	3200 (20 Oe)	>150	10^6	5.1
D_1L	0.1 to 2.0	350±25%	<500 (0.1 MHz)	25 to 35	3500 (20 Oe)	>150	10^5	5.1
D_3B	0.1 to 2.0	300±25%	<20 (0.1 MHz)	10 to 30	3300 (20 Oe)	>150	10^7	4.9
D_8	0.3 to 7.0	200±25%	<160 (0.3 MHz)	20 to 50	3700 (20 Oe)	>250	10^7	5.0
Q_1C	0.1 to 2.0	250±25%	<35 (0.1 MHz)	9 to 15	2900 (20 Oe)	>125	10^7	5.0
Q_1D	0.3 to 15	100±25%	<400 (0.3 MHz)	15 to 35	3800 (50 Oe)	>300	10^5	4.8
Q_2	0.1 to 5.0	200±25%	<25 (0.1 MHz)	25 to 65	3600 (20 Oe)	>150	10^7	4.6
Q_2M	0.1 to 2.0	350±25%	<20 (0.1 MHz)	4 to 12	2600 (20 Oe)	>150	10^7	4.7
Q_5B	0.4 to 20	100±25%	<25 (0.4 MHz)	5 to 12	3400 (50 Oe)	>300	10^4	4.7
Q_5M	0.4 to 30	90±25%	<25 (0.4 MHz)	5 to 13	3200 (50 Oe)	>300	10^4	4.7
M_5E	10 to 120	17±25%	<450 (10 MHz)	40 to 120	3000 (100 Oe)	>300	10^7	4.6
M_5M	10 to 120	12±25%	<500 (10 MHz)	30 to 90	2400 (100 Oe)	>300	10^7	4.8
M_5N	10 to 120	12±25%	<550 (10 MHz)	−10 to 10	2300 (100 Oe)	>300	10^7	4.8
M_8B	0.5 to 20	50±25%	<140 (0.5 MHz)	4 to 12	3000 (50 Oe)	>300	10^7	5.1
M_8C	0.5 to 15	70±25%	<90 (0.5 MHz)	5 to 15	3600 (50 Oe)	>300	10^7	4.8
M_8L	0.5 to 15	65±25%	<110 (0.5 MHz)	3 to 9	3000 (50 Oe)	>300	10^7	4.8
M_8N	0.5 to 20	70±25%	<130 (0.5 MHz)	−3 to 3	3600 (50 Oe)	>300	10^7	4.8
M_9	0.5 to 30	50±25%	<90 (0.5 MHz)	25 to 65	3500 (50 Oe)	>300	10^7	4.8
M_9D	1.0 to 50	55±25%	<150 (1.0 MHz)	30 to 80	3900 (50 Oe)	>300	10^7	4.8
M_9E	0.5 to 60	55±25%	<150 (0.5 MHz)	35 to 100	3500 (50 Oe)	>300	10^7	4.8
M_9M	0.5 to 30	45±25%	<130 (0.5 MHz)	5 to 15	3200 (50 Oe)	>300	10^7	4.8
M_9N	0.5 to 30	45±25%	<200 (0.5 MHz)	−5 to 5	3200 (50 Oe)	>300	10^7	4.7
M_{11}	3.0 to 80	25±25%	<220 (3 MHz)	30 to 70	2900 (50 Oe)	>300	10^7	4.6
$M_{11}E$	3.0 to 80	30±25%	<250 (3 MHz)	40 to 120	3400 (50 Oe)	>300	10^7	4.7
$M_{11}M$	3.0 to 80	25±25%	<200 (3 MHz)	10 to 30	2800 (50 Oe)	>300	10^7	4.6
F_3T	10 to 120	18±25%	<500 (10 MHz)	15 to 25	3100 (100 Oe)	>300	10^7	4.8
F_4N	10 to 120	12±25%	<550 (10 MHz)	−5 to 5	2500 (200 Oe)	>300	10^7	4.7
F_5N	10 to 120	10±25%	<850 (10 MHz)	−5 to 5	2200 (200 Oe)	>300	10^7	4.7
F_6T	10 to 120	7±25%	<1000 (10 MHz)	−7 to 7	1900 (200 Oe)	>300	10^7	4.7
V_1F	10 to 80	17±25%	<400 (10 MHz)	2 to 7	2700 (100 Oe)	>300	10^7	4.7
V_2F	10 to 70	30±25%	<210 (10 MHz)	25 to 75	3200 (100 Oe)	>300	10^7	4.8
V_3F	10 to 80	10±25%	<500 (10 MHz)	−40 to −10	2100 (200 Oe)	>300	10^7	4.7
V_3N	10 to 80	10±25%	<500 (10 MHz)	−65 to −35	2100 (200 Oe)	>300	10^7	4.6
V_4F	10 to 200	8±25%	<650 (10 MHz)	5 to 15	2100 (200 Oe)	>300	10^7	4.8
V_5F	10 to 250	9±25%	<550 (10 MHz)	25 to 65	1800 (200 Oe)	>300	10^7	4.9

**Average values*

1 gauss: 10 mT.; 1 Oe: 7.95775 × 10 A/m

FERRITE MATERIALS

TDK®

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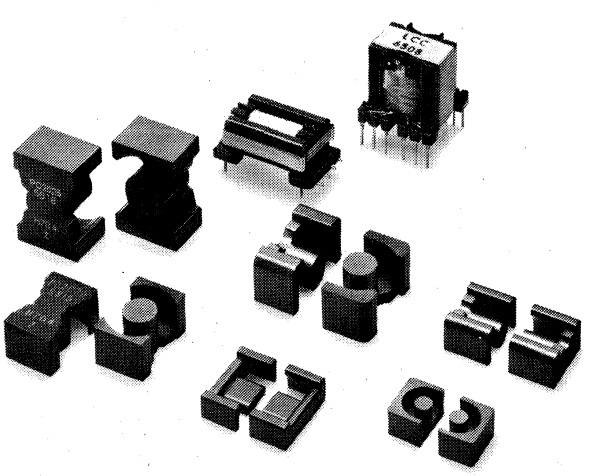
For industrial use

Material				H5A	H5B	H5B2	H5C2	H5D	H5E	HP3	HP4	HP5	H6A	H6A3	H6B
Practical frequency range			MHz	<0.2	<0.1	<0.1	<0.1	<0.05	<0.01	<0.2	<0.2	<0.1	0.01 to 0.3	0.01 to 0.3	0.01 to 0.3
Initial permeability		μiac		3300$^{+40}_{0}$%	5000$^{+40}_{0}$%	7500±25%	10000±30%	15000±30%	18000±30%	3000±20%	4000±20%	5000±20%	2000±20%	1500±20%	2000±20%
Relative loss factor		tanδ/μiac	$\times10^{-6}$	<2.5 (10kHz) <10 (100kHz)	<6.5 (10kHz) <40 (100kHz)	<6.5 (10kHz)	<7.0 (10kHz)	<15 (10kHz)		<3.5 (10kHz)	<3.5 (10kHz)	<3.5 (10kHz)	<3.5 (10kHz)	<6 (100kHz)	<2.5 (100kHz)
Temperature factor of permeability	−30 to 20°C 0 to 20°C 20 to 55°C 20 to 70°C	αμr	$\times10^{-6}$	−0.5 to 2.0 −0.5 to 2.0	−0.5 to 2.0 −0.5 to 2.0	0 to 1.8 0 to 1.8	−0.5 to 1.5 −0.5 to 1.5	−1.5 to 1.5 −0.5 to 2.0	0 to 2.0 −0.5 to 2.0	 ±7.5% ±7.5%	 ±10% ±10%	 ±12.5% ±12.5%	 0 to 2.5 0 to 2.5	0.8 to 2.0 0.8 to 2.0 0.8 to 2.0 0.8 to 2.0	0.5 to 2.0 0.5 to 1.3 0.5 to 1.3 0.5 to 1.5
Curie temperature		Tc	°C	>130	>130	>130	>120	>120	>115	>140	>140	>140	>130	>130	>130
Saturation flux density H = 1194A/m (15 Oe)		Bms	G	4100	4200	4200	4000	3200	4400	3700	4000	4000	3500	3600	3500
			mT	410	420	420	400	320	440	370	400	400	350	360	350
Remanence		Br	G	1000	1350	400	900	1000	1200	700	650	650	800	950	800
			mT	100	135	40	90	100	120	70	65	65	80	95	80
Coercivity		Hc	Oe	0.1	0.1	0.07	0.09	0.034	0.035	0.15	0.09	0.09	0.3	0.4	0.25
			A/m	8.0	8.0	5.6	7.2	2.7	2.8	12	7.2	7.2	24	32	20
Hysteresis material constant		ηB	10^{-6}	<0.8	<0.8	<0.3	<0.6	<0.52	<1.0	<0.4	<0.4	<0.4	<0.4	<0.8	<0.3
		mT													
		h_{10}		<40 (50kHz)	<40 (10kHz)	<15 (10kHz)	<30 (10kHz)	<26 (10kHz)	<30 (10kHz)	<20 (10kHz)	<20 (10kHz)	<20 (10kHz)	<20 (0.1MHz)	<40 (0.1MHz)	<15 (0.1MHz)
Disaccommodation factor (1 to 10 minutes)		DF	$\times10^{-6}$	<3	<3	<3	<2	<1	<1	<3	<3	<3	<3	<3	<3
Resistivity		ρ	Ω-m	1	1	0.1	0.15	0.02	0.05	0.2	0.2	0.15	40	50	45
Density		δ	g/cm^3	4.8	4.8	4.9	4.9	4.9	5.0	4.8	4.8	4.8	4.5	4.6	4.5

Material				H6F	H6H3	H6K	H6Z	H7A	H7B	H7C1	H7C4	K5	K6A	K7A	K8
Practical frequency range			MHz	0.2 to 2.0	0.01 to 0.8	0.01 to 0.3	0.01 to 0.3	<0.1	<0.2			<8	<20	1 to 50	<200
Initial permeability		μiac		800±20%	1300±15%	2200±20%	2200±20%	4500$^{+30}_{-20}$%	3700±25%	2500±25%	2300±25%	2900$^{+30}_{-20}$%	700$^{+20}_{-30}$%	25±20%	16
Relative loss factor		tanδ/μiac	$\times10^{-6}$	<13 (0.5MHz) <17 (1MHz)	<1.2 (100kHz)	<3.5 (100kHz)	<3.0 (100kHz)	<4 (100kHz) <20 (100kHz)	<12 (100kHz)			<28 (1MHz) <105 (5MHz)	<40 (1MHz) <60 (10MHz)	<150 (10MHz) <300 (30MHz)	<150 (50MHz) <250 (100MHz)
Temperature factor of permeability	−30 to 20°C 0 to 20°C 20 to 55°C 20 to 70°C	αμr	$\times10^{-6}$	 0 to 2.5 0 to 2.5 0 to 2.5	0.3 to 2.0 0.5 to 1.1 0.5 to 2.5 0.3 to 2.0	0.4 to 1.2 0.4 to 1.0 0.4 to 1.0 0.4 to 1.0	 −0.6 to 0.6 −0.6 to 0.6	0 to 2.5 −2.5 to 0				−4.0 to 2.0 0 to 4.0	2.5 to 7.5 5 to 15 2.5 to 7.5	 5 to 15 5 to 15	
Curie temperature		Tc	°C	>200	>200	>130	>150	>190	>200	>230	>215	>280	>350	>450	>500
Saturation flux density H = 1194A/m (15 Oe)		Bms	G	4000	4650	3900	3800	4650	4600			3300	3000 (30 Oe)	2600 (80 Oe)	2700 (80 Oe)
			mT	400	465	390	380	465	460	for power supplies See Table below		330	300 (2388A/m)	260 (6368A/m)	270 (6368A/m)
Remanence		Br	G	1600	1000	450	800	1100	1500			2500	2000	1500	1650
			mT	160	100	45	80	110	150			250	200	150	165
Coercivity		Hc	Oe	1.0	0.45	0.15	0.3	0.2	0.2			1.0	6.0	14	15
			A/m	80	36	12	24	15.9	15.9			80	477	1110	1190
Hysteresis material constant		ηB	10^{-6}	<1.0	<0.12	<0.5	<0.4	<0.6							
		h_{10}		<50 (0.1MHz)	<6 (0.1MHz)	<25 (0.1MHz)	<20 (0.1MHz)	<30 (50kHz)							
Disaccommodation factor (1 to 10 minutes)		DF	$\times10^{-6}$	<12	<5	<2	<3	<3				<30	<15	<20	
Resistivity		ρ	Ω-m	4	25	8	8	1	2	10	6.5	20×10^5	2.5×10^5	10×10^5	1.0×10^5
Density		δ	g/cm^3	4.6	4.8	4.5	4.6	4.8	4.8	4.8	4.8	4.4	4.4	4.1	4.4

Material characteristics for power supplies

Material				H7C1		H7C4	
Amplitude permeability μa at 2000 G (200mT) 25kHz		25°C		3200 min.		3000 min.	
		60°C		3200 min.			
		100°C		3200 min.			
Power loss at 2000 G (200mT) sine wave	P_L	25°C	kW/m^3	165 max.	at 25kHz	600	at 100kHz
		60°C		115 max.		450	
		100°C		155 max.		410	
		120°C				500	
Saturation flux density at 15 Oe (1194A/m)	Bms	25°C	Gauss	5100		5100	
			mT	510		510	
		60°C	Gauss	4500		4500	
			mT	450		450	
		100°C	Gauss	3900		3900	
			mT	390		390	
Remanence	Br	25°C	Gauss	1170		950	
			mT	117		95	
		60°C	Gauss	800		650	
			mT	80		65	
		100°C	Gauss	830		550	
			mT	83		55	
Coercivity	H_{CB}	25°C	Oersted	0.15		0.18	
			A/m	12		14	
		60°C	Oersted	0.10		0.13	
			A/m	80		10	
		100°C	Oersted	0.10		0.11	
			A/m	8.0		8.8	



FERRITE CORES
for switching – mode power supplies

TDK

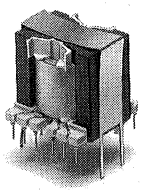
TDK CORPORATION OF AMERICA HEAD OFFICE 1600 Feehanville Drive, Mount Prospect, IL 60056, U.S.A. Phone: (312) 803-6100 **CHICAGO REGIONAL OFFICE** Phone: (312) 803-6100 **INDIANAPOLIS REGIONAL OFFICE** Phone: (317) 872-0370 **NEW YORK REGIONAL OFFICE** Phone: (516) 625-0100 **LOS ANGELES REGIONAL OFFICE** Phone: (213) 539-6631 **DETROIT DISTRICT OFFICE** Phone: (313) 353-9393 **NEW JERSEY DISTRICT OFFICE** Phone: (201) 736-0023 **HUNTSVILLE DISTRICT OFFICE** Phone: (205) 539-4551 **GREENSBORO DISTRICT OFFICE** Phone: (919) 292-0012 **DALLAS DISTRICT OFFICE** Phone: (214) 506-9800 **SAN FRANCISCO DISTRICT OFFICE** Phone: (408) 437-9585 **TDK CORPORATION,** TOKYO, JAPAN

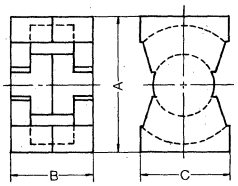
PQ CORES

TDK PQ cores are ferrite cores for switching power supplies which have the most appropriate shape for performing analysis of transformer iron and copper loss when used as a power supply transformer and driven at a high frequency. They are also appropriate for performing temperature rise and inductance analysis.

Features
- Cores for uses ranging from 50W to 1kW (100kHz); and employ the most appropriate shapes.
- Installation volume and on-board installation area are reduced.
- Pin equipped bobbins are employed to permit easy terminal handling.
- Permit various safety standards to be easily maintained.

Applications
Inverter transformers and choke coils for switching power supplies.





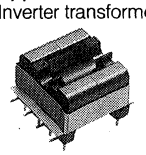
Type	Dimensions in mm (inches) A	B	C	Material	AL-value (μe) (nH/N²)
PQ20/16Z-12	20.5 (.80)	16.2 (.638)	14.0 (.55)	H7C1	3880 (1868)
				H7C4	3880 (1868)
PQ20/20Z-12	20.5 (.80)	20.2 (.793)	14.0 (.55)	H7C1	3310 (1944)
				H7C4	3150 (1850)
PQ26/20Z-12	26.5 (1.04)	20.2 (.793)	19.0 (.75)	H7C1	6170 (1920)
				H7C4	6170 (1920)
PQ26/25Z-12	26.5 (1.04)	24.8 (.947)	19.0 (.75)	H7C1	5250 (1972)
				H7C4	5250 (1972)
PQ32/20Z-12	32.0 (1.26)	20.6 (.809)	22.0 (.87)	H7C1	7310 (1896)
				H7C4	7310 (1896)
PQ32/30Z-12	32.0 (1.26)	30.4 (1.19)	22.0 (.87)	H7C1	5140 (1898)
				H7C4	5140 (1898)
PQ35/35Z-12	35.1 (1.38)	34.8 (1.37)	26.0 (1.02)	H7C1	4860 (1733)
				H7C4	4860 (1733)
PQ40/40Z-12	40.5 (1.59)	39.8 (1.57)	28.0 (1.1)	H7C1	4300 (1738)
				H7C4	4300 (1738)
PQ50/50Z-12	50.0 (1.97)	49.9 (1.97)	32.0 (1.26)	H7C1	6720 (1650)
				H7C4	6720 (1850)

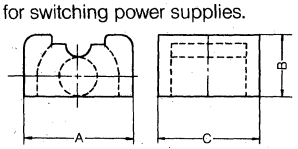
LP CORES

LP cores are products developed for extremely thin, flat type switching power supplies.

Features
- Maximum installation height: LP23/8 12.7mm (0.5 inches), LP22/13 17.78mm (0.7 inches), LP32/13 17.78mm (0.7 inches).
- Pin equipped bobbins are employed to permit easy terminal handling.
- Allows various safety standards to be easily maintained.

Applications
Inverter transformers and choke coils for switching power supplies.





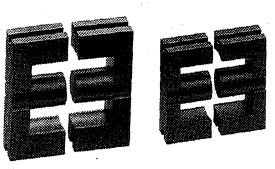
Type	Dimensions in mm (inches) A	B	C	Material	AL-value (μe) (nH/N²)	Σℓ/A (cm⁻¹)	Ae (cm²)
LP23/8	16.5 (.650)	8.7 (.343)	23.4 (.921)	H7C1	1600 (1795)	14.1	0.313
				H7C4	1600 (1795)		
LP22/13	25.0 (.984)	12.9 (.508)	22.4 (.882)	H7C1	3500 (2008)	7.21	0.679
				H7C4	3310 (1899)		
LP32/13	25.0 (.984)	12.9 (.508)	31.8 (1.252)	H7C1	2750 (1989)	9.09	0.703
				H7C4	2630 (1902)		

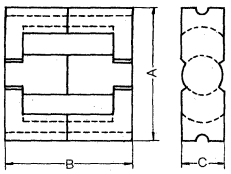
EC CORES

These ferrite cores are designed based on IEC PUb.647. They are in wide use as cores for switching power supplies.

Features
- Center leg is ound making winding easy.
- Winding area is large and permits the design of high output transformers.

Applications
Transformers and choke coils for switching power supplies.



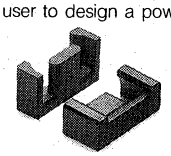


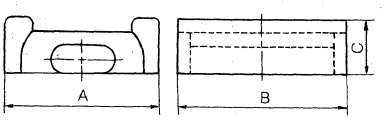
Part No.	Dimensions in mm (inches) A	B	C	Material	AL-value (nH/N²)	Σℓ/A (cm⁻¹)	Ae (cm²)
EC35	34.5 (1.36)	34.6 (1.36)	9.5 (.37)	H7C1	2400±25%	9.18	0.843
				H7C4	2400±25%		
EC41	40.6 (1.60)	39.0 (1.54)	11.6 (.46)	H7C1	3200±25%	7.35	1.21
				H7C4	3200±25%		
EC52	52.2 (2.01)	48.4 (1.91)	13.4 (.53)	H7C1	4200±25%	5.81	1.80
				H7C4	4200±25%		
EC70	70.0 (2.76)	69.0 (2.72)	16.4 (.65)	H7C1	4800±25%	5.14	2.79
				H7C4	4800±25%		
EC90	90.0 (3.54)	90.0 (3.54)	30.0 (1.18)	H7C1	6000 min.	3.46	6.24
				H7C4	5550 min.		
EC120	120.0 (4.72)	101.0 (3.98)	30.0 (1.18)	H7C1	6800 min.	3.32	7.53
				H7C4	6300 min.		

• *Dimensions of E core + I core*

EPC CORES

EPC cores are designed for thin (approximately 1 inch) power supply and have an installation height of 12 to 16mm, an elliptic center leg for easy winding, and 10 to 12 terminals for easy designing.
High-performance power ferrite H7C4 employed in these cores enables a user to design a power supply for high frequency with less heat generation.

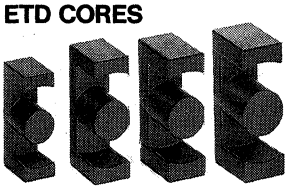


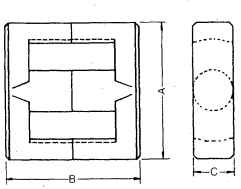


Part No.	Dimensions in mm (inches) A	B	C	Material	AL-value* (nH/N²)	Σℓ/A (cm⁻¹)	Ae (cm²)
EPC13	13.2 (.52)	13.2 (.52)	4.6 (.18)	H7C4	870±25%	0.246	0.125
EPC17	17.5 (.69)	17.1 (.67)	6.0 (.24)	H7C4	1150±25%	0.176	0.228
EPC19	19.0 (.75)	19.5 (.77)	6.0 (.24)	H7C4	940±25%	0.203	0.227
EPC25	25.0 (.98)	25.0 (.98)	8.0 (.32)	H7C4	1560±25%	0.128	0.464
EPC27	27.0 (1.06)	32.0 (1.26)	8.0 (.32)	H7C4	1540±25%	0.134	0.546
EPC30	30.0 (1.18)	35.0 (1.38)	8.0 (.32)	H7C4	1570±25%	0.132	0.610

**100 Ts, 1 kHz, 0.5 mA **200 mT, 100°C*

ETD CORES





Part No.	Dimensions in mm (inches) A	B	C	AL-value Material	(nH/N²)	Σℓ/A (cm⁻¹)	Ae (cm²)
ETD34	34.2 (1.35)	34.6 (1.36)	10.88 (.43)	H7C1	2850±25%	8.10	0.971
				H7C4	2780±25%		
ETD39	39.1 (1.54)	39.6 (1.56)	12.58 (.50)	H7C1	3240±25%	7.37	1.25
				H7C4	3150±25%		
ETD44	44.0 (1.73)	44.6 (1.76)	14.9 (.59)	H7C1	4110±25%	5.89	1.75
				H7C4	4000±25%		
ETD49	48.7 (1.92)	49.4 (1.94)	16.4 (.65)	H7C1	4570±25%	5.34	2.13
				H7C4	4440±25%		

FERRITE MAGNETS

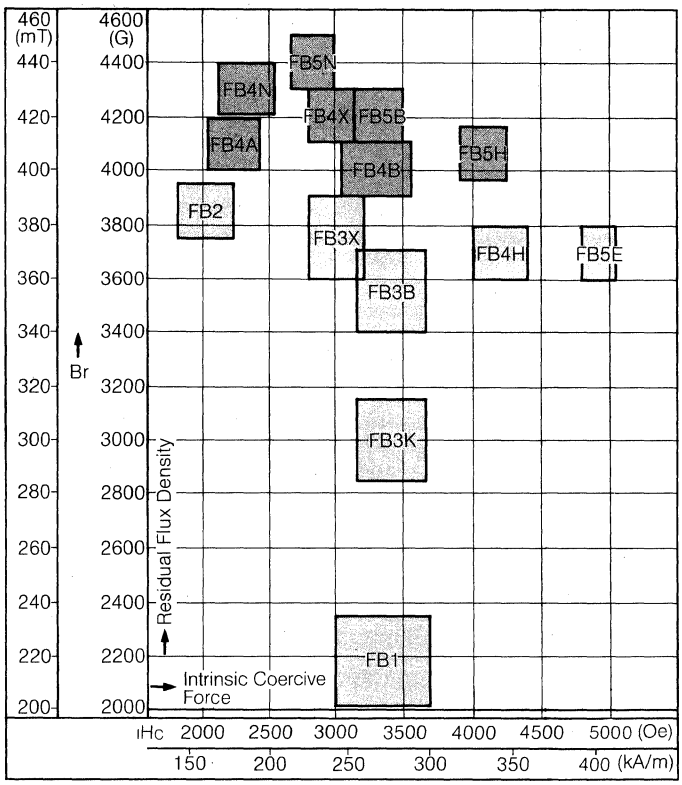
TDK CORPORATION OF AMERICA HEAD OFFICE 1600 Feehanville Drive, Mount Prospect, IL 60056, U.S.A. Phone: (312) 803-6100 **CHICAGO REGIONAL OFFICE** Phone: (312) 803-6100 **INDIANAPOLIS REGIONAL OFFICE** Phone: (317) 872-0370 **NEW YORK REGIONAL OFFICE** Phone: (516) 625-0100 **LOS ANGELES REGIONAL OFFICE** Phone: (213) 539-6631 **DETROIT DISTRICT OFFICE** Phone: (313) 353-9393 **NEW JERSEY DISTRICT OFFICE** Phone: (201) 736-0023 **HUNTSVILLE DISTRICT OFFICE** Phone: (205) 539-4551 **GREENSBORO DISTRICT OFFICE** Phone: (919) 292-0012 **DALLAS DISTRICT OFFICE** Phone: (214) 506-9800 **SAN FRANCISCO DISTRICT OFFICE** Phone: (408) 437-9585 **TDK CORPORATION,** TOKYO, JAPAN

FERRITE MAGNETS

TDK ferrite magnets are oxide magnets composed of iron oxide, barium, strontium and several other elements. TDK as the leading ferrite manufacturer has a widest choice of the material to meet every demand from High Br to High Hc. The following reflects part of the most popular shapes and dimensions.

Wet pressed materials: FB4A, FB4B, FB4X, FB4H, FB4N, FB5N, FB5B, FB5H, FB5E

Dry pressed materials: FB1, FB2, FB3B, FB3X, FB3K



Material characteristics

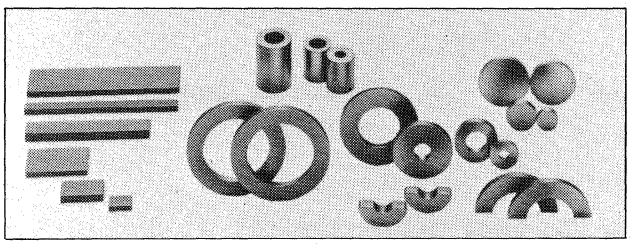
	Material	FB5N	FB5B	FB5H	FB5E	FB4A	FB4B	FB4X
	MMPA standard					Ceramic 5	Ceramic 8	
Residual magnetic flux density Br (G {mT})	Max.	4,500 {450}	4,300 {430}	4,150 {415}	3,750 {375}	4,200 {420}	4,100 {410}	4,300 {430}
	Typical	4,400 {440}	4,200 {420}	4,050 {405}	3,650 {365}	4,100 {410}	4,000 {400}	4,200 {420}
	Min.	4,300 {430}	4,100 {410}	3,950 {395}	3,550 {355}	4,000 {400}	3,900 {390}	4,100 {410}
Coercive BHc (Oe {kA/m})	Max.	3,000 {239}	3,450 {275}	3,800 {302}	3,550 {282}	2,400 {191}	3,400 {271}	3,100 {247}
	Typical	2,850 {227}	3,300 {263}	3,650 {290}	3,400 {271}	2,200 {175}	3,200 {255}	2,950 {235}
	Min.	2,700 {215}	3,150 {250}	3,500 {278}	3,250 {259}	2,000 {159}	3,000 {239}	2,800 {223}
Intrinsic coercive force IHc (Oe {kA/m})	Max.	3,030 {241}	3,500 {278}	4,200 {334}	5,000 {398}	2,420 {193}	3,550 {282}	3,200 {255}
	Typical	2,880 {229}	3,350 {226}	4,050 {334}	4,850 {386}	2,220 {177}	3,300 {263}	3,000 {239}
	Min.	2,730 {217}	3,200 {255}	3,900 {310}	4,700 {374}	2,020 {161}	3,050 {243}	2,800 {223}
Maximum energy product BHmax. (MG·Oe {kJ/m^3})	Max.	4.7	4.5	4.0	3.3	4.2	4.1	4.4
	Typical	4.5 {36}	4.3 {34}	3.8 {30}	3.1 {25}	4.0 {32}	3.8 {30}	4.2 {33}
	Min.	4.3	4.1	3.6	2.9	3.8	3.5	4.0
Curie temperature (°C)		460	460	450	450	450	460	460
Material composition		SrO $6Fe_2O_3$	SrO $6Fe_2O_3$	SrO $6Fe_2O_3$	SrO $6Fe_2O_3$	BaO $6Fe_2O_3$	SrO $6Fe_2O_3$	SrO $6Fe_2O_3$

	Material	FB4H	FB4N	FB3B	FB3X	FB3K	FB2	FB1
	MMPA standard	Ceramic 7		Ceramic 6				
Residual magnetic flux density Br (G {mT})	Max.	3,800 {380}	4,400 {440}	3,700 {370}	3,900 {390}	3,150 {315}	3,950 {395}	2,350 {235}
	Typical	3,700 {370}	4,300 {430}	3,550 {355}	3,750 {375}	3,000 {300}	3,850 {385}	2,200 {220}
	Min.	3,600 {360}	4,200 {420}	3,400 {340}	3,600 {360}	2,850 {285}	3,750 {375}	2,000 {200}
Coercive force BHc (Oe {kA/m})	Max.	3,600 {288}	2,500 {199}	3,200 {255}	3,100 {247}	2,950 {235}	2,200 {175}	2,000 {159}
	Typical	3,450 {275}	2,300 {183}	3,000 {239}	2,950 {235}	2,750 {219}	2,000 {159}	1,900 {151}
	Min.	3,300 {263}	2,100 {167}	2,800 {223}	2,800 {223}	2,550 {203}	1,800 {143}	1,800 {143}
Intrinsic coercive force IHc (Oe {kA/m})	Max.	4,400 {350}	2,520 {201}	3,650 {290}	3,200 {255}	3,650 {290}	2,220 {177}	
	Typical	4,200 {334}	2,320 {185}	3,400 {271}	3,000 {239}	3,400 {271}	2,020 {161}	3,500 {279}
	Min.	4,000 {318}	2,120 {169}	3,150 {251}	2,800 {223}	3,150 {251}	1,820 {145}	3,000 {239}
Maximum energy product BHmax. (MG·Oe {kJ/m^3})	Max.	3.5	4.6	3.2	3.5	2.4	3.7	1.2
	Typical	3.25 {26}	4.4 {35}	3.0 {24}	3.2 {26}	2.1 {17}	3.5 {28}	1.1 {8.9}
	Min.	3.0	4.2	2.8	2.9	1.8	3.3	0.9
Curie temperature (°C)		460	460	460	460	460	450	450
Material composition		SrO $6Fe_2O_3$	SrO $6Fe_2O_3$	SrO $6Fe_2O_3$	SrO $6Fe_2O_3$	SrO $6Fe_2O_3$	BaO·(SrO) $6Fe_2O_3$	BaO $6Fe_2O_3$

RARE EARTH COBALT MAGNETS

TDK CORPORATION OF AMERICA HEAD OFFICE 1600 Feehanville Drive, Mount Prospect, IL 60056, U.S.A. Phone: (312) 803-6100 **CHICAGO REGIONAL OFFICE** Phone: (312) 803-6100 **INDIANAPOLIS REGIONAL OFFICE** Phone: (317) 872-0370 **NEW YORK REGIONAL OFFICE** Phone: (516) 625-0100 **LOS ANGELES REGIONAL OFFICE** Phone: (213) 539-6631 **DETROIT DISTRICT OFFICE** Phone: (313) 353-9393 **NEW JERSEY DISTRICT OFFICE** Phone: (201) 736-0023 **HUNTSVILLE DISTRICT OFFICE** Phone: (205) 539-4551 **GREENSBORO DISTRICT OFFICE** Phone: (919) 292-0012 **DALLAS DISTRICT OFFICE** Phone: (214) 506-9800 **SAN FRANCISCO DISTRICT OFFICE** Phone: (408) 437-9585 **TDK CORPORATION,** TOKYO, JAPAN

RARE EARTH COBALT MAGNETS (REC MAGNETS)

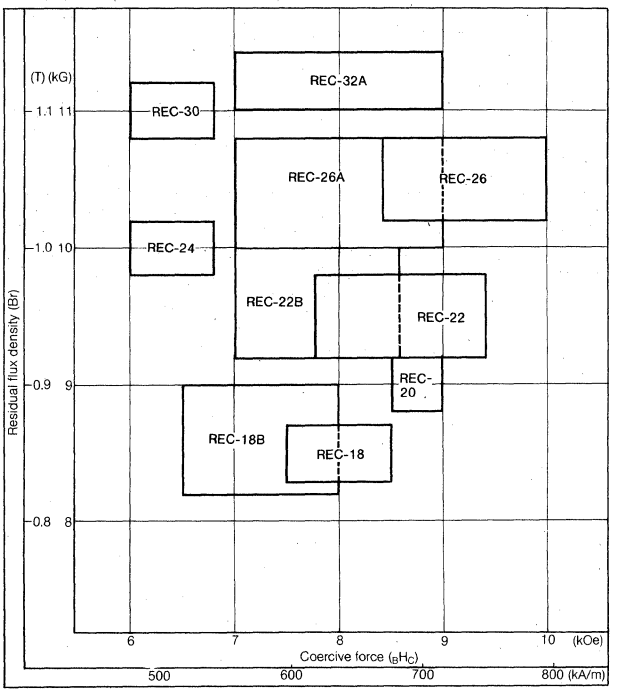


Demand for rare earth cobalt (REC) magnets has been increasing as that for smaller sized, higher efficient electronic equipment has never ceased to be active. TDK has a wide choice of REC magnets, including 2-17 series ones, whose excellent temperature characteristics compare Alnico. The conveniently small, easy-to-use TDK REC Magnets include the highest performing REC-32A and REC-30, REC-26A, REC-26, REC-24, REC-22, REC-22B and REC-18B, all power-efficient and high-performing.

Applications

Speakers, headphones, cartridges, microphones, printers, magnetic and optical disks, coreless motors, stepping motors, klystrons, magnetrons, isolators, circulators, various meters, noncontacting switches, sensors, watches, clocks, magnetic couplings, tools, magnetic medical instruments, etc.

Characteristic distribution figure



Material characteristics

			Series 2-17 [Sm2 (Co, Cu, Fe, Zr)17]								Series 1-5 [SmCo5]	
			REC-32A	REC-30	REC-26A	REC-26	REC-24	REC-22	REC-22B	REC-18B	REC-20	REC-18
(Magnetic characteristics)												
Residual flux density	Br	(kG) {T}	11 to 11.6 1.10 to 1.16	10.8 to 11.2 1.08 to 1.12	10 to 10.8 1.00 to 1.08	10.2 to 10.8 1.02 to 1.08	9.8 to 10.2 0.98 to 1.02	9.2 to 9.8 0.92 to 0.98	9.2 to 10.0 0.92 to 1.00	8.2 to 9.0 0.82 to 0.90	8.8 to 9.2 0.88 to 0.92	8.3 to 8.7 0.83 to 0.87
Coercive force	BHc	(kOe) {kA/m}	7 to 9 557.2 to 716.4	6.0 to 6.8 477.5 to 541.1	7 to 9 557.2 to 716.4	8.4 to 10.0 668.5 to 795.8	6.0 to 6.8 477.5 to 541.1	7.8 to 9.4 620.7 to 748.0	7.0 to 8.6 557.0 to 684.4	6.4 to 8.0 509.3 to 636.6	8.5 to 9.0 676.4 to 716.2	7.5 to 8.5 596.8 to 676.4
	iHc	(kOe) {kA/m}	8 min. 636.8 min.	6.2 to 7.0 493.4 to 557.0	8 min. 636.8 min.	10.0 min. 795.8 min.	6.2 to 7.0 493.4 to 557.0	10.0 min. 795.8 min.	8.0 to 10.0 636.6 to 795.8	8.0 to 10.0 636.6 to 795.8	12.0 to 20.0 954.9 to 1591.6	12.0 to 20.0 954.9 to 1591.6
Maximum energy product (BH) max.		(MG·Oe) {kJ/m^3}	28 to 32 222 to 254	29 to 31 231 to 247	23 to 27 183 to 215	25 to 27 192 to 224	22 to 24 175 to 191	20 to 24 159 to 191	20 to 24 159 to 191	16 to 20 127 to 159	19 to 21 151 to 167	17 to 19 135 to 151
(Physical characteristics)												
Curie temperature		°C {K}	800 to 850 {1073 to 1123}	800 to 850 {1073 to 1123}	800 to 850 {1073 to 1123}	800 to 850 {1073 to 1123}	800 to 850 {1073 to 1123}	800 to 850 {1073 to 1123}	750 to 800 {1023 to 1073}	750 to 800 {1023 to 1073}	700 to 750 {973 to 1023}	700 to 750 {973 to 1023}
*Thermal expansion coefficient	C//	1/°C {1/K}	8×10^{-6} {8×10^{-6}}	8×10^{-6} {8×10^{-6}}	8×10^{-6} {8×10^{-6}}	8×10^{-6} {8×10^{-6}}	8×10^{-6} {8×10^{-6}}	8×10^{-6} {8×10^{-6}}	8×10^{-6} {8×10^{-6}}	8×10^{-6} {8×10^{-6}}	6×10^{-6} {6×10^{-6}}	6×10^{-6} {6×10^{-6}}
	C⊥	1/°C {1/K}	11×10^{-6} {11×10^{-6}}	11×10^{-6} {11×10^{-6}}	11×10^{-6} {11×10^{-6}}	11×10^{-6} {11×10^{-6}}	11×10^{-6} {11×10^{-6}}	11×10^{-6} {11×10^{-6}}	11×10^{-6} {11×10^{-6}}	11×10^{-6} {11×10^{-6}}	13×10^{-6} {13×10^{-6}}	13×10^{-6} {13×10^{-6}}
Thermal conductivity		(kcal/mhr·°C) {W/mK}	10 {12}	10 {12}	10 {12}	10 {12}	10 {12}	10 {12}	10 {12}	10 {12}	11 {13}	11 {13}
Specific heat		(cal/g·°C) {J/kg·K}	8×10^{-2} {335}	8×10^{-2} {335}	8×10^{-2} {335}	8×10^{-2} {335}	8×10^{-2} {335}	8×10^{-2} {335}	8×10^{-2} {335}	8×10^{-2} {335}	9×10^{-2} {377}	9×10^{-2} {377}
Specific resistivity		(Ω-cm)	8.6×10^{-5}	8.6×10^{-5}	8.6×10^{-5}	8.6×10^{-5}	8.6×10^{-5}	8.6×10^{-5}	9.0×10^{-5}	9.0×10^{-5}	5.3×10^{-5}	5.3×10^{-5}
Density		(g/cm^3)	8.3 to 8.5	8.3 to 8.5	8.3 to 8.5	8.3 to 8.5	8.3 to 8.5	8.3 to 8.5	8.2 to 8.4	8.2 to 8.4	8.1 to 8.3	8.1 to 8.3
(Mechanical characteristics)												
Deflection strength		(kgf/mm^2) {N/m^2}	15 {1.5×10^8}	15 {1.5×10^8}	15 {1.5×10^8}	15 {1.5×10^8}	15 {1.5×10^8}	15 {1.5×10^8}	15 {1.5×10^8}	15 {1.5×10^8}	18 {1.8×10^8}	18 {1.8×10^8}
Compressive strength		(kgf/mm^2) {N/m^2}	82 {8×10^8}	82 {8×10^8}	82 {8×10^8}	82 {8×10^8}	82 {8×10^8}	82 {8×10^8}	82 {8×10^8}	82 {8×10^8}	102 {10×10^8}	102 {10×10^8}
Tensile strength		(kgf/mm^2) {N/m^2}	3.6 {3.5×10^7}	3.6 {3.5×10^7}	3.6 {3.5×10^7}	3.6 {3.5×10^7}	3.6 {3.5×10^7}	3.6 {3.5×10^7}	3.6 {3.5×10^7}	3.6 {3.5×10^7}	4.1 {4×10^7}	4.1 {4×10^7}
Young's modulus		(kgf/mm^2) {N/m^2}	1.2×10^4 {1.2×10^{11}}	1.2×10^4 {1.2×10^{11}}	1.2×10^4 {1.2×10^{11}}	1.2×10^4 {1.2×10^{11}}	1.2×10^4 {1.2×10^{11}}	1.2×10^4 {1.2×10^{11}}	1.2×10^4 {1.2×10^{11}}	1.2×10^4 {1.2×10^{11}}	1.6×10^4 {1.6×10^{11}}	1.6×10^4 {1.6×10^{11}}
Vickers hardness		(Hv)	500 to 600	500 to 600	500 to 600	500 to 600	500 to 600	500 to 600	500 to 600	500 to 600	450 to 500	450 to 500

Tooling is available for various shapes and dimensions. Please contact TDK for further information.
**C// is the value measured in the easy magnetization direction while C⊥ is the value measured in the direction vertical to the easy magnetization direction.*

MAGNETIC HEADS

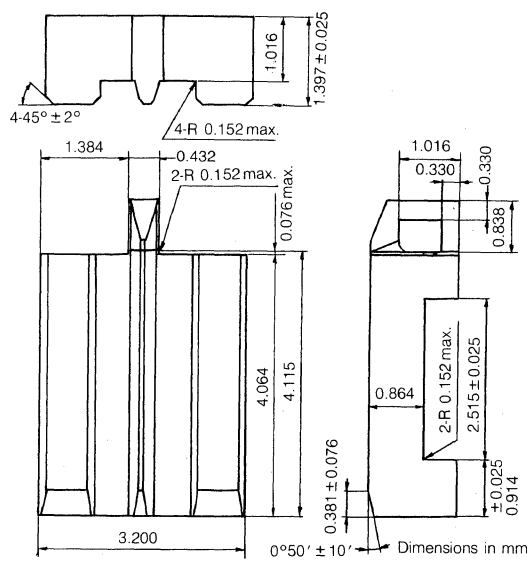
TDK CORPORATION OF AMERICA HEAD OFFICE 1600 Feehanville Drive, Mount Prospect, IL 60056, U.S.A. Phone: (312) 803-6100 **CHICAGO REGIONAL OFFICE** Phone: (312) 803-6100 **INDIANAPOLIS REGIONAL OFFICE** Phone: (317) 872-0370 **NEW YORK REGIONAL OFFICE** Phone: (516) 625-0100 **LOS ANGELES REGIONAL OFFICE** Phone: (213) 539-6631 **DETROIT DISTRICT OFFICE** Phone: (313) 353-9393 **NEW JERSEY DISTRICT OFFICE** Phone: (201) 736-0023 **HUNTSVILLE DISTRICT OFFICE** Phone: (205) 539-4551 **GREENSBORO DISTRICT OFFICE** Phone: (919) 292-0012 **DALLAS DISTRICT OFFICE** Phone: (214) 506-9800 **SAN FRANCISCO DISTRICT OFFICE** Phone: (408) 437-9585 **TDK CORPORATION,** TOKYO, JAPAN

MINI MONOLITHIC HARD SLIDERS FOR HARD DISK DRIVES

A small monolithic type head for use in magnetic disk devices. High density, high flux density Mn-Zn ferrite is used to satisfy the need for high density recording. This material has been developed through TDK's untiring efforts of ferrite development.

Features
- High flux density Mn-Zn ferrite (HR52).
- Hole rate <0.03 because of high density ferrite.
- Ultra small head. 50% less in size than previous monolithic head sliders.
- Excellent wear resistance.

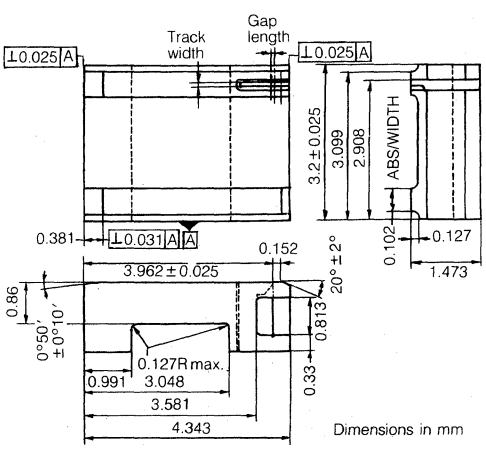
Applications
Hard disk drives.



MINI COMPOSITE HEAD SLIDERS FOR HARD DISK DRIVES

Features
- Durable narrow track embeded in hard glass.
- Asymmetrical configuration enables the use of outer portion of disk.
- Improved durability by TDK original glass.

Applications
Hard disk drives.



3.5 INCH FLOPPY DISK DRIVE MAGNETIC HEAD

TDK's unique manufacturing process and newly developed construction compact high-capacity floppy disks technology have produced magnetic heads that can cope effectively with small, large capacity floppy disks. TDK's 1 MB and 1.6 MB high-density recording magnetic heads are very reliable.

Features
- Mn-Zn ferrite developed for high-density recording.
- Track accuracy highly improved by TDK's unique mechanical technology.
- Heads employ only glass bonding to ensure high workability in varied circumstances.

Applications
3.5 inch, 135TPI 1 MB, 1.6 MB, and 1.6/1 MB multiple use floppy disk drives.

Basic characteristics (for 1 MB)			
Inductance	R/W	mH	1.5±20%
	ER	μH	31±20%
DC resistance	R/W	Ω	39±20%
	ER	Ω	1.4±20%
Resonant frequency	kHz		450 min.

Operating characteristics (for 1 MB)			
Output	Tr00	mVp-p	5 max.(1F)
	Tr79	mVp-p	1.2 min.(2F)
Resolution		%	68 min.
Overwrite		dB	−26 max.

5.25 INCH FLOPPY DISK DRIVE MAGNETIC HEAD

These tunnel erase type heads (48 TPI, 96 TPI) are made of very dense Mn-Zn ferrite with TDK's ferrite technology and precision mechanical technology developed over many years of experience.

Features
- High electromagnetic conversion characteristics provided by R/W core made of high-density Mn-Zn ferrite.

5.25 INCH 48 TPI, FDD MAGNETIC HEAD

Applications
5.25 inch, 0.5 MB floppy disk drives.

Basic characteristics			
Inductance	R/W	mH	1.1±20%
	ER	μH	10.0±20%
DC resistance	R/W	Ω	15.0±20%
	ER	Ω	1.5±20%
Resonant frequency	kHz		450 min.

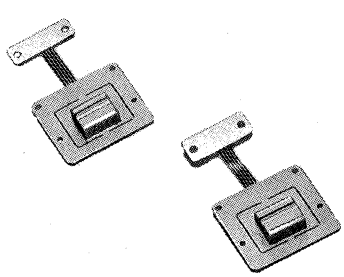
Operating characteristics			
Output	Tr00	mVp-p	20 max. (1F)
	Tr39	mVp-p	2.5 min. (2F)
Resolution		%	65 min.
Overwrite		dB	−28 max.

5.25 INCH 96 TPI, FDD MAGNETIC HEAD

Applications
5.25 inch, 1 MB, 1.6 MB, and 1.6/1 MB, multiple use floppy drives.

Basic characteristics (for 1 MB)			
Inductance	R/W	mH	1.0±20%
	ER	μH	7.0±20%
DC resistance	R/W	Ω	20.0±20%
	ER	Ω	1.0±20%
Resonant frequency	kHz		500 min.

Operating characteristics (for 1 MB)			
Output	Tr00	mVp-p	7 max. (1F)
	Tr76	mVp-p	1.2 min. (2F)
Resolution		%	65 min.
Overwrite		dB	−26 max.



MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 88/89 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1134, **B**•1098, **C**•1082, **D**•1038
ASCII Code ..... **D**•1073
Batteries, Product Selection Guide ..... **D**•1428
Batteries & Fuel Cells, Characteristics ..... **D**•1454
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1030
Capacitors, Miniglossary ..... **A**•1027
Capacitors, Product Selection Guide ..... **A**•1003
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1193
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1760
Connectors, Miniglossary ..... **C**•1374
Connectors, Terminals & Sockets, Product Selection Guide ..... **C**•1127
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide ..... **A**•1331
Delay Lines, Product Selection Guide ..... **A**•1495
Discrete Semiconductors, Product Selection Guide ..... **A**•2113
Displays, Readouts, & CRTs, Product Selection Guide ..... **B**•1033
EBCDIC Code ..... **D**•1162
Encapsulation, Miniglossary ..... **C**•1110
Fans, Blowers, Cooling Equipment & Heat Exchangers, Product Selection Guide ..... **C**•1643
Filters, Product Selection Guide ..... **A**•1633
IC Master ..... **A**•1718
Instruments, Panel Meters, Product Selection Guide ..... **D**•1350
Instruments, Test & Measuring, Product Selection Guide ..... **D**•1190
Interconnection Systems, Product Selection Guide ..... **C**•1719
Keyboards & Keypads, Product Selection Guide ..... **B**•1808
Lamps, Lights, & Inductors, Product Selection Guide ..... **B**•1104
Logofinder & Trademark Directories ..... **C**•901
Microwave Components, Product Selection Guide ..... **A**•1761
Military Qualified Products List ..... **B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1181
Opto Semiconductors, Miniglossary ..... **B**•1262
Oscilloscopes, Product Selection Guide ..... **D**•1408
Panel Hardware, Product Selection Guide ..... **C**•1603
Potentiometers, Trimmers, Controls & Rheostats, Product Selection Guide ..... **A**•2057
Power Supplies, Miniglossary ..... **D**•1504
Power Supplies, AC, Product Selection Guide ..... **D**•2060
Power Supplies, DC, Product Selection Guide ..... **D**•1497
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide ..... **B**•1297
Relay Contact Forms ..... **B**•1371
Relays, Electromechanical, Miniglossary ..... **B**•1364
Relays, Product Selection Guide ..... **B**•1355
Resistor Color Codes ..... **A**•1911
Resistors, Product Selection Guide ..... **A**•1849
Servo Components, Miniglossary ..... **B**•1238, **D**•2176
SI Units, Basic Guide To, ... **A**•1090, **B**•1050, **C**•1092, **D**•1048
Solenoids, Product Selection Guide ..... **B**•1612
Switches, Product Selection Guide ..... **B**•1636
Thermal Components, Product Selection Guide ..... **B**•1834
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1842
Thyristors/High Power Diodes, Miniglossary ..... **A**•2145
Trademark & Logofinder Directories ..... **C**•901
Transducers & Encoders, Product Selection Guide ..... **B**•1874
Transformers, Product Selection Guide ..... **A**•2153
Voltage Drop Nomograph ..... **C**•1912, **D**•2042
Wire & Cable, Product Selection Guide ..... **C**•1763
Wire Guages—Diameter, Area, Copper Weight ..... **C**•1864

FERRITES Tokin Tokin America Inc.
155 Nicholson Lane, San Jose, California 95134, U.S.A.
Tel: 408-432-8020 Fax: 408-434-0375
Chicago Branch
Presidential Plaza 1, Suite 700N, 9600 W. Bryn Mawr, Chicago, IL 60631
Tel: 312-380-0050 Fax: 312-693-6334

FERRITE MATERIALS for Telecommunication Applications

Material		AC initial permeability μiac	Relative loss factor $\tan\delta/\mu$iac $\times 10^{-6}$	Hysteresis loss coefficient h_{10} (10kHz)	Temperature coefficient $\alpha\mu r \times 10^{-6}$ (0~60°C)	Curie temperature Tc (°C)	Electrical resistivity ϱ (Ω-m)	Standard core shape
F-series Mn-Zn low-loss ferrites	1801F	1800±20%	<4.5 (100kHz)	<30	0.5~2.0	>145	2	Pot, toroid
	2001F	2000±20%	<4.5 (100kHz)	<15	0.5~1.5	>150	7	Pot
	2300F	2300±20%	<6.0 (100kHz)	<30	−0.5~2.0	>200	0.5	Pot
Super Neferrite low-loss ferrites	1000SFP	1000±20%	1.1 (100kHz) 2.5 (500kHz)	<5 (30kHz)	0.4 (0~50°C)	>250	6	Pot
H-series Mn-Zn high-permeability ferrites	4000H	4000±20%	<20 (100kHz)	<20	−0.5~2.0	>140	0.05	Pot, toroid, EI
	6000H	6000±25%	<20 (100kHz)	<20	−0.5~2.0	>120	1.2	Pot, toroid, EI
	7000H	7000±20%	<45 (100kHz)	<15	0~2.0	>110	0.08	Toroid, EI
	12001H	12000±30%	<15 (10kHz)	<25	0~2.0	>120	0.02	Pot, toroid, EI

Note: Each type of material is designated by a code number, which is a combination of the AC initial permeability and a letter representing the series.

FERRITE CORES for Industrial Applications

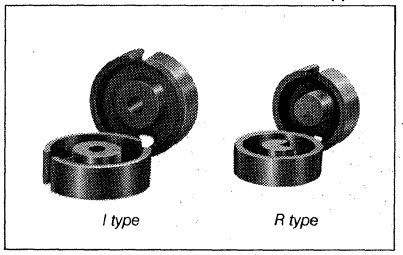
B-Series

Material	AC initial permeability μiac	Effective saturation magnetic flux density B_{15} (mT) [at 1200A/m]	Effective coercivity Hc (A/m)	Core loss P.B (kW/m²) f=25kHz B=2000 Gauss	Curie temperature Tc (°C)	Electrical resistivity ϱ (Ω-m)	Standard core shape
2500B	2500±20%	490	15.9	60°C: 90 100°C: 130	>230	1.3	E, FPQ, ETD
2500B2	2500±20%	500	15.1	60°C: 120 100°C: 70	>205	5	E, FPQ, FQK, ETD
HBM	1500±20%	510	15.9	60°C: 170 100°C: 135	>235	0.5	E, FQK, ER
3100B	3100±20%	490	15.9	60°C: 180 100°C: 240	>200	0.2	E
5000B	5000±20%	500	9.5	60°C: 80 100°C: 110	>180	0.2	E

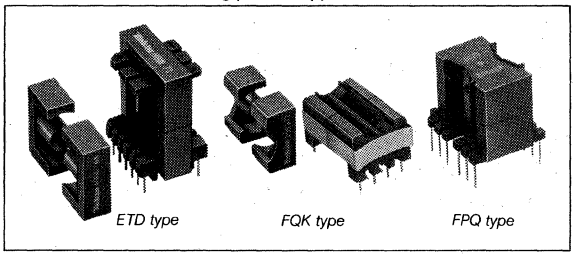
L-Series

Material	AC initial permeability μiac	Relative loss factor $\tan\delta/\mu$iac $\times 10^{-4}$	Hysteresis loss coefficient h_{10} (50kHz)	Temperature coefficient $\alpha\mu r \times 10^{-6}$ (0~60°C)	Curie temperature Tc (°C)	Electrical resistivity ϱ (Ω-m)	Standard core shape
10L	10±20%	<1.8 (100MHz)	2000	−150~150	>500	1×10^{4}	Bar, toroid
20L	20±20%	<1.1 (50MHz)	2000	−150~150	>500	1×10^{4}	Bar, toroid
40L	40±20%	<0.75 (10MHz)	3000	3~18	>400	3×10^{4}	Pot, bar
50L	50±20%	<0.5 (10MHz)	2000	2~12	>400	3×10^{5}	Pot, bar
100L	100±20%	<1.0 (10MHz)	1500	0~6	>350	5×10^{3}	Pot, toroid
150L	150±20%	<0.8 (5MHz)	2000	2~8	>350	2×10^{3}	Pot, bar
250L	250±20%	<0.9 (5MHz)	1000	0~5	>320	2×10^{4}	Pot, toroid
400L	400±20%	<0.3 (1MHz)	400	2~8	>140	2×10^{4}	Pot, bar
601L	600±20%	<0.5 (0.5MHz)	200	3~10	>160	5×10^{2}	Pot, bar
700L	700±25%	<0.6 (1MHz)	250 (30kHz)	0~7	>140	1×10^{7}	Bar, toroid
1400L	1400±25%	<1.4 (1MHz)	800 (10kHz)	0~6	>110	1×10^{7}	Bar, toroid
2000L	2000±20%	<1.2 (0.5MHz)	300	3~15	>100	1×10^{2}	Various

Ferrite materials for telecommunication applications (left); ferrite cores for switching power supplies.



I type *R type*

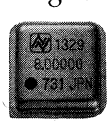


ETD type *FQK type* *FPQ type*

NDK: When timing is critical rely on the leader.

Clock frequencies from 28 kHz to 70 MHz. Only from NDK

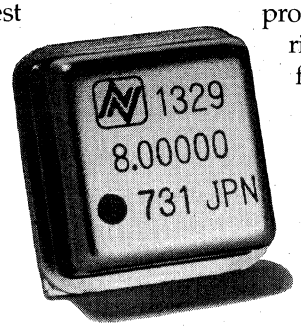
Tiny tornado. NDK's 1300 Series Compact Crystal Clock Oscillators pack up to 70 MHz in a package 0.52" on a side. That means you can pack higher frequency oscillators on a smaller board. They're perfect for high speed applications such as modems, computers and CAD/CAM workstations. And the 1300 Series offers the widest range of TTL and CMOS-compatible oscillators you'll find. Enable/disable is standard. Dual frequency output is an option.



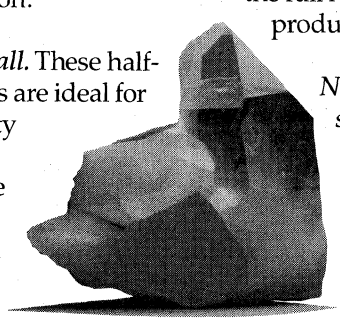
Actual Size: 0.52" square. Less real estate. Full frequency range.

Think Small. These half-size clock oscillators are ideal for rugged, high density board applications. Particularly portable instruments, PCs and "harsh environment" applications.

Absolute quality control. Because we're the world's largest manufacturer of synthetic quartz crystals, we can establish and maintain absolute quality control. NDK unconditionally guarantees all of our crystal products to be free of impurities and defects. Thus, you can expect not only longer product life, but absolutely accurate frequencies over the full NDK product spectrum.



NDK 1300 Series: Broadest range of frequencies — 28 kHz to 70 MHz. Low power/low heat CMOS. Choice of TTL, CMOS or dual-compatibility. Rise and fall times (5, 7, 10 ns). Fan out (2 or 5 TTL gates). Sealed, grounded metal case is ideal for harsh environments.



NDK controls every step from growing our own crystals, to manufacture and testing. That's why you can rely on NDK.

NDK: Your single source. NDK offers the widest range of compact crystal clock oscillators, microprocessor quartz crystals, standard crystal clock oscillators and crystal filters available. And most products are available right off the shelf from NDK's nationwide network of stocking distributors.

Free catalog. Free samples. Contact us for our free catalog. And if you're designing or prototyping a system, ask for free evaluation samples. We'll get back with samples. Fast. Because at NDK, timing is everything.

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Telex: 352057 NDKCOLTD CPTO
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NDK

CRYSTALS

Manufacturer	Starting EEM Page No.	Crystal Blanks	Microprocessor	Quartz	Quartz (Watches)	Crystal Holders
Anderson Electronics	A•1337	¤	¤	¤	¤	
Bliley Electric*§	A•1345	¤	¤	¤		
Colorado Crystal*	A•1355	¤	¤	¤		¤
Croven Crystals*	A•1365	¤		¤		
CTS Corporation*§	A•1366		¤	¤	¤	
Electronic Research	A•1392			¤		
Epson America§	A•1393		¤	¤	¤	
Fox Electronics§	A•1397	¤	¤		¤	
GTE Products	A•1401		¤	¤		
HiQ/Uni-Power	A•1478	¤	¤	¤		
ITT Components	A•1404		¤	¤		
McCoy Electronics*§	A•1406			¤		
Micro Crystal/SMH	A•1421		¤	¤	¤	
Monitor Products§	A•1426		¤	¤	¤	
M-tron Industries*§	A•1428		¤	¤		
Murata Erie*	A•1430		¤	¤		
NDK America	A•1432		¤	¤		
Pletronics§	A•1447		¤			
Raltron§	A•1453		¤	¤		
SaRonix§	A•1458		¤	¤	¤	
Seiko Instruments§*	A•1464		¤	¤	¤	
Standard Crystal*§	A•1469	¤	¤	¤	¤	
Statek§	A•1470		¤	¤	¤	

* Mil. Spec. §Surface Mounts

crystal filters-2300

CRYSTAL FILTERS

Manufacturer	Starting EEM Page No.	Active	AF	IF	UHF/ VHF	RF	Microwave	LC	Comb	Single Sideband	Vestigial Sideband	Bandpass	Lowpass	Highpass	Notch (Band Elim.)	Linear Phase	Equalizer	Hybrid	Other Types
Damon§*	A•1391	¤		¤	¤	¤		¤		¤		¤	¤	¤	¤	¤			
Fox Electronics	A•1397					¤						¤							
Frequency Electronics*	A•1398				¤	¤				¤		¤			¤				Telemetering
Frequency Selective Networks	A•1400	¤			¤	¤		¤	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤	
McCoy Electronics§*	A•1406		¤	¤	¤	¤	¤			¤		¤				¤	¤	¤	
Microsonics*	A•1425			¤				¤	¤			¤		¤	¤	¤			
Monitor Products	A•1426			¤		¤		¤				¤							
Murata Erie*	A•1430		¤	¤	¤	¤													Ladder; Ceramic Resonators
NTK Technical Ceramics	A•1438				¤	¤													Piezo-ceramic filters; Resonators
OPT/United Transformer*	A•1479							¤	¤			¤	¤	¤	¤	¤		¤	
Sawtek*	A•1463											¤							SAW; Low-loss Resonator
Vernitron	A•1487	¤	¤									¤							Ceramic Resonators: Ladder

* MIL Spec §Surface Mount

OSCILLATORS

Manufacturer	Starting EEM Page	AF	LF	RF	Ultrasonic	Microwave	Sinusoidal	Square Wave	Pulse	UHF/VHF	Crystal Control Module)	Tuning Fork Control	Ovenized	Voltage Control VCXO	Temp. Compensated TCXO	Volt Control Temp. Comp.	Clock	LC	RC	Other
Andersen Labs	A•1335			¤		¤	¤			¤			¤							VCOs; Timing Recovery
Anderson§ Electronics	A•1337									¤							¤			
AT & T	A•1339									¤					¤					
Austron *	A•1342			¤			¤	¤			¤		¤	¤						Low phase Noise
Ball Efratom*	A•1344			¤			¤				¤		¤							Atomic
Bliley Electric§*	A•1345		¤	¤			¤	¤		¤	¤		¤	¤	¤		¤			DCXO
Comclok	A•1358							¤			¤						¤			
Comstron	A•1359																			Synthesizers; Simulators
Connor-Winfield§*	A•1360			¤			¤	¤	¤				¤	¤	¤	¤	¤	¤	¤	Digitally Compensated
CTS Corp.*§	A•1366			¤			¤	¤		¤	¤		¤	¤	¤	¤	¤			Hybrid Clock
Dale Electronics§	A•1388			¤				¤	¤		¤						¤			
Damon§*	A•1391		¤	¤			¤	¤		¤	¤		¤	¤	¤	¤				
Electronic Research	A•1392	¤		¤			¤				¤		¤							
Epson America	A•1393			¤					¤	¤	¤						¤			Programmable
Fox Electronics§*	A•1397			¤				¤						¤	¤	¤	¤			
Frequency Electronics*	A•1398		¤	¤		¤					¤		¤	¤	¤	¤				Frequency Standards; Atomic Time beam
Isotemp Research*	A•1402			¤			¤	¤	¤	¤	¤		¤		¤					
ITT Components	A•1404																¤			
McCoy Electronics*§	A•1406	¤	¤	¤			¤	¤	¤	¤	¤		¤	¤	¤	¤	¤			
MF Electronics*§	A•1418			¤						¤	¤			¤						

OSCILLATORS (cont'd)

Manufacturer	Starting EEM Page	AF	LF	RF	Ultrasonic	Microwave	Sinusoidal	Square Wave	Pulse	UHF/VHF	Crystal Control Module)	Tuning Fork Control	Ovenized	Voltage Control VCXO	Temp. Compensated TCXO	Volt Control Temp. Comp.	Clock	LC	RC	Other
Micro Crystal Div.\SMH§	A•1421											¤					¤			
Microsonics*	A•1425			¤			¤	¤	¤	¤	¤		¤	¤	¤	¤	¤			
Monitor Products*§	A•1426			¤			¤	¤	¤	¤	¤		¤	¤	¤	¤	¤			
M-tron Indstries§*	A•1428							¤			¤			¤			¤			
Murata Erie	B•1430	¤	¤	¤			¤			¤	¤		¤	¤	¤		¤			Ceramic
NDK America	A•1432									¤			¤		¤	¤	¤			
NTK Technical	A•1438					¤														
Oscillatek*	A•1440	¤	¤	¤			¤	¤	¤		¤			¤	¤		¤			Generatrors Baud Rate
Ovenaire	A•1442										¤		¤	¤	¤	¤				
Pletronics§	A•1447							¤			¤						¤			
Q-Tech Corp.*§	A•1450	¤	¤	¤				¤		¤	¤			¤		¤	¤	¤		
Reeves-Hoffman	A•1454			¤			¤	¤	¤	¤	¤		¤	¤	¤	¤	¤			
SaRonix§	A•1458							¤			¤	¤					¤			
Sawtek	A•1463													¤	¤		¤			
Seiko Instruments§*	A•1464										¤			¤	¤	¤	¤			
Spectrum Technology*§	A•1465			¤			¤	¤	¤	¤	¤		¤	¤			¤			
Standard Crystal§	A•1469										¤	¤		¤			¤			
Statek§*	A•1470		¤		¤		¤	¤	¤	¤	¤	¤	¤				¤			
Techtrol Cyclonetics*	A•1476					¤	¤				¤		¤	¤						Phased Locked
Vectron Labs.*§	A•1480	¤	¤	¤			¤	¤		¤	¤		¤	¤	¤	¤	¤			
Xsis*§	A•1488			¤			¤	¤		¤	¤		¤				¤			
Z-Communications§	A•1491			¤	¤	¤								¤						Synthesizers RF Modulars

* Mil. Spec. § Surface Mount

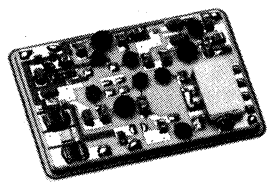
OSCILLATORS—SAW

APPLICATIONS:

- **PHASE LOCK LOOPS**
- **MILITARY**
- **RADAR**
- **TELEMETRY**
- **COMMERCIAL**
- **COMMUNICATIONS**
- **FIBER OPTIC RECONSTITUTION**
- **MIXING/LOCAL OSCILLATORS**

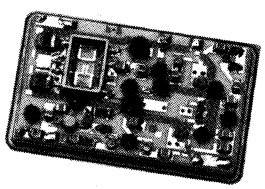
KEY FEATURES INCLUDE:

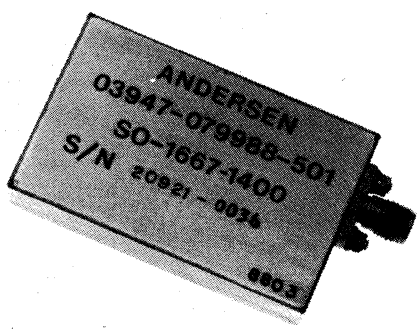
- Operating Frequencies from 100 to 2.4 GHz
- SAW (Surface Acoustic Wave) Stabilized
- Low Phase Noise
- Compact Size
- No Alignment Necessary
- Good Frequency Stability
- Rugged Construction
- Fixed Frequency or Voltage Controlled



GENERAL SPECIFICATIONS: *(Custom Requirements—see below*)*

Parameters	Performance Range
Operating Frequency	100 MHz to 2.4 GHz
Output Power	0 dBm to 13 dBm, 10 dBm typical
Power Variation over Temp.	± 1.5 dBm typical
Frequency Deviation with Temp.	.04 $(T\text{-}T_{REF})^2$ ppm max. T_{REF} = 25°C nominal
Spurious Outputs	
Harmonic	−30 dBc, maximum
Non-Harmonic	−60 dBc, maximum
Phase Noise	−93 dBc/Hz to −119 dBc/Hz @ 1 KHz offset
Load Pulling Maximum VSWR = 2.0:1	<5 ppm
Operating Temperature	0°C to 70°C typical −55°C to +100°C max.
Power Supply	+15 ±5% Vdc, 125 mA typical
Power Supply Sensitivity	<2 ppm/volt
Power Supply Rejection (to 100 KHz @ 25 mV p-p)	−60 dBc, maximum
Packaging	DIL, Flatpak connectorized available
Size	1.5″ x 1.01″ x .23″ typical 1.9″ x 1.25″ x .40″ maximum





VCO TUNING CHARACTERISTICS:

Tuning Range (Δf)	100 KHz to 1500 KHz
Tuning Voltage (ΔV)	0 to 12 V typical
Tuning Port Impedance	2 K Ω, min.
Modulation Bandwidth	50 KHz to 500 KHz

***CUSTOM OSCILLATOR DESIGNS:**

To meet individual requirements, ALI can also provide:

- Special Packaging techniques
- Temperature compensation
- Ovenized versions
- Multiple outputs
- Variation in performance levels

ANDERSEN LABORATORIES

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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
ABS acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CAMAC computer automated measurement and control
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3)
KSR keyboard send /receive

L
LC inductance capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
μF microfarad
MHz megahertz
MIB microcomputer interface board
MIC microwave IC
MIPS million instructions per second
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

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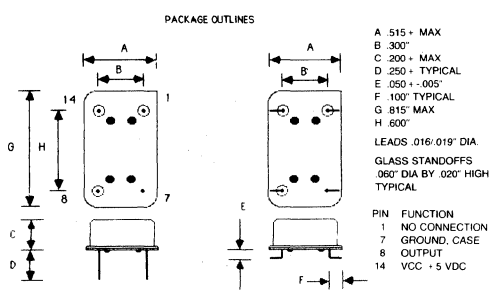

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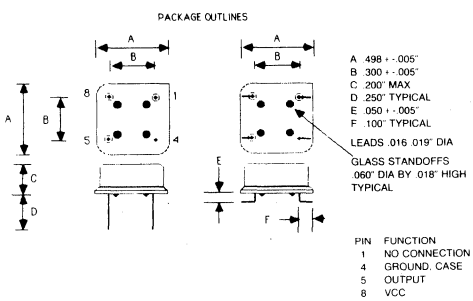
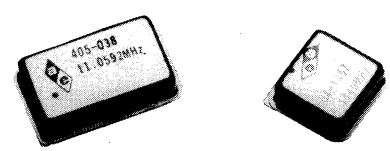
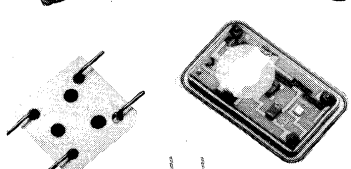
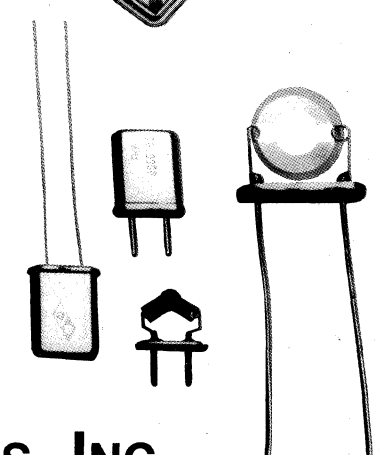
Minidip Crystal or Clock Oscillator package .500" square by .200 high thru hole or surface mount. *Send for Data Sheets.*









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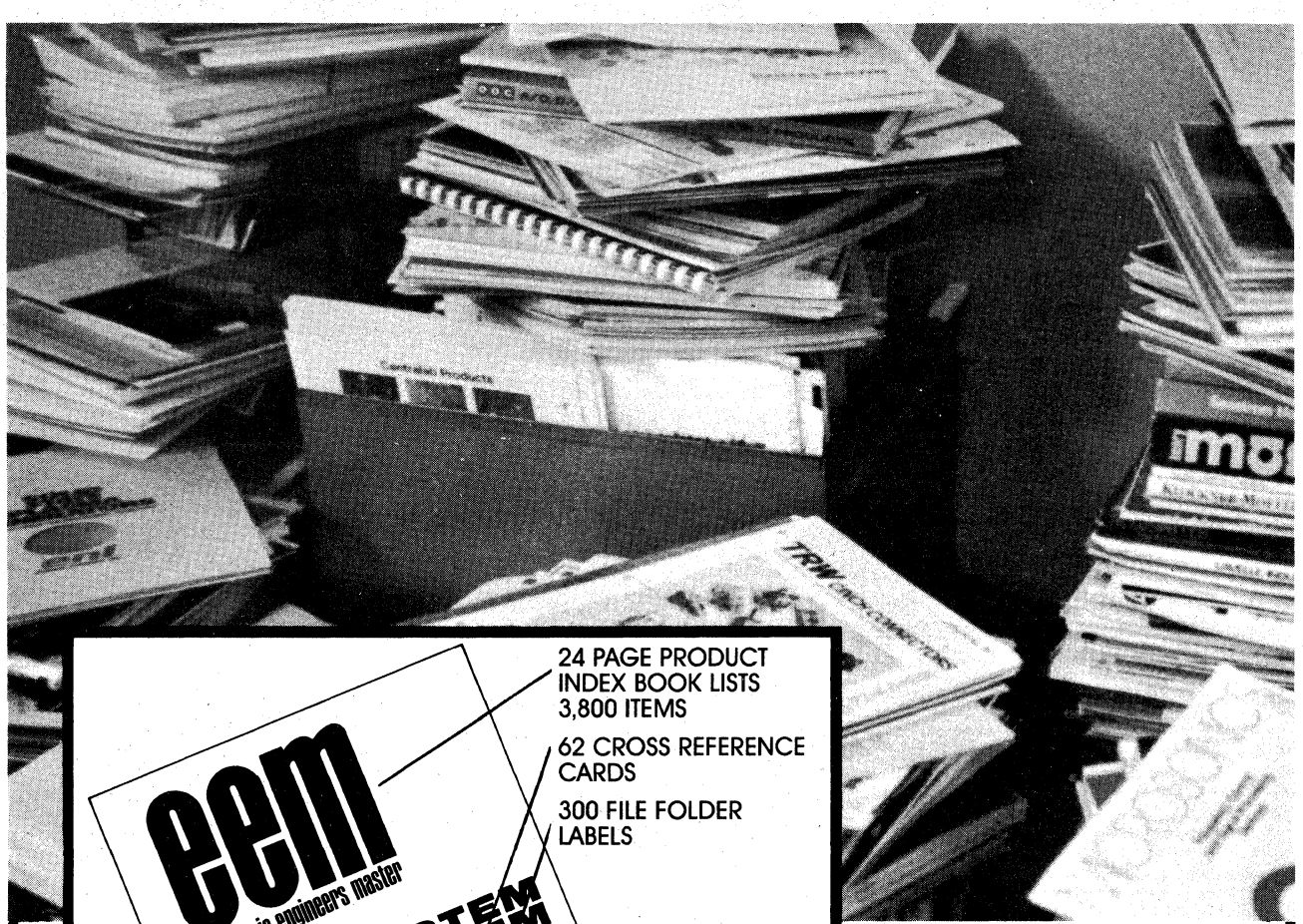

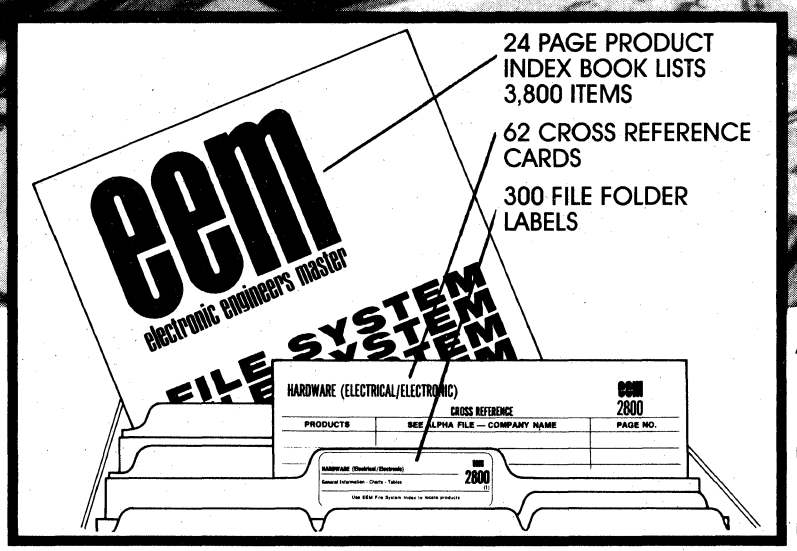

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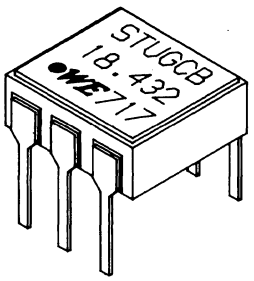
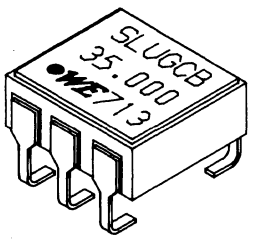
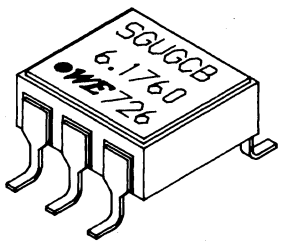
AT&T

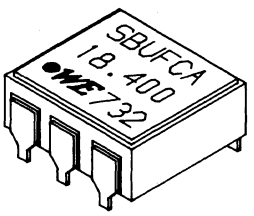
FREQUENCY CONTROL

S-Type Crystal Oscillators









Features

- Small package — 6-pin DIP
- Choice of lead configurations
- VCXO or fixed frequency
- Stability to 25 ppm
- Frequencies to 35 MHz
- TTL- or CMOS-compatible
- Tristateable
- High reliability
- Phase jitter <200 ps
- Choice of temperature ranges
- Machine insertable

Description

The S-Type Crystal Oscillators are quartz-stabilized, TTL/CMOS-compatible square wave generators. They are hermetically packaged in low-profile, ceramic 6-pin DIPs. Long-term reliability is expected to be better than 20 million hours MTBF.

Electrical Characteristics

Parameter	Symbol	Minimum	Maximum	Unit
Supply Voltage	V_{DD}	4.50	5.50	V
Supply Current (Frequency Dependent)	I_{DD}	5	25	mA
Transition Times[1]				
Rise Time	t_r	—	5	ns
Fall Time	t_f	—	5	ns
TTL Output Voltage Levels (V_{DD} = 4.5 V)				
Output Logic High[1]	V_{OH}	2.50	—	V
Output Logic Low[1]	V_{OL}	—	0.50	V
CMOS Output Voltage Levels (V_{DD} = 4.5 V)				
Output Logic High[2]	V_{OH}	0.8 × V_{DD}		V
Output Logic Low[2]	V_{OL}		0.2 × V_{DD}	V
Specs for VCXOs Only				
Center Voltage[3]	V_o	Typical 2.5 ±.5		V
Absolute Frequency Pull Range	Δf			
Control Voltage V_C = 1.0 V		−50	—	ppm from f_o[4]
Control Voltage V_C = 4.0 V		+50	—	ppm from f_o[4]
Control Voltage Bandwidth (−3 dB, V_C = 2.50 V)	—	5	—	kHz
Sensitivity at V_C = V_o	—	60	180	ppm/V

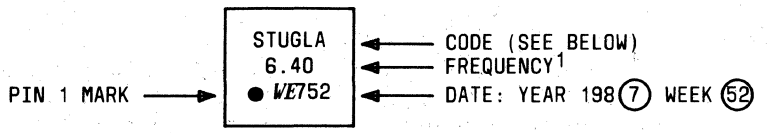
Notes:
1. Figure 1 defines these parameters. Figure 2 illustrates the simulated five-gate MTTL load and operating conditions under which these parameters are measured.
2. Figure 1 defines these parameters with a typical CMOS load of 15 pF.
3. V_o is the control voltage at which the output frequency is equal to the specified frequency f_o, at 25 ±5°C ambient temperature.
4. f_o is defined as the specified oscillator output frequency. The absolute pull range in ppm is the minimum guaranteed output frequency shift from f_o over supply voltage, temperature, and aging variations. V_o is typically near 2.5 volts, but may vary depending on temperature, aging, power supply, and load variations.

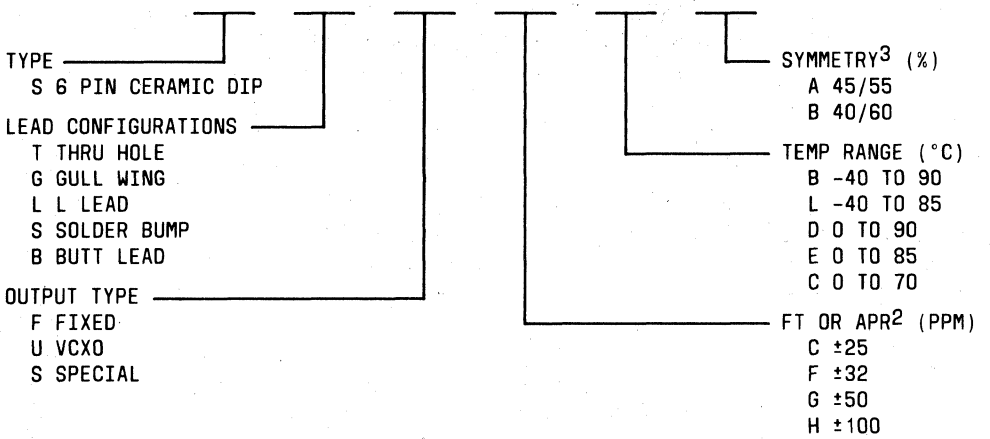
For additional information, contact your AT&T Account Manager, or call:
☐ AT&T Microelectronics, Dept. 51AL230230, 555 Union Boulevard, Allentown, PA 18103 **1-800-372-2447** (In Canada, **1-800-553-2448)**

AT&T

FREQUENCY CONTROL

S-Type Crystal Oscillators





Notes:
1. Frequency: Given in Hz, unless punctuated by " . ", then in MHz.
   Date Stamp: Year (last digit) Week Example: 701
2. Frequency tolerance (FT) or absolute pull range (APR):
   For codes S__F____, non-VCXO, the frequency tolerance is the maximum frequency deviation, in ppm, from the specified output frequency, f_o, including variations due to temperature, power supply, load, and aging.
   For codes S__U____, VCXO, the absolute pull range is the minimum guaranteed output frequency shift from f_o including variations due to temperature, power supply, load, and aging.
3. Symmetry (%) = ON TIME/PERIOD with V_S = 1.4 for TTL or V_S = 2.5 for CMOS.

Figure 1. Waveform Parameters

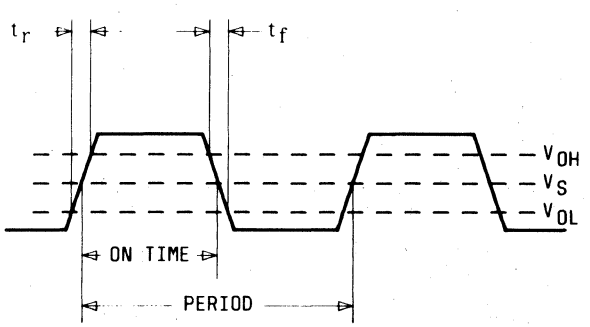
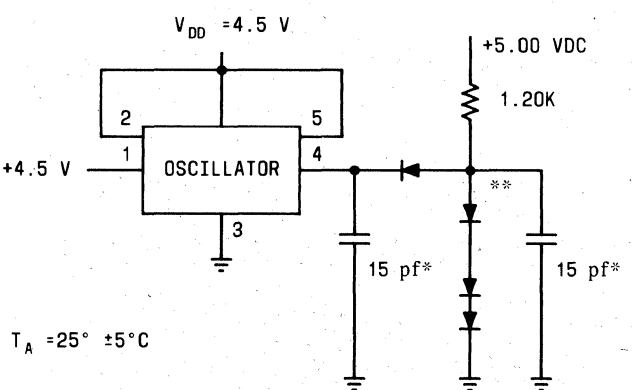


Figure 2. MTTL Load and Operating Conditions



* INCLUDES PROBE AND TEST JIG CAPACITANCE
** 458E DIODES OR 1N914 DIODES

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AT&T

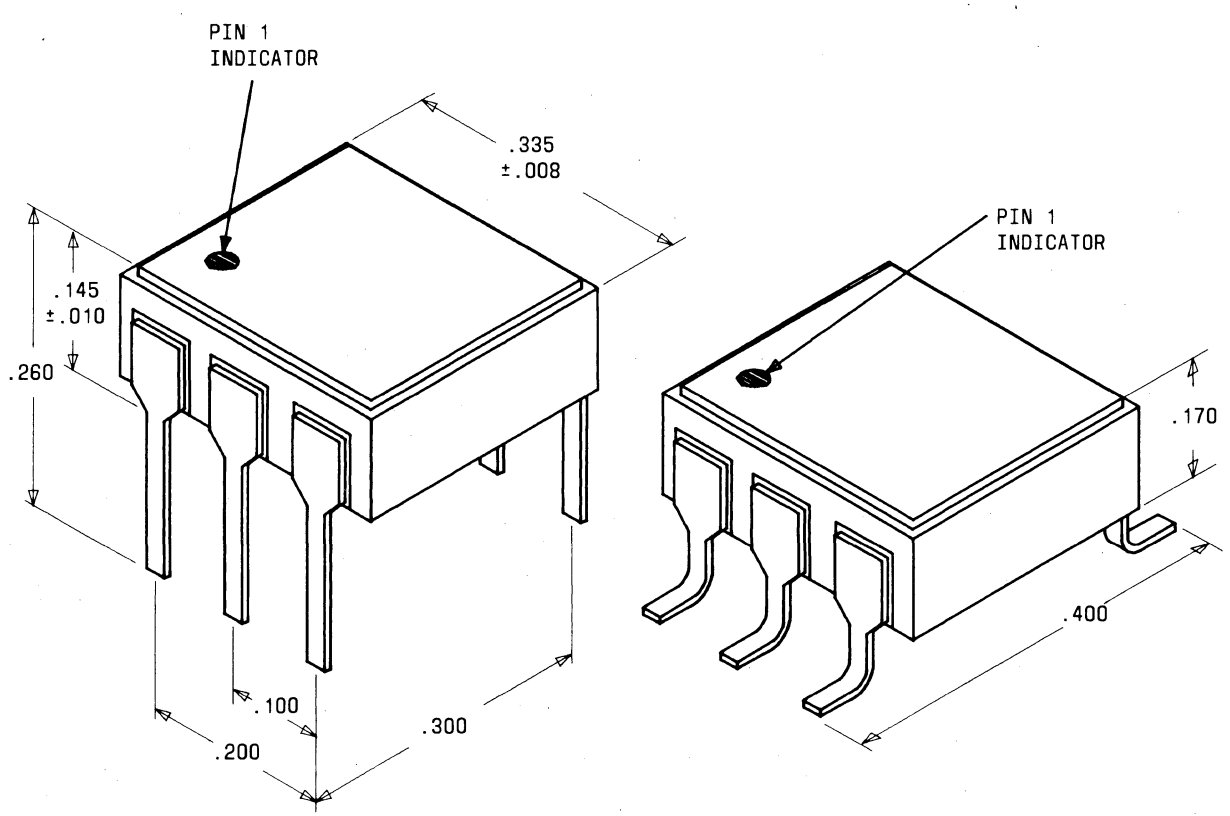
FREQUENCY CONTROL

S-Type Crystal Oscillators

Pin Description

Pin No.	Function	Description
1	VCXO Control or No Connection	Control voltage (V_C) to modulate output frequency. Fixed-frequency oscillator.
2	Tristate	TTL logic low. TTL logic high or no connection enables output frequency switches output to high impedance state and disables output signal.
3	Ground	Circuit and cover ground.
4	Output	Output waveform.
5	TTL/CMOS	TTL logic low provides waveform symmetry for CMOS. TTL logic high or no connection provides waveform symmetry for TTL. For $f_O \leq 12$ MHz, TTL symmetry only is provided and this pin should be grounded for electrical isolation.
6	V_{DD}	Supply voltage, 5 V ±10%.

Figure 3. Pin Drawing



NOTE:
OTHER PIN CONFIGURATIONS MAY BE AVAILABLE ON REQUEST.

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When time is critical, count on Austron.

The fact is, customers have been counting on Austron for time determination and frequency control instruments and systems for over 20 years. Austron's design and test capabilities have won us contracts ranging from feasibility studies through design, manufacturing, support, training and equipment updates.

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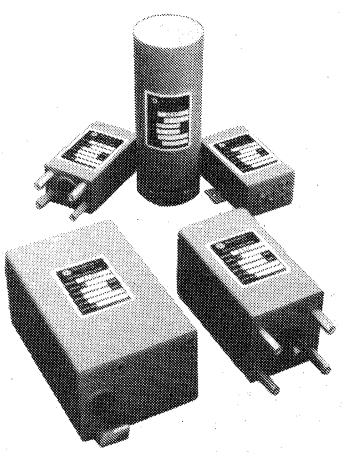
OSCILLATORS

Austron offers a complete family of high-precision, ovenized crystal oscillators.

- Up to 5×10^{-11}/24 hours aging
- Frequencies from 1 to 120 MHz
- MIL-SPEC, JANTX, Radiation hardened
- Custom engineering



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1100 SMALL LIGHTWEIGHT

Combines high stability with low power drain. Small, lightweight, plug-in package finds application whenever space is at a premium and performance cannot be compromised.
OUTPUT FREQUENCY: 5 MHz (standard)
SIZE: 1.25 x 1.75 x 3.25 inches
AGING RATE: 5, 2, or 1×10^{-9}/24 hrs. after 72 hrs. continuous operation
AMBIENT TEMPERATURE STABILITY:
$< 2.5 \times 10^{-8}$ from −20° to +65°C

1105 DIGITAL APPLICATIONS

Low profile, solid-state provides highly stable 1 MHz logic output for IC applications. Operates from a 5-volt power supply packaged with size, weight and stability performance in a configuration for the IC instrument designer.
OUTPUT FREQUENCY: 1 MHz, TTL logic
SIZE: 1.25 x 1.75 x 3.25 inches
AGING RATE: 10, 5, 2 or 1×10^{-9}/24 hrs. after 72 hrs. continuous operation
AMBIENT TEMPERATURE STABILITY:
$< 2 \times 10^{-8}$ from 0° to +55°C

1115 EXTREMELY LOW POWER

Specifically designed for undersea applications where high stability and minimal power drain are of prime importance.
OUTPUT FREQUENCY: 5 MHz
SIZE: Cylinder, 2" diameter, 5.5" length
AGING RATE:
3×10^{-9}/24 hrs. after 72 hrs. continuous operation
1×10^{-9}/24 hrs. after 30 days.
AMBIENT TEMPERATURE STABILITY:
$< 5 \times 10^{-9}$ from −2° to +25°C
(NOTE: Higher temperature models available)

1120 VERSATILITY

Compact, rugged and designed for a wide range of applications. Available in many different frequencies, input voltages and mechanical configurations.
OUTPUT FREQUENCY: 1 MHz through 10 MHz
SIZE: 2.27 x 2.14 x 4 inches
AGING RATE: 5, 2 or 1×10^{-9}/24 hrs. after 72 hrs. continuous operation
AMBIENT TEMPERATURE STABILITY:
$< 2 \times 10^{-8}$ from −20° to +65°C

1120L LOW PHASE NOISE

Features extremely low phase noise performance.
OUTPUT FREQUENCY: 5 or 10 MHz
PHASE NOISE (1 Hz BW):
135 dB, 10 Hz 155 dB, 100 Hz 160 dB, 1 kHz

1150 ULTRA HIGH STABILITY

Very rugged, high precision developed for use in satellite navigation systems. Required whenever system applications demand a precise time base or frequency reference. Ultimate aging of 5×10^{-11}/day, low phase noise and 5 MHz standard frequency.
OUTPUT FREQUENCY: 5 MHz (standard)
SIZE: 2.37 x 3.18 x 5 inches
AGING RATE:
5×10^{-10}/24 hrs. after 24 hours operation;
1×10^{-10}/24 hrs. after 30 days operation
AMBIENT TEMPERATURE STABILITY:
$< 2 \times 10^{-9}$ from −40° to +60°C
$< 5 \times 10^{-10}$ from 0° to +50° C
(Ultimate drift is typically 5×10^{-11} after 90 days operation.)

1170 HIGHER FREQUENCY

The latest addition to the Austron family, 1170 Series VHF, includes several units in the range of 35 MHz to 120 MHz. CALL FOR DETAILED INFORMATION AND AVAILABILITY.

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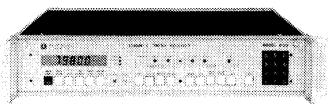
Austron manufactures a full line of instruments for precise management of time and frequency.

2100/2100F LORAN-C RECEIVER/MONITOR

Austron receivers are microprocessor-based, automatic acquisition and tracking receivers that utilize the LORAN-C groundwave to provide a traceable reference for time epoch determination, frequency management, calibration and control. These receivers provide time accuracy to one microsecond and frequency accuracy to parts in 10^{12}.



AUSTRON 2100

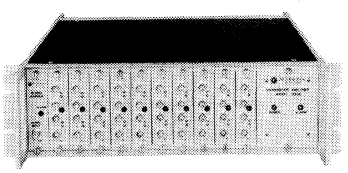
2110 DISCIPLINED FREQUENCY STANDARD

A state-of-the-art, microprocessor controlled system that automatically locks the frequency of its precision ovenized crystal oscillator to that of an externally applied reference having superior long-term stability. Uses a third-order servo technique to correct the frequency offset and aging of the internal oscillator. If the external reference is removed or fails, the 2110 will continue to apply corrections and will typically limit the frequency offset to parts in 10^{12} for several days following the reference loss.

AUSTRON 2110

1295D DISTRIBUTION AMPLIFIER

Provides the necessary noise immunity and drive capability to interface a local frequency standard to other equipment at distances up to 1000 feet. Four standard frequencies can be accommodated (10, 5, 1 and 0.1 MHz). For other frequencies consult factory. Input frequencies and number of outputs for each frequency are customer specified to provide a more cost effective system. Single frequency units can have up to 40 individual outputs, while units with 2 to 4 frequency inputs will have four or more outputs for each input.



AUSTRON 1295D

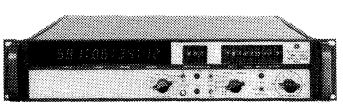
1210D SERIES PORTABLE CLOCKS

Compact, self-contained, self-powered time references providing stable time outputs at several pulse and sinusoidal frequencies with a digital time-of-day display.

AUSTRON 1210D

TIME CODE INSTRUMENTATION

A complete line of instruments from basic generators and readers to full complement tape search and control units. Available for bench, panel, rack or portable. All standard IRIG, XR3 and NASA codes are available to give these instruments the flexibility to meet any system requirement.



AUSTRON 8152

SYSTEMS

Complete systems for generation, management and distribution of precise time and/or frequency. Austron engineering has led to such sophisticated secure communication frequency control sets as AN/GSQ-174, AN/GSQ-183 and AN/GSQ-215.

Time and Frequency Receivers, Disciplined Standards, Distribution Amplifiers, Time Code Generators and Readers and all ancillary equipment along with Austron Engineering . . . put us to work, for you.

AUSTRON, INC. **P.O. BOX 14766 AUSTIN, TEXAS 78761**
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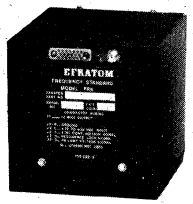
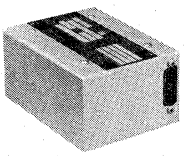
time and frequency systems

Ball Efratom Division

RUBIDIUM OSCILLATORS

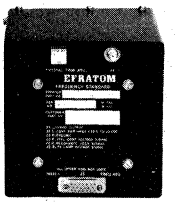


FRK

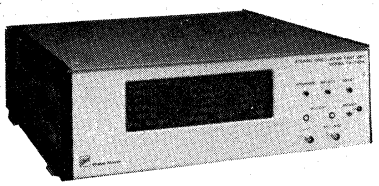


FRS-N

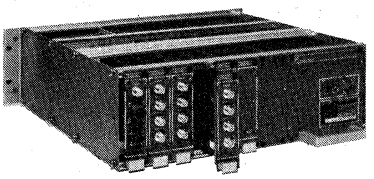
M-3100



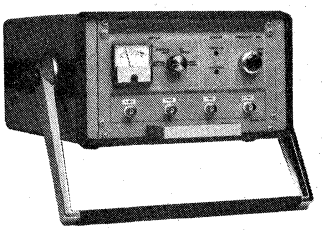
M-100



MODEL TS-105A
ATOMIC OSCILLATOR TEST SET



MODEL MFS
MODULAR FREQUENCY SYSTEM



MODEL MRT
RUBIDIUM FREQUENCY STANDARD

EFRATOM is the recognized world leader in precision time and frequency systems for military/aerospace and commercial applications. Utilizing state-of-the-art atomic oscillator technology, EFRATOM has conceived and developed a family of time and frequency references that find valuable application in radio navigation, geophysical survey positioning systems, satellite tracking and control, communication systems employing PCM and spread spectrum techniques and standard time and interval generation and transfer.

EFRATOM's Model M-3100 is the world's smallest military atomic oscillator measuring just 3.25 in x 3.25 in x 4.5 in (83 mm x 83 mm x 114 mm), yet this instrument has excellent long term stability and fast warm-up performance. Developed specifically for military use, the Model M-100 and M-3100 rubidium oscillators are radiation hardened and offer unparalled performance in the toughest of airborne and ground environments.

EFRATOM also offers a modular line of frequency components, Model MFS in a 19 inch rack, permitting the user to configure unique time and frequency systems including GPS and Omega calibration.

Complimentary to its range of precision oscillators, EFRATOM offers the Model MRT ultra-stable atomic frequency standard for laboratory and field calibration. More recently, EFRATOM introduced its Atomic Oscillator Test Set, Model TS-105A, for frequency stability (Allan Variance) measurements.

BALL's scientists, in conjunction with NBS, have developed a Compact Passive Hydrogen Maser for commercial production (not pictured above, but specified below).

MODEL	FRS-N	FRK-L	FRK-H	MRT-L	MRT-H	M-100	M-3100	CPHM
Output Frequency	10 MHz	10 MHz		2 ea 10; 5; 1; 0.1 MHz		10 MHz	10 MHz	5 MHz
Long Term Drift/mo	$5x10^{-11}$	$4x10^{-11}$	$1x10^{-11}$	$4x10^{-11}$	$1x10^{-11}$	$6x10^{-11}$/Opt. $1x10^{-11}$	$3x10^{-11}$	$<1x10^{-15}$/day
Short Term (100s)	$5x10^{-12}$	$3x10^{-12}$	$1x10^{-12}$	$3x10^{-12}$	$1x10^{-12}$	$3x10^{-12}$	$4x10^{-12}$	$2x10^{-13}$
Phase Noise (1 Hz BW) SSB	−110 db (100 Hz)	>120 dB (100 Hz) >145 dB (1 KHz) from carrier				>120 dB @ 100 Hz >135 dB @ 1 KHz	>140 dB @ 100 Hz >150 dB @ 1 KHz	−113 dB (1 Hz) −155 dB (>100 Hz)
		Low Noise Option 155 dB (100 Hz)						
Warm-Up	4 min/$1x10^{-9}$	<10 minutes for $2x10^{-10}$				*<10 min to $2x10^{-10}$	<2.5 min to $5x10^{-10}$	~24 Hrs
Operations Temperature	−55°C to +65°C	−25°C to +65°C Base Plate		−10°C to +50°C Ambient		−55°C to +55°C Ambient (+68°C Base Plate)	−55°C to +71°C Ambient (+80°C Base Plate)	0°C to +50°C
Power at 25°C	10W	22 VDC to 32 VDC/13W		110/220 VAC/50W		22.5 to 32 VDC/18W	22 to 32 VDC/15W	<70W
Dimensions	2x3x4 inches	~4x4x4.5 inches		6x9x16 inches		~4x4x4.8 inches	3.25x3.25x4.5 in.	19x10.5x24 in.
Weight	1.2 lbs.	2.9 lbs		27 lbs		4 lbs	<2.3 lbs	~70 lbs

*5 min warm-up available

EFRATOM

USA/3 Parker, Irvine, CA 92718/Telephone 714/770-5000/Telex 68-5635
W. Germany/AM Perlacher Frost-186/D-8000 Muenchen 90/Phone (089) 648059/Telex 529701
Europe/Shaftesbury House, 20/22 Tylney Rd. Bromley, Kent, BRI 2RL, England/Tele: 44-1-290-1190/Telex: 896330

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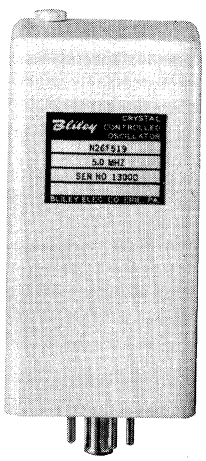
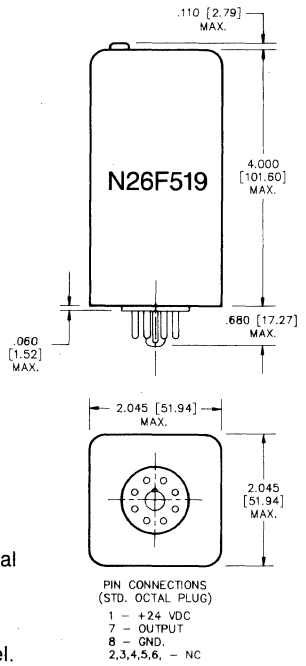
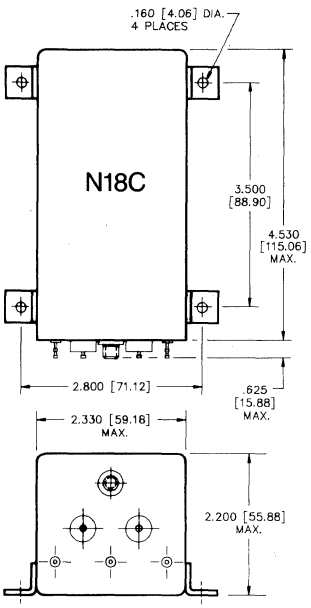
CRYSTAL OSCILLATORS

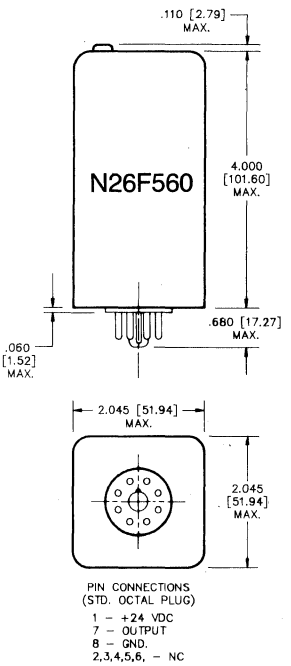
Oven Controlled (OCXO)



Bliley Oven Controlled Crystal Oscillators provide excellent frequency stability and time base reference, with a compatible phase noise level.







	N26F519	N18C	N26F560
FREQUENCY:	5 MHz standard; 4 MHz to 10 MHz available	5 MHz or 10 MHz	10 MHz standard; 5 MHz to 10 MHz available
FREQUENCY STABILITY:	$\pm 5 \times 10^{-9}$ 0°C to +50°C standard; $\pm 1 \times 10^{-8}$ –20°C to +70°C optional	$\pm 1 \times 10^{-9}$ 0°C to +55°C	$\pm 5 \times 10^{-9}$ 0°C to +50°C standard; $\pm 1 \times 10^{-8}$ –20°C to +60°C optional
AGING:	3×10^{-9}/day standard; 1×10^{-9}/day optional	1×10^{-10}/day after 30 days	1×10^{-9}/day
OUTPUT:	Sine Wave 0 dBm minimum with 50 ohm load standard; Sine Wave up to +7 dBm with 50 ohm load optional TTL or HCMOS optional	Sine Wave +7 dBm with 50 ohm load	Sine Wave 0 dBm minimum with 50 ohm load standard; Sine Wave up to +7 dBm with 50 ohm load optional TTL or HCMOS optional
FREQUENCY ADJUSTMENT:	Within 1×10^{-8} by mechanical adjustment standard; electrical tuning optional	$\pm 5 \times 10^{-7}$ by voltage control in the range 0 to 10 Vdc	Mechanical adjustment standard; electrical tuning optional
SINGLE SIDEBAND PHASE NOISE:	–135 dB/Hz at 10 KHz; –150 dB/Hz noise floor	–135 dB/Hz at 10 KHz; –140 dB/Hz noise floor	–150 dB/Hz at 10 KHz; –155 dB/Hz noise floor
POWER SUPPLY:	+24 Vdc ±10% standard Fixed value between +12 Vdc and +30 Vdc optional 6 watt maximum at turn on; 3 watt typical at 25°C	+24 Vdc 6 watt maximum at turn on	+24 Vdc ±10% standard Fixed value between +12 Vdc and +30 Vdc optional 6 watt maximum at turn on; 3 watt typical at 25°C
MOUNTING:	Octal plug standard; other connector/mounts available	Four brackets	Octal plug standard; other configurations optional
SIZE: (Maximum Dimensions)	2.045" x 2.045" x 4.000"	4.530" x 2.330" x 2.200"	2.045" x 2.045" x 4.000"

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CRYSTAL OSCILLATORS

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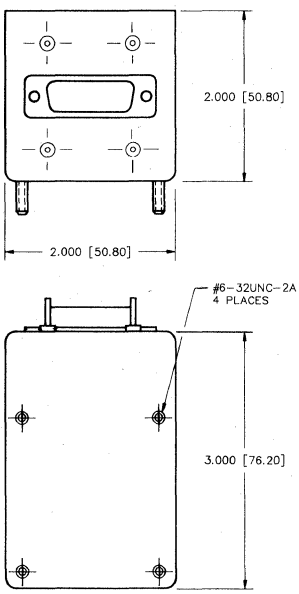
BLILEY TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS are designed to integrate the characteristics of high quality coldweld sealed crystals with temperature compensated circuitry to achieve improved frequency stability without temperature control and low aging to assure long term reliability.

D9A



Digitally Compensated (DCXO)

Frequency: 5 MHz and 10 MHz standard; 10 KHz to 20 MHz optional

Frequency Stability: ±5 x 10⁻⁸ 0°C to +60°C

Aging: 3 x 10⁻⁹/day standard; 1 x 10⁻⁹/day optional

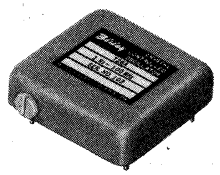
Output: High Speed CMOS standard; Sine Wave and TTL optional

Frequency Adjustment: ±3 x 10⁻⁶ minimum by multi-turn trimmer

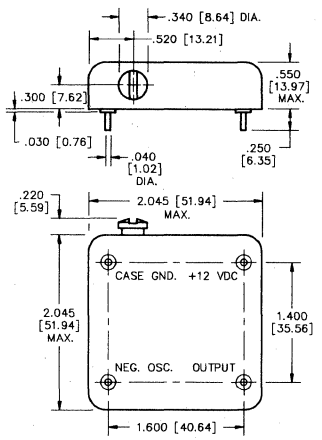
Power Supply: +15 Vdc ±10%, 30 mA typical Fixed voltage between +12 Vdc and +24 Vdc optional

Mounting: Four #6-32 Studs

Size: 3″ x 2″ x 2″



T26A



Temperature Compensated (TCXO)

STOCK OSCILLATORS - FAST DELIVERY					
BLILEY TYPE NO.	FREQ. (MHz)	FREQ. STABILITY	SUPPLY (DC) VOLTS	REG.	mA
T26A411	1	±1 x 10⁻⁶ OVER 0°C to +50°C	+ 5	± 1%	35
T26A412			+12	±10%	30
T26A413/440*	5/10*		+ 5	± 1%	25
T26A414/441*			+12	±10%	35

TTL LOGIC OUTPUT: "0": +0.4V MAX., "1": +2.4V MIN.,
Tr & Tf: 12 NS MAX., SYMMETRY: 60/40, LOAD: 10 TTL GATES.
FREQ. ADJUST. RANGE: ±5 x 10⁻⁶ MIN. AGING RATE: 1 x 10⁻⁶/YR.

CUSTOM OSCILLATORS	BLILEY TYPE T26A SERIES	
FREQUENCY RANGE/ OUTPUT WAVEFORM	FREQUENCY STABILITY VS TEMPERATURE RANGE	
1 MHz - 20 MHz SINE WAVE OR 50 kHz - 20 MHz TTL LOGIC	±1 x 10⁻⁶	0°C to +60°C
	±5 x 10⁻⁷	
	±1 x 10⁻⁶	-20°C to +70°C
	±5 x 10⁻⁷	
	±1 x 10⁻⁶	-40°C to +70°C
	±2 x 10⁻⁶	-55°C to +70°C
	±1 x 10⁻⁷	+20°C to +40°C

SUPPLY REQUIREMENTS:
+12 VDC ±10% REG. AGING RATE: 1 x 10⁻⁶/YR.
Options available:
- CMOS logic output from 1 Hz - 20 MHz
- Sine Wave & TTL logic output from 20 MHz - 100 MHz
- Other Supply Voltages

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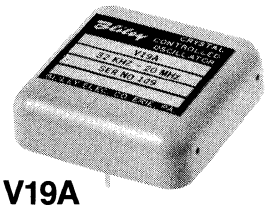
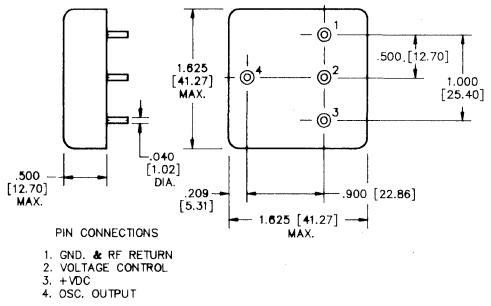
CRYSTAL OSCILLATORS

Voltage Controlled (VCXO)

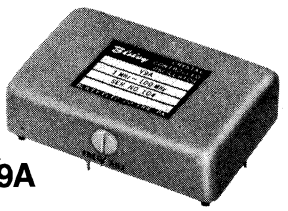
BLILEY VOLTAGE CONTROLLED CRYSTAL OSCILLATORS combine inherent crystal stability and voltage controlled frequency deviation in a single solid state device.



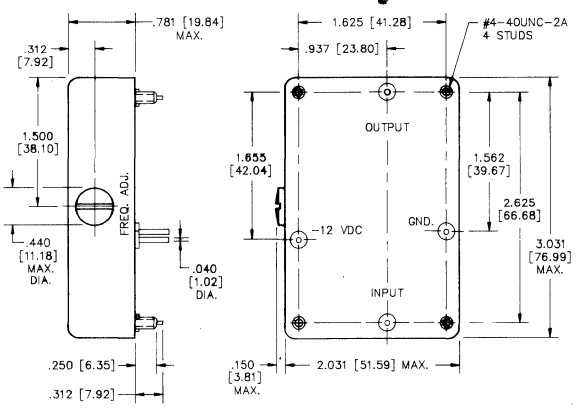
V19A



Frequency Range:	32 KHz to 20 MHz
Frequency Stability:	±.0015%
Operating Temperature Range:	0°C to +70°C
Frequency Deviation:	±.004% minimum
Linearity:	±20% maximum
Modulation Voltage:	+1V to +4V
Transfer Function:	positive
Output:	TTL compatible
Supply Voltage:	+5 Vdc ±5%
Mounting:	PC board mount using 4 terminals
Size:	1.625″ x 1.625″ x .500″ maximum
Options:	High Speed CMOS Output



V9A



FREQUENCY DEVIATION	FREQUENCY STABILITY	TEMPERATURE RANGE
±.01%	±.001% ±.002%	0°C to +50°C −20°C to +70°C
±.05%	±.002% ±.005%	0°C to +50°C −20°C to +70°C
±.1%	±.004% ±.008%	0°C to +50°C −20°C to +70°C
±.2%	±.005% ±.01%	0°C to +50°C −20°C to +70°C

- Center frequency range from 1 to 100 MHz.
- Standard design parameters are based on operation with −12 Vdc; 25 mA supply. Other voltages may be specified as a custom option.
- Standard output is Sine Wave, typical 1V rms into 1000 ohms or .25V rms into 50 ohms.
- Mechanical trim is provided for center frequency adjustment.
- Typical modulation voltage is ±5V with a modulating input impedance of 10K ohms and modulation rate from DC to 20 kHz.
- Linearity: ±1% to ±5% dependent upon frequency deviation.

Temperature Compensated Voltage Controlled (TCVCXO)

T9E

Frequency Range:
4 MHz to 20 MHz
Frequency Stability:
$\pm 1 \times 10^{-6}$ at any control voltage
Operating Temperature Range:
0°C to +60°C
Electrical Frequency Control:
a) Control Voltage:
0 to +10V
b) Range:
±10 ppm to ±15 ppm
c) Input Impedance:
2K ohms minimum

Output:
TTL
Aging:
1×10^{-6}/year typical
Supply Voltages:
+5 Vdc ±5% **and**
+12 Vdc ±5% required
Case Size:
2.00″ x 3.00″ x 0.75″ nominal
Options:
- High Speed CMOS (HCMOS)
- Sine Wave output & higher frequencies with a larger case size
- Other supply voltages
- Other case sizes

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CRYSTAL OSCILLATORS

CRYSTAL OSCILLATORS

Bliley

General Purpose-Clock Oscillators

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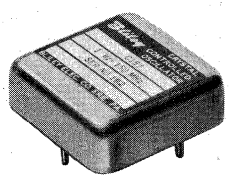
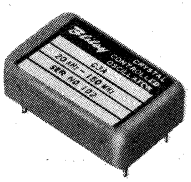
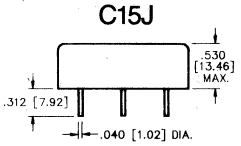
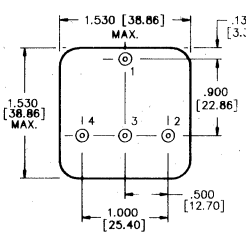
DESIGNED WITH PRIMARY EMPHASIS ON QUALITY — BACKED UP BY TOP TECHNOLOGY





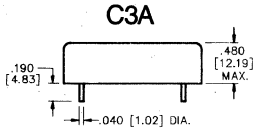
C15J

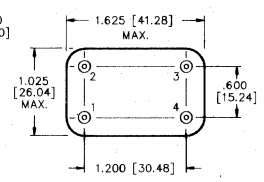




1 – OUTPUT
2 – +5 VDC
3 – NEG. OSC. & CASE GND.
4 – N.C. (OPT. 5 TO 15 VDC)

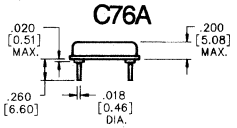
C3A

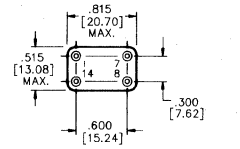




1 – NEG. OSC. & RF GND.
2 – N.C.
3 – +5 VDC
4 – OUTPUT

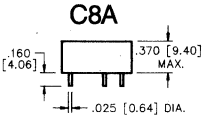
C76A

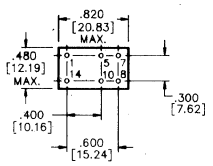




1 – N.C.
7 – GROUND
8 – OUTPUT
14 – +5 VDC
(14 PIN DIP COMPATIBLE)

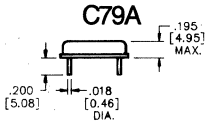
C8A

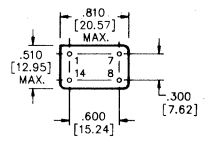




1,5,10 – N.C.
7 – GROUND
8 – OUTPUT
14 – +5 VDC
(14 PIN DIP COMPATIBLE)

C79A





1 – N.C.
7 – GROUND
8 – OUTPUT
14 – +5 VDC
(14 PIN DIP COMPATIBLE)

BLILEY TYPE	FREQUENCY RANGE	FREQ. TOL. (%) vs TEMP. RANGE (°C) (INCLUDES CALIBRATION AT +25°C)				OUTPUT
		0 to +50	0 to +70	−20 to +70	−40 to +70	
C15J	1 Hz — 2 MHz	±.001	±.0015	±.002	±.0025	TTL LOGIC
	50 kHz — 70 MHz	±.001	±.0012	±.0015	±.002	
	3 MHz — 150 MHz					SINE WAVE
C3A	20 kHz — 25 MHz	±.001	±.0012	±.0015	±.002	TTL LOGIC
	25 MHz — 50 MHz	±.001	±.0012	±.002	—	
	3 MHz — 100 MHz	±.001	±.0012	±.0015	±.002	SINE WAVE
C76A	1 MHz — 20 MHz	—	±.01	—	—	TTL LOGIC
C8A	4 MHz — 60 MHz	±.004	±.005	±.01	—	
C79A*	1 MHz — 20 MHz	—	±.01	—	—	

*(CASE DESIGN INCORPORATES AN ALL METAL RESISTANCE – WELD HERMETIC SEAL ENCLOSURE.)

GENERAL SPECIFICATIONS

SUPPLY: +5 VDC
OUTPUT: TTL LOGIC "1" +2.4 V MIN., LOGIC "0" +0.4 V MAX.
SYMMETRY: 60/40 DUTY CYCLE WORST CASE
LOAD: 10 TTL GATES
SINE WAVE: 0.7 VRMS (1000 Ω LOAD), 800 kHz – 25 MHz
0.2 VRMS (50 Ω LOAD), 1 – 150 MHz
CUSTOM OPTIONS AVAILABLE: CMOS LOGIC, COMPLEMENTARY OUTPUTS, DUAL-FREQUENCY OUTPUTS
FREQUENCY ADJUSTMENT: ELECTRICAL OR MECHANICAL AVAILABLE ON C15J AS A CUSTOM OPTION
HERMETIC ENCLOSURES: C15J, C3A AND C79A

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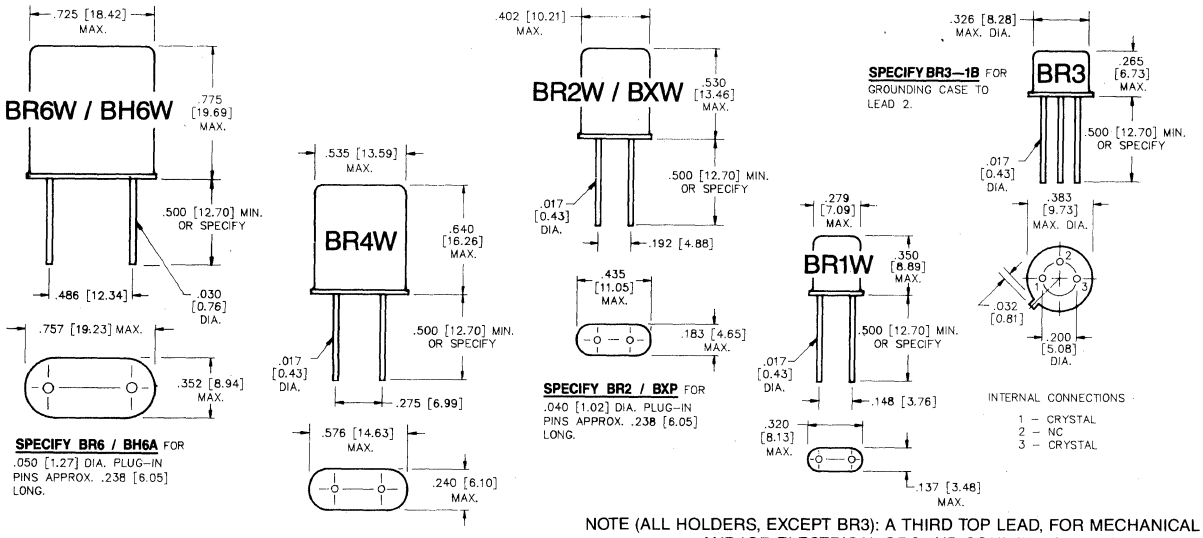
General Purpose and Mil-Spec.

Holder options include Mil-Spec. resistance-weld seal (BR Series) or solder seal (BH & BX Series).



NOTE (ALL HOLDERS, EXCEPT BR3): A THIRD TOP LEAD, FOR MECHANICAL AND/OR ELECTRICAL GROUND CONNECTION, IS AVAILABLE.

BLILEY TYPE	FREQUENCY RANGE (MHz)	FREQ. TOL. (%) vs TEMP. RANGE (°C)				MAX. SERIES RES. (Ω)	CUT	AGING (PPM)		MAX. DRIVE (mW)
		0 to +50	0 to +75	−40 to +70	−55 to +105			1ST MO.	NEXT 12 MOS.	
BR6/BH6	1-2	±.002	±.0025	±.003	±.005	400	A_f	3	3	5
BR6/BH6 & BR4W	2-3					200				
	3-4					100				
BR6/BH6 BR4W & BR2/BX	4-7					60				
	7-10					30				
	10-20					25				
	20-60					40	A_3			2
BR1W	10-30					25	A_f			5
	30-90					40	A_3			
BR2/BX & BR1W	60-87					60	A_5			2
	87-100					75				
	100-150					90	A_7			
BR3	7-9.9	±.0015	±.002	±.0025	±.003	40	A_f	3	3	0.5
	10-25					25				
	25-75					40	A_3			
	75-125					60	A_5			
	125-150					100	A_7			

ALL FREQUENCY TOLERANCES INCLUDE INITIAL CALIBRATION AT +25°C.
AGING VALUES ARE BASED UPON CONTINUOUS OPERATION AT +85°C AND DRIVE LEVELS AS INDICATED.

BLILEY TYPE	BR6W	BR6	BH6W	BH6A	BR4W	BR2W	BR2	BXW	BXP	BR1W	BR3
MIL-H-10056 HOLDER DESIGNATION	HC-51/U	HC-48/U	HC-33/U	HC-6/U	HC-46/U SIZE	HC-49/U	HC-50/U	HC-18/U	HC-25/U	HC-52/U	HC-35/U SIZE
VIBRATION	10 G FROM 10 TO 2000 Hz										
SHOCK	100 G FOR 11 ms										

INTERNALLY RUGGEDIZED DESIGNS ARE AVAILABLE FOR HIGHER LEVEL SHOCK AND VIBRATION.

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CRYSTALS

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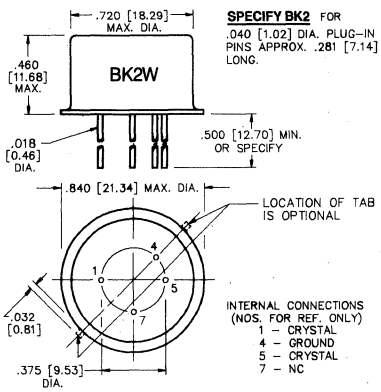
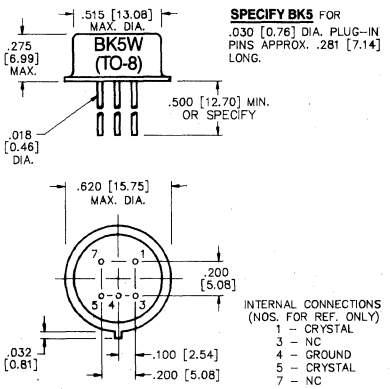
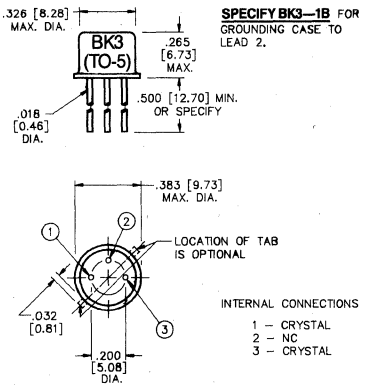
Coldweld Vacuum Sealed Transistor Case Styles

Unmatched performance during extreme shock and vibration combined with superior aging and high reliability have firmly established this style as first choice in advanced military and space systems. Ease of mounting and moderate cost also attract quality commercial usage.







BLILEY TYPE	FREQUENCY RANGE (MHz)	FREQ. TOL. (%) vs TEMP. RANGE (°C) (INCLUDES CALIBRATION AT +25°C)				MAX. SERIES RES. (Ω)	CRYSTAL CUT-AT (MODE)	TYPICAL DRIVE LEVEL (mW)
		0 to +50	0 to +70	−40 to +70	−55 to +105			
BK2W	1 – 1.9	±.0015	±.002	±.0025	±.003	150	FUNDAMENTAL	1.0
	2 – 2.9					40		
	3 – 6.0					25		
BK5W	2 – 2.9					250		
	3 – 3.9					120		
	4 – 4.9					60		
	5 – 5.9					30		
	6 – 7.9					22		
	8 – 15					15		
BK3	7 – 9.9					40		0.5
	10 – 25					25		
	25 – 75					40	3RD	
	75 – 125					60	5TH	
	125 – 150					100	7TH	

BLILEY TYPE	BK2W	BK5W	BK3-1B
MIL-H-10056 HOLDER DESIGNATION	HC-40/U	HC-37/U	HC-35/U
AGING GUIDELINES: 1ST MONTH	1 PPM	1 PPM	1 PPM
FOLLOWING YEAR	1 PPM	1.5 PPM	2 PPM
VIBRATION	20G FROM 10-2000 Hz		
SHOCK	150G FOR 7 ms		

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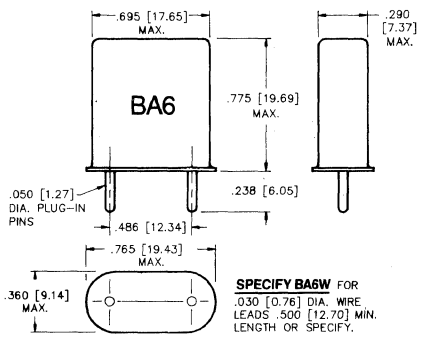
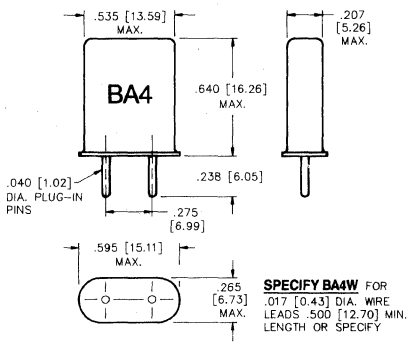
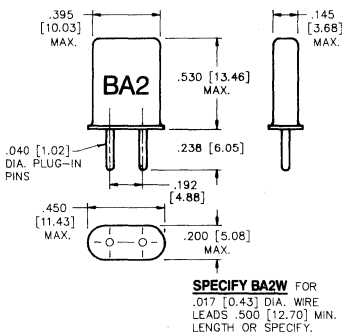
Coldweld Vacuum Sealed

Although similar in appearance and configuration to a commonly used solder-sealed counterpart, Bliley's **BA** series features unexcelled process cleanliness and flux-free sealing in vacuum to minimize contamination. Improved aging and reliability result at a modest cost premium. The data following is suggested for general guidance. Superior performance in temperature stability and aging can be provided if required.







BLILEY TYPE	FREQUENCY RANGE (MHz)	FREQ. TOL. (%) vs TEMP. RANGE (°C) (INCLUDES CALIBRATION AT +25°C)				MAX. SERIES RES. (Ω)	CRYSTAL CUT	AGING (PPM)		MAX. DRIVE LEVEL (mW)
		0 to +50	0 to +75	−40 to +70	−55 to +105			1ST MONTH	NEXT 12 MONTHS	
BA6	1-2	±.0015	±.002	±.0025	±.004	350	A_f	2	2	5
BA6 & BA4	2-3					175				
	3-4					75				
BA6, BA4, & BA2	4-7					50				
	7-10					30				
	10-20					25				
	20-60					40	A_3			2
BA2	60-87					50	A_5			1
	87-100					60				
	100-150					90	A_7			

AGING VALUES ARE BASED UPON CONTINUOUS OPERATION AT +85°C AND DRIVE LEVELS AS INDICATED.
A_f, A_3, A_5, A_7 DENOTE AT CUT-FUNDAMENTAL MODE, 3RD OVERTONE MODE, ETC.

BLILEY TYPE	BA6	BA6W	BA4	BA4W	BA2	BA2W
MIL-H-10056 HOLDER DESIGNATION	HC-36/U	HC-47/U	HC-46/U	–	HC-42/U	HC-43/U
VIBRATION	10G FROM 10–2000 Hz					
SHOCK	100G FOR 11 ms					

INTERNALLY RUGGEDIZED DESIGNS ARE AVAILABLE FOR HIGHER LEVEL SHOCK AND VIBRATION.

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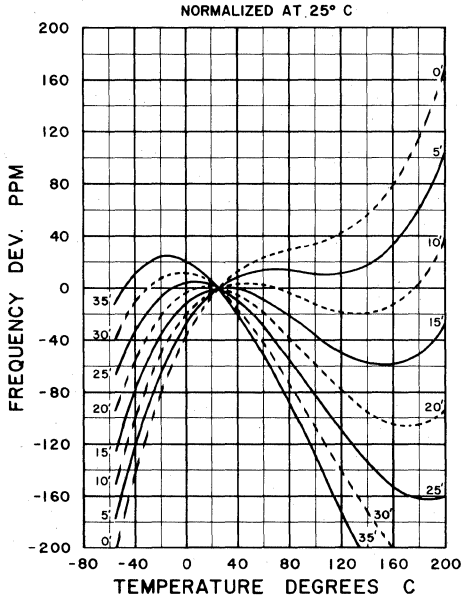
Stress Compensated Double Angle Rotation

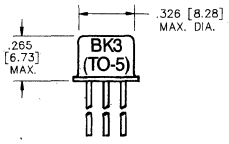
- Improved Frequency Stability During Acceleration and Vibration
- High Drive Capability — Several Times Typical AT Cut Levels
- Low Phase Noise
- Low Aging Rate
- Fast Warm-up

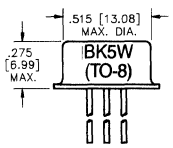
BLILEY TYPE	FREQUENCY RANGE (MHz)	MODE
BK5/BK5W	5–15	FUND.
BK3/BK3-1B	15–33	
BA6/BA6W	5–45	3RD
BK5/BK5W	33–45	
BK3/BK3-1B	45–100	
	75–140	5TH

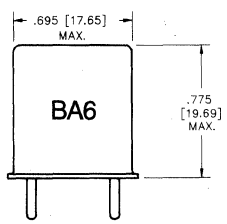
SC CUT

GENERALIZED TEMP./FREQ. CHARACTERISTICS
NORMALIZED AT 25° C









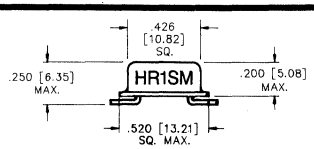
SEE PAGES 8 & 9 FOR COMPLETE DIMENSIONS

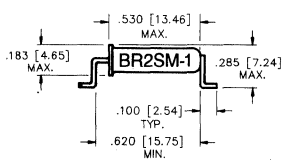
TEMPERATURE RANGE (°C)	FREQUENCY TOL.* (%)
0 to +50	±.0018
−10 to +60	±.0023
−40 to +85	±.0048
−55 to +85	±.006
−55 to +105	±.007
−55 to +125	±.0075
−55 to +200	±.01
+20 to +85	±.0023
+60 to +90	±.001

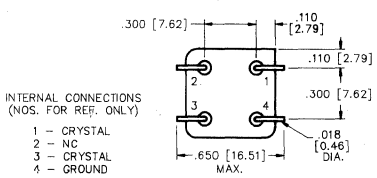
*INCLUDES STABILITY OVER TEMP. RANGE & CALIBRATION TOLERANCE.

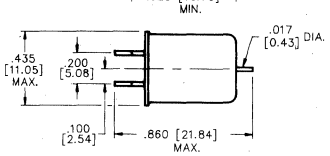
Surface Mount Designs

Bliley SM Style Crystals combine our traditional performance and reliability with the design advantages of surface mounting. Available in "gull wing" lead configuration. Holder style is resistance-weld seal, a volume production process which reduces cost and minimizes contamination.









BLILEY TYPE	FREQUENCY RANGE (MHz)	FREQ. TOL. (%) vs TEMP. RANGE (°C) 0 to +50	0 to +75	−40 to +75	−55 to +105	MAX. SERIES RES. (Ω)	CRYSTAL CUT	AGING (PPM) 1ST MONTH	NEXT 12 MONTHS	MAX. DRIVE LEVEL (mW)
HR1SM	4 - 7	±.002	±.0025	±.003	±.005	60	A_f	3	3	5
	7 - 10					30				
	10 - 20					25				
BR2SM-1	20 - 60					40	A_3			2
	60 - 87					60	A_5			
	87 - 100					75				
	100 - 150					90	A_7			

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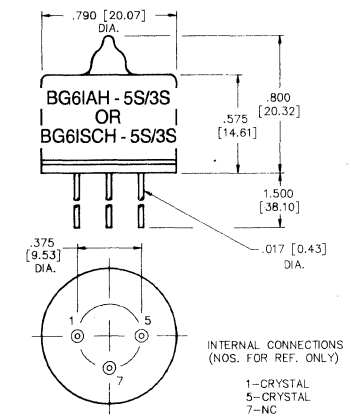
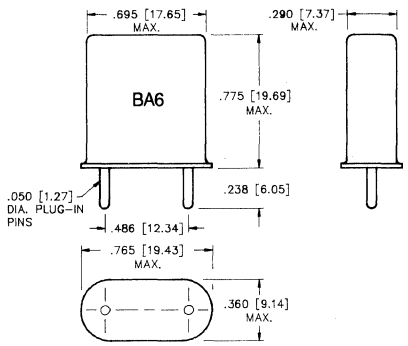
Vacuum Sealed
Ultra High Stability

Designed for optimum performance with temperature control

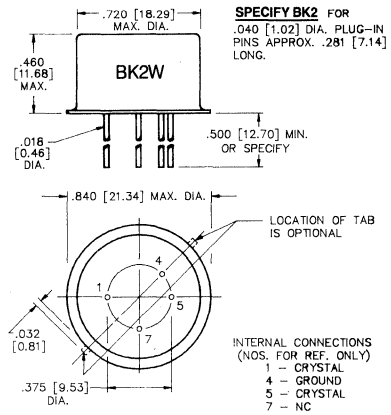
This outstanding group incorporates the technology and craftsmanship that has made Bliley famous for quality without compromise. Exceptionally low aging and high Q characteristics provide precision reference for frequency standards, synthesizers and ultra stable system clocks.



BG6IAH - 5S/3S OR BG6ISCH - 5S/3S
(GLASS ENCLOSURES)



BA6/BA6W



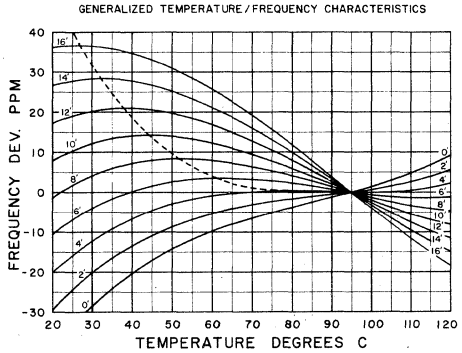
BK2/BK2W

(COLDWELD SEALED METAL ENCLOSURES)

	5TH OVERTONE (AT CUT)	3RD OVERTONE (AT CUT)					
BLILEY TYPE	BG61AH-5S	BG61AH-3S	BA6/BA6W		BK2/BK2W		
FREQ.MHz	5	3.8 – 6.0	3.8 – 7.9	8 – 12	3.8 – 6.0	6.1 – 10.9	11 – 15
AVERAGE Q (10^6)	2.5	1.5		0.6	1.0	0.6	0.4
MAX SERIES RESISTANCE (Ω)	140	50		35	50	40	35
FREQ. TOL. AT TURNING POINT	± 1 PPM	± 4 PPM	± 5 PPM				
TURNING POINT	AVAILABLE AT ANY TEMPERATURE (±5°C) FROM +45°C TO +90°C (TOLERANCE OF ±3°C OR ±4°C AVAILABLE UPON REQUEST)						
TEMPERATURE COEFFICIENT	$< 1 \times 10^{-7}$/°C FOR 1° EACH SIDE OF TURNING POINT						
AGING AT +75°C	5×10^{-10}/DAY AFTER 3 DAYS 7×10^{-10}/WEEK AFTER 1 MONTH	2×10^{-9}/DAY AFTER 3 DAYS 2×10^{-9}/WEEK AFTER 1 MONTH	2×10^{-8}/WEEK AFTER 1 WEEK				
DRIVE LEVEL	70μA ± 20%	15μW MAX.	25μW MAX.				
FREQ. CHANGE 50G SHOCK OR 10G VIBRATION	$< \pm 1 \times 10^{-8}$	$< \pm 2 \times 10^{-8}$					
	10 – 200 Hz	10 – 1500 Hz	10 – 2000 Hz				

SC CUT

GENERALIZED TEMPERATURE / FREQUENCY CHARACTERISTICS



	STRESS COMPENSATED – DOUBLE ANGLE ROTATION				
	5TH OVERTONE (SC CUT)	3RD OVERTONE (SC CUT)			
BLILEY TYPE	BG61SCH-5S	BG61SCH-3S		BA6/BA6W AND BK2/BK2W	
FREQ. (MHz)	5	5	10	5	10
AVERAGE Q ($\times 10^6$)	2.5	2.2	1.2	2.0	1.0
MAX SERIES RESISTANCE (Ω)	350	110	65	120	70
FREQ.TOL.(PPM) AT TURNING POINT	±0.5	±1.5	±1.5	±1.5	±1.5
TURNING POINT	WITHIN ±7.5°C OF ANY TEMP. IN THE RANGE OF +50°C TO +75°C			WITHIN ±7.5°C OF ANY TEMP. IN THE RANGE OF +30°C TO +75°C	
AGING AT +75°C	7×10^{-10}/WEEK AFTER 1 MO.	2×10^{-9}/WEEK AFTER 1 MO.		2×10^{-8}/WEEK AFTER 1 WEEK	

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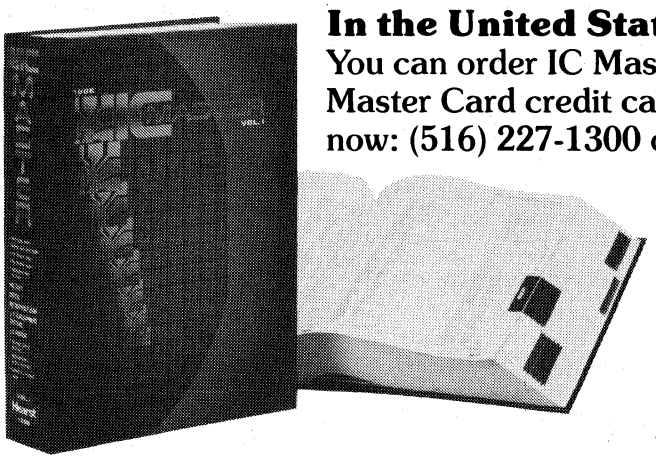

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PRECISION AT CUT CRYSTALS

Since 1968 Colorado Crystal Corporation has been dedicated to the design of Precision Quartz Crystals. One of our fundamental beliefs is that customer confidence is one of our most important assets. To maintain this confidence each design developed and order processed is considered vital to the continual success of the compnay. Our staff would be pleased to work with you on your current or future frequency control applications where precision, quality, and confidence are required.

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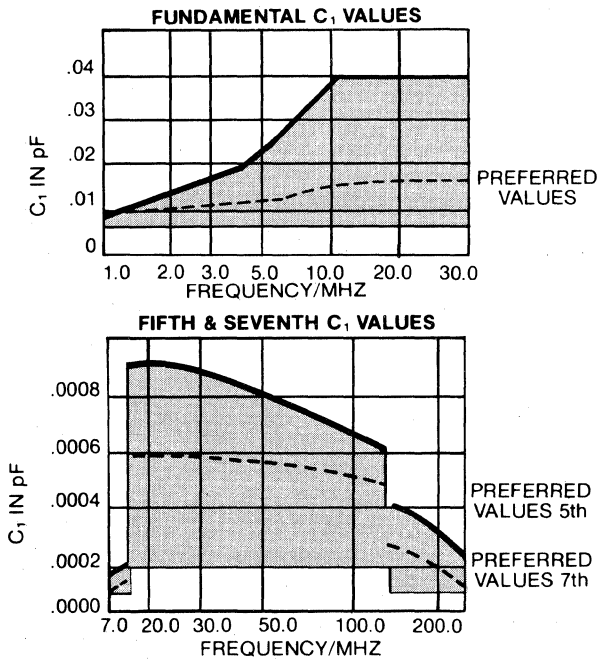
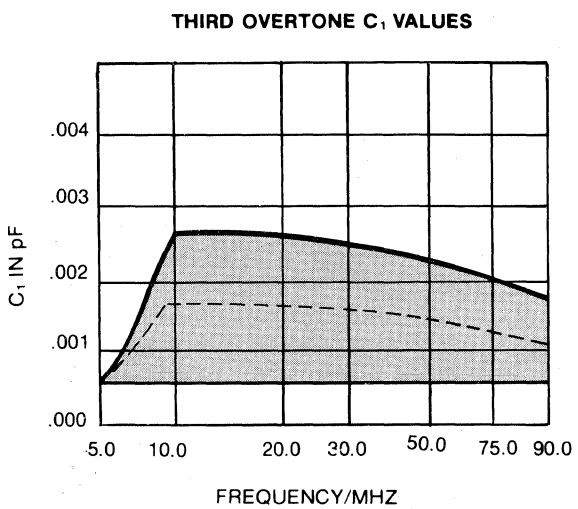
Hi Q (Quality Factor)
Low Aging
Short Term Stability
Single Sideband Phase Noise
Vibration Sensitivity, 2G
Activity Dips for Precision TCXO Applications

CAPABILITIES:

Frequency Range: 1 to 250 MHz
Aging: Low parts in 10^{-10}/day
Short Term Stability: Mid to low parts in 10^{-10}/sec.
Phase Noise: > −130 DBM, 10 Hz Offset, 1 Hz Bandwidth
Vibration Sensitivity, 2G: Low parts in 10^{-10}/G
Activity Dips: Low parts in 10^{-7}
Holder Style: Glass, Coldweld, Resistance Weld, and Solder Seal
Military and Industry Specs:
Mil-I-45208
Mil-C-3098
Mil-H-10056
Mil-Std-683
Mil-Std-202
Mil-Std-810
EIA 512





MINIMUM PARAMETERS REQUIRED TO DESIGN A CRYSTAL

Frequency
Mode of operation-fund. or overtone. (3rd, 5th, etc.)
Frequency calibration tolerance and temperature
Frequency drift tolerance and temperature range, if required
Holder size desired
Series or parallel resonant and load capacitance
Drive level

OTHER PARAMETERS REQUIRED WHERE APPLICABLE

Equivalent series resistance, ESR
Co, Cm, Lm
Aging rate, daily or yearly
Spurious or unwanted modes and activity dips
Environmental requirements such as shock, vibration, and acceleration
Phase noise
Short term stability
Vibration sensitivity, 2G

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PRECISION SC CUT CRYSTALS

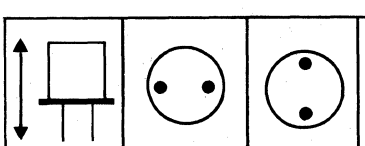
In 1974 it was announced that a theoretically predicted double-rotated crystal cut which would result in no frequency excusion or transients do to thermal shock had been derived. In 1975 the stress compensated, SC cut, was predicted which would result in a zero first-order temperature coefficient and eliminate frequency changes due to mechanical stress within or induced on the quartz crystal blank. During 1976 an experimental configuration of this previous work was reported on which had determined an orientation for the crystal axis for optimum stress compensation. Colorado Crystal Corp. has carried this work by many individuals in our field to the point of production. Colorado Crystal Corp. presently designs and manufacturers SC cut crystals utilizing specially designed equipment to insure the maximum performance from each and every SC cut crystal supplied to our customers.

Precision SC cut crystals can be designed and manufactured to cover the full frequency and overtone spectrum. Specifications for commonly used designs are listed below. Crystals can be ordered to these specifications by using the CCC P/N or the specifications can be varied within certain limits to meet your requirements.

PARAMETER		CCSC-101001	CCSC-303001	CCSC-303003	CCSC-303005	CCSC-505010
Frequency	MHz	5.000	5.000	10.000	10.000	10.000
Cut		SC	SC	SC	SC	SC
Vibration Mode		Fund	3rd	3rd	3rd	5th
Holder		HC-27/U	HC-27/U	HC-27/U	HC-27/U	HC-27/U
Load Capacitance	pF	22	22	22	22	22
Co Nominal	pF	6.8	3.6	5.2	5.2	3.3
C_1 Nominal	fF	4.4	0.18	.30	0.75	.045
L Nominal	mH	220	5600	840	350	5700
R Nominal	Ohms	7	85	55	35	290
Q Nominal	(millions)	1.2	2.0	1.0	0.500	1.3
Q Minimum	(millions)	—	—	—	—	1.2
*Trimability	(ppm/pF)	.25	0.15	.21	0.5	.035
Inflection Temperature	°C	+100	+98	+95	+95	+95
Lower Turning Point Range	°C	+30 to +75	+30 to +75	+30 to +75	+30 to +75	+30 to +75
Lower Turning Point Tolerance	°C	±5	±5	±5	±5	±5
Max Slope for LTP from +75°C to Inflection Temperature	($°C^{-1}$)	$\pm 8 \times 10^{-8}$	$\pm 8 \times 10^{-8}$	$\pm 8 \times 10^{-8}$	$\pm 8 \times 10^{-8}$	$\pm 8 \times 10^{-8}$
Calibration at LTP	(ppm)	±10	±1.5	±1.5	±3	±1.5
Max T.C. ±1°C from LTP of +82°C	($°C^{-1}$)	$\pm 4 \times 10^{-9}$	$\pm 4 \times 10^{-9}$	$\pm 4 \times 10^{-9}$	$\pm 4 \times 10^{-9}$	$\pm 4 \times 10^{-9}$
"C" Mode Inharmonics	(Resistance Ratio)	2:1	2:1	2:1	2:1	2:1
"B" Mode (Freq above "C")		10%	10%	10%	10%	10%
Drive Level (Recommended Maximum)	uW	10	10	10	10	10

2G, VIBRATION SENSITIVITY

The G sensitivity of a quartz crystal is normally specified 2 ways, either as a per axis frequency shift or a vector sum of all 3 axis. Colorado Crystal Corp. can test and supply SC cut crystals to either or both of these requirements. The G sensitivity can be effected by many factors such as freqency, overtone, holder and crystal design. At right is typical data, per G and Vector, for a shipping lot of specially designed 10 MHz, 3rd overtone, SC cut crystals.



Per Axis, Per G			Vector Sum	Units
2.2	2.4	1.8	3.7	$x10^{-10}Hz/G$
.5	1.1	.7	1.4	$x10^{-10}Hz/G$
2.8	4.0	.3	4.9	$x10^{-10}Hz/G$
.7	2.7	1.8	3.3	$x10^{-10}Hz/G$
1.3	2.2	.5	2.6	$x10^{-10}Hz/G$

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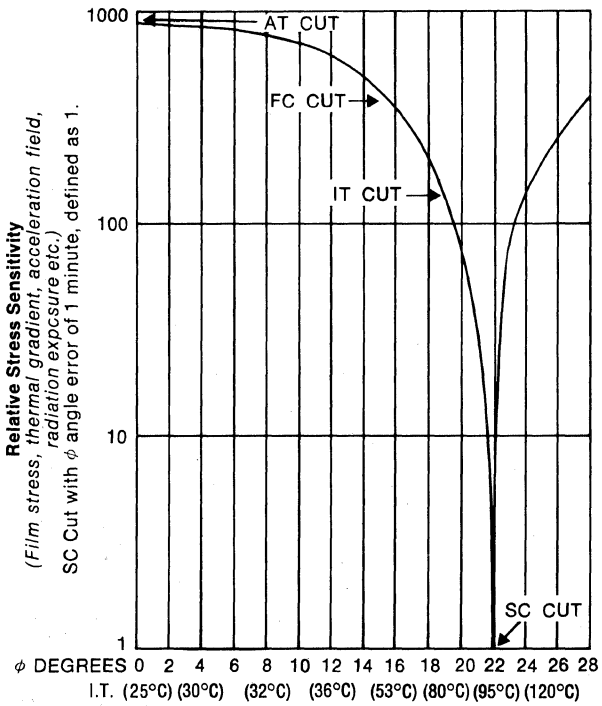
PRECISION SC CUT CRYSTALS

Relative Stress Sensitivity

Due to stress compensation in the SC cut crystal, the SC cut crystal is approximately 830 times less sensitive to certain stress effects upon frequency stability than are AT cut crystals.

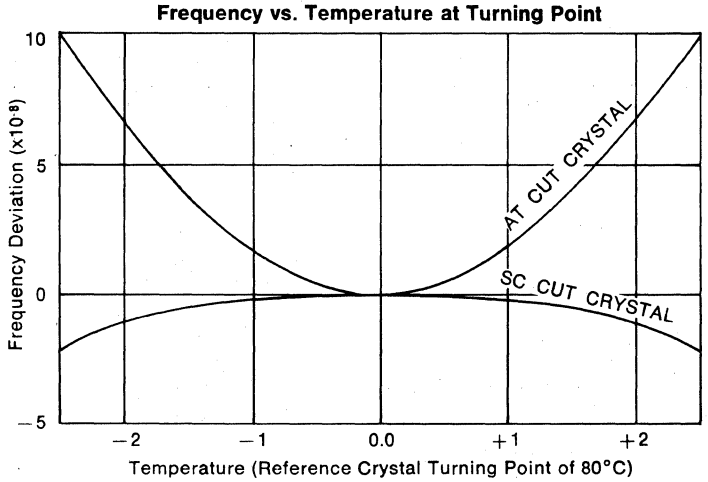
Thermal Transient Effect versus ϕ (θ for zero temperature coefficient focus)



All CCC SC cut crystals are tested not only for turning point but also for Inflection Temperature to insure that our customers receive what they payed for.

Temperature stability enhanced, around the turning point, by a factor of 6

Frequency vs. Temperature at Turning Point



Due to the second rotation of the SC cut crystal blank, about the ϕ orientation of 21.9°, the accuracy of your oscillator can be improved by a factor of 6 within 2°C of the turning point.

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TTL Clock Oscillators

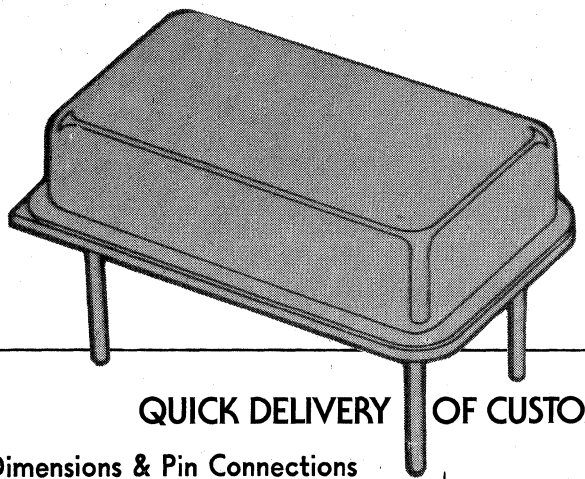
Models:

- ☐ CCO 100A (100 ppm)
- ☐ CCO 50A (50 ppm)
- ☐ CCO 25A (25 ppm)

Features:

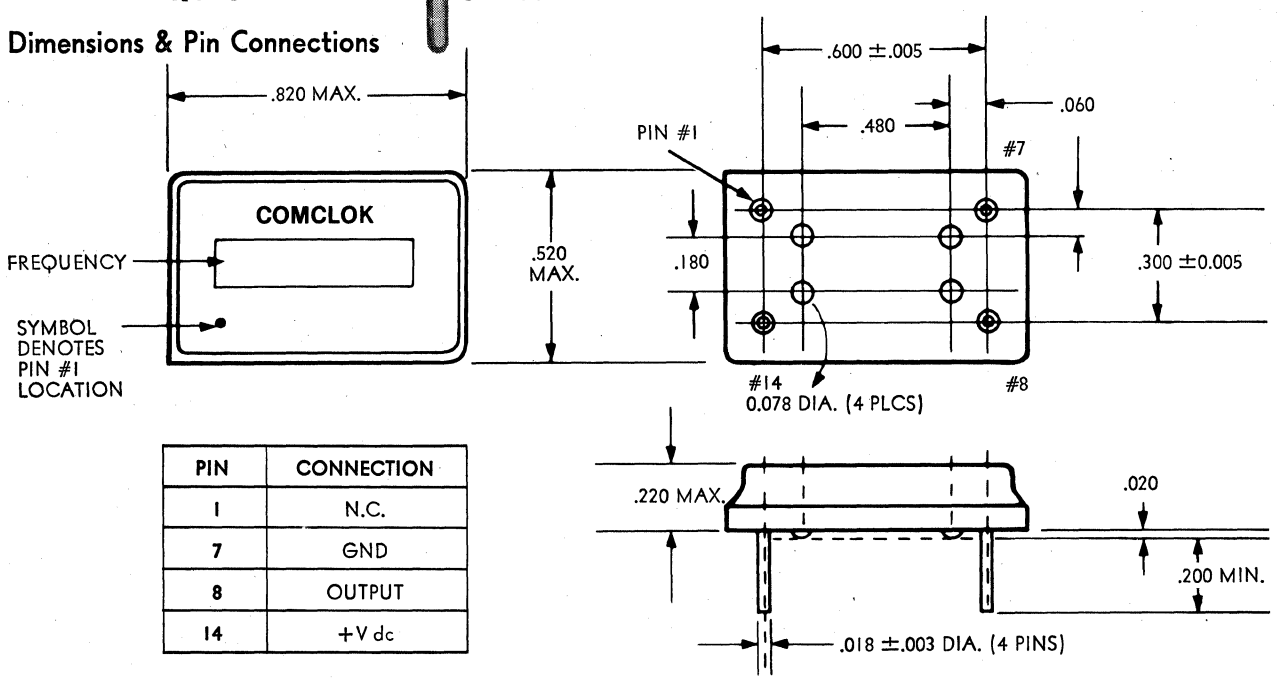
- ☐ 0.820"(L) x 0.520"(W) x 0.240"(H)*
- ☐ Dual In Line Spacing
- ☐ TTL Compatible Output
- ☐ High Reliability
- ☐ Resistance Welded

* INCLUDES INSULATED STAND OFF.



QUICK DELIVERY OF CUSTOM AND STANDARD FREQUENCIES

Dimensions & Pin Connections



PIN	CONNECTION
1	N.C.
7	GND
8	OUTPUT
14	+V dc

Specifications

Frequency Range ..... 250 KHz - 70 MHz

Frequency Stability ..... ±0.01%, ±0.005%, ±0.0025%

Temperature Range
Operating ..... 0° −70°C
Storage ..... −55° - +125°C

Input Current .. 80 mA Max. 250 KHz - 3.9 MHz
50 mA Max. 4.0 MHz - 31.9 MHz
60 mA Max. 32.0 MHz - 70.0 MHz

Input Voltage ..... +5 V DC ±10%

TTL Output
Symmetry ..... 60/40% @ 1.4 V DC level

Rise and Fall Time
10 ns Max. 250 KHz - 23.0 MHz
4 ns Typ, 10 ns Max. 23.0 MHz - 70.0 MHz

"0" Level ..... +0.5 V Max.

"1" Level ..... +2.4 V Min.

Output ..... 1 to 10 TTL Gates

Beat the Competition

PUT THE FASTEST AND CLEANEST FREQUENCY SYNTHESIZERS INTO YOUR SYSTEM...10 MHz—18.4 GHz

The FS-2000 Family: Only from COMSTRON

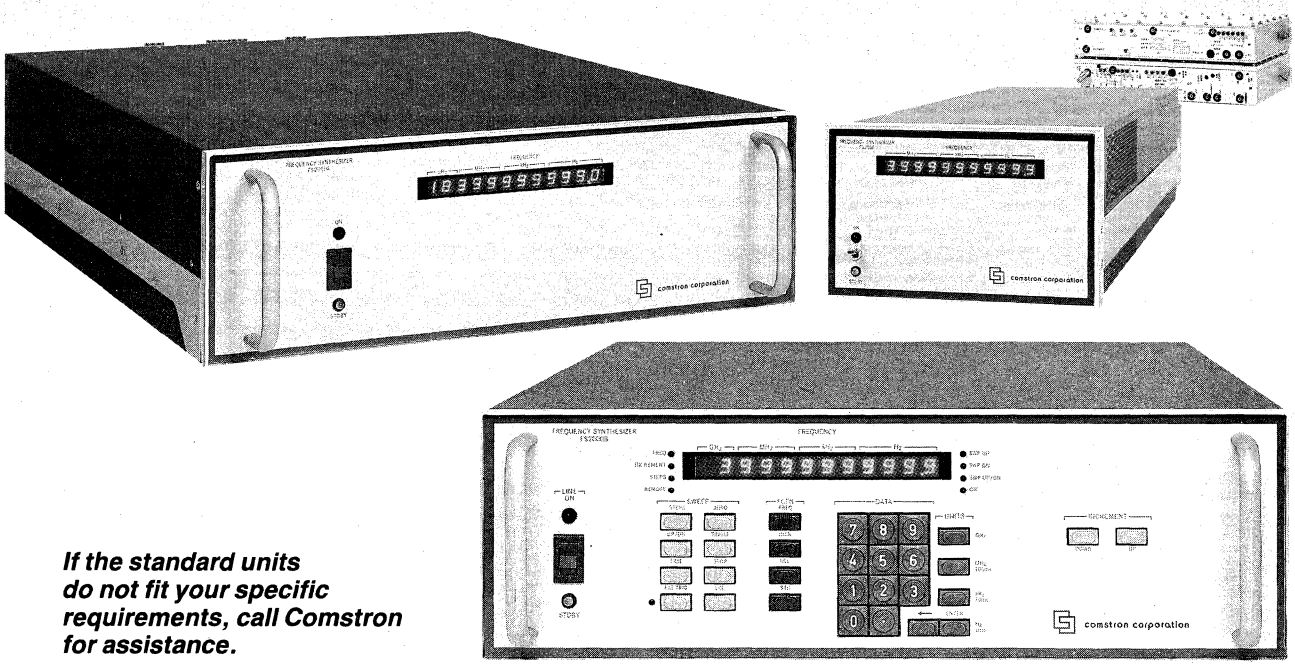
Comstron's FS-2000 is the most significant advance in Frequency Synthesizer technology in over 10 years. It is the first synthesizer to combine ultra fast switching, low phase noise, and low spurious over a wide frequency range.

The FS-2000 frequency synthesizers have uncompromising performance. Switching speed is specified simply; <1 microsecond between any two frequencies with any resolution — no ifs, ands, or buts.

Close-in spectral purity is virtually that of the frequency reference multiplied to the output frequency, while far-out noise decreases monotonically to the floor. No phase-locked loops, no complicated schemes. Just simple, direct, and reliable.

The Standard FS-2000 Family comprises 3 chassis (see photos below) and 4 frequency ranges:

- **10 MHz – 2.3 GHz**
- **10 MHz – 4.6 GHz**
- **10 MHz – 9.2 GHz**
- **10 MHz–18.4 GHz**



If the standard units do not fit your specific requirements, call Comstron for assistance.

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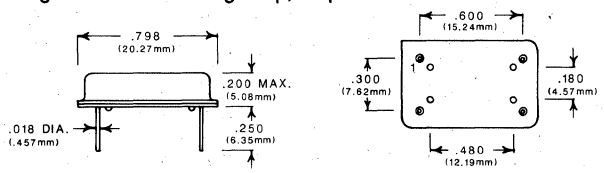
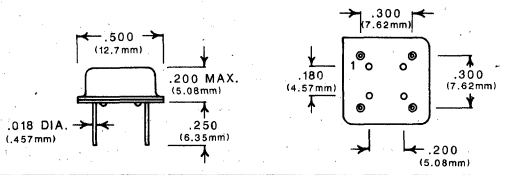
Package Outlline 1: .2" high cap, 14 pin DIP



Package Outline 2: Reduced size 8-pin DIP



Frequency Tolerance / Temperature Range Options

Designator:	14-pin Models	8-pin* Models	Option
	13	41	±25 ppm; 0°C to +70°C
	14	42	±50 ppm; -25°C to +75°C
Standard ----------->	**15**	**53**	**±100 ppm; 0°C to +70°C**
	16	63	±100 ppm; -40°C to +85°C
	17	73	±100 ppm; -55°C to +125°C
Tight Tolerance	B		±5 ppm; 0°C to +50°C
	C		±10 ppm; 0°C to +50°C
	D		±25 ppm; -25°C to +75°C
	E		±50 ppm; -40°C to +85°C

* Also designator for Dual Frequency, Dual Phase, Hi Speed Sinewave, and Advanced CMOS models.

TTL

Output load	1 - 10 TTL gates, Square wave	
Symmetry	50/50 ± 10%	
Supply voltage	5 Vdc ± 5%	
Supply current	85 mA max. (30-50 mA typical)	
Logic "0" level	1Hz to 80 MHz 25 MHz to 80 MHz	+ .4V max. + .5V max.
Logic "1" level	1 Hz to 80 MHz	2.4V min.
Rise/Fall time	1 Hz to 8.999 MHz 9 MHz to 31.999 MHz 32 MHz to 80 MHz	15ns 10 ns 7 ns

Model Description	Frequency Range	**Model**	Package Outline
Low Frequency	1 Hz - <255 KHz	S15R7**	1
High Frequency	255 KHz - 60 MHz	S15R6**	1
Stock Freq. Model	1 MHz - 80 MHz	S15R8	1
Reduced Size 8-pin	250 KHz - 25 MHz	T53*	2
Dual Frequency	200 KHz - 25 MHz	T53DF**	1
Dual Phase	20 KHz - 25 MHz	DPT53**	1
Tri-state Gated	30 KHz - 25 MHz	S15R6T**	1
Tight Tolerance	32 KHz - 25 MHz	S10C**	1

LS-TTL

Output load	1 - 10 LSTTL gates, Square wave
Supply voltage	5 Vdc ± 5%
Supply current	50 mA max. 85 mA max. on S09C model
Symmetry	50/50 ± 10 %

Model Description	Frequency Range	**Model**	Package Outline
Low Frequency	1 Hz - < 20 KHz	S15P5**	3
High Frequency	20 KHz - 20 MHz	S15P6**	1
Reduced Size 8-pin	31 KHz - 25 MHz	L53**	2
Tight Tolerance	32 KHz - 25 MHz	S09C**	3

HCMOS

Wave form	HCMOS logic Square wave	
Supply voltage	5 Vdc ± 10%	
Supply current (@ 25°C)	25 mA max. (typ.: 1 hz - 20 MHz 7mA)	
Output load	CMOS: Capacitance load = 50 pf max.	
Output driving ability	TTL Equivalent: LSTTL Equivalent: ALS: Fast: S & AS:	2 TTL gates 10 LSTTL gates 20 ALS gates 6 Fast gates 2 S & AS gates
Symmetry	50/50 ± 10% (typ. 52/48%)	
Voltage "0" level	0.5 V max. 10% VDD	
"1" level	4.5 V min. 90% VDD	
Rise/Fall time	10 nS,max. (typ. 6 nS) at CL = 15 pf	

Type Description	Frequency Range	**Model**	Package Outline
Low Freq., 14-pin	1 Hz - < 1 KHz	HC15R6**	1
High Freq., 14-pin	1 KHz - 50 MHz	HC15R5**	1
Stock Freq. Models	4 MHz - 50 MHz	HC15R8	1
Reduced Size 8-pin	250 Hz - 20 MHz	H53**	2
Reduced Size/Low Cost	500 KHz - 50 MHz	S53	2
Dual Frequency	3.84 MHz - 50 MHz	H53DF**	1
Dual Phase	20 KHz - 25 MHz	DPH53**	1
Tri-state Gated	30 KHz - 50 MHz	HC15R6T**	1
Tight Tolerance	32 KHz - 25 MHz	H10C**	3

CMOS

Wave form	CMOS logic Square wave	
Supply voltage	+ 5 Vdc to + 15 Vdc inclusive	
Output load	1 Hz to < 4 MHz 4 MHz to 8 MHz 4 MHz to 8 MHz	CL = 40 pf @ + 5 - 15 Vdc CL = 15 pf @ + 5 - 8 Vdc CL = 40 pf @ > 8 - 15 Vdc
Supply current	3 to 20 mA (3 mA @ 5 Vdc and 20 mA @15 Vdc)	
"L" suffix option	2 mA max. @ 5 Vdc; 15 mA max. @ 15 Vdc	
Symmetry	1 Hz - 3 MHz > 3 MHz - 8 MHz	50/50 ± 2% 50/50 ± 10%

Model Description	Frequency Range	**Model**	Package Outline
Low Frequency	1 Hz - 200 Hz	C15R6**	1
High Frequency	201 Hz - 8 MHz	C15R5**	1
Reduced Size 8-pin	250 Hz - 8 MHz	C53**	2
Dual Frequency	3.84 Mz - 8 MHz	C53DF**	1

** For Surface Mount package, add J to beginning of model number.

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Stock Frequency / Low Cost

TTL Clocks: Model S15R8 at these frequencies is available for immediate delivery:

1M, 2M, 2.048M, 3M, 3.6864M, 4M, 4.9152M, 5M, 6M, 8M, 8.192M, 10M, 12M, 12.5M, 14.31818M, 14.4M, 16M, 16.384M, 20M, 24M, 25M, 30M, 32M, 36M, 40M, 48M, 50M, 60M, 70M, 80M

See page 1 for specs.

HCMOS Clocks: Model HC15R8 at these frequencies is available for immediate delivery:

4M, 4.9152M, 5M, 8M, 10M, 12M, 16M, 20M, 24M, 25M, 30M, 32M, 40M, 48M, 50M

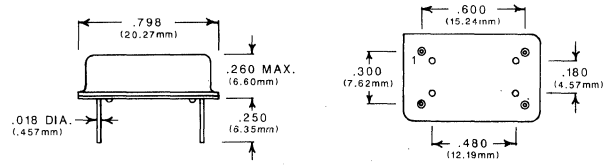
See page 1 for specs.

Reduced Size 8-pin HCMOS Clocks: Model S53 at these frequencies is available for immediate delivery:

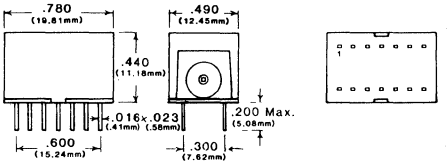
4M, 4.9152M, 8M, 10M, 12M, 16M, 20M

See page 1 for specs.

Package Outlline 3: .26" high cap, 14 pin DIP



Package Outline 4: Epoxy Encapsulated 14-pin DIP



ECL Package Outline 3*

Specifications	ECLA-1	ECLA-2	ECLB-1	ECLB-2
Fixed frequencies	8 MHz to 150 MHz		8 MHz to 200 MHz	
Frequency tolerance	±.005%		± .01%	
Supply voltage (±5%)	-5.2 Vdc	-4.5 Vdc	-5.2 Vdc	-4.5 Vdc
Temperature range	0°C to +70°C (0°C to +50°C ≥ 150 MHz)			
Output logic	10 K or 100 K ECL Square Wave; Duty Cycle: 50/50 ± 5%			

* Pin 1: complementary output. Pin 14: Vcc (case ground). Pin 8: output. Pin 7: Vce. Supply current: 75 mA max.

Special Oscillator Features:

Dual Frequency Oscillators: C-W's Dual Frequency oscillators combine two individual unique frequencies into a single 14-pin DIP. The DF models can be provided with outputs in TTL, CMOS or HCMOS logic. In HCMOS logic, both fundamental and 3rd Overtone (24-50 MHz) frequencies can be provided in the same package. In all DF models, the higher of the two frequencies will be on pin 8, while the lower frequency will be on pin 1. The DF models are a great way to reduce space on a crowded board where two or more independent frequency signals are required.

Tri-State Gated Oscillator: Clock oscillator circuit design which uses a tri-state buffer for controlling the output of the oscillator. Applying logic "0" to pin 1 "enables" the oscillator, while applying logic "1" to pin 1 "disables" the output. However, when disabled, the output goes to the hi impedance state. When the oscillator has gone to the hi impedance state, it appears to have been removed from the circuit. A recently added option allows you to enable the oscillator by applying logic "1" to pin 1 while disabling the oscillator when applying logic "0" to pin 1, exactly the opposite of the above combination.

Dual Phase Oscillator: C-W's Dual Phase oscillators also provide two frequencies from the same 14-pin package. In contrast to the dual frequency models, the dual phase models emit two outputs at the same frequency; however, the two outputs are 180 degrees out of phase with each other. The primary output is on pin 8, while the second output (180 degrees out of phase with the primary output) is on pin 1. The DP models are available with output logics of either TTL or HCMOS.

Surface Mount Models: Most C-W metal DIP models are available with a gull-wing surface-mountable base. Gold plated, flat leads are used to enhance solderability and connection quality. Add J to the beginning of the base model number. (Not available in the stock frequency / low cost series models.)

Advanced CMOS Logic Package Outline 3*

Model**	AC53	
Fixed frequencies	10 MHz - 200 MHz	
Output voltage	Voh Vol	3.7 V min. .44 V max.
Output current	Io	24 mA max.
Duty cycle	50/50 ± 10%	
Supply current	70 mA max.	

Output: CMOS Squarewave. Supply voltage: + 5 Vdc ± 10%.
* Pin 8: output. Pin 14: + 5 V. Pin 7: Gnd.

Sinewave Low Frequency Package Outline 3

Specifications	DPS1	DPS3	DPS2	DPS4
Fixed frequencies	1kHz to 75 kHz		100 Hz to 100 kHz	
Frequency tolerance	± .01%	± 005%	± .01%	± .005%
Output, 10K load T.H.D. ≤5%	1 Vrms min. DC coupled		1.5 Vrms min.@ 8 Vdc 3.0 Vrms min.@15 Vdc DC coupled	
Supply voltage	5 Vdc ± 10%		+8 to +15 Vdc (must specify) ± 10%	
Supply current	50 mA max.		35 mA max.	

Temperature range: -25°C to +75°C. Output wave: Sinewave.
Option: Adding "D" option to end of model number calls out ≤ 1% T.H.D.

High Speed Package Outline 3

Model**	SW53
Frequency range	100 KHz to 60 MHz
Output*	0 dBm to 10 dBm
Load*	50 ohm to 10K ohm; Output AC coupled
Supply voltage	5 Vdc ± 10%
Supply current	50 mA max.; 25 mA typ.

Distortion (THD): ≤ 5%. *Output voltage dependent upon frequency and fixed load. Consult factory for details. Pin 8: output. Pin 14: + 5V. Pin 7: Gnd.

High Frequency Package Outline 4

Specifications	SW44-1	SW44-2
Fixed frequency range	30 MHz - 130 MHz	
Supply voltage	+5 Vdc ± 5%	+12 Vdc ± 5%
Output	0 dBm into 50 Ω	10 dBm into 50 Ω

Frequency tolerance: .01%. Temperature range: 0°C to +70°C.
Supply current: 20mA max.

** See page 1 for frequency tolerance / temperature range options.

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Aurora, IL 60505 Fax: 312-851-5040 Cable: CONWIN WCGO

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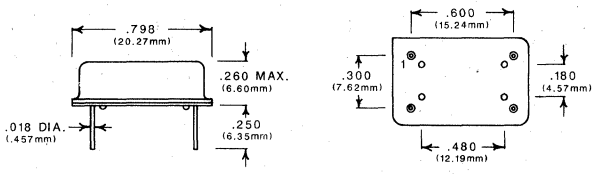
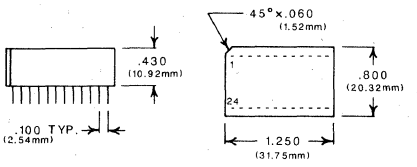
Package Outlline 5: .26" high cap, 14-pin DIP



Package Outline 6: Epoxy Encapsulated 24-pin DIP



PIN	CONNECTION
5	OUTPUT
12	GROUND
24	(+) SUPPLY

DIP TCXO

Package Outline 5*

Specifications		LS12**	T12**
Fixed frequencies		650 KHz - 25 MHz	
Output		10 LSTTL Square	10 TTL Square
Frequency Tol./	**A	± .00005%; +20°C to +40°C	
Temp. Range	**B	± .00015%; 0° to +50°C	
Options	**C	± .00025%; -25°C to +65°C	
Supply		+5 Vdc ± 1%; TTL (<50 mA) LSTTL (<30 mA)	

* Pin 1: Frequency adjust pin. 0-5 V applied to pin 1 adjusts the output frequency ± 10 ppm minimum. Voltage must be applied to pin 1 to control frequency.
Output symmetry ≤ 12.5 MHz-50/50 ± 1%; >12.5MHz-50/50 ± 10%
Rise/Fall time: ≤ 12.5 MHz-<20 ns; >12.5 MHz-<5 ns
Ordering information: To determine model number, add frequency tolerance option letter and fixed frequency to base model shown above.

TCXO

Package Outline 6

Specifications	C24A	C24B	C24C
Frequency tolerance	±.00005%	±.00015%	±.00025%
Temperature range	+20°C to +40°C	0°C to +50°C	-25°C to +65°C

Output code	-T	-C	-HC	-E
Output Load	TTL 10TTL	CMOS CMOS Load	HCMOS HCMOS Load	ECL 10K or 100K
Frequency range	15 KHz to 30 MHz	1Hz to 8MHz	1Hz to 30 MHz	4Mz to 30 MHz
Supply voltage	+ 5Vdc ± 1%	+ 5--15 Vdc ± 1% (specify)	+5Vdc ± 1%	-4.5 Vdc or -5.2 Vdc ± 1%
Supply	<50 mA	<25 mA	<40 mA	<150 mA

Ordering information: Please specify model base and output suffix. For ECL and CMOS models, specify exact supply voltage.

For Sinewave output, refer to TCXO Series C12 models in Full-line Catalog.

Other Oscillator Models Available

Connor-Winfield has been designing and manufacturing high quality oscillators and frequency control products for over 25 years.

This information is only a brief listing of our many products available to you. Other models which are not shown here include solid state (shock and vibration resistant) oscillators and military screened oscillators. In addition, our engineers are always happy to discuss any new requirements you might have, even if they do not match our standard specs. So if you don't see what you need, please call and ask!

You will also find that Connor-Winfield consistently offers the best delivery available in the industry. Quality is guaranteed. All parts are 100% tested to ensure zero defects. We are committed to providing you with the best oscillator products you can buy anywhere!

DIP VCO

Package Outline 5*

Specifications	PL14R1	PL14R2	PL14R3
Fixed frequencies	100 KHz to 80 MHz (please specify center frequency)		
Frequency stability 0°C to +70°C	± 1%	± 1%	± 2%
Output: Wave / Load / Symmetry	TTL Squarewave 10 TTL max. 50/50 ± 10%		
Deviation from F (nominal)	± 2% min. ± 3% max.	± 10% min. ± 15% max.	± 20% min ± 30% max.
Control voltage	0 V min. to + 5 V max. F (nominal) at 2-3 V Positive transfer characteristic		

* Pin 1: control voltage
Supply voltage: 5 Vdc ± 10%
Supply current: 85 mA max.

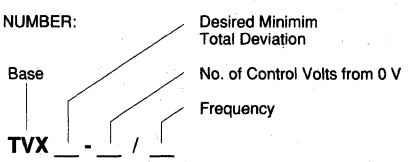
DIP VCXO

Package Outline 5*

Specifications	TVX__-__/__	LVX__-__/__
Fixed frequencies	450 KHz to 20 MHz (please specify center frequency)	
Frequency stability	± .001%; 0°C to + 70°C	
Deviation	80 ppm/ V max. (minimum total deviation must be specified)	
Control voltage	0V min. to + 10 V max. (control voltage range must be specified) Positive transfer characteristic	
Output: Wave / Load / Symmetry	TTL Squarewave 10 TTL max. 50/50 ± 10%	LS-TTL Squarewave 10 LSTTL max. 50/50 ± 10%
Supply current	50 mA max.(typ. 35)	25 mA max.(typ. 15)

* Pin 1: Control voltage pin.
Supply voltage: 5 Vdc ± 10%.
Note: Linearity is ± 20% with respect to the actual deviation at the control voltage extremes.

TO DETERMINE MODEL NUMBER:



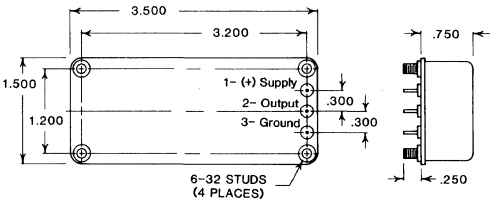
Example: TVX 200 - 5 / 20 MHz

CONNOR-WINFIELD OSCILLATORS

DCXO Series **Digitally Compensated Oscillators**

Specifications	DTM2	DTC1	DCM2	DCC1
Frequency range	15KHz to 25 MHz		250 Hz to 6 MHz	
Temp. range	-40°C to +85°C	0°C to +70°C	-40°C to +85°C	0°C to +70°C
Stability	±.00005%	±.00002%	±.00005%	±.00002%
Output	TTL		CMOS	
Supply voltage	+ 7 to + 15 Vdc			
Supply current	100 mA Max.		50 mA Max.	
Pin connections	1: (+) Supply, 2: Output, 3: Ground			
Package	Hermetically sealed, solder-sealed can			

Connor-Winfield can now provide the digital technology in this high precision oscillator over the wide temperature ranges shown at left for much less than you might think. Call us for details!



Series 76 **High Frequency Series**

Fill in Blanks to Construct your Model Number

Example: XF3 ☐ ☐ ☐

When ordering please specify: Series No., Model No., Frequency & Supply Voltage	FREQ. STAB. W, X or Z	OUTPUT A, B, D, E, F or G	PACKAGE 1, 2, 3, 4 or 5

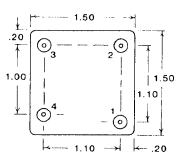
Frequency Stability

Parameter	Ordering Guide		
	W	X	Z
Temperature range	-55°C to +75°C	0°C to +60°C	+15°C to +35°C
Frequency stability	±.005%	±.001%	±.0005%

Output Specifications

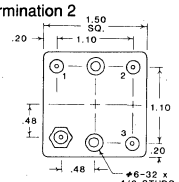
Parameter	Ordering Guide					
	A	B	D	E	F	G
Frequency range	1 Hz to 5 MHz	100 Hz to 100 MHz	10 MHz to 300 MHz	60 Hz to 1 MHz	1 MHz to 400 MHz	30 MHz to 300 MHz
Supply voltage	+ 5 to + 15 Vdc (specify)	+ 5 Vdc ± 5%	- 5.2 Vdc ± 5%	+ 12 Vdc ± 5%	+ 12 Vdc ± 5%	-4.5 Vdc ± 5%
Supply current	3 to 20 mA	70mA	100mA	25mA	70mA	100mA @ No Load
Output	CMOS	TTL	10K ECL Compatible	Sine 1 Vrms ± 10%	Sine + 10dBm ± 3dBm	100K ECL
Rise/Fall time	< 100nS	< 100nS	≤ 1.5nS	----	----	≤ 1 ns
Symmetry / Distortion	50/50 ± 10%	50/50 ± 10%	50/50 ± 10%	< 5%	- 25 dBm	50/50 ± 10%
Load	CMOS	1 - 10 TTL	ECL	10K	50	ECL
Termination	1 4 5	1 4 5	1 2 3	1 4 5	1 2 3	1 2 3
Height (in inches)	.62 1.50 1.50	.62 1.50 1.50	.62 2.00 2.50	1.50 2.00 2.00	1.50 2.00 2.50	.62 2.00 2.50

Termination 1



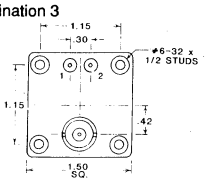
Dimensional Tolerance: ±.005

Termination 2



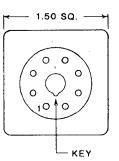
Dimensional Tolerance: ±.005

Termination 3



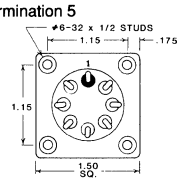
Dimensional Tolerance: ±.005

Termination 4



Dimensional Tolerance: ±.005

Termination 5



Dimensional Tolerance: ±.005

Series 79 **Precision Oscillator Series**

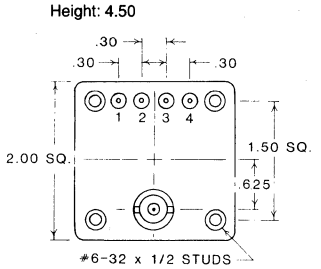
Parameter	Ordering Guide		
	A	B	C
Frequency range	1 MHz to 20 MHz	20 MHz to 60 MHz	60 MHz to 150 MHz
Temperature range	0°C to +60°C	0°C to +60°	0°C to +60°C
Frequency stability	±5 x 10^{-8}	±1 x 10^{-7}	±5 x 10^{-7}

Output Specifications

Parameter	Sinewave	TTL
Frequency range	1 MHz to 150 MHz	1 Hz to 60 MHz
Osc. supply	+12 Vdc, 35 mA	+12 Vdc, 50 mA
Ovn. supply	+28 Vdc, 6W Avg.	+28 Vdc, 6W Avg.
Output, Load	Sinewave, 50	TTL, to 10 TTL
Output voltage	0 dBm ± 1.5 dBm	TTL
Harmonic content	-20 dBm	----

Termination 1
1 Osc. 2 Osc. Common
3 Ovn. Common 4 Ovn. Supply
BNC Output

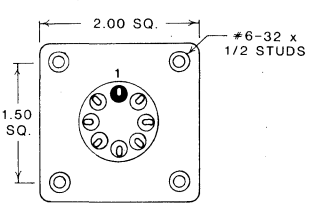
Height: 4.50



Dimensional Tolerance: ±.005

Termination 2
1 Osc. Common 2 Osc. Supply
5 Ovn. Supply 6 Ovn. Common
8 Output

Height: 4.50 All dimensions in inches.



Dimensional Tolerance: ±.005

Specifications subject to change without notice.

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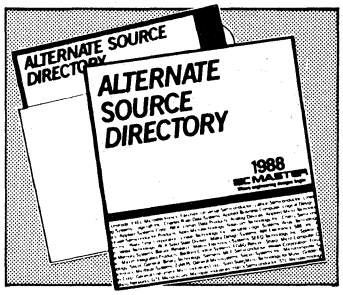

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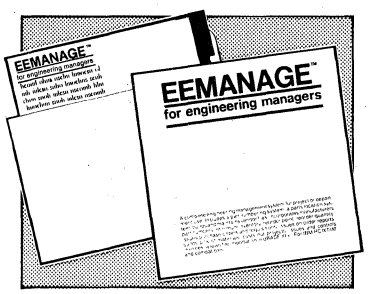

EEMANAGE does many things: 1. Develops Bills of Materials 2. Assigns Part Numbers logically 3. Manages Engineering Inventories 4. Issues Purchase Requisitions 5. Relieves Engineering Inventories 6. Manages a Parts Storage System 7. Issues Engineering Change Notices 8. Interfaces with dBaseIII+ Programs.

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MILITARY CRYSTAL UNITS

We are on the Qualified Products List (QPL) for the types below.

MILITARY CR-TYPE	MILITARY SPEC. NO.	FREQUENCY RANGE IN MHZ	CROVEN CODE
CR-5A/U*	3098/77	2.000- 10.000	A170 FWM-25
CR-6A/U*	3098/78	2.000- 10.000	A170 FWJ-13
CR-8A/U*	3098/111	1.000- 10.000	A170 FWJ-00
CR-18A/U*	3098/3	0.800- 20.000	A061 FWM-32
CR-19A/U*	3098/4	0.800- 20.000	A061 FWM-00
CR-52A/U*	3098/30	10.000- 61.000	B061 FWM-00
CR-55A/U*	3098/33	17.000- 62.000	B180 FWM-00
CR-56A/U*	3098/34	50.000-125.000	C180 FWM-00
CR-58A/U*	3098/36	0.800- 20.000	A170 FWM-32
CR-59A/U*	3098/37	50.000-125.000	C180 EBS-00
CR-60A/U*	3098/38	5.000- 20.000	A180 FWM-00
CR-61/U*	3098/39	17.000- 61.000	B180 EBS-00
CR-64/U*	3098/42	2.900- 20.000	A180 FWM-30
CR-65/U*	3098/43	10.000- 61.000	B061 CXP-00
CR-67A/U*	3098/45	17.000- 62.000	B180 CUM-00
CR-69A/U*	3098/47	2.900- 25.000	A180 CSM-30
CR-72/U*	3098/50	17.000- 61.000	B259 FWM-00
CR-76A/U*	3098/53	16.000- 61.000	B180 CSM-00
CR-77/U*	3098/55	17.000- 62.000	B251 CSM-00
CR-78A/U*	3098/62	2.200- 20.000	A251 FWM-30
CR-79/U*	3098/63	2.200- 20.000	A251 FWM-00
CR-80/U*	3098/57	50.000-125.000	C180 CSM-00
CR-81/U*	3098/58	17.000- 61.000	B251 FWM-00
CR-82/U*	3098/59	50.000-125.000	C251 FWM-00
CR-83/U*	3098/60	50.000-125.000	C251 CSM-00
CR-84/U*	3098/61	17.000- 61.000	B251 EBS-00
CR-89/U*	3098/67	2.120- 6.200	A321 FWM-30
CR-97/U*	3098/72	8.000- 10.000	A180 FWJ-32
CR-106A/U*	3098/82	10.500- 11.500	A180 FWM-32
CR-117/U*	3098/93	30.000- 63.000	B251 DEJ-00
CR-139/U*	3098/118	20.000- 22.000	A180 FWM-30
CR-140/U*	3098/119	3.500- 12.500	A061 FWM-60
CR-157/U*	3098/137	0.800- 20.000	A330 FWM-00

HOW TO SPECIFY A QUARTZ CRYSTAL

If the parameters for the crystal in question are not already covered by a MIL-SPECIFICATION or by a formal SPECIFICATION CONTROL DRAWING, then Items 1 through 6 are essential.

(1) **MODE OF OPERATION** i.e. fundamental, third, fifth, seventh, ninth or eleventh overtone.
(2) **HOLDER STYLE** i.e. HC-6/u, HC-18/u, HC-35/u, etc, depending on your individual application and the frequency.
(3) **CALIBRATION TOLERANCE AT REFERENCE TEMPERATURE** i.e. ± 20 ppm @ + 25°C, ± 5 ppm @ + 75°C, etc.
(4) **TEMPERATURE STABILITY** the allowable frequency deviation over a specified temperature range, with reference to the actual frequency measured at the calibration temperature. (i.e. ± 15 ppm, ± 2.0 ppm, etc.)
OR TOTAL TOLERANCE the total allowable deviation over a specified temperature range, with reference to the nominal frequency (i.e. calibration tolerance and temperature stability combined). (i.e. ± 50 ppm, ± 30 ppm, etc.)
(5) **OPERATING TEMPERATURE RANGE** the temperature range over which the temperature stability or the total tolerance is to be effective.
(6) **CIRCUIT CONDITION** will be either PARALLEL or SERIES resonance. If PARALLEL resonance, please state the load capacitance.

SPECIFICATION CODING

We use a system whereby we code the major parameters of a crystal specification using a combination of 9 digits. A typical code would be **A251DFE-32** and would be interpreted as follows. **A** = fundamental mode, **25** = HC-25/U holder, **1** = undercut pins per MIL-H-10056, **D** = calibration tolerance of ± 10 ppm @ + 25°C, **F** = temperature stability of ± 20 ppm with reference to the actual frequency measured @ + 25°C, **E** = temperature range of — 15°C to + 65°C over which the temperature stability is effective, **-32** = a circuit condition of parallel resonance and with a load capacitance of 32 pF.

MODE		HOLDER				CALIBRATION TOLERANCE AT REFERENCE TEMPERATURE		TEMPERATURE STABILITY OR TOTAL TOLERANCE		OPERATING TEMPERATURE RANGE (°C)		CIRCUIT CONDITION	
CODE	DESC.	CODE	DESCRIPTION	CODE	DESCRIPTION***	CODE	DESCRIPTION	CODE	DESCRIPTION	CODE	DESCRIPTION	CODE	DESCRIPTION
A	Fund	06	HC- 6 standard **	0	Standard			X	± 2PPM stability	X	+ 15 to + 35	00	Series resonance
B	3rd ot.	13	HC-13 standard	1	Undercut pins			Y	± 3PPM stability	Y	+ 10 to + 40		
C*	5th ot.	17	HC-17 standard	2	Modified can			Z	± 4PPM stability	Z	+ 5 to + 45		
D*	7th ot.	18	HC-18 standard		height					A	+ 0 to + 50		
E*	9th ot.	25	HC-25 standard	3	Slimline	B	± 5 PPM	B	± 5PPM stability	B	— 5 to + 55		
		32	HC-32 standard	4	3rd wire	C	± 7 PPM	C	± 7PPM stability				
		33	HC-33 (HC-6 wires)	5	Modified can	D	± 10PPM	D	± 10PPM stability	D	— 10 to + 60		
		34	HC-34 (HC-13 wires)		height	E	± 15PPM	E	± 15PPM stability	E	— 15 to + 65	01	Parallel resonance load capacity 100pf or more.
		35	HC-35 (TO 5 - type)	6	Modified can	F	± 20PPM	F	± 20PPM stability	F	— 20 to + 70		
		37	HC-37 (TO 8 - type)		height	G	± 25PPM	G	± 25PPM stability	G	— 25 to + 75		
		39	HC-39 (Flat-Pack)	7	Coldweld	H	± 30PPM	H	± 30PPM stability	H	— 30 to + 80		
		80	HC-45 (micro-min.)					J	± 40PPM stability	J	— 40 to + 90		
				9	Resistance Weld	M	± 50PPM	M	± 50PPM stability	M	— 55 to + 105		
								L	± 75PPM stability	L	+ 55/+ 65 Oven	10 to 90	Parallel resonance load capacity in pf as indicated by code.****
								K	±100PPM stability	T	+ 60/+ 70 Oven		
								N	±150PPM stability	N	+ 65/+ 75 Oven		
								S	Specific curve	P	+ 70/+ 80 Oven		
								T	± 20PPM‡ (B)†	R	+ 75/+ 85 Oven		
								U	± 25PPM‡ (C)†	S	+ 80/+ 90 Oven		
								V	± 30PPM‡ (D)†		Reference or Calibration temperature is the mid-point of the above ranges		
								W	± 50PPM‡ (F)†			99	Calibration at reference temperature in customer's oscillator.
								P	±100PPM‡ (H)†				
								R	±200PPM‡ (M)†				
								O	Not Specified	O	Not Specified		

† We use these calibration codes with corresponding total tolerances

* Available at series resonance only
** Standard types for all codes as per MIL-H-10056
*** Not all holders available with modifications
**** When using a Croven code only to describe your requirement, you must choose from one of the following standard load capacitance values, 10, 12, 14, 16, 18, 20, 24, 27, 30, 32, 35, 40, 45, 50, 55, 60, 70, 80, 90, 100 pf.
‡ Total tolerance (measured from nominal frequency)

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FAX 815-786-9743

CTS Standard Microprocessor Crystals

CTS Knight offers 45 standard microprocessor crystals to use with many of the popular microprocessors on the market. CTS microprocessor crystals feature low start-up resistance. Reliability is assured by use of a MIL-approved Quality Control process. These are solder seal and resistance weld crystals with 0.5″ minimum lead lengths.

Microprocessor crystals are available as "off-the-shelf" items from authorized CTS distributors.

Top wires and/or insulating sleeving can be ordered special with minimal cost and leadtime.

Standard Tolerance is ±.01% at 25°C and ±.005% over 0 to 70°C.

CTS P/N	FREQUENCY	LOAD CAP.	PKG.
MP010	1.0MHz*	13 pf	HC33/51
MP018	1.8432*	13 pf	HC33/51
MP020	2.0	20 pf	HC33/51
MP021	2.097152	20 pf	HC33/51
MP024	2.4576	32 pf	HC33/51
MP0245	2.4576	32 pf	HC18/49
MP030	3.0	18 pf	HC33/51
MP031	3.2	20 pf	HC33/51
MP032	3.2768	15 pf	HC33/51
MP036	3.579545	18 pf	HC33/51
MP036S	3.579545	18 pf	HC18/49
MP037	3.6864	20 pf	HC18/49
MP040	4.0	20 pf	HC18/49
MP04A	4.0	Series	HC18/49
MP041	4.194304	12 pf	HC18/49
MP042	4.9152	20 pf	HC18/49
MP043	4.032	22 pf	HC18/49
MP05A	5.0	20 pf	HC18/49
MP05B	5.0	Series	HC18/49
MP050	5.0688	Series	HC18/49
MP051	5.185	20 pf	HC18/49
MP057	5.7143	Series	HC18/49
MP060	6.0	20 pf	HC18/49
MP061	6.144	20 pf	HC18/49
MP062	6.250	30 pf	HC18/49

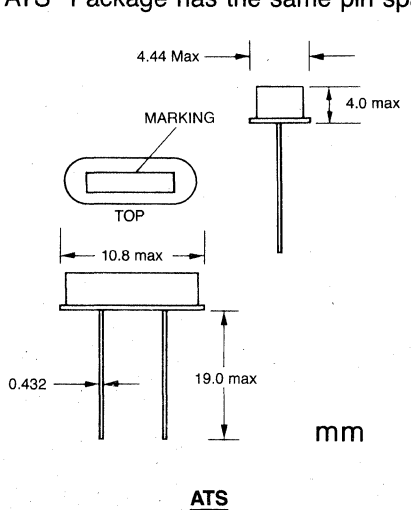
CTS P/N	FREQUENCY	LOAD CAP.	PKG.
MP073	7.3728MHz	20 pf	HC18/49
MP080	8.0	Series	HC18/49
MP080A	8.0	20 pf	HC18/49
MP098	9.8304	20 pf	HC18/49
MP100	10.0	Series	HC18/49
MP101	10.0	30 pf	HC18/49
MP107	10.738635	32 pf	HC18/49
MP110	11.0	18 pf	HC18/49
MP120	12.0	Series	HC18/49
MP122	12.288	32 pf	HC18/49
MP143	14.31818	Series	HC18/49
MP147	14.7456	Series	HC18/49
MP150	15.0	Series	HC18/49
MP160	16.0	Series	HC18/49
MP180	18.0	Series	HC18/49
MP184	18.432	Series	HC18/49
MP196	19.6608	Series	HC18/49
MP200	20.0	Series	HC18/49
MP221	22.1184	Series	HC18/49
MP240	24.0	Series	HC18/49
MP245	24.576	Series	HC18/49
MP250	25.0	Series	HC18/49
MP400	40.0M (3rd)	20 pf	HC18/49
MP480	48.0M (3rd)	Series	HC18/49

*Temperature tolerance is ±.01% over 0 to 70°C.

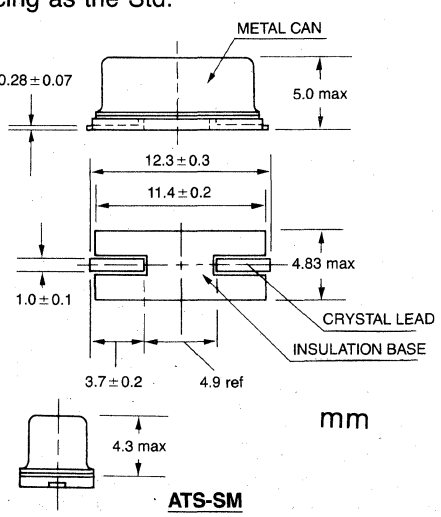
CTS AT-Strip Crystals

CTS Knights offers AT-Strip Crystals at Standard Frequencies between 3.5M and 20.0MHz for use with microprocessors. The AT Strip Crystals offer improved shock and vibration performance with their reduced size.

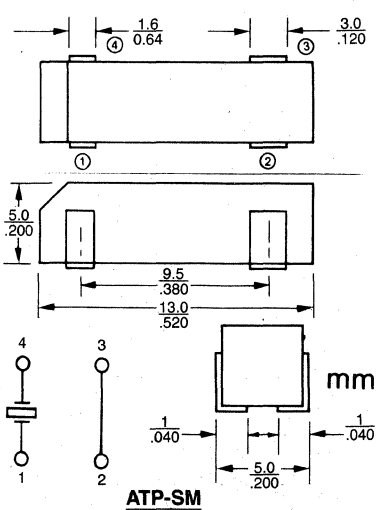
AT Strip Crystals are offered in 3 package styles. The "ATS" Package has the same pin spacing as the Std. HC-49 with a lower profile. The "ATS-SM" is the surface mount version of the "ATS" and the "ATP" is a plastic surface mount package. The ATP-SM is available in tape & reel for volume applications. Contact the factory or your local distributor for list of frequencies and specification details.



ATS



ATS-SM



ATP-SM

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Custom Crystals (CHART A)

Custom CTS Crystals can be ordered in a variety of tolerances in almost any package style to suit every application.

CHART A shows standard part numbers which can be purchased by specifying the Part Number and Frequency. Each of the following options must be specified: Calibration Tolerance, Load Capacity and Holder Style. If you don't see what you need just ask. NOTE: −0 Tolerance not available at all frequencies in all packages.

CHART A

CALIBRATION TOLERANCE (@ 25°C) Temperatures other than 25°C must be specified.	**HOLDER STYLE*** *See Outline Dwgs to Follow	**LOAD CAPACITY**
0—±.0005% (±5ppm) 1—±.001% (±10ppm) 2—±.002% (±20ppm) 3—±.003% (±30ppm) 4—±.004% (±40ppm) 5—±.005% (±50ppm) 6—±.01% (±100ppm)	A HC-50 (Fig. #8), R3 B HC-49 (Fig. #8), R3W C HC-48 (Fig. #10), R17 D HC-51 (Fig. #10), R17W E HC-45 (Similar) (Fig. #13) F R3W-SM (Fig. #18) G R2W-SM (Fig. #19) L HC-37 (Fig. #15), RTO-8 M HC-40 (Fig. #12) S HC-32 (Fig. #12), R5W T HC-35 (Fig. 16), RTO-5 H DIP .5×.5 (Fig. #17) J DIP-SM (Fig. #20) 13	A—20 pF B—32 pF C—Series D—Other (Specify) E—18 pF F—30 pF

FREQUENCY MHz	MAX SERIES RESISTANCE	P/N	CAL. TOL.	HOLDER	LOAD CAPACITY
1.0-1.699 (Fund)	650/300	R1553-			
1.7-2.999 (Fund)	300/150	R1435-			
2.5-2.999 (Fund)	250/210	R1535-			
3.0-3.699 (Fund)	200/130 (HC-49) 130/75 (HC-51)	R1435-			
3.7-3.999 (Fund)	130/100 (HC-49) 75/60 (HC-51)	R1335-			
4.0-5.499 (Fund)	100/60 (HC-49) 75/50 (HC-51)	R1335-			
5.5-9.999 (Fund)	60/30 (HC-49) 40/25 (HC-51)	R1235-			
10.0-15.00 (Fund)	30	R1032-			
16.0-25.0 (Fund)	25	R1027-			
17.0-19.999 (3rd O.T.)	60	R3335-			
20.0-56.999 (3rd O.T.)	50	R3032-			
57.0-75.0 (3rd O.T.)	45	R3127-			
50.0-59.999 (5th O.T.)	80	R5132-			
60.0-125.0 (5th O.T.)	80	R5127-			
110.0-200.0 (7th O.T.)	130	R7127-			

Standard Stability: ±.003% of 25°C frequency from −40 to +85°C.

Other stabilities and Temperature Ranges must be specified.

Part Number Example: Specifications 12.0 MHz, ±.002% @ 25°C, HC-49 (R3W), Series P/N, R1032-2B @ 12.0 MHz.

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Military Crystals

CTS KNIGHT'S test lab is government approved for qualification testing to military specification MIL-C-3098G, and includes equipment for environmental testing such as humidity, shock, vibration and aging.

Production test equipment conforms to maintenance and periodic re-calibration required by U.S. Government calibration system requirements in MIL-C-45662A.

CTS KNIGHTS is QPL Approved On The Following Military Types:

CR-18A/U (1-5, 10-20 MHz)
CR-19A/U (1-5, 10-20 MHz)
CR-52A/U (19-61 MHz)
CR-54A/U (50-110 MHz)
CR-55A/U
CR-56A/U (50-110 MHz)
CR-58A/U (1-20 MHz)
CR-60A/U
CR-64/U (2.9-20 MHz)
CR-67A/U
CR-72/U
CR-75/U (50-110 MHz)
CR-76A/U (17-61 MHz)
CR-77A/U
CR-78A/U (4.2-20 MHz)
CR-79/U (4.2-20 MHz)
CR-80/U (50-125 MHz)
CR-81/U (17-62 MHz)
CR-82/U (50-110 MHz)
CR-83/U (50-110 MHz)
CR-89/U
CR-97/U
CR-106/U
CR-111/U
CR-114/U
CR-117/U (30-62 MHz)
CR-124/U
CR-128/U
CR-139/U (20 MHz)
CR-140/U
CR-141/U (50-90 MHz)
CR-157/U (1-20 MHz)

MIL-Equivalent Crystals

MIL-C-3098G requires special testing to ensure compliance with the entire specification. Any crystal marked with the "CR" number must receive this testing.

If your required crystal details match those of a mil spec in general parameters, but your commercial application does not demand the exhaustive testing, you can order a mil equivalent crystal. The design will be the same. The crystal **will not** receive the detailed testing. Marking will be standard commercial marking. The "CR" number will not appear on the crystal.

A mil vs commercial cross reference is shown below:

SPEC SHEET MIL-C-3098	MIL TYPE	MIL HOLDER	CTS HOLDER	FREQUENCY RANGE - MHz	VIBRATION MODE	OPERATING TEMPERATURE RANGE (°C)	FREQ. TOL. VS. TEMP. (%)	LOAD CAP. OR SERIES
/3	CR-18A/U	HC-6/U	R17	1.0-20.0	Fund.	−55 to +105	±.005	32 pf
/4	CR-19A/U	HC-6/U	R17	1.0-20.0	Fund.	−55 to +105	±.005	Series
/30	CR-52A/U	HC-6/U	R17	15.0-61.0	3rd O.T.	−55 to +105	±.005	Series
/32	CR-54A/U	HC-6/U	R17	50.0-110.0	5th O.T.	−55 to +105	±.005	Series
/33	CR-55A/U	HC-18/U	R3W	17.0-62.0	3rd O.T.	−55 to +105	±.005	Series
/34	CR-56A/U	HC-18/U	R3W	50.0-110.0	5th O.T.	−55 to +105	±.005	Series
/36	CR-58A/U	HC-17/U	R17 Mod.	1.0-20.0	Fund.	−55 to +105	±.005	32 pf
/38	CR-60A/U	HC-18/U	R3W	5.0-20.0	Fund.	−55 to +105	±.005	Series
/42	CR-64/U	HC-18/U	R3W	2.9-20.0	Fund.	−55 to +105	±.005	30 pf
/45	CR-67A/U	HC-18/U	R3W	17.0-61.0	3rd O.T.	−55 to +105	±.0025	Series
/50	CR-72/U	HC-25/U Mod.	R3 Mod.	17.0-61.0	3rd O.T.	−55 to +105	±.005	Series
/52	CR-75/U	HC-6/U	R17	50.0-125.0	5th O.T.	−55 to +70 −(80 to 90) & +(70 to 80)	±.008	Series
/53	CR-76A/U	HC-18/U	R3W	17.0-61.0	3rd O.T.	−40 to +90	±.002	Series
/55	CR-77/U	HC-25/U	R3	17.0-62.0	3rd O.T.	−(55 to 40) & +(90 to 105)	±.003	Series
/62	CR-78A/U	HC-25/U	R3	4.2-20.0	Fund.	−55 to +105	±.005	30 pf
/63	CR-79/U	HC-25/U	R3	4.2-20.0	Fund.	−55 to +105	±.005	Series
/57	CR-80/U	HC-18/U	R3W	50-125.0	5th O.T.	−40 to +90 −(55 to 40) & +(90 to 105)	±.002 ±.003	Series
/58	CR-81/U	HC-25/U	R3	17.0-62.0	3rd O.T.	−55 to +105	±.005	Series
/59	CR-82/U	HC-25/U	R3	50.0-110.0	5th O.T.	−55 to +105	±.005	Series
/60	CR-83/U	HC-25/U	R3	50.0-110.0	5th O.T.	−40 to +90 −(55 to 40) & +(90 to 105)	±.002 ±.003	Series
/67	CR-89/U	HC-32/U	R5	2.12-6.2	Fund.	−55 to +90	±.005	30 pf
/72	CR-97/U	HC-18/U	R3W	8.0-10.0	Fund.	−40 to +85	±.005	32 pf
/82	CR-106/U	HC-18/U	R3W	10.5-11.5	Fund.	−55 to +105	±.005	32 pf
/87	CR-111/U	HC-18/U	R3W	17.0-62.0	3rd O.T.	−55 to +105	±.005	Series
/90	CR-114/U	HC-25/U Mod.	R3 Mod.	2.9-3.85	Fund.	−55 to +105	±.005	32 pf
/93	CR-117/U	HC-25/U	R3	30.0-63.0	3rd O.T.	Ref. 25°C −40 to +65	±.001 ±.0015	Series
/101	CR-124/U	HC-18/U	R3W	2.9-3.8	Fund.	−55 to +100	±.005	32 pf
/108	CR-128/U	HC-18/U	R3W	17.0-62.0	3rd O.T.	−55 to +105	±.005	Series
/118	CR-139/U	HC-18/U	R3W	20.0-22.0	Fund.	−55 to +105	±.005	30 pf
/119	CR-140/U	HC-6/U	R17	9.5-12.5	Fund.	−55 to +90	±.005	60 pf
/122	CR-141/U	HC-18/U Mod.	R3W Mod.	50.0-90.0	5th O.T.	−30 to +55 −(55 to 30) & +(55 to 65)	±.0025 ±.0045	Series
/137	CR-157/U	HC-33/U	R17W	1.0-20.0	Fund.	−55 to +105	±.005	Series

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Precision Quartz Crystal Resonators

I. DESCRIPTION

CTS High Stability Precision Resonators are used where specific tight parameter control is required. These crystals are used in communication, instrumentation, and military applications where specialized performance, documentation, or testing demands extra attention. These crystals are either calibrated at room temperature, or at elevated temperature for ovenized oscillator applications. Holder types see Fig. 8 and Fig. 9.

II. ELECTRICAL PERFORMANCE

A. Q-VALUE $\left(\frac{1}{2\pi C_1 f_s R_s}\right)$	Normal	Custom Designs	Optimum Designs
Fund. 1-50 MHz	75K	200K	750K
3rd O.T. 5-30	100K	200K	750K
3rd 30-85	60K	100K	125K
5th, 7th, 9th 50-200	40K	75K	100K

B. FREQUENCY TOLERANCE

Calibration Tolerance	±15 ppm	±5 ppm	±3ppm @ T.P.
Temperature Tolerance (Freq. Dev. from 25°C reading)			
0 +50°C	±6 PPM	±3 PPM	±2 PPM
−40° +85°C	±20 PPM	±15 PPM	±11 PPM
−55° +105°C	±30 PPM	±24 PPM	±20 PPM
T.P. @ 85°C (Ovenized Application)	±5°C	±3°C	±2°C

C. AGING

@ Room Temp.	≤1 PPM/yr	≤½ PPM/yr	—
@ Turning Point (Ovenized Application)	≤1 PPM/yr	≤½ PPM/yr	≤2 x10^{-7}/yr ≤1 x 10^{-9}/day

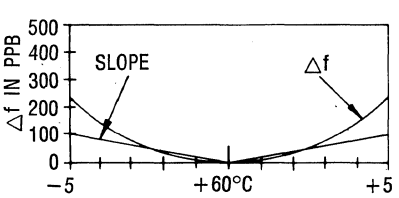
D. INHARMONIC MODES (SPURS)

	6 db (min) (2:1 R ratio)	15 db (min)	30 db (min) (Funds)

III. ENVIRONMENTAL PERFORMANCE (MIL-STD 202F)

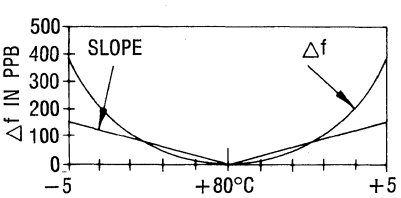
	Typical	Custom Designs	Optimum Designs
Mech. Shock 213B	100g/6 msec	1000g/1 msec	10,000g/5 msec
Vibration 204D	10g; 10-500 Hz	20g; 20-2000 Hz	50g; 20-5000 Hz
Hermeticity (≤ 1 x 10^{-8}cc/sec/atm)	All Designs	All Designs	All Designs

IV. CRYSTAL FREQUENCY STABILITY NEAR TURNING POINT— OVENIZED APPLICATIONS



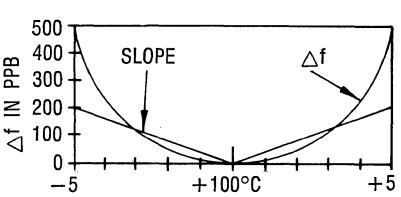
$\frac{\Delta f}{f}$ = (9.6 PPB/°C²) x ΔT^2

SLOPE = (19 PPB/°C) x ΔT



$\frac{\Delta f}{f}$ = (15.6 PPB/°C²) x ΔT^2

SLOPE = (31 PPB/°C) x ΔT



$\frac{\Delta f}{f}$ = (21.6 PPB/°C²) x ΔT^2

SLOPE = (43 PPB/°C) x ΔT

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Engineering Data

IV. MECHANICAL/ENVIRONMENTAL CAPABILITIES

A. MECHANICAL ENCLOSURES—CTS Knights uses flux-free sealing techniques (resistance weld and cold weld) for improved cleanliness, superior hermeticity, and long term reliability. CTS Knights manufactures crystals in 16 standard packages. One half inch hold-down wire (for mechanical support and/or grounding case) are available on the oval packages.

Enclosure vs Frequency (MHz)

ENCLOSURE	FUNDAMENTAL FREQ.							3rd O.T.					5th O.T.			7th O.T.				9th O.T.			
	1.0	1.8	2.4	6.0	10.0	20.0	30.0	10.0	18.0	30.0	60.0	75.0	50	80	130	75	100	150	180	150	175	200	225
HC-48, 51, 36, 47																							
HC-40																							
HC-49, 50, 42, 43 R3W-SM, DIP, DIP-SM																							
HC-37																							
HC-46, K5, R5W, R5																							
HC-35, HC-45 (sim.) R2W-SM																							

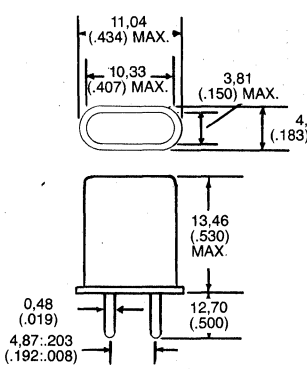
B. ENVIRONMENTAL TESTING—CTS Knights has its own MIL-QPL approved test lab capable of all normal environmental testing. In addition to performing any qualification testing necessary, the Q.C. organization is involved in monitoring key process control points, as well as sampling outgoing product for specification compliance, in compliance with MIL-I-45208 and MIL-Q-9858. Complete environmental testing capabilities per MIL-STD-202 include:

a. Mechanical Shock Method 213
b. High Frequency Vibration Method 204
c. Random Vibration Method 214
d. Moisture Resistance Method 106
e. Salt Spray Method 101
f. Seal Method 112
g. Static and dynamic aging
h. Drive linearly and reduced drive level testing capabilities
i. Complete crystal parameter temperature testing capability (−55°C to +125°C)
j. Insulation Resistance Method 302

Package Outline and Specifications

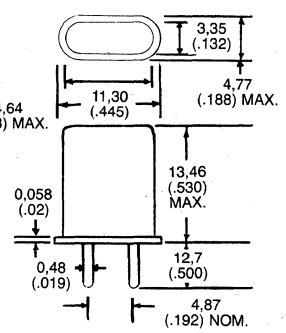
HC-49 GROUP

RESISTANCE WELD



R3W (HC-49/U)
FIG. 8
R3 (HC-50/U)
Leads .238
Dia. .040

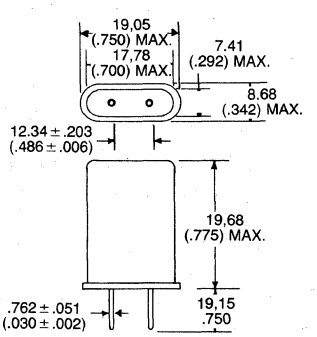
COLDWELD



K3W (HC-43/U)
FIG. 9
K3 (HC-42/U)
Leads .238
Dia. .040

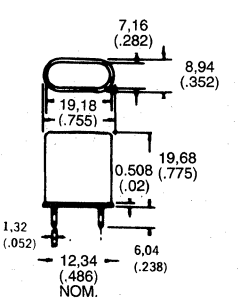
HC-48 GROUP

RESISTANCE WELD



R17W (HC-51/U)
FIG. 10
R17 (HC-48/U)
Leads .238
Dia. .050

COLDWELD



K17W (HC-47/U)
FIG. 11
K17 (HC-36/U)
Leads .238
Dia. .050

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Package Outline and Specifications

SPECIAL PACKAGES

RESISTANCE WELD
R5W

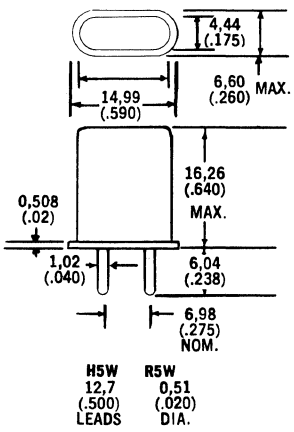

FIG. 12

R-2W (Similar to HC-45/U-2)
RESISTANCE WELD
R-2W

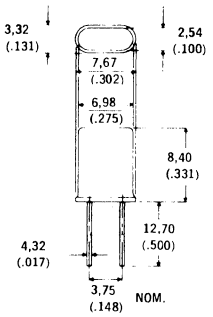

FIG. 13

TOP WIRE

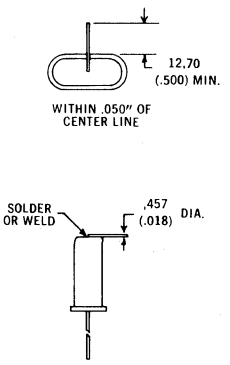

FIG. 14

TO-8 (HC-37/U)

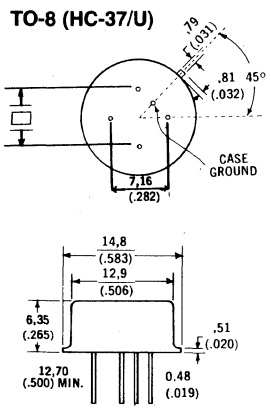

FIG. 15

RESISTANCE WELD
TO5 (HC-35/U)

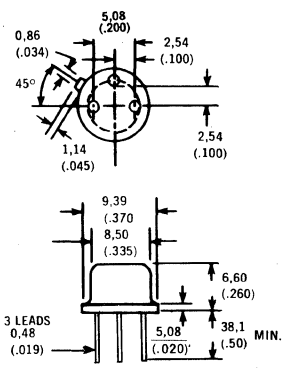

FIG. 16

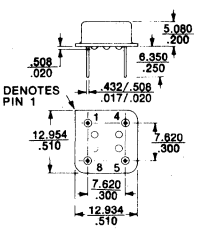

FIG. 17

SURFACE MOUNT PACKAGES

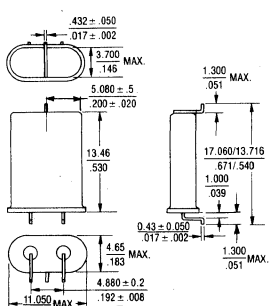

FIG. 18

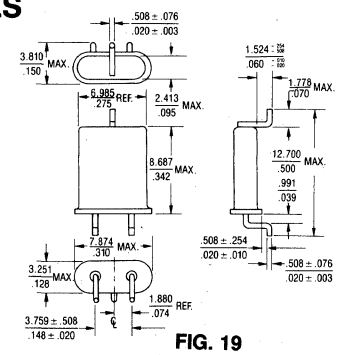

FIG. 19

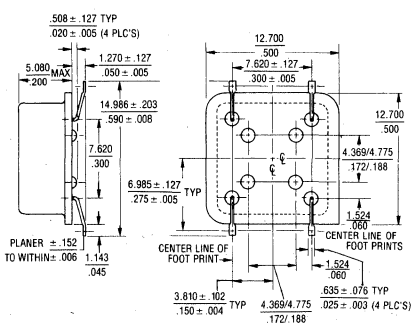

FIG. 20

CTS® CORPORATION SPECIALISTS IN FREQUENCY MANAGEMENT
KNIGHTS DIVISION 400 Reimann Ave., Sandwich, IL 60548 • 815/786-8411 • TWX 910-642-0860 Cable CTS
FAX 815-786-9743

Standard Distributor Hybrid Clock Oscillators

Choice of Three Logic Types:
TTL, H-CMOS, ECL
Fully Hermetic

Resistance Weld package, 14 PIN DIP Compatible.

FREQUENCY STABILITY: Inclusive of calibration tolerance @ 25°C, operating temperature range, environmental conditions, input voltage, aging and load change; ±.01%.
Other stabilities available upon request.

OPERATING CONDITIONS:
Supply Voltage: 5.0V ± 10%
Operating Temperature: 0 to 70°C
Fan Out: 10 TTL loads
Storage Temperature: −55 to +125°C
Popular frequencies of CTS Hybrid Clock Oscillators are available as "off-the-shelf" items from authorized CTS distributors under the following part numbers:

OUTLINE DRAWING

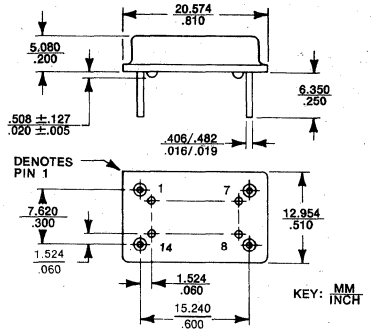

FIG. 9 MXO-55 PACKAGE

MX0-55 SERIES
TTL Logic ±.01% Stability

CTS P/N	FREQUENCY
MX055GB-2C	1.8432 MHz
MX055GB-2C	3.6864 MHz
MX055GB-2C	4.0000 MHz
MX055GA-2C	4.9152 MHz
MX055GA-2C	5.0688 MHz
MX055GA-2C	7.3728 MHz
MX055GA-2C	8.0000 MHz
MX055GA-2C	10.0000 MHz
MX055GA-2C	12.0000 MHz

CTS P/N	FREQUENCY
MX055GA-2C	14.31818 MHz
MX055GA-2C	16.0000 MHz
MX055GA-2C	16.257 MHz
MX055GA-2C	18.432 MHz
MX055GA-2C	19.6608 MHz
MX055GA-2C	20.0000 MHz
MX055GA-2C	24.0000 MHz
MX055GA-2C	32.0000 MHz
MX055GA-2C	40.0000 MHz

CX065 SERIES
HCMOS Logic ±.01% Stability

FREQUENCY	PART NUMBER
4.0000 MHz	CX065GA-2C-4.0 MHz
4.9152 MHz	CX065GA-2C-4.9152 MHz
8.0000 MHz	CX065GA-2C-8.0 MHz
10.0000 MHz	CX065GA-2C-10.0 MHz
12.0000 MHz	CX065GA-2C-12.0 MHz
16.0000 MHz	CX065GA-2C-16.0 MHz
20.0000 MHz	CX065GA-2C-20.0 MHz
24.0000 MHz	CX065GA-2C-24.0 MHz

EX055 SERIES
10KH ECL Logic ±0.01% Stability

FREQUENCY	PART NUMBER
80.0 MHz	EX055GO-2C-80.0 MHz
100.0 MHz	EX055GO-2C-100.0 MHz
110.0 MHz	EX055GO-2C-110.0 MHz
120.0 MHz	EX055GO-2C-120.0 MHz

See Data Sheets to Follow for Pin Connections and Complete Electrical Specifications.

Consult factory for new frequencies available in HCMOS logic.

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FAX 815-786-9743

Hybrid Clock Oscillators

MXO-55 SERIES

TTL logic outputs
14 pin DIP compatible
19.2 KHz to 100 MHz

PIN CONNECTIONS

Pin 1: N/C, enable, or output
Pin 7: Ground/case
Pin 8: Output
Pin 14: +5 VDC

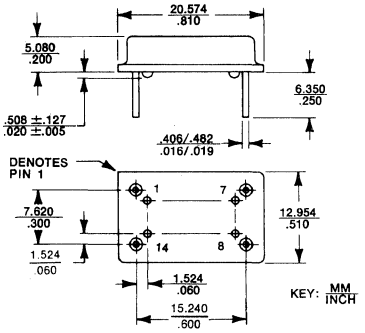

FIG. 9 MXO-55 PACKAGE

ORDERING INFORMATION

MXO-55 [ ][ ] [ ][ ] • [ ] SEE NOTE 1
OUTPUT FREQUENCY (PIN 8)

FREQUENCY, MODEL & OPTIONS	CODE
4.9152 MHz to 100 MHz Basic oscillator No enable	GA
4.9152 MHz to 70 MHz Basic oscillator with enable (NOTE 3, 5)	GAE
19.2 KHz to 4.9151 MHz Basic oscillator w/dividers	GB
307.2 KHz to 4.9151 MHz Divider output with enable	GBE
2.4576 MHz to 60 MHz Complementary outputs	GC
Dual outputs Pin 8: 307.2 KHz to 1.25 MHz Pin 1: 16X Pin 8	GD16
Dual outputs Pin 8: 614 KHz to 2.5 MHz Pin 1: 8X Pin 8	GD18
Dual outputs Pin 8: 1.228 MHz to 5 MHz Pin 1: 4X Pin 8	GD28
Dual outputs Pin 8: 2.457 MHz to 10 MHz Pin 1: 2X Pin 8	GD48

FREQUENCY TOLERANCE (NOTE 2)	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4
±.0025% (25 ppm) (0°C to 70°C only)	5

OPERATING TEMP. RANGE	CODE
0°C to +70°C	C
−40°C to +85°C	I
−55°C to +105°C	P
−55°C to +125°C	M

NOTE:

1. When ordering screening similar to MIL-O-55310, Class B, add -MLB after frequency.
2. Tolerances include 25°C accuracy, changes in operating temperature, supply voltage, load, environmental conditions, and aging.
3. ENABLE FUNCTION (50 nsec max response time)
   HI: ENABLES OSCILLATOR
   LO: Disables oscillator (output latches HI)
4. On frequencies below 307.2 KHz the crystal frequency will be on Pin 1.
5. See MX053 Series for TRISTATE Output option.
6. Short Circuit Output current = 100ma max and 5 minutes max duration at RMT

ELECTRICAL SPECIFICATIONS (MXO-55 SERIES)

SPECIFICATION	MODEL	FREQUENCY RANGE	TEMPERATURE RANGE	SYMBOL	MINIMUM	TYPICAL	MAXIMUM	UNITS
Operating Voltage	A, B, C, D	19.2 KHz to 100 MHz	−55°C to +125°C	V_{CC}	4.75	5.00	5.25	V
			−40°C to +85°C		4.50	5.00	5.50	
Maximum Supply Voltage			−55°C to +125°C	V_{CC} Max.			7.00	
Supply Current	A	4.9152 to 25 MHz	−55°C to +125°C	I_{CC}		20	35	mA
		>25 to <70 MHz				33	65	
		70 to 100 MHz				60	110	
	B	2.4576 to <4.9152 MHz				30	50	
		307.2 KHz to <2.4576 MHz				45	75	
		19.2 to <307.2 KHz				70	125	
	C	>12 to 60 MHz			15	22	75	
		2.4576 to 12 MHz				30	50	
	D	307.2 KHz to 10 MHz				45	75	
Output Voltage — HI	A, B, C, D	19.2 KHz to 100 MHz	−55°C to +125°C	V_{OH}	2.40	3.60		V
Output Voltage — LO				V_{OL}		0.30	0.50	
			−40°C to +85°C			0.25	0.40	
Rise & Fall Time (measured between 0.5V & 2.4V)	A	4.9152 to 25 MHz	−55°C to +125°C	t_R & t_F		3	5	nS
		>25 to 100 MHz				2	4	
	B	2.4576 to <4.9152 MHz				3	5	
		19.2 KHz to <2.4576 MHz				8	18	
	C	2.4576 to 60 MHz				3	5	
	D	307.2 KHz to 10 MHz				8	18	
Start-up Time	A, B, C, D	19.2 KHz to 25 MHz	−55°C to +125°C	t_S		2	5	mS
	A	>25 to 100 MHz				8	15	
Duty Cycle (uptime) (measured @ 1.5V)	A	4.9152 to 25 MHz	0°C to +70°C		45	50	55	%
			−55°C to +125°C		40	50	60	
		>25 to 100 MHz			35	50	65	
	B	2.4576 to <4.9152 MHz	−55°C to +125°C		45	50	55	
		19.2 KHz to <2.4576 MHz			40	50	60	
			0°C to +70°C		45	50	55	
	C	2.4576 to 12 MHz	−55°C to +125°C		45	50	55	
		>12 MHz to 60 MHz			35	50	65	
			0°C to +70°C		45	50	55	
	D	307.2 KHz to 10 MHz	−55°C to +125°C		40	50	60	
			0°C to +70°C		45	50	55	
Phase Delay (measured @ 1.5V)	C	>12 to 60 MHz	0°C to +70°C	$t\delta_1$ & $t\delta_2$		6	10	nS
			−55°C to +125°C			6	12	
		2.4576 to 12 MHz	0°C to +70°C			3	5	
			−55°C to +125°C			3	8	
Enable Input Load Factor	AE	4.9152 to 70 MHz	−50°C to +125°C	F_1			1	
Fanout (per output)	A, B, C	2.4576 to 70 MHz	−55°C to +125°C	F_0			10	S-TTL Gates
		>70 MHz to 100 MHz					2	
			−40°C to +85°C				5	
	A	19.2 KHz to <2.4576 MHz	−55°C to +125°C				10	TTL Gates
	D	307.2 KHz to 10 MHz	−55°C to +125°C				10	

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FAX 815-786-9743

JKTO-79 SERIES

TTL logic outputs
"A" MODELS are electrically similar to MXO55GA Models
"B" MODELS are electrically similar to MXO55GB Models from 307.2 KHZ to <2.4576 MHZ
TO-8 compatible
500 KHz to 70 MHz

ENABLE FUNCTION

4 MHz to 12 MHz:
HI: Enables oscillator
LO: Disables oscillator (Q_A latches LO, Q_B latches HI)
500 KHz to <4 MHz:
LO: Enables oscillator
HI: Disables oscillator (Q_A & Q_B latch LO)

CE MODEL now available from 3.5 to 25.0 MHZ
Enable and latch as above *except* from 12.01 to 25.0 MHZ
HI: Enables oscillator
LO: Disables oscillator
Q_A latches HI
Q_B latches LO

ORDERING INFORMATION

JKTO-79 [ ] [ ] [ ] [ ] ● [ ]
OUTPUT FREQUENCY

FREQUENCY AND MODEL AND OPTION	CODE
7.0 MHz to 70.0 MHz Basic oscillator No enable	A
500 KHz to 7.0 MHz Oscillator with divider No enable	B
3.5 MHz to 25 MHz Oscillator with Complementary output – No enable	C
Oscillator with dual outputs and no enable Q_A = 4X Q_B Q_B = 1 to 3 MHz	D28
Oscillator with dual outputs and no enable Q_A = 2X Q_B Q_B = 1 to 3 MHz	D48
Any of above (below 12 MHz) with enable For CE MODEL see note at left	AE BE D28E D48E

FREQUENCY TOL. (NOTE 2)	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4
±.0025% (25 ppm) (0°C to 70°C only)	5

OPERATING TEMP. RANGE	CODE
0°C to +70°C	C
−40°C to +85°C	I
−55°C to +105°C	P
−55°C to +125°C	M

NOTE 2:
Tolerance includes 25°C accuracy, changes in operating temperature, supply voltage, load, environmental conditions, and aging.

PIN	CONNECTION
1	Enable/disable option (otherwise NC)
2	Internal connection
3	Output A (Q_A) (otherwise NC)
4	Ground
5	Output B (Q_B)
6	Internal connection
7	NC (Model A) Internal connection (Model B, C, D) Crystal frequency (Model C, D)
8	V_{CC}

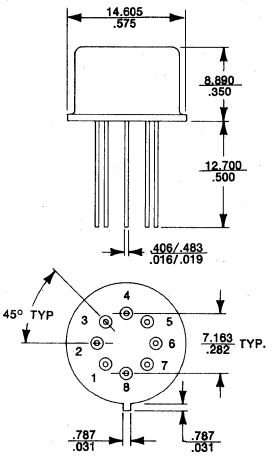


FIG. 11 TO-8 PACKAGE

NOTE: Screening Similar to MIL-0-55310, Class B Available by Adding -MLB to the End of the P/N.

JKTO-81 SERIES

TTL logic output
"A" MODELS are electronically similar to MXO55GA Models
"B" MODELS are electrically similar to MXO55GB Models from 307.2 KHZ to <2.4576 MHZ
TO-5 compatible
1 MHz to 25 MHz

PIN CONNECTION

Pin 1: N/C
Pin 2: Internal connection
Pin 3: N/C
Pin 4: Ground/case
Pin 5: Output
Pin 6: Internal connection
Pin 7: N/C
Pin 8: +5 VDC

ORDERING INFORMATION

JKTO-81 [ ] [ ] [ ] [ ] ● [ ]
OUTPUT FREQUENCY

FREQUENCY AND MODEL AND OPTION	CODE
12 to 25MHz Basic oscillator	A
1 to <12 MHz Basic oscillator with dividers	B

FREQUENCY TOL. (NOTE 2)	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4

OPERATING TEMP. RANGE	CODE
0°C to +70°C	C
−40°C to +85°C	I
−55°C to +105°C	P
−55°C to +125°C	M

See NOTE 2 above.

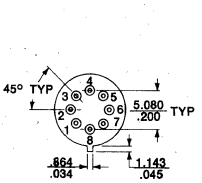
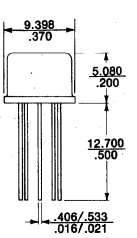


FIG. 10 TO-5 PACKAGE



NOTE: Screening Similar to MIL-0-55310, Class B Available by Adding -MLB to the End of the P/N.

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FAX 815-786-9743

C-MOS Compatible Hybrid Clock Oscillators

CXO-65 SERIES

High speed CMOS logic output
14-pin DIP compatible
(MXO-55 style)
200 Hz to 50 MHz

PIN CONNECTIONS
Pin 1: N/C or Enable
Pin 7: Ground/Case
Pin 8: Output
Pin 14: +5 VDC

ENABLE INPUT	OUTPUT
Open or High	Oscillator Output
Low	Latches High

ORDERING INFORMATION

CXO-65 [ ] [ ] [ ] [ ]● [ ] OUTPUT FREQUENCY

FREQUENCY AND MODEL	CODE
3.0 to 50 MHz Basic oscillator	GA
200 Hz to <3.0 MHz Basic oscillator with dividers	GB
3.0 to 50.0 MHz Basic oscillator with enable (active high)	GAE

FREQUENCY TOL. (NOTE 2)	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4
±.0025% (25 ppm) (0°C to 70°C only)	5

OPERATING TEMP. RANGE	CODE
0°C to +70°C	C
−40°C to +85°C	I
−55°C to +105°C	P
−55°C to +125°C	M

NOTE: Screening Similar to MIL-O-55310, Class B Available by Adding -MLB to the End of the P/N.

CX065G SERIES ELECTRICAL CHARACTERISTICS

SPECIFICATION	MODEL	FREQ. RANGE	TEMP. RANGE	CONDITIONS	SYMBOL	MIN.	TYPICAL	MAX.	UNITS
Operating Voltage	A, B	200 Hz - 25 MHz	−40°C to + 85°C		V_{DD}	4.50	5.00	5.50	VDC
		25 MHz - 50 MHz	−55°C to +125°C			4.75		5.25	
Max. Supply Voltage		200 Hz - 50 MHz			V_{DD} (max.)			7.00	
Input Current vs. Frequency	B	200 Hz - <3 MHz	−55°C to +125°C	C_L = 50 pf	I_{DD}		6.0	10.0	mA
	A	3 MHz - 50 MHz					1.0	1.2	mA/MHz
Output Voltage - Hi	A, B	200 Hz - 50 MHz	−55°C to +125°C	C_L = 50 pf	V_{OH}	V_{DD} - 0.2	V_{DD} - 0.1		V
				FO = 10 LS TTL		3.5	4.5		
Output Voltage - Lo	A, B			C_L = 50 pf	V_{OL}		0.1	0.2	V
				FO = 10 LS TTL			0.2	0.4	
Rise & Fall Times	B	200 Hz - 50 MHz	−40°C to +85°C	C_L = 50 pf 10% to 90% of Waveform	t_R & t_F		14	20	nS
			−55°C to +125°C					25	
	A	3 MHz - 25 MHz	−40°C to +85°C				9	12	
			−55°C to +125°C					15	
		>25 MHz - 50 MHz	−40°C to +85°C				5	8	
			−55°C to +125°C					10	
(FO = Fan Out)	A, B	200 Hz - 50 MHz	−55°C to +125°C	FO = 10 LS TTL 0.5V to 2.4V			2	.5	
Duty Cycle (% Uptime)	B	200 Hz - <3 MHz	−55°C to +125°C	C_L = 50 pf @50% of Waveform		45		55	%
	A	3 MHz - 50 MHz	−40°C to +85°C			40	50	60	
			−55°C to +125°C						
	A, B	200 Hz - 50 MHz	−55°C to +125°C	10 LS TTL @ 1.5V Level		40	51	60	
Output Current - Hi	A,B	200 Hz - 50 MHz	−55°C to +125°C	V_{OH} = 3.7V	I_{OH}	4.0			mA
Input Current - Lo				V_{OL} = 0.4V	I_{OL}	4.0			
Fan Out	A, B	200 Hz - 50 MHz	−55°C to +125°C		C_L	50			pf
					FO	10			LS TTL
Enable Input Volt	AE	3 MHz - 50 MHz	−55°C to +125°C		V_{IH}	3.20		5.50	V
Disable Input Volt					V_{IL}	−0.50		1.30	

CXO-55 SERIES

Low power consumption
CMOS logic output
14-pin DIP compatible
(MXO-55 style)
200 Hz to 5 MHz

PIN CONNECTIONS
Pin 1: N/C
Pin 7: Ground/Case
Pin 8: Output
Pin 14: +5 VDC to + 15 VDC

ORDERING INFORMATION (SEE NOTE)

CXO-55 [ ] [ ] [ ] [ ]● [ ] OUTPUT FREQUENCY (PIN 8)

FREQUENCY AND MODEL	CODE
3 to 5 MHz Basic oscillator	GA
200 Hz to <3 MHz Basic oscillator with dividers	GB

FREQUENCY TOL. (NOTE 2)	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4

OPERATING TEMP. RANGE	CODE
0°C to +70°C	C
−40°C to +85°C	I
−55°C to +105°C	P
−55°C to +125°C	M

ELECTRICAL SPECIFICATIONS

SPECIFICATION	MODEL	FREQ. RANGE	TEMP. RANGE	CONDITIONS		SYMBOL	MIN.	TYPICAL	MAX.	UNITS
Operating Voltage	A, B	200 Hz to 5 MHz	−55°C to +125°C			V_{DD}	4.50	5.00	15.50	V
Max. Supply Voltage						V_{DD} Max.			18	
Supply Current	B	200 Hz to <3 MHz	−55°C to +125°C	V_{DD} = 5V	C_L = 15 pf	I_{DD}			3	mA
				V_{DD} = 10V					5	
				V_{DD} = 15V					8	
	A	3 MHz to 5 MHz		V_{DD} = 5V					4	
				V_{DD} = 10V					7	
				V_{DD} = 15V					12	
Output Voltage—HI	A, B	200 Hz to 5 MHz	−55°C to +125°C	C_L = Max.		V_{OH}	V_{DD} −.5	V_{DD} −.1		V
Output Voltage—LO						V_{OL}		.1	.5	
Rise & Fall Times (measured from 10% to 90% waveform)	A, B	4 MHz to 5 MHz	−55°C to +125°C	V_{DD} = 5V	C_L = Max.	t_R & t_F			130	nS
				V_{DD} = 10V					70	
				V_{DD} = 15V					45	
Duty Cycle (uptime) (@ 50% of waveform)	A, B	200 Hz to 5 MHz	−55°C to +125°C	C_L = Max.			40	50	60	%
Output Load	B	200 Hz to <3.0 MHz	−55°C to +125°C			C_L			50	pf
	A	3.0 MHz to 5 MHz							15	
Output Current—HI (source)	A, B	200 Hz to 5 MHz	−55°C to +125°C	V_{DD} = 5V	V_{OH} = 4.5V	I_{OH}	−100			μA
				V_{DD} = 10V	V_{OH} = 9.5V		−250			
				V_{DD} = 15V	V_{OH} = 14.5V		−800			
Output Current—Lo (Sink)	A, B	200 Hz to 5 MHz	−55°C to +125°C	V_{DD} = 5V	V_{OL} = .5V	I_{OL}	300			
				V_{DD} = 10V			900			
				V_{DD} = 15V			2000			

NOTE: Frequency stability is guaranteed for ±10% supply voltage tolerance. Although the CXO-55 may operate from 5 to 15 VDC, standard frequency calibration is done at V_{DD}=5 VDC. If your application requires V_{DD} to be other than 5 VDC, please specify nominal V_{DD}, when ordering, to insure proper frequency accuracy and stability.

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FAX 815-786-9743

ECL Compatible Hybrid Clock Oscillators

EXO-55 SERIES

10KH ECL logic output
14-pin DIP compatible
8 MHz to 130 MHz
Standard Frequencies Available thru Franchised Distributors.

ORDERING INFORMATION

EXO-55 [ ] – [ ] [ ] – [ ] • [ ] OUTPUT FREQUENCY

CASE GROUND	CODE
ISOLATED CASE	G0
PIN 1 CASE	G1
PIN 7 CASE	G7
PIN 14 CASE	G14

FREQUENCY TOL. (NOTE 2)	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4

OPERATING TEMPERATURE RANGE	CODE
0°C to +70°C	C
−40°C to +85°C	I

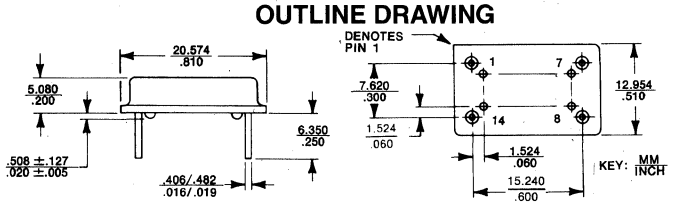
ELECTRICAL CHARACTERISTICS (INTO 50 Ω TO −2.0 VDC LOAD)

FREQUENCY RANGE	OPERATING TEMPERATURE	SPECIFICATION	SYMBOL	MINIMUM	TYPICAL	MAXIMUM	UNITS
8.0 to 130 MHz	−40°C to +85°C	Operating Voltage	V_{EE}	−4.94	−5.20	−5.46	V
		Max. Supply Voltage	V_{EE} Max.			−7.0	
		Supply Current	I_{EE}		50	75	mA
		Output Voltage—HI	V_{OH}	−1.05	− .95	− .75	V
		Output Voltage—LO	V_{OL}	−2.05	−1.80	−1.60	
		Rise & Fall Times (measured between 20% & 80%)	t_R & t_F		1.5	2.5	nS
		Duty Cycle (uptime) (measured @ 50%)		40	50	60	%
		Output Current—HI @ − .95V	I_{OH}	−19.0	−22.0		mA
		Output Current—LO @ −1.75V	I_{OL}	−1.0	−5.0		
		Output Load		50 Ω to −2.0 VDC			

PIN CONNECTIONS				
	STANDARD	(OPTIONAL)		
PIN	EX055G0	EX055G1	EX055G7	EX055G14
1	N/C	CASE	N/C	N/C
7	-Vee	-Vee	GND/CASE	-Vee
8	OUTPUT	OUTPUT	OUTPUT	OUTPUT
14	GROUND	GROUND	-Vee	GND/CASE

Note: Military Designs Available
Complementary output available as GOC, G7C or G14C only

OUTLINE DRAWING



EXO-65 SERIES

100K ECL logic output
14-pin DIP compatible
25 MHz to 200 MHz

ORDERING INFORMATION

EXO-65 [ ] [ ] [ ] – [ ] • [ ] OUTPUT FREQUENCY

CASE GROUND	CODE
ISOLATED CASE	G0
PIN 1 CASE	G1
PIN 7 CASE	G7
PIN 14 CASE	G14

FREQUENCY TOL. (NOTE 2)	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4

OPERATING TEMPERATURE RANGE	CODE
0°C to +70°C	C

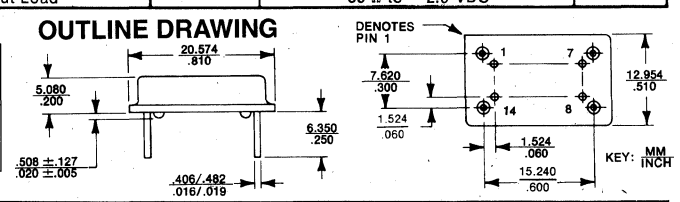
ELECTRICAL CHARACTERISTICS (INTO 50 Ω TO −2.0 VDC LOAD)

FREQUENCY RANGE	OPERATING TEMPERATURE	SPECIFICATION	SYMBOL	MINIMUM	TYPICAL	MAXIMUM	UNITS
25.0 to 200 MHz	−40°C to +85°C	Operating Voltage	V_{EE}	−4.20	−4.50	−5.46	V
		Max. Supply Voltage	V_{EE} Max.			−5.70	
		Supply Current	I_{EE}		85	100	mA
		Output Voltage—HI	V_{OH}	−1.04	− .95	− .85	V
		Output Voltage—LO	V_{OL}	−1.90	−1.80	−1.60	
		Rise & Fall Times (measured between 20% & 80%)	t_R & t_F		1.0	1.5	nS
		Duty Cycle (uptime) (measured @ 50%)		40	50	60	%
		Output Current—HI @ −1.0V	I_{OH}	−19.2	−21.0		mA
		Output Current—LO @ −1.7V	I_{OL}	−2.0	− 6.0		
		Output Load		50 Ω to −2.0 VDC			

PIN CONNECTIONS				
	STANDARD	(OPTIONAL)		
PIN	EX065G0	EX065G1	EX065G7	EX065G14
1	N/C	CASE	N/C	N/C
7	-Vee	-Vee	GND/CASE	-Vee
8	OUTPUT	OUTPUT	OUTPUT	OUTPUT
14	GROUND	GROUND	-Vee	GND/CASE

Note: Military Designs Available Compout same as EXO55 series

OUTLINE DRAWING



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Voltage Controlled Hybrid Clock Oscillator

VXO-55 SERIES

TTL logic output*
14 pin DIP compatible
(MXO-55 style/.290" Max Height)
765 KHz to 25 MHz
*HCMOS Logic Models also available, consult factory for VXO65 Model

PIN CONNECTIONS
Pin 1: Frequency control voltage
Pin 7: Ground/case
Pin 8: Output
Pin 14: +5 VDC

ORDERING INFORMATION

VXO-55 [ ] – [ ] [ ] [ ] – [ ] • [ ]
(OUTPUT FREQUENCY)

FREQUENCY AND MODEL	CODE
12.25 to 25.0 MHz Basic Oscillator	GA
765 KHz to <12.25 MHz Basic oscillator with dividers	GB

FREQUENCY DEVIATION*	CODE
±120 ppm min.	1
±200 ppm min.	2

* Positive slope

FREQUENCY TOLERANCE V_C = 2.50V	CODE
±.01% (100 ppm)	2
±.005% (50 ppm)	3

OPERATING TEMPERATURE RANGE	CODE
0°C to 70°C	C
−40°C to 85°C	I

ELECTRICAL SPECIFICATIONS

SPECIFICATION	MODEL	FREQUENCY RANGE	SYMBOL	MINIMUM	TYPICAL	MAXIMUM	UNITS
Operating Voltage	A, B	765 KHz to 25 MHz	V_{CC}	4.50	5.00	5.50	V
Maximum Supply Voltage			V_{CC} Max.			7.00	
Supply Current	A	12.25 MHz to 25 MHz	I_{CC}		18	25	mA
	B	3.0625 MHz to <12.25 MHz			30	60	
		765 KHz to <3.0625 MHz			45	75	
Output Voltage — HI	A, B	765 KHz to 25 MHz	V_{OH}	2.40	3.60		V
Output Voltage — LO			V_{OL}		0.25	0.40	
Rise & Fall Time (measured between 0.5V to 2.4V)	A, B	3.0625MHz to 25 MHz	t_R, t_F		3	5	nS
		765 KHz to <3.0625 MHz			8	18	
Duty Cycle (measured @ 1.5V)	A, B	12.25 MHz to 25 MHz		40	50	60	%
		765 KHz to <12.25 MHz		45	50	55	
Control Voltage	A, B	765 KHz to 25 MHz	V_C	0.0	2.5	5.0	V
Start-up Time	A, B	765 KHz to 25 MHz	t_S		5	15	mS
Control Voltage Input Impedance	A, B	765 KHz to 25 MHz		100K			Ω
Fanout	A	12.25 MHz to 25 MHz	F_O			10	TTL Loads
	B	765 KHz to <12.25 MHz				10	

Tri-State Hybrid Clock Oscillators

MXO-53 SERIES

3-state, TTL logic output*
14-pin DIP compatible
(MXO-55 style)
200 Hz to 70 MHz
*HCMOS Logic also available, consult factory for CXO63 Model.

PIN CONNECTIONS
Pin 1: Enable
Pin 7: Ground/case
Pin 8: Output
Pin 14: +5 VDC

ENABLE FUNCTION
HI: Enables oscillator
LO: Disables oscillator
(HI impedance output)

Designed for automated, in-circuit, and functional board test applications where a high impedance output state is required to allow the injection of external test signals.

ORDERING INFORMATION

MXO-53 [ ] [ ] [ ] – [ ] • [ ]
(OUTPUT FREQUENCY (PIN 5))

FREQUENCY & MODEL	CODE
4.9152 to 70 MHz Basic 3-state oscillator	GA
200 Hz to 4.9151 MHz 3-state oscillator with dividers	GB

FREQUENCY TOLERANCE	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4
±.0025% (25 ppm) (0°C to 70°C only)	5

OPERATING TEMP. RANGE	CODE
0°C to +70°C	C
−40°C to +85°C	I

ELECTRICAL SPECIFICATIONS (SIMILAR TO MXO-55 EXCEPT AS NOTED BELOW)

SPECIFICATION	MODEL	FREQUENCY RANGE	TEMPERATURE RANGE	SYMBOL	MINIMUM	TYPICAL	MAXIMUM	UNITS
Supply Current	A	4.9152 to 25 MHz	−40°C to +85°C	I_{CC}		35	55	mA
		>25 to 70 MHz				50	80	
	B	200 Hz to <4.9151 MHz				60	100	
Duty Cycle (uptime) (measured @ 1.5V)	A, B	200 Hz to 70 MHz	−40°C to +85°C		40	50	60	%
High Impedance Output Current	A, B	200 Hz to 70 MHz	−40°C to +85°C	$I_{O\ (OFF)}$			50	µA

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Surface Mount Hybrid Clock Oscillators

■ SURFACE MOUNT APPLICATIONS—CTS Knights presently offers a number of options to suit your surface mount needs. Besides the CCXO series, leadless chip carriers, we are offering the MXO-55 style package in an economical surface mountable configuration, through a simple lead formation operation. The surface mount option is specified by adding an "S" to the part number (eg. SMXO-55, SCXO-65).

■ VAPOR PHASE REFLOW—CTS Knights' standard hybrid oscillators are capable of withstanding hand and wave soldering processes, but are not manufactured to survive vapor phase reflow profiles without degradation to device reliability. All surface mountable products are built with a special, high-temperature construction process to allow vapor phase reflow.

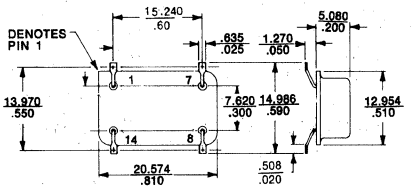

FIG. 6 SMXO-55

Standard DIP SERIES

The Standard DIP surface mount series squarewave crystal oscillator is contained in a rugged, economical .500" × .800", hermetically sealed metal package. The leads are shaped for surface mounting in a fullwing design.

AVAILABLE MODELS:

SURFACE MOUNT	EQUIVALENT STANDARD SERIES	LOGIC	FREQUENCY RANGE
SMX055	MX055	TTL	19.2 KHz TO 100 MHz
SCX055	CX055	CMOS	200 Hz TO 5 MHz
SCX065	CX065	HCMOS	1 MHz TO 25 MHz
SVX055	VX055	TTL VXCO	765 KHz TO 25 MHz
SEX055	EX055	10KH ECL	8 MHz TO 125 MHz
SEX065	EX065	100K ECL	25 MHz TO 150 MHz
SMX065	MX065	MOS OR MOS/TTL	2.4576 MHz TO 12 MHz
SMX053	MX053	TTL TRI-STATE	200 Hz TO 70 MHz

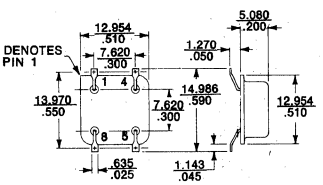

FIG. 6 SMXO-25

Mini-DIP SERIES

The Mini-DIP surface mount series of squarewave crystal oscillators are contained in a rugged, economical .500" × .500", hermetically sealed metal package. The leads are shaped for surface mounting in a gullwing design.

AVAILABLE MODELS:

SURFACE MOUNT	ELECTRICALLY EQUIVALENT STANDARD SERIES	LOGIC	FREQUENCY RANGE
SMX025	MX055	TTL	307.2 KHz TO 70 MHz
SCX025	CX065	HCMOS	3 MHz TO 25 MHz

MINIATURE DUAL-IN-LINE OSCILLATORS

MX0-25 SERIES

TTL logic output
electrically similar to MX0-55
310 KHz to 70 MHz

CX0-25 SERIES

Hi-speed CMOS logic output
Electrically similar to CX0-65
200 Hz to 50 MHz

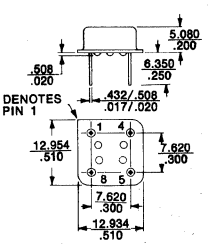

FIG. 5 Mini-DIP PACKAGE

Pin 1—N/C
Pin 4—Ground/case
Pin 5—Output
Pin 8—+5 VDC supply

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Military Hybrid Clock Oscillators

CTS Knights is a Qualified Products List (QPL) supplier for MIL-O-55310/8, 14, 16, 17, 14-pin dual-in-line package
TTL logic output
Frequencies from 50 Hz to 60 MHz
Class B screening

PIN CONNECTIONS
In accordance with appropriate slash sheet

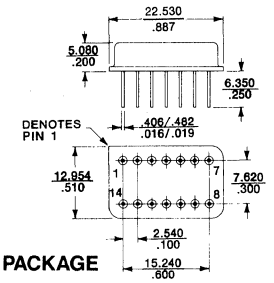

FIG. 8 MILITARY PACKAGE

CTS Knights also supplies product equivalent to the following MIL-O-55310 specification with qualification anticipated soon:

SPECIFICATION	TYPE
M55310/9	TTL, TO-5
M55310/10	TTL, TO-8
M55310/11	CMOS, 14-pin DIP
M55310/15	CMOS, 14-pin DIP
M55310/18	CMOS, 14-pin DIP
M55310/19	TTL, 40-pin LCC
M55310/20	TTL, 44-pin LCC

M55310/16 SERIES
ORDERING INFORMATION M55310/16- □ □ □□ -(EXACT FREQUENCY)

SCREENING	
CODE	CLASS
B	CLASS B

FREQUENCY RANGE	
CODE	FREQUENCY
0	50 Hz to <250 Hz
1	250 Hz to <150 KHz
2	150 KHz to <4.0 KHz
3	4.0 MHz to <20 MHz
4	20 MHz to 60MHz

TOLERANCE (PPM)				
CODE	TEMP. RANGE	FREQ. ACCURACY @ 23°C	FREQ. STABILITY VS TEMP.	AGING (PER YEAR)
1A	−55°/125°C	15 ppm	50	5 ppm
1B	−55°/105°C		40	
1C	−20°/70°C		25	
4A	−55°/125°C	25 ppm	100	10 ppm
4B	−55°/105°C		80	
4C	−20°/70°C		50	

M55310/08 SERIES
ORDERING INFORMATION M55310/08- □ □□ □ -(EXACT FREQUENCY)

SCREENING	
CODE	CLASS
B	CLASS B

FREQUENCY RANGE		AGING (PER YEAR)
CODE	FREQUENCY	
01	1.0 KHz to <150.0 KHz	5
02	150.0 KHz to <300.0 KHz	
03	300.0 KHz to <600.0 KHz	
04	600.0 KHz to <2.5 MHz	
05	2.5 MHz to <5.0 MHz	
06	5.0 MHz to <10.0 MHz	10
07	10.0 MHz to <20.0 MHz	
08	20.0 MHz to <30.0 MHz	
09	30.0 MHz to <50.0 MHz	
10	50.0 Hz to <1.0 KHz	

TOLERANCE (PPM)			
CODE	TEMP. RANGE	FREQ. ACCURACY @ 23°C	FREQ. STABILITY VS TEMP.
A	−55 to +125°C	15 ppm (TYP)	±50ppm
B	−55 to +105°C		±40ppm
C	−20 to +70°C		±25ppm

M55310/14 SERIES
ORDERING INFORMATION M55310/14- □ □□ □ -(EXACT FREQUENCY)

SCREENING	
CODE	CLASS
B	CLASS B

FREQUENCY RANGE	
CODE	FREQUENCY
01	50 Hz to <1.0 KHz
02	1.0 KHz to <150.0 KHz
03	150.0 KHz to <300.0 KHz
04	300.0 KHz to <600.0 KHz
05	600.0 KHz to <2.5 MHz
06	2.5 MHz to <5.0 MHz
07	5.0 MHz to <10.0 MHz
08	10.0 MHz to <15.0 MHz
09	15.0 MHz to ≤25.0 MHz

TOLERANCE (PPM)				
CODE	TEMP. RANGE	FREQ. ACCURACY @ 23°C	FREQ. STABILITY VS TEMP.	AGING (PER YEAR)
A	−55 to +125°C	15 ppm	±50 ppm	5 ppm
B	−55 to +105°C		±40 ppm	
C	−20 to +70°C		±25 ppm	

M55310/17 SERIES
ORDERING INFORMATION M55310/17- □ □ □□ -(EXACT FREQUENCY)

SCREENING	
CODE	CLASS
B	CLASS B

FREQUENCY RANGE	
CODE	FREQUENCY
0	250.0 KHz to <5.0 MHz
1	4.0 MHz to <20.0 MHz
2	20.0 MHz to ≤50.0 MHz

TOLERANCE (PPM)				
CODE	TEMP. RANGE	FREQ. ACCURACY @ 23°C	FREQ. STABILITY VS TEMP.	AGING (PER YEAR)
1A	−55°/125°C	15 ppm*	50	5 ppm
1B	−55°/105°C		40	
1C	−20°/70°C		25	
4A,BorC	as above	25 ppm	100	10 ppm

*01 is 10 ppm

NOTE:
■ **HIGH RELIABILITY SCREENING**—All hybrid oscillators, at your option, can be screened similar to the Class B requirements of MIL-0-55310. To request this option, add "MLB" after the part number (e.g. MXO-55GA-2C-16.0 MHz-MLB).

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Military Hybrid Clock Oscillators

CCXO SERIES

Leadless chip carrier package
TTL logic output
Low Profile
Excellent Environmental Performance
1.0 to 45.0 MHz
Electrically similar to
MXO-55 as follows:
"A" MODELS are electrically similar to MXO55GA Models
"B" MODELS are electrically similar to MXO55GB Models from 307.2 KHZ to <2.4576 MHZ

PACKAGE OUTLINES

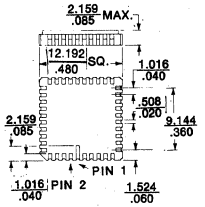

FIG. 12 CCXO-140

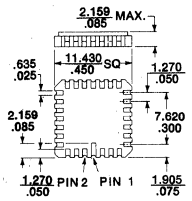

FIG. 13 CCXO-150

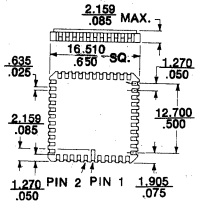

FIG. 14 CCXO-250

ORDERING INFORMATION

CCXO- [ ] [ ] – [ ] [ ] – [ ] • [ ]

OUTPUT FREQUENCY

PACKAGE STYLE	CODE
40-pin, .040" spaced	140
28-pin, .050" spaced	150
44-pin, .050" spaced	250

FREQUENCY AND MODEL	CODE
12 to 45 MHz Basic oscillator	A
1 to <12 MHz Oscillator with dividers	B

FRQUENCY TOL. (NOTE 2)	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4

OPERATING TEMPERATURE RANGE	CODE
0°C to +70°C	C
−40°C to +85°C	I
−55°C to +105°C	P
−55°C to +125°C	M

STANDARD PIN ASSIGNMENT

CCXO-140 PINS	CCXO-150 PINS	CCXO-250 PINS	FUNCTION FOR FREQUENCY 1-45 MHz
1	2	1	NC
4	4	6	+5 VDC
5	15		NC
10	8	12	+5 VDC
15	12	18	NC
25	18	28	NC
31	22	34	GND
35			NC
37	26	40	GND
39	28	42	Output
40	1	44	NC

NOTES:
1. NC — Indicates internal connection. No external electrical connection allowed.
2. Tolerance includes 25°C accuracy, changes in operating temperature, supply voltage, load, environmental conditions and aging.
3. Multiple +5 VDC and GND pins are internally connected and redundant.
4. Non-standard pin assignments may be possible. Consult factory with requirements.
5. Screening similar to MIL-O-55310, Class B available by adding -MLB to end of P/N.
6. Unspecified pins may have external electrical connections.

Engineering Data For Hybrid Oscillators

TYPICAL CHARACTERISTICS

- STORAGE TEMPERATURE: −65°C to +150°C.
- TEMPERATURE CYCLE: 25 cycles, −55°C to +125°C, per method 1010 of MIL-STD-883.
- CONSTANT ACCELERATION: 5000 G, Y1 direction, per method 2001 of MIL-STD-883.
- MECHANICAL SHOCK: 1500 G, 0.5 mS, 3 shocks per direction, per method 2002 of MIL-STD-883.
- SINUSOIDAL VIBRATION: 0.06" D.A., 10 to 55 Hz and 30 G, 55 to 2000 Hz, 3 cycles per direction, per method 2007 of MIL-STD-883.
- RANDOM VIBRATION: 20 G, 20 to 2000 Hz, per method 2026 of MIL-STD-883.
- LEAD INTEGRITY: Per conditions B1 and B2 in method 2004 of MIL-STD-883.
- HERMETICITY: 1×10^8 ATC-cc/sec, per conditions A1 and C in method 1014 of MIL-STD-883.
- MOISTURE RESISTANCE: 10 cycles, per method 1004 of MIL-STD-883 with step 7 subcycle omitted.
- CORROSION RESISTANCE: 24 hours, per condition A in method 1009 of MIL-STD-883.
- SOLDERABILITY: Per method 2003 of MIL-STD-883, or method 208 of MIL-STD-202, except 1 hour steam aging.
- QUALITY: In accordance with MIL-I-45208.
- RESISTANCE TO SOLDERING HEAT: Per conditions A and C in method 210 of MIL-STD-202.
- MARKING PERMANENCE: Per method 2015 of MIL-STD-883.
- THERMAL RESISTANCE: Per method 1012.1 of MIL-STD-883.
  MXO-55 style package = 12°C/watt typical.
  TO-5/TO-8 style package = 8°C/watt typical.
  CCXO style package = 7°C/watt typical.
- ELECTROSTATIC DISCHARGE SENSITIVITY: Per method 3015 of MIL-STD-883:
  TTL output models — > 4 KV
  (Class B — not sensitive)
  ECL output models — > 4 KV
  (Class B — not sensitive)
  CMOS output models — < 2 KV
  (Class A — sensitive)
- STEADY-STATE LIFE: 1000 hrs. @ 125°C per method 1005 of MIL-STD-883, disregarding frequency shift.
- FREQUENCY AGING: <10ppm shift in 30 days @ 85°C ambient.
- No External Connection Allowed on N/C Pinouts.

SPECIAL REQUIREMENTS

- ELECTROMAGNETIC INTERFERENCE PROTECTION
  The metal package construction, used extensively on CTS Knights hybrid oscillators, effectively reduces radiated EMI due to the oscillator circuitry. Further reduction can be accomplished by connecting the case to circuit ground, which is standard on MXO and CXO series oscillators. Case grounding is specified by a "G" in the part number (eg. MXO-55GA, CXO-65GA). CTS Knights has also gained considerable experience in reducing conducted EMI in specific customer applications. Contact CTS with your EMI problems or requirements, we'll offer a solution.
- CUSTOM DESIGN CAPABILITIES—CTS Knights' in-house capabilities include circuit design and artwork generation, crystal and hybrid thick film manufacturing facilities, manual and automated manufacture and test techniques, and mechanical and environmental testing. This gives CTS a unique flexibility to design and manufacture to your custom hybrid oscillator specifications. Consult the innovative staff at CTS Knights with your special requirements.

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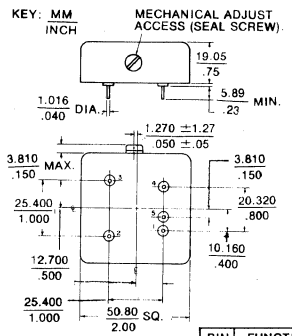
Precision Crystal Oscillators

JKVXO-220
HIGH STABILITY TCVCXO



TOLERANCE	
.XX	.XXX
±.76 MM	±.381 MM
±.03	±0.15

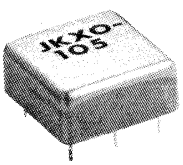
PIN	FUNCTION
1	OUT
2	Vcc 12 V
3	0 VOLTS, CASE
4	VCXO INPUT
5	RF RETURN, CASE

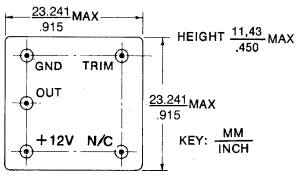
Designed for telecommunications use in phase locked and digital frequency locked loop applications where tight stability is needed during unlocked operation. Deviation range, temp. stability and aging rate combine to provide a highly stable TCVCXO with excellent free running stability and reference locking capability over an extremely long life.

SPECIFICATIONS

- Frequency range: 1 MHz to 25 MHz
- Excellent long term Aging: <4 ppm in 20 yrs.
- Operating range: 0 to +50°C or 0 to +70°C.
- $\pm 3 \times 10^{-7}$ ΔF vs. temp. at any deviation voltage setting.
- Deviation: ±10 to ±15 ppm for 0 to +10V input, centered at +5 VDC.
- TTL or HCMOS output.
- Available with or without trim access port.
- +12V supply (other voltages available).

JKXO-105
HYBRID TCXO





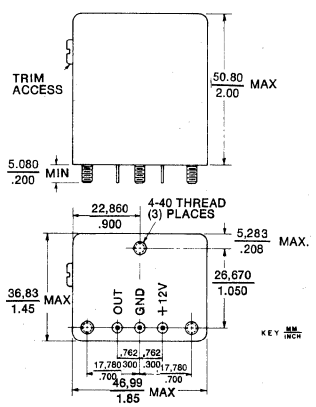
SPECIFICATIONS

The JKXO-105 is a subminiature TCXO designed to meet the requirements of modern battery operated systems. Its small size (0.32 cubic inches) and very low power consumption combine to form state-of-the-art TCXO performance for industry and military applications.

- Frequency range: 10 MHz to 20 MHz
- Temp. Stability: −1) $\pm 1 \times 10^{-6}$, 0 to +70°C.
  −2) $\pm 2 \times 10^{-6}$, −28 to +70°C.
  −3) $\pm 2 \times 10^{-6}$, −55 to +85°C.
- Input: +12 VDC ±5% at 2.2 mA typ., 3 mA max.
- Output: Sinewave 1 vp-p into 1 KΩ.
- Stability vs time: $\pm 1 \times 10^{-6}$/yr.
- Stability vs. voltage: $\pm 5 \times 10^{-8}$/0.1 volt change.
- External trim sufficient for 10 yrs. aging via external resistor.

ADD "T" or "H" to Part number for TTL or HCMOS output signal—5V supply required

JKXO-200
HIGH STABILITY TCXO — 5 MHz*



* CONTACT FACTORY FOR OTHER FREQUENCIES.

The JKXO-200 is a precision TCXO designed to maintain state-of-the-art stability during variations in environment and electrical inputs. Temperature hysteresis, temperature slew, trim adjust effects and aging have been minimized. The very low power consumption and rugged construction make this oscillator ideal for battery operated portable use. The JKXO-200 can be manufactured using Hi-Rel military components providing an ultra stable TCXO capable of surviving the harshest of military environments.

CONDENSED SPECIFICATIONS

	−2
Frequency vs. temp. −55°C to +85°C including hysteresis	$\pm 5 \times 10^{-7}$
1°C/min temp. slew −55°C to +85°C including trim adjust effect	$\pm 7 \times 10^{-7}$
Stability vs. time	$\pm 3 \times 10^{-7}$ 1st yr $\pm 8 \times 10^{-7}$/5 yrs
Stability vs. voltage (12V ±1V)	$\pm 5 \times 10^{-9}$
Output level: 50Ω load	50 mV RMS
1000Ω load	150 mV RMS
Warm up to within $\pm 5 \times 10^{-8}$	10 seconds max.
Input power at +12V	50 mW max.

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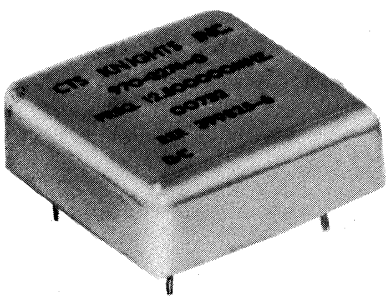
Precision Oscillators — TCXO/TCVCXO

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS (TCXO's) VOLTAGE CONTROLLED - TEMPERATURE COMPSENSATED CRYSTAL OSCILLATORS (TCVCXO's)

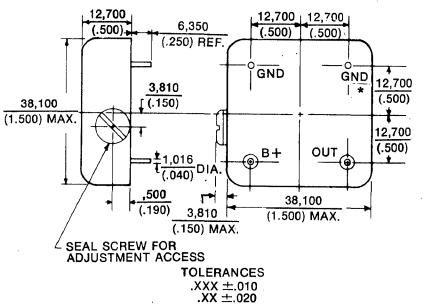
Low power consumption, high stability over wide temperature extremes, and small physical size characterize CTS Knights' TCXO and TCVCXO crystal oscillators. Add excellent environmental characteristics including immunity to humidity, vibration and shock, satisfying the requirements of the instruments and communications industries.

High reliability and stringent long term qualities common in military applications are available in a variety of designs. Note the options and modifications, the flexibility of design which offers the user choices to fulfill specific needs.

JKXO-12 (TCXO) JKVXO-12 (TCVCXO)



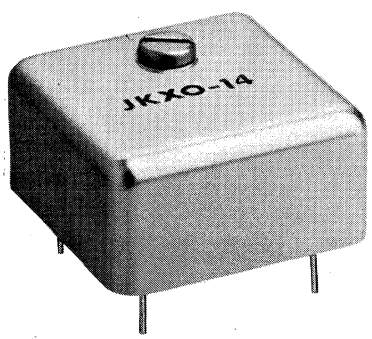
FEATURES:
- Low profile
- Solder seal
- Vibration 15G's, to 10-2000 Hz



* VCO INPUT ON TCVCO MODELS

Fig. 21

JKXO-14 (TCXO)



FEATURES:
- Top access hex drive trim adjustment
- Sine or TTL output
- Solder seal

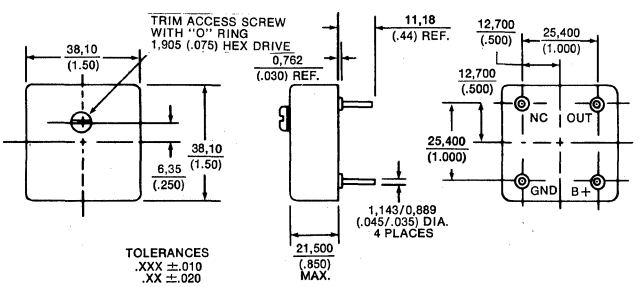
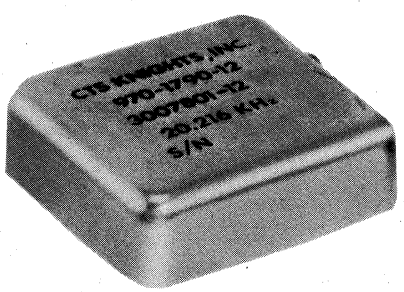
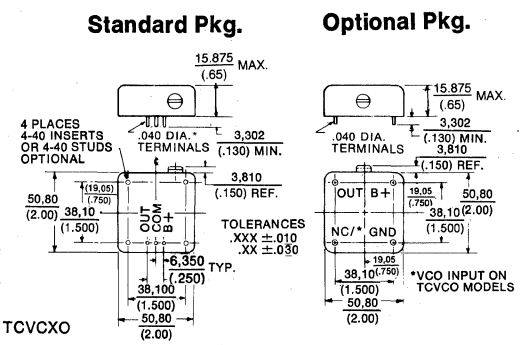


Fig. 22

JKXO-16 (TCXO) JKVXO-16 (TCVCXO)



FEATURES:
- Solder seal
- Wide frequency range
- Specialized outputs available



* 4 PINS FOR TCVCXO

Fig. 23

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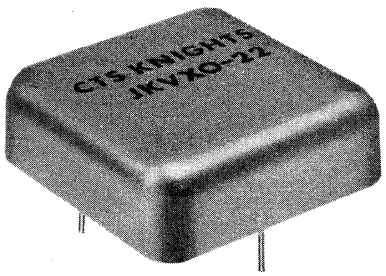
Precision Crystal Oscillators — TCXO/TCVCXO

JKVXO-22



FEATURES:

- Available as VCXO or TCVCXO. Temperature stability and deviation are customized per application. 5 volt supply, Mod voltage range 0 to +5 VDC.

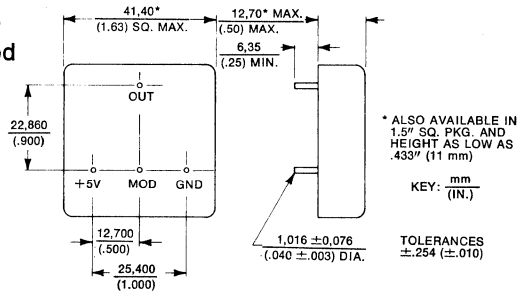
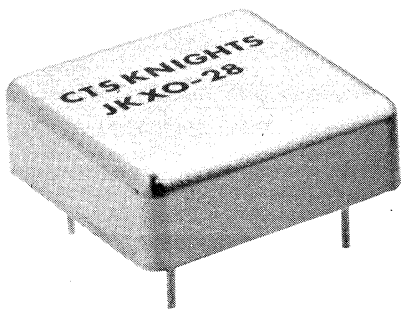


Fig. 24

JKXO-28 (TCXO)



FEATURES:

- Frequency range: 8 MHz to 20 MHz
- 5 VDC supply
- ±1 ppm, 0°C to +70°C
- TTL or HCMOS output
- <±3 ppm aging in 10 yrs.

The JKXO-28 is a low cost design providing excellent long term stability without need for re-calibration over a long life.

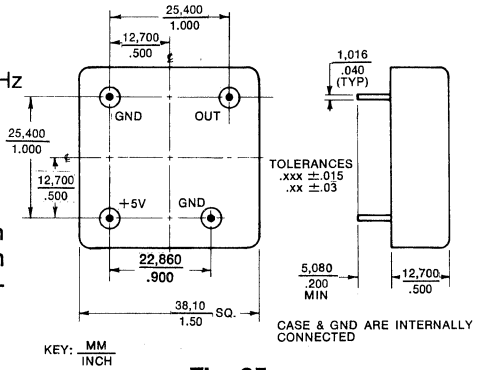


Fig. 25

FIG.	MODEL	*FREQUENCY RANGE	SUPPLY VOLTAGE OPTIONS (VDC)	STABILITY WITH TEMPERATURE	VCXO DEVIATION OPTIONS	MAX. AGING 1st YR.	OUTPUT OPTIONS
21	JKXO-12A	3-30 MHz	12-20	±2 ppm, −55 to +85°C	NONE	1 ppm	Sine Wave, TTL, HCMOS, CMOS (Below 10 MHz)
	JKXO-12B	3-30 MHz	12-20	±1 ppm, −40 to +75°C	NONE	1 ppm	
	JKXO-12C	3-50 MHz	12-20	±.5 ppm, 0 to +70°C	NONE	1 ppm	
22	JKXO-14A	3-30 MHz	12-28	±.5 ppm, 0 to +50°C	NONE	1 ppm	TTL or Sine
	JKXO-14B	3-30 MHz	12-28	±1 ppm, 0 to +70°C	NONE	1 ppm	
23	JKXO-16A	1 Hz to 30 MHz	12-28	±1 ppm, −40 to +75°C	NONE	1 ppm	Sine (Above 500 KHz) ECL, TTL, HCMOS CMOS (Below 10 MHz)
	JKXO-16B	1 Hz to 30 MHz	12-28	±1 ppm, −55 to +85°C	NONE	1 ppm	
	JKXO-16C	1 Hz to 30 MHz	12-28	±2 ppm, −40 to +75°C	NONE	1 ppm	
	JKXO-16D	30 to 100 MHz	15-28	±2 ppm, −20 to +70°C	NONE	1 ppm	
	JKXO-16E	1 KHz to 30 MHz	5	±2 ppm, −20 to +70°C	NONE	1 ppm	
25	JKXO-28	8-20 MHz	5	±1 ppm, 0 to +70°C	NONE	.75 ppm	TTL or HCMOS
21	JKVXO-12A	8-30 MHz	9-20	±10 ppm, 0 to +70°C	±100 ppm, ±5V Input	1 ppm	TTL
	JKVXO-12B	30 to 50 MHz	12-20	±5 ppm, 0 to +70°C	±15 ppm, ±3V Input	1 ppm	Sine Wave
	JKVXO-12C	8 to 35 MHz	12-20	±2 ppm, 0 to +70°C	±40 ppm, ±3V Input	1 ppm	Sine, TTL
23	JKVXO-16A	1 KHz to 30 MHz	5-20	±10 ppm, 0 to +70°C	±40 ppm, 0 to 5 VDC	1 ppm	TTL, ECL, HCMOS CMOS (Below 10 MHz) Sine (Above 500 KHz)
	JKVXO-16B	1 KHz to 30 MHz	9-20	±20 ppm, −20 to +70°C	±100 ppm, ±5V Input	1 ppm	
	JKVXO-16C	1 MHz to 30 MHz	5	±30 ppm, −55 to +85°C	±100 ppm, 0 to 5V Input	1 ppm	
	JKVXO-16D	30 MHz to 150 MHz	12-20	±5 ppm, 0 to +50°C	±15 ppm, ±5V Input	1 ppm	Sine, ECL
24	JKVXO-22A	1 MHz to 30 MHz	5	±10 ppm, 0 to +50°C	±40 ppm, 0 to +5 VDC	2 ppm	TTL, CMOS
	JKVXO-22B	30 MHz to 50 MHz	5	±5 ppm, 0 to +50°C	±12 ppm, 0 to +5 VDC	1 ppm	TTL ECL (−5V Supply Req.)
	JKVXO-22C	1 MHz to 30 MHz	5	±15 ppm, −20 to +70°C	±100 ppm, 0 to +5 VDC	2 ppm	

* Consult factory for available standard frequencies.

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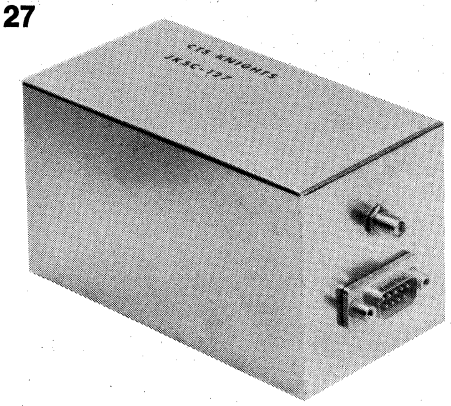
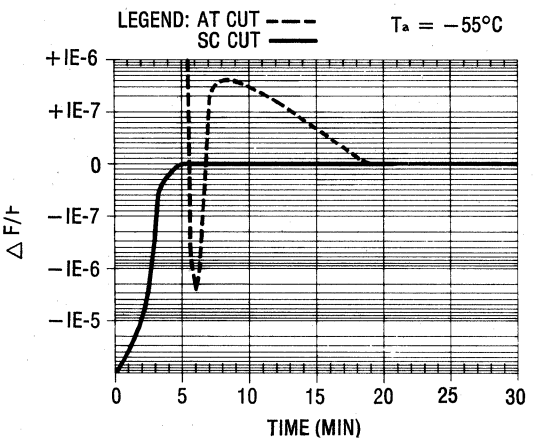
Fast Warm-Up SC Cut Ovenized Oscillator

JKSC-127





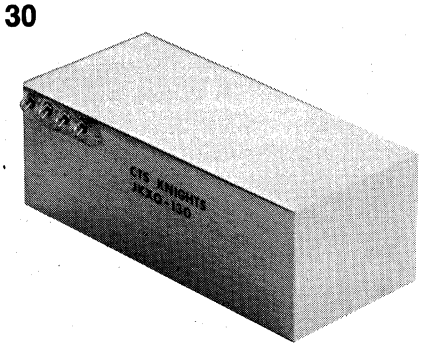
The JKSC-127 offers ultra fast warm-up with excellent long term, short term and phase noise characteristics. The design utilizes a 10 MHz coldweld sealed SC cut overtone crystal along with a uniquely designed proportionally controlled double oven which minimizes stabilized power consumption. The JKSC-127 is available fully militarized with an MTBF of greater than 100,000 hours in ground mobile and airborne environments.

GENERAL SPECIFICATIONS

FREQUENCY: 10.0 MHz or 10.230 MHz
INPUT VOLTAGE: Oven +28 VDC ±5%
Oscillator +15 VDC ±5%
INPUT CURRENT: Oven @ turn-on 1.2 amps maximum
@ −25°C 125 mA typical
@ −55°C 240 mA typical
Oscillator 20 mA maximum
FREQUENCY STABILITY VS. TEMPERATURE:
$\pm 5 \times 10^{-9}$ from −55°C to +71°C
FREQUENCY STABILITY VS. TIME:
$\pm 5 \times 10^{-12}$ RMS/sec
$\pm 5 \times 10^{-10}$/day at shipment
$\pm 3 \times 10^{-8}$/year
WARM UP: @ −55°C $< 5 \times 10^{-9}$ in 7 minutes
@ −32°C $< 5 \times 10^{-9}$ in 5 minutes
@ +25°C $< 5 \times 10^{-9}$ in 3 minutes
PHASE NOISE (1 HzBW): @ 10 Hz offset −120 dbc
@ 100 Hz offset −140 dbc
@ 1 KHz offset −150 dbc
@ 100 KHz offset −150 dbc
RF OUTPUT: +5 dbm minimum into 50 ohms
FREQUENCY ADJUSTMENT:
Coarse (mechanical) $\pm 5 \times 10^{-7}$ minimum
Fine (electrical) $\pm 5 \times 10^{-8}$ minimum for ±5 VDC
SIZE: 2.5″ x 4.5″ x 2.5″ H.
Modifications of the JKSC-127 available.

Ovenized Crystal Oscillator

JKXO-130



The JKXO-130 offers excellent long and short term stabilities at an economical price. The design utilizes a cold weld precision overtone crystal with a proportional oven controller.

GENERAL SPECIFICATIONS

FREQUENCY RANGE: 256 KHz to 12.5 MHz
STANDARD FREQUENCIES AVAILABLE: 5, 6, 10, 12.352 MHz
INPUT VOLTAGE AND POWER: +15 VDC ±5%
10 Watts maximum at turn on 4.5 Watts typical at room temperature.
RF OUTPUT: TTL compatible 2 loads
FREQUENCY STABILITY VS. TIME:
5×10^{-11} RMS/10 seconds
$\pm 5 \times 10^{-10}$/day at shipment
$\pm 3 \times 10^{-8}$/year
FREQUENCY STABILITY VS. TEMPERATURE:
$\pm 1 \times 10^{-8}$ from 0°C to +60°C
SSB PHASE NOISE (measured in a 1 Hz bandwidth):
@ 10 Hz offset −114 dbc
@ 100 Hz offset −130 dbc
@ 1 KHz offset −135 dbc
@ 10 KHz offset −140 dbc
FREQUENCY ADJUSTMENT: Coarse $>1 \times 10^{-6}$
Fine $>1 \times 10^{-8}$
Resolution $<1 \times 10^{-10}$
FREQUENCY RETRACE:
(After 48 hours off at room temperature)
$<\pm 1 \times 10^{-8}$ of the turn off frequency 1 hour after turn on.
SIZE: 1.6″ x 4.5″ x 2.11″ H.
Numerous modification of the JKXO 130 available — consult factory to discuss your application.

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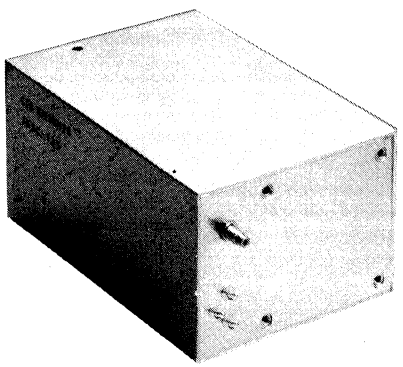
Precision Crystal Oscillators

JKSC-135

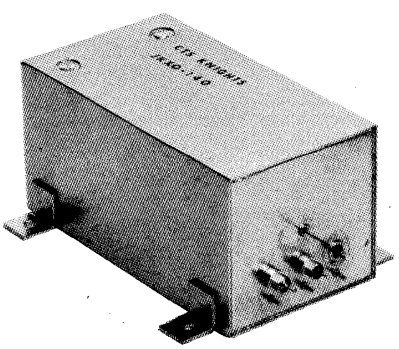


The JKSC-135 is an ultra stable 5 MHz double oven oscillator. Its utilization of a 5 MHz overtone SC cut crystal helps produce excellent long and short term stabilities. The JKSC-135 is well suited for portable battery operated systems.

SPECIFICATIONS

- FREQUENCY: 5.0 MHz
- INPUT VOLTAGE: +15 VDC
- INPUT POWER: 7 Watts maximum at turn on
  2.5 Watts @ 25°C
- FREQUENCY STABILITY:
  VS. TEMPERATURE: $\leq 1 \times 10^{-9}$ peak to peak
  −25°C to +60°C
  VS. TIME: 8×10^{-12} RMS/100 sec.
  $\pm 5 \times 10^{-10}$/day
  $\pm 2 \times 10^{-8}$/year
- OUTPUT: Sine, 1V RMS into 50 ohms
- Size: 5.0″ x 2.38″ x 3.20″ H

JKXO-140



The JKXO-140 is designed to meet the stringent frequency control requirements of modern telecommunications systems. Commonly used telecommunication output frequencies are standard.

SPECIFICATIONS

CENTER FREQUENCIES (MHz): 5.0, 5.12, 6.176, 10.0, 10.24, 12.352
INPUT VOLTAGE: +24 VDC
INPUT POWER: 8 Watts maximum at turn on
3.5 Watts stabilized @ +25°C

- FREQUENCY STABILITY:
  VS. TEMPERATURE: 3×10^{-10}/15°C (0°C to +55°C)
  VS. TIME: $\pm 3 \times 10^{-10}$/day after 30 days
  $\pm 2 \times 10^{-8}$/year
  $\pm 5 \times 10^{-8}$/20 years
- OUTPUT: 2 TTL loads
- ELECTRICAL ADJUSTMENT: $\pm 5 \times 10^{-8}$ minimum for ±5 VDC
- SIZE: 2.30″ x 4.50″ x 2.10″ H

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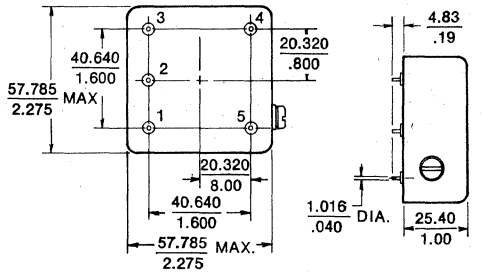
Precision Crystal Oscillators



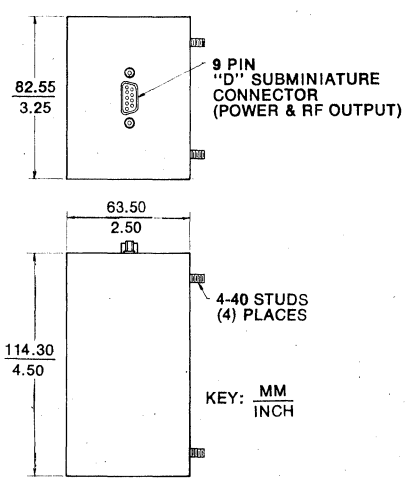
PIN	FUNCTION
1	N/C
2	+5 VDC
3	RF OUTPUT
4	GROUND
5	+15 VDC

JKXO-141

Designed primarily for the telecommunication market, the JKXO-141 series of OCXO's offers a wide range of stabilities. It's small size and low power consumption makes the JKXO-141 an excellent choice for "on card" requirements. Advanced construction techniques are used to make this oscillator the economical solution to your high volume needs.

FREQUENCY		5.0 MHz*		
OUTPUT LEVEL		TTL with fanout of 10 LSTTL loads		
FREQUENCY ADJUSTMENT		Sufficient for 20 Yrs. aging		
OPERATING TEMPERATURE RANGE		0°C to +60°C		
FREQUENCY STABILITY VS.		JKXO-141-1	JKXO-141-2	JKXO-141-3
TEMPERATURE	(0°C −60°C)	8×10^{-8}	3×10^{-8}	3×10^{-9}
	Any 15°C Change	—	6×10^{-9}	1.4×10^{-9}
AGING	Per Day	1×10^{-8}	3×10^{-9}	5×10^{-10}
	Per Year	1.5×10^{-6}	5×10^{-7}	1.5×10^{-7}
	Per 20 Years	3×10^{-6}	1×10^{-6}	5×10^{-7}
SUPPLY VOLTAGE		5×10^{-9}/%	5×10^{-10}/%	5×10^{-11}/%
WARM UP	20 minutes	1×10^{-7}	1×10^{-7}	1×10^{-7}
	8 Hours	—	—	1×10^{-9}
INPUT POWER		+5Vdc +5%	@ 50ma MAX	
		+15Vdc +5%	@500ma MAX (Cold Start)	
			@150ma Hot (35°C) Typ.	
SIZE		2.25″ x 2.25″ x 1″ H		
RELIABILITY		Better than 250,000 Hrs MTBF		
VIBRATION/SHOCK		2 G, 10-500 Hz/30 G, 11ms		

*Consult factory for other frequencies and options



JKSC-142

The JKSC-142 meets the stringent requirements of the "Stratum II" telecommunications specification. The use of a precision over-tone SC Cut crystal along with custom designed double oven results in exceptional stability performance over time and temperature.

OUTPUT FREQUENCY: 5.0 MHz*

DC INPUT REQUIREMENTS:
+15 VDC and +5 VDC (±5% regulated to ±1%)

INPUT POWER REQUIREMENTS (TYPICAL):

	+15VDC	+5VDC
@ turn-on	9 watts	0.18 watts
@ +35°C	3 watts	0.18 watts

OPERATING TEMPERATURE RANGE: 0°C to +60°C

RF OUTPUT CHARACTERISTICS:
Square wave
10 LS TTL Loads
Duty Cycle 45/55 to 55/45

WARM UP (+25°C): Less than $+1 \times 10^{-7}$ in 25 minutes from frequency at one hour on

STABILITY: $\pm 1 \times 10^{-7}$ for 20 years without adjustment
(After Stabilization): $\pm 1 \times 10^{-10}$ per day with any 15°C ambient temperature change and a 0.3% input voltage change

INPUT/OUTPUT CONNECTOR: 9 pin "D" sub-miniature

MTBF: greater than 250,000 hours

SIZE: 4.50″ x 3.25″ x 2.5″ H

*Consult factory for other frequencies and options

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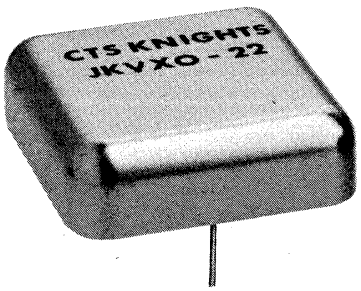
Voltage Controlled Crystal Oscillators—VCXO

JKVXO-22

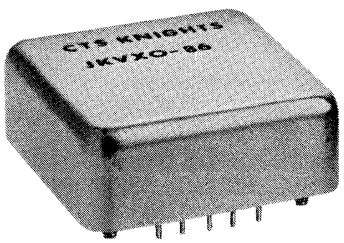


SIZE: 1.63″ x 1.63″ x .5″H

The JKVXO-22 is a low cost VCXO designed for phase locked loop applications. Temperature stability and deviation are customized per application. TTL, HCMOS or ECL outputs available. Operation is from +5V supply (−5V for ECL). Standard models are listed below.

MODEL	FREQUENCY RANGE	STABILITY	DEVIATION	AGING
JKVXO-22A	1 MHz to 30 MHz	±10 ppm, 0°C to +70°C	±40 ppm, 0 to +5 VDC	<2 ppm 1st yr
JKVXO-22B	30 MHz to 50 MHz	±5 ppm, 0°C to +50°C	±12 ppm, 0 to +5 VDC	<1 ppm 1st yr
JKVXO-22C	1 MHz to 30 MHz	±15 ppm, −20°C to +70°C	±100 ppm, 0 to +5 VDC	<2 ppm 1st yr

JKVXO-86



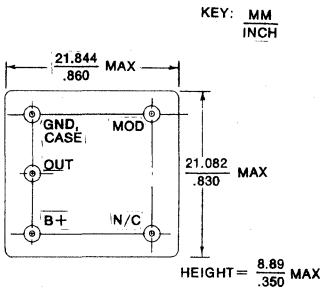
SIZE: 2″ x 2″ x .75″ H

The JKVXO-86 is a compact, low cost VCXO designed to meet your requirements. The unit exhibits good stability over the temperature range of 0 to +55°C and provides excellent modulation characteristics.

SPECIFICATIONS

- FREQUENCY RANGE: 5 to 30 MHz
- FREQUENCY DEVIATION: ±1000 ppm
- MODULATION LINEARITY: ±10%
- FREQUENCY STABILITY: ±100 ppm, 0 to +55°C
- DC INPUTS: +12V @ 15 mA typ.
- MODULATION INPUT: ±3V P.P., DC to 20 KHz
- MODULATION RESPONSE: ±1 dB, DC to 20 KHz
- RF OUTPUT: Sine, 0 dBm/min.

JKVXO-112



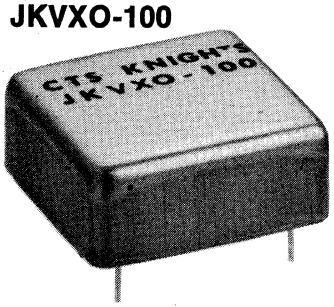
SIZE: .86″ max × .83″ max × .35″ max (H)

The JKVXO-112 is a subminiature VCXO ideal for use in digital phase locked loop applications. A wide frequency range is available in a .25 cubic inch package.

SPECIFICATIONS

- FREQUENCY RANGE: 2-35 MHz
- FREQUENCY DEVIATION: ±40 to ±90 ppm
- FREQUENCY VS. TEMPERATURE: ±15 ppm, 0°C to +70°C
- OUTPUT: TTL or HCMOS
- INPUT: 5 VDC ±5%
- MODULATION INPUT VOLTAGE OPTIONS:
  - −1) 0 VDC to +10 VDC, centered at 5 VDC
  - −2) 0 VDC to +5 VDC, centered at 2 VDC

JKVXO-100



SIZE: .86″ max × .83″ max × .35″ max (H)

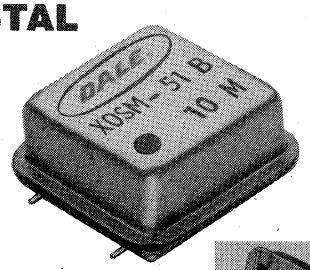
The JKVXO-100 is a subminiature VCXO designed to meet requirements for wide pullability and good center frequency stability. Uses include digital phase locked loop applications for frequency synthesis and data reception.

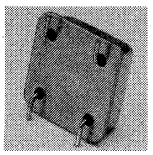
SPECIFICATIONS

- FREQUENCY RANGE: 10 to 35 MHz
- CENTER FREQUENCY AT ROOM TEMPERATURE: ±10 ppm at time of shipment
- PULLABILITY: ±200 ppm minimum
- TEMP. STABILITY: 0°C to +60°C ±40 ppm
- OSCILLATOR INPUT: +12 VDC ±10% @ 10 mA max. +5 VDC ±10% @ 25 mA max.
- OUTPUT: TTL (5 loads)

CTS — QUALITY FREQUENCY CONTROL COMPONENTS FOR RELIABLE ELECTRONICS

SURFACE MOUNT, HYBRID CRYSTAL CLOCK OSCILLATOR





ACTUAL SIZE

MODEL XOSM-51B, 240 Hz to 1.5 MHz; 4.0 MHz to 60.0 MHz

FEATURES

- HCMOS, CMOS, NMOS, TTL, LS-TTL, S-TTL Compatible
- Miniature size (.50" square) for greater packaging density
- Hermetically sealed package

SPECIFICATIONS

ELECTRICAL

Operating Temperature Range: 0°C to +70°C

Storage Temperature Range: −55°C to +125°C

Frequency Stability: (Inclusive of Calibration Tolerance at 25°C, Temperature Change, Input Voltage Change, Load Change, Aging, Shock and Vibration): ±.01% (±100 PPM)

Input Voltage: (Vdd) +5.0 ± 0.5 VDC

Input Current: 5 to 40 mA Typ. (see graph)

Rise Time: 10nS Max. (CMOS Levels), 6nS Max. (TTL Levels)

Fall Time: 10nS Max. (CMOS Levels), 6nS Max. (TTL Levels)

Logic '0' Level: 0.1 Vdd Max. CMOS, 0.4V Max. TTL

Logic '1' Level: 0.9 Vdd Min. CMOS, 2.4V Min. TTL

Logic '0' Sink Current: 16 mA Min.

Logic '1' Source Current: 0.4 mA Min.

Output Waveform: Squarewave, HCMOS, CMOS, NMOS, TTL, LS-TTL, S-TTL Compatible, Waveform Symmetry (0.5 Vdd CMOS or 1.4V TTL Levels): 50 + 10%

Output Load: 50 pF HCMOS or 1-10 TTL Loads (3 TTL Max. below 4 MHz)

Environmental:

Temperature Cycle: −55°C to + 85°C, 3 cycles

Shock: 1000 G's 0.35 millisecond, ½ sine wave, 3 shocks each plane

Vibration: .06 D.A., 10-55 Hz, 35 G, 55-2000 Hz

Humidity: 85% relative humidity @ 85°C, 240 Hours

Mechanical:

Hermetically Sealed Package: Leak rate less than 2 x 10^{-8} atmosphere cc/sec. of helium

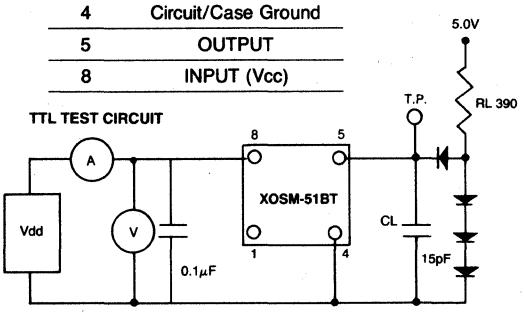
Marking Ink: Epoxy, solvent resistant

Solvent Resistance: Isopropyl alcohol, Trichloroethane, Freon TMC

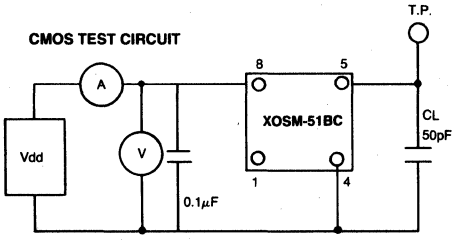
Terminal Solderability: Per MIL-STD-202, Method 208C

PIN	CONNECTION
1	N/C
4	Circuit/Case Ground
5	OUTPUT
8	INPUT (Vcc)

TTL TEST CIRCUIT



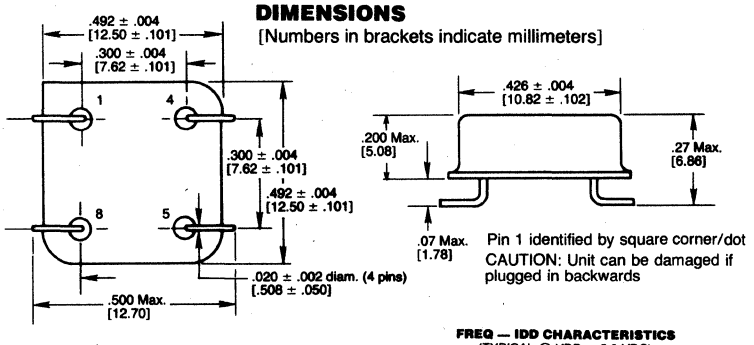
CMOS TEST CIRCUIT



CL — To include probe and fixture capacitance

DIMENSIONS

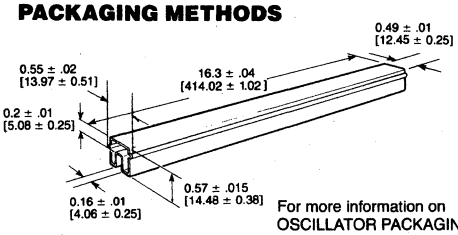
[Numbers in brackets indicate millimeters]



Pin 1 identified by square corner/dot

CAUTION: Unit can be damaged if plugged in backwards

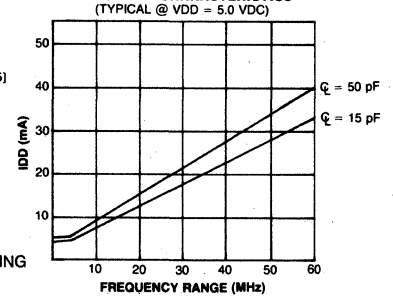
PACKAGING METHODS



For more information on OSCILLATOR PACKAGING write or phone.

FREQ — IDD CHARACTERISTICS

(TYPICAL @ VDD = 5.0 VDC)



HOW TO ORDER

XOSM-51	B		10
PART NO. CODE	FREQ. ACCURACY	MEASUREMENT METHOD	FREQ./MHz
	A = .005% **B** = .01% (Std. Tol.) **C** = .05%	**C:** C-MOS Level **T:** TTL Level	

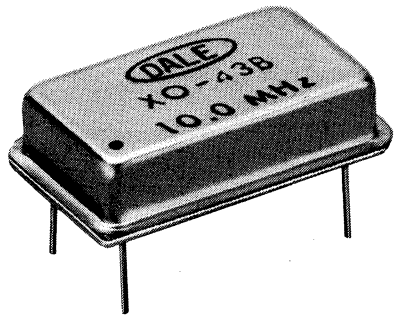
Contact factory for other models, logic families, stabilities and temperature ranges.

For complete information, write or phone

DALE ELECTRONICS, INC., 1155 West 23rd Street, Tempe, AZ 85282 • Phone 602-967-7874

DALE®

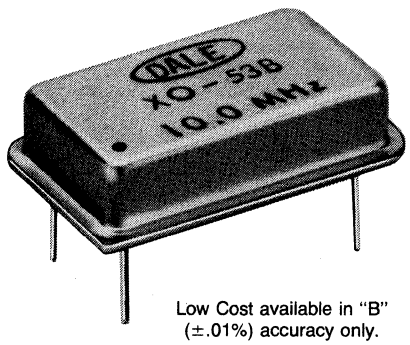
HYBRID CRYSTAL CLOCK OSCILLATOR



MODEL XO-43, XO-53B
250 KHz to 60 MHz

FEATURES

- Able to withstand flow soldering
- Wide range of standard frequencies available from stock (listed below)
- Hermetically sealed package
- Low profile .225 inches [5.72] max. seating height
- Metal Case - corrosion resistant and grounded for EMI shielding
- Glass standoffs for spacing from mounting surface



Low Cost available in "B" (±.01%) accuracy only.

SPECIFICATIONS

Input Voltage: +5 VDC ±0.5V

Frequency Range: 250 KHz to 60 MHz

Operating Temperature Range: 0°C to 70°C

TTL Compatible: Will drive 1-10 TTL Gates

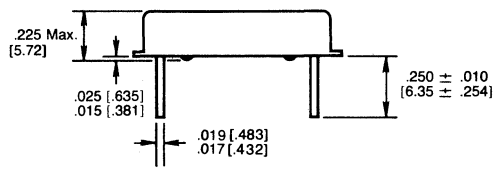
Environmental:
Temperature Cycle: −55°C to +85°C, 3 cycles
Shock: 1000 G's 0.35 millisecond, 1/2 sine wave, 3 shocks each plane
Vibration: .06" D.A., 10-55 Hz, 35 G, 55-2000 Hz
Humidity: 85% relative humidity @ 85°C, 240 Hours

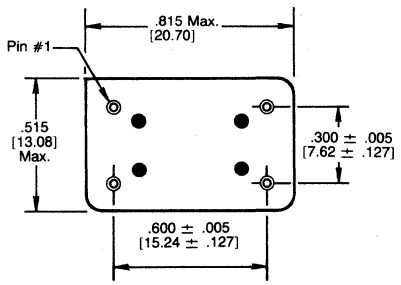
Mechanical:
Hermetically Sealed Package: Leak rate less than 2 x 10^{-8} atmosphere cc/sec. of helium
Marking Ink: Epoxy, solvent resistant
Solvent Resistance: Isopropyl alcohol, Trichloroethane, Freon TMC

Terminal Solderability: Per MIL-STD-202, Method 208C

Package: Cold Rolled Steel (CRS), Nickel-Plated Base with Resistance Welded Stainless Steel Cover

DIMENSIONS
[Numbers in brackets indicate millimeters]





Pin #1 is identified by square corner

STOCKING FREQUENCIES (MHz)
"B" accuracy only

1.0	4.0	9.8304*	16.384	30.0
1.2288	4.9152	10.0	18.432	32.0
1.8432*	5.0	12.0	19.6608	40.0
2.0	5.0688	14.31818*	20.0	50.0
2.4576	6.0	16.0	24.0	
3.6864*	8.0	16.257*	25.0	

*XO-53 model only

FREQ. ACCURACY
(All Conditions)

A = ±.005% (±50 PPM)
***B** = ±.01% (±100 PPM)
C = ±.05% (±500 PPM)
D = ±.1% (±1000 PPM)
H = ±1%

*XO-53B available in "B" (±.01%) accuracy only.

MODEL	FREQUENCY RANGE	INPUT CURRENT (mA)	WAVEFORM SYMMETRY @ 1.4 VDC	TTL OUTPUT RISE & FALL TIME (From Zero to One Level)	"ZERO" LEVEL SINKING 16 mA	"ONE" LEVEL SOURCING 0.4 mA
XO-43	250 KHz to 3.99 MHz	65 max.	55/45	15 nS max.	0.4 volts max.	2.4 volts min.
	4.0 MHz to 24.99 MHz	40 max.	60/40	10 nS max.	0.4 volts max.	2.4 volts min.
	25.0 MHz to 60.0 MHz	50 max.	60/40	6 nS max.	0.4 volts max.	2.4 volts min.
XO-53B	250 KHz to 3.999 MHz	90 max.	60/40	15 nS max.	0.4 volts max.	2.4 volts min.
	4.0 MHz to 8.999 MHz	40 max.	60/40	15 nS max.	0.4 volts max.	2.4 volts min.
	9.0 MHz to 24.999 MHz	40 max.	60/40	10 nS max.	0.4 volts max.	2.4 volts min.
	25.0 MHz to 31.999 MHz	70 max.	60/40	10 nS max.	0.5 volts max.	2.4 volts min.
	32.0 MHz to 60.0 MHz	70 max.	60/40	6 nS max.	0.5 volts max.	2.4 volts min.

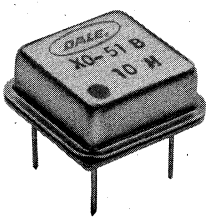
Contact factory for other models, logic families, stabilities and temperature ranges.

For complete information, write or phone
DALE ELECTRONICS, INC., 1155 West 23rd Street, Tempe, AZ 85282 • Phone 602-967-7874

HYBRID CRYSTAL CLOCK OSCILLATOR

MODEL XO-51B, 240 H_Z to 1.5 MH_Z; 4.0 MH_Z to 60.0 MH_Z

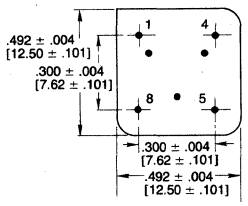
PIN	CONNECTION
1	N/C
4	Circuit/Case Ground
5	OUTPUT
8	INPUT (Vcc)

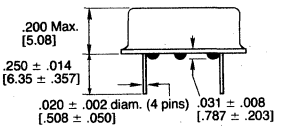


FEATURES

- HCMOS, CMOS, NMOS, TTL, LS-TTL, S-TTL compatible
- Miniature size (.50" square) for greater packaging density
- Hermetically sealed package

DIMENSIONS [Numbers in brackets indicate millimeters]





Pin 1 identified by square corner/dot

CAUTION: Unit can be damaged if plugged in backwards.

SPECIFICATIONS

ELECTRICAL

Operating Temperature Range: 0°C to +70°C

Storage Temperature Range: −55°C to °125°C

Frequency Stability (Inclusive of Calibration Tolerance at 25°C, Temperature Change, Input Voltage Change, Load Change, Aging, Shock and Vibration): ±.01% (±100 PPM)

Input Voltage: (Vdd) +5.0 ± 0.5 VDC

Input Current: 5 to 40 mA Typ.

Rise Time: 10nS Max. (CMOS Levels), 6nS Max. (TTL Levels)

Fall Time: 10nS Max. (CMOS Levels), 6nS Max. (TTL Levels)

Logic '0' Level: 0.1 Vdd Max. CMOS, 0.4V Max. TTL

Logic '1' Level: 0.9 Vdd Min. CMOS, 2.4V Min. TTL

Logic '0' Sink Current: 16 mA Min.

Logic '1' Source Current: 0.4 mA Min.

Output Waveform: Squarewave, HCMOS, CMOS, NMOS, TTL, LS-TTL, S-TTL Compatible, Waveform Symmetry (0.5 Vdd CMOS or 1.4V TTL Levels): 50 ± 10%

Output Load: 50 pF HCMOS or 1-10 TTL Loads (3 TTL Max. below 4 MH_Z)

Environmental:

Temperature Cycle: −55°C to +85°C, 3 cycles

Shock: 1000 G's 0.35 millisecond, 1/2 sine wave, 3 shocks each plane

Vibration: .06 D.A., 10-55 H_Z, 35 G, 55-2000 H_Z

Humidity: 85% relative humidity @ 85°C, 240 Hours

Mechanical:

Hermetically Sealed Package: Leak rate less than 2 x 10^{-8} atmosphere cc/sec. of helium

Marking Ink: Epoxy, solvent resistant

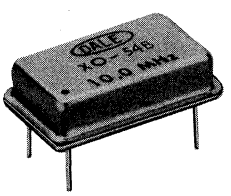
Solvent Resistance: Isopropyl alcohol, Trichloroethane, Freon TMC

Terminal Solderability: Per MIL-STD-202, Method 208C

MODEL XO-54B, 250 KH_Z to 60 MH_Z

Low Profile, Resistance Welded Metal Package

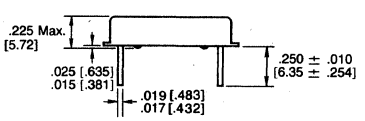
PIN	CONNECTION
1	N.C. or E/D
7	GND
8	OUTPUT
14	+5 VDC

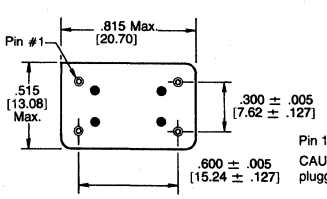


FEATURES

- HCMOS, CMOS, NMOS, TTL, LS-TTL, S-TTL compatible
- Enabled tri-state output optional
- Hermetically sealed package

DIMENSIONS [Numbers in brackets indicate millimeters]





Pin 1 identified by square corner/dot

CAUTION: Unit can be damaged if plugged in backwards.

SPECIFICATIONS

ELECTRICAL

Operating Temperature Range: 0°C to 70°C

Frequency Stability: (Inclusive of Calibration Tolerance at 25°C Temperature Change, Input Voltage Change, Load Change, Aging, Shock and Vibration): ±.01% (±100 PPM)

Input Voltage (Vdd): +5.0 ± 0.5 VDC

Input Current: 5 to 40 mA Typ.

Rise Time: 10nS Max. (CMOS Levels), 6nS Max. (TTL Levels)

Fall Time: 10nS Max. (CMOS Levels), 6nS Max. (TTL Levels)

Logic '0' Level: 0.1 Vdd Max. CMOS, 0.4V Max. TTL

Logic '1' Level: 0.9 Vdd Min. CMOS, 2.4V Min. TTL

Logic '0' Sink Current: 16 mA Min.

Logic '1' Source Current: 0.4 mA Min.

Output Waveform: Squarewave, HCMOS, CMOS, NMOS, TTL, LS-TTL, S-TTL Compatible, Waveform Symmetry (0.5 Vdd CMOS or 1.4V TTL Levels): 50 ± 10%

Output Load: 50 pF HCMOS or 1-10 TTL Loads

Enable Input Voltage: 2.2V Min.

Disable Input Voltage: 0.8V Max.

Enable Input Current: 10μA Max.

Disable Input Current: 150μA Min.

Enable/Disable Delay Time: 100nS Max.

Environmental: Same as XO-51B above.

Mechanical: Same as XO-51B above.

Terminal Solderability: Same as XO-51B above.

Contact factory for other models, logic families, stabilities and temperature ranges.

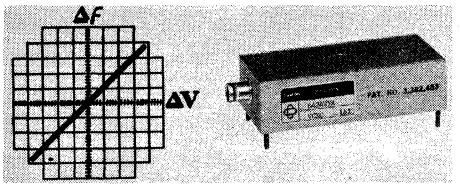
For complete information, write or phone

DALE ELECTRONICS, INC., 1155 West 23rd Street, Tempe, AZ 85282 • Phone 602-967-7874

DAMON *THE FORM FACTOR SPECIALISTS*

VCXOs — 1 KHz to 500 MHz

Damon VCXOs provide high stability over a broad range of center frequencies. An optional square wave or pulse output signal compatible with I. C. logic circuits is available.

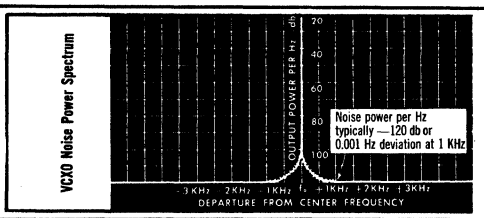


VCXO CHARACTERISTICS:

Center Frequency .. 1 KHz to 500 MHz
Deviation ..... .01% to 0.5% of Center Frequency
Linearity 1% to 5% of Peak Deviation
Frequency Stability .... Determined by Peak Deviation and Operating Temp.
Modulation Rates ..... DC to 2 MHz

Low Noise VCXOs

Damon low noise miniaturized VCXOs are all solid state quartz crystal stable oscillators whose frequencies can be varied linearly by an external DC or AC modulating signal. Only a source of power and control signal are required . . . no auxiliary compensating circuitry.

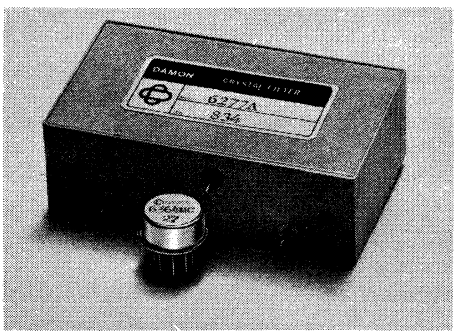


TYPICAL CHARACTERISTICS:

Center Frequency 10.000 MHz ±1 KHz
Deviation ..... ±10 KHz
Linearity ..... ±1%
Modulation Rate ..... Flat to 4 KHz
Output Power ..... >1 MW

Gaussian Crystal Filters

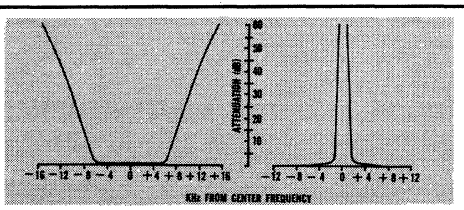
Gaussian Crystal Filters of either conventional or monolithic design. Useful in FM communications or radar systems where flat time delay is required. In a coherent pulsed radar, it can minimize return-pulse overshoot. Eliminates ringing problems in swept spectrum analysis. Available in 2 to 8 pole designs.



Center Frequency
Conventional ..... 10 KHz - 35 MHz
Monolithic ..... 3 - 30 MHz
3 dB Bandwidth ..... 100 Hz - 30 KHz
Shape Factor, 30 dB to 3 dB 3:1 to 7:1
Ringing, Pulse or Impulse 25 - 50 dB down
Phase Linearity ..... ±2%
No. of Poles
Conventional ..... 2 - 8
Monolithic ..... 2 - 4
Volume
Conventional ..... 1 - 6 cu. in.
Monolithic ..... 0.016 - 0.4 cu. in.

Band-Pass/Reject Crystal Filters

A wide variety of conventional crystal filters are produced at Damon. Standards designs such as Butterworth, Chebyshev, Gaussian, Bessel, and Legendre, as well as custom tailored designs are available.

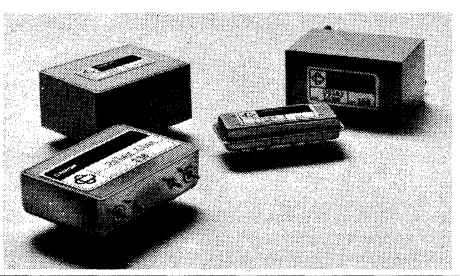


RANGE OF PARAMETERS:

Center Frequency .... 10 KHz - 75 MHz
Bandwidth ..... .01% - 3% of C.F.
Shape Factor ..... Down to 1.2:1
Differential Phase Shift ..... ±2°
Group Delay Uniformity ..... ±5%

Surface-Wave Delay Lines

With signal transfer **across** the surface instead of through the body (a state-of-the-art development), the new Surface-Wave concept results in substantially smaller packages, lower cost in production quantities and superior performance over a 20 MHz to 300 MHz range.

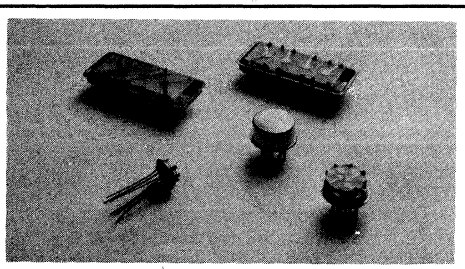


RANGE OF PARAMETERS:

Frequency Range .. 20 MHz - 300 MHz
Time Delay Range 0.5 - 20 Microsecs.
Bandwidth at −3 dB ..... 3% - 30% of Center Frequency
Insertion Loss ..... 10 - 20 dB
Spurious Responses 25 - 30 dB below Desired Response
Environment ..... Full Military Temp., Shock, Vibration Available
Typical Size ..... < 1 cu. in.

Monolithic Crystal Filters

Damon Monolithic Filters utilize a single quartz plate for multiple resonators and the coupling medium between them. Advantages over conventional crystal filters include smaller size, superior stability, and lower cost. Available in a wide variety of computer-assisted designs from Chebyshev to Gaussian characteristics and from 2 to 8 poles.



MONOLITHIC CHARACTERISTICS:

Center Frequency ..... 2.5 - 30 MHz
3 dB Bandwidth ..... 0.3 - 30 KHz
No. of Coupled Resonators ..... 2 - 6
Insertion Loss ..... 1 - 6 dB
Ripple ..... 0.5 dB Max.
Terminations .. 50 Ohms to 20 Kohms
Size ..... TO-5, TO-8, or Flat-Pack

Write for technical bulletins.

DAMON/ELECTRONICS DIVISION

DEPT. EM, 80 WILSON WAY, WESTWOOD, MASS. 02090, TEL: (617) 449-0800, TWX (710) 348-6222

electronic research company

7618 Wedd, Overland Park, Kansas 66204
TWX: (910) 749-6477
Telephone: (913) 631-6700 FAX: (913) 631-7849

GENERAL

Electronic Research Company Model ER8001 is a Precision Ovenized Crystal Oscillator utilizing a 5MHz third overtone crystal manufactured by E.R.C. Model ER8002 uses the same crystal except the output frequency is multiplied to 10MHz. These oscillators are ideal for applications where a precision time base is to be multiplied or synthesized requiring a low phase noise source.

SPECIFICATIONS

Output Frequency: Model ER8001, 5MHz; Model ER8002, 10MHz
Output Level: 1Vrms Minimum into a 50 ohm load
Waveform: Sine-Wave
Harmonic Distortion: 40dB below rated output
Frequency Adjustment: $\pm$2.5PPM Min. course mechanical; $\pm 2.0 \times 10^{-7}$ Min. fine mechanical; $\pm$1.0PPM Min. electrical option 3 only; By D.C. Voltage (-10 to $+10$V)
Input Voltage: +12VDC $\pm$10%, Current at Turn-on 340MA Max. Note input terminals No. 2 & 4 may be connected together externally.
Frequency Stability vs. Input: $\pm 3 \times 10^{-9}$ for a $\pm$10% change in input
Frequency Stability vs. Load: $\pm 1 \times 10^{-9}$ for a $\pm$10% change in load
Frequency Stability vs. Temperature: $\pm 5 \times 10^{-9}$ from -20°C to +65°C ambient
Warm-up Time: 1×10^{-7} in 15 Min.; $\pm 1 \times 10^{-8}$ in 20 Min.
Aging Rate: 1×10^{-9}/24 hours, after 72 hours on time
Short Term: 3×10^{-11} RMS for one second averaging time
Retrace: $\pm 1 \times 10^{-8}$ after 60 Min. warm-up following a 24 hour off time
Input Power: At turn-on 340MA — After warm-up operating at +25°C 135MA, After warm-up operating at -20°C 225MA
Frequency Stability vs. Orientation: 1.5×10^{-9} worst case
Size: Model ER8001 and Model ER8003 2″ x 2″ x 4″ H
Model ER8005 2.25″ x 2.25″ x 4.25″ H

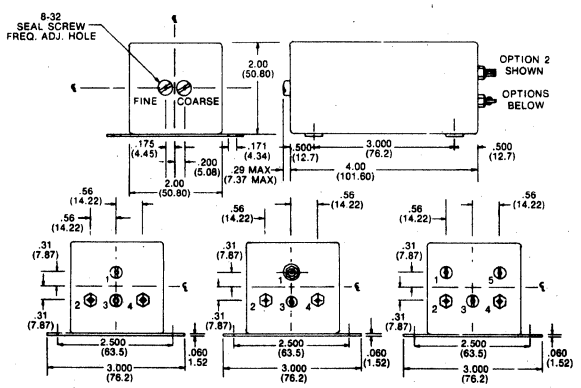
PHASE NOISE S.S.B. 1Hz BW

Offset From Carrier	S/N
10Hz	124dB
100Hz	135dB
1000Hz	145dB
5000Hz	150dB

OPTIONS AVAILABLE

Output Voltage: T.T.L.
Input Voltage: $\pm$12VDC, +15VDC, +24VDC, +30VDC
Mechanical: Various please specify
Long Term Stability: 5×10^{-10}/24 hours
Output Frequencies: 1MHz to 15MHz
Tuning: Electrical fine tune options

Technical specifications are subject to change without notice.



OPTION 1
PIN CONNECTIONS
1. OUTPUT RF
2. OSC. INPUT
3. GROUND + CASE
4. OVEN INPUT

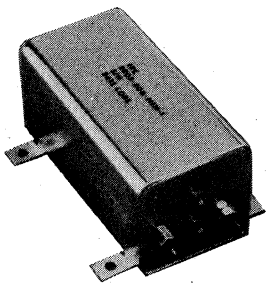
PINS 2 and 4
ERIE# 2499-008-502Z
PINS 1 and 3
104 - LOOP

OPTION 2
PIN CONNECTIONS
1. OUTPUT RF
2. OSC. INPUT
3. GROUND + CASE
4. OVEN INPUT

PINS 2 and 4
ERIE# 2499-008-502Z
PIN 1
SELECTRO
P/N 51-043-4300
PIN 3
104 - LOOP

OPTION 3
PIN CONNECTIONS
1. OUTPUT RF
2. OSC. INPUT
3. GROUND + CASE
4. OVEN INPUT
5. VCO INPUT

PINS 2 and 4
ERIE# 2499-008-502Z
PINS 1, 3 and 5
104 - LOOP



PRECISION CRYSTAL OSCILLATORS

SERIES 8000

Standard Frequency: 5.0MHz
Aging Rate: Model ER8001 1×10^{-9}/day
Model ER8003 1×10^{-10}/day
Model ER8005 5×10^{-11}/day
Phase Noise: SSB 1Hz BW at 10Hz offset
Model ER8001, 124dB
Model ER8003, 135dB
Input Voltage: 12VDC $\pm$10% standard
Output: Sine-wave 1VRMS into 50 ohm load
Size: Model ER8001 and Model ER8003 2″ x 2″ x 4″ H
Model ER8005 2.25″ x 2.25″ x 4.25″ H
Options: Many options are available to interface with your requirements

Electronic Research Company Series 8000 precision ovenized crystal oscillators are the ultimate choice where proven reliability and frequency stability is required. These oscillators are ideal for applications where a precision time base is to be multiplied or synthesized requiring a low phase noise source. All Electronic Research Company's oscillators utilize quartz crystals manufactured by ERC for maximum control on all parameters to insure performance specifications. If your application requires superior oscillator performance call us or write for our complimentary catalogue.

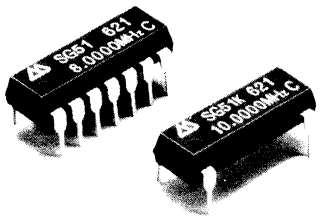
For information and prices, send your specifications to:

electronic research company
7618 Wedd, Overland Park, Kansas 66204
TWX: (910) 749-6477
Telephone: (913) 631-6700
FAX: (913) 631-7849

CMOS CRYSTAL OSCILLATOR

EPSON

SG-51/51E (14 PIN TYPE.) SG-51K (4 PIN TYPE.)



FEATURES

- **14 Pin Plastic Dip (SG-51, 51E)**
- **Auto Insertable**
- Tri-State Output Enable and Stand-By Functions (SG-51E)
- Low Current Consumption
- 5ns Rise & Fall Time (Typical)

OUTPUT FREQUENCIES

20.0000MHz	10.0000MHz	5.0000MHz
19.6608MHz	9.8304MHz	4.9152MHz
18.4320MHz	9.2160MHz	4.0000MHz
16.0000MHz	8.0000MHz	3.0720MHz
12.2880MHz	6.1440MHz	2.5000MHz
12.0000MHz	6.0000MHz	2.4576MHz

For Higher Frequencies Contact Epson America Inc.

TERMINAL CONNECTIONS

SG-51 No.	SG-51 Pin Out	SG-51E No.	SG-51E Pin Out	SG-51K No.	SG-51K Pin Out
1-6	NC	1,5	OE	1	NC
7	GND	2-4	NC	7	GND
8	OUT	6	ST	8	OUT
9-13	NC	7	GND	14	V_{DD}
14	V_{DD}	8	OUT		
		9-13	NC		
		14	V_{DD}		

SPECIFICATIONS

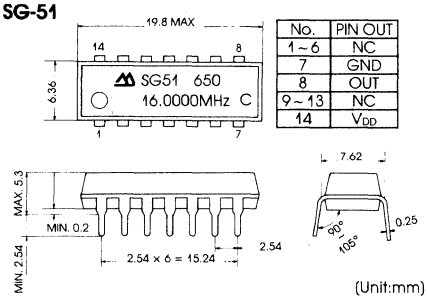
Frequency Range		2 ~ 50 MHz
Frequency Stability	5V ± 0.5V −10°C~+70°C	C = ± 100ppm
Temperature Range	Operating Storage	−10°C~+70°C −55°C~125°C
Input voltage		5V ± 0.5V
Maximum Input Voltage		−0.3V~+7.0V
Current Consumption		18mA MAX. TYP. 10mA (12MHz)
Aging	25°C	± 20ppm/Year TYP. ± 3ppm/Year
Output (−10°C~+70°C)	Duty Rise & Fall time Start up time "O" Level "I" Level Output Load	40/60 to 60/40% @ $1/2V_{DD}$ or 1.4V Level 8nsec MAX. TYP. 5nsec. 10msec MAX. TYP. 0.3msec. +0.4V MAX. (16mA) V_{DD}−0.4V MIN (−400μA) 10TTL Gate
Input (SG-51E)	H. Input Voltage L. Input Voltage	2.0V MIN. $I_{IH} = 1\mu A (V_{IH} = V_{DD})$ 0.8V MAX. $I_{IH} = -100\mu A (V_{IL} = GND)$

*The SG-51P: A 4 pin package with pin 1 as OUTPUT ENABLE is also available upon request.

Note: • This device is made with C-MOS circuitry. Please take precautions to prevent damage due to static discharge.
• We recommend placing a 0.1μF capacitor between V_{DD} and V_{SS} to protect against power line ripple. Start up time of input voltage is greater than 1msec.
• Though ultrasonic cleaning resistance is improved because of a cylindrical AT-cut crystal, please check your cleaning conditions before use.

DIMENSIONS

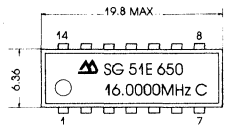
SG-51



No.	PIN OUT
1~6	NC
7	GND
8	OUT
9~13	NC
14	V_{DD}

(Unit:mm)

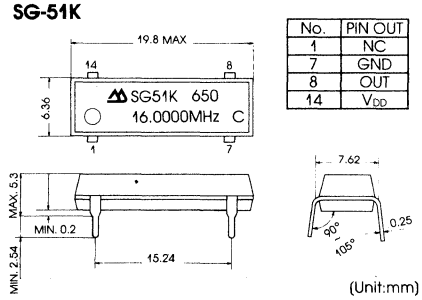
SG-51E



No.	PIN OUT
1,5	OE
2~4	NC
6	$\overline{ST}$
7	GND
8	OUT
9~13	NC
14	V_{DD}

(Unit:mm)

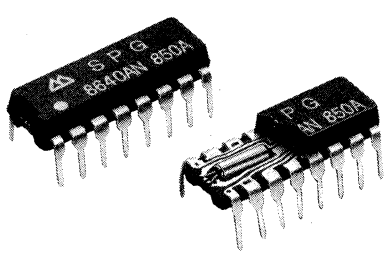
SG-51K



No.	PIN OUT
1	NC
7	GND
8	OUT
14	V_{DD}

(Unit:mm)

PROGRAMMABLE STANDARD PULSE GENERATOR SPG 8600 SERIES

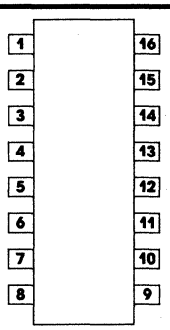


SPG 8600 Series high precision, time-base frequency generators contain a miniature quartz crystal element integrated with a CMOS monolithic chip. They provide low power consumption, high quality and low cost for a broad range of OEM applications.

TERMINAL CONNECTIONS

No.	Pin Out	No.	Pin Out
1	NC	16	V_{DD}
2	CTL_3	15	NC
3	CTL_2	14	RESET
4	CTL_1	13	NC (CSEL)
5	CTL_6	12	NC (EXC)
6	CTL_5	11	FOUT
7	CTL_4	10	TEST
8	V_{SS}	9	OUT

NC: Not connected.



SPECIFICATIONS

UNIT	RANGE
8640AN	600 KHz to 0.0005 Hz
8640BN	1 MHz to 1/120 Hz
8650A	60 KHz to 0.0005 Hz
8650B	60 KHz to 1/1200 Hz
8650E	32.768 KHz to 0.00027 Hz
8651A	1 MHz to 0.0005 Hz
8651B	100 KHz to 1/1200 Hz
8651E	32.768 KHz to 0.00027 Hz

EPSON AMERICA, INC. • Component Sales Department • OEM Division •
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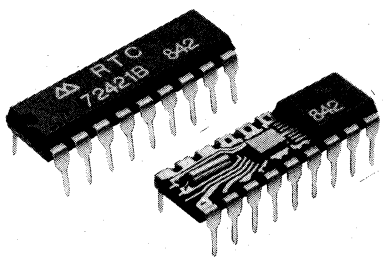
CMOS REAL TIME CLOCK MODULES

EPSON

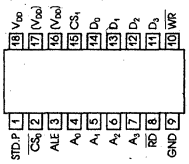
REAL TIME CLOCK MODULE RTC-72421



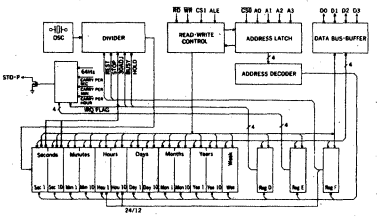
FEATURES

- **The built-in quartz oscillator makes regulation unnecessary and allows for easy design.**
- Direct bus-compatibility (120 nano second access time).
- ALE INPUT terminal available for 8048, 8051, and 8085 series.
- Incorporates built-in Time (hour, minute, second), and Date (year, month, week, day) counters.
- 12hr/24hr clock switchover function and automatic leap year setting.
- Interrupt masking.
- 30 seconds error adjustment function.
- READ, WRITE, HOLD, STOP, RESET, and CHIP SELECT INPUTS.
- The C-MOS IC boasts low current consumption and features a backup function.
- 18 pin dual in line package.
- Pin and function are compatible with the SMC 5242C.

TERMINAL CONNECTIONS



CIRCUIT DRAWING



SPECIFICATIONS — Operating Range

Item	Symbol	Conditions	Value	Unit
Power Supply	V_{DD}	—	4.5~5.5	V
Data-holding	V_{DH}	—	2.0~5.5	V
Crystal Frequency	fo	Ta=25°C	32.768	kHz
Operating Temp.	T_{OPR}	—	−10~+70	°C

Note) Data-holding voltage guarantees clock operations, though it does not guarantee operations outside the IC and data input/output.

Frequency Characteristics

Item		Conditions	MAX. Value	Unit
Frequency Tolerance	A	Ta=25°C	±10	ppm
	B	V_{DD}=5V	±50	
Frequency Temp. Characteristics		(−10~+70°C at 25°C=0ppm)	+10/−120	ppm
Aging		V_{DD}=5V Ta=25°C First year	±5	ppm/year

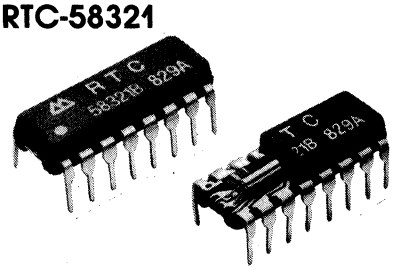
Electrical Characteristics

Item	Symbol	Conditions	MIN	TYP	MAX	UNIT	Terminal
H. Input Voltage	V_{IH1}	—	2.2	—	—	V	All inputs except CS_1
L. Input Voltage	V_{IL1}	—	—	—	0.8		
Input Leak 1.	I_{LK1}	$V_I=V_{DD}/0V$	—	—	1/−1	μA	Inputs except D_0~D_3
Input Leak 2.	I_{LK2}		—	—	10/−10		D_0~D_3
L. Output Voltage 1	V_{OL1}	I_{OL}=2.5mA	—	—	0.4	V	D_0~D_3
H. Output Voltage	V_{OH}	I_{OH}=−400μA	2.4	—	—		
L. Output Voltage 2	V_{OL2}	I_{OL}=2.5mA	—	—	0.4	V	STD.P
Off Leak Current	I_{OFFLK}	$V_I=V_{DD}/0V$	—	—	10	μA	
Input Capacitance 1	C_{I1}	Input freq. 1MHz	—	10	—	pF	Inputs except D_0~D_3
Input Capacitance 2	C_{I2}		—	20	—		D_0~D_3,STD.P
Current Consumption 1	I_{DD1}	CS_1=0V, V_{DD}=5V	—	—	10	μA	V_{DD}
Current Consumption 2	I_{DD2}	CS_1=0V, V_{DD}=2V	—	—	5		
H. Input Voltage 2	V_{IH2}	V_{DD}=2~5.5V	$\frac{4}{5}V_{DD}$	—	—	V	CS_1
L. Input Voltage 2	V_{IL2}		—	—	$\frac{1}{5}V_{DD}$		

(V_{DD}=5V±0.5V, Ta=−10~70°C)

Note • This device is made with C-MOS circuitry. Please take precautions to prevent damage due to static discharge.
• We recommend placing a 0.1μF capacitor and a 1 to 10μF capacitor next to RTC-72421 to protect against power line ripple. And start-up time of input voltage is greater than 1msec.
• Standard ultrasonic cleaning can be used on the RTC-72421, but please exercise caution in choosing a cleaning solution as the RTC-72421 could be damaged.

REAL TIME CLOCK MODULE RTC-58321

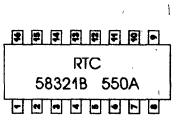


FEATURES

- The built-in quartz oscillator makes regulation unnecessary and allows for easy design.
- Incorporates a built-in time counter (hour, minute, second) and date counter (year, month, date and day of the week).
- 12hr/24hr clock switchover function and automatic leap year setting.
- Standard signal output can be set at 1024Hz, 1 second, 1 minute and 1 hour.
- Counter start, stop and reset functions included.
- A 4-bit bi-directional bus line is employed for data, which is written to and read from memory.
- The C-MOS IC boasts low current consumption and features a backup function.
- PIN and function are compatible with the MSM58321RS.

Note: • This device is made with C-MOS circuitry. Please take precautions to prevent damage due to static discharge. • We recommend placing a 0.1μF capacitor between V_{DD} and V_{SS} to protect against power line ripple. And start-up time of input voltage is greater than 1 msec. • Standard ultrasonic cleaning can be used on the RTC-58321, but please exercise caution in choosing a cleaning solution as the RTC-58321 could be damaged.

TERMINAL CONNECTIONS



1. CS_2
2. WRITE
3. READ
4. D_0
5. D_1
6. D_2
7. D_3
8. V_{SS}
16. V_{DD}
15. NC
14. NC
13. CS_1
12. TEST
11. STOP
10. BUSY
9. ADDRESS WRITE

NC: Do not connect externally.

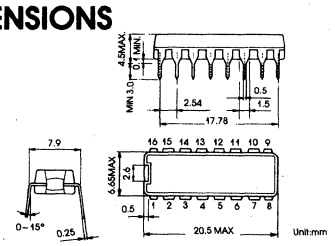
SPECIFICATIONS

Operating Range

Item	Symbol	Conditions	Range	Unit
Supply voltage	V_{DD}	—	4.5-5.5	V
Data-holding voltage	V_{DH}	—	2.2-5.5	V
Crystal Frequency	fo	—	32.768	kHz
Operating temperature	T_{OPR}	—	−10~+70	°C

Note) Data-holding voltage guarantees clock operations, though it does not guarantee operations outside the IC and data input/output.

DIMENSIONS



Frequency Characteristics

Item	Conditions	MAX. Value	Unit
Frequency tolerance	Ta=25°C V_{DD}=5V	A:±10 B:±50	ppm
Frequency Temp. Characteristics	Ta=−10~+70°C	+10/−120	ppm
Aging	Ta=25°C V_{DD}=5V	±5	ppm/year
Voltage coefficient	Ta=25°C V_{DD}=2.2~5.5V	±2	ppm/V

Electrical Characteristics

V_{DD}=5V±0.5V Ta=−10°C~+70C

Item	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
H. input voltage	V_{IH1} Note1 V_{IH2} Note2	—	3.6 V_{DD}−0.5	—	—	V
L. input voltage	V_{IL}	—	—	—	0.8	V
L. output voltage	V_{OL}	I_O=1.6mA	—	—	0.4	V
L. output current	I_{OL}	V_O=0.4V	1.6	—	—	mA
H. input current	I_{IH} Note3	V_I=5V	10	30	80	μA
L. input current	I_{IL} Note3	V_I=0V	—	—	−1	μA
D_0~D_3 terminals input off-leak current	I_{LIH}/I_{LIL}	V_I=5V V_I=0V	—	—	I−1	μA
Input capacity	C_I	f=IMHz	—	5	—	pF
Current consumption	I_{OP} Note4 Note5	Ta=25°C V_{DD}=5V/V_{DD}=3V		100/15 20/7	500/30 40/20	μA
Start up time (BUSY)	tosc	V_{DD}=5V Ta=25°C	—	1.5	3.0	sec.

Note 1. CS2 WRITE, READ, ADDRESS-WRITE, STOP, TEST, D_0~D_3 terminals. Note 2. CS1 terminals. Note 3. CS1, CS2, WRITE, READ, ADDRESS-WRITE, STOP, TEST terminals. Note 4. CS1 CS2—H BUSY OPEN. Note 5. CS1, CS2, BUSY OPEN

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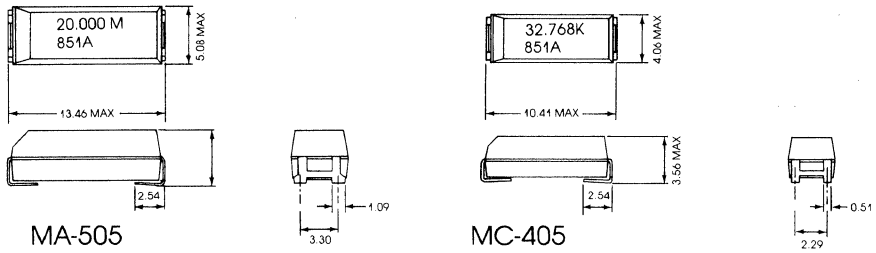
SURFACE MOUNT DEVICES

EPSON

NEW! SMD CRYSTALS & OSCILLATORS

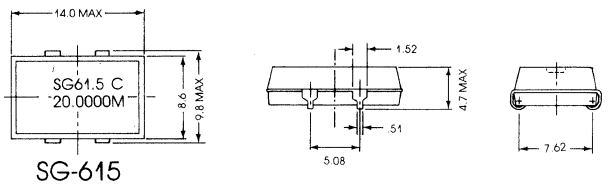
260°C 20 SECONDS
FOR VAPOR PHASE OR IR REFLOW SYSTEMS

- CRYSTAL
  - 32.768 KHz (MC-405)
  - 8.00 to 25.00 MHz (MA-505) (Future 4.0 to 60 MHz)



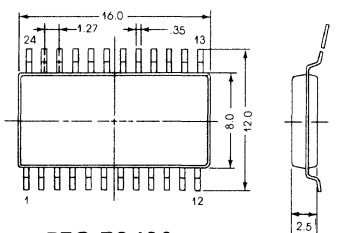
MA-505 MC-405

- OSCILLATOR
  1.5 to 24.9 MHz
  (SG-51 Specifications)



SG-615

- REAL TIME CLOCK
  RTC-72421 SPECIFICATIONS



RTC-72423

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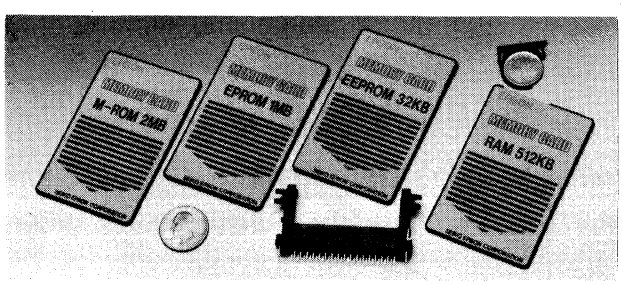
IC MEMORY CARDS

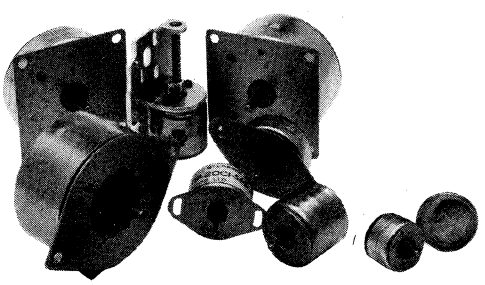


Epson offers a selection of high-quality, low cost IC cards in standard configurations. These include:

SRAM Card with Battery . . . . . (8 ~ 512 K Bytes)
One Time PROM Card . . . . . (8 ~ 1024 K Bytes)
Mask ROM Card . . . . . (8 ~ 2048 K Bytes)
EEPROM Card . . . . . (8 ~ 32 K Bytes)

A shutter mechanism protects the terminals. Card and connector are polarized to prevent incorrect insertion. A Write Protect Switch protects the SRAM card from overwriting the recorded data, and an internal, replaceable battery preserves the data.

STEPPING MOTORS



Epson's stepping motors, in sizes from 15mm to 55mm, afford exceedingly high output torque, rotor design flexibility and operating reliability. Three series are offered. STP Series comes in standard, high resolution and thin configurations. SST Series provides a lead screw.

EPSON AMERICA, INC. • Component Sales Department • OEM Division •
3415 Kashiwa Street • Torrance, California 90505 • TELEX: 664277 • FAX: 213/539-6423 • Telephone: 213/534-4500

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 88/89 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1134, **B**•1098, **C**•1082, **D**•1038
ASCII Code ..... **D**•1073
Batteries, Product Selection Guide ..... **D**•1428
Batteries & Fuel Cells, Characteristics ..... **D**•1454
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1030
Capacitors, Miniglossary ..... **A**•1027
Capacitors, Product Selection Guide ..... **A**•1003
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1193
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1760
Connectors, Miniglossary ..... **C**•1374
Connectors, Terminals & Sockets, Product Selection Guide ..... **C**•1127
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide ..... **A**•1331
Delay Lines, Product Selection Guide ..... **A**•1495
Discrete Semiconductors, Product Selection Guide ..... **A**•2113
Displays, Readouts, & CRTs, Product Selection Guide ..... **B**•1033
EBCDIC Code ..... **D**•1162
Encapsulation, Miniglossary ..... **C**•1110
Fans, Blowers, Cooling Equipment & Heat Exchangers, Product Selection Guide ..... **C**•1643
Filters, Product Selection Guide ..... **A**•1633
IC Master ..... **A**•1718
Instruments, Panel Meters, Product Selection Guide ..... **D**•1350
Instruments, Test & Measuring, Product Selection Guide ..... **D**•1190
Interconnection Systems, Product Selection Guide ..... **C**•1719
Keyboards & Keypads, Product Selection Guide ..... **B**•1808
Lamps, Lights, & Inductors, Product Selection Guide ..... **B**•1104
Logofinder & Trademark Directories ..... **C**•901
Microwave Components, Product Selection Guide ..... **A**•1761
Military Qualified Products List ..... **B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1181
Opto Semiconductors, Miniglossary ..... **B**•1262
Oscilloscopes, Product Selection Guide ..... **D**•1408
Panel Hardware, Product Selection Guide ..... **C**•1603
Potentiometers, Trimmers, Controls & Rheostats, Product Selection Guide ..... **A**•2057
Power Supplies, Miniglossary ..... **D**•1504
Power Supplies, AC, Product Selection Guide ..... **D**•2060
Power Supplies, DC, Product Selection Guide ..... **D**•1497
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide ..... **B**•1297
Relay Contact Forms ..... **B**•1371
Relays, Electromechanical, Miniglossary ..... **B**•1364
Relays, Product Selection Guide ..... **B**•1355
Resistor Color Codes ..... **A**•1911
Resistors, Product Selection Guide ..... **A**•1849
Servo Components, Miniglossary ..... **B**•1238, **D**•2176
SI Units, Basic Guide To, ... **A**•1090, **B**•1050, **C**•1092, **D**•1048
Solenoids, Product Selection Guide ..... **B**•1612
Switches, Product Selection Guide ..... **B**•1636
Thermal Components, Product Selection Guide ..... **B**•1834
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1842
Thyristors/High Power Diodes, Miniglossary ..... **A**•2145
Trademark & Logofinder Directories ..... **C**•901
Transducers & Encoders, Product Selection Guide ..... **B**•1874
Transformers, Product Selection Guide ..... **A**•2153
Voltage Drop Nomograph ..... **C**•1912, **D**•2042
Wire & Cable, Product Selection Guide ..... **C**•1763
Wire Guages—Diameter, Area, Copper Weight ..... **C**•1864

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Standard•Custom•Low Profile•Miniature•Tape & Reel•Surface Mount

Oscillators

TTL•ECL•CMOS•NMOS•Standard 14 & Half Size Pin
Dip Metal and IC Package•Enable/Disable•Dual Output•
Auto Insertable•Surface Mount•TCXO•VCXO

Filters

Discrete•Two Pole•Multi Pole•Monolithic

Real Time Clock

Microprocessor Applications•Built-in Quartz Crystal•Time
& Date Functions•CMOS Circuitry•Low Power Consumption

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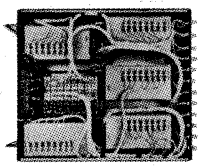
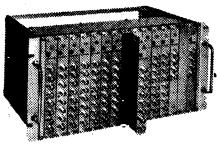
BROAD BAND MODULAR SWITCHING SYSTEMS

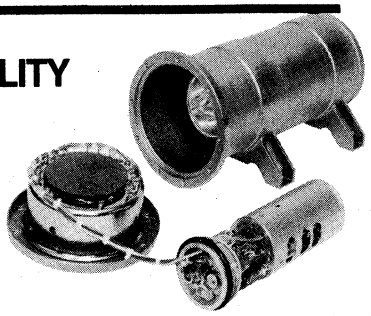
Complete systems with power supplies, digital interface converters, I/O equipment, control panels, and various other functions are available.



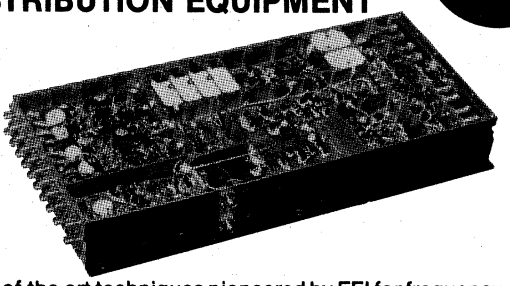


HIGH RELIABILITY PRODUCTS

Daily Aging
$<1x10^{11}$ /day

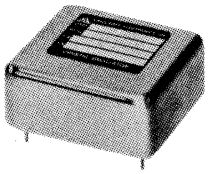


SATELLITE FREQUENCY GENERATION AND DISTRIBUTION EQUIPMENT



State-of-the-art techniques pioneered by FEI for frequency synthesis, processing, and distribution of low noise reference signals have been applied to the development of high reliability hardware for satellite applications. FEI systems consisting of precision oscillators and distribution equipment configured as redundant assemblies are presently being used on a wide variety of space programs resulting in performance capabilities previously unrealizable. The equipment incorporates FEI's high reliability hybrid techniques and results in light weight and low power consumption; considerations of primary importance in satellite applications.

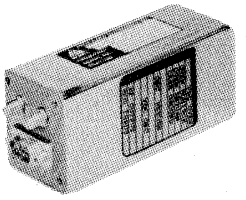
OSCILLATORS



(TCXO and TCVCXO)
Temperature
Compensated/
Voltage Controlled
Crystal Oscillators

Space Application
High Stability
Remotely Settable
Crystal Oscillator.

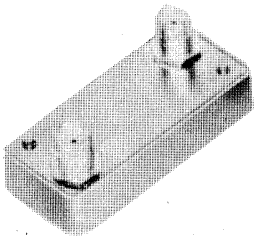
Daily Aging
<2 to $3x10^{11}$ /day

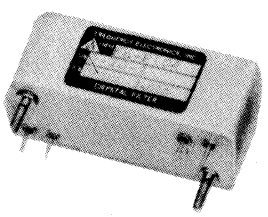


Proportionately
Controlled Ovenized
Oscillator

Daily Aging
$<1x10^{10}$ /day

CRYSTAL FILTERS AND DISCRIMINATORS





CLASS S & B CUSTOM HYBRID CAPABILITY

Multiple Technologies - DC to 22 GHz

Thick Film - DC to 2.5 GHz
Thin Film - 100 MHz to 22 GHz
Microwave, RF, Power, Analog, Digital
MIL-M-38510 Level "S" or Level "B"

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TEL: (516) 794-4500
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CRYSTAL FILTERS AND DISCRIMINATORS
Narrow Band Crystal Filters
Intermediate Wide Band Crystal Filters
Band Reject Crystal Filters
Single Side Band Crystal Filters
Discriminators

OSCILLATORS
Ovenized Crystal Oscillators
Ovenized Voltage Controlled Crystal Oscillators
Temperature Compensated Voltage Controlled Crystal Oscillators
Temperature Compensated Crystal Oscillators
Non-Ovenized Crystal Oscillators
LC Voltage Controlled Oscillators
Precision Low Power Oscillators
High Stability Proportional Ovens
Custom Engineered Oscillators

Low Phase-Noise Frequency Sources To 10 GHz

Frequency Electronics' capability is from the basic quartz crystal to complete time and frequency systems.

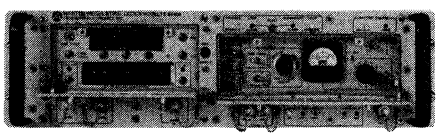
Timekeeper for Outer Space... Ask anyone who knows anything about this nation's deep space probe and satellite programs to mention any 10. Our instruments or equipment are aboard at least 8.

Hybridized Cesium Beam Primary Frequency Standard

Model FE-5440A, Option FH
Military Nomenclature (0-1824/U)

NEW

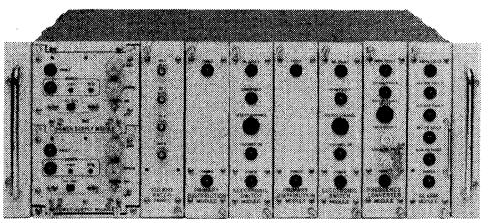
High Reliability, Militarized Cesium Beam Frequency Standards for aerospace, shipboard, laboratory and mobile applications.



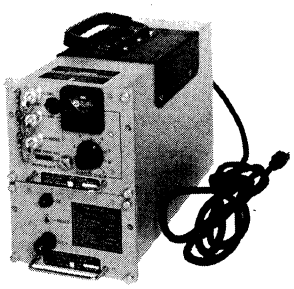
Frequency Distribution Systems

Models FE-798A/FE-799A

A militarized, high reliability RF distribution system for satellite ground stations and shipboard, mobile, and laboratory applications.



INSTRUMENTS

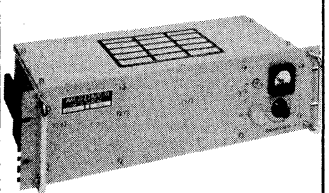


Model FE-1000Q
(AN/URQ-10A)
High Stability
Frequency Standards

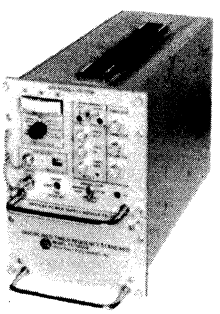
NEW

Model FE-7913A
Model FE-7914A

Low Noise,
High Isolation
Signal Distribution
Systems



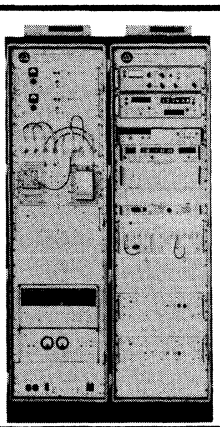
Model FE-70Q
(AM-2123A(V)/U)
Distribution
Amplifier



Model FE-1050A
(AN/URQ-23)
Disciplined Time
Frequency Standard

SYSTEM CAPABILITY

Model FE-5054A
(CTFS)
Communication
Time and Frequency
Standards



RUBIDIUM STANDARD

NEW

Model FE-5600A

MIL-E-5400, Class II
Fast Warm-up
MIL-SPEC Power
Low g Sensitivity

INSTRUMENTS
Disciplined Time Frequency Standards
High Stability Frequency Standards
Frequency Standard Carrying Cases
Digital Phase Comparators
Frequency Error Analyzers
Distribution Amplifiers
RF Switchovers
Passive Combiners
Digital Clocks
Microwave Frequency Multipliers
High Frequency Amplifiers
UHF Down-Converters
UHF Up-Converters

SYSTEMS
Time & Frequency Control Systems
UHF Synthesizers
Frequency Generators
Coherent Microwave Synthesizers
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Delay Lines • Discriminators

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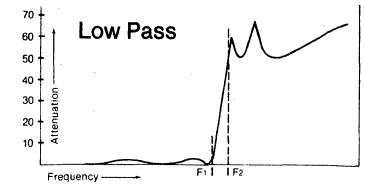
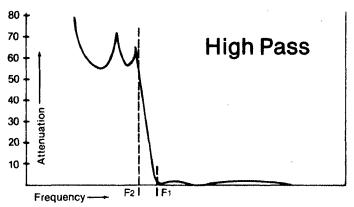
FSN is a filter and network house. We are strong in engineering. We are able and willing to work with system designers to apply state-of-the-art filter technology to optimize not just the filter but the application of filters to help our customers optimize their systems.

Use us as your filter specialist. We are knowledgeable in and have experience with all classes of filters, whether crystal or LC. We can select the proper type for best performance while optimizing the cost-vs-performance trade-off. We design and manufacture **all** the families such as: Butterworth, Chebyshev, Legendre, Cauer (elliptical), General Parameter, Gaussian, Bessel, Transitional Butterworth-Thompson (TBT), Bode, Lerner and others.

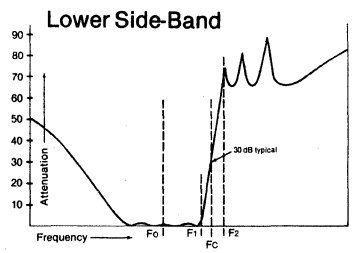
We also design and manufacture such other networks as delay lines, attenuators, phase and delay equalizers, discriminators, matching networks, etc.



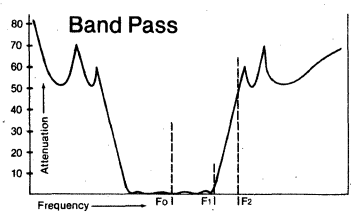
Shape Factor = $\frac{F_2}{F_1}$ As Low as 1.03



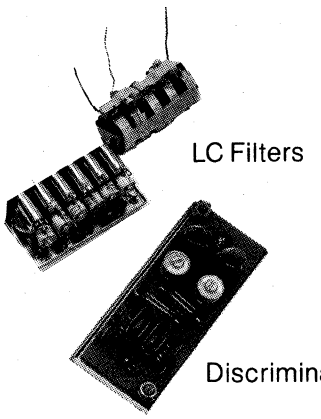
Shape Factor = $\frac{F_1}{F_2}$ As Low as 1.03

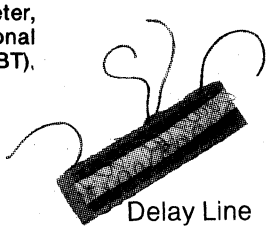


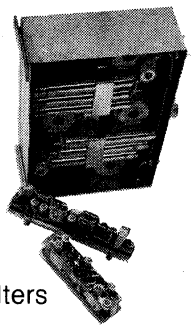
Shape Factor = $\frac{F_2 - F_0}{F_1 - F_0}$ As Low as 1.05



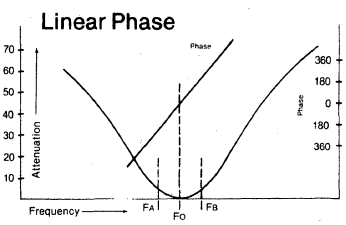
Shape Factor = $\frac{F_2 - F_0}{F_1 - F_0}$ As Low as 1.05



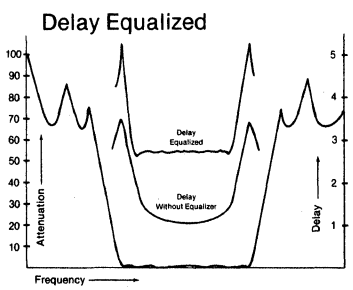




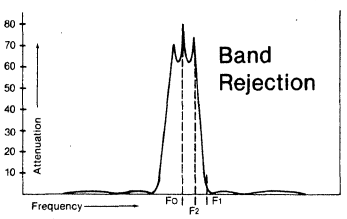
Representative Network Packages



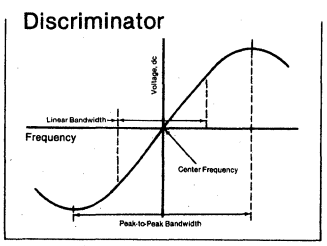
Phase Linearity better than 1°



Shape Factors better than 1.10
Delay Variation better than 2%



Shape Factor = $\frac{F_1 - F_0}{F_2 - F_0}$ As Low as 1.20



Wide and Narrow Band Linearity ±1%

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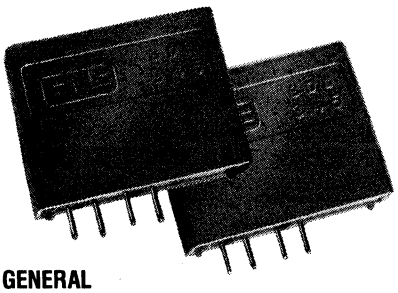
LC Filters • Crystal Filters • Delay Lines • Discriminators

DELAY LINES



GENERAL

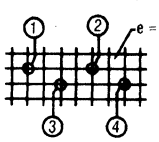
GTE's Ultrasonic Delay Lines provide stable and precise delay time, a proper bandwidth curve, and high spurious response rejection levels.

ELECTRICAL DATA

Data For NTSC Type Shown. PAL & SECAM Devices Also Available.

Type		SDL 345
Use		NTSC
Nominal frequency	MHz	3.579545
Phase delay time (± 0.005 μ sec)	μ sec	63.555
Insertion loss (± 3dB)	dB	8
Attenuation of unwanted reflections :3 tau :n tau	dB dB	30 30
Phase drift (+ 10°C to + 60°C) max.	± μ sec	0.005
Bandwidth (-3 dB)	MHz	2.80 – 4.40
Max input voltage	Vpp	10
Required load resistance: input output	Ω Ω	560 560
Input & output reactance	Ω	405
Input coil L_{1-2}	μH	18
Output coil L_{3-4}	μH	18

Hole pattern for mounting on printed circuit board (seen from soldering side)

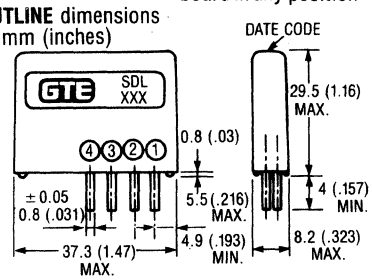


Hole diameter 1.3 ± 0.1 mm (0.05" ± .004")
Tolerance on distance of the different holes to reference lines ± 0.1 mm (.004")

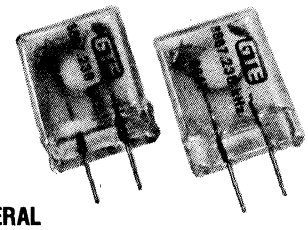
MECHANICAL DATA

Weight: 10 gm (0.325 oz)
Operating temperature range: -20°C to + 70°C
Solderability: max 5 sec at 260°C
Housing: fire retarding and non dripping according to UL94-SE1
Connections: tin plated pins
Mounting: directly into p.c. board in any position

OUTLINE dimensions in mm (inches)



QUARTZ CRYSTALS



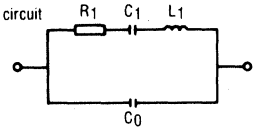
GENERAL

GTE's unique all glass encapsulation produces a low cost resonator with an extended temperature range, superior hermeticity, and low aging. Laser trim after sealing assures accuracy.

ELECTRICAL DATA

Nominal frequency: 3 to 18 MHz
Mode of operation: fundamental, series resonance
Load capacity: within range of 7 to 32 pF
Accuracy of adjustment: $\Delta f/fo \leq 10$ ppm at 25°C
Frequency deviation vs temperature: $\Delta f/fo \leq 30$ ppm
ESR (Equivalent Series Resistance):
f < 4 MHz < 150Ω
4 MHz ≤ f ≤ 6 MHz < 100Ω
6 MHz < f < 18 MHz < 40Ω
Static capacitance: < 9 pF
Drive level: ≤ 1 mW
Aging as per DIN 45103 $\Delta f/fo \leq 5$ ppm
Pulling sensitivity: $\Delta f/C_L \geq [fo(\text{in MHz}) \times 15]$ Hz/pF

Equivalent circuit

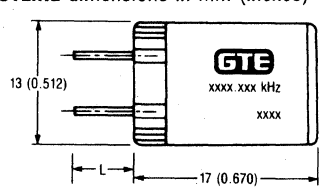


L_1 = motional or dynamic inductance
C_1 = motional or dynamic capacitance
R_1 = equivalent series resistance (ESR)
C_0 = parallel or static capacitance

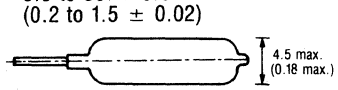
MECHANICAL DATA

Weight: 1.2 gm (0.0423 oz)
Connections: solder (40/60) dipped leads
Operating temperature: -10°C to + 100°C
Storage temperature: -30°C to + 120°C
Solderability: max 5 sec. at 260°C min 2 sec at 240°C

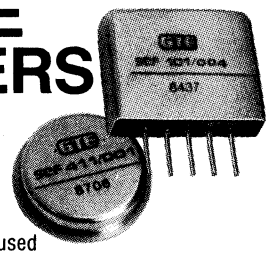
OUTLINE dimensions in mm (inches)



L = 5.5 to 38 ± 0.5
(0.2 to 1.5 ± 0.02)



SURFACE ACOUSTIC WAVE FILTERS



GENERAL

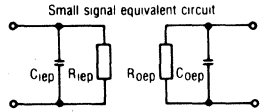
SAW Filters are used to replace conventional LC-Filters in intermediate frequency applications.

ELECTRICAL DATA

Type	Picture carrier (MHz)	Relative level (typ.) dB fp	fc	fs	Application	Housing
SCF 101	38.9	-6	-4	-18	PAL	TO8
SCF 104	38.9	-6	-3	-17	PAL	SIL
SCF 201	32.7	-6	0	-50	SECAM	TO8
SCF 204	32.7	-6	0	-50	SECAM	SIL
SCF 301	39.5	-6	-3	-24	UKPAL	TO8
SCF 303	39.5	-6	-3	-24	UKPAL	SIL
SCF 601	38.0	-5	-5	-24	OIRT	TO8
SCF 614	38.0	-6	-2.2	*	MULTI*	SIL
SCF 411	45.75	-5	-3.2	-12	USNTSC	TO8
SCF 424	45.75	-5	-5	-22	USNTSC	SIL

fp: picture carrier frequency
fc: color carrier frequency
fs: sound carrier frequency

Small signal equivalent circuit

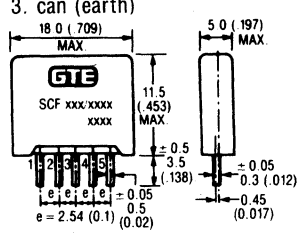


MECHANICAL DATA

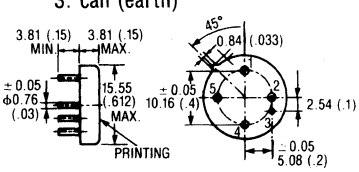
Weight: ca. 2.5 gm (TO8); 1.9 gm (SIL)
Operating temperature range: -10°C to + 70°C
Storage temperature: -25°C to + 85°C
Solderability: max 5 sec. at 250°C
Mounting: directly into p.c. board, in any position
Housing: hermetic metal/glass TO8 or hermetic SIL package with metal cover

OUTLINE dimensions in mm (inches)

SIL 1. input high 4. balanced output
2. input (earth) 5. balanced output
3. can (earth)



SCF 411 1. input (earth) 4. balanced output
2. input (high) 5. balanced output
3. can (earth)



For further information contact:
GTE Products Corporation, 2401 Reach Road, Williamsport, PA 17701
(717) 326-6591
In Europe:
GTE Sylvania N.V., Industriepark, 3300 Tienen, Belgium, Telephone: (016) 800-211

GTE **Electronic Components & Materials**

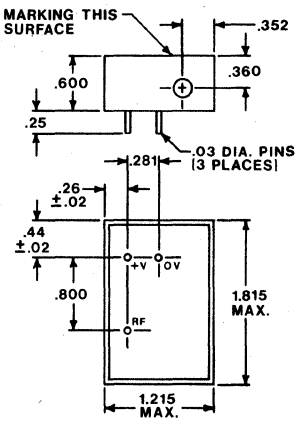
ISOTEMP RESEARCH, INC.

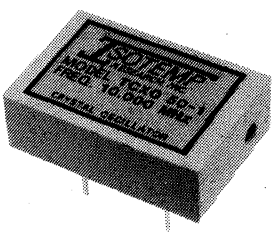
Post Office Box 3389
Charlottesville, Virginia 22903
Telephone (804) 295-3101

ISOTEMP specializes in custom design Temperature Compensated Crystal Oscillators (TCXO) and Oven Controlled Crystal Oscillators (OCXO) for all applications. These oscillators may include such options as Electrical Trim, choice of output wave forms, choice of input voltages from 5 VDC to 48 VDC, and many choices of case and pin styles. Call us for assistance in determining an oscillator for your needs.

TCXO 50 SERIES

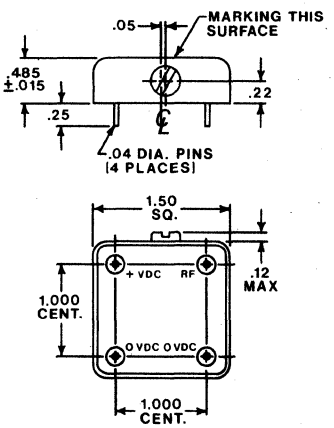
FREQUENCY RANGE	TTL OUTPUT 100 KHz to 20 MHz SINE WAVE OUTPUT 4 MHz to 20 MHz CMOS OUTPUT 100 KHz to 15 MHz
TEMPERATURE RANGE	Choice of 5°C increments over any temperature range from -30°C to +70°C
AMBIENT STABILITIES	±1.0 ppm from -30°C to +70°C ±0.5 ppm from 0°C to +70°C
AGING	1.0 ppm/year to 0.5 ppm/year
VOLTAGE STABILITY	$3x10^{-8}$/1% to $1x10^{-8}$/1% change
SHORT TERM STABILITY	$5x10^{-9}$/10 seconds rms to $1x10^{-9}$/10 seconds rms





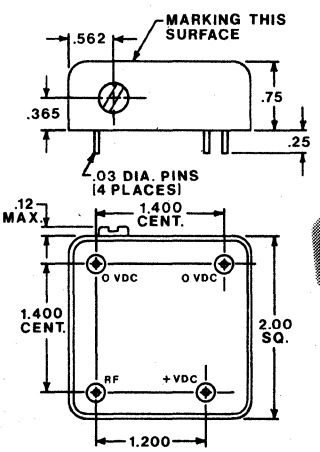
TCXO 74 SERIES

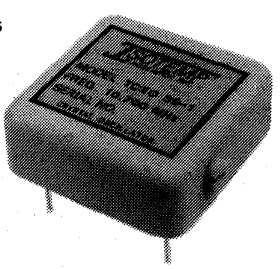
FREQUENCY RANGE	TTL OUTPUT 100 KHz to 30 MHz SINE WAVE OUTPUT 2 MHz to 50 MHz CMOS OUTPUT 100 KHz to 15 MHz
TEMPERATURE RANGE	Choice of 5°C increments over any temperature range from -30°C to +85°C
AMBIENT STABILITIES	±1.0 ppm from -30°C to +85°C ±0.5 ppm from 0°C to +70°C
AGING	1.0 ppm/year to 0.5 ppm/year
VOLTAGE STABILITY	$3x10^{-8}$/1% to $1x10^{-8}$/1% change
SHORT TERM STABILITY	$5x10^{-9}$/10 seconds rms to $5x10^{-10}$/10 seconds rms



TCXO 39 SERIES

FREQUENCY RANGE	TTL OUTPUT 1 KHz to 30 MHz SINE WAVE OUTPUT 2 MHz to 50 MHz CMOS OUTPUT 1 KHz to 15 MHz
TEMPERATURE RANGE	Choice of 5°C increments over any temperature range from -30°C to +85°C
AMBIENT STABILITIES	±1.0 ppm from -30°C to +85°C ±0.5 ppm from 0°C to +70°C ±0.25 ppm from 0°C to +55°C
AGING	1.0 ppm/year to 0.5 ppm/year
VOLTAGE STABILITY	$3x10^{-8}$/1% to $5x10^{-9}$/1% change
SHORT TERM STABILITY	$5x10^{-9}$/10 seconds rms to $5x10^{-10}$/10 seconds rms





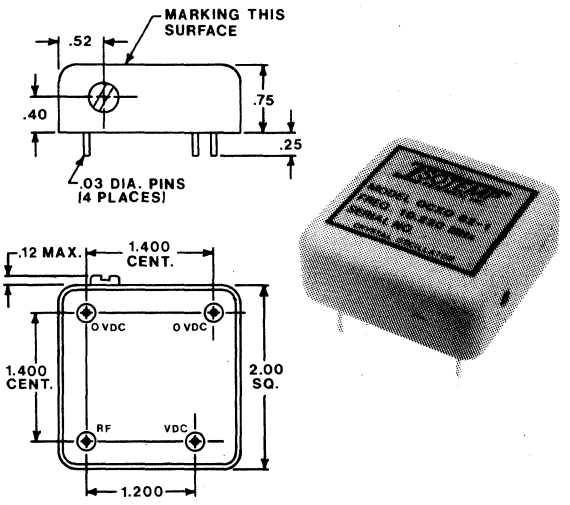
ISOTEMP RESEARCH, INC.

Post Office Box 3389
Charlottesville, Virginia 22903
Telephone (804) 295-3101

To order: Specify model number and frequency or contact factory for options.

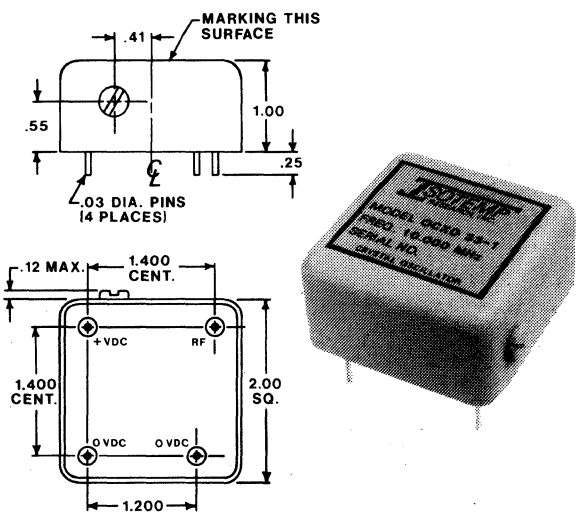
OCXO 82 SERIES

FREQUENCY RANGE	TTL OUTPUT 1 KHz to 30 MHz SINE WAVE OUTPUT 4 MHz to 50 MHz CMOS OUTPUT 1 KHz to 15 MHz
TEMPERATURE RANGE	Choice of 5°C increments over any temperature range from -30°C to +70°C
AMBIENT STABILITY	$\pm 3.5 \times 10^{-7}$ to $\pm 1 \times 10^{-7}$ over ambient referenced to +25°C
AGING	1.0 ppm/year to 0.5 ppm/year
VOLTAGE STABILITY	1×10^{-8}/1% to 2×10^{-9}/1% change
SHORT TERM STABILITY	5×10^{-9}/10 seconds rms to 5×10^{-10}/10 seconds rms
POWER	Turn on 3.5 Watts (-30°C to +70°C) 2.5 Watts (0°C to +70°C) Steady state at +25°C 1.2 Watts



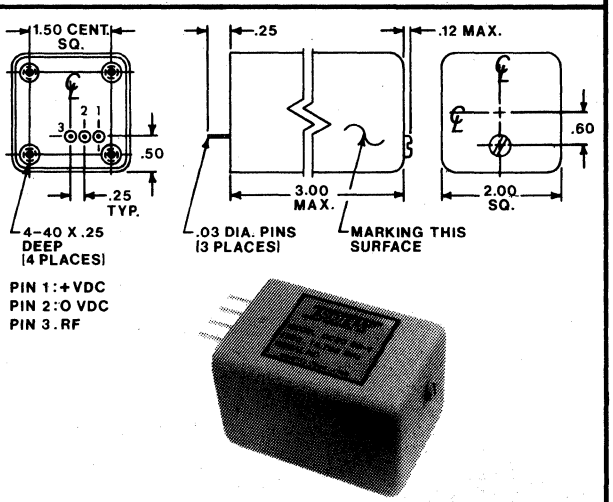
OCXO 33 SERIES

FREQUENCY RANGE	TTL OUTPUT 1 KHz to 30 MHz SINE WAVE OUTPUT 2 MHz to 50 MHz CMOS OUTPUT 1 KHz to 15 MHz
TEMPERATURE RANGE	Choice of 5°C increments over any temperature range from -30°C to +70°C
AMBIENT STABILITY	$\pm 1 \times 10^{-7}$ to $\pm 5 \times 10^{-8}$ over ambient referenced to +25°C
AGING	1.0 ppm/year to 0.5 ppm/year
VOLTAGE STABILITY	5×10^{-9}/1% to 2×10^{-9}/1% change
SHORT TERM STABILITY	1×10^{-9}/10 seconds rms to 2×10^{-10}/10 seconds rms
POWER	Turn on 3.5 Watts (-30°C to +70°C) 2.5 Watts (0°C to +70°C) Steady state at +25°C 1.2 Watts



OCXO 36 SERIES

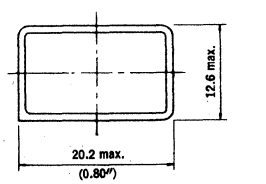
FREQUENCY RANGE	TTL OUTPUT 1 KHz to 30 MHz SINE WAVE OUTPUT 2 MHz to 50 MHz CMOS OUTPUT 1 KHz to 15 MHz
TEMPERATURE RANGE	Choice of 5°C increments over any temperature range from -30°C to +70°C
AMBIENT STABILITY	$\pm 5 \times 10^{-8}$ to $\pm 5 \times 10^{-9}$ over ambient referenced to +25°C
AGING	1.0 ppm/year to 1×10^{-7}/year
VOLTAGE STABILITY	3×10^{-9}/1% to 2×10^{-10}/1% change
SHORT TERM STABILITY	1×10^{-10}/10 seconds rms to 5×10^{-12}/10 seconds rms
POWER	Turn on power 12 Watts Steady state at +25°C 2.2 Watts

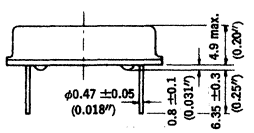


ITT Components
A Division of ITT Corporation

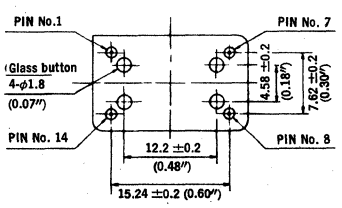
Crystal Clock Oscillators

TYPE		HS CMOS		TRANSISTOR TYPE	
Model		MC06100	MC06050	MC08100	MC08050
Frequency Range		3.0 MHz to 25.0 MHz		250 KHz to 70 MHz	
Operating Temperature Range		– 20 to + 70 Deg. C		0 to + 70 Deg. C.	
Storage Temperature Range		– 40 to + 100 Deg. C		– 40 to + 100 Deg. C.	
Frequency Stability (*)		+/– 100 ppm	+/– 50 ppm	+/– 100 ppm	+/– 50 ppm
Output	Symmetry (T = 25 Deg. C.)	40% to 60% Vcc/2 Level (45% to 55%; Option)		40% to 60% 1.4V Level (45% to 55%; Option)	
	Rise & Fall Time (T = 25 Deg. C.)	6nS		250 KHz to 2.9 MHz 15nS 3.0 MHz to 9.9 MHz 10nS 10.0 MHz to 31.9 MHz 7nS 32.0 MHz to 70.0 MHz 5nS	
	Level	L: 10% Vcc H: 90% Vcc		250 KHz to 31.9 MHz L: 0.4V H: 2.4V 32.0 MHz to 70.0 MHz L: 0.5V H: 2.4V	
Load		10 LS TTL or CMOS COMP.		10 TTL Gates	
Input	Voltage	Vcc: + 5V +/– 0.5V		Vcc: + 5V +/– 0.5V	
	Current (T = 25 Deg. C.) Vcc = 5V	10mA Vcc = 5V		250 KHZ to 2.9 MHz 45mA 3.0 MHz to 70.0 MHz 30mA	

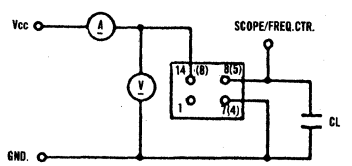




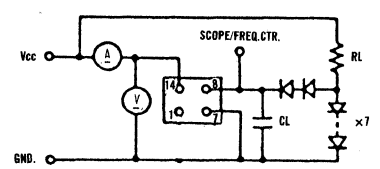
PIN CONNECTIONS
No. 1....NC
No. 7....GND
No. 8....OUT
No. 14....Vcc



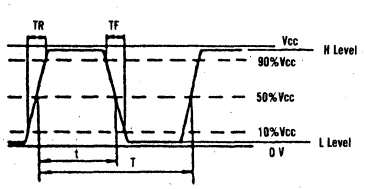
in mm (inch)

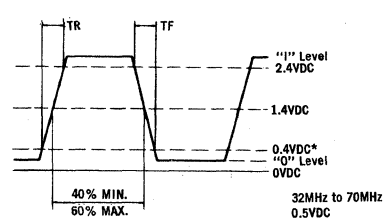


CL=15PF



RL=320 ohms, CL=15PF
All diodes is 1SS16 or equivalent





Ordering Information:

MCO — 8100 — 20.000 MHz

Type
Freq. Stability
Frequency

ITT COMPONENTS • 5 Jenner St. Ste 100 • Irvine CA 92718 • Phone: (714) 727-3001 • TWX: 910-595-1744 • Telel: 69-1389 • FAX: 714-727-2109

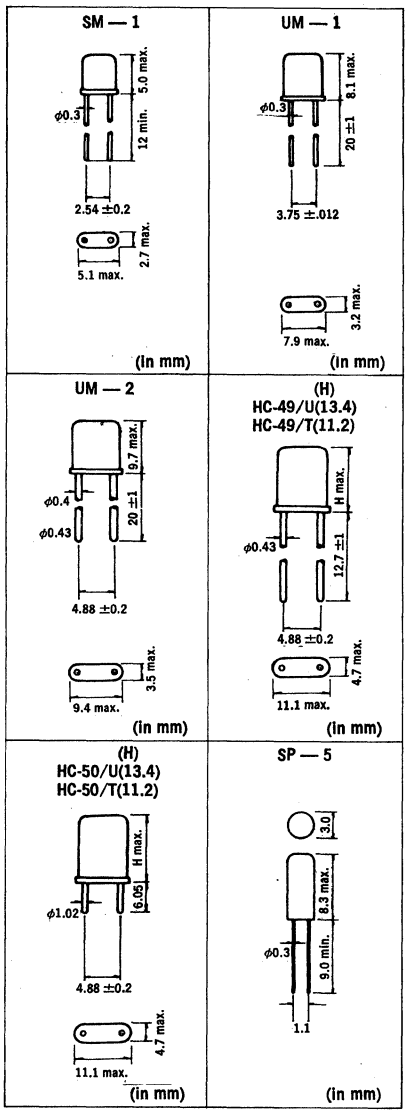
ITT Components

A Division of ITT Corporation

Crystal Units For Microprocessor

Frequency (MHz)	Load Capacitance (pF)	Max. E.S.R. (Ω)	Frequency (MHz)	Load Capacitance (pF)	Max. E.S.R. (Ω)
HC-33/U	RANGE		HC-49/U	RANGE	
1.000000	10-30	700	12.288000	10-30	30
1.843200	10-30	600	13.516800	10-30	25
2.000000	10-30	500	14.318180	10-30	25
2.097152	10-30	500	14.745600	10-30	25
2.457600	10-30	400	15.000000	10-30	25
3.579545	10-30	120	16.000000	10-30	25
			16.384000	10-30	25
HC-49/U			17.360000	10-30	25
1.000000	10-30	2000	18.000000	10-30	20
1.843200	10-30	700	18.432000	10-30	20
2.000000	10-30	500	19.354000	10-30	20
2.097152	10-30	500	19.660800	10-30	20
2.457600	10-30	400	20.000000	10-30	20
3.000000	10-30	200	22.118400	10-30	20
3.276800	10-30	180	23.400000	10-30	20
3.330000	10-30	180	24.000000	10-30	20
3.579545	10-30	180	24.576000	10-30	40
3.600000	10-30	180	25.000000	10-30	40
3.686400	10-30	160	27.000000	10-30	40
3.932160	10-30	120	30.000000	10-30	40
4.000000	10-30	100	32.000000	10-30	40
4,194304	10-30	100	36.000000	10-30	40
4.433619	10-30	80	40.000000	10-30	40
4.915200	10-30	70	48.000000	10-30	40
5.000000	10-30	70			
5.068800	10-30	70	UM-1		
5.185000	10-30	70	6.000000	10-30	120
5.714300	10-30	60	8.000000	10-30	80
5.990400	10-30	60	10.000000	10-30	60
6.000000	10-30	50	12.000000	10-30	40
6.144000	10-30	50	12.500000	10-30	40
6.400000	10-30	50	14.318180	10-30	30
6.553600	10-30	50	14.400000	10-30	30
7.000000	10-30	40	15.000000	10-30	30
7.159090	10-30	40	16.000000	10-30	30
7.372800	10-30	40	18.000000	10-30	30
8.000000	10-30	35	18.432000	10-30	30
9.216000	10-30	35	19.354000	10-30	30
9.830400	10-30	35	19.660800	10-30	30
10.000000	10-30	30	20.000000	10-30	30
10.738635	10-30	30	22.118400	10-30	30
11.000000	10-30	30	24.000000	10-30	30
11.059200	10-30	30	25.000000	10-30	30
12.000000	10-30	30			

Resistance Weld Type



ORDERING CODE

Holder Type (A, B, C) — Frequency (1.0) — (3 0)

Load Capacitance
Parallel - Specify (pF)
Series - S

Basic Specification	Frequency Tolerance at 25°C	±5 x 10^{-6} max.
	Operable Temperature Range	−30 to +80°C
	Frequency Drift	±5 x 10^{-6} (−20 to +70°C)
	Aging Rate	±5 x 10^{-6}/Year
	Drive Level	1 mW
	Shunt Capacitance	7 pF max.

* A HC-33/U
B HC-49/U
C UM-1

Exclusive Sales Agent • ITT COMPONENTS • A Division of ITT Corp. • FAX 714-727-2109
5 Jenner Street • Irvine, California • Phone: (714) 727-3001 • TWX: 910-595-1744 • Telex: 69-1389

MCCOY
ELECTRONICS COMPANY
a subsidiary of OAK Industries Inc.
100 WATTS STREET, P.O. BOX B,
MT. HOLLY SPRINGS, PA. 17065 717-486-3411 - TWX: 510-650-3548

McCoy Electronics Co. offers custom Crystals to the Aerospace, Military, and Industrial Marketplace.

A synopsis of product available is provided below:

FREQUENCY RANGE

Low Frequency 700 Hz to 1 MHz

Type Of Cut	Frequency Range
JT	700 Hz - 15 KHz
NT	4-150 KHz
5°X flexure	4-150 KHz
5°X	50-250 KHz
MT	50-250 KHz
GT	80-300 KHz
BD	80-300 KHz
DT	80-550 KHz
CT	150-700 KHz
SL	200 KHz - 1 MHz

High Frequency

Type Of Cut	Frequency Range
AT	1 MHz - 250 MHz
FC	3-30 MHz
IT	3-30 MHz
SC	3-30 MHz

Holders are offered in Solder Seal, Resistance Weld, Glass, and Cold Weld, for both PC board and Surface Mount applications.

McCoy is qualified under Military specification MIL-C-3098, for the following Government Designations.

QUALIFIED PRODUCTS LIST MIL-C-3098

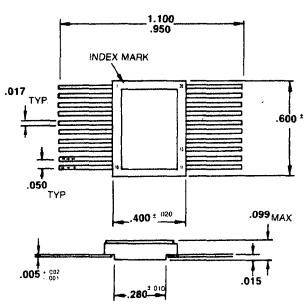
TYPE NO.	FREQ. RANGE
CR-5A/U	2 MHz - 10 MHz
CR-6A/U	2 MHz - 10 MHz
CR-8A/U	1.0 MHz - 10 MHz
CR-18A/U	1 MHz - 20 MHz
CR-19A/U	1.0 MHz - 20 MHz
CR-25B/U	200 KHz - 555 KHz
CR-26A/U	200 KHz - 500 KHz
CR-27A/U	1.0 MHz - 20 MHz
CR-28A/U	1.0 MHz - 20 MHz
CR-35A/U	1.0 MHz - 20 MHz
CR-36A/U	1.0 MHz - 20 MHz
CR-38A/U	16 KHz - 100 KHz
CR-46B/U	200 KHz - 550 KHz
CR-47A/U	190 KHz - 500 KHz
CR-50A/U	16 KHz - 100 KHz
CR-52A/U	10 MHz - 61 MHz
CR-55A/U	17 MHz - 62 MHz
CR-56A/U	75 MHz - 125 MHz
CR-58A/U	1.0 MHz - 20 MHz
CR-60A/U	5 MHz - 20 MHz
CR-62/U	1.0 MHz - 20 MHz
CR-63B/U	200 KHz - 555 KHz
CR-64/U	2.4 MHz - 20 MHz
CR-65/U	10 MHz - 61 MHz
CR-67A/U	17 MHz - 62 MHz
CR-69A/U	2.9 MHz - 25 MHz
CR-72/U	17 MHz - 61 MHz
CR-73/U	17 MHz - 61 MHz
CR-74/U	45 MHz - 125 MHz
CR-76A/U	16 MHz - 61 MHz
CR-77/U	17 MHz - 62 MHz
CR-78A/U	2.9 MHz - 20 MHz
CR-79/U	2.9 MHz - 20 MHz
CR-80/U	50 MHz - 125 MHz
CR-81/U	17 MHz - 62 MHz
CR-82/U	50 MHz - 125 MHz
CR-83/U	50 MHz - 125 MHz
CR-85/U	1.0 MHz - 20 MHz

TYPE NO.	FREQ. RANGE
CR-89/U	2.12 MHz - 6.2 MHz
CR-97/U	8 MHz - 10 MHz
CR-98/U	50 MHz - 134 MHz
CR-102/U	50 MHz - 125 MHz[1]
CR-103/U	17 MHz - 61 MHz
CR-104/U	200 KHz - 580 KHz
CR-105/U	48 MHz - 125 MHz
CR-106/U	10.5 MHz - 11.5 MHz
CR-107/U	50 MHz - 125 MHz
CR-108/U	50 MHz - 93 MHz
CR-110A/U	62.5 MHz - 75 MHz
CR-111/U	17 MHz - 62 MHz
CR-112/U	5 MHz - 20 MHz
CR-113/U	14.5 MHz - 61 MHz
CR-116/U	50 MHz - 125 MHz
CR-117/U	30 MHz - 62 MHz
CR-118/U	7 MHz - 25 MHz
CR-119/U	1.0 MHz - 20 MHz
CR-122/U	50 MHz - 125 MHz
CR-123/U	50 MHz - 125 MHz
CR-125/U	3 MHz - 3.05 MHz
CR-127/U	10 MHz - 61 MHz
CR-128/U	17 MHz - 61 MHz
CR-129/U	9 MHz - 12 MHz
CR-130/U	1.0 MHz - 20 MHz
CR-131/U	1.0 MHz - 20 MHz
CR-134/U	18 MHz - 21 MHz
CR-136/U	8 MHz - 10 MHz
CR-137/U	8.5 MHz - 19 MHz
CR-139/U	20 MHz - 22 MHz
CR-140/U	9.5 MHz - 12.5 MHz
CR-141/U	50 MHz - 90 MHz
CR-142/U	833.333 KHz
CR-147/U	200 KHz - 500 KHz
CR-149/U	46 MHz - 100 MHz
CR-150/U	45 MHz - 100 MHz
CR-151/U	50 MHz - 100 MHz
CR-157/U	1.8 MHz - 20 MHz

Illustrated herein are the most popular holders, and the frequency range that they can accommodate.

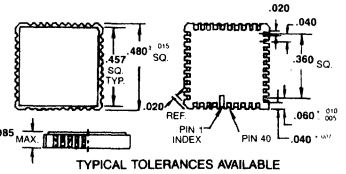
SURFACE MOUNTED CRYSTAL UNITS

LEADED PACKAGE
MCCOY HOLDER #L-20



AVAILABLE FROM 10 MHz to 300 MHz
CRYSTAL CONNECTION = PINS 11 & 13
ALL OTHER PINS, NO CONNECTION

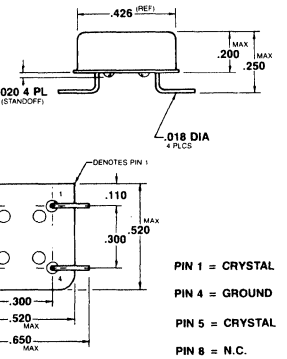
LEADLESS PACKAGE
MCCOY HOLDER #L-40



TYPICAL TOLERANCES AVAILABLE
Calibration Accuracy @ RT
Choices: ± .001%
± .002% (Standard)
± .005 %
Frequency Tolerances vs Temperature
Choices ± .002% 0° to 70°C
± .005% 0° to 70°C
± .002% -40° to +90°C
± .005% -55° to +105°C (Standard)
± .01% -55° to +105°C

AVAILABLE FROM 10 MHz to 300 MHz
CRYSTAL CONNECTION - PINS 4/10 & 31/37
ALL ELSE, NO CONNECTION

LEADED PACKAGE
MCCOY HOLDER # RS-65



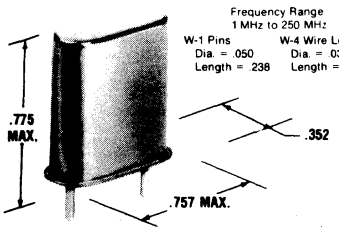
PIN 1 = CRYSTAL
PIN 4 = GROUND
PIN 5 = CRYSTAL
PIN 8 = N.C.

AVAILABLE FROM 5 MHz to 300 MHz

COLDWELD CRYSTALS

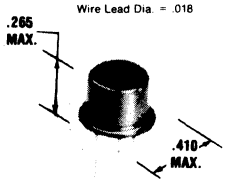
HOLDER SERIES
W-1 (HC-36/U) W-4 (HC-47/U)

Frequency Range
1 MHz to 250 MHz
W-1 Pins: Dia. = .050, Length = .238
W-4 Wire Leads: Dia. = .030, Length = 1.5



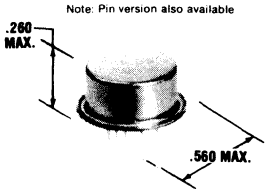
HOLDER SERIES
W-6 (HC-35/U)

Frequency Range:
10 MHz to 250 MHz
Wire Lead Dia. = .018



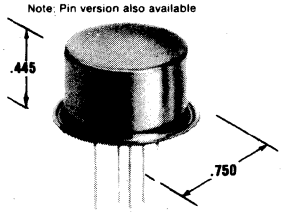
HOLDER SERIES
W-7 (HC-37/U)

Frequency Range:
3 MHz to 250 MHz
Wire Lead Dia. = .018
Note: Pin version also available



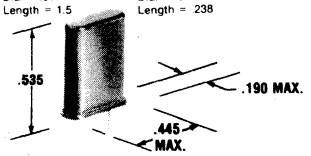
HOLDER SERIES
W-8

Frequency Range:
0.8 MHz to 250 MHz
Wire Lead Dia. = .018
Note: Pin version also available



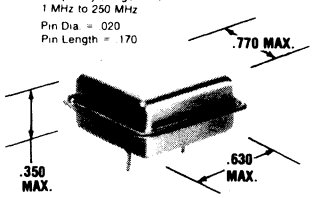
HOLDER SERIES
W-20 (HC-43/U) W-21 (HC-42/U)

Frequency Range
2.9 MHz to 250 MHz
W-20 Wire Leads: Dia. = .017, Length = 1.5
W-21 Pins: Dia. = .040, Length = .238



HOLDER SERIES
W-10 (HC-39/U)

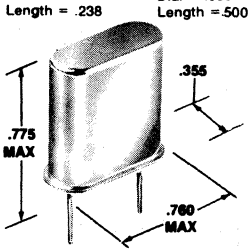
Frequency Range:
1 MHz to 250 MHz
Pin Dia. = .020
Pin Length = .170



RESISTANCE WELD CRYSTALS

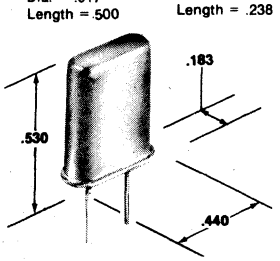
HOLDER SERIES
R-1 (HC-48/U) R-4 (HC-51/U)

Frequency Range
2 MHz to 250 MHz
R-1 = Pins: Dia. = .050, Length = .238
R-4 = Wire Leads: Dia. = .030, Length = .500



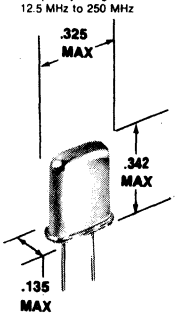
HOLDER SERIES
R-20 (HC-49/U) R-21 (HC-50/U)

Frequency Range:
2.5 MHz to 250 MHz
R-20 Wire Leads: Dia. = .017, Length = .500
R-21 Pins: Dia. = .040, Length = .238



HOLDER SERIES
R-60

Frequency Range:
12.5 MHz to 250 MHz



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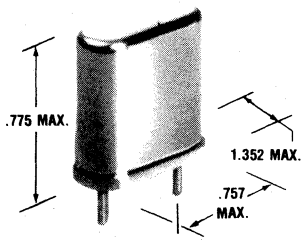
SOLDER SEAL CRYSTALS

HOLDER SERIES M-1 (HC-6/U) M-4 (HC-33/U)

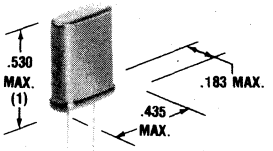
Frequency Range:
0.7 MHz to 250 MHz

M-1 Pins
Dia. = .050
Length = .248

M-4 Wire Leads
Dia. = .030
Length = 1.5



HOLDER SERIES M-20 (HC-18/U) M-21 (HC-25/U)



Frequency Range:
2.5 MHz to 250 MHz

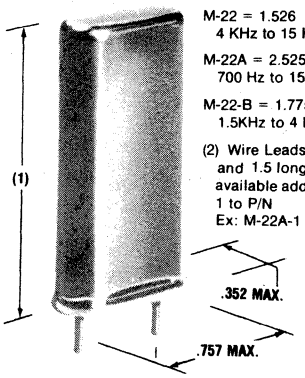
M-20 Wire Leads
Dia. = .017
Length = 0.5

M-21 Pins
Dia. = .040
Length = .238

(1) Also available with short cans
A Height = .460 (5 MHz to 250 MHz)
B Height = .425 (5 MHz to 250 MHz)
C Height = .360 (10 MHz to 250 MHz)
D Height = .312 (10 MHz to 250 MHz)
E Height = .250 (15 MHz to 250 MHz)
F Height = .400 (10 MHz to 250 MHz)

HOLDER SERIES M-22 (HC-13/U) M-22A/ M-22B

Frequency Range:
4 KHz to 15 KHz

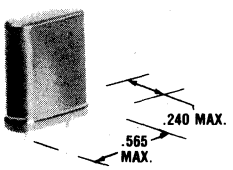


(1) Holder Height
M-22 = 1.526
4 KHz to 15 KHz
M-22A = 2.525
700 Hz to 15 KHz
M-22-B = 1.775
1.5KHz to 4 KHz

(2) Wire Leads .030 and 1.5 long also available add dash 1 to P/N
Ex: M-22A-1

HOLDER SERIES M-25 (HC-32/U) M-27/ M-28

Frequency Range:
2 MHz to 250 MHz

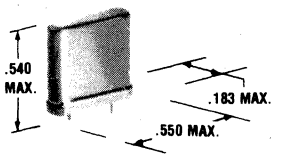


M-25 Pins
Dia. = .040
Length = .238
Holder Height = .650

M-27 Pins
Dia. = .040
Length = .238
Holder Height = .585

M-28 Wire Leads
Dia. = .017
Length = 2.0
Holder Height = .585

HOLDER SERIES M-40/ M-41

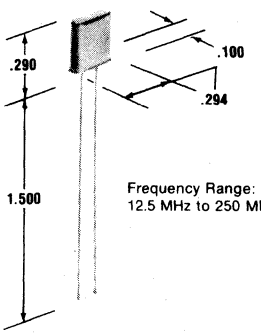


Frequency Range:
2 MHz to 250 MHz

M-40 Wire Leads
Dia. = .017
Length = 1.5

M-41 Pins
Dia. = .040
Length = .238

HOLDER SERIES M-60 (HC-44/U)



Frequency Range:
12.5 MHz to 250 MHz

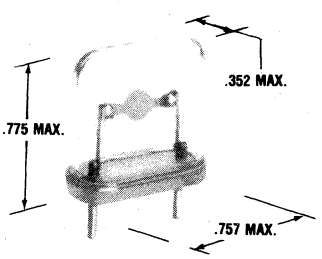
PRECISION GLASS CRYSTALS

HOLDER SERIES G-1 (HC-27/U) G-4

Frequency Range:
2 MHz to 100 MHz

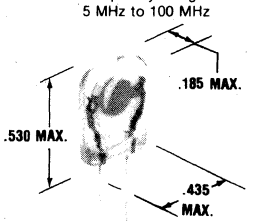
G-1 Pins
Dia. = .050
Length = .248

G-4 Wire Leads
Dia. = .030
Length = 1.5



HOLDER SERIES G-20 (HC-26/U) G-21 (HC-29/U)

Frequency Range:
5 MHz to 100 MHz

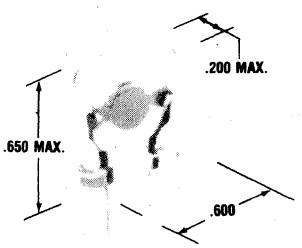


G-20 Wire Leads
Dia. = .017
Length = 1.5

G-21 Pins
Dia. = .040
Length = .238

HOLDER SERIES G-30/ G-31

Frequency Range:
5 MHz to 100 MHz



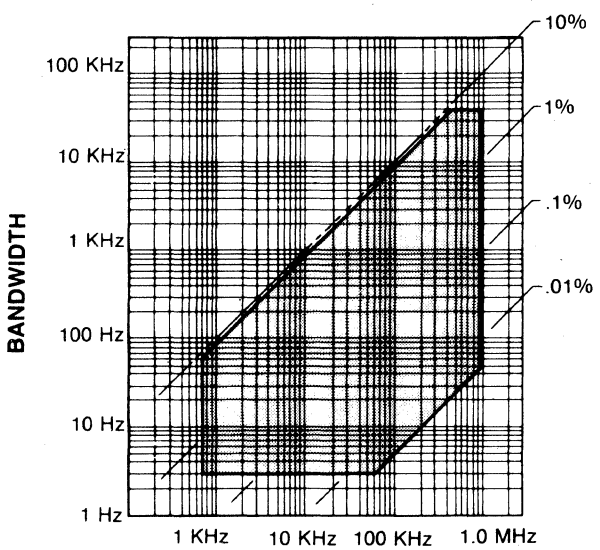
G-30 Wire Leads
Dia. = .017
Length = 1.5

G-31 Pins
Dia. = .040
Length = .238

LOW FREQUENCY CRYSTAL FILTERS

Low Frequency crystal filters between 1 KHz and 1 MHz are routinely produced utilizing advanced computer design technology. All filters are custom designed to customer requirements including unique package designs to fit unusual conditions. We invite your challenge. Call our Sales or Engineering Department today with your application.

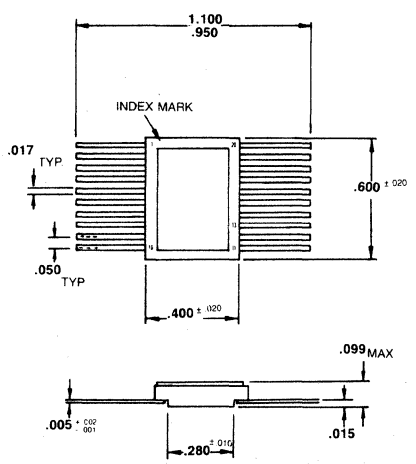
LOW FREQUENCY BANDWIDTH CHART

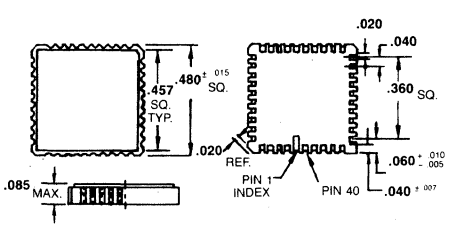


TYPICAL UNITS AVAILABLE

P/N	CENTRAL FREQUENCY	BANDWIDTH	BANDWIDTH	db I.L.	db RIPPLE	Ω IMPED.	SIZE
48B11	12 KHz	1 db 5 Hz Min	40 db 1 KHz	7	1	1 K	3 X 1 56 X 922
48B15	450 KHz	3 db 200 Hz	60 db 1500 Hz	5	3	20 K	2 605 X 595 X 955
48B35	455 KHz	3 db · 1450 Hz	60 db · 1 96 KHz	4 5	0 5	2 K	3 031 X 1 438 X 1

SURFACE MOUNTED CRYSTAL FILTERS





Center Frequency Range Available: 10 MHz to 30 MHz
3 db Bandwidth: .05% to .2%
Shape Factor from 30 to 3db = 7:1 max.
Passband Ripple: 1db max.
Insertion Loss: 2db max.
Source Load impedance: Natural Impedance of Filter

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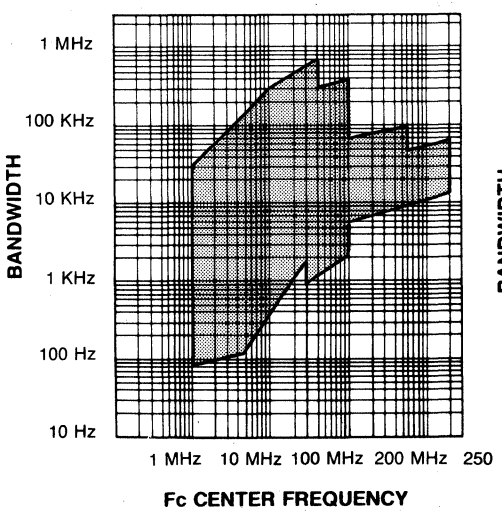
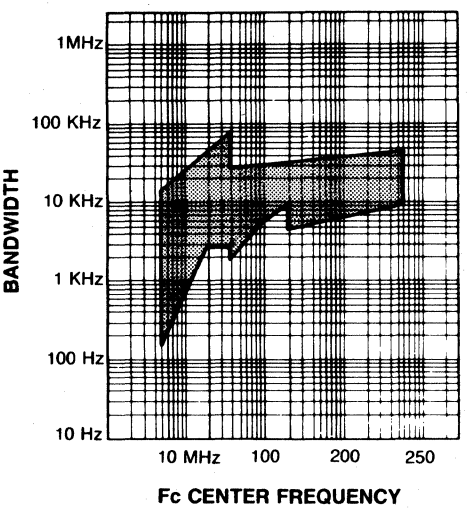
HIGH FREQUENCY CRYSTAL FILTERS

McCoy Electronics manufactures high frequency crystal filters from 1 MHz to over 250 MHz. Both discrete crystal design and monolithic filter designs are utilized to achieve the maximum in bandwidths, selectivity, miniaturization and competitive pricing.

DISCRETE FILTER BANDWIDTH



MONOLITHIC BANDWIDTH CHART



TYPICAL UNITS AVAILABLE

P/N	CENTER FREQUENCY MHz	NO. POLES	BANDWIDTH	BANDWIDTH	db I.L.	db RIPPLE	Ω IMPED.	SIZE
48B52	1.4	14	3 db ± 1.62 KHz	60 db 4.3 KHz	5	1	1K	2.975 x 1.63 x 1.18
48B30	10	6	1 db ± 15 KHz	60 db ± 58 KHz	5	0.5	500	1.87 x .5 x .475
48Q24	21.4	4	6 db 32 KHz	30 db 72 KHz	6	2	2.2K	.9 x .215 x .61
48Q19	25.5	6	6 db ± 34.5 KHz	60 db ± 80 KHz	5	1	3K	2.08 x .75 x .635
48Q06	30	8	3 db ± 15 KHz	60 db 60 KHz	4	1	1.5K	.73 x .47 x .59
48B45	50	6	6 db ± 9.5 KHz	55 db ± 25 KHz	8	1	50	2.73 x .64 x 1.085
48B40	70	8	1 db ± 20 KHz	45 db ± 70 KHz	6	1	50	.985 x .719 x .475
48B76	118 to 136	8	6 db ± 12 KHZ	90 db ± 75 KHZ	1	2	50	4.98 x .985 x .985
48Q2	156	2	3 db 15 KHz	30 db 60 KHz	2	1	5K	41 dia. x .265

**ONLY A FEW UNITS ARE SHOWN,
WRITE OR CALL FOR COMPLETE CATALOG.**

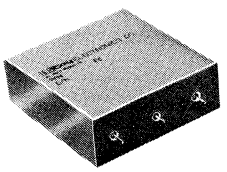
SWITCHABLE BANDWIDTH FILTERS

MODEL 48B12
Switchable Bandwidth

SPECIFICATIONS
Center Frequency: 70.0 MHz
Filter A: 3 db BW: ±35 KHz min.
60 db BW: ±180 KHz max.
Filter B: 6 db BW: ±19 KHz min.
60 db BW: ±90 KHz max.
Ripple: Filter A: 1.5 db max.
Filter B: 1.0 db max.
Insertion Loss: Filter A and B: 8.0 db max.
Ultimate Attenuation: 80 db min. ±200 KHz to ±20 MHz from center frequency
Source/Load Impedance: 50 Ω
Shock: 50G's, MIL-STD-202, method 202
Vibration: MIL-STD-202, method 204, test condition A
Temperature Range: –55° to +95°C
Switching Voltage:
Bias Voltage to Pin 5: 12 VDC
Filter A obtained by applying 0–1 VDC to pin o
Filter B obtained by applying 24 VDC to pin 6
Filter will sustain no damage with .5 VRMS applied to input

SINGLE SIDEBAND FILTERS

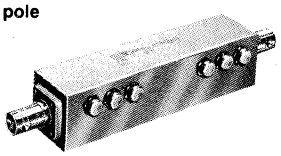
MODEL 48B33
SSB Single Sideband



Carrier Frequency: 1.750 MHz
1 db BW: Fc +295 Hz to Fc +3100 Hz min.
60 db BW: Fc –125 Hz to Fc +3975 Hz max.
Carrier Attenuation: Fc 40 db min.
Ripple: 1.0 db max.
Insertion Loss: 5.0 db max.
Ultimate Attenuation: 60 db min.
Source/Load Impedance: 500 Ω
Shock: MIL-STD-202, method 213
Vibration: MIL-STD-202, method 204A, tested condition A
Temperature Range: –40° to +78°C

HIGH FREQUENCY CRYSTAL FILTERS

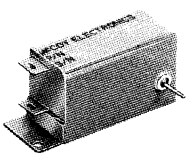
MODEL 48B76
8 pole



SPECIFICATIONS
Center Frequency: 118.0 MHz to 136 MHz
6 db BW: ±12 KHz min.
60 db BW: ±35 KHz max.
90 db BW: ±75 KHz max.
Ripple: 2.0 db max.
Insertion Loss: 1.0 db max.
Ultimate Attenuation: 90 db min.
Source/Load Impedance: 50 Ω
Shock: Standard Commercial
Vibration: Standard Commercial
Temperature Range: –40° to +70°C
External Supply Required: 10V ±10%
NOTE: Filter designed to eliminate adjacent channel interference and contains amplifier with built in power supply.

HIGH FREQUENCY CRYSTAL FILTERS

MODEL 48B10
8 pole

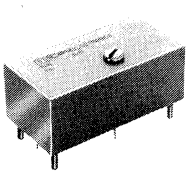


SPECIFICATIONS
Center Frequency: 30.0 MHz
3 db BW: ±31.8 KHz min.
6 db BW: ±34.5 KHz min.
60 db BW: ±57 KHz max.
Ripple: 1.0 db max. over ±25 KHz
Insertion Loss: 3.0 db max.
Ultimate Attenuation: 60 db min.
Source Impedance: 2K Ω
Load Impedance: 50 Ω
Shock: 15G's, 18 impacts
Vibration: 10–500 Hz, 10G's
Temperature Range: –55° to +105°C

CRYSTAL DISCRIMINATORS

MODEL 48D2
Crystal Discriminators

SPECIFICATIONS
Center Frequency: 498.750 KHz
Positive Slope
Peak-Peak BW: 300 Hz min.
Linear BW: ±100 Hz
Linearity: ±10%
Sensitivity: ±.5V Nominal At ±100 Hz



Driver Source Impedance: 50 Ω, 1 VRMS open circuit
Discriminator Load Impedance: 39K 1 VRMS open circuit
Drive Level: 1 VRMS open circuit
Shock: MIL-STD-202, method 213, condition J
Vibration: MIL-STD-202, method 201
Temperature Range: 0° to +70°C

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CRYSTAL OSCILLATORS

McCoy's line of custom designed Crystal Controlled Oscillators is unexcelled in the industry. From clocks, TCXO's, VCXO's, TCVCXO's thru oven controlled units, we have a unit to meet your requirements. A complete in-house thick film facility coupled with the industries best crystal facility gives you miniaturization capabilities and quality controls unavailable elsewhere. Our QPL approvals on MIL-0-55310 allows the use of military approved unit where the requirement exists.

MIL-0-55310 OSCILLATORS OFFERED BY McCOY ELECTRONICS

MIL-0-55310 SLASH SHEET NO.	CLASS # OF UNIT *	FREQUENCY RANGE COVERED	MAX. SCREENING LEVEL	OUTPUT WAVEFORM	MCCOY CORRESPONDING MODEL NUMBER	PACKAGE SIZE AND STYLE
5	3	1 MHz - 10 MHz	B	TTL	MC180X2-( )	2.0" × 2.0" × .7" PC MOUNT or CHASSIS
7	3	10 MHz - 70 MHz	B	SINE	MC178X2-( )	2.0" × 2.0" × .7" PC MOUNT
8	1	50 Hz - 50 MHz	B	TTL	MC765A1-( )	.887" × .54" × .4" 14 PIN DIP
8	1	512 Hz - 22 MHz	S	TTL	MC765A1-( )	.887" × .54" × .4" 14 PIN DIP
9	1	400 KHz - 30 MHz	B	TTL	MC717-( )	.410" dia. × .300" TO-5 PACKAGE
10	1	1 KHz - 30 MHz	B	TTL	MC708A1-( )	.565" dia. × .350" TO-8 PACKAGE
11	1	50 KHz - 10 MHz	B	CMOS	MC751A1-( )	.887" × .54" × .4" 14 PIN DIP
12	1	50 KHz - 10 MHz	B	CMOS	MC715A1-( )	.410" dia. × .350" TO-5 PACKAGE
13	1	300 Hz - 10 MHz	B	CMOS	MC714-( )	.565" dia. × .350" TO-8 PACKAGE
14	1	.1 Hz - 25 MHz	B	TTL	MC755A1-( )	.887" × .54" × .2" 14 PIN DIP
14	1	512 Hz - 22 MHz	S	TTL	MC755A1-( )	.887" × .54" × .2" 14 PIN DIP
15	1	.01 Hz - 10 MHz	B	CMOS	MC752A1-( )	.887" × .54" × .2" 14 PIN DIP
16	1	0.1 Hz - 60 MHz	B	TTL	MC741A1-( )	.887" × .54" × .2" 14 PIN DIP
16	1	512 Hz - 22 MHz	S	TTL	MC741A1-( )	.887" × .54" × .2" 14 PIN DIP
17	1	250 KHz - 50 MHz	B	TTL	MC726A1-( )	.887" × .54" × .2" 14 PIN DIP
17	1	250 KHz - 22 MHz	S	TTL	MC726A1-( )	.887" × .54" × .2" 14 PIN DIP
18	1	.01 Hz - 15 MHz	B	CMOS	MC745A1-( )	.887" × .54" × .2" 14 PIN DIP
19	1	1 MHz - 60 MHz	B	TTL	MC070	.480" SQ. × .085" 40 PAD LEADLESS CHIP CARRIER
20	1	1 MHz - 60 MHz	B	TTL	MC085-( )	.650" SQ. × .085" 44 PAD LEADLESS CHIP CARRIER

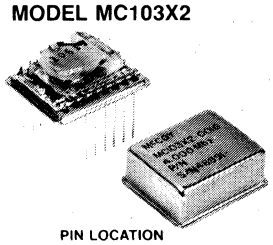
*MIL-0-55310 OSCILLATOR CLASSIFICATIONS

CLASS 1: CRYSTAL OSCILLATOR (XO)
CLASS 3: TEMPERATURE COMPENSATED CRYSTAL OSCILLATOR (TCXO)

ONLY A FEW UNITS ARE SHOWN, WRITE OR CALL FOR COMPLETE CATALOG.

MINIATURE THICK FILM HYBRID TCXO

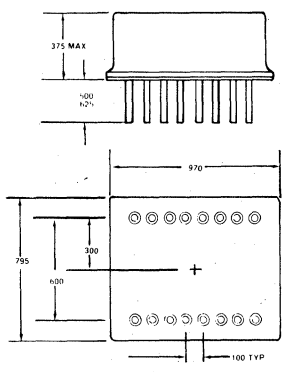
MODEL MC103X2



PIN LOCATION

1. GND
2. REG B+
3. ADJ.
4. N/C
5. N/C
6. N/C
7. N/C
8. GND.
9. R.F. OUT
10. N/C
11. N/C
12. N/C
13. N/C
14. N/C
15. N/C
16. +5.0 VDC

FREQ. ADJ. (10 K POT)



NOTE: SQUARE CORNER INDICATES PIN #1

SPECIFICATIONS

Frequency Range: 3.2 to 25 MHz
Frequency Stability Options: (Select one)
A) ±1 PPM over 0° to +50°C
B) ±2 PPM over −15° to +70°C
C) ±3 PPM over −30° to +70°C
Input: +5.0 VDC ±2%, 15 ma MAX.

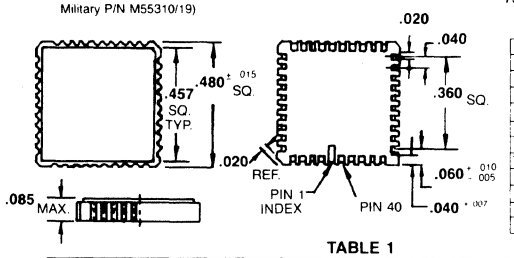
Output: TTL Compatible
Trim: Electrical, ±5 PPM, minimum, trimmed by external 10K pot connected to 3 terminals.
PACKAGE: 16 pin Dip, .375 High

SURFACE MOUNTED OSCILLATORS

MODEL MC070 LEADLESS CHIP CARRIER OSCILLATOR .040" PAD CTRS.

(This model also available as Military P/N M55310/19)

750 KHz to 100 MHz



PAD NO.	FUNCTION
4	B+
10	B+
31	GND.
37	GND.
39	OUTPUT
1-3	NC
5-9	NC
11-30	NC
32-36	NC
38	NC
40	NC

SPECIFICATIONS

Frequency stability:
Vs temperature: See table I
Vs supply voltage: ± 4 ppm maximum for a 5.0 V change in input voltage
Aging: ± 10 ppm per year maximum
Seal: Hermetic
Weight: 3 grams, maximum.
Temperature:
Operating: Within the specified limits over a temperature range of (see table I)
Storage: – 62° to + 125°C.
Oscillator load: Standard TTL loads (see table I)
Output waveform: Symmetrical square wave

Output voltage:
Logic 1: 2.4 Vdc Minimum at 400 µA source
Logic 0: 0.5 Vdc maximum with 16 mA sink

Vibration, high frequency: In accordance with MIL-0-55310 and MIL-STD-202, method 204
Nonoperating - Test condition G
Operating - Test condition G

Constant acceleration: MIL-STD-883, Method 2001, test condition A (Y1 Plane)

Altitude:
Nonoperating - In accordance with MIL-0-55310
Operating - MIL-STD-202, method 105, test condition C

This unit also available with maximum height of .075" under McCoy Model MC071

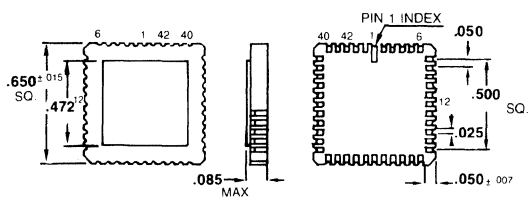
TABLE 1

OUTPUT FREQUENCY RANGE	INPUT CURRENT MAX MA	PULSE CHARACTERISTICS RISE AND FALL TIME MAX NS	SYMMETRY %	LOAD MAX	AGING PPM/YR AFTER 30 DAYS	FREQUENCY STABILITY PPM -55°C +125°C A	-55°C +105°C B	-20°C +70°C C
750 KHz to 16.0 MHz	75	15	40 to 60	10 TTL	10	± 100	± 75	± 50
750 KHz to 16.0 MHz	75	15	40 to 60	10 TTL	10	± 200	± 150	± 100
16.0 MHz to 40 MHz	40	5	40 to 60	10 TTL	10	± 100	± 75	± 50
16.0 MHz to 40 MHz	40	5	40 to 60	10 TTL	10	± 200	± 150	± 100
40 MHz to 60 MHz	70	5	40 to 60	10 TTL	10	± 100	± 75	± 50
40 MHz to 60 MHz	70	5	40 to 60	10 TTL	10	± 200	± 150	± 100
60 MHz to 80 MHz	85	5	40 to 60	10 TTL	10	N/A	± 75	± 50
60 MHz to 80 MHz	85	5	40 to 60	10 TTL	10	N/A	± 150	± 100
80 MHz to 100 MHz	85	5	40 to 60	10 TTL	10	N/A	N/A	± 50
80 MHz to 100 MHz	85	5	40 to 60	10 TTL	10	N/A	N/A	± 100

MODEL MC085 LEADLESS CHIP CARRIER OSCILLATOR .050" PAD CTRS.

(This model also available as Military P/N M55310/20)

1 MHz to 100 MHz



PAD NO.	FUNCTION
6	B+
12	B+
34	GND
40	GND
42	OUTPUT
1-5	NC
7-11	NC
13-33	NC
35-39	NC
41	NC
43-44	NC

SPECIFICATIONS

Frequency stability:
Vs temperature: See table I.
Vs supply voltage: ± 4 ppm maximum for a 5.0 V change in input voltage.

Aging: ± 10 ppm per year maximum.

Seal: Hermetic.
Weight: 3 grams, maximum.
Temperature:
Operating: Within the specified limits over a temperature range of (see table I).
Storage: – 62° to + 125°C.
Oscillator load: Standard TTL loads (see table I).
Output waveform: Symmetrical square wave

Output voltage:
Logic 1: 2.4 Vdc Minimum at 400 µA source
Logic 0: 0.5 Vdc maximum with 16 mA sink.

Vibration, high frequency: In accordance with MIL-0-55310 and MIL-STD-202, method 204.
Nonoperating - Test condition G.
Operating - Test condition G.

Constant acceleration: MIL-STD-883, Method 2001, test condition A (Y1 Plane)

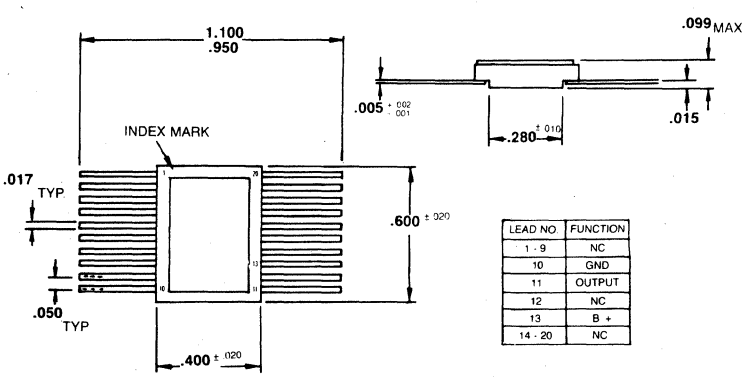
Altitude:
Nonoperating - In accordance with MIL-0-55310
Operating - MIL-STD-202, method 105, test condition C

TABLE 1

OUTPUT FREQUENCY RANGE	INPUT CURRENT MAX MA	PULSE CHARACTERISTICS RISE AND FALL TIME MAX NS	SYMMETRY %	LOAD MAX	AGING PPM/YR AFTER 30 DAYS	FREQUENCY STABILITY PPM -55°C +125°C A	-55°C +105°C B	-20°C +70°C C
1.0 MHz to 16.0 MHz	75	15	40 to 60	10 TTL	10	± 100	± 75	± 50
1.0 MHz to 16.0 MHz	75	15	40 to 60	10 TTL	10	± 200	± 150	± 100
16.0 MHz to 40 MHz	40	5	40 to 60	10 TTL	10	± 100	± 75	± 50
16.0 MHz to 40 MHz	40	5	40 to 60	10 TTL	10	± 200	± 150	± 100
40 MHz to 60 MHz	70	5	40 to 60	10 TTL	10	± 100	± 75	± 50
40 MHz to 60 MHz	70	5	40 to 60	10 TTL	10	± 200	± 150	± 100
60 MHz to 80 MHz	85	5	40 to 60	10 TTL	10	N/A	± 75	± 50
60 MHz to 80 MHz	85	5	40 to 60	10 TTL	10	N/A	± 150	± 100
80 MHz to 100 MHz	85	5	40 to 60	10 TTL	10	N/A	N/A	± 50
80 MHz to 100 MHz	85	5	40 to 60	10 TTL	10	N/A	N/A	± 100

MODEL MC102A1 FLAT PACK CRYSTAL OSCILLATORS .050" LEAD CTRS.

14 MHz to 60 MHz



LEAD NO.	FUNCTION
1 - 9	NC
10	GND
11	OUTPUT
12	NC
13	B +
14 - 20	NC

SPECIFICATIONS

STABILITY OPTIONS
± 50 ppm
± 75 ppm
± 100 ppm

TEMPERATURE RANGE
–20° to + 70°C
–55° to + 105°C
–55° to + 125°C

INPUT: + 5.0 VDC ± .50 volts

CURRENT DRAIN: 40 ma maximum 14 MHz to 40 MHz
70 ma maximum 50 MHz to 60 MHz

OUTPUT: Capable of driving 10 TTL loads

RISE AND FALL TIME: 5ns

SYMMETRY: 40/60 percent

ENVIRONMENTAL:

Hermetic Seal
Aging: 10 ppm/year maximum
Vibration: MIL-STD 202, Method 204 test condition G
CONSTANT ACCELERATION: MIL-STD 883, method 2001 test condition "A" (Y1 plane)

NOTE: For Military Applications, units can be screened IAW MIL-O-55310, Level B

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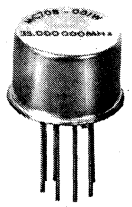
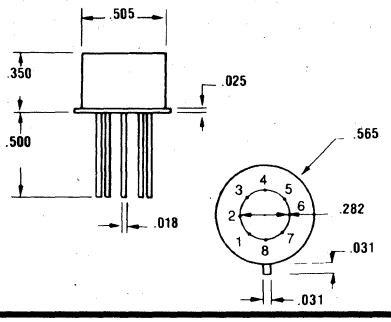
CRYSTAL OSCILLATORS

MODEL MC708

Standard Oscillator
(Also available as Military P/N M55310/10)





Frequency Range: 250 KHz to 50 MHz

Stability (Options):	Temperature Range:
±50 PPM	0°C to +70°C
±50 PPM	-40°C to +85°C
±50 PPM	-55°C to +105°C

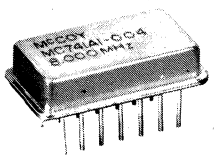
Input: +5V DC ±10%

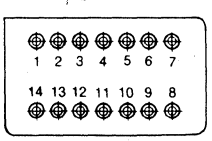
Output: TTL: Fan out 10 TTL Loads (156 KHz to 25 MHz)
TTL: Fan out 6 TTL Loads (25 MHz to 50 MHz)

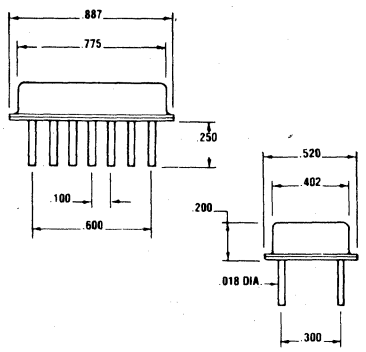
Pin Connections
1,3,& 7 N/C Internally
2 & 6 Connected Internally
4. Common
5. R.F. Output
8. Oscillator B+

MODEL MC741A1

Standard Oscillator
(Also available as Military P/N M55310/16)







Frequency Range: 250.0 KHz to 50 MHz

Stability (Options):	Temperature Range:
±50 PPM	0°C to +70°C
±50 PPM	-40°C to +85°C
±50 PPM	-55°C to +105°C
± 70 PPM	-55° C to +125° C

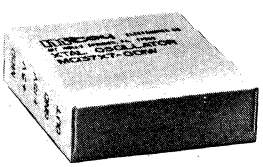
Input: +5V DC ±10%

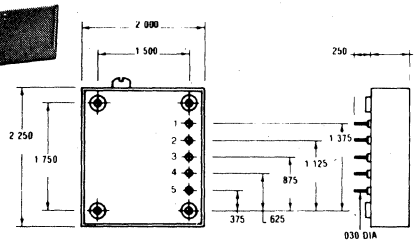
Output:
TTL: Fan out to 10 TTL Loads (250 KHz to 25 MHz)
TTL: Fan out to 6 TTL Loads (25 MHz to 50 MHz)

Pin Connections
1,2,3,4,5,6,9,10,11,12, & 13 N/C Internally
7. Common
8. R.F. Output
14. Oscillator B+

MODEL MC137X7

TCVCXO





Frequency Range: 180 KHz to 25 MHz

Stability	Temperature Range	Deviation
±1 PPM	-10°C to +70°C	±.001%
±5 PPM	-30°C to +70°C	±.0025%
±10 PPM	-40°C to +75°C	±.005%

Linearity: 5%

Output: TTL Compatible

Modulation Input Impedance: 10k Minimum

Control Voltage: ±2 Volts to ±10 Volts

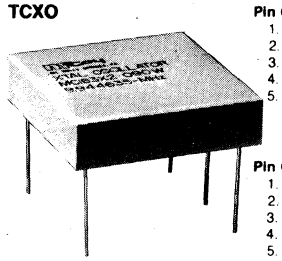
Negative Slope:

Input Voltage: +12 to +24V DC

Pin Connections
1. Modulation Input
2. Logic B+
3. Oscillator B+
4. Common and Case
5. R.F. Output

MODEL MC163X2

TCXO



Sinewave

Pin Connections
1. Oscillator B+
2. N.C.
3. R.F. Output
4. Common and Case
5. Common and Case

TTL

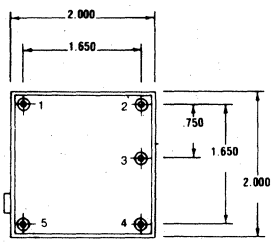
Pin Connections
1. Oscillator B+
2. Common and Case
3. R.F. Output
4. Logic B+
5. Common and Case

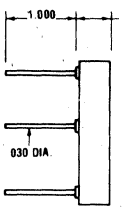
CMOS

Pin Connections
1. Oscillator B+
2. N.C.
3. R.F. Output (CMOS)
4. Common and Case
5. Common and Case

ECL

Pin Connections
1. OSC B+ or B-
2. GND
3. R.F. Output
4. Logic -5.2 VDC
5. GND





Frequency Range: 180 Hz to 150 MHz (depending upon output)

Stability Tr: ±0.5 PPM -20°C to +60°C
±1.0 PPM -40°C to +70°C
±5.0 PPM -55°C to +105°C
(Shown are typical specifications - this is a cost determining requirement and only actual needs should be specified)

Input Voltage Range: +12VDC to +24V DC ±3% and +5V DC ±5% (TTL/DTL units only)

External Trim: 5 PPM Minimum

Aging: 1 PPM/Year Maximum

Output:

Sine Wave	
Freq Range 3-150 MHz Output 1-10 MW 50 ohms Harmonics/ Sub-Harmonics -20 dB Minimum	
TTL/DTL	**CMOS**
187.5 KHz-25 MHz TTL/DTL Compatible	180 Hz-10 MHz CMOS Compatible

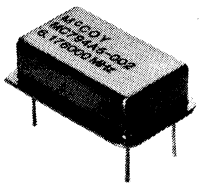
Frequency Range: 50 to 100 MHz

Input Voltage: ±12 to 24 DC ±3% and -5.2 VDC ±5%

Output: ECL Compatible

CRYSTAL OSCILLATORS

MODEL MC794A5 VOLTAGE CONTROLLED CRYSTAL OSCILLATOR



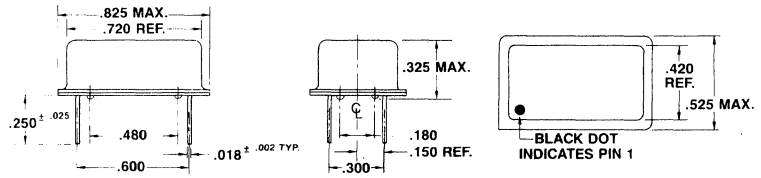


FIGURE 1

Package Size: See Figure 1

Mounting: See Figure 1

Output Frequency Range: 500 KHz to 33.0 MHz

Output Frequency: Frequency as designated at time of procurement

Frequency Stability: ± 50 ppm

Temperature Range:
Operating: – 40° to + 85° C
Storage: – 55° to + 125° C

Input Requirements:
Voltage: + 5 VDC ± 0.5 V
Current: 50 ma maximum
35 ma typical

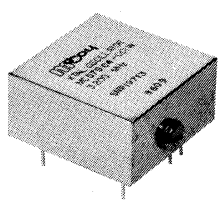
Output Specifications:
Wave Shape: TTL Compatible
Rise & Fall Times: 10 NSEC Max
Symmetry: 40/60%
Fan Out: 10 TTL Gates

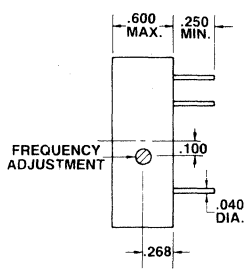
Pin Number	Function
1	VCO
7	GND
8	Output
14	VCC

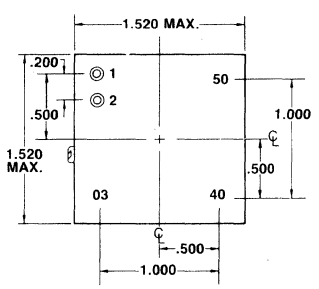
VCO Specifications:
Control Voltage: 2.5 VDC ± 0.5 VDC
Control Voltage Range: 1.0 VDC to 4.0 VDC
Control Voltage Sensitivity: 60 ppm per volt minimum, 150 ppm maximum at any point within the control voltage range.

Environmental Specifications:
Shock: 1000G's for .35 MS 1/2 sinewave
Vibration: 10 - 55 Hz, .06" double amplitude
55 Hz - 2 KHz, 15 G's, 12 hours duration
Leakage: 2×10^{-8} ATM CC/Sec. max

MODEL MC579C4-( ) STANDARD OVEN CRYSTAL OSCILLATOR







Pin Number	Function
1	B+
2	RF Out
3	Case/Circuit GND
4	Case GND
5	Case GND

Standard oven MC579C4-( ) is 1.5 x 1.5 x 0.6, and is intended for commercial applications where stability slightly tighter than a TCXO is required. Trim effect, hysteresis and stability in temperature slew are greatly improved over TCXO's.

Frequency Range: 2.5 - 13 MHz

Stability: ± 0.4, – 55 to + 85°C

Input Voltage: + 12V ± 5%

Input current: turn-on at – 55°C 700 ma for 3 minutes
Steady state at + 25°C 100 ma

Output: TTL compatible

Aging: 1ppm/year, maximum

Trim Range: ± 3ppm, minimum

Hermetic Seal: O-ring on seal screw

Hybrid Construction

MCCOY ELECTRONICS COMPANY 100 WATTS STREET, P.O. BOX B, MT. HOLLY SPRINGS, PA. 17065 717-486-3411 - TWX: 510-650-3548
a subsidiary of OAK Industries Inc.

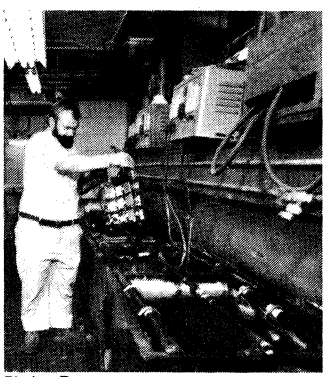
MC McCOY
ELECTRONICS COMPANY
100 WATTS STREET, P.O. BOX B,
a subsidiary of OAK Industries Inc. MT. HOLLY SPRINGS, PA. 17065 717-486-3411 - TWX: 510-650-3548

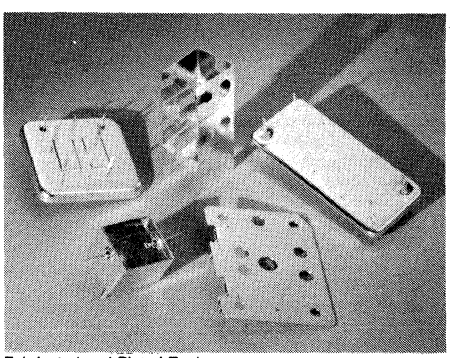
OTHER McCOY ELECTRONICS CAPABILITIES

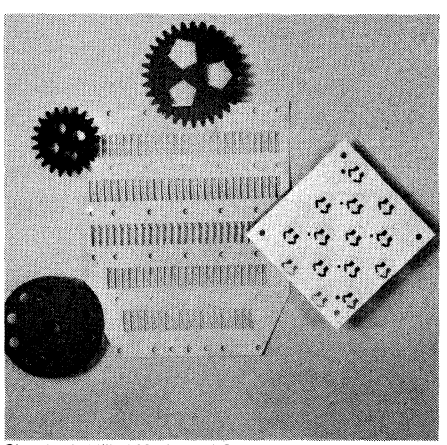
SPECIAL PRODUCTS

This department of McCoy offers a number of unique services and products outside of the normal frequency control type of device. One such service is chemically milled items such as plating masks and looping carriers. McCoy technicians can fabricate the necessary artwork or use customers supplied photo ready material. Rubyliths are cut at 100:1 and a photo lab step and reject system with fully automatic film development result in optimum results. Quick deliveries are typically achieved because all work is performed in-house. Materials chemical milled at McCoy include copper, brass, phosphor bronze, beryllium copper and both shim and blue steel. Other products made by for outside sale include printed circuit boards, chemical plating, fabricated metal enclosures and custom designed hybrid thick film circuits for our own in-house fabrication facilities.

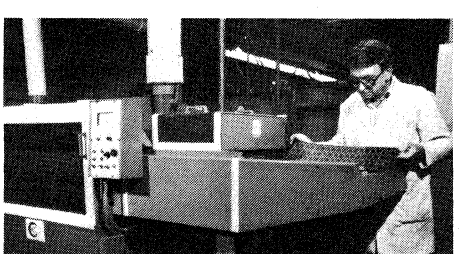
- Chemical Milling
- Printed Circuit Boards
- Electroplating
- Fabricated Metal Enclosures
- Custom Hybrid Thick Film Circuits


Plating Room


Fabricated and Plated Enclosures


Chemically Milled Masks and Carriers

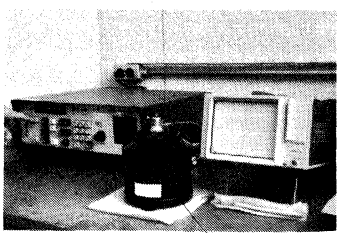
Resist Exposure Unit

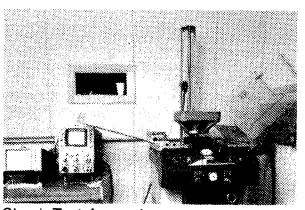

Conveyorized Etcher

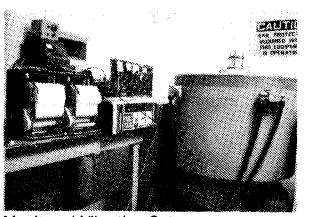
ENVIRONMENTAL TESTING

Over the past 20 years M^{c}Coy Electronics has been involved in practically every United States high reliability aerospace missile and satillite program. This program participation required us to create our own in-house environmental test laboratory and presently enjoys approval from all of our customers and the government. M^{c}Coy test capabilities include the following.

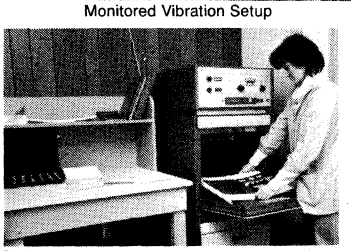
Test	MIL-STD-202E Method/Test Cond.		MIL-STD-883 Method/Test Cond.	
Salt Spray	101D	A,B	1009.4	A,B,C,D
Temperature Cycling	102A	C	1010.5	B
Humidity	103B	A,B		
Immersion (Seal)	104A	A,B,C,	1002	A,B,C
Moisture Resistance	106E		1004.4	
Thermal Shock	107F	All	1011.4	All
Life	108A	A,B,C,D		
Seal	112D	All	1014.5	A,C
Vibration, Line	201A			
Vibration, Line	204D	All	2007.1	A,B,C
Radiographic (Xray)	209		2012.5	
Acceleration	212A	A,B,C,	2001.2	A,B,C,D,F
Shock	213B	All	2002.3	A,B
Random Vibration	214	All		
PIND			2020.3	A,B


PIND Tester

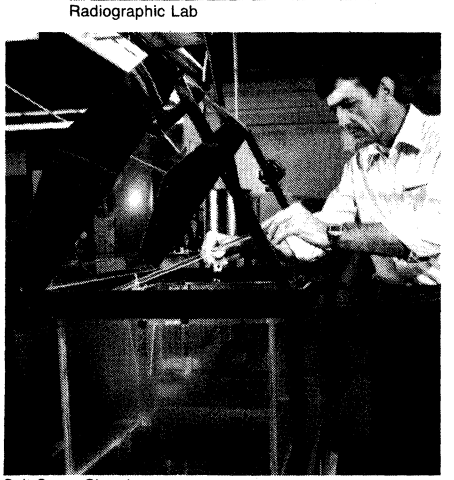

Shock Test Apparatus


Monitored Vibration Setup

Acceleration Centrifuge


Radiographic Lab

Hi Rel Test Area


Salt Spray Chamber

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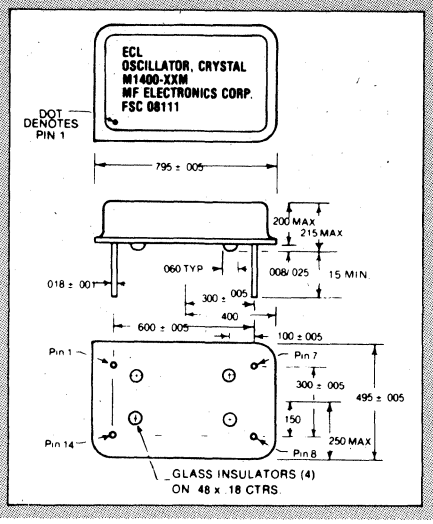
MF ELECTRONICS CORP. THE BROAD-LINE OSCILLATOR COMPANY



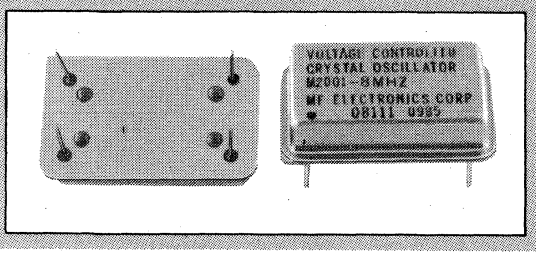
MOS (HIGH DRIVE)

DUAL INDEPENDENT FREQUENCY

TRI-STATE

ECL

HIGH REL



LOGIC FAMILY:	TTL					TTL & HCMOS								EXT.TEMP. TTL & HCMOS		TTL & MOS		LOW PWR CMOS		ECL					
M SERIES	1000	1200	1270	2001	5500	1280	1290	1295	3200	3290	3295			1256	4001	1257	1260	1251		1400	2400	3500	2500		
	1014	1214	1272	2002	5516	TO	TO	TO	TO	TO	TO			1258	TO	1259		1252		1410	2410	1510			
	1015	1215	1273	2003	5622	1284	1294	1299	3204	3294	3299				4008					1414	2414	1514			
		1216	1274	2004	5623															1415	2415	1515			
		1244																		1416	2416	1516			
		1245																		1444	2444	1544			
																				1445	2445	1545			
MOUNTING METHODS																									
SURFACE MOUNT	■																								
14-PIN DIP OR THRU-HOLE		■	■	■	■	■	■	■	■	■	■			■	■	■	■	■		■	■	■	■		
SPECIAL FEATURES																									
SINGLE OUTPUT	■	■	■	■	■	■	■	■	■	■	■			■	■		■	■		■	■	■			
INDEPENDENT DUAL OUT			■					■			■														
DUAL (DIV BY 2)																1259									
DUAL (DIV BY 4)																1257									
DUAL (COMPLEMENTARY)																				■		■			
PIN 7 & 14 REVERSAL																				■		■			
ENABLE/DISABLE						■		■																	
TRI-STATE ON "1"									■		■														
TRI-STATE ON "0"										■															
VOLTAGE CONTROLLED					■																				
OPERATING FREQUENCY																									
(KILOHERTZ)																									
0.825																									
20.0																									
50.0																									
250.0																									
(MEGAHERTZ)																									
1.0																									
4.0																									
8.0																									
10.0																									
16.0																									
30.0																									
32.678																									
35.0																									
48.0																									
50.0																									
100.0																									
125.0																									

MF ELECTRONICS CORP.
10 Commerce Drive, New Rochelle, N.Y. 10801 (914) 576-6570 TWX: 710-563-0643

FOR SURFACE MOUNT, SEE INSIDE FRONT COVER

OSCILLATORS IN DIL OR SURFACE MOUNT

TTL EXTENDED TEMPERATURE RANGE

ENABLE/DISABLE

DUAL DIV-BY-4

DUAL DIV-BY-2

HCMOS

DUAL COMPLEMENTARY

LOW POWER CMOS

VOLTAGE CONTROLLED CRYSTAL OSCILLATOR (VCXO)

| | | |

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
ABS acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CAMAC computer automated measurement and control
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3
KSR keyboard send /receive

L
LC inductance capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIB microcomputer interface board
MIC microwave IC
MIPS million instructions per second
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

MICRO CRYSTAL DIVISION/SMH
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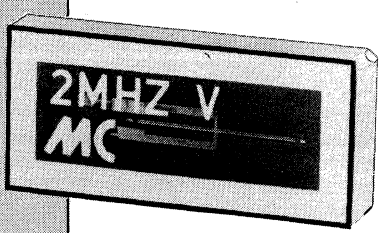
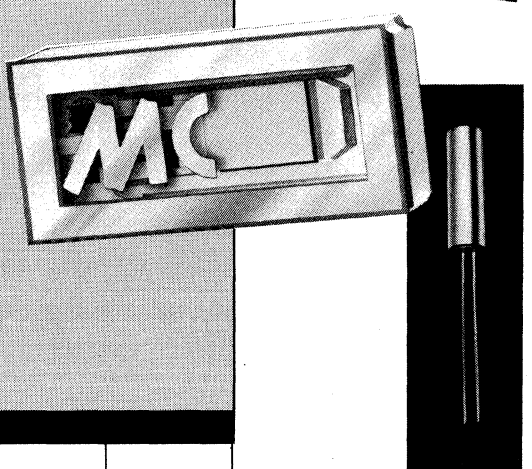
World's Smallest Quartz Crystals & Clock Oscillators 10KHz — 35MHz Surface Mount & Thru-Hole

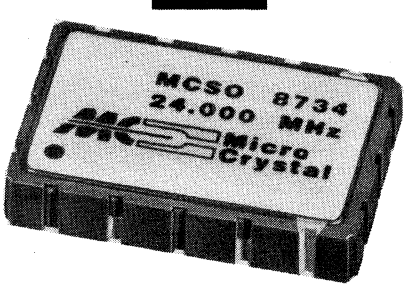
Micro Crystal is a world leader in miniature SMT and thru-hole quartz crystals and crystal clock oscillators. Our products meet the highest reliability standards for medical, industrial, military, commercial and consumer applications. Micro Crystal supports its products with professional technical services. We welcome the opportunity to work with you. Call 212/505-5340. FAX 212/505-6787.





MICRO CRYSTAL ADVANTAGES

- Miniature & sub-miniature sizes • Low-profile
- Complete range of lead configurations
- High temperature SMT versions
- Standard frequencies off-the-shelf
- Special frequencies available
- Standard calibrations off-the-shelf
- Tighter calibrations available
- High shock resistance • Low power use • Low aging
- High stability • Laser-tuned precision
- Tape & reel availability



Quartz Crystals Reference Chart

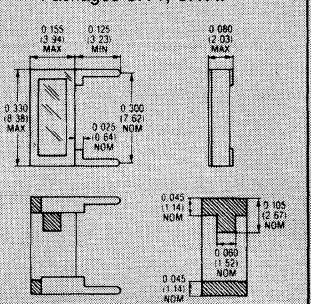
FREQUENCY RANGE	PACKAGE	MOUNTING	OSCILLATOR	TYPE
10-KHz-2MHz	Ceramic	Surface Mount Thru-Hole	Pierce	CX-1V, CX-2V
10-KHz-2MHz	Ceramic	Surface Mount Thru-Hole	Series	CX-1H, CX-2H
8-35MHz	Ceramic	Surface Mount Thru-Hole	Pierce	CX-AT
10-200KHz	Metal	Surface Mount Thru-Hole	Pierce	MX-1V

Crystal Clock Oscillator Reference Chart

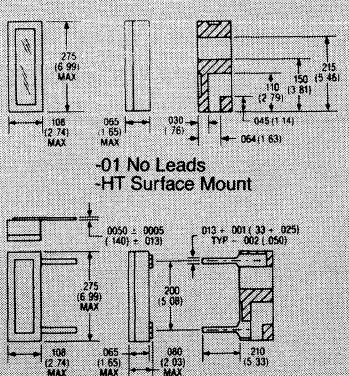
FREQUENCY RANGE	PACKAGE	MOUNTING	TYPE
0.1-35MHz	Ceramic	Surface Mount	MCSO

Package Dimensions

Packages CX-1, CX-AT



-03 Side Leads -01 No Leads

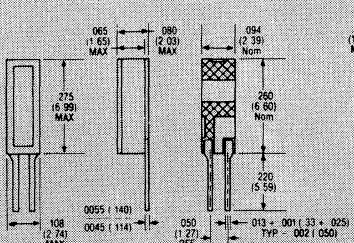


-01 No Leads
-HT Surface Mount

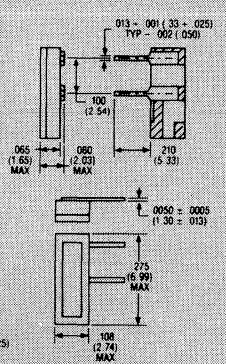
-03 Side Leads

Packages CX-2
Dimensions and case styles

Standard marking
frequency plus V (Pierce)
or H (Series).



-02 Side Leads



-04 Side Leads

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MCSO Clock Oscillator Surface Mountable 0.1 - 35MHz

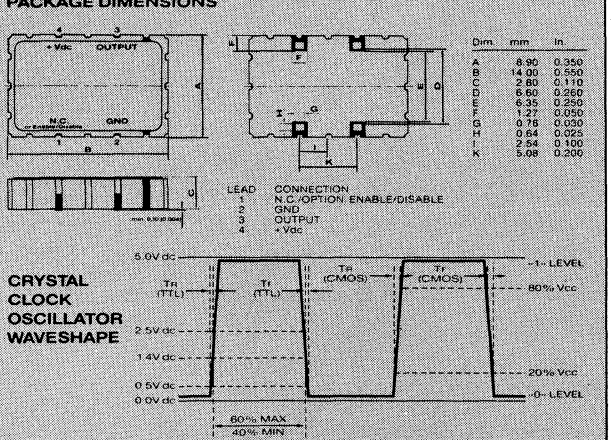
These surface-mountable, miniature crystal clock oscillators in the 0.1 - 35 MHz frequency range are designed for microprocessors used in any environment. Ideal for automated pick-and-place assembly, as well as for vapor phase (215°C for 5 minutes max) or wave solder (260°C for 5 seconds) mounting, these rugged oscillators come in leadless, hermetically-sealed, ceramic chip carriers. They measure 0.35" x 0.55" x 0.11" and are available on tape and reel or in sticks.

MCSO oscillators are CMOS and TTL compatible and feature low power use, low aging, excellent stability over a wide temperature range, high shock resistance and precise rise and fall times. An enable/disable option is available.

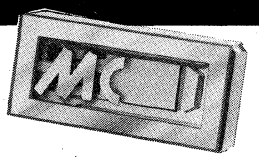
SPECIFICATIONS

Frequency Stability	A: ± 0.01% C: ± 0.50% Over 0° to 70°C range
Temperature Range	operating: 0° to 70°C Industrial −40° to 85°C Military
Input Voltage	+5 Vdc ±10%
Input Current (typ. for CL=15pF)	8mA at 1 MHz 20mA at 30 MHz
Output Symmetry:	(0° to 70°C) 45/55% typ 1.4 dc 40/60% (min/max)
Rise & Fall Times (Max)	tr tf
20% Vcc to 80% Vcc:	8 ns 7 ns CL=15pF
.5V to 2.5V:	6 ns 6 ns CL=15pF
"0" Level (Vol):	+.5V max IOL=16 mA
Start Up Time (typical)	≤5 ms
Cycle:	MIL883b, Method 1010.2 Level B
Shock:	5,000 g, 0.35 msec, 1/2 sinewave, 3 shocks each plane
Vibration:	10-55 Hz, 0.060" D.A., 55-2000 Hz 25g Duration time 12 hours
Thermal Shock:	−55° to +125°C, 100 cycles
Lead Material:	Gold plated over Nickel and Tungsten

PACKAGE DIMENSIONS



CX-AT, CX-AT-HT 8-35 MHz



Chemically etched thickness-shear resonators for use in simple Pierce oscillators. AT-cut crystals permit correct overtone selection without a tuned circuit. Reduced circuit count increases reliability. Surface mount and thru-hole versions available in rugged, miniature ceramic package.

SPECIFICATIONS

Temperature Range	
Operating (industrial)	−40° to +85°C
(military)	−55° to +125°C
Storage	−55° to +125°C
First Year Aging	5ppm max
Shock Resistance	5000g/0.3ms/1/2 sine
Vibration Resistance	20g 10-200Hz
Shunt Capacitance	2.4pF typ
Quality Factor	30000 typ
Drive Level	100 μW typ 500 μW max

Standard Frequencies (MHz)	
8.000	15.000
10.000	16.000
10.1506	16.384
11.059	19.6608
12.000	20.000
12.228	24.000
12.800	

Standard Tolerances* at 25°C	
Cal. A	±0.005%
Cal. B	±0.025%
Cal. C	±1.00%

*Tighter tolerances available

FIGURE 1: Typical Motional Resistance, R

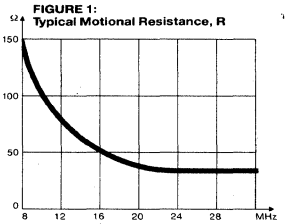


FIGURE 2: Typical Motional Capacitance, C_1

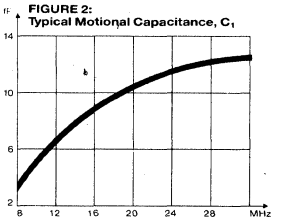
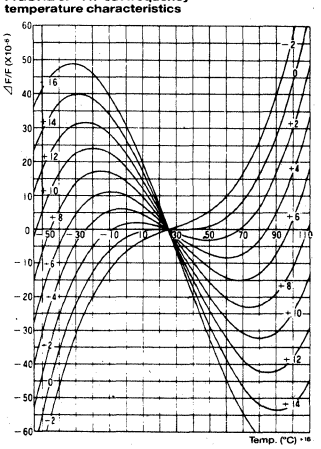


FIGURE 3: AT-cut frequency-temperature characteristics



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CX SERIES
10KHz - 2MHz

CX-1V, CX-1V-HT, CX-2V, CX-2V-HT

V-models are used in Pierce Oscillators for high volume applications. Typical uses include ultrasonics, communications and measuring equipment, realtime clocks, timers and uP clock circuits. Available in SMT and thru-hole versions.

CX-1H, CX-1H-HT, CX-2H, CX-2H-HT

H-models are used in rapid start Series Oscillators for low power applications including navigation, telecommunications, paging and alarm systems, computer terminals, timing devices and battery-powered microprocessors. Available in SMT and thru-hole versions.

Standard Frequencies (KHz)

10.000*	30.720	76.800	768.000
12.800*	31.500	77.500	1000.000
15.360*	32.768	100.000	1008.000
16.000*	38.400	153.600	1048.576
16.384*	40.000	240.000	1228.800
18.641	40.960	307.200	1500.000
19.200	48.000	384.000	1843.200
20.480	60.000	500.000	2000.000
25.000	75.000	560.000	2097.152

*CX-1 only

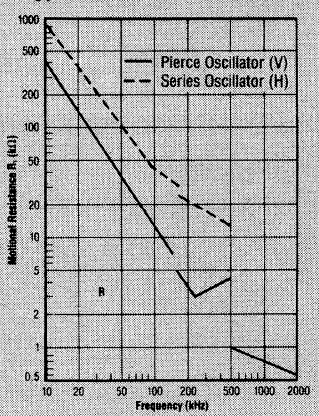
Standard Calibration Tolerances at 25°C

Frequency KHz	A	B	C
10-74.9	0.003%	±0.01%	±0.10%
75-169	±0.005%	±0.01%	±0.10%
170-249	±0.010%	±0.02%	±0.20%
250-499	±0.020%	±0.05%	±0.50%
500-2000	±0.050%	±0.10%	±1.00%

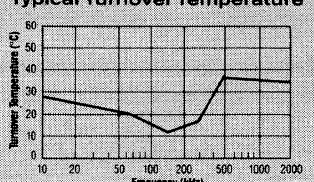
SPECIFICATIONS

Temperature Range	
Operating (Industrial)	−40° to +80°C
(Military)	−55° to +125°C
Storage	−55° to +125°C
Parabolic Temp. Coeff.	typically −0.038ppm (°C)
First Year Aging	10ppm max
Shock Resistance	1000g, 1ms, 1/2 sine wave
Vibration Resistance	10g rms. 10Hz-2KHz random
Shunt Capacitance	
CX-1V, CX-2V 10-499KHz	1.4pF
CX-1V, CX-2V 500-2000KHz	0.85pF
CX-1H, CX-2H 10-600KHz	1.4pF
Drive Level	≤1 μW (10-499KHz) 10 μW (500-2000KHz)

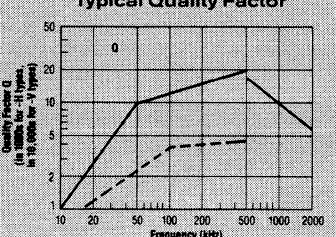
Typical Motional Resistance



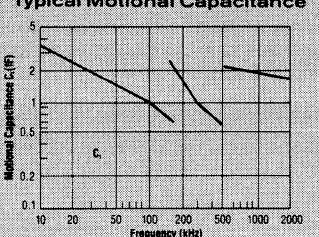
Typical Turnover Temperature



Typical Quality Factor

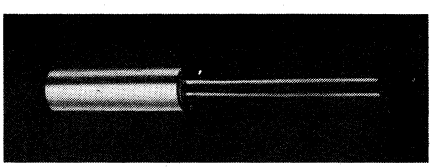


Typical Motional Capacitance



MX-1V 10-200KHz

A tuning-fork resonator for use in simple Pierce oscillators, MX-1V comes in a standard 2 x 7.5mm metal can with straight leads. Available on a 7″ tape reel in quantities of 2000. Millions have been produced for watch and technology applications. Standard frequencies and standard tolerances are listed in the CX-Series tables. Bent lead versions of MX-1V are available for surface mounting.



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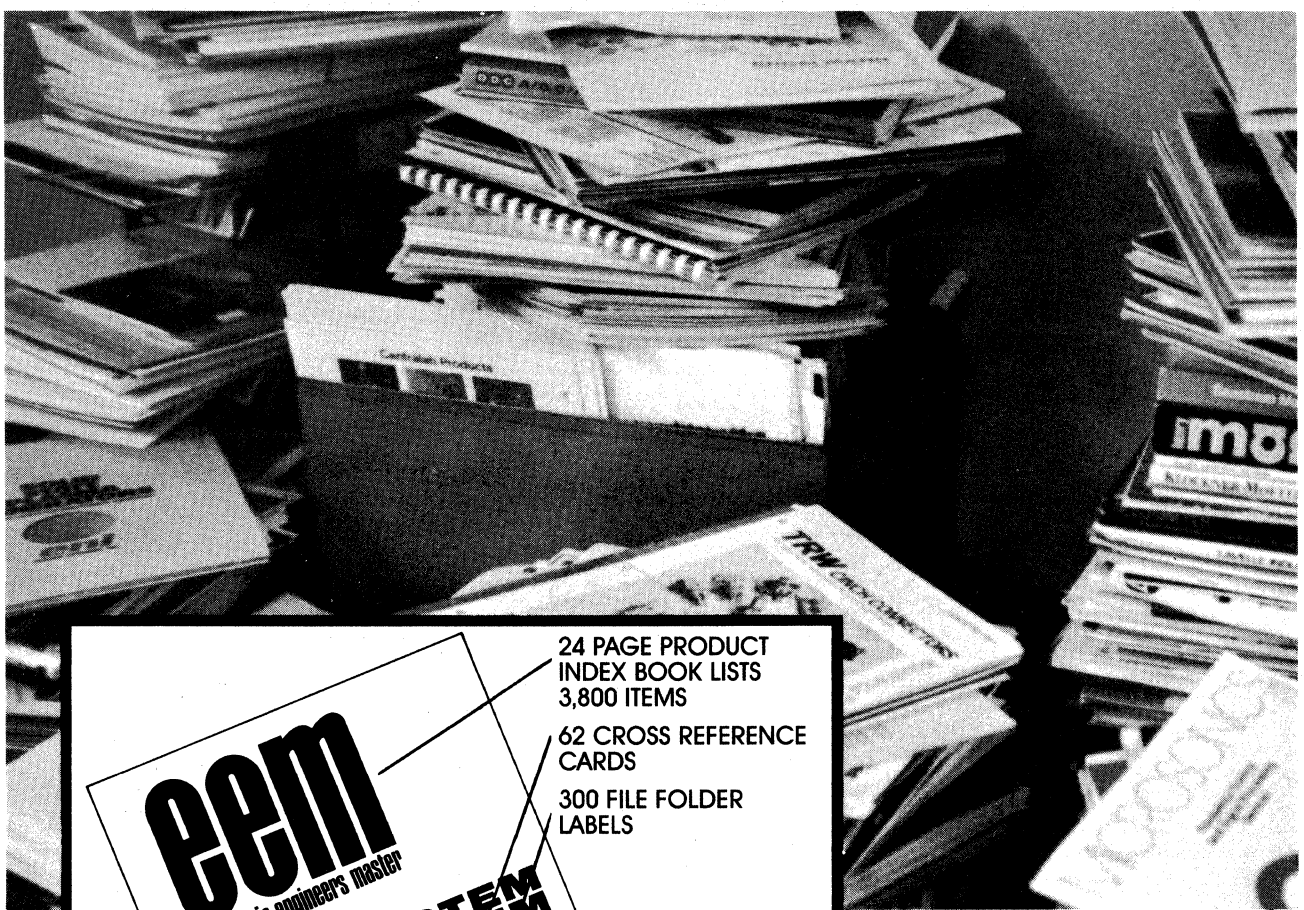

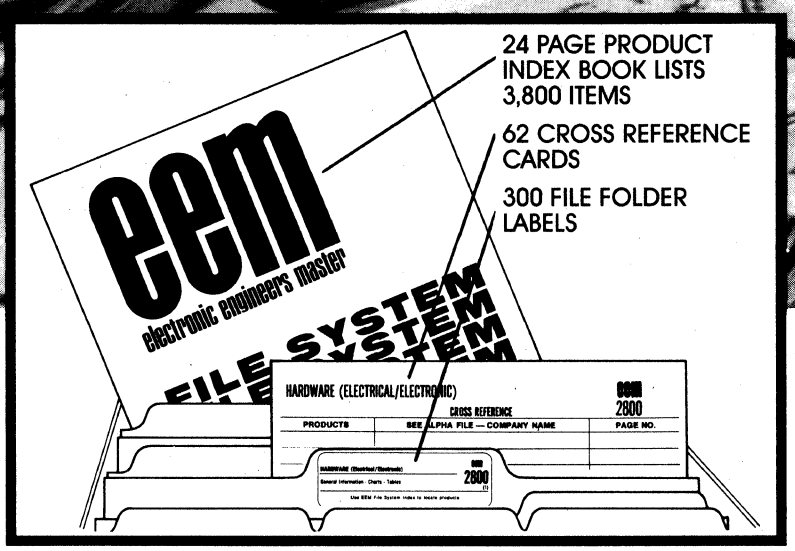

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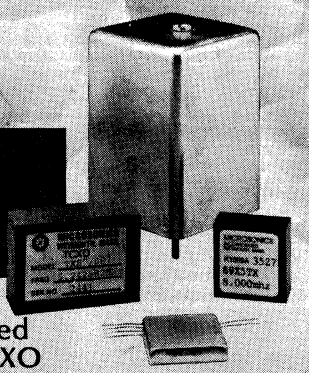
OCXO · TCXO · VCXO · TCVCXO

Crystal Oscillators



- 50 kHz to 1 GHz
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- High-Frequency TCXO
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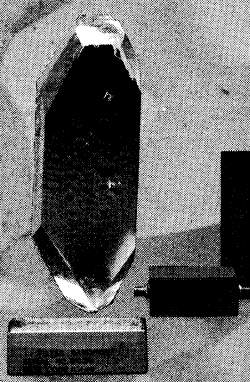
- Low Phase Noise VHF



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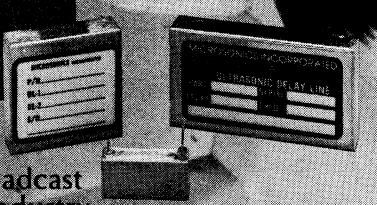

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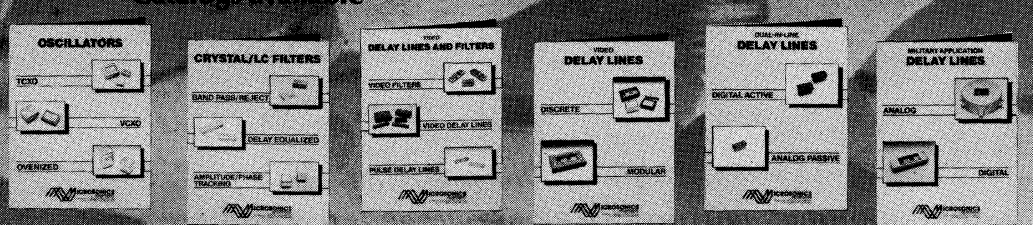

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Little Gems
MICROPROCESSOR CRYSTALS

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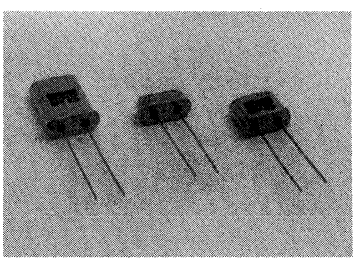
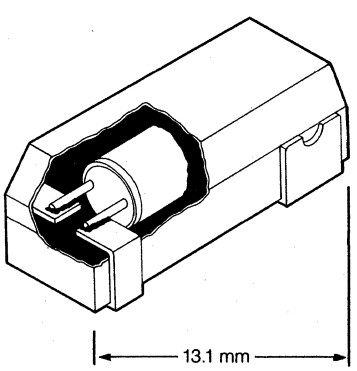


FREQUENCY STABILITY TOLERANCE:

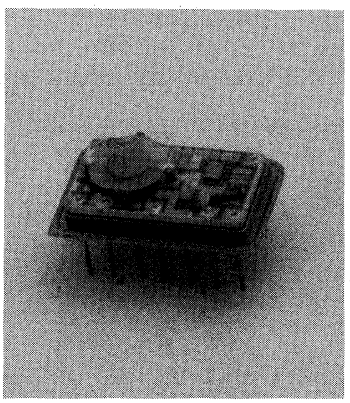
MM-33	±50 PPM at −10°C to +60°C
MM-18	±50 PPM at −20°C to +70°C
MM-44	±50 PPM at −20°C to +70°C
MM-38	±60 PPM at −10°C to +60°C

SURFACE MOUNT



FREQUENCY STABILITY TOLERANCE:

SM-55	±100 PPM at -10°C to +70°C
SM-49	±50 PPM at 20°C to +70°C



Voltage Controlled
VCXO
Crystal Oscillators

Monitor's in tune with industrial requirements. These VCXO's are a perfect three part harmony of low cost, high performance and small packaging (DIP).

- Frequency Range: 3.0-50.0 MHz.
- Stabilities: ±25 PPM at 25°C
- Deviation: 50 PPM/Volt 3.0-22.0 MHz, ±80 PPM 20.0 MHz-50 MHz
- Control Voltage Range: 0.5 to 4.5 Volts
- Linearity: ±20%

Temperature Compensated
INDUSTRIAL TCXO
Crystal Oscillators

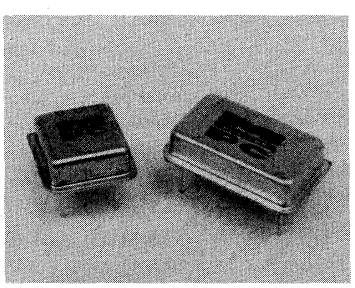
For high stability and low cost performance in demanding environments.

	7400			7401			7402		
	(A)	(B)	(C)	(A)	(B)	(C)	(A)	(B)	(C)
Frequency Range	5.0-20.0 MHz			1.0-20.0 MHz			1.0-20.0 MHz		
Frequency Tolerance (PPM) vs Temp Range	±5 PPM at +15° to +35°C	±1 PPM at +0° to +55°C	±2 PPM at −10° to +60°C	±1 PPM at −0° to +60°C	±1 PPM at −10° to +60°C	±2 PPM at −20° to +70°C	±1.5 PPM at −25° to +60°C	±2 PPM at −20° to +70°C	±3 PPM at −35° to +75°C

970 Series
CLOCK OSCILLATORS
High Speed Time Keepers

For digital and microprocessor controlled applications, Monitor's 970 Series Clock Oscillators are the pacesetters to rely on for high speed signal generation.

• TTL • CMOS • HCMOS • ECL • Enable-Disable Tri-State • Dual Output Including Independent Frequencies • Half Size



Operating Temperature Range: 0°C to 70°C
Storage: −55°C to +125°C
Supply Voltage: TTL: +5 ±5 VDC (40 MA typ); CMOS: +5 to 15 VDC (7 MA typ); HCMOS: +5 ±5 VDC (6 MA typ); ECL: −5.2 VDC ±.2 VDC (30 MA max)
Frequency Range: TTL: 250 KHz to 80 MHz CMOS/HCMOS: 1 MHz to 50 MHz; ECL: 50 MHz to 175 MHz
Frequency Stability: +100 PPM std.; 0°-70°C; Tighter tolerance to ± 5 PPM available
Pin Connections: Pin 1: N/C, Enable or Output; Pin 8: Ouput; Pin 7: # Case Ground; Pin 14: Supply Voltage

SURFACE MOUNT OPTIONS AVAILABLE FOR ALL CLOCK OSCILLATORS

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Aerospace Requirements

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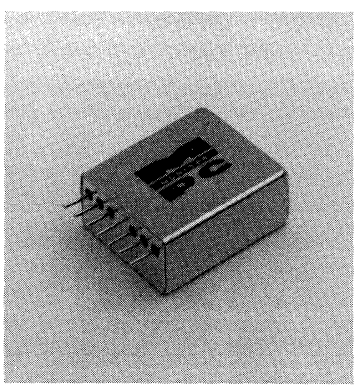
- MIL-STD-833 Screening
- MIL-STD-45662 Calibration System

Stabilties: up to ±0.2 PPM
Temperature Ranges: up to −55°C to +105°C (TCXO = 5 PPM)
TO-116: Compatible subminiature TCXOs and VCXOs
Supply Voltage: +5 VDC to +15 VDC
Outputs: TTL, CMOS, ECL, Sine Wave
Frequency Range: 200 KHz to 70 MHz
Environmental: MIL-STD-202, MIL-STD-883

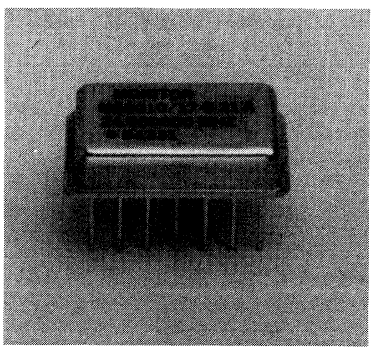


Over 200 Standard Designs

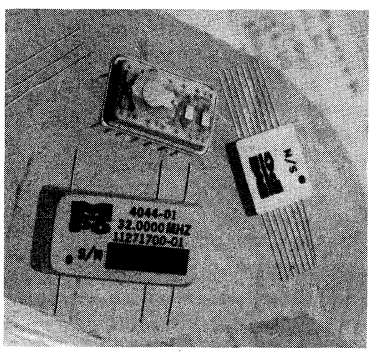
For Demanding Performance
OSCILLATORS
in Harsh Environments

Monitor's MIL-0-55310 Oscillators are qualified to meet the demands of military applications with a broad range of frequencies from 312 KHz to 30 MHz. Frequencies available to 100 MHz in many other configurations.

QUALIFIED TO MIL-O-55310



5500-6000 Series (QPL Type). One of many available package configurations in both TTL and HCMOS



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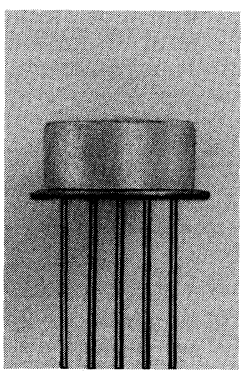

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Major manufacturers of commercial and military products have re-discovered the advantages of relying on American small businesses, such as M-tron Industries, Inc., which are both horizontally and vertically integrated. M-tron's location, skilled employees, and facilities provide an extremely reliable and cost effective resource on behalf of OEMs who are facing ever increasing demands for higher reliability, cost reduction, and increased functionality in an ever shrinking physical space.

COMMERCIAL PRODUCTS

M-tron's reliability in serving its extremely diverse customer base is derived from our ability to provide the advantages of multiple sourcing — combining production in Yankton, South Dakota, with that of our controlled offshore sources. Standard crystals and oscillator products are available locally from over 125 stocking distributors worldwide and also from inventories maintained at the factory.

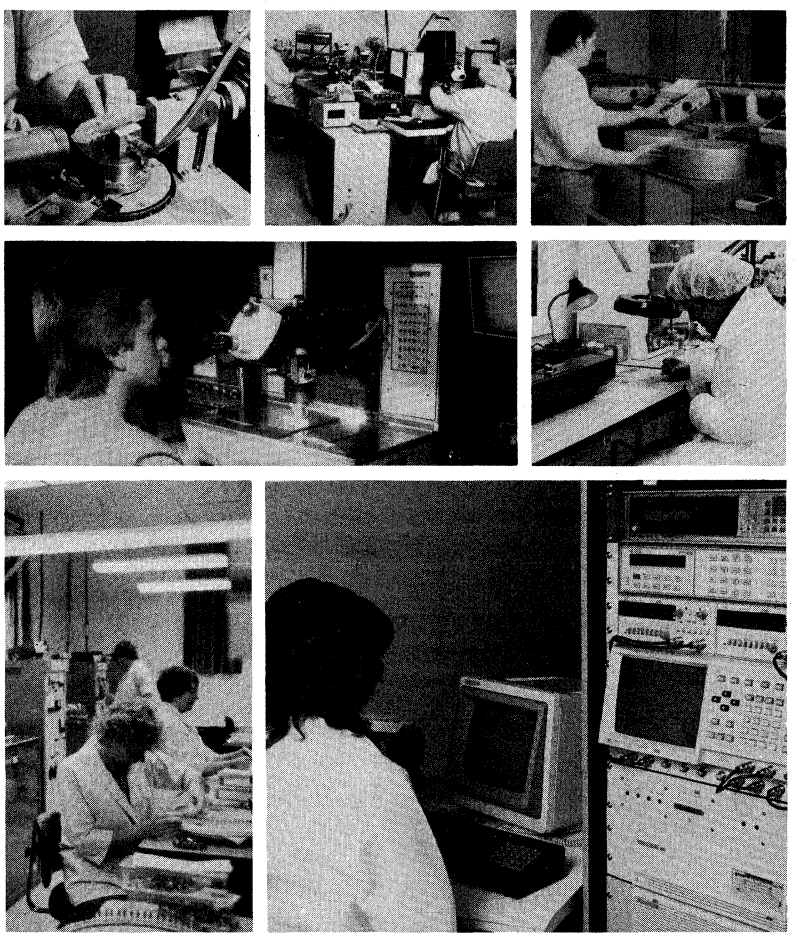
ENGINEERED PRODUCTS

M-tron has been a prime source of high performance commercial and military components for two decades. M-tron's engineering personnal are always accessible to customer counterparts with respect to applications assistance and non-standard design requirements.

FACILITIES

M-tron's two Yankton facilities house 25,000 square feet of manufacturing space. Separate isolated lines are devoted to production of military and high-performance commercial products, high volume standard commercial products, thick film hybrids, and facilities dedicated to pilot production of customer devices.

The Quality of Our Products is Based on The Quality of Our People



QUALITY ASSURANCE SYSTEMS

Half of M-tron's technical personnel are devoted full time to M-tron's comprehensive approach to maintaining the highest QA standards. Wherever appropriate, production is subject to Statistical Process Control (SPC) and lot inspection techniques, with 100% inspection of final product. M-tron maintains conformance to all applicable commercial and MIL standards.

The following QC procedures are invokable by customers: Traceability; Group B, C, and D testing; Failure analysis; Source inspection; non-destructive bond pull; Process documentation; QPL Listings; Qualification Environmental screening; and inspection by audit teams. M-tron welcomes inspection of our facilities and comprehensive audits.

M-TRON AT-CUT QUARTZ CRYSTALS

	MP-1µP	MP-2µP	SX2550P	ATS-1 Submin.
Freq.	1.8432-125.0 MHz	1.0-125.0 MHz	4.0-24.0 MHz	4.0-24.0 MHz
Cal:[1]	±.005%, 25°C	±.005%, 25°C	±.005%, 25°C	±.005%, 25°C
Stab:[1]	±.005%, 0° to +70°C	±.005%, 0° to +70°C	±.01%, 0° to +70°C	±.01%, -10° to +70°C
Aging:[1]	±5 ppm/year max	±5 ppm/year max	±3 ppm/year max	±7 ppm/year max
C_0	7.0 pf max	7.0 pf max	1.0-5.0 pf	5.0 pf max
C_L	18 pf std, series	18 pf std, series	18 pf std	18 pf std
R_1	25-800 ohm	25-800 ohm	50-150 ohm	40-90 ohm
Pkgs:	HC-18/U, HC-49/U	HC-33/U, HC-51/U	8 pin DIP, Surf Mount	cylindrical, 3x9 mm

	MMCC-1,-2	UM-1	ATS-49 Submin.	Military Crystals
Freq:	32.768 kHz	7.0-150 MHz	3.5-20.0 MHz	QPL'd per MIL-C-30980
Cal:[1]	±.002%, 25°C	per customer spec.	±.005%, 25°C	on a number of CR type
Stab:[1]	±.003%, 0° to +50°C	±.003%, -20° to +70°C	±.005%, -10° to 60°C	crystals. Request list.
Aging:[1]	±5 ppm first year max	±10 ppm/year max	±5 ppm max/year max	M-tron also supplies
C_0	1.7 pf of max	7.0 pf max		other military crystals.
C_L	12.5 pf std, series	18 pf std, series	per customer spec.	
R_1	35K ohm max	50-120 ohm		
Pkgs:	cyl., 3x8, 2x6 mm		.140″ high HC-43/U	

[1] Standard calibration, stability and aging specs. Tighter specs available over extended temperature ranges.

M-TRON HYBRID CLOCK OSCILLATOR PRODUCTS

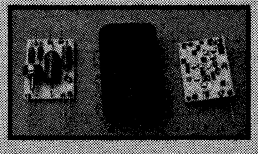
	MTO TTL	MHO HCMOS	MCO CMOS	MZO Zilog
Freq:	225 kHz-65.0 MHz	3.0-25.0 MHz	3.0-12.0 MHz	1.5-6 MHz NMOS/3.0-12 MHz TTL
Stab:[1]	±100 ppm, 0° to 70°C	±100 ppm, 0° to 70°C	±100 ppm, 0° to 70°C	+0/-20 ppm, 0° to 70°C
Aging:[1]	±10 ppm/year max	±10 ppm/year max	±10 ppm/year max	±10 ppm/year max
Supply:	4.5 to 5.5 VDC	2.5 to 6.0 VDC	5.0 to 15 VDC	4.5 to 5.5 VDC
Pkgs:	Metal 14-Pin DIP	Metal 14-Pin DIP	Metal 14-Pin DIP	Metal 14-Pin DIP
Opts:	Enable/Disable	Enable/Disable, Dual Ø	Dual output	

	SX07525PC CMOS	4-PIN SIP TTL	MT 1135 DBRG[2]	Military Oscillators
Freq:	3.579545-20.0 MHz	4.0-20.0 MHz	50-19200 Baud	QPL qualifications in process.
Stab:[1]	±100 ppm, -10° to +70°C	±100 ppm, 0° to 70°C	±.01%, all outputs	M-tron supplies various types
Aging:[1]	±10 ppm/year max	±10 ppm/year max		of military oscillator products
Supply:	4.5 to 5.5 VDC	4.5 to 5.5 VDC	4.5 to 5.5 VDC	for which there is no Qualified
Pkgs:	Plastic 14-Pin DIP	Epoxy .58″x.66″x.3″	Metal 18-Pin DIP	Product Listing.
Opts:	J-Lead, Gull, Butt		F_0 output	

[1] Standard stability and aging specs. Tighter specs available over extended commercial and military temperature ranges.
[2] All metal herietic units functionally and pinout compatable with Motorola K1135 series Dual Baud Rate Generators.

M-TRON COMMERCIAL AND MILITARY HYBRIDS

Consider M-tron's commercial and military hybrid capabilities part of your development and manufacturing team. M-tron's expertise is available to customers as an extension of their own product development resources for assistance in planning and optimizing designs.



Currently in production at M-tron, the thick film hybrid timing modules used in airborne ordinance are a good example of M-tron's service to contractors' needs for reduction of costs without tradeoffs in performance.

Carried in pods onboard attack helicopters such as the McDonnell Douglas AH-64A, weapons systems using the M-433 and M-439 fuses are critical assets in close-combat situations. Technologies involved in manufacturing the M-433 and M-439 modules combine thick film hybrid techniques with surface mount technology and hand soldering. Volume production throughout requires continuous use of automatic test equipment (ATE). Critical timing components and precision machined parts require hand soldering in conformance with MIL-STD-1460. The completed modules are injection molded for extreme ruggedness and longevity when stored in extreme environments.

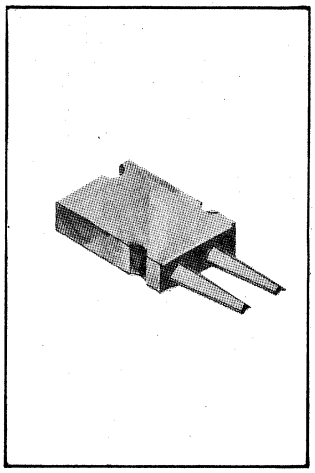
M-tron

Competitive Excellence in Quality Hybrid Products, Clock Oscillators and Quartz Crystals

P.O. Box 630, Yankton, SD 57078 • Phone (605) 665-9321 • FAX (605) 665-1709 • TWX 910-668-3603

crystal oscillators, crystal filters & ceramic resonators

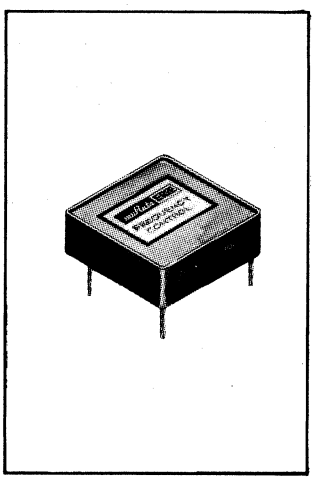
muRata ERiE®
MURATA ERIE NORTH AMERICA



Ceramic Resonators

Murata Erie's ceramic resonators derive their frequency stability from mechanical vibration resulting from a piezoelectric effect in the ceramic material. They are particularly useful in applications where tight frequency tolerances are not required such as clock oscillators and audio tone generators. They are extremely reliable and low cost.

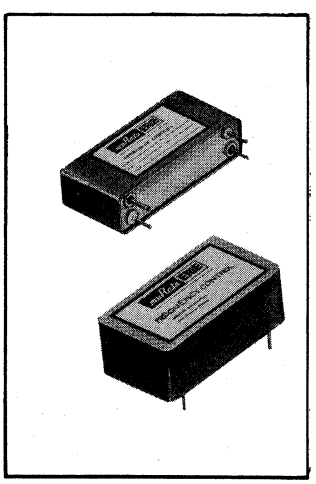
TYPE	CSA TYPE	CSB TYPE
Frequency Range	1.26 to 32 MHz	190 KHz to 1250 KHz
Vibration Mode	Thickness Vibration Fundamental	Area Vibration Fundamental
Frequency Tolerance	±0.5%	±0.5%
Temperature Stability (−20°C to +80°C)	±0.5%	±0.5%
Time Stability (10 years)	±0.3%	±0.3%



Crystal Oscillators

Murata Erie North America, Inc. manufactures a complete line of oscillators ranging from digital DIP clock oscillators to high stability, high reliability frequency sources. As a majority of our oscillators are custom designed, we welcome your inquiries and specifications. Write for our complete catalog.

- Frequency Range: 200 Hz to 600 MHz
- Size: .5″ x .8″ x .25″ to 2″ x 4″ x 1″
- Types: Clock (TTL, ECL, C/MOS or SINE). Integral Oven, Temperature Compensated, Voltage Controlled (VCO)
- Stability: From ±100ppm to ±3pp•10^8



Crystal Filters

Murata Erie North America, Inc. offers a complete line of sophisticated, discrete crystal filters ranging in frequency from 1 KHz to 100 MHz. In addition, we specialize in handling custom design specifications to fit your demanding applications. These high reliability units are rugged and compact, and can be designed to meet the environmental requirements of MIL-F-18327 in most cases.

We invite your questions and encourage you to contact Murata Erie for your special design requirements.

- Center Frequency: 1 KHz to 100 MHz
- Bandwidth: .005% to 10% of F_o
- Shape Factor: As low as 1.25 to 1
- Ripple: Generally less than 1 dB
- Insertion Loss: Usually less than 3.0 dB
- Ultimate Attenuation: Up to 100 dB max
- Maximum Operating Temperature: −55°C to +105°C

muRata ERiE®
MURATA ERIE NORTH AMERICA 2200 Lake Park Dr., Smyrna, Georgia 30080 Tel: (404) 436-1300 Telex: 26-1301 FAX: 404-436-3030

ceramic filters

MURATA ERIE NORTH AMERICA

Emitter Bypass Filters

Model	Center Frequency (KHz)	3dB Bandwidth (KHz)	Ripple (dB) max.	Selectivity (dB) min.	Termination Impedance (ohms) max.
BFU455K	455 ±2	8 (±2KHz)	—	8 @ -9KHz 12 @ +9KHz	30 (15)

TV Sound Filters

Model	Nominal Frequency (MHz)	3dB Bandwidth (KHz) min.	20dB Bandwidth (KHz) max.	Spurious Response (dB) min.	Insertion Loss (dB) max.	Input/Output Impedance (ohms)
SFE 4.5MBF	4.5	±60	530KHz	30dB min. (3.5-4.5MHz) 20dB min. (4.5-5.3MHz)	6	1000

Ceramic Filters For Digital Communications

Model	Nominal Center Frequency (KHz)	6dB Bandwidth (KHz) min.	Stopband Attenuation (dB) min. (f_0 ±100KHz)	Ripple (dB) max.	Selectivity (dB) min.	GDT 20μ/Sec. Bandwidth (KHz)	Insertion Loss (dB) min.	Input/Output Impedance (ohms)	Operating Temperature Range	Withstanding Voltage
SFP450D	450	±10	27	450 ±7 2	40 @ ±20KHz	—	4	1.5K	−20°C to +80°C	50V DC
SFP450F	450	±6	27	450 ±4 1.5	40 @ ±12.5KHz	—	6	2K		
SFR450D	450	±10	25	—	50 @ ±20KHz	—	5	2K		
SFR450F	450	±6	25	—	50 @ ±12.5KHz	—	4	1.5K		
SFG450D	450	±10	23	—	40 @ ±25KHz	±9	7	1.5K		
SFG450F	450	±6	23	—	40 @ ±17.5KHz	±6	9	2K		
SFH450D	450	±10	35	—	50 @ ±25KHz	±8	8	1.5K		
SFH450F	450	±6	35	—	50 @ ±17.5KHz	±5	10	2K		

Ceramic Filters For FM Radios

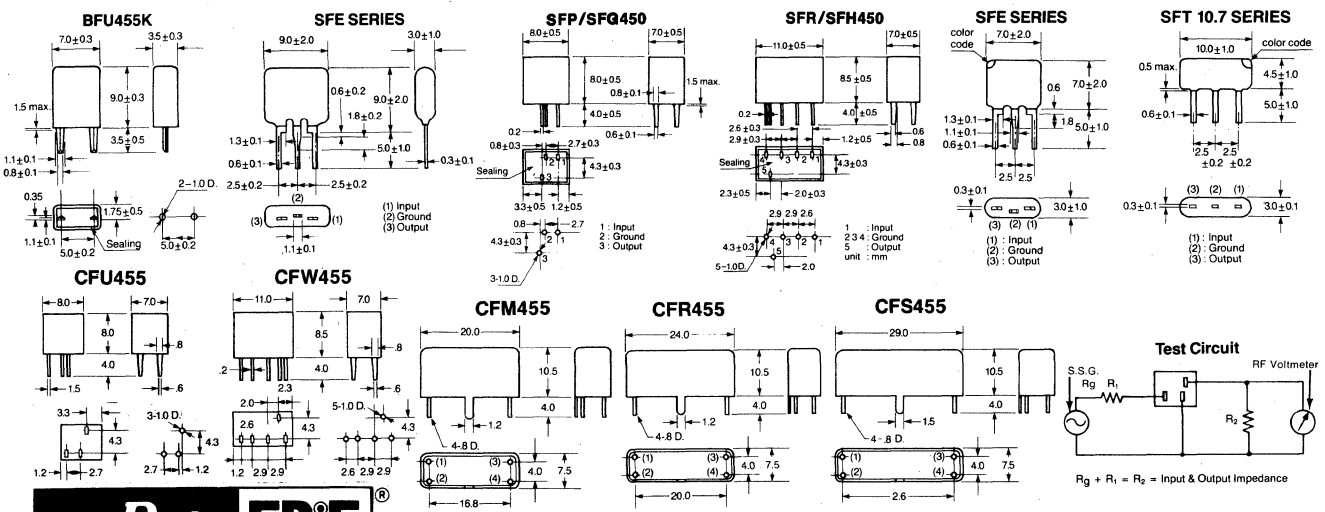
Model	Center Frequency (MHz, ±30KHz)	3dB Bandwidth (KHz) min.	20dB Bandwidth (KHz) max.	40dB Bandwidth (KHz) max.	Ripple (dB) max.	Spurious Response (8-12MHz) (dB) min.	Insertion Loss (dB) max.	Input/Output Impedance (ohms)	Operating Temperature Range	Withstanding Voltage
SFE 10.7MA5-Z	A:10.7 (Red)	280 ±50	650	—	1.0	30	6	330	−20°C to +80°C	50V DC
SFE 10.7MS2-Z	B:10.67 (Blue)	230 ±50	570	—	1.0	40	6			
SFE 10.7MS3-Z	C:10.730 (Orange)	180 ±40	520	—	1.0	40	7			
SFE 10.7MJ-Z	D:10.640 (Black)	150 ±40	380	—	1.0	38	10			
SFT 10.7MS3-Z	E:10.760 (White)	180 ±40	—	550	0.5	(9-12 MHz) 50	7.5			
SFT 10.7MA5-Z		280 ±50	—	700	0.5	(9-12 MHz) 50	6.0			

Z = Combination of all frequency groups (A thru E)

Multi-Element For High Selectivity Ladder Filters

Model	Center Frequency (KHz)	6dB Bandwidth (KHz) min.	Bandwidth (KHz) min.	Spurious Response (dB) min.	Insertion Loss (db) max.	Input/Output Impedance (ohms)	Operating Temperature Range	Withstanding Voltage
CFU455B2	455 ±2	±15	±30	27	4	1500	−20°C to +80°C	50V DC
CFU455E2	455 ±1.5	±7.5	±15	27	6	1500		
CFU455H2	455 ±1.0	±3	±9	25	6	2000		
CFW455B	455 ±2	±15	±30	35	4	1500		
CFW455E	455 ±2	±7.5	±15	35	6	1500		
CFW455H	455 ±2	±3	±9	35	6	2000		
CFM455A	455 ±2	±17.5	±30	50	3	1000		
CFM455E	455 ±2	±8	±16	45	5	1500		
CFM455H	455 ±2	±3	±7.5	45	6	2000		
CFR455A	455 ±2	±17.5	±30	60	4	1000		
CFR455E	455 ±2	±8	±16	55	6	1500		
CFR455H	455 ±2	±3	±7.5	55	7	2000		
CFS455A	455 ±2	±17.5	±30	70	4	1500		
CFS455E	455 ±2	±8	±15	70	6	1500		
CFS455H	455 ±2	±3	±7.5	70	7	2000		

ATT'N dB: CFU/40, CFW/50, CFM/60, CFR/60, CFS/70



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NDK AMERICA, INC.
20300 STEVENS CREEK BLVD. • CUPERTINO, CA 95014-2210
408/255-0831 • TELEX: 352057 • FAX: 408/725-0369

NDK'S QUARTZ CRYSTALS. A VITAL PART OF OUR EVERYDAY LIVES.

NDK® is one of the few manufacturers that grows its own synthetic quartz, taking full responsibility throughout manufacturing, right up to the finished product. Production from the ground up is NDK's® strength.

For 39 years NDK® has maintained high standards of quality and reliability world wide to large corporate customers. NDK® produces 250 million crystal products per year!

MANUFACTURING

- Application Specific Crystals
- Microprocessor Crystals
- (CCO) Crystal Clock Oscillators
- (PXO) Packaged Crystal Oscillators
- (VCXO) Voltage Controlled Oscillators
- (TCXO) Temperature Controlled Oscillators
- (OCXO) Oven Controlled Oscillators
- Monolithic Crystal Filters

APPLICATION SPECIFIC CRYSTALS

With our frequency ability of 2 KHz to 250 MHz and the best quality record in the industry you can be confident of our ability to help you with your designing, prototyping and manufacturing. Please call us at 800-NDK-XTAL.

MICROPROCESSOR CRYSTALS

NDK® manufactures a full line of standard frequency microprocessor crystals.

MONOLITHIC CRYSTAL FILTERS

The popular 10.7 MHz/21.4 MHz monolithic crystal filters with a variety of specifications, 45 MHz, 70 MHz and 90 MHz are available. Extended operating temperature from −40°C to +80°C is available upon request.

DIFFERENT BUT THE SAME

NDK's® small yet powerful AT-51 miniature AT-cut strip type crystal unit is less than half the size but holds the same footprint. This means you have space economy without having to redesign your board or absorb an extra expense. Plus, the general purpose AT-51 has a wide frequency range, a higher resistance to shock and vibration, and can be used to replace the HC 49/U type.

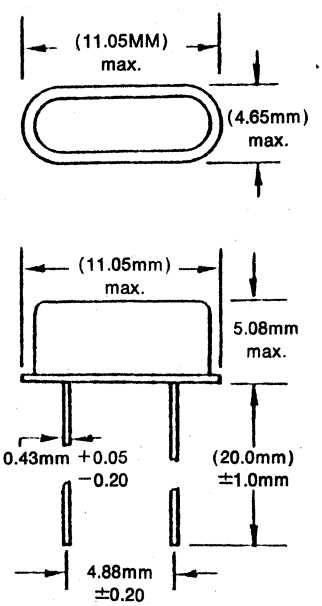
CUSTOM AT-51 CRYSTALS

NDK® can supply custom quartz crystals in addition to the standard range of crystals to meet your specific requirements. Most alterations in the specifications are available upon request. All that is required is the following information below when ordering and mail to NDK AMERICA, INC.

SPECIFICATIONS

Frequency Range: 3.579545 MHz: 20.000 MHz
Frequency Tolerance: ±20 ppm @ 25°C
Operating Temperature Range: −10°C to 60°C
Freq. Stability in Operating Temp. Range: ±30 ppm, over −10°C to 60°C
Aging: 5 ppm/Year
Vibration: MIL-STD-202E, Method 204C, Condition D
Shock: 1500G 0.5 MSEC Half sine wave, 3 Times in each of 3 Planes
Solderability: MIL-STD-202E, Method 208C, 230°C, 5°C, Immerse 5 Sec.
Drive Level: 50 μW typical

PACKAGE Dimensions



Technical Applications call: 804/846-7341 • Fax: 804/846-3299

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CRYSTAL CLOCK OSCILLATOR TD-1100 SERIES

Announcing the total cost saver for your computer manufacturing requirements.

NDK®, the professional on quality crystal oscillators and mass-production technology now presents the most economical, reliable and convenient clock idea in the computer and other industries. NDK® Crystal Clock Oscillators put you a step ahead of your competition by assuring cost savings, easy PC board interface, optimum electronic performance, and resistance against tough environments.

Advantages

Cost Savings
1. Simplifies material research and design process.
2. Reduces direct and indirect cost of assembling crystal clock oscillator block with discrete components.
3. Simplifies trouble shooting and reduces risk of accidents.

P.C. Board Interface
1. Terminal pins will fit DUAL IN LINE 14 Pin socket.
2. Solder dipped pins facilitate soldering
3. Low Profile.
4. Glass-Stand-Off is positioned away from dual in line pin holes and provides insulation between P.C. board and case, thus offering further freedom in double sided P.C. board applications.

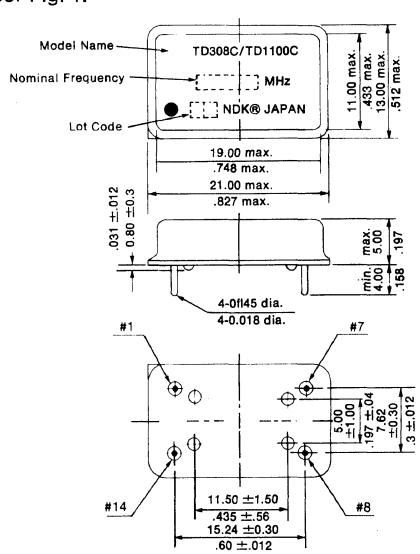
Performance
1. Transistor-drive oscillation offers a distinct advantage in start-up time over gate-drive oscillation.
2. Full range of frequencies from 1 MHz to 100 MHz and 250 KHz to 999 KHz available upon request.
3. Out-put signal compatible with TTL.
4. Variety of frequency stabilities available.

Tough Environmental Resistance
1. Resistance-welded metal package withstands high temperature and humidity.
2. Standard operating temperature = 0°C to +70°C. (−40°C to +80°C available upon request — TD1158C)

Quality vs. Cost
1. Our mass-production process assures uniformity of quality and lower costs.

Specifications

Outline
Outline dimensions, pin connections and marking information are as per Fig. 1.

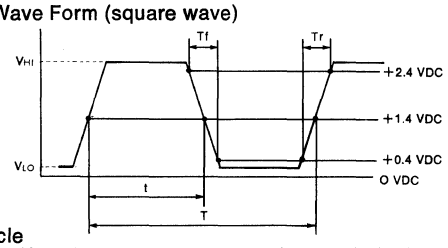


Dimensions in mm
in

Operating Conditions
- Input Voltage: +5V DC ±5%
- Input Current: 50 mA MAX. (less than 40 MHz)
  60 mA MAX. (more than 40 MHz)
- Operating Temperature: 0°C to 70°C

Frequency Characteristics
- Frequency Range
  1 MHz to 100 MHz
  (250 KHz to 999 KHz is available upon request)
- Frequency Stability
  Standard ±100 ppm (optional ±50 ppm)
  (Inclusive of calibration tolerance, operating temperature range, input volt change, load change, aging, shock and vibration).

Output Characteristics
- Output Voltage (TTL Level)
  V_{LO}: +0.4V MAX. (less than 40 MHz)
  V_{LO}: +0.5V MAX. (more than 40 MHz)
  V_{HI}: +2.4V MIN.
- Output Wave Form (square wave)

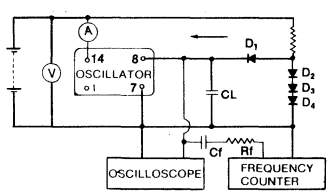


- Duty Cycle
  40% to 60% at 1.4V DC Level where duty cycle is determined by following formula.

$$\text{Duty Cycle} = \frac{t}{T} \times 100\%$$

- Rise (Tr) and Fall (Tf) Times
  1 MHz to 7.999 MHz 15 ns MAX.
  8 MHz to 20.999 MHz 10 ns MAX.
  21 MHz to 29.999 MHz 7 ns MAX.
  30 MHz to 70.000 MHz 5 ns MAX.
- Output Load
  1 to 10 TTL Gates

Test Circuit



Cf: 0.047 μF
CL: 15 pF (including input capacitance of oscilloscope
D1~D4: 1S953 or equivalent
Rf: 4.7 KΩ
RL: 390Ω (equiv. to Fanout 10) I=16 mA TTL
820Ω (equiv. to Fanout 5) I=10 mA TTL
4 KΩ (equiv. to Fanout 1) I=1.6 mA TTL

Environmental Characteristics
- Vibration
  10 Hz to 2000 Hz, 1.5 mm amplitude, sweep time 20 minutes for two hours each of three planes.
- Shock
  1000G, 0.5 ms, half sine for one time each of three planes.
- Humidity
  95% relative humidity at +60°C for 250 hours.
- Temperature
  ±50 ppm max. change after −40°C to +80°C for 30 minutes 100 cycles.

Mechanical Characteristics
- Leakage
  Mass spectrometer, Leak rate, less than 3 x 10^{-8} atom. cc/sec of helium.
- Solderability
  Solder-dipped pins up to 0.5 mm from height of stand-off.
- Resistance to Soldering Heat
  MIL-STD-202, Method 210, Condition B
- Leads Bend
  Will withstand max. bend of 90° reference to base for three bends.

Technical Applications call: 804/846-7341 • Fax: 804/846-3299

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PACKAGED CRYSTAL OSCILLATORS (PXO)

Model	Spec. Code	Freq. Range	Freq. Stability vs. Oper. Temp.	Power Supply	Output (Load)	Dimension	Application
TA302A	NSA0061A	6~170 MHz	±10x10⁻⁶/−10~50°C	+9 VDC 8 mA	0.3 Vr.m.s. (500Ω: less than 20 MHz) (100Ω: not less than 20 MHz)	Fig. 36	Mobile radio
	NSA0061B	6~150 MHz	±5x10⁻⁶/−10~50°C				
	NSA0061C	6~170 MHz	±15x10⁻⁶/−10~50°C				
TA403B	NSA0161A	100~220 MHz	±10x10⁻⁶/−10~50°C		0.1 Vr.m.s. (50Ω)	Fig. 37	
TA606C	NSA0064A	55~260 MHz	±20x10⁻⁶/−10~50°C	−18 VDC 40 mA	+7 dBm ±1 dB (50Ω)	Fig. 38	Micro wave satellite
	NSA0064B	55~170 MHz	±10x10⁻⁶/−10~50°C				
	NSA0064C	55~150 MHz	±5x10⁻⁶/−10~50°C				
TA503A	NSA0091A	1 Hz~1 MHz	±5x10⁻⁶/0~50°C	+5 VDC 60 mA	STD. TTL, Fan Out 10	Fig. 39	Standard oscillator in measuring equipment
	NSA0091B		±10x10⁻⁶/0~50°C				
TA402A	NSA0089F	1 MHz or 10 MHz	±0.5x10⁻⁶/10~40°C	+5 VDC 45 mA	STD. TTL, Fan Out 2	Fig. 40	Standard oscillator in measuring equipment
	NSA0089G		±1x10⁻⁶/0~50°C				
TD307B	NSA0158A	4~20 MHz	±5x10⁻⁶/0~50°C	+5 VDC 20 mA	STD. TTL, Fan Out 2	Fig. 41	Standard oscillator in measuring equipment
	NSA0158B		±10x10⁻⁶/0~50°C				
	NSA0158C		±20x10⁻⁶/0~50°C				
TA314A	NSA0171B	12.8 MHz or 14.5 MHz	±3x10⁻⁶/−10~60°C	+5 VDC 15 mA	2 Vp-p (10 kΩ)	Fig. 42	Personal radio

Table 12.

VOLTAGE CONTROLLED CRYSTAL OSCILLATORS (VCXO)

Model	Spec. Code	Freq. Range	Freq. Control Sensitivity (Voltage Control)	Freq. Stability vs. Oper. Temp.	Power Supply	Output (Load)	Dimension	Application
TC406E	NSA0137A	8~ 20 MHz	±2000x10⁻⁶ (0 ±2V)	±30x10⁻⁶/0~50°C	+12 VDC ±0.5V 20 mA max.	0 dBm ±2 dB (50Ω)	Fig. 43	Mobile radios
TA402C	NSA0129A	10~ 20 MHz	±200x10⁻⁶ (0 ±3V)	±15x10⁻⁶/0~50°C	+12 VDC ±0.25V 10 mA max.	0 dBm ±2 dB (50Ω)	Fig. 44	Measuring devices
TA408A	NSA0138A	50~125 MHz	±30x10⁻⁶ (2.5 ±2V)	±10x10⁻⁶/0~50°C	+12 VDC ±0.25V 15 mA max.	0 dBm ±2 dB (50Ω)	Fig. 45	

Table 13.

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS (TCXO)

Model	Spec. Code	Freq. Range	Freq. Stability vs. Oper. Temp.	Supply Voltage	Output (Load)	Dimension	Application
TC408B	NSA0117A	5~22 MHz	±1x10⁻⁶/−10~50°C	+12 VDC 10 mA	0 dBm (50Ω)	Fig. 46	Standard oscillator in measuring equipment
	NSA0117B		±0.5x10⁻⁶/−10~50°C				
TC406E	NSA0118A	22~60 MHz	±1x10⁻⁶/−10~50°C	+12 VDC 10 mA	0 dBm (50Ω)	Fig. 43	
	NSA0118B		±0.5x10⁻⁶/−10~50°C				
TC501CA	NSA0112A	5 MHz	±1x10⁻⁶/−40~75°C	+12 VDC 15 mA	1 Vr.m.s (1 kΩ)	Fig. 47	
TC402A	NSA0134A	10 MHz	±1x10⁻⁶/−10~60°C	+5 VDC 20 mA	STD. TTL, Fan out 2	Fig. 40	
TC310A	NSA0164A	12.8 MHz	±1x10⁻⁶/−20~60°C	+8 VDC 7 mA	1 Vp-p (1 kΩ)	Fig. 48	Mobile radio
	NSA0164B	or 14.5 MHz	±2x10⁻⁶/−20~60°C				
TC311A	NSA0165A	10~70 MHz	±5x10⁻⁶/−30~60°C	+5 VDC 3 mA	−10 dBm (50Ω)	Fig. 49	
	NSA0165B		±3x10⁻⁶/−20~60°C				
TC312A	NSA0166A	10~25 MHz	±5x10⁻⁶/−30~60°C	+5 VDC 10 mA	STD. TTL, Fan out 2	Fig. 50	
	NSA0166B		±3x10⁻⁶/−20~60°C				
TC313A	NSA0167A	10~70 MHz	±5x10⁻⁶/−30~60°C	+5 VDC 10 mA	0 dBm (50Ω)	Fig. 51	
	NSA0167C		±3x10⁻⁶/−20~60°C				
TC314A	NSA0168A	12.8 MHz or 14.5 MHz	±3x10⁻⁶/−20~60°C	+5 VDC 15 mA	2 Vp-p (1 kΩ)	Fig. 42	MCA

Table 14.

OVEN CONTROLLED CRYSTAL OSCILLATORS (OCXO)

Model	Spec. Code	Freq. Range	Aging Rate	Freq. Stability vs. Oper. Temp.	Power Supply	Output (Load)	Dimension	Application
TH413B	NSA0148A	5 MHz	±2x10⁻⁸/day	±5x10⁻⁷/−10~60°C	+12 VDC 4W (rising)	STD. TTL, Fan out 2	Fig. 52	Standard oscillator in measuring equipment
	NSA0148B			±5x10⁻⁸/−10~60°C				
	NSA0148C		±5x10⁻⁹/day					
TH413A	NSA0141A	10 MHz	±2x10⁻⁸/day	±1x10⁻⁷/−10~60°C		1 Vr.m.s (1 kΩ)		
	NSA0141B			±5x10⁻⁸/−10~60°C				
	NSA0141C		±5x10⁻⁹/day					
TH511A	NSA0140A	5 MHz or 10 MHz	±2x10⁻⁸/day	±1x10⁻⁷/−10~60°C		STD. TTL, Fan out 2	Fig. 53	
	NSA0140B			±5x10⁻⁸/−10~60°C				
	NSA0140C		±5x10⁻⁹/day					
TS521B28	NSA0102C	1 MHz	±2x10⁻⁸/day	±3x10⁻⁸/−10~60°C	+12 VDC 5W (rising)	AC couple square wave (2.5 Vp-p) or STD. TTL, Fan out 2	Fig. 54	
TS521B59	NSA0102E		±5x10⁻⁹/day	±15x10⁻⁹/−10~60°C				
TS521B29	NSA0102F		±2x10⁻⁹/day	±10x10⁻⁹/−10~60°C				
TS615A50	NSA0092H	5 MHz	±5x10⁻¹⁰/day	±3.5x10⁻⁹/−10~60°C	+24 VDC 7W (rising)	1 Vr.m.s (50Ω)	Fig. 55	
TH619A	NSA0151A	10 MHz	±5x10⁻¹⁰/day	±2x10⁻⁹/0~50°C	+24 VDC 8.5W (rising)	0~2 dBm (50Ω)	Fig. 56	
TH615A	NSA0142A	10~30 MHz	±5x10⁻⁹/day	±3x10⁻⁸/0~50°C	−15 VDC 10W (rising)	10~12 dBm (50Ω)	Fig. 57	
	NSA0142B	30~55 MHz	±1x10⁻⁸/day					

Upon placing orders, please specify the model, spec. code and frequency.

Table 15.

Technical Applications call: 804/846-7341 • Fax: 804/846-3299

NDK AMERICA, INC.

20300 STEVENS CREEK BLVD. • CUPERTINO, CA 95014-2210
408/255-0831 • TELEX: 352057 • FAX: 408/725-0369

DIMENSIONS

(Dimension: mm)

TA302A

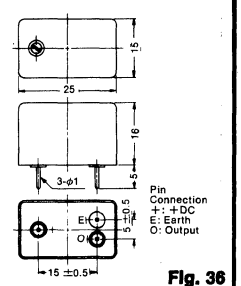

Fig. 36

TA403B

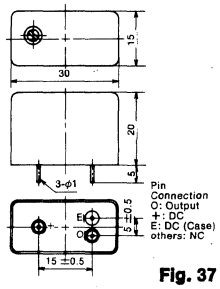

Fig. 37

TA606C

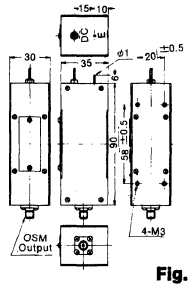

Fig. 38

TA503A

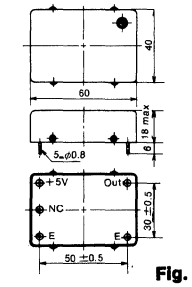

Fig. 39

TA402A TC402A

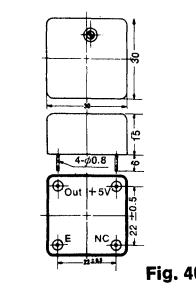

Fig. 40

TD307B

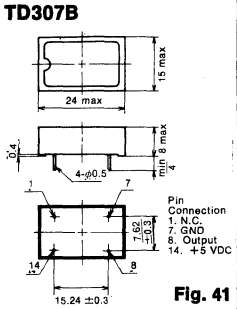

Fig. 41

TA314A TC314A

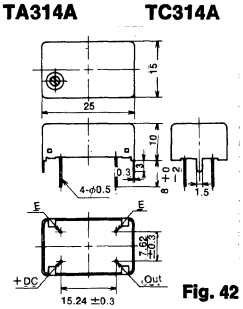

Fig. 42

TC406E

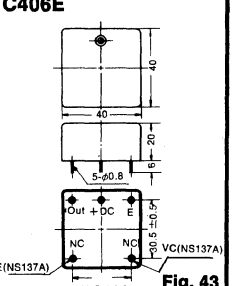

Fig. 43

TA402C

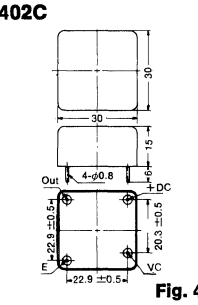

Fig. 44

TC408B

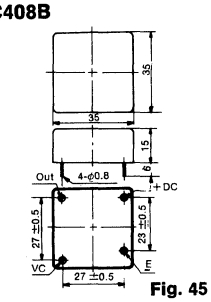

Fig. 45

TA408A

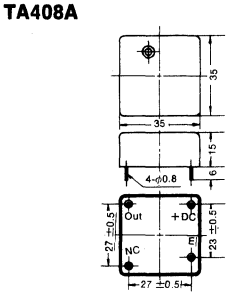

Fig. 46

TC501CA

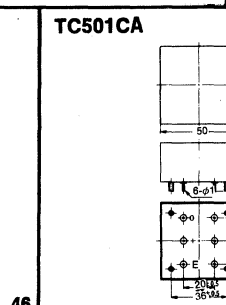

Fig. 47

TC310A

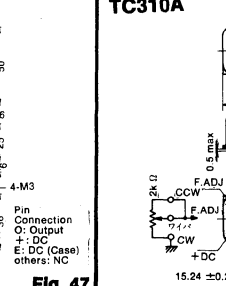

Fig. 48

TC311A

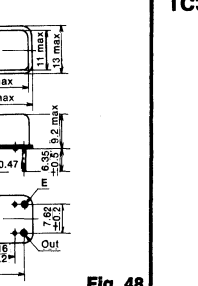

Fig. 49

TC312A

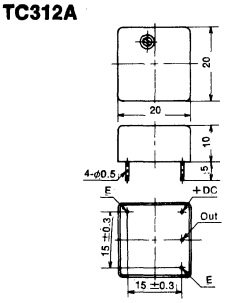

Fig. 50

TC313A

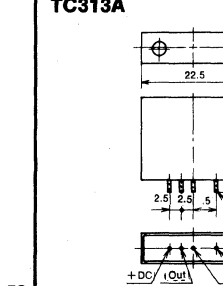

Fig. 51

TH413A TH413B

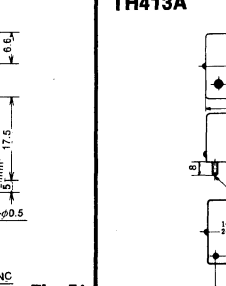

Fig. 52

TA511A

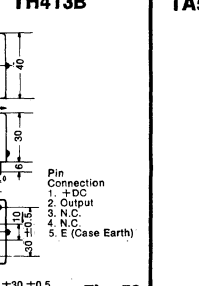

Fig. 53

TS521B28
TS521B29
TSL21B59

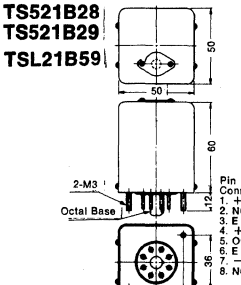

Fig. 54

TS615A50

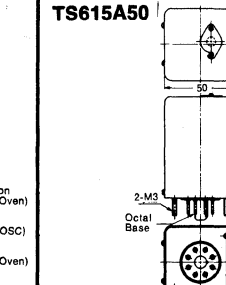

Fig. 55

TH619A

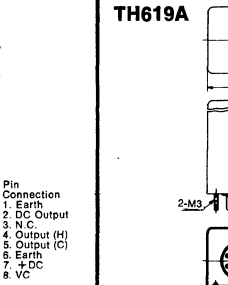

Fig. 56

TH615A

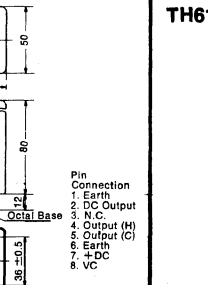

Fig. 57

Technical Applications call: 804/846-7341 • Fax: 804/846-3299

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20300 STEVENS CREEK BLVD. • CUPERTINO, CA 95014-2210
408/255-0831 • TELEX: 352057 • FAX: 408/725-0369

COMPACT CRYSTAL CLOCK OSCILLATOR — 1300 SERIES

NDK announces the development of a small size C-MOS oscillator to meet a variety of applications.

Features

Small sized package
(half size of the conventional)
L13.2 x W13.2 x H5.0 mm 8 pin DIP

Conventional type
L21.0 x W13.2 x H5.0 mm 14 pin DIP

Package is highly reliable and metal-sealed.
- Hermetically sealed
- Case grounding provided
- Stand off provided
- Countermeasures against EMI . . .
  Metal-sealed and case grounded

C-MOS is used as an active element, and also the characteristics have been improved.
- Low power consumption
- Quicker rise and fall time
  5, 7 and 10 ns available
- Sufficient fan out
  TTL 2 gates or 5 gates

Newly designed construction are withstand against drop & shock.
- Actual evaluation tests have verified sufficient resistivity against three natural drops onto a hard wooden board from the height of 75 cm. Resistivity against three natural drops from the height of 50 cm is one of guaranteed item. (Conventional models are resistant against 1000G or natural drop from the height of 30 cm.)

Widened frequency range of 28 KHz to 70 MHz in terms of both C-MOS/TTL levels.
(Conventional models frequency coverage is 4 to 20 MHz.)

A wide range of models are available for optimum oscillator selection. (Categorization by output level.)
- TTL/C-MOS compatible type: 1320, 1350 Series
- C-MOS compatible type: 1330 Series
- TTL compatible type: 1340 Series

Characteristics

Within a range of 3 to 25 MHz the following items are selectable:
- Electric current consumption
- Rise and fall time
- Output load (Fan out number)

With any series, either one of frequency stability ratios: ±50, ±100 ppm is selectable.

Optional features

Any Series has an optional standby function.
Model 1329 has an optional dual-output function. (However, in this case, the standby function is not available.)

Design Guide

Absolute max. rating
Source voltage (V_{DD}): −0.5 to +7.0 VDC
Storage temperature range: −55 to +125°C

Operating conditions
Source voltage (V_{DD}): +5 VDC ±0.5V
Operating temperature range: Subject to specs.

Tr/Tf measuring conditions
TTL compatible
Value between VoL MAX & VoH MIN . . .
Fig. 1 & Fig. 3 Refer to the measuring load conditions.

TTL/C-MOS compatible
Difference between 0.1 x V_{DD} and 0.9 x V_{DD} . . .
Fig. 2 & Fig. 4 Refer to the measuring load conditions.

Specification comparison

Specifications \ Series (Type)		1320 (1321-1329)	1330 (1330-1339)	1340 (1340-1349)	1350 (1351-1359)
Output		C-MOS	C-MOS	—	C-MOS
		TTL	—	TTL	TTL
Frequency range (greater or equal ~less than)		28K - 22 MHz	22 - 70 MHz	22 - 70 MHz	3 - 25 MHz
Power consumption	TYP	5 mA	13-22 mA	13-22 mA	11 mA
	MAX	10 mA	20-40 mA	20-40 mA	20 mA
$V_{OL}^{MAX}/V_{OH}^{MIN}$		0.5V/V_{DD} −0.5V	0.5V/V_{DD} −0.5V	0.4/2.4V or 0.5/2.4V	0.5V/V_{DD} −0.5V
T_r^{MAX}/T_f^{MAX}		10/10 ns	5/5 ns	5/5 ns	7/7 ns
Duty cycle (%)		45/55 40/60 for only 1329	40/60	40/60	45/55 at 1/2V_{DD} 40/60 at 1.4V
Fan out	TTL	2	5	5	5
	LS-TTL	10	25	25	25
Option	Standby	Available	Available	Available	Available
	2-output	Available only for 1329	Unavailable	Unavailable	Unavailable
Features		• Covers low frequencies • Low current consumption • Fan out TTL2 • Dual outputs available for the 1329		• Covers high frequencies • Fast rise & fall time • Max. fan out: TTL5	• Fast Tr/Tf: 7 ns • Max. fan out: TTL5

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COMPACT CRYSTAL CLOCK OSCILLATOR — 1300 SERIES

Measuring Load Condition

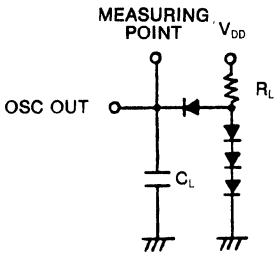


FIG. 1

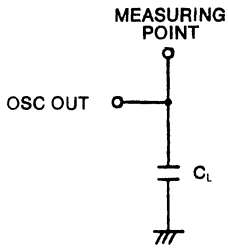


FIG. 2

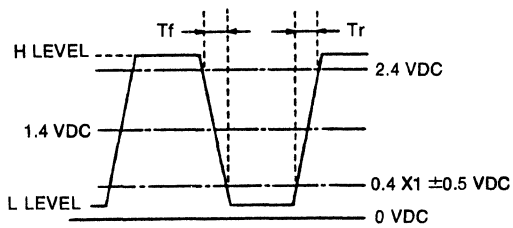


FIG. 3

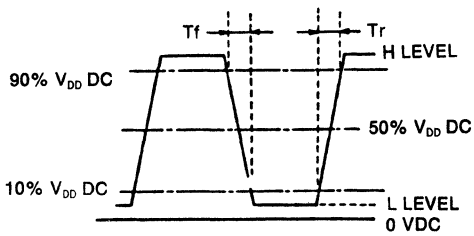


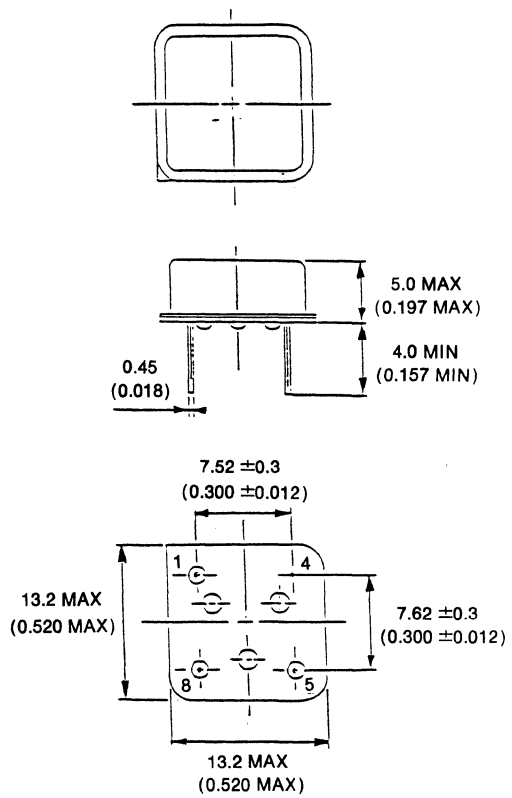
FIG. 4

I TTL = 5 LSTTL

TTL	C_L	R_L
1	15 pF	kΩ
2	15 pF	2 kΩ
5	15 pF	800Ω
10	15 pF	400Ω

Note CL: includes the stray capacitance of measuring system.

Outline Drawings — 1300 Series



Unit = mm ( ) = inch
Conversion to inch is subject to 1 mm = 0.03937

PIN	Connection
#1	NC or standby or output (divided frequency for dual output)
#4	GND (CASE)
#5	Output (original oscillation frequency)
#8	+5V DC

Operating Temperature Range and Frequency Stability

- Any one of A to R in the table is selectable. Specify the symbol for ordering.

Operating Temperature Range \ Frequency stability	±50	±100
0 ~ +70°C	A	B
−10 ~ +70°C	—	G
−20 ~ +70°C	—	M

Option Standby function and dual-output function

- One of 0, 1, 2 in the table is selectable. Specify the number for ordering.

Option \ Selectable No.	0	1	2
Standby function	Unavailable	Available	Unavailable
Dual-output function	Unavailable	Unavailable	Available
Applicable type	All types	All types	Only for 1329

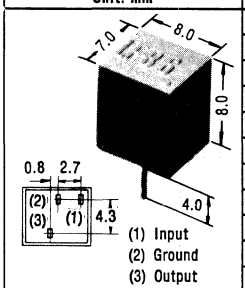
Technical Applications call: 804/846-7341 • Fax: 804/846-3299

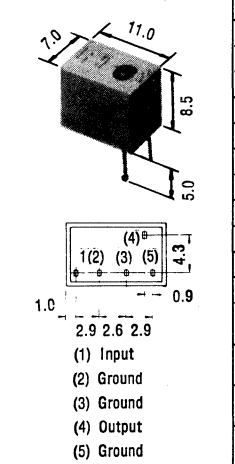
TECHNICAL CERAMICS

NGK SPARK PLUGS (U.S.A.), INC.
99 Morris Ave., Springfield, NJ 07081
Phone: (201) 376-6070
1701 North Greenville Ave., #205 Richardson, TX 75081,
Phone: (214) 235-8332. TELEX: 170547UT

NTK PIEZO CERAMIC FILTERS FOR COMMUNICATIONS

PLASTIC CASE FILTER

Dimensions Unit: mm	Item Model	Center Freq.	−6dB BW (KHz)	−40dB BW Max. (KHz)	Attn. (455 ±100) Min. (dB)	I.L. Max. (dB)	In. Out. Imp. (KΩ)
	LF-B4	455	4	15	25	9	2
	LF-B6	455	6	18	25	8	2
	LF-B8	455	8	21	25	7	2
	LF-B10	455	10	23	25	6	2
	LF-B12	455	12	26	25	6	2
	LF-B15	455	15	30	25	6	2
	LF-B20	455	20	40	25	5	2
	LF-B25	455	25	50	25	5	2
	LF-B4S	455	4	15	35	7	2
	LF-B6S	455	6	18	35	6	2
	LF-B8S	455	8	21	35	6	2

Dimensions Unit: mm	Item Model	Center Freq.	−6dB BW (KHz)	−50dB BW Max. (KHz)	Attn. (455 ±100) Min. (dB)	I.L. Max. (dB)	In. Out. Imp. (KΩ)
	LF-H4	455	4	15	40	8	2
	LF-H6	455	6	18	40	6	2
	LF-H8	455	8	21	40	6	2
	LF-H12	455	12	24	35	6	2
	LF-H15	455	15	30	35	6	1.5
	LF-H18	455	18	36	35	6	1.5
	LF-H4S	455	4	14	45	9	2
	LF-H6S	455	6	16	45	8	2
	LF-H8S	455	8	19	45	7	2
	LF-H12S	455	12	24	40	6	2
	LF-H15S	455	15	30	40	6	1.5
	LF-H18S	455	18	36	40	6	1.5
	LF-K9	400	9	@60dB 18	60	5	1.5
	LF-K12	400	12	@60dB 24	60	5	1.5
	LF-K14A	455	14	@70dB 25	50	6	1.5
	LF-K15	400	15	@60dB 30	60	5	1.5

LOW GROUP DELAY FILTERS

Dimension	Item Model	Center Freq.	−3dB BW (KHz)	−60dB BW (KHz)	Attn. (455 ±100) Min. (dB)	G.D. (μsec.) Max.	I.L. Max. (dB)	In. Out. Imp. (KΩ)
Same as CLF-D Type	CLF-G6	455	6	20	60	35	20	1.5
	CLF-G16	455	16	40	60	20	10	1.5
	CLF-G28	455	28	70	60	15	10	1.5
	CLF-G36	455	36	90	60	10	10	1.5

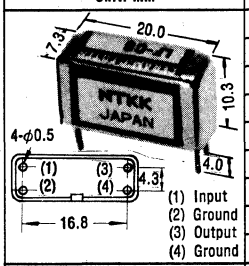
APPLICATIONS

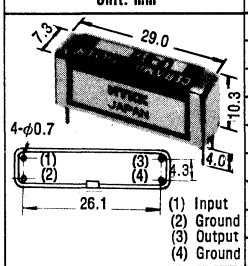
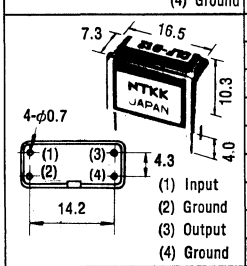
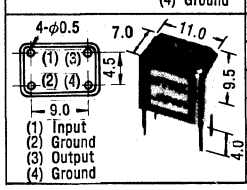
- Cordless Telephones
- Radios
- Transceivers

FEATURES

- Compact Size
- High Performance
- Low Insertion Loss

METAL CASE FILTER

Dimensions Unit: mm	Item Model	Center Freq.	−6dB BW (KHz)	−50dB BW Max. (KHz)	Attn. (455 ±100) Min. (dB)	I.L. Max. (dB)	In. Out. Imp. (KΩ)
	LF-C4	455	4	12	40	9	2
	LF-C6	455	6	16	45	7	1.5
	LF-C8	455	8	20	45	6	1.5
	LF-C12	455	12	24	45	6	1.5
	LF-C15	455	15	28	45	6	1.5
	LF-C18	455	18	30	45	5	1.5
	LF-C20	455	20	38	50	5	1.5
	LF-C25	455	25	44	50	5	1
	LF-C30	455	30	50	50	5	1

Dimensions Unit: mm	Item Model	Center Freq.	−6dB BW (KHz)	−70dB BW Max. (KHz)	Attn. (455 ±100) Min. (dB)	I.L. Max. (dB)	In. Out. Imp. (KΩ)
	LF-D4	455	4	10	70	12	2
	LF-D6	455	6	15	70	10	1.5
	LF-D8	455	8	18	70	9	1.5
	LF-D12	455	12	22	70	8	1.5
	LF-D15	455	15	28	70	7	1.5
	LF-D18	455	18	34	70	6	1.5
	LF-D20	455	20	36	70	6	1.5
	LF-D25	455	25	44	70	6	1
	LF-D30	455	30	50	70	6	1
	CLF-D2	455	2	8	60	10	2
	CLF-D4	455	4	10	70	9	2
	CLF-D6	455	6	15	70	7	1.5
	CLF-D8	455	8	18	70	7	1.5
	CLF-D10	455	10	20	70	6	1.5
	CLF-D12	455	12	22	70	6	1.5
	CLF-D15	455	15	28	70	6	1.5
	CLF-D18	455	18	34	70	5	1.5
	CLF-D20	455	20	36	70	5	1.5
	SLF-D4	455	4	10	70	9	2
	SLF-D6	455	6	15	70	7	1.5
	SLF-D8	455	8	18	70	7	1.5
	SLF-D10	455	10	20	70	6	1.5
	SLF-D12	455	12	22	70	6	1.5
	SLF-D15	455	28	28	70	6	1.5

455 KHz Ceramic Discriminators (P/N D455) and MHz Filters (10.7 MHz, etc.) are also available.

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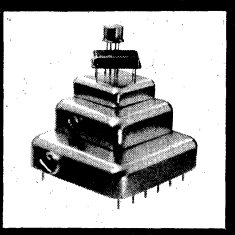
CRYSTAL CLOCK OSCILLATORS

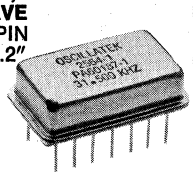


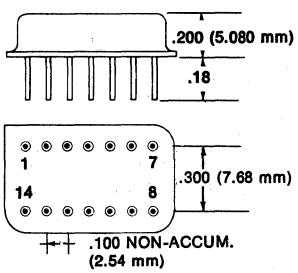
TCXO's

- Crystal controlled thick film hybrid oscillators (XO's)
- Baud rate generators and microprocessor drivers
- QPL'd to MIL-0-55310/09/14/16
- Temperature compensated crystal oscillators (TCXO's)
- Custom designed oscillators to meet your specifications
- Standard frequencies are available from stock

DIP

TTL, CMOS, ECL & SINEWAVE
4-PIN, 14-PIN
.8″ x .5″ x .2″

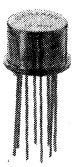


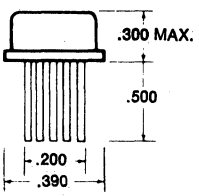


Pin	Connection	
	TTL, CMOS, SINE	ECL
7	Gnd	-5.2V
8	Out	Out
14	Vcc	Gnd
Rest	NC/ITP	

TO5

TTL, CMOS
TO5:
Dia = .39″ Max
H = .30″ Max.
Pins = .50″ Min.

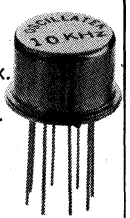


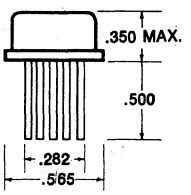


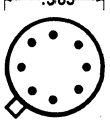
Pin	Conn.
4	Gnd
5	Out
8	Vcc
Rest	NC/ITP

TO8

TTL, CMOS
TO8:
Dia = .565″ Max.
H = .350″ Max.
Pins = .50″ Min.



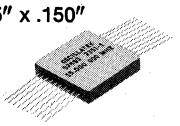


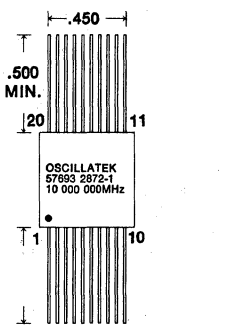


Pin	Conn.
4	Gnd
5	Out
8	Vcc
Rest	NC/ITP

FLAT PACKAGE

TTL, CMOS
.625″ x .625″ x .150″
20 Pins

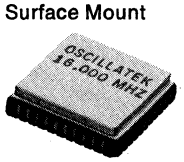




Pin	Conn.
10	Vcc
11	Out
20	Gnd
Rest	NC/ITP

LCC

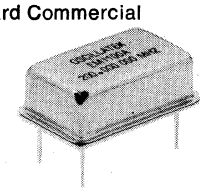
TTL, CMOS
.480″ x .480″ x .085″
40 Leads Surface Mount
.650″ x .650″ x .085″
44 Leads Surface Mount

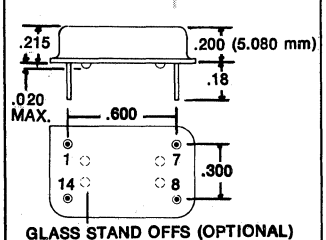


480	650	Conn.
4, 10	6, 12	Vcc
31, 37	34, 40	Gnd
39	42	Out
Rest	Rest	NC/ITP

M1100 Series

TTL, ECL, CMOS
.8″ x .5″ x .2″
Standard Commercial Series



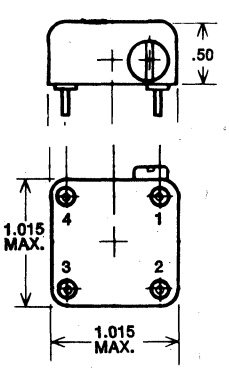


GLASS STAND OFFS (OPTIONAL)

Pin	Connection	
	TTL, CMOS, SINE	ECL
1	N/C	N/C
7	Gnd	-5.2V
8	Out	Out
14	Vcc	Gnd

X101

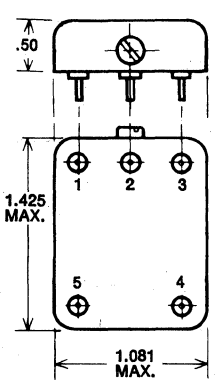
TTL, ECL, CMOS & SINEWAVE Outputs
Weight = <2 oz.
Mounting = P.C.B. Type
Seal = Solder



Pin	Connection
1	Gnd, Case
2*	Gnd
3	Supply
4	Output

X114

TTL, ECL, CMOS & SINEWAVE Outputs
Weight = <2 oz.
Mounting = P.C.B. Type
Seal = Solder



Pin	Connection
1†	NC
2†	NC
3	Supply
4	Output
5	Case, Ground

* Pin 2 serves as VCO input or connection for an external potentiometer where external frequency adjust is required.
† Pins 1 and 2 serve as VCO inputs or connections for an external potentiometer where external frequency adjust is required.

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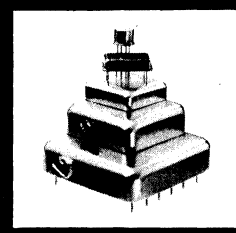
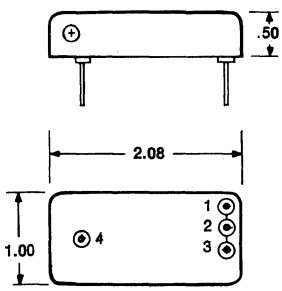
CRYSTAL CLOCK OSCILLATORS



TCXO's

X121

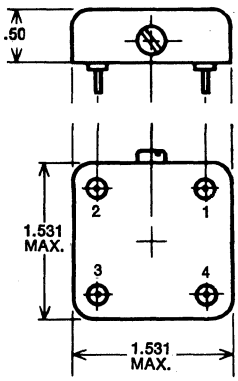
TTL, ECL, CMOS & SINEWAVE Outputs
Weight = <2 oz.
Mounting = P.C.B. Type
Seal = Solder



Pin	Connection
1	Output
2	Supply
3	Gnd
4	Gnd

X151

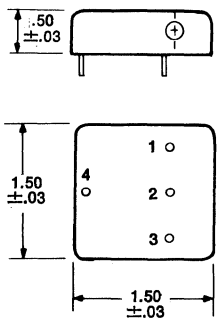
TTL, ECL, CMOS & SINEWAVE Outputs
Weight = <2 oz.
Mounting = P.C.B. Type
Seal = Solder



Pin	Function
1	Common, case gnd
2	Supply
3	Output
4‡	NC or electronic frequency adjust

X154

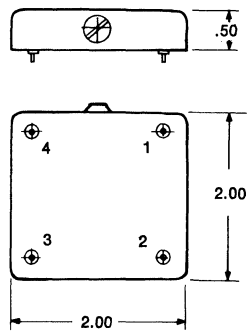
TTL, ECL, CMOS & SINEWAVE Outputs
Weight = <2 oz.
Mounting = P.C.B. Type
Seal = Solder



Pin	Connection
1	Gnd
2	Case
3	Supply
4	Output

X201

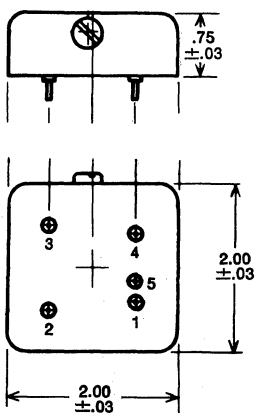
TTL, ECL, CMOS & SINEWAVE Outputs
Weight = <2 oz.
Mounting = P.C.B. Type
Seal = Solder



Pin	Connection
1	Supply
2	Comm. (Gnd)
3	NC
4	Output

X202

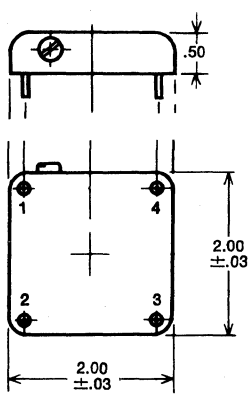
TTL, ECL, CMOS & SINEWAVE Outputs
Weight = <2 oz.
Mounting = P.C.B. Type
Seal = Solder



Pin	Function
1	RF output
2	Supply
3•	Supply common
4	Case
5•	RF return

X205

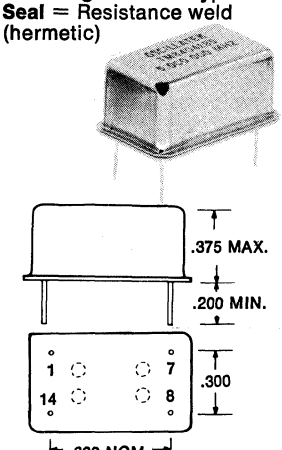
TTL, ECL, CMOS & SINEWAVE Outputs
Weight = <2 oz.
Mounting = P.C.B. Type
Seal = Solder



Pin	Function
1	Common, case
2	Supply
3	Out
4	Common, case

DIP-TCXO

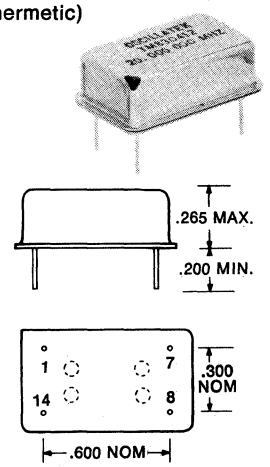
TTL, ECL, CMOS & SINEWAVE Outputs
Size = .8″ x .5″ x .375″, 4 Pin DIP
Weight = <1.5 oz.
Mounting = P.C.B. Type
Seal = Resistance weld (hermetic)



Pin	Connection	
	TTL, CMOS, SINE	ECL
7	Gnd/case gnd	-5.2V
8	Out	Out
14	V_{CC}	Gnd
1	Freq. Adj/Mod (Opt.)	

DIP-VCXO

TTL Output
Size = .8″ x .5″ x .265″
4 Pin DIP
Weight = <1.5 oz.
Mounting = P.C.B. Type
Seal = Resistance weld (hermetic)



Pin	Connection
7	Gnd
8	Out
14	V_{CC}
1	V cont.

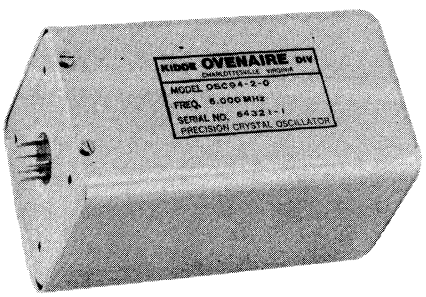
• Internally connected

‡ With electronic frequency adjust option, frequency control voltage is applied from Pin 4 to Pin 1.

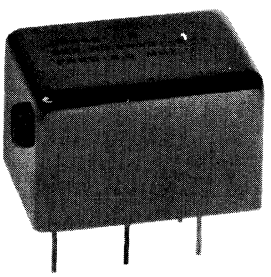
ovenaire oscillators

Ovenaire has the capabilities, experience and production techniques to meet the most exacting crystal oscillator requirements — from State-Of-The-Art Precision Crystal Oscillators to high volume, low cost TCXO's.
The following tables list condensed specifications on regular production models. For additional information on these and other crystal oscillators, call the Ovenaire factory.

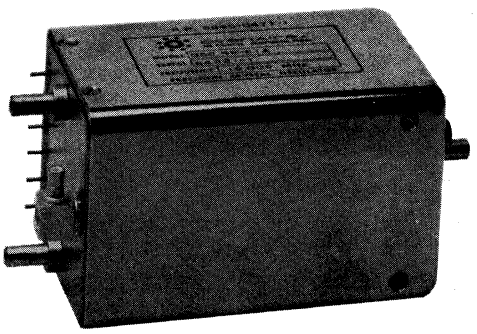
PRECISION AND OVENIZED CRYSTAL OSCILLATORS



OSC94 SERIES



OSC85-1 SERIES



OSC49 SERIES

PRECISION CRYSTAL OSCILLATORS

Model Series	Frequency MHz	Aging	Power @ 25°C	Supply Voltage	Output	Max. Size mm	Ambient Range	Ambient Stability
OSC46-1A	1	$2x10^{-8}$/WK	2.2 Watts	+25VDC	Sine	75x75x93	−10°C to +60°C	$2x10^{-10}$/°C
OSC46-2A	1	$2x10^{-8}$/WK	2.2 Watts	+30VDC	Sine	75x75x93	−10°C to +60°C	$2x10^{-10}$/°C
OSC49-3	3 or 10	$1x10^{-8}$/WK	2.2 Watts	+28VDC	Sine	41x114x53	−15°C to +60°C	$\pm7.5x10^{-9}$
OSC49-5	10	$4x10^{-9}$/WK	2.2 Watts	+20VDC	Optional	(A) 51x51x54 (B) 49x75x54	0°C to +60°C	$7x10^{-9}$
OSC58-1	8 to 12		2.0 Watts	+13.2VDC ±15%	TTL or C'MOS	69x48x41	−10°C to +60°C	$\pm1x10^{-8}$
OSC74	7.5 to 15	$1.5x10^{-8}$/WK	2.0 Watts	+15VDC	TTL	(A) 64x81x32 (B) 51x51x79	−15°C to +60°C	$3x10^{-10}$/°C
OSC75	10	$1x10^{-8}$/WK	2.2 Watts	+28VDC	TTL	37x44x90	−40°C to +70°C	$3x10^{-10}$/°C
OSC78-12	5	$2x10^{-8}$/WK	0.6 Watts	+15VDC	TTL	65x75x114	0°C to +50°C	$5x10^{-10}$/°C
OSC94	5 or 10	$7x10^{-9}$/WK	1.8 Watts	+12VDC	Optional	54x54x97		$\pm7x10^{-9}$

OVENIZED CRYSTAL OSCILLATORS

Model Series	Frequency MHz	Aging	Power @ 25°C	Supply Voltage		Max. Size mm	Ambient Range	Ambient Stability
				OSC	Oven			
OSC11-3	1	$1.5x10^{-7}$/WK	3.5 Watts	+12 or +24VDC	115VAC	38x38x84	−20°C to +60°C	$5x10^{-9}$/°C
OSC11-5	1	$1.5x10^{-7}$/WK	1.9 Watts	+12 or +24VDC	+12 or +24VDC	57x57x93	−30°C to +60°C	$5x10^{-9}$/°C
OSC11-7A	1 thru 20	$5x10^{-7}$/WK	4.0 Watts	+12 or +24VDC	115VAC	38x38x84	−20°C to +60°C	$8x10^{-9}$/°C
OSC11-7B	3 thru 8	$5x10^{-8}$/WK	4.0 Watts	+12 or +24VDC	115VAC	38x38x84	−20°C to +60°C	$5x10^{-9}$/°C
OSC29-32	12 to 22	$8x10^{-7}$/YR	2.5 Watts	+24VDC	+24VDC	37x48x90	−20°C to +60°C	$\pm1x10^{-7}$
OSC29-1	10 to 25	$2x10^{-7}$/WK	2.2 Watts	+22.5VDC	+28VDC	37x48x83	−20°C to +60°C	$5x10^{-9}$/°C
OSC29-2	2 to 10	$1x10^{-7}$/WK	2.7 Watts	+22.5VDC	+28VDC	37x48x83	−20°C to +60°C	$2.5x10^{-9}$/°C
OSC32-1	2 to 10	$2x10^{-6}$/YR	.54 Watts	+12VDC	+24VDC	51x51x70	0°C to +55°C	$\pm2x10^{-8}$
OSC44-1	2 to 40	$1x10^{-6}$/YR	1.6 Watts	+9, +12 or +15VDC	+15, +20, +24 or +28VDC	Choice of 3 Compact Packages, Octal or Solder Pin Mounting	−20°C to +60°C	$\pm4x10^{-7}$
OSC44-2	2 to 40	$1x10^{-6}$/YR	1.6 Watts	+12 or +15VDC	+15, +20, +24 or +28VDC		−10°C to +60°C	$\pm4x10^{-7}$
OSC44-3	2 to 40	$1x10^{-6}$/YR	1.1 Watts	+9, +12 or +15VDC	+15, +20, +24 or +28VDC		−20°C to +55°C	$\pm3x10^{-7}$
OSC44-4	2 to 40	$1x10^{-6}$/YR	1.1 Watts	+12 or +15VDC	+15, +20, +24 or +28VDC		−20°C to +55°C	$\pm3x10^{-7}$
OSC45	2 to 12	$1x10^{-6}$/YR	1.8 Watts	+9 to +28VDC	+9 to +28VDC	(A) 43x64x33 (B) 32x44x70	0°C to +55°C	$\pm1x10^{-7}$
OSC55	10 to 55	$1x10^{-6}$/YR	1.4 Watts	+28VDC	+28VDC	33x67x19	−20°C to +50°C	$\pm1x10^{-6}$
OSC70	22 to 120	$2x10^{-6}$/YR	2.2 Watts	+28VDC	+28VDC	37x48x90	−20°C to +60°C	$\pm5x10^{-8}$
OSC73-1	9 to 15	$3.5x10^{-7}$/YR	2.0 Watts	+15VDC	+15VDC	33x79x54	−30°C to +65°C	$\pm7.5x10^{-8}$
OSC73-2	2 to 6	$5x10^{-7}$/YR	2.0 Watts	+15VDC	+15VDC	47x68x35	−10°C to +65°C	$\pm5x10^{-8}$
OSC73-3	12 to 25	$1.5x10^{-6}$/YR	2.3 Watts	+20VDC	+20VDC	36x75x41	−30°C to +65°C	$\pm1x10^{-7}$
OSC83	7.2 to 13.2	$1.5x10^{-6}$/YR	2.2 Watts	+28VDC	+28VDC	37x48x84	−10°C to +55°C	$\pm2x10^{-7}$
OSC85-1-1	1 to 16	$1x10^{-6}$/YR	1.8 Watts	+5VDC	+24VDC	27x32x45	0°C to +60°C	$\pm1x10^{-7}$
OSC85-6-1	10 to 40	$8x10^{-7}$/YR	1.1 Watts	+12.6VDC	+12.6VDC	37x48x54	0°C to +65°C	$\pm1x10^{-7}$

PCB MOUNT CRYSTAL OSCILLATORS

Model Series	Frequency MHz	Aging	Power	Supply Voltage	Output	Max. Size mm	Ambient Range	Ambient Stability
OSC51	1 to 60	N/S	300MW	+12VDC	Optional	38x38x13	0°C to +60°C	$\pm1x10^{-5}$
OSC52	10 to 150	N/S	300MW	+12VDC	Sine	38x38x25	0°C to +60°C	$\pm1x10^{-5}$
OSC69-2	5 to 20	$1x10^{-5}$/YR	75MW	+5VDC	TTL	25x38x13	−30°C to +85°C	$\pm5x10^{-5}$
OSC69-3	6 to 22	$8x10^{-6}$/YR	75MW	+5VDC	TTL	25x38x13	−30°C to +85°C	$\pm3.5x10^{-5}$

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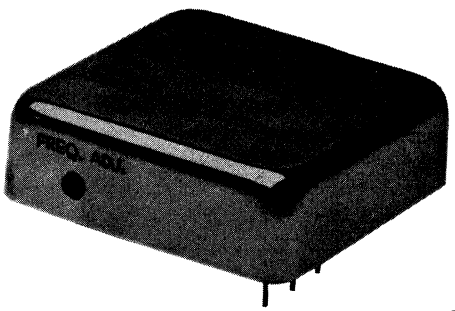
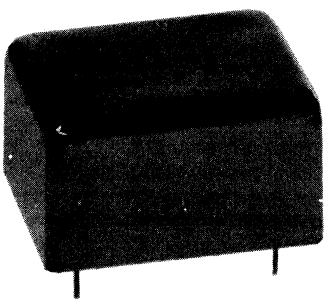
ovenaire oscillators

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

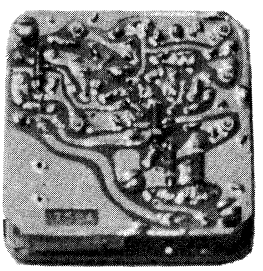


OSC27 SERIES



OSC61 SERIES

OSC88 SERIES



OSC34 SERIES

TCXO'S

Model Series	Frequency MHz	Aging	Power	Supply Voltage	Output	Max. Size mm	Ambient Range	Ambient Stability
OSC20-1	10 to 15	$3x10^{-6}$/YR	135MW	5 or 9VDC	Sine	26x15x54	−30°C to +75°C	$\pm5x10^{-6}$
OSC20-2	10 to 15	$3x10^{-6}$/YR	135MW	5 or 9VDC	Sine	26x15x54	0°C to +50°C	$\pm2x10^{-6}$
OSC27-5-1	2 to 12	$1x10^{-6}$/YR	300MW	+12VDC	TTL	51x51x15	0°C to +55°C	$\pm1x10^{-6}$
OSC27-5-2	2 to 12	$1x10^{-6}$/YR	300MW	+12VDC	TTL	51x51x15	0°C to +55°C	$\pm5x10^{-7}$
OSC27-5-3	2 to 5	$5x10^{-6}$/YR	300MW	+12VDC	TTL	51x51x15	0°C to +55°C	$\pm3x10^{-7}$
OSC27-6-1	2 to 12	$1x10^{-6}$/YR	360MW	+12VDC	TTL	51x51x15	−40°C to +85°C	$\pm1.5x10^{-6}$
OSC27-6-2	2 to 12	$1x10^{-6}$/YR	360MW	+12VDC	TTL	51x51x15	−30°C to +75°C	$\pm1x10^{-6}$
OSC27-6-3	2 to 6	$5x10^{-7}$/YR	360MW	+12VDC	TTL	51x51x15	−15°C to +70°C	$\pm5x10^{-7}$
OSC34-2	10 to 20	$7.5x10^{-7}$/YR	240MW	+12VDC	Sine	45x45x15	0°C to +50°C	$\pm1x10^{-6}$
OSC35-1-1	2.5 to 12	$1x10^{-6}$/YR	300MW	+12VDC	TTL	51x51x13	−5°C to +60°C	$\pm1x10^{-6}$
OSC35-1-2	2.5 to 12	$1x10^{-6}$/YR	300MW	+12VDC	TTL	51x51x13	−5°C to +60°C	$\pm5x10^{-7}$
OSC35-1-3	2.5 to 6	$5x10^{-7}$/YR	300MW	+12VDC	TTL	51x51x13	0°C to +55°C	$\pm3x10^{-7}$
OSC35-2-X	15 to 22	$4x10^{-7}$/YR	300MW	+12VDC	Sine	58x51x16	−30°C to +60°C	$\pm1x10^{-6}$
OSC37-1-1	1 to 5	$1x10^{-6}$/YR	180MW	+12VDC	TTL	44x44x19	0°C to +55°C	$\pm2x10^{-6}$
OSC37-2-1	5.01 to 10	$2.5x10^{-6}$/YR	180MW	+12VDC	TTL	44x44x19	0°C to +55°C	$\pm2x10^{-6}$
OSC37-3-1	1 to 5	$1x10^{-6}$/YR	216MW	+12VDC	TTL	44x44x19	−5°C to +60°C	$\pm1x10^{-6}$
OSC37-1-2	1 to 5	$1x10^{-6}$/YR	180MW	+12VDC	TTL	44x44x19	−10°C to +65°C	$\pm1.5x10^{-6}$
OSC37-2-2	5.01 to 10	$2.5x10^{-6}$/YR	180MW	+12VDC	TTL	44x44x19	−10°C to +65°C	$\pm1.5x10^{-6}$
OSC39-1	2.5 to 12	$1x10^{-6}$/YR	125MW	+5VDC	TTL	48x31x17	0°C to +60°C	$\pm1x10^{-6}$
OSC40-1	4KHz to 1MHz	$1x10^{-6}$/YR	504MW	−18VDC	AC Square	57x51x21	0°C to +55°C	$\pm8x10^{-6}$
OSC61-2-2	6 to 16	$1x10^{-6}$/YR	180MW	+12VDC	Clipped Sine	37x28x19	−20°C to +70°C	$\pm2x10^{-6}$
OSC67-1-1	2 to 8	$1x10^{-6}$/YR	275MW	+12 & +5VDC	TTL	51x41x17	0°C to +55°C	$\pm2x10^{-6}$
OSC67-1-2	2 to 8	$1x10^{-6}$/YR	275MW	+12 & +5VDC	TTL	51x41x17	0°C to +55°C	$\pm1x10^{-6}$
OSC88-1-1	10	$.75x10^{-6}$/YR	230MW	+12VDC	TTL	38x38x14	0°C to +55°C	$\pm3x10^{-6}$
OSC88-1-2	10	$.75x10^{-6}$/YR	230MW	+12VDC	TTL	38x38x14	0°C to +55°C	$\pm1x10^{-6}$
OSC88-1-3	10	$.75x10^{-6}$/YR	230MW	+12VDC	TTL	38x38x14	0°C to +55°C	$\pm5x10^{-6}$
OSC88-1-4	10	$.75x10^{-6}$/YR	230MW	+12VDC	TTL	38x38x14	−5°C to +70°C	$\pm3x10^{-6}$
OSC88-1-5	10	$.75x10^{-6}$/YR	230MW	+12VDC	TTL	38x38x14	−5°C to +70°C	$\pm1x10^{-6}$
OSC88-1-6	10	$.75x10^{-6}$/YR	230MW	+12VDC	TTL	38x38x14	−5°C to +70°C	$\pm5x10^{-7}$
OSC88-2-1	10	$.75x10^{-6}$/YR	230MW	+12VDC	TTL	38x38x14	−40°C to +75°C	$\pm2x10^{-6}$
OSC88-2-2	10	$.75x10^{-6}$/YR	230MW	+12VDC	TTL	38x38x14	−40°C to +75°C	$\pm1x10^{-6}$
OSC88-2-3	10	$.75x10^{-6}$/YR	230MW	+12VDC	TTL	38x38x14	−55°C to +105°C	$\pm5x10^{-6}$
TCX0101	.0075Hz to 10MHz	$\pm2x10^{-8}$/DAY	Freq Dep	+12VDC	12V Square	Pkg B	0°C to +50°C	$\pm1x10^{-6}$
TCX0101A	.0075Hz to 10MHz	$\pm2x10^{-8}$/DAY	Freq Dep	+12VDC	12V Square	Pkg B	−55°C to +75°C	$\pm5x10^{-6}$
TCX034	.0005Hz to 40MHz	$\pm2x10^{-8}$/DAY	Freq Dep	+5VDC	4V Square	Pkg B	0°C to +50°C	$\pm1x10^{-6}$
TCX056	100KHz to 30MHz	$\pm2x10^{-8}$/DAY	Freq Dep	+5VDC	4V Square	Pkg A	0°C to +50°C	$\pm1x10^{-6}$
TCX0152	200Hz to 10MHz	$\pm1x10^{-8}$/DAY	Freq Dep	+15VDC	10V Square	Pkg OA	0°C to +50°C	$\pm1x10^{-7}$
TCX0152A	200Hz to 10MHz	$1x10^{-6}$/YR	Freq Dep	+15VDC	10V Square	Pkg OA	−40°C to +70°C	$\pm1x10^{-6}$

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PKG STYLE A
Printed ckt mount
Encapsulated
1.5″ x 2.0″ x .56″
(AX: Without mtg. hole)
(AC: 7 pin plug-in; stud mt.)

PKG STYLE B
Printed ckt mount
Encapsulated
1.9″ x 2.5″ x .5″
(BY: 1.9″ x 2.5″ x 1.0″)
(BZ: 1.9″ x 2.5″ x .375″)

PKG STYLE F & Q
Printed ckt mount
Encapsulated
F: 1.0″ x 1.25″ x .5″
Q: 2″ x 2″ x .6″

PKG STYLE G
I.C. plug-in
Encapsulated
.78″ x 1.125″ x .5″
(GX: .75″ x 1.5″ x .5″)

PKG STYLE H
Printed ckt mount
Encapsulated
.875″ x .875″ x .5″

PKG STYLE J
Printed ckt mount
Encapsulated
1.25″ x 1.25″ x .5″
(JX: 1.25″ x 1.25″ x .32″)

PKG STYLE L
Octal plug-in
Stud mount
Metal can
2″ x 2″ x .75″

PKG STYLE P
Special plug-in
Encapsulated metal can
.7″ x 1.3″ x 1.7″

PKG STYLE M, N, & O
Printed ckt mount
Encapsulated metal can
M: 2.5″ x 2.5″ x .625″
N: 2″ x 2″ x .75″
O: 2″ x 2.5″ x .75″
(stud mount)
OA: 2″ x 2.5″ x .65″

Model Series	Frequency Range	Stability	Temperature Range	PK-to-PK Output	Load	Supply Voltage	Pkg. Style
CRYSTAL CONTROLLED OSCILLATORS — NO OVEN REQUIRED							
X0128	7.5KHz to 85KHz	±.02%	0°C to +70°C	6.7V Sine	10K ohms	+15V	Q
X062	4KHz to 16MHz	±.01 to ±.025%[4]	−20°C to +70°C	5V Square	1.5K ohms	+12V	AX
X0110	4MHz to 10MHz	±.01%	0°C to +70°C	4V Square	10 TTL	+5V	F
X0111	250KHz to 3.99MHz	±.01%	0°C to +70°C	4V Square	10 TTL	+5V	J
X0112	63Hz to 249KHz	±.01%	0°C to +70°C	4V Square	10 TTL	+5V	AX
X0123	7.5KHz to 60KHz	±.01%	0°C to +50°C	1.5V Sine	10K ohms	+5V	A
X0100	.005Hz to 3MHz	±.007%	−40°C to +85°C[2]	12V Square[5]	50 CMOS[5]	+12V	A
X096	5MHz to 16MHz	±.005%	0°C to +70°C	1V Square	3 ECL	−5V	JX
X032	12.5KHz to 5.99MHz	±.003 to ±.01%[4]	0°C to +75°C[2]	4V Square[3]	25 DTL	+5V	A
X032C	6MHz to 40MHz	±.003%	0°C to +75°C[2]	4V Square[3]	9 TTL	+5V	A
X033	.001Hz to 30MHz	±.003%	0°C to +75°C[2]	4V Square[3]	9 DTL/TTL	+5V	B
X082	190KHz to 30MHz	±.003%	0°C to +75°C[2]	4V Square	9 DTL/TTL	+5V	F
X094	190KHz to 16MHz	±.003%	0°C to +75°C[2]	4V Square	9 DTL/TTL	+5V	H
X0181	12Hz to 12.49KHz	±.003%	0°C to +75°C[2]	4V Square	1 TTL	+5V	GX
X081	12.5KHz to 199KHz	±.003%	0°C to +75°C[2]	4V Square	9 DTL/TTL	+5V	GX
X071	200KHz to 20MHz	±.003%	0°C to +75°C[2]	4V Square	9 DTL/TTL	+5V	G
X081	20.1MHz to 30MHz	±.003%	0°C to +75°C[2]	4V Square	9 DTL/TTL	+5V	GX
X045	1MHz to 5MHz	±.001%	+10°C to +50°C	.63V Sine	50 ohms	+15V	AC
LC AND RC OSCILLATORS							
LC035	70KHz to 5MHz	±.5%	0°C to +85°C	2V Sine	10K ohms	+12V	A
LC01028	733KHz to 5MHz	±1%	−50°C to +100°C	2V Sine	1K ohms	+12V	J
PS057	10Hz to 40KHz	±1%/±2%[4]	0°C to +50°C	6V Sine	10K ohms	+12V	A
RC036A	1Hz to 1MHz	±2%	−20°C to +85°C	4V Square[3]	9 DTL/TTL	+5V	A
RC036B	1Hz to 1MHz	±1%	0°C to +75°C	4V Square[3]	9 DTL/TTL	+5V	A
UJ039A	.1Hz to 100Hz	±2%	0°C to +50°C	3V Square	1.5K ohms	+12V	A
RC0109	1Hz to 1MHz	±1%	0°C to +50°C	2.5V Sine	600 ohms	+15V	B
RC0168	1.5Hz to 30KHz	±.5%	0°C to +75°C	4V Square[3]	9 DTL/TTL	+10V	B
SINE WAVE OPTIONS — ADD "S" VERSION TO MODEL NUMBER (MAY REQUIRE LARGER PACKAGE[4])							
S11/12[4]	10KHz to 40MHz	5% Distortion	0°C to +75°C	1 mw into 50 ohms		+12V	May be Combined with Oscillator Voltage[4]
S13	5Hz to 100KHz	5% Distortion	−55°C to +75°C	1.75V RMS into 600 ohms		+15V	
S14	10KHz to 1MHz	3% Distortion	−55°C to +125°C	2V pk-to-pk into 10K ohms		None	
S17	20Hz to 200KHz	5% Distortion	0°C to +50°C	3V pk-to-pk into 10K ohms		+5V	
S18	5Hz to 100KHz	3% Distortion	−55°C to +75°C	2.5V pk-to-pk into 600 ohms		+15V	
S19/20[4]	10KHz to 40MHz	5% Distortion	0°C to +75°C	2mw into 50 ohms		+15V	
S21	20Hz to 200KHz	5% Distortion	0°C to +50°C	3V RMS into 10K ohms		+15V	
S23	10KHz to 1MHz	1% Distortion	0°C to +75°C	8V pk-to-pk into 10K ohms		+12V	
S24	100KHz to 15MHz	5% Distortion	0°C to +75°C	.5V RMS into 5K ohms		None	

VOLTAGE CONTROLLED OSCILLATORS — CRYSTAL AND NON-CRYSTAL TYPES

Model Series	Center Frequency Range	Minimum Deviation	Input[6]	Linearity	Stability	Temperature Range	PK-to-PK Output	Load	Voltage Supply	Pkg. Style
VC0114	300Hz to 10KHz	±60%	+1.5V to +9V	±10%	±5%	+10°C to +44°C	3V Sine	125 ohms	+6V	B
VC0137	1Hz to 30MHz	±10%	−5V to +5V	±10%	±.5%	0°C to +50°C	4V Square[3]	9 TTL	+5V	B
VC047	1Hz to 75MHz	±10%	0V to −7V	±10%	±3%	0°C to +75°C	4V Square[3]	9 TTL	+5V	B
VC068	5Hz to 15KHz	±10%	0V to −7V	±1%	±.5%	0°C to +75°C	4V Square[3]	9 TTL	+15V	B
VC01019	.5MHz to 5MHz	±2%	+5V to −5V	±5% to ±10%[4]	±.5%	+55°F to +95°F	4V Square	5 TTL	+12V	A
VC01160	100KHz to 30MHz	±1.25%	−5V to +5V	±5%	±.5%	0°C to +50°C	.8V Sine	50 ohms	+12V	BM
VCX01095B	35MHz to 85MHz	±0.03%	−5V to +5V	±5%	±.01%	−40°C to +90°C	1V Square	3 ECL	+5V & −5.2V	BY
VCX0103	1Hz to 20MHz	±.01% to ±10%	±3V or 0V to +6V	±5% to ±10%	±.0001% to ±1%	0°C to +50°C	4V Square[3]	5 TTL	+5V	BY
VCX0255	1Hz to 40MHz	±.005%	0V to +6V	±5%	±.003%	0°C to +75°C	4V Square[3]	9 TTL	+5V	B

[2]For ±.01% over −55°C to +125°C add "A" to Model Number.

[3]Sine wave options listed above. S11/12/19/20 not available for voltage control ranges greater than ±1%.

[4]Depending on frequency.

[5]TTL option available.

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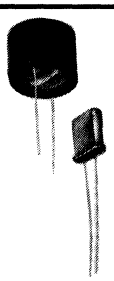
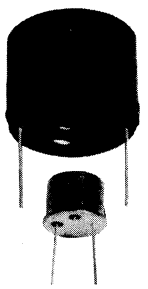
ovenaire ovens

Ovenaire's Circuit Design Technology is providing State-Of-The-Art Electronic Proportional Control Miniature Crystal and Component Ovens. Space-saving packages for PCB mount, low power consumption, low cost. A representative few of many available designs are shown. Most models are available with temperature setting from +35°C to +95°C, voltage from 5VDC to 36VDC. Ovenaire also offers a complete range of other ovens for commercial and military applications.



MODEL PCL1-43

For HC-18/U, HC-25/U, HC-42/U or HC-43/U crystals. 0.750″ dia., 0.562″ high. Temperature stability ±3°C over −30°C to +60°C typical. Also available with temperature adjustability of ±5°C of nominal.

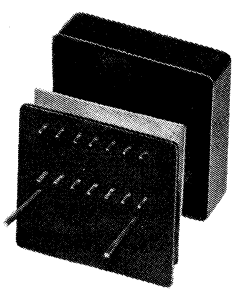


MODEL TO5P

For TO5 crystal, transistor or IC. 0.750″ dia., 0.500″ high. Temperature stability ±3°C over −30°C to +60°C ambient typical. Available with temperature adjustability of ±5°C nominal.

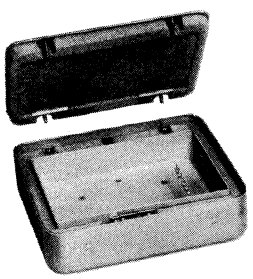
MODEL TO5C

For crystal, transistor or IC with TO5 case. Access to cavity by removing top cover. .750″ dia., .550″ high. Temperature stability ±3.0°C over −30°C to +60°C ambient typical.



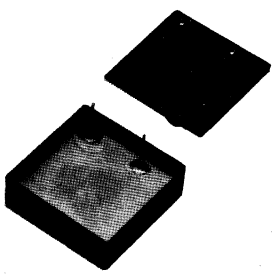
MODEL PC1-25

For 14 pin or 16 pin DIP IC or .375″ x .875″ x .156″ component. Overall size .312″ x 1″ x 1″. Temperature stability ±4°C over −30°C to +60°C ambient typical.



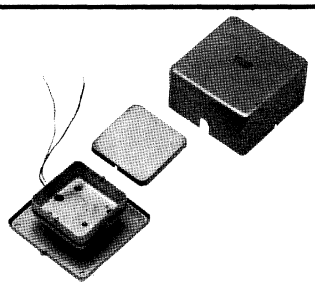
MODEL CO2001

High stability proportional control component oven. Temperature stability ±1°C over 0 to +60°C ambient. Cavity area 2.75″ x 3.93″ x .78″ high. Feed-thru pins for internal connections. O.D. 3.94″ x 4.63″ x 1.25″ high. 24VDC.



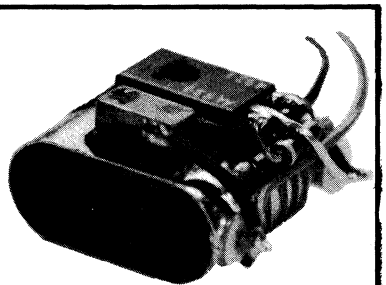
MODEL PC1-34

For 1 or 2 DIP's. Component area 1.45″ Sq. x .250″ tall. Overall dimensions 1.5″ Sq. x .50″ tall. Temperature stability is ±3°C over an ambient range of −30°C to within 10°C of the set-point. Various combinations of set-point temperature and DC operating voltage are available.



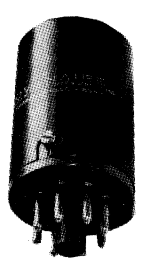
MODEL CO2106

Component oven with customer-adjustable set-point from 50°C to 90°C. Nominal operating voltage is 19-24 VDC. Heated cavity sizes available from 2″ Sq. x .75″ tall to 6″ Sq. x 1.75″ tall. Control is solid-state, proportional.



MODEL PCL1-21

Slip-on oven for HC-6/U crystal. Size .97″ x .53″ x .83″ high. Temperature stability ±3°C over −30°C to +60°C ambient typical. Models also available for HC-25/U crystal.



MODEL PC2-10

Low cost proportional control oven for 2 HC-6/U crystals. Temperature stability ±2°C over −30°C to +60°C ambient. Size 1.25″ dia. x 1.75″ seated height. Octal plug base.

OVENAIRE-AUDIO-CARPENTER
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TELEPHONE 804-977-8050 TWX 910-997-8053 CABLE "OVENS"

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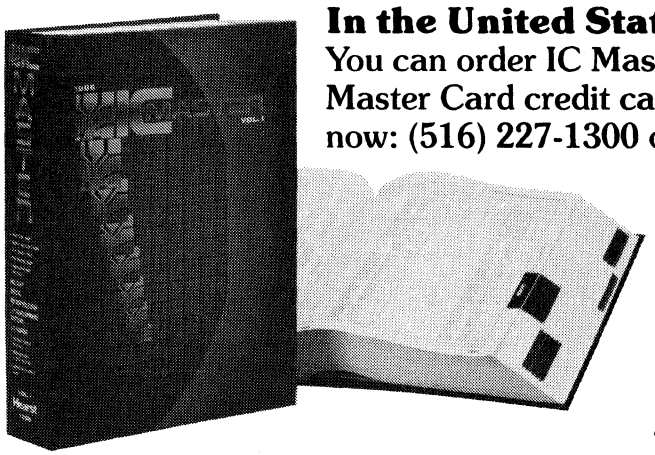

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Pletronics

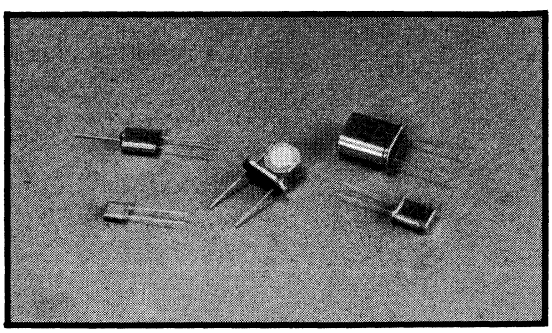
PLETRONICS *presents . . .*

A full line of quartz crystals and clock oscillators available from stock immediately from the following categories:

- Standard Microprocessor Crystals
- Low Profile Crystals
- Miniature (UM-1) Crystals
- Tuning Fork Watch Crystals
- TTL Compatible Oscillators
- CMOS Compatible Oscillators
- HCMOS Compatible Oscillators
- Tri-State (Enable/Disable) Oscillators
- Dual Output Oscillators
- 4-Pin Mini-DIP Oscillators

If the product you need is not listed here among our standard crystals and oscillators, our engineering staff will be happy to custom design a product to fit your exact specifications.

QUARTZ CRYSTALS



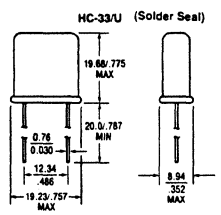
Standard Microprocessor Crystals MP33 and MP18 Series

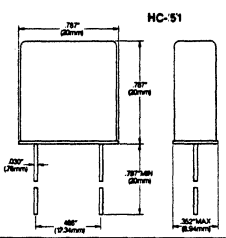
The following standard microprocessor crystals are available immediately from stock:

Crystals in HC-33 Package:

Part Number	Frequency (MHz)	Part Number	Frequency (MHz)
MP33-13*	1.000000	MP33-20	2.097152
MP33-13	1.843200	MP33-32	2.457600
MP33-20	2.000000	MP33-16	3.579545

*Dashed numbers (i.e. –13) indicate load capacitance in picoFarads (i.e. 13pF)





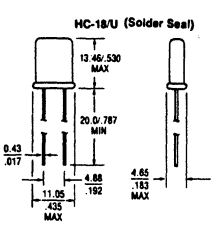
Crystals in HC-18 Package:

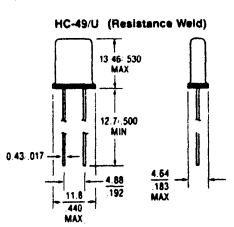
Part Number	Frequency (MHz)	Part Number	Frequency (MHz)
MP18-32*	2.457600	SRMP18	9.830400
MP18-18	3.579545	SRMP18	10.000000
MP18-20	3.686400	MP18-32	10.738635
SRMP18**	3.686400	SRMP18	11.000000
MP18-20	4.000000	SRMP18	11.059200
SRMP18	4.000000	SRMP18	12.000000
MP-18-12	4.194304	SRMP18	13.516800
MP18-20	4.433619	SRMP18	14.318180
SRMP18	4.915200	SRMP18	15.000000
SRMP18	5.000000	SRMP18	16.000000
SRMP18	5.068800	SRMP18	18.000000
MP18-20	5.185000	SRMP18	18.432000
SRMP18	5.714300	SRMP18	19.660800
SRMP18	6.000000	SRMP18	20.000000
MP18-30	6.144000	SRMP18	22.118400
SRMP18	6.553600	SRMP18	24.000000
SRMP18	7.372800	SRMP18	36.000000
SRMP18	8.000000	SRMP18	48.000000

* Dashed numbers (i.e. –32) indicate load capacitance in picoFarads (i.e. 32pF)

** Model numbers without dashed numbers indicate Series resonance.

1. Calibration Tolerance: ±0.005% (50 ppm) at 25°C.
2. Overall Frequency Stability: ±0.01% (100ppm), 0-70°C.
3. Equivalent Series Resistance:
   1.000-2.4576MHz . . . 250-750ohms
   3.579545-7.3728MHz . . . 75-150ohms
   8.00-48.00MHz . . . 25-40ohms, max
4. Sealing Method: Solder Seal (HC-18 & HC-33 pkg's.)
   Resistance Weld (HC-49 & HC-51 pkg's.)





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Low Profile Crystals
LP40 Series

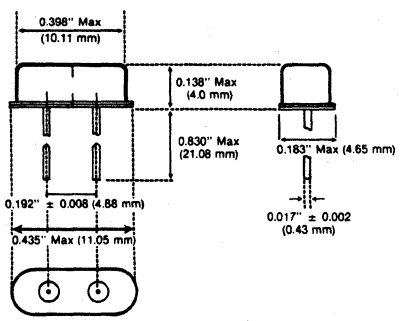
AT-Strip crystals are housed in low-profile packages (Height: 4.0mm).* They may be substituted for HC-18 or HC-49 crystals when height is a constraining factor. The following standard frequencies (in MHz) and load capacitances (where shown) are available from stock. If capacitance is not shown, application is series.

3.579545(18pF)	5.068800	12.000000
3.686400(20pF)	6.000000	14.318180
4.000000(20pF)	6.144000(30pF)	15.000000
4.194304(12pF)	8.000000	16.000000
4.915200	10.000000	18.000000
5.000000(20pF)	11.059200	20.000000
		24.000000

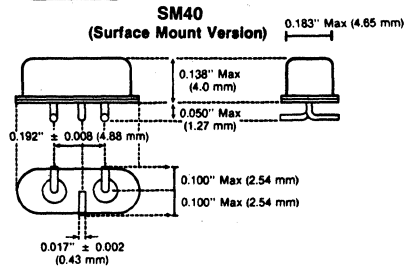
*Also available in 3.5mm package (LP49 Series)

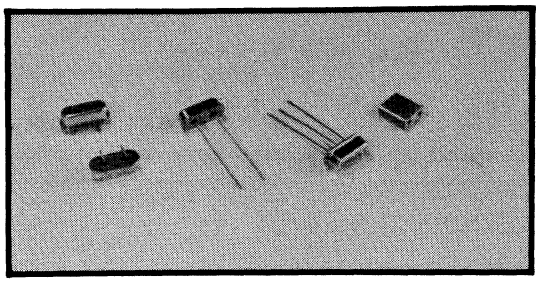
1. Calibration Tolerance: ±0.005% (50ppm) at 25°C.
2. Overall Frequency Stability:
   ±0.01% (100ppm), 0-70°C.
3. Crystals housed in LP40 and SM40 packages as 3-lead package (3LP40) also available.

LP40



SM40
(Surface Mount Version)



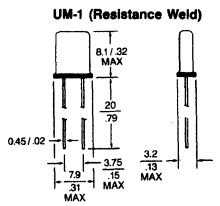


Miniature Crystals
UM-1 Package

Miniature crystals housed in UM-1 packages are available as follows:

—Frequency Range: 8.000000 to 120.000000MHz.
—Overall Frequency Stability:
±0.001% (10ppm) to ±0.01% (100ppm)

UM-1 (Resistance Weld)



Tuning Fork Watch Crystals

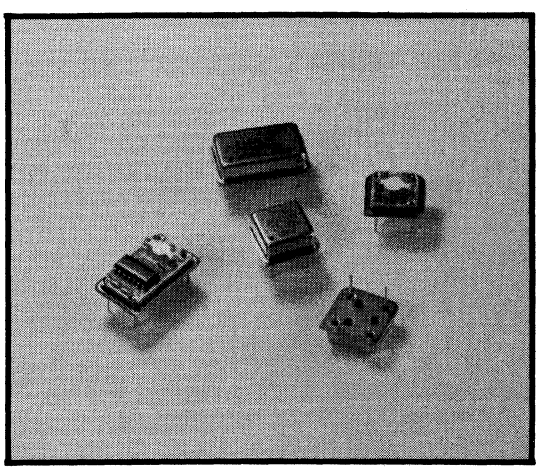
Industry standard, 32.768kHz tuning fork watch crystals are also available from stock in 3X8mm packages.

Custom Designed Crystals

PLETRONICS will design and manufacture quartz crystals to customer specifications within the following limits:

—Frequency Range: 1.000000 to 200.000000MHz.
—Overall Frequency Stability:
±0.001% (10ppm) to ±0.01% (100ppm)

CLOCK OSCILLATORS



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CLOCK OSCILLATORS

HC Series Clock Oscillators

These clock oscillators are HCMOS and TTL compatible.

—Frequency Range: 250Hz to 72MHz.
—Operating Temperature Range: 0 to 70°C.
—Overall Frequency Stability across the operating temperature range:

Part Number	Stability
P1144-HC	±0.0025% (25ppm)
P1145-HC	±0.005% (50ppm)
P1100-HC	±0.01% (100ppm)
P1115-HC	±0.1% (1000ppm)

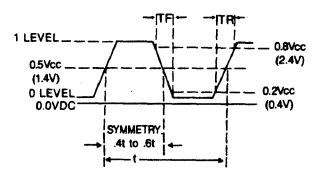
—Input Current: 10 to 40mA (dependent on crystal frequency and load)
—Input Voltage (Vcc): 5VDC ±10%
—Test Load: 50pF when tested as HC device.
10-TTL +20pF when tested as TTL device.

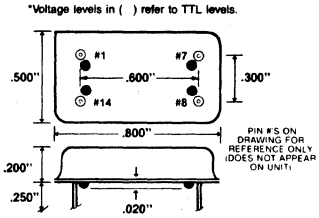
—Output Symmetry: 60/40 to 40/60

—Rise & Fall Times: 6nS maximum with a test load of 10-TTL +20pF.
—Logic Level "1": 90% of Vcc minimum when used as HC device.
2.4V minimum when used as TTL device.
Sink Current: 16mA
—Logic Level "0": 10% of Vcc minimum when used as HC device.
0.4V minimum when used as TTL device.
Source Current: 400μA

Part number P1100-HC (100ppm) is available from stock in the following standard frequencies (MHz):

1.843200	5.068800	12.000000	24.000000
2.457600	6.000000	14.318180	30.000000
3.579545	6.144000	15.000000	32.000000
3.686400	8.000000	16.000000	36.000000
4.000000	10.000000	18.432000	40.000000
5.000000	11.059200	20.000000	48.000000
			60.000000





Four Glass Bead Stand-offs

PIN	CONNECTION
1	N/C or Enable/Disable input
7	Circuit/Case Ground
8	Output
14	Input (Vcc)

3-S Series Clock Oscillators (Tri-State or Enable/Disable Clock Oscillators)

These "True" tri-state clock oscillators are fully HCMOS and TTL compatible. When the input at pin 1 is in "Enable State," the output at pin 8 is also in "Enable State" (normal). When the input at pin 1 is in "Disable State," the output at pin 8 is also in "Disable State" (high impedance). The input is normally disabled by grounding pin 1. Thus, with pin 8 in the high impedance condition, the unit is ready to receive test signals or to connect to alternative circuits.

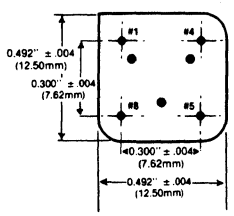
—Enable/Disable input requirements at pin 1:
Vih 2.4 V minimum Vil 0.4V maximum
Iih 10μA maximum Iil −150μA maximum
—Frequency Range, Stability, Input Voltage (Vcc): Same as HC Series Clock Oscillators
—Output Waveform and Drive capabilities when output is normal:
Same as HC Series Clock Oscillators

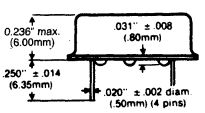
SQ Series Clock Oscillators

The SQ Series Clock Oscillators are fully HCMOS and TTL compatible, and they are housed in 4-pin, Mini-DIP packages. This package size is one half the size of regular clock oscillator packages. (See Drawings.)

—Frequency Range: 250 to 1500kHz
4 to 60MHz
—Other specifications: Same as HC Series except the drive capability in the 250 to 1500kHz range is limited to a 3-TTL loads.

SQ SERIES





DF Series Clock Oscillators

These clock oscillators contain two independently operating crystals in one package. One independent output from pin 1; the other independent output from pin 8.

—Frequency Range: Pin 1: 4 to 60MHz
Pin 8: 4 to 60MHz
—Other specifications: Same as HC Series except the drive capability for each output is limited to 3-TTL loads.

SC Series Clock Oscillators

These CMOS compatible clock oscillators are designed for applications requiring high voltage and low current consumption.

—Input Voltage (Vdd): 6 to 15VDC (specified)
—Frequency Range: 250Hz to 15MHz (Vdd: 12-15V)
250Hz to 11MHz (Vdd: 9-12V)
3.75MHz to 7MHz (Vdd: 6-9V)
—Input Current: 1 to 15mA (Dependent on voltage and crystal frequency)
—Test Load: 20pF
—Symmetry: 60/40 to 40/60
—Rise & Fall Times: 100nS max. (Vdd: 6V)
30nS max. (Vdd: 15V)

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Quality Hybrid Crystal Clock Oscillators

LOGIC FAMILIES: TTL, CMOS & HCMOS, & ECL

TTL

Standard TTL outputs can drive up to 10 TTL loads. Some Q-Tech clocks use low power Schottky (LS) dividers and gates to reduce internal power consumption. These units drive 2 TTL loads or 4 LS loads over the full military temperature range.

SPECIFICATION	FREQUENCY RANGE	SYMBOL	MIN	TYP	MAX	UNIT
Operating Voltage	All	V_{CC}	4.5	5.0	5.5 *7.0	Volt (V)
Supply Current	50 MHz-100 MHz	I_{CC}		40		milliAmpere (mA)
	27 MHz to 50 MHz			25		
	6.5 MHz to 27 MHz			12		
	.01Hz to 6.5 MHz			20		
Output Voltage -High	All	V_{OH}	2.4	3.8		Volt (V)
Output Voltage -Low	All	V_{OL}		0.3	0.4	
Rise/Fall Times (measured btw .8V & 2.0V)	5 MHz to 65 MHz	t_r/t_f		3	5	nanosecond (ns)
	Less than 5 MHz			8	10	
Start-Up Time	27.5 MHz to 66 MHz	t_s		10		millisecond (ms)
	16 MHz to 27.5 MHz			2		
	10 MHz to 16 MHz			5		
	Less than 10 MHz			15		
**Duty Cycle or Symmetry	27 MHz to 65 MHz	N/A	40	50	60	percent %
	6.5 MHz to 27 MHz		40	50	60	
	With divider(s)		45	50	55	
	Less than 5 MHz		45	50	55	
Load	27 MHz to 65 MHz	N/A		6		TTL loads
	Less than 27 MHz			10		TTL loads
***Stability vs. Supply Voltage	All	N/A		$\pm 1x10^{-6}$	$\pm 2x10^{-6}$	$\triangle F/\triangle V$ for $\triangle V = \pm 10\%$
Stability vs. Load	All	N/A			$\pm 1x10^{-6}$	$\triangle F/\triangle$ Load for $\triangle$ Load = $\pm 20\%$
Aging & Stability	All	N/A		± 5	± 10	PPM/Year
Screening	Full MIL Temperature Range: −55°C to +125°C with special option to +200°C if required					
Package	**Available in all Q-Tech packages**					

* Absolute maximum operating voltage. ** For tighter tolerance, or special waveform, consult the factory. *** $\triangle V = \pm 10\%$

CMOS, HCMOS & "Z" DRIVERS

Q-Tech **"C"** type clock oscillators are compatible with the **high voltage, 4000 series CMOS** logic family. Frequencies from .01 Hz to 15 MHz and voltages from 5 volts to 15 volts are available.
The **"HC"** clock oscillators match the **High Speed CMOS** logic family. Q-Tech HC clocks produce **rail-to-rail** CMOS logic levels at frequencies to over 100 MHz. These units can drive one TTL load or high capacitance CMOS and NMOS loads.
Options available in the HC line include provisions for **special symmetry** option, a **low current** option for battery operation when the output frequency is below 100 KHz, and optional 10 TTL drive capability. Although normally run at 5.0 volts like TTL, HC clocks can operate down to 2.5 volts, with some restrictions on maximum frequency.
The **"Z"** type clock oscillators have **more power to drive very high capacitance loads.** Use "Z" designation in part number: e.g. QT6Z9M—12 MHz. This unit can drive 150 pF load with a typical 6 nanoseconds (ns) rise & fall times (t_r, t_f).
Extra outputs, gates and special digital functions can often be included, at low cost.

SPECIFICATION	STD CMOS	HI SPEED CMOS
Frequency Range	.01 Hz to 15 MHz (Max. frequency depends on voltage)	.01 Hz to 100 MHz
Supply Voltage	*5 to 15 volts	*2.5 to 5.0 Volts
Supply Current	2-4 mA typical at 5 V and 6 MHz	6 mA typical @ 10 MHz
Load	10 CMOS/MOS loads typical (depends on frequency)	±2 mA drive typical. Can drive 1 TTL load, excellent for high capacitance loads ***
Rise/Fall Times (t_r and t_f)	<100 ns @ 5 V (depends on load)	6 ns typical @ 6 MHz. 10 ns max.
Logic Level "1"	V_{CC} −0.1 V min.	V_{CC} −0.1 min.
Logic Level "0"	0.0 +0.1 V max.	0.0 +0.1 V max.
Aging & Stability	Same as TTL	Same as TTL
Symmetry	60/40 4 MHz to 15 MHz 50/50 below 4 MHz	60/40 STD **50/50 available up to 25 MHz.
Screening	Full MIL Temperature Range −55°C to +125°C	
Package	**Available in all Q-Tech packages**	

Notes: *Special supply voltage. Ultra low current for battery operation available.
**Special tightened symmetry or arbitrary specified symmetry available.
***Higher drive capabilities available.

ECL

The **ECL logic family** is characterized by **very high speed** (clocks available to 140 MHz.) Q-Tech ECL clocks use MECL* 10K series output gates for compatibility with most ECL systems.
ECL components typically use a negative **Vcc of −5.2 Volts D.C.**, referenced to ground pin. For example, the Q-Tech QT48 package, built as an ECL clock, would use −5.2 Volts on pin 7 ("Vcc") and ground on pin 14. Other pin configurations are also available.
2 new ECL options are available (QT6E1 and QT41E1 series) with quick delivery on standard frequencies. For more information, request bulletin **ECL.**

Available Features:

1. Full Military Temperature range
2. Low output impedance for driving three ECL loads (50 OHMS terminated at −2 Volts D.C.)
3. Internal bias (Vbb) available on a pin
4. Low cost commercial version (request bulletin ECL)
5. A.C. coupled output for r.f. applications
6. Custom clocks with gates, complementary outputs, etc.
7. Positive Vcc.

SPECIFICATION	ECL
**Frequency Range	1 MHz to 200 MHz
Supply Voltage	−5.2 V std for 10K output
	−4.5 V std for 100K output
Supply Current	30 mA typical
Load	Std ECL, designed for military application can drive 3 ECL 50 Ω to −2 Volt loads
Rise/Fall Times (t_r and t_f)	Std 10K and 100K
Levels	Outputs STD ECL
Aging & Stability	Same as TTL
Symmetry	60/40 (max), 55/45 (typical)
Screening	Full MIL Temperature range: −55° to +125°C
Package	**Available in all Q-Tech standard packages except QT1, QT3, QT14 and QT60 series**

Notes: *MECL 10K is a trademark of Motorola Semiconductor Inc., 100K operating at −4.5 Volts Vcc is available on special order.
**For higher frequency, refer to UHF and VHF sources in our catalog.

Q-Tech Corporation
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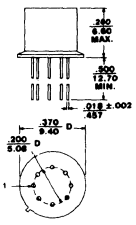
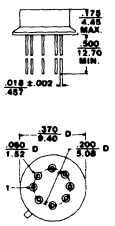
QPL to Full Mil-O-55310/08 Thru /20

QUALITY HYBRID CRYSTAL CLOCK OSCILLATORS DRAWING OUTLINES

QT1



QT14



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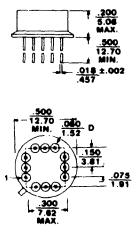
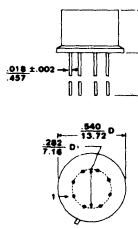
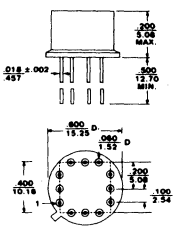


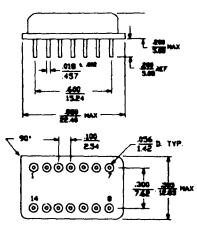
QT3



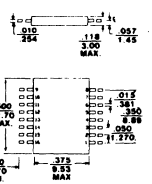
QT8



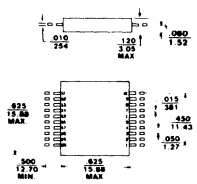
QT4, 6, 10, 12



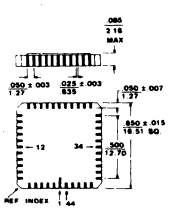
QT22



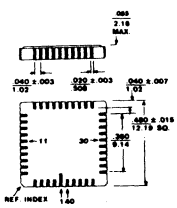
QT24



QT62



QT66



Upper dimensions in inches, lower dimensions in millimeters.

					LOGIC FAMILY	TTL	CMOS		HCMOS	ECL
					INPUT VOLTAGE	5.0V	5.0V - 10.0V	10.0V - 15.0V	5.0V	−5.2V
MODEL #	PCKG.	PIN CONNECTIONS VCC/ VDD	GND/ CASE	OUT	EQUIVALENT MIL-O-P/N M 55310/XX	FREQUENCY RANGE				
QT1	TO 5	8	4/4	5	/09 = TTL & /12 = CMOS	400 Hz - 30 MHz	1.5 KHz - 8.5 MHz	1.5 KHz - 15 MHz	400 Hz - 30 MHz	N/A
QT14	TO 5	8	4/4	5	N/A					
QT2	TO 8	12	6/6	5	N/A	1 Hz - 80 MHz	1 Hz - 8.5 MHz	1 Hz - 15 MHz	.01 Hz - 80 MHz	1 MHz - 200 MHz
QT3	TO 8	8	4/4	5	/10 = TTL & /13 = CMOS	1.5 KHz - 30 MHz			.01 Hz - 30 MHz	N/A
QT4	DIP	4	7/7	5	/14 = TTL	0.1 Hz	0.01 Hz	0.01 Hz	.03 Hz	1 MHz
QT6	DIP	14	7/7	8	/16 & /17 = TTL & /18 = CMOS					
QT10	DIP	14	8/2	1	/08 = TTL & /11 & /15 = CMOS					
QT12	DIP	14	7/7	4	N/A	100 MHz	8.5 MHz	15 MHz		200 MHz
QT22	FP	8	9/9	10	N/A	1.5 KHz - 100 MHz	1 Hz	1 Hz		
QT24	FP	13	10/10	11	/21 = TTL	1 Hz - 100 MHz				
QT62	LCC	6, 12	34, 40	42	/20 = TTL	1.5 KHz - 100 MHz			100 MHz	N/A
QT66	LCC	4, 10	31,37	39	/19 = TTL		8.5 MHz	15 MHz		

FREQUENCY STABILITY VS TEMPERATURE**

OPTION CODE	±%	±PPM	TEMPERATURE
1	.01	100	0°C — +70°C
4	.005	50	
2	.005	50	0°C — +50°C
*3	.0005	5	
5	.0025	25	−20°C — +70°C
6	.005	50	−55°C — +105°C
9	.005	50	−55°C — +125°C
10	.01	100	
8	TO CUSTOMER SPECIAL REQUIREMENTS		

* Requires external tuning capacitor.
** All units operate from −55°C to +125°C.
Tolerance unspecified outside of temperature limits.

HOW TO ORDER (213) 820-4921

QT			M	
MODEL #	LOGIC FAMILY	STABILITY OPTION	MILITARY SCREENING	FREQUENCY IN Hz, KHz OR MHz

EXAMPLE:

QT6	T	9	M	20.000 MHz

NORMALLY WRITTEN: QT6T9M-20.000 MHz

There are three ways to order a Q-Tech Clock Oscillator:

1. By ordering a Q-Tech standard part number such as: **QT6 T 9 M-20 MHz.**
2. By ordering a MIL-O-55310 part number such as **M55310/16-B31 A-20 MHz.**
3. By ordering a special custom requirement unit (whether the product is governed by a customer source control document or is a Q-Tech special design), a special part number **MCM XXXX** will be assigned to the product designating **Microelectronic Custom (Oscillator) Module,** which will also assure you of **confidentiality** regarding the **proprietary nature** of your design.

SPECIAL OPTIONS AVAILABLE

- Gated Outputs
- Multiple Frequency Outputs
- Tri-State Outputs
- Fine Frequency Adjustment
- Precise Programmed Outputs
- Reliable Start-Up Time
- Special Symmetry
- Logic: TTL, CMOS, HCMOS, ECL and 'Z' Drivers
- Extended Operating Temperature Range
- Very Low Current Consumption
- Special Package Configurations
- Special Pin Configurations

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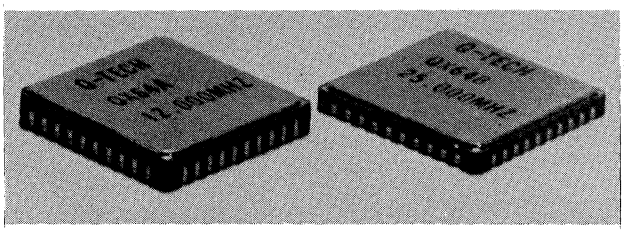
Other Q-Tech Products

SURFACE MOUNT CRYSTALS

Q-Tech is introducing its new line of Surface Mount Crystals: the ***QX64A*** (85 mils thick) and ***QX64B*** (65 mils thick) ***series*** with a frequency range of 5 MHz to 125 MHz. These surface mount crystals can withstand full military environmental testings. They are hermetically sealed in a 40 pad LCC with any pin configuration at no extra charge. They are also available in swept quartz for ***radiation hardened applications.*** For more details please request bulletin ***SMX.***



Surface Mount Crystals

UHF & VHF SOURCES

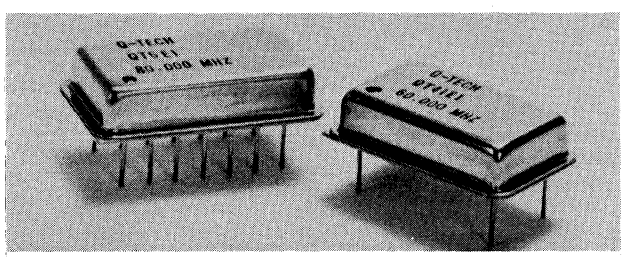
Q-Tech has specialized in a line of ***UHF & VHF Sources*** available in ***a thin profile*** standard solder sealed package (1.5″ × 1.5″ × .5″) with solder pins or SMA connectors. Frequency ranges from 20 MHz to 550 MHz. Consider the following features: phase locked option, low spurious and harmonic outputs and phase noise data available. For full details please request bulletin ***UVS.***

VCXO'S

Q-Tech ***Voltage Controlled Crystal Oscillators*** can be ***"frequency shifted"*** or ***"controlled"*** by means of an external voltage source. Often used to phase lock a clock to a master frequency source, a typical "pulling" (frequency shift) range is ±100 PPM (±.01%) for a control voltage range of 5 Volts. Consult factory for other range/capabilities. Also consider packaging your phase locked loop dividers, phase detector and loop amplifier in one custom hybrid to reduce cost and space. For full details please request bulletin ***VCXO.***

ECL CLOCK OSCILLATORS

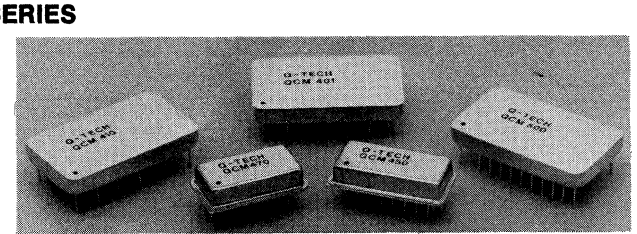
In addition to its complete line of ECL Clock Oscillators, Q-Tech now offers another version of unscreened and fast delivery ECL in 2 standard DIPS: ***QT6E1*** (14 pin DIP) and the ***QT41E1*** (4 pin DIP) ***series.*** These units operate at −5.2 Volts with a frequency range of 40 MHz to 110 MHz. For more details please request bulletin ***ECL.***



ECL Clock Oscillators

MICROPROCESSOR CLOCK DRIVERS — THE QCM SERIES

Q-Tech has developed ***clock generators/drivers*** with quartz crystal stability for all commonly used microprocessors. Versions are available with TTL, CMOS and/or NMOS output levels (as required). ***The QCM series clock drivers*** are available in both commercial and full MIL-spec designs. Q-Tech can provide drivers for almost all available microprocessors. For full details please request bulletin ***MCD.***



The QCM Series

MCD CROSS REFERENCE CHART

GENERIC MICROPROCESSOR	NOMINAL MFR.	APPLICABLE Q-TECH DESIGN
6800	Motorola	QCM-410, QCM-420, QCM-430, QCM-440, QCM-450, QCM-460, QCM-500.
6802/6804/6805/6809	Motorola	Any standard Q-Tech single-phase TTL or HC clock oscillator.
Z80/8001/8002	Zilog	QT6-ZYY (YY refers to frequency stability).
8080	Intel	QCM-401
68000	Motorola	Any Q-Tech single phase clock oscillator with rise and fall times less than 10 nsec.

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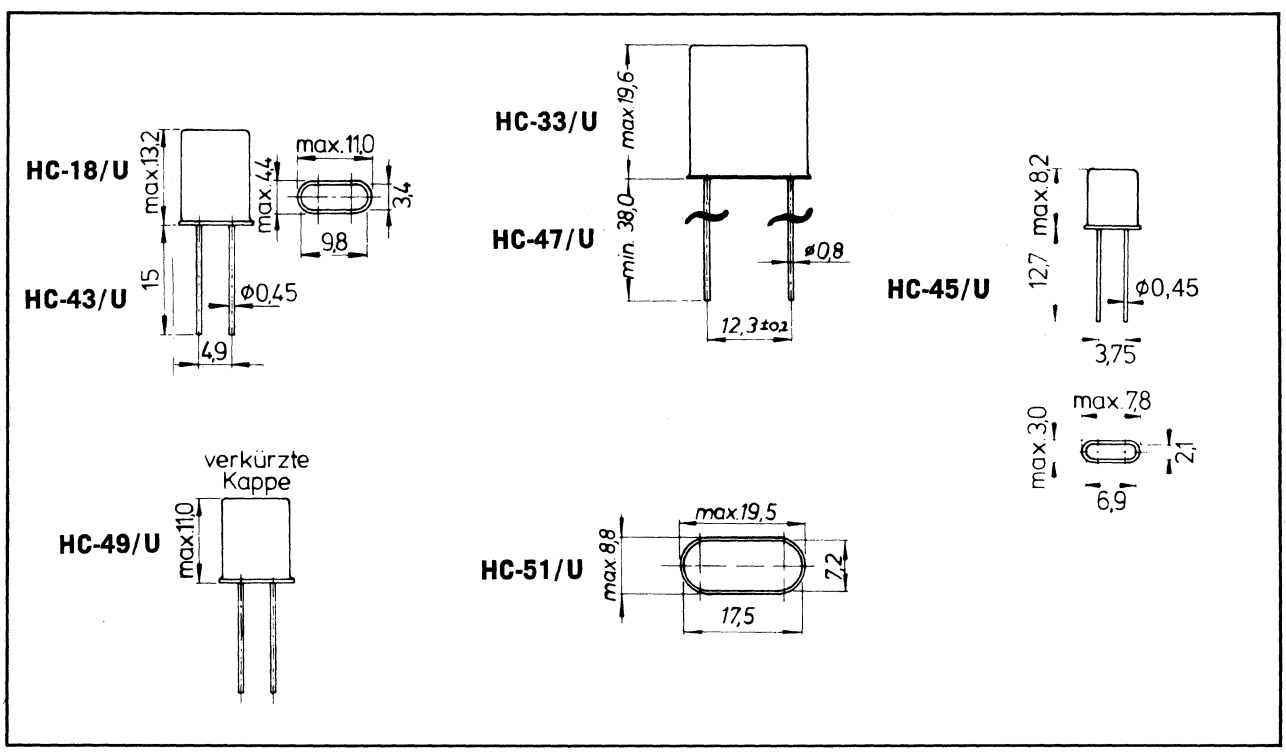
HOLDER: TYPES: HC-6/U, HC-33/U, HC-25/U, HC-18/U, HC-49/U, HC-45/U, etc.

MODE OF OSCILLATION: Fundamental up to 9th overtone.

When ordering, please also specify the following parameters:
— Frequency tolerance, temperature stability, ESR, load capacitance, drive level, ageing and any special requirement.



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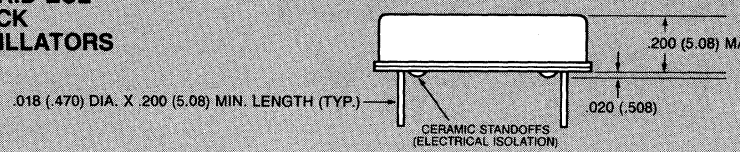
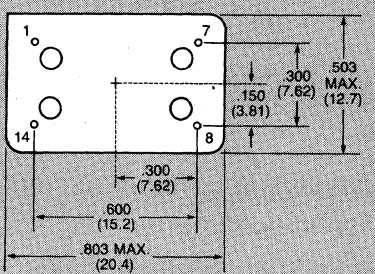
OSCILLATORS

HYBRID ECL CLOCK OSCILLATORS



NOTE: HT = .250 (6.35) MAX. FOR 150 TO 200 MHz

PACKAGE STYLE



PIN CONNECTIONS
1. NC
7. – VEE
8. Output
14. + VCC

Numerous optional configurations available.

LOGIC	10K	10KH
FREQUENCY RANGE	4 to 115 MHz	4 to 200 MHz
TEMPERATURE RANGE	◄ 0° to 70°C standard ►	
FREQUENCY STABILITY	±100 ppm inclusive of temperature, one year aging, initial set accuracy, load variations, and VEE ±5% standard.	
INPUT VOLTAGE	◄ –5.2 VDC ±5% ►	
OUTPUT	10K ECL	10KH ECL
LOAD	◄ 50 ohms into –2 VDC ►	
INPUT CURRENT	◄ 50 mA maximum ►	
DUTY CYCLE	◄ 50/50 ±10% ►	
RISE & FALL TIME	2 ns typical	1 ns typical

NOTE:
Screening per MIL-STD 883 available on all hybrid oscillators.

DISABLE OPTION

Same package and electrical specs as above.

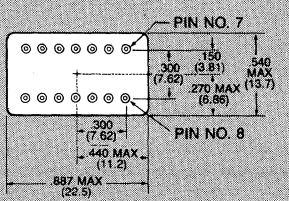
PIN CONNECTIONS
1. Disable
7. – 5.2 VDC
8. Output
14. Case & Circuit GND

NOTE: Logic "1" on pin 1 will result in logic "0" output. Logic "0" or open on pin 1 will result in normal operation.

DISABLE AND COMPLEMENTARY OUTPUT OPTION

4.00 to 200.00 MHz 10KH compatible
14 pin DIP configuration

PIN CONNECTIONS
1. No connect
7. – 5.2 VDC
8. Output 1
9. Output 2
10. Disable
14. Case & Circuit GND



Additional temperature ranges and stabilities available upon request.

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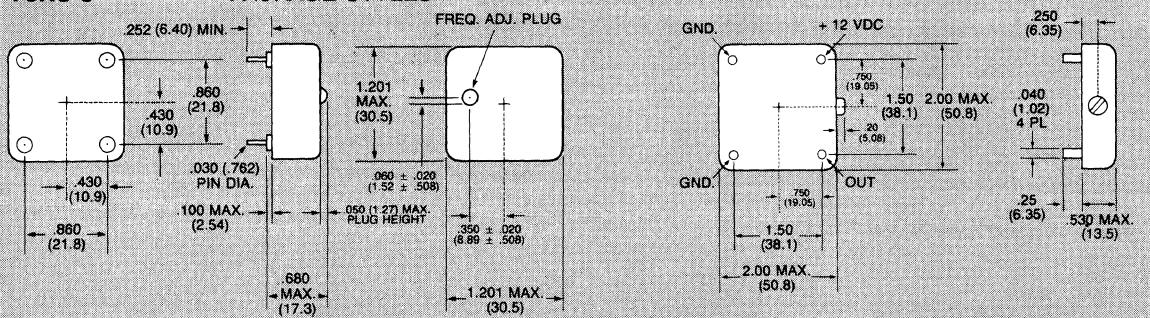
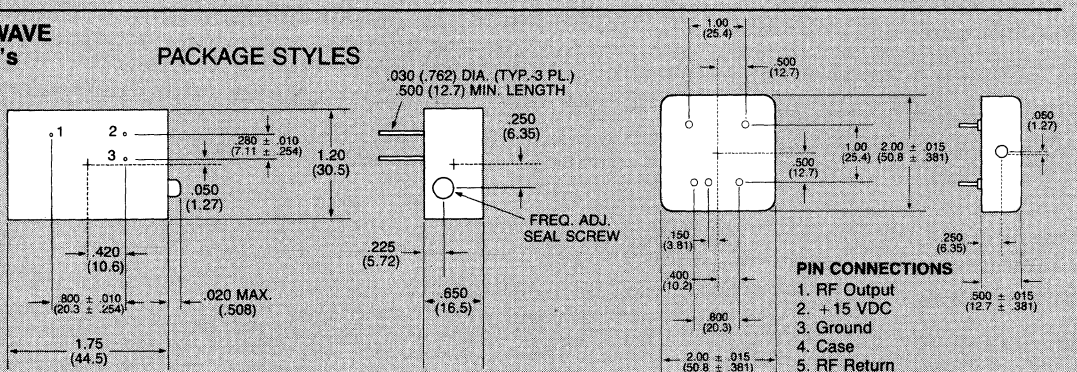
TTL TCXO's PACKAGE STYLES



LOGIC	TTL	TTL
FREQUENCY RANGE	4 to 15 MHz	
ACCURACY AT 25 °C	±1 ppm adjustable with trimmer	
FREQUENCY STABILITY	±1 ppm 0° to 50 °C	±1 ppm −30° to 70 °C
ADJUSTMENT RANGE	±5 ppm minimum	±10 ppm minimum
AGING	±1 ppm/year	
INPUT VOLTAGE	+5 VDC ±10%	+12 VDC ±5%
INPUT CURRENT	15 mA maximum	20 mA maximum
OUTPUT SIGNAL	5 TTL	
RISE & FALL TIME	20 ns maximum	
SYMMETRY	50/50 ±10%	
SHORT TERM STABILITY	$1x10^{-9}$ per 100 msec	

NOTE:
Additional specifications (including phase noise measurement) available upon request.

SINEWAVE TCXO's PACKAGE STYLES



LOGIC	SINEWAVE	SINEWAVE
FREQUENCY RANGE	4 to 15 MHz	20 to 200 MHz
ACCURACY AT 25 °C	±1 ppm adjustable with trimmer	
FREQUENCY STABILITY	±2 ppm 0° to 70 °C	±1 ppm −30° to 70 °C
ADJUSTMENT RANGE	±5 ppm minimum	±10 ppm minimum
AGING	±1 ppm per year	
INPUT VOLTAGE	+5 VDC ±5%	+15 VDC ±1%
INPUT CURRENT	15 mA maximum	25 mA maximum
OUTPUT SIGNAL	0 dbm minimum	+10 dbm minimum
HARMONICS & SUBHARMONICS	−20 dbc	−40 dbc
LOAD	50 ohms	
SHORT TERM STABILITY	$\pm 2x10^{-9}$ per 100 msec	$1x10^{-9}$ per second

NOTE:
Additional specifications (including phase noise measurement) available upon request.

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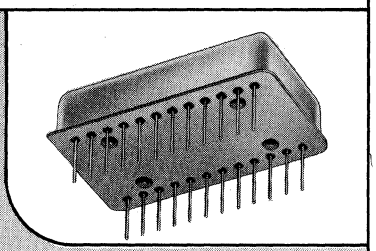
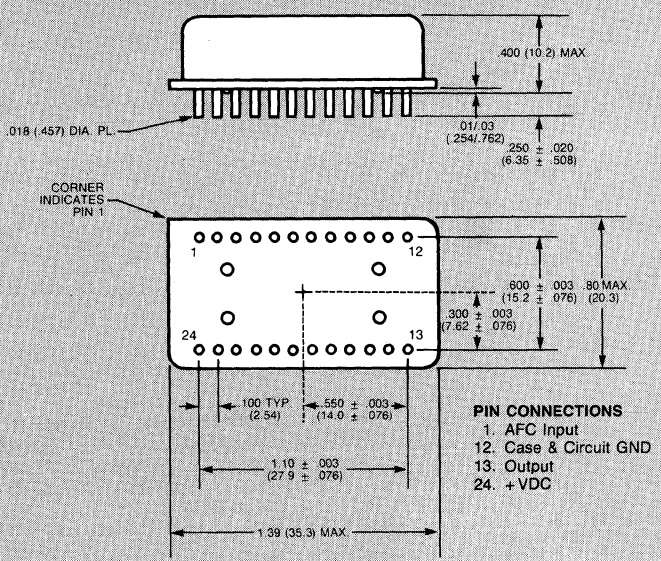


HYBRID SINEWAVE VCXO'S

OUTPUT	SINEWAVE
FREQUENCY RANGE	20 to 100 MHz
OPERATING TEMP. RANGE	0 to 70ºC
TEMPERATURE STABILITY	±50 ppm
△ f vs. TIME	±5 ppm/year
INPUT VOLTAGE	+12 to +15 VDC ±5%
POWER CONSUMPTION	30 mA
OUTPUT POWER	+10 dbm min.
LOAD	50 Ω
HARMONICS & SUB HARMONICS	−20 dbc
STANDARD PACKAGE	24 pin hybrid DIP

AFC CHARACTERISTICS	
FREQUENCY DEVIATION	to ±500 ppm
MODULATION INPUT VOLTAGE	0V ±5V
MODULATION RATE	DC to 15K
LINEARITY	±10%
MODULATION SLOPE	Negative
INPUT IMPEDANCE	10K Ω

NOTE: Linearity to 5% available.

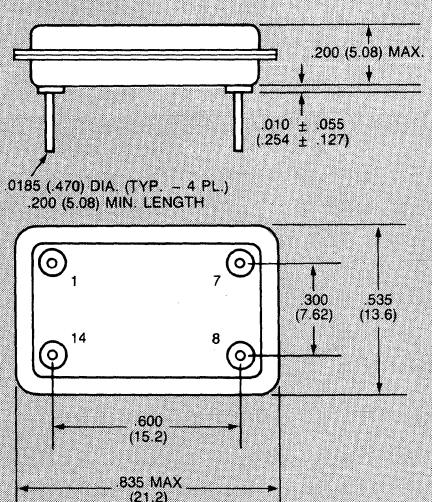


HYBRID TTL VCXO'S

R-H PART NUMBER	03-02034-XXX	03-02073-XXX
LOGIC	← TTL →	
FREQUENCY RANGE	← 2 to 35 MHz →	
OPERATING TEMP. RANGE	← 0 to 70ºC →	
FREQUENCY STABILITY	±25 ppm includes: combined effect of temperature, one year aging, initial set accuracy, load variations, and VCC variations.	
INPUT VOLTAGE	← +5 VDC ±5% →	
POWER CONSUMPTION	← 15 mA to 75 mA →	
OUTPUT VOLTAGE	← +0.5 to +2.4 VDC →	
LOAD	2.0 to 14.9 MHz 0 to 10 LS 15.0 to 30.0 MHz 0 to 10 TTL	0 to 10 TTL
SYMMETRY	← 50/50 ±10% →	
STANDARD PACKAGE	← 4 pin DIP →	

AFC CHARACTERISTICS		
FREQUENCY DEVIATION	±75 ppm minimum	±140 ppm minimum
MODULATION INPUT VOLTAGE	← +2.5V ±1.5V →	
MODULATION RATE	DC to 20 KHz	DC to 15 KHz
LINEARITY	Less than 5% from straight line.	
MODULATION SLOPE	← Positive →	
INPUT IMPEDANCE	← 50K Ω min. →	

NOTE: Additional logic levels, package styles and frequency stabilities available upon request.



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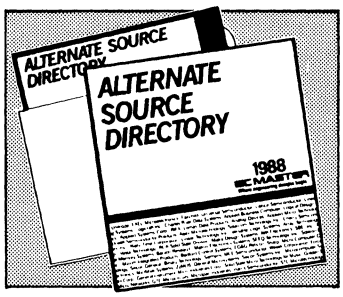

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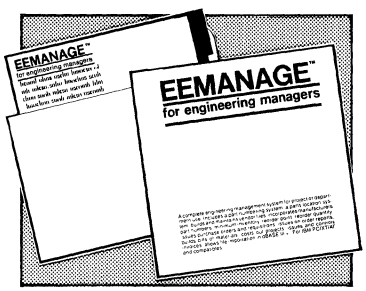

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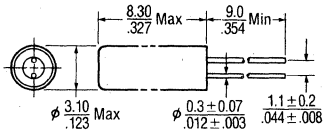
Standard Microprocessor Crystals

The following selection chart lists NYMPH AT-cut quartz crystals for most common microprocessor applications available from stock.

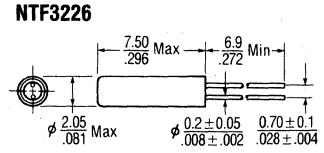
Freq. MHz	NYMPH Part No.	Freq. MHz	NYMPH Part No.	Freq. MHz	NYMPH Part No.	Freq. MHz	NYMPH Part No.	Freq. MHz	NYMPH Part No.
HC-33/U		**HC-18/U**		**HC-18/U**		**HC-18/U**		**HC-18/U**	
1.000000	NYP010-13	3.330000	NMP033A	7.159090	NYP071-20	16.000000	NYP160-20	30.000000	NMP300
1.000000	NMP010	3.579545	NYP035A-18	7.372800	NYP073-20	16.000000	NMP160	32.000000	NMP320
1.843200	NYP018-13	3.579545	NMP035A	7.372800	NMP073	16.257000	NYP162-20	36.000000	NMP360
1.843200	NMP018	3.600000	NYP036-30	8.000000	NYP080-18	16.384000	NYP163-20	40.000000	NMP400
2.000000	NYP020-20	3.686400	NYP037-20	8.000000	NMP080	16.384000	NMP163	48.000000	NMP480
2.000000	NMP020	3.686400	NMP037	8.192000	NYP081-20	17.360000	NMP173		
2.097152	NYP021-20	3.932160	NYP039-12	9.216000	NMP092	18.000000	NMP180	**HC-44/U**	
2.457600	NYP024-32	3.932160	NMP039	9.830400	NYP098-20	18.432000	NYP184-20	6.000000	44N060
2.457600	NMP024	4.000000	NYP040-20	9.830400	NMP098	18.432000	NMP184	8.000000	44N080
3.579545	NYP035-18	4.000000	NMP040	10.000000	NYP100-20	19.354000	NYP193-20	10.000000	44N100
HC-18/U		4.096000	NYP0409-20	10.000000	NMP100	19.354000	NMP193	12.000000	44N120
1.000000	NMP010A	4.194304	NYP041-12	10.738635	NYP107-32	19.660800	NYP196-20	12.500000	44N125
1.843200	NYP018A-13	4.433619	NYP044-20	11.000000	NMP110	19.660800	NMP196	14.318180	44N143
1.843200	NMP018A	4.915200	NMP049	11.059200	NYP111-20	20.000000	NYP200-20	14.400000	44N144
2.000000	NYP020A-20	5.000000	NYP050-20	11.059200	NMP111	20.000000	NMP200	15.000000	44N150
2.000000	NMP020A	5.068800	NMP051	12.000000	NYP120-20	22.118400	NMP221	16.000000	44N160
2.097152	NYP021A-20	5.185000	NYP052-20	12.000000	NMP120	23.400000	NMP234	18.000000	44N180
2.457600	NYP024A-20	5.714300	NMP057	12.288000	NYP122-20	24.000000	NYP240-20	18.432000	44N184
2.457600	NMP024A	5.990400	NMP059	12.288000	NMP122	24.000000	NMP240	19.354000	44N193
3.000000	NYP030A-30	6.000000	NMP060	13.516800	NMP135	24.576000	NYP245-18	19.660800	44N196
3.000000	NMP030A	6.144000	NYP061-30	14.318180	NYP143-32	25.000000	NMP250	20.000000	44N200
3.276800	NYP032A-15	6.400000	NYP064-20	14.318180	NMP143	27.000000	NMP270	22.118400	44N221
3.276800	NMP032A	6.553600	NMP065	14.745600	NMP147	28.636360	NYP286-32	24.000000	44N240
		7.000000	NMP070	15.000000	NMP150	30.000000	NYP300-20	25.000000	44N250

Miniature Quartz Crystals

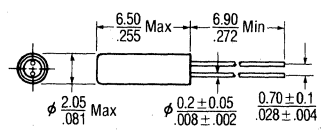
NTF3238



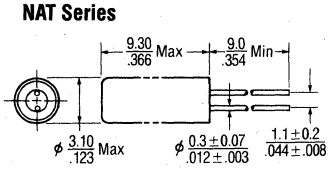
NTF3226



MX Series



NAT Series



Scale: None (Dimensions in mm / inches)

NTF Series (32.768 kHz)

Designed for use in parallel resonant Pierce oscillators. Highly stable, low cost fundamental mode tuning fork type crystals for low power applications.

Electrical Specifications:
Frequency Tolerance at 25°C . . . . ±20 ppm (0.002%)
Turnover Temperature-T_o . . . . . 25°C ±5°C
Temp. Characteristics-K . . . . . −0.038 ppm/°C², typ.
Quality Factor-Q . . . . . 80,000, typ.
Load Capacitance-C_L . . . . . 9.5 to 15 pF, typ.
Series Resistance-R_s . . . . . 30 k Ohms, typ.
Motional Capacitance-C_1 . . . . . 0.003 pF, typ.
Shunt Capacitance-C_0 . . . . . 1.5 pF, typ.
Drive Level-P_d . . . . . 10 μW max.

Temperature Range:
Storage . . . . . −55 to +125°C
Operating (Industrial) . . . −10 to +60°C
Aging First Year . . . . . 10 ppm max.
Shock Resistance . . . . . 1000 g, 1 ms, ½ sine wave
Vibration Resistance . . . . . 10 g, 10 Hz to 2 kHz random

Note: Other selected frequencies are available.

MX Series (10 kHz to 180 kHz)

Frequency Tolerance . . . . . ±30 to ±10,000 ppm (frequency dependent)
Temperature Range:
Storage . . . . . −40 to +85°C
Operating (Industrial) . . . . . −40 to +80°C
Operating (Military) . . . . . −55 to +85°C
Aging Rate +25°C . . . . . 15 ppm max.

Turnover Temperature . . . . . +10 to +30°C (frequency dependent)
Quality Factor . . . . . 15,000-150,000 typical (frequency dependent)
Effective Series Resistance . . . . 50 k Ohms max.
Drive Level . . . . . 0.5 −1 μW max.
Shunt Capacitance . . . . . 1.4 pF
Temperature Coefficient . . . . . −0.035 ppm/°C²

NAT Series (4.000 MHz to 24.0000 MHz)

An AT cut strip resonator crystal housed in a miniature 3.1 × 9.3 mm tubular package. It has the same temperature characteristics as traditional AT cut crystals but requires only 20% of physical PC board space compared to the standard HC-18/U holders.

Electrical Specifications:
Freq. Calib. Tolerance at +25°C . . ±30 ppm
Temp. Stability Tolerance . . . . . ±50 ppm −20 to +85°C
Load Capacitance-C_L . . . . . 20 pF to 32 pF

Effective Series Resistance-R_s . . . . 120-15 Ohms (frequency dependent)
Drive Level-P_d . . . . . 500 μW max.
Shunt Capacitance-C_0 . . . . . 7 pF max.

SaRonix reserves the right to change all data without notice.

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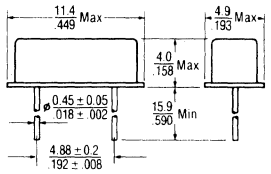
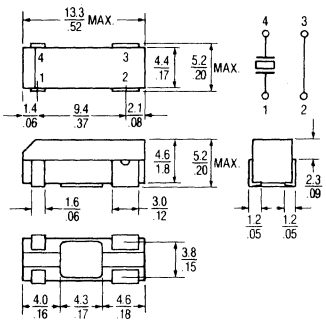
Nymph Products by SaRonix

Quartz Crystals / Surface Mountable Crystals

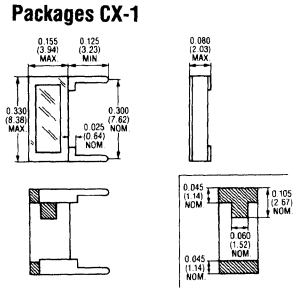


These AT cut strip crystals are sealed in tubular metal holder to ensure hermeticity and minimum aging, and encapsulated in a thermoplastic housing to allow surface mounting. They are available in bulk or on 24 mm tape and reel.



These photolithographically produced crystals are hermetically sealed in a miniature ceramic package. They are available with leads for through-hole mounting or leadless on 12 mm and 16 mm tape and reel for surface mounting.

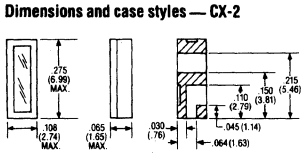
Packages CX-1



-03 Side Leads **-01 No Leads**

Packages CX-2

Dimensions and case styles — CX-2



-01 No Leads

Standard marking is frequency plus V (Pierce) or H (Series).

Scale: None (Dimensions in mm / inches)

49S Series (3.500 MHz to 40.0000 MHz)

Designed to replace the standard HC-18/U, HC-43/U and HC-49/U holder in applications where board height is a problem. This miniature AT cut strip resonator crystal is housed in a 4 mm high package.

Electrical Specifications:

Freq. Calib. Tol. at 25°C	±30 ppm	Effective Series Resistance-R_s	50 to 200 Ohms (frequency dependent)
Freq. Stability Tolerance	±50 ppm −20 to +70°C	Drive Level-P_d	500 µW max.
		Shunt Capacitance-C_o	7 pF max.

NMS Series (3.5000 MHz to 24.0000 MHz)

Freq. Calib. Tol. at +25°C	0.005% (tighter tolerances available)	Load Capacitance	16 pF to 32 pF or Series
Freq. Stability Tolerance	±0.010% from −20 to +70°C (tighter tolerances available)	Effective Series Resistance	50 to 250 Ohms (frequency dependent)
Oper. Temp. Range	−20 to +70°C	Drive Level	0.5 mW maximum
		Shunt Capacitance	7 pF maximum

Standard Frequencies: The following selection chart lists the NMS Series crystals available from stock. Special frequencies are available upon request.

Frequency MHz	Nymph Part Number	Circuit Calibration Condition	Maximum ESR (Ohms)	Frequency MHz	Nymph Part Number	Circuit Calibration Condition	Maximum ESR (Ohms)
3.579545	NMS035-18	18 pF	250	10.000000	NMS100	Series	60
3.686400	NMS037-20	20 pF	250	12.000000	NMS120	Series	60
4.000000	NMS040-20	20 pF	150	14.318180	NMS143	Series	50
4.000000	NMS040	Series	150	16.000000	NMS160	Series	50
4.915200	NMS049	Series	150	18.432000	NMS184	Series	50
5.068800	NMS051	Series	150	19.660800	NMS196	Series	50
6.000000	NMS060	Series	100	20.000000	NMS200	Series	50
7.372800	NMS073	Series	80	22.118400	NMS221	Series	50
8.000000	NMS080	Series	80	24.000000	NMS240	Series	50

CX Series (10 kHz to 2.0000 MHz) Equivalent to Statek CX Series

- High Performance
- Superior Quality Factor
- Rugged and Shock Resistant
- Low Power Consumption
- Excellent Stability
- Extremely Low Aging
- Small IC Compatible Dimensions
- Precision Tuned by Laser

Temperature Range:		Vibration Resistance	10 g rms, 10 Hz to 2 kHz random
Storage	−55 to +125°C	Drive Level	≤1 µW (10-499 kHz)
Operating (Industrial)	−40 to +80°C		10 µW (500-2000 kHz)
Operating (Military)	−55 to +125°C	Typical Shunt Capacitance:	
Parabolic Temp. Coef	typ. −0.038 ppm/°C²	CX-1V or 2V	10-499 kHz, 1.4 pF
Aging First Year	10 ppm max.	CX-1V or 2V	500-2000 kHz, 0.85 pF
Shock Resistance	1000 g 1 ms, ½ sine wave	CX-1H or 2H	10-600 kHz, 1.4 pF

Standard Frequencies (kHz)

10.000*	25.000	60.000	500.000
12.800*	30.720	75.000	768.000
15.360*	31.500	76.800	1000.000
16.000	32.768	77.500	1048.576
16.384	38.400	100.000	1228.800
18.641	40.000	153.600	1500.000
19.200	40.960	240.000	1843.200
20.480	48.000	307.200	2000.000

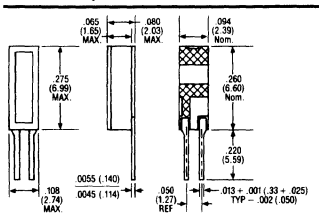
*CX-1 only.

Standard Calibration Tolerances

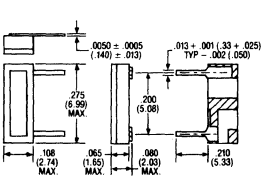
Frequency kHz	Calibration Tolerances at 25°C A	B	C
10-74.9	±0.003%	±0.01%	±0.10%
75-169	±0.005%	±0.01%	±0.10%
170-249	±0.010%	±0.02%	±0.20%
250-499	±0.020%	±0.05%	±0.50%
500-2000	±0.050%	±0.10%	±1.00%

Special frequencies and tolerances available upon request.

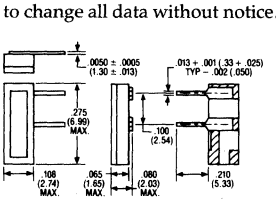
SaRonix reserves the right to change all data without notice.



-02 End Leads



-03 Side Leads



-04 Side Leads

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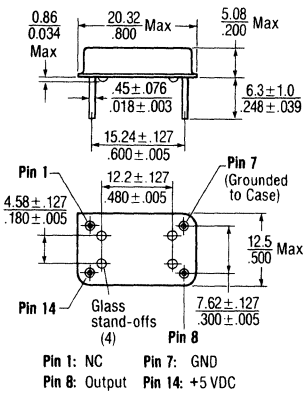
Nymph Products by SaRonix

Crystal Clock Oscillators

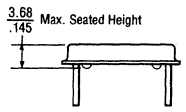
The SaRonix NYMPH crystal clock oscillator family includes a wide variety of state-of-the-art thick film hybrid devices for generating TTL, CMOS, HCMOS, ECL, Tri-State, Dual Independent Output, Baud Rates, and special output characteristics.

Standard Package



Pin 1: NC Pin 7: GND
Pin 8: Output Pin 14: +5 VDC

Low Profile Package



NCT Series (TTL)/NTT Series (Tri-State TTL)*

Frequency Range	250 kHz to 110 MHz
Frequency Stability	±0.0025% to ±1.00% (over all conditions)
Temperature Range:	
Operating	0 to +70°C
Storage	−55 to +125°C
Input Voltage	+5VDC ±10%

TTL Output:	
Symmetry	50% ±10% @ 1.4VDC Level
Rise & Fall Times	8 ns max. for 250 kHz to 25 MHz 6 ns max. for 25 MHz to 70 MHz 3 ns max. for over 70 MHz
"0" Level	+0.4 Volts
"1" Level	+2.4 Volts
Output Load	1 to 10 TTL gates

**Tri-State Control Pin 1: Logic "1" or no connection = RF out; Logic "0" or ground = High Impedance.*

Note: NCT Series available in standard and low profile packages.

NCC Series (CMOS)

Frequency Range	250 kHz to 24 MHz
Frequency Stability	±0.0025% to ±0.05% (over all conditions)
Temperature Range:	
Operating	0 to +70°C
Storage	−55 to +125°C
Input Voltage:	
Rated	+5VDC ±10%
Operating	+3VDC min. to +7VDC max.

Input Current:	2 to 8.5 mA typical (frequency dependent)
CMOS Output:	
Symmetry	50% ±10% @ 50% V_{DD}
Rise & Fall Times	20% V_{DD} to 80% V_{DD} = 12 ns max.
(1 TTL)	0.5V to 2.5V = 8 ns max.
"0" Level	V_{SS} +0.5 Volt max.
"1" Level	V_{DD} −0.5 Volt min.

Note: Enable/Disable Function available.

32.768 kHz (Real Time Low Power CMOS)

Part Number	NCC 020C–32.7680
Frequency	32.7680 kHz
Frequency Tolerance	±0.001% or 0.0025% (initial accuracy @ +25°C)
Operating Stability	±0.0025% 0 to +50°C ±0.005% −20 to +70°C
Temperature Range:	
Operating	0 to +70°C
Storage	−30 to +85°C

Input Voltage:	
Rated	+5VDC ±10%
Operating	+3VDC min. +10VDC max.
Input Current	40 µA typical, 80 µA max.
CMOS Output:	
Symmetry	50% ±10% @ 50% V_{DD}
Rise & Fall Times	40 ns typical, 60 ns max.
"0" Level	V_{SS} +0.5V max.
"1" Level	V_{DD} −0.5V min.
Output Load	200 kΩ at 15 pF

A crystal controlled CMOS oscillator suitable for extremely low power applications including portable devices, handheld instruments, and other battery powered equipment.

NCL Series (Low Power CMOS)

Frequency Range	10 kHz to 2.0000 MHz
Frequency Tolerance	0.0010% to 1.000% (initial accuracy @ +25°C)
Temperature Range:	
Operating	−20 to +70°C
Storage	−30 to +85°C
Input Voltage:	
Rated	+5VDC ±10%
Operating	+3VDC min., +10VDC max.

Input Current	40 µA typical (rated at +5VDC, 40.0000 kHz)
CMOS Output:	
Symmetry	50% ±10% @ 50% V_{DD}
Rise & Fall Times	40 ns typical, 60 ns max.
"0" Level	V_{SS} +0.5V max.
"1" Level	V_{DD} −0.5V min.
Output Level	200 k Ohms at 15 pF

A crystal controlled, low current hybrid oscillator circuit providing precise rise and fall times to drive high speed CMOS and NMOS microprocessors. Compatible with both CMOS and TTL. Physically and functionally interchangeable with RASCO.*

***RASCO is a trademark of MOTOROLA.**

NCH Series (HCMOS)

Frequency Range	500 kHz to 50 MHz
Frequency Stability	±0.0025 to ±0.05% (over all conditions)
Temperature Range:	
Operating	0 to +70°C
Storage	−55 to +125°C
Input Voltage:	
Rated	+5VDC ±10%
Operating	+4VDC min. to +7VDC max.

Input Current:	
500 kHz-24 MHz	15 mA max. @ 25°C, 10 mA typ. 20 mA max. over oper. temp. range
Over 24 MHz	30 mA max. @ 25°C, 20 mA typ. 35 mA max. over oper. temp. range
HCMOS Output:	
Symmetry	50% ±5% @ 50% V_{DD}
Rise & Fall Times	20% to 80% V_{DD} = 4 ns max.
(10 TTL Loads)	0.5V to 2.5V = 6 ns max.
"0" Level	V_{SS} +0.5 Volt max.
"1" Level	V_{DD} −0.5 Volt min.

Note: Enable/Disable Function available.

SaRonix reserves the right to change all data without notice.

Scale: None (Dimensions in mm / inches)

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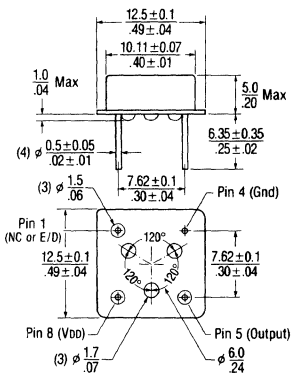
Nymph Products by SaRonix

Crystal Clock Oscillators



NCC/NCH Series (CMOS/HCMOS) Half Size Package

Frequency Range:
- CMOS . . . . . 250 kHz to 24.0000 MHz
- HCMOS . . . . . 1.8432 MHz to 50.0000 MHz

Frequency Stability . . . . . ±0.0025% to ±0.05% (over all conditions)

Temperature Range:
- Operating . . . . . 0 to +70°C
- Storage . . . . . −55 to +125°C

Input Voltage . . . . . +5VDC ±10%

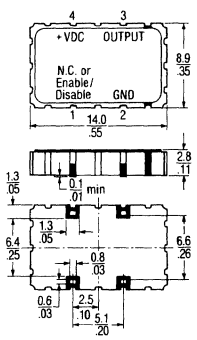
Input Current:
- CMOS . . . . . 2 to 8.5 mA typical (frequency dependent)
- HCMOS . . . . . 10 mA typical to 24 MHz; 20 mA typical over 24 MHz

Symmetry:
- CMOS . . . . . 50% ±10% max.
- HCMOS . . . . . 50% ±5% max.

Rise & Fall Times:
- CMOS (1 TTL) . . . . . 20% to 80% V_{DD} = 12 ns max. 0.5V to 2.5V = 8 ns max.
- HCMOS (10 TTL) . . . . 20% to 80% V_{DD} = 4 ns max. 0.5V to 2.5V = 6 ns max.

"0" Level . . . . . V_{SS} +0.5 Volt max.

"1" Level . . . . . V_{DD} −0.5 Volt min.



NCH Series (HCMOS) SMD Equivalent to Motorola MSO Series

Frequency Range: . . . . . 100 kHz to 35 MHz

Frequency Stability: . . . . . ±0.005% to ±0.050% (over all conditions)

Temperature Range:
- Operating . . . . . 0 to +70°C (Industrial); −40 to +85°C (Military)
- Storage . . . . . −55 to +125°C

Input Voltage . . . . . +5VDC ±10%

Input Current . . . . . 8 mA at 1 MHz

(typical when C_L = 15 pF) 20 mA at 30 MHz

Rise & Fall Times: . . . . . 20% to 80% V_{CC}:

(when C_L = 15 pF) T_r = 8 ns max., T_f = 7 ns max. 0.5 to 2.5V: T_r & T_f = 6 ns max., each

Start Up Time: . . . . . ≤5 ns typical

Note: Enable/Disable Function available.

A crystal controlled hybrid clock oscillator with two independent frequency outputs in one package. This device allows for a choice of any two exact frequencies to drive CMOS, HCMOS, TTL or any combination. Each unit contains an internal by-pass supply capacitor which minimizes "cross-talk" and RFI.

NPC Series (Dual Independent Output)

Frequency Range:
- CMOS . . . . . 250 kHz to 24 MHz
- HCMOS . . . . . 2 MHz to 24 MHz

Frequency Stability . . . . ±0.0025% to ±0.05% (over all conditions)

Temperature Range:
- Operating . . . . . 0 to +70°C
- Storage . . . . . −55 to +125°C

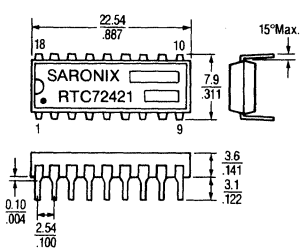
Input Voltage:
- CMOS Rated . . . . . +5VDC ±10%
- CMOS Operating . . . . +3VDC min., +7VDC max.
- HCMOS Rated . . . . . +5VDC ±10%
- HCMOS Operating . . +4VDC min., +7VDC max.

Input Current:
- CMOS . . . . . 8 mA max. @ 25°C, 4 mA typ.
- CMOS . . . . . 10 mA max. over oper. temp.
- HCMOS . . . . . 15 mA max. @ 25°C, 10 mA typ.
- HCMOS . . . . . 20 mA max. over oper. temp.

Symmetry:
- CMOS . . . . . 50% ±10% at 50% V_{DD}
- HCMOS . . . . . 50% ±5% at 50% V_{DD}

Rise & Fall Times:
- CMOS . . . . . 20% to 80% V_{DD}: (1 TTL Load) T_r = 10 ns max., T_f = 7 ns max. 0.5 to 2.5V: T_r & T_f = 6 ns max., each
- HCMOS . . . . . 20% to 80% V_{DD}: (10 TTL Loads) T_r & T_f = 4 ns max., each 0.5 to 2.5V: T_r = 6 ns max., T_f = 4 ns max.

RTC 72421



Scale: None (Dimensions in mm / inches)

RTC Series (Real Time Clock) RTC 72421

- Built in 32.768 kHz quartz crystal
- Low power CMOS IC with backup function
- Built in time and date
- 30 second error adjustment feature
- Automatic leap year selection
- Direct bus-compatibility (120 ns access time)
- Standard 18-pin DIP package

SaRonix reserves the right to change all data without notice.

..SaRonix..... Palo Alto, California 94303
(415) 856-6900 • (800) 227-8974 • (800) 422-3355 (CA)

Nymph Products by SaRonix

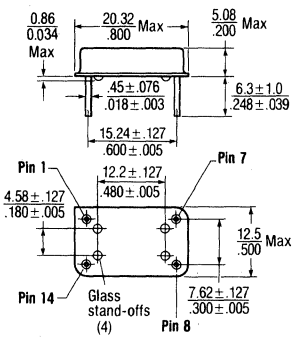
Crystal Clock Oscillators

A crystal controlled hybrid oscillator circuit providing precise rise and fall times to drive ECL devices. Unit is packaged in a 14-pin DIP compatible, resistance welded, all metal case. Options include Internal Termination, Open Emitter Output, Complementary Output, and Positive Logic.

NCK/NCE Series (ECL)

Frequency Range:	
10 k Family	5.0 MHz to 140 MHz
10 kH Family	50 MHz to 200 MHz
Frequency Stability	±0.0025% to ±0.05% (over all conditions)
Temperature Range:	
Operating	0 to +70°C
Storage	−55 to +125°C
Input Voltage	−5.2V ±5%
Input Current	40 mA typical
Rise & Fall Times:	
10 k Family	1.0 ns typical
10 kH Family	1.5 ns typical
Symmetry	50% ±10% at V_{BB}

The S1149 Series of ECL "clocks" offers a wide variety of output conditions and pin outs. This series is a direct equivalent to the Motorola K1149 family of ECL devices.



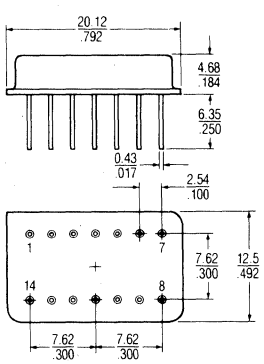
S1149 Series (ECL) Equivalent to Motorola K1149 Series

Frequency Range:	
10 k Family	5.0 MHz to 140 MHz
10 kH Family	50 MHz to 160 MHz
Frequency Stability	±0.0025% to ±1.00% (over all conditions)
Temperature Range:	
Operating	0 to +70°C
Storage	−55 to +125°C
Input Voltage	−5.2V ±5%
Input Current	40 mA typical
Rise & Fall Times:	
10 k Family	1.0 ns typical
10 kH Family	1.5 ns typical
Symmetry	50% ±10% at V_{BB}

Part Numbering and Pin Assignment Guide

	S1149AA	S1149AB	S1149AC	S1149AM	S1149BA	S1149BC	S1149BM
Pin 1	GND	GND	N.C.	N.C.	ECL comp out	ECL comp out	ECL comp out
Pin 7	V_{EE}	V_{CC}	V_{EE}	GND	GND	V_{EE}	GND
Pin 8	ECL out	ECL out	ECL out	ECL out	ECL out	ECL out	ECL out
Pin 14	V_{CC}	V_{EE}	GND	V_{EE}	V_{CC}	GND	V_{EE}

A multiple output crystal oscillator combining an AT cut crystal and CMOS IC circuitry in a standard 14-pin DIP package. The unit has a primary output between 10 and 20 MHz and an auxiliary divider system providing outputs of 1/2, 1/4, 1/8 and 1/16 of the primary frequency. Pin 7 is grounded to the case to reduce RFI.



Scale: None (Dimensions in mm / inches)

NCM Series (Multiple Output)

Frequency Range	250 kHz to 20 MHz
Frequency Stability	±0.010% over oper. temp. and voltage
Temperature Range:	
Operating	−10 to +70°C
Storage	−30 to +80°C
Input Voltage:	
Rated	+5VDC ±10%
Operating	+4VDC to +7VDC
Input Current	10 mA max. at 25°C, 4 mA typical 15 mA max. over oper. temp.
Symmetry	50% ±10% at 50% V_{DD}
Rise & Fall Times (1 TTL)	20% V_{DD} to 80% V_{DD} = 15 ns max. 0.4V to 2.4V = 6 ns max.
"0" Level	V_{SS} + 0.5V max.
"1" Level	V_{DD} − 0.5V min.

Output Frequencies (in MHz)

Base Frequency	Output Dividing Ratios 1/1	1/2	1/4	1/8	1/16
10.0000	10.0000	5.0000	2.5000	1.2500	0.6250
12.0000	12.0000	6.0000	3.0000	1.5000	0.7500
12.2880	12.2880	6.1440	3.0720	1.5360	0.7680
14.31818	14.31818	7.15909	3.579545	1.789773	0.894886
16.0000	16.0000	8.0000	4.0000	2.0000	1.0000
17.734476	17.734476	8.867238	4.433619	2.216810	1.108405
18.4320	18.4320	9.2160	4.6080	2.3040	1.1620
19.6608	19.6608	9.8304	4.9152	2.4576	1.2288
20.0000	20.0000	10.0000	5.0000	2.5000	1.2500

SaRonix reserves the right to change all data without notice.

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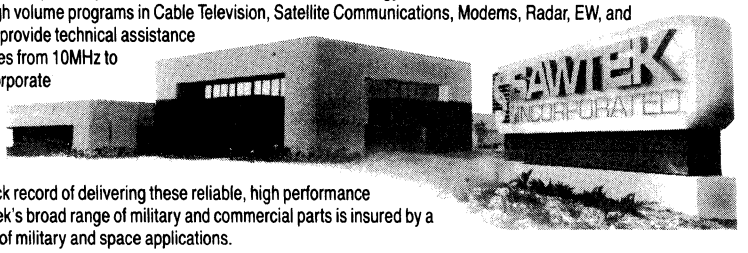
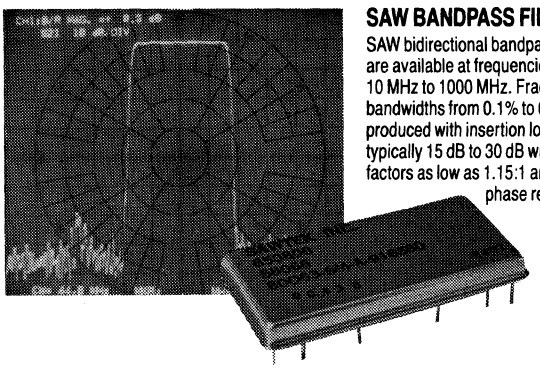
SURFACE ACOUSTIC WAVE TECHNOLOGY

provides performance advantages and design flexibility that have proven invaluable to engineers in need of reliable, reproducible components featuring linear phase, temperature stability, small size, or other SAW characteristics. Increasingly, SAW technology is meeting the exacting requirements of modern systems with high performance bandpass filters, resonator products, delay lines, and other state-of-the-art signal processing components. Sawtek offers the industry's broadest product line and provides the total engineering support needed to make the proper design trade-offs among key parameters in order to achieve the optimum performance available from SAW technology.

Sawtek produces hundreds of standard SAW products for both low and high volume programs in Cable Television, Satellite Communications, Modems, Radar, EW, and many other applications. In addition, Sawtek's custom design capability can provide technical assistance and rapid response to new design and production requirements at frequencies from 10MHz to more than 1GHz. Sawtek also designs and produces subsystems which incorporate SAW components. These include filter banks comprised of cascaded filters packaged in a single assembly, SAW resonator-controlled oscillators, and ovenized components.

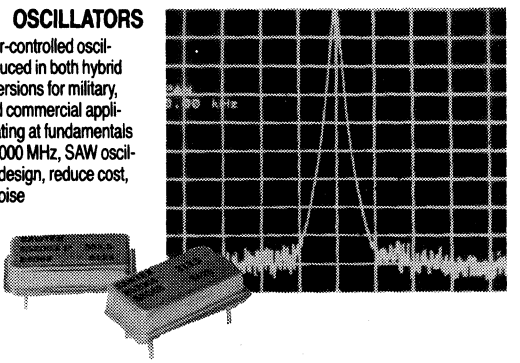


Sawtek maintains a leadership role in SAW technology through the development and production of superior SAW components and a proven track record of delivering these reliable, high performance products on time and at a very competitive price. Product reliability for Sawtek's broad range of military and commercial parts is insured by a watchful quality control program that meets even the exacting requirements of military and space applications.



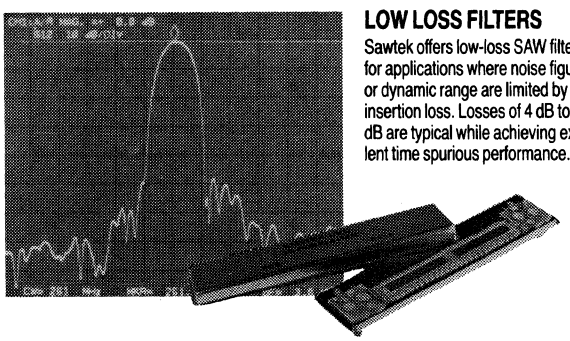
SAW BANDPASS FILTERS

SAW bidirectional bandpass filters are available at frequencies from 10 MHz to 1000 MHz. Fractional bandwidths from 0.1% to 65% are produced with insertion loss that is typically 15 dB to 30 dB with shape factors as low as 1.15:1 and linear phase response.



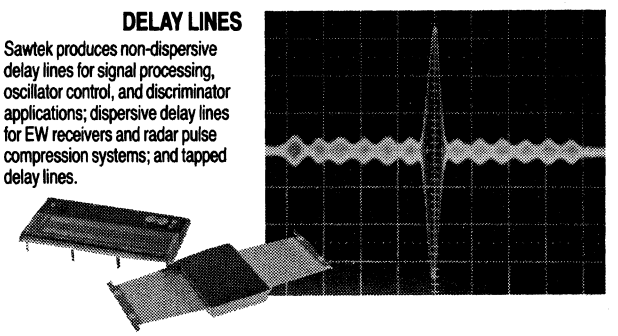
OSCILLATORS

SAW resonator-controlled oscillators are produced in both hybrid and discrete versions for military, aerospace and commercial applications. Operating at fundamentals to more than 1000 MHz, SAW oscillators simplify design, reduce cost, and improve noise performance through the elimination of multiplier stages.



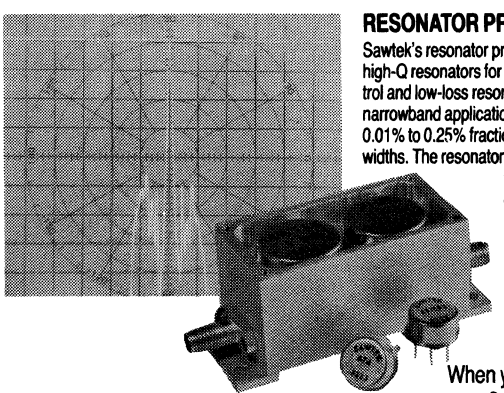
LOW LOSS FILTERS

Sawtek offers low-loss SAW filters for applications where noise figure or dynamic range are limited by filter insertion loss. Losses of 4 dB to 10 dB are typical while achieving excellent time spurious performance.



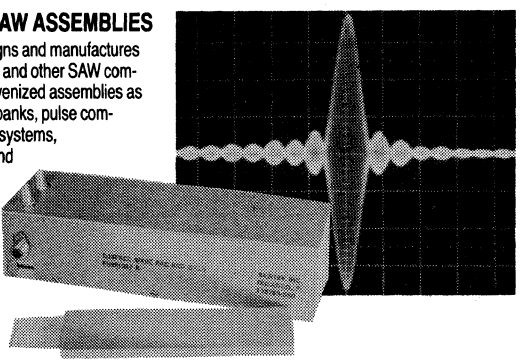
DELAY LINES

Sawtek produces non-dispersive delay lines for signal processing, oscillator control, and discriminator applications; dispersive delay lines for EW receivers and radar pulse compression systems; and tapped delay lines.



RESONATOR PRODUCTS

Sawtek's resonator products include high-Q resonators for oscillator control and low-loss resonator filters for narrowband applications requiring 0.01% to 0.25% fractional bandwidths. The resonator filters are provided in individual two-pole stages and in custom modules.



SAW ASSEMBLIES

Sawtek designs and manufactures RAC devices and other SAW components in ovenized assemblies as well as filter banks, pulse compression subsystems, oscillators, and specialized signal processing modules.

When your system demands the advantages of SAW Technology...Demand Sawtek.

SAWTEK INCORPORATED

Post Office Box 609501 • Orlando, Florida 32860-9501
(407) 886-8860

Seiko Instruments

TIGHT TOLERANCE CRYSTALS/OSCILLATORS

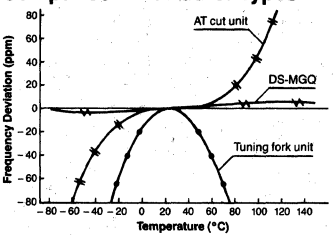
DS-MGQ SERIES

Standard Specifications

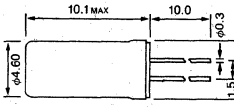
- ☐ *Frequency Range:* 1.0MHz to 3.0MHz
- ☐ *Frequency Temperature Stability:* Down to ±2.5ppm
- ☐ *Operating Temperature:* −30°C to +70°C
- ☐ *Series Resistance:* 35Ω to 120Ω Typical
- ☐ *Aging:* ±1ppm (1st year)
- ☐ Extremely Shock Resistant

*Frequency Dependent

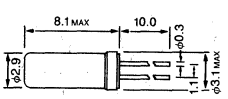
Comparison with Other Types



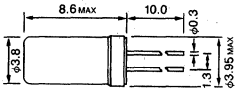
DS-MGQ460



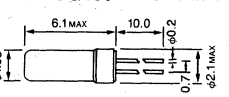
DS-MGQ308



DS-MGQ388



DS-MGQ206 Unit: mm



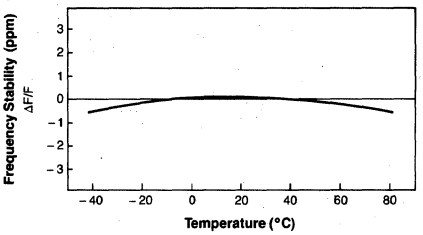
MGX0 SERIES OSCILLATORS

- ☐ 14 Pin DIP Compatible
- ☐ TCX0 Specs/Low Power
- ☐ Extremely Shock Resistant

The DS-MGX0 series oscillators use miniature GT cut crystal units (DS-MGQ) developed by SEIKO INSTRUMENTS. Their excellent frequency temperature characteristics (down to +2.5ppm over temperature) make the DS-MGX0 ideal for applications, such as cellular telephones to facsimile machines and computer designs.

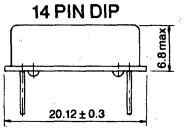
The DS-MGX0 incorporates precision electrical adjustable capacitance (PEAC) elements verses the use of trimmer capacitors. PEACs are floating gate semiconductor elements that can vary internal capacitance by applying voltage to pin #1 (#3 for SM model). When not adjusting frequency, voltage can be removed and the PEAC maintains the capacitance setting. The PEAC coupled with the excellent temperature characteristics of the DS-MGQ enable +2.5ppm temperature stability over a wide temperature range.

Characteristics

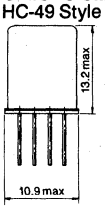


NEW

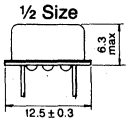
DS-MGX0-68
14 PIN DIP



DS-MGX0-SM
HC-49 Style



DS-MGXO-DM
½ Size



Standard Specifications Unit: mm

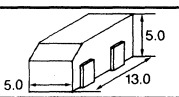
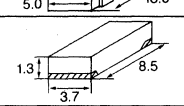
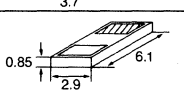
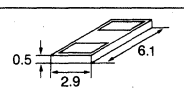
Items	A	B	C	D	E
Oscillation Frequency	0.5 Hz ~ 3 MHz				
Frequency Stability (at room temperature)	±2 ppm	± 3ppm	± 5 ppm	±10 ppm	± 20 ppm
Frequency Temperature Stability (−20°C ~ +70°C)	±5 ppm	±10 ppm	±25 ppm	±50 ppm	±100 ppm
Aging (first year)	±2 ppm/First Year				
Power Supply Voltage	DC 5.0V ± 0.5V				
Current Consumption	Max. 200μA (3mA in MHz range)				
Output Current	0.2mA (3mA in MHz range)				
Output Waveform	Square wave duty ratio 50% ± 10%				
Rise and Fall Time	Max. 100ns				
Operating Temperature Range	−20°C ~ +70°C				

SURFACE MOUNT

SURFACE MOUNT CRYSTALS

Seiko Instruments supplies a full range of surface mount crystals to meet your design needs. Our surface mount line covers frequencies from 32KHz to 20MHz. Offering one of the most extensive SM crystal lines in the industry.

NEW

Item	Dimension (mm)	Frequency Range
SMC-3		4.0MHz ~ 25MHz
SMA		4.19MHz ~ 20MHz
SMG		1.536MHz ~ 3.0MHz
SMC		32.768KHz ~ 1.53MHz
SMT		32.768KHz ~ 200KHz

SURFACE MOUNT OSCILLATORS

SM0-100

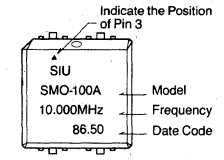
- ☐ 28 PCCC Compatible

Parameter	Specification
Frequency	4–20MHz
Frequency Stability	±10 ppm
Operating Temperature Range	0– +70°C
Power Supply Voltage	3–6 Volts
Current Consumption*	4 mA MAX

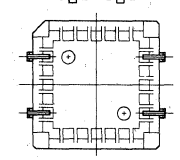
Parameter	Specification
Output Load	2 TTL (10 TTL avail. @ higher current)
Output Waveform** (Square wave duty ratio)	60/40 (45/55 available)
Rise and Fall Time	10 ns MAX
Storage Temperature Range	−30– +80°C

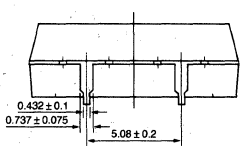
*V_{DD} = 5V **V_{DD}/2 Temp = 25°C

NEW



Pin No.
3: NC
13: V_{SS}
17: Output
27: V_{DD}





Seiko Instruments USA. Inc.. Electronic Components Division. 2990 W. Lomita Blvd.. Torrance. CA 90505 (213) 517-7770 FAX: (213) 517-7792

Spectrum Technology inc
a DATUM company

TEL: (805) 964-7791
FAX: (805) 683-3481
TWX: 910 334-1163

Spectrum Technology specializes in the design and manufacture of high reliability and QPL crystal controlled oscillators. Applications include communications and dedicated computer systems for Defense, Aerospace and Commercial systems.

SPECTRUM** offers a full line of **FREQUENCY CONTROL DEVICES...

QPL LOGIC	**TCVCXO**	**OCXO**	**LOGIC CLOCKS**
QPL TCXO	**TCXO**	**VCXO**	**HYBRID OSCILLATOR**

SPECTRUM MANUFACTURING CAPABILITIES...

PACKAGE CONFIGURATIONS	ENVIRONMENTAL	ELECTRICAL
* PC BOARD	* AEROSPACE	* TTL-HCMOS-CMOS
* LCC	* M55310	* ECL-NMOS
* FLATPACK	* CLASS B & S SCREENING	* SINEWAVE
* SURFACE MOUNT	* RUGGEDIZED DESIGNS	* 1 Hz to125 MHz
* LOW PROFILE	* RADIATION HARDENING	* STABILITIES to ±0.3 ppm

CUSTOM DESIGN CAPABILITIES...

Spectrum welcomes new product design inquiries.
Call our Sales Application Engineers at: (805) - 964-7791

SAVE TIME... FAX YOUR SPECIFICATIONS (805)-683-3481

TCXO TCVCXO VCXO

Spectrum Technology's advanced computer test and compensation system allows Spectrum to achieve stabilities to ±0.5 PPM in high volume production.

TYPICAL STABILITIES

±0.3 ppm	+15 to +35 °C
±0.5 ppm	0 to +55 °C
±1.0 ppm	- 20 to +70 °C
±2.0 ppm	- 40 to +85 °C
±4.0 ppm	- 55 to +105 °C

VCXO and TCVCXO designs are available from ±2 ppm to ±200 ppm (to 20 MHz) deviation.

Frequency range: 1.0 Hz to 125.0 MHz
Outputs: TTL HCMOS CMOS ECL SINEWAVE
Aging: 1.0 ppm/year standard
0.5 ppm/year available

QPL OSCILLATORS

Spectrum Technology is a
QUALIFIED SUPPLIER TO MIL-0-55310

/04 to /07	TCXO's
/08 to /12	Hybrid Logic Clocks
/14 to /19	Hybrid Logic Clocks
/20 & /21	Are pending certification. Spectrum PN 7120 & 7121 are immediately available as NON QPL equivalents.

COMMON FREQUENCIES NORMALLY IN STOCK

OCXO

OVEN CONTROLLED CRYSTAL OSCILLATORS

Spectrum Technology manufactures OCXO's and VCOCXO's for applications requiring stabilities better than ±0.3 ppm vs. temperature.

Frequency range: 1.0 Hz to 100.00 MHz

LOW POWER package sizes from 2.0" x 2.0" x .8"

Typical PRECISION FREQUENCY STANDARD specs
STI PN 8000-026

Frequency:	10.0 MHz
Stability/day:	$\pm 1.0 \times 10^{-8}$
Operating temp:	0 to + 60 °C
Power:	8 watts max.
Package:	2.0" x 2.0" x 4.0"

HYBRID LOGIC CLOCKS

Spectrum manufactures a full line of AEROSPACE, HIGH RELIABILITY & COMMERCIAL Hybrid Oscillators.

Standard outputs: TTL HCMOS CMOS NMOS
ECL SINEWAVE

Standard Packages:
* 14 PIN DIP
* LCC Leadless Chip Carrier
* FLATPACK
* TO-5 and TO-8

Standard frequency range: .01 Hz to 65.0 MHz.

Stabilities to: ±50 ppm -55 to +125 °C
±30 ppm -20 to +70 °C

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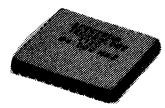
Spectrum Technology Inc
a DATUM company

QPL TO

Spectrum Technology is a QUALIFIED SUPPLIER of Crystal Oscillators to the MIL-O-55310 specifications listed below. These can be screened to Class S, B, or C.



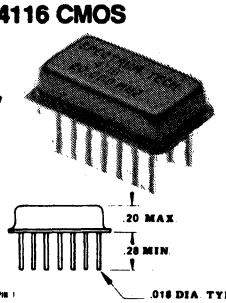
Spectrum has many standard TCXO and Hybrid Logic Clock designs; modifications and custom designs are available. Hybrids can be produced with TTL, CMOS, HCMOS, NMOS, ECL or Sinewave outputs.

SERIES STI PN	M55310/xx	Package Type (9)	Frequency Range
5004	/04	1.5 x 1.5 x .5" h.	750 KHz, 10 MHz
5005	/05	2 x 2 x .7" h.	1 MHz, 10 MHz
5006	/06	1.55 x 1.015 x .7" h.	15.7 KHz, 10 MHz
5007	/07	2 x 2 x .7" h.	10 MHz, 90 MHz
7116	/08	14-pin DIP, .2" h.	50Hz, 50 MHz
7150	/09	TO-5	400 KHZ, 60 MHz
7181	/10	TO-8	1KHz, 60 MHz
4116	/11	14-pin DIP, .4" h.	.05 MHz, 10 MHz
4150	/12	TO-5	.05 MHz, 10 MHz
7116	/14	14-pin DIP, .2" h.	.1 Hz, 25 MHz
4116	/15	14-pin DIP, .2" h.	.01 Hz, 10 MHz
7116	/16	14-pin DIP, .2" h.	.1 Hz, 60 MHz
7116	/17	14-pin DIP, .2" h.	250 KHz, 50 MHz
4116	/18	14-pin DIP, .2" h.	.01 Hz, 15 MHz
7110	/19	40-pin LCC, .085" h.	1.0 MHz, 60 MHz
7120		44-pin LCC, .085" h.	40 KHz, 70 MHz
7121		20-pin FLATPACK, .12" h	1.0 MHz, 60 MHz

NOTES: STABILITY OPTIONS	(1)	(2)	(3)	(4)
A: -55 to +125 °C	±50 or 100 ppm	±100 or 200 ppm	±50 ppm	±100ppm
B: -55 to +105 °C	±40 or 80 ppm	±75 or 150 ppm	±40 ppm	±70 ppm
C: -20 to + 70 °C	±25 or 60 ppm	±50 or 100ppm	±25 ppm	±55 ppm

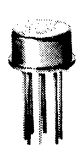
SERIES: 7116 TTL
4116 CMOS

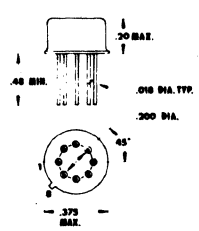
FEATURES:
* High Reliability
* Low Profile
* DIP Mounting
* 0.015 Hz to 65 MHz



SERIES: 7150 TTL
4150 CMOS

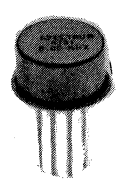
FEATURES:
* High Reliability
* TO-5 package
* Low Profile
* Resistance Weld
* 3.5 Hz to 65 MHz

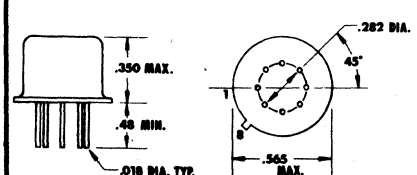




SERIES: 7181 TTL
4181 CMOS

FEATURES:
* High Reliability
* TO-8 package
* Low Profile
* Resistance Weld
* 3.5 Hz to 65 MHz





M55310

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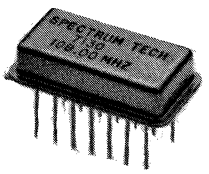
FAX: (805) 683-3481
TWX: 910 334-1163

Spectrum Technology's Hybrid Logic Clock Oscillators are produced with THICK FILM hybrid circuits and integrally mounted crystals in hermetically sealed 14 PIN DIP, TO-5 or TO-8 packages: LCC and FLATPACK designs are seam welded.

These proven designs provide a mechanically rugged package for HIGH RELIABILITY, LOW AGING applications in military, aerospace and high reliability commercial systems.



7130 ECL

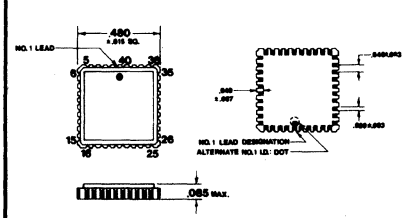
Stability Option	Output Type	Out	Pin Numbers		
			Case	B-	B+
(5)	CMOS	1	4	3	2
(5)	TTL	1	4	3	2
(6)	TTL	1	4	3	2
(7)	SINE	3	4	5	1
(3)	TTL	1	2	8	14
(3)	TTL	5	4	4	8
(3)	TTL	5	4	4	8
(3)	CMOS	1	2	8	14
(4)	CMOS	5	4	4	8
(3)	TTL	5	7	7	4
(3)	CMOS	1	2	8	14
(1)	TTL	8	7	7	14
(1)	TTL	8	7	7	14
(1)	CMOS	8	7	7	14
(2)	TTL	39	-	31/37	4/10
(1)	TTL	42	-	34/40	6/12
(1)	TTL	11	10	10	13

(5) ±.5 ppm or ±10 ppm depending on supply voltage and temperature range. Contact STI for details.
(6) ±50 ppm from -65 to +85 °C. (7) ±1 to ±10 ppm depending on temperature range.

SERIES: 7110 TTL
4110 CMOS

FEATURES:

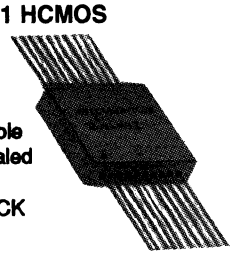
* High Reliabilty
* Minimum Size
* Surface Mountable
* Hermetically Sealed
* 600 Hz to 65 MHz

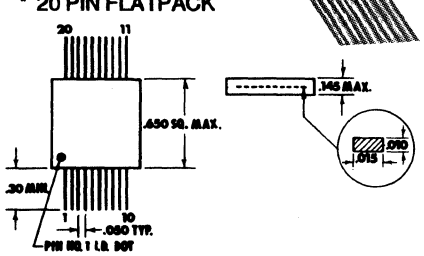


SERIES: 7121 TTL
4121 HCMOS

FEATURES:

* High Reliability
* Minimum Size
* Surface Mountable
* Hermetically Sealed
* 1.0 to 60.0 MHz
* 20 PIN FLATPACK

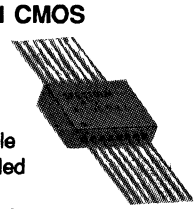


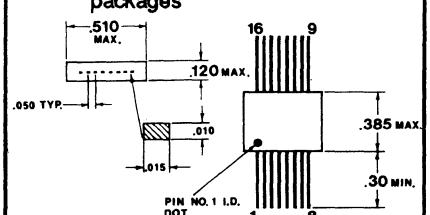


SERIES: 7111 TTL
4111 CMOS

FEATURES:

* High Reliability
* Minimum Size
* Surface Mountable
* Hermetically Sealed
* 3.5 Hz to 65 MHz
* 14, 16, 20 and 36 PIN packages





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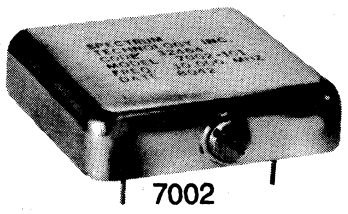
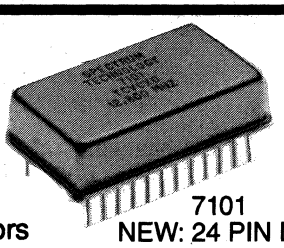


7002

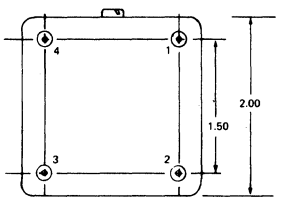
TCXO
TCVCXO

Temperature Compensated Crystal Oscillators



7101
NEW: 24 PIN DIP

SERIES 7002

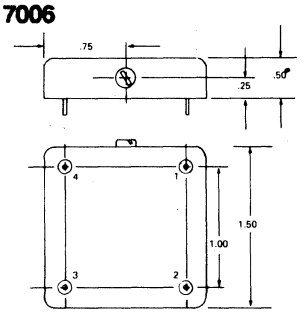


PIN
1 = B+
2 = B-
3 = NC
4 = OUT

TYPE = TCXO

Freq. range: 1Hz to 125 MHz
Output:TTL/HCMOS/CMOS/Sinewave
Stability: to ±0.3 ppm
Op. Temp: -55 to 105 °C
Environmental:
Commercial
Military
Aerospace

SERIES 7006

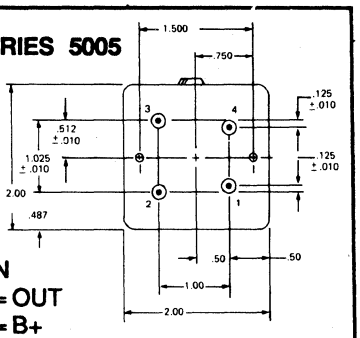


PIN
1 = B+
2 = B-
3 = NC
4 = OUT

TYPE = TCXO

Freq. range: 1 Hz. to 22 MHz
Output: TTL/HCMOS/CMOS/Sinewave
Stability: to ±0.5 ppm
Op. Temp: -55 to 105 °C

SERIES 5005



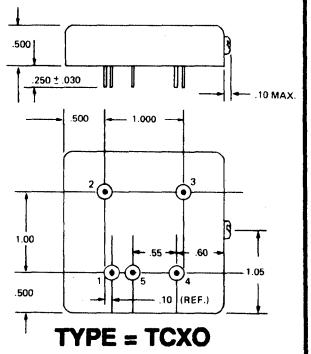
PIN
1 = OUT
2 = B+
3 = B-
4 = Case

TYPE = QPL TCXO
MIL-O-55310/05

Freq. Range: 1.0 to 10 MHz
Ouput: TTL
Stability: ±0.5 ppm to 0-50 °C
±5.0 ppm -55 to +85 °C

SAVE TIME... FAX YOUR SPECIFICATIONS (805)-683-3481

SERIES 7007

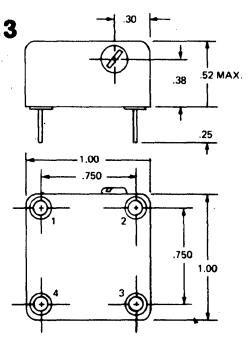


PIN
1 = OUT
2 = B+
3 = B-
4 = Case
5 = B-

TYPE = TCXO

Freq. Range: 1.0 to 75 MHz
Output:TTL/HCMOS/CMOS/
ECL/Sinewave
Stability: to ±0.3 ppm
Environmental
Commercial
Military
Aerospace

SERIES 7013

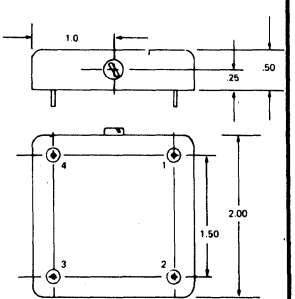


PIN
1 = B+
2 = B-
3 = NC
4 = OUT

TYPE = TCXO
1 INCH SQUARE

Freq. Range: 3.0 to 22.0 MHz
Ouput: HCMOS
Stability: to ±1.0 ppm
Voltage: +5.0 VDC
Package: 1.0 x 1.0 x 0.5"

SERIES 7009



PIN
1 = B+
2 = GND
3 = VC
4 = OUT

TYPE = TCVCXO

Freq. Range: 1.0 to 20.0 MHz
Output: TTL
Stability: ±1.0 ppm -40 to +85 °C
Deviation: 5 to 200 ppm
Linearity: 10 %

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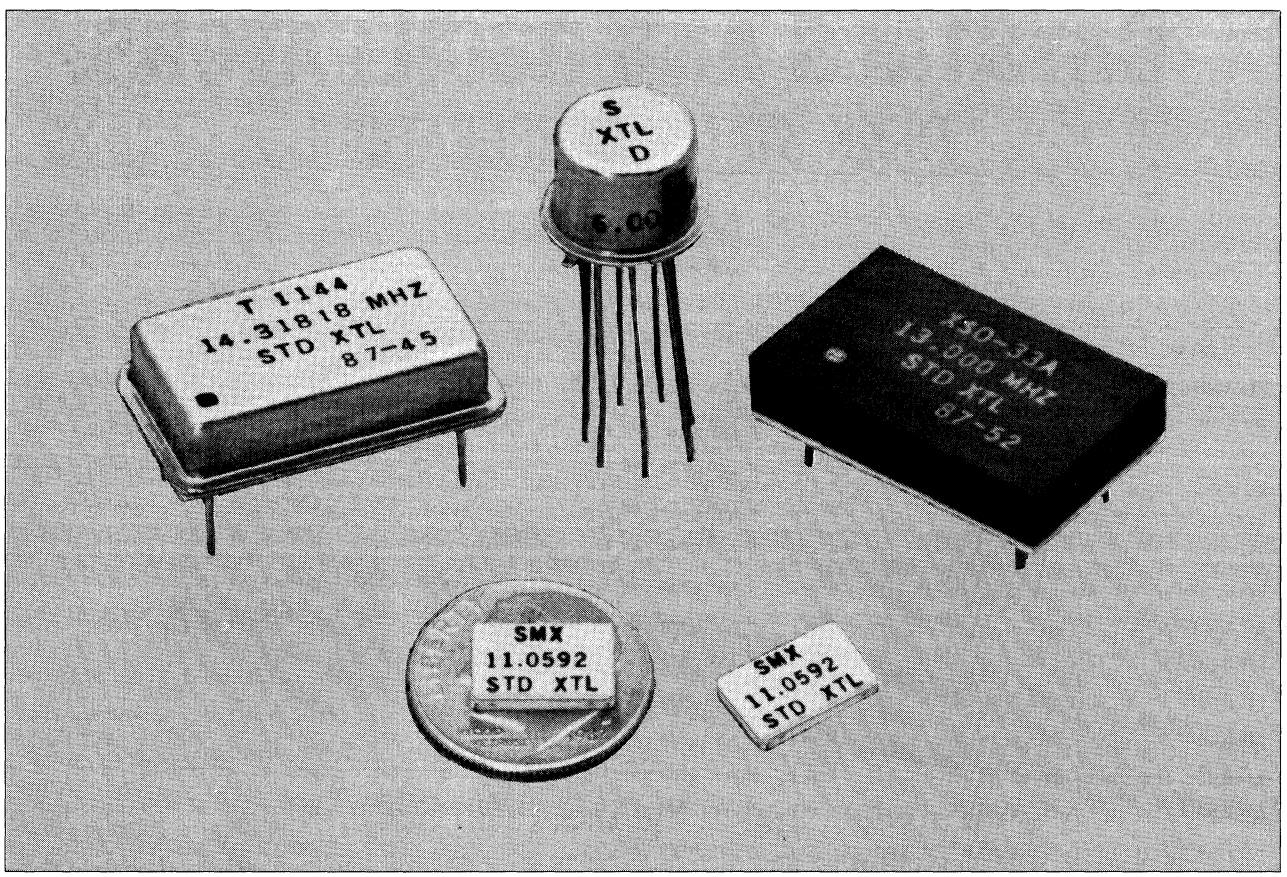
Crystals and Oscillators

the STANDARD of excellence.....



CRYSTAL BLANKS

We offer a full range of flat or contoured, finished or semi-finished quartz crystal blanks. These blanks are available with or without plated electrodes in any one of eight plating materials.

CRYSTALS

Our frequency range is one of the widest in the industry. From an audible frequency of 800 Hz all the way to 300 MHz. We offer these crystals mounted in a multitude of holders to fit almost any design application. From the tiny surface-mount package to the massive 8-pin octal holder. We also offer glass holders T-5½ and T-6½.

OSCILLATORS

Our oscillator product range covers the spectrum from 1 Hz to 200 MHz in the following types: VCXO, TTL, FAST TTL, CMOS, HIGHSPEED CMOS, LPO at 32.768 KHz and 25.600 KHz, ECL and CERAMIC TTL. Package is 14DIP with four leads.

STANDARD CRYSTAL CORPORATION

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Quartz Crystals and Crystal Oscillators

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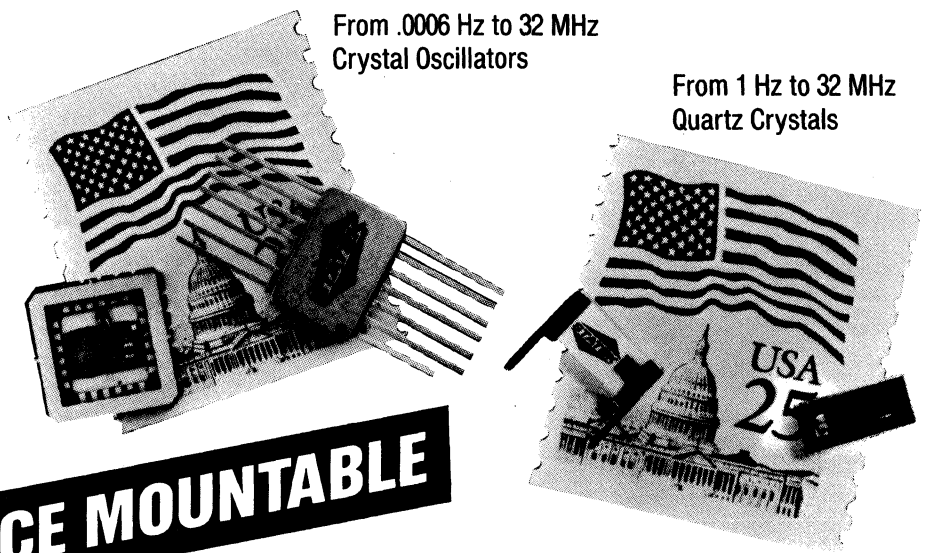
THINK STATEK CORPORATION!

From .0006 Hz to 32 MHz
Crystal Oscillators

From 1 Hz to 32 MHz
Quartz Crystals



SURFACE MOUNTABLE

LEADED

- Manufactured in the U.S. (with SPC)
- JIT delivery
- High shock resistance
- Low aging
- CMOS and TTL compatible
- Oscillators housed in standard 24-pin CLCC
- Low power consumption
- Tests to MIL Specs
- Custom packaging available

STATEK

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Miniature Surface Mountable AT Quartz Crystals

10 MHz to 32 MHz

Features

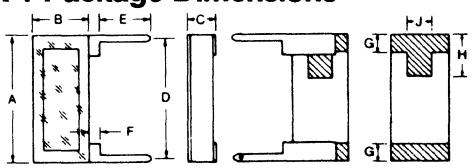
- ☐ Low-profile hermetically-sealed package
- ☐ High shock resistance
- ☐ Excellent aging characteristics
- ☐ Fundamental mode
- ☐ Full military testing available

Special Features

CX-1 — available without leads for hybrid epoxy mounting

CX-1-SM — designed for surface mount using infrared, vapor phase or wave solder

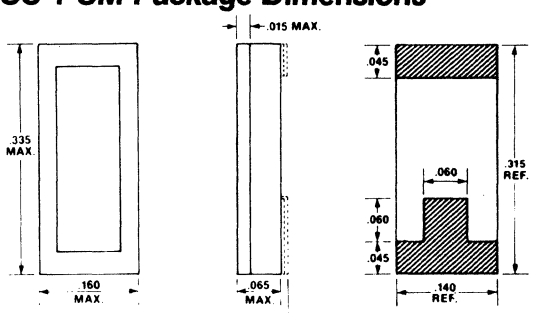
CX-1 Package Dimensions



DIM	IN	MM	NOTES
A	0.330	8.38	Max
B	0.155	3.94	Max
C	0.080	2.03	Max
D	0.300±0.01	7.62±0.25	
E	0.125	3.23	Min
F	0.040	1.02	Max
G	0.045	1.14	Nom
H	0.105	2.67	Nom
J	0.060	1.52	Nom

Leads 0.010" x 0.018" (0.25 x 46 mm) nom.

CS-1-SM Package Dimensions



NOTES:
1. DIM "A" is 0.075" MAX. on solder plated parts.
2. DIM "A" is 0.080" MAX. on solder dipped parts.
3. Plating is not drawn to scale.

Typical processes for surface mounting

CX-SM crystals

1) Vapor Phase	215°F or 253°C for 10 sec to 5 min.
2) Wave Solder	260°C for 10 sec
3) Infrared	
4) Conductive Epoxy	

Terminations

Designation	Termination
SM1	Gold Plated
SM2	Ni Sn Plated
SM3	Ni Sn Plated, Solder Dipped

Specifications

Specifications are typical at 25°C unless otherwise noted. Specifications subject to change without notice.

TYPICAL CRYSTAL PARAMETERS

	10 MHz	16 MHz	20 MHz
Motional Resistance R_1 (Ω)	70	20	15
Motional Capacitance C_1 (ff)	5.5	8.7	10
Quality Factor Q	35,000	57,000	54,000
Shunt Capacitance C_0 (pf)	2.5	2.7	3.4

Calibration Tolerance*	Calibration A: ±0.01% Calibration B: ±0.1% Calibration C: ±1.0%
Load Capacitance	20 pf (other available)
Drive Level	500 μW maximum
Frequency-Temperature Stability* **	±0.01% -20 to 70°C ±0.015% -40 to +85°C
Aging. first year	5 ppm
Shock. survival	1000g. 1 ms. 1/2 sine
Vibration. survival	20g rms. 10-2000 Hz random
Operating Temperature	-40 to +85°C
Storage Temperature	-55 to +85°C

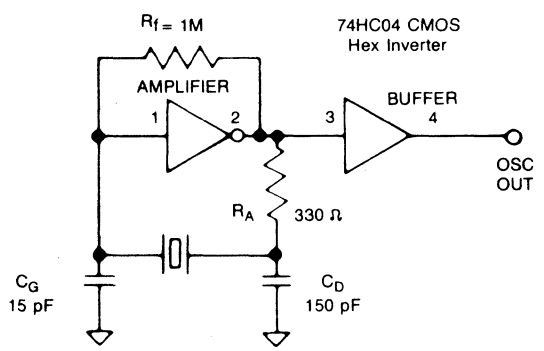
* Tighter tolerance available

** Does not include calibration tolerance.

Circuit Design

A conventional CMOS Pierce Oscillator is shown below. The crystal oscillates at a frequency f_O above the crystal's series-resonant frequency f_S. The crystal is effectively inductive and, in combination with R_A, C_D and C_G in the feedback loop, provides approximately 180° phase shift necessary to obtain oscillation. Typical component values for a Pierce Oscillator using a 16 MHz crystal with a 74HC04 hex inverter are shown below:

TYPICAL APPLICATON AS PIERCE OSCILLATOR
Using 74HC04 CMOS Hex Inverter at 5 VDC



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Miniature Low-Frequency Quartz Crystals

TABLE 3: CX Series Specifications 10 kHz to 2 MHz

Specifications are typical at 25°C unless otherwise noted.
Specifications subject to change without notice.

Frequency (see Table 4)[1]	10 kHz to 2 MHz*
Calibration Tolerance[2] (see Table 5)	A, B or C Tolerance
Motional Resistance, R_1	Figure 4
Maximum:	
10-169 kHz	2 x typical
170-600 kHz	2.5 x typical
600 kHz-2 MHz	
H Model	5 KΩ maximum
V Model	3 KΩ maximum
Motional Capacitance, C_1	Figure 5
Quality Factor, Q	Figure 6
Shunt Capacitance, C_0	
10-600 kHz	1.4 pf typical
600 kHz-2 MHz	1.0 pf typical
Drive Level	
10-25 kHz	
H Model	1.5 μw maximum
V Model	0.5 μw maximum
25-600 kHz	
H Model	3 μw maximum
V Model	1 μw maximum
600 kHz-2 MHz	
H Model	5 μw maximum
V Model	3 μw maximum
Turning Point, T_0	Figure 7
Temperature Coefficient, K	-0.035 (ppm/°C²)
Aging, first year	
10-600 kHz	5ppm maximum
600 kHz-2 MHz	10ppm maximum
Shock Survival	
10-600 kHz	1000g, 1ms, ½ sine
600 kHz-2 MHz	750g, 1ms, ½ sine
Vibration Survival	
10-600 kHz	20g rms, 10-2000 Hz
600 kHz-2 MHz	10g rms, 10-2000 Hz
Operating Temperature	
Industrial	-40 to +85°C
Military	-55 to +125°C
Storage Temperature	-55 to +125°C
Maximum Temperature[3]	
Lead/Package Junction	175°C
Lid Seal	210°C
Tuning Fork Flexure Mode	10-600 kHz
Extentional Mode	600 kHz-2 MHz

1. Frequency specified for Statek standard oscillator circuit. Tighter calibration tolerances available.
3. Higher temperature capabilities available in surface mountable crystals, see below.

*10-15.9 kHz not available in CX-2 case size.

TABLE 4: Standard Frequencies, CX Series

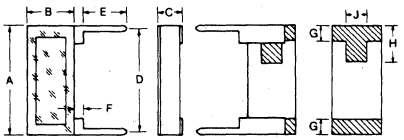
FREQUENCY	COMMON DIVISION	APPLICATION
10* kHz	10	1 kHz audio
12.8* kHz	2^8	50 Hz time base
15.36* kHz	2^8	60 Hz time base
16 kHz	2^4	1 kHz audio
16.384 kHz	2^{14}	1 Hz time base
18.641 kHz	2^{26}	1 cycle per hour
19.2 kHz	$2^{6,5,4}$	300, 600, 1200 baud modem
20.48 kHz	2^{12}	5 Hz clock motor
25 kHz	–	Ultrasonic alarm transducer
30.72 kHz	2^9	60 Hz time base
31.5 kHz	–	TV. raster
32.768 kHz	2^{15}	1 second time base
38.4 kHz	$2^{6,5,4}$	600, 1200, 2400 baud modem
40 kHz	–	Ultrasonic alarm transducer
40.96 kHz	2^{12}	10 Hz clock motor
60 kHz	–	WWVB PLL
76.8 kHz	$2^{6,5,4}$	1200, 2400, 4800 baud modem
100 kHz	–	Calibrator
153.6 kHz	$2^{6,5,4}$	2400, 4800, 9600 baud modem
240 kHz	2^7	Motor control
307.2 kHz	$2^{7,6,5}$	2400, 4800, 9600 baud modem
500 kHz	–	Microprocessor
1 MHz	–	Microprocessor
1.048576 MHz	2^{20}	Microprocessor, real time clock
1.2288 MHz	–	Microprocessor, baud rate generator
1.8432 MHz	–	Baud rate generator
2.0 MHz	–	Microprocessor
2.097152 MHz	2^{21}	Microprocessor, real time clock

*CX-1 only

TABLE 5: Calibration tolerances at 25°, CX Series

CALIBRATION	10-74.9 kHz	75-169 kHz	170-249 kHz	250-600 kHz	600 kHz-2 MHz
A	±0.003%	±0.005%	±0.01%	±0.02%	±0.05%
B	±0.01%	±0.01%	±0.02%	±0.05%	±0.1%
C	±0.1%	±0.1%	±0.2%	±0.5%	±1.0%

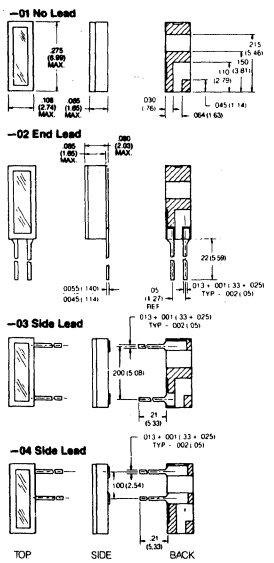
FIG 2A: Dimensions and case styles—CX-1 Series



DIM.	IN.	MM	NOTES
A	0.330	8.38	Max
B	0.155	3.94	Max
C	0.080	2.03	Max
D	0.300 ± 0.01	7.62 ± 0.25	
E	0.125	3.23	Min
F	0.040	1.02	Max
G	0.045	1.14	Nom
H	0.105	2.67	Nom
J	0.060	1.52	Nom

Leads 0.010" x 0.018" (0.25 x 0.46 mm) nom.

FIG 2 B: Dimensions and case styles—CX-2 Series



Surface Mountable Crystals and Oscillators

CX-1 and CX-2 Series crystals are available in higher-temperature leadless versions for surface mounting. SQXO-2 series oscillators are available in a 24-pin leadless ceramic chip carrier for surface mounting. Surface-mountable crystals are designated CX-1 (H or V)-SM or CX-2 (H or V)-SM, and surface-mountable oscillators are designated SQXO-2-SM or DQXO-3-SM.

All Statek surface-mountable devices are designed for use with vapor phase solder reflow processes and wave solder processes up to 260°C. See individual data sheets for specifications.

FIG 3: Equivalent circuit, CX Series

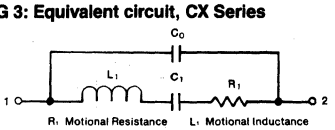


FIG. 4: Typical Motional Resistance R_1, CX Series

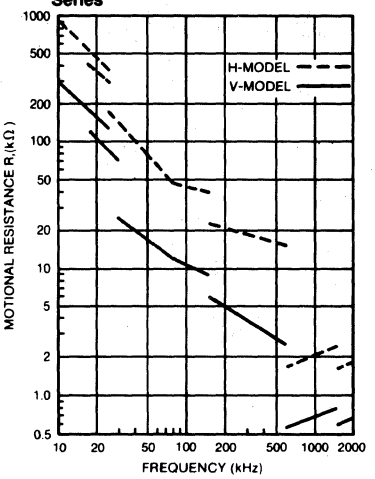


FIG. 5: Typical Motional Capacitance C_1, CX Series

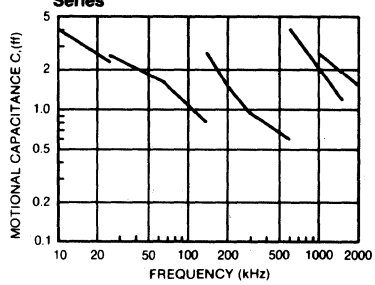


FIG. 6: Typical Quality Factor Q, CX Series

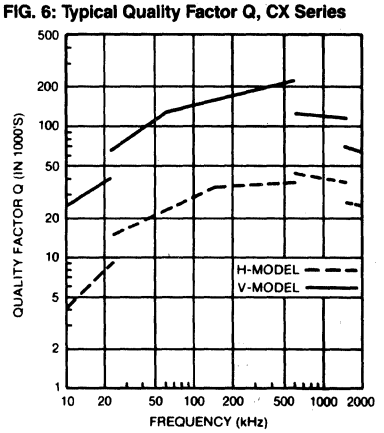
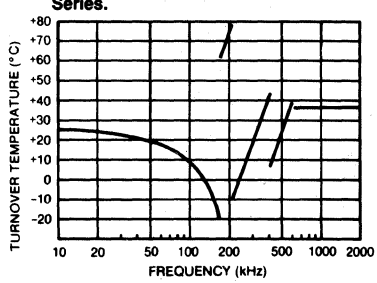


FIG. 7: Typical Turning Point Temperature, CX Series.



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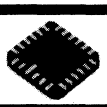
Surface Mountable Crystal Oscillators

1 Hz to 2 MHz



Actual size

Model SQXO-2-SM: 10 kHz to 2 MHz
Model DQXO-3-SM: 1 Hz to 10kHz

Features

Standard 24-pin ceramic leadless chip carrier

Designed for surface mounting using vapor phase solder reflow or wave solder

TTL and CMOS compatible

Low power consumption

High shock resistance

Full military testing available

Description

Statek surface-mountable crystal oscillators consist of a CMOS-compatible hybrid circuit and a miniature, low-frequency quartz crystal in a standard 24-pin ceramic leadless chip carrier. They are compatible with conventional vapor phase solder reflow and wave solder processing techniques and offer small size, low power consumption, high shock resistance and excellent long-term stability.

Specifications

Specifications are typical at 25°C unless otherwise noted.
Specifications are subject to change without notice.

Calibration tolerance	A: ±0.01% B: ±0.03%
Frequency stability	See Frequency Range Table below
Supply voltage	4 to 6 V
Frequency range	1 Hz to 2 MHz*
Supply current**	50µA at 1 Hz 200µA at 10 kHz 2mA at 2MHz
Operating Temperature	
Industrial	−40 to +85°C
Military	−55 to +125°C
Shock	
1 Hz to 600kHz	1000g, 1mS, 1/2 sine
600 kHz to 2 MHz	750G, 1 mS, 1/2 sine
Vibration	10g, 10 to 2000 Hz
Storage temperature	−55 to +125°C
Aging, first year	10 ppm maximum
Typical processes	
vapor phase	215°C or 253° C for 10 sec to 5 min
wave solder	260°C for 10 sec

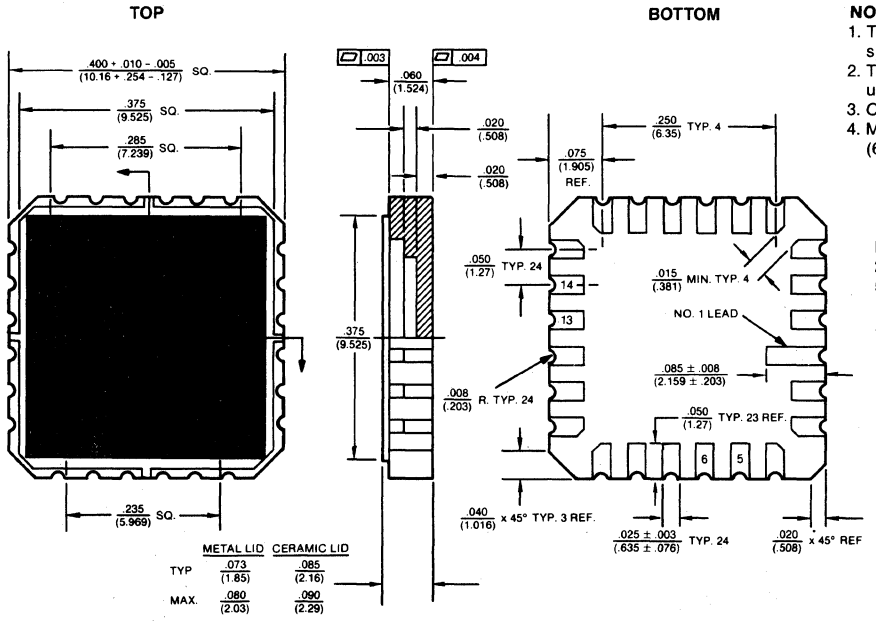
*Lower frequencies available, contact factory
**5V supply voltage; 10pr, 10 MΩload.

FREQUENCY RANGE	1 Hz-10 kHz	10-24.9 kHz	25-49.9 kHz	50-149.9 kHz	150-600 kHz	1-2 MHz
Frequency −55 to +125°C Stability* −40 to +85°C	−0.04% −0.025%	−0.04% −0.025%	−0.04% −0.025%	−0.07% −0.03%	−0.08% −0.06%	−0.04% −0.025%

*Does not include calibration tolerance. Positive variations small compared to negative variations.

Dimensions

Inch
(mm)



NOTES:
1. Tolerances ± 1%, NLT ±.005 (.127) unless otherwise specified.
2. Thickness tolerance ± 10%, NLT ± .003 (.0076) unless otherwise specified.
3. Ceramic material: AlSiMag* 777 (94% Al_2O_3).
4. Metalizing refractory metal + nickel + gold (60µ" thick minimum).

PIN CONNECTIONS:

23,24	Ground
5,6	V_{DD}
13,14	Output
All Others	Not Connected

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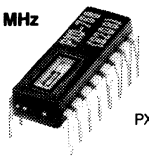
Low Frequency Crystal Oscillators

Programmable Crystal Oscillators

PXO Series
0.002 Hz to 2 MHz



PXO-768

Generates 57 discrete, programmable frequencies from a single crystal • Packaged in standard 16-pin DIP • Low power • Low aging • TTL compatible.

All frequencies generated are derived from a single built-in quartz crystal oscillator and exhibit the same high levels of accuracy and stability as those of the base frequency.

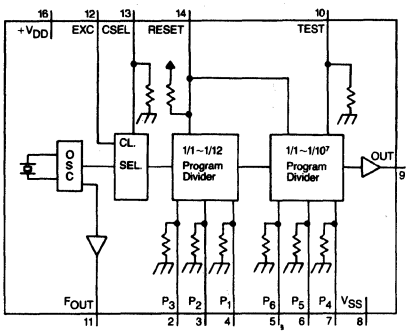
Standard calibration tolerance for PXO 32768,A: ±10 ppm, All others ±100 ppm. Tighter tolerances available • Frequency stability: ±0.015%*, -10 to +70°C • Supply voltage 4-6V • Supply current 1 mA max • Rise time: 70 nsec typ • Fall time: 30 nsec typ • Aging: 10 ppm max first year.
*Does not include calibration tolerance

Standard Frequency Ranges, PXO Series*

MODEL	BASE FREQUENCY	OUTPUT FREQUENCY RANGE
PXO-32768	327.68 kHz	0.00273 Hz to 327.68 kHz
PXO-600	600 kHz	0.005 Hz to 600 kHz
PXO-768	768 kHz	0.0064 Hz to 768 kHz
PXO-1000	1 MHz	0.0083 Hz to 1 MHz

*Other frequencies available. Consult factory.

Block Diagram, PXO Series



Output Frequencies, PXO Series

Example–Model PXO-1000
UNIT: Hz

PROGRAM PIN SETTINGS	P4	0	0	0	0	1	1	1	1
	P5	0	0	1	1	0	0	1	1
	P6	0	1	0	1	0	1	0	1
P1 P2 P3									
0 0 0		1M	100K	10K	1K	100	10	1	0.1
0 0 1		100K	10K	1K	100	10	1	0.1	0.01
0 1 0		500K	50K	5K	500	50	5	0.5	0.05
0 1 1		333.3̄K	33.3̄K	3.3̄K	333.3̄	33.3̄	3.3̄	0.33̄	0.033̄
1 0 0		250K	25K	2.5K	250	25	2.5	0.25	0.025
1 0 1		200K**	20K	2K	200	20	2	0.2	0.02
1 1 0		166.6̄K	16.6̄K	1.6̄K	166.6̄	16.6̄	1.6̄	0.16̄	0.016̄
1 1 1		83.3̄K	8.3̄K	833.3̄	83.3̄	8.3̄	0.83̄	0.083̄	0.008̄3̄

*33% duty cycle **40% duty cycle

Pin Functions, PXO Series

Prog 1 through Prog 6 control divide ratio of base frequency.

P_1	P_2	P_3	DIVIDING RATIO	P_4	P_5	P_6	DIVIDING RATIO
0	0	0	1/1	0	0	0	1/1
0	0	1	1/10	0	0	1	1/10
0	1	0	1/2	0	1	0	$1/10^2$
0	1	1	1/3	0	1	1	$1/10^3$
1	0	0	1/4	1	0	0	$1/10^4$
1	0	1	1/5	1	0	1	$1/10^5$
1	1	0	1/6	1	1	0	$1/10^6$
1	1	1	1/12	1	1	1	$1/10^7$

OUT: Supplies programmed output frequency with rectangular pulse shape (50% duty cycle).

TEST: Setting this terminal Hi multiplies programmed output frequency by 1,000, except when programmed divide ratio is less than 1/1000.

FOUT: Supplies base frequency of internal crystal oscillator.

EXC: Input for counting external clock instead of internal clock.

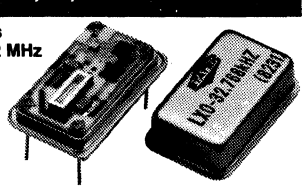
CSEL: Clock select. Setting this terminal Hi causes the divider to count the frequency of an external clock instead of the internal clock.

RESET: Setting this terminal Lo resets all counters and sets output switches to Lo.

(All inputs except EXC and RESET have internal pull-down resistor. RESET has pull-up resistor.)

High Accuracy Crystal Oscillators

LXO Series
10 kHz to 2 MHz

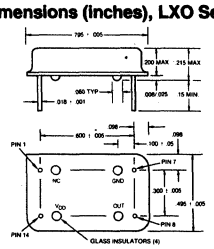


Laser tuned for high accuracy • Low aging • Low power • CMOS compatible • Low profile, hermetically-sealed package.

The LXO Series has the highest accuracy and stability of all Statek oscillators.
Specifications and characteristics of the LXO Series vary with frequency. Characteristics of the LXO-32.768 kHz model are presented below as an example. Contact factory for other frequencies.

Standard calibration tolerances: A: ±10 ppm; B: ±25 ppm; C: ±100 ppm. Tighter tolerances available • Frequency stability: -0.012%, -20 to +70°C* • Supply voltage: 3-6V • Rise time: 1.0 μsec max • Fall time: 1.0 μ sec max. • Supply current: 50 μA typical at 5V, 20 μA typical at 3V • Aging: 1 ppm/yr typical, 3 ppm max.
*Does not include calibration tolerance.

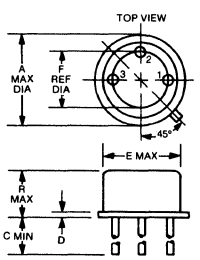
Package Dimensions (inches), LXO Series



Miniature Quartz Crystal Oscillators

Statek manufactures three series of oscillators in TO-5 packages: SQXO-2 Series, LQXO-4 Series and DQXO Series. They all have these features in common: Laser tuning for high accuracy • Hybrid construction • Low aging • Operating temperature: industrial –40 to +85°C; military: –55 to +125°C* • Shock (survival): 1 Hz to 600 kHz: 1000 g, 1mS, ½ sine; 600 kHz to 2 MHz: 750g, 1mS, ½ sine. Vibration (survival): 10g, 10 to 2000 Hz.

TO-5 Dimensions



PIN	CONNECTION	DIM	INCHES	MILLIMETERS
1	V_{DD}	A	0.380	9.19
2	Output	B	0.185	4.70
3	Gnd.	C	0.500	12.70
		D	0.029	0.74
		E	0.326	8.28
		F	0.200	5.08

1. All metal parts are gold plated.
2. Leads are 0.019″ (0.48mm) dia. max.

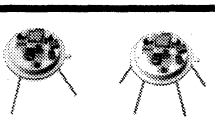
SQXO-2 Series
10 kHz to 2 MHz

TTL and CMOS compatible • Standard calibration tolerances: A: ±0.01%; B: ±0.03% • Frequency stability: ±0.02 typ., –40 to +85°C* • Supply voltage: 4-6V • Supply current: 200 uA-3mA • Standard frequencies: same as CX-1 crystals • Available in TO-5 or 24-pin leadless chip carrier. See SQXO-2-SM Data Sheet.
*Does not include calibration tolerance.

Low Power
LQXO-4 Series
10 kHz to 2 MHz

Low power • CMOS compatible • Standard calibration tolerance: A: ±0.01%, B: 0.03%, • Frequency stability: ±0.02% typ., –40 to +85°C** • Supply voltage: 4-6V • Supply current: 10 uA-1.5mA • Standard frequencies: same as CX-1 crystal.
*Does not include calibration tolerance.

Low Frequency
DQXO Series
0.0006 Hz to 10 kHz*



CMOS compatible • Low power • Standard calibration tolerances: A: ±0.01%; B: 0.03% • Frequency stability: ±0.02% typ., –40 to +85°C** • Supply voltage 4-6V • Supply current 10 uA to 3 mA • Available in 3-pin TO-5 (or 6-pin TO-5 for frequencies below 1 Hz) and 24-pin leadless chip carrier. See DQXO-SM Data Sheet.
*Lower frequencies available.
**Does not include calibration tolerance.

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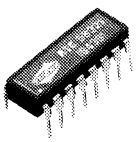
Low Frequency Crystal Oscillators

Real Time Clock Module

Model RTC-58321



Features

Built-in crystal oscillator
- eliminates need for external components
- eliminates design time
- reduces board space

Low current consumption
Low-voltage battery backup function
4-bit bidirectional multiplexed address/data bus
Counter start, stop and reset functions
12 or 24 hour format, automatic leap year selection
Standard 16-pin DIP, pin-compatible with MSM 58321RS

Surface Mountable Crystal Oscillators

Model SQXO-2-SM: 10 kHz to 2 MHz
Model DQXO-3-SM: 1 kHz to 10 kHz

Features

Standard 24-pin ceramic leadless chip carrier
Designed for surface mounting using vapor phase solder reflow or wave solder
TTL and CMOS compatible
Low power consumption
High shock resistance
Full military testing available

Description

Statek surface-mountable crystal oscillators consist of a CMOS-compatible hybrid circuit and a miniature, low-frequency quartz crystal in a standard 24-pin ceramic leadless chip carrier. They are compatible with conventional vapor phase solder reflow and wave solder processing techniques and offer small size, low power consumption, high shock resistance and excellent long-term stability.

Additional products and services available.

Products

Custom hybrid oscillators:
- ☐ very low current
- ☐ high/low voltages
- ☐ multiple outputs
- ☐ special packaging

High temperature oscillators - to 200°C
Ruggedized, high-shock crystals (15,000g and above)
Custom-designed quartz crystal sensors

Services

Full military testing
Circuit evaluation
Design assistance

Part Number Coding System

CRYSTAL OSCILLATORS

Part Number Code

Series: SQXO/LQXO/DQXO/LXO/PXO/RTC
Generation
Surface Mountable Designation when required
Frequency
Calibration Tolerance: A/B/C
Operating Temperature Range
I-Industrial -40 to +85°C
M-Military -55 to +125°C

SQXO-2 SM 12.8kHz (A/M)
LXO — 32.768kHz (A/I)
PXO — 1000
RTC — 58321

Standard Calibration Tolerances				
Calibration Tolerance		A	B	C
Product	Frequency			
PXO	32.768	±0.001%	—	—
	600kHz - 2MHz	±0.01%	—	—
LXO	32.768	±0.001%	±0.0025%	±0.01%
	10kHz - 74.9kHz	±0.003%	±0.01%	±0.1%
	75kHz - 169kHz	±0.005%	±0.01%	±0.1%
	170kHz - 2MHz	±0.01%	±0.05%	±0.1%
SQXO-2, LQXO-4	10kHz - 2MHz	±0.01%	±0.03%	—
SQXO-2-SM	10kHz - 2MHz	±0.01%	±0.03%	—
DQXO-3	1Hz - 10kHz	±0.01%	±0.03%	—
DQXO-3-SM	1Hz - 10kHz	±0.01%	±0.03%	—
RTC-58321		±0.005%	—	—

QUARTZ CRYSTALS

Part Number Code

Series: CX
Case Size: 1/2
Oscillator Type: H/V
Frequency
Calibration Tolerance: A/B/C
Lead Configuration, when required

CX - 1V - 01 32.768 kHz (A)

Standard Frequencies			
10 kHz*	20.48 kHz	40.96 kHz	500 kHs
12.8 kHz*	25 kHz	60 kHz	1 MHz
15.36 kHz*	30.72 kHz	76.8 kHz	1.048576 MHz
16 kHz	31.5 kHz	100 kHz	1.2288 MHz
16.384 kHz	32.768 kHz	153.6 kHz	1.8432 MHz
18.641 kHz	38.4 kHz	240 kHz	2 MHz
19.2 kHz	40 kHz	307.2 kHz	2.097152 MHz
*CX-1 only			11.0592 MHz

Calibration Tolerance			
Frequency	Calibration Tolerance		
	A	B	C
10 - 74.9 kHz	±0.003%	±0.01%	±0.1%
75 - 169 kHz	±0.005%	±0.01%	±0.1%
170 - 249 kHz	±0.01 %	±0.02%	±0.2%
250 - 600 kHz	±0.02 %	±0.05%	±0.5%
601 kHz - 2 MHz	±0.05 %	±0.1 %	±1.0%
10 MHz - 30 MHz	±0.01 %	±0.1 %	±1.0%

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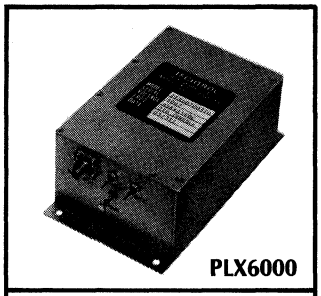
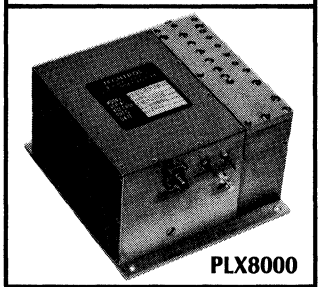
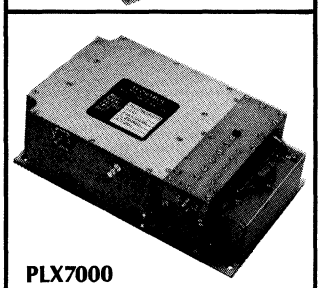
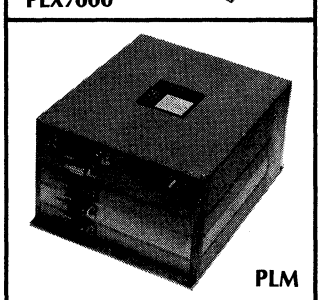
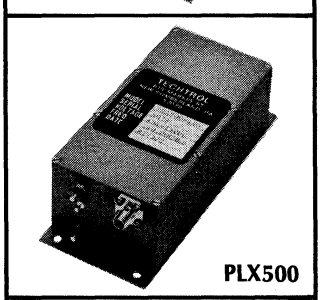
TCI TCI TCI TCI TCI TCI TCI TCI TCI TCI TCI TCI

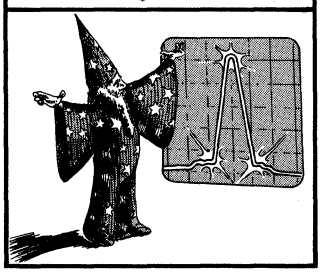

PLX6000


PLX8000


PLX7000


PLM


PLX500



SYNTHESIZERS

PLX6000 SERIES

FEATURES:

- Output Frequency Range 10 MHz thru 1GHz
- Exceptional Low Noise Performance (A OPTION)
- Compact and Rugged

STANDARD SPECIFICATIONS:

- Output Level: +10 dBm min.
- Input ref.: 5 MHz or 10 MHz Standard
- Input Level: 0 dBm ±3dB
- Coherent Spurious: −60 dBc (*−70 dBc)
- Sub-harmonics: −35 dBc (*−60 dBc)
- Harmonics: −25 dBc (*−55 dBc)
- Non-Coherent Spurious: −90 dBc
- Phase Noise: Per Quotation
- Operating Temperature: −20°C to +60°C #
- Supply Voltage: +15 VDC at 100 ma typical
  +5 VDC at 225 ma typical
  2% Regulation 10 mV Ripple
- Reverse Polarity and Over Voltage Protection
- Size 4.0″ x 2.75″ x 1.85″

*Optional Limit
#Optional Temperature ranges are available

PLX8000

(800 MHz to 1.6 GHz)

PLX7000

(1.6 GHz to 12 GHz)

FEATURES

- 800 MHz TO 12 GHz output
- EXCEPTIONALLY LOW NOISE (A OPTION)
- COMPACT AND RUGGED

STANDARD SPECIFICATIONS:

- Output level: +10 dBm
- Input ref.: 5 MHz or 10 MHz standard
- Coherent Spurious: −60 dBc
- Harmonics: −45 dBc (*−60)
- Operating Temp.: −20 to +50 degrees C
- DC Supply:
  +24 VDC, +15 VDC, (**−15 VDC)
  +5 VDC (±2% regulation)
- Connectors: SMA female and Filtercons
- A Lock Indicator is Optional; High = Lock.
- Negative logic is also available

*indicates option
**used on 7000A and 8000A only

RESOLUTION SYNTHESIZERS

PLM7000 and PLM8000

FEATURES:

- Ultra Low Phase Noise (A OPTION)
- Compact and Rugged
- Digital Control

SPEC. (Additional):

- 100 KHz Frequency Step Size: (800–1600 MHz)
- TTL Digital Control
- 10% Bandswidth

DISCIPLINE REFERENCE

PLR2100

FEATURES: • Compact
• Input to Output Noise Ratio is Exceptional • Ultra Low Phase Noise

SPECIFICATIONS:

- Input: 5 MHz to 10 MHz
- Output Phase Noise @ 10 MHz:
  10 Hz removed −120 dBc per Hz
  100 Hz removed −140 dBc per Hz
  1KHz removed −157 dBc per Hz
  10KHz removed −160 dBc per Hz
- Stand Alone Frequency Stability:
  5×10^{-10}/Day
  2.5×10^{-9}/0°C to +71°C
- Supply Voltage: ±15VDC
- Size: 4.75″ x 4.5″ x 2″

DIGITAL PHASE LOCKED MULTIPLIERS

PLX500 SERIES

FEATURES:

- Low Phase Noise Degradation
- Ease of High Order Prime Number Multiplication
- Very High Subharmonic Rejection
- Small Size

Standard Specifications:

- Frequency Range: 10 MHz to 1400 MHz
- Input Level:
  −20 dBc to +10 dBc, 50 Ohms
- Power Output: +10 dBm Min.
  (Optional Up to +20 dBm)
- Operating Temperature Range:
  0°C to 50°C
  (−20°C to +60°C, Optional)
- Coherant Spurious: −50dBc
- Harmonics: Less Than −26 dBc
  (−60 dBc Optional)
- Output Impedance: 50 Ohms
- VSWR: 1.5:1 Max.
- Connectors: SMA + Filtercon
- Supply Voltage: +15 VDC and +5 VDC
- Size: 2 × 4 × 1½
- Mounting: Flange

YOUR ULTRA LOW NOISE SOURCE SOURCE

TCI TCI TCI TCI TCI TCI TCI TCI TCI TCI TCI TCI

TCI TCI TCI TCI TCI TCI TCI TCI TCI TCI TCI TCI

MICROWAVE FREQUENCY SOURCE

M4000 SERIES

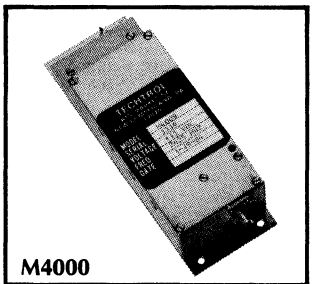
FEATURES:

• Very Compact • High Efficiency • Low Noise

SPECIFICATIONS:

- Frequency Range: 500 MHz to 6 GHz
- Frequency Stability:
  ±.001% 0°C to +50°C
  ±.003% −20°C to +60°C
  ±.005% −55°C to +85°C
- Harmonic Rejection: −60 dBc
- Sub-harmonics Rejection: −60 dBc
- Connectors: SMA and Filtercon

MODEL	FREQUENCY	OUTPUT POWER	VOLTAGE
M4001	.50 to 1 GHz	10 mw	+15 VDC
M4002	.50 to 1 GHz	50 mw	+15 VDC
M4003	.50 to 1 GHz	100 mw	+24 VDC
M4004	1.01 to 2 GHz	10 mw	+15 VDC
M4005	1.01 to 2 GHz	50 mw	+15 VDC
M4006	1.01 to 2 GHz	100 mw	+24 VDC
M4007	2.01 to 3 GHz	10 mw	+15 VDC
M4008	2.01 to 3 GHz	50 mw	+24 VDC
M4009	2.01 to 3 GHz	100 mw	+24 VDC
M4010	3.01 to 6 GHz	10 mw	+24 VDC
M4011	3.01 to 6 GHz	50 mw	+24 VDC
M4012	3.01 to 6 GHz	100 mw	+24 VDC



M4000

CRYSTAL CONTROLLED MICROWAVE SOURCE

MODEL M5000

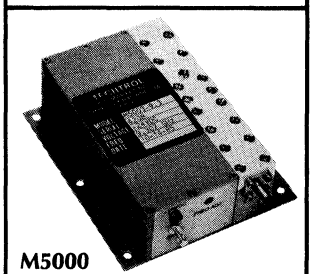
6 GHz TO 16 GHz

FEATURES: • Low Noise • High Output Power • Small Size

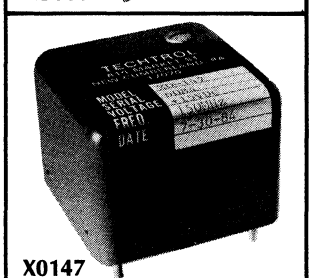
MODEL	FREQUENCY	POWER
M5001	6.0 GHz TO 12.0 GHz	10 mw
M5002	6.0 GHz TO 12.0 GHz	50 mw
M5003	6.0 GHz TO 12.0 GHz	100 mw
M5004	12.0 GHz TO 15.0 GHz	10 mw
M5005	12.0 GHz TO 15.0 GHz	35 mw
M5006	12.0 GHz TO 15.0 GHz	50 mw
M5007	12.0 GHz TO 15.0 GHz	100 mw
M5008	15.0 GHz TO 16.0 GHz	10 mw
M5009	15.0 GHz TO 16.0 GHz	35 mw
M5010	15.0 GHz tO 16.0 GHz	50 mw

SPECIFICATIONS:

- Output freq. Range: 6 GHz TO 16 GHz
- RF Output: SEE CHART
- Frequency Stability:
  ±.001% 0°C to +50°C
  ±.003% −20°C to +50°C
  ±.005% −54°C to +71°C
- Crystal Harmonic Rejection: −45 dBc
- Harmonic Rejection: −60 dBc
- Spurious Rejection: −90 dBc
- Operating Voltage: +24 VDC ±2% Regulation



M5000



X0147

MICROWAVE FREQUENCY SOURCES

M400 Series

FEATURES:

- Output Frequency:
  500 MHz–12 GHz available
- Power: 5 mw–100 mw available
- Harmonics: −30 dBc (outputs <1 GHz)
  −50 dBc (outputs > 1 GHz)
- Sub-Harmonics: −30 dBc (outputs <1 GHz)
  −40 dBc (outputs > 1 GHz)
- Frequency Stability:
  ±.001% −20°C to +60°C
- Size: 3.4×2.0×(2.2–4.3" L)
  Depending on Frequency

Options Available:

- Oven Controlled
- Improved Phase Noise
- Voltage Controlled

Consult Factory

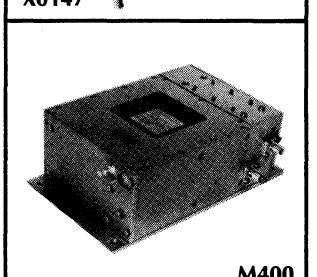
DISCRETE FREQUENCY MULTIPLIERS

MODEL	FXA217	117
Input Freq.	5-25 MHz	1 MHz-1 GHz
Output Freq.	10-500 MHz	1 GHz–12 GHz
Bandswidth	±1%	±1%
Input Power	0 dBm±3 dB	0 dBm±3 dB
Output Power	+10 dBm min.	+7 − +20 dBm
Harmonics	−60 dBc	−60 dBc
Subharmonics	−45 dBc	−45 dBc
Spurious	−90 dBc	−90 dBc
Operating Temp	0 to +50°C	0 to +50°C
Phase Noise Deg.	20 LogN + 3 dB	20 LogN + 3 dB
Supply Voltage	+15 VDC	+15 or +24 VDC (option dependent)

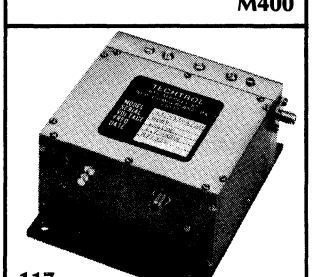
SPECIFICATIONS:

- Frequency Range: 1 MHz to 600 MHz
- RF Output: 10 mw min.*
- Frequency stability: ±.003% −20°C to +60°C
  ±.005% −54° to +71°C
- Aging: ±1PPM/Year
- Harmonic Rejection: −26 dBc
- Sub-Harmonics Rejection: −26 dBc
- Operating Voltage: +15 VDC ±2%
- Connectors: SMA and Filtercon

*Power output up to +30 dBm available



M400



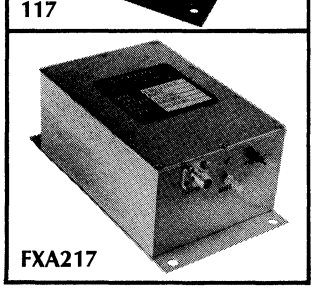
117

CRYSTAL OSCILLATOR

MODEL X0147

1 MHz to 600 MHz

Ovenized Option Available



FXA217

TCI

Techtrol Cyclonetics Inc.

815 Market Street New Cumberland, Pennsylvania 17070

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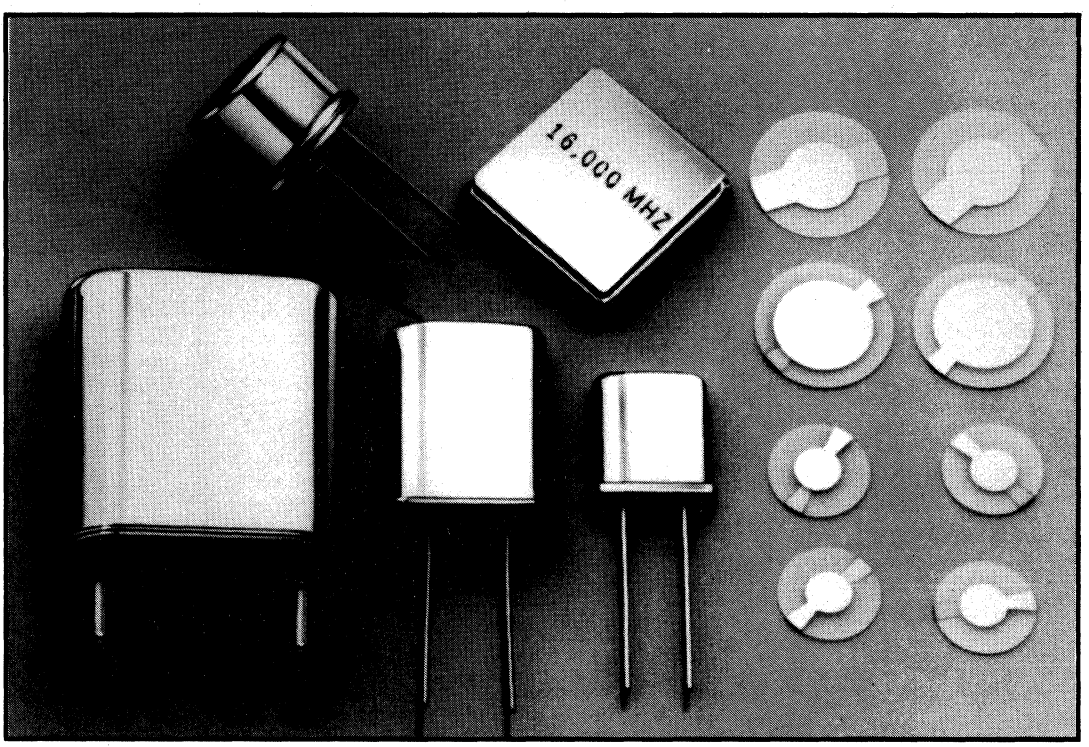

QUARTZ CRYSTALS

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- Processed blanks without base plating
- Blanks custom base plated with silver, aluminum, gold or chrome gold for clock oscillators and miniature filter applications.

SEALED CRYSTALS

- HC 45 or UM-1 miniature packages from 8MHz to 200MHz
- Precision crystals cold-weld or resistance-weld for **TCXO** and **FILTER** design applications.

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- LCC or any other custom size for surface mounting applications.

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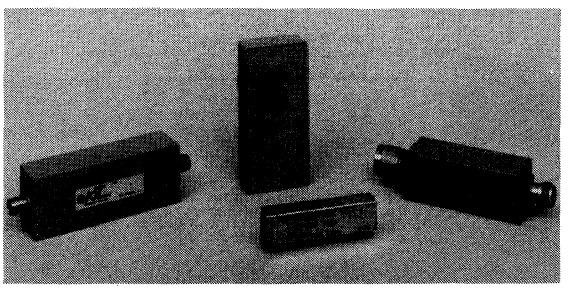
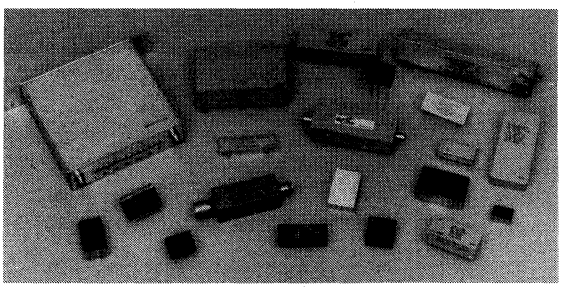
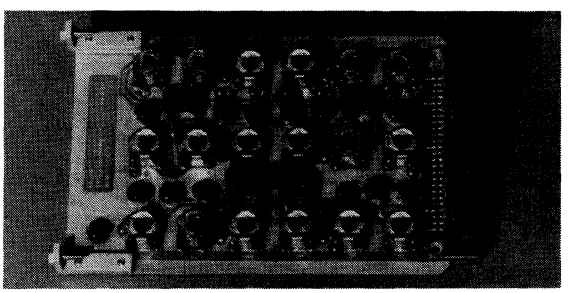
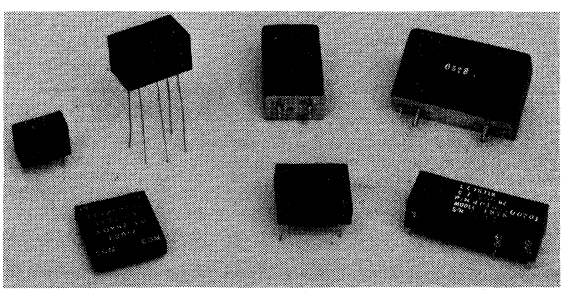
Custom Filters Engineering & Manufacturing









Discrete Crystal Filters, LC Filters And Networks, Monolithic Crystal Filters

OPT's custom engineering and manufacturing capabilities for monolithic crystal filters range from 4.0 MHz to 30 MHz with relative bandwidths from .04% to .3% of center frequency. Discrete crystal filters range from 1 KHz to 70 MHz with relative bandwidths upwards from .005% of center frequency.

LC Filters and networks include low pass, band pass, high pass, band reject, amplitude and delay correcting, impedance matching in frequencies ranging from DC to 400 MHz with relative bandwidths higher than .2% of center frequency where design permits.

OPT's success in meeting and achieving new goals is reflected in our continued participation in many advanced military programs as well as high quality communication systems.

OPT, in addition to complying with MIL-F-18327 has on certain programs complied with MIL-Q-9858A requirements.

OPT is at the forefront of filter engineering as a result of company sponsored research and development in addition to the technology gained thru the acquisition of all engineering drawings and manufacturing rights from the following companies:

- Bulova Filter Co.
- Filtech
- Omnitec
- Burnell & Co.
- Nytronics
- Ortho Filter

Broad application experience supported by a library of computer synthesis, analysis and optimization programs, assist in supplying the best solution of specific requirements.

OPT is unique in being able to provide in depth engineering support on prototype development as well as quality controlled manufacturing capacity to supply high volume requirements.

Component stabilization procedures permit guaranteeing maximum stability with operating life. Areas of specialization include delay correction, phase matching and time domain synthesis.

For brochures and additional information call OPT Industries, Magnetics Division.

Clock Oscillators

TTL

DIP & SURFACE MOUNT

PCB Mount

	CO-401: 4 Pin DIP CO-402: 14 Pin DIP ● CO-406: Surface Mount CO-407: Flatpack	CO-238	CO-231 CO-231H
Series			
Frequency	16 kHz-100 MHz	16 kHz-100 MHz	CO-231: 1 Hz-75 MHz CO-231H: 75.01-100 MHz
Output	Drives 10 TTL loads (above 50 MHz, drives 2 Schottky loads).		
Supply	5 Vdc ±5% at 30-90 mA depending upon frequency.		
Accuracy (at 25°C)	CO-40 ☐ A: ±50 ppm CO-40 ☐ C: ±25 ppm CO-40 ☐ D: ±15 ppm CO-40 ☐ B: ±10 ppm *CO-40 ☐ E: ±1 ppm [1] for 4 pin DIP [2] for 14 pin DIP [6] for surface mount [7] for flatpack *Set to ±1 ppm via external capacitor (16 kHz-20 MHz)	CO-238A: ±50 ppm CO-238C: ±25 ppm CO-238D: ±15 ppm CO-238B: ±10 ppm **CO-238T: ±1 ppm **(16 kHz-30 MHz only) **Tuning adjust settable to ±1 ppm; available in CO-238T to 30 MHz and CO-231T/HT to 100 MHz.	CO-231: ±10 ppm **CO-231T: ±1 ppm CO-231H: ±10 ppm **CO-231HT: ±1 ppm
Temperature Stability	STANDARD: 0°C to +70°C: ±25 ppm Option 1: −55°C to +85°C: ±50 ppm Option 2: −55°C to +125°C: ±50 ppm (N/A > 70 MHz, except for CO-231) Option 3: 0°C to +50°C: ±3 ppm (N/A in CO-400 Series) Option 4: 0°C to +50°C: ±1 ppm (only for CO-231, 12 kHz-20 MHz) Option 5: 0°C to +50°C: ±5 ppm Option 6: 0°C to +50°C: ±10 ppm Option 7: −55°C to +125°C: ±100 ppm (N/A > 70 MHz, except for CO-231) ***Option 8: 0°C to +70°C: ±100 ppm (N/A in CO-400 Series) ***Option 9: −55°C to +200°C: ±300 ppm (only for CO-400 Series in 4-20 MHz range) ***Specified stability includes initial accuracy; do not specify A, B, C, D, E or T accuracy		
Aging Rate (Typical after 30 days)	3 ppm first year 2 ppm/year thereafter	Standard: 5 ppm first year, 3 ppm/year thereafter Option "Y": 1-2 ppm first year, 1 ppm/year thereafter	
Size	†CO-401: 0.5" x 0.8" x 0.2" CO-402: 0.5" x 0.8" x 0.2" CO-406: 0.5" x 0.8" x 0.25" CO-407: 0.6" x 0.8" x 0.17"	0.5" x 0.8" x 0.35"	1.5" x 1.5" x 0.5"
Case	Resistance welded metal case †CO-401 Series available with insulated standoffs; height increases to 0.23" (5.8mm)	Epoxy Case	Metal can, epoxy base "C" option: Solder sealed metal case, height 0.68"
Environmental	See chart on page 3		

CMOS HCMOS

	DIP & SURFACE MOUNT			PCB MOUNT
	HCMOS (5V)	CMOS (8-15V)	CMOS (5V)	CMOS (5-15V)
Series	CO-441: 4 Pin DIP CO-442: 14 Pin DIP CO-446: Surface Mount CO-447: Flatpack	CO-411: 4 Pin DIP ● CO-412: 14 Pin DIP ● CO-416: Surface Mount CO-417: Flatpack	CO-421: 4 Pin DIP ● CO-422: 14 Pin DIP ● CO-426: Surface Mount CO-427: Flatpack	CO-236
Frequency	1 Hz-50 MHz	1 Hz-15 MHz	1 Hz-8 MHz	.01 Hz-15 MHz
Output	HCMOS	Standard CMOS	Standard CMOS	Standard CMOS
Supply	5 Vdc ±5% (3 Vdc opt. to 20 MHz)	8-15 Vdc	5 Vdc ±5%	5-15 Vdc to 6 MHz 10-15 Vdc to 15 MHz
Accuracy (at 25°C)	CO-44 ☐ A: ±50 ppm CO-44 ☐ C: ±25 ppm CO-44 ☐ D: ±15 ppm CO-44 ☐ B: ±10 ppm *CO-44 ☐ E: ±1 ppm	CO-41 ☐ A: ±50 ppm CO-41 ☐ C: ±25 ppm CO-41 ☐ D: ±15 ppm CO-41 ☐ B: ±10 ppm *CO-41 ☐ E: ±1 ppm	CO-42 ☐ A: ±50 ppm CO-42 ☐ C: ±25 ppm CO-42 ☐ D: ±15 ppm CO-42 ☐ B: ±10 ppm *CO-42 ☐ E: ±1 ppm	CO-236: ±10 ppm **CO-236T: ±1 ppm
	CO-412 and CO-422 Opt. to MIL-O-55310-18 [1] for 4 pin DIP [2] for 14 pin DIP [6] for surface mount [7] for flatpack *Settable via external capacitor: 16 KHz-20 MHz only.			**Includes tuning adjustment with ±1 ppm settability
Temperature Stability	STANDARD: 0°C to +70°C: ±25 ppm Option 1: −55°C to +85°C: ±50 ppm Option 2: −55°C to +125°C: ±50 ppm Option 3: 0°C to +50°C: ±3 ppm (only available in CO-236) Option 4: 0°C to +50°C: ±1 ppm (only available in CO-236; specify supply voltage) Option 5: 0°C to +50°C: ±5 ppm Option 6: 0°C to +50°C: ±10 ppm Option 7: −55°C to +125°C: ±100 ppm *Option 8: 0°C to +70°C: ±100 ppm (only available in CO-236) *Option 9: −55°C to +200°C: ±300 ppm (N/A in CO-236 or above 20 MHz in CO-440 Series) *Specified stability includes initial accuracy; do not specify A, B, C, D, E or T accuracy			
Aging Rate (Typical after 30 days)	3 ppm first year 2 ppm/year thereafter			5 ppm first year 3 ppm/year thereafter Opt "Y": 1 ppm/year
Size	†CO-411/421/441: 0.5" x 0.8" x 0.2" CO-412/422/442: 0.5" x 0.8" x 0.2" CO-416/426/446: 0.5" x 0.8" x 0.25" CO-417/427/447: 0.6" x 0.8" x 0.17"			1.5" x 1.5" x 0.5"
Case	Resistance Welded Metal Case †4 pin DIP Series available with insulated standoffs; height increases to 0.23"			Metal can, epoxy base. "C" option: Solder sealed metal case, height 0.68"
Environmental	See chart on page 3			

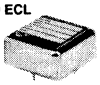
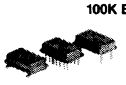
Sinewave Oscillators (for higher stability see TXCO and Oven Sections)

	Low Frequency **CO-261**	*HF/VHF* **CO-233 (H, F, FW)**	*HF/VHF Hybrid* **CO-484**	*UHF* **CO-283W**	*VHF High Power* **CO-284W**
Frequency	50 Hz to 4 MHz	4 MHz to 500 MHz	4 MHz to 200 MHz	500.1 MHz to 1000 MHz	4 MHz to 500 MHz
Output	Std: > 1 Vrms/1 kΩ Opt: > 0 dBm/50Ω to +13 dBm/50Ω	Standard: > 0.5 Vrms into 50Ω (+7 dBm) *Option R: > 1 Vrms into 50Ω (+13 dBm) *(not available above 200 MHz in CO-233H)	Standard: > 0.5 Vrms/50Ω (+7 dBm) Option R: > 1 Vrms/50Ω (+13 dBm)	Standard: > 0.5 Vrms/50Ω (+7 dBm) Option R: > 1 Vrms/50 Ω (+13 dBm)	> 1 Watt/50 Ω (+30 dBm) (above +70°C level derates to +27 dBm minimum)
Supply	+15 Vdc ±5%	+15 Vdc ±5%	+15 Vdc ±5%	+15 Vdc ±5%	+15 Vdc ±5% (18-24 Vdc optional with output 3 dB below standard)
	(Any supply in 16-24 Vdc range optional; supply less than 15 Vdc subject to reduced output level)				
Accuracy (at 25°C)	Standard: ±10 ppm *Option "T": ±1 ppm *Tuning adjustment settable to ±1 ppm	Standard: ±10 ppm *Option "T": ±1 ppm	CO-484A: ±50 ppm CO-484C: ±25 ppm CO-484D: ±15 ppm CO-484B: ±10 ppm	Standard: ±10 ppm *Option "T": ±1 ppm *Tuning adjust settable to ±1 ppm	Standard: ±10 ppm *Option "T": ±1 ppm
Temperature Stability	Standard: 0°C to +70°C: ±25 ppm Option 1: −55°C to +85°C: ±50 ppm Option 2: −55°C to +125°C: ±50 ppm (not available in CO-283W or CO-284W) Option 3: 0°C to +50°C: ±3 ppm (not available in CO-484 or CO-284W) Option 4: 0°C to +50°C: ±1 ppm (only in CO-281) Option 5: 0°C to +50°C: ±5 ppm Option 6: 0°C to +50°C: ±10 ppm For higher stability, see sections describing Vectron TCXOs and oven-controlled types.				
Aging Rate (Typical after 30 days)	Standard: 5 ppm first year, 3 ppm per year thereafter Option Y: 2 ppm first year, 1 ppm per year thereafter		3 ppm first year 2 ppm per year thereafter	Standard: 5 ppm first year, 3 ppm per year thereafter Option Y: 2 ppm first year, 1 ppm per year thereafter	
Phase Noise (typical to 100 MHz)	Offset from Carrier / Standard / *Option L2 100 Hz: −100 dBc/Hz / −115 dBc/Hz 1 kHz: −125 dBc/Hz / −140 dBc/Hz 10 kHz: −140 dBc/Hz / −155 dBc/Hz 50 kHz: −145 dBc/Hz / −160 dBc/Hz			Noise degrades by 6 dB per octave above 100 MHz. *L2 Option is available only in CO-233FW and is limited to 200 MHz; above 100 MHz, output of CO-233FWL2 is restricted to +7 dBm.	
Size	2" x 2" x ¾"	CO-233, CO-233H: 1½" x 1½" x ⅝" CO-233F, CO-233FW: 2" x 2" x ¾"	0.8" x 1.0" x 0.20"	2" x 3" x ¾" (1" x 2" x 0.65" optional)	2" x 3" x ¾"
Configuration	pins for pcb mount Option "W": SMA connector Option "U": SMC connector Option "X": BNC connector	CO-233: (4-149 MHz) pcb mount CO-233H: (150-200 MHz) pcb mount CO-233FW: (4-500 MHz) SMA connector, terminals and studs on base. CO-233F: (4-500 MHz) pcb mount	16 pin double DIP resistance welded. Hermetic seal per MIL-STD-883, Method 1014, 10^{-8} atm cc/second	SMA connector and EMI filter capacitor on side surface; mounting studs on base Option U: SMC in place of SMA Option X: BNC in place of SMA	
Environmental	See chart on page 3				

VECTRON
The Crystal Oscillator Company
VECTRON LABORATORIES, INC.
166 Glover Avenue, Norwalk, Connecticut 06850
Tel.: 203/853-4433 TWX: 710/468-3796 FAX: 203/849-1423

Clock Oscillators

ECL

	STANDARD ECL		100K ECL	
				
Series	**CO-431:** 4 Pin DIP **CO-432:** 14 Pin DIP **CO-434:** 16 Pin Double DIP **CO-436:** Surface Mount **CO-437:** Flatpack	**CO-233ME** **CO-233MEH**	**CO-451:** 4 Pin DIP **CO-452:** 14 Pin DIP **CO-454:** 16 Pin Double DIP **CO-456:** Surface Mount **CO-457:** Flatpack	**CO-233KEQ**
Frequency	5 MHz-200 MHz except 5 MHz-300 MHz for CO-434 and CO-454 (to 500 MHz in CO-454 soon)			150 MHz-500 MHz
Output	5 MHz-110 MHz: output from 10K Series gate Above 110 MHz: output from MECLIII gate 10KH optional to 200 MHz Complementary outputs optional		Output from 100K Series gate. *Complementary* outputs optional	Complementary outputs from 100K Series gate
Supply	−5.2V ± 5%: <40 mA to 110 MHz <60 mA above 110 MHz		−4.5V ± 5% at <60 mA (−5.2V optional at <70 mA)	
Accuracy (at 25°C)	**CO-43** ☐ **A:** ±50 ppm **CO-43** ☐ **C:** ±25 ppm **CO-43** ☐ **D:** ±15 ppm **CO-43** ☐ **B:** ±10 ppm ▲ 1 4 pin DIP 2 14 pin DIP 4 double DIP 6 surface mount 7 flatpack	5-149.9 MHz models **CO-233ME:** ±10 ppm ***CO-233MET:** ± 1 ppm *Tuning adjust settable to ± 1ppm 150-200 MHz models: **CO-233MEHA:** ±50 ppm **CO-233MEHB:** ±10 ppm	**CO-45** ☐ **A:** ±50 ppm **CO-45** ☐ **C:** ±25 ppm **CO-45** ☐ **D:** ±15 ppm **CO-45** ☐ **B:** ±10 ppm ▲ 1 4 pin DIP 2 14 pin DIP 4 double DIP 6 surface mount 7 flatpack	**CO-233KEQ:** ±10 ppm ***CO-233KEQT:** ± 1 ppm *Tuning adjust settable to ± 1ppm
Temperature Stability	**STANDARD:** 0°C to +70°C: ±25 ppm Option **1:** −55°C to +85°C: ±50 ppm (−30/+85°C above 110 MHz; 0/+85°C for 100K ECL) Option **2:** −55°C to +125°C: ±50 ppm (N/A above 110 MHz) Option **3:** 0°C to +50°C: ±3 ppm (N/A in CO-430 Series, CO-450 Series or CO-233MEH) Option **5:** 0°C to +50°C: ±5 ppm Option **6:** 0°C to +50°C: ±10 ppm Option **7:** −55°C to +125°C: ±100 ppm (N/A above 110 MHz)			
Aging Rate (typical after 30 days)	3 ppm first year 2 ppm/year thereafter	5 ppm first year 3 ppm/year thereafter Opt. "Y": 1 ppm/year	3 ppm first year 2 ppm/year thereafter	5 ppm first year 3 ppm/year thereafter Opt. "Y": 1 ppm/year
Size	**#CO-431:** 0.5" x 0.8" x 0.2" **CO-432:** 0.5" x 0.8" x 0.2" **CO-434:** 0.8" x 1.0" x 0.2" **CO-436:** 0.5" x 0.8" x 0.25" **CO-437:** 0.6" x 0.8" x 0.17"	1.5" x 1.5" x 0.625"	**#CO-451:** 0.5" x 0.8" x 0.2" **CO-452:** 0.5" x 0.8" x 0.2" **CO-454:** 0.8" x 1.0" x 0.2" **CO-456:** 0.5" x 0.8" x 0.25" **CO-457:** 0.6" x 0.8" x 0.17"	1.5" x 1.5" x 0.5"
Case	resistance welded metal case #CO-431 available with insulated standoffs: increases height to 0.23"	metal case **"C"** option: meets gross leak test	resistance welded metal case #CO-451 available with insulated standoffs: increases height to 0.23"	metal case **"C"** option: meets gross leak test
Environmental	See chart below			

How to Specify Clock Sinewave Models

■ CO-400 Series Hybrid Models

CO-4 ☐☐☐ − ☐☐ at ☐

- ☐☐☐: TTL/5V = 0; CMOS/8-15V = 1; CMOS/5V = 2; ECL/ 5.2V = 3; HCMOS/5V = 4; Sine/15V = 8
- ☐☐: 4 pin DIP = 1; 14 pin DIP = 2; *16 pin double DIP = 4; Surface mount = 6; Flatpack = 7
- Initial accuracy at 25°C (A, B, C, D, or E)
- Screen test option (X, B, D or S)
- Temperature stability (0 for standard, or option 1, 2, 5, 6, 7 or 9)
- Frequency

*Applies to CO-484 sinewave series

SCREEN TESTING OF ABOVE MODELS

SCREEN TEST	MIL-STD-883 METHOD	Standard CLASS X	Options CLASS D	Options *CLASS B	Options CLASS S
Internal Visual	2017	X	X	X	Per Class S screen test requirements of MIL-O-55310/16. Includes 24 hour additional bakeout, 80 hour additional burn-in, thermal shock, PIND test and radiographic inspection in addition to Class B Screens. Has major cost impact.
Stabilization Bake (24 Hours @ 150°C)	1008, Cond C	X	X	X	
Seal Test (Gross and Fine)	1014	X	X	X	
Temperature Cycling (Thermal shock)	1010, Cond B		X	X	
Burn-In, operating 168 hours @ 125°C	—		X	X	
Acceleration (5000 g in Y_1 axis)	2001, Cond A			X	

*Complies with Class B Screen Test requirements of MIL-O-55310/16, MIL-O-55310/18

■ All Other Clock/Sinewave Models

CO- ☐ − ☐☐☐ at ☐

- Basic Model
- *Accuracy/tuning (A, B, C, D or T)
- *Stability option (1, 2, 3, 4, 5, 6, 7 or 8)
- Frequency
- *C for solder sealed case
- *Y for improved aging

*leave blank if not applicable to your requirement

Environmental Characteristics of Vectron Oscillators

	HYBRID CRYSTAL OSCILLATORS (RESISTANCE WELDED)	ALL OTHER VECTRON OSCILLATORS
Operating Temperature	Per product temperature stability specification (from +15/+35°C to −55/+200°C depending upon model and option selected)	
Storage Temperature	−62°C to +125°C	−55°C to +85°C (+125°C optional)
Shock	100 G, 6 ms per MIL-STD-202, Method 213, Condition C or I.	Standard: 30 G, 11 ms per MIL-STD-202, Method 213, Condition J. Optional: 100 G, 6 ms per MIL-STD-202, Method 213, Condition C or I.
Vibration	Sine: 20 G to 2 kHz per MIL-STD-202, Method 204, Condition D. Random: 20 grms to 2 kHz per MIL-STD-202, Method 214, Condition I-F.	Standard: MIL-STD-202, Method 201 and 5 G to 500 Hz. Optional: same as left column for most types
Humidity	100% per MIL-STD-202, Method 103, Condition B	All models: 95%, no condensation. Sealed models: same as left column
Seal	Hermetic per MIL-STD-883, Method 1014, 10^{-8} atm cc/second	Sealed models: MIL-STD-202, Method 112, Condition D
Altitude	Sea level to space per MIL-STD-202, Method 105	

NOTES:
1. More stringent specification levels optional.
2. Vectron can perform screen testing to Class B or S of MIL-O-55310.
3. Vectron's Environmental Test Laboratory is equipped to perform all of these tests except for Altitude which, when required, is tested at an independent test laboratory. In addition, Vectron can perform in-house bond pull, die shear and PIND testing.
4. Vectron has produced oscillators for airborne, shipboard, manpack, mobile, spacecraft, rocket and missile applications.

VECTRON
The Crystal Oscillator Company
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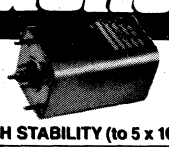
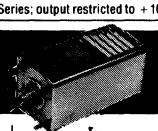
High Frequency OCXOs Oven Controlled Crystal Oscillators

✱ Low Phase Noise



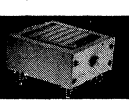
	HIGH STABILITY (to 5 x 10^{-10}/day)			ULTRA-STABLE (to 1 x 10^{-10}/day)	
	Most economical **CO-211 SERIES**	Higher stability and output **CO-200 SERIES**	Superior temperature stability **CO-244 SERIES**	Best aging: single oven **CO-206 SERIES**	Best aging: double oven **CO-246 SERIES**
Frequency	1, 2, 4, 5 or 10 MHz standard (broad range of frequencies available)			5 MHz standard (other frequencies available to 100 MHz)	
Temperature Stability (Temp. Range A) +15/+35°C	CO-21 ☐ **A38:** ±3 x 10^{-8} CO-21 ☐ **A59:** ±5 x 10^{-9}	CO-20 ☐ **A39:** ±3 x 10^{-9} CO-20 ☐ **A19:** ±1 x 10^{-9}	CO-24 ☐ **A510:** ±5 x 10^{-10}	CO-20 ☐ **A39-V:** ±3 x 10^{-9} CO-20 ☐ **A510-V:** ±5 x 10^{-10}	CO-24 ☐ **A210-V:** ±2 x 10^{-10}
(Temp. Range B) 0/+50°C	CO-21 ☐ **B58:** ±5 x 10^{-8} CO-21 ☐ **B18:** ±1 x 10^{-8}	CO-20 ☐ **B59:** ±5 x 10^{-9} CO-20 ☐ **B39:** ±3 x 10^{-9}	CO-24 ☐ **B19:** ±1 x 10^{-9}	CO-20 ☐ **B59-V:** ±5 x 10^{-9} CO-20 ☐ **B19-V:** ±1 x 10^{-9}	CO-24 ☐ **B510-V:** ±5 x 10^{-10}
(Temp. Range D) −20/+70°C	CO-21 ☐ **D17:** ±1 x 10^{-7} CO-21 ☐ **D38:** ±3 x 10^{-8}	CO-20 ☐ **D18:** ±1 x 10^{-8} CO-20 ☐ **D59:** ±5 x 10^{-9}	CO-24 ☐ **D39:** ±3 x 10^{-9}	CO-20 ☐ **D18-V:** ±1 x 10^{-8} CO-20 ☐ **D39-V:** ±3 x 10^{-9}	CO-24 ☐ **D19-V:** ±1 x 10^{-9} (−20/+60°C)
(Temp. Range G) −55/+75°C	CO-21 ☐ **G27:** ±2 x 10^{-7} CO-21 ☐ **G58:** ±5 x 10^{-8}	CO-20 ☐ **G38:** ±3 x 10^{-8}	CO-24 ☐ **G18:** ±1 x 10^{-8}	CO-20 ☐ **G38-V:** ±3 x 10^{-8} CO-20 ☐ **G18-V:** ±1 x 10^{-8}	
Aging	**4:** 1 x 10^{-8}/day **5:** 5 x 10^{-9}/day **6:** 3 x 10^{-9}/day **7:** 1 x 10^{-9}/day ***8:** 5 x 10^{-10}/day	**1:** 1 x 10^{-8}/day **2:** 5 x 10^{-9}/day **3:** 3 x 10^{-9}/day **4:** 1 x 10^{-9}/day ***5:** 5 x 10^{-10}/day	**4:** 1 x 10^{-9}/day ***5:** 5 x 10^{-10}/day	**6:** 3 x 10^{-10}/day 5 x 10^{-8}/year ***7:** 1 x 10^{-10}/day 3 x 10^{-8}/year	**6:** 3 x 10^{-10}/day 5 x 10^{-8}/year ***7:** 1 x 10^{-10}/day 3 x 10^{-8}/year
	*5 x 10^{-10}/day average aging rate models are only available at 1, 2, 4, 5 or 10 MHz; however, 5 x 10^{-10}/day (1 x 10^{-7}/year) aging can be specially provided using SC or IT cut crystals.			*1 x 10^{-10}/day models available only at 1, 5 and 10 MHz	
Output Level	Standard: >1 Vrms into 500Ω Optional: 0 or +7 dBm/50Ω, TTL or CMOS	Standard: >1 Vrms into 50Ω Optional: TTL, CMOS, or ECL	Standard: >1 Vrms into 500Ω Optional: 0, 7 or +13 dBm/50Ω, TTL, CMOS or ECL	Standard: >1 Vrms into 50Ω Optional: TTL or CMOS	
Supply Voltage	24 Vdc standard (Operation from any voltage in 5-28 Vdc range optional)			24 Vdc standard (Operation from any voltage in 15-28 Vdc range optional)	
Input Power	< 6 watts at turn-on (−20/+70°C); < 3 watts stabilized (25°C) reduced power drain available			< 6 watts at turn-on (−20/+70°C) < 3 watts stabilized (25°C)	11 watts at turn-on (0-50°C) 5 watts stabilized (25°C)
Frequency Adjustment	Screwdriver adjustment settable to 1 x 10^{-8} nominal. Electronic tuning (VCXO) option "V"			Screwdriver adjustment and electronic tuning	
Size	2" x 2" x 3" (51 x 51 x 76 mm)	2" x 2" x 4" (51 x 51 x 102 mm)	2¼" x 2¼" x 4¼" (57 x 57 x 110 mm)	2¼" x 2¼" x 4¼" (57x57 x 110 mm)	3" x 3" x 5½" (76 x 76 x 140 mm)
Base	Octal plug, solder header or rf connector with solder header			Same options as CO-244	Solder header and BNC
Phase noise (typical) with sine output in 4-12 MHz range for "High Stability" Series and in 4-6 MHz range for "Ultra-Stable" Series ✱	Offset from Carrier / Standard / Low Noise Option (L1) / *Ultra Low Noise Option (L2) 100 Hz: −130 dBc/Hz / −135 dBc/Hz / −145 dBc/Hz 1 kHz: −140 dBc/Hz / −145 dBc/Hz / −160 dBc/Hz 10 kHz: −143 dBc/Hz / −148 dBc/Hz / −165 dBc/Hz 50 kHz: −145 dBc/Hz / −150 dBc/Hz / −168 dBc/Hz *L2 option not available in CO-211 Series; output restricted to +10 dBm sine			Offset from Carrier / Standard / *Ultra-Low Noise Option (L2) 10 Hz: −115 dBc/Hz / −135 dBc/Hz 100 Hz: −135 dBc/Hz / −155 dBc/Hz 1 kHz: −145 dBc/Hz / −165 dBc/Hz 10 kHz: −148 dBc/Hz / −168 dBc/Hz 50 kHz: −150 dBc/Hz / −168 dBc/Hz *L2 option restricted to +10 dBm or less output	

Fast Warm-up Models Using SC, IT Cut Crystals



	Fastest warm-up; lowest noise **CO-505S SERIES**	*Small size; hybrid design* **CO-305S SERIES**
Frequency	5 MHz and 10 MHz Standard (Other frequencies available)	
Temperature Stability (Temp. Range A) +15°C to +35°C	CO-505SA39VW: ±3 x 10^{-9} CO-505SA19VW: ±1 x 10^{-9}	CO-305SA29V: ±2 x 10^{-9} CO-305SA510V: ±5 x 10^{-10}
(Temp. Range B) 0°C to +50°C	CO-505SB59VW: ±5 x 10^{-9} CO-505SB29VW: ±2 x 10^{-9}	CO-305SB59V: ±5 x 10^{-9} CO-305SB19V: ±1 x 10^{-9}
(Temp. Range D) −20°C to +70°C	CO-505SD18VW: ±1 x 10^{-8} CO-505SD59VW: ±5 x 10^{-9}	CO-305SD18V: ±1 x 10^{-8} CO-305SD39V: ±3 x 10^{-9}
(Temp. Range E) −40°C to +75°C	CO-505SE18VW: ±1 x 10^{-8} CO-505SE59VW: ±5 x 10^{-9}	CO-305SE18V: ±1 x 10^{-8} CO-305SE39V: ±3 x 10^{-9}
(Temp. Range F) −55°C to +85°C	CO-505SF58VW: ±5 x 10^{-8} CO-505SF18VW: ±1 x 10^{-8}	CO-305SF58V: ±5 x 10^{-8} CO-305SF18V: ±1 x 10^{-8}
Aging	5 x 10^{-10}/day, 1 x 10^{-7}/year	
Restabilization (frequency relative to that 24 hours after turn-on)	at 25°C: 1 x 10^{-7} 2 minutes; 3 x 10^{-8} 4 minutes; 1 x 10^{-8} 7 minutes at −55°C: 7 minutes; 9 minutes; 12 minutes	at 25°C: 1 x 10^{-7} 4 minutes; 3 x 10^{-8} 5 minutes; 1 x 10^{-8} 8 minutes at −55°C: 9 minutes; 10 minutes; 12 minutes
Output Level	Standard: >0.5 Vrms into 50Ω (+7 dBm) Optional: +13 dBm/50Ω, TTL, HCMOS	
Supply Voltage	+24 Vdc standard (Operation from any specified supply in 12-28 Vdc range optional)	
Input Power	< 15 watts at turn-on; < 3 watts stabilized at 25°C (lower turn-on power optional)	
Frequency Adjustment	Screwdriver adjustment settable to 5 x 10^{-9} and electronic tuning	
Size	2" x 2" x 4" (51 x 51 x 102 mm)	1½" x 1½" x 3" (38 x 38 x 76 mm)
Base	SMA output connector, solder header and four studs	7 pin solder header and four studs (SMA optional)
Phase Noise (with sinewave output) ✱	Offset from Carrier / Standard / Ultra Low Noise Option L2 10 Hz: −120 dBc/Hz / −120 dBc/Hz 100 Hz: −140 dBc/Hz / −150 dBc/Hz 1 kHz: −145 dBc/Hz / −160 dBc/Hz 10 kHz: −148 dBc/Hz / −165 dBc/Hz 50 kHz: −148 dBc/Hz / −168 dBc/Hz +13 dBm output not available with L2 Option	Offset from Carrier / Phase Noise 10 Hz: −120 dBc/Hz 100 Hz: −140 dBc/Hz 1 kHz: −145 dBc/Hz 10 kHz: −148 dBc/Hz 50 kHz: −148 dBc/Hz

Low Profile (1" high) Hybrid OCXOs



CO-311 SERIES

Frequency	4, 5 or 10 MHz standard (broad range of frequencies available)
Temperature Stability (Temp. Range A) +15/+35°C	CO-31 ☐ **A38:** ±3 x 10^{-8} CO-31 ☐ **A59:** ±5 x 10^{-9}
(Temp. Range B) 0/+50°C	CO-31 ☐ **B58:** ±5 x 10^{-8} CO-31 ☐ **B18:** ±1 x 10^{-8}
(Temp. Range D) −20/+70°C	CO-31 ☐ **D17:** ±1 x 10^{-7} CO-31 ☐ **D38:** ±3 x 10^{-8}
(Temp. Range G) −55/+75°C	CO-31 ☐ **G27:** ±2 x 10^{-7} CO-31 ☐ **G58:** ±5 x 10^{-8}
Aging	**4:** 1 x 10^{-8}/day **5:** 5 x 10^{-9}/day **6:** 3 x 10^{-9}/day **7:** 1 x 10^{-9}/day ***8:** 5 x 10^{-10}/day *CO-318 only available at 4, 5 or 10 MHz. Improved aging optional with SC/IT cut crystals.
Output Level	Standard: TTL Optional: 0 or +7 dBm/50Ω, or CMOS
Supply Voltage	15 Vdc ±5% (5-28 Vdc optional) 5 Vdc also required for TTL output
Input Power	<3 watts at turn-on (−20/+70°C) 1.3 watts stabilized (25°C)
Frequency Adjustment	Screwdriver adjustment, settable to 1 x 10^{-8}. Electronic tuning optional
Size	2¼" x 2¼" x 1"; pins on base for printed circuit board mounting
MIL Hybrid Option	Internal hybrid can be sealed per MIL-STD-883 and screen tested per MIL-O-55310, Class B

VECTRON
The Crystal Oscillator Company

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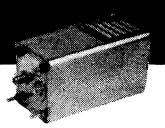
VHF OCXOs Oven Controlled Crystal Oscillators (25-400 MHz)



*Low Phase Noise

	Most Economical **CO-228/CO-229 SERIES**	*Higher Output Level and Higher Frequency* **CO-223/CO-224 SERIES**	*Superior Aging and Stability* **CO-220/CO-225 SERIES**
Frequency	25 MHz to 200 MHz	25 MHz to 400 MHz	25 MHz to 200 MHz
Temperature Stability (Temp. Range **A**): + 15°C to + 35°C	**CO-22** ☐ **A38:** $\pm 3 \times 10^{-8}$ **CO-22** ☐ **A59:** $\pm 5 \times 10^{-9}$	**CO-22** ☐ **A38:** $\pm 3 \times 10^{-8}$ **CO-22** ☐ **A59:** $\pm 5 \times 10^{-9}$	**CO-22** ☐ **A18:** $\pm 1 \times 10^{-8}$ **CO-22** ☐ **A19:** $\pm 1 \times 10^{-9}$
(Temp. Range **B**): 0°C to + 50°C	**CO-22** ☐ **B58:** $\pm 5 \times 10^{-8}$ **CO-22** ☐ **B18:** $\pm 1 \times 10^{-8}$	**CO-22** ☐ **B58:** $\pm 5 \times 10^{-8}$ **CO-22** ☐ **B18:** $\pm 1 \times 10^{-8}$	**CO-22** ☐ **B58:** $\pm 5 \times 10^{-8}$ **CO-22** ☐ **B18:** $\pm 1 \times 10^{-8}$ **CO-22** ☐ **B29:** $\pm 2 \times 10^{-9}$
(Temp. Range **D**): − 20°C to + 70°C	**CO-22** ☐ **D17:** $\pm 1 \times 10^{-7}$ **CO-22** ☐ **D38:** $\pm 3 \times 10^{-8}$	**CO-22** ☐ **D17:** $\pm 1 \times 10^{-7}$ **CO-22** ☐ **D38:** $\pm 3 \times 10^{-8}$	**CO-22** ☐ **D38:** $\pm 3 \times 10^{-8}$ **CO-22** ☐ **D18:** $\pm 1 \times 10^{-8}$ **CO-22** ☐ **D59:** $\pm 5 \times 10^{-9}$
(Temp. Range **G**): − 55°C to + 75°C	**CO-22** ☐ **G27:** $\pm 2 \times 10^{-7}$ **CO-22** ☐ **G58:** $\pm 5 \times 10^{-8}$	**CO-22** ☐ **G27:** $\pm 2 \times 10^{-7}$ **CO-22** ☐ **G58:** $\pm 5 \times 10^{-8}$	**CO-22** ☐ **G17:** $\pm 1 \times 10^{-7}$ **CO-22** ☐ **G38:** $\pm 3 \times 10^{-8}$
Aging	[8] 3×10^{-8}/day, 5×10^{-6}/year [9] 1×10^{-8}/day, 2×10^{-6}/year	[3] 3×10^{-8}/day, 5×10^{-6}/year [4] 1×10^{-8}/day, 2×10^{-6}/year	[0] 3×10^{-9}/day, 1×10^{-6}/year [5] 1×10^{-9}/day, 3×10^{-7}/year
Output Level	Standard: >0.5 Vrms into 50Ω (+ 7 dBm) Optional: TTL to 100 MHz	Standard: >1 Vrms into 50Ω (+ 13 dBm) Optional: ECL (to 200 MHz)	Standard: >0.5 Vrms into 50Ω (+ 7 dBm) Optional: + 13 dBm ("**R**"), TTL, ECL
Supply Voltage	24 Vdc standard. Operation from any specified voltage in 12-28 Vdc range optional.		
Input Power	<6 watts at turn-on (− 20/ + 70°C); <3 watts stabilized (25°C)		
Frequency Adjustment	Screwdriver adjust, settable to $<1 \times 10^{-8}$ nominal. Electronic tuning (VCXO) option "**V**"		
Size	2" x 2" x 3" (51 x 51 x 77 mm)	2" x 2" x 4" (51 x 51 x 102 mm)	2" x 2" x 4" (51 x 51 x 102 mm)
Base	SMC output, solder header and 4 studs; SMA or BNC optional		

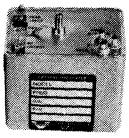
*** Phase noise** typical, with sine output in 75-125 MHz range

Offset from Carrier	Standard	Standard	*Ultra Low Noise Option (**L2**)	Standard	*Ultra Low Noise Option (**L2**)
100 Hz	− 120 dBc/Hz	Ultra-low noise option not available	− 130 dBc/Hz	− 105 dBc/Hz	− 120 dBc/Hz
1 kHz	− 135 dBc/Hz		− 145 dBc/Hz	− 115 dBc/Hz	− 130 dBc/Hz
10 kHz	− 140 dBc/Hz		− 150 dBc/Hz	− 120 dBc/Hz	− 135 dBc/Hz
50 kHz	− 145 dBc/Hz		− 155 dBc/Hz	− 125 dBc/Hz	− 140 dBc/Hz

*L2 option is restricted to 300 MHz with sine output of + 10 dBm or less

*L2 option is available to 125 MHz

Replacement for for Hewlett Packard Model 10811B



Vectron type CO-811B offers mechanical and electrical-interface interchangeability with discontinued HP10811B

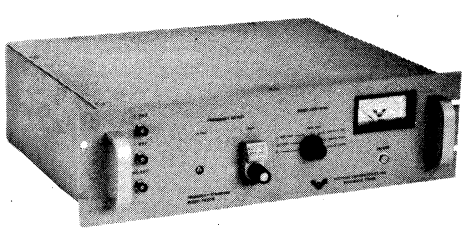
Aging	5×10^{-10}/day 1×10^{-7}/year
0/ + 71°C **− 55/ + 71°C**	2.5×10^{-9} p-p 4.5×10^{-9} p-p
Noise	100 Hz: − 140 dBc/Hz 10 kHz: − 160 dBc/Hz
Crystal	SC-cut for fast stabilization

Note: if mechanical interchangeability with HP10811B is not required, we suggest that you select a model from page 4.

Frequency Standards

FS-321 SERIES

Aging Rate	3×10^{-10}/day at time of shipment 1×10^{-10}/day typical within 60 days
Option 1 **Option 2**	1×10^{-10}/day at time of shipment 5×10^{-11}/day at time of shipment
Frequencies	5, 1 & 0.1 MHz
Output Level	1 Vrms/50 ohms
Temperature	$\pm 5 \times 10^{-10}$ over 0-50°C
Noise Floor	160 dB below 5 MHz output
Oven Control	Double proportional
Supply	115/230 VAC or 22-30 Vdc
Battery	**FS-321C:** None **FS-321D:** 12 hour rechargeable **FS-321E:** 24 hour rechargeable
Size	5¼" x 19" x 14" (13.4 x 48.3 x 35.6 cm)



VECTRON
The Crystal Oscillator Company

VECTRON LABORATORIES, INC.
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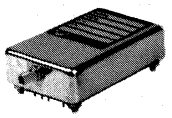
TCXOs Temperature Compensated Crystal Oscillators

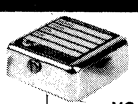


	50 Hz to 20 MHz		20.1 MHz to 140 MHz	140 MHz to 420 MHz	420 MHz to 630 MHz
	CO-251 SERIES Moderate Stability	**CO-252 SERIES** High Stability	**CO-254 SERIES**	**CO-255 SERIES**	**CO-256 SERIES**
Temperature Stability (Temp. Range **A**) + 15°C to + 35°C	**CO-251A57:** ± 5 x 10^{-7} **CO-251A27:** ± 2 x 10^{-7}	**CO-252A17:** ± 1 x 10^{-7} **CO-252A58:** ± 5 x 10^{-8}	**CO-254A57:** ± 5 x 10^{-7} **CO-254A17:** ± 1 x 10^{-7}	**CO-255A57:** ± 5 x 10^{-7} **CO-255A17:** ± 1 x 10^{-7}	**CO-256A57:** ± 5 x 10^{-7} **CO-256A17:** ± 1 x 10^{-7}
(Temp. Range **B**) 0°C to + 50°C	**CO-251B16:** ± 1 x 10^{-6}	**CO-252B57:** ± 5 x 10^{-7} **CO-252B27:** ± 2 x 10^{-7} **CO-252B17:** ± 1 x 10^{-7}	**CO-254B16:** ± 1 x 10^{-6} **CO-254B57:** ± 5 x 10^{-7} **CO-254B27:** ± 2 x 10^{-7}	**CO-255B16:** ± 1 x 10^{-6} **CO-255B57:** ± 5 x 10^{-7} **CO-255B27:** ± 2 x 10^{-7}	**CO-256B16:** ± 1 x 10^{-6} **CO-256B57:** ± 5 x 10^{-7} **CO-256B27:** ± 2 x 10^{-7}
(Temp. Range **C**) 0°C to + 70°C	**CO-251C36:** ± 3 x 10^{-6}	**CO-252C16:** ± 1 x 10^{-6} **CO-252C57:** ± 5 x 10^{-7} **CO-252C37:** ± 3 x 10^{-7}	**CO-254C36:** ± 3 x 10^{-6} **CO-254C16:** ± 1 x 10^{-6} **CO-254C37:** ± 3 x 10^{-7}	**CO-255C36:** ± 3 x 10^{-6} **CO-255C16:** ± 1 x 10^{-6} **CO-255C37:** ± 3 x 10^{-7}	**CO-256C36:** ± 3 x 10^{-6} **CO-256C16:** ± 1 x 10^{-6} **CO-256C37:** ± 3 x 10^{-7}
(Temp. Range **D**) 20°C to + 70°C	**CO-251D56:** ± 5 x 10^{-6}	**CO-252D16:** ± 1 x 10^{-6} **CO-252D57:** ± 5 x 10^{-7}	**CO-254D56:** ± 5 x 10^{-6} **CO-254D16:** ± 1 x 10^{-6} **CO-254D57:** ± 5 x 10^{-7}	**CO-255D56:** ± 5 x 10^{-6} **CO-255D16:** ± 1 x 10^{-6} **CO-255D57:** ± 5 x 10^{-7}	**CO-256D56:** ± 5 x 10^{-6} **CO-256D16:** ± 1 x 10^{-6} **CO-256D57:** ± 5 x 10^{-7}
(Temp. Range **E**) 40°C to + 75°C	**CO-251E15:** ± 1 x 10^{-5}	**CO-252E56:** ± 5 x 10^{-6} **CO-252E26:** ± 2 x 10^{-6} **CO-252E16:** ± 1 x 10^{-6}	**CO-254E56:** ± 5 x 10^{-6} **CO-254E26:** ± 2 x 10^{-6} **CO-254E16:** ± 1 x 10^{-6}	**CO-255E56:** ± 5 x 10^{-6} **CO-255E26:** ± 2 x 10^{-6} **CO-255E16:** ± 1 x 10^{-6}	**CO-256E56:** ± 5 x 10^{-6} **CO-256E26:** ± 2 x 10^{-6} **CO-256E16:** ± 1 x 10^{-6}
(Temp. Range **F**) 55°C to + 85°C	**CO-251F25:** ± 2 x 10^{-5}	**CO-252F56:** ± 5 x 10^{-6} **CO-252F26:** ± 2 x 10^{-6} **CO-252F16:** ± 1 x 10^{-6}	**CO-254F56:** ± 5 x 10^{-6} **CO-254F26:** ± 2 x 10^{-6} **CO-254F16:** ± 1 x 10^{-6}	**CO-255F56:** ± 5 x 10^{-6} **CO-255F26:** ± 2 x 10^{-6} **CO-255F16:** ± 1 x 10^{-6}	**CO-256F56:** ± 5 x 10^{-6} **CO-256F26:** ± 2 x 10^{-6} **CO-256F16:** ± 1 x 10^{-6}
(Temp. Range **G**) 55°C to + 105°C		**CO-252G56:** ± 5 x 10^{-6}	**CO-254G56:** ± 5 x 10^{-6}	**CO-255G56:** ± 5 x 10^{-6}	**CO-256G56:** ± 5 x 10^{-6}
(Temp. Range **H**) 55°C to + 125°C		**CO-252H15:** ± 1 x 10^{-5}	**CO-254H15:** ± 1 x 10^{-5}	**CO-255H15:** ± 1 x 10^{-5}	**CO-256H15:** ± 1 x 10^{-5}
Output Level & Frequency	TTL: 50 Hz -20 MHz CMOS: 50 Hz -15 MHz SINE: 1 MHz-20 MHz		SINE: 20 MHz-140 MHz TTL: 20 MHz-100 MHz ECL: 20 MHz-140 MHz	SINE: 140 MHz-420 MHz ECL: 140 MHz-280 MHz	SINE: 420 MHz-630 MHz
Supply	Any supply voltage in 5-28 Vdc range; current as low as 3 mA for some models			12-28 Vdc	12-28 Vdc
Frequency Adjustment	Screwdriver adjustment, settable to 1 x 10^{-7}. Electronic tuning (TC/VCXO) capability optional.				
Aging Rate	5 x 10^{-7} to 1 x 10^{-6} per year		1 to 2 x 10^{-6}/year	1 to 2 x 10^{-6}/year	1 to 2 x 10^{-6}/year
Size	2" x 2" x ¾" (51 x 51 x 19 mm) ½" height and smaller size available			2" x 3" x ¾" (51 x 76 x 19 mm)	2" x 4" x ¾" (51 x 102 x 19 mm)

Low Profile Hybrid TCXOs

	CO-258 SERIES *Smallest Size*	**CO-259 SERIES** *Higher stability available Mechanical frequency adjustment*
Output Level & Frequency	TTL: 20 kHz to 60 MHz with TTL output CMOS: 400 Hz to 15 MHz with CMOS output	
Temperature Stability (Temp. Range **A**) + 15°C to + 35°C	**CO-258A57:** ± 5 x 10^{-7} **CO-258A27:** ± 2 x 10^{-7}	**CO-259A57:** ± 5 x 10^{-7} **CO-259A27:** ± 2 x 10^{-7} **CO-259A17:** ± 1 x 10^{-7}
(Temp. Range **B**) 0°C to + 50°C	**CO-258B16:** ± 1 x 10^{-6} **CO-258B37:** ± 3 x 10^{-7}	**CO-259B16:** ± 1 x 10^{-6} **CO-259B37:** ± 3 x 10^{-7} **CO-259B27:** ± 2 x 10^{-7}
(Temp. Range **C**) 0°C to + 70°C	**CO-258C16:** ± 1 x 10^{-6} **CO-258C57:** ± 5 x 10^{-7}	**CO-259C16:** ± 1 x 10^{-6} **CO-259C57:** ± 5 x 10^{-7}
(Temp. Range **D**) 20°C to + 70°C	**CO-258D36:** ± 3 x 10^{-6} **CO-258D16:** ± 1 x 10^{-6}	**CO-259D36:** ± 3 x 10^{-6} **CO-259D16:** ± 1 x 10^{-6} **CO-259D57:** ± 5 x 10^{-7}
(Temp. Range **E**) 40°C to + 75°C	**CO-258E56:** ± 5 x 10^{-6} **CO-258E26:** ± 2 x 10^{-6}	**CO-259E56:** ± 5 x 10^{-6} **CO-259E26:** ± 2 x 10^{-6} **CO-259E16:** ± 1 x 10^{-6}
(Temp. Range **F**) 55°C to + 85°C	**CO-258F56:** ± 5 x 10^{-6} **CO-258F26:** ± 2 x 10^{-6}	**CO-259F56:** ± 5 x 10^{-6} **CO-259F26:** ± 2 x 10^{-6}
(Temp. Range **G**) 55°C to + 105°C	**CO-258G56:** ± 5 x 10^{-6}	**CO-259G56:** ± 5 x 10^{-6}
(Temp. Range **H**) 55°C to + 125°C	**CO-258H15:** ± 1 x 10^{-5}	**CO-259H15:** ± 1 x 10^{-5}
Aging Rate	1 x 10^{-6} per year	1 x 10^{-6} per year
Supply Voltage	TTL: 15 Vdc & 5 Vdc (single 5 Vdc optional in CO-259) CMOS: Any supply in 10-15 Vdc range.	
Frequency Adjustment	Voltage control	Screwdriver adjustment
Size	1.5" x 1.5" x .32" (38 x 38 x 8.2 mm)	1.5" x 2.0" x 0.4" (38 x 51 x 10.2 mm)
Note	These Series are intended for use when the small package size and/or the high reliability afforded by their hybrid design are desired. For less stringent size requirements, consider the standard TCXOs at the top of this page which are priced lower than the hybrid series.	

VCOs Non-Crystal Oscillators



Series	**VC-381**	**VC-371**
Center Frequency	10 Hz to 500 kHz	500 kHz to 500 MHz
Deviation	± 10% (wider and narrower deviation optional, up to a full octave below 300 MHz)	
Control Voltage	± 5V (higher and lower sensitivity optional)	
Linearity	± 1%	± 10% standard (± 3% and ± 1% optional with limited deviation)
Transfer Function	Positive	Negative
Accuracy (25°C)	± 0.5% (tuning adjust optional, settable to ± 0.1%)	
Temperature Stability	**Standard:** 0/ + 50°C: ± 1.5% Option **1**: − 20/ + 70°C: ± 3% Option **2**: − 55/ + 85°C: ± 6%	**Standard:** 0/ + 50°C: + 1% Option **1**: − 20/ + 70°C: ± 2% Option **2**: − 55/ + 85°C: ± 4% *Option **3**: 0/ + 50°C: ± 0.3% *Option **4**: − 20/ + 70°C: ± 0.5% *Only for deviation ≤ ± 10% Improved stability with oven
Output Level	>1 Vrms into 1kΩ (TTL and CMOS optional)	>0.5 Vrms into 50Ω (TTL, CMOS, ECL optional)
Supply Voltage	15 Vdc ± 5% (12-28 Vdc optional) + 5 Vdc required for TTL, − 5.2 Vdc required for ECL	
Size	2" x 2" x ¾" (51 x 51 x 19 mm), reduced height optional	
Configuration	Pins on base for pc board mounting Option "**W**": SMA, pins and mounting studs on base Option "**SW**": SMA on side, pins on base (size is 2" x 2¼" x ¾")	

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VCXOs Voltage Controlled Crystal Oscillators

for Phase Locking Applications

	TTL			CMOS	HCMOS	ECL		SINEWAVE			
Configuration	PC board mount	Low profile hybrid DIP		PC board mount	low profile hybrid DIP	PC board mount	low profile hybrid DIP	PC board mount		Chassis mount with rf output connector	low profile hybrid DIP
Series	(a) **CO-231V** (b) **CO-231VH**	**CO-401V** **CO-402V**	**CO-404V**	**CO-236V**	**CO-444V**	**CO-233MEV**	**CO-434V**	(a) **CO-233V** (b) **CO-233VH**	**CO-233VF**	(a) **CO-233VFW** (b) **CO-283VW**	**CO-484V**
Center Frequency	(a) 32 kHz-25 MHz (b) 25.1-70 MHz	32 kHz-25 MHz	25.1-70 MHz	300 Hz-10 MHz	1 kHz-50 MHz	8-200 MHz	8-200 MHz	(a) 8-149.9 MHz (b) 150-200 MHz	8-400 MHz	(a) 8-400 MHz (b) 400.1-600 MHz	8-200 MHz
Supply Voltage	+ 5 Vdc			+ 12 Vdc	+ 5 Vdc	5.2 Vdc		+ 15 Vdc (+ 12 Vdc to + 24 Vdc optional)			

Deviation/ Stability Alternatives

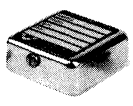
Code	Temperature Range	Temperature Stability	Deviation
0	0/+ 50°C	± 10 ppm	± 30 ppm
A	0/+ 50°C	± 20 ppm	± 50 ppm
B	0/+ 50°C	± 35 ppm	± 100 ppm
C*	0/+ 50°C	± 35 ppm	± 200 ppm
D	0/+ 70°C	± 20 ppm	± 40 ppm
E	0/+ 70°C	± 40 ppm	± 100 ppm
F*	0/+ 70°C	± 40 ppm	± 200 ppm
G	20/+ 70 C	± 30 ppm	± 60 ppm
H	20/+ 70 C	± 40 ppm	± 100 ppm
I*	20/+ 70 C	± 40 ppm	± 200 ppm
J	40/+ 85 C	± 40 ppm	± 60 ppm
K	40/+ 85 C	± 50 ppm	± 100 ppm
L*	40/+ 85 C	± 50 ppm	± 200 ppm
M	55/+ 85 C	± 50 ppm	± 100 ppm
N*	55/+ 85 C	± 50 ppm	± 200 ppm

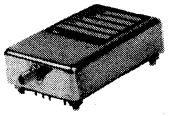
For ECL above 110 MHz, lower temperature limit is -30 C

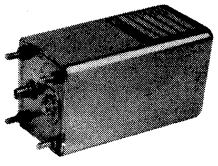
*The following notes apply to options C, F, I, L and N (± 200 ppm deviation)
- They are only available at frequencies up to 25 MHz
- Linearity of ± 10% is standard
- Models CO-231V and CO-236V, which are normally packaged in a 1.5" x 1.5" x 0.5" metal can with epoxy base, require a metal base which increases height to 3/8"; pin diameter is then .030".

Control Voltage	0 to 5V; positive transfer function (lowest frequency at 0V)			0 to 5V; positive transfer function (lowest frequency at 0V)		0 to 5V (lowest frequency at 0V) ± 3V to ± 10V optional for CO-233MEV		0 to + 6V positive transfer function (lowest frequency at 0V) + 3V to + 10V optional except for CO-283VW			
Linearity	± 20% (± 10% optional); ± 10% is standard with bipolar control voltage and with deviation/stability options C, F, I, L and N at frequencies up to 25 MHz					*(With bipolar control voltage option, transfer function is negative, linearity is ± 10%, and an additional + 12V to + 24V supply is required for ECL models)					
Mechanical Tuning Option	"T"	N/A	N/A	"T"	N/A	"T"	N/A	"T"	"T"	"T"	N/A
	"T" indicates that a mechanical tuning option is available; add "T" to model number					"T" indicates that a mechanical tuning option is available; add "T" to model number					
Size	(a) CO-231V 1½" x 1½" x ½" (b) CO-231VH 1⅜" x 1⅜" x ½"	0.5" x 0.8" x 0.2" CO-401V: 4 pin CO-402V: 14 pin	0.8" x 0.8" x 0.2" 14 pin double DIP	1½" x 1½" x ½"	0.8" x 0.8" x 0.2" 14 pin double DIP	2" x 3" x ½"	0.8" x 0.98" x 0.2" 16 pin double DIP	1½" x 1½" x ⅝" CO-233V & VH differ in pin configuration	2" x 2" x ¾"	(a) 2" x 2" x ¾" (b) 2" x 3" x ¾"	0.8" x 0.98" x 0.2" 16 pin double DIP

Wide Deviation Linear VCXOs







Series	BASIC VCXOs CO-271	BASIC VCXOs CO-275	TEMPERATURE COMPENSATED (TC/VCXOs) CO-351	TEMPERATURE COMPENSATED (TC/VCXOs) CO-352	OVEN CONTROLLED (OC/VCXOs) CO-272	OVEN CONTROLLED (OC/VCXOs) CO-276
Center Frequency	to 23 MHz	to 23.1-500 MHz	to 20 MHz	20.1-500 MHz	to 23 MHz	23.1-500 MHz
Deviation	± .001% to ± .25%. Model Codes for ± .01%, ± .03%, and ± 1% are shown in the stability section below (for deviation exceeding ~ 0.25% consider a Vectron non-crystal VCO or custom VCXO).					
Control Voltage	+ 5 volts (higher or lower sensitivity, or unipolar control, available); Negative transfer function					
Linearity	"N": ± 5% (smooth monotonic) "A": ± 3% characteristic with "B": ± 1% no discontinuities)					

Temperature Stability	± .01% deviation (G)		± .03% deviation (H)		± .1% deviation (L)		± .01% deviation (G)		± .03% deviation (H)		± .1% deviation (L)		± .01% deviation (G)		± .03% deviation (H)		± 1% deviation (L)	
	Code	Stability	Code	Stability	Code	Stability	Code	Stability	Code	Stability	Code	Stability	Code	Stability	Code	Stability	Code	Stability
(Temperature Range B) 0°C to + 50°C	**GB35** **GB15**	± .003% ± .001%	**HB55** **HB25**	± .005% ± .002%	**LB14** **LB35**	± .01% ± .003%	**GB56** **GB16**	± .0005% ± .0001%	**HB15** **HB56**	± .001% ± .0005%	**LB25** **LB15**	± .002% ± .001%	**GB37**	± .00003%	**HB16**	± .0001%	**LB36**	± .0003%
(Temperature Range D) - 20°C to + 70°C	**GD55** **GD35**	± .005% ± .003%	**HD14** **HD55**	± .01% ± .005%	**LD24** **LD14**	± .02% ± .01%	**GD56** **GD16**	± .0005% ± .0001%	**HD15** **HD56**	± .001% ± .0005%	**LD55** **LD25**	± .005% ± .002%	**GD57**	± .00005%	**HD26**	± .0002%	**LD56**	± .0005%
(Temperature Range F) - 55°C to + 85°C	**GF55**	± .005%	**HF14**	± .01%	**LF34**	± .03%	**GF25** **GF56**	± .002% ± .0005%	**HF55** **HF25**	± .005% ± .002%	**LF14** **LF55**	± .01% ± .005%						

Output Level	Sinewave is standard (3.5-500 MHz); TTL optional (700 kHz-200 MHz), ECL optional (20-200 MHz); lower frequency sine/TTL, and CMOS/HCMOS available on special order.					
Supply Voltage	15 Vdc ± 5% standard; 12-28 Vdc optional. + 5 Vdc required for TTL; 5.2 Vdc required for ECL				24 Vdc standard; 12-28 Vdc optional. + 5 Vdc required for TTL; 5.2 Vdc required for ECL	
Frequency Adjust.	Screwdriver adjustment permits setting center frequency; range is approximately 10% of deviation, but no less than ± .001%					
Size	2" x 2" x ¾" (51 x 51 x 19mm) 2" x 2¼" x ¾" for SW option	2" x 3" x ¾" (51 x 77 x 19mm) (reduced size available)	2" x 2" x ¾" (51 x 51 x 19mm) 2" x 2¼" x ¾" for SW option	2" x 3" x ¾" (51 x 77 x 19mm)	2" x 2" x 4" (51 x 51 x 102mm)	2" x 2" x 4" (51 x 51 x 102mm)
Configuration Options	pins for pc board mounting (rf output connector option recommended above 200 MHz) "W": SMA, pins, and mounting studs on base "SW": SMA on side, pins on base (studs optional) (SMC connector available)		pins for pcb mount "W": SMA, pins, and mounting studs on base "SW": SMA on side, pins on base (studs optional) (SMC connector available)	pins for pcb mount and studs (rf output connector option recommended above 200 MHz) "SW": SMA on side, pins and studs on base (SMC connector available)	octal plug-in, studs "W": SMA, solder header, studs "U": SMC, solder header, studs "X": BNC, solder header, studs	SMC, solder header, studs "W": SMA, solder header, studs "X": BNC, solder header, studs

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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
ABS acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CAMAC computer automated measurement and control
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3
KSR keyboard send /receive

L
LC inductance capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIB microcomputer interface board
MIC microwave IC
MIPS million instructions per second
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

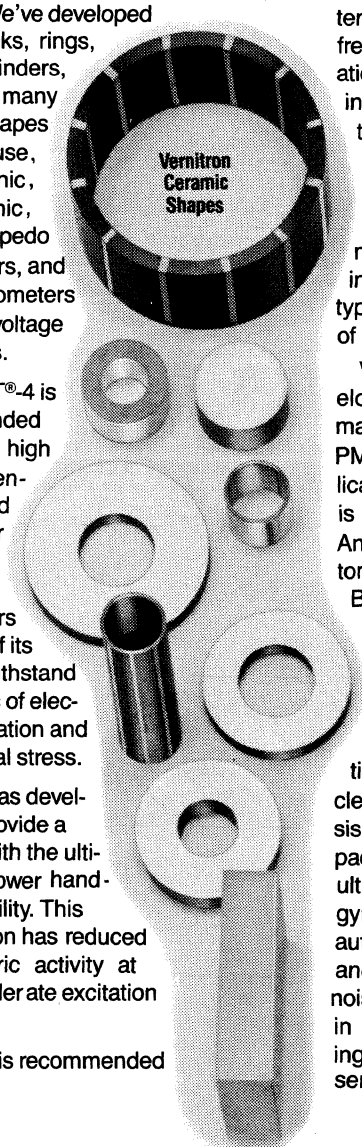
Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

Electronic components and piezo ceramics by Vernitron. Over 45 years of innovation.

In piezo ceramics of diverse shapes. In Bimorphs and Unimorphs. Also in ceramic bandpass and ladder filters. In ceramic resonators. And in piezo igniters. That's Vernitron Piezoelectric Division.

We've been making innovations in electronic components and piezo ceramics since 1938. And we're still doing it. Take a look at some of our accomplishments in modern ceramic shapes. We've developed discs, blocks, rings, plates, cylinders, tubes and many custom shapes for sonar use, as ultrasonic, hydrophonic, and as torpedo transducers, and in accelerometers and high voltage generators.



Our PZT®-4 is recommended for use in high voltage generators and high power acoustic radiating transducers because of its ability to withstand high levels of electrical excitation and mechanical stress.

PZT-8 was developed to provide a material with the ultimate in power handling capability. This composition has reduced piezoelectric activity at low to moderate excitation levels.

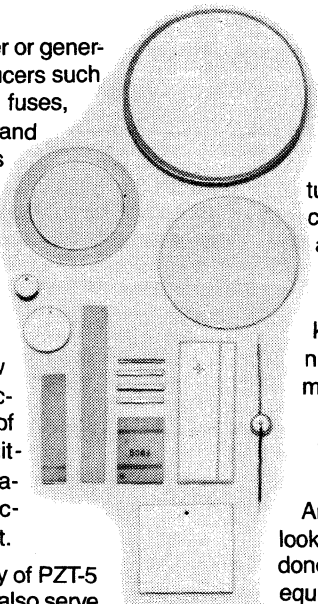
PZT-5A is recommended for use in receiver or generator type transducers such as hydrophones, fuses, accelerometers, and vibration pickups in general etc., because of its high sensitivity, permittivity and time stability.

PZT-5H is better suited to low frequency applications because of increased permittivity, accompanied by a reduced Curie point.

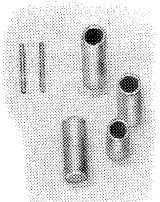
The family of PZT-5 materials may also serve in very low power motor-type transducers because of high motion sensitivity.

Vernitron also has developed lead metaniobate materials, PMN-1 and PMN-2, for diverse applications. Their feature is higher Curie points. And we are the originators of Unimorphs and Bimorphs to serve as compact transducers for audio tones.

The above compositions are used in such applications as ultrasonic cleaners, kidney dialysis equipment, heart pacemakers, ink jets, ultrasound scanners, gyros, sonobuoys, automatic erasers and a variety of noisemakers. Also in laser positioning and as motion sensors.

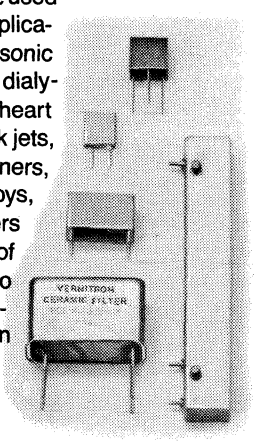


Shapes, Unimorphs, Bimorphs



Ink Jet and Ceramic Tubes

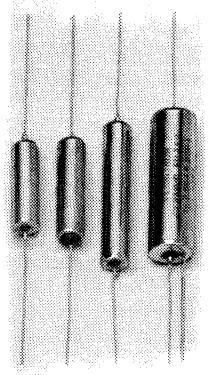
Bandpass Filters and Resonators



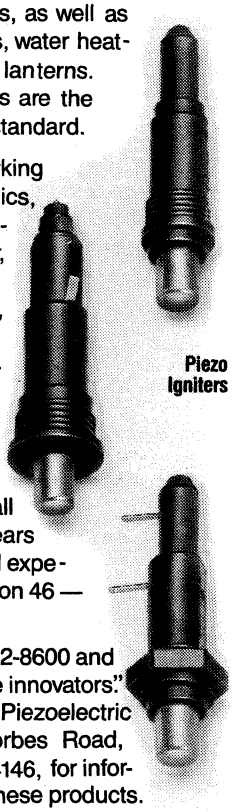
Innovation is also true of our work in bandpass filters, ladder filters, and ceramic resonators. We offer light weight, stable, fixed tuned, miniature ceramic filters and resonators with varieties for almost any kind of communications equipment:

consumer —
commercial —
military.

Ceramic Ladder Filters



And don't overlook what we've done in piezo igniters for gas fired equipment of all types. Vernitron igniters are original equipment in most makes of barbeque grills, as well as in many furnaces, water heaters and camping lanterns. Vernitron igniters are the world industry standard.



Piezo Igniters

So if you're working with piezo ceramics, in alarms, speakers, lasers, sonar, ink jet printing data processing, communications, telephone development, gyros, or hydrophones, pacemakers or gas-fired equipment give us a call and put our 45 years of innovation and experience — going on 46 — to work.

Just call (216) 232-8600 and ask for "one of the innovators." Or write Vernitron Piezoelectric Division, 232 Forbes Road, Bedford, Ohio 44146, for information on any of these products.

Vernitron Piezoelectric Division

232 Forbes Rd. / Bedford OH 44146-5478 / 216-232-8600 / TWX 810-427-2274

ADVANCED DESIGN MICROCIRCUIT CRYSTAL OSCILLATORS

XSIS ELECTRONICS

XSIS Electronics advanced-design microcircuit crystal oscillators

Expanded manufacturing and test facilities coupled with continuing consistency in the quality of workmanship and a nearly perfect on-time delivery history provide customers with a high degree of confidence. Many call it "experienced reliability".

All products, TTL, CMOS, FAST CMOS, ECL and gated are 100% tested for all electrical parameters over the operating temperature range. In-house capabilities include not only automated temperature range testing but also PIND test, destructive, non-destructive bond pull test, automatic temperature cycling, fine and gross leak check, die shear test and constant acceleration. XSIS also monitors and controls the parameters and processes of the quartz crystal. Custom designs for CMOS output up to 30.0 MHz are now available. ECL oscillators with either 10 KH or 100K compatibility up to 150 MHz are also available. Please consult our engineering department for more information on these devices.

XSIS Microcircuit Oscillators are manufactured to the electrical parameters of MIL-O-55310, workmanship standards are in accordance with MIL-M-38510 and the quality system is as required by MIL-I-45208.

XSIS is a QPL Source for crystal oscillators to MIL-O-55310/8, /11, /14, /15, /16, /17, /18, /19.

TYPICAL SPECS AVAILABLE

	100 SERIES-TTL	200 SERIES-CMOS	300 SERIES-ECL-10KH
Frequency Range	100Hz to 70MHz	250Hz to 30.0MHz	20MHz to 150MHz
Frequency @ +25°C	±.0015%	±.0015%	±.0015%
		for Higher Frequencies—contact factory	
		(200A Series-Fast CMOS)	(300A Series-100K)

STABILITIES AVAILABLE

Part Number

1	±.1%
2	±.05%
3	±.01%
4	±.005%
5	±.0025%**

** Not available with -55°C to +125°C

TEMPERATURE RANGES

Part Number

1	0 to 70°C
2	-30 to +85°C
3	-55 to +125°C***

*** Consult Factory For Above 90MHz on ECL

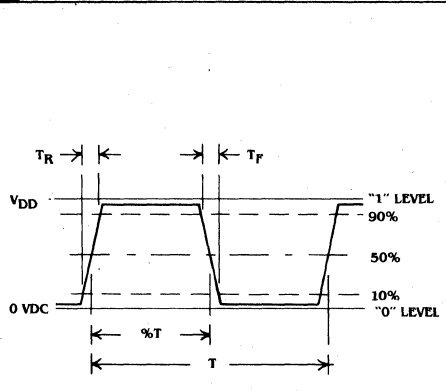
PACKAGE TYPE + PIN CONNECTIONS

OPTION 'X'	OPTION 'E'	OPTION 'M'	OPTION 'T' (4 PIN)
PIN 7 GRD	PIN 4 B+	PIN 1 Output	PIN 1 N/C
8 Output	5 Output	2 Case	7 GRD
14 B+	7 GRD/Case	8 GRD	8 Output
1 thru 6 N/C	1, 2, 3, 6, N/C	14 B+	14 B+
9 thru 13 N/C	8 thru 14 N/C	3 thru 7 N/C	2 thru 6 Missing
Same As M55310/16/18	Same As M55310/14	9 thru 13 N/C Same As M55310/8/11/15	9 thru 13 Missing

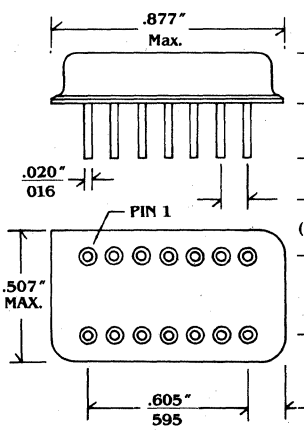
PART NUMBER ORDERING EXAMPLE

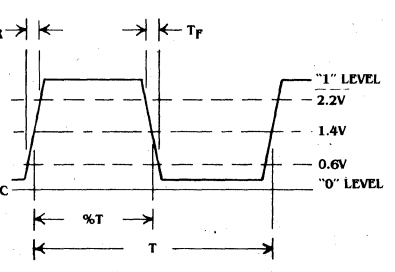
X 1 4 3-20.0 MHz

- 14 PIN with Option 'X' PINOUT
- TTL Compatible (2 For CMOS -3 for ECL)
- ±.005% Stability
- -55° to ±125°C Temperature Range



C-MOS WAVEFORM





TTL WAVEFORM

XSIS ELECTRONICS, INC., 12620 W. 63RD. ST., SHAWNEE, KS 66216 • (913) 631-0448 • TELEX 437227 • FAX 913-631-1170

XSIS ELECTRONICS

XSIS XE10 SERIES SURFACE-MOUNT LEADLESS CHIP CARRIER OSCILLATORS

XSIS has developed another advanced design micro-circuit oscillator in a leadless chip carrier with features significantly superior to any presently available.

- Calibration accuracy of ± .0015% @ + 25°C.
- Frequency stability-vs-temperature of ± .005% over -55°C to + 125°C.
- Frequency aging @ + 25°C of ± .0005% per year.
- Lowered input current.
- Unique, rugged design for high shock and vibration environs.
- A resistance welded hermetically sealed package for utmost long term reliability.
- QPL to M55310/19

FREQUENCY RANGE	500 KHZ TO 25.0 MHZ
FREQUENCY ACCURACY @ 25°C	± 0.0015%
FREQUENCY STABILITY VS. TEMPERATURE	SEE TABLE BELOW
OPERATING TEMPERATURE RANGE	
STORAGE TEMPERATURE	-55°C to +125°C
INPUT VOLTAGE	+5VDC ± 10%
OUTPUT	TTL (10 LOADS)
SYMMETRY	60-40% @ 1.4 VDC LEVEL
RISE & FALL TIMES	500 KHZ-15.0 MHZ 15nS MAX. 15.0 MHZ-25.0 MHZ 5nS MAX.
'0' LEVEL (16MA SINK CURRENT)	500 KHZ-15.0 MHZ 0.4VDC MAX. 15.0 MHZ-25.0 MHZ 0.5VDC MAX.
'1' LEVEL (400 MA SOURCE CURRENT)	500 KHZ-15.0 MHZ 2.4VDC MIN. 15.0 MHZ-25.0 MHZ 2.5VDC MIN.
INPUT CURRENT (@ 5.0 VDC)	500 KHZ-15.0 MHZ 60mA MAX. 15.0 MHZ-25.0 MHZ 30mA MAX.
AGING @ 25°C	5PPM/YR MAX.
FREQUENCY STABILITY VS. INPUT VOLTAGE	± 5PPM Max. for 10% change in INPUT VOLTAGE

PART NUMBERING CODE, FREQUENCY STABILITY & OPERATING TEMP. OPTIONS

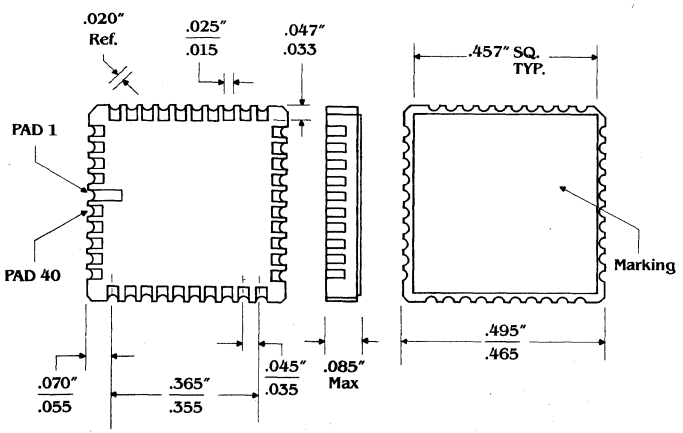
XE10-① ● ● @ FREQUENCY

① = FREQUENCY STABILITY:
1 = ± 0.1%
2 = ± 0.05%
3 = ± 0.01%
4 = ± 0.005%
5 = ± 0.002%*

*not available for -55°C to +125°C

1 = TTL COMPATIBLE

● = OPERATING TEMP.:
1 = 0°C to +70°C
2 = -30°C to +85°C
3 = -55°C to +125°C



PAD	FUNCTION
4 & 10	B+
31 & 37	GND
39	OUTPUT
ALL OTHERS	N/C

XSIS ELECTRONICS

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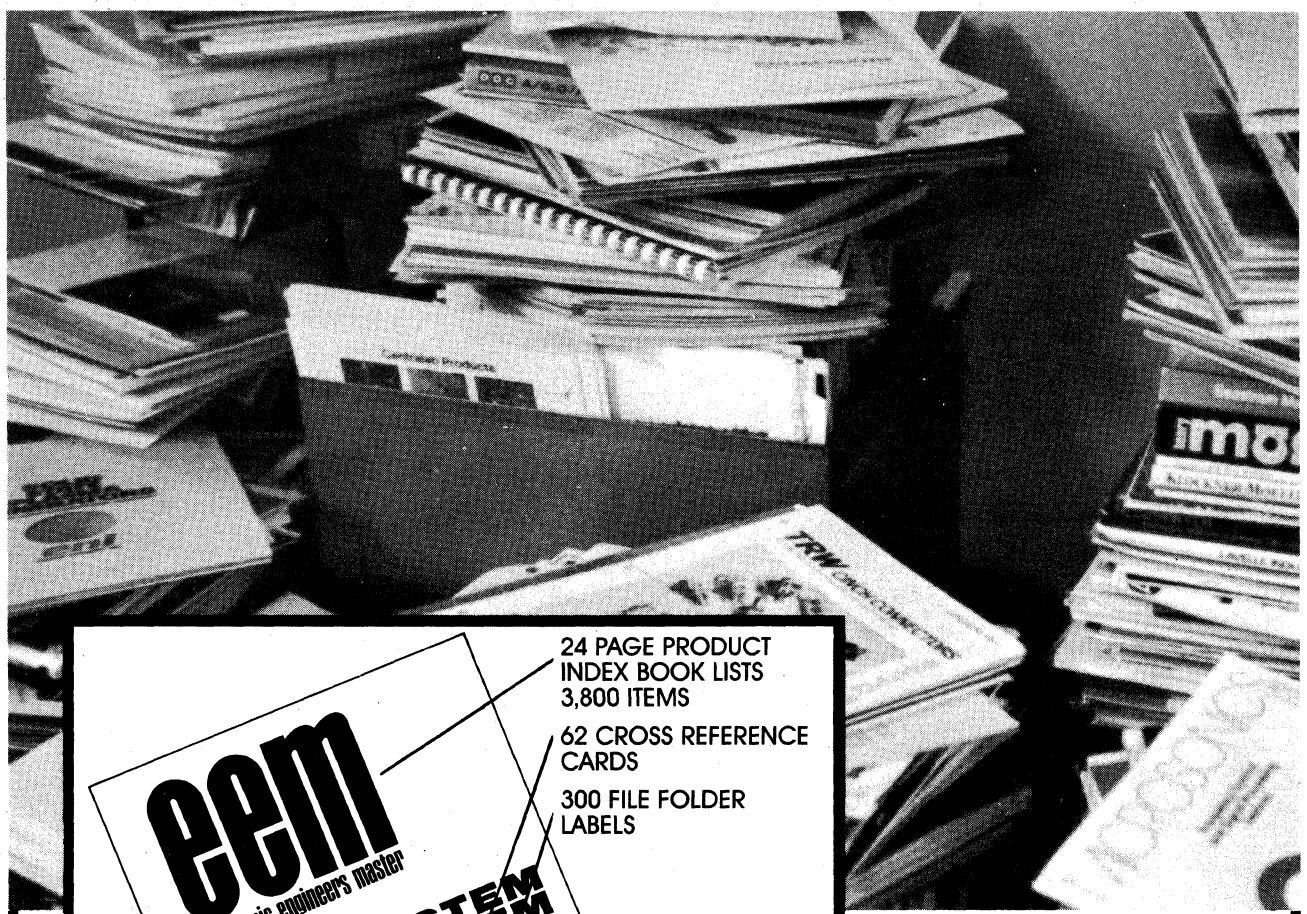

ALL NEW with this edition of EEM

GET ORGANIZED!

Are your catalog files organized? Can you find any given catalog in a matter of seconds? If your answer is "Yes," you probably already have the EEM File System. But, if you said "No," you really ought to look into this simple system. It will save hours of time and tons of aggravation.

The EEM File System was invented over twenty-five years ago to help people who specify, buy, or work with electronic products and equipment. It is upgraded on a constant basis to reflect the current state of the art. It's easy to use and easy to customize to your particular needs.

You say you want to file catalogs by type of product? That's easy to do with The System. But, what are you going to do when there are multiple products in one catalog? Take Mallory for example. There are all kinds of products in the Mallory Short Form Catalog. With the EEM File System all you do is file the catalog under "M" for Mallory and refer to it on all of the cross reference cards that apply.

There are thousands of EEM File Systems in everyday use in engineering and procurement offices all over the world. Shouldn't you be using this proven system?

The EEM File System is shipped in one neat package. The package contains everything you need to set up your very own filing system. Best of all, it's easy to get and very affordable. Send a check or money order for $25.00 and EEM will pay the postage and sales tax. If you must use a purchase order, please add $5.00 for postage and handling. An invoice will accompany your System.

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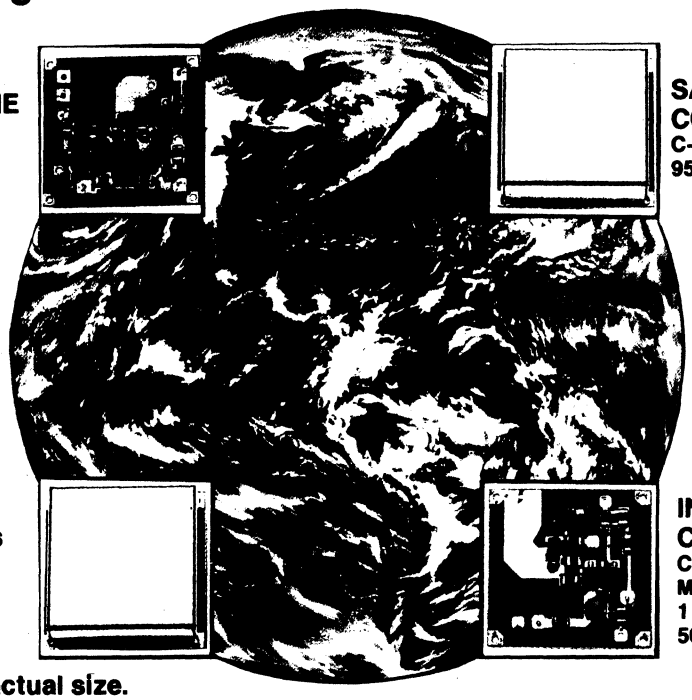
VCO's

Voltage Controlled Oscillators Are Our Business.

CELLULAR PHONE
C-900 Models
825-960 MHz



SATELLITE COMMUNICATIONS
C-500, C-600 Models
950 MHz - 2.3 GHz

RF MODEM LAN's
C-500 Model
500 MHz Tuning

INSTRUMENTATION, CATV
C-500, C-600, C-700 Models
1 GHz Tuning
500 MHz Tuning

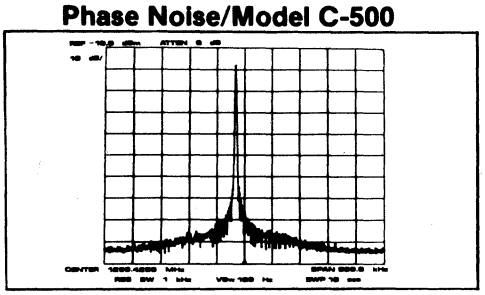
Products shown are actual size.

AND HOW DO WE COMPARE?

COMPANY	MODEL	PHASE NOISE	HARMONICS	LIST PRICE*
Z-Communications	C-500	-90dbc	-20dbc	$ 50.00*
Avantek	VTO-9090	-65dbc	-15dbc	$156.00
Magnum	V66T-1	-70dbc	-20dbc	$166.00

Ask us about our OEM price schedule. Samples in stock.
CALL TODAY: 305-735-1000 or FAX 305-735-1094

Phase Noise/Model C-500



Z-Communications designs and manufactures Voltage Controlled Oscillators (VCO's), Synthesizers and RF-Modular products for the broad spectrum of applications ranging from Satellite Communications, Cellular Phones, CATV Industry, Instrumentation to RF-Modem LAN applications and many others with unique expertise in frequency ranges from MHz to 3GHz and to 22GHz respectively.
Z-Communications' capabilities range from schematic design to layout and artwork generation. The production facility utilizes Surface Mount Technology and every single part leaving our facility is 100% tested over the entire operating temperature range. In short, we feel you will find our products to be the industry's finest RF, Microwave designs and of the highest production quality at a price nobody in the industry can beat.

Call us today for your RF and Microwave requirements.

SHORT FORM CATALOG 1988/89

Z-Communications Inc.

5450 N.W. 33rd Ave., Suite 100 • Ft. Lauderdale, FL 33309
TEL: (305) 735-1000 / FAX: (305) 735-1094

Z-Communications Inc.

VCO PRODUCT SELECTOR GUIDE

MODEL #	FREQUENCY RANGE (MHz)	TUNING VOLTAGE (VDC)	PHASE NOISE @1KHz (dBc)	PHASE NOISE @10KHz (dBc)	POWER OUTPUT (dBm)	SECOND HARMONIC (dBc)	SUPPLY VOLTAGE (VCC)	SUPPLY CURRENT (mA)	PKG STYLE
L-100	50-100	0-12	95	110	4 +/- 1	30	12	15	A
L-105	100-150	0-12	95	110	4 +/- 1	30	12	15	A
L-150	135-175	0-12	95	110	4 +/- 1	30	12	15	A
M-200	150-300	0-20	90	105	10 +/- 1.5	20	15,5	80	B
M-300	200-400	0-24	90	105	10 +/-1.5	20	15,5	80	B
M-400	300-600	0-24	85	105	10 +/- 1.5	20	15,5	80	C
M-500	475-800	0-20	85	105	10 +/-1.5	20	15,5	80	C
C-404	300-700	0-24	85	105	12 +/- 1.5	20	15	50	A
C-706	600-1200	0-24	78	100	13 +/- 1.5	20	15	36	P,S
C-700	700-1300	0-24	78	100	13 +/- 1.5	20	15	36	P,S
C-500A	850-1550	0-24	76	100	13 +/- 1.5	20	15	42	P,S
C-500B	925-1500	0-12	76	100	13 +/-1.5	20	12	36	P,S
C-500BX	950-1735	0-24	76	100	13 +/- 1.5	20	12	36	P,S
C-500BL	900-1500	0-12	76	100	13 +/- 1.5	20	15	15	P,S
C-600	1300-2300	2.5-30	78	100	13 +/- 1.5	20	15	46	P,S
C-602	2200-2300	2.5-12	76	100	10 +/-1.5	20	15	46	P,S
C-580	840-990	0-12	78	100	13 +/-1.5	20	12	35	P,S

Z-COMMUNICATIONS, INC. IS A PIONEER AND LEADER IN THE APPLICATION OF S.M.T. ON A VARIETY OF THE SUBTRATES USED FOR RF & MICROWAVE PRODUCTS. OUR PRODUCTS REPRESENT THE COMMUNICATION INDUSTRY'S BEST DESIGN AND ARE COMPETITIVE IN WORLD-WIDE MARKETS.

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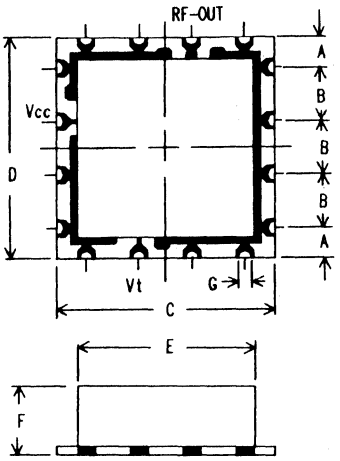
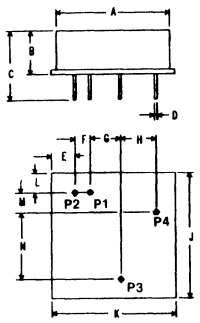
PACKAGING STYLES

S



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	3.05	3.30	.120	.130
B	5.46	5.72	.215	.225
C	22.99	23.24	.905	.915
D	22.99	23.24	.905	.915
E	18.54	18.80	.730	.740
F	7.26	7.52	.286	.296
G	1.65	1.91	.065	.075

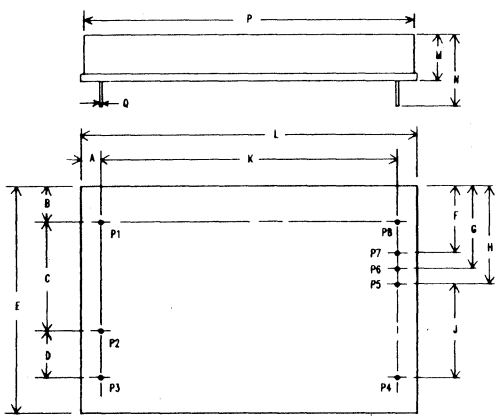
P



P1 - RF OUTPUT
P2 - GROUND
P3 - Vt
P4 - Vcc

DIM	MILLIMETER		INCHES	
	MIN	MAX	MIN	MAX
A	18.54	18.80	.730	.740
B	7.26	7.52	.286	.296
C	11.56	11.81	.455	.465
D	.41	.51	.016	.020
E	3.05	3.30	.120	.130
F	2.41	2.67	.095	.105
G	4.95	5.21	.195	.205
H	5.72	5.97	.225	.235
J	20.45	20.70	.805	.815
K	20.45	20.70	.805	.815
L	3.05	3.30	.120	.130
M	3.18	3.43	.125	.135
N	10.80	11.05	.425	.435

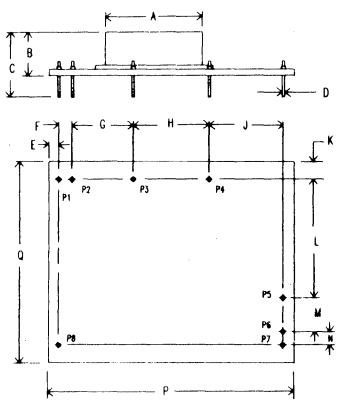
A



P1 - Vcc
P2 - GND
P3 - Vt
P4 - GND
P5 - GND
P6 - RF OUT
P7 - GND
P8 - BAND SW.

DIM.	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	3.18	3.43	.125	.135
B	5.72	5.97	.225	.235
C	17.65	17.90	.695	.705
D	7.49	7.75	.295	.305
E	36.90	37.16	1.453	1.463
F	10.80	11.05	.425	.435
G	13.34	13.60	.525	.535
H	15.88	16.13	.625	.635
J	15.11	15.37	.595	.605
K	48.74	49.00	1.919	1.929
L	55.35	55.60	2.179	2.189
M	7.67	7.92	.302	.312
N	11.56	11.81	.455	.465
P	54.33	54.46	2.014	2.024
Q	.41	.51	.016	.020

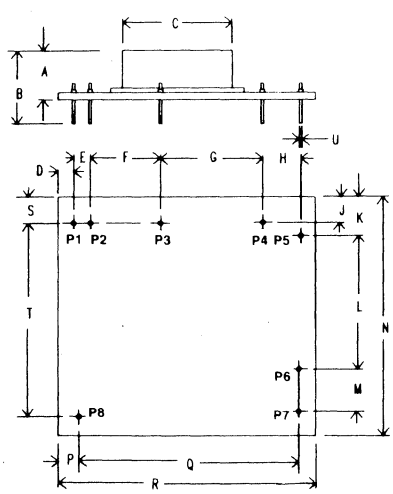
B



P1 - GND
P2 - +15VCD
P3 - VC
P4 - FR OUT
P5 - +15VCD
P6 - +5VDC
P7 - GND
P8 - GND

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	18.54	18.80	.730	.740
B	8.59	8.84	.338	.348
C	12.47	12.73	.491	.501
D	.41	.51	.016	.020
E	1.78	2.03	.070	.080
F	2.41	2.67	.095	.105
G	11.84	12.09	.466	.476
H	14.53	14.78	.572	.582
J	14.07	14.33	.554	.564
K	3.30	3.56	.130	.140
L	22.55	22.81	.888	.898
M	6.40	6.65	.252	.262
N	2.41	2.67	.095	.105
P	47.27	47.52	1.861	1.871
Q	38.48	38.74	1.515	1.525

C



P1 - GND
P2 - +15V
P3 - V TUNE
P4 - +15V
P5 - RF OUT
P6 - +5V
P7 - GND
P8 - GND

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	8.59	8.84	.338	.348
B	12.47	12.73	.491	.501
C	18.54	18.80	.730	.740
D	2.54	2.79	.100	.110
E	2.74	2.99	.108	.118
F	11.84	12.09	.466	.476
G	17.23	17.55	.681	.691
H	6.40	6.65	.252	.262
J	4.14	4.39	.163	.173
K	6.43	6.68	.253	.263
L	22.48	22.73	.885	.895
M	6.73	6.98	.265	.275
N	40.36	40.61	1.589	1.599
P	3.33	3.58	.131	.141
Q	37.47	37.72	1.475	1.485
R	43.76	44.02	1.723	1.733
S	4.29	4.55	.169	.179
T	32.69	32.94	1.287	1.297
U	.41	.51	.016	.020

Z-Communications Inc.
5450 N.W. 33rd Ave. Suite 100 • Ft. Lauderdale, FL 33309
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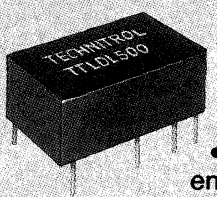
Circuit timing.

Why adjust it when you can perfect it?



Let's say you've just designed the fastest, tightest digital circuit you've ever seen. But it needs a super delay line to tie into your overall scheme. Something special. Certainly high-performance.

You need Technitrol. For leading- or trailing-edge timing of any logic-based circuit.

• Only Technitrol can give you a selection of lumped-constant active delay lines with 5 ns to 2000 ns delay times that are ±1 ns or ±1% repeatable over −55° to +125°C, at rated voltage input ±10%. That's full voltage and temperature compensation!

(We aren't just telling you they perform this well—we'll put it on the part if you wish.)

• Our programmable delay lines, up to 100k ECL, give you a selection of up to 15 different delay times per module, differing by as little as 500 ps.

• Technitrol chip-carrier delay modules enable tighter board stacking and the use of vapor-phase reflow technology.

If you're really serious about quality and performance, you'll appreciate our meticulously balanced designs that produce consistent lows and highs for both positive- and negative-going logic signals. And our low failure rates are unheard of elsewhere. Who else can give you all this?

You'll find the same performance and reliability in all of our military- and commercial-grade products. Our toughest customers demand this. You should, too.

Technitrol, Inc.

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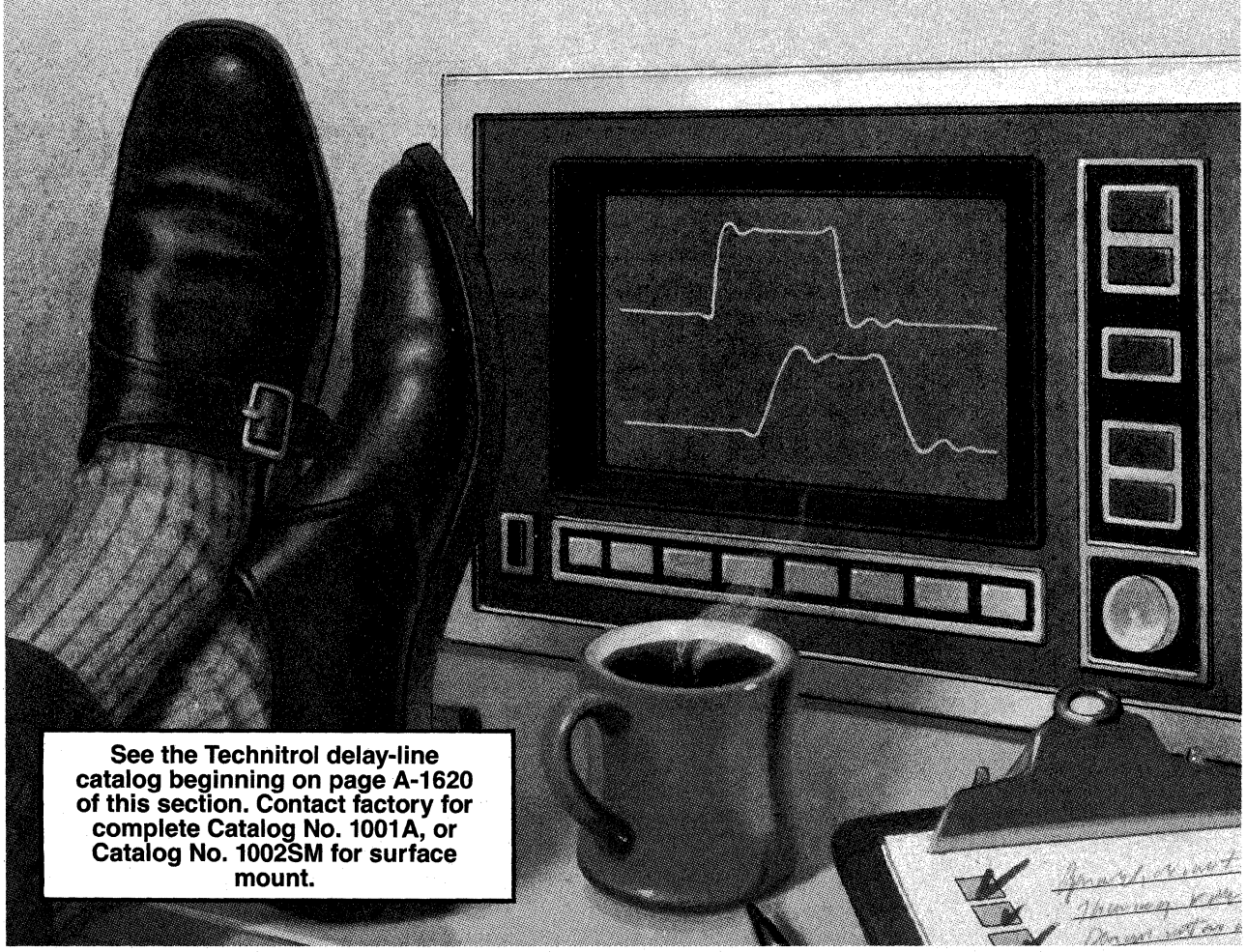
active and passive delay lines • pulse transformers • Manchester encoder/decoders • data bus couplers • pulse-width regulators • high voltage, Scott T, and ferroresonant transformers

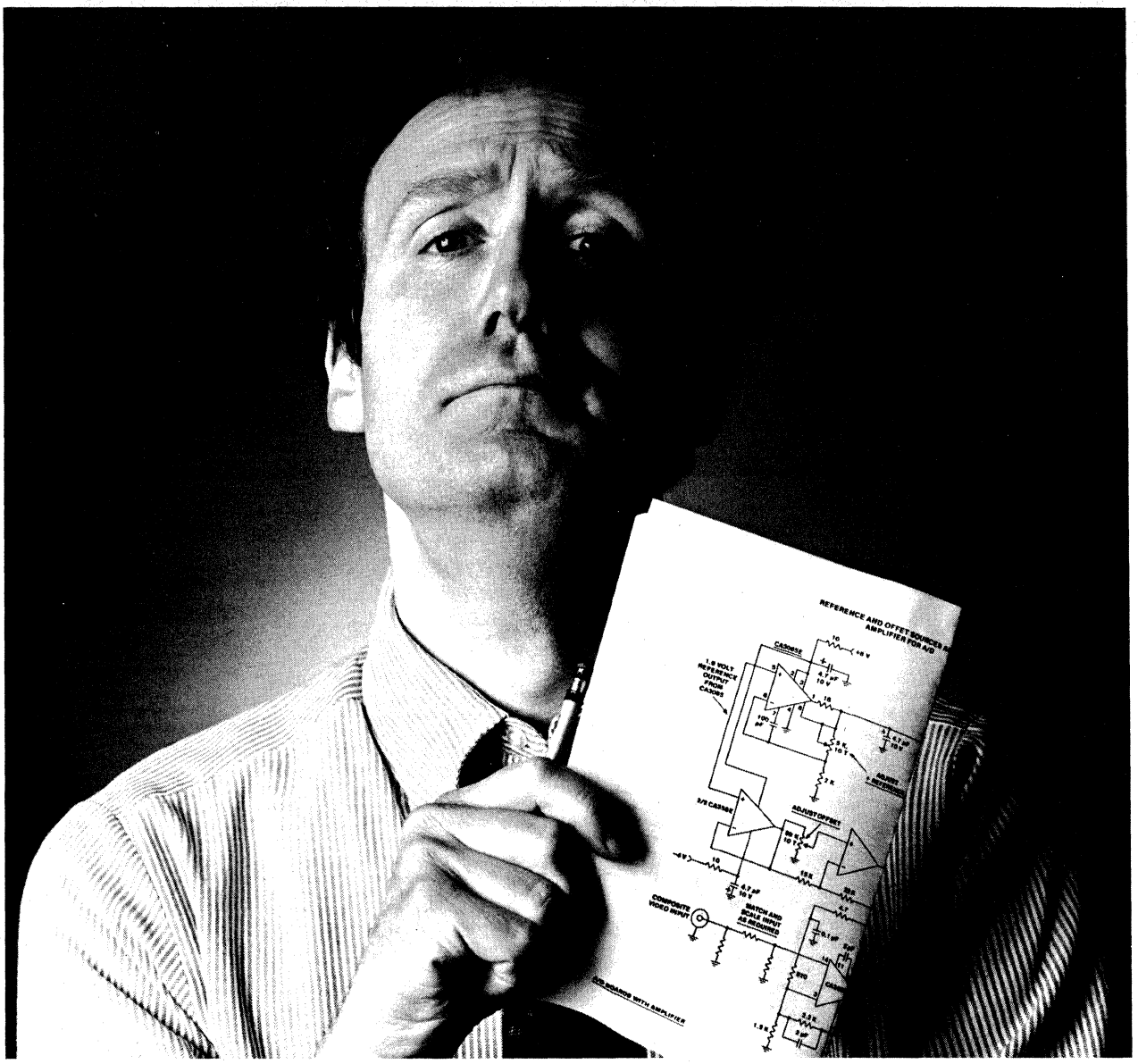


See the Technitrol delay-line catalog beginning on page A-1620 of this section. Contact factory for complete Catalog No. 1001A, or Catalog No. 1002SM for surface mount.

DELAY LINES

Manufacturer	Starting EEM Page No.	Passive				Digital		Video	Glass & Quartz	Other Types
		Distributed Constant		Lumped Constant						
		Fixed	Variable	Fixed	Variable	Tapped	Program-mable			
Allen Avionics*§	A•1496	¤	¤	¤	¤			¤		
Andersen Labs*	A•1497			¤				¤	¤	UHF, VHF, Analog, tapped, Coded, Dispersive, Nondispersive
Automatic Coil*	A•1498	¤		¤		¤	¤	¤		
Bel Fuse*§	A•1503	¤	¤	¤	¤	¤	¤			Digital Delay Oscillators; Generators Pulse, Function, Timing Digital
Control Electronics*	A•1534	¤	¤			¤				Dispersive Audio; Transponder Decoder Networks
Data Delay Devices*	A•1535	¤	¤			¤	¤			Generators, Oscillators, DRAM Timers
Delta Products§	A•1551	¤	¤			¤	¤			
Elmec*	A•1552	¤	¤	¤	¤		¤			
ESC Electronics*§	A•1558	¤	¤	¤	¤	¤	¤	¤		Trimmer, Equalized, Beam, Low Distortion
Kappa Networks*§	A•1575		¤	¤	¤	¤	¤	¤		Trimmers, Transponder Sonar
Nytronics*	A•1594			¤		¤				
PCA Electronics§	A•1602	¤	¤			¤	¤			
Rhombus*§	A•1613	¤		¤		¤	¤			Electromagnetic
TDK	A•1619			¤	¤	¤				
Technitrol*§	A•1620			¤		¤	¤			
Toko America§	A•1629			¤		¤				
Valor§	A•1630					¤	¤			

* Mil Specs § Surface Mount

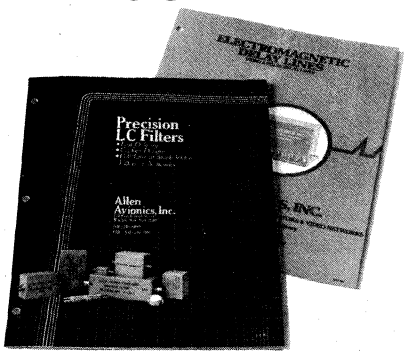


IF YOU'RE A DEMANDING, PICKY, IMPATIENT PERFECTIONIST, WE'VE GOT THE BOOKS FOR YOU.

The tougher you are as a customer, the happier you'll be with us. Start with our products. Because we design, manufacture and stock one of the most extensive lines in the industry, chances are you'll find exactly what you need in either or both catalogs. And if you don't, we'll design circuitry or customize a package to your exact specifications. So, stock or custom, there's no need to look any further than Allen Avionics.

Then there's reliability. Every single component we deliver has been individually tested and is guaranteed to be within the electrical and physical parameters specified. Regarding price and delivery . . . we're competitive on every item and lower on many. More important, whether it's a product in stock, a custom order or a prototype, you'll have it when you need it, and that's a promise.

If your standards are a little too high for other suppliers, send for our Delay Line and/or Filter catalog, or better yet, give us a call. We handle tough problems for tough customers. With ease.



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SIGNAL PROCESSING DEVICES
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SAW Components
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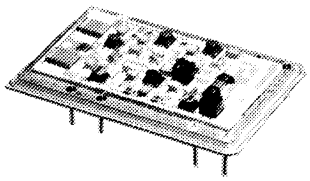
SAW Bandpass Filters

Optimum amplitude and phase characteristics for radar, ECM, ESM and communications filtering.

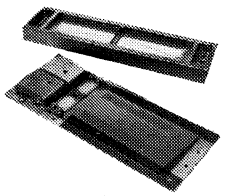
SAW Hybrid Oscillators



Compact, rugged, alignment-free frequency sources available in standard industry packages for PC mounting, VHF, UHF frequency range and voltage controlled tuning.

Specific models available for IFF applications and Fiber Optic timing recovery.

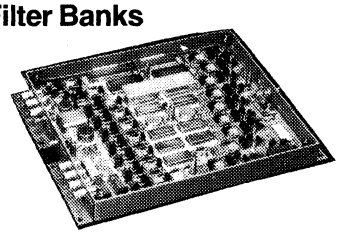
SAW and IMCON Dispersive Delay Lines



The powerful signal processing tool for radar, ELINT, ESM receivers.

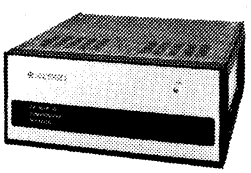
Super Components
for radar & communications

SAW Filter Banks



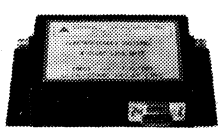
Standard and custom Filter Bank designs for multichannel communication applications. SAW filters provide excellent filter selectivity and rejection characteristics. Custom packages available with integrated electronics for amplification, phase and amplitude matching, and channel switching.

Compressive IF Receivers



100% probability of intercept and real time spectrum analysis for ESM and ELINT Receivers.

Bulk Acoustic Wave Delay Lines and Subsystems



Practical and economical memory for radar, communications and TV signal processing.

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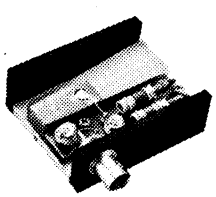
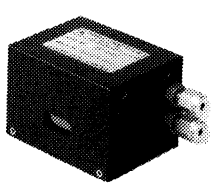


Q-Switches

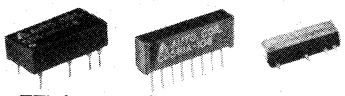


Controlling laser energy in computer printing, semiconductor processing, laser scanning and communications.

ANDERSEN LABORATORIES

Andersen Laboratories, Inc., 1280 Blue Hills Avenue, Bloomfield, CT 06002 Telephone (203) 242-0761/TWX 710-425-2390

TTL Digital Delay Module, 5 TAP



- TTL input and outputs
- Precise and stable delays
- Reliable hybrid construction
- No external components required
- Fan out 10 TTL loads/tap, 20 TTL loads/package
- Operating temperature 0° to 70°C
- Storage temperature −55° to +125°C

Electrical Characteristics:

VIH (High level input voltage) ..2.0 to 5.0V
IIH (High level input current) ..50 μA Max.
VIL (Low level input voltage) ....0.8V Max.
IIL (Low level input current) . −2 ma Max.
VOH (High level output voltage) ..2.5V Min.
VOL (Low level output voltage) ..0.5V Max.
VCC (Supply voltage) .....5.0V ±0.25 VDC
ICC (Supply current) ..... 75 ma Max.
Specifications subject to change without notice.

Test Conditions:

1) All measurements are made @ 25°C
2) VCC is maintained @ 5.0 VDC
3) All measurements are made with no loads on outputs
4) Delays are measured @ 1.5V level
5) Delays and tolerances for leading edges only (TPLH) — falling edges (TPHL) closely matched to TPLH

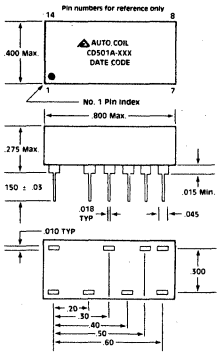
Input Conditions:

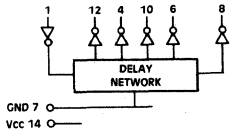
1) Pulse amplitude 3.20V
2) Input rise time 3.0 NS (10 to 90%)
3) Pulse width 2 x total delay
4) Duty cycle < 25%

Input and test conditions are not limiting parameters.

CD501 SERIES, 14 PIN DIP

COMMERCIAL VERSION





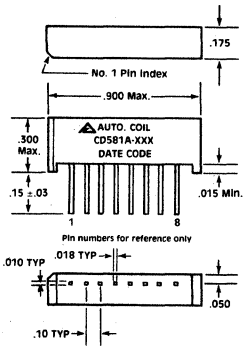
Mechanical Specifications:
Case: Epoxy filled D.A.P.
Leads: Alloy 42 or equiv. solder coated
Marking: White epoxy ink
Also Available:
Intermediate delays
Non symmetrical tap delays
Tighter delay tolerances
Failing edge delay specifications
Non tapped modules
Military versions
LS and ALS versions
Auto insertable modules

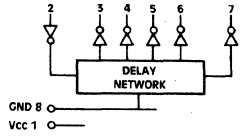
Nominal Delays (in NS) ±2 NS or 5% Whichever is Greater					
Automatic Coil Part Number	PIN 12	PIN 4	PIN 10	PIN 6	PIN 8
CD501A-101	5	10	15	20	25
CD501A-102	6	12	18	24	30
CD501A-103	7	14	21	28	35
CD501A-104	8	16	24	32	40
CD501A-105	9	18	27	36	45
CD501A-106	10	20	30	40	50
CD501A-107	15	30	45	60	75
CD501A-108	20	40	60	80	100
CD501A-109	25	50	75	100	125
CD501A-110	30	60	90	120	150
CD501A-111	40	80	120	160	200
CD501A-112	50	100	150	200	250
CD501A-113	60	120	180	240	300
CD501A-114	70	140	210	280	350
CD501A-115	80	160	240	320	400
CD501A-116	90	180	270	360	450
CD501A-117	100	200	300	400	500

Output rise times (TPLH) 4.0 NS Max. (0.75 to 2.4V level)

CD581 SERIES, 8 PIN SIP

ULTRA THIN SPACE SAVER





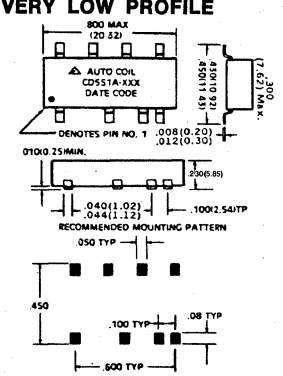
Mechanical Specifications:
Case: Epoxy filled D.A.P.
Leads: Phosphor bronze or equiv. solder coated
Marking: White epoxy ink
Also Available:
Intermediate delays
Non symmetrical tap delays
Tighter delay tolerances
Falling edge delay specifications
Non tapped modules

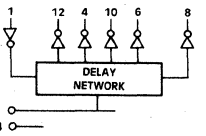
Nominal Delays (in NS) ±2 NS or 5% Whichever is Greater					
Automatic Coil Part Number	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7
CD581A-101	5	10	15	20	25
CD581A-102	6	12	18	24	30
CD581A-103	7	14	21	28	35
CD581A-104	8	16	24	32	40
CD581A-105	9	18	27	36	45
CD581A-106	10	20	30	40	50
CD581A-107	15	30	45	60	75
CD581A-108	20	40	60	80	100
CD581A-109	25	50	75	100	125
CD581A-110	30	60	90	120	150
CD581A-111	40	80	120	160	200
CD581A-112	50	100	150	200	250
CD581A-113	60	120	180	240	300
CD581A-114	70	140	210	280	350
CD581A-115	80	160	240	320	400
CD581A-116	90	180	270	360	450
CD581A-117	100	200	300	400	500

Output rise times (TPLH) 4.0 NS Max. (0.75 to 2.4V level)

CD551 SERIES, 14 PIN SMD

VERY LOW PROFILE





Mechanical Specifications:
Case: Transfer molded epoxy
Leads: Phosphor bronze or equiv. solder coated
Marking: White epoxy ink
Also Available:
Intermediate delays
Non symmetrical tap delays
Tighter delay tolerances
Falling edge delay specifications
Non tapped modules

Nominal Delays (in NS) ±2 NS or 5% Whichever is Greater					
Automatic Coil Part Number	PIN 12	PIN 4	PIN 10	PIN 6	PIN 8
CD551A-101	5	10	15	20	25
CD551A-102	6	12	18	24	30
CD551A-103	7	14	21	28	35
CD551A-104	8	16	24	32	40
CD551A-105	9	18	27	36	45
CD551A-106	10	20	30	40	50
CD551-107	15	30	45	60	75
CD551A-108	20	40	60	80	100
CD551A-109	25	50	75	100	125
CD551A-110	30	60	90	120	150
CD551A-111	40	80	120	160	200
CD551A-112	50	100	150	200	250
CD551A-113	60	120	180	240	300
CD551A-114	70	140	210	280	350
CD551A-115	80	160	240	320	400
CD551A-116	90	180	270	360	450
CD551A-117	100	200	300	400	500

Output rise times (TPLH) 4.0 NS Max. (0.75 to 2.4V level)

COMPLETE TECHNICAL SPECIFICATIONS SHOWN IN CATALOG AC-37, AVAILABLE FREE UPON REQUEST.

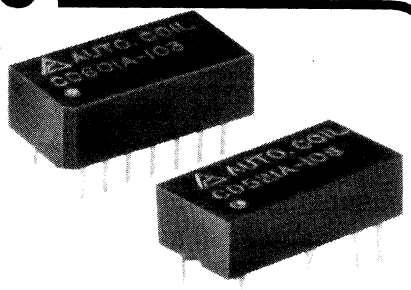
Automatic Coil Corp.
a DSG company
Dept. E 3545 N.W. 71ST Street, Miami, Fl. 33147
Telephone: (305) 696-6660, Fax: (305) 696-0626

TTL Digital Delay Module

- TTL input and outputs
- Usable for pulse widths to 20% of total delay
- Precise and stable delays
- Reliable hybrid construction
- No external components required
- Fan out 10 TTL loads/tap, 20 TTL loads/package
- Operating temperature 0° to 70°C
- Storage temperature −55° to +125°C

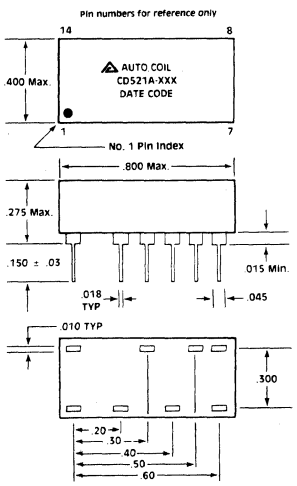
Electrical Characteristics:

VIH (High level input voltage) ..2.0 to 5.0V
IIH (High level input current) ..50 μA Max.
VIL (Low level input voltage) ....0.8V Max.
IIL (Low level input current) . −2 ma Max.
VOH (High level output voltage) ..2.5V Min.
VOL (Low level output voltage) ..0.5V Max.
VCC (Supply voltage) .....5.0V ±0.25 VDC
Specifications subject to change without notice.



CD521 SERIES 14 PIN, 5 TAP

CONTROLLED LEADING AND FALLING EDGES



Test Conditions:

1) All measurements are made @ 25°C
2) VCC is maintained @ 5.0 VDC
3) All measurements are made with no loads on outputs
4) Delays are measured @ 1.5V level
5) Delays and tolerances for leading and falling edges

Input Conditions:

1) Pulse amplitude: 3.20V
2) Input rise time: 3.0 NS (10 to 90%)
3) Pulse width 2 x total delay
4) Duty cycle: < 25%

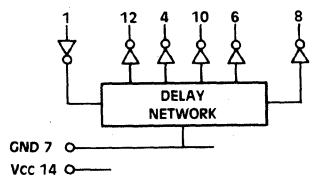
Also Available:
Intermediate delays
Non symmetrical tap delays
Tighter delay tolerances
Non tapped modules
Input and test conditions are not limiting parameters.

ICC (Supply Current) ..... 75 ma Max.

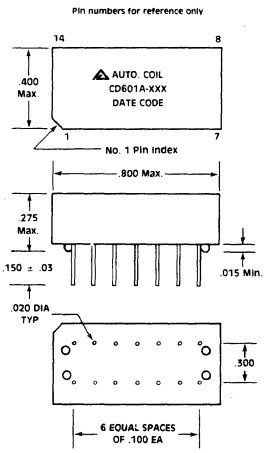
Nominal Delays (in NS) ±2 NS or 5% Whichever is Greater

Automatic Coil Part Number	PIN 12	PIN 4	PIN 10	PIN 6	PIN 8
CD521A-101	5	10	15	20	25
CD521A-102	6	12	18	24	30
CD521A-103	7	14	21	28	35
CD521A-104	8	16	24	32	40
CD521A-105	9	18	27	36	45
CD521A-106	10	20	30	40	50
CD521A-107	15	30	45	60	75
CD521A-108	20	40	60	80	100
CD521A-109	25	50	75	100	125
CD521A-110	30	60	90	120	150
CD521A-111	40	80	120	160	200
CD521A-112	50	100	150	200	250
CD521A-113	60	120	180	240	300
CD521A-114	70	140	210	280	350
CD521A-115	80	160	240	320	400
CD521A-116	90	180	270	360	450
CD521A-117	100	200	300	400	500

Output rise times (TPLH) 4.0 NS Max. (0.75 to 2.4V level)



CD601 SERIES 14 PIN, 10 TAP



Test Conditions:

1) All measurements are made @ 25°C
2) VCC is maintained @ 5.0 VDC
3) All measurements are made with no loads on outputs
4) Delays are measured @ 1.5V level
5) Delays and tolerances for leading edges only (TPLH) — falling edges (TPHL) closely matched to TPLH

Input Conditions:

1) Pulse amplitude: 3.20V
2) Input rise time: 3.0 NS (10 to 90%)
3) Pulse width: 2 x total delay
4) Duty cycle: < 25%

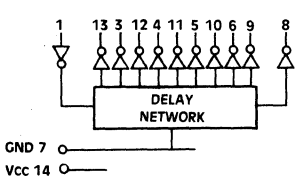
Also Available:
Intermediate delays
Non symmetrical tap delays
Tighter delay tolerances
Falling edge delay specifications
Input and test conditions are not limiting parameters.

ICC (Supply Current) .....150 ma Max.

Nominal Delays (in NS) ±2 NS or 5% Whichever is Greater

Automatic Coil Part Number	Total Delay	Tap Delay
CD601A-101	50	5.0
CD601A-102	75	7.5
CD601A-103	100	10.0
CD601A-104	150	15.0
CD601A-105	200	20.0
CD601A-106	250	25.0
CD601A-107	300	30.0
CD601A-108	350	35.0
CD601A-109	400	40.0
CD601A-110	450	45.0
CD601A-111	500	50.0
CD601A-112	600	60.0
CD601A-113	700	70.0
CD601A-114	800	80.0
CD601A-115	900	90.0
CD601A-116	1000	100.0

Output rise times (TPLH) 4.0 NS Max. (0.75 to 2.4V level)



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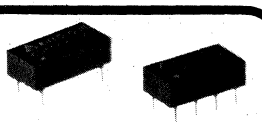
COMPLETE TECHNICAL SPECIFICATIONS SHOWN IN CATALOG AC-37, AVAILABLE FREE UPON REQUEST.

Automatic Coil Corp.
a DSG company
Dept. E 3545 N.W. 71ST Street, Miami, Fl. 33147
Telephone: (305) 696-6660, Fax: (305) 696-0626

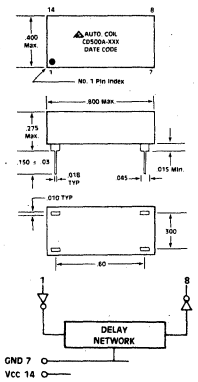
TTL Digital Delay Module

CD500/502 Series
14 PIN, SINGLE & MULTI DELAY MODULE



CD500A SERIES

Pin numbers for reference only



Test Conditions:
1) All measurements are made @ 25°C
2) VCC is maintained @ 5.0 VDC
3) All measurements are made with no loads on outputs
4) Delay measured @ 1.5V level
5) Delay and tolerance for leading edges only (TPLH) — falling edges (TPHL) closely matched to TPLH

Input Conditions:
1) Pulse amplitude: 3.20V
2) Input rise time: 3.0 NS (10 to 90%)
3) Pulse width: 2 x total delay
4) Duty cycle: < 25%

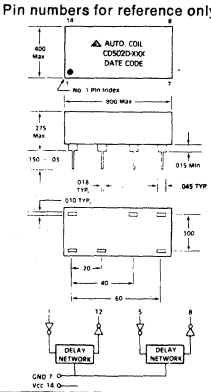
Input and test conditions are not limiting parameters.

Nominal Delays (in NS) ±2 NS or 5% Whichever is Greater			
Automatic Coil Part Number	PIN 1 to 8	Automatic Coil Part Number	PIN 1 to 8
CD500A-101	6	CD500A-118	60
CD500A-102	8	CD500A-119	70
CD500A-103	10	CD500A-120	80
CD500A-104	12	CD500A-121	90
CD500A-105	14	CD500A-122	100
CD500A-106	16	CD500A-123	110
CD500A-107	18	CD500A-124	120
CD500A-108	20	CD500A-125	130
CD500A-109	22	CD500A-126	140
CD500A-110	24	CD500A-127	150
CD500A-111	26	CD500A-128	200
CD500A-112	28	CD500A-129	250
CD500A-113	30	CD500A-130	300
CD500A-114	35	CD500A-131	350
CD500A-115	40	CD500A-132	400
CD500A-116	45	CD500A-133	450
CD500A-117	50	CD500A-134	500

Output rise times (TPLH) 4.0 NS Max. (0.75 to 2.4V level)

CD502D SERIES

Pin numbers for reference only



Test Conditions:
1) All measurements are made @ 25°C
2) VCC is maintained @ 5.0 VDC
3) All measurements are made with no loads on outputs
4) Delays are measured @ 1.5V level
5) Delays and tolerances for leading edges only (TPLH) — falling edges (TPHL) closely matched to TPLH

Input Conditions:
1) Pulse amplitude: 3.20V
2) Input rise time: 3.0 NS (10 to 90%)
3) Pulse width: 3 x total delay
4) Duty cycle: < 25%

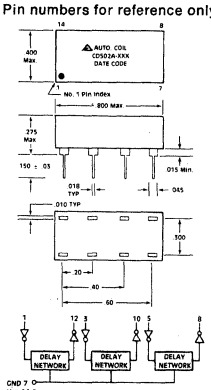
Input and test conditions are not limiting parameters.

Nominal Delays (in NS) ±2 NS or 5% Whichever is Greater		
Automatic Coil Part Number	PIN 1 to 12	PIN 5 to 8
CD502D-151	5	5
CD502D-152	10	10
CD502D-153	20	20
CD502D-154	30	30
CD502D-155	40	40
CD502D-156	50	50
CD502D-157	60	60
CD502D-158	70	70
CD502D-159	80	80
CD502D-160	90	90
CD502D-161	100	100
CD502D-171	5	20
CD502D-172	10	20
CD502D-173	10	30
CD502D-174	20	50
CD502D-175	50	100

Output rise times (TPLH) 4.0 NS Max. (0.75 to 2.4V level)

CD502A SERIES

Pin numbers for reference only



Test Conditions:
1) All measurements are made @ 25°C
2) VCC is maintained @ 5.0 VDC
3) All measurements are made with no loads on outputs
4) Delays are measured @ 1.5V level
5) Delays and tolerances for leading edges only (TPLH) — falling edges (TPHL) closely matched to TPLH

Input Conditions:
1) Pulse amplitude: 3.20V
2) Input rise time: 3.0 NS (10 to 90%)
3) Pulse width: 3 x total delay
4) Duty cycle: < 25%

Input and test conditions are not limiting parameters.

Nominal Delays (in NS) ±2 NS or 5% Whichever is Greater			
Automatic Coil Part Number	PIN 1 to 12	PIN 3 to 10	PIN 5 to 8
CD502A-101	5	5	5
CD502A-102	10	10	10
CD502A-103	20	20	20
CD502A-104	30	30	30
CD502A-105	40	40	40
CD502A-106	50	50	50
CD502A-107	60	60	60
CD502A-108	70	70	70
CD502A-109	80	80	80
CD502A-110	90	90	90
CD502A-111	100	100	100
CD502A-121	5	10	20
CD502A-122	10	20	20
CD502A-123	10	10	30
CD502A-124	20	30	50
CD502A-125	50	50	100

Output rise time (TPLH) 4.0 NS Max. (0.75 to 2.4V level)

- TTL input and outputs
- Precise and stable delays
- Reliable hybrid construction
- No external components required
- Fan out 10 TTL loads/tap, 20 TTL loads/package
- Operating temperature 0° to 70°C
- Storage temperature −55° to +125°C

Electrical Characteristics:

VIH (High level input voltage) ..2.0 to 5.0V
IIH (High level input current) ..50 μA Max.
VIL (Low level input voltage) ....0.8V Max.
IIL (Low level input current) . −2 ma Max.
VOH (High level output voltage) ..2.5V Min.
VOL (Low level output voltage) ..0.5V Max.
VCC (Supply voltage) .....5.0V ±0.25 VDC
Specifications subject to change without notice.

Also Available:

Intermediate delays
Lower profiles
Tighter delay tolerances
Falling edge delay specifications tapped modules
Military versions, LS, AS and ALS modules

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Passive Delay Line

- Standard packages
- Compatible with various logic systems including TTL and video
- Precise and stable delays
- Reliable hybrid construction
- Designed to meet MIL-D-23859
- Operating temperature −55° to +125°C

Electrical Characteristics:

Total delay tolerances: ±2 NS or 5%, whichever is greater
Tap interval tolerances:
Below 5.0 NS: ±0.5 NS or ±20%, whichever is greater
5 NS and above: ±1.0 NS or ±10%, whichever is greater
Impedance tolerance: ±10%
Temperature coefficient: 100 PPM/°C
Dielectric strength: 100 VDC @ 50 ma 5 Sec. Min.
Insulation resistance: 1000MΩ Min.
Attenuation: 10% Max.

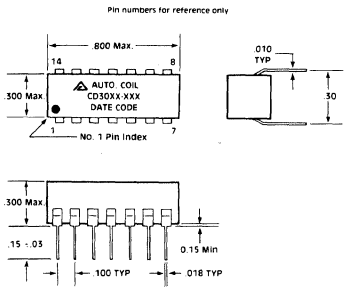
Specifications subject to change without notice.

Test Conditions:

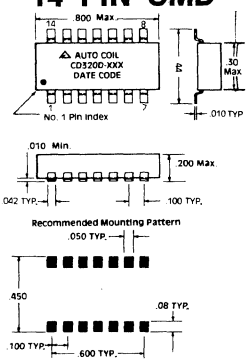
1) All measurements are made @ 25°C
2) Delays are measured @ 50% points
3) Rise times are measured from 10% to 90% points
4) Pulse width 3 x total delay

Input and test conditions are not limiting parameters.

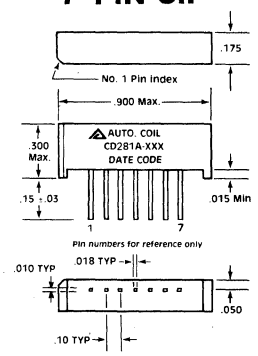
CD300 SERIES 14 PIN DIP



CD320 SERIES 14 PIN SMD

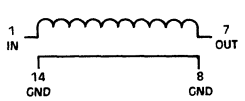


CD281 SERIES 7 PIN SIP

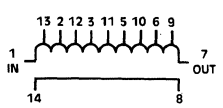


Total Delay (nsec)	Tap Interval (nsec)	Rise Time (nsec)	Automatic Coil Part Number				
			50Ω	100Ω	200Ω	350Ω	500Ω
5	.5	2.5	CDXXXX-101	CDXXXX-121	CDXXXX-141	CDXXXX-201	CDXXXX-221
10	1.0	3.5	CDXXXX-102	CDXXXX-122	CDXXXX-142	CDXXXX-202	CDXXXX-222
15	1.5	4.5	CDXXXX-103	CDXXXX-123	CDXXXX-143	CDXXXX-203	CDXXXX-223
20	2.0	5.5	CDXXXX-104	CDXXXX-124	CDXXXX-144	CDXXXX-204	CDXXXX-224
25	2.5	6.0	CDXXXX-105	CDXXXX-125	CDXXXX-145	CDXXXX-205	CDXXXX-225
30	3.0	6.5	CDXXXX-106	CDXXXX-126	CDXXXX-146	CDXXXX-206	CDXXXX-226
35	3.5	7.0	CDXXXX-107	CDXXXX-127	CDXXXX-147	CDXXXX-207	CDXXXX-227
40	4.0	8.0	CDXXXX-108	CDXXXX-128	CDXXXX-148	CDXXXX-208	CDXXXX-228
45	4.5	9.0	CDXXXX-109	CDXXXX-129	CDXXXX-149	CDXXXX-209	CDXXXX-229
50	5.0	10.0	CDXXXX-110	CDXXXX-130	CDXXXX-150	CDXXXX-210	CDXXXX-230
60	6.0	12.0	CDXXXX-111	CDXXXX-131	CDXXXX-151	CDXXXX-211	CDXXXX-231
70	7.0	14.0	CDXXXX-112	CDXXXX-132	CDXXXX-152	CDXXXX-212	CDXXXX-232
80	8.0	16.0	CDXXXX-113	CDXXXX-133	CDXXXX-153	CDXXXX-213	CDXXXX-233
90	9.0	18.0	CDXXXX-114	CDXXXX-134	CDXXXX-154	CDXXXX-214	CDXXXX-234
100	10.0	20.0	CDXXXX-115	CDXXXX-135	CDXXXX-155	CDXXXX-215	CDXXXX-235
125	12.5	25.0	CDXXXX-116	CDXXXX-136	CDXXXX-156	CDXXXX-216	CDXXXX-236
150	15.0	30.0	CDXXXX-117	CDXXXX-137	CDXXXX-157	CDXXXX-217	CDXXXX-237
200	20.0	40.0	CDXXXX-118	CDXXXX-138	CDXXXX-158	CDXXXX-218	CDXXXX-238
250	25.0	50.0	CDXXXX-119	CDXXXX-139	CDXXXX-159	CDXXXX-219	CDXXXX-239
300	30.0	60.0	CDXXXX-120	CDXXXX-140	CDXXXX-160	CDXXXX-220	CDXXXX-240

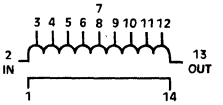
STYLE CD300D



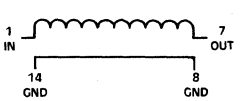
STYLE CD301A



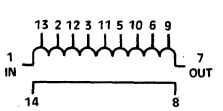
STYLE CD301K



STYLE CD320D



STYLE CD321A



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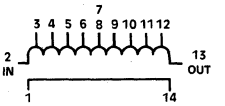
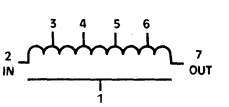


STYLE CD281A



Tap delay 2 x listed interval.

Also Available:
Intermediate delays
Special taps
Electrical parameters other than listed
Independent delay increments
Internal terminations
Tighter tolerances
Auto insertable versions

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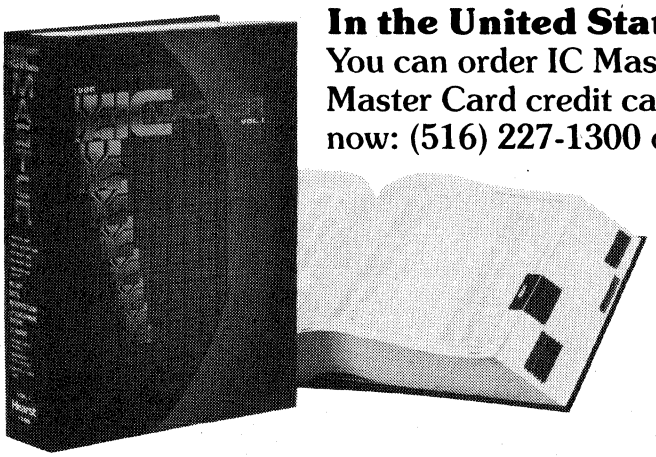

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DELAY LINES

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DIGITAL DELAY LINE SERIES 0447 AND A447 5 TAP

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Pulse Width	1.2 × Total Delay
Pulse Period	4 × Pulse Width
Supply Current, I_{CCL}	60.0 Milliamps max.
Supply Voltage, V_{CC}	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Logic 1 Input Current
50 Microamp max.
Logic 0 Input Current
−2 Milliamp max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Delay Tolerance From Input To Tap
±2 Nsec or 5% whichever is greater
Delay Tolerance From Tap To Tap
±2 Nsec or 7% whichever is greater

All specified Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

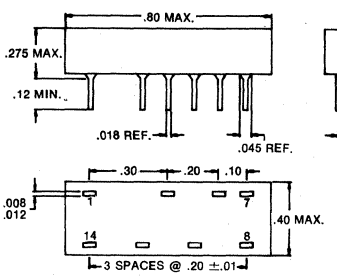
Supply Voltage, V_{CC}
4.75 to 5.25 Volts
Operating Temperature Range
0°C To 70°C
Temperature Coefficient Of Total Delay
500PPM/°C Typical
Minimum Input Pulse Width
40% Of Total Delay
Maximum Duty Cycle
50%

DRIVE CAPABILITIES

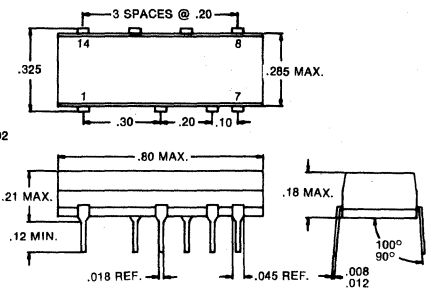
10 TTL Loads/Tap max.
20 TTL Loads/Unit max.

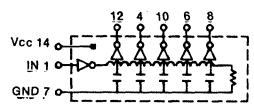
— Compatible with TTL and DTL circuits
— Other delays and tolerances upon request

0447



A447





Part * Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise, Time 2, 3
0447-0025-02	25NS	5NS	4NS
0447-0050-02	50NS	10NS	4NS
0447-0100-02	100NS	20NS	4NS
0447-0150-02	150NS	30NS	4NS
0447-0200-02	200NS	40NS	4NS
0447-0250-02	250NS	50NS	4NS
0447-0300-02	300NS	60NS	4NS
0447-0400-02	400NS	80NS	4NS
0447-0450-02	450NS	90NS	4NS
0447-0500-02	500NS	100NS	5NS

1 Delays measured at 1.5 Volts level on Leading Edge only.
2 Rise Times measured from .75 Volts to 2.4 Volts.
3 Measured with no loads on taps.
* Auto insertable package part number starts with A447.

Specifications Subject To Change Without Notice

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DIGITAL DELAY LINE SERIES 0447 AND A447 10 TAP

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Pulse Width	1.2 × Total Delay
Pulse Period	4 × Pulse Width
Supply Current, I_{CCL}	120.0 Milliamps max.
Supply Voltage, V_{CC}	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Logic 1 Input Current
100 Microamp max.
Logic 0 Input Current
−4 Milliamp max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Delay Tolerance From Input To Tap
±2 Nsec or 5% whichever is greater
Delay Tolerance From Tap To Tap
±2 Nsec or 7% whichever is greater

All specified Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

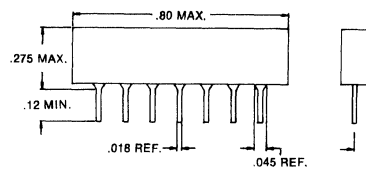
Supply Voltage, V_{CC}
4.75 to 5.25 Volts
Operating Temperature Range
0°C To 70°C
Temperature Coefficient Of Total Delay
500PPM/°C Typical
Minimum Input Pulse Width
40% Of Total Delay
Maximum Duty Cycle
50%

DRIVE CAPABILITIES

10 TTL Loads/Tap max.
20 TTL Loads/Unit max.

— Compatible with TTL and DTL circuits
— Other delays and tolerances upon request

0447



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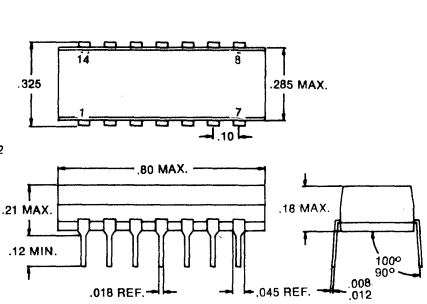

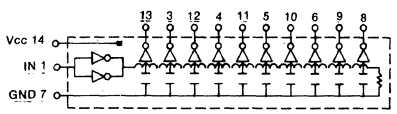

Part * Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise, Time 2, 3
0447-0050-10	50NS	5NS	4NS
0447-0100-10	100NS	10NS	4NS
0447-0150-10	150NS	15NS	4NS
0447-0200-10	200NS	20NS	4NS
0447-0250-10	250NS	25NS	4NS
0447-0300-10	300NS	30NS	4NS
0447-0350-10	350NS	35NS	4NS
0447-0400-10	400NS	40NS	4NS
0447-0500-10	500NS	50NS	5NS
0447-0750-10	750NS	75NS	5NS
**0447-1000-10	1000NS	100NS	5NS

1 Delays measured at 1.5 Volts level on Leading Edge only.
2 Rise Times measured from .75 Volts to 2.4 Volts.
3 Measured with no loads on taps.
* Auto insertable package part number starts with A447.
** Not available as auto insertable package.

Specifications Subject To Change Without Notice

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DIGITAL DELAY LINE SERIES 0447 AND A447 CONTROLLED LEADING & TRAILING EDGE DELAY MODULE 5 TAP

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Pulse Width	1.2 × Total Delay
Pulse Period	4 × Pulse Width
Supply Current, I_{CCL}	60.0 Milliamps max.
Supply Voltage, V_{CC}	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Logic 1 Input Current
50 Microamp max.
Logic 0 Input Current
– 2 Milliamp max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Delay Tolerance From Input To Tap
±2 Nsec or 5% whichever is greater
Delay Tolerance From Tap To Tap
±2 Nsec or 7% whichever is greater

All specified Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

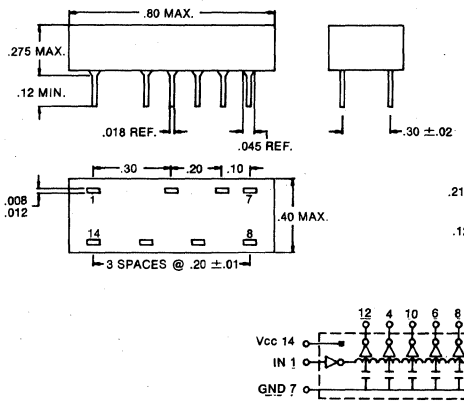
Supply Voltage, V_{CC}
4.75 to 5.25 Volts
Operating Temperature Range
0°C To 70°C
Temperature Coefficient Of Total Delay
500PPM/°C Typical
Minimum Input Pulse Width
20% Of Total Delay
Maximum Duty Cycle
50%

DRIVE CAPABILITIES

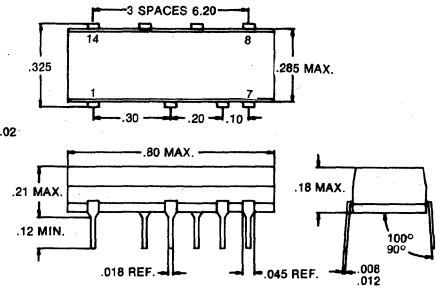
10 TTL Loads/Tap max.
20 TTL Loads/Unit max.

— Compatible with TTL and DTL circuits
— Other delays and tolerances upon request

0447



A447



Part * Number	Total Delay 1, 3	Delay / Tap 1, 3	Rise, Time 2, 3
0447-0025-A1	25NS	5NS	4NS
0447-0050-A1	50NS	10NS	4NS
0447-0100-A1	100NS	20NS	4NS
0447-0150-A1	150NS	30NS	4NS
0447-0200-A1	200NS	40NS	4NS
0447-0250-A1	250NS	50NS	4NS
0447-0300-A1	300NS	60NS	4NS
0447-0350-A1	350NS	70NS	4NS
0447-0400-A1	400NS	80NS	4NS
0447-0450-A1	450NS	90NS	4NS
0447-0500-A1	500NS	100NS	5NS

1 Delays measured at 1.5 Volts level on Leading and Trailing Edge.
2 Rise and Fall Times measured from .75 Volts to 2.4 Volts.
3 Measured with 1 STTL (15PF) load per tap.
* Auto insertable package part number starts with A447.

Specifications Subject To Change Without Notice

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DIGITAL DELAY LINE SERIES 0447 AND A447 TRIPLE OUTPUT MODULE

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Pulse Width	1.2 × Total Delay
Pulse Period	4 × Pulse Width
Supply Current, I_{CCL}	Constant "0" in 115 mA max Constant "1" in 90 mA max.
Supply Voltage, V_{CC}	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Logic 1 Input Current
50 Microamp max.
Logic 0 Input Current
− 2 Milliamp max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.

All specified Performance Characteristics apply at above listed Test Conditions.

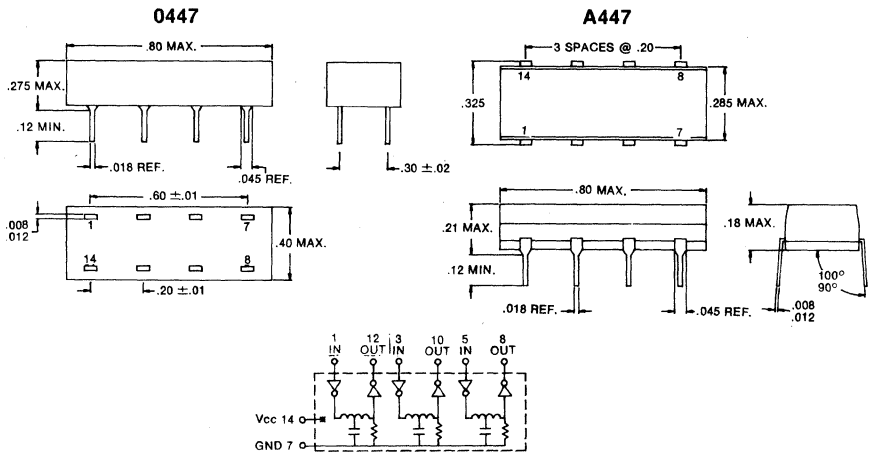
ELECTRICAL CHARACTERISTICS

Supply Voltage, V_{CC}
4.75 to 5.25 Volts
Operating Temperature Range
0°C to 70°C
Temperature Coefficient of Total Delay
1200PPM/°C Typical
Minimum Input Pulse Width
100% of Total Delay
Maximum Duty Cycle
50%

DRIVE CAPABILITIES

10 TTL Loads/Output max.
20 TTL Loads/Unit max.

— Compatible with TTL and DTL circuits
— Other delays and tolerances upon request



Part * Number	Delay Time 1, 3	Rise Time 2, 3
0447-0010-A3	10 NS ± 1.5 NS	3 NS
0447-0020-A3	20 NS ± 1.5 NS	3 NS
0447-0030-A3	30 NS ± 2.0 NS	3 NS
0447-0040-A3	40 NS ± 2.0 NS	3 NS
0447-0050-A3	50 NS ± 2.5 NS	3 NS
0447-0060-A3	60 NS ± 3.0 NS	4 NS
0447-0070-A3	70 NS ± 3.5 NS	4 NS
0447-0080-A3	80 NS ± 4.0 NS	4 NS
0447-0090-A3	90 NS ± 4.0 NS	4 NS
0447-0100-A3	100 NS ± 5.0 NS	4 NS

1 Delays measured at 1.5 Volt Leading Edge only.
2 Rise Times measured from .75 to 2.4 Volts.
3 Measured with 1 STTL load (15PF) on each output.
* Auto insertable package part number starts with A447.

Specifications Subject To Change Without Notice

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DIGITAL DELAY LINE SERIES 0447 SINGLE-IN-LINE 10 TAP

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Pulse Width	1.2 × Total Delay
Pulse Period	4 × Pulse Width
Supply Current, I_{CCL}	120.0 Milliamps max.
Supply Voltage, V_{CC}	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Logic 1 Input Current
50 Microamp max.
Logic 0 Input Current
−2 Milliamp max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Delay Tolerance From Input To Tap
±2 Nsec or 5% whichever is greater
Delay Tolerance From Tap To Tap
±2 Nsec or 7% whichever is greater

All specified Performance Characteristics apply at above listed Test Conditions.

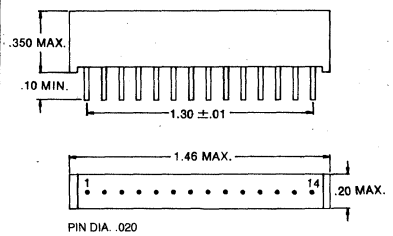
ELECTRICAL CHARACTERISTICS

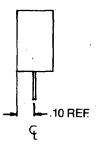
Supply Voltage, V_{CC}
4.75 to 5.25 Volts
Operating Temperature Range
0°C To 70°C
Temperature Coefficient Of Total Delay
500PPM/°C Typical
Minimum Input Pulse Width
40% Of Total Delay
Maximum Duty Cycle
50%

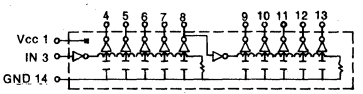
DRIVE CAPABILITIES

10 TTL Loads/Tap max.
20 TTL Loads/Unit max.

—Compatible with TTL and DTL circuits.
—Other delays and tolerances upon request







Part Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise, Time 2, 3
0447-0050-07	50NS	5NS	4NS
0447-0100-07	100NS	10NS	4NS
0447-0150-07	150NS	15NS	4NS
0447-0200-07	200NS	20NS	4NS
0447-0250-07	250NS	25NS	4NS

1 Delays measured at 1.5 Volts level on Leading Edge only.
2 Rise Times measured from .75 Volts to 2.4 Volts.
3 Measured with no loads on taps.

Specifications Subject To Change Without Notice

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DIGITAL DELAY LINE SERIES 0462 8-PIN SINGLE-IN-LINE 5 TAP

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Pulse Width	1.2 × Total Delay
Pulse Period	4 × Pulse Width
Supply Current, I_{CCL}	60.0 Milliamps max.
Supply Voltage, V_{CC}	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Logic 1 Input Current
50 Microamp max.
Logic 0 Input Current
−2 Milliamp max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Delay Tolerance From Input To Tap
± 2 Nsec or 5% whichever is greater
Delay Tolerance From Tap To Tap
± 2 Nsec or 7% whichever is greater

All specified Performance Characteristics apply at above listed Test Conditions.

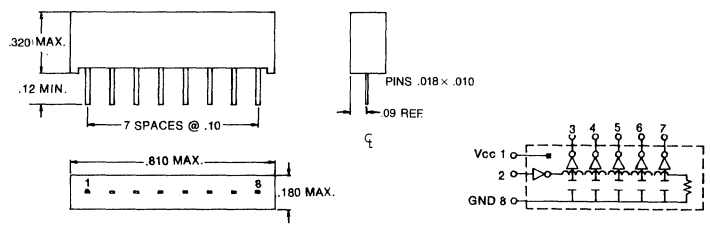
ELECTRICAL CHARACTERISTICS

Supply Voltage, V_{CC}
4.75 To 5.25 Volts
Operating Temperature Range
0°C To 70°C
Temperature Coefficient Of Total Delay
500PPM/°C Typical
Minimum Input Pulse Width
40% Of Total Delay
Maximum Duty Cycle
50%

DRIVE CAPABILITIES

10 TTL Loads/Tap max.
20 TTL Loads/Unit max.

— Compatible with TTL and DTL circuits
— Other delays and tolerances upon request



Part Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise Time 2, 3
0462-0025-02	25NS	5NS	4NS
0462-0050-02	50NS	10NS	4NS
0462-0100-02	100NS	20NS	4NS
0462-0150-02	150NS	30NS	4NS
0462-0200-02	200NS	40NS	4NS
0462-0250-02	250NS	50NS	4NS
0462-0300-02	300NS	60NS	4NS

1 Delays measured at 1.5 Volt level on Leading Edge only.
2 Rise Times measured from .75 Volts to 2.4 Volts.
3 Measured with no loads on taps.

Specifications Subject To Change Without Notice

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DIGITAL DELAY LINE SERIES 0463 AND A463 8 PINS 5 TAP

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Pulse Width	1.2 x Total Delay
Pulse Period	4 x Pulse Width
Supply Current, I_{CCL}	60.0 Milliamps max.
Supply Voltage, V_{CC}	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Logic 1 Input Current
50 Microamp max.
Logic 0 Input Current
– 2 Milliamp max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Delay Tolerance From Input To Tap
± 2 Nsec or 5% whichever is greater
Delay Tolerance From Tap To Tap
± 2 Nsec or 7% whichever is greater

All specified Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

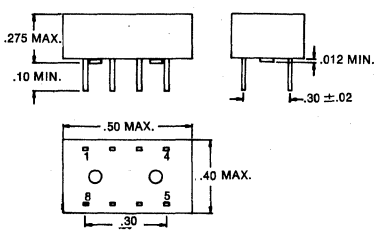
Supply Voltage, V_{CC}
4.75 To 5.25 Volts
Operating Temperature Range
0°C To 70°C
Temperature Coefficient Of Total Delay
500PPM/°C Typical
Minimum Input Pulse Width
40% Of Total Delay
Maximum Duty Cycle
50%

DRIVE CAPABILITIES

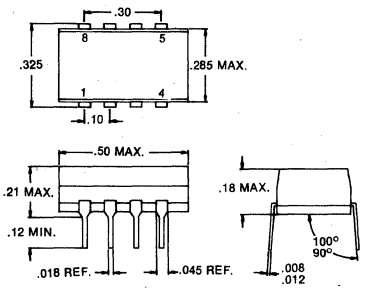
10 TTL Loads/Tap max.
20 TTL Loads/Unit max.

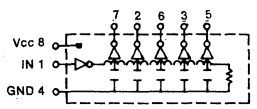
—Compatible with TTL and DTL circuits
—Other delays and tolerances upon request

0463



A463





Part * Number	Total Delay 1,3	Dealy/Tap 1,3	Rise Time 2,3
0463-0025-02	25NS	5NS	4NS
0463-0050-02	50NS	10NS	4NS
0463-0100-02	100NS	20NS	4NS
0463-0150-02	150NS	30NS	4NS
0463-0200-02	200NS	40NS	4NS
0463-0250-02	250NS	50NS	4NS

1 Delays measured at 1.5 Volt level on Leading Edge only.
2 Rise Times measured from .75 Volts to 2.4 Volts.
3 Measured with no loads on taps.
*Auto insertable package part number starts with A463.

Specifications Subject To Change Without Notice

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SMD DIGITAL DELAY LINE 5 TAP SERIES S405

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Pulse Width	1.2 x Total Delay
Pulse Period	4 x Pulse Width
Supply Current, I_{CCL}	60.0 Milliamps max.
Supply Voltage, V_{CC}	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Logic 1 Input Current
50 Microamp max.
Logic 0 Input Current
– 2 Milliamp max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Delay Tolerance From Input To Tap
±2 Nsec or 5% whichever is greater
Delay Tolerance From Tap To Tap
±2 Nsec or 7% whichever is greater

All specified Performance Characteristics apply at above listed Test Conditions.

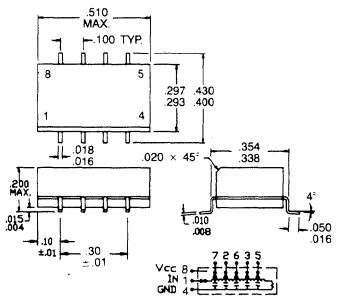
ELECTRICAL CHARACTERISTICS

Supply Voltage, V_{CC}
4.75 to 5.25 Volts
Operating Temperature Range
0°C To 70°C
Temperature Coefficient Of Total Delay
500PPM/°C Typical
Minimum Input Pulse Width
40% Of Total Delay
Maximum Duty Cycle
50%

DRIVE CAPABILITIES

10 TTL Loads/Tap max.
20 TTL Loads/Unit max.

— Compatible with TTL and DTL circuits
— Other delays and tolerances upon request



COPLANARITY ± .002

Part * Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise Time 2, 3
S405-0025-02	25NS	5NS	4NS
S405-0030-02	30NS	6NS	4NS
S405-0040-02	40NS	8NS	4NS
S405-0050-02	50NS	10NS	4NS
S405-0060-02	60NS	12NS	4NS
S405-0070-02	70NS	14NS	4NS
S405-0080-02	80NS	16NS	4NS
S405-0090-02	90NS	18NS	4NS
S405-0100-02	100NS	20NS	4NS
S405-0125-02	125NS	25NS	4NS
S405-0150-02	150NS	30NS	4NS
S405-0200-02	200NS	40NS	4NS
S405-0250-02	250NS	50NS	4NS

Designed for Vapor Phase Soldering at temperatures below 218°C for durations of up to 2 minutes.

1 Delays measured at 1.5 Volts level on Leading Edge only.
2 Rise Times measured from .75 Volts to 2.4 Volts.
3 Measured with no loads on taps.

Specifications Subject To Change Without Notice

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SMD DIGITAL DELAY LINE 10 TAP SERIES S409

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Pulse Width	1.2 x Total Delay
Pulse Period	4 x Pulse Width
Supply Current, I_{CCL}	120.0 Milliamps max.
Supply Voltage, V_{CC}	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Logic 1 Input Current
100 Microamp max.
Logic 0 Input Current
– 4 Milliamp max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Delay Tolerance From Input To Tap
±2 Nsec or 5% whichever is greater
Delay Tolerance From Tap To Tap
±2 Nsec or 7% whichever is greater

All specified Performance Characteristics apply at above listed Test Conditions.

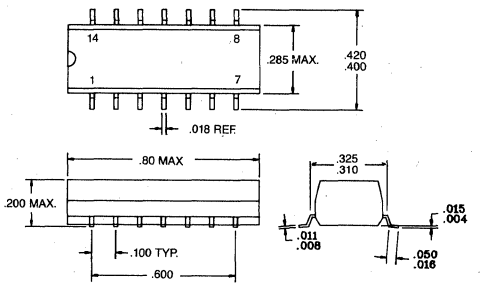
ELECTRICAL CHARACTERISTICS

Supply Voltage, V_{CC}
4.75 to 5.25 Volts
Operating Temperature Range
0°C To 70°C
Temperature Coefficient Of Total Delay
500PPM/°C Typical
Minimum Input Pulse Width
40% Of Total Delay
Maximum Duty Cycle
50%

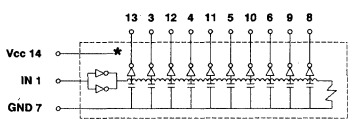
DRIVE CAPABILITIES

10 TTL Loads/Tap max.
20 TTL Loads/Unit max.

— Compatible with TTL and DTL circuits
— Other delays and tolerances upon request



COPLANARITY ±.002



Part Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise Time 2, 3
S409-0050-10	50NS	5NS	4NS
S409-0100-10	100NS	10NS	4NS
S409-0150-10	150NS	15NS	4NS
S409-0200-10	200NS	20NS	4NS
S409-0250-10	250NS	25NS	4NS
S409-0300-10	300NS	30NS	4NS
S409-0350-10	350NS	35NS	4NS
S409-0400-10	400NS	40NS	4NS
S409-0500-10	500NS	50NS	5NS

Designed for Vapor Phase Soldering at temperatures below 218°C for durations of up to 2 minutes.

1 Delays measured at 1.5 Volts level on Leading Edge only.
2 Rise Times measured from .75 Volts to 2.4 Volts.
3 Measured with no loads on Taps.

Specifications Subject To Change Without Notice

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LUMPED CONSTANT DELAY LINE SERIES 0446 AND A446 10 TAP

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Width	3.0 × Total Delay
Pulse Period	4 × Pulse Width
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Distortion	10% max.
Max. Attenuation	See Table

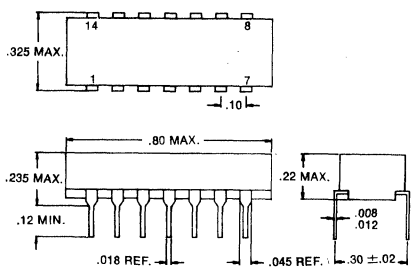
All specified Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

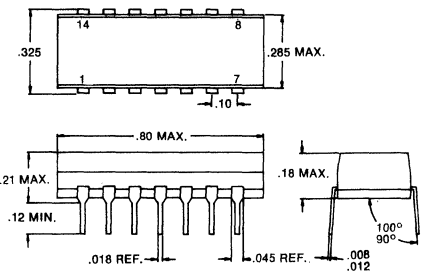
Operating Temperature Range
– 55°C To 125°C
Temperature Coefficient
100PPM/°C Typical
Dielectric Withstanding Voltage
50 Volt

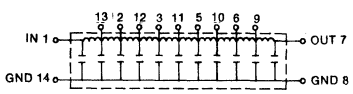
— Compatible with TTL and ECL circuits
— Other delays and impedances upon request
— Built to conform to MIL D-23859
— Untapped units available on request

0446



A446





Total Delay ±5%	Tap to Tap Delay	Attenuation Max.	Impedance ± 10% 50 OHMS *	100 OHMS *	200 OHMS *
5NS	.5±.3NS	5%	0446-0005-50 Tr = 3	0446-0005-01 Tr = 3	0046-0005-02 Tr = 3.5
10NS	1±.35NS	5%	0446-0010-50 Tr = 3.8	0446-0010-01 Tr = 3.8	0446-0010-02 Tr = 4
20NS	2±1NS	5%	0446-0020-50 Tr = 5	0446-0020-01 Tr = 5	0446-0020-02 Tr = 5
30NS	3±1NS	5%	0446-0030-50 Tr = 7	0446-0030-01 Tr = 7	0446-0030-02 Tr = 7
40NS	4±1NS	5%	0446-0040-50 Tr = 8.5	0446-0040-01 Tr = 8.5	0446-0040-02 Tr = 8.5
50NS	5±2NS	5%	0446-0050-50 Tr = 10	0446-0050-01 Tr = 10	0446-0050-02** Tr = 10
60NS	6±2NS	8%	0446-0060-50 Tr = 12	0446-0060-01 Tr = 12	0446-0060-02 Tr = 12
70NS	7±2NS	8%	0446-0070-50 Tr = 14	0446-0070-01 Tr = 14	0446-0070-02 Tr = 14
80NS	8±2NS	8%	0446-0080-50 Tr = 16	0446-0080-01 Tr = 16	0446-0080-02 Tr = 16
90NS	9±2NS	8%	0446-0090-50 Tr = 18	0446-0090-01 Tr = 18	0446-0090-02 Tr = 18
100NS	10±3NS	10%	0446-0100-50 Tr = 20	0446-0100-01** Tr = 20	0446-0100-02 Tr = 20
150NS	15±3NS	10%	0446-0150-50 Tr = 30	0446-0150-01 Tr = 30	0446-0150-02 Tr = 30
200NS	20±3NS	10%	0446-0200-50** Tr = 40	0446-0200-01 Tr = 40	0446-0200-02 Tr = 40
250NS	25±3NS	10%	0446-0250-50 Tr = 50	0446-0250-01 Tr = 50	0446-0250-02 Tr = 50
300NS	30±3NS	10%	0446-0300-50 Tr = 60	0446-0300-01 Tr = 60	0446-0300-02 Tr = 60
400NS	40±3NS	10%	0446-0400-50 Tr = 80	0446-0400-01 Tr = 80	0446-0400-02 Tr = 80
500NS	50±3NS	10%	0446-0500-50 Tr = 100	0446-0500-01 Tr = 100	0446-0500-02 Tr = 100

* Auto insertable package part number starts with A446.
Rise time measured from 10% to 90% of the pulse.
** Max. delay for Auto insertable package.

Specifications Subject To Change Without Notice

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LUMPED CONSTANT DELAY LINES SINGLE IN-LINE SERIES 0401

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Width	3 x Total
Pulse Period	4 x Pulse Width
Ambient Temperature	25°C
Input Rise Time	2.0 NS (10%–90%)

PERFORMANCE CHARACTERISTICS

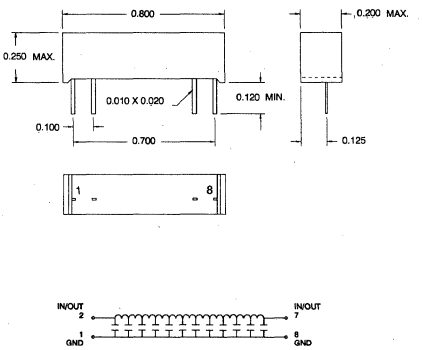
Distortion	10% Max.
Rise Time	See Table

All specified Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

Operating Temperature Range
– 55°C To 125°C
Temperature Coefficient
100PPM/C° Typical
Dielectric Withstanding Voltage
50 Volt

— Compatible with TTL and ECL circuits
— Built to conform to MIL D-23859



Time Delay (ns)	Tolerance (Max.) (ns)	Max. * Rise Time (ns)	DCR (Ohms) (Max.)	Impedance Ohms (Zo) ± 10%	Part Number
0.0	+0.25	1.0	1.0	100	0401-1403-01
0.5	±0.25	1.0	1.0	100	0401-1403-02
1.0	±0.25	1.0	1.0	100	0401-1403-03
1.5	±0.25	1.0	1.0	100	0401-1403-04
2.0	±0.25	1.0	1.0	100	0401-1403-05
2.5	+0.25	1.0	1.0	100	0401-1403-06
3.0	±0.25	1.0	1.0	100	0401-1403-07
3.5	±0.25	1.0	1.0	100	0401-1403-08
4.0	±0.25	1.0	1.0	100	0401-1403-09
4.5	±0.25	1.0	1.0	100	0401-1403-10
5.0	+0.25	1.1	1.0	100	0401-1403-11
5.5	±0.25	1.2	1.0	100	0401-1403-12
6.0	±0.25	1.3	1.0	100	0401-1403-13
6.5	±0.25	1.4	1.0	100	0401-1403-14
7.0	±0.25	1.5	1.0	100	0401-1403-15
7.5	+0.25	1.6	1.0	100	0401-1403-16
8.0	±0.25	1.7	1.0	100	0401-1403-17
8.5	±0.25	1.8	1.0	100	0401-1403-18
9.0	±0.25	1.9	1.0	100	0401-1403-19
9.5	±0.25	2.0	1.0	100	0401-1403-20
10.0	±0.25	2.0	1.0	100	0401-1403-21
11.0	±0.25	2.2	2.0	100	0401-1403-23
12.0	±0.25	2.3	2.0	100	0401-1403-25
13.0	±0.25	2.5	2.0	100	0401-1403-27
14.0	±0.25	2.6	2.0	100	0401-1403-29
15.0	±0.25	2.8	2.0	100	0401-1403-31
16.0	±0.25	3.0	2.5	100	0401-1403-33
17.0	±0.25	3.2	2.5	100	0401-1403-35
18.0	±0.25	3.4	2.5	100	0401-1403-37
19.0	±0.25	3.6	2.5	100	0401-1403-39
20.0	±0.50	3.8	2.5	100	0401-1403-40
25.0	±0.50	4.5	4.0	100	0401-1403-46
30.0	±0.50	5.5	4.5	100	0401-1403-51
35.0	±0.50	6.4	5.5	100	0401-1403-56
40.0	±0.50	7.4	6.0	100	0401-1403-61

*Rise Time measured from 10% to 90% of the pulse

Specifications Subject To Change Without Notice

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LUMPED CONSTANT DELAY LINES SINGLE IN-LINE

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Width	3.0 × Total Delay
Pulse Period	4 × Pulse Width
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Distortion	10% max.
Max. Attenuation	See Tables

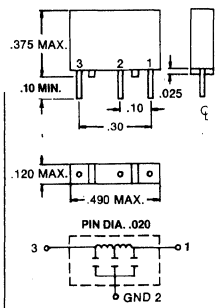
All specified Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

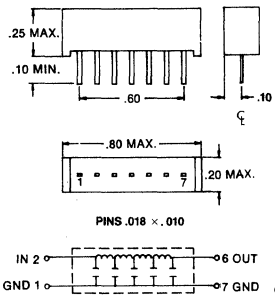
Operating Temperature Range
−55°C To 125°C
Temperature Coefficient
100PPM/°C Typical
Dielectric Withstanding Voltage
50 Volt DC

— Compatible with TTL and ECL circuits
— Other delays and impedances upon request
— Built to conform to MIL D-23859

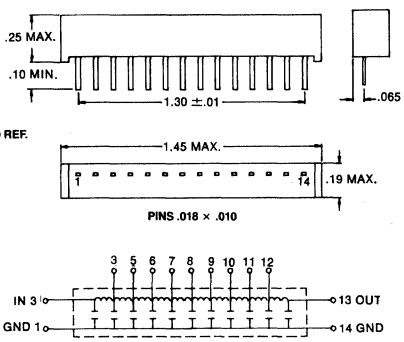
0402



0403



0438



Time Delay	Rise Time *	D.C.R. Max. In OHMS	Part Number 55 OHMS ± 10%	Part Number 93 OHMS ± 10%
1 ± .2NS	1.6NS	.20	0402-0001-55	0402-0001-93
2 ± .2NS	1.6NS	.25	0402-0002-55	0402-0002-93
3 ± .2NS	1.7NS	.37	0402-0003-55	0402-0003-93
4 ± .2NS	1.7NS	.50	0402-0004-55	0402-0004-93
5 ± .25NS	1.8NS	.62	0402-0005-55	0402-0005-93
6 ± .3NS	2.0NS	.75	0402-0006-55	0402-0006-93
7 ± .3NS	2.2NS	.80	0402-0007-55	0402-0007-93
8 ± .3NS	2.4NS	.85	0402-0008-55	0402-0008-93
9 ± .3NS	2.6NS	.90	0402-0009-55	0402-0009-93
10 ± .3NS	2.8NS	.95	0402-0010-55	0402-0010-93

* Rise Time measured from 20% to 80% of the pulse

Time Delay	Rise * Time	Atten. Max. In %	Part Number 55 OHMS ± 10%	Part Number 100 OHMS ± 10%	200 OHMS ± 10%
1 ± .3NS	2.6NS	3	0403-0001-55	0403-0001-01	0403-0001-02
2 ± .3NS	2.75NS	3	0403-0002-55	0403-0002-01	0403-0002-02
3 ± .3NS	2.9NS	3	0403-0003-55	0403-0003-01	0403-0003-02
4 ± .3NS	3.15NS	3	0403-0004-55	0403-0004-01	0403-0004-02
5 ± .3NS	3.2NS	5	0403-0005-55	0403-0005-01	0403-0005-02
10 ± .5NS	4.0NS	5	0403-0010-55	0403-0010-01	0403-0010-02
15 ± .7NS	5.25NS	5	0403-0015-55	0403-0015-01	0403-0015-02
20 ± 1NS	6.1NS	5	0403-0020-55	0403-0020-01	0403-0020-02
25 ± 1.2NS	7.5NS	5	0403-0025-55	0403-0025-01	0403-0025-02
30 ± 1.5NS	9.0NS	6	0403-0030-55	0403-0030-01	0403-0030-02
35 ± 1.7NS	10.5NS	6	0403-0035-55	0403-0035-01	0403-0035-02
40 ± 2NS	12.5NS	6	0403-0040-55	0403-0040-01	0403-0040-02
45 ± 2.3NS	13.5NS	6	0403-0045-55	0403-0045-01	0403-0045-02
50 ± 2.5NS	15.0NS	6	0403-0050-55	0403-0050-01	0403-0050-02

* Rise Time measured from 10% to 90% of the pulse

Time Delay ±5%	Tap to Tap Delay	Rise Time * 1.	Z_0 ± 10% In OHMS	D.C.R. In OHMS	Part Number
10NS	1 ± .25NS	2.5NS	50	.8	0438-0010-50
20NS	2 ± .4NS	4NS	50	1	0438-0020-50
50NS	5 ± 1.5NS	9NS	50	2	0438-0050-50
100NS	10 ± 2NS	18NS	50	3	0438-0100-50
10NS	1 ± .25NS	2.5NS	100	1.6	0438-0010-01
20NS	2 ± .4NS	4NS	100	2	0438-0020-01
50NS	5 ± 1.5NS	9NS	100	4	0438-0050-01
100NS	10 ± 2NS	19NS	100	9	0438-0100-01
20NS	2 ± .4NS	4.5NS	200	5	0438-0020-02
50NS	5 ± 1.5NS	10NS	200	12	0438-0050-02
100NS	10 ± 2NS	20NS	200	17	0438-0100-02

* Rise Time measured from 10% to 90% of the pulse

Specifications Subject To Change Without Notice

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LUMPED CONSTANT DELAY LINE PICOLINE SERIES

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Width	5.0 Nsec
Pulse Period	4 × Pulse Width
Ambient Temperature	25°C

PERFORMANCE CHARACTERISITC

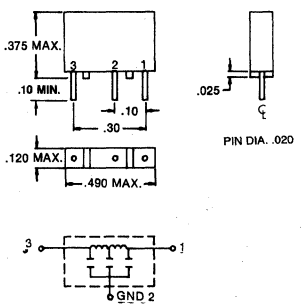
Distortion 10% max.

All specified Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

Operating Temperature Range
−55°C To 125°C
Temperature Coefficient Of Total Delay
100PPM/°C Typical
Dielectric Withstanding Voltage
50 Volt DC
Operation
Bidirectional

— Compatible with TTL and ECL circuits.
— Other delays and impedances upon request.
— Built to conform to MIL D-23859
— Gold coated pins for excellent conductivity.



Part Number	Time Delay (PS)	Rise Time (1) (NS)	DCR Max (OHMS)	$Z_0 \pm 10\%$ (OHMS)
0402-0100-55	100 ± 50	0.9	0.20	55
0402-0200-55	200 ± 50	0.9	0.20	55
0402-0300-55	300 ± 50	0.9	0.20	55
0402-0400-55	400 ± 50	1.0	0.20	55
0402-0500-55	500 ± 50	1.0	0.22	55
0402-0600-55	600 ± 60	1.1	0.24	55
0402-0700-55	700 ± 70	1.2	0.26	55
0402-0800-55	800 ± 80	1.3	0.28	55
0402-0900-55	900 ± 90	1.4	0.30	55
0402-1000-55	1000 ±100	1.5	0.30	55

1 Rise time measured from 20% to 80% of the pulse

Specifications Subject To Change Without Notice

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DIGITAL DELAY LINE SERIES 0449 TTL PROGRAMMABLE LOGIC DELAY MODULE 3 BIT

TECHNICAL INFORMATION

TEST CONDITIONS

Driving Signal	Schottky TTL Buffer
Pulse Width	1.5 × Maximum Delay
Pulse Period	5 × Pulse Width
Supply Current	50.0 Milliamps max.
Supply Voltage, Vcc	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Logic 1 Input Voltage
2.5 Volts min.
5.5 Volts max.
Logic 0 Input Voltage
.8 Volts max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Programmable Delay Tolerance
±2 Nsec or 5% whichever is greater

All specified Performance Characteristics apply at above listed Test Conditions.

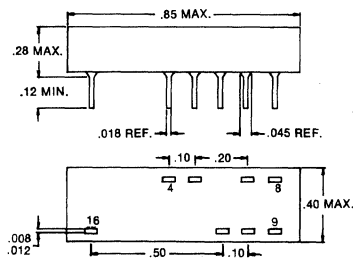
ELECTRICAL CHARACTERISTICS

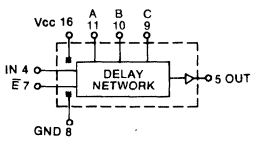
Supply Voltage, Vcc
4.75 to 5.25 Volts
Operating Temperature Range
0°C To 70°C
Temperature Coefficient Of Total Delay
500PPM/°C Typical

DRIVE CAPABILITIES

10 TTL Loads/Tap max.

— Compatible with TTL and DTL circuits.
— Other delays and tolerances upon request





Part Number	* Min. Delay (NOM) 1, 2	** Max. Delay (NOM) 1, 2	ΔDelay/Step 1, 2
0449-0014-03	7NS	14NS	1 ± .5NS
0449-0021-03	7NS	21NS	2 ± .6NS
0449-0028-03	7NS	28NS	3 ± .7NS
0449-0035-03	7NS	35NS	4 ± .8NS
0449-0042-03	7NS	42NS	5 ± 1.0NS
0449-0049-03	7NS	49NS	6 ± 1.2NS
0449-0056-03	7NS	56NS	7 ± 1.4NS
0449-0063-03	7NS	63NS	8 ± 1.6NS
0449-0070-03	7NS	70NS	9 ± 1.8NS
0449-0077-03	7NS	77NS	10 ± 2.0NS

1 Delays measured at 1.5 Volt level on leading edge only.
2 Measured with no loads on output.

CONTROL SIGNAL TABLE

C	B	A	
0	0	0	*
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	**

* Minimum Delay Code
** Maximum Delay Code

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DIGITAL DELAY LINE SERIES 0449 TTL PROGRAMMABLE LOGIC DELAY MODULE 4 BIT

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Pulse Width	1.5 × Maximum Delay
Pulse Period	5 × Pulse Width
Supply Current	100.0 Milliamps max.
Supply Voltage, Vcc	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Logic 1 Input Voltage
2.0 Volts min.
Logic 0 Input Voltage
.8 Volts max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Programmable Delay Tol.
±2 Nsec or 5% whichever is greater

All specified Performance characteristics apply at above listed Test conditions.

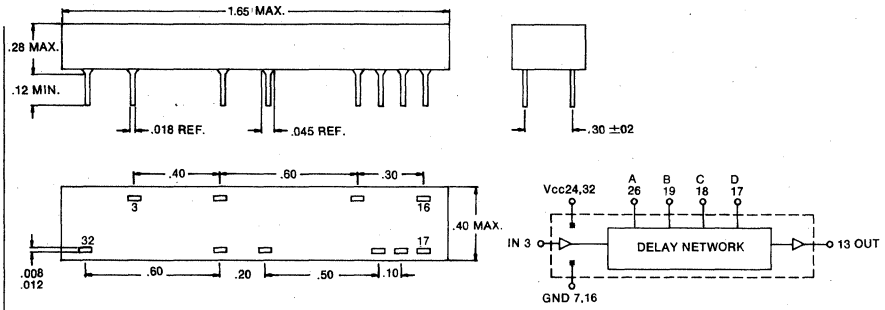
ELECTRICAL CHARACTERISTICS

Supply Voltage, Vcc
4.75 To 5.25 Volts
Operating Temperature Range
0°C To 70°C
Temperature Coefficient
500PPM/°C Typical

DRIVE CAPABILITIES

10 TTL Loads maximum

— Compatible with TTL and DTL circuits
— Other delays and tolerances upon request



Part Number	* Min. Delay 1, 2	** Max. Delay (NOM) 1, 2	ΔDelay/Step 1, 2
0449-0030-04	15±1NS	30NS	1± .7NS
0449-0045-04	15±1NS	45NS	2± .7NS
0449-0060-04	15±1NS	60NS	3± .7NS
0449-0075-04	15±1NS	75NS	4± .8NS
0449-0090-04	15±1NS	90NS	5±1.0NS
0449-0105-04	15±1NS	105NS	6±1.2NS
0449-0120-04	15±1NS	120NS	7±1.4NS
0449-0135-04	15±1NS	135NS	8±1.6NS
0449-0150-04	15±1NS	150NS	9±1.8NS
0449-0165-04	15±1NS	165NS	10±2.0NS

1 Delays measured at 1.5 Volt level on Leading Edge only.
2 Measured with no loads on output.

CONTROL SIGNAL TABLE

D	C	B	A	
0	0	0	0	*
0	0	0	1	
0	0	1	0	
0	0	1	1	
0	1	0	0	
0	1	0	1	
0	1	1	0	
0	1	1	1	
1	0	0	0	
1	0	0	1	
1	0	1	0	
1	0	1	1	
1	1	0	0	
1	1	0	1	
1	1	1	0	
1	1	1	1	**

* Minimum Delay Code
** Maximum Delay Code

Specifications Subject To Change Without Notice

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DIGITAL DELAY LINE SERIES 0449 TTL PROGRAMMABLE LOGIC DELAY MODULE 6 BIT

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Pulse Width	1.5 × Maximum Delay
Pulse Period	5 × Pulse Width
Supply Current	120.0 Milliamps max.
Supply Voltage, Vcc	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Logic 1 Input Voltage
2.0 Volts min.
Logic 0 Input Voltage
.8 Volts max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Programmable Delay Tol.
±2 Nsec or 5% whichever is greater

All specified Performance characteristics apply at above listed Test conditions.

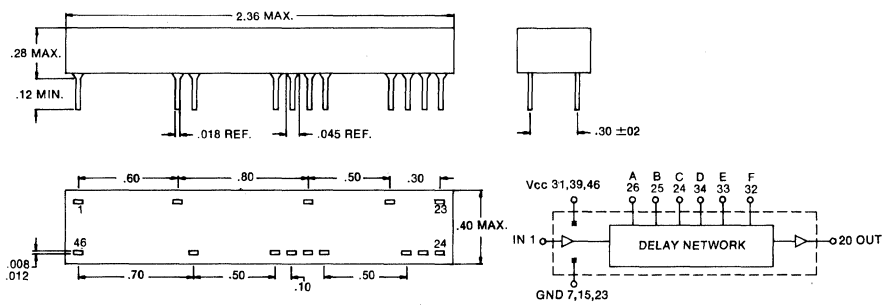
ELECTRICAL CHARACTERISTICS

Supply Voltage, Vcc
4.75 To 5.25 Volts
Operating Temperature Range
0°C To 70°C
Temperature Coefficient
500PPM/°C Typical

DRIVE CAPABILITIES

10 TTL Loads maximum

— Compatible with TTL and DTL circuits
— Other delays and tolerances upon request



Part Number	* Min. Delay 1, 2	** Max. Delay (NOM) 1, 2	Δ Delay Per Step 1, 2
0449-0078-06	15NS±1	78NS	1± .7NS
0449-0141-06	15NS±1	141NS	2± .7NS
0449-0204-06	15NS±1	204NS	3± .7NS
0449-0267-06	15NS±1	267NS	4± .8NS
0449-0330-06	15NS±1	330NS	5±1.0NS
0449-0393-06	15NS±1	393NS	6±1.2NS
0449-0456-06	15NS±1	456NS	7±1.4NS
0449-0519-06	15NS±1	519NS	8±1.6NS
0449-0582-06	15NS±1	582NS	9±1.8NS
0449-0645-06	15NS±1	645NS	10±2.0NS

1 Delays measured at 1.5 Volt level Leading Edge only.
2 Measured with no loads on output.

CONTROL SIGNAL TABLE

F	E	D	C	B	A	
0	0	0	0	0	0	*
0	0	0	0	0	1	
0	0	0	0	1	0	
0	0	0	0	1	1	
0	0	0	1	0	0	
1	1	1	1	0	0	
1	1	1	1	0	1	
1	1	1	1	1	0	
1	1	1	1	1	1	**

64 STEPS

* Minimum Delay Code
** Maximum Delay Code

Specifications Subject To Change Without Notice

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PULSE WIDTH GENERATOR SERIES A456 TTL COMPATIBLE

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Pulse Width	10 Nsec
Pulse Period	4 × Output Pulse Width
Supply Current	60.0 Milliamps max.
Supply Voltage, Vcc	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Logic 1 Input Voltage
2.0 Volts min.
Logic 0 Input Voltage
0.8 Volts max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Output Width Tolerance
± 2 Nsec or 5% whichever is greater

All specified Performance Characteristics apply at above listed Test Conditions.

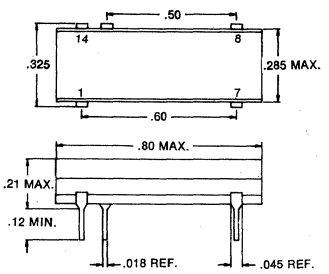
ELECTRICAL CHARACTERISTICS

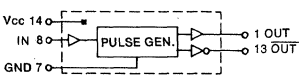
Supply Voltage, Vcc
4.75 To 5.25 Volts
Operating Temperature Range
0°C To 70°C
Temperature Coefficient Of
Output Pulse Width
1200PPM/°C Typical

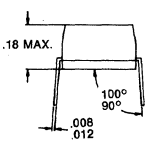
DRIVE CAPABILITIES

8 TTL Loads/Output max.

— Compatible with TTL and DTL circuits
— Other pulse widths and tolerances upon request
— Positive edge trigger







Part Number	Pulse Width (NS) 1, 2	Maximum Pulse Rate (MHz)
A456-0005-01	5	66
A456-0006-01	6	58
A456-0007-01	7	52
A456-0008-01	8	47
A456-0009-01	9	43
A456-0010-01	10	40
A456-0015-01	15	28
A456-0020-01	20	22
A456-0025-01	25	18
A456-0030-01	30	15
A456-0035-01	35	13
A456-0040-01	40	11
A456-0045-01	45	10
A456-0050-01	50	9
A456-0060-01	60	8
A456-0070-01	70	6
A456-0080-01	80	6
A456-0090-01	90	5
A456-0100-01	100	4

1 Pulse Width measured at 1.5 Volt on both Leading and Trailing Edge.
2 Measured with no load on outputs.

Specifications Subject To Change Without Notice

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SQUARE WAVE GENERATOR SERIES A457 TTL COMPATIBLE

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Fall Time	.75 To 2.4 Volts
Supply Current	60.0 Milliamps max.
Supply Voltage, Vcc	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Logic 1 Input Voltage
2.0 Volts min.
Logic 0 Input Voltage
0.8 Volts max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Output Frequency Tolerance
± 2%

All specified Performance Characteristics apply at above listed Test Conditions.

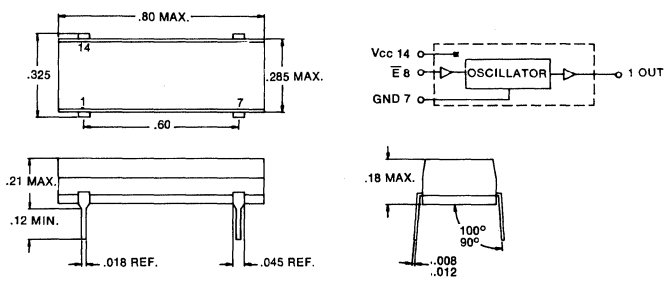
ELECTRICAL CHARACTERISTICS

Supply Voltage, Vcc
4.75 To 5.25 Volts
Operating Temperature Range
0 °C To 70°C
Temperature Coefficient Of Output Frequency
500PPM/°C Typical

DRIVE CAPABILITIES

10 TTL Loads max.

— Compatible with TTL and DTL circuits
— Output wave train is synchronized with random gating signal
— Enable input "high" will result in a constant "high" at output
— First output "low" appears one half cycle after input goes "low"
— Other frequencies upon request



Part Number	Output Frequency
A457-0002-01	2 MHz
A457-0003-01	3 MHz
A457-0004-01	4 MHz
A457-0005-01	5 MHz
A457-0006-01	6 MHz
A457-0007-01	7 MHz
A457-0008-01	8 MHz
A457-0009-01	9 MHz
A457-0010-01	10 MHz
A457-0011-01	11 MHz
A457-0012-01	12 MHz
A457-0013-01	13 MHz
A457-0014-01	14 MHz
A457-0015-01	15 MHz
A457-0020-01	20 MHz
A457-0025-01	25 MHz
A457-0030-01	30 MHz
A457-0035-01	35 MHz
A457-0040-01	40 MHz
A457-0045-01	45 MHz
A457-0050-01	50 MHz

Specifications Subject To Change Without Notice

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DIGITAL DELAY OSCILLATOR SERIES 0458

This delay oscillator works as an asynchronous start-stop free running clock pulse generator. The oscillator is intended as the primary control element of state machines used in digital controllers. The assertion of the input (high) trigger causes the oscillator to free run, producing TR thru T4 clock pulses for as long as the input is asserted. Oscillation ceases when the input trigger is negated.

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Pulse Width	5.0 Nsec min.
Supply Voltage, Vcc	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

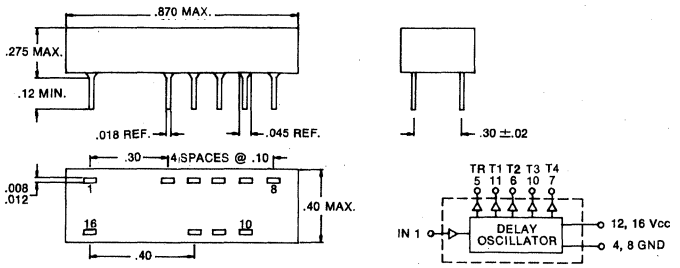
Logic 1 Input Current
50 Microamp max.
Logic 0 Input Current
– 2 Milliamp max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Period Tolerance
± 7%
Delay Tolerance From Tap To Tap
± 2 Nsec or 5% whichever is greater

All specified Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

Supply Voltage, Vcc
4.75 To 5.25 Volts
Operating Temperature Range
0°C To 70°C
Temperature Coefficient Of Total Delay
500PPM/°C Typical

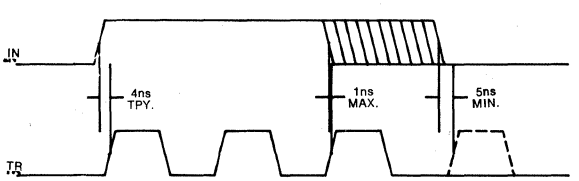
—Compatible with TTL and DTL circuits
—Other delays and tolerances upon request
—Square wave on all outputs



Part Number	Period 1, 3	Tap 1 1, 3, 4	Tap 2 1, 3, 4	Tap 3 1, 3, 4	Tap 4 1, 3, 4	Rise Time 2,3
0458-0060-01	60NS	20NS	30NS	40NS	50NS	4NS
0458-0070-01	70NS	20NS	35NS	50NS	60NS	4NS
0458-0080-01	80NS	20NS	40NS	60NS	70NS	4NS
0458-0090-01	90NS	20NS	45NS	65NS	80NS	4NS
0458-0100-01	100NS	30NS	50NS	70NS	90NS	4NS
0458-0110-01	110NS	30NS	55NS	75NS	100NS	4NS

1 All times measured at 1.5V leading edge only
2 Rise time measured from .75V to 2.4V level
3 Measured with no loads on taps
4 Delays are relative to Tap R (The delay from input to Tap R is 4NS TYP)

TIMING DIAGRAM



Specifications Subject To Change Without Notice

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DIGITAL DELAY LINE SERIES 0450 CMOS DELAY MODULE 5 TAP

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	5.0 Volts
Rise Time	6.0 Nsec (10%-90%)
Pulse Width	1.2 × Total Delay
Pulse Period	4 × Pulse Width
Supply Current, I_{CCL}	10.0 Milliamps max.
Supply Voltage, V_{CC}	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Logic 1 Output Voltage
4.0 Volts min.
Logic 0 Output Voltage
0.3 Volts max.
Input Leakage Current
± 1 Microamp max.
Delay Tolerance From Input To Tap
± 2 Nsec or 5% whichever is greater
Delay Tolerance From Tap To Tap
± 2 Nsec or 7% whichever is greater

All specified Performance Characteristics apply at above listed Test Conditions.

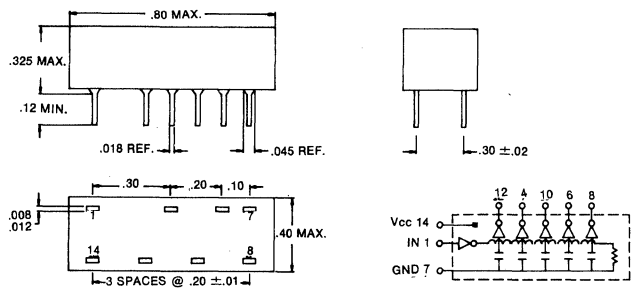
ELECTRICAL CHARACTERISTICS

Supply Voltage, V_{CC}
4.75 To 5.25 Volts
Operating Temperature Range
−40°C To 85°C
Temperature Coefficient Of Total Delay
500PPM/°C Typical
Minimum Input Pulse Width
40% Of Total Delay
Maximum Duty Cycle
50%

DRIVE CAPABILITIES

10 LSTTL Loads min.

— Compatible with 5V CMOS and TTL circuits
— Diode protection on input
— Low power consumption
— Low input current
— Other delays and tolerances upon request



Part Number	Total Delay 1, 3,	Delay/Tap 1, 3	Rise Time 2, 3
0450-0075-02	75NS	15NS	6NS
0450-0100-02	100NS	20NS	6NS
0450-0125-02	125NS	25NS	6NS
0450-0150-02	150NS	30NS	6NS
0450-0175-02	175NS	35NS	6NS
0450-0200-02	200NS	40NS	6NS

1 Delays measured at 50% of the pulse on the leading edge only.
2 Rise times measured from 10% to 90% of the pulse.
3 Measured with No Load on Taps.

Specifications Subject To Change Without Notice

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DIGITAL DELAY LINE SERIES 0443 ECL 10K DELAY MODULE 5 TAP

TECHNICAL INFORMATION

TEST CONDITIONS

Logic 1	−0.9 Volts
Logic 0	−1.8 Volts
Rise Time	2.0 Nsec (20% to 80%)
Pulse Width	Total Delay + 10.0 Nsec
Pulse Period	4 × Pulse Width
Supply Voltage, Vee	−5.2 Volts
Output Termination	100 Ohm ±1% to −2 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

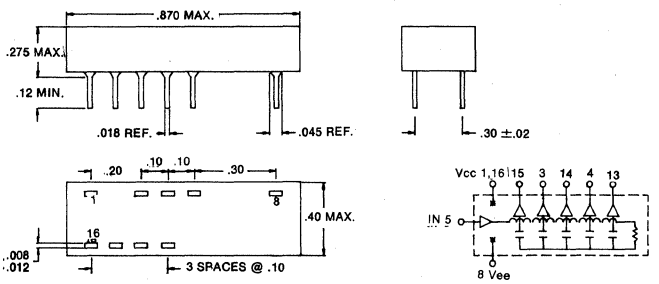
Logic 1 Input Voltage
−0.98 Volts min.
Logic 1 Input Current
265 Microamp max.
Logic 1 Output Voltage
−0.96 Volts min.
Logic 0 Input Voltage
−1.63 Volts max.
Logic 0 Output Voltage
−1.65 Volts max.

All specified Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

Supply Voltage, Vee
−4.94 To −5.46 Volts
Operating Temperature Range
−30°C To 85°C
Temperature Coefficient Of Total Delay
300PPM/°C Typical
Minimum Input Pulse Width
40% Of Total Delay
Maximum Duty Cycle
50%

— Compatible with ECL 10K circuits
— Other delays and tolerances upon request



Part Number	Tap 1 1, 3, 4	Tap 2 1, 3, 4	Tap 3 1, 3, 4	Tap 4 1, 3, 4	Output 1, 3, 4	Rise Time 2, 3, 4
0443-0006-02	2±.5	3±.5	4±1	5±1	6±1	4
0443-0010-02	2±.5	4±1	6±1	8±2	10±2	4
0443-0015-02	3±1	6±1	9±2	12±2	15±2	4
0443-0020-02	4±1	8±2	12±2	16±2	20±2	4
0443-0025-02	5±1	10±2	15±2	20±2	25±2	4
0443-0030-02	6±1	12±2	18±2	24±2	30±2	4
0443-0035-02	7±1	14±2	21±2	28±2	35±2	4
0443-0040-02	8±2	16±2	24±2	32±2	40±2	4
0443-0045-02	9±2	18±2	27±2	36±2	45±2	5
0443-0050-02	10±2	20±2	30±2	40±2	50±2	5
0443-0075-02	15±2	30±2	45±2	60±3	75±3	5
0443-0100-02	20±2	40±2	60±3	80±3	100±3	10
0443-0125-02	25±2	50±2	75±3	100±3	125±4	15
0443-0150-02	30±2	60±3	90±3	120±4	150±5	15
0443-0175-02	35±2	70±3	105±4	140±5	175±5	20
0443-0200-02	40±2	80±3	120±4	160±5	200±6	20
0443-0225-02	45±2	90±3	135±4	180±6	225±7	25
0443-0250-02	50±2	100±3	150±5	200±6	250±8	25
0443-0300-02	60±3	120±4	180±5	240±7	300±9	30
0443-0350-02	70±3	140±5	210±7	280±9	350±11	30
0443-0400-02	80±3	160±5	240±7	320±10	400±12	35
0443-0450-02	90±3	180±6	270±8	360±11	450±14	35
0443-0500-02	100±3	200±6	300±9	400±12	500±15	40

1 Delays measured at 50% of the pulse on leading edge only.
2 Rise time measured from 20% to 80% of the pulse.
3 All outputs terminated with 100Ω to −2V or equivalent.
4 All delays in NS.

Specifications Subject To Change Without Notice

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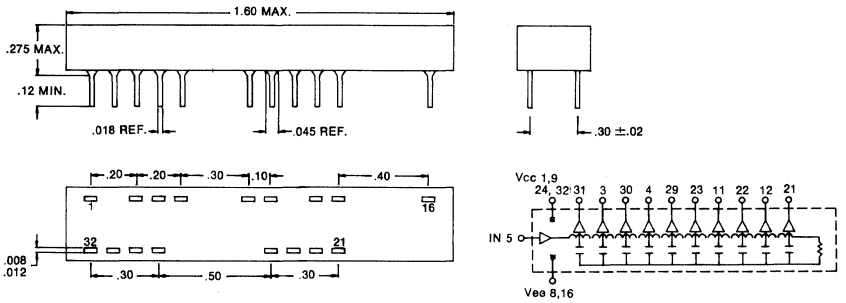
DIGITAL DELAY LINE SERIES 0443 ECL 10K DELAY MODULE 10 TAP



TECHNICAL INFORMATION

TEST CONDITIONS

Logic 1	−0.9 Volts
Logic 0	−1.8 Volts
Rise Time	2.0 Nsec (20% to 80%)
Pulse Width	Total Delay + 10.0 Nsec
Pulse Period	4 × Pulse Width
Supply Voltage, Vee	−5.2 Volts
Output Termination	100 Ohm ± 1% to −2 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Logic 1 Input Voltage
−0.98 Volts min.
Logic 1 Input Current
265 Microamp max.
Logic 1 Output Voltage
−0.96 Volts min.
Logic 0 Input Voltage
−1.63 Volts max.
Logic 0 Output Voltage
−1.65 Volts max.

All specified Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

Supply Voltage, Vee
−4.94 To −5.46 Volts
Operating Temperature Range
−30°C To 85°C
Temperature Coefficient Of Total Delay
300PPM/°C Typical
Minimum Input Pulse Width
40% Of Total Delay
Maximum Duty Cycle
50%

— Compatible with ECL10K
— Other delays and tolerances upon request

Part Number	Tap 1 1, 3, 4	Tap 2 1, 3, 4	Tap 3 1, 3, 4	Tap 4 1, 3, 4	Tap 5 1, 3, 4	Tap 6 1, 3, 4
0443-0011-10	2±.5	3±.5	4±.5	5±1	6±1	7±1
0443-0020-10	2±.5	4±.5	6±1	8±2	.10±2	12±1
0443-0030-10	3±.5	6±1	9±2	12±2	15±2	18±2
0443-0040-10	4±.5	8±2	12±2	16±2	20±2	24±2
0443-0050-10	5±1	10±2	15±2	20±2	25±2	30±2
0443-0060-10	6±1	12±2	18±2	24±2	30±2	36±2
0443-0070-10	7±1	14±2	21±2	28±2	35±2	42±2
0443-0080-10	8±2	16±2	24±2	32±2	40±2	48±2
0443-0090-10	9±2	18±2	27±2	36±2	45±2	54±2
0443-0100-10	10±2	20±2	30±2	40±2	50±2	60±3
0443-0150-10	15±2	30±2	45±2	60±3	75±3	90±3
0443-0200-10	20±2	40±2	60±3	80±3	100±3	120±4
0443-0250-10	25±2	50±2	75±3	100±3	125±4	150±4
0443-0300-10	30±2	60±3	90±3	120±4	150±5	180±6
0443-0350-10	35±2	70±3	105±4	140±5	175±5	210±7
0443-0400-10	40±2	80±3	120±4	160±5	200±6	240±7
0443-0450-10	45±2	90±3	135±4	180±6	225±7	270±8
0443-0500-10	50±2	100±3	150±5	200±6	250±8	300±9

Part Number	Tap 7 1, 3, 4	Tap 8 1, 3,4	Tap 9 1, 3, 4	Output 1, 3, 4	Rise Time 2, 3, 4
0443-0011-10	8±2	9±2	10±2	11±2	4
0443-0020-10	14±2	16±2	18±2	20±2	4
0443-0030-10	21±2	24±2	27±2	30±2	4
0443-0040-10	28±2	32±2	36±2	40±2	4
0443-0050-10	35±2	40±2	45±2	50±2	4
0443-0060-10	42±2	48±2	54±2	60±3	4
0443-0070-10	49±2	56±2	63±3	70±3	4
0443-0080-10	56±2	64±3	72±3	80±3	4
0443-0090-10	63±3	72±3	81±3	90±3	5
0443-0100-10	70±3	80±3	90±3	100±3	5
0443-0150-10	105±4	120±4	135±4	150±5	8
0443-0200-10	140±5	160±5	180±5	200±6	10
0443-0250-10	175±5	200±6	225±7	250±8	15
0443-0300-10	210±7	240±7	270±8	300±9	15
0443-0350-10	245±8	280±9	315±10	350±11	20
0443-0400-10	280±9	320±10	360±11	400±12	20
0443-0450-10	315±10	360±11	405±12	450±14	25
0443-0500-10	350±11	400±12	450±14	500±15	25

1 Delays measured at 50% of the pulse on leading edge only.
2 Rise times measured from 20% to 80% of the pulse.
3 All outputs terminated with 100Ω to −2V or equivalent.
4 All delays in NS.

Specifications Subject To Change Without Notice

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DIGITAL DELAY LINE SERIES 0464 ECL 10K DELAY MODULE DUAL OUTPUTS

TECHNICAL INFORMATION

TEST CONDITIONS

Logic 1	−0.9 Volts
Logic 0	−1.8 Volts
Rise Time	2.0 Nsec(20% to 80%)
Pulse Width	2 x Delay
Pulse Period	4 x Pulse Width
Supply Voltage, Vee	−5.2 Volts
Output Termination	100 Ohm ±1% to −2 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

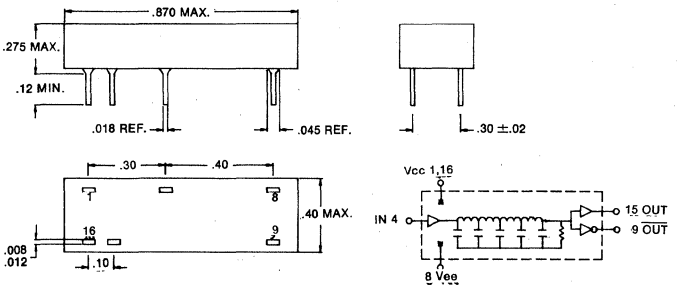
Logic 1 Input Voltage
−0.98 Volts min.
Logic 1 Input Current
245 Microamp max.
Logic 1 Output Voltage
−0.96 Volts min.
Logic 0 Input Voltage
−1.63 Volts max.
Logic 0 Output Voltage
−1.65 Volts max.

All specified Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

Supply Voltage, Vee
−4.94 To −5.46 Volts
Operating Temperature Range
−30°C To 85°C
Temperature Coefficient Of Total Delay
500PPM/°C Typical
Minimum Input Pulse Width
100% Of Total Delay
Maximum Duty Cycle
50%

— Compatible with ECL 10K circuits
— Other delays and tolerances upon request



Part Number	Rise Time 2, 3	Output 1, 3	Part Number	Rise Time 2, 3	Output 1, 3
0464-0004-01	3	4±.5	0464-0035-01	7	35±2
0464-0005-01	3	5±1	0464-0040-01	8	40±2
0464-0006-01	3	6±1	0464-0045-01	8	45±2
0464-0007-01	3	7±1	0464-0050-01	9	50±2
0464-0008-01	3	8±1.5	0464-0055-01	9	55±2
0464-0009-01	3	9±1.5	0464-0060-01	10	60±2
0464-0010-01	4	10±1.5	0464-0065-01	10	65±2.5
0464-0011-01	4	11±1.5	0464-0070-01	11	70±2.5
0464-0012-01	4	12±1.5	0464-0075-01	11	75±2.5
0464-0013-01	4	13±1.5	0464-0080-01	12	80±2.5
0464-0014-01	4	14±1.5	0464-0085-01	13	85±3
0464-0015-01	5	15±1.5	0464-0090-01	13	90±3
0464-0016-01	5	16±1.5	0464-0095-01	14	95±3
0464-0017-01	5	17±1.5	0464-0100-01	15	100±3
0464-0018-01	5	18±1.5	0464-0125-01	18	125±4
0464-0019-01	5	19±1.5	0464-0150-01	20	150±5
0464-0020-01	5	20±2	0464-0200-01	25	200±6
0464-0021-01	6	21±2	0464-0250-01	25	250±8
0464-0022-01	6	22±2	0464-0300-01	30	300±10
0464-0023-01	6	23±2	0464-0350-01	30	300±10
0464-0024-01	6	24±2	0464-0400-01	30	400±12
0464-0025-01	6	25±2	0464-0450-01	30	450±14
0464-0030-01	7	30±2	0464-0500-01	30	500±15

1 Delays measured at 50% of the pulse on Leading Edge.
2 Rise time measured from 20% to 80% of the pulse.
3 All delays and rise times in NS.

Specifications Subject To Change Without Notice

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PULSE GENERATOR SERIES 0452 ECL 10K

TECHNICAL INFORMATION

TEST CONDITIONS

Logic 1	– 0.9 Volts
Logic 0	– 1.8 Volts
Rise Time	2.0 Nsec (20% to 80%)
Pulse Width	5 Nsec
Pulse Period	4 × Output Pulse Width
Supply Voltage, Vee	– 5.2 Volts
Output Termination	100 Ohm ± 1% to – 2 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

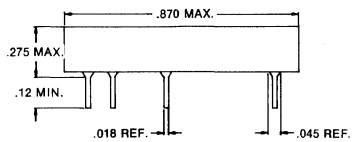
Logic 1 Input Voltage
– 0.98 Volts min.
Logic 1 Input Current
265 Microamp max.
Logic 1 Output Voltage
– 0.96 Volts min.
Logic 0 Input Voltage
– 1.63 Volts max.
Logic 0 Input Current
.50 Microamp max.
Logic 0 Output Voltage
– 1.65 Volts max.

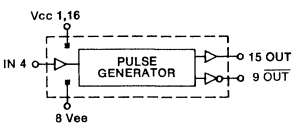
All specified Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

Supply Voltage, Vee
– 4.94 To – 5.46 Volts
Operating Temperature Range
– 30°C To 85°C
Temperature Coefficient Of Output Pulse Width
300PPM/°C Typical

— Compatible with ECL 10K circuits.
— Other pulse widths and tolerances upon request.





Part Number	Pulse Width (NS)	Maximum Pulse Rate (MHZ)
0452-0005-01	5 ± 1	76
0452-0006-01	6 ± 1	66
0452-0007-01	7 ± 1	56
0452-0008-01	8 ± 1	50
0452-0009-01	9 ± 1	45
0452-0010-01	10 ± 1	42
0452-0015-01	15 ± 1	30
0452-0020-01	20 ± 1	23
0452-0025-01	25 ± 1	18
0452-0030-01	30 ± 1	15
0452-0035-01	35 ± 1.5	13
0452-0040-01	40 ± 1.5	11
0452-0045-01	45 ± 1.5	10
0452-0050-01	50 ± 1.5	9
0452-0060-01	60 ± 1.5	8
0452-0070-01	70 ± 2.0	7
0452-0080-01	80 ± 2.0	6
0452-0090-01	90 ± 3.0	5
0452-0100-01	100 ± 3.0	4

Specifications Subject To Change Without Notice

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DIGITAL DELAY LINE
SERIES 0459
HIGH SPEED
ECL 10KH DELAY MODULE
5 TAP

TECHNICAL INFORMATION

TEST CONDITIONS

Logic 1	−0.9 Volts
Logic 0	−1.8 Volts
Rise Time	1.0 Nsec (20% to 80%)
Pulse Width	Total Delay + 10.0 Nsec
Pulse Period	4 × Pulse Width
Supply Voltage, Vee	−5.2 Volts
Output Termination	100 Ohm ±1% to −2 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

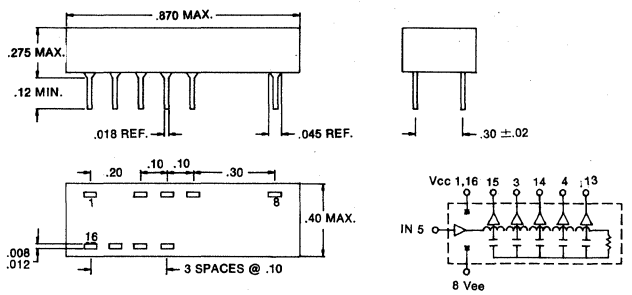
Logic 1 Input Voltage
−1.13 Volts min.
Logic 1 Input Current
310 Microamp max.
Logic 1 Output Voltage
−0.96 Volts min.
Logic 0 Input Voltage
−1.48 Volts max.
Logic 0 Output Voltage
−1.63 Volts max.

All specified Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

Supply Voltage, Vee
−4.94 To −5.46 Volts
Operating Temperature Range
0°C To 75°C
Temperature Coefficient Of Total Delay
300PPM/°C Typical
Minimum Input Pulse Width
40% Of Total Delay
Maximum Duty Cycle
50%

— Compatible with ECL 10KH circuits.
— Other delays and tolerances upon request.



Part Number	Tap 1 1, 3	Tap 2 1, 3	Tap 3 1, 3	Tap 4 1, 3	Output 1, 3	Rise Time 2, 3
0459-0006-02	2±.5	3±.5	4±1	5±1	6±1	2
0459-0010-02	2±.5	4±1	6±1	8±2	10±2	2
0459-0015-02	3±1	6±1	9±2	12±2	15±2	2
0459-0020-02	4±1	8±2	12±2	16±2	20±2	2
0459-0025-02	5±1	10±2	15±2	20±2	25±2	3
0459-0030-02	6±1	12±2	18±2	24±2	30±2	3
0459-0035-02	7±1	14±2	21±2	28±2	35±2	3
0459-0040-02	8±2	16±2	24±2	32±2	40±2	3
0459-0045-02	9±2	18±2	27±2	36±2	45±2	4
0459-0050-02	10±2	20±2	30±2	40±2	50±2	4
0459-0075-02	15±2	30±2	45±2	60±3	75±3	5
0459-0100-02	20±2	40±2	60±3	80±3	100±3	8
0459-0125-02	25±2	50±2	75±3	100±3	125±4	8
0459-0150-02	30±2	60±3	90±3	120±4	150±5	10
0459-0175-02	35±2	70±3	105±4	140±5	175±5	10
0459-0200-02	40±2	80±3	120±4	160±5	200±6	12
0459-0225-02	45±2	90±3	135±4	180±6	225±7	13
0459-0250-02	50±2	100±3	150±5	200±6	250±8	14
0459-0300-02	60±3	120±4	180±5	240±7	300±9	15
0459-0350-02	70±3	140±5	210±7	280±9	350±11	15
0459-0400-02	80±3	160±5	240±7	320±10	400±12	18
0459-0450-02	90±3	180±6	270±8	360±11	450±14	18
0459-0500-02	100±3	200±6	300±9	400±12	500±15	20

1 Delays measured at 50% of the pulse on leading edge only.
2 Rise time measured from 20% to 80% of the pulse.
3 All delays in NS.

Specifications Subject To Change Without Notice

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DIGITAL DELAY LINE SERIES 0453 ECL 10KH PROGRAMMABLE LOGIC DELAY MODULE 3 BIT

TECHNICAL INFORMATION

TEST CONDITIONS

Driving Signal	ECL 10KH Buffer
Pulse Width	1.5 × Total Delay
Pulse Period	1000 Nsec
Supply Voltage, Vee	−5.2 Volts
Output Termination	100 Ohm ±1% to −2 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

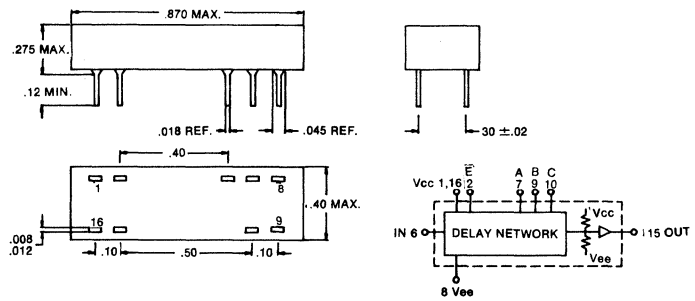
Logic 1 Input Voltage
−1.13 Volts min.
Logic 1 Output Voltage
−0.98 Volts min.
Logic 0 Input Voltage
−1.48 Volts max.
Logic 0 Output Voltage
−1.63 Volts max.

All specified Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

Supply Voltage, Vcc
−4.94 To −5.46 Volts
Input Impedance
100 Ohms ± 5%
Operating Temperature Range
0°C To 75°C
Temperature Coefficient Of Total Delay
150PPM/°C Typical

— Compatible with ECL 10KH circuits.
— Other delays and tolerances upon request.



Part Number	*Min. Delay (Nom.) 1	** Max. Delay (Nom.) 1	Δ Delay /Step 1	Total Programmable Delay and its Tolerance 1
0453-0009-03	1.5NS	8.5NS	1±.3NS	7±.4NS
0453-0016-03	1.5NS	15.5NS	2±.4NS	14±.6NS
0453-0023-03	1.5NS	22.5NS	3±.5NS	21±.8NS
0453-0030-03	1.5NS	29.5NS	4±.5NS	28±.9NS
0453-0037-03	1.5NS	36.5NS	5±.5NS	35±.1NS
0453-0044-03	1.5NS	43.5NS	6±.6NS	42±1.2NS
0453-0051-03	1.5NS	50.5NS	7±.7NS	49±1.4NS
0453-0058-03	1.5NS	57.5NS	8±.8NS	56±1.6NS
0453-0065-03	1.5NS	64.5NS	9±.9NS	63±1.8NS
0453-0072-03	1.5NS	71.5NS	10±1NS	70±2.0NS

1 Delays measured at 50% of the pulse on leading edge only.

CONTROL SIGNAL TABLE

C	B	A	
0	0	0	*
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	**

* Minimum delay code
** Maximum delay code

Specifications Subject To Change Without Notice

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DIGITAL DELAY LINE SERIES 0453 ECL 10KH PROGRAMMABLE LOGIC DELAY MODULE 4 BIT

TECHNICAL INFORMATION

TEST CONDITIONS

Logic 1	−0.9 Volts
Logic 0	−1.8 Volts
Rise Time 20% to 80%	1.0 Nsec
Pulse Width	1.5 × Total Delay
Pulse Period	1000 Nsec
Supply Voltage, Vee	−5.2 Volts
Output Termination	100 Ohm ±1% to −2 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

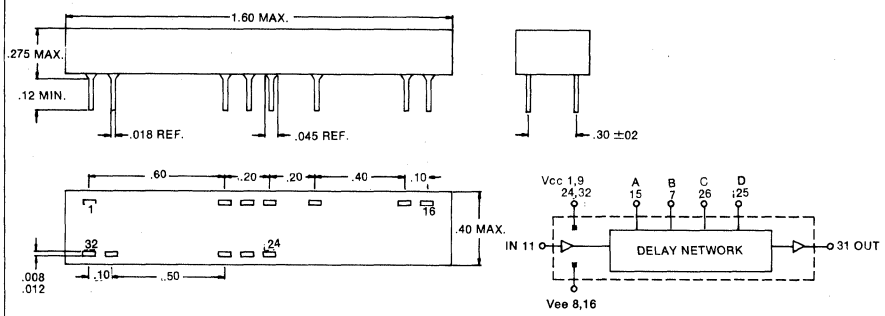
Logic 1 Input Voltage
−1.13 Volts min.
Logic 1 Input Current
600 Microamp max.
Logic 1 Output Voltage
−0.98 Volts min.
Logic 0 Input Voltage
−1.48 Volts max.
Logic 0 Input Current
1 Microamp min.
Logic 0 Output Voltage
−1.63 Volts max.

All specified Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

Supply Voltage, Vcc
−4.94 To −5.46 Volts
Operating Temperature Range
0°C To 75°C
Temperature Coefficient Of Total Delay
150PPM/°C Typical

— Compatible with ECL 10KH circuits.
— Other delays and tolerances upon request.



Part Number	* Min. Delay (Nom.) 1	** Max. Delay (Nom.) 1	Δ Delay /Step 1	Total Programmable Delay and its Tolerance 1
0453-0020-04	5±1NS	20NS	1±.4NS	15± .8NS
0453-0035-04	5±1NS	35NS	2±.5NS	30±1.2NS
0453-0050-04	5±1NS	50NS	3±.5NS	45±1.6NS
0453-0065-04	5±1NS	65NS	4±.6NS	60±1.8NS
0453-0080-04	5±1NS	80NS	5±.6NS	75±2.0NS
0453-0095-04	5±1NS	95NS	6±.8NS	90±2.4NS
0453-0100-04	5±1NS	100NS	7±.8NS	105±2.8NS
0453-0125-04	5±1NS	125NS	8±1NS	120±3.2NS
0453-0140-04	5±1NS	140NS	9±1NS	135±3.6NS
0453-0155-04	5±1NS	155NS	10±1NS	150±4.0NS

1 Delays measured at 50% of the pulse on leading edge only.

CONTROL SIGNAL TABLE

D	C	B	A	
0	0	0	0	*
0	0	0	1	
0	0	1	0	
1	1	1	0	
1	1	1	1	**

16 STEPS

* Minimum delay code
** Maximum delay code

Specifications Subject To Change Without Notice

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PULSE GENERATOR SERIES 0454 HIGH SPEED ECL 10KH

TECHNICAL INFORMATION

TEST CONDITIONS

Logic 1	−0.9 Volts
Logic 0	−1.8 Volts
Rise Time 20% to 80%	1.0 Nsec
Pulse Width	5 Nsec
Pulse Period	4 × Output Pulse Width
Supply Voltage, Vee	−5.2 Volts
Output Termination	100 Ohm ±1% to −2 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

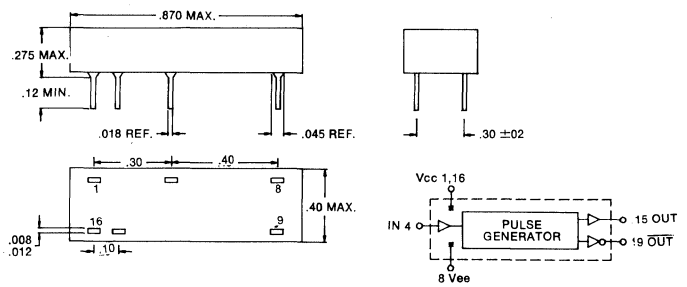
Logic 1 Input Voltage
−1.13 Volts min.
Logic 1 Input Current
265 Microamp max.
Logic 1 Output Voltage
−0.98 Volts min.
Logic 0 Input Voltage
−1.48 Volts max.
Logic 0 Input Current
.5 Microamp min.
Logic 0 Output Voltage
−1.63 Volts max.

All specified Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

Supply Voltage, Vcc
−4.94 To −5.46 Volts
Operating Temperature Range
0°C To 75°C
Temperature Coefficient Of Output Pulse Width
300PPM/°C Typical

— Compatible with ECL 10KH circuits
— Other pulse widths upon request



Part Number	Pulse Width (NS)	Maximum Pulse Rate (MHz)
0454-0005-01	5 ± 1.0	98
0454-0006-01	6 ± 1.0	80
0454-0007-01	7 ± 1.0	70
0454-0008-01	8 ± 1.0	60
0454-0009-01	9 ± 1.0	54
0454-0010-01	10 ± 1.0	49
0454-0015-01	15 ± 1.0	32
0454-0020-01	20 ± 1.0	24
0454-0025-01	25 ± 1.0	19
0454-0030-01	30 ± 1.0	15
0454-0035-01	35 ± 1.5	13
0454-0040-01	40 ± 1.5	11
0454-0045-01	45 ± 1.5	10
0454-0050-01	50 ± 1.5	9
0454-0060-01	60 ± 1.5	8
0454-0070-01	70 ± 2.0	7
0454-0080-01	80 ± 2.0	6
0454-0090-01	90 ± 3.0	5
0454-0100-01	100 ± 3.0	4

Specifications Subject To Change Without Notice

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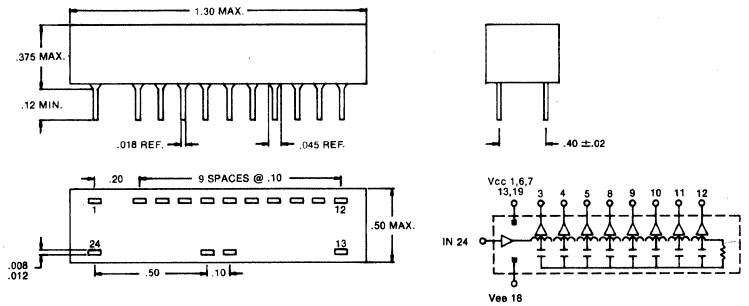
DIGITAL DELAY LINE SERIES 0461 ECL 100K DELAY MODULE 8 TAP



TECHNICAL INFORMATION

TEST CONDITIONS

Logic 1	−0.9 Volts
Logic 0	−1.7 Volts
Rise Time 20% to 80%	1.0 Nsec
Pulse Width	Total Delay + 10.0 Nsec
Pulse Period	4 × Pulse Width
Supply Voltage, Vee	−4.5 Volts
Output Termination	50 Ohm ± ±1% to −2 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Logic 1 Input Voltage
−1.165 Volts min.
Logic 1 Input Current
350 Microamp max.
Logic 1 Output Voltage
−1.025 Volts min.
Logic 0 Input Voltage
−1.475 Volts max.
Logic 0 Input Current
0.5 Microamp min.
Logic 0 Output Voltage
−1.62 Volts max.

All specified Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

Supply Voltage, Vee
−4.2 To −4.8 Volts
Operating Temperature Range
0°C To 85°C
Temperature Coefficient Of Total Delay
300PPM/°C Typical
Minimum Input Pulse Width
40% Of Total Delay
Maximim Duty Cycle
50%

— Compatible with ECL 100K circuits.
— Other delays and tolerances upon request.

Part Number	Rise Time 2, 3	Tap 1 1, 3	Tap 2 1, 3	Tap 3 1, 3	Tap 4 1, 3
0461-0016-01	2.0	2±.5	4±5	6±1	8±1
0461-0020-01	2.0	2.5±.5	5±.5	7.5±1	10±1.5
0461-0024-01	2.0	3±.5	6±1	9±1	12±1.5
0461-0028-01	2.0	3.5±.5	7±1	10.5±1.5	14±1.5
0461-0032-01	2.5	4±.5	8±1	12±1.5	16±1.5
0461-0036-01	2.5	4.5±.5	9±1	13.5±1.5	18±1.5
0461-0040-01	2.5	5±.5	10±1.5	15±1.5	20±1.5
0461-0044-01	3.0	5.5±1	11±1.5	16.5±1.5	22±2
0461-0048-01	3.0	6±1	12±1.5	18±1.5	24±2
0461-0052-01	3.0	6.5±1	13±1.5	19.5±1.5	26±2
0461-0056-01	3.0	7±1	14±1.5	21±2	28±2
0461-0060-01	4.0	7.5±1	15±1.5	22.5±2	30±2
0461-0064-01	4.0	8±1	16±1.5	24±2	32±2
0461-0068-01	4.0	8.5±1	17±1.5	25.5±2	34±2
0461-0072-01	4.5	9±1	18±1.5	27±2	36±2
0461-0076-01	4.5	9.5±1	19±1.5	28.5±2	38±2
0461-0080-01	4.5	10±1.5	20±2	30±2	40±2

Part Number	Tap 5 1, 3	Tap 6 1, 3	Tap 7 1, 3	Output 1, 3
0461-0016-01	10±1.5	12±1.5	14±1.5	16±1.5
0461-0020-01	12.5±1.5	15±1.5	17.5±1.5	20±2
0461-0024-01	15±1.5	18±1.5	21±2	24±2
0461-0028-01	17.5±1.5	21±2	24.5±2	28±2
0461-0032-01	20±2	24±2	28±2	32±2
0461-0036-01	22.5±2	27±2	31.5±2	36±2
0461-0040-01	25±2	30±2	35±2	40±2
0461-0044-01	27.5±2	33±2	38.5±2	44±2
0461-0048-01	30±2	36±2	42±2	48±2
0461-0052-01	32.5±2	39±2	45.5±2	52±2
0461-0056-01	35±2	42±2	49±2	56±2
0461-0060-01	37.5±2	45±2	52.5±2	60±2.5
0461-0064-01	40±2	48±2	56±2	64±2.5
0461-0068-01	42.5±2	51±2	59.5±2	68±2.5
0461-0072-01	45±2	54±2	63±2.5	72±3
0461-0076-01	47.5±2	57±2	66.5±2.5	76±3
0461-0080-01	50±2	60±2.5	70±3	80±3

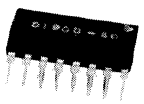
1 Delays measured at 50% of the pulse on leading edge only.
2 Rise time measured from 20% to 80%.
3 All delays in NS.

Specifications Subject To Change Without Notice

FIXED AND TAPPED DELAY LINES

SUB-MINIATURE DUAL-IN-LINE TAPPED LUMPED CONSTANT LINES

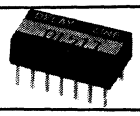
Each line has 10 tap delays spaced at equal intervals. Attenuation less than 1 dB. Temp. Coeff. less than 50 PPM/°C. DIP configuration compatible with automatic inserting equipment. Commercial and MIL Spec. models available.



MODEL	DELAY RANGE	RISE TIME OR FREQ. RESP.	IMPED-ANCE OHMS	SIZE INCHES
D1900-10	10 Nsec	2 Nsec	100	.21 x .30 x .78
D1900-20	20	3	100	.21 x .30 x .78
D1900-40	40	6	100	.21 x .30 x .78
D1900-60	60	9	100	.21 x .30 x .78
D1900-80	80	10	100	.21 x .30 x .78
D1900-100	100	20	100	.21 x .30 x .78
D8001	5	1	50	.21 x .30 x .78
D8004	10	2	100	.21 x .30 x .78
D8005	25	5	100	.21 x .30 x .78
D8007	30	6	100	.21 x .30 x .78

TAPPED DELAYS

Each line provides 10 tap delays spaced at equal intervals.



D1511-1	10 Nsec	3 Nsec		
D1511-2	20	6		
D1511-4	40	13		Dual-In-Line
D1511-6	60	20	100	Pin Spacing
D1511-8	80	26		.21 x .39 x .7
D1511-10	100	33		

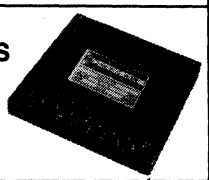
MINIATURE LUMPED CONSTANT

Hermetically sealed in a metal container. Delay tolerance ±5%. Temperature stability less than 50 PPM/°C, P.C. Mounting.

D647-110	50 Nsec	12 Nsec	50	.30 x 1.0 x 1.25
D647-211	100	12.5	50	.30 x 1.0 x 2.45
D647-312	250	21	50	.30 x 1.0 x 3.45
D647-323	500	42	150	.30 x 1.0 x 3.45
D647-334	750	63	500	.30 x 1.0 x 3.45
D647-115	1,000	250	50	.30 x 1.0 x 1.25
D647-236	1,450	180	500	.30 x 1.0 x 2.45
D647-327	2,900	240	150	.30 x 1.0 x 3.45
D647-338	4,350	360	500	.30 x 1.0 x 3.45

ATC TRANSPONDER AND BEACON CODING DELAY LINES

Standard 1.45 μsec tap spacings plus other special delay points are provided. Hermetically sealed steel cased, plastic encapsulated and P.C. mounted units are offered.



D1560	10.15 μsec	.33 μsec	400	.55 x 2.25 x 3.62
D1365	20.3	.5	180	.87 x 3.5 x 3.5
D1000	20.3	.5	330	.35 x 2 x 4
D120	25.0	.55	180	.75 x 5 x 4.37
D298A	25.3	.6	500	1.62 x 2.87 x 4.25
D637	20.3	.3	180	2.37 x 2.75 x 3.18
D1190	20.3	.4	400	.63 x 4 x 5
D1191	24.65	.5	500	.63 x 4 x 5
D1210	8.0	.5	500	5 x 1 x 4

VARIABLE DELAY LINES

DUAL-IN-LINE COMPATIBLE VARIABLE DELAY LINES

Sealed in plastic case. Temp. coeff. less than 50 PPM/°C. .020" P.C. mounting pins.

V1570-1	0 - 10 Nsec	2 Nsec	100	.25 x .75 x 1.5
V1570-2	0 - 20	4	100	.25 x .75 x 1.5
V1570-3	0 - 40	8	100	.25 x .75 x 1.5
V1570-4	0 - 80	16	100	.25 x .75 x 1.5
V1570-5	0 - 160	32	200	.25 x .75 x 1.5
V1570-6	0 - 320	64	200	.25 x .75 x 1.5

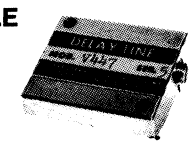
MIL VERSION

Hermetically sealed in a metal case.

V1768-1	0 - 10 Nsec	2 Nsec	100	.25 x .87 x 1.6
V1768-2	0 - 20	4	100	.25 x .87 x 1.6
V1768-3	0 - 40	8	100	.25 x .87 x 1.6

MINIATURE LUMPED VARIABLE Nanosecond Range

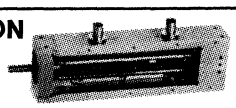
Hermetically sealed in a metal case. Lumped constant parameter. Temperature coefficient less than 50 PPM/°C. .030" P.C. mounting pins.



V447-1	0 - 55 Nsec	15 Nsec	150	.31 x 1 x 1.25
V447-2	0 - 100	30	50	.31 x 1 x 1.25
V447-3	0 - 150	25	150	.31 x 1 x 2.45
V447-4	0 - 250	30	50	.31 x 1 x 2.45
V447-5	0 - 300	30	150	.31 x 1 x 3.45
V447-6	0 - 500	60	50	.31 x 1 x 3.45

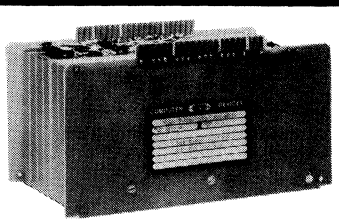
NOVEL INFINITE RESOLUTION

With input and output impedance of equal value. Voltage standing wave ratio less than ½ db to 45 MHz.



DV575-1	2 - 25 Nsec	70 MHz	200	1 x 1.25 x 5.37
DV575-2	2 - 50	70	100	1 x 1.25 x 5.37
DV575-3	2 - 50	70	200	1 x 1.25 x 5.37
DV575-4	2 - 50	70	93	1 x 1.25 x 5.37
DV575-5	2 - 25	70	50	1 x 1.25 x 5.37
DV575-6	2 - 50	70	93	1 x 1.25 x 5.37

DELAY LINE COMPUTER MEMORIES DELCOMS



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Military and Commercial
DELAY LINES

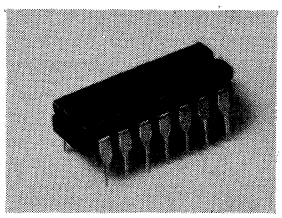
MINIATURE TAPPED DELAY LINES • MILITARY DELAY LINES • DISPERSIVE DELAY LINES • VARIABLE DELAY LINES
TRANSPONDER DECODER NETWORKS • PRECISION AUDIO DELAY LINES • VARIABLE MAGLINES

MILITARY DELAY LINES

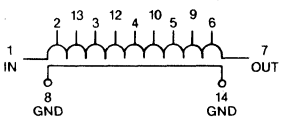
Series MIL-23 Low Profile to MIL-D-23859/23

SPECIFICATIONS

Total Time Delay Tolerance:	±2 ns below 40 ns Delay ±5% above 40 ns Delay
No. of Taps:	10
Distortion:	±10% max
Attenuation:	10% max
Temperature Coefficient:	100 ppm/°C max
Temperature Range:	−55°C to +125°C
Dielectric Strength:	50 VDC
Environmental Conditions:	per MIL-D-23859/23
Dimensions:	14 PIN, .750"L x .300"W x .187"H



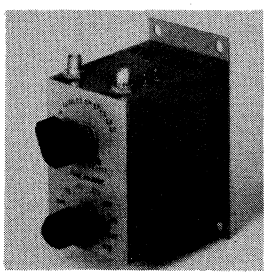
SCHEMATIC



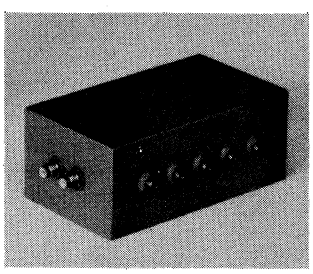
Total Td ns	Rise Time max (ns)	P/N M23859/23- Impedance ± 10% 50 Ω	100Ω	200Ω
20	5.5	004	104	
25	6	005	105	
30	6.5	006	106	
35	7	007	107	
40	8	008	108	208
45	9	009	109	209
50	10	010	110	210
55	11	011	111	211
60	12	012	112	212
65	13	013	113	213
70	14	014	114	214
75	15	015	115	215
80	16	016	116	216
85	17	017	117	217
90	18	018	118	218
95	19	019	119	219
100	20	020	120	220
110	22	021	121	221
120	24	022	122	222
130	26	023	123	223
140	28	024	124	224
150	30	025	125	225
160	32	026	126	226
170	34	027	127	227

Total Td ns	Rise Time max (ns)	P/N M23859/23- Impedance ± 10% 50 Ω	100Ω	200Ω
180	36	028	128	228
190	38	029	129	229
200	40	030	130	230
210	45		131	231
220	45		132	232
230	50		133	233
240	50		134	234
250	50		135	235
260	55		136	236
270	55		137	237
280	60		138	238
290	60		139	239
300	60		140	240
310	65		141	241
320	65		142	242
330	70		143	243
340	70		144	244
350	70		145	245
360	75		146	246
370	75		147	247
380	80		148	248
390	80		149	249
400	80		150	250

VARIABLE DELAY LINES



V1434
Sectional tap with discrete calibrated delays.

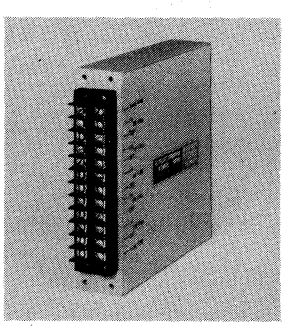


V1703
Unique calibrated switched line, in and out.

Model	Delay Adjustment	Rise Time	Adjustment Resolution	Impedance (Ohms)	Comments
VR903	0 to 950 nsec	90 nsec	1.5 nsec	500	Note 1
V1254	0-176 nsec	10 nsec	10 nsec	95	Notes 4 & 5 5 switches
V1434	0 to 4.4 μsec	0.2 μsec	.045 μsec	100	Notes 2 & 5
V1535	0 to 1280 nsec	25 nsec	2.5 nsec	95	Notes 4 & 5 9 switches
V1554	2 to 6.4 μsec	0.25 μsec	.045 μsec	100	Notes 2 & 5
V1611	10 to 150 nsec	15 nsec	.25 nsec	200	Note 1
V1702	0 to 200 nsec	10 nsec	10 nsec	95	Note 3 & 5
V1703	0 – 200 nsec	10 nsec	10 nsec	95	Notes 4 & 5 5 switches
V1743	100-250 nsec	20 nsec	10 nsec	500	Notes 4 & 5 4 switches

NOTES
1. Continuously variable output, high impedance tap.
2. Variable output via a coarse control 10 steps of 0.4 μsec and a fine control of 10 steps of .045 μsec.
3. Delay adjustment programmable by remote control.
4. Variable output via discrete screw driver slotted switches.
5. No high impedance tap necessary.

PRECISION AUDIO DELAY LINES



Over the years Control Electronics has developed a special skill in precise audio delay lines, including sectional balanced and unbalanced units ranging into the millisecond region. The sectional line terminals are arranged so as to conveniently enable the user to externally connect and disconnect the various sections for proper delay.

Model	Total Delay μsec	Tol. %	Impedance (Ohms)	3 dB Bandwidth KHz	Dimensions (Inches)
F344	74.60	1	1170	25	4x2.31x1.31
F416	1700	1	1000	6	10x5x5
F483	1000	1	600*	15	19x3⅝x5½ Rack Mounted
FA784	5000	1	600*	5	19x5¼x10 Rack Mounted
FA573	25,000	1	1000	1	19x5¼x10 Rack Mounted
FA1772	10, 20, 40, 60, 100	3	600*	10	6½x6¾x2
FA1787	40, 80, 160, 320, 640	3	600*	10	6½x15x2¾
FA1812	50, 100, 200, 200	3	600*	10	6x5x3
FA1839	50, 100, 200 200 (6 sets)	3	600*	10	5¼ Rack Mounted
FA1840	50, 100, 200 200 (3 sets)+ 1100	3	600*	10	5¼ Rack Mounted

*Balanced

Control Electronics
139 Florida St., Farmingdale, New York 11735 (516) 694-0125
Division of Neurotech Corp.

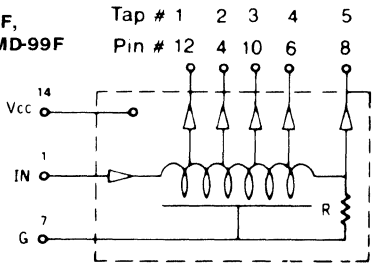
ACTIVE DELAY LINES (FAST-TTL LOGIC)

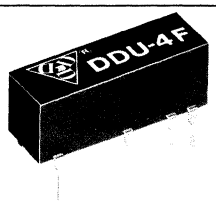
5 Equal Taps

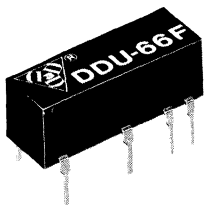
Specifications:

- **Outputs:** 5, equally spaced.
- **Delay Tolerance:** see table.
- **Rise time:** 2 NS typically.
- **Minimum pulse width:** 20% of total delay for DDU-4F.
  40% of total delay for rest.
- **Temperature range:** 0 C to + 70 C.
- **Temperature coefficient:** 100 PPM/ C.
- **Input signal requirement:** TTL logic.
- **Output fan-out:** TTL Schottky load.
- **Supply voltage:** 4.75 to 5.25 Vdc.
- **Supply current:**
  I_{CCL}: 32 ma.
  I_{CCH}: 7 ma.

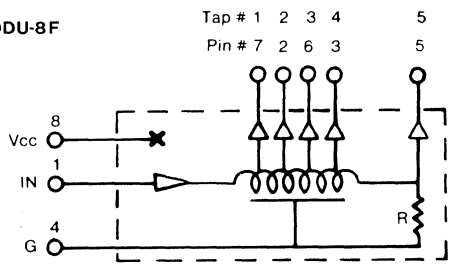
Series DDU-4F, DDU-66F-, SMD-99F

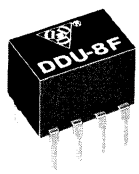




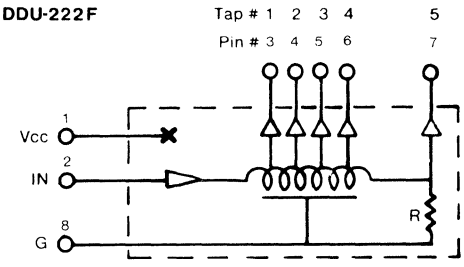


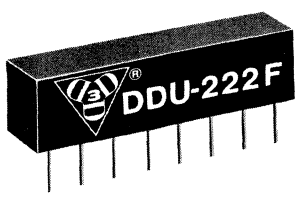
Series DDU-8F





Series DDU-222F





Part Numbers					Total Delay
DDU-4F-5004	DDU-8F-5004	DDU-66F-4	SMD-99F-5004	DDU-222F-4	4
DDU-4F-5006	DDU-8F-5006	DDU-66F-6	SMD-99F-5006	DDU-222F-6	6
DDU-4F-5008	DDU-8F-5008	DDU-66F-8	SMD-99F-5008	DDU-222F-8	8
DDU-4F-5010	DDU-8F-5010	DDU-66F-10	SMD-99F-5010	DDU-222F-10	10
DDU-4F-5012	DDU-8F-5012	DDU-66F-12	SMD-99F-5012	DDU-222F-12	12
DDU-4F-5016	DDU-8F-5016	DDU-66F-16	SMD-99F-5016	DDU-222F-16	16
DDU-4F-5020	DDU-8F-5020	DDU-66F-20	SMD-99F-5020	DDU-222F-20	20
DDU-4F-5025	DDU-8F-5025	DDU-66F-25	SMD-99F-5025	DDU-222F-25	25
DDU-4F-5030	DDU-8F-5030	DDU-66F-30	SMD-99F-5030	DDU-222F-30	30
DDU-4F-5035	DDU-8F-5035	DDU-66F-35	SMD-99F-5035	DDU-222F-35	35
DDU-4F-5040	DDU-8F-5040	DDU-66F-40	SMD-99F-5040	DDU-222F-40	40
DDU-4F-5045	DDU-8F-5045	DDU-66F-45	SMD-99F-5045	DDU-222F-45	45
DDU-4F-5050	DDU-8F-5050	DDU-66F-50	SMD-99F-5050	DDU-222F-50	50
DDU-4F-5060	DDU-8F-5060	DDU-66F-60	SMD-99F-5060	DDU-222F-60	60
DDU-4F-5075	DDU-8F-5075	DDU-66F-75	SMD-99F-5075	DDU-222F-75	75
DDU-4F-5100	DDU-8F-5100	DDU-66F-100	SMD-99F-5100	DDU-222F-100	100
DDU-4F-5125	DDU-8F-5125	DDU-66F-125	SMD-99F-5125	DDU-222F-125	125
DDU-4F-5150	DDU-8F-5150	DDU-66F-150	SMD-99F-5150	DDU-222F-150	150
DDU-4F-5175	DDU-8F-5175	DDU-66F-175	SMD-99F-5175	DDU-222F-175	175
DDU-4F-5200	DDU-8F-5200	DDU-66F-200	SMD-99F-5200	DDU-222F-200	200
DDU-4F-5250	DDU-8F-5250	DDU-66F-250	SMD-99F-5250	DDU-222F-250	250
DDU-4F-5300					300
DDU-4F-5350					350
DDU-4F-5400					400
DDU-4F-5450					450
DDU-4F-5500					500

DATA DELAY DEVICES Inc. ■ 3 Mt. Prospect Avenue, Clifton, New Jersey 07013 ■ (201) 773-2299 ■ TWX 710-989-7008

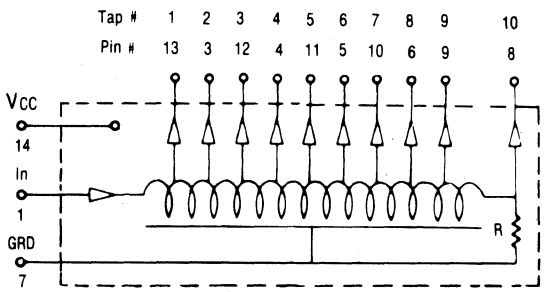
ACTIVE DELAY LINES (FAST-TTL LOGIC)

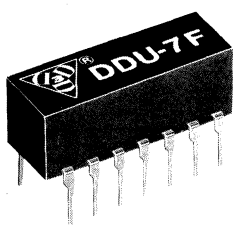
10 Taps

Specifications:

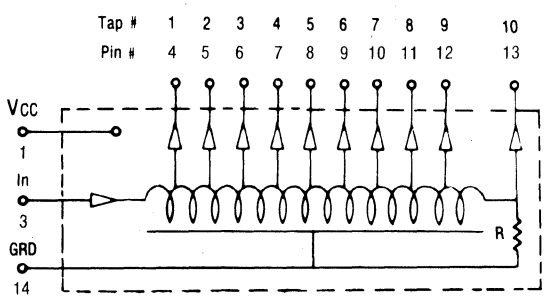
- **No. Taps:** 10 equally spaced taps
- **Total Delay Tolerance:** ± 5% or better, or 2 NS whichever is greater
- **Rise time:** 2 NS typically
- **Temperature coefficient:** 100 PPM/ C
- **Temperature range:** 0 to + 70 C
- **Minimum pulse-width:** 20% of total delay
- **input signal requirement:** TTL logic
- **Output fan-out:** TTL Schottky load.
- **Supply voltage:** 4.75 to 5.25 V
- **Supply Current:**
  I_{CCL}: 50 ma.
  I_{CCH}: 15 ma.

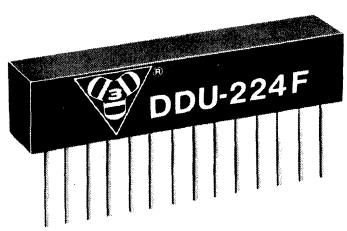
Series DDU-7F





Series DDU-224F





Part Numbers		Tap Delay	Total Delay
DDU-7F-10	DDU-224F-10	1	9
DDU-7F-20	DDU-224F-20	2	18
DDU-7F-25	DDU-224F-25	2.5	22.5
DDU-7F-50	DDU-224F-50	5	45
DDU-7F-100	DDU-224F-100	10	100
DDU-7F-150	DDU-224F-150	15	150
DDU-7F-200	DDU-224F-200	20	200
DDU-7F-250	DDU-224F-250	25	250
DDU-7F-300	DDU-224F-300	30	300
DDU-7F-400	DDU-224F-400	40	400
DDU-7F-500	DDU-224F-500	50	500

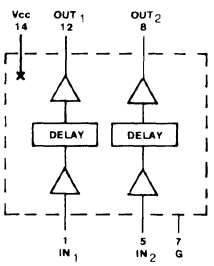
ACTIVE DELAY LINES (FAST-TTL LOGIC)

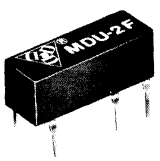
Multiple Delay Lines

Specifications:

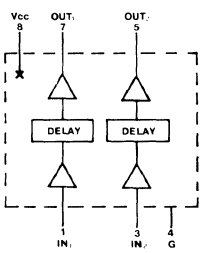
- **Delay Tolerance:** ±5% or 2 NS whichever is greater.
- **Rise-time:** 2 NS typically.
- **Temperature coefficient:** 100 PPM/°C.
- **Temperature range:** 0° to + 70°C.
- **Input signal requirement:** TTL logic.
- **Input pulse width:** Min. 100% of total delay.
- **Input rep. rate** = min. 3 × pulse width.
- **Output fan-out:** TTL loads.
- **Supply voltage:** 5Vdc ± 5%.
- **Supply current:** see Table 2.

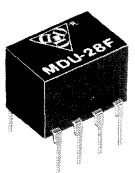
Series MDU-2F



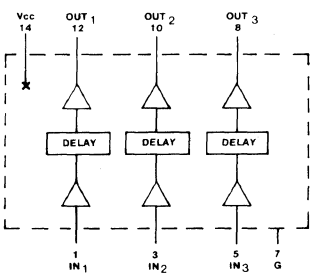


Series MDU-28F





Series MDU-3F



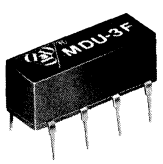


Table 1

Part Numbers			
MDU-28F	MDU-2F	MDU-3F	Delay Per Line (NS)
MDU-28F-5	MDU-2F-5	MDU-3F-5	5
MDU-28F-6	MDU-2F-6	MDU-3F-6	6
MDU-28F-8	MDU-2F-8	MDU-3F-8	8
MDU-28F-10	MDU-2F-10	MDU-3F-10	10
MDU-28F-12	MDU-2F-12	MDU-3F-10	12
MDU-28F-15	MDU-2F-15	MDU-3F-15	15
MDU-28F-16	MDU-2F-16	MDU-3F-16	16
MDU-28F-20	MDU-2F-20	MDU-3F-20	20
MDU-28F-25	MDU-2F-25	MDU-3F-25	25
MDU-28F-30	MDU-2F-30	MDU-3F-30	30
MDU-28F-35	MDU-2F-35	MDU-3F-35	35
MDU-28F-40	MDU-2F-40	MDU-3F-40	40
MDU-28F-45	MDU-2F-45	MDU-3F-45	45
MDU-28F-50	MDU-2F-50	MDU-3F-50	50
MDU-28F-60	MDU-2F-60	MDU-3F-60	60
MDU-28F-75	MDU-2F-75	MDU-3F-75	75
MDU-28F-100	MDU-2F-100	MDU-3F-100	100
MDU-28F-125	MDU-2F-125		125
MDU-28F-150	MDU-2F-150		150
MDU-28F-175	MDU-2F-175		175
MDU-28F-200	MDU-2F-200		200
MDU-28F-250	MDU-2F-250		250

Table 2

Series	ICCH	ICCL
MDU-28F	12 MA	54 MA
MDU-2F	12 MA	54 MA
MDU-3F	14 MA	74 MA

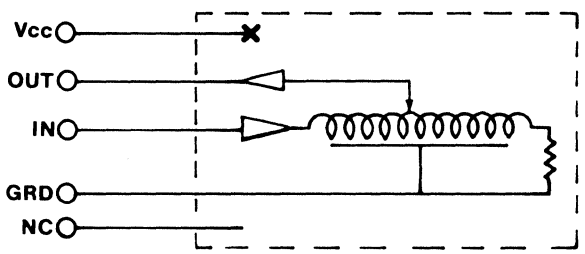
ACTIVE DELAY LINES (FAST-TTL LOGIC)

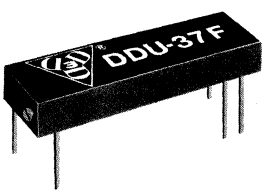
Trimmer Delay

Specifications:

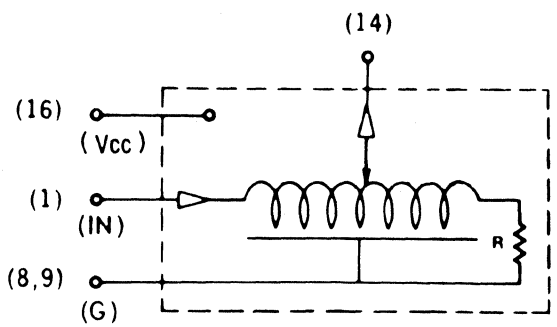
- **Input signal requirement:** TTL logic.
- **Output fan-out:** TTL Schottky load.
- **Inherent delay:** 10 NS typ.
- **Delay resolution:** .12 NS.
- **Output rise-time:** 4 NS typ.
- **Temperature coefficient:** 100 PPM/°C.
- **Temperature range:** 0°C to 70°C standard. (−55°C to +125°C on request)
- **Supply voltage:** 5.0 Vdc ± 5%.
- **Power dissipation:** 230 MW max.

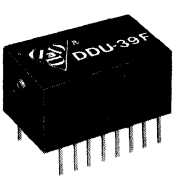
Series DDU-37F





Series DDU-39F





Part No.	Min. Delay Variation (NS)
DDU-37F-25	15
DDU-37F-30	20
DDU-37F-40	30
DDU-37F-50	40
DDU-37F-60	50
DDU-37F-70	60
DDU-37F-80	70
DDU-37F-100	90
DDU-37F-120	100
DDU-37F-150	140
DDU-37F-200	180

Part No.	Inherent Delay Typ.	Adjustment Range Typ.
DDU-39F	7 NS	7 NS to 25 NS

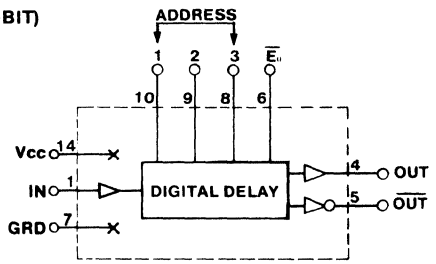
ACTIVE DELAY LINES (FAST-TTL LOGIC)

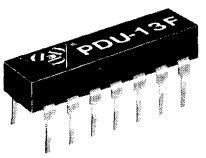
Digitally Programmable (3 - 8 BIT)

Specifications:

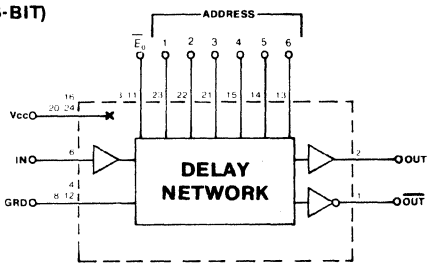
- **Input signal requirement:** TTL logic
- **Propagation delay:**
  Address to output = 7 NStyp.
  Enable to output = 6 NS typ.
- **Output fan-out:** TTL Schottky load
- **Delay variation:** Monotonic in one direction
- **Programmed delay tolerance:** ± 5% or 1 NS whichever is greater
- **Operating temperature:** 0-70°C
- **Temperature coefficient:** 100 PPM/°C
- **Supply current:** see Table 2
- **Supply voltage:** 4.75 to 5.25 Vdc.

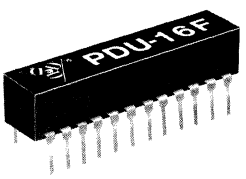
Series PDU-13F (3-BIT)



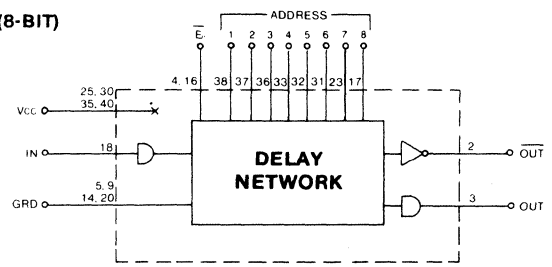


Series PDU-16F (6-BIT)





Series PDU-18F (8-BIT)



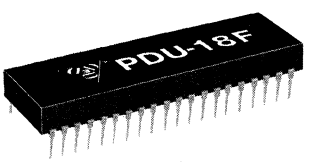


TABLE 1

Part Numbers						
PDU-13F	PDU-14F	PDU-15F	PDU-16F	PDU-17F	PDU-18F	Delay Increment
PDU-13F-.5	PDU-14F-.5	PDU-15F-0.5	PDU-16F-0.5	PDU-17F-.5	PDU-18F-.5	.5 NS
PDU-13F-1	PDU-14F-1	PDU-15F-1	PDU-16F-1	PDU-17F-1	PDU-18F-1	1 NS
PDU-13F-2	PDU-14F-2	PDU-15F-2	PDU-16F-2	PDU-17F-2	PDU-18F-2	2 NS
PDU-13F-3	PDU-14F-3	PDU-15F-3	PDU-16F-3	PDU-17F-3	PDU-18F-3	3 NS
PDU-13F-4	PDU-14F-4	PDU-15F-4	PDU-16F-4	PDU-17F-4	PDU-18F-4	4 NS
PDU-13F-5	PDU-14F-5	PDU-15F-5	PDU-16F-5	PDU-17F-5	PDU-18F-5	5 NS
PDU-13F-6	PDU-14F-6	PDU-15F-6	PDU-16F-6	PDU-17F-6	PDU-18F-6	6 NS
PDU-13F-7	PDU-14F-7	PDU-15F-7	PDU-16F-7	PDU-17F-7	PDU-18F-7	7 NS
PFU-13F-8	PDU-14F-8	PDU-15F-8	PDU-16F-8	PDU-17F-8	PDU-18F-8	8 NS
PDU-13F-9	PDU-14F-9	PDU-15F-9	PDU-16F-9	PDU-17F-9	PDU-18F-9	9 NS
PDU-13F-10	PDU-14F-10	PDU-15F-10	PDU-16F-10	PDU-17F-10	PDU-18F-10	10 NS
PDU-13F-12	PDU-14F-12	PDU-15F-12				12 NS
PDU-13F-15	PDU-14F-15	PDU-15F-15				15 NS
PDU-13F-20	PDU-14F-20	PDU-15F-20				20 NS
PDU-13F-25	PDU-14F-25					25 NS
PDU-13F-30	PDU-14F-30					30 NS
PDU-13F-35	PDU-14F-35					35 NS
PDU-13F-40	PDU-14F-40					40 NS
PDU-13F-45	PDU-14F-45					45 NS
PDU-13F-50	PDU-14F-50					50 NS
	PDU-14F-60					60 NS
	PDU-14F-80					80 NS
	PDU-14F-100					100 NS

TABLE 2

Series No.	ICCH (MA)	ICCL (MA)	TDO (NS)
PDU-13F	20	45	4
PDU-14F	30	74	9
PDU-15F	30	74	13
PDU-16F	30	74	13
PDU-17F	68	86	14
PDU-18F	65	130	14

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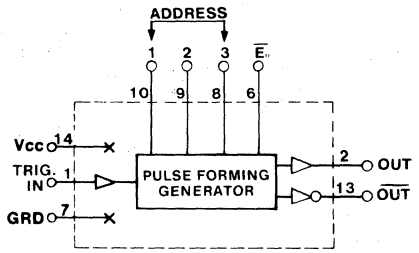
ACTIVE PULSE-WIDTH GENERATORS (FAST-TTL LOGIC)

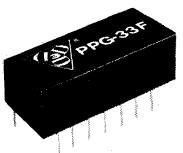
Programmable (3 - 8BITS)

Specifications:

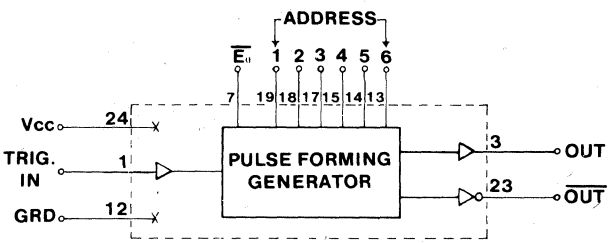
- **Input signal requirement:** TTL rising-edge.
- **Output fan-out:** TTL Schottky loads.
- **Trigger inherent delay:** 6 NS Typ.
- **Inherent pulse-width:** 11 NS Typ.
- **Pulse-width variation:** monotonic in one direction.
- **Programmed pulse-width tolerance:** ± 5% or 1 NS whichever is greater.
- **Propagation delay:**
  Address to output = 7 NS Typ.
  Enable to output = 6 NS Typ.
- **Min. PRR** = 2 × programmed PW.
- **Min, down-time** = 1 × programmed PW.
- **Supply voltage:** 5 Vdc.
- **Operating temperature:** 0 C to 70 C.
- **Temperature coefficient:** 100 PPM/ C.
- **Power dissipation:** see Table 2.

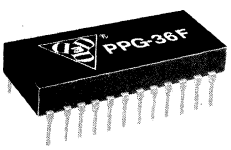
Series PPG-33F (3-BIT)



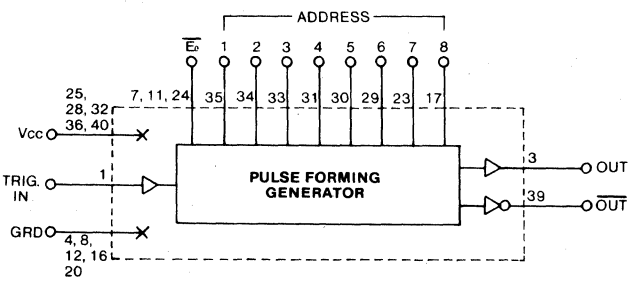


Series PPG-36F (6-BIT)





Series PPG-38F (8-BIT)



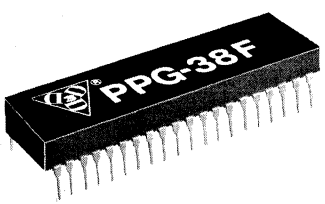


Table 1

Part Numbers			Incremental Pulse-Width
PPG-33F-.5	PPG-36F-.5	PPG-38F-.5	.5 NS
PPG-33F-1	PPG-36F-1	PPG-38F-1	1 NS
PPG-33F-2	PPG-36F-2	PPG-38F-2	2 NS
PPG-33F-3	PPG-36F-3	PPG-38F-3	3 NS
PPG-33F-4	PPG-36F-4	PPG-38F-4	4 NS
PPG-33F-5	PPG-36F-5	PPG-38F-5	5 NS
PPG-33F-6	PPG-36F-6	PPG-38F-6	6 NS
PPG-33F-7	PPG-36F-7	PPG-38F-7	7 NS
PPG-33F-8	PPG-36F-8	PPG-38F-8	8 NS
PPG-33F-9	PPG-36F-9	PPG-38F-9	9 NS
PPG-33F-10	PPG-36F-10	PPG-38F-10	10 NS
PPG-33F-15			15 NS
PPG-33F-20			20 NS
PPG-33F-40			40 NS
PPG-33F-50			50 NS

Table 2

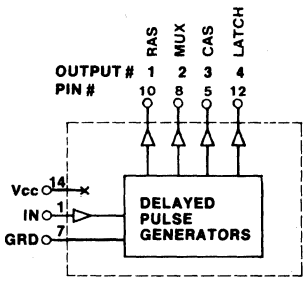
Part Numbers	I_{CCL} (MA)	I_{CCH} (MA)
PPG-33F	41	20
PPG-36F	72	27
PPG-38F	150	42

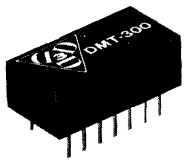
ACTIVE MODULES

Dram Timer (Schottky-TTL Logic)
Series DMT-300

Specifications:

- **Input requirement:** TTL logic, rising-edge triggered.
- **Input pulse width:** 4 NS min.
- **Max. rep. rate of (MREQ) =** T_E of latch strobe.
- **Output fan-out:** TTL Schottky load.
- **Time delay tolerance:** ± 5% or 2 NS whichever is greater.
- **Supply voltage (Vcc): 5 Vdc** ± 5%.
- **Operating temperature:**) C to 70 C.
- **Temperature Coefficient:** 100 PPM/ C.
- **Power dissipation:** 740 MW max.





Part No.	Output 1 (RAS) LE	TE	Output 2 (MUX control) LE	TE	Output 3 (CAS) LE	TE	Output 4 (Latch Strobe) LE	TE
DMT-301-1	15	190	40	190	65	190	140	190
DMT-301-2	15	165	40	165	65	165	115	215
DMT-301-3	15	190	40	190	65	190	190	240
DMT-301-4	15	215	40	215	65	215	165	265
DMT-301-5	15	265	40	265	115	265	215	315
DMT-301-6	15	215	40	215	65	215	165	335
DMT-301-7	15	165	30	165	50	165	115	265
DMT-301-8	15	135	30	135	50	135	85	235
DMT-301-9	15	275	40	275	65	275	220	370
DMT-302-1	15	265	65	265	90	265	215	315
DMT-302-2	15	290	75	290	115	290	240	340
DMT-303-1	25	300	75	300	125	300	250	350

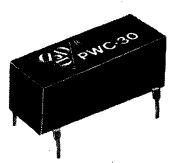
Pulse Width Controller (Fast-TTL Logic)
Series PWC-30

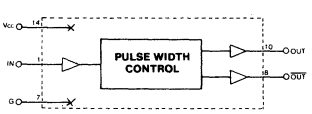
Specifications:

- **Input signal:** TTL.
- **Output fan-out:** 10 TTL loads.
- **Trigger inherent delay:** 5 NS typ.
- **Pulse-width tolerance** = 5% or 2 NS (others on request)
- **Min. PRR** = 1.1 × PW
- **Supply voltage:** 5 Vdc.
- **Supply current:**
  I_{CCL}: 32 ma.
  I_{CCH}: 7 ma.
- **Operating temperature:** 0 C to 70 C (−55 to 125 C on request).*
- **Temperature coefficient:** 100 PPM/ C.
- **Output rise-time:** 2 NS typ.

*DIL package used.

Part No.	Pulse Width
PWC-30-5	5 NS
PWC-30-10	10 NS
PWC-30-15	15 NS
PWC-30-20	20 NS
PWC-30-30	30 NS
PWC-30-40	40 NS
PWC-30-50	50 NS
PWC-30-60	60 NS
PWC-30-75	75 NS
PWC-30-100	100 NS
PWC-30-125	125 NS
PWC-30-150	150 NS
PWC-30-175	175 NS
PWC-30-200	200 NS
PWC-30-250	250 NS
PWC-30-300	300 NS
PWC-30-350	350 NS
PWC-30-400	400 NS
PWC-30-500	500 NS

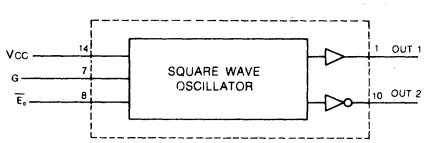


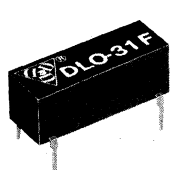


Gated-Oscillator (Fast-TTL Logic)
Series DLO-31F

Specifications:

- **Frequencies:** See table; others on request.
- **Tolerance:** ± 2%.
- **Temperature coefficient:** 100 PPM/ C.
- **Operating temperature:** 0 - 70 C.
- **Supply voltage:** 4.75 to 5.25 Vdc.
- **Supply current:** 40 ma.
- **Storage temperature:** −55 C to 125 C.
- **Enable signal:** TTL logic.
- **Output fan-out:** TTL Schottky load.
- **Inherent delay:** 4 NS typ.





Part Number	Frequency	Part Number	Frequency
DLO-31F-2	2 MHz	DLO-31F-10	10 MHz
DLO-31F-2.5	2.5 MHz	DLO-31F-11	11 MHz
DLO-31F-3	3 MHz	DLO-31F-12	12 MHz
DLO-31F-3.5	3.5 MHz	DLO-31F-13	13 MHz
DLO-31F-4	4 MHz	DLO-31F-14	14 MHz
DLO-31F-4.5	4.5 MHz	DLO-31F-15	15 MHz
DLO-31F-5	5 MHz	DLO-31F-20	20 MHz
DLO-31F-5.5	5.5 MHz	DLO-31F-25	25 MHz
DLO-31F-6	6 MHz	DLO-31F-30	30 MHz
DLO-31F-7	7 MHz	DLO-31F-35	35 MHz
DLO-31F-8	8 MHz	DLO-31F-40	40 MHz
DLO-31F-9	9 MHz		

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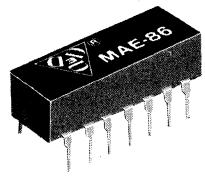
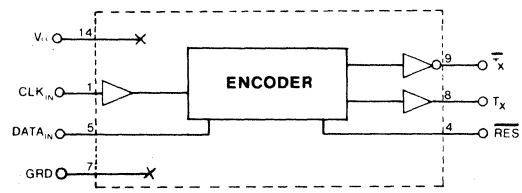
ACTIVE MODULES (SCHOTTKY-TTL LOGIC)

Manchester Encoder Series MAE-86

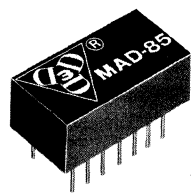


Specifications:

- **Input signal requirement:** TTL logic.
- **Output fan-out:** TTL Schottky load.
- **Operating temperature:** 0° to 70°C.
- **Temperature coefficient:** 100 PPM/°C.
- **Supply voltage V_{CC}:** 5 Vdc ± 5%.
- **Power dissipation:** 300 MW max.
- **CLK_{IN} =** 1 X operating data rates (15 NS min. PW).
- **Data rates up to 30 MB/S.**

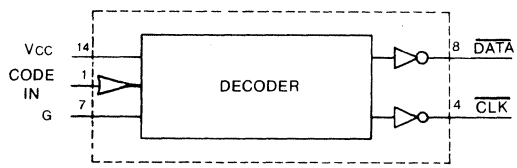


Manchester Decoder Series MAD-85



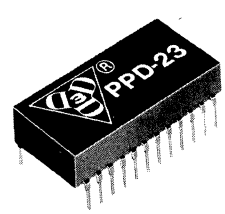
Specifications:

- **Input signal requirement:** TTL logic.
- **Output fan-out:** TTL Schottky load.
- **Operating temperature:** 0°C to 70°C.
- **Temperature coefficient:** 100 PPM/° C.
- **Supply voltage V_{CC}:** 5Vdc ± 5%.
- **Power dissipation:** 740 MW max.



Part No.	Operating Data Rates	Part No.	Operating Data Rates	Part No.	Operating Data Rates
MAD-85-1	1 MB/S	MAD-85-10	10 MB/S	MAD-85-18	18 MB/S
MAD-85-2	2 MB/S	MAD-85-11	11 MB/S	MAD-85-19	19 MB/S
MAD-85-3	3 MB/S	MAD-85-12	12 MB/S	MAD-85-20	20 MB/S
MAD-85-4	4 MB/S	MAD-85-13	13 MB/S	MAD-85-21	21 MB/S
MAD-85-5	5 MB/S	MAD-85-14	14 MB/S	MAD-85-22	22 MB/S
MAD-85-6	6 MB/S	MAD-85-15	15 MB/S	MAD-85-23	23 MB/S
MAD-85-7	7 MB/S	MAD-85-16	16 MB/S	MAD-85-24	24 MB/S
MAD-85-8	8 MB/S	MAD-85-17	17 MB/S	MAD-85-25	25 MB/S
MAD-85-9	9 MB/S				

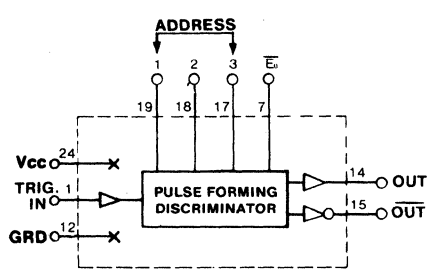
Programmable Pulse Discriminator Series PPD-23



Specifications:

- **Input requirement:** TTL logic.
- **Inherent pulse width:** 5 NS typ.
- **Supply voltage:** 5 Vdc ± 5%.
- **Operating temperatures:** 0°C to 70°C.
- **Temperature coefficient:** 100 PPM/°C.
- **Power dissipation:** 850 MW max.

Part Number	Incremental Pulse Width Per Step	Total Programmed Pulse Width
PPD-23-1	1 NS ± .4NS	7 NS
PPD-23-2	2 NS ± .4NS	14 NS
PPD-23-3	3 NS ± .5NS	21 NS
PPD-23-5	5 NS ± .6NS	35 NS
PPD-23-10	10 NS ± 1.0 NS	70 NS
PPD-23-15	15 NS ± 1.3 NS	105 NS
PPD-23-20	20 NS ± 1.5 NS	140 NS
PPD-23-40	40 NS ± 2.0 NS	280 NS
PPD-23-50	50 NS ± 2.5 NS	350 NS



ACTIVE DELAY LINES (ECL-LOGIC)

Multiple Delay Lines
Series MDU-12, MDU-13 (10KH ECL)

Specifications:

- **Total Delay Tolerance:** ± 5% or better, or 1 NS whichever is greater.
- **Rise-time:** 2 NS typical.
- **Logic 1 voltage:** −.96V
- **Logic 1 current:** .26 MA
- **Logic 0 current:** .5μA
- **Logic 0 voltage:** −1.65V
- **Supply voltage:** −5.2V
- **Operating Temperature:** −30 C to 85 C
- **Temperature Coefficient:** 100 PPM/ C

Part No.	Delay Per Line (NS)
MDU-12-5	5
MDU-12-10	10
MDU-12-15	15
MDU-12-20	20
MDU-12-25	25
MDU-12-30	30
MDU-12-35	35
MDU-12-40	40
MDU-12-45	45
MDU-12-50	50
MDU-12-60	60
MDU-12-75	75
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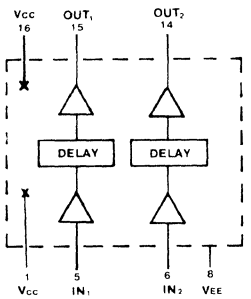
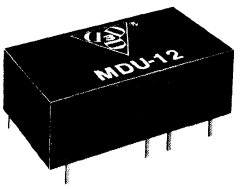
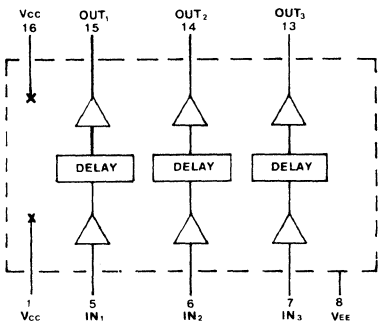
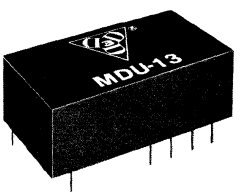
MDU-12-125	125
MDU-12-150	150
MDU-12-200	200
MDU-12-250	250





Part No.	Delay Per Line (NS)
MDU-13-5	5
MDU-13-10	10
MDU-13-15	15
MDU-13-20	20
MDU-13-25	25
MDU-13-30	30
MDU-13-35	35
MDU-13-40	40
MDU-13-45	45
MDU-13-50	50



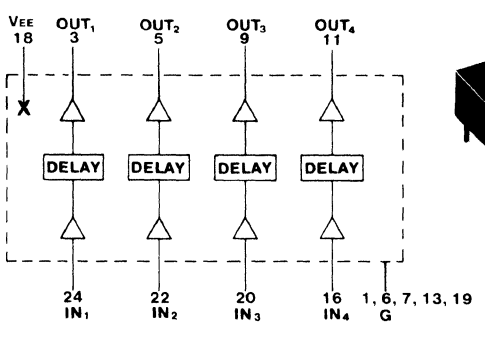


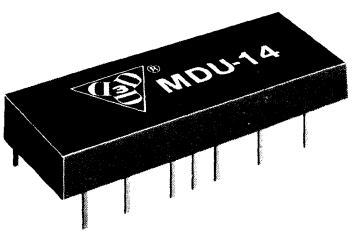
Series: MDU-14 (100K ECL)

Specifications:

- **Total delay tolerance:** ±5% or 1 NS whichever is greater.
- **Rise time:** 1 NS typ.
- **Input pulse width:** 40% of total delay.
- **Input pulse voltage:** .8V p-p (−.9V to −1.7V).
- **Logic 1 input voltage:** −1.16V min.
- **Logic 0 input voltage:** −1.47V max.
- **Logic 1 output voltage:** −1.02V min.
- **Logic 0 output voltage:** −1.62V max.
- **Supply voltage (Vee):** −5V.
- **Operating Temperature:** 0 C to + 85 C.
- **Temperature Coefficient:** 100 PPM/ C.
- **Fan-out capabilities:** 70 ECL.

Part No.	Delay Per Line (NS)
MDU-14-2	2
MDU-14-2.5	2.5
MDU-14-3	3
MDU-14-4	4
MDU-14-5	5
MDU-14-6	6
MDU-14-7	7
MDU-14-8	8
MDU-14-9	9
MDU-14-10	10
MDU-14-12.5	12.5
MDU-14-15	15
MDU-14-20	20
MDU-14-25	25





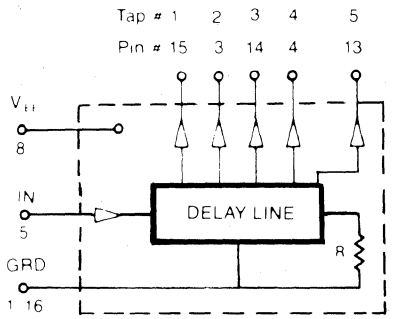
ACTIVE DELAY LINES (ECL-LOGIC)

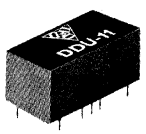
Multi Taps

Specifications:

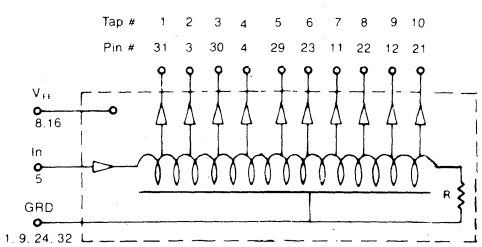
- **Total Delay Tolerance:** ± 5% or better, or 2 NS whichever is greater.
- **No. Taps:** 5 - 10
- **Rise-Time:** 2 NS typical
- **Supply Voltage:** −5.2V
- **Operating Temperature:** −30°C to 85°C
- **Temperature Coefficient:** 100 PPM/°C
- **Family Type:** 10K ECL (DDU-11 & 12)
  100K ECL (DDU-18)

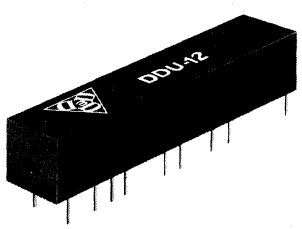
Part No.	Total Delay NS	Tap Delay NS
DDU-11-5	4	1
DDU-11-10	8	2
DDU-11-20	16	4
DDU-11-25	20	5
DDU-11-50	50	10
DDU-11-75	75	15
DDU-11-100	100	20
DDU-11-150	150	30
DDU-11-200	200	40
DDU-11-250	250	50
DDU-11-300	300	60
DDU-11-400	400	80
DDU-11-500	500	100



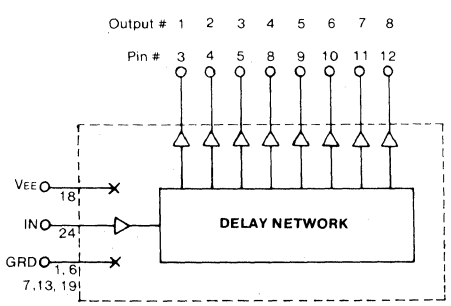


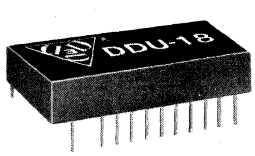
Part No.	Total Delay NS	Delay Tap NS
DDU-12-10	9	1
DDU-12-20	18	2
DDU-12-25	22.5	2.5
DDU-12-40	36	4
DDU-12-50	45	5
DDU-12-75	75	7.5
DDU-12-100	100	10
DDU-12-150	150	15
DDU-12-200	200	20
DDU-12-250	250	25
DDU-12-300	300	30
DDU-12-400	400	40
DDU-12-500	500	50
DDU-12-750	750	75
DDU-12-1000	1000	100
DDU-12-1500	1500	150





Part No.	Delay Increment NS	Total Delay NS
DDU-18-4	.5	3.5
DDU-18-8	1	7.0
DDU-18-12	1.5	10.5
DDU-18-16	2	16
DDU-18-20	2.5	20
DDU-18-24	3	24
DDU-18-32	4	32
DDU-18-40	5	40
DDU-18-48	6	48
DDU-18-56	7	56
DDU-18-64	8	64
DDU-18-72	9	72
DDU-18-80	10	80
DDU-18-100	12.5	100
DDU-18-120	15	120
DDU-18-160	20	160
DDU-18-200	25	200





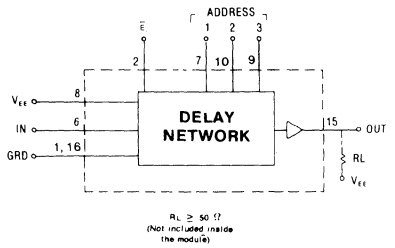
ACTIVE DELAY LINES (10KH-ECL LOGIC)

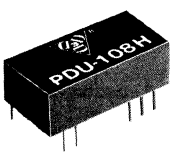
Programmable Delay Lines (3-8 BIT)

Specifications:

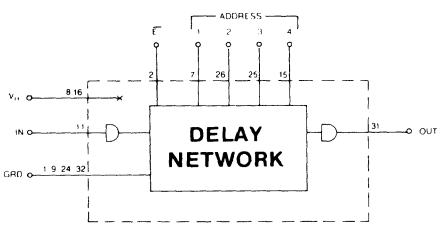
- **Input signal requirement:** ECL logic
- **Output fan-out:** ECL loads
- **Delay variation:** Monotonic in one direction
- **Programmed delay tolerance:** ±5% or 1 NS whichever is greater
- **Inherent delay:** see Table 2
- **Propagation delay:**
  Address to output = 3.6 NS typ
  Enable to output = 1.7 NS typ
- **Power dissipation:** see Table 2
- **Supply voltage:** −5Vdc ± 5%
- **Operating Temperature:** 0-70°C
- **Temperature Coefficient:** 100 PPM/°C

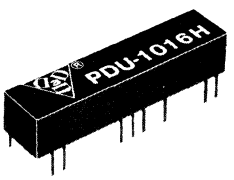
Series PDU-108H



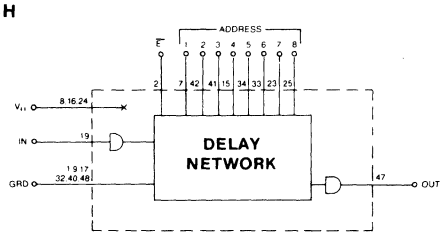


Series PDU-1016H





Series PDU-10256H



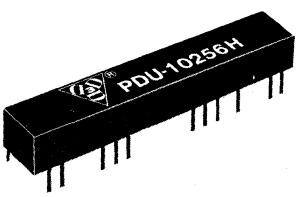


Table 1

Part Numbers			Delay Increment
PDU-108H-.5	PDU-1016H-.5	PDU-10256H-.5	.5 NS
PDU-108H-1	PDU-1016H-1	PDU-10256H-1	1 NS
PDU-108H-2	PDU-1016H-2	PDU-10256H-2	2 NS
PDU-108H-3	PDU-1016H-3	PDU-10256H-3	3 NS
PDU-108H-4	PDU-1016H-4	PDU-10256H-4	4 NS
PDU-108H-5	PDU-1016H-5	PDU-10256H-5	5 NS
PDU-108H-6	PDU-1016H-6	PDU-10256H-6	6 NS
PDU-108H-7	PDU-1016H-7	PDU-10256H-7	7 NS
PDU-108H-8	PDU-1016H-8	PDU-10256H-8	8 NS
PDU-108H-9	PDU-1016H-9	PDU-10256H-9	9 NS
PDU-108H-10	PDU-1016H-10	PDU-10256H-10	10 NS
PDU-108H-12	PDU-1016H-12		12 NS
PDU-108H-15	PDU-1016H-15		15 NS
PDU-108H-20	PDU-1016H-20		20 NS
PDU-108H-25	PDU-1016H-25		25 NS
PDU-108H-30	PDU-1016H-30		30 NS
PDU-108H-35	PDU-1016H-35		35 NS
PDU-108H-40	PDU-1016H-40		40 NS
PDU-108H-45	PDU-1016H-45		45 NS
PDU-108H-50	PDU-1016H-50		50 NS
	PDU-1016H-60		60 NS
	PDU-1016H-80		80 NS
	PDU-1016H-100		100 NS

Table 2

Series	Power Dissipation	Inherent Delay
PDU-108H	290 MW	2.8 NS
PDU-1016H	615 MW	5.5 NS
PDU-1032H	615 MW	5.5 NS
PDU-1064H	925 MW	12 NS
PDU-10256H	925 MW	12 NS

DATA DELAY DEVICES Inc. ■ 3 Mt. Prospect Avenue, Clifton, New Jersey 07013 ■ (201) 773-2299 ■ TWX 710-989-7008

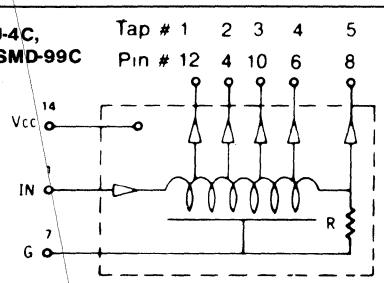
ACTIVE DELAY LINES (H-CMOS)

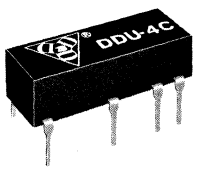
5 Taps

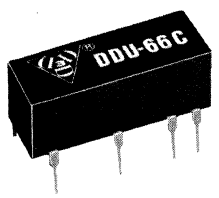
Specifications:

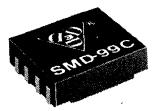
- **No. Taps:** 5 equally spaced taps.
- **Total delay tolerance:** 5% or 2 NS whichever is greater.
- **Rise-time:** 8 NS typ.
- **Temperature coefficient:** 300 PPM/°C.
- **Temperature range:** 0°C to + 70°C.
- **Supply voltage:** 5 Vdc ± 5%.
- **Logic 1 input:** 3.2V.
- **Logic 0 input:** .9V.
- **Logic 1 output:** 4.5V.
- **Logic 0 output:** 0.1V.
- **Input current:** 1 μa max.
- **Supply current:**
  I_{CCH} = 5 MA
  I_{CCL} = 20 μa
- **Fan-out:** 10 LSTTL loads min.

Series DDU-4C, DDU-66C, SMD-99C

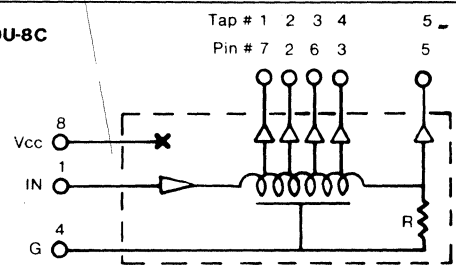


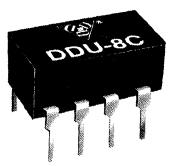




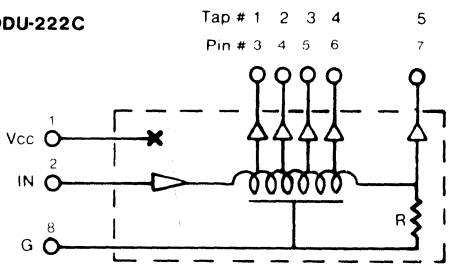


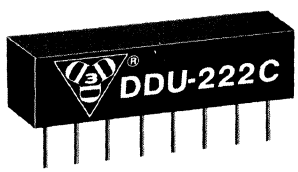
Series DDU-8C





Series DDU-222C





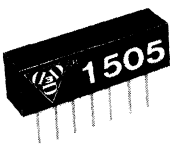
Part Numbers					Total Delay (NS)
DDU-8C-5050	DDU-4C-5050	DDU-66C-50	SMD-99C-5050	DDU-222C-50	50
DDU-8C-5060	DDU-4C-5060	DDU-66C-60	SMD-99C-5060	DDU-222C-60	60
DDU-8C-5075	DDU-4C-5075	DDU-66C-75	SMD-99C-5075	DDU-222C-75	75
DDU-8C-5100	DDU-4C-5100	DDU-66C-100	SMD-99C-5100	DDU-222C-100	100
DDU-8C-5125	DDU-4C-5125	DDU-66C-125	SMD-99C-5125	DDU-222C-125	125
DDU-8C-5150	DDU-4C-5150	DDU-66C-150	SMD-99C-5150	DDU-222C-150	150
DDU-8C-5175	DDU-4C-5175	DDU-66C-175	SMD-99C-5175	DDU-222C-175	175
DDU-8C-5200	DDU-4C-5200	DDU-66C-200	SMD-99C-5200	DDU-222C-200	200
DDU-8C-5250	DDU-4C-5250	DDU-66C-250	SMD-99C-5250	DDU-222C-250	250

PASSIVE DELAY LINES (SIP-TYPE)

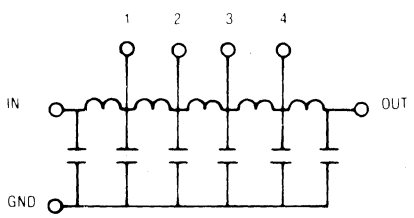
Series 1505

Specifications:

- **5 Equal taps**
- **Meets or exceeds:** MIL-D-23859C
- **Operating temperature range:** −55°C to + 125°C
- **Storage temperature range:** −55°C to + 125°C
- **Temperature coefficient:** 100 PPM/°C
- **Dielectric breakdown:** 50 Vdc
- **Epoxy encapsulated**
- **Maximum distortion @ output:** 10%



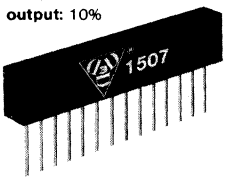
Part No.	Total Delay (NS)	Imp. Ω
1505-A	5	50
1505-10A	10	50
1505-20A	20	50
1505-30A	30	50
1505-40A	40	50
1505-50A	50	50
1505-60A	60	50
1505-70A	70	50
1505-80A	80	50
1505-90A	90	50
1505-100A	100	50
1505-5B	5	100
1505-10B	10	100
1505-20B	20	100
1505-30B	30	100
1505-40B	40	100
1505-50B	50	100
1505-60B	60	100
1505-75B	75	100
1505-100B	100	100
1505-30C	30	200
1505-50C	50	200
1505-60C	60	200
1505-100C	100	200
1505-50G	50	500
1505-100G	100	500
1505-200G	200	500
1505-300G	300	500



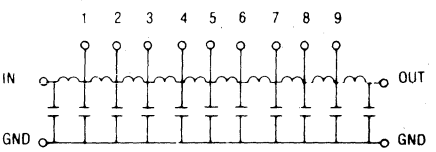
Series 1507

Specifications:

- **10 Equal taps**
- **Meets or exceeds:** MIL-D-23859C
- **Operating temperature range:** −55°C to +125°C
- **Storage temperature range:** −55°C to + 125°C
- **Temperature coefficient:** 100 PPM/°C
- **Dielectric breakdown:** 50 Vdc
- **Epoxy encapsulated**
- **Maximum distortion @ output:** 10%



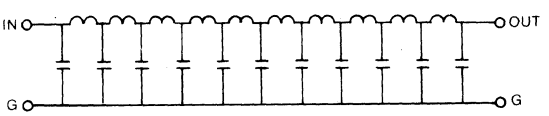
Part No.	Total Delay (NS)	Imp. Ω
1507-20A	20	50
1507-40A	40	50
1507-50A	50	50
1507-100A	100	50
1507-150A	150	50
1507-200A	200	50
1507-20B	20	100
1507-50B	50	100
1507-100B	100	100
1507-200B	200	100
1507-250B	250	100
1507-20C	20	200
1507-50C	50	200
1507-100C	100	200
1507-200C	200	200
1507-50G	50	500
1507-100G	100	500
1507-200G	200	500
1507-300G	300	500
1507-500G	500	500



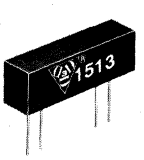
Series 1513

Specifications:

- **Meets or exceeds:** MIL-D-23859C.
- **Operating temperature:** −55 C to + 125 C.
- **Storage temperature:** −55 C to + 125 C.
- **Temperature coefficient:** 100 PPM/ C.
- **Dielectric breakdown:** 50 Vdc.
- **Epoxy encapsulated.**
- **Distortion @ output:** 10% max.
- **Rise-time:** 1 NS or 20% of TD (whichever is greater).
- **Delay tolerance:** 5% or 1 NS whichever is greater.



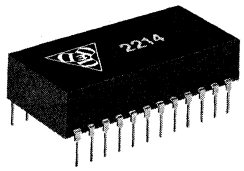
Part No.	Delay (NS)	Imp. Ω	Part No.	Delay (NS)	Imp. Ω	Part No.	Delay (NS)	Imp. Ω
1513-2.5A	2.5	50	1513-3.5Y	3.5	75	1513-5B	5	100
1513-5A	5	50	1513-7.5Y	7.5	75	1513-10B	10	100
1513-10A	10	50	1513-15Y	15	75	1513-20B	20	100
1513-15A	15	50	1513-22.5Y	22.5	75	1513-30B	30	100
1513-20A	20	50	1513-30Y	30	75	1513-40B	40	100
1513-25A	25	50	1513-37.5Y	37.5	75	1513-50B	50	100
1513-30A	30	50	1513-45Y	45	75	1513-60B	60	100
1513-40A	40	50	1513-60Y	60	75	1513-80B	80	100
1513-50A	50	50	1513-75Y	75	75	1513-100B	100	100
1513-60A	60	50	1513-90Y	90	75	1513-120B	120	100
1513-70A	70	50	1513-105Y	105	75	1513-140B	140	100
1513-80A	90	50	1513-120Y	120	75	1513-150B	150	100
1513-90A	90	50	1513-135Y	135	75			
1513-100A	100	50	1513-150Y	150	75			



DATA DELAY DEVICES Inc. ■ 3 Mt. Prospect Avenue, Clifton, New Jersey 07013 ■ (201) 773-2299 ■ TWX 710-989-7008

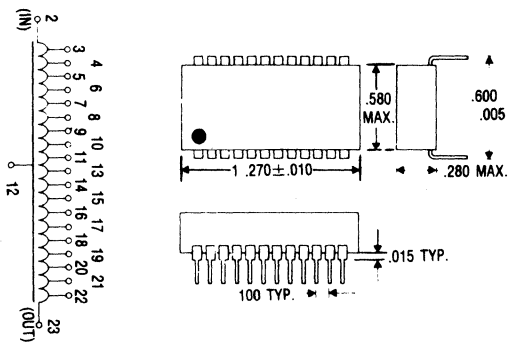
DIP-TAPPED DELAY LINES

SERIES 2214
20 Taps



Specifications

- **20 Equally spaced taps.**
- **Td/Tr = 10/1.**
- **Delay tolerance:** ± 5% or 1 NS whichever is greater.
- **Tap tolerance:** ± 5% or 1 NS whichever is greater.
- **Temperature coefficient:** 100 PPM/°C.
- **Temperature range:** -55°C to +125°C.
- **Dielectric breakdown:** 50 Vdc.
- **Meets or exceeds MIL-D-23859C.**
- **Epoxy encapsulated.**

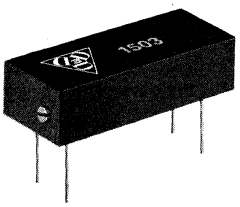


Part No.	Imp. (Ω)	Total Delay (NS)	Tap Increment (NS)	Rdc (Ω)
2214-50A	50	50	2.5	3.2
2214-60A	50	60	3.0	3.6
2214-80A	50	80	4.0	5.0
2214-100A	50	100	5.0	6.0
2214-150A	50	150	7.5	6.0
2214-200A	50	200	10.0	7.0
2214-50B	100	50	2.5	6.0
2214-60B	100	60	3.0	6.0
2214-80B	100	80	4.0	6.5
2214-100B	100	100	5.0	7.0
2214-150B	100	150	7.5	8.0
2214-200B	100	200	10.0	8.5
2214-300B	100	300	15.0	11.0
2214-400B	100	400	20.0	12.0
2214-40C	200	40	2.0	7.0
2214-80C	200	80	4.0	8.0
2214-120C	200	120	6.0	10.0
2214-200C	200	200	10.0	13.0
2214-300C	200	300	15.0	12.0
2214-400C	200	400	20.0	15.0
2214-500C	200	500	25.0	17.0
2214-600C	200	600	30.0	23.0
2214-800C	200	800	40.0	38.0
2214-50D	250	50	2.5	7.0
2214-100D	250	100	5.0	10.0
2214-150D	250	150	7.5	12.0
2214-200D	250	200	10.0	22.0
2214-250D	250	250	12.5	21.0
2214-300D	250	300	15.0	23.0
2214-400D	250	400	20.0	26.0
2214-500D	250	500	25.0	30.0
2214-600D	250	600	30.0	37.0
2214-800D	250	800	40.0	41.0
2214-1000D	250	1000	50.0	47.0
2214-200G	500	200	10.0	20.0
2214-300G	500	300	15.0	37.0
2214-400G	500	400	20.0	40.0
2214-500G	500	500	25.0	45.0
2214-600G	500	600	30.0	52.0
2214-800G	500	800	40.0	80.0
2214-1000G	500	1000	50.0	100.0
2214-1200G	500	1200	60.0	110.0
2214-1500G	500	1500	75.0	130.0
2214-2000G	500	2000	100.0	156.0

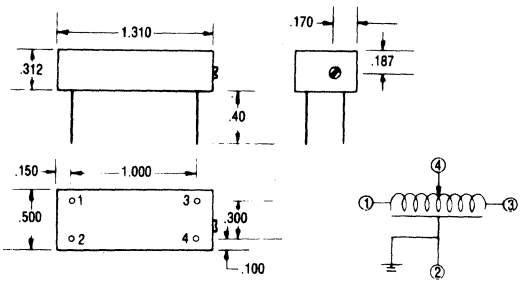
CONTINUOUSLY VARIABLE DELAY LINES

SERIES 1503

Specifications



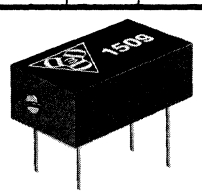
- **Continuously variable delay.**
- **Multi-turn adjusting screw** (40 turns approx.).
- **Temperature coefficient:** 100 PPM/°C.
- **Rise-time:** 20% of time delay.
- **Flat leads** (.020 x .010).
- **Withstanding voltage:** 50 Vdc.
- **Resolution:** .12 NS approx.



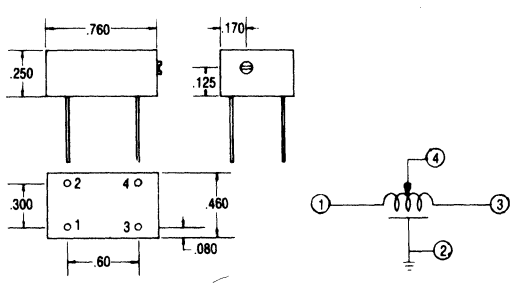
Part No.	Td (NS)	Imp. (Ω)	Rdc (Ω)	Part No.	Td (NS)	Imp. (Ω)	Rdc (Ω)
1503-15A	15	50	.7	1503-100B	100	100	6.0
1503-25A	25	50	.8	1503-120B	120	100	8.0
1503-30A	30	50	1.0	1503-160B	160	100	10.0
1503-40A	40	50	1.5	1503-200B	200	100	14.0
1503-50A	50	50	1.7	1503-30C	30	200	4.0
1503-60A	60	50	2.0	1503-60C	60	200	8.0
1503-80A	80	50	3.0	1503-100C	100	200	14.0
1503-100A	100	50	3.5	1503-20D	20	250	5.0
1503-15B	15	100	1.0	1503-20E	20	300	5.0
1503-30B	30	100	2.0	1503-30F	30	350	8.0
1503-50B	50	100	3.0	1503-25G	25	400	8.0
1503-60B	60	100	4.0	1503-40H	40	500	12.0
1503-80B	80	100	5.0				

SERIES 1509

Specifications



- **Low cost unit.**
- **Fits standard DIP sockets.**
- **Continuously variable.**
- **20 Turns approx.**
- **Resolution — .15 NS.**
- **Withstanding voltage — 100 Vdc.**
- **Temperature coefficient — 200 PPM/°C.**
- **Flat leads (.020 x .010).**



Part No.	Td (NS)	Impedance (Ω)	TR (NS)	Rdc (Ω)
1509-05B	5	100	3	.4
1509-20C	20	200	8	1.0
1509-30F	30	400	10	7.0
1509-40H	40	500	15	13.0

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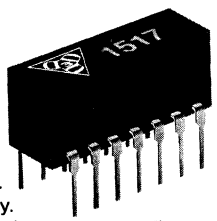
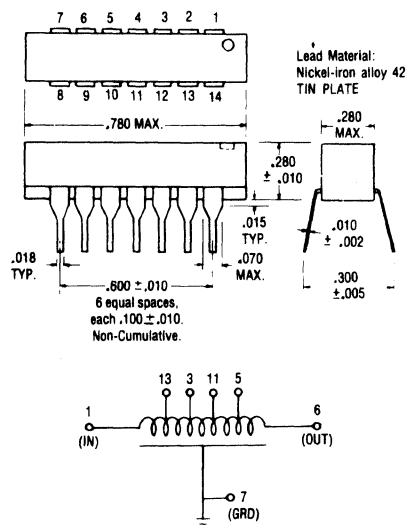
DIP-TAPPED DELAY LINES

SERIES 1517
5 Taps



Specifications

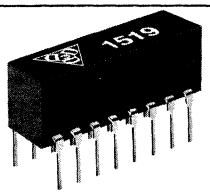
- **Delay accuracy:** ± 5% (others on request).
- **No. taps:** 5 Equally spaced taps.
- **Taps accuracy:** ± 5% of tap delay.
- **Impedance tolerance:** ± 10%.(others on request).
- **Rise-Time:** 30% of time delay.
- **Withstanding voltage:** 50 Vdc. Min.
- **Temperature coefficient:** 100 PPM/°C.
- **Environment:** Meets or exceeds MIL-D-23859C.



TAPS - CONNECTION

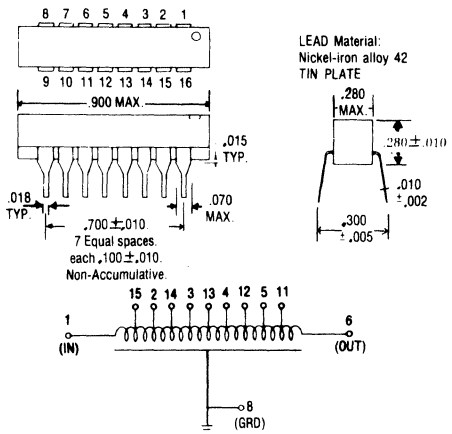
Part No.	Total Delay (NS)	Imp. (Ω)	Rdc. (Ω)	Part No.	Total Delay (NS)	Imp. (Ω)	Rdc. (Ω)
1517-10A	10	50	0.6	1517-150D	150	250	8.5
1517-15A	15	50	0.6	1517-15E	15	300	2.5
1517-20A	20	50	0.7	1517-30E	30	300	3.0
1517-30A	30	50	0.7	1517-50E	50	300	4.0
1517-40A	40	50	0.9	1517-60E	60	300	4.0
1517-5B	5	100	0.5	1517-75E	75	300	4.5
1517-10B	10	100	0.7	1517-90E	90	300	5.5
1517-15B	15	100	0.7	1517-120E	120	300	8.0
1517-20B	20	100	0.9	1517-130E	130	300	9.0
1517-25B	25	100	1.0	1517-180E	180	300	11.0
1517-30B	30	100	1.5	1517-220E	220	300	13.0
1517-40B	40	100	1.8	1517-20F	20	400	4.5
1517-50B	50	100	2.0	1517-40F	40	400	5.0
1517-60B	60	100	2.0	1517-60F	60	400	5.0
1517-75B	75	100	2.5	1517-80F	80	400	8.0
1517-10C	10	200	1.5	1517-100F	100	400	9.0
1517-20C	20	200	2.0	1517-120F	120	400	10.0
1517-30C	30	200	2.5	1517-160F	160	400	13.0
1517-40C	40	200	3.0	1517-180F	180	400	14.0
1517-50C	50	200	3.0	1517-240F	240	400	19.0
1517-60C	60	200	3.5	1517-300F	300	400	23.0
1517-80C	80	200	3.5	1517-25G	25	500	3.0
1517-90C	90	200	5.0	1517-50G	50	500	5.0
1517-120C	120	200	5.0	1517-75G	75	500	8.0
1517-150C	150	200	8.0	1517-100G	100	500	15.0
1517-25D	25	250	2.5	1517-125G	125	500	9.0
1517-37D	37	250	3.0	1517-150G	150	500	13.0
1517-50D	50	250	3.5	1517-200G	200	500	21.0
1517-60D	60	250	4.0	1517-225G	225	500	23.0
1517-75D	75	250	4.0	1517-300G	300	500	29.0
1517-100D	100	250	5.0				

SERIES 1519
10 Taps



Specifications

- **Delay Accuracy:** ± 5% (others on request)
- **No. taps:** 10 Equally spaced taps.
- **Taps accuracy:** ± 5% of tap delay.
- **Impedance tolerance:** ± 10% (others on request).
- **Rise-Time:** 20% of time delay.
- **Withstanding voltage:** 50 Vdc. Min.
- **Temperature coefficient:** 100 PPM/°C.
- **Environment:** Meets or exceeds MIL-D-23859C.



Part No.	Total Delay (NS)	Imp. (Ω)	Rdc. (Ω)	Part No.	Total Delay (NS)	Imp. (Ω)	Rdc. (Ω)
1519-20A	20	50	1.0	1519-200D	200	250	10.0
1519-25A	25	50	1.0	1519-225D	225	250	11.0
1519-30A	30	50	1.2	1519-300D	300	250	17.0
1519-40A	40	50	1.5	1519-375D	375	250	20.0
1519-45A	45	50	1.5	1519-500D	500	250	24.0
1519-50A	50	50	1.5	1519-30E	30	300	5.0
1519-60A	60	50	1.5	1519-60E	60	300	6.0
1519-75A	75	50	1.8	1519-90E	90	300	7.0
1519-100A	100	50	2.0	1519-120E	120	300	8.0
1519-10B	10	100	1.0	1519-150E	150	300	9.0
1519-20B	20	100	1.5	1519-180E	180	300	11.0
1519-30B	30	100	1.5	1519-240E	240	300	16.0
1519-40B	40	100	1.8	1519-270E	270	300	18.0
1519-50B	50	100	2.0	1519-360E	360	300	21.0
1519-60B	60	100	3.0	1519-450E	450	300	25.0
1519-80B	80	100	3.5	1519-600E	600	300	40.0
1519-90B	90	100	3.5	1519-40F	40	400	8.5
1519-100B	100	100	4.0	1519-80F	80	400	9.0
1519-120B	120	100	4.0	1519-120F	120	400	9.0
1519-150B	150	100	5.0	1519-160F	160	400	16.0
1519-200B	200	100	6.0	1519-200F	200	400	18.0
1519-250B	250	100	7.0	1519-240F	240	400	20.0
1519-20C	20	200	3.0	1519-320F	320	400	26.0
1519-40C	40	200	4.0	1519-360F	360	400	28.0
1519-60C	60	200	4.5	1519-480F	480	400	38.0
1519-80C	80	200	5.5	1519-600F	600	400	45.0
1519-100C	100	200	6.0	1519-800F	800	400	40.0
1519-120C	120	200	6.5	1519-50G	50	500	6.0
1519-160C	160	200	7.0	1519-100G	100	500	10.0
1519-180C	180	200	8.5	1519-150G	150	500	16.0
1519-200C	200	200	9.0	1519-200G	200	500	30.0
1519-240C	240	200	9.5	1519-250G	250	500	18.0
1519-300C	300	200	16.0	1519-300G	300	500	26.0
1519-400C	400	200	16.0	1519-400G	400	500	42.0
1519-50D	50	250	5.5	1519-450G	450	500	45.0
1519-75D	75	250	6.0	1519-500G	500	500	55.0
1519-100D	100	250	7.0	1519-600G	600	500	58.0
1519-125D	125	250	8.0	1519-750G	750	500	50.0
1519-150D	150	250	8.5	1519-1000G	1000	500	65.0

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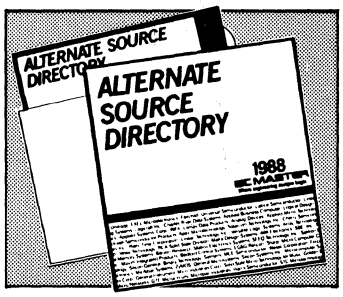

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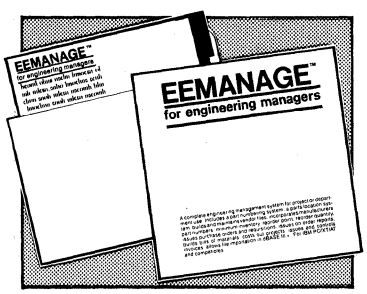

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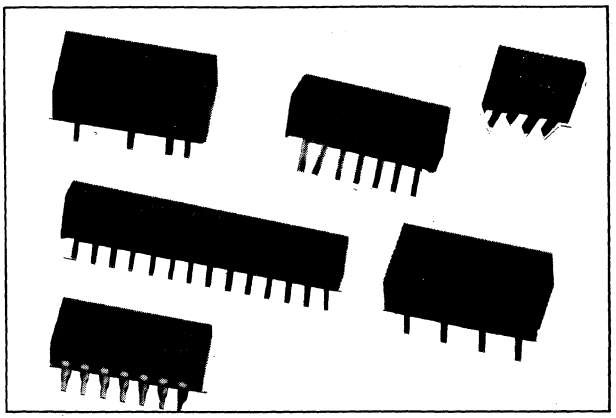
DELAY LINES

FEATURES

- Passive and active types available
- Precise delay time and impedance
- Very competitive price due to automated production



GENERAL SPECIFICATIONS

Pulse Distortion: PR1 < 0.75V; PR2 > 2.40V
(Pr = Pulse Ripple Amplitude)
Temperature Coefficient: ±100 ppm/°C max.
Insulation Resistance: 100 MΩ min. (50 VDC)
Peak Pulse Voltage: 50V
Operating Temperature: 0° to +70°C
Storage Temperature: −50° to +125°C
Termination Resistance: 1/16W ±5%

MAJOR TYPES

Series	DS			DD		DT	
Pkg	SIP			DIP		Active DIP	
Taps	1	5	10	10		3 5	10
Pins	3	7	14	14	16	5	14
Termination				$(R_1//R_2) = Z_O$		$R_I = Z_O$	
Resistance	—	—	—	$R_L = Z_O$	—		
Delay Time (nsec ±5%)	1-10	5-80	10-120	10-500		25-500	25-250
(Impedance) ohm ±10%	100-200			50-350		—	

HIGH SPEED PULSE TRANSFORMERS

FEATURES

- Excellent transmission performance
- Fast rise time
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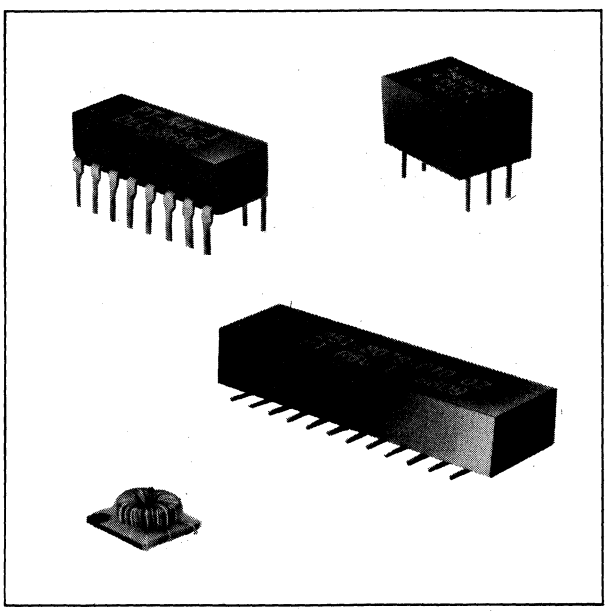
- "Multiple" types combine several transformers in a compact package for cost savings and size reduction



GENERAL SPECIFICATIONS

Operating Temperature: 0° to +70°C
Storage Temperature: −40° to +100°C
Insulation Resistance: 100 MΩ min. (100 VDC)
Withstand Voltage: 300 VDC min.
Temperature Coefficient: ±100 ppm/°C max.
Maximum Rated Current: 50 mA
Hipot Rating (minimum): 500 VDC (single types)
200 VDC (multiple types)

ALSO AVAILABLE!

- **RF PULSE TRANSFORMERS**
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ELMEC PROGRAMMABLE DELAY LINES

PDF TYPE 5-BIT SUPER ULTRA HIGH-SPEED PROGRAMMABLE DELAY LINE (Faster than Ultra High-Speed)

PDF type is a sophisticated, super ultra high-speed programmable delay line combined with ECL 100K series and super ultra high-speed logical elements. It has a built-in address timing circuit so that it can be used on a "timing on the fly" (real time delay setting) basis.

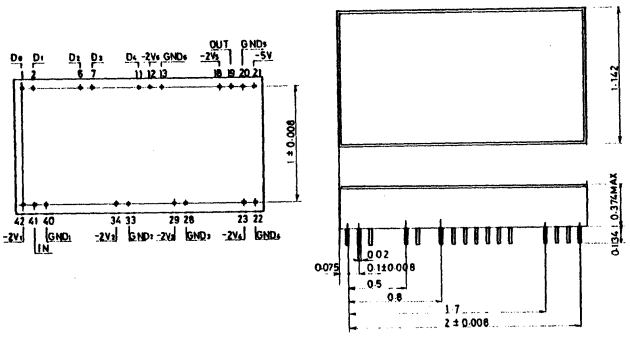
SPECIFICATION (PDF 5002)

- Guaranteed frequency for step accuracy: 166.6MHz max.
- Step accuracy: 62.5ps ±½LSB
- Number of steps: 32 steps (5 bit)
- Input pulse width: 2ns min.
- Temperature coefficient: within ±100 ppm/°C
- Supply voltage: −5V±5%, −2V±5%
- Power consumption: −5V: 200mA typical, −2V: 225mA typical
- Residual delay time: 7ns typical
- Operating temperature range: −10°C to +70°C
- Storage temperature range: −40°C to +120°C

Logic 1: ECL (H), Logic 0: ECL (L) LEVEL

Step	Address D_0	D_1	D_2	D_3	D_4	Delay Time
0	0	0	0	0	0	0ps
1	1	0	0	0	0	62.5ps
2	0	1	0	0	0	125.0ps
3	1	1	0	0	0	187.5ps
4	0	0	1	0	0	250.0ps
5	1	0	1	0	0	312.5ps
6	0	1	1	0	0	375.0ps
∫			∫			∫
29	1	0	1	1	1	1812.5ps
30	0	1	1	1	1	1875.0ps
31	1	1	1	1	1	1937.5ps

OUTER DIMENSIONS AND PIN ARRANGEMENT
Unit:inch



PDE TYPE 6-BIT ULTRA HIGH-SPEED PROGRAMMABLE DELAY LINES

PDE types are ultra high-speed, programmable delay lines wherein ELMEC's ultra high-speed delay lines (Tr < 500 ps) and ELC 100K series are combined.

A combination of ELC 100K's ultra high-speed performance, ELMEC's high-resolution delay lines and attached high-precision adjustment system provide higher precision to any variable step.

Also, radiating system is well designed so that high reliability is assured.

COMMON SPECIFICATIONS

- Guaranteed frequency for Step accuracy: 100 MHz
- Number of steps: 64 steps
- VEE voltage: −5V standard
- Residual delay time: 6ns±1ns
- Output rise time: ECL 100K compatible
- Power consumption: −2V: 90 mA typical, −5V: 170 mA typical
- Delay time temperature coefficient: ±100ppm/°C
- Operating temperature range: −10°C to +60°C
- Storage temperature range: −40°C to +120°C

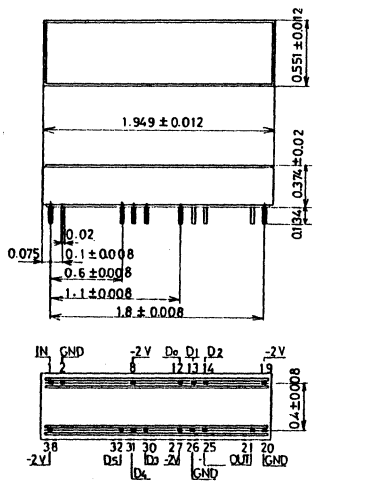
OUTER DIMENSIONS AND PIN ARRANGEMENT Unit: Inch

SPECIFICATIONS

Logic 1: ECL (H) Level, Logic 0: ECL (L) Level

Step	Address D_0	D_1	D_2	D_3	D_4	D_5	Part Number PDE6050	PDE6100	PDE6125	PDE6500
0	0	0	0	0	0	0	0(PS)	0(PS)	0(PS)	0(ns)
1	1	0	0	0	0	0	50	100	125	0.5
2	0	1	0	0	0	0	100	200	250	1.0
3	1	1	0	0	0	0	150	300	375	1.5
4	0	0	1	0	0	0	200	400	500	2.0
5	1	0	1	0	0	0	250	500	625	2.5
6	0	1	1	0	0	0	300	600	750	3.0
7	1	1	1	0	0	0	350	700	875	3.5
∫							∫	∫	∫	∫
61	1	0	1	1	1	1	3050	6100	7625	30.5
62	0	1	1	1	1	1	3100	6200	7750	31.0
63	1	1	1	1	1	1	3150±5%	6300±5%	7875±5%	31.5±5%
Step Accuracy: ±½ LSB up to 100 MHz.							50PS ±25PS	100PS ±50PS	125PS ±62.5PS	500PS ±250PS

*Higher frequency is available at wider range of accuracy. For reference: ±1 LSB at 150 MHz:



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ELMEC VARIABLE DELAY LINES

QDG TYPE VOLTAGE CONTROL VARIABLE DELAY LINE

QDG type is an ultra-high-speed variable delay line wherein varister-capped diodes and ECL 10KH series are combined and the delay time is changed by changing the DC voltage. It has extensive and universal applications and can be easily incorporated into self-control systems. Also, combined with DAC (D/A converter), it can be used as a programmable delay line.

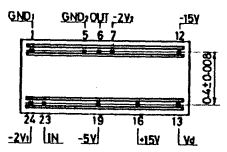
SPECIFICATION

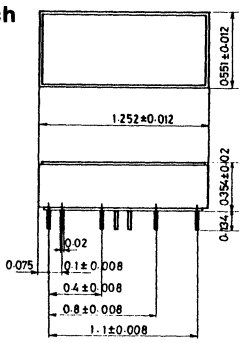
- Variable range of analog voltage: 0V (delay time max.) to −10V (delay time min.)
- Rise time, Fall time: ECL 10KH compatible
- VEE voltage: −5V standard
- Power consumption: −2V: 65mA typical; −5V: 20mA typical; +15V: 5mA typical; −15V: 10mA typical
- Delay time change by temperature rise: Less than 5ps/°C (25°C to 45°C)
- Operating temperature −10°C to +60°C
- Storage temperature −40° to +120°C

CHARACTERISTIC LISTS

Part Number	Time Delay Min.	Pulse Width Min.	Residual Time Delay	Guaranteed Frequency for Time Delay
QDG 0501	0-0.5ns	2.0ns	3.4ns	1KHz-200MHz
QDG 1001	0-1.0ns	2.0ns	3.7ns	1KHz-200MHz
QDG 2001	0-2.0ns	2.0ns	5.5ns	1KHz-120MHz
QDG 3001	0-3.0ns	3.0ns	6.5ns	1KHz-100MHz
QDG 4001	0-4.0ns	3.0ns	7.5ns	1KHz- 70MHz

OUTER DIMENSIONS AND PIN ARRANGEMENT Unit:inch





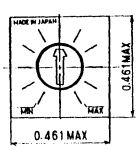
VDJ 1010 ULTRA HIGH-SPEED VARIABLE DELAY LINE

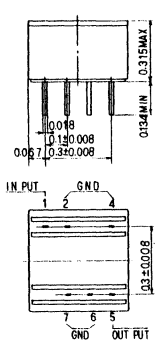
VDJ type (VDJ 1010) is an ultra-high-speed delay line which can be fully matched to ultra-high-speed logical elements such as ECL 100K series. It provides an extensive range of applications including analog signal circuits. Also, it is compact and sealed and easy to wash.

SPECIFICATION

- Dealy time range: 0 – 1ns ±10%
- Rise time (20% – 80%): 300ps max. (at the max delay time point)
- Increment resolution: 33ps
- Number of steps: 30 settings
- Residual delay time: 150ps max. (at the min. point within the variable range)
- Band width (−3dB): 1GHz min.
- Input impedance: 50 ohms ±10%
- Output impedance 100 ohms ±10%
- DC max. voltage: 2.5V max.
- Distortion Less than ±10%
- Temperature coefficient: Within ±100ppm/°C
- Switching life expectancy: Less than 100 cycles (one cycle is defined as the movement of the knob from one end to the other)
- Operating temperature range: −10°C to +80°C
- Storage temperature range: −40°C to +120°C

OUTER DIMENSION AND PIN ARRANGEMENT Unit:inch





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ELMEC PROGRAMMABLE DELAY LINES

PDH TYPE 6-BIT ULTRA HIGH-SPEED PROGRAMMABLE DELAY LINES

PDH (6-bit) types are ultra high-speed programmable delay lines wherein ELMEC's ultra high-speed delay lines and ECL 10KH series are combined.

COMMON SPECIFICATIONS

- Guaranteed frequency for Step accuracy: 80 MHz
- No of steps: 64 steps
- VEE voltage: −5V standard
- Residual delay time: 7 ns Max.
- Output rise time: ECL 10KH compatible
- Power consumption:
  -2V 90 mA typical
  -5V 120 mA typical
- Delay time temperature coefficient: ±100 ppm/°C
- Operating temperature range: −10°C to 60°C
- Storage temperature range: −40°C to 120°C

SPECIFICATIONS

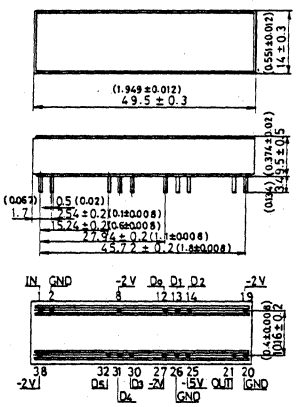
LOGIC 1: ECL (H) Level, LOGIC 0: ECL (L) Level

	Address						Part Number			
Step	D_0	D_1	D_2	D_3	D_4	D_5	PDH6050	PDH6100	PDH6125	PDH6500
0	0	0	0	0	0	0	0 (PS)	0 (PS)	0 (PS)	0 (ns)
1	1	0	0	0	0	0	50	100	125	0.5
2	0	1	0	0	0	0	100	200	250	1.0
3	1	1	0	0	0	0	150	300	375	1.5
4	0	0	1	0	0	0	200	400	500	2.0
5	1	0	1	0	0	0	250	500	625	2.5
6	0	1	1	0	0	0	300	600	750	3.0
7	1	1	1	0	0	0	350	700	875	3.5
⋮		⋮					∫	∫	∫	∫
61	1	0	1	1	1	1	3050	6100	7625	30.5
62	0	1	1	1	1	1	3100	6200	7750	31.0
63	1	1	1	1	1	1	3150 ±5%	6300 ±5%	7875 ±5%	31.5 ±5%
Step Accuracy: ±½ LSB up to 80 MHz.							50 PS ±25 PS	100 PS ±50 PS	125 PS ±62.5 PS	0.5 ns ±0.25 ns

* Higher frequency is available at wider range of accuracy. For reference: ±1 LSB at 150 MHz.

OUTER DIMENSIONS AND PIN ARRANGEMENT

Unit: mm (inch)



PDH TYPE—4-BIT ULTRA HIGH-SPEED PROGRAMMABLE DELAY LINES

PDH (4-bit) types are ultra high-speed programmable delay lines wherein ELMEC's ultra high-speed delay lines and ECL 10KH series are combined.

COMMON SPECIFICATIONS

- Guaranteed frequency for Step accuracy: 80 MHz
- No of steps: 16 steps
- VEE voltage: −5V standard
- Residual delay time: 4.5 ns Max.
- Output rise time: ECL 10KH compatible
- Power consumption:
  -2V 40 mA typical
  -5V 85 mA typical
- Delay time temperature coefficient: ±100 ppm/°C
- Operating temperature range: −10°C to 60°C
- Storage temperature range: −40°C to 120°C

SPECIFICATIONS

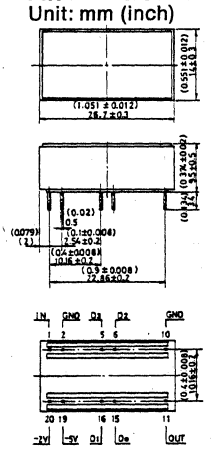
LOGIC 1: ECL (H) Level, LOGIC 0: ECL (L) Level

	Address				Part Number				
Step	D_0	D_1	D_2	D_3	PDH4050	PDH4100	PDH4125	PDH4500	PDH4102
0	0	0	0	0	0 (PS)	0 (PS)	0 (PS)	0 (ns)	0 (ns)
1	1	0	0	0	50	100	125	0.5	1
2	0	1	0	0	100	200	250	1.0	2
3	1	1	0	0	150	300	375	1.5	3
4	0	0	1	0	200	400	500	2.0	4
5	1	0	1	0	250	500	625	2.5	5
⋮		⋮			∫	∫	∫	∫	∫
13	1	0	1	1	650	1300	1625	6.5	13
14	0	1	1	1	700	1400	1750	7.0	14
15	1	1	1	1	750 ±5%	1500 ±5%	1875 ±5%	7.5 ±5%	15 ±5%
Step accuracy ±½ LSB up to 80 MHz					50 PS ±25 PS	100 PS ±50 PS	125 PS ±62.5 PS	0.5 ns ±0.25 ns	1 ns ±0.5 ns

*Higher frequency is available at wider range of accuracy. For reference: ±1 LSB at 150 MHz.

OUTER DIMENSIONS AND PIN ARRANGEMENT

Unit: mm (inch)



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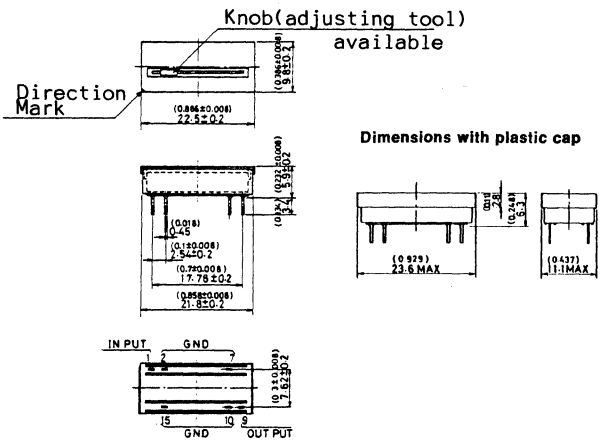
ELMEC VARIABLE DELAY LINES

VDK TYPE ULTRA HIGH SPEED VARIABLE DELAY LINES

VDK type is designed to be used with high-speed logical elemental devices such as ECL 100K series, CML or more. VDK type is suitable for analog circuits also.

- Standard 16-pin DIP equivalent package
- 40 settings in equal delay increment
- Simple, quick time delay adjustments
- Band Width (−3dB): 800 MHz Min.
- Residual Time Delay: 220 ps Max. at the minimum point within the variable range.
- Distortion of waveform: Over-shoot/pre-shoot: under ±20%
- D.C. Maximum Voltage: D.C. 2.5V Max.
- Switching Life Expectancy: Less than 100 cycles (one cycle is defined as the movement of the knob from one end to the other).
- Temperature Coefficient: within ±100 ppm/°C
- Operating Temperature: −10°C to +80°C
- Storage Temperature: −40°C to +120°C

OUTER DIMENSIONS AND PIN ARRANGEMENT
Unit: mm (inch)
Tolerance: ±0.5 (0.02)



Part Number	Time Delay ns ±20% −0%	Increment Resolution ps	Rise Time (20-80%) ps Max.	Input Impedance Ω ±10%	Output Impedance Ω ±10%	Logic Family Preferred
VDK 0510	0-0.5 ns	12.5 ps	300 ps	50Ω	100Ω	ECL 100K
VDK 2010	0- 2 ns	50 ps	300 ps	50Ω	100Ω	ECL 100K
VDK 0515	0-0.5 ns	12.5 ps	300 ps	75Ω	150Ω	CML
VDK 2015	0- 2 ns	50 ps	300 ps	75Ω	150Ω	CML

VDS TYPE VERY HIGH-SPEED VARIABLE DELAY LINES

VDS Type is designed to be used with high-speed logical elemental devices such as ECL 10KH, 10K series, TTL Fast Series or more. VDS type is suitable for analog circuits also.

- Standard 16-pin DIP equivalent package
  *Outer Dimension and PIN arrangement is same as VDK type.
- 40 delay increment settings with 20 delay line sections
- Simple, quick time delay adjustments.
- Rise Time: (2)* 20%-80%, (3)* 10%-90%
- Residual Time Delay: 450 ps Max. at the minimum point within the variable range.
- Distortion of waveform: Over-shoot/pre-shoot: under ±20%
- Switching Life Expectancy: Less than 100 cycles (one cycle is defined as the movement of the knob from one end to the other).
- Temperature Coefficient: Within ± ppm/°C, VDS2110, and VDS2120 is −400 ±200 ppm/°C
- Operating Temperature: −10°C to +80°C
- Storage Temperature: −40°C to +120°C

Part Number	Time Delay ns ±20% −0%	*(1) Increment Resolution PS		Rise Time ns Max.		Input Impedance Ω ±10%	Output Impedance Ω ±10%	D.C. Max. Voltage V Max.	Logic Family Preferred
		1.75%	3.25%						
VDS 5010	0- 5 ns	88 ps	163 ps	(2)*	0.8 ns	50Ω	100Ω	2.5V	ECL 10KH
VDS 1110	0-10 ns	175 ps	325 ps	(2)*	1.3 ns	50Ω	100Ω	2.5V	ECL 10KH
VDS 2110	0-20 ns	350 ps	650 ps	(2)*	2.3 ns	50Ω	100Ω	2.5V	ECL 10K
VDS 5020	0- 5 ns	88 ps	163 ps	(3)*	2.0 ns	100Ω	200Ω	4.5V	TTL FAST
VDS 1120	0-10 ns	175 ps	325 ps	(3)*	2.5 ns	100Ω	200Ω	4.5V	TTL FAST
VDS 2120	0-20 ns	350 ps	650 ps	(3)*	3.5 ns	100Ω	200Ω	4.5V	TTL FAST

*(1) VDS has alternate increments of 1.75% and 3.25%.

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ELMEC FIXED DELAY LINES

FDA TYPE SINGLE IN-LINE ULTRA HIGH-SPEED, FIXED DELAY LINES

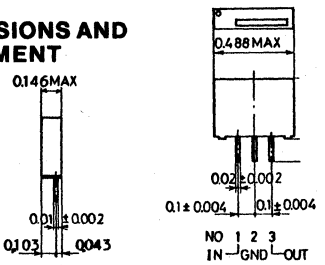
The FDA types are ultra high-speed/compact-designed, fixed delay lines with ELMEC's uniquely high performance/high density delay line elements housed in a Single In-Line package.

The FDA Series are compatible with ECL 100K, 10KH and 10K series high-speed logic circuits. Also, FDA products can be used in a wider range including analog signal circuits.

COMMON SPECIFICATIONS

- Distortion of waveform: Over-shoot/pre-shoot: under ±20%
- Applied voltage: DC5.5V Max.
- Operating temperature range: −10°C to +80°C
- Storage temperature range: −40°C to +120°C

OUTER DIMENSIONS AND PIN ARRANGEMENT



Part Number	Impedance	Time Delay	Output Rise Time (20%-80%)	−3dB Passband	Delay time Temperature Coefficient
FDA 0505	50Ω±10%	0.5ns ± 0.10ns	300 ps or less	800 MHz or more	±100ppm/°C
FDA 1005		1.0ns ± 0.10ns	300 ps or less	800 MHz or more	
FDA 1505		1.5ns ± 0.15ns	400 ps or less	550 MHz or more	
FDA 2005		2.0ns ± 0.20ns	500 ps or less	450 MHz or more	
FDA 2505		2.5ns ± 0.20ns	600 ps or less	400 MHz or more	
FDA 3005		3.0ns ± 0.20ns	600 ps or less	400 MHz or more	
FDA 3505		3.5ns ± 0.25ns	700 ps or less	350 MHz or more	−400 ± 200ppm/°C
FDA 4005		4.0ns ± 0.30ns	900 ps or less	250 MHz or more	
FDA 4505		4.5ns ± 0.30ns	900 ps or less	250 MHz or more	
FDA 5005		5.0ns ± 0.30ns	900 ps or less	250 MHz or more	

Part Number	Impedance	Time Delay	Output Rise Time (20%-80%)	−3dB Passband	Delay Time Temperature Coefficient
FDA 0510	100Ω±10%	0.5ns ± 0.10ns	300 ps or less	800 MHz or more	±100ppm/°C
FDA 1010		1.0ns ± 0.10ns	300 ps or less	800 MHz or more	
FDA 1510		1.5ns ± 0.15ns	400 ps or less	550 MHz or more	
FDA 2010		2.0ns ± 0.20ns	500 ps or less	450 MHz or more	
FDA 2510		2.5ns ± 0.20ns	600 ps or less	400 MHz or more	
FDA 3010		3.0ns ± 0.20ns	600 ps or less	400 MHz or more	
FDA 3510		3.5ns ± 0.25ns	700 ps or less	350 MHz or more	
FDA 4010		4.0ns ± 0.30ns	900 ps or less	250 MHz or more	
FDA 4510		4.5ns ± 0.30ns	900 ps or less	250 MHz or more	
FDA 5010		5.0ns ± 0.30ns	900 ps or less	250 MHz or more	

FDB TYPE SINGLE IN-LINE ULTRA HIGH-SPEED, FIXED DELAY LINES

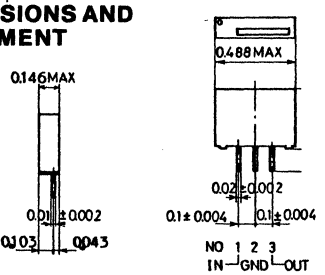
The FDB types are ultra-high speed and compact FIXED DELAY LINE with our unique delay line elements of high performance and high density housed in a single-in-line package in response to the need for "longer delay time and smaller size"

This delay line can be used with high-speed logic circuit ECL 100K, 10KH and 10K series and also can be used in a wide range of applications including analog signal circuits.

COMMON SPECIFICATIONS

- Distortion of wave form: Over-shoot/pre-shoot under ±20%
- Applied voltage: DC5.5V Max.
- Operating templerature range: −10°C to +80°C
- Storage temperature range: −40°C to +120°C

OUTER DIMENSIONS AND PIN ARRANGEMENT



Part Number	Impedance	Time Delay	Output Rise Time (20%-80%)	−3dB Passband	Delay time Temperature Coefficient
FDB 5505	50Ω ± 10%	5.5ns ± 0.3ns	800 ps or less	280 MHz or more	−400±200ppm/°C
FDB 6005		6.0ns ± 0.3ns	900 ps or less	250 MHz or more	
FDB 6505		6.5ns ± 0.4ns	900 ps or less	250 MHz or more	
FDB 7005		7.0ns ± 0.4ns	1000 ps or less	220 MHz or more	
FDB 7505		7.5ns ± 0.4ns	1000 ps or less	220 MHz or more	
FDB 8005		8.0ns ± 0.5ns	1100 ps or less	200 MHz or more	
FDB 8505		8.5ns ± 0.5ns	1200 ps or less	180 MHz or more	
FDB 9005		9.0ns ± 0.5ns	1300 ps or less	170 MHz or more	
FDB 9505		9.5ns ± 0.5ns	1300 ps or less	170 MHz or more	
FDB 1105		10.0ns ± 0.5ns	1400 ps or less	150 MHz or more	

Part Number	Impedance	Time Delay	Output Rise Time (20%-80%)	−3dB Passband	Delay Time Temperature Coefficient
FDB 5510	100Ω±10%	5.5ns ± 0.3ns	800 ps or less	280 MHz or more	−400±200ppm/°C
FDB 6010		6.0ns ± 0.3ns	900 ps or less	250 MHz or more	
FDB 6510		6.5ns ± 0.4ns	900 ps or less	250 MHz or more	
FDB 7010		7.0ns ± 0.4ns	1000 ps or less	220 MHz or more	
FDB 7510		7.5ns ± 0.4ns	1000 ps or less	220 MHz or more	
FDB 8010		8.0ns ± 0.4ns	1100 ps or less	200 MHz or more	
FDB 8510		8.5ns ± 0.5ns	1200 ps or less	180 MHz or more	
FDB 9010		9.0ns ± 0.5ns	1300 ps or less	170 MHz or more	
FDB 9510		9.5ns ± 0.5ns	1300 ps or less	170 MHz or more	
FDB 1110		10.0ns ± 0.5ns	1400 ps or less	150 MHz or more	

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ELMEC FIXED DELAY LINES

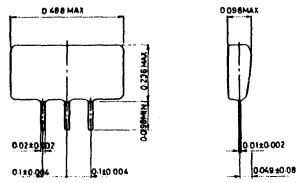
FDC TYPE SINGLE-IN-LINE ULTRA HIGH-SPEED FIXED DELAY LINES

FDC type can be fully matched to high-speed logical elements such as ECL 100K, 10KH and 10K series and has an extensive range of applications including analog signal circuit. Also, it is coated with expoxy resin, compact and easy to wash.

COMMON SPECIFICATION

- Distortion of waveform: Over-shoot/pre-shoot: under ±20%
- D.C. Maximum Voltage: D.C. 5.5V Max
- Operating Temperature: −10°C to +80°C
- Storage Temperature: −40°C to + 120°C

OUTER DIMENSION AND PIN ARRANGEMENT Unit:inch



SPECIFICATION

Part Number	Impedance	Time Delay	Output Rise Time (20%-80%)	−3dB Passband	Delay time Temperature Coefficient
FDC 0505	50Ω±10%	0.5ns ± 0.10ns	300 ps or less	800 MHz or more	±100ppm/°C
FDC 1005		1.0ns ± 0.10ns	300 ps or less	800 MHz or more	
FDC 1505		1.5ns ± 0.15ns	400 ps or less	550 MHz or more	
FDC 2005		2.0ns ± 0.20ns	400 ps or less	550 MHz or more	
FDC 2505		2.5ns ± 0.20ns	500 ps or less	450 MHz or more	
FDC 3005		3.0ns ± 0.20ns	500 ps or less	450 MHz or more	
FDC 3505		3.5ns ± 0.25ns	600 ps or less	400 MHz or more	
FDC 4005		4.0ns ± 0.30ns	700 ps or less	350 MHz or more	
FDC 4505		4.5ns ± 0.30ns	700 ps or less	350 MHz or more	
FDC 5005		5.0ns ± 0.30ns	700 ps or less	350 MHz or more	

Part Number	Impedance	Time Delay	Output Rise Time (20%-80%)	−3dB Passband	Delay Time Temperature Coefficient
FDC 0510	100Ω±10%	0.5ns ± 0.10ns	300 ps or less	800 MHz or more	±100ppm/°C
FDC 1010		1.0ns ± 0.10ns	300 ps or less	800 MHz or more	
FDC 1510		1.5ns ± 0.15ns	400 ps or less	550 MHz or more	
FDC 2010		2.0ns ± 0.20ns	400 ps or less	550 MHz or more	
FDC 2510		2.5ns ± 0.20ns	500 ps or less	450 MHz or more	
FDC 3010		3.0ns ± 0.20ns	500 ps or less	450 MHz or more	
FDC 3510		3.5ns ± 0.25ns	600 ps or less	400 MHz or more	
FDC 4010		4.0ns ± 0.30ns	700 ps or less	350 MHz or more	
FDC 4510		4.5ns ± 0.30ns	700 ps or less	350 MHz or more	
FDC 5010		5.0ns ± 0.30ns	700 ps or less	350 MHz or more	

FDY TYPE ULTRA HIGH-SPEED FIXED DELAY LINES

FDY type is designed to be used with high-speed logical elemental devices such as ECL 100K series or more. FDY type is suitable for analog circuits also.

- Standard 16-pin DIP equivalent package
- Impedance: 50Ω ± 10%
- Distortion of waveform: Over-shoot/pre-shoot: under ±20%
- D.C. Maximum Voltage: D.C. 5.5V Max.
- Temperature Coefficient: within ±100 ppm/°C
- Operating Temperature: −10°C to +80°C
- Storage Temperature: −40°C to +120°C

Part Number	Time Delay ns	Rise Time ps. Max. (20-80%)	Band Width -3dB MHz Min.
FDY 0005 (1)*	0.13 ns ± 30 PS	200 PS	1000
FDY 1005	1ns ± 50 PS	350 PS	600
FDY 2005	2ns ± 100 PS	350 PS	600
FDY 3005	3ns ± 150 PS	400 PS	550
FDY 4005	4ns ± 200 PS	450 PS	500
FDY 5005	5ns ± 200 PS	500 PS	450
FDY 6005	6ns ± 200 PS	500 PS	450

(1)* FDY 0005 is only used in case of the combined application with VDK 2010

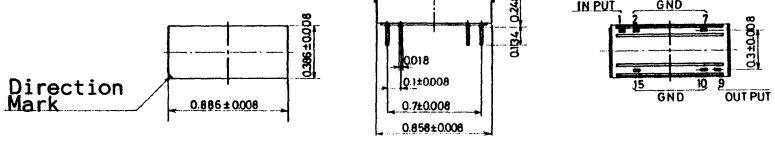
FDS TYPE VERY HIGH-SPEED FIXED DELAY LINES

FDS type is designed to be used with high speed logical elemental devices such as ECL 10KH, 10K and TTL Fast series or more. It is suitable for analog circuits also.

- Standard 16-pin DIP equivalent package
- Rise Time: (1)* 10%-90%, (2)* 20%-80%
- Distortion of waveform: Over-shoot/pre-shoot: under ±20%
- D.C. Maximum Voltage: D.C. 5.5V Max.
- Operating Temperature: −10°C to +80°C
- Storage Temperature: −40°C to +120°C

Part Number	Time Delay ns	Rise Time ns Max.		Impedance Ω	Temperature Coefficient ppm/°C
FDS 13010	13 ± 5%	(1)*	2ns	100 ± 10%	±100 MAX
FDS 2110	20 ± 5%	(1)*	3ns	100 ± 10%	− 400 ± 200
FDS 15005	15 + 1ns −0	(2)*	1.5ns	50 + 15% −10%	−400 ± 200
FDS 18005	18 ± 1.5%	(2)*	1.7ns	50 + 15% −10%	−400 ± 200

FDY, FDS TYPE OUTER DIMENSIONS AND PIN ARRANGEMENT Unit: (inch)



ELMEC TECHNOLOGY OF AMERICA, INC. 1225 Ridgecrest St., Monterey Park, CA 91754 Phone: (213) 265-1861 Telefax: (213) 265-1908

•SINCE 1953•

ESC DELAY LINES

THE FOLLOWING PAGES REPRESENT A MINIMUM VARIETY OF ESC'S CURRENTLY AVAILABLE DELAY LINES

Most ESC DELAY LINES are available for MIL applications!

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NOTE • NEW! FAX NO. 201-947-0406

(D) Denotes availability in Auto-Insertable DIP package
(C) Denotes availability for high temperature, MIL applications

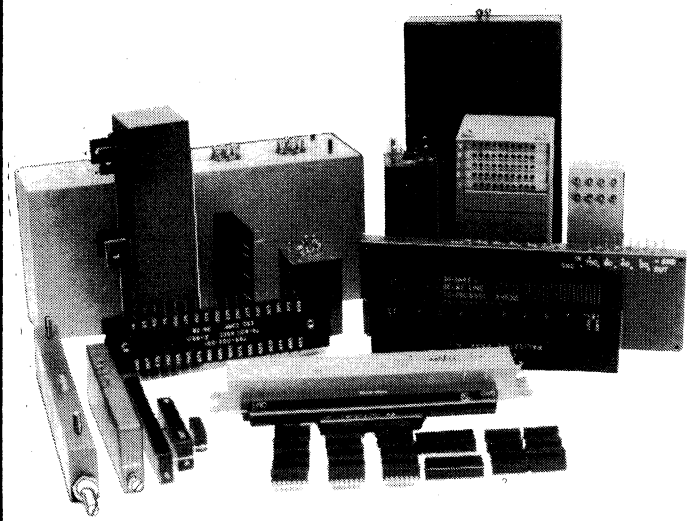
ESC ELECTRONICS CORP.

ESC ELECTRONICS CORP.
534 BERGEN BOULEVARD ● PALISADES PARK, N.J. 07650
PHONE: (201) 947-0400 ● TWX 710-991-9780
TOLL FREE 800-631-0853 (EXCEPT N.J.)

DELAY LINES

• SINCE 1953 •

30 years of experience and expertise in delay line design and manufacture. The following pages list a large sampling of the industry's current demand for short delay lines both analog and digital types, but ESC is still the most chosen source for delay lines ranging up to several hundred milliseconds and with delay-to-rise time ratios up to 250:1. In addition to lumped constant types, also manufactured are distributed constant, voltage variables and mechanically variable devices.



ESC ALSO DESIGNS AND MANUFACTURES TYPICALLY:

Equalized, Precision tapped, low distortion, beam forming delay lines for sonars, scanners, transponders, sorters, Tacan and DME, etc.

Programmable and mechanically variable Delay lines for the TV Broadcast industry, including video cable simulators and voltage variable Delay Lines.

Proven design, manufacturing capabilities, and facilities encompassing all quality levels dictated by MIL-I-45208 and MIL-Q-9858A.

The proven design and manufacturing techniques are employed by ESC for all levels of reliability required for the military, satellite or space probes and encompass quality levels dictated by MIL-I-45208 & MIL-Q-9858A as applicable.

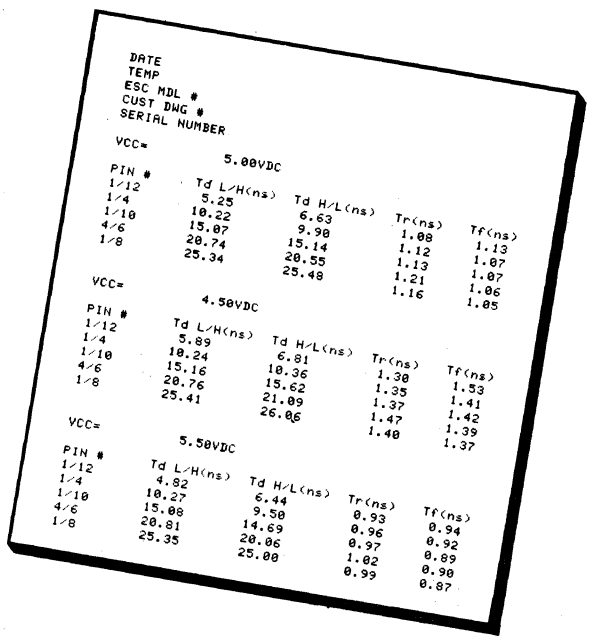
ESC has participated in many hi-rel programs over the years starting with Apollo, Minuteman and the Viking Probe and currently in such programs as Trident, F15, F16, B-1, Space Shuttle and Peacekeeper.

ESC maintains an extensive continuous program of life testing on the new generation of military TTL compatible hybrid delay lines. This program has accumulated data indicating exceptionally high reliability for both commercial and military applications.

ESC has expanded its testing capabilities for the new generation of TTL, DTL, ECL, FAST, and CMOS Compatible hybrid delay lines. Testing is accomplished by computer controlled, state-of-the-art equipment, which is capable of recording leading and trailing edge delay time, rise and fall time, all within seconds. In addition, and at comparable speeds, the hybrid delay line DC parameters such as Icc, Vi, Vol, Voh, Ii, Iil and Iin are swiftly measured and recorded if necessary.

The highly accurate and high speed testing system allows all parameters to be tested on a 100% basis guaranteeing the highest quality product to our customers.

At the side is a sample computer read-out exhibiting the leading and trailing edge delay and rise and fall times of three operating levels for a TTL hybrid delay line.



DATE
TEMP
ESC MDL #
CUST DWG #
SERIAL NUMBER

VCC= 5.00VDC

PIN #	Td L/H(ns)	Td H/L(ns)	Tr(ns)	Tf(ns)
1/12	5.25	6.63	1.08	1.13
1/4	10.22	9.90	1.12	1.07
1/10	15.07	15.14	1.13	1.07
4/6	20.74	20.55	1.21	1.06
1/8	25.34	25.48	1.16	1.05

VCC= 4.50VDC

PIN #	Td L/H(ns)	Td H/L(ns)	Tr(ns)	Tf(ns)
1/12	5.89	6.81	1.38	1.53
1/4	10.24	10.36	1.35	1.41
1/10	15.16	15.62	1.37	1.42
4/6	20.76	21.09	1.47	1.39
1/8	25.41	26.06	1.40	1.37

VCC= 5.50VDC

PIN #	Td L/H(ns)	Td H/L(ns)	Tr(ns)	Tf(ns)
1/12	4.82	6.44	0.93	0.94
1/4	10.27	9.50	0.96	0.92
1/10	15.08	14.69	0.97	0.89
4/6	20.81	20.06	1.02	0.90
1/8	25.35	25.00	0.99	0.87

WRITE OR CALL TOLL FREE 1-800-631-0853 (EXCEPT N.J.) FOR CATALOG!

DELAY LINES

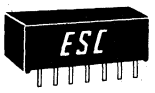
DELAY LINES

Intermediate delay values available upon request.

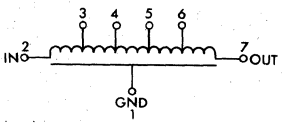
SERIES SIL-7
SINGLE-IN-LINE
5 TAPS

Also available in 8 Pin Series SIL-8

SPECIFICATIONS:
- Output Time Delay Tolerance: ± 5% for 20ns and above, ± 10% or .25ns whichever is greater, for 10ns and less
- Distortion: ± 10% at output
- Attenuation: 0.5db max
- Temperature Coefficient: 100 ppm/°C
- Operating Temperature Range: -55°C to + 125°C
- Dielectric Strength: 50 VDC
- Conforms to applicable portions of MIL-D-23859
- Size: SIL-7: .80L X .20W X .25H; SIL-14: 1.50L X .20W X .25H

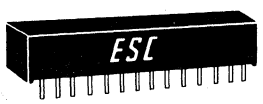


7 PIN

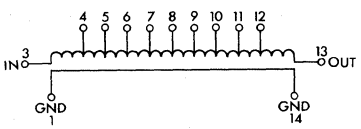


TD (ns)	Rise Time max (ns)	No. of Taps	TD/Tap (ns)	Atten. max %	MODEL NO. 50 Ω ± 10%	MODEL NO. 100 Ω ± 10%
1	1.5	none	—	2.0	SLA-1	SLB-1
2	1.5	none	—	2.0	SLA-2	SLB-2
3	1.5	none	—	2.0	SLA-3	SLB-3
4	2.0	none	—	2.0	SLA-4	SLB-4
5	2.0	5	1.0 ± 0.3	2.0	SLA-5	SLB-5
10	3.0	5	2.0 ± 0.4	2.0	SLA-10	SLB-10
20	6.0	5	4.0 ± 0.5	2.0	SLA-20	SLB-20
30	9.0	5	6.0 ± 1.0	2.0	SLA-30	SLB-30
40	12.0	5	8.0 ± 1.0	2.0	SLA-40	SLB-40
50	15.0	5	10.0 ± 1.0	2.5	SLA-50	SLB-50
60	18.0	5	12.0 ± 1.5	3.0	—	SLB-60
70	22.0	5	14.0 ± 1.5	4.0	—	SLB-70
80	25.0	5	16.0 ± 1.5	4.5	—	SLB-80
90	28.0	5	18.0 ± 2.0	4.5	—	SLB-90
100	30.0	5	20.0 ± 2.0	5.0	—	SLB-100

SERIES SIL-14
SINGLE-IN-LINE
10 TAPS

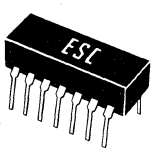


14 PIN



TD (ns)	Rise Time max (ns)	TD/Tap (ns)	Atten. max %	MODEL NO. 50 Ω ±10%	MODEL NO. 100 Ω ±10%
10	2.0	1.0 ± 0.5	2.5	SLA14-10	—
20	4.0	2.0 ± 0.5	2.5	SLA14-20	SLB14-20
25	5.0	2.5 ± 1.0	2.5	SLA14-25	SLB14-25
30	6.0	3.0 ± 1.0	2.5	SLA14-30	SLB14-30
40	8.0	4.0 ± 1.0	2.5	SLA14-40	SLB14-40
50	10.0	5.0 ± 1.0	3.0	SLA14-50	SLB14-50
60	12.0	6.0 ± 1.0	3.5	SLA14-60	SLB14-60
70	14.0	7.0 ± 1.0	3.5	SLA14-70	SLB14-70
75	15.0	7.5 ± 1.0	4.0	SLA14-75	SLB14-75
80	16.0	8.0 ± 1.0	4.5	SLA14-80	SLB14-80
90	18.0	9.0 ± 1.0	4.5	SLA14-90	SLB14-90
100	20.0	10.0 ± 1.0	4.5	SLA14-100	SLB14-100
150	30.0	15.0 ± 2.0	8.0	—	SLB14-150
200	40.0	20.0 ± 2.0	10.0	—	SLB14-200

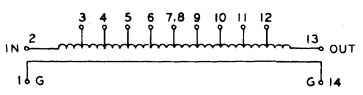
SERIES DIP-14
10 TAPS
AND
SERIES DIP-G14
SURFACE MOUNTING
G LEADS



14 PIN DIP

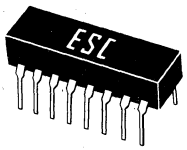
SPECIFICATIONS:
- Operating Temperature: -55°C to +125°C
- Temperature Coefficient: 100ppm/°C max
- Attenuation: 1db max
- Distortion (at max delay): ± 10% max
- Dielectric Strength: 50VDC
- Conforms to applicable portions of MIL-D-23859
- Size: DIP14: .785L X .285W X .250H; DIP16: .890L X .285W X .280H

IMPEDANCE ± 10% →				50	75	100	200
Time Delay (nsec) ± 5%	Rise Time (nsec)	No. of Taps	Delay per Tap (nsec) non-cumulative	MODEL NO.			
10 ± 5%	2.0	10	1.0 ± .5	5P10	7P10	1P10	–
20	4.0	10	2.0 ± .5	5P20	7P20	1P20	2P20
30	6.0	10	3.0 ± 1	5P30	7P30	1P30	2P30
40	7.0	10	4.0 ± 1	5P40	7P40	1P40	2P40
50	8.0	10	5.0 ± 1	5P50	7P50	1P50	2P50
100	16.0	10	10.0 ± 1.5	5P100	7P100	1P100	2P100
150	25.0	10	15.0 ± 1.5	5P150	7P150	1P150	2P150
200	35.0	10	20.0 ± 2	5P200	7P200	1P200	2P200
250	42.0	10	25.0 ± 2.5	5P250	7P250	1P250	2P250
300	50.0	10	30.0 ± 3.0	5P300	7P300	1P300	2P300



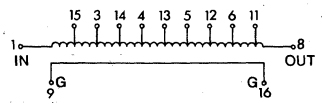
Also Available in Surface Mount G Lead Package

SERIES DIP-16
EXTENDED DELAY
10 TAPS
AND
SERIES DIP-G16
SURFACE MOUNTING
G LEADS

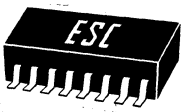


16 PIN DIP

Impedance ± 10% (ohms) →				100	200	300	500
Time Delay (ns) ± 5%	Rise Time (ns)	No. of Taps	Delay per Tap (ns) ± 2ns or 5% (whichever is greater)	MODEL NO.			
250	45	10	25	1N25	2N25	3N25	5N25
300	55	10	30	1N30	2N30	3N30	5N30
350	65	10	35	1N35	2N35	3N35	5N35
400	70	10	40	1N40	2N40	3N40	5N40
450	80	10	45	1N45	2N45	3N45	5N45
500	90	10	50	1N50	2N50	3N50	5N50
600	110	10	60	1N60	2N60	3N60	5N60
800	145	10	80	1N80	2N80	3N80	5N80
1000	180	10	100	1N100	2N100	3N100	5N100



Also available in Surface Mount G Lead Package



ESC ELECTRONICS CORP.

ESC ELECTRONICS CORP.

SERIES DIP-24
TO 2000 NSEC
20 TAPS
AND
SERIES DIP-G24
SURFACE MOUNTING
G LEADS

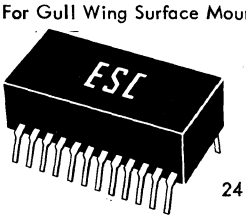
Intermediate delay values available upon request.

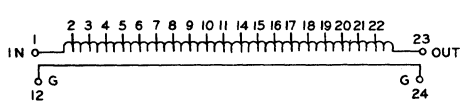
SPECIFICATIONS:

- Operating Temperature: -55°C to + 125°C
- Temperature Coefficient: 100ppm/°C
- Attenuation: 1 db max
- Distortion: 10% max
- Dielectric Strength: 50 VDC
- Conforms to applicable portions of MIL-D-23859
- Size: 1.3 lg X .580 w X .300 h.

IMPEDANCE ± 10% (OHMS) →			100	200	500
Time Delay ± 5%	Rise Time (nsec) Max	Delay per Tap ± 5% or 1nsec WIG	MODEL NO.		
200	17	10.0	124-2	224-2	524-2
250	21	12.5	124-2.5	224-2.5	524-2.5
400	34	20.0	124-4	224-4	524-4
500	42	25.0	124-5	224-5	524-5
600	50	30.0	124-6	224-6	524-6
750	63	37.5	124-7.5	224-7.5	524-7.5
800	67	40.0	124-8	224-8	524-8
1000	84	50.0	124-10	224-10	524-10
1200	110	60.0	124-12	224-12	524-12
1500	125	75.0	124-15	224-15	524-15
2000	170	100.0	-	224-20	524-20

For Gull Wing Surface Mount Package add letter G following 1st 3 digits. Example: 124-5 converts to 124G-5.





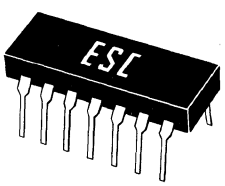
24 PIN DIP

Also available in Surface Mount G Lead Package

SERIES MIL-23
LOW PROFILE
TO
MIL-D-23859/23

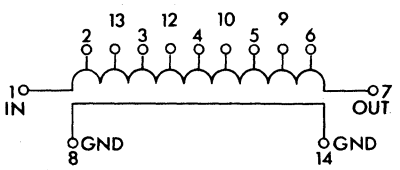
SPECIFICATIONS:

- Total Time Delay Tolerance: ± 2 ns Below 40 ns Delay; ± 5% Above 40 ns Delay
- No. of Taps: 10 Equally Spaced
- Temperature Coefficient: 100 ppm/°C max.
- Operating Temp. Range: -55°C to + 125°C
- Distortion at max delay: ± 10% max.
- Attenuation: 10% max.
- Dielectric Strength: 50 VDC
- Environmental Conditions: per MIL-D-23859/23
- Size: 14 Pin, .750L X .300W X .187H



14 PIN DIP

Note: For longer time delays refer to Series DIP16

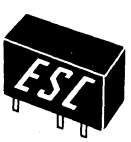


Total Td ns	Rise Time max(ns)	IMPEDANCE ± 10% 50Ω	100Ω	200Ω
10	3	A002	B102	-
15	4	A003	B103	-
20	5.5	A004	B104	-
25	6	A005	B105	-
30	6.5	A006	B106	-
35	7	A007	B107	-
40	8	A008	B108	C208
45	9	A009	B109	C209
50	10	A010	B110	C210
60	12	A012	B112	C212
80	16	A016	B116	C216
100	20	A020	B120	C220
120	24	A022	B122	C222
140	28	A024	B124	C224
150	30	A025	B125	C225
160	32	A026	B126	-
180	36	A028	B128	-
200	40	A030	B130	-
220	45	-	B132	-
240	50	-	B134	-
250	50	-	B135	-
260	55	-	B136	-
280	60	-	B138	-
300	60	-	B140	-
330	70	-	B143	-

SERIES SAT
AND
SERIES SBT
MINIATURE
SINGLES

Miniature trimming delay lines in increments of 0.5 ns for your fine "tweeking."

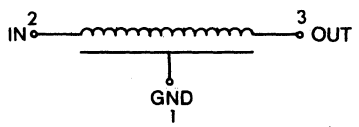
Td (ns)	Impedance ± 10% 50 Ω	100 Ω
1.0	SAT-10	SBT-10
1.5	SAT-15	SBT-15
2.0	SAT-20	SBT-20
2.5	SAT-25	SBT-25
3.0	SAT-30	SBT-30
3.5	SAT-35	SBT-35
4.0	SAT-40	SBT-40
4.5	SAT-45	SBT-45
5.0	SAT-50	SBT-50



3 PIN SIL

SPECIFICATIONS:

- Delay Tolerance: ± .25 ns
- Operating Temperature: -55°C to + 125°C
- Attenuation: 0.25 db max
- Dielectric Strength: 50VDC
- Temp. Coefficient: 100 ppm/°C
- Conforms to applicable portions of MIL-D-23859
- Band Width: 200 Mhz (-3db)
- Size: .56 L X .25 W X .20 H

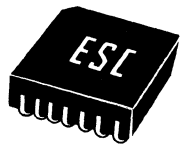


DELAY LINES

SERIES JSA AND SERIES JSB

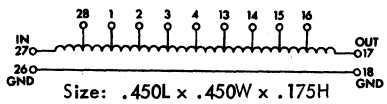
LOW PROFILE
10 TAPS
SURFACE MOUNTING
J LEADS

SURFACE MOUNTING

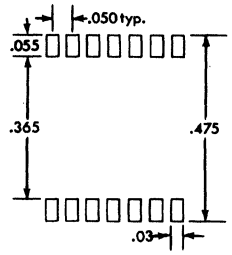


Intermediate delay values available upon request.

Time Delay (ns) ± 2ns or 5%	Rise Time (ns)	Attenuation (db) max	Delay per Tap (ns)	Impedance ± 10%	
				100 Ω Model No.	200 Ω Model No.
25	5	3%	2.5 ± 0.5	JSA25	JSB25
30	6	3%	3.0 ± 0.5	JSA30	JSB30
35	7	3%	3.5 ± 0.5	JSA35	JSB35
40	8	3%	4.0 ± 0.5	JSA40	JSB40
45	9	3%	4.5 ± 0.5	JSA45	JSB45
50	10	3%	5.0 ± 1.0	JSA50	JSB50
60	12	5%	6.0 ± 1.0	JSA60	JSB60
75	15	5%	7.5 ± 1.0	JSA75	JSB75
100	20	5%	10.0 ± 2.0	JSA100	JSB100
125	25	8%	12.5 ± 2.0	JSA125	JSB125
150	30	8%	15.0 ± 2.0	JSA150	JSB150
175	35	10%	17.5 ± 2.0	JSA175	JSB175
200	40	12%	20.0 ± 2.0	JSA200	JSB200
250	50	12%	25.0 ± 2.0	JSA250	JSB250



Size: .450L x .450W x .175H



Suggested PC Board Solder Pads

SPECIFICATIONS:

- Operating temperature range: -55°C to + 125°C
- Temperature Coefficient: 100 ppm/°C max
- Terminals: Electro tin plated, Alloy 42 .020 w x .010 th.
- Distortion (at max delay): ± 10% max
- Dielectric Strength: 50 VDC
- Conforms to applicable portions of MIL-D-23859

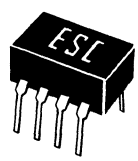
SERIES 8A AND SERIES 8B

DIP
DELAY LINES
8 PIN
PACKAGE
5 TAPS

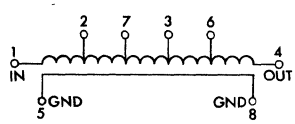
MACHINE INSERTABLE

Delay (ns)	Delay per Tap (ns)	Rise Time (ns) max	Impedance	
			50Ω	100Ω
5	1	2	8A05	8B05
10	2	3	8A10	8B10
15	3	5	8A15	8B15
20	4	7	8A20	8B20
25	5	8	8A25	8B25
30	6	10	8A30	8B30
35	7	12	8A35	8B35
40	8	13	8A40	8B40
50	10	17	8A50	8B50

Total Time Delay Tolerance: ±1ns or ±5%, whichever is greater.



8 PIN



Size: .50L x .285W x .250H

SPECIFICATIONS:

- Delay Tolerance: ±1ns or ±5% whichever is greater
- Distortion (at max delay): ± 10% max
- Attenuation: 0.5db max
- Dielectric Strength: 50VDC
- Temperature Coefficient: 100ppm/°C max
- Operating Temperature Range: -55°C to +125°C
- Terminals: Electro tin plated alloy 42
- Conforms to applicable portions of MIL-D-23859

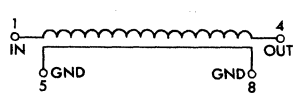
SERIES 8GSA AND SERIES 8GSB

LOW PROFILE
8 PIN
PACKAGE
SURFACE MOUNTING
G LEADS

SURFACE MOUNTING

Delay (ns) ± .25ns	Impedance	
	50Ω	100Ω
1.0	8GSA-10	8GSB-10
1.5	8GSA-15	8GSB-15
2.0	8GSA-20	8GSB-20
2.5	8GSA-25	8GSB-25
3.0	8GSA-30	8GSB-30
3.5	8GSA-35	8GSB-35
4.0	8GSA-40	8GSB-40
4.5	8GSA-45	8GSB-45
5.0	8GSA-50	8GSB-50

4 PIN



Size: .50L x .285W x .200H

SPECIFICATIONS:

- Band Width: 200Mhz (-3db)
- Delay Tolerance: ±.25ns
- Attenuation: 0.25db max
- Dielectric Strength: 50VDC
- Operating Temperature: -55°C to +125°C
- Temp. Coefficient: 100ppm/°C
- Conforms to applicable portions of MIL-D-23859
- Terminals: Electro tin plated #24AWG

ESC ELECTRONICS CORP.

ESC ELECTRONICS CORP.

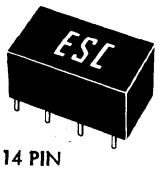
DIGITAL DELAY LINES

Intermediate delay values available upon request.

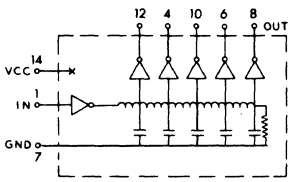
SERIES 14T
DIGITAL TTL 5 TAPS

TTL, DTL

Model No.	Delay (ns)	Delay/ Tap (ns)
14T25	25	5
14T30	30	6
14T35	35	7
14T40	40	8
14T45	45	9
14T50	50	10
14T75	75	15
14T100	100	20
14T150	150	30
14T200	200	40
14T250	250	50
14T300	300	60
14T500	500	100
14T750	750	150
14T1000	1000	200



14 PIN



SERIES 14LT
LOW POWER SCHOTTKY 5 TAPS

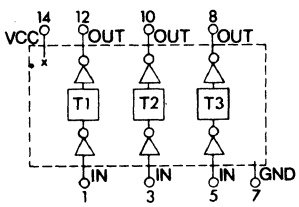
LOW POWER SCHOTTKY

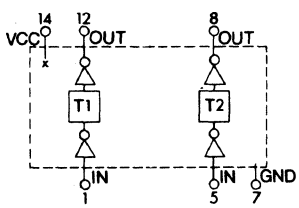
Model No.	Delay (ns)	Delay Tap (ns)
14LT50	50	10
14LT75	75	15
14LT100	100	20
14LT150	150	30
14LT200	200	40
14LT250	250	50
14LT300	300	60
14LT500	500	100

SERIES 14P AND SERIES 14D
DIGITAL TTL TRIPLETS AND DUAL

Model No.		*Delay (ns)
14P Series	14D Series	
14P5	14D5	5
14P10	14D10	10
14P15	14D15	15
14P20	14D20	20
14P25	14D25	25
14P50	14D50	50
14P75	14D75	75
14P100	14D100	100

*Per Line





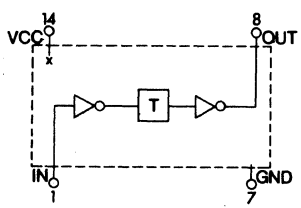
SERIES 14LP AND SERIES 14LD
LOW POWER SCHOTTKY TRIPLETS AND DUAL

Model No.		*Delay (ns)
14LP Series	14LD Series	
14LP5	14LD5	5
14LP10	14LD10	10
14LP15	14LD15	15
14LP20	14LD20	20
14LP25	14LD25	25
14LP50	14LD50	50
14LP75	14LD75	75
14LP100	14LD100	100

*Per Line

SERIES 14G
DIGITAL TTL SINGLE OUTPUT

Model No.	Delay (ns)
14G5	5
14G10	10
14G20	20
14G25	25
14G50	50
14G75	75
14G100	100
14G150	150
14G200	200
14G500	500
14G750	750
14G1000	1000



Model No.	Delay (ns)
14LG10	10
14LG20	20
14LG25	25
14LG50	50
14LG75	75
14LG100	100
14LG150	150
14LG200	200
14LG300	300
14LG500	500

SERIES 14LG
LOW POWER SCHOTTKY SINGLE OUTPUT

SPECIFICATIONS:		
	14 Series	14L Series
Supply voltage	5V ± 5%	5V ± 5%
Supply current	70Ma Max	25Ma Max
Rise & Fall Time	4ns Max	6ns Max
Operating Temp.	0 to 70°C	0 to 70°C
Size	.8x.4x.28	.8x.4x.28
Delay tolerance: ± 5% or 2ns, whichever is greater		

ESC can also supply these devices with ceramic IC's that have been screened to MIL-STD-883 for -55°C to + 125°C operation. Case size will be .82L X .40W X .36H. When ordering add letter "C" after fourth digit in part number.
Example: 14LP10 converts to 14LPC10.
14T100 converts to 14TC100.
All items above available in the low profile auto-insertable package. Contact Plant.

NOTE•NEW!
FAX NO. 201-947-0406

DELAY LINES

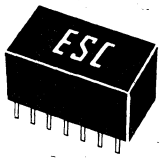
DELAY LINES

MACHINE INSERTABLE LOW PROFILE DIP DIGITAL DELAY LINES

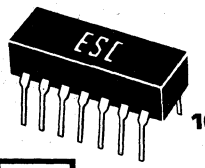
SERIES 10T AND SERIES 10TD
DIGITAL
TTL
COMPATIBLE
10 TAPS
14 PIN
PACKAGE

AND

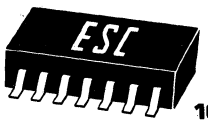
SERIES 10SGT
SURFACE MOUNTING
G LEAD



10T



10TD

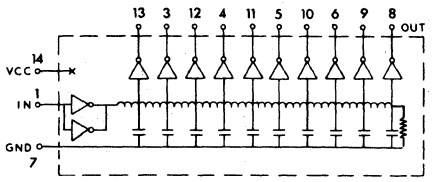


10SGT

SURFACE MOUNTING

Model Nos.			Delay (ns)	Delay/ Tap (ns)
Series 10T	Series 10TD	Series 10SGT		
10T50	10TD50	10SGT50	50	5
10T60	10TD60	10SGT60	60	6
10T70	10TD70	10SGT70	70	7
10T80	10TD80	10SGT80	80	8
10T90	10TD90	10SGT90	90	9
10T100	10TD100	10SGT100	100	10
10T200	10TD200	10SGT200	200	20
10T250	10TD250	10SGT250	250	25
10T300	10TD300	10SGT300	300	30
10T350	10TD350	10SGT350	350	35
10T400	10TD400	10SGT400	400	40
10T450	10TD450	10SGT450	450	45
10T500	10TD500	10SGT500	500	50
10T750	10TD750	10SGT750	750	75
10T1000	10TD1000	10SGT1000	1000	100

For variations in delay from above listing, modify part number by changing delay. Example: 375ns, 10SGT series becomes 10SGT375



10T Size: .80L x .40W x .28H
10TD Size: .785L x .285W x .25H
10SGT Size: .785L x .285W x .25H

Also available in Low Power Schottky - Series 10LT, 10LTD, or 10LSGT

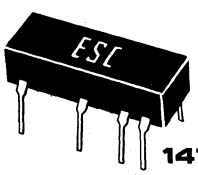
ESC can also supply the 10T Series with ceramic IC's that have been screened to MIL-STD-883 for -55°C to +125°C operation. The height will increase to .32 inches. When specifying, add letter "C" after "T". Example: 10T50 converts to 10TC50.

DC PARAMETERS		LIMITS	
		Min.	Max.
V_{oh}	Vcc = min I_{oh} = 1.0 mA	2.5V	—
V_{ol}	Vcc = min I_{ol} = 20 mA	—	0.5V
I_{ih}	Vcc = max V_{ih} = 2.7V	—	50 µA
I_{il}	Vcc = max V_{il} = 0.5V	-2.0 mA	—
I_i	Vcc = max V_i = 5.5V	—	1.0 mA
V_i	Vcc = min I_{in} = -18 madc	-1.2vdc	—
I_{cc}	Vcc = max outputs low	Series 10T 140mA Series 10TD 140mA Series 10SGT 140mA Series 14TD 70mA Series 14TDL 70mA	

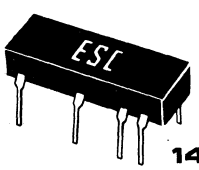
SERIES 14TD
TTL/DTL
COMPATIBLE
5 TAPS
14 PIN
PACKAGE
LOW PROFILE

AND

SERIES 14TDL
LOW-LOW PROFILE



14TD

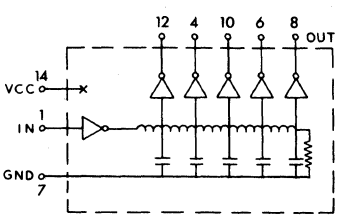


14TDL

LOW PROFILE **LOW-LOW PROFILE**

Model Nos.		Delay (ns)	Delay/ Tap (ns)
Series 14TD	Series 14TDL		
14TD25	14TDL25	25	5
14TD30	14TDL30	30	6
14TD35	14TDL35	35	7
14TD40	14TDL40	40	8
14TD45	14TDL45	45	9
14TD50	14TDL50	50	10
14TD75	14TDL75	75	15
14TD100	14TDL100	100	20
14TD150	14TDL150	150	30
14TD200	14TDL200	200	40
14TD250	14TDL250	250	50
14TD300	14TDL300	300	60
14TD500	14TDL500	500	100
14TD750	N/A	750	150
14TD1000	N/A	1000	200

For variations in delay from above listing, modify part number by changing delay: Example: 400ns, 14TDL Series becomes 14TDL400



14TD Size: .785L x .285W x .250H
14TTL Size: .785L x .285W x .165H

SPECIFICATIONS:

- Supply Voltage: 5.0VDC ± 5%
- Delay Tolerance: ±2ns or ±5% WIG
- Rise Time: 4ns max
- Minimum Pulse Width: 20% of total delay(10 taps) 40% of total delay(5 taps)
- Maximum Duty Cycle: 50%
- Operating Temp. Range: 0°C to +70°C
- Temp. Coeff. of Delay: 1.0ns +500ppm/°C
- Terminals: Electro tin plated alloy 42 .020w x .010th

TEST CONDITIONS:

- Vcc = 5.0VDC, Temp. 25° ± 5°C
- Time delay measured at the 1.5V level
- Rise time measured from .75V to 2.4V
- All outputs loaded with 15pf
- Input Test Pulse:
  - Pulse voltage: 3.0V
  - Pulse rise time: 2 ns
  - Pulse width: 1.2 x max Td
  - Pulse spacing: 5 x max Td

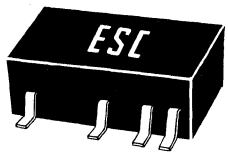
The auto-insertable versions of the single output 14G Series and the triplet 14P Series are available as Series 14GD & 14PD respectively. The low-low profile series is available as above (14TDL) and in the single output 14GDL Series only.

ESC ELECTRONICS CORP.

ESC ELECTRONICS CORP.

SURFACE MOUNTING DIGITAL DELAY LINES
TTL AND DTL COMPATIBLE
5 TAPS • 14 PIN PACKAGE • G LEADS

SERIES 14SGT • 14SGG • 14SGD • 14SGP



Series 14SGT (5 tap)		
MODEL NO. (Fig. 1)	Delay ns	Delay/Tap ns
14SGT25	25	5
14SGT30	30	6
14SGT35	35	7
14SGT40	40	8
14SGT45	45	9
14SGT50	50	10
14SGT60	60	12
14SGT75	75	15
14SGT100	100	20
14SGT125	125	25
14SGT200	200	40
14SGT225	225	45
14SGT300	300	60
14SGT400	400	80
14SGT500	500	100
14SGT750	750	150
14SGT1000	1000	250

Delay/ line (ns)	MODEL NUMBERS		
	Series 14SGG	Series 14SGD	Series 14SGP
	One output (Fig. 2)	Dual output (Fig. 3)	Triple output (Fig. 4)
5	14SGG5	14SGD5	14SGP5
10	14SGG10	14SGD10	14SGP10
15	14SGG15	14SGD15	14SGP15
20	14SGG20	14SGD20	14SGP20
25	14SGG25	14SGD25	14SGP25
50	14SGG50	14SGD50	14SGP50
75	14SGG75	14SGD75	14SGP75
100	14SGG100	14SGD100	14SGP100
150	14SGG150	14SGD150	14SGP150
200	14SGG200	14SGD200	14SGP200
250	14SGG250	14SGD250	14SGP250
300	14SGG300	14SGD300	14SGP300
400	14SGG400	14SGD400	14SGP400
500	14SGG500	14SGD500	14SGP500
750	14SGG750	14SGD750	14SGP750
1000	14SGG1000	14SGD1000	14SGP1000

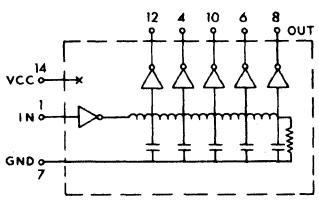


FIG. 1

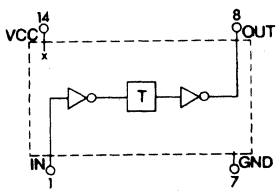


FIG. 2

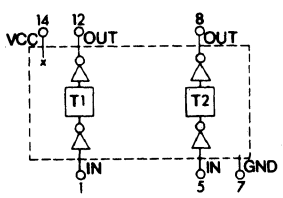


FIG. 3

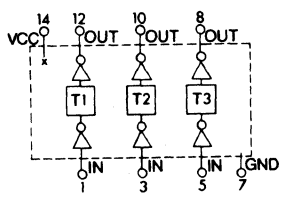


FIG. 4

Size: .780L X .280W X .200H

DC PARAMETERS		LIMITS Min.	LIMITS Max.
V_{oh}	Vcc = min, I_{oh} = 1.0 mA	2.5V	-
V_{ol}	Vcc = min, I_{ol} = 20 mA	-	0.5V
I_{ih}	Vcc = max, V_{ih} = 2.7V	-	50 µA
I_{il}	Vcc = max, V_{il} = 0.5V	-2.0 mA	-
I_i	Vcc = max, V_i = 5.5V	-	1.0 mA
V_i	Vcc = min, I_{in} = -18 madc	-1.2vdc	-
I_{cc}	Vcc = max, outputs low	14SGT Series: 14SGG " 14SGD " 14SGP "	70 mA 55 mA 100 mA 120 mA

SPECIFICATIONS:

- Supply voltage: 5.0 VDC ± 10%
- Delay tolerances: ± 2ns or ± 5% whichever is greater
- Rise time: 4ns max
- Operating temp. range: 0°C to + 70°C
- Temp. coeff. of delays: 1.0ns + 500 ppm/°C
- Terminals: Electro tin plated Alloy 42 .020 w x .010 th.
- Minimum Pulsewidth: 40% of Td

TEST CONDITIONS:

- Vcc = 5.0VDC, Temp. 25° ± 5°C
- Time delay measured at the 1.5V level
- Rise time measured from .75V to 2.4V
- All outputs loaded with 15pf
- Input Test Pulse: Pulse voltage: 3.0V; Pulse rise time: 2ns; Pulse width: 1.2 x max Td; Pulse spacing: 5 x max Td

DELAY LINES

DELAY LINES

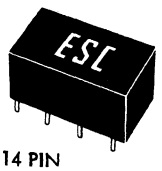
HIGH PERFORMANCE DIGITAL DELAY LINES

DELAY TOLERANCE CONTROLLED AT LEADING AND TRAILING EDGES

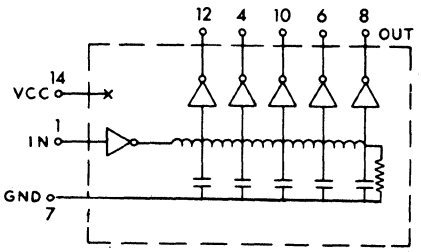
Intermediate delay values available upon request.

SERIES 14HT
HIGH PERFORMANCE TTL COMPATIBLE 5 TAPS

Model No.	Delay (ns)	Delay/ Tap(ns)
14HT25	25	5
14HT30	30	6
14HT35	35	7
14HT40	40	8
14HT45	45	9
14HT50	50	10
14HT75	75	15
14HT100	100	20
14HT150	150	30
14HT200	200	40
14HT250	250	50
14HT300	300	60
14HT500	500	100
14HT750	750	150
14HT1000	1000	200



14 PIN



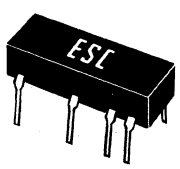
Size: .80L x .40W x .28H

. Also available as single output 14HG series or 14HGD series.

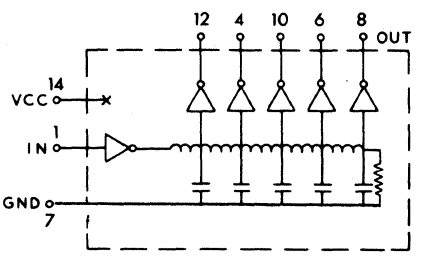
MACHINE INSERTABLE

SERIES 14HTD
LOW PROFILE DIP PACKAGE TTL COMPATIBLE 5 TAPS

Model No.	Delay (ns)	Delay/ Tap(ns)
14HTD25	25	5
14HTD30	30	6
14HTD35	35	7
14HTD40	40	8
14HTD45	45	9
14HTD50	50	10
14HTD75	75	15
14HTD100	100	20
14HTD150	150	30
14HTD200	200	40
14HTD250	250	50
14HTD300	300	60
14HTD500	500	100
14HTD750	750	150
14HTD1000	1000	200



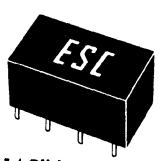
14 PIN



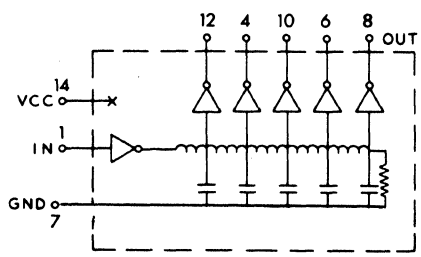
Size: .785 lg x .285 w x .25 h

SERIES 14HLT
HIGH PERFORMANCE LOW POWER SCHOTTKY 5 TAPS

Model No.	Delay (ns)	Delay/ Tap (ns)
14HLT50	50	10
14HLT75	75	15
14HLT100	100	20
14HLT150	150	30
14HLT200	200	40
14HLT250	250	50
14HLT300	300	60
14HLT500	500	100



14 PIN



Size: .80L x .40W x .28H

Available as Machine Insertable SERIES 14HLTD

SPECIFICATIONS:		
	14HT 14HTD	14HLT
Supply Voltage	5V± 5%	5V ± 5%
Supply Current	70 Ma Max	25 Ma Max
Rise & Fall Time	4ns Max	6ns Max
Operating Temp.	0 to 70°C	0 to 70°C
Delay Tolerance	± 5% or 2ns*	± 5% or 3ns*
Min. Pulse Width:	20% of TD	
Max Duty Cycle:	50%	
Temp. Coeff. of Delay:	1.0ns +500ppm/°C	
Operating Temperature:	0 to 70°C	

* Whichever is greater

ESC can supply the 14HT and 14HLT series with ceramic IC's that have been screened to MIL-STD-883 for -55°C to + 125°C operation. Case size will be .82L X .40W X .36H. When ordering add suffix "C" (14HTC, 14HLTC.)

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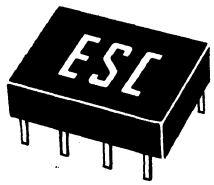
TOLL FREE 800-631-0853 (EXCEPT N.J.)

LOW PROFILE DIGITAL DELAY LINES FOR MILITARY APPLICATIONS

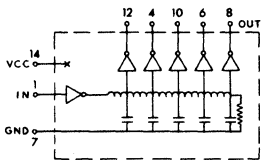


14 PIN

SERIES 9T
TTL COMPATIBLE 5 TAPS

TTL

Model No.	Delay (ns)	Delay/ Tap (ns)
9T25	25	5
9T30	30	6
9T35	35	7
9T40	40	8
9T45	45	9
9T50	50	10
9T75	75	15
9T100	100	20
9T150	150	30
9T200	200	40



SERIES 9LT
LOW POWER SCHOTTKY 5 TAPS

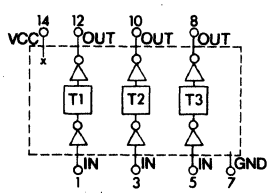
LOW POWER SCHOTTKY

Model No.	Delay (ns)	Delay/ Tap (ns)
9LT50	50	10
9LT75	75	15
9LT100	100	20
9LT150	150	30
9LT200	200	40

Intermediate delay values available upon request.

SERIES 9P
TTL COMPATIBLE TRIPLETS

Model No.	Delay per line (ns)
9P5	5
9P10	10
9P15	15
9P20	20
9P25	25
9P50	50

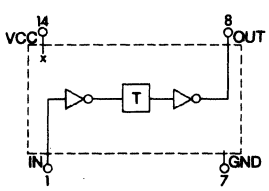


Model No.	Delay per line (ns)
9LP10	10
9LP15	15
9LP20	20
9LP25	25
9LP50	50

SERIES 9LP
LOW POWER SCHOTTKY TRIPLETS

SERIES 9G
TTL COMPATIBLE SINGLE OUTPUT

Model No.	Delay (ns)
9G5	5
9G10	10
9G20	20
9G25	25
9G50	50
9G100	100
9G200	200



Model No.	Delay (ns)
9LG10	10
9LG20	20
9LG25	25
9LG50	50
9LG100	100
9LG200	200

SERIES 9LG
LOW POWER SCHOTTKY SINGLE OUTPUT

SPECIFICATIONS:		
	9 Series	9L Series
Supply Voltage	5.0 VDC ± 5%	5.0 VDC ± 5%
Supply Current	70 Ma Max	25 Ma Max
Rise & Fall Time	4.0 ns Max	6.0 ns Max
Operating Temp.	-55°C to + 125°C	-55°C to + 125°C
Size *	.80L X .50W X .165H	
Delay Tolerance	± 5% or 2 ns whichever is greater	

These devices are supplied with ceramic IC's that have been screened to MIL-STD-883 for -55°C to + 125°C operation.

* Also available with stand-offs, maximum height becomes .180. Specify above series with suffix "S". Example: 9T25 becomes 9T25S.

NOTE • NEW! FAX NO. 201-947-0406

DELAY LINES

SERIES 8T AND SERIES 8TD

DIGITAL TTL COMPATIBLE
5 TAPS
8 PIN PACKAGE
DUAL-IN-LINE OR AUTO INSERTABLE

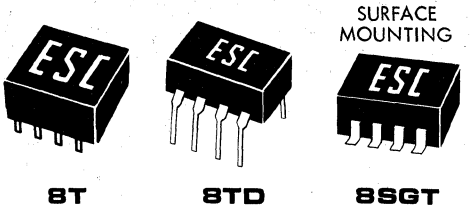
AND SERIES 8SGT

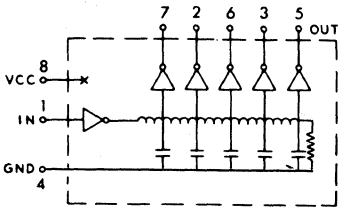
SURFACE MOUNTING
G LEADS

Intermediate delay values available upon request.

Model Nos.			Delay (ns)	Delay/ Tap(ns)
Series 8T	Series 8TD	Series 8SGT		
8T25	8TD25	8SGT25	25	5
8T30	8TD30	8SGT30	30	6
8T40	8TD40	8SGT40	40	8
8T50	8TD50	8SGT50	50	10
8T75	8TD75	8SGT75	75	15
8T100	8TD100	8SGT100	100	20
8T200	8TD200	8SGT200	200	40
8T250	8TD250	8SGT250	250	50
8T300	8TD300	8SGT300	300	60
8T400	8TD400	8SGT400	400	80
8T500	8TD500	8SGT500	500	100

For variations in delay from above listing, modify part number by changing delay.
Example: 350ns, 8T Series becomes 8T350





8T Size: .50L x .40W x .25H
8TD Size: .50L x .28W x .25H
8SGT Size: .50L x .28W x .25H

SPECIFICATIONS:

- Supply voltage: 5.0VDC ±5%
- Delay tolerances: ± 2ns or ±5% whichever is greater
- Rise Time: 4ns max
- Minimum Pulse Width: 40% of total delay
- Maximum Duty Cycle: 50%
- * Operating temp. range: 0°C to + 70°C
- Temp. Coeff. of delay: 1.0ns + 500ppm/°C.
- Terminals: Electro tinplated alloy 42 .020w x .010th.

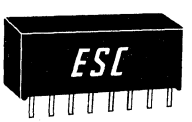
Note: 1- All packages can be supplied in the single-output type as Series 8G, 8GD or 8SGG or dual-output types as Series 8D, 8DD or 8SGD.
* 2- For -55°C to 125° C operation specify Series 8TC.

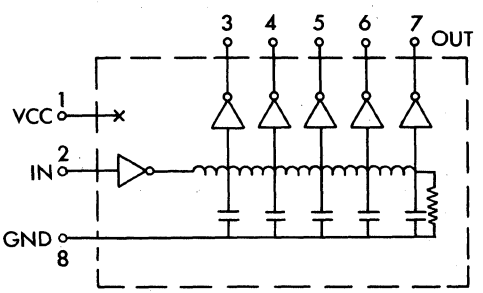
SERIES 5T

DIGITAL TTL COMPATIBLE
5 TAPS

Model No.	TD (ns)	TD/Tap (ns)
5T25	25	5
5T30	30	6
5T35	35	7
5T40	40	8
5T45	45	9
5T50	50	10
5T75	75	15
5T100	100	20
5T150	150	30
5T200	200	40
5T250	250	50
5T300	300	60
5T350	350	70
5T400	400	80

Also available as a single output Series 5G





Size: .81L x .18W x .34H

Looking for LC Filters? See our pages in Section 2700

SPECIFICATIONS:

- Supply voltage: 5V ± 5%
- Logic 1 input current: 50 µA max.
- Logic 0 input current: 2 MA max.
- Logic 1 voltage out: 2.4V min.
- Logic 0 voltage out: 0.5V max.
- Operating temperature: 0 to + 70°C
- Fan-out capabilities (max): 10 TTL loads/tap, 20 TTL loads/unit
- Delay tolerances: ± 2 ns or ± 5% whichever is greater
- Rise Time: 4 ns max

NOTE•NEW! FAX NO. 201-947-0406

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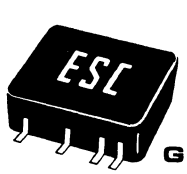
SERIES GSMT
SURFACE MOUNTING
TTL COMPATIBLE
5 TAPS
G LEADS

AND

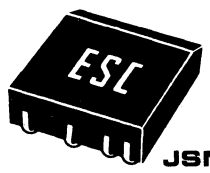
SERIES JSMT
SURFACE MOUNTING
TTL COMPATIBLE
5 TAPS
J LEADS

SURFACE MOUNTING DIGITAL DELAY LINES

Intermediate delay values available upon request.

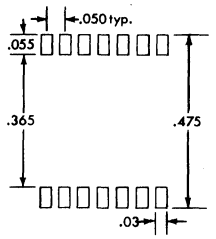


14 PIN GSMT

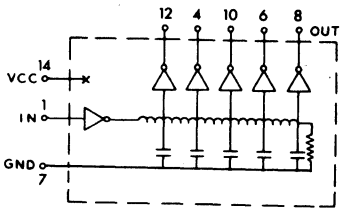


JSMT

Model No. G Style	Model No. J Style	Total Delay (ns)	Delay/ Tap (ns)
GSMT25	JSMT25	25	5
GSMT30	JSMT30	30	6
GSMT45	JSMT45	45	9
GSMT50	JSMT50	50	10
GSMT75	JSMT75	75	15
GSMT100	JSMT100	100	20
GSMT125	JSMT125	125	25
GSMT150	JSMT150	150	30
GSMT200	JSMT200	200	40
GSMT250	JSMT250	250	50



Suggested PC Board Solder Pads



Size: GSMT .450L x .370W x .175H
JSMT .450L x .450W x .175H

SPECIFICATIONS:

- Supply voltage (Vcc): 5.0VDC ± 5%
- Delay tolerance: ± 2ns or 5% whichever is greater
- Rise Time: 4ns max
- Minimum Pulse Width: 40% of total delay
- Maximum Duty Cycle: 50%
- Operating temp. range: 0 to 70°C
- Temp. coeff. of delay: 1.0ns + 500ppm/°C
- Terminals: .018 w x .010 th.

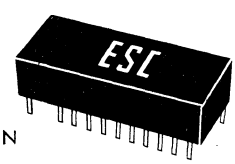
TEST CONDITIONS:

- Temperature: 25° ± 5°C; Vcc=5.0VDC
- Input pulse width: 1.2 times the total delay time
- Pulse spacing: 5 times the total delay time
- Input rise time: 2ns; input pulse amplitude 3.0VDC
- All outputs loaded with 15pf
- Time delays measured at the 1.5 volts level on the leading edges
- Rise time measured from .75 to 2.4V

SERIES 24ECL
ECL "100K" COMPATIBLE
8 TAPS

ECL "100,000" DIGITAL DELAY LINES

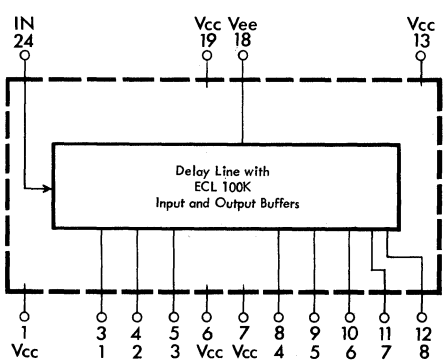
These 100K ECL Hybrid Delay Lines are contained in a 24 Pin DIP package using ECL "100,000" Series Circuits



24 PIN

Model No.	Total Delay (ns)	Delay/ Tap (ns)	Delay Tolerances *
24ECL8	10	**1	± .5ns or ± 5%
24ECL16	17	**2	± .5ns or ± 5%
24ECL24	24	3	± 1.0ns or ± 5%
24ECL32	32	4	± 1.5ns or ± 5%
24ECL40	40	5	
24ECL48	48	6	
24ECL56	56	7	
24ECL64	64	8	
24ECL72	72	9	
24ECL80	80	10	
24ECL160	160	20	
24ECL200	200	25	

*Whichever is greater
**First tap is 3.0 nsec.



Size: 1.3L X .50W X .375H

SPECIFICATIONS:

- 100K ECL Input and Output
- Operating Temp: 0°C to + 85°C
- Storage Temp: -55°C to + 125°C
- Vee: -4.5VDC ± 5%
- Logic 1 Output: -1.025 min
- Logic 0 Output: -1.620 max

TEST CONDITIONS:

- Pulse Width: 2 X total Td
- Pulse Spacing: 5 X total Td
- Pulse Amplitude: (-1.475 max to -1.165 min)
- Vee: -4.5VDC
- Vcc: 0VDC
- Temperature: + 25°C

Outputs connected to external 50 ohms pulldown resistor to -2.0V

NOTE • NEW!
FAX NO. 201-947-0406

ESC ELECTRONICS CORP.

Intermediate delay values available upon request.

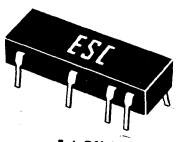
HIGH SPEED CMOS DIGITAL DELAY LINES

SERIES 14CMOS DIGITAL DELAY LINES 5 TAPS 14 PIN PACKAGE

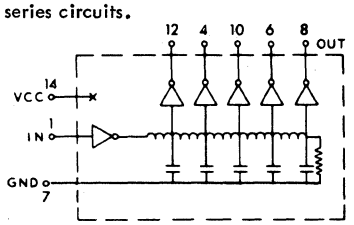
This series of digital hybrid delay lines are contained in a 14 Pin DIP package using High Speed CMOS series circuits.

Model No.	Delay (ns)	Delay/ Tap (ns)
14CMTD32	32	*5
14CMTD36	36	*6
14CMTD40	40	*7
14CMTD44	44	*8
14CMTD48	48	*9
14CMTD52	52	*10
14CMTD60	60	12
14CMTD75	75	15
14CMTD100	100	20
14CMTD125	125	25
14CMTD150	150	30
14CMTD175	175	35
14CMTD200	200	40
14CMTD250	250	50
14CMTD300	300	60
14CMTD350	350	70
14CMTD400	400	80
14CMTD420	420	84
14CMTD440	440	88
14CMTD450	450	90
14CMTD500	500	100

*Residual Delay first tap-12ns.



14 PIN



Size: .785L X .285W X .250H

DC PARAMETERS		LIMITS Min.	LIMITS Max.
Voh	Vcc=min Ioh =4.0mA	4.0V	-
Vol	Vcc=min Iol =4.0mA	-	.3V
Vih	Vcc=min-max	2.0V	-
Vil	Vcc=min-max	-	.8V
IL	Vcc=max	-	+/-1.0µA
Icc	Vcc=max outputs low	-	15mA
max load	Vcc=max Voh=4.0V	10 LSTTL Loads	

SPECIFICATIONS:

- Supply voltage: 5.0VDC ± 10%
- Delay tolerances: ± 2ns or ± 5% whichever is greater
- Rise Time: 4ns max
- Five equally spaced taps
- ** Operating temp. range: 0°C to + 70°C
- Terminals: Electro tin plated alloy 42 .020w x .010th.

TEST CONDITIONS:

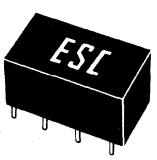
- Vcc = 5.0VDC, Temp. 25° ± 5°C
- Time delay measured at the 1.5V level
- Rise time measured from .75V to 2.4V
- Input test pulse:
  - Pulse voltage: 3.0V
  - Pulse rise time: 2ns
  - Pulse width: 1.5 x max Td
  - Pulse spacing: 5 x max Td

**Also available for -55°C to + 125°C operation. The dimensions will change to .82L X .40W X .36H.

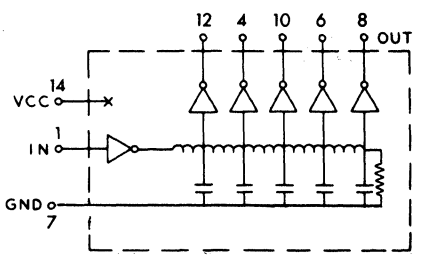
FAST TTL LOGIC DELAY LINES

SERIES 14FT FAST TTL COMPATIBLE 14 PIN PACKAGE 5 TAPS

Model No.	Time Delay (nsec)	Delay/Tap (nsec)
14FT25	25	5
14FT30	30	6
14FT35	35	7
14FT40	40	8
14FT45	45	9
14FT50	50	10
14FT75	75	15
14FT100	100	20
14FT150	150	30
14FT200	200	40
14FT250	250	50
14FT300	300	60
14FT500	500	100



14 PIN



Size: .80L x .40W x .28H

For variations in delay from above listing, modify part number by changing delay.
Example: 400ns, 14FT series becomes 14FT400.

SPECIFICATIONS:

- Supply voltage: 5.0VDC ± 5%
- Delay tolerances: ± 2ns or ± 5% whichever is greater
- Rise Time: 3ns max
- Minimum Pulse Width: 40% of total delay
- Maximum Duty Cycle: 50%
- Operating temp. range: 0°C to +70°C
- Temp. coeff. of delay: 1.0ns +500ppm/°C
- Terminals: Electro tin plated alloy 42 .020w x .010th.

TEST CONDITIONS:

- Vcc = 5.0VDC, Temp. 25° ± 5°C
- Time delay measured at the 1.5V level
- Rise time measured from .75V to 2.4V
- All outputs loaded with 15pf
- Input Test Pulse:
  - Pulse voltage: 3.0V
  - Pulse rise time: 2 ns
  - Pulse width: 1.2 x max Td
  - Pulse spacing: 5 x max Td

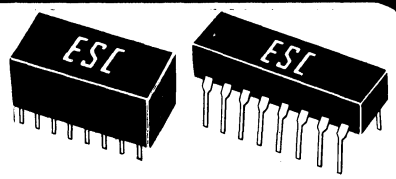
NOTE • NEW! FAX NO. 201-947-0406

DELAY LINES

DELAY LINES

ECL "10,000" DIGITAL DELAY LINES

16 PIN DIL & AUTO INSERTABLE PACKAGES



Intermediate delay values available upon request.

SPECIFICATIONS:

- Cumulative delay tolerances: ± 1ns or ± 5% whichever is greater
- Log 1 (output): - .96V min
- Logic 0 (output): -1.65V max
- Logic 1 (input): - .98V min
- Logic 0 (input): -1.63V max
- Output rise time: 3ns max
- Supply voltage: -5.2V ± 5%
- Supply current: EC series: 65mA max
  EG series: 70mA
  ED series: 100mA
  EP series: 140mA
- * Operating temperature: 0°C to +70°C
- Delay temp. coefficient: 1.0ns +500ppm/°C
- Terminals: Electro tin plated alloy 42
  .020w x .010th.

TEST CONDITIONS:

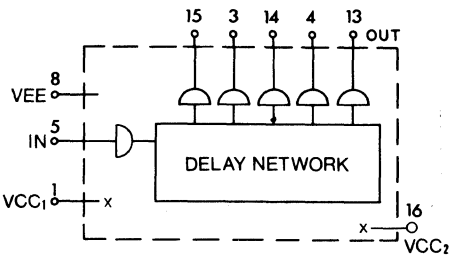
- Temp. = 25°C Vee = -5.2 VDC Vcc = Grd
- ** Input Amplitude: 1.0V (-.75V to -1.75V)
- Pulse Width: 3 X max Td
- Pulse Spacing: 5 X max Td
- Time delays measured at the -1.3 V level
- Output terminals connected through an external pulldown resistor of 100 Ω to -2 VDC

** Input pulse is provided by standard open emitter ECL 10,000 gate.

The 16EC, 16EP, 16ED and 16EG series are DIL packages. The 16ECD, 16EPD, 16EDD and 16EGD series are Auto Insertable (DIP) packages.

SERIES 16EC AND SERIES 16ECD
ECL COMPATIBLE 5 TAPS

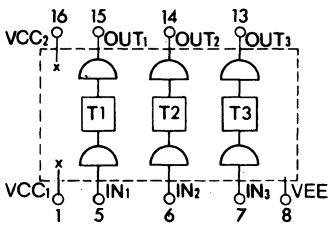
Model No.	Model No.	Delay (ns)	Delay/ Tap(ns)
16EC10	16ECD10	10	2
16EC15	16ECD15	15	3
16EC20	16ECD20	20	4
16EC25	16ECD25	25	5
16EC30	16ECD30	30	6
16EC40	16ECD40	40	8
16EC50	16ECD50	50	10
16EC60	16ECD60	60	12
16EC80	16ECD80	80	16
16EC100	16ECD100	100	20



Size: .8L x .4W x .28H

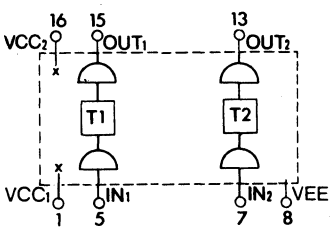
SERIES 16EP AND SERIES 16EPD
ECL COMPATIBLE TRIPLETS

Model No.	Model No.	Delay per line(ns)
16EP5	16EPD5	5
16EP10	16EPD10	10
16EP15	16EPD15	15
16EP20	16EPD20	20
16EP25	16EPD25	25
16EP50	16EPD50	50



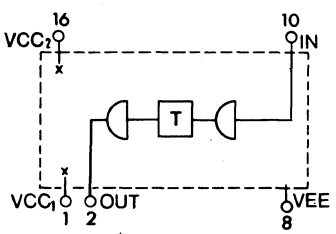
SERIES 16ED AND SERIES 16EDD
ECL COMPATIBLE DUAL

Model No.	Model No.	Delay per line(ns)
16ED5	16EDD5	5
16ED10	16EDD10	10
16ED15	16EDD15	15
16ED20	16EDD20	20
16ED25	16EDD25	25
16ED50	16EDD50	50
16ED60	16EDD60	60
16ED80	16EDD80	80
16ED100	16EDD100	100



SERIES 16EG AND SERIES 16EGD
ECL COMPATIBLE SINGLE OUTPUT

Model No.	Model No.	Delay(ns)
16EG5	16EGD5	5
16EG10	16EGD10	10
16EG15	16EGD15	15
16EG20	16EGD20	20
16EG25	16EGD25	25
16EG50	16EGD50	50
16EG75	16EGD75	75
16EG100	16EGD100	100



* Available for -55°C to +125°C operation with dimensions increased to .360 high x .820 long. Specify 16ECC, 16EPC, 16EDC, or 16EPC when ordering.

DELAY LINES

TTL DIGITAL PROGRAMMABLE DELAY LINES

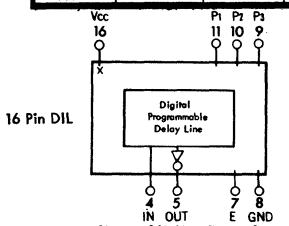
This series of programmable hybrid delay lines utilize TTL Schottky circuits. The PTT's are offered in 3, 4, 6 & 8 Bit Series.

SERIES PTT3 AND SERIES PTT6

TTL COMPATIBLE PROGRAMMABLE DELAY LINES

3 BIT

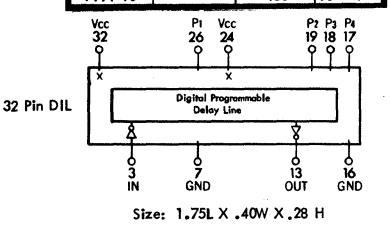
Model No.	Zero Step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PTT3-1	7 ± 2	14	1 ± .5
PTT3-2		21	2 ± .5
PTT3-3		28	3 ± .6
PTT3-4		35	4 ± .8
PTT3-5		42	5 ± 1
PTT3-6		49	6 ± 1
PTT3-7		56	7 ± 1
PTT3-8		63	8 ± 1
PTT3-9		70	9 ± 1
PTT3-10		77	10 ± 1



Size: .80L X .40W X .28 H

4 BIT

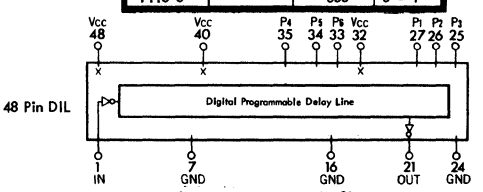
Model No.	Zero Step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PTT4-1	15 ± 2	30	1 ± .5
PTT4-2		45	2 ± .5
PTT4-3		60	3 ± .6
PTT4-4		75	4 ± .8
PTT4-5		90	5 ± 1
PTT4-6		105	6 ± 1
PTT4-7		120	7 ± 1
PTT4-8		135	8 ± 1
PTT4-9		150	9 ± 1
PTT4-10		165	10 ± 1



Size: 1.75L X .40W X .28 H

6 BIT

Model No.	Zero Step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PTT6-1	20 ± 2	83	1 ± .5
PTT6-2		146	2 ± .5
PTT6-3		209	3 ± .6
PTT6-4		272	4 ± .8
PTT6-5		335	5 ± 1



Size: 2.55L X .40W X .28 H

SPECIFICATIONS:

- Logic 1 (output): 2.4 min
- Logic 0 (output): .50 VDC max
- Operating Temp. Range: 0°C to + 70°C *
- Storage Temp. Range: -55°C to + 125°C

*For -55°C to + 125°C operation - Contact Plant

TEST CONDITIONS:

- Vcc = 5 VDC Temp. = 25°C
- Input Pulse Width: 3 X max Td
- Input Rise Time: 2ns max
- Input Pulse Spacing: 5 X max Td
- Td measured at 1.5 V level
- Output loaded with 15pf

ECL DIGITAL PROGRAMMABLE DELAY LINES

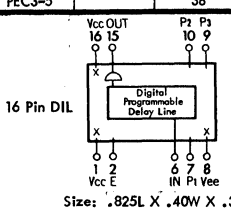
This series of programmable hybrid delay lines utilize ECL 10,000 Series IC's. The PEC's are offered in 3, 4, 6 & 8 Bit Series.

SERIES PEC3 AND SERIES PEC6

ECL COMPATIBLE PROGRAMMABLE DELAY LINES

3 BIT

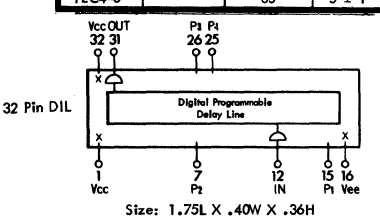
Model No.	Zero Step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PEC3-1	3 ± 2	10	1 ± .5
PEC3-2		17	2 ± .5
PEC3-3		24	3 ± .6
PEC3-4		31	4 ± .8
PEC3-5		38	5 ± 1



Size: .825L X .40W X .36H

4 BIT

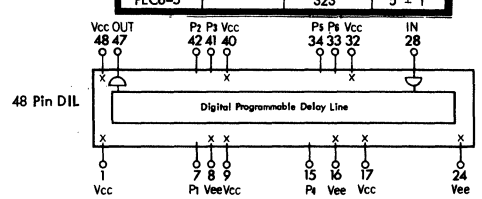
Model No.	Zero Step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PEC4-1	10 ± 2	25	1 ± .5
PEC4-2		40	2 ± .5
PEC4-3		55	3 ± .6
PEC4-4		70	4 ± .8
PEC4-5		85	5 ± 1



Size: 1.75L X .40W X .36H

6 BIT

Model No.	Zero Step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PEC6-1	8 ± 2	71	1 ± .5
PEC6-2		134	2 ± .5
PEC6-3		197	3 ± .6
PEC6-4		260	4 ± .8
PEC6-5		323	5 ± 1



Size: 2.50L X .40W X .36H

SPECIFICATIONS:

- Logic 1 (output): -.96V min
- Logic 0 (output): -1.65V max
- Operating Temp. Range: -0°C to + 70°C
- Storage Temp. Range: -55°C to + 125°C

TEST CONDITIONS:

- Input Pulse Width: 3 X max delay time
- Input Pulse Spacing: 5 X max delay time
- Input Rise Time: 2 ns max
- Input Pulse Voltage: 1.0V (-.75V to -1.75V)
- Vee: -5.2VDC
- Output connected to -2VDC through 100 ohms.
- Time delays measured at -1.3 Volt Level.

Also available for -55°C to + 125°C operation as Series PECC3, PECC4 and PECC6. Intermediate delay values available upon request.

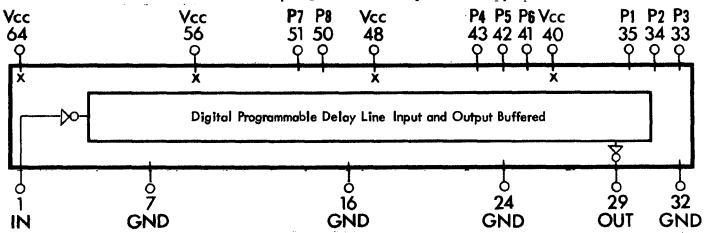
ESC ELECTRONICS CORP.

ELECTRONICS CORP.
534 BERGEN BOULEVARD ● PALISADES PARK, N.J. 07650
PHONE: (201) 947-0400 ● TWX 710-991-9780
TOLL FREE 800-631-0853 (EXCEPT N.J.)

TTL DIGITAL PROGRAMMABLE DELAY LINES

This series of 8 Bit programmable hybrid delay lines utilize TTL Schottky circuits.

SERIES PTT 8 8 BIT
TTL COMPATIBLE PROGRAMMABLE DELAY LINES



Size: 3.30 L X .40 W X .28 H

Model No.	Zero step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PTT8-1	20 ± 2	275	1 ± .5
PTT8-2		530	2 ± .5
PTT8-3		785	3 ± .6
PTT8-4		1040	4 ± .8
PTT8-5		1295	5 ± 1

Intermediate delay values available upon request.

SPECIFICATIONS:

- Zero step delay is measured from the input pin #1
- All programmable delays after step zero are referenced to step zero
- Programmable delay tolerance: ± 2ns or 5% whichever is greater
- Rise time: 4ns max
- Operating temp. range: 0°C to + 70°C
- Vol: .4V max
- Voh: 2.4V min
- Vcc: 5VDC ± 0.25V
- Terminals: Electro tin plated alloy 42, .020 w x .010 th.

TEST CONDITIONS:

- Vcc = 5.0VDC, Temp. 25°C
- Time delay measured at the 1.5 volt level of the leading edge
- Rise time measured from .75V to 2.4 volts
- Output loaded with 15pf
- Input pulse width: 3 x max time delay
- Input rise time: 2ns
- Pulse amplitude: 3.0 volts
- Pulse spacing: 1000ns

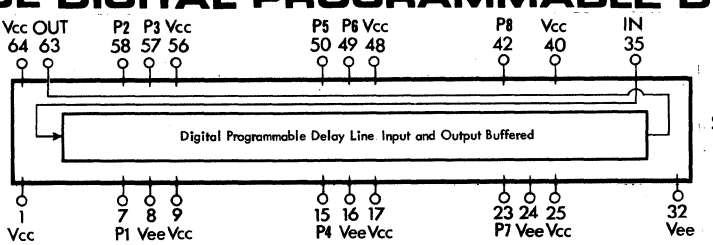
This Series is supplied in two versions: PTT8 and PTTC8

PTT8: Employs a plastic packaged IC for an operating temperature range of 0°C to + 70°C

PTTC8: Manufactured with a ceramic packaged IC which has been screened per MIL-STD-883 for a -55°C to + 125°C operating temperature range. The height of this series is .360. When specifying add letter "C" after "T"

ECL DIGITAL PROGRAMMABLE DELAY LINES

SERIES PEC8 8 BIT
ECL COMPATIBLE PROGRAMMABLE DELAY LINES



Size: 3.3 L X .40 W X .36 H

Model No.	Zero Step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PEC8-1	12 ± 2	267	1 ± .5
PEC8-2		522	2 ± .5
PEC8-3		777	3 ± .6
PEC8-4		1032	4 ± .8
PEC8-5		1287	5 ± 1.0

Intermediate delay values available upon request.

SPECIFICATIONS:

- Zero step delay is measured from the input pin #35
- All programmable delays after step zero are referenced to step zero
- Programmable delay tolerances are ± 2ns or 5% whichever is greater
- Rise time (20% to 80% points) = 5ns max
- * Operating temperature range: 0°C to + 70°C
- Logic 1 (output): -.96V min
- Logic 0 (output): -1.65V max
- Logic 1 (input): -.98V min
- Logic 0 (input): -1.63V max
- Terminals: Electro tin plated alloy 42 .020 w x .010 th.

* Also available for -55°C to + 125°C operation as PECC8 Series

TEST CONDITIONS:

- Temp. 25°C Vee = 5.2 VDC Vcc = Grd
- ** Input pulse amplitude: 1.0V (-.75V H to -1.75 L)
- Pulse width: 3 X max Td
- Pulse spacing: 10 X max Td
- Time delay measured at the -1.3 V level
- Output connected through an external pulldown resistor of 100 ohms to -2 VDC

** Input pulse provided by a standard open emitter ECL 10,000 gate.

NOTE • NEW! FAX NO. 201-947-0406

DELAY LINES

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 88/89 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1134, **B**•1098, **C**•1082, **D**•1038
ASCII Code ..... **D**•1073
Batteries, Product Selection Guide ..... **D**•1428
Batteries & Fuel Cells, Characteristics ..... **D**•1454
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1030
Capacitors, Miniglossary ..... **A**•1027
Capacitors, Product Selection Guide ..... **A**•1003
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1193
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1760
Connectors, Miniglossary ..... **C**•1374
Connectors, Terminals & Sockets, Product Selection Guide ..... **C**•1127
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide ..... **A**•1331
Delay Lines, Product Selection Guide ..... **A**•1495
Discrete Semiconductors, Product Selection Guide ..... **A**•2113
Displays, Readouts, & CRTs, Product Selection Guide ..... **B**•1033
EBCDIC Code ..... **D**•1162
Encapsulation, Miniglossary ..... **C**•1110
Fans, Blowers, Cooling Equipment & Heat Exchangers, Product Selection Guide ..... **C**•1643
Filters, Product Selection Guide ..... **A**•1633
IC Master ..... **A**•1718
Instruments, Panel Meters, Product Selection Guide ..... **D**•1350
Instruments, Test & Measuring, Product Selection Guide ..... **D**•1190
Interconnection Systems, Product Selection Guide ..... **C**•1719
Keyboards & Keypads, Product Selection Guide ..... **B**•1808
Lamps, Lights, & Inductors, Product Selection Guide ..... **B**•1104
Logofinder & Trademark Directories ..... **C**•901
Microwave Components, Product Selection Guide ..... **A**•1761
Military Qualified Products List ..... **B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1181
Opto Semiconductors, Miniglossary ..... **B**•1262
Oscilloscopes, Product Selection Guide ..... **D**•1408
Panel Hardware, Product Selection Guide ..... **C**•1603
Potentiometers, Trimmers, Controls & Rheostats, Product Selection Guide ..... **A**•2057
Power Supplies, Miniglossary ..... **D**•1504
Power Supplies, AC, Product Selection Guide ..... **D**•2060
Power Supplies, DC, Product Selection Guide ..... **D**•1497
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide ..... **B**•1297
Relay Contact Forms ..... **B**•1371
Relays, Electromechanical, Miniglossary ..... **B**•1364
Relays, Product Selection Guide ..... **B**•1355
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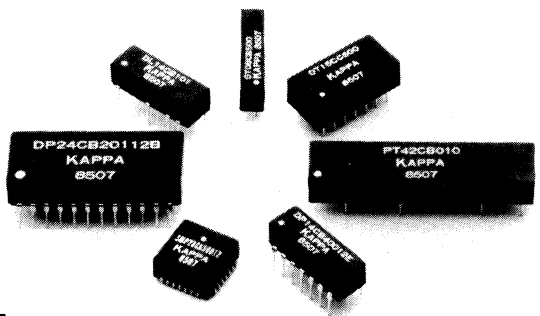

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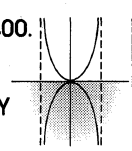
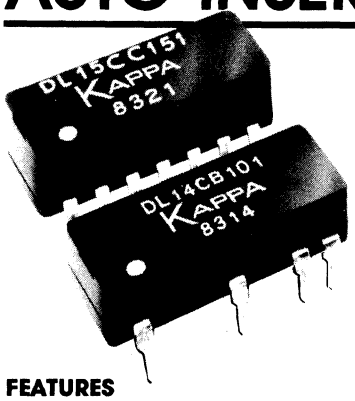


KAPPA® NETWORKS, INC.

SERIES DL14/DL15 TTL SCHOTTKY (14-PIN) 5-TAP/10-TAP

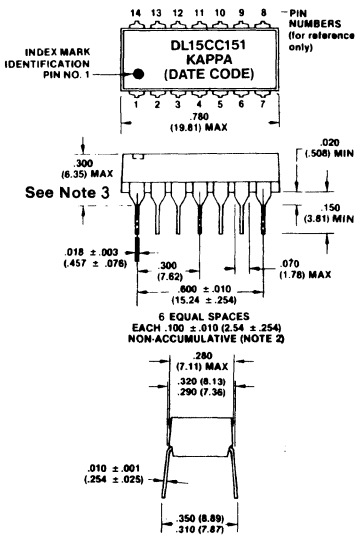
AUTO-INSERTABLE DELAY LINES



FEATURES

- Auto-Insertable 14-pin package
- TTL Schottky interfaced
- 5/10 equally spaced taps
- Risetime: 4 ns max(5) (6)
- Total delays from 25-500 ns

MARKINGS AND DIMENSIONS, in (mm)



Marking and dimension notes:

1. A notch may be substituted for PIN #1 Dot Index.
2. Each terminal is located within ±.010 of its nominal multiple of .100 along this longitudinal dimension relative to terminals 7 and 8.
3. **Also available in .200 in. max mounting height as DL14CA and .165 in. max mounting height as DL14CZ.**

RECOMMENDED OPERATING CONDITIONS

		MIN	TYP	MAX	UNIT
V_{CC}	Supply Voltage	4.75	5.00	5.25	V
V_{IH}	High-Level Input Voltage	2.0			V
V_{IL}	Low-Level Input Voltage			0.8	V
I_{IK}	Input Clamp Current			−18	mA
I_{OH}	High-Level Output Current			−1.0	mA
I_{OL}	Low-Level Output Current			20	mA
T_A	Operating Free-Air Temperature	0	+25	+70	°C

DC ELECTRICAL CHARACTERISTICS — **TEST CONDITIONS**

V_{OH}	High-Level Output Voltage	V_{CC} = min, V_{IH} = min, I_{OH} = max	2.7	3.4		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min, V_{IL} = max, I_{OL} = max			0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min, I_I = I_{IK}			−1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max, V_{IN} = 2.7V			50	μA
		V_{CC} = max, V_{IN} = 5.25V			1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max, V_{IN} = 0.5V			−2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max, V_{OUT} = 0, one output at a time	−40		−100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max, V_{IN} = OPEN		30/60	45/75	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max, V_{IN} = 0		65/120	75/150	mA
N_H	Fanout High-Level Output	V_{CC} = max, V_{OH} = 2.7V			20	TTL load
N_L	Fanout Low-Level Output	V_{CC} = max, V_{OL} = 0.5V			10	TTL load

INPUT PULSE TEST CONDITIONS

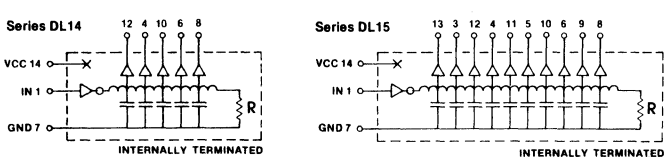
E_{IN}	Pulse Voltage	3.1	3.2	3.3	V
T_{RI}	Pulse Rise-Time			2.0	ns
T_W	Pulse Width, of Total Delay	40/20	100		%
d	Duty Cycle		33.3	50	%

PART NUMBER	Total Delay (ns)(1) (2)	Tap Delay (ns)(1) (2)
DL14CB250	25	5
DL14CB500	50	10
DL14CB750	75	15
DL14CB101	100	20
DL14CB251	250	50
DL14CB501	500	100
DL15CC500	50	5
DL15CC101	100	10
DL15CC151	150	15
DL15CC201	200	20
DL15CC251	250	25
DL15CC501	500	50

Notes:

1. Delays measured at 1.5V level on leading edge only.
2. Delay tolerances: ±5% or ±2 ns, whichever is greater, referenced from input and guaranteed only under the following test conditions: V_{CC} = Typ, T_A = Typ, E_{IN} = Typ, T_{RI} = max, T_W = Typ, P_{RR} = 1MHz (or d/tw, whichever is less), R_L 1 megohm and C_L2 pf.
3. Temperature coefficient of delay will vary, depending upon total delay, according to the formula: $T_{PTA} = (100 + (25{,}000/T_{PLH}))$.
4. Delay will vary approximately 4% for every 5% change in supply voltage.
5. Risetime measured from 0.75V to 2.4V level.
6. Measured with no loads on taps.
7. **Other delays also available upon request.**
8. Typical trailing edge delay = leading edge delay within ±15% typ.

FIGURE 1 — SCHEMATIC



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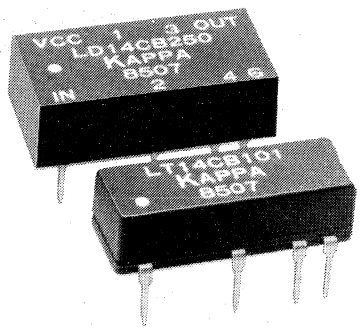
SERIES LT14/LD14 TTL SCHOTTKY (14-PIN) 5-TAP

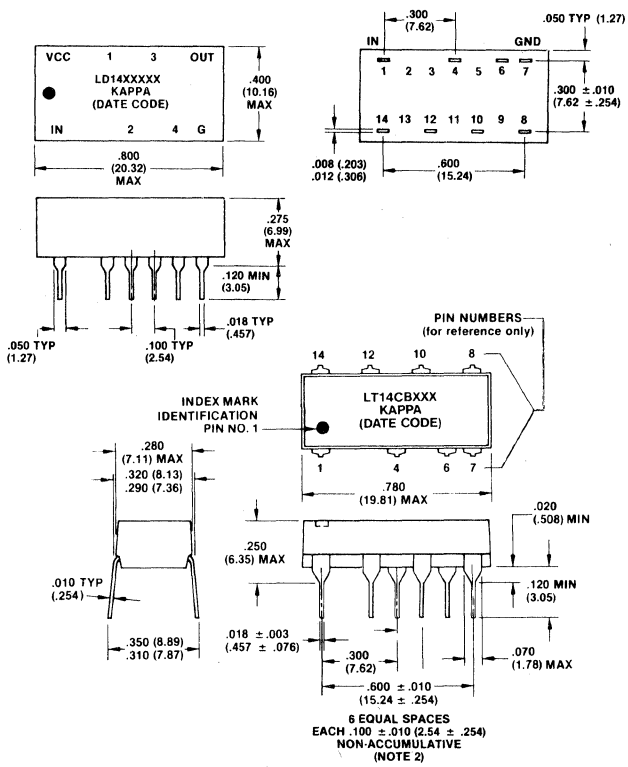
LEADING & TRAILING EDGE DELAY LINE



FEATURES

- T_{PLH} and T_{PHL} controlled
- Available in auto-insertable (LT14) and standard (LD14) 14-pin package
- 5 equally-spaced taps
- Total delays from 25-500 ns

MARKINGS AND DIMENSIONS, in (mm)



Marking and dimensions notes:

1. A notch may be substituted for PIN #1 Dot Index.
2. Each terminal is located within ±.010 of its nominal multiple of .100 along this longitudinal dimension relative to terminals 7 and 8.

RECOMMENDED OPERATING CONDITIONS		MIN	TYP	MAX	UNIT
V_{CC}	Supply Voltage	4.75	5.00	5.25	V
V_{IH}	High-Level Input Voltage	2.0			V
V_{IL}	Low-Level Input Voltage			0.8	V
I_{IK}	Input Clamp Current			−18	mA
I_{OH}	High-Level Output Current			−1.0	mA
I_{OL}	Low-Level Output Current			20	mA
T_A	Operating Free-Air Temperature	0	+25	+70	°C

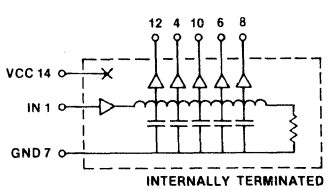
DC ELECTRICAL CHARACTERISTICS		TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{OH}	High-Level Output Voltage	V_{CC} = min, V_{IH} = min, I_{OH} = max	2.7	3.4		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min, V_{IL} = max, I_{OL} = max			0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min, I_I = I_{IK}			−1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max, V_{IN} = 2.7V			50	μA
		V_{CC} = max, V_{IN} = 5.25V			1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max, V_{IN} = 0.5V			−2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max, V_{OUT} = 0, one output at a time	−40		−100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max, V_{IN} = OPEN		30	45	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max, V_{IN} = 0		65	75	mA
N_H	Fanout High-Level Output	V_{CC} = max, V_{OH} = 2.7V			20	TTL load
N_L	Fanout Low-Level Output	V_{CC} = max, V_{OL} = 0.5V			10	TTL load

INPUT PULSE TEST CONDITIONS					
E_{IN}	Pulse Voltage	3.1	3.2	3.3	V
T_{RI}	Pulse Rise-Time			2.0	ns
T_W	Pulse Width, of Total Delay	40	100		%
d	Duty Cycle		25	50	%

PART NUMBER(7)	Total Delay (ns)(1) (2)	Tap Delay (ns)(1) (2)
LT14/LD14CB250	25	5
LT14/LD14CB500	50	10
LT14/LD14CB750	75	15
LT14/LD14CB101	100	20
LT14/LD14CB251	250	50
LT14/LD14CB501	500	100

Notes:

1. Delays measured at 1.5V level at leading and trailing edge.
2. Delay tolerances: ±5% or ±2 ns, whichever is greater, referenced from input.
3. Temperature coefficient of delay will vary, depending upon total delay, according to the formula: $T_{PTA} = (100 + (25{,}000/T_{PLH}))$.
4. Delay will vary approximately 4% for every 5% change in supply voltage.
5. Risetime measured from 0.75V to 2.4V level.
6. Measured with no loads on taps.
7. Other delays also available upon request.



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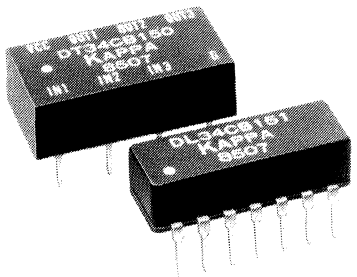
SERIES DL34/DT34 TTL SCHOTTKY • 3 INDEPENDENT DELAYS

TRIPLE DELAY LINES (14-PIN)



RECOMMENDED OPERATING CONDITIONS

		MIN	TYP	MAX	UNIT
V_{CC}	Supply Voltage	4.75	5.00	5.25	V
V_{IH}	High-Level Input Voltage	2.0			V
V_{IL}	Low-Level Input Voltage			0.8	V
I_{IK}	Input Clamp Current			−18	mA
I_{OH}	High-Level Output Current			−1.0	mA
I_{OL}	Low-Level Output Current			20	mA
T_A	Operating Free-Air Temperature	0	+25	+70	°C

DC ELECTRICAL CHARACTERISTICS **TEST CONDITIONS**

			MIN	TYP	MAX	UNIT
V_{OH}	High-Level Output Voltage	V_{CC} = min, V_{IH} =min, I_{OH} = max	2.7	3.4		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min, V_{IL} = max, I_{OL} =max			0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min, I_I = I_{IK}			−1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max, V_{IN} = 2.7V			50	μA
		V_{CC} = max, V_{IN} = 5.25V			1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max, V_{IN} = 0.5V			−2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max, V_{OUT} = 0, one output at a time	−40		−100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max, V_{IN} = OPEN			90	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max, V_{IN} = 0			115	mA
N_H	Fanout High-Level Output	V_{CC} = max, V_{OH} = 2.7V			10	TTL load
N_L	Fanout Low-Level Output	V_{CC} = max, V_{OL} = 0.5V			10	TTL load

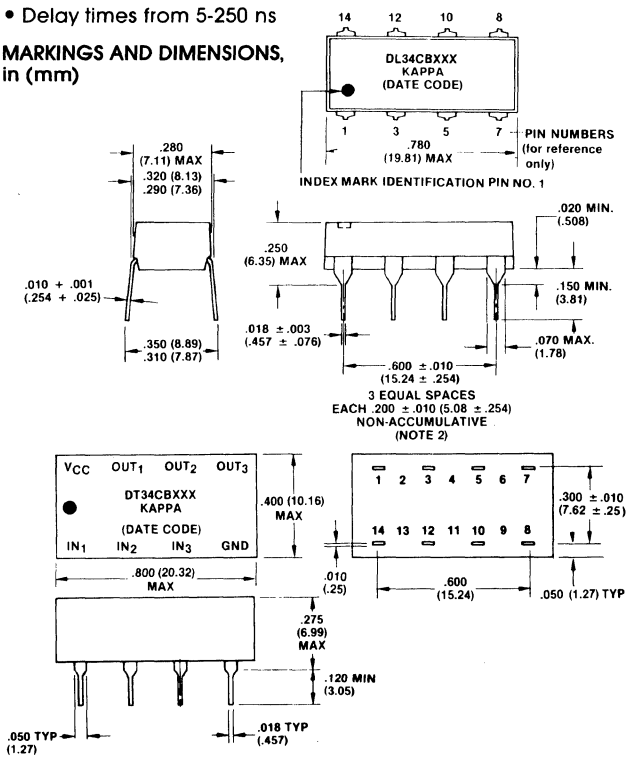
FEATURES

- Available in auto-insertable (DL34) and standard (DT34) 14-Pin package
- Risetime: 4 ns max(5)(6)
- 3 independent equal delays
- TTL Schottky interfaced
- Delay times from 5-250 ns

INPUT PULSE TEST CONDITIONS

E_{IN}	Pulse Voltage	3.1	3.2	3.3	V
T_{RI}	Pulse Rise-Time			2.0	ns
T_W	Pulse Width, of Total Delay	100			%
d	Duty Cycle			25	%

MARKINGS AND DIMENSIONS, in (mm)



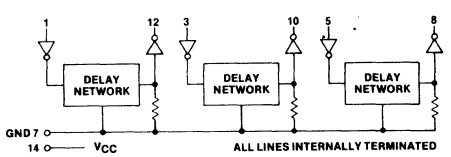
Marking and dimensions notes:

1. A notch may be substituted for PIN #1 Dot Index.
2. Each terminal is located within ±.010 of its nominal multiple of .100 along this longitudinal dimension relative to terminals 7 and 8.

PART NUMBER(7)	Total Delay (ns)(1) (2)
DL34/DT34CB250	25
DL34/DT34CB500	50
DL34/DT34CB750	75
DL34/DT34CB101	100
DL34/DT34CB251	250

Notes:

1. Delays measured at 1.5V level on leading edge only.
2. Delay tolerance: ±5% or ±2 ns, whichever is greater.
3. Temperature coefficient of delay will vary, depending upon total delay, according to the formula: $T_{PTA} = (100 + (25{,}000/T_{PLH}))$.
4. Delay will inversely vary about 4% for every 5% change in supply voltage.
5. Risetime measured from 0.75V to 2.4V level.
6. Measured with no loads.
7. Other delays also available upon request.



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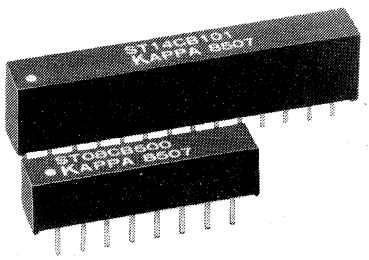
5

Revised 5/87; previous editions obsolete

SERIES ST08C/ST14C TTL SCHOTTKY (8-PIN/14-PIN)

5-&10-TAP SIP DELAY LINES



FEATURES

- 8-Pin (ST08C) and 14-Pin (ST14C) SIP Package
- TTL Schottky interfaced
- 5/10 equally-spaced taps
- Risetime: 4 ns max(5)(6)
- Total delays from 25-1000 ns

RECOMMENDED OPERATING CONDITIONS

		MIN	TYP	MAX	UNIT
V_{CC}	Supply Voltage	4.75	5.00	5.25	V
V_{IH}	High-Level Input Voltage	2.0			V
V_{IL}	Low-Level Input Voltage			0.8	V
I_{IK}	Input Clamp Current			−18	mA
I_{OH}	High-Level Output Current			−1.0	mA
I_{OL}	Low-Level Output Current			20	mA
T_A	Operating Free-Air Temperature	0	+25	+70	°C

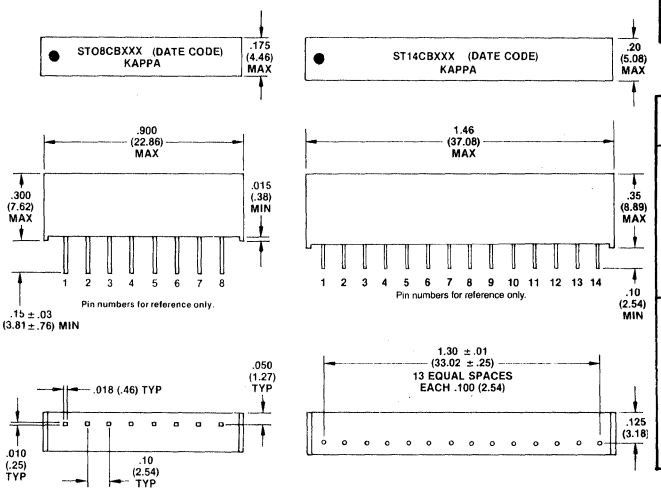
DC ELECTRICAL CHARACTERISTICS

		TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{OH}	High-Level Output Voltage	V_{CC} = min, V_{IH} = min, I_{OH} = max	2.7	3.4		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min, V_{IL} = max, I_{OL} = max			0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min, I_I = I_{IK}			−1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max, V_{IN} = 2.7V			50	μA
		V_{CC} = max, V_{IN} = 5.25V			1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max, V_{IN} = 0.5V			−2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max, V_{OUT} = 0, one output at a time	−40		−100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max, V_{IN} = OPEN		30/60	45/75	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max, V_{IN} = 0		65/120	75/150	mA
N_H	Fanout High-Level Output	V_{CC} = max, V_{OH} = 2.7V			20	TTL load
N_L	Fanout Low-Level Output	V_{CC} = max, V_{OL} = 0.5V			10	TTL load

INPUT PULSE TEST CONDITIONS

E_{IN}	Pulse Voltage	3.1	3.2	3.3	V
T_{RI}	Pulse Rise-Time			2.0	ns
T_W	Pulse Width, of Total Delay	40/20	100		%
d	Duty Cycle		25	50	%

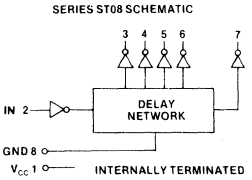
MARKINGS AND DIMENSIONS, in (mm)



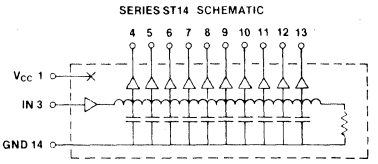
24 AWG round leads may be used.

PART NUMBER(7)	Total Delay (ns)(1) (2)	Tap Delay (ns)(1) (2)
ST08CB250	25	5
ST08CB500	50	10
ST08CB750	75	15
ST08CB101	100	20
ST08CB251	250	50
ST08CB501	500	100
ST14CD500	50	5
ST14CD101	100	10
ST14CD151	150	15
ST14CD201	200	20
ST14CD251	250	25
ST14CD501	500	50
ST14CD102	1000	100

SERIES ST08 SCHEMATIC



SERIES ST14 SCHEMATIC



Notes:

1. Delays measured at 1.5V level on leading edge only.
2. Delay tolerances: ±5% or ±2 ns, whichever is greater, referenced from input.
3. Temperature coefficient of delay will vary, depending upon total delay, according to the formula: $T_{PTA} = (100 + (25{,}000/T_{PLH}))$.
4. Delay will vary approximately 4% for every 5% change in supply voltage.
5. Risetime measured from 0.75V to 2.4V level.
6. Measured with no loads on taps.
7. Other delays also available upon request.

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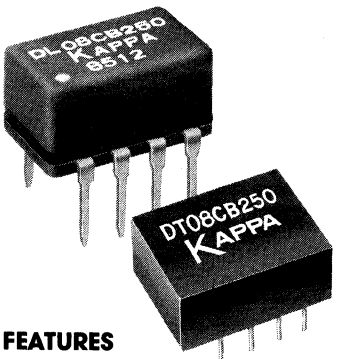
West Coast Office: 13455 Ventura Blvd. #220, Sherman Oaks, CA 91423, (818) 995-2401. West Coast Distributor: Phone (213) 283-2058.

SERIES DL08CB/DT08CB TTL SCHOTTKY

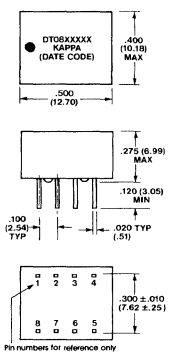
5-TAP TTL DELAY LINE (8-PIN)



FEATURES

- TTL Schottky Interfaced
- 8-pin package
- 5 equally-spaced taps
- Total delays from 25-1000 ns

MARKINGS AND DIMENSIONS, in (mm)

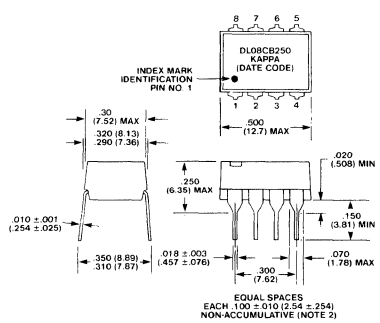


RECOMMENDED OPERATING CONDITIONS		MIN	TYP	MAX	UNIT
V_{CC}	Supply Voltage	4.75	5.00	5.25	V
V_{IH}	High-Level Input Voltage	2.0			V
V_{IL}	Low-Level Input Voltage			0.8	V
I_{IK}	Input Clamp Current			−18	mA
I_{OH}	High-Level Output Current			−1.0	mA
I_{OL}	Low-Level Output Current			20	mA
T_A	Operating Free-Air Temperature	0	+25	+70	°C

DC ELECTRICAL CHARACTERISTICS		TEST CONDITIONS				
V_{OH}	High-Level Output Voltage	V_{CC} = min, V_{IH} =min, I_{OH} = max	2.7	3.4		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min, V_{IL} = max, I_{OL} =max			0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min, I_I = I_{IK}			−1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max, V_{IN} = 2.7V			50	μA
		V_{CC} = max, V_{IN} = 5.25V			1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max, V_{IN} = 0.5V			−2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max, V_{OUT} = 0, one output at a time	−40		−100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max, V_{IN} = OPEN		30	45	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max, V_{IN} = 0		65	75	mA
N_H	Fanout High-Level Output	V_{CC} = max, V_{OH} = 2.7V			20	TTL load
N_L	Fanout Low-Level Output	V_{CC} = max, V_{OL} = 0.5V			10	TTL load

AC ELECTRICAL CHARACTERISTICS						
T_{PLH}	Low-to-High Level Delay Time	V_{CC} = typ, T_A = typ, E_{IN} = typ T_W = typ, d = typ(1)(2)(6)	−5		+5	%
T_{PCC}	V_{CC} Coefficient of Delay	V_{CC} = min-to-max, T_A = typ E_{IN} = typ, T_W = typ, d = typ(1)(2)(4)(6)		−.016		%/mV
T_{RO}	Output Risetime	V_{CC} = typ, T_A = typ, E_{IN} = typ T_W = typ, d = typ(5)(6)		3	4	ns

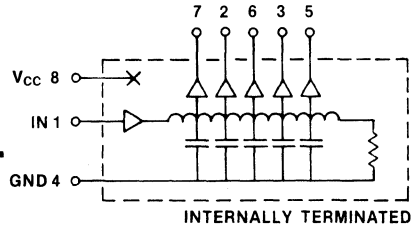
INPUT PULSE TEST CONDITIONS					
E_{IN}	Pulse Voltage	3.1	3.2	3.3	V
T_{RI}	Pulse Rise-Time			2.0	ns
T_W	Pulse Width, of Total Delay	40	100		%
d	Duty Cycle		25	50	%



PART NUMBER(7)	Total Delay (ns)(1) (2)	Tap Delay (ns)(1) (2)
DL08/DT08CB250	25	5
DL08/DT08CB500	50	10
DL08/DT08CB750	75	15
DL08/DT08CB101	100	20
DL08/DT08CB251	250	50
DL08/DT08CB501	500	100

Notes:

1. Delays measured at 1.5V level on leading edge only.
2. Delay tolerances: ± 5% or ± 2 ns, whichever is greater, referenced from input and guaranteed only under the following test conditions: V_{CC} = Typ, T_A = Typ, E_{IN} = Typ, T_{RI} = max, T_W = Typ, P_{RR} = 1mHz (or d/tw, whichever is less), RL = 1 megohm and CL = 2pf.
3. Temperature coefficient of delay will vary, depending upon total delay, according to the formula: T_{PTA} = (100 +(25,000/T_{PLH})).
4. Delay will vary about 4% for every 5% change in supply voltage.
5. Risetime measured from 0.75V to 2.4V level.
6. Measured with no loads on taps.
7. Other delays also available upon request.



INTERNALLY TERMINATED

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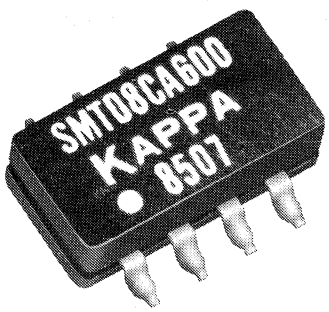
SERIES SMT08 TTL SCHOTTKY (8-PIN) 5-TAP

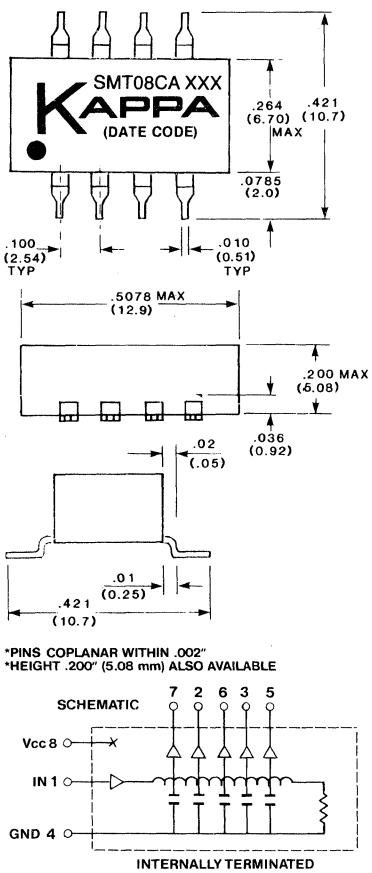
SURFACE MOUNTED DELAY LINE



FEATURES

- 8-pin leaded SMD package
- TTL Schottky Interfaced
- 5 equally-spaced taps
- Total Delays from 25-500 ns

MARKINGS AND DIMENSIONS, in (mm)



*PINS COPLANAR WITHIN .002"
*HEIGHT .200" (5.08 mm) ALSO AVAILABLE

RECOMMENDED OPERATING CONDITIONS

		MIN	TYP	MAX	UNIT
V_{CC}	Supply Voltage	4.75	5.00	5.25	V
V_{IH}	High-Level Input Voltage	2.0			V
V_{IL}	Low-Level Input Voltage			0.8	V
I_{IK}	Input Clamp Current			−18	mA
I_{OH}	High-Level Output Current			−1.0	mA
I_{OL}	Low-Level Output Current			20	mA
T_A	Operating Free-Air Temperature	0	+25	+70	°C

DC ELECTRICAL CHARACTERISTICS

		TEST CONDITIONS				
V_{OH}	High-Level Output Voltage	V_{CC} = min, V_{IH} =min, I_{OH} = max	2.7	3.4		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min, V_{IL} = max, I_{OL} =max			0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min, $I_I = I_{IK}$			−1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max, V_{IN} = 2.7V			50	μA
		V_{CC} = max, V_{IN} = 5.25V			1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max, V_{IN} = 0.5V			−2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max, V_{OUT} = 0, one output at a time	−40		−100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max, V_{IN} = OPEN		30	45	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max, V_{IN} = 0		65	75	mA
N_H	Fanout High-Level Output	V_{CC} = max, V_{OH} = 2.7V			20	TTL load
N_L	Fanout Low-Level Output	V_{CC} = max, V_{OL} = 0.5V			10	TTL load

AC ELECTRICAL CHARACTERISTICS

T_{PLH}	Low-to-High Level Delay Time	V_{CC} = typ, T_A = typ, E_{IN} = typ T_W = typ, d = typ(1)(2)(6)	−5		+5	%
T_{PCC}	V_{CC} Coefficient of Delay	V_{CC} = min-to-max, T_A = typ E_{IN} = typ, T_W = typ, d = typ(1)(2)(4)(6)		−.016		%/mV
T_{RO}	Output Risetime	V_{CC} = typ, T_A = typ, E_{IN} = typ T_W = typ, d = typ(5)(6)		3	4	ns

INPUT PULSE TEST CONDITIONS

E_{IN}	Pulse Voltage	3.1	3.2	3.3	V
T_{RI}	Pulse Rise-Time			2.0	ns
T_W	Pulse Width, of Total Delay	40	100		%
d	Duty Cycle		25	50	%

PART NUMBER(7)	Total Delay (ns)(1) (2)	Tap Delay (ns)(1) (2)
SMT08CA250	25	5
SMT08CA500	50	10
SMT08CA750	75	15
SMT08CA101	100	20
SMT08CA251	250	50
SMT08CA501	500	100

Notes:

1. Delays measured at 1.5V level on leading edge only.
2. Delay tolerance: ±5% or ±2 ns, whichever is greater, referenced from input.
3. Temperature coefficient of delay will vary, depending upon total delay, according to the formula: $T_{PTA} = (100 + (25{,}000/T_{PLH}))$.
4. Delay will inversely vary about 4% for every 5% change in supply voltage.
5. Risetime measured from 0.75V to 2.4V level.
6. Measured with no loads on taps.
7. Other delays also available upon request.

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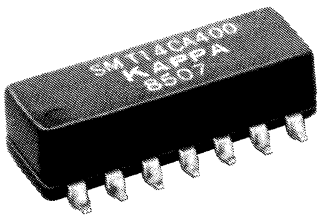
SERIES SMT14 TTL SCHOTTKY (14-PIN) 5-TAP

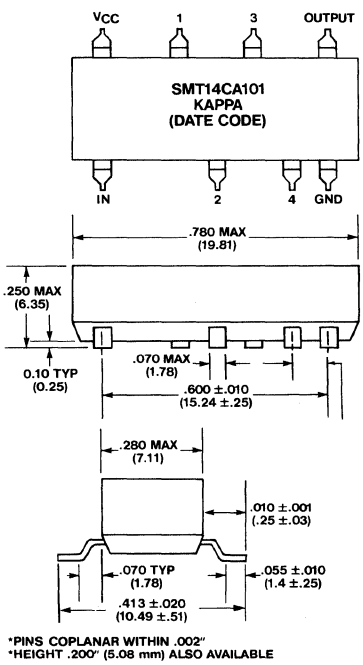
SURFACE MOUNTED DELAY LINE



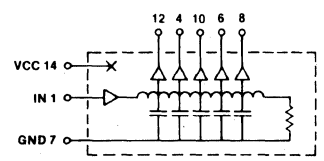
FEATURES

- 14-Pin Leadless SMD Package
- TTL Schottky interfaced
- 5 Equally-Spaced Taps
- Risetime: 4 ns max.

MARKINGS AND DIMENSIONS, in (mm)



*PINS COPLANAR WITHIN .002"
*HEIGHT .200" (5.08 mm) ALSO AVAILABLE



RECOMMENDED OPERATING CONDITIONS		MIN	TYP	MAX	UNIT
V_{CC}	Supply Voltage	4.75	5.00	5.25	V
V_{IH}	High-Level Input Voltage	2.0			V
V_{IL}	Low-Level Input Voltage			0.8	V
I_{IK}	Input Clamp Current			−18	mA
I_{OH}	High-Level Output Current			−1.0	mA
I_{OL}	Low-Level Output Current			20	mA
T_A	Operating Free-Air Temperature	0	+25	+70	°C

DC ELECTRICAL CHARACTERISTICS		TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{OH}	High-Level Output Voltage	V_{CC} = min, V_{IH} =min, I_{OH} = max	2.7	3.4		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min, V_{IL} = max, I_{OL} =max			0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min, I_I = I_{IK}			−1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max, V_{IN} = 2.7V			50	μA
		V_{CC} = max, V_{IN} = 5.25V			1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max, V_{IN} = 0.5V			−2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max, V_{OUT} = 0, one output at a time	−40		−100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max, V_{IN} = OPEN		30	45	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max, V_{IN} = 0		65	75	mA
N_H	Fanout High-Level Output	V_{CC} = max, V_{OH} = 2.7V			20	TTL load
N_L	Fanout Low-Level Output	V_{CC} = max, V_{OL} = 0.5V			10	TTL load

AC ELECTRICAL CHARACTERISTICS			MIN	TYP	MAX	UNIT
T_{PLH}	Low-to-High Level Delay Time	V_{CC} = typ, T_A = typ, E_{IN} = typ T_W = typ, d = typ(1)(2)(6)	−5		+5	%
T_{PCC}	V_{CC} Coefficient of Delay	V_{CC} = min-to-max, T_A = typ E_{IN} = typ, T_W = typ, d = typ(1)(2)(4)(6)		−.016		%/mV
T_{RO}	Output Risetime	V_{CC} = typ, T_A = typ, E_{IN} = typ T_W = typ, d = typ(5)(6)		3	4	ns

INPUT PULSE TEST CONDITIONS		MIN	TYP	MAX	UNIT
E_{IN}	Pulse Voltage	3.1	3.2	3.3	V
T_{RI}	Pulse Rise-Time			2.0	ns
T_W	Pulse Width, of Total Delay	40	100		%
d	Duty Cycle		25	50	%

PART NUMBER(7)	Total Delay (ns)(1) (2)	Tap Delay (ns)(1) (2)
SMT14CA250	25	5
SMT14CA500	50	10
SMT14CA600	60	12
SMT14CA750	75	15
SMT14CA101	100	20
SMT14CA151	150	30
SMT14CA201	200	40

Notes:

1. Delays measured at 1.5V level on leading edge only.
2. Delay tolerance: ±5% or ±2 ns, whichever is greater, referenced from input.
3. Temperature coefficient of delay will vary, depending upon total delay, according to the formula: $T_{PTA} = (100 + (25{,}000/T_{PLH}))$.
4. Delay will inversely vary about 4% for every 5% change in supply voltage.
5. Risetime measured from 0.75V to 2.4V level.
6. Measured with no loads on taps.
7. Other delays also available upon request.

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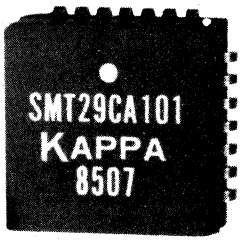
SERIES SMT28/29 TTL SCHOTTKY (28-PIN) 5-TAP/10-TAP

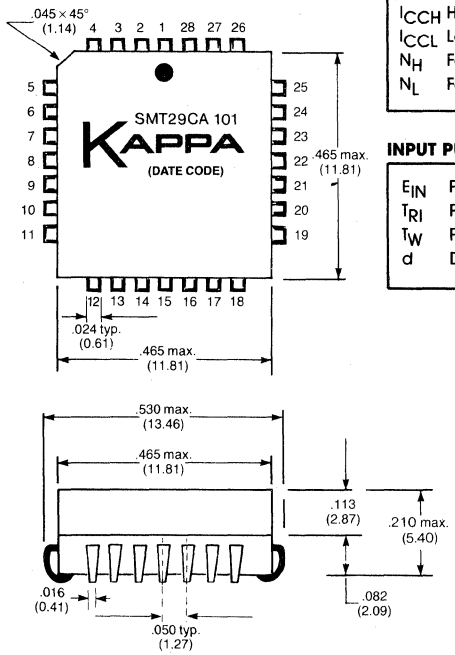
SURFACE MOUNTED DELAY LINE

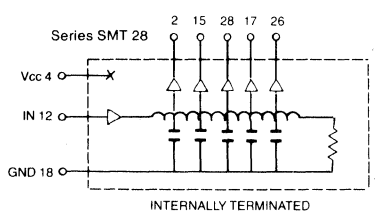


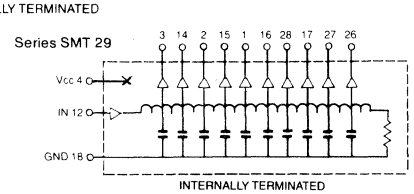
FEATURES

- 28-Pin Leaded SMD Package
- TTL Schottky interfaced
- 5/10 equally-spaced taps
- Delays from 25-200 ns

MARKINGS AND DIMENSIONS, in (mm)







RECOMMENDED OPERATING CONDITIONS

		MIN	TYP	MAX	UNIT
V_{CC}	Supply Voltage	4.75	5.00	5.25	V
V_{IH}	High-Level Input Voltage	2.0			V
V_{IL}	Low-Level Input Voltage			0.8	V
I_{IK}	Input Clamp Current			−18	mA
I_{OH}	High-Level Output Current			−1.0	mA
I_{OL}	Low-Level Output Current			20	mA
T_A	Operating Free-Air Temperature	0	+25	+70	°C

DC ELECTRICAL CHARACTERISTICS

		TEST CONDITIONS				
V_{OH}	High-Level Output Voltage	V_{CC} = min, V_{IH} =min, I_{OH} = max	2.7	3.4		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min, V_{IL} = max, I_{OL} =max			0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min, I_I = I_{IK}			−1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max, V_{IN} = 2.7V			50	μA
		V_{CC} = max, V_{IN} = 5.25V			1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max, V_{IN} = 0.5V			−2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max, V_{OUT} = 0, one output at a time	−40		−100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max, V_{IN} = OPEN		30/60	45/75	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max, V_{IN} = 0		65/120	75/150	mA
N_H	Fanout High-Level Output	V_{CC} = max, V_{OH} = 2.7V			20	TTL load
N_L	Fanout Low-Level Output	V_{CC} = max, V_{OL} = 0.5V			10	TTL load

INPUT PULSE TEST CONDITIONS

E_{IN}	Pulse Voltage	3.1	3.2	3.3	V
T_{RI}	Pulse Rise-Time			2.0	ns
T_W	Pulse Width, of Total Delay	40/20	100		%
d	Duty Cycle		25	50	%

PART NUMBER	Total Delay (ns) ±5% (1-4) (6) (8)	Tap Delay (ns) ±5% (1-4) (6) (8)	Max Output Risetime (ns) (5) (6)
SMT28CA250	25	5	3.0
SMT28CA500	50	10	3.5
SMT28CA600	60	12	3.6
SMT28CA750	75	15	3.8
SMT28CA101	100	20	4.0
SMT28CA151	150	30	4.0
SMT28CA201	200	40	4.0
SMT29CA500	50	5	3.5
SMT29CA101	100	10	4.0
SMT29CA151	150	15	4.0
SMT29CA201	200	20	4.0

Notes:

1. Delays measured at 1.5V level on leading edge only, V_{CC} = Typ, T_A = Typ, E_{IN} = Typ, T_W = Typ, d = Typ.
2. Delay tolerance: ±5% or ±2 ns, WIG, referenced from input.
3. Temperature coefficient of delay will vary, depending upon total delay, according to the formula: $T_{PTA} = (100 + (25{,}000/T_{PLH}))$.
4. Delay will inversely vary about 4% for every 5% change in supply voltage.
5. Risetime measured from 0.75V to 2.4V level, V_{CC} = Typ, T_A = Typ, E_{IN} = Typ, T_W = Typ, d = Typ.
6. Measured with no loads on taps.
7. Other delays also available upon request.

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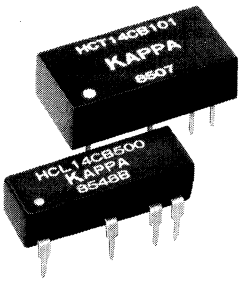
SERIES HCL14/HCT14 (14-PIN) 5-TAP

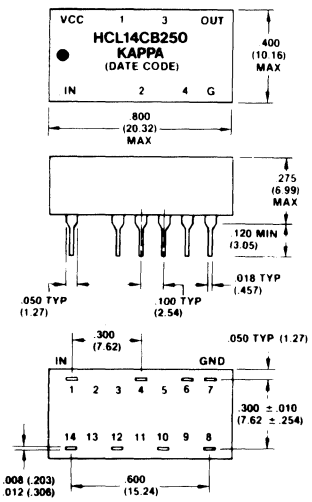
HCMOS DELAY LINES



FEATURES

- HCMOS logic interfaced
- Delays from 50 to 500 ns
- 5 equally-spaced taps
- Available in auto-insertable (HCL14) and standard (HCT14) packages
- Drives up to 10 LS TTL loads
- Compatible with standard LS TTL family

MARKINGS AND DIMENSIONS, in (mm)



RECOMMENDED OPERATING CONDITIONS

PARAMETER		TEST CONDITIONS	V_{CC}	MIN	TYP	MAX	UNIT
V_{CC}	Supply Voltage			4	5	6	V
V_{IH}	High-Level Input Voltage		4V	1.5			V
			5V	3.15			
			6V	4.2			
V_{IL}	Low-Level Input Voltage		4V	0		0.3	
			5V	0		0.9	V
			6V	0		1.2	
V_I	Input Voltage			0		V_{CC}	V
V_O	Output Voltage			0		V_{CC}	V
I_{IK}	Input Diode Current	$V_I<0$ or $V_I>V_{CC}$				±20	mA
I_{OK}	Output Diode Current	$V_O<0$ or $V_O>V_{CC}$				±20	mA
I_O	Continuous Output Current	$V_O = 0$ to V_{CC}				±25	mA
T_A	Operating Free-Air Temperature			−40	+25	+85	°C

DC ELECTRICAL CHARACTERISTICS

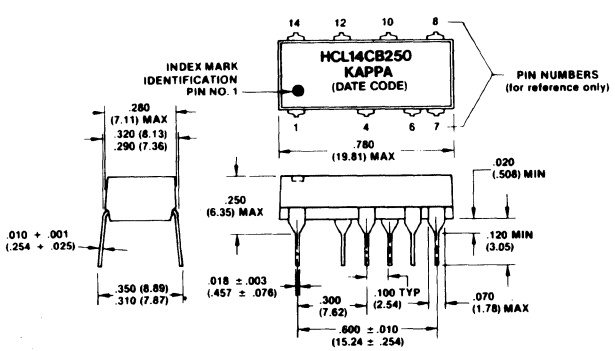
V_{OH}	High-Level Output Voltage	$V_I = V_{IH}$ or V_{IL}, $I_{OH} = -20\mu A$	4V	1.9			
			5V	4.4			
			6V	5.9			
		$V_I = V_{IH}$ or V_{IL}, $I_{OH} = 4mA$	5V	3.84			V
		$V_I = V_{IH}$ or V_{IL}, $I_{OH} = 5.2mA$	6V	5.34			
I_{OH}	High-Level Output Current	$V_I = V_{IH}$ or V_{IL}, $V_O = V_{CC}$	6V			5	μA
V_{OL}	Low-Level Output Voltage	$V_I = V_{IH}$ or V_{IL}, $I_{OL} = 20\mu A$	4V			0.1	
			5V			0.1	
			6V			0.1	
		$V_I = V_{IH}$ or V_{IL}, $I_{OL} = 4mA$	5V			0.4	V
		$V_I = V_{IH}$ or V_{IL}, $I_{OL} = 5.2mA$	6V			0.4	
I_I	Input Current	$V_I = 0$ to V_{CC}	6V			±1.0	μA
I_{CC}	Supply Current	$V_I = V_{CC}$ or 0, $I_O = 0$	6V		5	10	mA
N	Fanout	$V_O = V_{OL}$ to V_{OH}, V_{CC} = min-to-max				10	LS TTL Loads

INPUT PULSE TEST CONDITIONS

E_{IN}	Pulse Voltage		3.1	3.2	3.3	V
T_{RI}	Pulse Risetime				2.0	ns
T_W	Pulse Width, in % of Total Delay Time		100			%
d	Duty Cycle			33.3	50	%

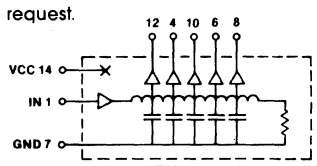
AC ELECTRICAL CHARACTERISTICS

T_{PLH}	Low-to-High Level Delay Time	$V_{CC} = T_{YP}$, $T_A = T_{YP}$, $E_{IN} = T_{YP}$, T_W = min, d = T_{YP}(1) (2) (4)		−5		+5	%
T_{RO}	Output Risetime	$V_{CC} = T_{YP}$, $T_A = T_{YP}$, $E_{IN} = T_{YP}$, T_W = min, d = T_{YP} (3) (4)			8		ns



Notes:

1. Delays measured at 1.5V level on leading edge only.
2. Delay tolerances: ±5% or ±2 ns, whichever is greater, referenced from input.
3. Risetime measured from 0.75V to 2.4V level.
4. Measured with no load on delay taps.
5. Other delays available upon request.



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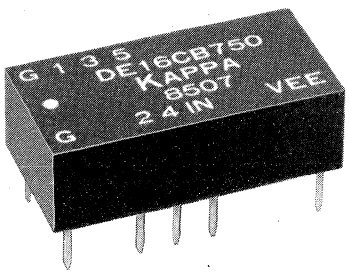
SERIES DE16CB (16-PIN) 5-TAP

ECL 10K DIGITAL DELAY LINE



RECOMMENDED OPERATING CONDITIONS

		MIN	TYP	MAX	UNIT
V_{EE}	Supply Voltage	−5.72	−5.20	−4.68	Vdc
V_{IH}	High-Level Input Voltage	−1.105		−0.810	Vdc
V_{IL}	Low-Level Input Voltage	−1.850		−1.475	Vdc
T_A	Operating Temperature (with 500 LFPM air flow)	−30	+25	+85	°C

DC ELECTRICAL CHARACTERISTICS(1) **TEST CONDITIONS**

I_E	Supply Current				75	mAdc
I_{IH}	High-Level Input Current	$V_{IH} = -0.810V$			425	μAdc
I_{IL}	Low-Level Input Current	$V_{IL} = -1.850V$	0.5			μAdc
V_{OH}	High-Level Output Voltage	$V_{IH} = -0.810V$	-1.060		-0.700	Vdc
V_{OL}	Low-Level Output Voltage	$V_{IL} = -1.850V$	-1.890		-1.615	Vdc
N	Fanout				85	ECL loads

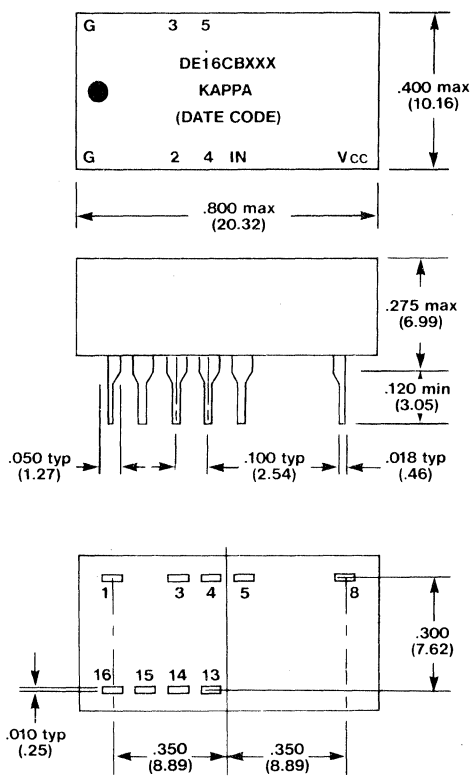
INPUT PULSE TEST CONDITIONS

E_{IN}	Pulse Amplitude (See Notes)		0.98		V
T_{RI}	Pulse Risetime			2.0	ns
T_{FI}	Pulse Falltime			2.0	ns
T_W	Pulse Width, % of Total Delay	100			%
d	Duty Cycle			60	%

FEATURES

- ECL 10K interfaced
- Delays from 10 ns to 500 ns
- 5 equally spaced delay taps
- Standard 16-pin package
- Power dissipation: 200 mW_{typ} (no load)

MARKINGS AND DIMENSIONS, in (mm)

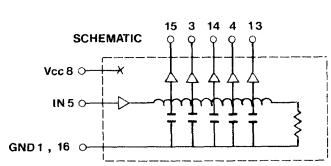


AC ELECTRICAL CHARACTERISTICS

PART NUMBER	Total Delay (ns)(2)(3)(5)	Tap Delay (ns)(2)(3)(5)	Max Output Risetime (ns)(4)(5)	Max Output Falltime (ns)(4)(5)
DE16CB100	10	2.0	4.0	4.0
DE16CB200	20	4.0	4.0	4.0
DE16CB250	25	5.0	4.0	4.0
DE16CB500	50	10.0	4.0	4.0
DE16CB750	75	15.0	5.0	5.0
DE16CB101	100	20.0	6.0	6.0
DE16CB151	150	30.0	7.0	7.0
DE16CB201	200	40.0	8.0	8.0
DE16CB251	250	50.0	10.0	10.0
DE16CB301	300	60.0	15.0	15.0
DE16CB401	400	80.0	15.0	15.0
DE16CB501	500	100.0	20.0	20.0

Notes:

1. All DC electricals are specified over the operating temperature range at $V_{EE} = -5.2V \pm 0.01V$
2. Delays measured at −1.3V level on leading edge only, $V_{IH} = -0.810V$, $V_{IL} = -1.790V$, $V_{EE} = -5.2V$, $V_{CC} = GND$, $T_A = +25°C$.
3. Delay tolerance: ±5% or ±1.0 ns, whichever is greater, referenced to input.
4. Risetime measured from 20% to 80%, and Falltime measured from 80% to 20%, $V_{EE} = -5.2V$, $V_{CC} = GND$, $T_A = +25°C$.
5. Output terminals terminated with 100 Ω to −2.0 Volts.



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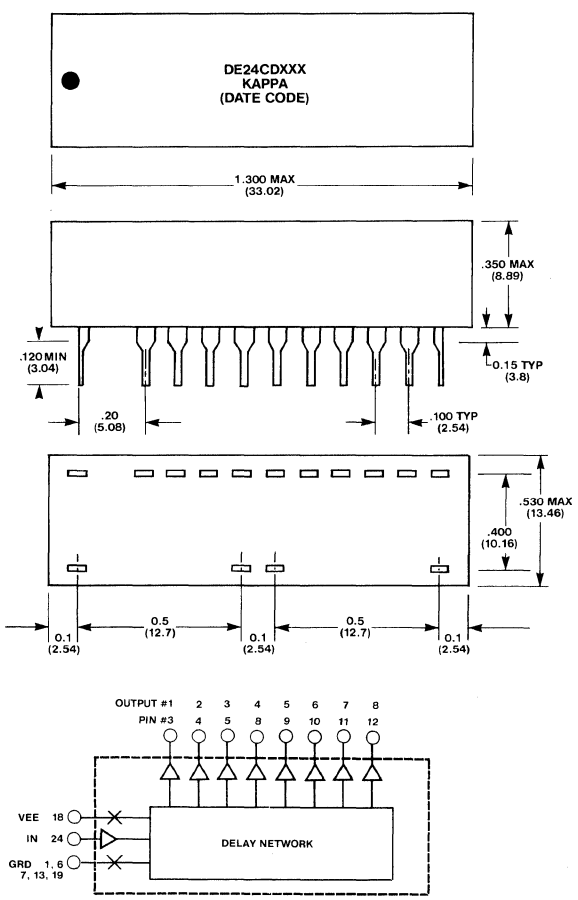
SERIES DE24 (24-PIN) 8-TAP

ECL 100K DELAY LINE

FEATURES

- ECL 100K Input and Output
- 24-Pin Package
- 8 Equally-Spaced Taps
- 70 ECL Fan Out Capability
- Operating temperature range: 0°C to +85°C

MARKINGS AND DIMENSIONS, in (mm)



RECOMMENDED OPERATING CONDITIONS

		MIN	TYP	MAX	UNIT
V_{EE}	Supply Voltage		−4.5		V
V_{CC}	Ground		0		V
T_A	Operating Free-Air Temperature	0	+25	+85	C
V_{IH}	High-Level Input Voltage	−1.16			V
V_{IL}	Low Level Input Voltage			−1.63	V

DC ELECTRICAL CHARACTERISTICS **TEST CONDITIONS**

			MIN	TYP	MAX	UNIT
V_{OH}	High-Level Output Voltage	$V_{IN} = V_{IH}$ (MAX)	−1.02			V
V_{OL}	Low-Level Output Voltage	$V_{IN} = V_{IL}$ (MIN)			−1.62	V
I_{IH}	High-Level Input Current	$V_{IN} = V_{IH}$ (MAX)			18	mA
I_{IL}	Low-Level Input Current	$V_{IN} = V_{IL}$ (MIN)	0.5			μA
I_{EE}	Supply Current	V_{IN} = Open		100		mA

INPUT PULSE TEST CONDITIONS

		MIN	TYP	MAX	UNIT
E_{IN}	Pulse Voltage (0.9V to 1.7V)		0.8		V
T_{RI}	Pulse Risetime		1		ns
T_W	Pulse Width of Total Delay	100	300		%
d	Duty Cycle			50	%

PART NUMBER	Total Delay (ns)	Tap Delay ± (ns)
DE24CD080	8	1 ± 0.5
DE24CD160	16	2
DE24CD240	24	3
DE24CD320	32	4
DE24CD400	40	5
DE24CD480	48	6
DE24CD560	56	7
DE24CD640	64	8
DE24CD720	72	9
DE24CD800	80	10
DE24CD161	160	20
DE24CD201	200	25

Notes:

1. Delays measured at −1.3V level on leading edge only.
2. Risetime measured from 20% to 80% of waveform.
3. Tap tolerances: ±5% or ±1 ns, whichever is greater.
4. Tap delays referenced from input.
5. Other delays are also available.
6. Output load with a 50 ohms pulldown resistor to −2.0V.

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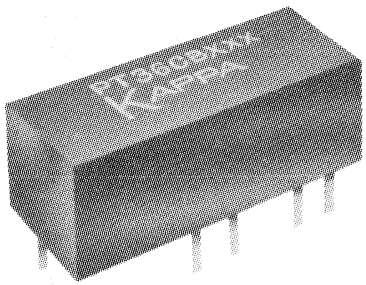
SERIES PT36 TTL SCHOTTKY (16-PIN)

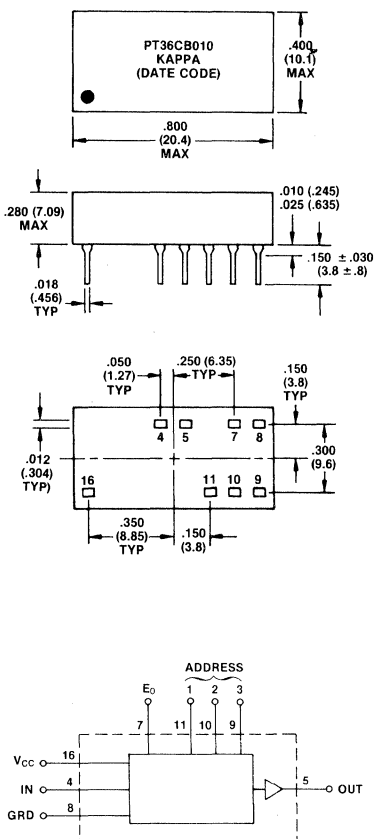
3-BIT PROGRAMMABLE DELAY LINE



FEATURES

- Inherent Delay: 7 ns ±1 ns
- 16-Pin DIL package
- Total Delay Tolerance: ±5% or ±1 ns, WIG
- TTL Schottky Interfaced

MARKINGS AND DIMENSIONS, in (mm)



RECOMMENDED OPERATING CONDITIONS		MIN	TYP	MAX	UNIT
V_{CC}	Supply Voltage	4.75	5.00	5.25	V
V_{IH}	High-Level Input Voltage	2.0			V
V_{IL}	Low-Level Input Voltage			0.8	V
I_{IK}	Input Clamp Current			−18	mA
I_{OH}	High-Level Output Current			−1.0	mA
I_{OL}	Low-Level Output Current			20	mA
T_A	Operating Free-Air Temperature	0	+25	+70	°C

DC ELECTRICAL CHARACTERISTICS		TEST CONDITIONS				
V_{OH}	High-Level Output Voltage	V_{CC} = min, V_{IL} = max, I_{OH} = max	2.7	3.4		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min, V_{IH} =min, I_{OL} =max			0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min, I_I = I_{IK}			−1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max, V_{IN} = 2.7V			50	μA
		V_{CC} = max, V_{IN} = 5.25V			1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max, V_{IN} = 0.5V			−2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max, V_{OUT} = 0, one output at a time	−40		−100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max, V_{IN} = OPEN			90	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max, V_{IN} = 0			115	mA
N_H	Fanout High-Level Output	V_{CC} = max, V_{OH} = 2.7V			20	TTL load
N_L	Fanout Low-Level Output	V_{CC} = max, V_{OL} = 0.5V			10	TTL load

INPUT PULSE TEST CONDITIONS					
E_{IN}	Pulse Voltage	3.1	3.2	3.3	V
T_{RI}	Pulse Rise-Time			2.0	ns
T_W	Pulse Width, of Total Delay	50	100		%
d	Duty Cycle		25	50	%

FUNCTION TABLE

Enable	Address (Bit No.) 3	2	1	Delay Out
L	L	L	L	T_0
L	L	L	H	T_1
L	L	H	L	T_2
L	L	H	H	T_3
L	H	L	L	T_4
L	H	L	H	T_5
L	H	H	L	T_6
L	H	H	H	T_7
H	X	X	X	L

H = High
L = Low
X = Don't care
T_0 = Reference or Inherent delay of circuit.
T_1 to T_7 = Multiplier of incremental delay.

Part[2] Number	Incremental Delay Per Step[3]	Total Delay[1] Change
PT36CB010	1 ns ± .4 ns	7 ns
PT36CB020	2 ns ± .4 ns	14 ns
PT36CB030	3 ns ± .5 ns	21 ns
PT36CB050	5 ns ± .6 ns	35 ns
PT36CB100	10 ns ±1.0 ns	70 ns
PT36CB150	15 ns ±1.3 ns	105 ns
PT36CB200	20 ns ±1.5 ns	140 ns
PT36CB400	40 ns ±2.0 ns	280 ns
PT36CB500	50 ns ±2.5 ns	350 ns

1. This delay value does not include the T_0 delay.
2. Other delay increments available on request.
3. V_{CC} = T_{YP}, E_{IN} = T_{YP}, T_{RI} = Max, T_W = T_{YP}, d = T_{YP}, T_A = T_{YP}

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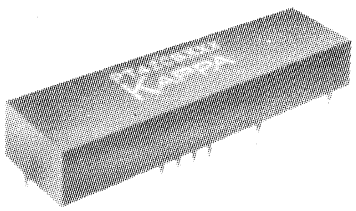
SERIES PT42 TTL SCHOTTKY (32-PIN)

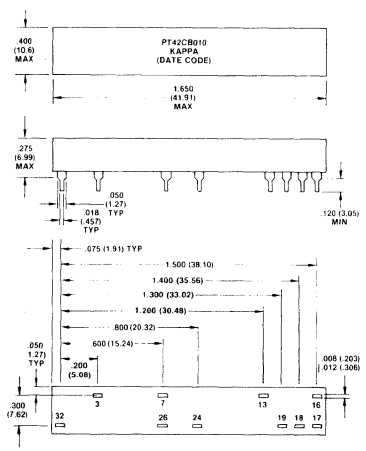
4-BIT PROGRAMMABLE DELAY LINE

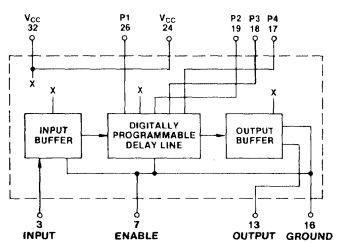


FEATURES

- Inherent Delay: 15 ns ±1 ns
- Input signal requirements: TTL logic
- Output fan-out: TTL Schottky load
- Total Delay Tolerance: ±5% or ±1 ns, WIG

MARKINGS AND DIMENSIONS, in (mm)





RECOMMENDED OPERATING CONDITIONS		MIN	TYP	MAX	UNIT
V_{CC}	Supply Voltage	4.75	5.00	5.25	V
V_{IH}	High-Level Input Voltage	2.0			V
V_{IL}	Low-Level Input Voltage			0.8	V
I_{IK}	Input Clamp Current			−18	mA
I_{OH}	High-Level Output Current			−1.0	mA
I_{OL}	Low-Level Output Current			20	mA
T_A	Operating Free-Air Temperature	0	+25	+70	°C

DC ELECTRICAL CHARACTERISTICS		TEST CONDITIONS				
V_{OH}	High-Level Output Voltage	V_{CC} = min, V_{IL} = max, I_{OH} = max	2.7	3.4		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min, V_{IH} =min, I_{OL} =max			0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min, I_I = I_{IK}			−1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max, V_{IN} = 2.7V			50	μA
		V_{CC} = max, V_{IN} = 5.25V			1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max, V_{IN} = 0.5V			−2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max, V_{OUT} = 0, one output at a time	−40		−100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max, V_{IN} = OPEN			90	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max, V_{IN} = 0			115	mA
N_H	Fanout High-Level Output	V_{CC} = max, V_{OH} = 2.7V			20	TTL load
N_L	Fanout Low-Level Output	V_{CC} = max, V_{OL} = 0.5V			10	TTL load

INPUT PULSE TEST CONDITIONS					
E_{IN}	Pulse Voltage	3.1	3.2	3.3	V
T_{RI}	Pulse Rise-Time			2.0	ns
T_W	Pulse Width, of Total Delay	50	100		%
d	Duty Cycle		25	50	%

FUNCTION TABLE

Enable	Address (Bit No.) 4	3	2	1	Delay Out
L	L	L	L	L	T_0
L	L	L	L	H	T_1
L	L	L	H	L	T_2
L	L	L	H	H	T_3
L	L	H	L	L	T_4
L	L	H	L	H	T_5
L	L	H	H	L	T_6
L	L	H	H	H	T_7
L	H	L	L	L	T_8
L	H	L	L	H	T_9
L	H	L	H	L	T_{10}
L	H	L	H	H	T_{11}
L	H	H	L	L	T_{12}
L	H	H	L	H	T_{13}
L	H	H	H	L	T_{14}
L	H	H	H	H	T_{15}
H	X	X	X	X	L

L = Logic 0
H = Logic 1
X = Don't care
T_0 = Reference or Inherent delay of circuit.
T_1 to T_{15} = Multiplier of incremental delay.

Part (2) Number	Incremental Delay Per Step (3)	Total Delay (1) Change
PT42CB010	1 ns	15 ns
PT42CB020	2 ns	30 ns
PT42CB030	3 ns	45 ns
PT42CB040	4 ns	60 ns
PT42CB050	5 ns	75 ns
PT42CB060	6 ns	90 ns
PT42CB080	8 ns	120 ns
PT42CB100	10 ns	150 ns
PT42CB120	12 ns	180 ns
PT42CB150	15 ns	225 ns
PT42CB200	20 ns	300 ns
PT42CB250	25 ns	375 ns
PT42CB300	30 ns	450 ns
PT42CB350	35 ns	525 ns
PT42CB400	40 ns	600 ns
PT42CB450	45 ns	675 ns
PT42CB500	50 ns	750 ns
PT42CB600	60 ns	900 ns
PT42CB800	80 ns	1,200 ns
PT42CB101	100 ns	1,500 ns

1. This delay value does not include the T_0 delay.
2. Other delay increments available on request.
3. V_{CC} = Typ, E_{IN} = Typ, T_{RI} = Max, T_W = Typ, d = Typ, T_A = Typ

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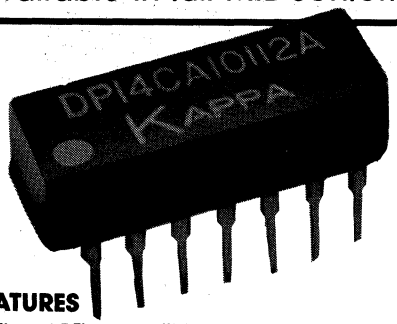
SERIES DP14C/DP16C ANALOG 10-TAP

14-PIN & 16-PIN DIP DELAY LINES

(available in full-MIL conformance as Series DP14M/DP16M)



FEATURES

- TTL and DTL compatible
- Meets applicable requirements of MIL-D-23859
- 5/1 Delay-to-Risetime Ratio
- 10 Equally-Spaced Taps
- Wide Operating Temperature Range
- Low cost

ELECTRICAL SPECIFICATIONS

Total Delay: 10 to 1000 ns
Tap Delays: 10% increments standard (other increments available upon request)
Risetime: 20% maximum of total delay (see Table 1)
Characteristic Impedance: 50 to 500 ohms (±10%)
Attenuation: 2dB max (see Table 1)
Distortion: ±10% max
Temperature Coefficient of Delay: 100ppm/°C max
Operating Temperature Range: −55°C to +125°C
Storage Temperature Range: −65°C to +130°C
Insulation Resistance: 1000 megohms min @ 50VDC @ 25°C
Dielectric Strength: 50VDC

MECHANICAL SPECIFICATIONS

Case Configuration: See FIGURE 2
Case Material: Molded Epoxy
Terminals: Flat, DIP-type (See FIGURE 2)
Terminal Material: Kovar or equivalent, tin-plated
Pin Connections: See TABLE II and III
Potting: 100% filled with a two-component epoxy
Marking: Includes manufacturer's name, part number and date code (See FIGURE 2)

PART NUMBER EXAMPLE

Typical part number is a combination of the Basic Series Number, Mounting Height Code, Delay Time, Impedance, and Pin Sequence Code.

EXAMPLE: DP14CA10112A

(100 ns, 100 ohm, 0.200" (5.08 mm) Max. Height, using the code "A" Pin Sequence)

DP14(16)C A 101 12 A

DP14C is 14-Pin DIP
DP16C is 16-Pin DIP

MOUNTING HEIGHT CODE (See Table IV)

DELAY TIME: Expressed in nanoseconds (ns). First two digits are significant figures. Last digit specifies number of zeros to follow.

IMPEDANCE: Expressed in ohms (Ω). First digit is significant. Last digit specifies number of zeros to follow.

PIN SEQUENCE CODE (See Table II and III). "STANDARD" Pin Sequence if omitted.

TABLE I

Td (ns)(1) (±5%)	Td/tap (ns)(2)(3) (±10%)	Tr (ns) MAX	ATTENUATION (%) TYPICAL PER IMPEDANCE (Ω)				
			50	100	200	300	500
10	1	3		5			
20	2	5.5	3	5	5		
30	3	6.5	3	5	5		
40	4	8	3	5	5	5	
50	5	10	3	5	5	5	7
60	6	12	3	5	5	5	7
75	7½	15	3	5	5	5	7
100	10	20	3	5	5	7	7
120	12	24	3	5	6	7	8
150	15	30	3	5	6	7	8
180	18	36	4	5	6	7	8
200	20	40	4	5	6	7	8
220	22	44	4	5	6	7	8
250	25	50	4	5	6	7	8
300	30	60		5	8	10	10
375	37½	75		7	8	10	10
500	50	100		8	10	12	12
600	60	120				15	15
750	75	150				15	20
1000	100	200					20

(1) Or ±2 ns, whichever is greater. (2) Or ±1 ns, whichever is greater. (3) For 10-tap lines only.

TABLE II. PIN-NUMBER SEQUENCE (FOR DP14C ONLY)*

CODE	IN	10%	20%	30%	40%	50%	60%	70%	80%	90%	OUT	GND
Standard	14	2	12	3	11	4	5	10	6	9	7	1, 8
A	1	2	13	3	12	4	10	5	9	6	7	14
B	2	3	4	5	6	7	9	10	11	12	13	1, 14
C	7	9	6	10	5	11	12	3	13	2	14	1, 8
D	1	13	2	12	3	11	4	10	5	9	6	7, 8, 14
E	2	3	4	5	6	7, 8	9	10	11	12	13	1, 14
F	1	13	2	12	3	11	4	10	5	9	6	7
G	2	13	3	12	4	11	5	10	6	9	7	8, 14
H	2	3	4	5	6	7	9	10	11	12	13	1
I	1	13	2	12	3	11	5	10	6	9	7	8, 14
J	1	2	13	3	12	4	10	5	9	6	7	8, 14
U	2	3	4	5	6	8	9	10	11	12	13	1, 7
V	2	3	4	5	6	8	9	10	11	12	13	1
W	1	13	2	12	3	11	4	10	5	9	6	7, 14

*Other pin sequences available upon request.

TABLE III. PIN-NUMBER SEQUENCE (FOR DP16C ONLY)*

CODE	IN	10%	20%	30%	40%	50%	60%	70%	80%	90%	OUT	GND
A	15	2	14	3	13	4	5	11	6	10	7	1, 9
B	1	15	2	14	3	13	4	12	5	11	6	8
C	1	15	3	14	4	13	5	12	6	11	8	9, 16

*Other pin sequences available upon request.

TABLE IV
MOUNTING HEIGHT

CODE	DIMENSION (MAX)
A	.200 (5.08)
B	.250 (6.35)
C	.300 (7.62)

FIGURE 1 — SCHEMATIC

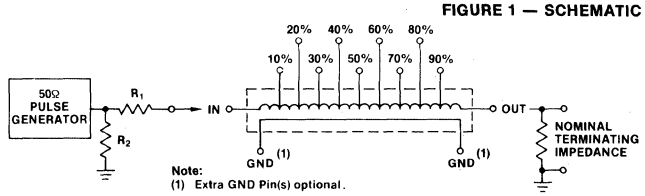
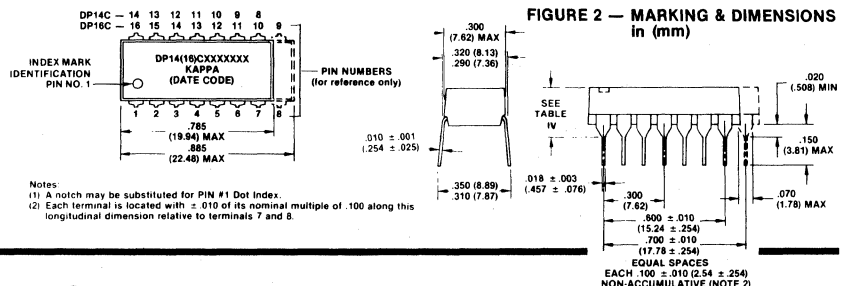


FIGURE 2 — MARKING & DIMENSIONS in (mm)



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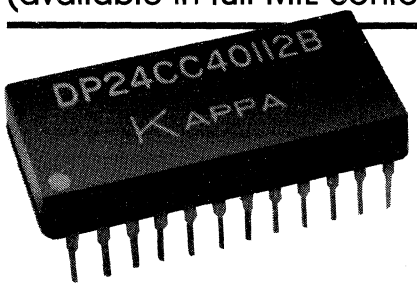
West Coast Office: 13455 Ventura Blvd. #220, Sherman Oaks, CA 91423, (818) 995-2401. West Coast Distributor: Phone (213) 283-2058.

SERIES DP24C ANALOG 20-TAP

24-PIN DIP DELAY LINE

(available in full-MIL conformance as Series DP24M)



ELECTRICAL SPECIFICATIONS

Total Delay: 20 to 2000 ns
Tap Delays: 5% increments standard
(other increments available upon request)
Risetime: 10% maximum of total delay (see Table 1)
Characteristic Impedance: 50 to 200 ohms (±10%)
Attenuation: 2dB max (see Table 1)
Distortion: ±10% max
Temperature Coefficient of Delay: 100ppm/°C max
Operating Temperature Range: −55°C to +125°C
Storage Temperature Range: −65°C to +130°C
Insulation Resistance: 1000 megohms min @ 50VDC @ 25°C
Dielectric Strength: 50VDC

MECHANICAL SPECIFICATIONS

Case Configuration: See FIGURE 2
Case Material: Molded Epoxy
Terminals: Flat, DIP-type (See FIGURE 2)
Terminal Material: Kovar or equivalent, tin-plated
Pin Connections: See TABLE II
Potting: 100% filled with a two-component epoxy
Marking: Includes manufacturer's name, part number and date code (See FIGURE 2)

TABLE I

PART NUMBER	TD (ns)(1) (±5%)	Td/tap (ns)(2) (±10%)	Tr (ns) (Max)	Zo (ohms) (±10%)
20051	20	1	3	
40051	40	2	4	
60051	60	3	6	50
80051	80	4	8	
10151	100	5	10	
20151	200	10	20	
20012	20	1	3	
40012	40	2	4	
60012	60	3	6	
80012	80	4	8	
10112	100	5	10	
20112	200	10	20	
30112	300	15	30	
40112	400	20	40	100
50112	500	25	50	
60112	600	30	60	
80112	800	40	80	
10212	1000	50	100	
12212	1200	60	120	
15212	1500	75	150	
40022	40	2	4	
60022	60	3	6	
80022	80	4	8	
10122	100	5	10	
20122	200	10	20	
30122	300	15	30	
40122	400	20	40	200
50122	500	25	50	
60122	600	30	60	
80122	800	40	80	
10222	1000	50	100	
12222	1200	60	120	
15222	1500	75	150	
20222	2000	100	200	

*Notes: (1)Or ±2 ns, whichever is greater. (2)Or ±1 ns, whichever is greater.

TABLE II. PIN-NUMBER SEQUENCE*

CODE	TAP #	IN	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	OUT	GND
A		2	3	4	5	6	7	8	9	10	11	12	14	15	16	17	18	19	20	21	22	23	1, 24
B		2	3	4	5	6	7	8	9	10	11	13	14	15	16	17	18	19	20	21	22	23	12
C		1	2	3	4	5	6	7	8	9	10	11	14	15	16	17	18	19	20	21	22	23	12, 24

*Other pin sequences available upon request.

FIGURE 1 — SCHEMATIC

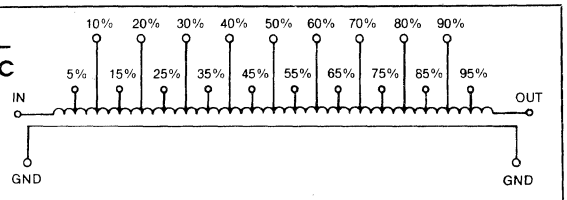
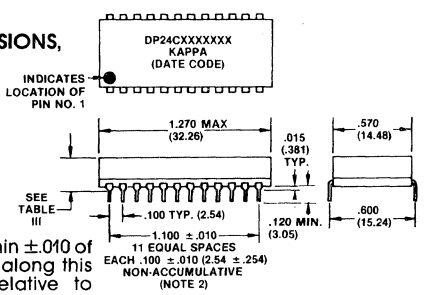


FIGURE 2 — MARKINGS AND DIMENSIONS, in (mm)



Notes:

1. A notch may be substituted for PIN #1 Dot index.
2. Each terminal is located within ±.010 of its nominal multiple of .100 along this longitudinal dimension relative to terminals 12 and 13.

TABLE III. MOUNTING HEIGHT

CODE	DIMENSION (MAX)
B	.250 (6.35)
C	.300 (7.62)

HOW TO ORDER

1. Select MOUNTING HEIGHT CODE from Table III.
2. Select PART NUMBER CODE from Table I.
3. Select PIN-NUMBER SEQUENCE CODE from Table II.
4. Construct the MODEL NUMBER. (See example below.)

This example, Model DP24CB-40112B, identifies a 400 ns, 100-ohm line with 0.300" mounting height and the "B" pin-number sequence.

DP24C	C	40112	B
BASIC SERIES NUMBER	MOUNTING HEIGHT CODE (Table III)	PART NUMBER (Table I)	PIN-NUMBER SEQUENCE (Table II)

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SERIES SP07 COMPUTER GRADE
7-PIN SIP DELAY LINE

FEATURES

- 7-Pin SIP Package
- Five (5) Equally-Spaced Delay Taps
- Operating Temperature Range: 0°C to +70°C
- Low Output Distortion — ±10% Max.
- 5 ns to 100 ns Delay Range (other values available upon request)

ELECTRICAL SPECIFICATIONS

Total Delay: 5 to 100 ns
Tap Delays: 20% Increments
Risetime: See Table 1
Characteristic Impedance: 50 to 100 ohms (±10%)
Attenuation: 5% maximum
Distortion: ± 10% maximum
Temperature Coefficient of Delay: 100ppm/°C max.

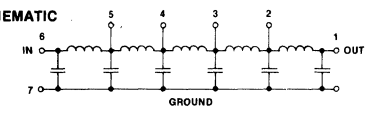
MECHANICAL SPECIFICATIONS

Case Configuration: See Dimension Drawing
Case Material: Molded Epoxy
Terminals: Flat, DIP-type (See Dimension Drawing)
Terminal Material: Kovar or equivalent, tin-plated
Potting: 100% filled with a two-component epoxy
Marking: Includes manufacturer's name, part number, and date code (See Dimension Drawing)

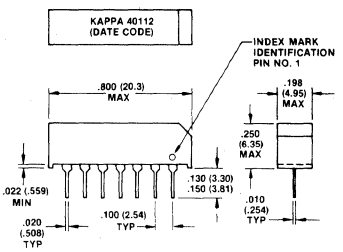
TABLE I

TOTAL DELAY (ns) ±5%	TAP DELAY (ns) ±10%	RISETIME (ns) MAX	DC RESISTANCE (Ω) MAX. PER IMPEDANCE (Ω)	
			50	100
5 ±0.5	1 ±0.3	2.0	0.3	0.5
10 ±1.0	2 ±0.4	3.3	0.5	1.0
20 ±1.5	4 ±0.6	6.0	0.8	1.5
30 ±2.0	6 ±1.0	9.0	1.2	2.5
40 ±2.5	8 ±1.5	12.0	1.8	4.0
50 ±3.0	10 ±1.8	15.0	2.3	5.0
60 ±3.5	12 ±2.0	18.0	2.5	
70 ±4.0	14 ±2.0	22.0	3.5	
80 ±4.5	16 ±2.0	24.0	4.2	
90 ±5.0	18 ±3.0	27.0	4.5	
100 ±5.0	20 ±3.0	28.0	5.2	

SCHEMATIC



MARKING & DIMENSIONS in inches and (mm)



PART NUMBER EXAMPLE

Typical part number is a combination of the Basic Series Number, Mounting Height Code, Delay Time, and Impedance

EXAMPLE: SP07CB10051

SP07C B 100 51

BASIC SERIES NUMBER

MOUNTING HEIGHT CODE

DELAY TIME: Expressed in nanoseconds (ns)
First two digits are significant figures.
Last digit specifies number of zeros to follow

IMPEDANCE: Expressed in ohms (Ω).
First digit is significant
Last digit specifies number of zeros to follow.

SERIES SP14 COMPUTER GRADE
14-PIN SIP DELAY LINE

FEATURES

- 14-Pin SIP Package
- Ten (10) Equally-Spaced Delay Taps
- Low Attenuation — 5% Maximum
- Optional Internal Termination

ELECTRICAL SPECIFICATIONS

Total Delay: 10 to 200 ns
Tap Delays: 10% increments
Risetime: 20% maximum of total delay (see Table II)
Characteristic Impedance: 50 to 100 ohms (±10%)
Distortion: 10% maximum
Temperature Coefficient of Delay: 100ppm/°C max.
Operating Temperature Range: 0°C to +70°C
Storage Temperature Range: −55°C to +125°C

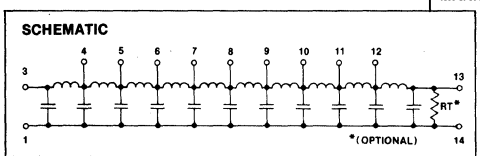
MECHANICAL SPECIFICATIONS

Same as Series SP07 above.

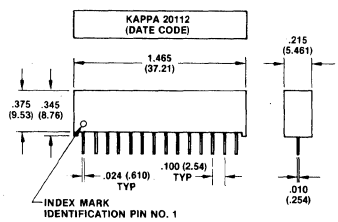
TABLE II

TOTAL DELAY (ns) ±5%	TAP DELAY (ns) ±10%	RISETIME (ns) MAX	DC RESISTANCE (Ω) MAX. PER IMPEDANCE (Ω)	
			50	100
100	1.0	2.0	1.0	
20	2.0	4.0	1.0	4.0
30	3.0	6.0	1.0	
40	4.0	8.0	1.0	4.0
50	5.0	10.0	1.0	
60	6.0	12.0	2.0	4.0
70	7.0	14.0	2.0	
80	8.0	16.0	2.0	4.0
90	9.0	18.0	2.0	
100	10.0	20.0	2.0	4.0
120	12.0	24.0		6.0
140	14.0	28.0		6.0
160	16.0	32.0		6.0
180	18.0	36.0		6.0
200	20.0	40.0		6.0

SCHEMATIC



MARKING & DIMENSIONS in inches and (mm)



PART NUMBER EXAMPLE

Typical part number is a combination of the Basic Series Number, Mounting Height Code, Delay Time, and Impedance

EXAMPLE: SP14CD10051T

SP14C D 100 51 T

BASIC SERIES NUMBER

MOUNTING HEIGHT CODE

DELAY TIME: Expressed in nanoseconds (ns)
First two digits are significant figures.
Last digit specifies number of zeros to follow

IMPEDANCE: Expressed in ohms (Ω).
First digit is significant.
Last digit specifies number of zeros to follow.

INTERNAL TERMINATION: (OPTIONAL)

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CUSTOM MINIATURE & PRECISION DELAY LINES...

Optimization of Most Critical Parameters as Required.

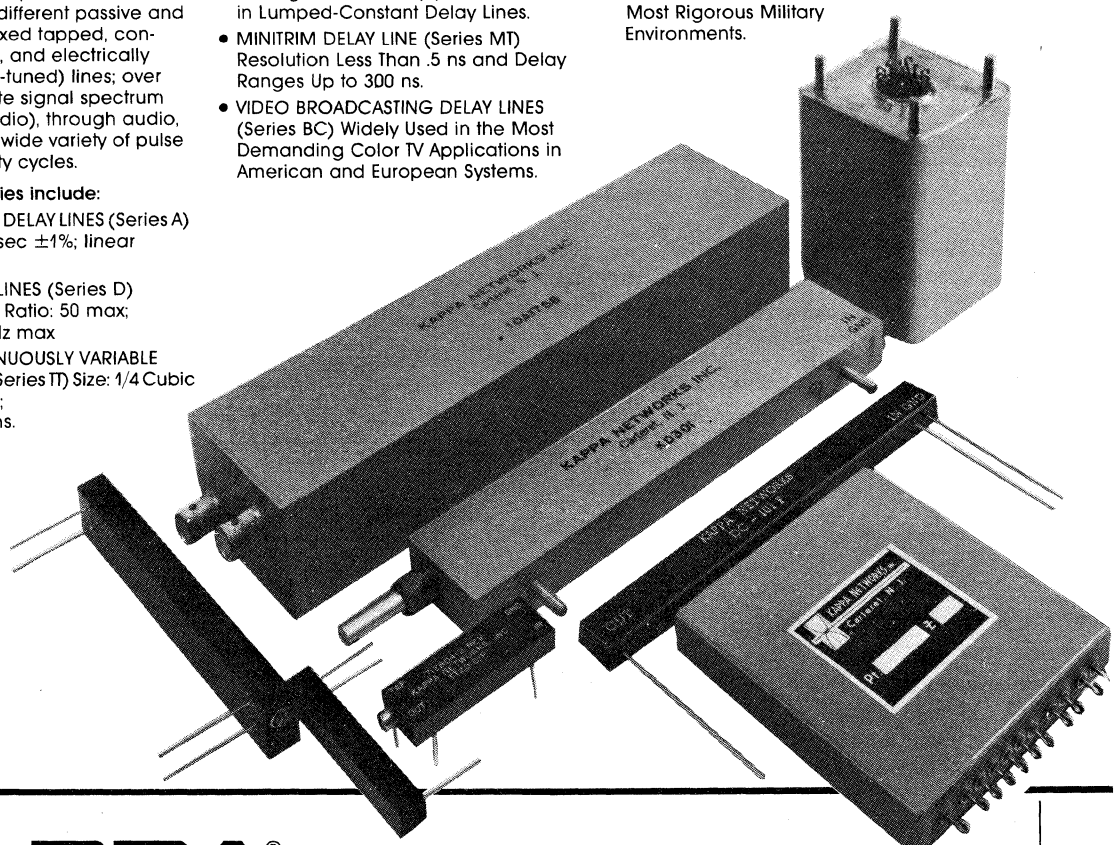
DESCRIPTION	PRECISION AUDIO/SONAR	VIDEO BROADCAST	LOW DISTORTION	STD. DIST. CONSTANT	SUPER η	CONTINUOUS VARIABLE	STD. LUMPED CONSTANT	MINI® TRIM	TINY® TRIM
SERIES NUMBER	A	BC	D	DC	H	K	LC	MT	TT
DELAY RANGE (in microseconds)	500 to 10^6	.05 to 10	up to 100	up to 3	.5 to 500	up to .5	.05 to 10^6	up to .25	up to .12
STANDARD DELAY TOLERANCES (±%)	1	2	1	5	5	+10/−0	5	+10/−0	+10/−0
IMPEDANCE RANGE (in ohms)	500 to 10K	75	100 to 1K	300 to 2K	50 to 2K	100 to 1K	100 to 20K	50 to 1K	300 to 500
STANDARD IMPEDANCE TOLERANCES (±%)	5	2	5	10	5	10	5	10	10
DELAY RESOLUTION	N/A	N/A	N/A	N/A	N/A	> of .1% or 1 ns	N/A	.25 ns	.25 ns
DELAY-to-RISETIME RATIO (max)	N/A	N/A	50	11	150	8	200	7	4
DELAY LINEARITY (±%)	.05 to .25	.025 to 1	.25	N/A	1	N/A	.5	N/A	N/A
BANDWIDTH (max)	70 KHz	20 MHz	50 MHz	30 MHz	10 MHz	25 MHz	250 MHz	100 MHz	70 MHz
ATTENUATION (in dB)	A.S.	A.S.	A.S.	*	A.S.	*	A.S.	<.5 dB	<25 dB
DISTORTION (±%)	N/A	A.S.	1 to 2	*	10	15	10	15	15
DIELECTRIC STRENGTH (VDC)	100	100	100	100 or A.S.	100 or A.S.	100 or A.S.	A.S.	100	100
OPERATING TEMP. RANGE (°C)	−55/+85 A.S.	−55/+125	−55/+125	−55/+125	−55/+125	−55/+125	−55/+125	−55/+125	−55/+125
DELAY STABILITY vs. TEMPERATURE (ppm/°C)	50	50	50	200	50	50 or 200	50	200	200

Abbreviations: A.S. = As Specified; N/A = Not Applicable; * = See Data Sheet.

Over the past two decades, **Kappa** has optimized, packaged, and critically tested literally thousands of specific variations of several hundred different passive and hybrid delay lines: fixed tapped, continuously adjustable, and electrically trimmable (varactor-tuned) lines; over virtually the complete signal spectrum from control (subaudio), through audio, sonar, RF, HF, and a wide variety of pulse rates widths and duty cycles.

Typical design families include:

- PRECISION SONAR DELAY LINES (Series A) 500 μsec to 10^6 μsec ±1%; linear to ±0.05%
- LOW-DISTORTION LINES (Series D) Delay-to-Risetime Ratio: 50 max; Bandwidth: 50 MHz max
- MINIATURE CONTINUOUSLY VARIABLE DELAY TRIMMERS (Series TT) Size: 1/4 Cubic Inch; up to 120 ns; resolution ≤0.25 ns.
- SUPER-η™ DELAY LINES (Series H) Embody New Design Principle Providing the Highest Efficiency yet Obtainable in Lumped-Constant Delay Lines.
- MINITRIM DELAY LINE (Series MT) Resolution Less Than .5 ns and Delay Ranges Up to 300 ns.
- VIDEO BROADCASTING DELAY LINES (Series BC) Widely Used in the Most Demanding Color TV Applications in American and European Systems.
- TRANSPONDER/TACAN/DME (Series C) Designed to Meet the Requirements of MIL-D-23859 and to Withstand the Most Rigorous Military Environments.



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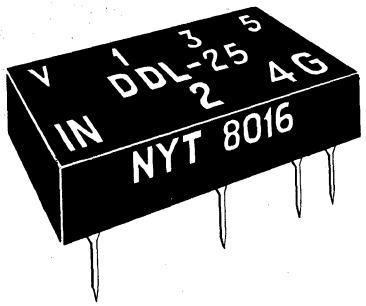
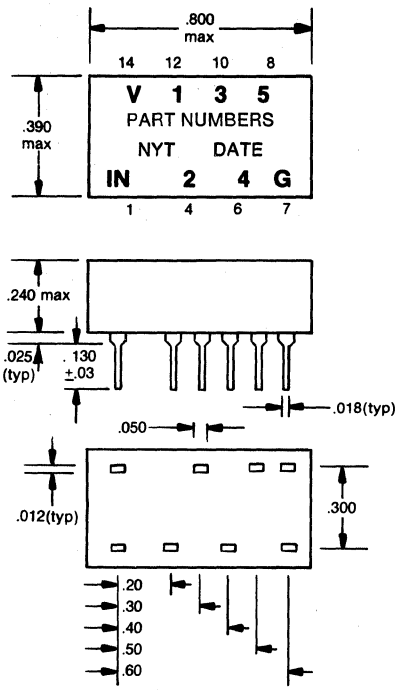
700 ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

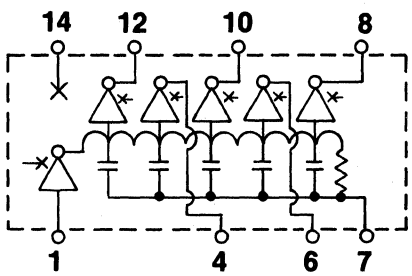
DDL-XXX SCHOTTKY DELAY LINES





FEATURES

- TTL Driven Inputs
- TTL Buffered Outputs
- Internal Terminations
- Low Profile Packages (.240")
- 14-Pin, DIP-IC Compatible
- Output Rise Time 4.0ns max. (0.75V to 2.40V)



PART NUMBER	TOTAL DELAY (NS) (1) (2)	TAP DELAY (NS) (1) (2)	INPUT PULSE WIDTH (NS MINIMUM)
DDL-25	25	5	10
DDL-30	30	6	12
DDL-35	35	7	14
DDL-40	40	8	16
DDL-45	45	9	18
DDL-50	50	10	20
DDL-55	55	11	22
DDL-60	60	12	24
DDL-65	65	13	26
DDL-70	70	14	28
DDL-75	75	15	30
DDL-100	100	20	40
DDL-125	125	25	50
DDL-150	150	30	60
DDL-175	175	35	70
DDL-200	200	40	80
DDL-250	250	50	100
DDL-300	300	60	120
DDL-350	350	70	140
DDL-400	400	80	160
DDL-450	450	90	180
DDL-500	500	100	200

(1) Measured at 1.5V level leading edge; Vcc = 5.00VDC; No loads; at +25°C.
(2) Nominal delay, ±2NS or ±5%, whichever is greater; reference to input.

RECOMMENDED OPERATING CONDITIONS

(Vcc) Supply Voltage ..... 5.00 ±0.25VDC
(Icc) Supply Current ..... 55ma Typ./70ma Max.
(TRin) Input Rise Time ..... 3ns.
(TWin) Input Pulse Width ..... 40% of Delay
(Ein) Input Pulse Voltage 3.20VDC
Operating Temperature ..... 0°C to 70°C
Storage Temperature ..... −55°C to +125°C

ELECTRICAL CHARACTERISTICS

(VIH) High-Level Input Voltage ..... 2.0 to 5.0V
(IIH) High-Level Input Current ..... 50ua Max.
(VIL) Low-Level Input Voltage ..... 0.8V Max.
(IIL) Low-Level Input Current ..... −2ma Max.
(VOH) High-Level Output Voltage ..... 2.4V Min.
(VOL) Low-Level Output Voltage ..... 0.4V Max.
High-Level Output Drives ..... 20 TTL Loads/Unit Max.
Low-Level Output Drives ..... 10 TTL Loads/Tap Max.
20 TTL Loads/Unit Max.

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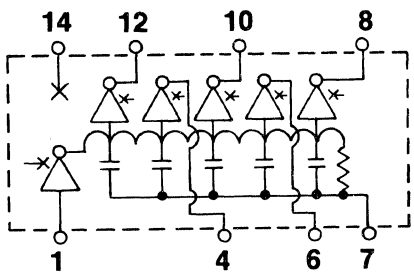
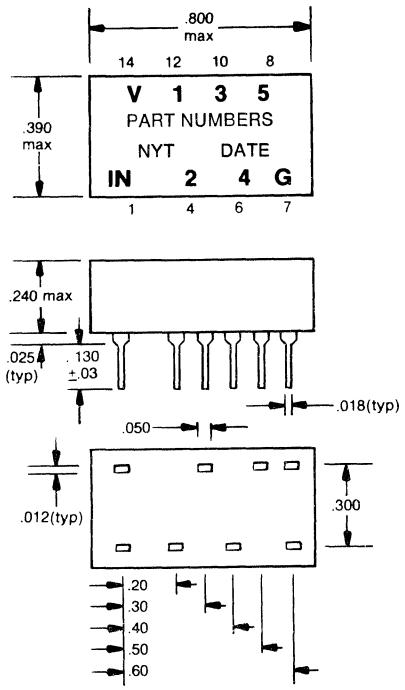
DDL-XXXF & LPS-XXX ADVANCED SCHOTTKY DELAY LINES





ADVANCED SCHOTTKY (DDL-XXXF)

RECOMMENDED OPERATING CONDITIONS

(Vcc) Supply Voltage ..... 5.00 ±0.25 VDC
(Icc) Supply Current ..... 35 ma Typ./40 ma Max.
(TRin) Input Rise Time ..... 3 ns.
(TWin) Input Pulse Width ..... 40% of Delay
(Ein) Input Pulse Voltage ..... 3.20 VDC
Operating Temperature ..... 0°C to 70°C
Storage Temperature ..... −55°C to 125°C

ELECTRICAL CHARACTERISTICS

(VIH) High-Level Input Voltage ..... 2.0 to 5.0V
(IIH) High-Level Input Current ..... 20 μa Max.
(VIL) Low-Level Input Voltage ..... 0.8V Max.
(IIL) Low-Level Input Current ..... −0.6 ma Max.
(VOH) High-Level Output Voltage ..... 2.4V Min.
(VOL) Low-Level Output Voltage ..... 0.4V Max.
High-Level Output Drives ..... 25 TTL Loads/Unit Max.
Low-Level Output Drives ..... 12.5 TTL Loads/Tap Max.
25 TTL Loads/Unit Max.

ADVANCED LOW-POWER SCHOTTKY (LPS-XXX)

RECOMMENDED OPERATING CONDITIONS

(Vcc) Supply Voltage ..... 5.00 ±0.25 VDC
(Icc) Supply Current ..... 25 ma Typ./30 ma Max.
(TRin) Input Rise Time ..... 3 ns.
(TWin) Input Pulse Width ..... 40% of Delay
(Ein) Input Pulse Voltage ..... 3.20 VDC
Operating Temperature ..... 0°C to 70°C
Storage Temperature ..... −55°C to +125°C

ELECTRICAL CHARACTERISTICS

(VIH) High-Level Input Voltage ..... 2.0 to 5.0V
(IIH) High-Level Input Current ..... 20 μa Max.
(VIL) Low-Level Input Voltage ..... 0.8V Max.
(IIL) Low-Level Input Current ..... −0.2 ma Max.
(VOH) High-Level Output Voltage ..... 2.4V Min.
(VOL) Low-Level Output Voltage ..... 0.4V Max.
High-Level Output Drives ..... 10 TTL Loads/Unit Max.
Low-Level Output Drives ..... 5 TTL Loads/Tap Max.
10 TTL Loads/Unit Max.

OUTPUT RISE TIME (0.75v to 2.40v)
DDL-XXXF SERIES = 4.0 ns Max.
LPS-XXX SERIES = 6.0 ns Max.

PART NUMBER	PART NUMBER	TOTAL DELAY (NS) (1) (2)	TAP DELAY (NS) (1) (2)	INPUT PULSE WIDTH (NS MINIMUM)
DDL-25F	LPS-25	25	5	10
DDL-30F	LPS-30	30	6	12
DDL-35F	LPS-35	35	7	14
DDL-40F	LPS-40	40	8	16
DDL-45F	LPS-45	45	9	18
DDL-50F	LPS-50	50	10	20
DDL-55F	LPS-55	55	11	22
DDL-60F	LPS-60	60	12	24
DDL-65F	LPS-65	65	13	26
DDL-70F	LPS-70	70	14	28
DDL-75F	LPS-75	75	15	30
DDL-100F	LPS-100	100	20	40
DDL-125F	LPS-125	125	25	50
DDL-150F	LPS-150	150	30	60
DDL-175F	LPS-175	175	35	70
DDL-200F	LPS-200	200	40	80
DDL-250F	LPS-250	250	50	100
DDL-300F	LPS-300	300	60	120
DDL-350F	LPS-350	350	70	140
DDL-400F	LPS-400	400	80	160
DDL-450F	LPS-450	450	90	180
DDL-500F	LPS-500	500	100	200

(1) Measured at 1.5v level leading edge; Vcc = 5.00 VDC; No loads; at +25°C.
(2) Nominal delay ±2 NS or ±5%; whichever is greater; reference to input.

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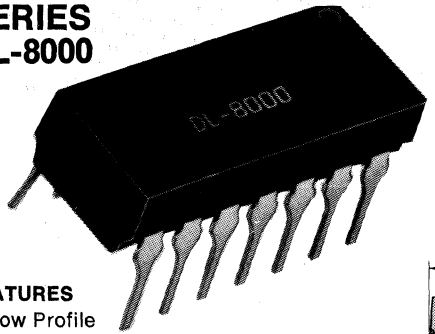
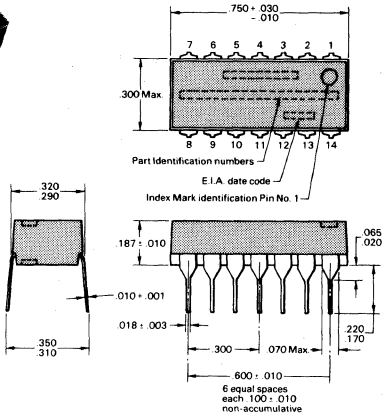
DL-8000- 14 PIN PASSIVE DELAY LINES

SERIES DL-8000

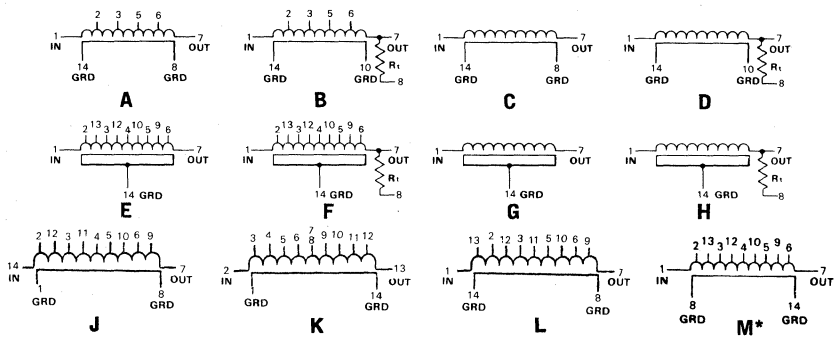




FEATURES

- Low Profile
- 14-Lead, DIP-IC Compatible Packages
- Standard Delay Times from 5 nsec to 500 nsec
- Standard Impedances of 50, 100, 200, 360 and 500 ohms
- Standard and Special Attenuations
- Easy to Order Special Models
- Epoxy Transfer Molding

M* BUILT TO MEET MILITARY SPECIFICATION MIL-D-23859/23C



R_t = Terminating Resistor (value of Z_o) ±5%, ⅛ watt.

HOW TO ORDER

To allow the greatest possible range of parameters, the following ordering system should be followed on both standard and special orders.

Example: DL-8000-045-09-100-05 A
14-Pin Lumped Constant Dual In-Line Delay Line, 45 nsec T_d, 9 nsec T_r, 100 ohm impedance, 5% (Max.) attenuation, internal configuration "A."

DL-8000 — **PLACE 1**
Base No. DL-8000 = 14-pin, Lumped Constant Dual In-Line Delay Lines (6 characters and dash)

045 — **PLACE 2**
Delay Time (T_d)
Standard Models:
005 = 5 nsec, 050 = 50 nsec.
150 = 150 nsec, etc., from above table (3 digits)
Special Orders:
Enter full 3-digit nsec value (e.g., 075)

09 — **PLACE 3**
Rise Time (T_r)
Standard Models:
Enter nsec digit
Value from table
(e.g., 2.0, 6.5, 40)
Special Orders:
Enter desired rise time in nsec (2 or more digits)

100 — **PLACE 4**
Impedance (Z_o)
Standard Models:
050 = 50 ohms, 200 = 200 ohms
100 = 100 ohms, 360 = 360 ohms
(3 digits)
Special Orders:
Enter full 3-digit Ohm value (e.g., 075)

05 — **PLACE 5**
Attenuation
Standard Models:
Enter 2-digit percent value from table (e.g., 05, 10)
Special Orders:
Enter Max. allowable percent attenuation (2 digits)

A — **PLACE 6**
Internal Configuration
Enter Schematic reference Letters
(1 letter)

STANDARD DL-8000 MODELS

Delay Time (T_d), nsec*	Rise Time (T_r), Max nsec	% Attenuation Max Per Impedance† 50 ohms	100 ohms	200 ohms	360 ohms	500 ohms
5	02	3	5	5	5	7
10	03	3	5	5	5	7
15	04	3	5	5	5	7
20	5.5	3	5	5	5	7
25	05	3	5	5	5	7
30	6.5	3	5	5	5	7
35	07	3	5	5	5	7
40	08	3	5	5	5	7
45	09	3	5	5	5	7
50	10	3	5	5	5	7
55	11	3	5	5	5	7
60	12	3	5	5	5	7
65	13	3	5	5	5	7
70	14	3	5	5	5	7
75	15	3	5	5	5	7
80	16	3	5	5	5	7
85	17	3	5	5	5	7
90	18	3	5	5	5	7
95	19	3	5	5	5	7
100	20	3	5	5	5	7
110	22	3	5	6	7	8
120	24	3	5	6	7	8
130	26	3	5	6	7	8
140	28	3	5	6	7	8
150	30	3	5	6	7	8
160	32	3	5	6	7	8
170	34	3	5	6	7	8
180	36	3	5	6	7	8
190	38	3	5	6	7	8
200	40	3	5	6	7	8
210	45	5	5	6	7	8
220	45	5	5	6	7	8
230	50	5	5	6	7	8
240	50	5	5	6	7	8
250	50	5	5	6	7	8
260	55	5	5	6	7	8
270	55	5	5	6	7	8
280	60	5	5	6	7	8
290	60	5	5	6	7	8
300	60	5	5	6	7	8
310	65	5	7	8	10	10
320	65	5	7	8	10	10
330	70	5	7	8	10	10
340	70	5	7	8	10	10
350	70	5	7	8	10	10
360	75	5	7	8	10	10
370	75	5	7	8	10	10
380	80	5	7	8	10	10
390	80	5	7	8	10	10
400	80	5	7	8	10	10
410	85	5	8	10	10	10
420	85	5	8	10	10	10
430	90	5	8	10	10	10
440	90	5	8	10	10	10
450	90	5	8	10	10	10
460	95	5	8	10	10	10
470	95	5	8	10	10	10
480	100	5	8	10	10	10
490	100	5	8	10	10	10
500	100	5	8	10	10	10

Taps in equal increments of total delay.

* ±5% Tolerance for 40 through 500 nsec T_d. 2 nsec for 5 through 40 nsec T_d.

† ±10% Impedance Tolerance.

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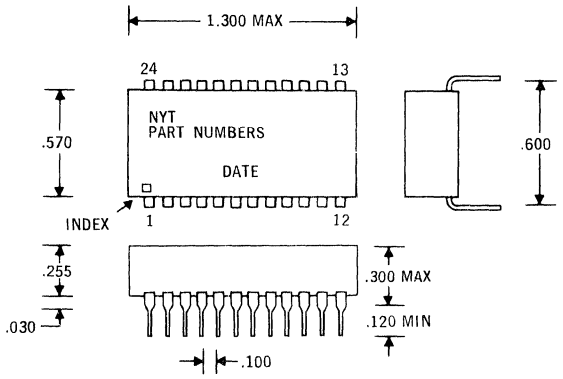
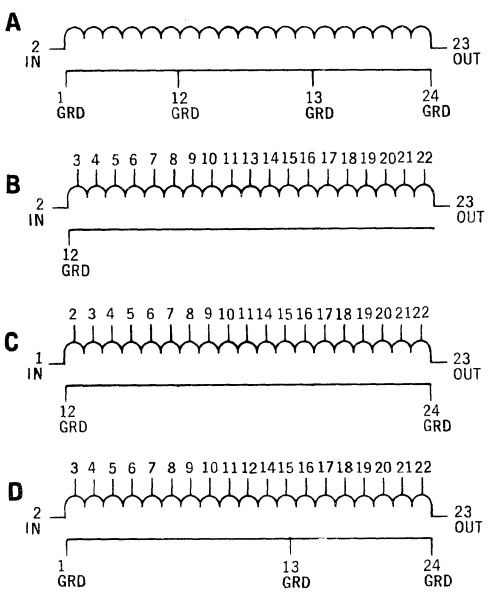
**DL-2400-
24 PIN PASSIVE
DELAY LINES**

DL-2400 SERIES

FEATURES

- Standard 24 Pin Dip
- Epoxy Encapsulated
- Operating Temp. −55°C to +125°C
- Hi-Pot = 100VDC
- Up to 20 Outputs
- Temp. Coeff. of Delay
  Up to 1000ns = 100ppm/°C
  Above 1000ns = 200ppm/°C
- Easy to Order Specials
- 1%, 2%, and Other Tolerances Available
- Many Other Delays, Impedances, and Rise Times Available
- Many Other Schematics Available
- **Lead Material: Alloy 42**





Delay Time (Td), nsec*	Rise Time (Tr), Max nsec	% Attenuation Max. per Impedance†				
		50 ohms	100 ohms	200 ohms	360 ohms	500 ohms
50	5	6	6	8	—	—
100	10	6	8	8	8	8
150	15	8	8	8	8	8
200	20	8	8	8	8	10
250	25	8	8	8	10	10
300	30	8	8	8	10	10
400	40	8	8	10	10	10
500	50	8	8	10	10	10
600	60	8	8	10	10	10
700	70	8	8	10	10	10
800	80	8	10	10	10	15
900	90	8	10	10	10	15
1000	100	8	10	10	10	15
1500	150	—	10	10	15	15
2000	200	—	10	15	15	15
3000	300	—	—	15	15	15
4000	400	—	—	15	15	15
5000	500	—	—	—	15	15
6000	600	—	—	—	15	—
7000	700	—	—	—	15	—

* ±5% Tolerance
† ±10% Impedance Tolerance.
Taps in equal increments of total delay.

HOW TO ORDER

To allow the greatest possible range of parameters, the following ordering system should be followed on both standard and special orders.

EXAMPLE: DL-2400-1000-100-100-10A

24-Pin Lumped Constant Dual In-Line Delay Line, 1000 nsec Td, 100 nsec Tr, 100 ohm impedance, 10% (Max.) attenuation, internal configuration "A".

DL-2400 — 1000 — 100 — 100 — 10 — A

PLACE 1
Base No. DL-2400 24-Pin, Lumped Constant Dual In-Line Delay Lines (6 Characters and dash)

PLACE 2
Delay Time (Td)
Standard Models:
050 = 50 nsec,
150 = 150 nsec, 1500 = 1500 nsec, etc., from above table (3 digits or more)

PLACE 3
Rise Time (Tr)
Standard Models:
Enter nsec digit Value from table (e.g. 05, 50, 500, etc.)
Special Orders:
Enter desired rise time in nsec (2 or more digits)

PLACE 4
Impedance (Z_o)
Standard Models:
050 = 50 ohms, 200 = 200 ohms,
100 = 100 ohms, 360 = 360 ohms
(3 digits)
Special Orders:
Enter full 3-digit Ohm value (e.g. 075)

PLACE 5
Attenuation
Standard Models:
Enter 2-digit percent value from table (e.g., 06, 10)
Special Orders:
Enter Max. allowable percent attenuation (2 digits)

PLACE 6
Internal Configuration
Enter Schematic reference Letters
A, B, C or D (1 letter)

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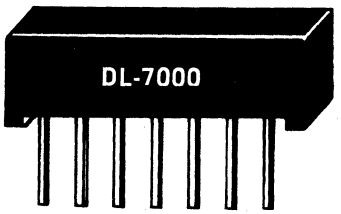
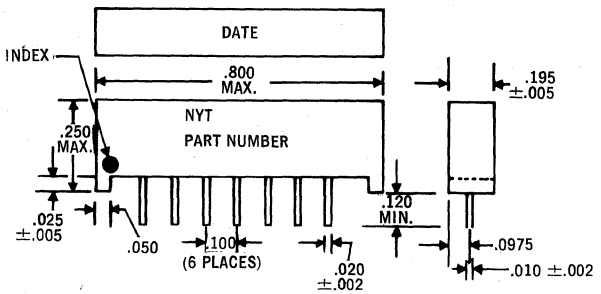
DL-7000- 7 PIN PASSIVE DELAY LINE

SERIES DL-7000



FEATURES

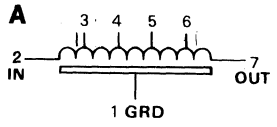
- Standard 7 Pin SIP
- Epoxy Encapsulated
- Terminal Material — Kovar, Flat
- Tap Delays ("A" Configuration) = 20% Increments (±5% or ±1 ns, whichever is greater)
- T_d/T_R Ratio ≥5/1 or ≥ 3/1
- Temperature Coefficient of Delay = 100 ppm/°C
- Hi-Pot = 100 VDC
- Operating Temperature = −55°C to +125°C
- Storage Temperature = −65°C to +130°C
- Meets or Exceeds Applicable Requirements of MIL-STD-202
- Easy to Order Specials
- Many Other Delays, and Impedances Available



DELAY TIME (T_d), nsec†	RISE TIME (T_R), MAX nsec		% ATTENUATION MAX. PER IMPEDANCE*			
	$T_d/T_R \geq 3/1$	$T_d/T_R \geq 5/1$	50 Ohms	100 Ohms	200 Ohms	500 Ohms
20	6.0	4.0	3	5	5	—
30	9.0	6.0	3	5	5	—
40	12.0	8.0	3	5	5	—
50	15.0	10.0	3	5	5	—
60	18.0	12.0	3	5	5	—
70	22.0	14.0	3	5	5	—
80	24.0	16.0	3	5	5	—
90	27.0	18.0	3	5	5	—
100	30.0	20.0	3	5	5	7
200	60.0	40.0	3	5	6	8
300	90.0	60.0	5	5	6	8
400	120.0	80.0	—	7	8	10
500	150.0	100.0	—	8	10	10

† ±5% Tolerance.
* ±10% Impedance Tolerance.

A



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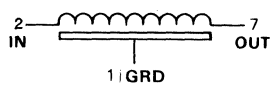

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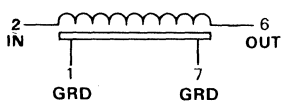

HOW TO ORDER

To allow the greatest possible range of parameters, the following ordering system should be followed on both standard and special orders.

EXAMPLE: **DL-7000 — 100 — 020 — 100 — 05 — A**

PLACE 1
Base No. DL-7000 7-Pin, Lumped Constant single in-line package (6 characters and dash)

PLACE 2
Delay Time (T_d)
Standard Models:
050 = 50 nsec,
150 = 150 nsec, etc., from above table (3 digits or more)

PLACE 3
Rise Time (T_R)
Standard Models:
Enter nsec digit Value from table (e.g. 6.0, 40, 100, etc.)
Special Orders:
Enter desired rise time in nsec (2 or more digits)

PLACE 4
Impedance (Z_o)
Standard Models:
050 = 50 ohms, 200 = 200 ohms,
100 = 100 ohms, (3 digits)
Special Orders:
Enter full 3-digit Ohm value (e.g. 075)

PLACE 5
Attenuation
Standard Models:
Enter 2-digit percent value from table (e.g., 06, 10)
Special Orders:
Enter Max. allowable percent attenuation (2 digits)

PLACE 6
Internal Configuration
Enter Schematic reference Letters
A, B, C (1 letter)

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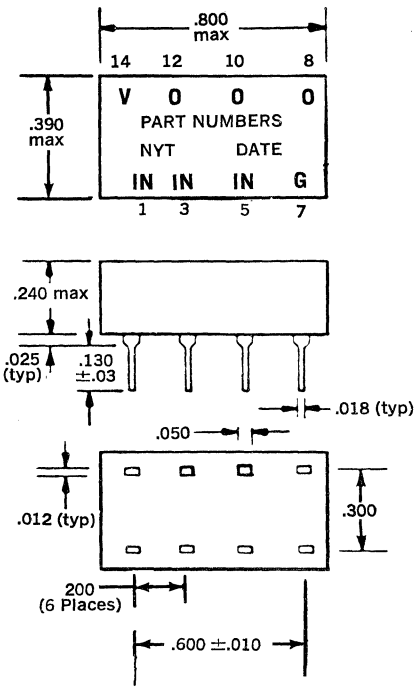
MDDL-XXX SCHOTTKY DELAY LINES

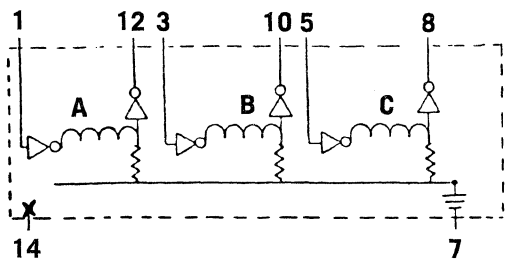
MDDL SERIES

MERET℠ QUALITY
Meet Every Requirement, Every Time



FEATURES

- 14 Pin, DIP/IC Compatible
- Low Profile Package (.240″)
- TTL and DTL Compatible
- Internally Terminated
- THREE INDIVIDUAL DELAY SEGMENTS/UNIT
- Closer Delay Tolerances Available
- Custom Delays Upon Request
- Output Rise Time 4.0ns max. (0.75v to 2.40v)



ELECTRICAL CHARACTERISTICS

(VIH) High -Level Input Voltage ..... 2.0 to 5.0V
(IIH) High-Level Input Current ..... 50μa Max.
(VIL) Low-Level Input Voltage ..... 0.8V Max.
(IIL) Low-Level Input Current ..... —2ma Max.
(VOH) High-Level Output Voltage ..... 2.4V Min.
(VOL) Low-Level Output Voltage ..... 0.4V Max.
High-Level Output Drives ..... 10 TTL Loads/Segment Max.
Low-Level Output Drives ..... 10 TTL Loads/Segment Max.

RECOMMENDED OPERATING CONDITIONS

(Vcc) Supply Voltage ..... 5.00 ±0.25VDC
(Icc) Supply Current ..... 60ma (typ.)
(TRin) Input Rise Time ..... 3ns.
(TWin) Input Pulse Width ..... 100% of Delay
(Ein) Input Pulse Voltage 3.20VDC
Operating Temperature ..... 0°C to 70°C
Storage Temperature ..... −55°C to +125°C

PART NUMBER	TOTAL DELAY (NS) (1) (2)	INPUT PULSE WIDTH (NS MINIMUM)
MDDL-25	25	25
MDDL-30	30	30
MDDL-35	35	35
MMDL-40	40	40
MDDL-45	45	45
MDDL-50	50	50
MDDL-55	55	55
MDDL-60	60	60
MDDL-65	65	65
MDDL-70	70	70
MDDL-75	75	75
MDDL-100	100	100
MDDL-125	125	125
MDDL-150	150	150
MDDL-175	175	175
MDDL-200	200	200
MDDL-250	250	250

(1) Measured at 1.5V level leading edge; Vcc = 5.00VDC; No loads; at +25°C.
(2) Nominal delay, ±2NS or ±5%, whichever is greater; reference to input.

Nytronics Components Group, Inc.
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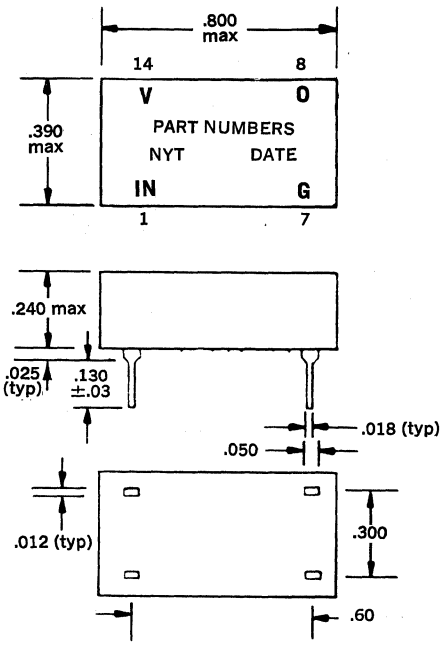
FDDL-XXX SCHOTTKY DELAY LINES

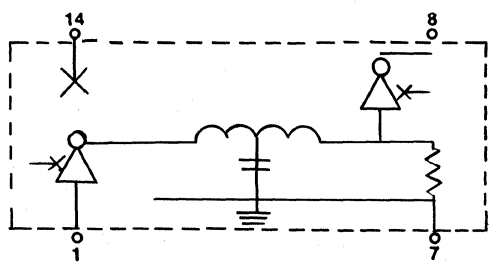
FDDL SERIES

MERET™ QUALITY
Meet Every Requirement, Every Time



FEATURES

- 14 Pin, DIP/IC Compatible
- Low Profile Package (.240")
- TTL and DTL Compatible
- Internally Terminated
- Single Output
- Closer Delay Tolerances Available
- Custom Delays Upon Request
- Output Rise Time 4.0ns max. (0.75v to 2.40v)



ELECTRICAL CHARACTERISTICS

(VIH) High-Level Input Voltage ..... 2.0 to 5.0V
(IIH) High-Level Input Current ..... 50μa Max.
(VIL) Low-Level Input Voltage ..... 0.8V Max.
(IIL) Low-Level Input Current ..... −2ma Max.
(VOH) High-Level Output Voltage ..... 2.4V Min.
(VOL) Low-Level Output Voltage ..... 0.4V Max.
High-Level Output Drives ..... 20 TTL Loads/Unit Max.
Low-Level Output Drives ..... 20 TTL Loads/Unit Max.

RECOMMENDED OPERATING CONDITIONS

(Vcc) Supply Voltage ..... 5.00 ±0.25VDC
(Icc) Supply Current ..... 55ma Typ./70ma Max.
(TRin) Input Rise Time 3ns
(TWin) Input Pulse Width ..... 40% of Delay
(Ein) Input Pulse Voltage 3.20VDC
Operating Temperature ..... 0°C to 70°C
Storage Temperature ..... −55°C to +125°C

PART NUMBER	TOTAL DELAY (NS) (1) (2)	INPUT PULSE WIDTH (NS MINIMUM)
FDDL-25	25	10
FDDL-30	30	12
FDDL-35	35	14
FDDL-40	40	16
FDDL-45	45	18
FDDL-50	50	20
FDDL-55	55	22
FDDL-60	60	24
FDDL-65	65	26
FDDL-70	70	28
FDDL-75	75	30
FDDL-100	100	40
FDDL-125	125	50
FDDL-150	150	60
FDDL-175	175	70
FDDL-200	200	80
FDDL-250	250	100
FDDL-300	300	120
FDDL-350	350	140
FDDL-400	400	160
FDDL-450	450	180
FDDL-500	500	200

(1) Measured at 1.5V level leading edge; Vcc = 5.00VDC; No loads; at +25°C.

(2) Nominal delay, ±2NS or ±5%.

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
ABS acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CAMAC computer automated measurement and control
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3)
KSR keyboard send /receive

L
LC inductance capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIB microcomputer interface board
MIC microwave IC
MIPS million instructions per second
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

14 Pin DIP 5 Tap TTL Compatible Active Delay Lines

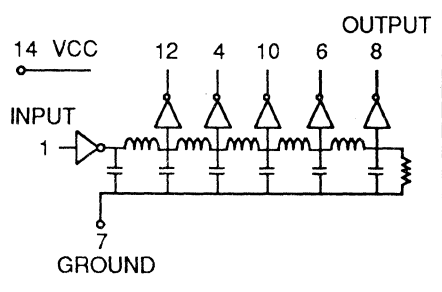
TAP DELAYS ±5% or ±2 nS	TOTAL DELAYS ±5% or ±2 nS	PART NUMBER	TAP DELAYS ±5% or ±2 nS	TOTAL DELAYS ±5% or ±2 nS	PART NUMBER
5, 10, 15, 20	25	EP8200	80, 160, 240, 320	400	EP8208
6, 12, 18, 24	30	EP8213	84, 168, 252, 336	420	EP8218
7, 14, 21, 28	35	EP8214	88, 176, 264, 352	440	EP8222
8, 16, 24, 32	40	EP8215	90, 180, 270, 360	450	EP8209
9, 18, 27, 36	45	EP8216	94, 188, 282, 376	470	EP8223
10, 20, 30, 40	50	EP8201	100, 200, 300, 400	500	EP8210
12, 24, 36, 48	60	EP8211	110, 220, 330, 440	550	EP8230
15, 30, 45, 60	75	EP8217	120, 240, 360, 480	600	EP8224
20, 40, 60, 80	100	EP8202	130, 260, 390, 520	650	EP8231
25, 50, 75, 100	125	EP8219	140, 280, 420, 560	700	EP8225
30, 60, 90, 120	150	EP8203	150, 300, 450, 600	750	EP8229
35, 70, 105, 140	175	EP8220	160, 320, 480, 640	800	EP8226
40, 80, 120, 160	200	EP8204	170, 340, 510, 680	850	EP8232
45, 90, 135, 180	225	EP8221	180, 360, 540, 720	900	EP8227
50, 100, 150, 200	250	EP8205	190, 380, 570, 760	950	EP8233
60, 120, 180, 240	300	EP8206	200, 400, 600, 800	1000	EP8228
70, 140, 210, 280	350	EP8207			

Delay times referenced from input to leading edges at 25°C, 5.0V.

DC Electrical Characteristics

	Parameter	Test Conditions	Min	Max	Unit
V_{OH}	High-Level Output Voltage	V_{CC} = min. V_{IL} = max. I_{OH} = max	2.7		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min. V_{iH} = min. I_{OL} = max		0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min. $I_I = II_K$		-1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max. V_{IN} = 2.7V		50	µA
		V_{CC} = max. V_{IN} = 5.25V		1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max. V_{IN} = 0.5V		-2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max. V_{OUT} = 0. (One output at a time)	-40	-100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max. V_{IN} = OPEN		75	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max. V_{IN} = 0		75	mA
T_{RO}	Output Rise Time	Td ≤ 500 nS (0.75 to 2.4 Volts)		4	nS
		Td > 500 nS		5	nS
N_H	Fanout High-Level Output	V_{CC} = max. V_{OH} = 2.7V		20 TTL LOAD	
N_L	Fanout Low-Level Output	V_{CC} = max. V_{OL} = 0.5V		10 TTL LOAD	

Schematic



Recommended Operating Conditions

		Min	Max	Unit
V_{CC}	Supply Voltage	4.75	5.25	V
V_{IH}	High-Level Input Voltage	2.0		V
V_{IL}	Low-Level Input Voltage		0.8	V
I_{IK}	Input Clamp Current		-18	mA
I_{OH}	High-Level Output Current		-1.0	mA
I_{OL}	Low-Level Output Current		20	mA
P_W*	Pulse Width of Total Delay	40		%
d*	Duty Cycle		40	%
T_A	Operating Free-Air Temperature	0	+70	°C

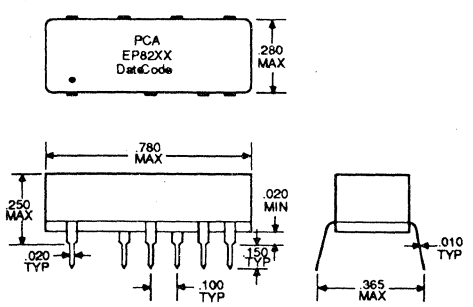
**These two values are inter-dependent.*

Input Pulse Test Conditions @ 25° C

			Unit
E_{IN}	Pulse Input Voltage	3.2	Volts
P_W	Pulse Width % of Total Delay	110	%
T_{RI}	Pulse Rise Time (0.75 - 2.4 Volts)	2.0	nS
P_{RR}	Pulse Repetition Rate @ Td ≤ 500 nS	1.0	MHz
	Pulse Repetition Rate @ Td > 500 nS	500	KHz
V_{CC}	Supply Voltage	5.0	Volts

EP8200 1186

Package Dimensions



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TWX: (910) 496-1525

SO SMD 14 Pin 5 Tap TTL Compatible Active Delay Lines

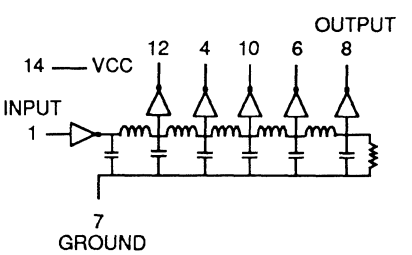
TAP DELAYS ±5% or ±2 nS	TOTAL DELAYS ±5% or ±2 nS	PART NUMBER	TAP DELAYS ±5% or ±2 nS	TOTAL DELAYS ±5% or ±2 nS	PART NUMBER
5, 10, 15, 20	25	EPA424-25	20, 40, 60, 80	100	EPA424-100
6, 12, 18, 24	30	EPA424-30	25, 50, 75, 100	125	EPA424-125
7, 14, 21, 28	35	EPA424-35	30, 60, 90, 120	150	EPA424-150
8, 16, 24, 32	40	EPA424-40	35, 70, 105, 140	175	EPA424-175
9, 18, 27, 36	45	EPA424-45	40, 80, 120, 160	200	EPA424-200
10, 20, 30, 40	50	EPA424-50	45, 90, 135, 180	225	EPA424-225
12, 24, 36, 48	60	EPA424-60	50, 100, 150, 200	250	EPA424-250
15, 30, 45, 60	75	EPA424-75			

Delay times referenced from input to leading edges at 25°C, 5.0V.

DC Electrical Characteristics

	Parameter	Test Conditions	Min	Max	Unit
V_{OH}	High-Level Output Voltage	V_{CC} = min. V_{IL} = max. I_{OH} = max	2.7		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min. V_{IH} = min. I_{OL} = max		0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min. I_I = I_{IK}		-1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max. V_{IN} = 2.7V		50	µA
		V_{CC} = max. V_{IN} = 5.25V		1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max. V_{IN} = 0.5V		-2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max. V_{OUT} = 0. (One output at a time)	-40	-100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max. V_{IN} = OPEN		75	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max. V_{IN} = 0		75	mA
T_{RO}	Output Rise Time	Td ≤ 500 nS (0.75 to 2.4 Volts)		4	nS
		Td > 500 nS		5	nS
N_H	Fanout High-Level Output	V_{CC} = max. V_{OH} = 2.7V		20 TTL LOAD	
N_L	Fanout Low-Level Output	V_{CC} = max. V_{OL} = 0.5V		10 TTL LOAD	

Schematic



Recommended Operating Conditions

		Min	Max	Unit
V_{CC}	Supply Voltage	4.75	5.25	V
V_{IH}	High-Level Input Voltage	2.0		V
V_{IL}	Low-Level Input Voltage		0.8	V
I_{IK}	Input Clamp Current		-18	mA
I_{OH}	High-Level Output Current		-1.0	mA
I_{OL}	Low-Level Output Current		20	mA
P_W*	Pulse Width of Total Delay	40		%
d*	Duty Cycle		40	%
T_A	Operating Free-Air Temperature	0	+70	°C

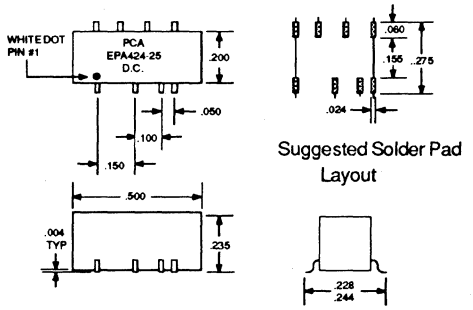
**These two values are inter-dependent.*

Input Pulse Test Conditions @ 25° C

			Unit
E_{IN}	Pulse Input Voltage	3.2	Volts
P_W	Pulse Width % of Total Delay	110	%
T_{RI}	Pulse Rise Time (0.75 - 2.4 Volts)	2.0	nS
P_{RR}	Pulse Repetition Rate @ Td ≤ 500 nS	1.0	MHz
	Pulse Repetition Rate @ Td > 500 nS	500	KHz
V_{CC}	Supply Voltage	5.0	Volts

EPA424 1/88

Package Dimensions



Suggested Solder Pad Layout

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14 Pin DIP 10 Tap TTL Compatible Active Delay Modules

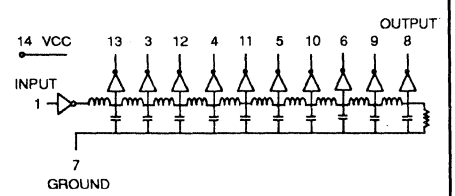
TAP DELAYS ±5% or ±2 nS	TOTAL DELAYS ±5% or ±2 nS	PART NUMBER	TAP DELAYS ±5% or ±2 nS	TOTAL DELAYS ±5% or ±2 nS	PART NUMBER
5	50	EP8301	44	440	EP8322
6	60	EP8311	45	450	EP8309
7.5	75	EP8317	47	470	EP8323
10	100	EP8302	50	500	EP8310
12.5	125	EP8319	55	550	EP8330
15	150	EP8303	60	600	EP8324
17.5	175	EP8320	65	650	EP8331
20	200	EP8304	70	700	EP8325
22.5	225	EP8321	75	750	EP8329
25	250	EP8305	80	800	EP8326
30	300	EP8306	85	850	EP8332
35	350	EP8307	90	900	EP8327
40	400	EP8308	95	950	EP8333
42	420	EP8318	100	1000	EP8328

Delay times referenced from input to leading edges at 25°C, 5.0V.

DC Electrical Characteristics

	Parameter	Test Conditions	Min	Max	Unit
V_{OH}	High-Level Output Voltage	V_{CC} = min. V_{IL} = max. I_{OH} = max	2.7		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min. V_{IH} = min. I_{OL} = max		0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min. I_I = I_{IK}		-1.2V	V
I_{IH}	High-Level Input Current	V_{CC} = max. V_{IN} = 2.7V		50	µA
		V_{CC} = max. V_{IN} = 5.25V		1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max. V_{IN} = 0.5V		-2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max. V_{OUT} = 0. (One output at a time)	-40	-100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max. V_{IN} = OPEN		150	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max. V_{IN} = 0		150	mA
T_{RO}	Output Rise Time	Td ≤ 500 nS (0.75 to 2.4 Volts)		4	nS
		Td > 500 nS		5	nS
N_H	Fanout High-Level Output	V_{CC} = max. V_{OH} = 2.7V		20 TTL LOAD	
N_L	Fanout Low-Level Output	V_{CC} = max. V_{OL} = 0.5V		10 TTL LOAD	

Schematic

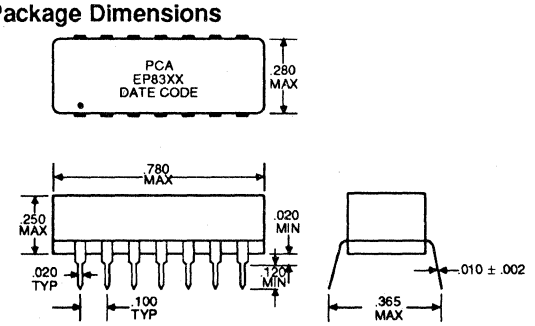


Recommended Operating Conditions

		Min	Max	Unit
V_{CC}	Supply Voltage	4.75	5.25	V
V_{IH}	High-Level Input Voltage	2.0		V
V_{IL}	Low-Level Input Voltage		0.8	V
I_{IK}	Input Clamp Current		-18	mA
I_{OH}	High-Level Output Current		-1.0	mA
I_{OL}	Low-Level Output Current		20	mA
P_W*	Pulse Width of Total Delay	40		%
d*	Duty Cycle		40	%
T_A	Operating Free-Air Temperature	0	+70	°C

**These two values are inter-dependent.*

Package Dimensions



Input Pulse Test Conditions @ 25° C

			Unit
E_{IN}	Pulse Input Voltage	3.2	Volts
P_W	Pulse Width % of Total Delay	110	%
T_{RI}	Pulse Rise Time (0.75 - 2.4 Volts)	2.0	nS
P_{RR}	Pulse Repetition Rate @ Td ≤ 500 nS	1.0	MHz
	Pulse Repetition Rate @ Td > 500 nS	500	KHz
V_{CC}	Supply Voltage	5.0	Volts

8301 7/88

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Mini SIL Single Output TTL Compatible Active Delay Lines

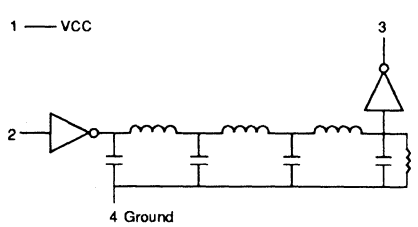
TIME DELAYS * (nS) ±5% or ±2 nS	PART NUMBER	TIME DELAYS * (nS) ±5% or ±2 nS	PART NUMBER
5	EP9748-5	60	EP9748-60
10	EP9748-10	75	EP9748-75
15	EP9748-15	100	EP9748-100
20	EP9748-20	125	EP9748-125
25	EP9748-25	150	EP9748-150
30	EP9748-30	175	EP9748-175
35	EP9748-35	200	EP9748-200
40	EP9748-40	225	EP9748-225
45	EP9748-45	250	EP9748-250
50	EP9748-50		

** Delay times referenced from input to leading edges at 25°C, 5.0V.*

DC Electrical Characteristics

Parameter		Test Conditions	Min	Max	Unit
V_{OH}	High-Level Output Voltage	V_{CC} = min. V_{IL} = max. I_{OH} = max	2.7		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min. V_{IH} = min. I_{OL} = max		0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min. I_I = I_{IK}		-1.2V	V
I_{IH}	High-Level Input Current	V_{CC} = max. V_{IN} = 2.7V		50	µA
		V_{CC} = max. V_{IN} = 5.25V		1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max. V_{IN} = 0.5V		-2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max. V_{OUT} = 0.	-40	-100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max. V_{IN} = OPEN		75	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max. V_{IN} = 0		75	mA
T_{RO}	Output Rise Time	V_{CC} = 5.0 V (.75 - 2.4 Volts)		4	nS
N_H	Fanout High-Level Output	V_{CC} = max. V_{OH} = 2.7V		20 TTL LOAD	
N_L	Fanout Low-Level Output	V_{CC} = max. V_{OL} = 0.5V		10 TTL LOAD	

Schematic



Recommended Operating Conditions

		Min	Max	Unit
V_{CC}	Supply Voltage	4.75	5.25	V
V_{IH}	High-Level Input Voltage	2.0		V
V_{IL}	Low-Level Input Voltage		0.8	V
I_{IK}	Input Clamp Current		-18	mA
I_{OH}	High-Level Output Current		-1.0	mA
I_{OL}	Low-Level Output Current		20	mA
P_W*	Pulse Width of Total Delay	40		%
d*	Duty Cycle		40	%
T_A	Operating Free-Air Temperature	0	+70	°C

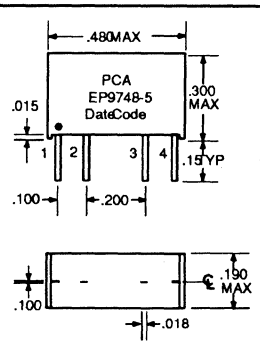
**These two values are inter-dependent.*

Input Pulse Test Conditions @ 25° C

			Unit
E_{IN}	Pulse Input Voltage	3.2	Volts
P_W	Pulse Width % of Total Delay	110	%
T_{RI}	Pulse Rise Time (0.75 - 2.4 Volts)	2.0	nS
P_{RR}	Pulse Repetition Rate @ Td ≤ 500 nS	1.0	MHz
	Pulse Repetition Rate @ Td > 500 nS	500	KHz
V_{CC}	Supply Voltage	5.0	Volts

EP9748 1086

Package Dimensions



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TWX: (910) 496-1525

16 Pin DIP 3 Bit Programmable TTL Delay Lines

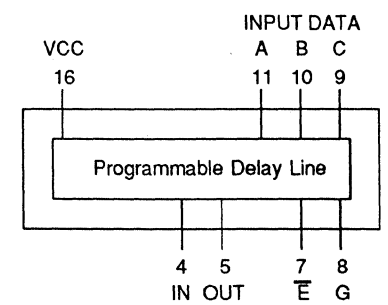
PART NUMBER	MIN DELAY ±2 nS	MAX DELAY nS	STEP	OUTPUT DELAY TIME PROGRAMMING (nS) DATA INPUT (CBA) 000	001	010	011	100	101	110	111
EP8076-1	7	14	1 ± .5 nS	7	8	9	10	11	12	13	14
EP8076-2	7	21	2 ± .5 nS	7	9	11	13	15	17	19	21
EP8076-3	7	28	3 ± .6 nS	7	10	13	16	19	22	25	28
EP8076-4	7	35	4 ± .8 nS	7	11	15	19	23	27	31	35
EP8076-5	7	42	5 ± 1.0 nS	7	12	17	22	27	32	37	42
EP8076-6	7	49	6 ± 1.0 nS	7	13	19	25	31	37	43	49
EP8076-7	7	56	7 ± 1.0 nS	7	14	21	28	35	42	49	56
EP8076-8	7	63	8 ± 1.0 nS	7	15	23	31	39	47	55	63
EP8076-9	7	70	9 ± 1.0 nS	7	16	25	34	43	52	61	70
EP8076-10	7	77	10 ± 1.0 nS	7	17	27	37	47	57	67	77

Max delay tolerances ±2 nS or ±5% whichever is greater
All delays measured at 1.5V level on leading edge, no load (enable = "0"), at 25°C, 5.0Vdc

DC Electrical Characteristics

	Parameter	Test Conditions	Min	Max	Unit
V_{OH}	High-Level Output Voltage	V_{CC} = min. V_{IL} = max. I_{OH} = max	2.7		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min. V_{IH} = min. I_{OL} = max		0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min. $I_I = I_{IK}$		-1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max. V_{IN} = 2.7V		50	µA
		V_{CC} = max. V_{IN} = 5.25V		1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max. V_{IN} = 0.5V		-2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max. V_{OUT} = 0. (One output at a time)	-40	-100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max. V_{IN} = OPEN		45	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max. V_{IN} = 0		90	mA
T_{RO}	Output Rise Time	Td ≤ 500 nS (0.75 to 2.4 Volts)		4	nS
N_H	Fanout High-Level Output	V_{CC} = max. V_{OH} = 2.7V		20 TTL LOAD	
N_L	Fanout Low-Level Output	V_{CC} = max. V_{OL} = 0.5V		10 TTL LOAD	

Schematic

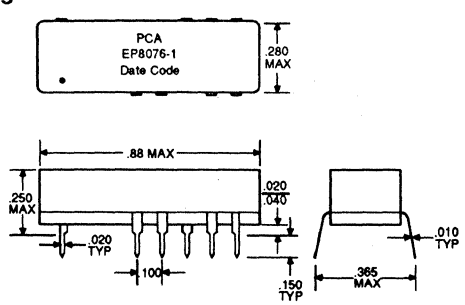


Recommended Operating Conditions

		Min	Max	Unit
V_{CC}	Supply Voltage	4.75	5.25	V
V_{IH}	High-Level Input Voltage	2.0		V
V_{IL}	Low-Level Input Voltage		0.8	V
I_{IK}	Input Clamp Current		-18	mA
I_{OH}	High-Level Output Current		-1.0	mA
I_{OL}	Low-Level Output Current		20	mA
P_W*	Pulse Width of Total Delay	100		%
d*	Duty Cycle		20	%
T_A	Operating Free-Air Temperature	0	+70	°C

These two values are inter-dependent.

Package Dimensions



Input Pulse Test Conditions

			Unit
E_{IN}	Pulse Input Voltage	3.2	Volts
P_W	Pulse Width % of Total Delay	150	%
T_{RI}	Pulse Rise Time (0.75 - 2.4 Volts)	2.0	nS
P_{RR}	Pulse Repetition Rate @ Td ≤ 500 nS	1.0	MHz
V_{CC}	Supply Voltage	5.0	Volts

EP8076 7/88

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14 Pin DIL 5 Tap High Speed CMOS (HCT) Compatible Active Delay Lines

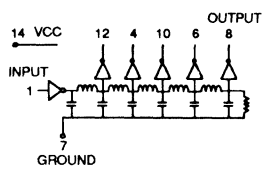
Tap Delays ±5% or ±2 nS				Total Delay ±5% or ±2 nS	Part Number
12*	17	22	27	32	EPA220-32
12*	18	24	30	36	EPA220-36
12*	19	26	33	40	EPA220-40
12*	20	28	36	44	EPA220-44
12*	21	30	39	48	EPA220-48
12*	22	32	42	52	EPA220-52
12*	24	36	48	60	EPA220-60
15	30	45	60	75	EPA220-75
19.	38	57	76	95	EPA220-95
20	40	60	80	100	EPA220-100
25	50	75	100	125	EPA220-125
30	60	90	120	150	EPA220-150
35	70	105	140	175	EPA220-175
40	80	120	160	200	EPA220-200
50	100	150	200	250	EPA220-250
60	120	180	240	300	EPA220-300

Tap Delays ±5% or ±2 nS				Total Delay ±5% or ±2 nS	Part Number
70	140	210	280	350	EPA220-350
80	160	240	320	400	EPA220-400
84	168	252	336	420	EPA220-420
88	176	264	352	440	EPA220-440
90	180	270	360	450	EPA220-450
100	200	300	400	500	EPA220-500
110	220	330	440	550	EPA220-550
120	240	360	480	600	EPA220-600
130	260	390	520	650	EPA220-650
140	280	420	560	700	EPA220-700
150	300	450	600	750	EPA220-750
160	320	480	640	800	EPA220-800
170	340	510	680	850	EPA220-850
180	360	540	720	900	EPA220-900
190	380	570	760	950	EPA220-950
200	400	600	800	1000	EPA220-1000

** Inherent Delay • Delay times referenced from input to leading edges ay 25°C, 5.0V.*

DC Electrical Characteristics Parameter		Test Conditions	Min	Max	Unit
V_{IH}	High Level Input Voltage	V_{CC}=4.5 to 5.5	2.0		Volt
V_{IL}	Low Level Input Voltage	V_{CC}=4.5 to 5.5		0.8	Volt
V_{OH}	High Level Output Voltage	V_{CC}=4.5V,I_O=-4.0mA@V_{IH} or V_{IL}	4.0		Volt
V_{OL}	Low Level Output Voltage	V_{CC}=4.5V,I_O= 4.0mA@V_{IH} or V_{IL}		0.3	Volt
I_L	Input Leakage Current	V_{CC}=5.5V @V_{IH} or V_{IL}		±1.0	uA
I_{CC}	Supply Current	V_{CC}=5.5V,V_{IN}=0		15	mA
T_{RO}	Output Rise Time	≤550 nS (.75 - 2.4 Volts)		4	nS
		>550 nS		5	nS
N_H	High Fanout	V_{CC}=5.5V,V_{OH}=4.0V	10	LSTTL Load	

Schematic



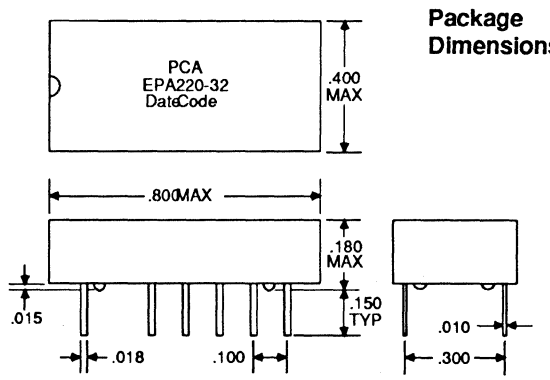
Recommended Operating Conditions		Min	Max	Unit
V_{CC}	DC Supply Voltage	4.5	5.5	Volt
V_I	DC Input Voltage Range	0	V_{CC}	Volt
V_O	DC Output Voltage Range	0	V_{CC}	Volt
I_O	DC Output Source/Sink Current		25	mA
P_W*	Pulse Width % of Total Delay	40		%
D*	Duty Cycle		40	%
T_A	Operating Free Air Temperature	0	70	°C

**These two values are inter-dependent.*

Input Pulse Test Conditions @ 25°C (Taps Unloaded)		
E_{IN}	Pulse Input Voltage	3.2 Volts
P_W	Pulse Width % of Total Delay	150%
T_{RI}	Input Rise Time (0.75 - 2.4 Volts)	2.0 nS
P_{RR}	Pulse Repetition Rate @ Td ≤ 500nS	1.0 MHz
	Pulse Repetition Rate @ Td > 500nS	500 KHz
V_{CC}	Supply Voltage	5.0 Volts

EPA220 0687 A

Package Dimensions



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Passive Variable Delay Lines

PART NUMBER	VARIABLE DELAYS (nS) LOW MAX	RANGE	HIGH MIN	DC RESISTANCE OHMS MAX	OUTPUT RISE TIME 20 - 80% NS MAX	CHAR. IMPEDANCE OHMS ± 10%
EPA087-10A	2	10	12	0.6	2.5	50
EPA087-15A	2	15	17	0.7	3.0	50
EPA087-25A	3	25	28	0.9	5.0	50
EPA087-30A	4	30	34	1.0	6.0	50
EPA087-40A	5	40	45	1.3	8.0	50
EPA087-50A	6	50	56	1.7	10.0	50
EPA087-75A	9	75	84	2.6	15.0	50
EPA087-100A	12	100	112	3.5	20.0	50
EPA087-10F	2	10	12	1.0	2.5	75
EPA087-15F	2	15	17	1.5	3.0	75
EPA087-25F	3	25	28	2.0	5.0	75
EPA087-30F	4	30	34	2.5	6.0	75
EPA087-40F	5	40	45	3.0	8.0	75
EPA087-50F	6	50	56	3.5	10.0	75
EPA087-75F	9	75	84	4.5	15.0	75
EPA087-100F	12	100	112	5.5	20.0	75
EPA087-10B	2	10	12	1.5	2.5	100
EPA087-15B	2	15	17	2.0	3.0	100
EPA087-25B	3	25	28	2.5	5.0	100
EPA087-30B	4	30	34	3.0	6.0	100
EPA087-40B	5	40	45	3.5	8.0	100
EPA087-50B	6	50	56	4.0	10.0	100
EPA087-75B	9	75	84	5.0	15.0	100
EPA087-100B	12	100	112	6.0	20.0	100

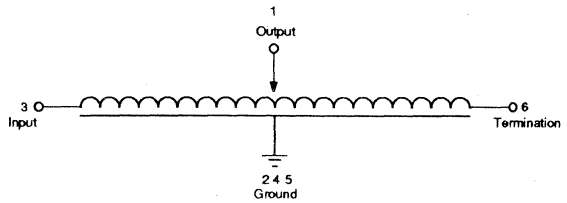
DC Electrical Characteristics	Min	Max	Unit
Distortion		±10	%
Temperature Coefficient of Delay		100	PPM/°C
Insulation Resistance @ 100 Vdc	1K		Meg Ohms
Dielectric Strength		100	Vdc

Recommended Operating Conditions		Min	Max	Unit
P_W*	Pulse Width % of Total Delay	200		%
D*	Duty Cycle		40	%
T_A	Operating Free Air Temperature	0	70	°C

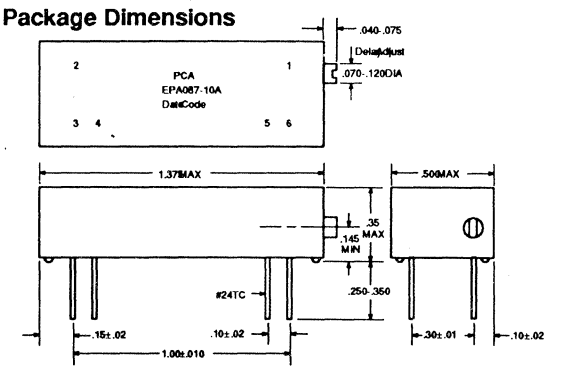
**These two values are inter-dependent.*

Input Pulse Test Conditions @ 25°C		
V_{IN}	Pulse Input Voltage	10 Volts
P_W	Pulse Width % of Total Delay	300 %
T_{RI}	Input Rise Time (10 - 90%)	2.0 nS
P_{RR}	Pulse Repetition Rate	1.0 MHz

Schematic



Package Dimensions



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EPA087 11/86

8 Pin Single-in-Line Passive Delay Lines

Zo OHMS ±10%	DELAY NS MAX	DELAY TOL NS	RISE TIME NS MAX (Calculated)	DCR OHMS MAX	PCA PART NUMBER	Zo OHMS ±10%	DELAY NS MAX	DELAY TOL NS	RISE TIME NS MAX (Calculated)	DCR OHMS MAX	PCA PART NUMBER
100	0.0	+0.25	1.0	1.0	EP123101	100	9.0	±0.25	1.9	1.0	EP123119
100	0.5	±0.25	1.0	1.0	EP123102	100	9.5	±0.25	2.0	1.0	EP123120
100	1.0	±0.25	1.0	1.0	EP123103	100	10.0	±0.25	2.0	1.0	EP123121
100	1.5	±0.25	1.0	1.0	EP123104	100	11.0	±0.25	2.2	2.0	EP123123
100	2.0	±0.25	1.0	1.0	EP123105	100	12.0	±0.25	2.3	2.0	EP123125
100	2.5	±0.25	1.0	1.0	EP123106	100	13.0	±0.25	2.5	2.0	EP123127
100	3.0	±0.25	1.0	1.0	EP123107	100	14.0	±0.25	2.6	2.0	EP123129
100	3.5	±0.25	1.0	1.0	EP123108	100	15.0	±0.25	2.8	2.0	EP123131
100	4.0	±0.25	1.0	1.0	EP123109	100	16.0	±0.25	3.0	2.5	EP123133
100	4.5	±0.25	1.0	1.0	EP123110	100	17.0	±0.25	3.2	2.5	EP123135
100	5.0	±0.25	1.1	1.0	EP123111	100	18.0	±0.25	3.4	2.5	EP123137
100	5.5	±0.25	1.2	1.0	EP123112	100	19.0	±0.25	3.6	2.5	EP123139
100	6.0	±0.25	1.3	1.0	EP123113	100	20.0	±0.50	3.8	2.5	EP123141
100	6.5	±0.25	1.4	1.0	EP123114	100	25.0	±0.50	4.5	4.0	EP123146
100	7.0	±0.25	1.5	1.0	EP123115	100	30.0	±0.50	5.5	4.5	EP123151
100	7.5	±0.25	1.6	1.0	EP123116	100	35.0	±0.50	6.4	5.5	EP123156
100	8.0	±0.25	1.7	1.0	EP123117	100	40.0	±0.50	7.4	6.0	EP123161
100	8.5	±0.25	1.8	1.0	EP123118	100	45.0	±1.0	8.0	6.5	EPA594

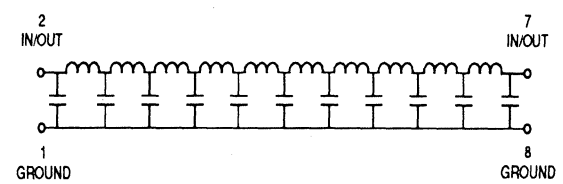
DC Electrical Characteristics	Min	Max	Unit
Distortion		±10	%
Temperature Coefficient of Delay		100	PPM/°C
Insulation Resistance @ 100 Vdc	1K		Meg Ohms
Dielectric Strength		100	Vdc

Recommended Operating Conditions		Min	Max	Unit
P_W*	Pulse Width % of Total Delay	200		%
D*	Duty Cycle		40	%
T_A	Operating Free Air Temperature	0	70	°C

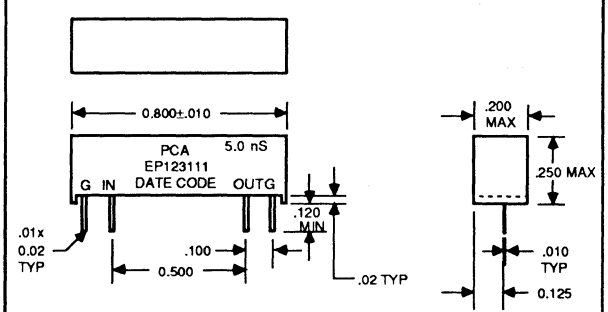
**These two values are inter-dependent.*

Input Pulse Test Conditions @ 25°C		
V_{IN}	Pulse Input Voltage	10 Volts
P_W	Pulse Width % of Total Delay	300 %
T_{RI}	Input Rise Time (10 - 90%)	2.0 nS
P_{RR}	Pulse Repetition Rate	1.0 MHz

Schematic



Package Dimensions



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EP123101 7/88

Toroidal Power Inductors

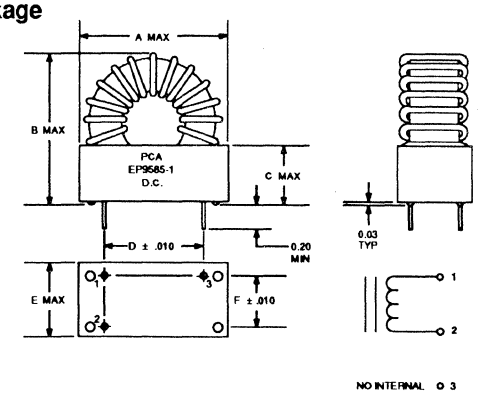
Features

- 2:1 Inductance swing from 0 ADC to max rated DC current
- 40° C max temperature rise
- Available with or without case

PART NUMBER	INDUCTANCE RATED ADC µH MIN	ADC AMPS	TEST LEVEL @ 15.75 KHz VRMS	INDUCTANCE @ 0 ADC µH MIN	DCR OHMS MAX	ET 20 KHz V-µS	ET 40 KHz V-µS	LEAD DIA INCH ± .005	PACKAGE
EP9585-1	17	17	1.1	40	.0065	190	130	.081	3
EP9585-2	32	16	2.2	74	.0092	290	200	.081	4
EP9585-3	60	16	3.9	125	.012	390	270	.081	5
EP9585-4	14	10	0.6	27	.009	135	95	.057	1
EP9585-5	23	11	1.1	46	.012	170	120	.057	2
EP9585-6	43	10	1.7	90	.018	280	195	.057	3
EP9585-7	78	10	3.2	165	.025	430	300	.057	4
EP9585-8	144	10	5.7	275	.032	570	400	.057	5
EP9585-9	32	6.5	0.85	64	.025	200	140	.04	1
EP9585-10	52	7	1.5	97	.032	230	160	.04	2
EP9585-11	98	6	2.4	185	.048	400	280	.04	3
EP9585-12	175	6	4.6	330	.068	620	425	.04	4
EP9585-13	335	6	8.5	600	.095	840	580	.04	5

ADC=Rated DC Current

Package



Dimensions

PKG	A	B	C	D	E	F
1	1.20	1.20	.45	.800	.60	.400
2	1.45	1.45	.70	.900	.80	.600
3	1.60	1.75	.70	.900	.80	.600
4	2.00	2.00	.90	1.200	.95	.70
5	2.30	2.30	1.00	1.500	1.20	.900

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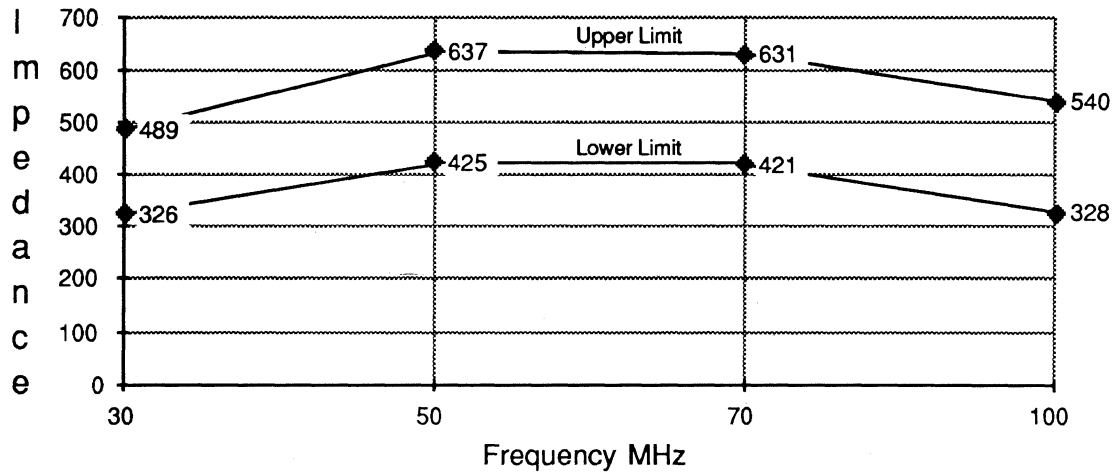
EP9585 7/88

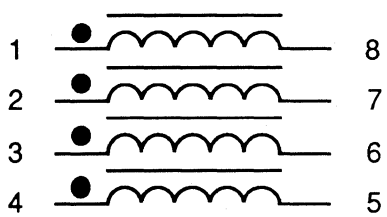
4 Line Common Mode Filter

PCA P/N EPA120

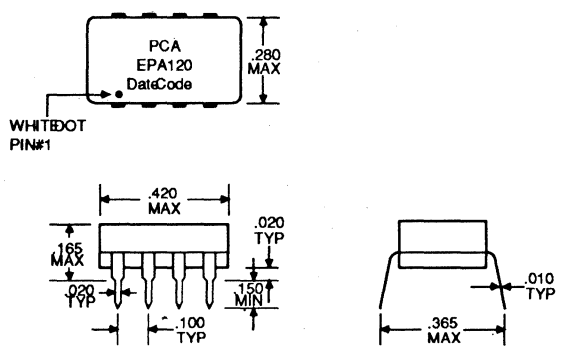
Impedance Table



Schematic



Package



- Impedance limits per chart measured using HP4193A Vector Impedance Meter
- Max Current 1 A DC/Winding
- Temperature rise 45° C Max at 25° C ambient
- Package transfer-molded epoxy suitable for auto-insertion
- Part is symmetrical: May be inserted either way
- 500 VDC Hipot

EPA120 7/88

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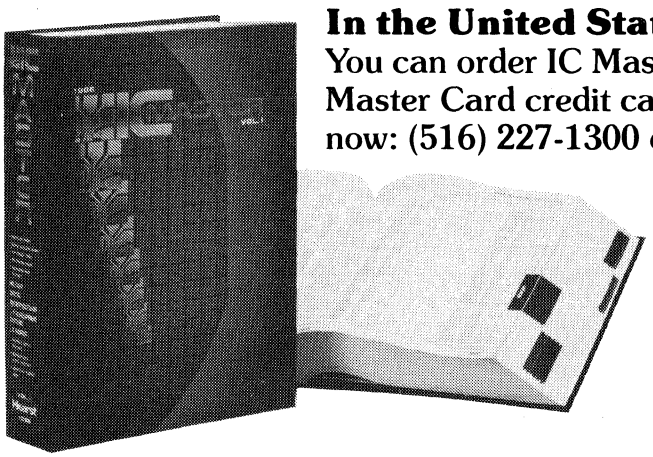

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AUTO-INSERTABLE & SURFACE MOUNT TTL 10 TAP DELAY MODULES

FEATURES

- Low profile auto-insertable package, also gull-wing or "J" bend surface mount versions
- 14 lead transfer molded epoxy packages
- Schottky TTL buffered input/output
- Taps at 10% increments of total delay

The low profile auto-insertable and surface mount series of TTL delay modules offered by Rhombus Industries Inc. have been designed to provide precise tapped delays with all necessary drive and pick-off circuitry in a single package. The modules are compatible with all TTL integrated circuits and include compensation for propagation delays. All inputs and outputs are Schottky-type and require no additional components to achieve specified delays.

All versions are fully compatible with standard automatic handling equipment. The surface mount devices can be used in either infrared or vapor phase manufacturing processes, and are designed to withstand automatic solder and cleaning processes. Devices are offered in delays from 50 to 300 nanoseconds. Delay time and tap tolerances are shown in the tables below. Temperature coefficient of delay is typically better than +800 ppm/°C over the temperature range of 0° to 70°C.

The devices accept either Logic "1" or Logic "0" and will reproduce these levels at the output without inversion. Each module has the capability of driving up to 20 TTL loads with a maximum of 10 TTL loads on any one tap.

These devices are designed to meet or exceed all applicable environmental requirements of MIL-D-23859, MIL-STD-883 and MIL-STD-202.

ELECTRICAL SPECIFICATIONS AT 25°C

14 Lead 10 Tap Part Number	Total Delay Time[2] (ns)	10 Taps @ (ns)
AITD-50	50±2.5	5±2
AITD-60	60±3	6±2
AITD-70	70±3.5	7±2
AITD-75	75±3.75	7.5±2
AITD-80	80±4	8±2
AITD-90	90±4.5	9±2
AITD-100	100±5	10±2
AITD-120	120±6	12±2.5
AITD-125	125±6.25	12.5±2.5
AITD-150	150±7.5	15±3
AITD-175	175±8.75	17.5±3
AITD-200	200±10	20±3
AITD-225	225±11.25	22.5±3
AITD-250	250±12.5	25±3
AITD-300	300±15	30±5

PART NUMBER INFORMATION

Factory orders should include complete part numbers as explained below:

AITD - XXX X

14 pin 10 Tap TTL Delay

Delay in nanoseconds (ns)

Lead Style
Blank = 14 lead auto insertable
J = "J" Style Surface Mount
G = "Gull Wing" Style Surface Mount

Examples:
AITD-50 = 14 auto-insertable, 50ns, 10 tap delay module.
AITD-100J = 14 lead "J" style surface mount, 100ns, 10 tap delay module.

1. Measured from .75v to 2.4v.
2. Measured at 1.5v level on the leading edge.
3. For non-standard delays and/or improved accuracy for special applications, please consult the factory.

Unless otherwise specified, delays referenced from the leading edge of the input meet ±5% or 2ns (whichever is greater).

INTRODUCTION

Rhombus Industries Inc., a leading manufacturer of digital and electromagnetic delay lines, has been providing high quality products since 1970 and is backed by a highly talented and dedicated staff — from management through the assembly line.

Rhombus Industries provides customers with responsive, cost effective service, and our engineers will provide minor engineering services free of charge, allowing customers unencumbered design freedom.

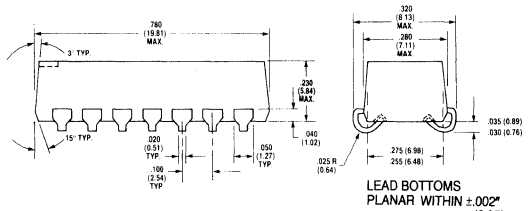
- **Fast turnaround on prototypes.**
- **Digital and Electromagnetic (passive) delay lines.**
- **Similar versions of standard Schottky TTL Series available in FAST and Low Power (LS).**
- **Similar versions of standard 10K ECL Series available in 100K ECL.**

TEST CONDITIONS

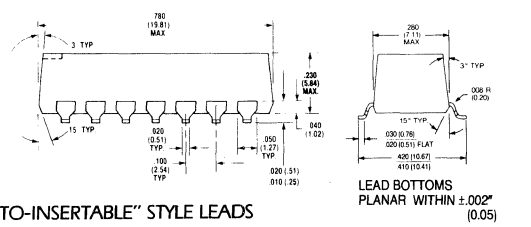
Measurements made at 25°C
Supply Voltage, Vcc ..... 5.00 VDC
Input Pulse Voltage 3.2V
Input Pulse Rise Time ..... 3ns max.
Period ..... 4 X total delay
Duty Cycle 50%
No Loads on Output

PHYSICAL DIMENSIONS All dimensions in inches (mm).

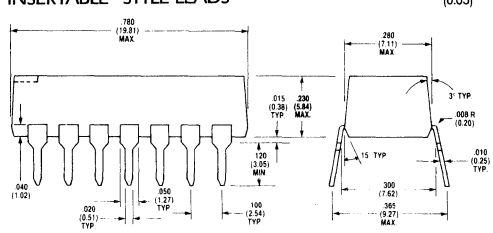
"J" STYLE LEADS



"GULL WING" STYLE LEADS

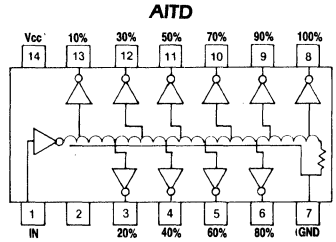


"AUTO-INSERTABLE" STYLE LEADS



SCHEMATIC DIAGRAMS WITH PINOUTS
Notch denotes Pin 1.

AITD



Specifications are subject to change without notice.

RHOMBUS INDUSTRIES INC.
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TWX: 910-596-1826 • FAX: (714) 896-0971
TELEX: 62891137 RHOMBUS HTBH

AUTO INSERTABLE & SURFACE MOUNT TTL DELAY MODULES

FEATURES

- Low profile auto-insertable package, also gull-wing or "J" bend surface mount versions
- 14 lead or mini 8 lead transfer molded epoxy packages
- Schottky TTL buffered input/output
- Tapped, single output or multi-line configurations

The low profile auto-insertable and surface mount series of TTL delay modules offered by Rhombus Industries Inc. have been designed to provide precise tapped or fixed delays with all necessary drive and pick-off circuitry in a single package. The modules are compatible with all TTL integrated circuits and include compensation for propagation delays. All inputs and outputs are Schottky-type and require no additional components to achieve specified delays.

All versions are fully compatible with standard automatic handling equipment. The surface mount devices can be used in either infrared or vapor phase manufacturing processes, and are designed to withstand automatic solder and cleaning processes. Devices are offered in delays from 5 to 250 nanoseconds. Delay time and tap tolerances are shown in the tables below. Temperature coefficient of delay is typically better than +500 ppm/°C over the temperature range of 0° to 70°C.

The devices accept either Logic "1" or Logic "0" and will reproduce these levels at the output without inversion. Each module has the capability of driving up to 20 TTL loads with a maximum of 10 TTL loads on any one tap.

These devices are designed to meet or exceed all applicable environmental requirements of MIL-D-23859, MIL-STD-883 and MIL-STD-202.

ELECTRICAL SPECIFICATIONS AT 25°C

8 Lead 5 Tap Part Number	Total Delay Time[2] (ns)	5 Taps @ (ns)
AMDM-25	25±2	5±2
AMDM-30	30±2	6±2
AMDM-35	35±2	7±2
AMDM-40	40±2	8±2
AMDM-45	45±2.25	9±2
AMDM-50	50±2.5	10±2
AMDM-60	60±3	12±2
AMDM-75	75±3.75	15±3
AMDM-100	100±5	20±3
AMDM-125	125±6.25	25±3
AMDM-150	150±7.5	30±3
AMDM-200	200±10	40±4
AMDM-250	250±12.5	50±5

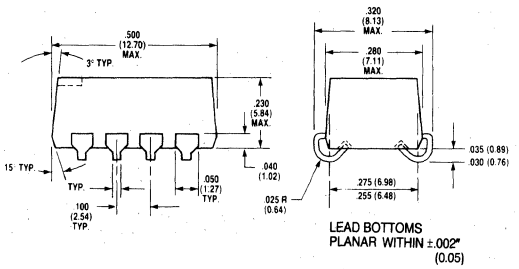
8 Lead Single Output Part Number	8 Lead 2 Independent Lines Part Number	Delay (ns)
AMDL-5	AM2D-5	5±1
AMDL-10	AM2D-10	10±1.5
AMDL-15	AM2D-15	15±2
AMDL-20	AM2D-20	20±2
AMDL-25	AM2D-25	25±2
AMDL-30	AM2D-30	30±2
AMDL-35	AM2D-35	35±2
AMDL-40	AM2D-40	40±2
AMDL-45	AM2D-45	45±2.25
AMDL-50	AM2D-50	50±2.5
AMDL-60	—	60±3
AMDL-75	—	75±3.75
AMDL-100	—	100±5
AMDL-125	—	125±6.25
AMDL-150	—	150±7.5
AMDL-200	—	200±10
AMDL-250	—	250±12.5

1. Measured from .75v to 2.4v.
2. Measured at 1.5v level on the leading edge.
3. For non-standard delays and/or improved accuracy for special applications, please consult the factory.

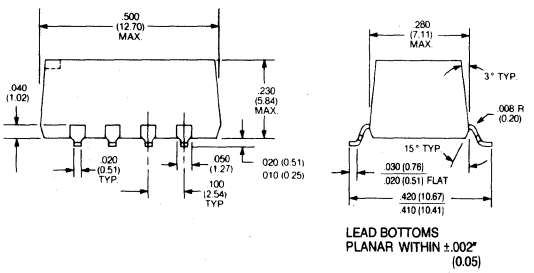
Unless otherwise specified, delays referenced from the leading edge of the input meet ±5% or 2ns (whichever is greater).

PHYSICAL DIMENSIONS *All dimensions in inches (mm).*

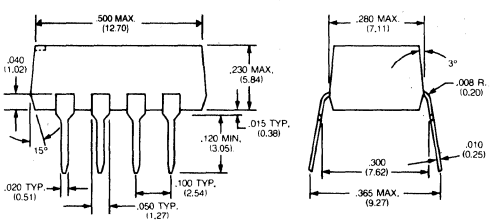
"J" STYLE 8 LEADS



"GULL WING" STYLE 8 LEADS

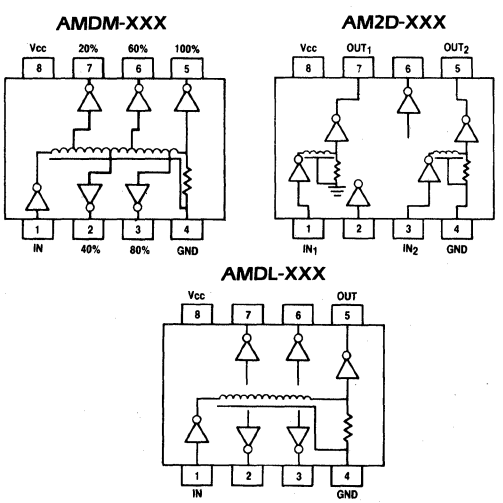


"AUTO-INSERTABLE" STYLE 8 LEADS



8 PIN MINIATURE SCHEMATIC DIAGRAMS WITH PINOUTS

Notch denotes Pin 1.



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TELEX: 62891137 RHOMBUS HTBH

AUTO INSERTABLE & SURFACE MOUNT TTL DELAY MODULES

OPERATING SPECIFICATIONS

Supply Voltage, Vcc	5.00 ±0.25 VDC
Supply Current, Icc	60mA typical 90mA typical AI3D, AM2D
Logic "1" Input:	
Voltage	2.0V min., 5.5V max.
Current	50μA max. @ 2.4V
Logic "0" Input:	
Voltage	0.8V max.
Current	-2mA max.
Logic "1" Voltage Out	2.4V min.
Logic "0" Voltage Out	0.5V max.
Output Rise Time	4ns max. (0.75V to 2.40V)
Input Pulse Width	Minimum 40% of total delay: AIDM, AIDL, AMDM, AMDL Minimum 100% of total delay: AI3D, AM2D
Storage Temperature Range	-55° to +125°C
Operating Temperature Range	0° to 70°C

TEST CONDITIONS

Measurements made at 25°C

Supply Voltage, Vcc	5.00 VDC
Input Pulse Voltage	3.2V
Input Pulse Rise Time	3ns max.
Period	4 X total delay
Duty Cycle	50%

No Loads on Output

ELECTRICAL SPECIFICATIONS AT 25°C

14 Lead 5 Tap Part Number	Total Delay Time[2] (ns)	5 Taps @ (ns)
AIDM-25	25±2.5	5±2
AIDM-30	30±2	6±2
AIDM-35	35±2	7±2
AIDM-40	40±2	8±2
AIDM-45	45±2.25	9±2
AIDM-50	50±2.5	10±2
AIDM-60	60±3	12±2
AIDM-75	75±3.75	15±3
AIDM-100	100±5	20±3
AIDM-125	125±6.25	25±3
AIDM-150	150±7.5	30±3
AIDM-200	200±10	40±4
AIDM-225	225±11.25	45±4.5
AIDM-250	250±12.5	50±5

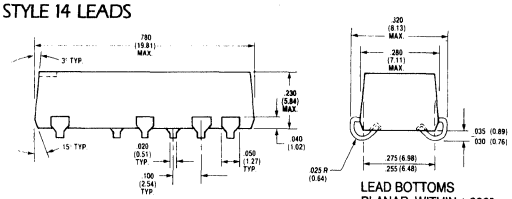
14 Lead Single Output Part Number	14 Lead 3 Independent Lines Part Number	Delay (ns)
AIDL-5	AI3D-5	5±1
AIDL-10	AI3D-10	10±1.5
AIDL-15	AI3D-15	15±2
AIDL-20	AI3D-20	20±2
AIDL-25	AI3D-25	25±2
AIDL-30	AI3D-30	30±2
AIDL-35	AI3D-35	35±2
AIDL-40	AI3D-40	40±2
AIDL-45	AI3D-45	45±2.25
AIDL-50	AI3D-50	50±2.5
AIDL-60	—	60±3
AIDL-75	—	75±3.75
AIDL-100	—	100±5
AIDL-125	—	125±6.25
AIDL-150	—	150±7.5
AIDL-200	—	200±10
AIDL-250	—	250±12.5

1. Measured from .75v to 2.4v.
2. Measured at 1.5v level on the leading edge.
3. For non-standard delays and/or improved accuracy for special applications, please consult the factory.

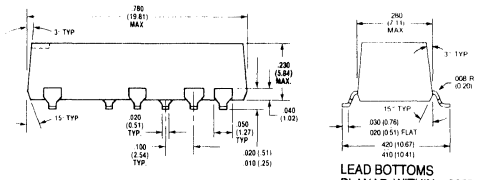
Unless otherwise specified, delays referenced from the leading edge of the input meet ±5% or 2ns (whichever is greater).

PHYSICAL DIMENSIONS All dimensions in inches (mm).

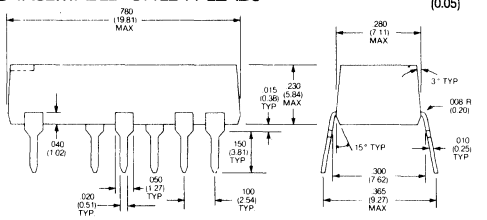
"J" STYLE 14 LEADS



"GULL WING" STYLE 14 LEADS

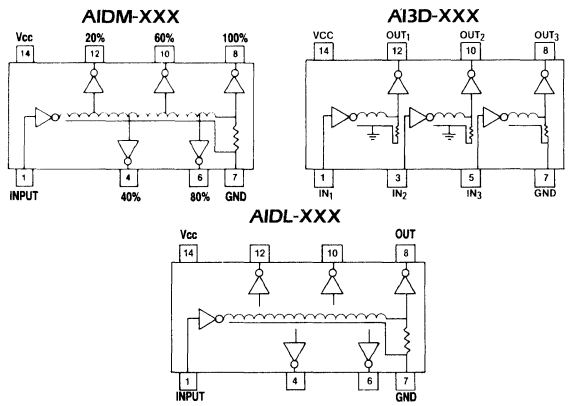


"AUTO-INSERTABLE" STYLE 14 LEADS



14 PIN SCHEMATIC DIAGRAMS WITH PINOUTS

Notch denotes Pin 1.



PART NUMBER INFORMATION

Factory orders should include complete part numbers as explained below:

XX XX - XXX X

Package
- AI = 14 pin
- AM = Mini 8 pin

Configuration
- DL = Single Output Delay
- DM = 5 Tap Delay Module
- 2D = Two Independent Lines
- 3D = Three Independent Lines
  (Available 14 pin package only, AI3D)

Delay in nanoseconds (ns)

Lead Style
- Blank = Auto-Insertable
- J = "J" Style Surface Mount
- G = "Gull Wing" Style Surface Mount

Examples:

AIDM-100 = 14 pin auto-insertable, 100ns, 5 tap delay module.

AMDL-50G = 8 pin "gull wing" surface mount package, 50ns, single output.

Specifications are subject to change without notice.

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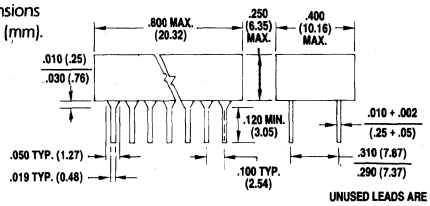
TELEX: 62891137 RHOMBUS HTBH

ECL BUFFERED DELAY LINES

GENERAL SPECIFICATIONS

Supply Voltage		-5.2 VDC to V_{EE}
Logic "1" Input:	Voltage	-.98 min.
	Current	265μa max.
Logic "0" Input:	Voltage	-1.63v max.
	Current	.5μa min.
Logic "1" Voltage Out		-.96 min.
Logic "0" Voltage Out		-1.650 max.
Rise Time Out		<5ns typ.
Storage Temperature Range		-55° to +125°C
Operating Temperature Range		-30° to +85°C

All dimensions in inches (mm).

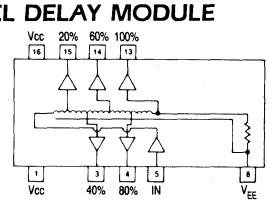


UNUSED LEADS ARE OMITTED.

10K ECL DELAY MODULE DECL Series

5 TAP 10K ECL DELAY MODULE

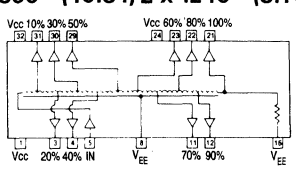
16 pin DIL



5 Tap Part Number	Total Delay Time[3] (ns)	5 Taps[2] @ (ns)
DECL-10	10±2	2±1
DECL-15	15±2	3±2
DECL-20	20±2	4±2
DECL-25	25±2	5±2
DECL-30	30±2	6±2
DECL-35	35±2	7±2
DECL-40	40±2	8±2
DECL-45	45±2.25	9±2
DECL-50	50±2.5	10±2
DECL-75	75±4	15±3
DECL-100	100±5	20±3
DECL-150	150±7.5	30±3
DECL-200	200±10	40±4
DECL-250	250±12.5	50±5

10 TAP 10K ECL DELAY D2ECL Series

32 pin DIL 1.600" (40.64) L x .240" (6.10) HT

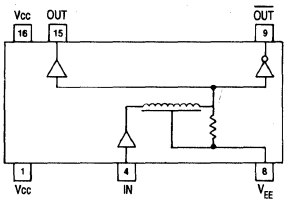


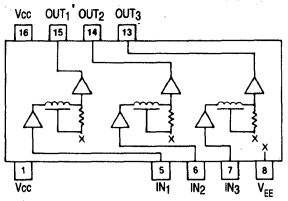
10 Tap Part Number	Total Delay Time[3] (ns)	10 Taps @ (ns)
D2ECL-30	30±2	3±1
D2ECL-35	35±2	3.5±1
D2ECL-40	40±2	4±1
D2ECL-45	45±2.25	4.5±1
D2ECL-50	50±2.5	5±2
D2ECL-75	75±4	7.5±2
D2ECL-100	100±5	10±2
D2ECL-150	150±7.5	15±3
D2ECL-200	200±10	20±3
D2ECL-250	250±12.5	25±3

1. Tap delays referenced from leading edge of input meet ±5% or 2ns whichever is greater.
2. For non-standard delays and/or improved accuracies, please consult factory.
3. Measured at -1.3V on leading edge.

FIXED (Single Output) 10K ECL DELAY FECL Series

MULTI (3 Independent) 10K ECL DELAY MECL Series

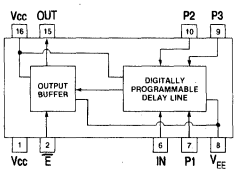




16 Pin, Single Output Part Number	16 Pin, 3 Independent Lines Part Number	Total Delay Time[3] (ns)
FECL-5	MECL-5	5±1
FECL-10	MECL-10	10±1
FECL-15	MECL-15	15±2
FECL-20	MECL-20	20±2
FECL-25	MECL-25	25±2
FECL-30	MECL-30	30±2
FECL-35	MECL-35	35±2
FECL-40	MECL-40	40±2
FECL-45	MECL-45	45±2.25
FECL-50	MECL-50	50±2.5
FECL-75	MECL-75	75±4
FECL-100	MECL-100	100±5
FECL-150	MECL-150	150±7.5
FECL-200	MECL-200	200±10

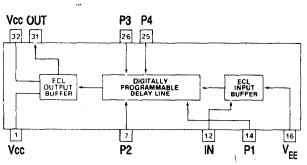
PROGRAMMABLE 10K ECL DELAY MODULES PECL Series

3 BIT: 7 steps above minimum delay
10K ECL buffered output
16 pin DIL, .800" (20.32) L
x .260" (6.60) HT



3 Bit Part Number	Min. Delay Time (ns)	Max. Delay Time (Nom.) (ns)	Max. Dev. from Programming Delay* (ns)	Delay Change Per Step (ns)
PECL 3-1	3±1	10	±.4	1±.3
PECL 3-2	3±1	17	±.6	2±.4
PECL 3-3	3±1	24	±.8	3±.5
PECL 3-4	3±1	31	±.9	4±.5
PECL 3-5	3±1	38	±1.0	5±.5
PECL 3-10	3±1	73	±2.0	10±1

4 BIT: 15 steps above minimum delay
10K ECL buffered input/output
32 pin DIL, 1.600" (40.64) L
x .240" (6.10) HT



4 Bit Part Number	Min. Delay Time (ns)	Max. Delay Time (Nom.) (ns)	Max. Dev. from Programming Delay* (ns)	Delay Change Per Step (ns)
PECL 6-1	6±1	21	±1	1±.5
PECL 15-1	15±1	30	±1	1±.5
PECL 30-1	30±2	45	±2	1±.5
PECL 45-1	45±2	60	±2.5	1±.5
PECL 15-2	15±1	45	±1	2±.8
PECL 15-3	15±1	60	±2	3±1
PECL 15-5	15±1	90	±2	5±1
PECL 15-10	15±1	165	±2	10±1

* Programmed delays referenced to minimum delay.

Specifications are subject to change without notice.

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TELEX: 62891137 RHOMBUS HTBH

ELECTROMAGNETIC (Passive) DELAY LINES

FEATURES

- **DIP and SIP Packages.**
- **High delay to rise time ratio.**
- **Extreme temperature stability.**
- **Low attenuation and distortion.**

Tap-to-Tap Tolerance:

1ns	±0.35ns
1 - 3ns	±0.5ns
4 - 5ns	±1ns
6 - 10ns	±2ns
11 - 50ns	±3ns

*All units tested 100% electrically.

GENERAL SPECIFICATIONS

Overshoot	5% to 10% typical
Line Distortion	3% max.
Working Volts	25VDC max.
Dielectric Strength	100VDC
Insulation Resistance @ 100VDC	1,000 Megohms
Temperature Coefficient	70PPM/°C
Input-to-Tap Tolerance	±5% or 1ns, whichever is greater
Storage Temperature	-55° to +125°C
Operating Temperature	0° to +125°C

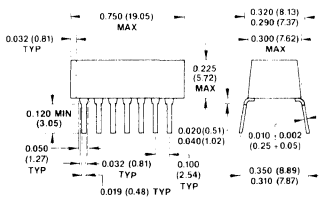
10 TAP 14 PIN, 16 PIN DIP

TZB, TYD, TZD Series

10 TAP, 14 PIN DIP DIMENSIONS

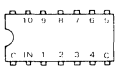
PHYSICAL DIMENSIONS

All dimensions in inches (mm).

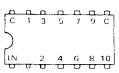


PIN BREAK-OUTS

TYB BREAK-OUT



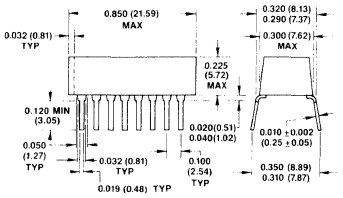
TZB BREAK-OUT



10 TAP, 16 PIN DIMENSIONS

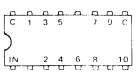
PHYSICAL DIMENSIONS

All dimensions in inches (mm).



PIN BREAK-OUT

TZD BREAK-OUT



Delay Coding Number	Delay Time (±5%) (ns)	Taps (Typical) (ns)	50 Ω Impedance		100 Ω Impedance		200 Ω Impedance	
			Rise Time (Max.) (ns)	DCR Ω (Maximum)	Rise Time (Max.) (ns)	DCR Ω (Maximum)	Rise Time (Max.) (ns)	DCR Ω (Maximum)
XXX6-XX	10±1	1	3.0	.7	3.8	.75	5.5	1.0
XXX12-XX	20	2	4.0	.7	4.6	1.5	8.5	1.5
XXX18-XX	25	2.5	4.5	.9	5.5	1.7	9.0	1.8
XXX24-XX	30	3	5.5	1.0	5.8	2.0	10.0	2.0
XXX30-XX	40	4	6.0	1.2	7.5	2.2	13.0	2.2
XXX36-XX	50	5	7.0	1.3	8.0	2.3	15.5	2.4
XXX42-XX	60	6	8.0	1.6	8.5	2.5	16.0	2.5
XXX48-XX	70	7	9.0	1.7	12.7	2.75	17.0	2.5
XXX54-XX	80	8	10.0	1.9	15.5	3.0	19.0	2.5
XXX60-XX	90	9	12.0	2.0	16.5	3.1	20.0	2.5
XXX66-XX	100	10	14.0	2.1	18.0	3.2	20.0	2.6
XXX72-XX	150	15	20.0	2.2	26.0	3.5	30.0	3.6
XXX78-XX	200	20	30.0	2.4	39.0	3.5	40.0	4.8
XXX84-XX	250	25	35.0	2.4	46.0	4.0	51.0	5.2
XXX90-XX	300	30	43.0	2.5	54.0	4.2	—	—
XXX92-XX	350	35	50.0	2.7	61.0	4.2	—	—
XXX94-XX	400	40	55.0	2.8	67.0	4.5	—	—
XXX96-XX	450	45	60.0	3.0	77.0	4.7	—	—
XXX98-XX	500	50	75.0	3.3	86.0	5.0	—	—

Td to Tr RATIO — 8:1 TYP.
TAPS @ 10% INCREMENTS OF Td.
CAN BE SERIES CONNECTED.
ATTENUATION — 0.5 dB MAX.

PART NUMBER INFORMATION XXX XX-XX

Series
TZB, 14 pin DIP
TYB, 14 pin DIP
TZD, 16 pin DIP

Delay Coding Number
(Determines delay and rise time per table)

Impedance
- 5 = 50 Ω
-10 = 100 Ω
-20 = 200 Ω

Example:
TZB66-10 = 14 pin DIP, Z pin break-out, 100ns delay time, 100 Ω impedance.
TYB24-5 = 14 pin DIP, Y pin break-out 30ns delay time, 50 Ω impedance.

Numerous TZB and TYB delays are also available in low profile versions: TZG, TYG 14 pin DIP 0.180" (4.57mm) max. case height. Consult factory for availability.

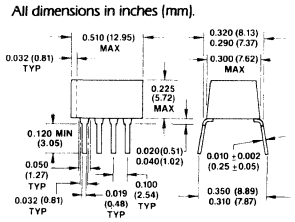
5 TAP, 8 PIN DIP TYA/TZA Series

Delay Coding Number	Delay Time (±5%) (ns)	Taps (Typical) (ns)	50 Ω Impedance		100 Ω Impedance	
			Rise Time (Max.) (ns)	DCR Ω (Maximum)	Rise Time (Max.) (ns)	DCR Ω (Maximum)
XXX1-XX	5±0.5	1	2.9	.5	3.6	.6
XXX2-XX	10±1	2	3.8	.5	4.4	.7
XXX3-XX	15±1	3	5.0	.5	5.6	.9
XXX4-XX	20	4	5.8	.7	7.3	1.2
XXX5-XX	25	5	6.8	.9	7.8	1.3
XXX6-XX	30	6	7.8	1.0	8.3	1.4
XXX7-XX	35	7	8.8	1.25	12.5	1.5
XXX8-XX	40	8	9.9	1.4	15.2	1.6
XXX9-XX	45	9	11.6	1.5	16.0	1.7
XXX10-XX	50	10	13.0	1.7	17.6	1.8
XXX11-XX	75	15	19.0	1.9	25.0	2.0
XXX12-XX	100	20	28.0	2.0	38.0	2.0
XXX13-XX	125	25	34.0	2.0	45.0	2.0
XXX14-XX	150	30	41.0	2.0	52.0	2.0
XXX15-XX	175	35	47.0	2.2	59.0	2.2
XXX16-XX	200	40	54.0	2.2	65.0	2.2
XXX17-XX	225	45	59.0	2.5	75.0	2.5
XXX18-XX	250	50	73.0	2.5	84.0	2.5

8 LEAD "DIP"
Td to Tr RATIO — 4:1 TYP.
TAPS @ 20% INCREMENTS OF Td.
CAN BE SERIES CONNECTED.
ATTENUATION — 0.25 db MAX.

PHYSICAL DIMENSIONS

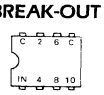
All dimensions in inches (mm).



PIN BREAK-OUTS

TYA BREAK-OUT

TZA BREAK-OUT



PART NUMBER INFORMATION XXX XX-XX

Series
TYA, 8 pin DIP
TZA, 8 pin DIP

Delay Coding Number
(Determines delay and rise time per table)

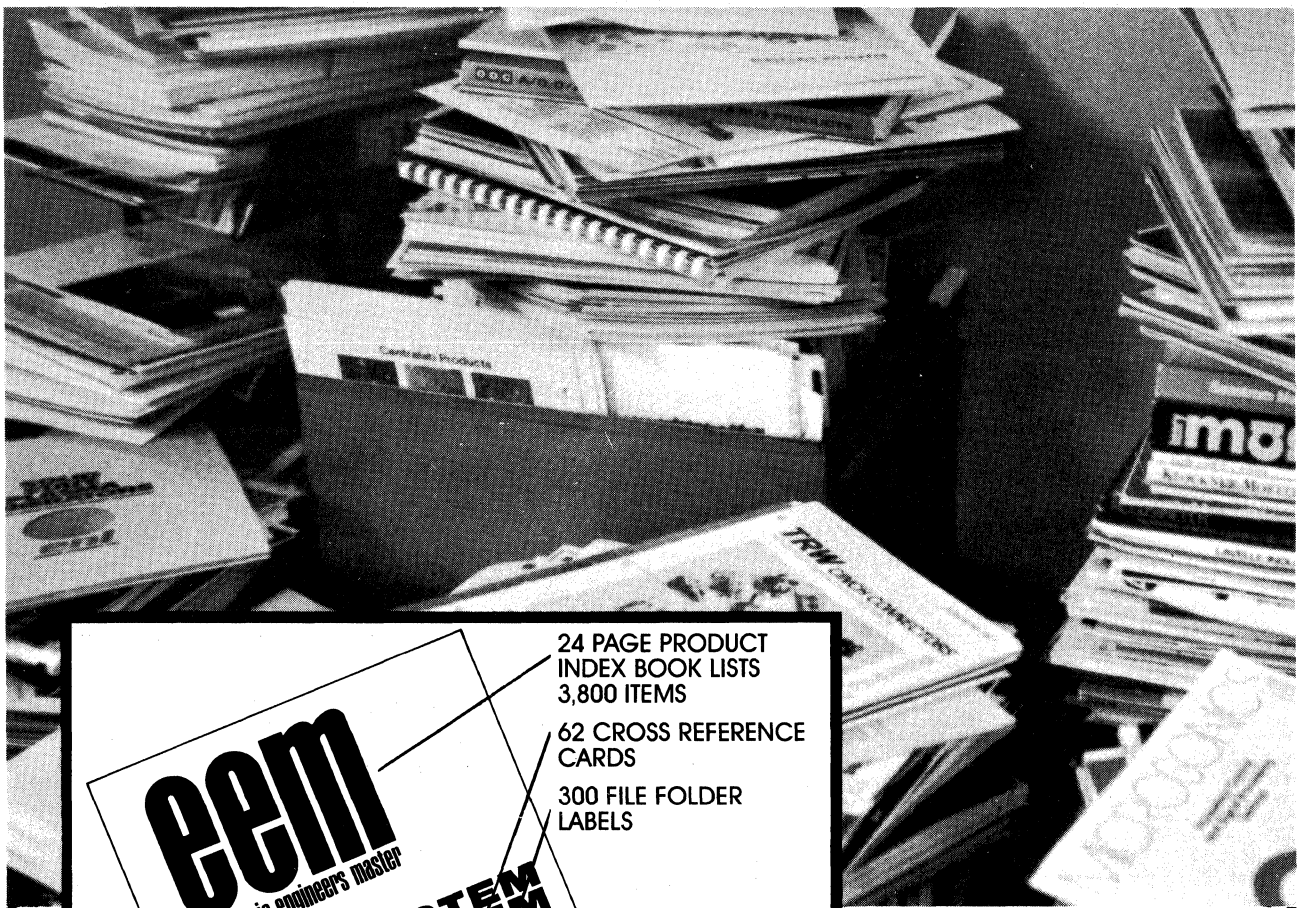
Impedance
- 5 = 50 Ω
-10 = 100 Ω

Example:
TZA14-10 = 8 pin DIP, Z pin break-out, 150ns delay time, 100 Ω impedance

Specifications are subject to change without notice.

RHOMBUS INDUSTRIES INC.

15801 Chemical Lane, Huntington Beach, CA 92649
(714) 898-0960 • (213) 594-8918
TWX: 910-596-1826 • FAX: (714) 896-0971
TELEX: 62891137 RHOMBUS HTBH



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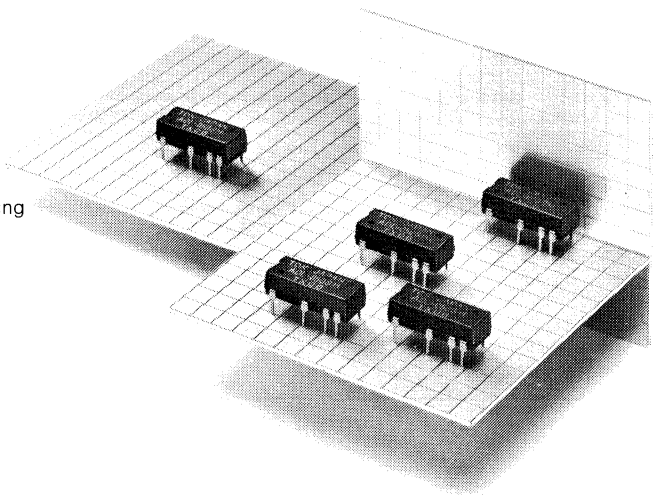
ACTIVE DELAY LINES (ADL-H/EDL SERIES)

TDK CORPORATION OF AMERICA HEAD OFFICE 1600 Feehanville Drive, Mount Prospect, IL 60056, U.S.A. Phone: (312) 803-6100 **CHICAGO REGIONAL OFFICE** Phone: (312) 803-6100 **INDIANAPOLIS REGIONAL OFFICE** Phone: (317) 872-0370 **NEW YORK REGIONAL OFFICE** Phone: (516) 625-0100 **LOS ANGELES REGIONAL OFFICE** Phone: (213) 539-6631 **DETROIT DISTRICT OFFICE** Phone: (313) 353-9393 **NEW JERSEY DISTRICT OFFICE** Phone: (201) 736-0023 **HUNTSVILLE DISTRICT OFFICE** Phone: (205) 539-4551 **GREENSBORO DISTRICT OFFICE** Phone: (919) 292-0012 **DALLAS DISTRICT OFFICE** Phone: (214) 506-9800 **SAN FRANCISCO DISTRICT OFFICE** Phone: (408) 437-9585 **TDK CORPORATION,** TOKYO, JAPAN

ACTIVE DELAY LINES (ADL-H/EDL SERIES)

TDK Active Delay Line ADL-SH/EDL Series are 5-output (EDL: 2-output) lumped constant type delay lines with built-in TTL logic elements (Schottky type). In addition. TDK multilayer chip inductors are employed as inductance elements, and by combining these with multilayer chip capacitors, a compact, high reliability construction has been obtained.



Features

- Contained in DUAL-IN-LINE type package.
- Excellent quality due to transfer molding using high quality resin.
- A low height of only 5.08mm maximum is realized as a result of using TDK multilayer chip inductors and multi-layer chip capacitors.
- Since a TTL IC is built in, waveform shaping is not required.
- IC automatic insertion equipment can be used.
  Weight (ADL-SH: 2g max., EDL: 1.5g max.)

Maximum ratings

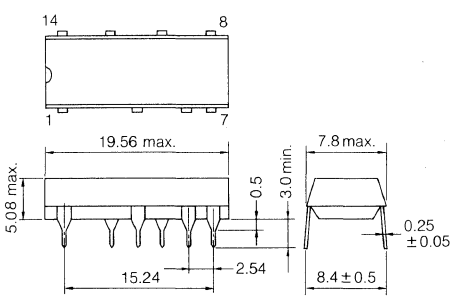
Power supply voltage (V_{CC}) 7.0V
Input voltage (V_I) . . . . . −0.5 to +5.5V
Operating temperature (Ta) . . . . . − 20 to + 75°C
Storage temperature (Tstg.) . . . . . −55 to +125°C

Applications

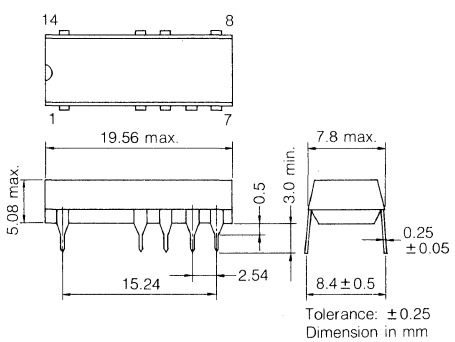
- D-RAM controllers
- Multiphase clock OSC.
- Pulse width convertion

ADL-H SERIES

S Type

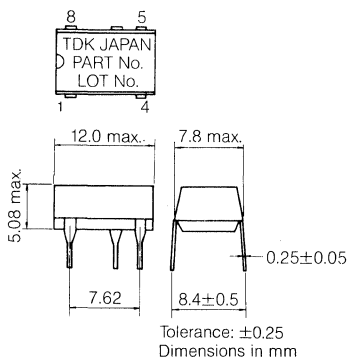


L Type



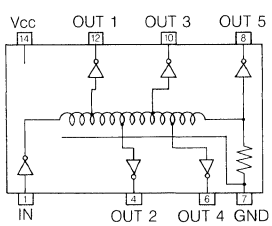
Tolerance: ±0.25
Dimension in mm

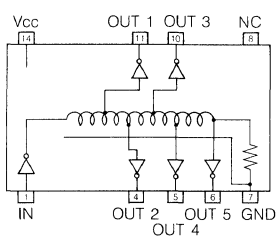
EDL SERIES

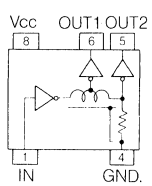


Tolerance: ±0.25
Dimensions in mm

Connection and Pin Numbering







Part No.	Total delay time (ns) ±5%	Delay time between taps (ns) ±3ns	Rise time (ns) max.	Input pulse width (ns) min.
ADL-020□H	20±2ns	4±2ns	4	8
ADL-025□H	25±3ns	5±2ns	4	10
ADL-050□H	50±3ns	10±2ns	4	20
ADL-060□H	60±3ns	12	4	24
ADL-075□H	75	15	4	30
ADL-100□H	100	20	4	40
ADL-125□H	125	25	4	50
ADL-150□H	150	30	4	60
ADL-200□H	200	40	4	80
ADL-250□H	250	50	4	100

□: *S or L*

Part No.	Delay time between IN-OUT2 (ns)	Delay time between IN-OUT1 (ns)	Rise time (ns) max.
EDL-040	40±4	20±3	4
EDL-050	50±5	30±4	4
EDL-060	60±5	30±4	4
EDL-070	70±5	30±4	4
EDL-080	80±5	30±4	4
EDL-090	90±5	40±4	4
EDL-100	100±6	40±4	4
EDL-110	110±6	50±5	4
EDL-120	120±7	60±6	4
EDL-150	150±9	70±7	4

(VCC: 50±0.1V, Ta: 25±1°C, each tap no load)

Technitrol

1952 East Allegheny Avenue
Philadelphia, PA 19134
Telephone (215) 426-9105 • Telex 834245
FAX (215) 426-2836

Technitrol delay-module performance is widely known and highly regarded by both military and commercial users. Many models, such as the ultrastable STTLDL shown below, are unmatched in performance and reliability. Designed primarily for high-performance applications, the STTLDL has very high output stability over a wide range of temperature and input-voltage variations. Increasingly, the STTLDL is selected as a commercial prototype for brand-new designs — and then written in because of the superior perfcrmance it offers.

We invite you to consider the STTLDL as an example of Technitrol capability. Its technology is an integral part of all our delay modules — including low-cost products — shown on this and the following pages.

ULTRA-STABLE TTL DELAY MODULES

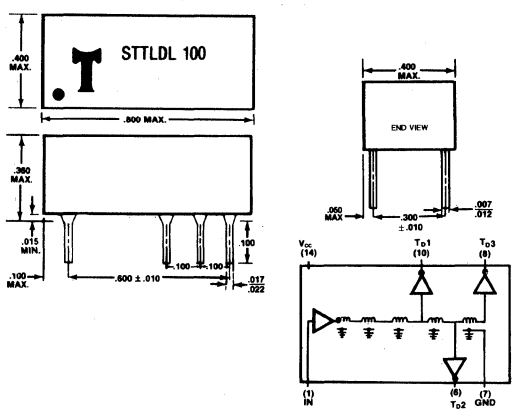
- Ultra stable. ±1 ns or ±1% delay variance over 0 to +70°C at 5V supply ±10%. −55 to +125°C available.
- 5 to 1000 ns delays available.
- Meets Mil-D-23859.
- Three-tap, lumped constant, active.
- For Schottky TTL, FAST, TTL, and low-power Schottky TTL circuits.
- Transfer-molded — reliable.
- Pin-compatible to 74/54 Series 14-pin DIP package.
- Trailing-edge timing available.

Minimum % input-pulse width to total delay	20%
Temperature coefficient at maximum delay	±1 ns or ±1%, WIG*
Operable input-supply-voltage variance from 5V rated	±10%

Part No.	NANOSECONDS T_{D1}	T_{D2}	T_{D3}	All Taps (Max.) T_R+	T_R-
STTLDL025	15.0	20.0	25.0	2.0	2.0
STTLDL050	30.0	40.0	50.0	2.0	2.0
STTLDL075	45.0	60.0	75.0	2.0	2.0
STTLDL100	60.0	80.0	100.0	2.0	2.0
STTLDL125	75.0	100.0	125.0	2.0	2.0
STTLDL150	90.0	120.0	150.0	2.0	5.0
STTLDL200	120.0	160.0	200.0	2.0	5.0
STTLDL250	150.0	200.0	250.0	2.0	5.0
STTLDL500	300.0	400.0	500.0	2.0	9.0

Delay characteristics measured at V_{cc} = 5.0±0.1V, 25°C, no load.
Delay tolerance ±1.5 ns or 5%, WIG.

Recommended Operating Conditions	Min.	Typ.	Max.	Unit
Supply voltage V_{cc}	4.5	5.0	5.5	Volts
Operating ambient temp. range	0	25	+70	°C



*Whichever is greater.

HIGH-PERFORMANCE TTL DELAY MODULES

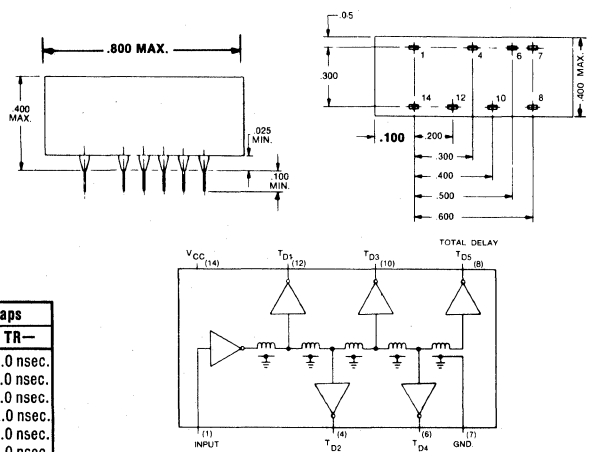
- ±1.5 ns or ±5% delay tolerance (whichever is greater) @ 25°C.
- 5 to 1000 ns delays available.
- Meets MIL-D-23859.
- Five-tap, lumped constant, active; available in ten-tap.
- For Schottky TTL, FAST, TTL, and low-power Schottky TTL circuits.
- Supply-voltage tolerance ±10%.
- Transfer-molded — reliable.
- Pin-compatible to 74/54 series 14-pin.
- 14-pin DIP package.
- Trailing-edge timing available.

Minimum % input-pulse width to total delay	20%
Temperature coefficient at maximum delay	±1 ns or ±2%, WIG
Operable input-supply-voltage variance from 5V rated	±10%

Part No.	NANOSECONDS T_{D1}	T_{D2}	T_{D3}	T_{D4}	T_{D5}	All Taps TR+ & TR−
TTLDL020	10.0 ±1.5	12.5 ± 1.5	15.0 ± 1.5	17.5 ± 1.5	20.0 ± 1.5	2.0 2.0 nsec.
TTLDL025	5.0 ±1.5	10.0 ± 1.5	15.0 ± 1.5	20.0 ± 1.5	25.0 ± 1.5	2.0 2.0 nsec.
TTLDL050	10.0 ±1.5	20.0 ± 1.5	30.0 ± 1.5	40.0 ± 2.0	50.0 ± 2.5	2.0 2.0 nsec.
TTLDL075	15.0 ±1.5	30.0 ± 1.5	45.0 ± 2.25	60.0 ± 3.0	75.0 ± 3.75	2.0 2.0 nsec.
TTLDL100	20.0 ±1.5	40.0 ± 2.0	60.0 ± 3.0	80.0 ± 4.0	100.0 ± 5.0	2.0 2.0 nsec.
TTLDL125	25.0 ±1.5	50.0 ± 2.5	75.0 ± 3.75	100.0 ± 5.0	125.0 ± 6.25	2.0 2.0 nsec.
TTLDL150	30.0 ±1.5	60.0 ± 3.0	90.0 ± 4.5	120.0 ± 6.0	150.0 ± 9.0	2.0 5.0 nsec.
TTLDL200	40.0 ±2.0	80.0 ± 4.0	120.0 ± 6.0	160.0 ± 8.0	200.0 ±10.0	2.0 5.0 nsec.
TTLDL250	50.0 ±2.5	100.0 ± 5.0	150.0 ± 7.5	200.0 ±10.0	250.0 ±12.5	2.0 5.0 nsec.
TTLDL500	100.0 ±5.0	200.0 ±10.0	300.0 ±15.0	400.0 ±20.0	500.0 ±25.0	2.0 9.0 nsec.

Delay characteristics measured at V_{cc} = 5.0V, 25°C no load.

Recommended Operating Conditions	Min.	Typ.	Max.	Unit
Supply voltage V_{cc}	4.5	5.0	5.5	Volts
Operating ambient temp range	0	25	70	°C



CONNECTION DIAGRAM 5 TAP VERSION

Available in hermetically sealed, surface-mount models in gull wing and flat pack configurations. Contact factory for details.

Technitrol products: Manchester encoder/decoders • pulse transformers • data bus couplers • pulse-width regulators • delay lines including digital, fixed-constant-distributed, fixed-lumped-constant, programmable, and trimmer types • transformers including audio, autotransformer, chopper, constant-voltage, dc-to-dc-conversion, decade, differential, discriminator, driver, ferroresonant, filament, 400 Hz, high-voltage, input, instrument, interstage, inverter, isolation, magnetic-amplifier, matching, microminiature, microphone, mixing, modulation, output, plate, power, pc-mounting, pulse, rf, rectifier, reference, Scott T, servo, synchro-control, telephone-coupling, toroidal, transistor, voltage-dividing, voltage-regulating, voltage-stabilizing, wideband, MIL-audio, MIL-power, MIL-rf, and MIL-pulse, and MIL-variable types • saturable reactors • filter reactors • square-wave oscillators • magnetic amplifiers • coils including foil-wound, high-Q/low frequency, toroidal, and transformer types.

Technitrol

1952 East Allegheny Avenue
Philadelphia, PA 19134
Telephone (215) 426-9105 • Telex 834245
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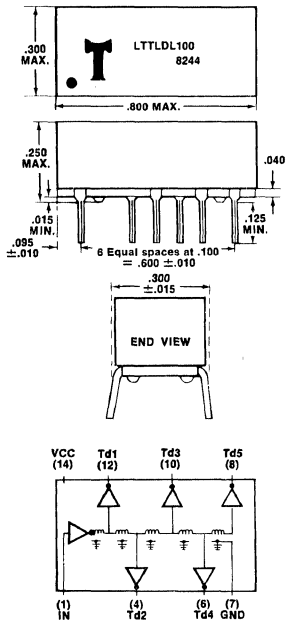
STANDARD TTL DELAY MODULE

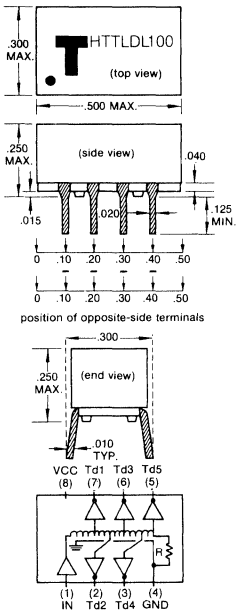
Low-profile delay modules with good performance **not** commensurate with their low cost. Half-size package available.

- Low cost.
- 0 to 70°C temperature range.
- 5 to 500 ns delay times available.
- 5 equal taps in 20% increments of total delay.
- Available in ten-tap.
- For Schottky TTL, TTL, and low-power Schottky TTL circuits.
- Supply-voltage tolerance ±5%.
- Transfer-molded — reliable.
- Pin compatible to 74/54 series 14-pin DIP package.
- Trailing-edge timing available.
- HALF-DIP PACKAGE AVAILABLE.

STANDARD LTTL PACKAGE



HALF-DIP HTTL PACKAGE



Minimum % input-pulse width to total delay 40%
Temperature coefficient at maximum delay ..... ±2 ns or ±4%, WIG

Higher performance modules available.

Part No.	NANOSECONDS					All Taps (Max.)	
	$T_{D}1$	$T_{D}2$	$T_{D}3$	$T_{D}4$	$T_{D}5$	$T_{R}+$	$T_{R}-$
LTTLDL025	5.0	10.0	15.0	20.0	25.0	2.0	2.0
LTTLDL050	10.0	20.0	30.0	40.0	50.0	2.0	2.0
LTTLDL075	15.0	30.0	45.0	60.0	75.0	2.0	2.0
LTTLDL100	20.0	40.0	60.0	80.0	100.0	2.0	2.0
LTTLDL125	25.0	50.0	75.0	100.0	125.0	2.0	2.0
LTTLDL150	30.0	60.0	90.0	120.0	150.0	2.0	5.0
LTTLDL200	40.0	80.0	120.0	160.0	200.0	2.0	5.0
LTTLDL250	50.0	100.0	150.0	200.0	250.0	2.0	5.0
LTTLDL500	100.0	200.0	300.0	400.0	500.0	2.0	9.0

Delay characteristics measured at V_{CC} = 5.0V, 25°C no load.
Delay tolerance ±2 ns or 5% whichever is greater.

Recommended Operating Conditions	Min.	Typ.	Max.	Unit
Supply voltage V_{CC}	4.75	5.0	5.25	Volts
Operating ambient temp. range	0	25	70	°C

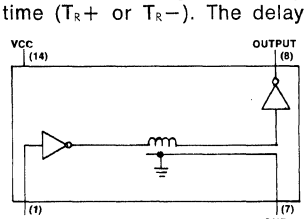
Surface-mount models available in gull wing configuration. Contact factory for details.

TECHNITROL TTL DELAY MODULES

Technitrol TTL delay modules are designed to be used directly with super-high-speed TTL, standard TTL, and DTL logic circuits. They interface with little or no additional requirements. They can be cascaded in various combinations to get any delay without degrading output rise time (T_R+ or T_R−). The delay rise-time ratio (T_D/T_R) of individual modules is very high (approximately 50:1) and improves with cascading modules. Output rise times of each module are independent of input rise times up to 50 ns. All Technitrol delay modules are transfer molded, not potted, assuring maximum reliable operating lives.

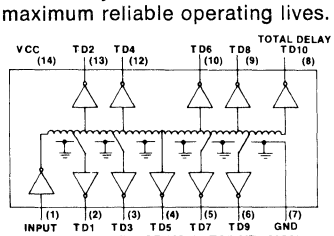
SINGLE-OUTPUT DELAY MODULES

Single-output modules are available with 5 to 500 ns delays. Buffered. Only the pins to be used are supplied.



10-TAP DELAY MODULES

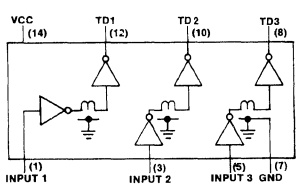
10-tap delay modules are available with 50 to 500 ns total delays. Dimensions same as standard 5-tap, with the exception of 5 additional pins. See connection diagram.



CONNECTION DIAGRAM 10 TAP VERSION

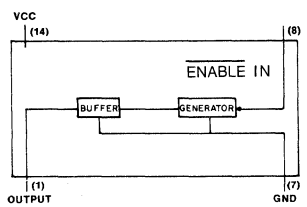
TRIPLE-OUTPUT DELAY MODULES

Technitrol TTL buffered delay modules are available with three individual inputs and outputs in delays from 5 to 250 ns per delay.



TTL SQUARE-WEAVE OSCILLATORS

Available in 2 to 100 MHz frequency range. Frequency tolerance ±2%. Dimensions same as Technitrol standard 5-tap delay module.



For complete information on Technitrol delay lines and modules, call or write for Catalog No. 1001A or, for surface-mount, Condensed Catalog No. 1002SM.

Technitrol

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Telephone (215) 426-9105 • Telex 834245
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PULSE DIFFERENTIATOR

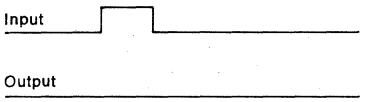
Technitrol's Pulse Differentiator will differentiate input pulses, accepting or rejecting them based on a specified minimum pulse width.

- Available in pulse widths from 5 to 500 ns.
- Propagation delay from rising edge of input pulse to rising edge of output pulse is equal to nominal differentiator pulse width.
- Transfer molded—reliable.
- Military models with ceramic IC screened per Mil Std 883C and 38510 and military temperature range, add suffix "MX".
- Temperature range 0 to 70°C.—55 to +125°C available.
- Programmable model available.
- Fanout: Logic 1—20 loads; logic 0—10 loads.
- Delay characteristics @ V_{cc} 5.0., 25°C. no load.

Part number	Reject pulses width (ns)	Pass pulses width (ns)
TTLPD005	4	6.5
TTLPD010	8.5	11.5
TTLPD015	13.5	16.5
TTLPD020	18.5	21.5
TTLPD025	23.5	26.5
TTLPD030	28.5	31.5
TTLPD035	33.0	37.0
TTLPD040	38.0	42.0
TTLPD045	42.5	47.5
TTLPD050	47.5	52.5
TTLPD060	57.0	63.0
TTLPD070	66.0	74.0
TTLPD075	71.0	79.0
TTLPD100	95.0	105.0
TTLPD150	142.5	157.5
TTLPD200	190.0	210.0
TTLPD250	237.5	262.5
TTLPD300	285.0	315.0
TTLPD400	380.0	420.0
TTLPD500	475.0	525.0

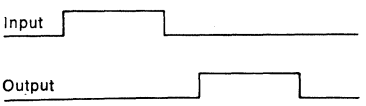
Situation A:

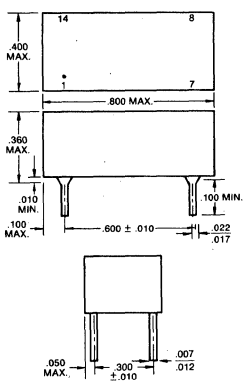
Input pulse width < specified minimum pulse width.

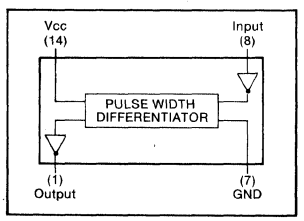


Situation B:

Input pulse width > specified minimum pulse width.







TTL PROGRAMMABLE DELAY MODULE

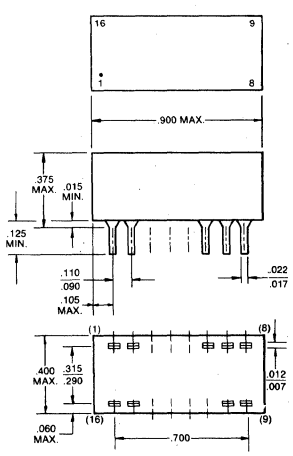
For delay adjustments via BCD programming. Simplifies minor adjustments and adds flexibility. Although indicated below that programmable modules are available up to 4-bit, 6- and 8-bit are available through a simple combination of modules.

- 3-bit binary (1, 2, 4) programming gives 7 equal step delays.
- Low on $\bar{E}$ enables output.
- Available in 19 step delays from 1 to 64 ns.

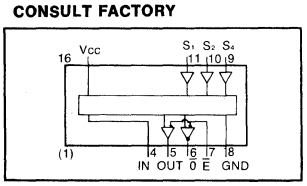
- Low inherent delay from:
  Input to output = 6.0 ± 1.5 ns
  Input to $\overline{\text{output}}$ = 3.0 ± 1.5 ns
  $\bar{E}$ to output = 10.0 ns Maximum
  Sn to output = 13.0 ns Maximum
- Military models with temperature range −55 to +125°C available.
- Manufactured to meet Mil-D-23859.

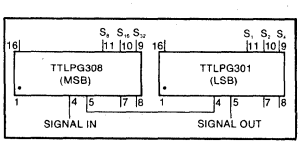
Technitrol Part No.	Step ns ±ns	Max. Delay ns ±ns	Output Rise Time (ns)
TTLPG301	1.0 ±.4	13.0 ±2.0	2.0
TTLPG302	2.0 ±.6	20.0 ±2.0	2.0
TTLPG303	3.0 ±1.0	27.0 ±2.0	2.0
TTLPG304	4.0 ±1.0	34.0 ±2.0	2.0
TTLPG305	5.0 ±1.5	41.0 ±2.0	2.0
TTLPG306	6.0 ±1.5	48.0 ±2.5	2.0
TTLPG307	7.0 ±1.5	55.0 ±2.5	2.0
TTLPG308	8.0 ±1.5	62.0 ±3.0	2.0
TTLPG309	9.0 ±1.5	69.0 ±3.5	2.0
TTLPG310	10.0 ±1.5	76.0 ±4.0	2.0
TTLPG315	15.0 ±1.5	111.0 ±5.0	2.0
TTLPG320	20.0 ±1.5	146.0 ±7.0	2.0
TTLPG325	25.0 ±1.5	181.0 ±9.0	2.0
TTLPG330	30.0 ±2.0	216.0 ±11.0	2.0
TTLPG335	35.0 ±2.0	251.0 ±12.0	2.0
TTLPG340	40.0 ±2.5	286.0 ±14.0	2.0
TTLPG345	45.0 ±2.5	321.0 ±16.0	2.0
TTLPG350	50.0 ±2.5	356.0 ±17.0	2.0
TTLPG364	64.0 ±3.2	454.0 ±23.0	2.0

Delay characteristics @ V_{cc} = 5.0V and T_a = 25°C. no load.
Delay time measured at 1.5V level.



ALSO AVAILABLE IN DIP PACKAGE. CONSULT FACTORY





Example of a 6-bit cascade with 63 steps of 1.0 ns delay with an inherent (or reference) delay of 12.0 ns (2 × 6.0 ns).

Technitrol products: Manchester encoder/decoders • pulse transformers • data bus couplers • pulse-width regulators • delay lines including digital, fixed-constant-distributed, fixed-lumped-constant, programmable, and trimmer types• transformers including audio, autotransformer, chopper, constant-voltage, dc-to-dc conversion, decade, differential, discriminator, driver, ferroresonant, filament, 400 Hz, high-voltage, input, instrument, interstage, inverter, isolation, magnetic-amplifier, matching, microminiature, microphone, mixing, modulation, output, plate, power, pc-mounting, pulse, rf, rectifier, reference, Scott T, servo, synchro-control, telephone-coupling, toroidal, transistor, voltage-dividing, voltage-regulating, voltage-stabilizing, wideband, MIL-audio, MIL-power, MIL-rf, and MIL-pulse, and MIL-variable types • saturable reactors • filter reactors • square-wave oscillators • magnetic amplifiers • coils including foil-wound, high-Q/low frequency, toroidal, and transformer types.

Technitrol

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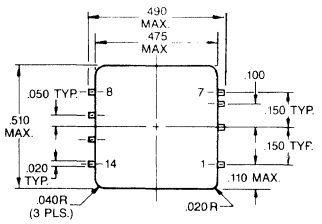
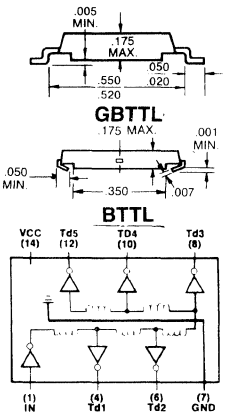
ACTIVE CHIP-CARRIER DELAY MODULES, ½" AND ¾"

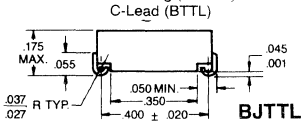
- Compact.
- For Schottky TTL, TTL, and low-power Schottky TTL circuits.
  Gull-wing configuration available for ½" and ¾" models.
- "J" leads available for ½" models.
- Designed for surface mounting via reflow soldering.
- 5-tap.
- 5 to 200 ns delays.
- ±10% supply voltage tolerance.
- −55 to 125°C temperature range available.

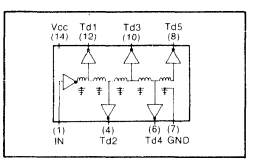
½" MODELS





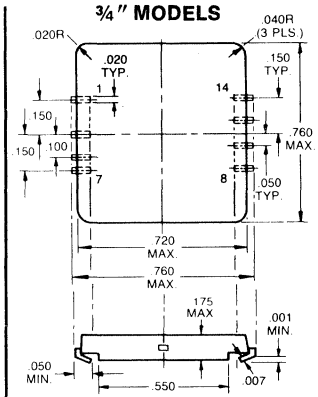
Gull wing (GBTTL) &
C-Lead (BTTL)



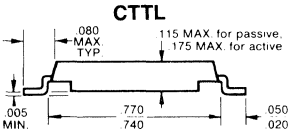


J-LEAD (BJTTL)

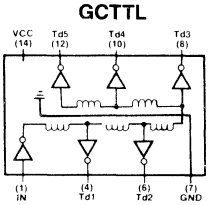
¾" MODELS



CTTL



GCTTL



Part No.*	NANOSECONDS					All Taps (Max.)	
	TD1	TD2	TD3	TD4	TD5	TR+	TR−
BTTLDL020	10.0	12.5	15.0	17.5	20.0	2.0	2.0
BTTLDL025	5.0	10.0	15.0	20.0	25.0	2.0	2.0
BTTLDL050	10.0	20.0	30.0	40.0	50.0	2.0	2.0
BTTLDL075	15.0	30.0	45.0	60.0	75.0	2.0	2.0
BTTLDL100	20.0	40.0	60.0	80.0	100.0	2.0	2.0
BTTLDL125	25.0	50.0	75.0	100.0	125.0	2.0	2.0
BTTLDL150	30.0	60.0	90.0	120.0	150.0	2.0	5.0
BTTLDL200	40.0	80.0	120.0	160.0	200.0	2.0	5.0

Delay characteristics @ V_{cc} = 5.0 V, 25°C no load.
Delay tolerance = ±2.0 ns or 5%, WIG.

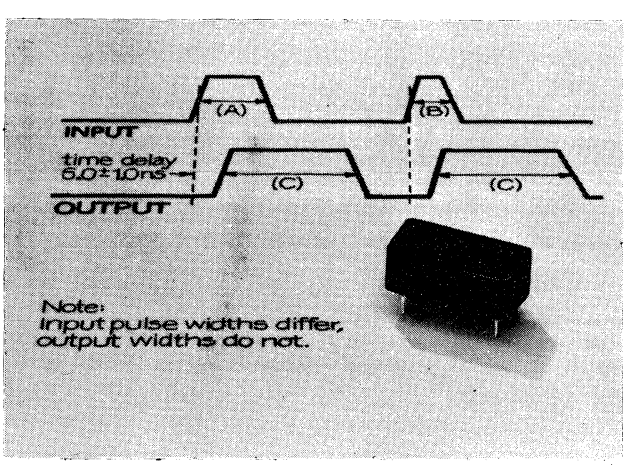
* Sample listing. For ½" delay modules, use prefix BT in part number (as shown). For ¾" delay modules, use prefix CT. For gull-wing configuration, use prefix GBT (½") or GCT (¾"). Otherwise, specify interchangeably.

For "J" configuration, use prefix BJT (½" only)

NEW TTL PULSE-WIDTH REGULATORS

A new concept. Takes TTL-level input signals of unequal duration and transforms these into TTL-level output signals of precisely timed and equal duration. Can replace a monostable multivibrator, and provide improved output stability.

5 ns minimum input-pulse width. 5 to 500 ns output-pulse width, as selected. Input-pulse width can vary; output-pulse width remains the same. Precisely timed output-pulse trailing edge permits trailing-edge timing or gating functions.



- 6 ± 1.5 ns propagation delay from input to output.
- −55 to +125°C temperature range available.
- For Schottky TTL, TTL, and low-power Schottky TTL circuits.
- ±10% supply voltage tolerance.
- Minimum input-pulse width only 5 ns.
- Pin compatible with 74/54 series TTL/SSI 14-pin DIP.
- Temperature and voltage compensated to ±1ns or 1% over 0-70°C temperature range.

Part No.	Pulse Width (PW) ns	Max. Input Freq. (MHz)	Part No.	Pulse Width (PW) ns	Max. Input Freq. (MHz)
TTLPW005	5.0	98.0	TTLPW060	60.0	8.0
TTLPW010	10.0	49.0	TTLPW070	70.0	6.5
TTLPW015	15.0	30.0	TTLPW075	75.0	6.0
TTLPW020	20.0	23.0	TTLPW100	100.0	4.0
TTLPW025	25.0	18.0	TTLPW150	150.0	3.0
TTLPW030	30.0	15.0	TTLPW200	200.0	2.0
TTLPW035	35.0	13.0	TTLPW250	250.0	1.9
TTLPW040	40.0	11.0	TTLPW300	300.0	1.5
TTLPW045	45.0	10.0	TTLPW400	400.0	1.0
TTLPW050	50.0	9.0	TTLPW500	500.0	0.9

- Delay Characteristics @ V_{CC} = 5.0V., ±10% 25°C no load.
- Pulse width tolerance ±1.5 ns or 5% whichever is greater.
- Maximum frequency with input pulse ≤ output pulse width.
- Rise and fall time 2 ns max.

For complete information on Technitrol delay lines and modules, call or write for Catalog No. 1001A or, for surface-mount, Condensed Catalog No. 1002SM.

SEE PAGE A-1626 FOR PASSIVE CHIP CARRIER DELAY LINES

Technitrol

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FAX (215) 426-2836

10K ECL DELAY MODULES

DELAY CHARACTERISTICS

Part No.	NANOSECONDS T_{D1}	T_{D2}	T_{D3}	T_{D4}	T_{D5}	All Taps (Max.) T_R+*	T_R−*
ECLDL025	5 ±1.0	10 ± 1.0	15 ± 1.0	20 ± 1	25 ± 1.0	4	4
ECLDL050	10 ±1.0	20 ± 1.0	30 ± 1.5	40 ± 2	50 ± 2.5	4	4
ECLDL075	15 ±1.0	30 ± 1.5	45 ± 2.0	60 ± 3	75 ± 3.75	5	5
ECLDL100	20 ±1.0	40 ± 2.0	60 ± 3.0	80 ± 4	100 ± 5.0	6	6
ECLDL125	25 ±1.0	50 ± 2.5	75 ± 3.75	100 ± 5	125 ± 6.0	7	7
ECLDL150	30 ±1.5	60 ± 3.0	90 ± 4.5	120 ± 6	150 ± 7.5	7	7
ECLDL200	40 ±2.0	80 ± 4.0	120 ± 6.0	160 ± 8	200 ±10.0	8	8
ECLDL250	50 ±2.5	100 ± 5.0	150 ± 7.5	200 ±10	250 ±12.5	10	10
ECLDL300	60 ±3.0	120 ± 6.0	180 ± 9.0	240 ±12	300 ±15.0	15	15
ECLDL350	70 ±3.5	140 ± 7.0	210 ±10.5	280 ±14	350 ±17.5	15	15
ECLDL400	80 ±4.0	160 ± 8.0	240 ±12.0	320 ±16	400 ±20.0	15	15
ECLDL450	90 ±4.5	180 ± 9.0	270 ±13.5	350 ±18	450 ±22.5	20	20
ECLDL500	100 ±5.0	200 ±10.0	300 ±15.0	400 ±20	500 ±25.0	20	20

* T_R = Measured from 20% to 80%.

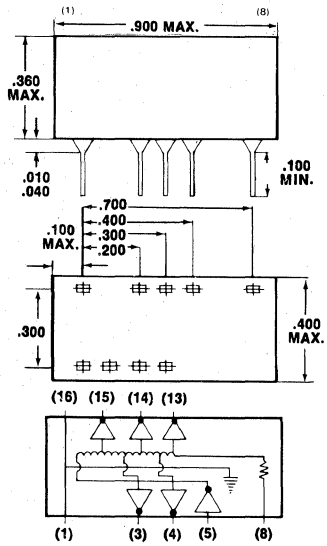
ELECTRICAL CHARACTERISTICS

Over operating temperature range and Vee = −5.2 ±0.01V with 500 linear FPM air flow and all output terminals with 50Ω to −2.0 VDC. T_D measured at −1.3V level.

Symbol	Parameter	Min.	Max.	Unit	Test Conditions
I_{EE}	Supply Current		−85	mA	
I_{IH}	Input Current HIGH		425	μA	V_{IH} = −0.810V
I_{IL}	Input Current LOW	.5		μA	V_{IL} = —1.850V
V_{OH}	Logic "1" Output Voltage	−1.060	−0.700	VDC	V_{IH} = −0.810
V_{OL}	Logic "0" Output Voltage	−1.890	−1.615	VDC	V_{IL} = —1.850

All specifications are subject to change without notice.

- V_{ee} −5.2V ±10%. 10k ECL buffered input and output in 16-pin transfer-molded DIP.
- 5-tap line provides delays from 5 ns to 500 ns.
- Minimum input pulse width is 20% of total delay.
- Military models available.



Recommended Operating Conditions	Min.	Typ.	Max.
Vee	−5.72	−5.2	−4.68
Operating temp. range With Airflow 500 LFPM	−30°C	25°C	80°C
Fan Out			85 ECL Loads

10K ECL PROGRAMMABLE DELAY MODULES

DELAY CHARACTERISTICS Ta = 25°C

Technitrol Part No.	Step Delay ns ± ns	Max. Delay ns ± ns	Output Rise Time Max. (ns)
ECLPG301	1.0 ± 0.4	11.0 ± 1.5	3.6
ECLPG302	2.0 ± 0.6	17.0 ± 1.5	3.6
ECLPG303	3.0 ± 1.0	24.0 ± 1.5	3.6
ECLPG304	4.0 ± 1.0	31.0 ± 2.0	3.6
ECLPG305	5.0 ± 1.5	38.0 ± 2.0	3.6
ECLPG306	6.0 ± 1.5	45.0 ± 2.5	3.6
ECLPG307	7.0 ± 1.5	52.0 ± 2.5	3.6
ECLPG308	8.0 ± 1.5	59.0 ± 3.0	3.6
ECLPG309	9.0 ± 1.5	66.0 ± 3.5	3.6
ECLPG310	10.0 ± 1.5	73.0 ± 4.0	3.6
ECLPG315	15.0 ± 1.5	108.0 ± 5.0	5.0
ECLPG320	20.0 ± 1.5	143.0 ± 7.0	5.0
ECLPG325	25.0 ± 1.5	178.0 ± 9.0	5.0
ECLPG330	30.0 ± 2.0	213.0 ± 11.0	5.0
ECLPG335	35.0 ± 2.0	248.0 ± 12.0	5.0
ECLPG340	40.0 ± 2.5	283.0 ± 14.0	5.0
ECLPG345	45.0 ± 2.5	318.0 ± 16.0	5.0
ECLPG350	50.0 ± 2.5	353.0 ± 17.0	5.0

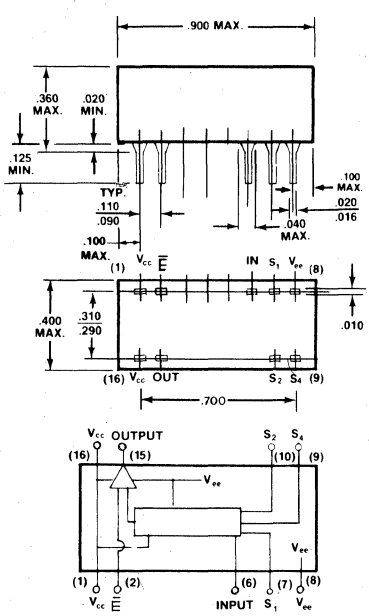
ELECTRICAL CHARACTERISTICS

Over operating temperature range and Vee = −5.2 ±0.01V with 500 linear FPM air flow and all output terminals with 50Ω to −2.0VDC. T_D measured at −1.3V level.

Symbol	Parameter	Min.	Max.	Unit	Test Conditions
I_{EE}	Supply Current		100	mA	
I_{IH}	Input Current HIGH		13.5	mA	V_{IH} = −0.700V
I_{IL}	Input Current LOW	.3	600	mA	V_{IL} = −1.850V
V_{OH}	Logic "1" Output Voltage	−1.060	−0.700	VDC	V_{IH} = −0.810
V_{OL}	Logic "0" Output Voltage	−1.890	−1.615	VDC	V_{IL} = —1.850

All specifications subject to change without notice.

- V_{ee} = −5.2V ±10%. 10k ECL input and output in 16-pin transfer-molded DIP.
- 3-bit binary gives 7 equal step delays.
- Available in 18 step delays from 1 ns to 50 ns.
- Low inherent delay (T_o); T_o = 3.0 ±1.5 ns.
- Minimum input pulse width 8 ns or 8 × step delay (W.I.G.).
- Military models available.



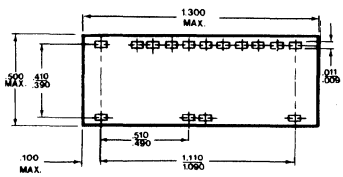
Technitrol products: Manchester encoder/decoders • pulse transformers • data bus couplers • pulse-width regulators • delay lines including digital, fixed-constant-distributed, fixed-lumped-constant, programmable, and trimmer types • transformers including audio, autotransformer, chopper, constant-voltage, dc-to-dc-conversion, decade, differential, discriminator, driver, ferroresonant, filament, 400 Hz, high-voltage, input, instrument, interstage, inverter, isolation, magnetic-amplifier, matching, microminiature, microphone, mixing, modulation, output, plate, power, pc-mounting, pulse, rf, rectifier, reference, Scott T, servo, synchro-control, telephone-coupling, toroidal, transistor, voltage-dividing, voltage-regulating, voltage-stabilizing, wideband, MIL-audio, MIL-power, MIL-rf, and MIL-pulse, and MIL-variable types • saturable reactors • filter reactors • square-wave oscillators • magnetic amplifiers • coils including foil-wound, high-Q/low frequency, toroidal, and transformer types.

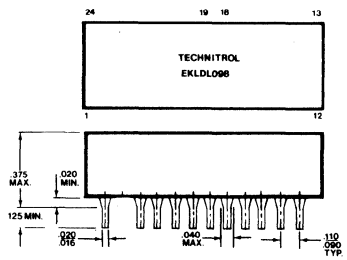
Technitrol

1952 East Allegheny Avenue
Philadelphia, PA 19134
Telephone (215) 426-9105 • Telex 834245
FAX (215) 426-2836

100K ECL DELAY MODULES

- 100K ECL input and output.
- 24 pin transfer molded dip package on .400 lead center.
- Available in delays from 5 ns to 200 ns.
- Eight (8) equal taps each buffered with 70 ECL fanout capacity.
- Operating temperature range 0°C to 85°C.
- Other delays available.

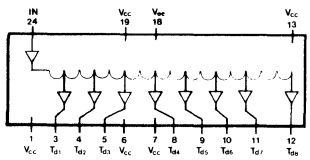




DELAY CHARACTERISTICS : TA, +25°C, V_{ee} −4.5V ±.1V, NO LOAD.

Technitrol Part No.	T_D1 ns	T_D2 ns	T_D3 ns	T_D4 ns	T_D5 ns	T_D6 ns	T_D7 ns	T_D8 ns	Tol. T_D1 (ns or %,WIG)	Output Rise Time Max. (ns)
EKLDL005	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	± .25 or 10%	2.0
EKLDL008	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	± .40 ns	2.0
EKLDL016	2.0	4.0	6.0	8.0	10.0	12.0	14.0	16.0	± .50 or 5%	2.0
EKLDL025	4.0	7.0	10.0	13.0	16.0	19.0	22.0	25.0	±1.0 or 5%	2.0
EKLDL032	4.0	8.0	12.0	16.0	20.0	24.0	28.0	32.0	±1.5 or 5%	2.0
EKLDL040	5.0	10.0	15.0	20.0	25.0	30.0	35.0	40.0	±1.5 or 5%	2.0
EKLDL048	6.0	12.0	18.0	24.0	30.0	36.0	42.0	48.0	±1.5 or 5%	2.4
EKLDL056	7.0	14.0	21.0	28.0	35.0	42.0	49.0	56.0	±1.5 or 5%	2.8
EKLDL064	8.0	16.0	24.0	32.0	40.0	48.0	56.0	64.0	±1.5 or 5%	3.2
EKLDL072	9.0	18.0	27.0	36.0	45.0	54.0	63.0	72.0	±1.5 or 5%	3.6
EKLDL080	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	±1.5 or 5%	4.0
EKLDL100	12.5	25.0	37.5	50.0	62.5	75.0	87.5	100.0	±1.5 or 5%	5.0
EKLDL120	15.0	30.0	45.0	60.0	75.0	90.0	105.0	120.0	±1.5 or 5%	6.0
EKLDL160	20.0	40.0	60.0	80.0	100.0	120.0	140.0	160.0	±1.5 or 5%	8.0
EKLDL200	25.0	50.0	75.0	100.0	125.0	150.0	175.0	200.0	±1.5 or 5%	10.0

T_D measured at −1.3V Level. **Specifications subject to change without notice.**



Symbol	Parameter	Min.	Max.	Unit	Test Conditions
I_{ee}	Supply Current		−115	mA	
I_{ih}	Input Current High		350	µA	V_{ih} = −0.890Vdc
I_{il}	Input Current Low	0.05		µA	V_{il} = −1.810Vdc
V_{oh}	Logic "1" Output Voltage	−1.025	−0.880	mV	V_{ih} = −0.880Vdc
V_{ol}	Logic "0" Output Voltage	−1.810	−1.620	mV	V_{il} = −1.810Vdc

100K ECL PROGRAMMABLE DELAY MODULES

DELAY CHARACTERISTICS Ta = 25°C

Technitrol Part No.	Step Delay ns ± ns	Max. Delay ns ± ns	Output Rise Time Maximum (ns)
EKLPGR10	0.10 ± 0.05	3.50 ± 1.0	2.0
EKLPGR25	0.25 ± 0.13	5.75 ± 1.0	2.0
EKLPGR50	0.50 ± 0.20	9.50 ± 1.0	2.0
EKLPGR75	0.75 ± 0.25	13.25 ± 1.5	2.0
EKLPG010	1.00 ± 0.40	17.00 ± 1.5	2.0
EKLPG015	1.50 ± 0.50	24.50 ± 1.5	2.0
EKLPG020	2.00 ± 0.50	32.00 ± 1.5	2.0
EKLPG025	2.50 ± 0.50	39.50 ± 2.0	2.0
EKLPG030	3.00 ± 0.50	47.00 ± 2.5	2.0
EKLPG035	3.50 ± 0.50	54.50 ± 2.5	2.0
EKLPG040	4.00 ± 0.50	62.00 ± 3.0	2.0
EKLPG045	4.50 ± 0.50	69.50 ± 3.0	2.0
EKLPG050	5.00 ± 1.00	77.00 ± 4.0	2.0
EKLPG060	6.00 ± 1.00	92.00 ± 5.0	2.0
EKLPG070	7.00 ± 1.00	107.00 ± 5.0	2.0
EKLPG080	8.00 ± 1.00	122.00 ± 6.0	2.0
EKLPG090	9.00 ± 1.00	137.00 ± 7.0	2.0
EKLPG100	10.00 ± 1.00	152.00 ± 8.0	2.0

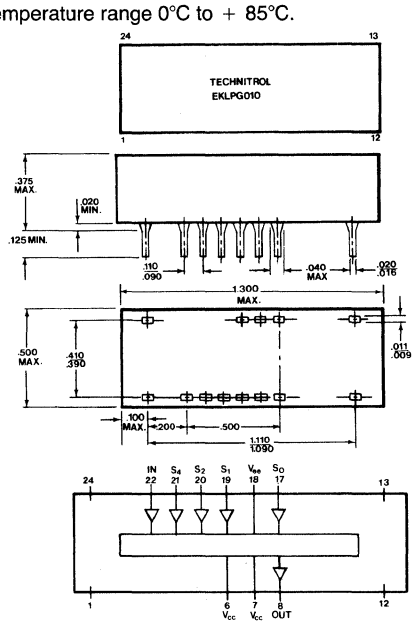
ELECTRICAL CHARACTERISTICS

- For 100K ECL Programmable Delay Line Module
- V_{ee} = 4.5V ± 5%
- 500 linear FPM air flow and output terminated with 50 ohm to −2.0 VDC

Symbol	Parameter		Min.	Max.	Unit	Test Conditions
I_{ee}	Supply Current			−120	mA	
I_{ih}	Input Current High	Input (22) Selects (17,19, 20,21)		13.7 240	mA µA	V_{ih} = −0.880V
I_{il}	Input Current Low	Input (22) Selects (17,19, 20,21)	 0.50	7.8	mA µA	V_{il} = 1.475V
V_{oh}	Logic "1" Output Voltage			−1.025	−0.880	Vdc	V_{ih} = −0.880V
V_{ol}	Logic"0" Output Voltage			−1.810	−1.620	Vdc	V_{il} = −1.810V

Specifications subject to change without notice.

- T_D measured @ −1.3V level.
- 100K ECL input and output.
- 24-pin transfer-molded DIP on .400 lead center.
- Four (4) bit binary (1, 2, 4, 8) programming gives 15 equal step delays.
- Available in 18 step delays from .1 ns to 10 ns; other step delays available.
- Low inherent delay (T_o) T_o = 2.0 ± 1.0 ns.
- Seventy (70) ECL fanouts.
- Temperature range 0°C to + 85°C.



For complete information on Technitrol delay lines and modules, call or write for Catalog No. 1001A or, for surface-mount, Condensed Catalog No. 1002SM.

Technitrol

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Philadelphia, PA 19134
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FAX (215) 426-2836

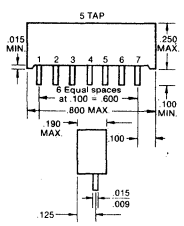
PASSIVE DELAY LINES

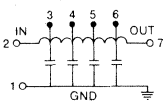
- Manufactured to meet Mil-D-23859.
- Temperature coefficient: 100 ppm/°C.
- Standard impedance 100 ohms. Also available in 50 and 200 ohms. Others available.
- Insulation resistance: 10k meg. ohms.
- Military temperature range: −55 to +125°C.
- Lead material: alloy 42, bright tin plate.
- Some models available with delays of less than one ns, contact factory.
- Minimum pulse width 2.5 × output rise time.
- DIP models are auto-insertable.
- To compensate for the low expansion coefficient of ceramic-substrate thick-film hybrids, contact the factory about our GCF10-2 delay line series.

5-TAP PASSIVE DELAY LINE (SIP)

Part No.	Delay (ns)	Rise Time (ns-Max.)	DCR (Ohms (Max.)	Tap Delay (ns)
SF05C1	5	2.0	1.0	1.0
SF05D1	10	3.5	1.0	2.0
SF05F1	20	7.0	1.5	4.0
SF05G1	25	8.5	1.5	5.0
SF05K1	50	17.0	3.2	10.0
SF05M1	100	35.0	4.1	20.0
SF05P1	200	67.0	5.0	40.0
SF05Q1	250	85.0	6.0	50.0
SF05R1	500	170.0	7.0	100.0

Delay tolerance ±1.5 ns or 5% W.I.G. Measured from 50% to 50%.
Standard impedance 100Ω ±10%.

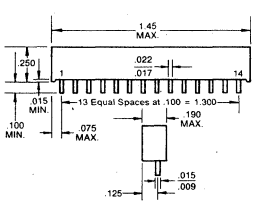


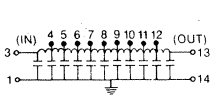


10-TAP PASSIVE DELAY LINE (SIP)

Part No.	Total Delay (ns)	Tap Delay (ns)	Rise Time (ns-Max.)	DCR (Ohms Max.)
SF10D1	10	1.0	2.0	1.0
SF10F1	20	2.0	4.0	1.0
SF10G1	25	2.5	5.0	1.0
SF10K1	50	5.0	10.0	1.5
SF10M1	100	10.0	20.0	3.2
SF10P1	200	20.0	40.0	4.1
SF10Q1	250	25.0	50.0	5.0
SF10R1	500	50.0	100.0	7.5
SF10S1	1000	100.0	200.0	10.0

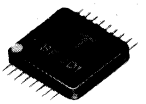
Delay tolerance ±1.5 ns or 5% W.I.G. Measured from 50% to 50%.
Standard impedance 100Ω ±10%.





NEW! MINIATURE FLAT-PACK PASSIVE DELAY LINE

- Only 0.075″high
- To 75 ns maximum delay
- Ten-tap
- −55 to +125°C available

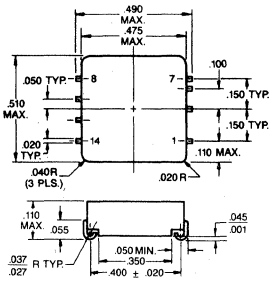


Only 75 mils high! Contact factory for details.

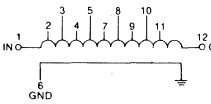
10-TAP CHIP-CARRIER PASSIVE DELAY—½″

Part No.	Total Delay T_D (ns)	Tap Delay (ns)	Rise Time T_R (ns)	DCR (Ohms Max.)
BJF10D1	10.0	1.0	2.2	1.0
BJF10F1	20.0	2.0	4.0	2.0
BJF10G1	25.0	2.5	5.0	3.0
BJF10K1	50.0	5.0	10.0	5.0
BJF10L1	75.0	7.5	15.0	6.5
BJF10M1	100.0	10.0	20.0	8.0

Delay tolerance ±1.5 ns or 5% W.I.G. Measured from 50% to 50%.
Standard impedance 100Ω ±10%.



(Gull wing version available. Use prefix GBF.)



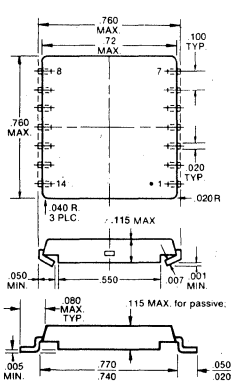
ADDITIONAL FEATURES

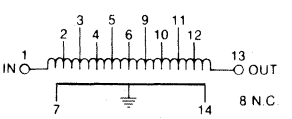
- Compact module .175″ high
- Ten tap line provides delays from 10 ns to 100 ns
- Designed to use with TTL logic
- Can be mounted in standard chip carrier socket
- Designed for surface mounting using vapor phase reflow soldering
- Military temperature range −55°C to 125°C

10-TAP CHIP-CARRIER PASSIVE DELAY LINE—¾″

Part No.	Total Delay T_D (ns)	Tap Delay (ns)	Rise Time T_R (ns)	DCR (Ohms Max.)
CF10D1	10.0	1.0	2.2	1.0
CF10F1	20.0	2.0	4.0	2.0
CF10G1	25.0	2.5	5.0	3.0
CF10K1	50.0	5.0	10.0	5.0
CF10M1	100.0	10.0	20.0	8.0
CF10N1	125.0	12.5	25.0	9.0
CF10P1	150.0	15.0	30.0	10.0
CF10Q1	200.0	20.0	40.0	12.0

Delay tolerance ±1.5 ns or 5% W.I.G. Measured from 50% to 50%.
Standard impedance 100Ω ±10%.





ADDITIONAL FEATURES

- Compact module .115″ high
- Ten tap line provides delays from 10 ns to 100 ns
- Designed to use with TTL logic
- Can be mounted in standard chip carrier socket
- Designed for surface mounting using reflow soldering
- Military temperature range −55°C to 125°C

Technitrol products: Manchester encoder/decoders • pulse transformers • data bus couplers • pulse-width regulators • delay lines including digital, fixed-constant-distributed, fixed-lumped-constant, programmable, and trimmer types• transformers including audio, autotransformer, chopper, constant-voltage, dc-to-dc conversion, decade, differential, discriminator, driver, ferroresonant, filament, 400 Hz, high-voltage, input, instrument, interstage, inverter, isolation, magnetic-amplifier, matching, microminiature, microphone, mixing, modulation, output, plate, power, pc-mounting, pulse, rf, rectifier, reference, Scott T, servo, synchro-control, telephone-coupling, toroidal, transistor, voltage-dividing, voltage-regulating, voltage-stabilizing, wideband, MIL-audio, MIL-power, MIL-rf, and MIL-pulse, and MIL-variable types • saturable reactors • filter reactors • square-wave oscillators • magnetic amplifiers • coils including foil-wound, high-Q/low frequency, toroidal, and transformer types.

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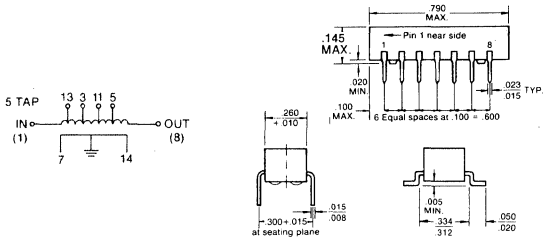
PASSIVE DELAY LINES

5-TAP PASSIVE DELAY LINE (DIP)

Part No.	Total Delay (ns)	Tap Delay (ns)	Rise Time (ns-Max.)	Impedance (Ohms) ±10%	DCR (Ohms (Max.)
LF05C1	5.0	1.0	2.0	100	1.0
LF05D1	10.0	2.0	3.5	100	1.0
LF05E1	12.5	2.5	5.0	100	1.0
LF05F1	20.0	4.0	7.0	100	1.0
LF05G1	25.0	5.0	8.5	100	1.5
LF05K1	50.0	10.0	17.0	100	2.5
LF05M1	100.0	20.0	35.0	100	5.0

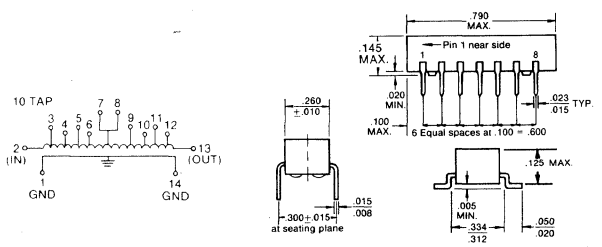
Delay tolerance ±1.5 ns or 5% W.I.G. Measured from 50% to 50%.



10-TAP PASSIVE DELAY LINE (DIP)

Part No.	Total Delay (ns)	Tap Delay (ns)	Rise Time (ns-Max.)	Impedance (Ohms) ±10%	DCR (Ohms (Max.)
LF10D1	10	1.0	2.2	100	1.0
LF10E1	12.5	1.2	2.5	100	1.0
LF10F1	20	2.0	4.0	100	1.5
LF10G1	25	2.5	5.0	100	1.5
LF10K1	50	5.0	10.0	100	2.5
LF10M1	100	10.0	20.0	100	5.0
LF10P1	200	20.0	40.0	100	11.5

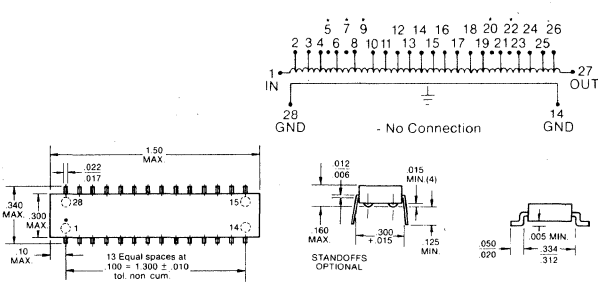
Delay tolerance ±1.5 ns or 5% W.I.G. Measured from 50% to 50%.



20-TAP PASSIVE DELAY LINE (DIP)

Part No.	Total Delay (ns)	Tap Delay (ns)	Rise Time (ns-Max.)	Impedance (Ohms) ±10%	DCR (Ohms (Max.)
LF20D1	10	0.50	1.5	100	2.0
LF20F1	20	1.0	2.7	100	3.0
LF20G1	25	1.25	3.3	100	3.0
LF20K1	50	2.50	6.4	100	5.0
LF20M1	100	5.0	13.0	100	5.0
LF20Q1	200	10.0	25.0	100	10.0

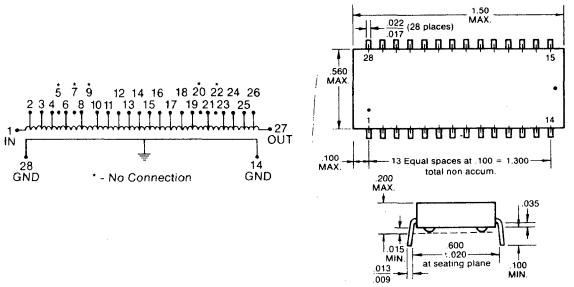
Delay tolerance ±1.5 ns or 5% W.I.G. Measured from 50% to 50%.



UP-TO-2μS 20-TAP PASSIVE DELAY LINE (DIP)

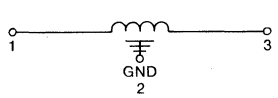
Part No.	Total Delay (ns)	Tap Delay (ns)	Rise Time (ns-Max.)	Impedance (Ohms) ±10%	DCR (Ohms (Max.)
LF20Q2	200.0	10.0	25.0	100	5.0
LF20S2	300.0	15.0	38.0	100	5.0
LF20U2	400.0	20.0	50.0	100	5.0
LF20W2	500.0	25.0	63.0	100	8.0
LF20X2	600.0	30.0	75.0	100	10.0
LF20Y2	1000.0	50.0	125.0	100	16.0
LF20Z2	2000.0	100.0	250.0	100	20.0

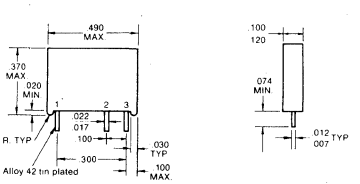
Delay tolerance ±1.5 ns or 5% W.I.G. Measured from 50% to 50%.



1-OUTPUT DELAY LINE (SIP)

Part No.	Delay (ns) ±.5 ns	Rise Time (ns) Max.	Impedance (Ohms) ±10%	DCR (Ohms Max.)
LE04DC-05	.5	2.0	93	0.75
LE04DC-10	1.0	2.0	93	0.75
LE04DC-15	1.5	2.0	93	1.0
LE04DC-20	2.0	3.0	93	1.0
LE04DC-25	2.5	3.0	93	1.0
LE04DC-30	3.0	3.0	93	1.0
LE04DC-35	3.5	3.0	93	1.0
LE04DC-40	4.0	3.0	93	1.0
LE04DC-45	4.5	3.0	93	1.0
LE04DC-50	5.0	3.5	93	1.0
LE04DC-55	5.5	3.5	93	1.5
LE04DC-60	6.0	3.5	93	1.5
LE04DC-65	6.5	3.5	93	1.5
LE04DC-70	7.0	3.5	93	2.0
LE04DC-75	7.5	4.0	93	2.0
LE04DC-80	8.0	4.0	93	2.0
LE04DC-100	10.0	4.0	93	2.0





For complete information on Technitrol delay lines and modules, call or write for Catalog No. 1001A or, for surface-mount, Condensed Catalog No. 1002SM.

Technitrol

1952 East Allegheny Avenue
Philadelphia, PA 19134
Telephone (215) 426-9105 • Telex 834245
FAX (215) 426-2836

Surface-mount components

The requirement for surface mounting need not supersede that of high performance and reliability. The surface-mount delay lines, pulse transformers, and Manchester encoder/decoders described below give the same outstanding performance provided by their non-surface-mountable counterparts, industry's finest.

Technitrol surface-mount passive delay lines and active, internally buffered delay modules demonstrate good balance of design, resulting in the opportunity to choose both leading- and trailing-edge circuit timing.

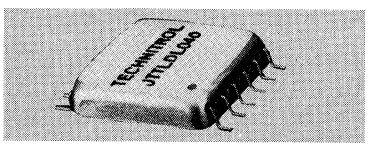
These designs, followed up by well controlled manufacturing, produce reliably-performing products in the 10s, 100s, or 1000s. Our low failure rates are unheard-of elsewhere.

For isolation and impedance-matching tasks in data interfacing, SCR triggering, balun line conversions, and other applications, find out why Technitrol pulse transformers are so often called on for the tough jobs.

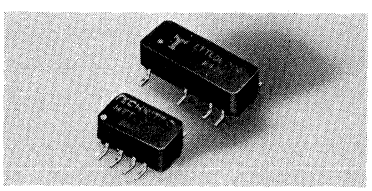
Technitrol surface-mount Manchester encoder/decoders are available for any data rate from 1 Mb/s to 50 Mb/s (including 16.8696 Mb/s) from minor adjustments in one good design — not from complete redesigns.

***NEW HIGH-REL MATERIAL* — Technitrol surface-mount components are now available in a new high-rel material that provides maximum reliability, a higher temperature coefficient and better stability.**

SURFACE-MOUNT DELAY MODULES

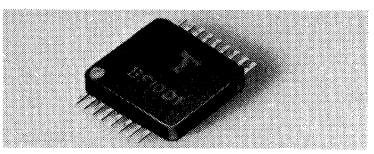


Hermetically-sealed TTL chip-carrier delay modules.
For extra strength, durability, and protection from extreme temperature and humidity variations. Several plated and non-plated hermetic packages available.
Turn back to page **A**•1620 in this section.



Half-DIP surface-mount TTL delay modules.
Compact DIP packaging — 0.25″ X 0.3″ X 0.5″ installed.
Turn back to page **A**•1621 in this section.

10-tap DIP surface-mount TTL delay modules.
Turn back to page **A**•1626 in this section.



Miniature passive delay lines.
Only .075 in. high — thinnest in the industry.
Turn back to page **A**•1626 in this section.

Hermetically-sealed passive delay lines.
For extra strength, durability, and protection from extreme temperature and humidity variations. Several plated and non-plated hermetic packages available.

For complete information, call or write for Catalog No. 1002SM.

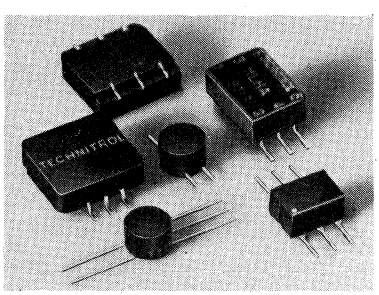
Surface-mount lumped-constant passive delay lines.
Turn back to page **A**•1626.

Chip-carrier passive delay lines, ½″ and ¾″.
Turn to page **B**•1023 and **A**•1626.

MANCHESTER ENCODER/ DECODER
Any rate from 1 to 50 Mb/s.
Usage currents of less than 25 mA.

For complete information, call or write for Catalog No. 118B.

SURFACE-MOUNT PULSE TRANSFORMERS



Surface-mount data-bus interface transformers.
1 Mb/s LAN, Mil-Std-1553B; Mil-T-21038 grades 5 or 7, life expectancy X. 2.5 Mb/s LAN. 10 Mb/s LAN IEEE 802.3 (Ethernet-type).
Call or write for Catalog #141.
Also see page **A**•2407, Section 5600 in this volume, and page **B**•1025, Section 2440 in Volume B.

Surface-mount Mil-Std-1553B interface transformers.
Meet all requirements of Mil-Std-1553B, including the impedance requirement of $\geq 3k\Omega$ at $-55°C$, a common area of noncompliance.
Call or write for Catalog. #141.
Also see page **A**•2407, Section 5600 in this volume, and page **B**•1025, Section 2440 in Volume B.

Surface-mount hermetically-sealed pulse transformers.
Choice of alloys, plated or non-plated, for extra strength, durability, and protection from extreme temperature and humidity variations.
Also see page **A**•2407, Section 5600 in this volume, and page **B**•1025, Section 2440 in Volume B.

Surface-mount general-purpose pulse transformers.
Also see page **A**•2407, Section 5600 in this volume, and page **B**•1025, Section 2440 in Volume B.

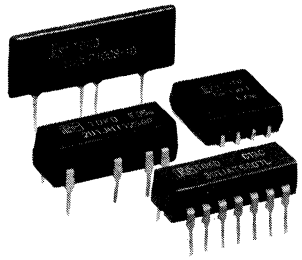
For complete information, call or write for Catalog No. 141.

TOKO AMERICA DELAY LINES

DELAY LINES

Available in SIP, DIP and SMT packages.

- Transfer-molded epoxy resin package provides superior environmental protection.
- Each delay line meets rigid quality control standards—100% testing with seven separate inspections during manufacture.
- Total delay times from 100 pico seconds up to 7 micro seconds ±5%.
- Backed by Toko . . . one of the world's largest delay line manufacturers.



PASSIVE-GENERAL SPECIFICATIONS

	JAT	JBT	JD/JDT	RET	R5ET	R20ET	RQT	SP	SQ/SS
Temp. Range Operating	0° to + 70°C	0° to +70°C	0° to + 70°C	0° to +70°C	0° to +70°C	0° to +70°C	0° to +70°C	0° to +70°C	0° to 70°C
Storage Temperature	−45° to +125°C	−45° to +125°C	−30° to +125°C	−50° to +125°C	−55° to +125°C	−50° to +125°C	−55° to +125°C	−40° to +125°C	−55° to +125°C
Insulation Resistance	>100 MΩ @ 50 vdc	>100 MΩ @ 50v	100 MΩ @ 50 vdc	50 vdc 100 MΩ min	>100 MΩ @ 50 vdc	Over 100 MΩ (50 vdc)	100 MΩ @ 50 vdc	100 MΩ @ 50 vdc	100 MΩ @ 50 vdc
Waveform Distortion	Within ±15%	Within ±15%	Within ±15%	Within ±10%	Within ±10%	Within ±10%	Within ±15%	±10% max	Within ±10%
Temperature Coefficient	150 ppm/°C	150 ppm/°C	NA	Within ±100 ppm/°C	< ±100 ppm/°C	Below ±100 ppm/°C	±150 ppm/°C	100 ppm/°C max	NA
Peak Pulse	50v	50v	50v	50v	50v	50v	50v	50v	50v
Packaging	Epoxy Transfer Molded	Epoxy Transfer Molded	Epoxy resin powder coating	Epoxy Transfer Molded	Epoxy Transfer Molded	Epoxy Transfer Molded	Epoxy Transfer Molded	Epoxy resin powder coating	Epoxy Transfer Molded

ACTIVE-GENERAL SPECIFICATIONS

	JET	JHG	RHT/JHT	RMT	RNT
Temp. Range Operating	0° to +70°C	0° to +70°C	0° to +70°C	0° to +70°C	0° to 70°C
Storage Temperature	−55° to +125°C	−50° to +125°C	−40° to +120°C	−55° to +125°C	−40° to +120°C
Insulation Resistance	10 MΩ @ 50 vdc	100 MΩ @ 50 vdc	–	10 MΩ @ 50 vdc	–
Waveform Distortion	NA	NA	NA	NA	NA
Temperature Coefficient	100 ppm/°C max	100 ppm/°C max	100 ppm/°C	100 ppm/°C max	100 ppm/°C
Peak Pulse	NA	NA	NA	NA	NA
Packaging	Epoxy Transfer Molded	Epoxy Transfer Molded	Epoxy Transfer Molded	Epoxy Transfer Molded	Epoxy Transfer Molded

ACTIVE-DELAY LINES PERFORMANCE SPECIFICATIONS

JET TYPE—8 PIN SIP/5 TAP

Total Delay Time (ns) ±5%	Tap Delay
20-500	4-100

JHG TYPE—14 PIN DIP/3 INDEPENDENT DELAYS

Total Delay Time (ns)	Delay Per Group ±5% (ns)	Rise time (ns)
30-300	10-100	4

RHT/JHT TYPE—14 PIN DIP/5 TAP

Total Delay Time (ns) ±5%	Delay Time per Tap (ns)	Rise Time Tro Max (ns)
20-500	4-100	3-4

RMT TYPE—SMD/5 TAP

Total Delay Time (ns)	Tap Delay (ns)
20-500	4-100

RNT TYPE—8 PIN DIP/2 OR 3 TAP

Delay Time Tap 1 (ns)	Delay Time Tap 2 (ns)	Delay Time In-out (ns)	Rise Time (ns)
30-90	40-120	50-150	4
30-70	–	60-150	4

PASSIVE-DELAY LINES PERFORMANCE SPECIFICATIONS

JAT TYPE—14 PIN DIP/10 TAP

Impedance Zo (Ω) ±10%	Total Delay Time (ns) ±5%
50	10-150
100	10-300
200	15-300
300	25-250
500	50-150

JBT TYPE—7 PIN SIP/5 TAP

Impedance Zo (Ω) ±10%	Total Delay Time (ns) ±5%	Delay Time Between Taps (ns)	Rise & Fall Time, 10-90%
100	10-300	2-60	7-59
300	10-300	2-60	8-59
350	20-200	4-40	13-35

JD/JDT TYPE—3 OR 4 PIN SIP/1 OR 2 OUTPUT

Impedance Zo ±10%	Delay Time (ns)	Tap Delay Time (ns)
100	10-150	–
350	10-70	–
100	10-150	5-75
350	10-120	5-60
500	50-100	25-50

PASSIVE-DELAY LINES PERFORMANCE SPECIFICATIONS

RET TYPE—14 PIN DIP/10 TAP

Impedance Zo (Ω) ±10%	Total Delay Time (ns) ±%	Delay Time Per Tap (ns)	Rise Time Tr (ns) Max.
75	10-300	1-30	3-52.5
100	10-300	1-30	3-52.5
200	15-300	1.5-30	6-54
300	25-250	2.5-25	9-48
500	40-200	4-20	3-35

R5ET TYPE—14 PIN DIP/5 TAP

Impedance Zo (Ω) ±10%	Total Delay Time (ns) ±5%	Delay Time Per Tap (ns)	Rise Time Tr (ns) Max.
50	10-100	2-20	4-29
100	10-250	2-50	4-70
200	10-300	2-60	4-86
300	20-200	4-40	8-57
500	50-100	10-20	15-29

R20ET TYPE—16 PIN DIP/10 TAP

Impedance Zo ±10%	Total Delay Time (Ps) ±5%	Delay Time Per Tap (Ps)	Rise Time Tr (ps) Max.
100	2,000-10,000	200-1,000	1,800-3,000

RQT TYPE—8 PIN DIP/5 TAP

Impedance Zo ±10%	Delay Time (ns)	Tap Delay Time (ns)
100	20-200	4-40
300	20-150	4-30
350	50-120	10-24

SP TYPE—4 PIN SIP/SINGLE DELAY

Delay Time ±5% (ns)	Rise Fall Time (ns Max)	Length Inch (mm)
.1-1.0	1.0	0.86 (21.85)
1.1-2.0	1.0	1.13 (28.70)

SQ TYPE—3 PIN SIP/SINGLE DELAY/ ECL LOGIC

Impedance Zo ±10%	Total Delay Time (ns)	Rise Time (ns-max.)
55	0.2-2.0±0.1	1.0

SS TYPE—3 PIN SIP/SINGLE DELAY/ ECL LOGIC

Impedance Zo ±10%	Total Delay Time (ns)	Rise Time (ns-max.)
50	1-5±0.25	2.0

Toko America, Inc. / 1250 Feehanville Drive, Mount Prospect, IL 60056 / Tel. 312/297-0070 / FAX 312/699-7864
Western Office / 10080 N. Wolfe Rd., SW3-211, Cupertino, CA 95014 / Tel. 408/996-7575 / FAX 408/996-7280
Eastern Office / Danbury Corp. Center, 107 Mill Plain Road, Danbury, CT 06811 / Tel 203/748-6871 / FAX 203/797-1223
S. Eastern Office / Executive Plaza, 555 Sparkman Drive, Suite 820-C, Huntsville, AL 35816 / Tel. 205/830-0952 / FAX 205/830-5399

VALOR

Digital Delay Lines

Surface Mountable 5 and 10 TAP Digital Delay Modules

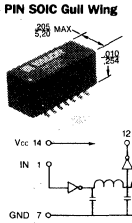
FEATURES

- Low profile
- Industry standard .050 or .100 pin pattern
- Schottky TTL buffered input/output
- 5 equally spaced taps
- Leading edge precision
- Meets requirements of infrared and vapor phase soldering methods
- Lead coplanarity of ±.002
- Minimum input pulse width: 40% total delay

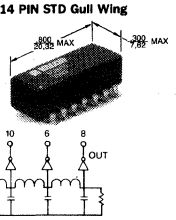
5 TAP ELECTRICAL SPECIFICATIONS (25°C AND Vcc=5.0 V)

Total Delay (ns±5%)	Tap Delay (ns)	Rise Time (ns)	Gull Wing 14 PIN SOIC	Gull Wing 14 PIN STD NEW!
25	5	3	SM0025	SG5025
30	6	3	SM0030	SG5030
35	7	3	SM0035	SG5035
40	8	3	SM0040	SG5040
45	9	3	SM0045	SG5045
50	10	3	SM0050	SG5050
60	12	3	SM0060	SG5060
75	15	3	SM0075	SG5075
80	16	3	SM0080	SG5080
100	20	3	SM0100	SG5100
125	25	4	SM0125	SG5125
150	30	4	SM0150	SG5150
175	35	4	SM0175	SG5175
200	40	4	SM0200	SG5200
225	45	4	SM0225	SG5225
250	50	4	SM0250	SG5250

14 PIN SOIC Gull Wing



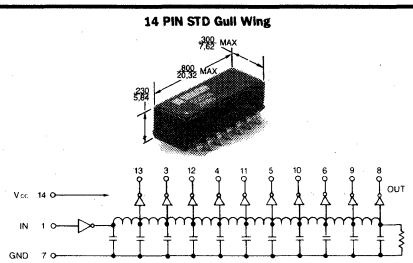
14 PIN STD Gull Wing



10 TAP ELECTRICAL SPECIFICATIONS (25°C AND Vcc=5.0 V)

Total Delay (ns±5%)	Tap Delay (ns)	Rise Time (ns)	Part Number
50	5	3	SG0050
60	6	3	SG0060
70	7	3	SG0070
80	8	3	SG0080
90	9	3	SG0090
100	10	3	SG0100
125	12.5	4	SG0125
150	15	4	SG0150
175	17.5	4	SG0175
200	20	4	SG0200
250	25	4	SG0250

14 PIN STD Gull Wing



5 TAP Digital Delay Modules

FEATURES

- TTL compatible
- Standard delay times
- 14 and 16 PIN packages
- 5 equally spaced TAPS
- Dynamic RAM timing precision
- Minimum pulse widths: 25% of total delay

ELECTRICAL SPECIFICATIONS (25°C AND Vcc=5.0 V)

Total Delay (1) (ns±5%)	Delay/Tap (2) (ns)	Standard (3) 14 PIN	Dual (4)(5) 14 PIN	STD (3) 16 PIN
25	5	DL1883	DL1909	DL1803
30	6	DL2080	DL3158	—
35	7	DL2081	DL3159	—
40	8	DL2082	DL3160	—
45	9	DL2083	DL3161	—
50	10	DL1884	DL1910	DL1804
60	12	DL2171	DL3162	—
75	15	DL2084	DL1911	—
80	16	DL2427	DL3163	—
100	20	DL1885	DL1912	DL1805
125	25	DL2333	DL2240	—
150	30	DL1886	DL1913	DL1806
175	35	DL1846	DL1901	—
200	40	DL1887	DL1914	DL1807
225	45	DL2437	DL3164	—
250	50	DL1888	DL1915	DL1808
300	60	DL2060	—	—
350	70	DL2334	—	—
400	80	DL2061	—	—
450	90	DL2335	—	—
500	100	DL1889	—	DL1809
600	120	DL2336	—	—
700	140	DL2337	—	—
800	160	DL2338	—	—
900	180	DL2339	—	—
1000	200	DL2340	—	DL1810

NOTES: (1) Rise time 3 ns for delays less than 100 ns and 4 ns for the delays greater than 100 ns. Measured from .75 V to 2.4 V levels.

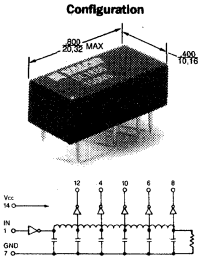
(2) Tol. ±10% or ±2 ns, whichever is greater.

(3) Delays measured at 1.5 V levels at positive edges.

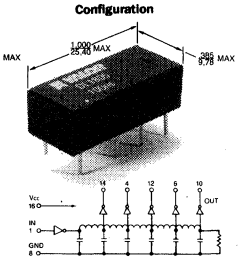
(4) Minimum pulse width 25% of total delay.

(5) Delay measured at 1.5 V levels of both positive and negative edge.

14 PIN STD and Dual Configuration



16 PIN STD Configuration



VALOR ELECTRONICS, INC., 6275 NANCY RIDGE DRIVE, SAN DIEGO, CA 92121-2245
PHONE: 619/458-1471 FAX: (619) 458-0875 TELEX: 653-406 VALORSD

3-In-1 Digital Delay Modules

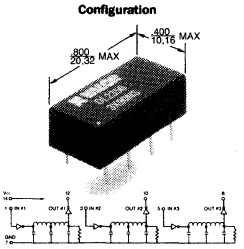
FEATURES	
3 independent logic buffer delays	
8 or 14 pin package	
TTL compatible	
Minimum pulse width:	40% of total delay
SUPPLY CURRENT	
High level output:	40 mA MAX
Low level output:	100 mA MAX

ELECTRICAL SPECIFICATIONS (25°C AND Vcc=5.0 V)

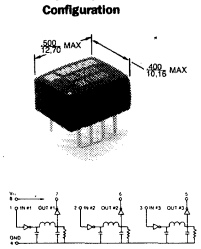
Delay Per(1)(2) Output (ns)	Rise Time(3) (ns MAX)	Standard 14 PIN	NEW! Mini 8 PIN
5	3	DL2357	DL3200
10	3	DL2358	DL3201
12	3	DL2425	DL3202
15	3	DL2441	DL3203
20	3	DL2229	DL3204
25	3	DL2445	DL3205
30	3	DL2352	DL3206
40	3	DL2353	DL3207
45	3	DL2454	DL3208
50	3	DL2230	DL3209
60	3	DL2328	DL3210
65	3	DL2325	DL3211
70	3	DL2354	DL3212
75	3	DL2442	DL3213
80	3	DL2355	DL3214
90	3	DL2356	DL3215
100	3	DL2231	DL3216
125	4	DL2359	—
134	4	DL2455	—
150	4	DL2452	—
175	4	DL2451	—
200	4	DL2349	—

NOTES: (1) Measured at 1.5 V level of positive going edge.
(2) Tolerance of ±5% or 2 ns, whichever is greater.
(3) Measured from 0.75 V to 2.4 V levels.

14 PIN STD Configuration



8 PIN STD Configuration



NEW! 8 PIN SIL and Mini DIP

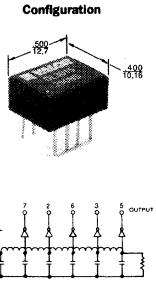
FEATURES	
TTL compatible	
Standard delay times	
8 PIN SIL and Mini DIP packages	
5 equally spaced TAPS	
Dynamic RAM timing precision	
Minimum pulse widths:	40% of total delay
SUPPLY CURRENT	
High:	30 mA MAX
Low:	60 mA MAX

ELECTRICAL SPECIFICATIONS (25°C AND Vcc=5.0 V)

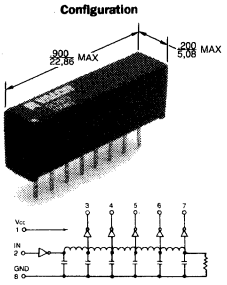
Total Delay(1)(3) (ns±5%)	Delay/Tap(2)(3) (ns)	Mini DIP 8 PIN	SIL 8 PIN
25	5	DL3000	DL2968
30	6	DL3001	DL2969
35	7	DL3002	DL2970
40	8	DL3003	DL2971
45	9	DL3004	DL2972
50	10	DL3005	DL2973
60	12	DL3006	DL2974
75	15	DL3007	DL2975
80	16	DL3008	DL2976
100	20	DL3009	DL2977
125	25	DL3010	DL2978
150	30	DL3011	DL2979
175	35	DL3012	DL2980
200	40	DL3013	DL2981
225	45	DL3014	DL2982
250	50	DL3015	DL2983

NOTES: (1) Rise time 3 ns for delays less than 100 ns and 4 ns for the delays greater than 100 ns. Measured from .75 V to 2.4 V levels.
(2) Tol. ±10% or ±2 ns, whichever is greater.
(3) Delay measured at 1.5 V levels of positive going edge.

8 PIN Mini DIP Configuration

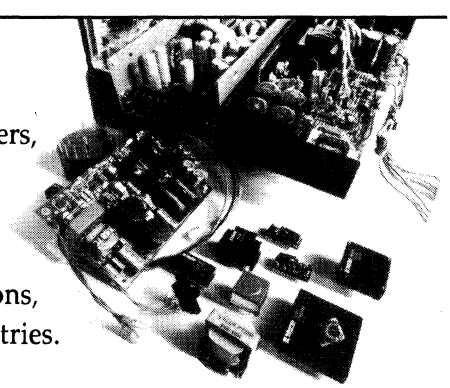


8 PIN SIL Configuration



Digital Delay Lines

Valor offers a full range of custom, standard, and modified standard timing components, pulse transformers, DC/DC converters, functional modules, and switching and linear power supplies, to major worldwide manufacturers in data communications, computer and instrumentation industries.



VALOR ELECTRONICS, INC., 6275 NANCY RIDGE DRIVE, SAN DIEGO, CA 92121-2245
PHONE: 619/458-1471 FAX: (619) 458-0875 TELEX: 653-406 VALORSD

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
ABS acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CAMAC computer automated measurement and control
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3)
KSR keyboard send /receive

L
LC inductance capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIB microcomputer interface board
MIC microwave IC
MIPS million instructions per second
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

POWER LINE FILTERS

Manufacturer	Starting EEM Page No.	EMI	AC	DC	RFI	AC	DC	UL	CSA	VDE	SEV	HPF	SEMCO	MIL STD; custom & other
Corcom Inc.	A•1640	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤	Power Emtry Modules
Curtis Industries	A•1642	¤			¤			¤	¤	¤	¤			Fused; Custom
Delta Electronic	A•1644	¤	¤					¤	¤	¤		¤		Power Entry Modules; Fused
Eichhoff	A•1648	¤			¤			¤	¤	¤				Power Entry Modules; Fused; Custom
FDK America	A•1654	¤	¤					¤	¤					
Filter Concepts	A•1656	¤	¤	¤	¤	¤	¤	¤	¤					TUV; Custom
Filtron/ARX	A•1659	¤			¤									
JMK Filters	A•1663	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤		461; F-15733; Custom
Metuchen Capacitors	A•1672	¤	¤	¤	¤	¤	¤							220; F-15733
Murata Erie	A•1675	¤		¤	¤		¤							Q-9858; F-15733; Custom
Oxley	A•1677				¤		¤							QPL-15733; F-28861; Custom
Power Dynamics	A•1679	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤			Power Entry Modules; Fused
RFI Corp.	A•1687	¤			¤									F-15733
RTE Aerovox	A•1688	¤	¤		¤	¤		¤	¤	¤				Custom; Power Entry Modules; Fused
Schaffner EMC	A•1691	¤			¤			¤	¤	¤				Power Entry; Modles;Fused
Schurter	A•1692				¤			¤	¤	¤	¤			Power Entry Modules; Fused
Sprague	A•1694	¤	¤		¤	¤		¤	¤	¤				F-28861; Ceramic
Tamura	A•1695	¤	¤		¤	¤		¤	¤	¤				Inductors
TDK Corp.	A•1698	¤	¤		¤	¤		¤	¤	¤				
Tokin America	A•1700	¤												Cores
Tri-Mag Inc.	A•1702	¤	¤	¤	¤	¤	¤	¤	¤	¤				F-15733; Custom
Tusonix	A•1714	¤			¤									Ceramic; Custom

SIGNAL FILTERS

Manufacturer	Starting EEM Page No.	Low Pass	High Pass	Band-pass (incl SAW)	Band Reject	AF	IF	RF Micro-wave	VHF/ UHF	Act-ive	Digi-tal	Vari-able (incl. Pgml.)	LC	Video	Equal-izer	Other
Allen Avionics	A•1635	¤•	¤•	¤*	¤*			¤*					¤*	¤*	¤•	
Andersen Labs	A•1636			¤	¤			¤	¤							Vestigial Sideband; Linear Phase Filter Banks
A. P Circuit	A•1637	¤	¤	¤	¤	¤				¤		¤				
Chesterfield Products	A•1638	¤*	¤*		¤*								¤		¤*	Linear Phase C-Notch
Comstron	A•1639	¤					¤*		¤				¤*	¤	¤	Crystal, Linear Phase
Eagle	A•1647	¤*	¤*	¤*	¤*			¤*	¤*							
Electronic Precision Comps.	A•1652	¤*	¤*	¤*	¤*	¤*	¤*							¤*	¤*	Harmonic Telemetering Elliptic
ESC Electronics	A•1653	¤*	¤*	¤*	¤*	¤*	¤*	¤*	¤*				¤*	¤*		Linear Phase; Hybrid/Thick film
Frequency Devices	A•1660	¤	¤	¤	¤					¤		¤				
JMK Inc.	A•1663	¤														
KR Electronics	A•1666	¤	¤	¤	¤		¤	¤					¤		¤	Linear Phase Antialias; Delay
Krohn-Hite	A•1669	¤	¤	¤	¤	¤	¤		¤	¤		¤				Modules Mainframes
Matthey	A•1670	¤												¤		
Metuchen Capacitors	A•1672	¤*	¤*	¤*												
Murata Erie	A•1675								¤		¤*					Coax; Pi section Networks
Oxley, Inc.	A•1677															Pi Section SMD; Feed thru arrays
Piconics	A•1678	¤§*	¤§*	¤§*									¤§*	¤§*	¤§*	Connectors (BNC, SMA, OSSM) Pins
Precision Filters	A•1680	¤	¤	¤	¤						¤	¤				Antialias, Elliptic
Tokin	A•1700			¤	¤											Chip; Bead
Toko America	A•1701	¤§	¤§	¤§		¤§				¤	¤§		¤§	¤§	¤§	Helical; Ceramic
TTE, Inc.	A•1706	¤	¤	¤	¤	¤	¤	¤	¤	¤		¤	¤	¤	¤	SIN X/X Correction
Western Multiplex	A•1715														¤	Passive Networks

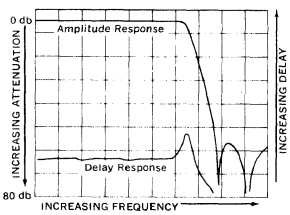
§ Surface Mount * MIL Spec

ALLEN AVIONICS, INC.
224 EAST SECOND STREET • MINEOLA, NY 11501 • PHONE (516) 248-8080 • FAX 516/747-5481

PRECISION LC FILTERS

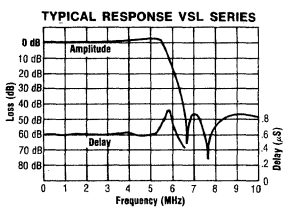
FAST DELIVERY / CUSTOM DESIGNS / FULL LINE OF STOCK VIDEO FILTERS

ALLEN AVIONICS OFFERS A COMPLETE LINE OF STOCKED VIDEO FILTERS COVERING THE MOST POPULAR VIDEO APPLICATIONS.



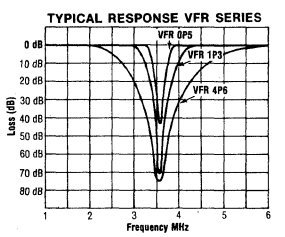
VFL, MVFL & VCL SERIES

Delay and amplitude equalized lowpass filters designed for video filtering requirements. .1 MHz to 10 MHz, low ripple, flat delay response, sharp cutoff, small size. 75 Ohm impedance and a stop band ratio of 1.375 to 1.



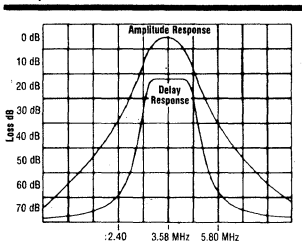
VSL SERIES

This series of filters is intended as post-aliasing filters in digital processing applications. Sin X/X shaping can be incorporated for any sampling frequency. 75 Ohm impedance.



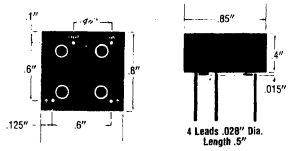
VFR SERIES

NTSC color sub-carrier Band Reject Filter designed to remove the 3.58 MHz sub-carrier from video signals to provide isolation from the luminance signal. Three bandwidths are available. 75 Ohm impedance. Low phase distortion.



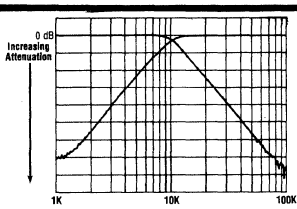
VFB SERIES

Low distortion video Bandpass Filter used to attenuate the luminance information and isolate the chrominance information in color TV transmission. 75 ohm impedance.

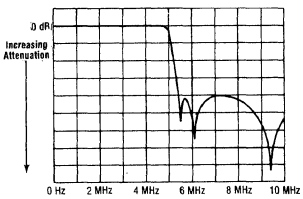


VGF SERIES

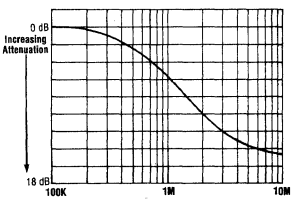
These Video Gaussian Lowpass Filters are used for bandwidth limiting and pulse shaping. They cover the range of .17 MHz to 12 MHz and can be used for the removal of unwanted distortions. Impedance 50, 75, 500 Ohms.



NW100



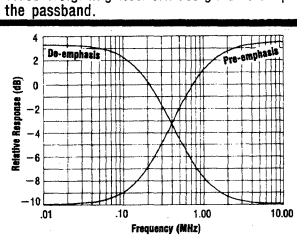
NW200



NW300

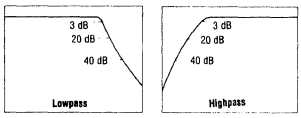
VIDEO NETWORKS RANDOM NOISE MEASUREMENT SYSTEM (EIA STANDARD RS-250B)

Allen Avionics manufactures three passive networks for use in video noise measurements in a 75 ohm system. NW100: Junction Filter to cut-off all frequencies below 10 KHz. NW200: 5 MHz lowpass Filter to cut-off all frequencies above 5 MHz. NW300: Video Weighting Network designed to shape the passband.



WAVE SHAPING NETWORKS

Pre-emphasis networks and De-emphasis networks are used to optimize TV transmission in a 75 ohm system. NW400: Pre-emphasis network preceding the FM modulator. NW500: De-emphasis follows the demodulator.



LOWPASS FILTERS

20 Hz to 1000 MHz

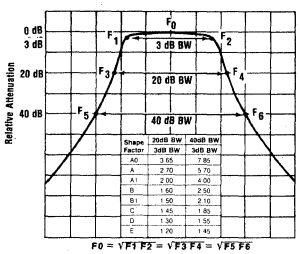
HIGHPASS FILTERS

100 Hz to 500 MHz

All types of Lowpass and Highpass Filters are available from Allen Avionics that can be used in communications, video processing and transmission, information transmission, digital applications and research of all types. The following types are covered in our LC FILTER CATALOG. Call for information on custom designs and applications.

FEATURES

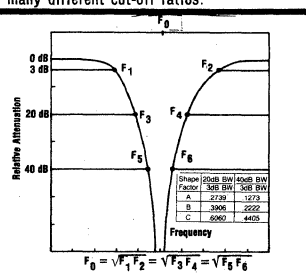
- Medium and Sharp Cut Off
- 40 dB @ 1.063 x the 3 dB Freq.
- Delay Equalized
- Linear Phase
- Low Profile
- Subminiature—T08 Style
- Tubular Low & High



BANDPASS FILTERS

400 Hz to 500 MHz

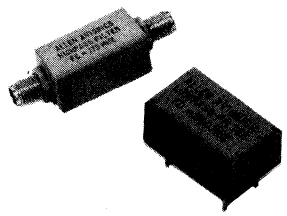
Allen Avionics extensive LC FILTER CATALOG covers a wide range of custom and standard Bandpass Filter design types. Special emphasis is given to Linear Phase Constant Delay types for the communication industry. Easy to use specification forms are included with our Filter catalog that allow you to design your Bandpass Filter from the tabulated listings of standard Bandpass, Linear Phase or Sub-miniature types. Bandpass filters with bandwidths of 2% to 50% can be designed with many different cut-off ratios.



BAND REJECT FILTERS

500 Hz to 20 MHz

Special applications require the attenuation of small bands of frequencies while allowing all others to pass. Allen Avionics tabulated listings of Band Reject Filters will allow the optimization of specifications for Band Reject Filters.

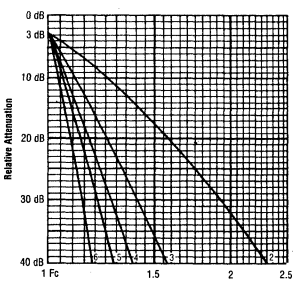


SUB-MINIATURE LOWPASS, HIGHPASS AND BANDPASS

5 MHz to 1000 MHz

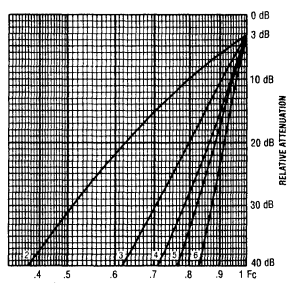
A complete line of miniature filters designed for small size, low insertion loss, sharp cutoffs and good temperature stability are tabulated in our LC FILTER CATALOG. Impedance 50 Ohms.

NEW!



TUBULAR LOWPASS

.5 MHz to 1000 MHz

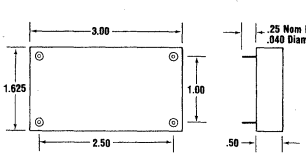


TUBULAR HIGHPASS

.5 MHz to 500 MHz

Easy to use listing for Tubular Filters. You can specify the number of sections, frequency, impedance and connector type from our FILTER CATALOG. Designed for low cost and reduced size over conventional tubular types.

NEW!



LOW PROFILE LOWPASS AND HIGHPASS

10 KHz to 5 MHz

All the filters in the low profile series are a maximum of ½ inch high to accommodate modern high density low profile circuit board design.

CALL OR WRITE FOR OUR COMPLETE FILTER CATALOG

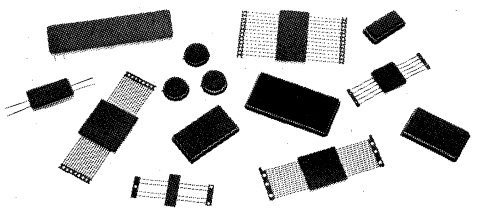
SEE SECTION 2350 FOR DELAY LINES AND HUM ELIMINATORS

SAW Filters For Signal Processing

Linear Phase–Economical–Compact

SAW BANDPASS FILTERS: Optimum amplitude and phase characteristics for:

- RADAR
- DIGITAL COMMUNICATIONS
- T.V.
- COMMUNICATIONS
- FIBER OPTICS
- SATELLITE

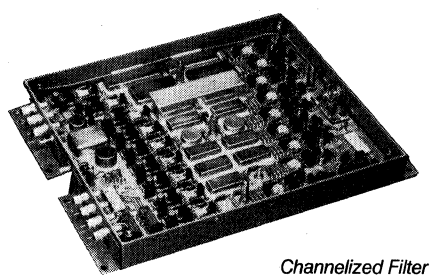


Sampling of Filter Package Designs

Range of Performance	
Center Frequency	20-1100 MHz
bandwidth	100KHz to 60% f.
Rejection bandwidth	Δf + 600 KHz min
Transition bandwidth	300 KHz min
Shape factor (1 dB to 40 dB)	1.1 min
Insertion Loss	10 dB to 30dB, 20 dB typical
Rejection level	30 dB to 55dB, 45 dB typical
Amplitude ripple	±.2 dB to ±.5 dB, ±.3 dB typical
phase deviation from linear	±2° to ±5°, ±3° typical

SAW FILTER BANKS

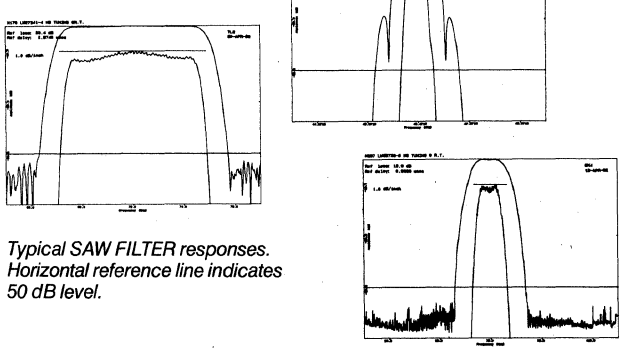
- Ideal for Channelized Receivers and Multichannel Communications
- Excellent Filter Selectivity and Rejection Characteristics
- Custom Packages available with integrated electronics for:
  Amplification
  Phase and Amplitude Matching
  Channel Switching
- Hybridization available



Channelized Filter Bank

SPECIALIZED SAW FILTER DESIGNS

- Bandpass
- Band Reject (Notch)
- Vestigial Sideband (VSB)
- Gaussian
- NYQUIST
- SINX/X
- PSK/MSK Generation
- Amplified or Unity Gain Modules



Typical SAW FILTER responses. Horizontal reference line indicates 50 dB level.

ANDERSEN LABORATORIES

Andersen Laboratories, Inc., 1280 Blue Hills Avenue, Bloomfield, CT 06002 Telephone (203) 242-0761/TWX 710-425-2390

A. P. CIRCUIT CORP.

256 LINCOLN AVE., BROOKLYN, N.Y. 11208 TEL: 212 / 737-1348

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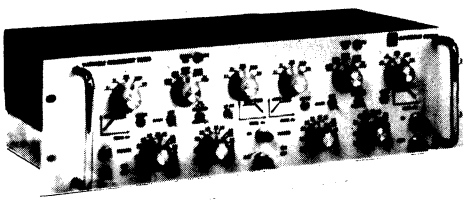
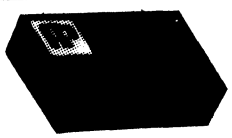
Variable Frequency Analyzer



VARIABLE FREQUENCY INSTRUMENTS FEATURE:

- Low Noise (50 micro Volt RMS)
- High Input, Low Output impedance
- OdB insertion loss or +20dB Preamplifier
- 24 dB/octave slope
- Frequency range 0.01 Hz to 5MHz
- Portable battery operated option



MODEL AP6

3 pole pair filter
Implement all typical characteristics, e.g. Tschebyscheff, Elliptic, Bessel, Butterworth
Accessible internal trimmers for precision tuning and gain adjust
Wide Dynamic Range: over 70 dB

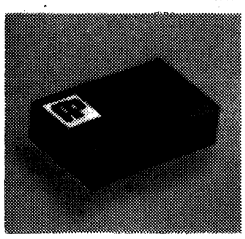
Model	Low Pass	High Pass	Band Pass	Band Reject	FUNCTION
AP 295-5			■		10Hz-1MHz
AP 255-5	■	■	■	■	0.2Hz-20KHz
AP 260-5	■	■	■	■	0.1Hz-10KHz
AP 265-5	■	■	■	■	0.02Hz-2KHz
AP 280-5*	■	■	■	■	2.0Hz-200KHz
AP 220-5*	■	■	■	■	20Hz-2MHz
AP 301			■		0.1-10KHz
AP 302			■		0.1-1KHz
AP 401			■		0.1-10KHz

*AC Supply only
Nl. Cd. Power Pack Option

Filters *(antialiasing, lowpass, highpass, bandpass, bandreject, response matching, weighting, etc.)*

Miniature Active Filters from 2 Pole to 9 Pole

Options: Low Profile
Low Power
Amplification
Surface Mount Package

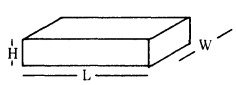


Features:
Standard Dip Package
Low Noise

Ideal Functional Block:
High Input Impedance
Low Output Impedance

Characteristics:
Butterworth, Tschebyscheff
Bessel,
Frequency Stability 0.017%/°C

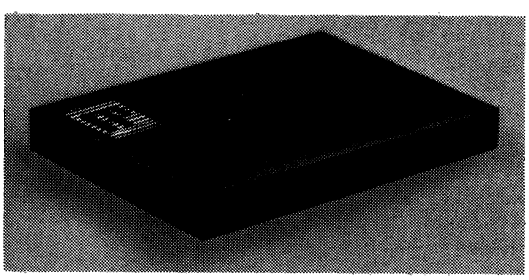
Mechancial Drawing for Miniature Filter



TYPE	H	L	W
	SIZES		
2-5 Pole	.43"	1.25"	0.6"
6 Pole	.43"	2.1"	0.6"
7-9 Pole	.43"	2.5"	0.6"

Variable Frequency Models

AP-6 VC-Series
(Voltage controlled Filters)
continuous frequency selectability



DP8-Series

Features: All Characteristics Available

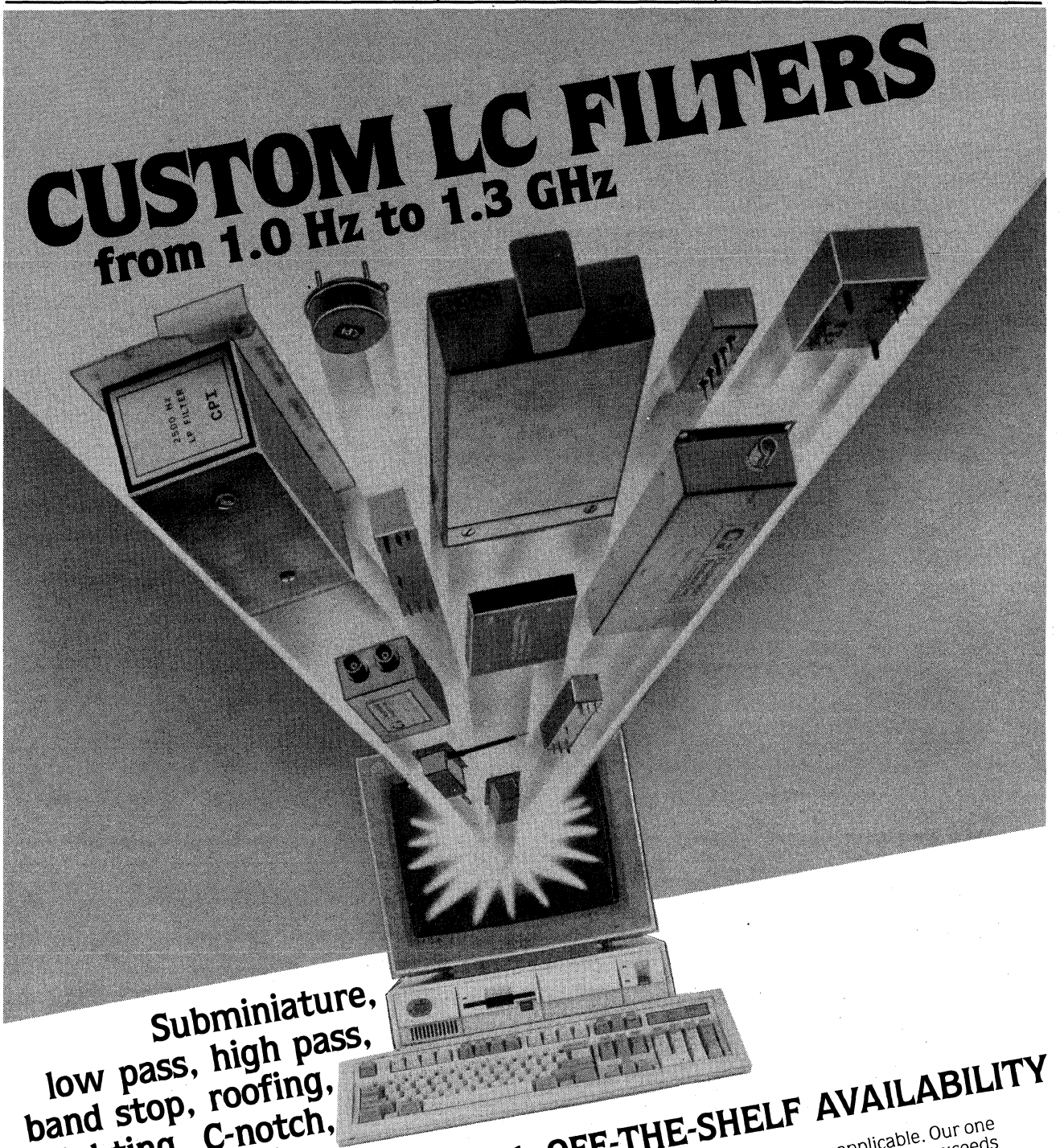
Uses: Data Acquisition, Remote Sensing.
Particularly useful as antialiasing filters.

TTL Compatible, Fast Setting Time,
Low D.C. Drift, 2-8 Pole, 2-8 bit, Amplication

AP-DP-Series

Features: Exceptional DC Stability: DC Drift < 0.5mV,
Low Pass, High Pass, 3 bit programmable,
frequency selectable fo to 128 fo,
Data Acquisition; such as Transducer
(Temperature, Pressure, etc.)

CUSTOM LC FILTERS
from 1.0 Hz to 1.3 GHz



Subminiature, low pass, high pass, band stop, roofing, weighting, C-notch, equalizing, C-message, junction filters with OFF-THE-SHELF AVAILABILITY

CHESTERFIELD PRODUCTS, INC. has a large inventory of custom filter designs:
• Butterworth • Bessel • Legendre • Elliptical
• Gaussian • Chebychev • Linear phase
for a wide variety of commercial and military applications.

CHESTERFIELD can accommodate 15th order requirements; balanced or unbalanced versions, phase matching, group delay, phase linearity, VSWR, and return loss specifications.

CHESTERFIELD is qualified to MIL-F-18327 and will insure compliance MIL-I-45208 when applicable. Our one hundred percent inspection and testing program exceeds industry standards.

CHESTERFIELD uses state of the art computer instrumentation and testing equipment, thus ensuring accuracy, reliability and verification. Plotted data is available when needed.

CHESTERFIELD is geared to your special engineering needs as well as quick action response.

Since 1969, the leader in LC filters.

For more information, call, write or FAX:

CP Chesterfield Products/inc.

37 Midland Avenue
Elmwood Park, NJ
07407

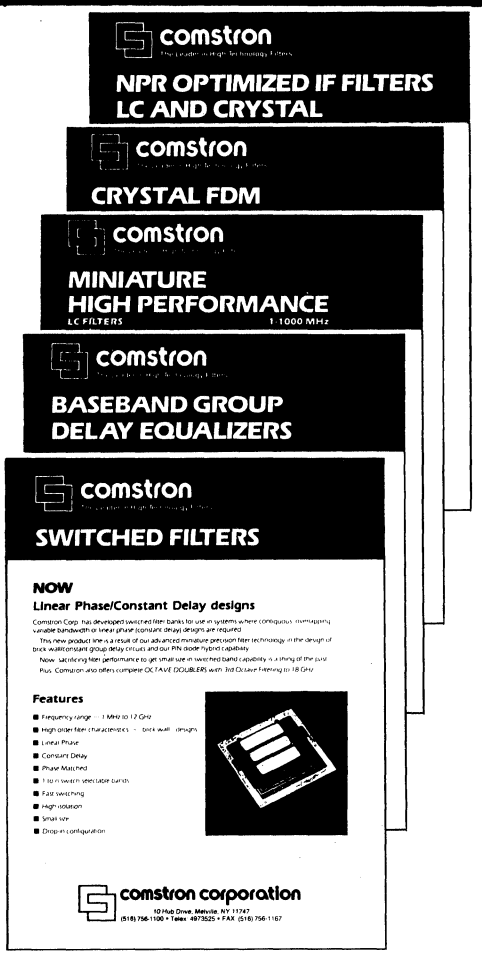
Telephone: 201/797-9655
FAX: 201/797-9504

comstron corporation

TECHNOLOGY " + " FILTERS

The Extra Edge in Systems Performance DC to 1 GHz

Comstron has developed optimum frequency or time domain filters to produce near theoretical system performance. These technology + filters are available as catalog items or custom tailored to your needs.



Design

Comstron has implemented modern network synthesis and physical realization techniques to the point where highly reliable, compact, LC and crystal filters are available — quickly and economically. Proprietary computer analysis, modeling, and optimization programs efficiently arrive at near-optium solutions to spectral, time domain, and stochastic problems. The Company's Enhanced Synthesis Program (ESP). Filter Optimization Program (FOP) and Parameter Optimization Program (POP) provide design parameters for systems oriented functions. Requirements for group delay equalization, wide band arithmetic symmetry, x/sin x amplitude correction, corrected Nyquist filters, phase compensation, and time domain response designs are routinely and efficiently handled.

Test

The Company's commitment to excellence is evident in its extensive test facilities. Automatic computer based network analyzers cover the frequency range from dc to 1.3 GHz with full plotting and printer output capability. Parameters which are automatically measured include amplitude response, phase response, group delay, and return loss. Time domain testing can also be performed to verify impulse response or response to complex waveforms.
Computer directed environmental testing allows unattended measurements of performance over temperature on a production basis. Comstron's proprietary Automatic Filter Test (AFT) programs permits rapid and accurate generation of acceptance test procedures as well as full documentation and data files when required.

Quality Control

Comstron maintains a Quality Control Department that ensures compliance with MIL-I-45208A and MIL-Q-9858A when applicable. Microscopic inspection, controlled environment, material control and traceability, solder training programs, and strict configuration management all contribute to producing an exceptionally reliable product.
The quality control program is continuously monitored. Over the years since its inception, Comstron has assembled a dedicated, conscientious staff whose pride of workmanship and customer loyalty is the keynote of the Company.

Send for our complete Data Sheets.

Standard Filter Catagories

- FDM Channel
- Switched Filter Banks
- Miniature LC.
- USB/LSB
- Miniature Linear Phase
- Group Delay Equalizer
- NPR Optimized
- Pulse Response Optimized
- Nyquist
- Video
- Speech Plus
- Group/Super Group/Master Group/Pilot Notch
- 70/140 MHz Satellite IF Filters
- 70 MHz Switchable Equalizer (Delay or Amplitude)

Call Comstron for applications assistance for your LC and Crystal Filter requirements.

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RFI Power Line Filters

World Leader In RFI Technology
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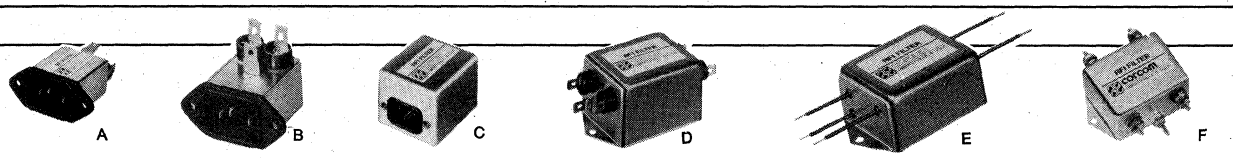
Libertyville, IL 60048 USA
312-680-7400
TLX 910-687-1058



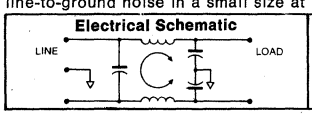
CORCOM'S FAMILY OF PRODUCTS

For Corcom Power Entry Modules See Volume C

SUSCEPTIBILITY CONTROL

SERIES B FILTER

Series B general purpose filters effectively provide RFI control of line-to-ground noise in a small size at low cost.



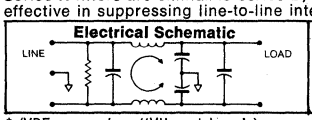
* (VDE approval on "V" models only)

Type	Case Style	Size L x W x H	Rated Current	Type	Case Style	Size L x W x H	Rated Current
1B1	D	2.10 x 2.53 x .66"	1A	5B1	D	2.46 x 2.53 x .78"	5A
1VB1	D	2.25 x 2.53 x .66"	1A	5VB1	D	2.61 x 2.53 x .78"	5A
1VB3	E	.96 x 2.53 x .66"	1A	5VB3	E	1.32 x 2.53 x .78"	5A
2B1	D	2.10 x 2.53 x .66"	2A	10B1	D	2.46 x 2.53 x 1.16"	10A
2VB1	D	2.25 x 2.53 x .66"	2A	10VB1	D	2.61 x 2.53 x 1.16"	10A
2VB3	E	.96 x 2.53 x .66"	2A	10VB3	E	1.32 x 2.53 x 1.16"	10A
				10VB6	F	2.72 x 2.53 x 1.16"	10A
3B1	D	2.46 x 2.53 x .78"	3A	20B1	D	3.21 x 2.81 x 1.16"	20A
3VB1	D	2.61 x 2.53 x .78"	3A	20VB1	D	3.36 x 2.81 x 1.16"	20A
3VB3	E	1.32 x 2.53 x .78"	3A	20VB6	F	3.46 x 2.81 x 1.16"	20A
				30VB6	F	5.34 x 4.20 x 1.53"	30A

1 to 30 AMPS; 120/250 VOLTS, 50/60 Hz AC

SERIES K — With Line-to-Line Capacitors

Series K filters are similar to series B, but have the added feature of being effective in suppressing line-to-line interference as well as line-to-ground.



* (VDE approval on "V" models only)

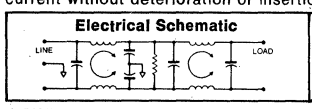
Type	Case Style	Size L x W x H	Rated Current	Type	Case Style	Size L x W x H	Rated Current
1K1	D	2.95 x 2.81 x .91"	1A	5K1	D	2.95 x 2.81 x 1.16"	5A
1VK1	D	3.10 x 2.81 x .91"	1A	5VK1	D	3.10 x 2.81 x 1.16"	5A
1VK3	E	1.81 x 2.81 x .91"	1A	5VK3	E	1.81 x 2.81 x 1.16"	5A
2K1	D	2.95 x 2.81 x .91"	2A	10K1	D	3.20 x 2.81 x 1.16"	10A
2VK1	D	3.10 x 2.81 x .91"	2A	10VK1	D	3.35 x 2.81 x 1.16"	10A
2VK3	E	1.81 x 2.81 x .91"	2A	10VK3	E	2.07 x 2.81 x 1.16"	10A
				10VK6	F	3.46 x 2.81 x 1.16"	10A
3K1	D	2.95 x 2.81 x 1.16"	3A	10VK7	C	3.71 x 2.25 x 1.28"	10A
3VK1	D	3.10 x 2.81 x 1.16"	3A				
3VK3	E	1.81 x 2.81 x 1.16"	3A	20K1	D	3.20 x 3.35 x 1.53"	20A
3VK7	C	3.21 x 2.25 x 1.28"	3A	20VK1	D	3.35 x 3.35 x 1.53"	20A
				20VK6	F	3.46 x 3.35 x 1.53"	20A
				30VK6	F	5.34 x 4.20 x 1.53"	30A

1 to 30 AMPS; 120/250 VOLTS, 50/60 Hz AC

Rated Current 30A not 20A

SERIES R FILTER

The R series dual T section RFI power line filters provide premium performance at moderate cost. They are well suited for low impedance loads where noisy RFI environments are present. At frequencies as low as 150 KHz the R series has an insertion loss as high as 45 DB. The control pulsed, continuous and/or intermittent interference insuring protection of your equipment from power line noise in addition to protecting the line from equipment noise. The R series is an ideal replacement for Pi type filters while incorporating the "value added" concept. Pi filters have used large capacitors to eliminate low frequency RFI, resulting in high line-to-ground leakage current. The R series dual T type provides extremely low leakage current without deterioration of insertion loss characteristics.



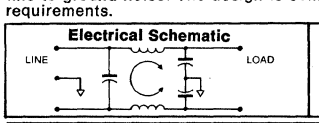
* (VDE approval on "V" models only)

Type	Case Style	Size L x W x H	Rated Current	Type	Case Style	Size L x W x H	Rated Current
1R1	D	3.20 x 1.81 x 1.16"	1A	5R1	D	3.70 x 2.07 x 1.16"	5A
1VR1	D	3.35 x 1.81 x 1.16"	1A	5VR1	D	3.85 x 2.07 x 1.16"	5A
1VR3	E	2.78 x 1.81 x 1.16"	1A	5VR3	E	3.35 x 2.07 x 1.16"	5A
				5VR7	C	4.33 x 2.25 x 1.28"	5A
2R1	D	3.20 x 1.81 x 1.16"	2A	10R1	D	3.70 x 2.07 x 1.53"	10A
2VR1	D	3.35 x 1.81 x 1.16"	2A	10VR1	D	3.85 x 2.07 x 1.53"	10A
2VR3	E	2.78 x 1.81 x 1.16"	2A	10VR3	E	3.35 x 2.07 x 1.53"	10A
3R1	D	3.70 x 2.07 x 1.16"	3A	10VR6	F	3.96 x 2.07 x 1.53"	10A
3VR1	D	3.85 x 2.07 x 1.16"	3A	10VR7	C	4.33 x 2.25 x 1.53"	10A
3VR3	E	3.35 x 2.07 x 1.16"	3A				
3VR7	C	4.33 x 2.25 x 1.28"	3A	20R1	D	5.08 x 3.37 x 1.53"	20A
				20VR1	D	5.23 x 3.37 x 1.53"	20A
				20VR6	F	5.34 x 3.37 x 1.53"	20A

1 to 20 AMPS; 120/250 VOLTS, 50/60 Hz AC

EF INTERNATIONAL SERIES FILTERS

This rugged international series of RFI filters incorporates the special IEC (International Electrotechnical Commission) power line connector. This series includes ¼ inch fastons (F suffix) or solder terminals on the load side which can be soldered or crimp terminated. Electrically the EF international series is a general purpose filter effectively providing RFI control of line-to-ground noise. The design is compact and meets low leakage requirements.

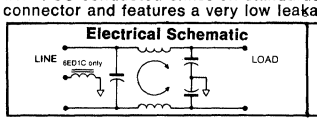


Type	Case Style	Size L x W x H	Rated Current	Type	Case Style	Size L x W x H	Rated Current
1EF1F*	A	2.20 x 1.98 x .81"	1 amp	1EF1	A	1.99 x 1.98 x .81"	1 amp
3EF1F*	A	2.20 x 1.98 x .81"	3 amp	3EF1	A	1.99 x 1.98 x .81"	3 amp
6EF1F*	A	2.20 x 1.98 x .81"	6 amp	6EF1	A	1.99 x 1.98 x .81"	6 amp
1EF2F*	B	1.55 x 1.98 x 1.50"	1 amp	1EF2	B	1.55 x 1.98 x 1.29"	1 amp
3EF2F*	B	1.55 x 1.98 x 1.50"	3 amp	3EF2	B	1.55 x 1.98 x 1.29"	3 amp
6EF2F*	B	1.55 x 1.98 x 1.50"	6 amp	6EF2	B	1.55 x 1.98 x 1.29"	6 amp

* Models with F suffix have SEMKO approval
1 to 6 AMPS; 120/250 VOLTS, 50/60 Hz AC

ED SERIES — High Performance RFI Power Line Filters

The ED series filters are high performance filters that are extremely effective in applications where line-to-line and low frequency line-to-ground noise must be controlled in such cases as bringing equipment into compliance with FCC conducted emission standards. The series incorporates an IEC connector and features a very low leakage current.

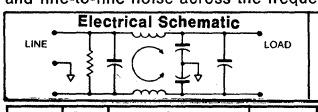


Type	Case Style	Size L x W x H	Rated Current	Type	Case Style	Size L x W x H	Rated Current
1ED1	A	2.20 x 1.98 x .81"	1A	1ED2	B	1.55 x 1.98 x 1.50"	1A
3ED1	A	2.20 x 1.98 x .81"	3A	3ED2	B	1.55 x 1.98 x 1.50"	3A
6ED1	A	2.20 x 1.98 x .81"	6A	6ED2	B	1.55 x 1.98 x 1.50"	6A

1 to 6 AMPS; 120/250 VOLTS, 50/60 Hz AC

EC SERIES

The EC series RFI power line filters provide the highest attenuation of any standard filters available in a small package size. These filters combine high common mode inductance with high differential-mode capacitance and minimal parasitic elements, for the effective attenuation of line-to-ground and line-to-line noise across the frequency range.

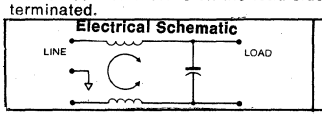


Type	Case Style	Size L x W x H	Rated Current	Type	Case Style	Size L x W x H	Rated Current
1EC1	A	2.62 x 1.98 x .81"	1A	1EC2	B	1.97 x 1.98 x 1.46"	1A
3EC1	A	2.62 x 1.98 x .81"	3A	3EC2	B	1.97 x 1.98 x 1.46"	3A
6EC1	A	2.62 x 1.98 x .81"	6A	6EC2	B	1.97 x 1.98 x 1.46"	6A

1 to 6 AMPS; 120/250 VOLTS, 50/60 Hz AC

H SERIES — RFI Power Line Filters for Medical Equipment Application

The H series is designed to meet UL 544 specifications for medical and dental equipment. The model 6EH1 is suited for patient care equipment. Model 6EH4 and 6EH9 are suited for non-patient equipment (equipment that is intended for use where contact with the patient is unlikely). The H series include ¼ inch fastons on the load side which can be soldered or crimp terminated.



Type	Case Style	Size L x W x H	Rated Current	Type	Case Style	Size L x W x H	Rated Current
6H1	NP	2.10 x 2.53 x .66"	6A	6EH4	A	2.20 x 1.98 x .81"	6A
6EH1	NP	2.25 x 2.53 x .66"	6A	6EH9	B	1.55 x 1.98 x .85"	6A

NP — Not Pictured
6 AMPS: 120/250 VOLTS, 50/60 Hz AC

RECOGNIZED UNDER UL544
CSA CERTIFIED, VDE & SEV APPROVED

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RFI Power Line Filters

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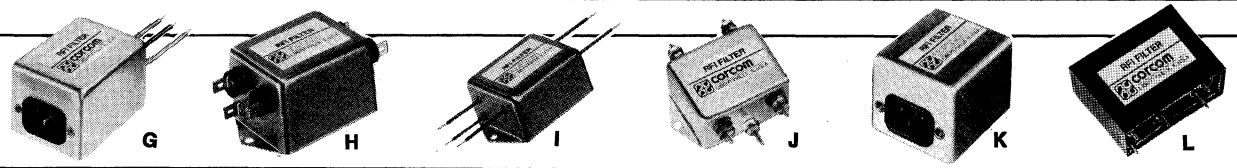


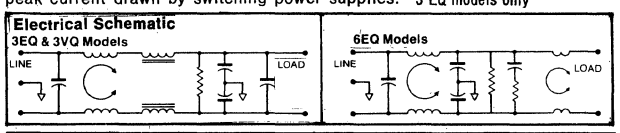
CORCOM'S FAMILY OF PRODUCTS

For Corcom Power Entry Modules See Volume C

EMISSION CONTROL

Q SERIES — RFI Powerline Filter For switching power supply noise suppression

The Q series of RFI power line filters has been developed specifically for switching power supplies and is designed to be all the power line filtering required to control conducted emissions down to 10 kHz. High attenuation is provided for both line-to-line and line-to-ground interference throughout the frequency range, with no graduation of performance due to the large peak current drawn by switching power supplies. * 3 EQ models only

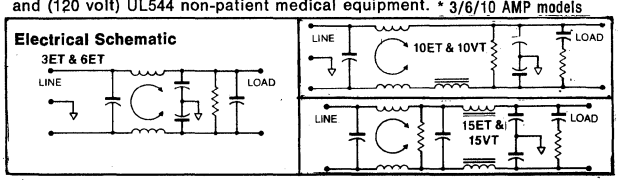


Type	Case Style	Size L x W x H	Rated Current	Type	Case Style	Size L x W x H	Rated Current
3VQ1	H	3.85 x 2.07 x 1.78″	3A	3EQ1	H	3.85 x 2.07 x 1.78″	3A
3VQ3	I	3.34 x 2.07 x 1.78″	3A	3EQ3	I	3.34 x 2.07 x 1.78″	3A
3VQ8	G	3.07 x 2.25 x 1.78″	3A	3EQ8	G	3.07 x 2.25 x 1.78″	3A
				6EQ1	H	4.98 x 2.26 x 1.80″	6A
				6EQ3	I	4.47 x 2.26 x 1.80″	6A
				6EQ8	G	5.47 x 2.07 x 1.74″	6A

3 to 6 AMPS; 120/250 VOLTS, 50/60 Hz AC

T SERIES

The T series provides superior common-mode and differential-mode attenuation in a small package. These filters are a size and cost effective choice for very noisy equipment that must meet the emission limits of FCC Parts 15 and 18, or VDE 0871 A-level. In many instances, these filters can bring equipment into compliance with VDE 0871 B-level. This series meets the low leakage current requirements of SEV, VDE portable equipment, and (120 volt) UL544 non-patient medical equipment. * 3/6/10 AMP models

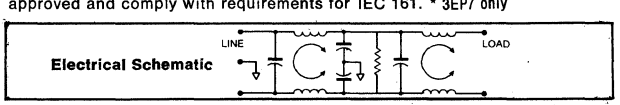


Type	Case Style	Size L x W x H	Rated Current	Type	Case Style	Size L x W x H	Rated Current
3ET1	H	3.56 x 2.15 x 1.81″	3A	15ET1	H	5.45 x 3.96 x 2.18″	15A
6ET1	H	3.56 x 2.15 x 1.81″	6A	15ET6	J	5.95 x 3.96 x 2.18″	15A
10ET1	H	4.69 x 2.26 x 1.80″	10A	10VT1	H	4.69 x 2.26 x 1.80″	10A
10ET3	I	4.47 x 2.26 x 1.80″	10A	10VT3	I	4.47 x 2.26 x 1.80″	10A
				15VT1	H	5.45 x 3.66 x 2.18″	15A
				15VT6	J	5.95 x 3.96 x 2.18″	15A

3 to 6 AMPS; 120/250 VOLTS, 50/60 Hz AC

EP SERIES

EP series RFI filters developed to reduce conducted noise to acceptable limits for equipment that must comply with requirements of VDE 0871 in West Germany, and FCC specifications in USA. Filters provide high insertion losses for both line-to-ground and line-to-line emissions throughout frequency range. Filters are UL recognized, CSA certified, VDE and SEV approved and comply with requirements for IEC 161. * 3EP7 only

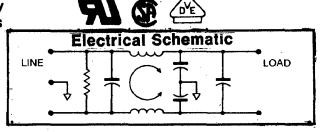


Type	Case Style	Size L x W x H	Rated Current	Type	Case Style	Size L x W x H	Rated Current
3EP1	H	3.85 x 2.07 x 1.78″	3 Amp	6EP1	H	6.62 x 2.07 x 2.28″	6 Amp
3EP3	I	3.35 x 2.07 x 1.78″	3 Amp	6EP3	I	6.03 x 2.07 x 2.28″	6 Amp
3EP7	K	3.21 x 2.25 x 1.78″	3 Amp	10EP1	H	6.62 x 2.07 x 2.78″	10 Amp
				10EP3	I	6.03 x 2.07 x 2.78″	10 Amp

3 to 10 AMPS; 120/250 VOLTS, 50/60 Hz AC

SK SERIES — High Performance RFI Power Line Filters

The SK Series filters are significantly higher performance than the K series which makes this new series particularly suited for equipment with high line-to-ground as well as line-to-line conducted emissions.

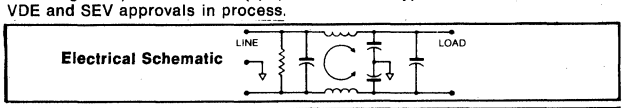


Type	Case Style	Size L x W x H	Rated Current	Type	Case Style	Size L x W x H	Rated Current
3VSK1	H	3.85 x 2.07 x 1.16″	3A	6VSK1	H	4.34 x 2.25 x 1.28″	6A
3VSK3	I	3.35 x 2.07 x 1.16″	3A	6VSK3	I	3.83 x 2.25 x 1.28″	6A
3VSK7	K	3.21 x 2.25 x 1.53″	3A	6VSK7	K	3.21 x 2.25 x 1.78″	6A
				10VSK1	H	4.97 x 2.25 x 1.78″	10A
				10VSK3	I	4.46 x 2.25 x 1.78″	10A
				10VSK7	K	4.33 x 2.25 x 1.78″	10A

3 to 10 AMPS; 120/250 VOLTS, 50/60 Hz AC

SERIES X, Y, Z

Compact power line filters designed for emission control applications such as switching power supplies. Available as PC Board mountable, they feature excellent common and differential mode performance from 10 kHz to 30 MHz, while meeting the very low leakage current requirements of SEV and VDE portable equipment. X models are designed to bring equipment into compliance with FCC Class B emission limits. Y models are designed for equipment compliance to VDE 0871 Level A emission limits. Z models designed for equipment compliance to VDE 0871 Level B emission limits. UL recognized, CSA Certified (1, 2, 3A models only).
VDE and SEV approvals in process.

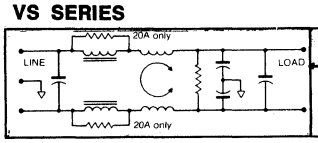


Type	Case Style	Size L x W x H	Rated Current	Type	Case Style	Size L x W x H	Rated Current
3EXP	L	2.61 x 1.13 x 1.62″	3A	2EYP	L	2.61 x 1.13 x 1.62″	2A
4EXP	L	2.61 x 1.13 x 1.62″	4A	3EYP	L	2.61 x 1.13 x 1.75″	3A
6EXP	L	2.61 x 1.13 x 1.75″	6A	4EYP	L	2.61 x 1.13 x 1.75″	4A
3EX1	H	3.54 x 2.08 x 1.31″	3A	1EZP	L	2.61 x 1.13 x 1.62″	1A
				2EZP	L	2.61 x 1.13 x 1.75″	2A
3EZ1	H	3.54 x 2.08 x 1.31″	3A	3EZP	L	2.61 x 1.13 x 1.75″	3A

SERIES S, V, and W Filters

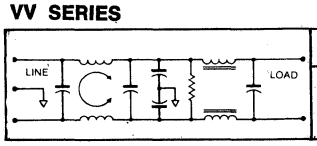
The S, V, and W series combine line-to-ground interference rejection filters with additional circuitry designed to reduce low freq. line-to-line noise and add a balanced N = 3 ("PI") line-to-line filter with high rejection at low freq. to the N = 2 ("L") and N = 3 ("T") sections to eliminate switching type power supplies, SCR and TTL circuits. VS/VV/VW have VDE approval. *

VS SERIES



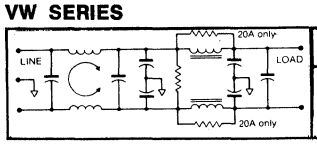
Type	Size L x W x H	Rated Current
3VS1	3.36 x 1.82 x 1.16″	3A
6VS1	3.86 x 2.08 x 1.53″	6A
10VS1	3.86 x 2.08 x 1.53″	10A
20VS1	5.23 x 4.20 x 1.53″	20A

VV SERIES



Type	Size L x W x H	Rated Current
3VV1	3.36 x 1.82 x 1.28″	3A
6VV1	3.86 x 2.08 x 1.53″	6A
10VV1	3.86 x 2.08 x 1.53″	10A
20VV1	5.23 x 4.20 x 1.53″	20A

VW SERIES

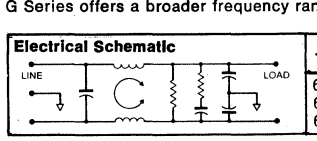


Type	Size L x W x H	Rated Current
3VW1	3.36 x 1.82 x 1.28″	3A
6VW1	3.86 x 2.08 x 1.53″	6A
10VW1	3.86 x 2.08 x 1.53″	10A
20VW1	5.23 x 4.20 x 1.53″	20A

Case Style, all models: H for all 3 series

G SERIES — N SERIES

High performance RFI filters designed to provide excellent common mode and differential mode attenuation for switching power supplies over the range of 50 kHz to 145 kHz. The N Series offers high performance while the G Series offers a broader frequency range of 20 kHz to 145 kHz.



Type	Case Size	Size L x W x H	Rated Current
6VG1	H	3.56 x 2.15 x 1.56″	6A
6EG1	H	3.56 x 2.15 x 1.56″	6A
6VN1	H	3.56 x 2.15 x 1.81″	6A

CURTIS

Your Best Source for RFI Power Line Filters

Broad selection, cost-effective design, applications engineering assistance, custom filter capabilities, delivery, responsive service . . . make **CURTIS** your first source for RFI power line filters.

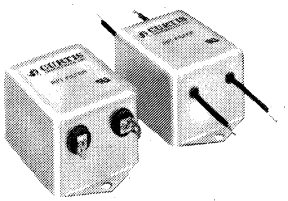
One to 30-amp models in both standard and custom designs. High performance switching power, linear, power entry, general purpose, medical, and TEMPEST applications. IEC connectors, ON/OFF switches, fusing and other variations give you broader design options for more cost-effective packaging. Curtis filters are UL, CSA, and VDE approved. Some have SEV approval, too. And Curtis offers fast conducted emissions testing of your equipment in our engineering test lab.

SWITCHING POWER SUPPLY FILTERS

F2700 SERIES

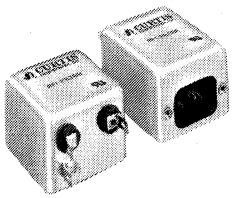
- Very high inductance design with differential-mode choke to provide improved performance below 100 KHz.
- Designed for FCC-B and VDE-B switching power supply applications.
- Compact, space-efficient package available in 3 and 6-amp ratings.
- Also available with integral fused IEC connector and ON/OFF switch.
- UL, CSA, and VDE approved.

F1400 SERIES



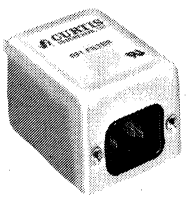
- High peak current design — high insertion loss for switching power supply emissions. Low leakage current.
- Compact case sizes in 3, 6, and 10-amp models.
- Available with integral IEC connector in 3 and 6-amp units.
- UL, CSA, and VDE approved.

F1500 SERIES



- High inductance design with improved attenuation.
- L-circuit configuration — cost-effective in many linear and switching power supply applications.
- 3, 6, and 10-amp models available — compact case size.
- Fused IEC connector option available in 3 and 6-amp models.
- UL, CSA, and VDE approved.

F1600 SERIES

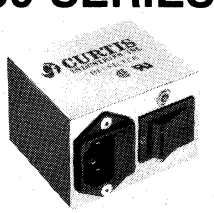


- T-section, dual-coil design — high insertion loss for switching power supply emissions.
- Low leakage current design.
- Space efficient with integral IEC connector and compact case.
- Current rating to 10 amps.
- Available in fused IEC-connector and PC-mount versions.
- UL, CSA, and VDE approved.

F1700 SERIES

- General purpose filters designed for applications with higher differential-mode noise.
- Higher line-to-line capacitance — protection from pulsed, intermittent or continuous RFI.
- 3, 6, 10, 20, 30-amp models with QC, wire or IEC connector options.
- Cost-effective replacement for independent coil designs in many SMPS applications.
- UL, CSA, and VDE approved.

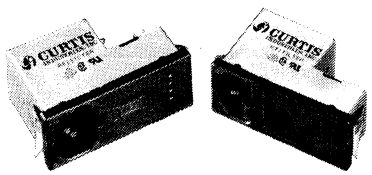
F1800 SERIES



- High performance 3-amp filters designed for switching power supply emissions.
- Fused IEC connector.
- Integral ON/OFF power switch.
- Low leakage current design.
- UL and CSA approved.

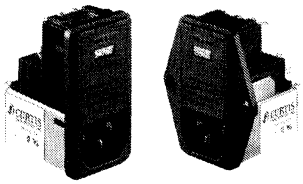
POWER ENTRY FILTERS

PE60/PM60 SERIES



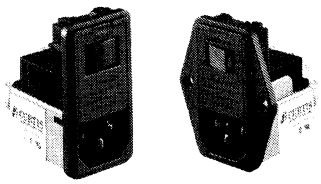
- 6-amp filter module combines IEC connector, fusing, and voltage select features in one compact unit.
- Accepts standard U.S. or European fuse sizes.
- Provides greater differential-mode attenuation at 1 MHz than comparable competitive units.
- PM60 Series meets UL 544 specifications for medical and dental equipment.
- UL, CSA, and VDE approved.

PE70/PM70 SERIES



- 3 and 6-amp modules combine IEC connector, fusing, and voltage select features in one compact unit.
- PE70 Series provides 20% more differential-mode attenuation than comparable competitive units.
- Accepts standard U.S. or European fuse sizes.
- PM70 Series meets UL 544 specifications for medical and dental equipment.
- UL, CSA, and VDE approved.

PE80/PM80 SERIES



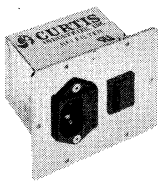
- Power entry filters available in 3 and 6-amp models combine IEC connector, fusing, and ON/OFF power switch in one compact unit.
- Accepts standard U.S. or European fuse sizes.
- PE80 Series affords 20% more differential-mode attenuation than comparable competitive filters.
- PM80 Series meets UL 544 specifications for medical and dental equipment.
- UL, CSA, and VDE approved.

PE90/PM90 SERIES

- 3 and 6-amp modules integrate IEC connector, fusing, voltage select and ON/OFF switch in a single, space-efficient assembly.
- PE90 Series provides 20% more differential-mode attenuation than comparable competitive units.
- Accepts standard U.S. or European fuse sizes.
- PM90 Series meets UL 544 specifications for medical and dental equipment.
- UL, CSA, and VDE approved.

TEMPEST SECURE FILTERS

F5900 SERIES



- High performance filters designed for switching power supply emissions in TEMPEST secure systems.
- * 70dB insertion loss from 200 KHz to 1 GHz.
- Integral power switch and 5 x 20mm fuse holder.
- Available in 3 and 6-amp versions with optional mounting faceplate and internally wired power cord.
- UL approved.
- TEMPEST test capabilities to 1 GHz.

Call CURTIS first for all your RFI filter needs.

Send for NEW 48-page filter engineering manual loaded with helpful RFI filter information. Consult factory for TEMPEST application/performance data.

"We Build Confidence!"

CURTIS INDUSTRIES, INC.

7400 W. Douglas Avenue, P.O. Box 18699
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Phone 414/535-1500, Twx 910-262-3035
Fax 414/535-1150

DELTA

EMI FILTERS

HPF 0565-3

FEATURES

- Over 350 part numbers UL recognized and CSA certified
- More than 200 part numbers VDE approved
- ALL UNITS 100% tested for hipot, leakage current, and insertion loss before and after potting
- Defect rate below 200 ppm
- Superior mechanical construction, corrosion-proof case
- Molded core cover to separate toroid windings
- Precision balance between choke windings
- Use low leakage current, high voltage temperature-stable capacitors for excellent operating performance
- New ME/MK series designed for PCB mounting, ease of installation and space saving

SPECIFICATIONS

Maximum leakage current, each line-to-ground:
@ 115 VAC 60 Hz: 0.25 mA
@ 250 VAC 50 Hz: 0.45 mA

Hipot rating (one minute): line-to-ground: 2250 VDC
line-to-line: 1450 VDC

Operating frequency: 50-60 Hz

Rated voltage: 115/250 VAC

Minimum insertion loss (L-G) in dB, in 50 ohm system

Series No.	Frequency — MHz .15	.50	1.0	5.0	10	30
01, 03 DE	23	28	34	45	45	50
06 DE	12	21	26	40	45	50
01, 03 GE	26	36	38	38	40	40
06 GE	12	18	24	35	40	40
01, 03 SE	42	65	70	70	65	60
06 SE	25	50	60	70	65	55
02-06 BE	25	35	45	50	55	55
01, 02 DB	25	30	38	50	50	50
10 DB	25	35	40	50	50	48
03-10 DK	22	30	38	50	55	55
20 DK	14	19	28	42	45	50
01-05 DR	45	65	70	70	65	65
10, 20 DR	20	44	60	70	60	50
03 (S) DP	50	70	70	65	60	40
03 DP	65	75	75	70	60	50
01 ME	27	40	45	50	52	55
03 ME	25	35	41	50	52	55
06 ME	12	22	30	45	50	55
01 MK	45	45	40	40	40	33
02 MK	35	45	40	40	40	32
03 MK	30	45	40	40	40	32

DIMENSIONS

Delta Part No.	Current Rating	Fig.	Inches Dimensions mm LxWxH—M**	LxWxH—M**
*—DEEG3E	1, 3, 6A	1	1.95x1.11x0.82—1.58	49.5x 28.1x20.8— 40.1
*—DEEG3V	1, 3, 6A	2	1.53x1.99x0.82—1.58	38.9x 50.5x20.8— 40.1
*—GEEG3E	1, 3, 6A	1	1.95x1.11x0.82—1.58	49.5x 28.1x20.8— 40.1
*—SEEG3H	1, 3, 6A	3	3.47x1.99x0.82—1.58	88.2x 50.5x20.8— 40.1
*—SEEG3V	1, 3, 6A	4	3.04x1.99x0.82—1.58	77.2x 50.5x20.8— 40.1
04BEEG3S	4A	5	2.19x1.73x1.28—1.41	55.5x 43.9x32.5— 35.8
*—BEEG3H	2, 4, 6A	5	2.54x1.73x1.28—1.41	64.5x 43.9x32.5— 35.8
01DBAG5	1A	6	2.13x2.50x0.63—2.13	54.1x 63.5x16.0— 54.1
01DBAW5	1A	7	0.94x2.50x0.63—2.13	23.9x 63.5x16.0— 54.1
02DBAG5	2A	6	2.13x2.50x0.63—2.13	54.1x 63.5x16.0— 54.1
02DBAW5	2A	7	0.94x2.50x0.63—2.13	23.9x 63.5x16.0— 54.1
10DBAG5	10A	6	2.52x2.50x1.16—2.13	64.0x 63.5x29.5— 54.1
10DBAW5	10A	7	1.31x2.50x1.16—2.13	33.3x 63.5x29.5— 54.1
03DKAG5	3A	6	2.97x2.75x1.13—2.38	75.4x 69.9x28.7— 60.5
03DKAW5	3A	7	1.81x2.75x1.13—2.38	46.0x 69.9x28.7— 60.5
05DKAG5	5A	6	2.97x2.75x1.13—2.38	75.4x 69.9x28.7— 60.5
05DKAW5	5A	7	1.81x2.75x1.13—2.38	46.0x 69.9x28.7— 60.5
10DKAG5	10A	6	3.23x2.75x1.13—2.38	82.0x 69.9x28.7— 60.5
10DKAW5	10A	7	2.06x2.75x1.13—2.38	52.3x 69.9x28.7— 60.5
20DKBG5	20A	8	3.23x3.32x1.50—2.94	82.0x 84.3x38.1— 74.7
*—DKDG3	3, 5A	9	3.20x2.20x1.25—1.58	81.3x 55.9x31.8— 40.1
*—DKDW3	3, 5A	10	2.61x2.20x1.25—1.58	66.3x 55.9x31.8— 40.1
01DRCG5	1A	11	3.23x1.75x1.13—2.38	82.0x 44.5x28.7— 60.5
01DRCW5	1A	12	2.75x1.75x1.13—2.38	69.9x 44.5x28.7— 60.5
02DRCG5	2A	11	3.23x1.75x1.13—2.38	82.0x 44.5x28.7— 60.5
02DRCW5	2A	12	2.75x1.75x1.13—2.38	69.9x 44.5x28.7— 60.5
03DRCG5	3A	11	3.73x2.00x1.13—2.94	94.7x 50.3x28.7— 74.7
03DRCW5	3A	12	3.32x2.00x1.13—2.94	84.3x 50.8x28.7— 74.7
05DRCG5	5A	11	3.73x2.00x1.13—2.94	94.7x 50.8x28.7— 74.7
05DRCW5	5A	12	3.32x2.00x1.13—2.94	84.3x 50.8x28.7— 74.7
10DRCG5	10A	11	3.73x2.00x1.50—2.94	94.7x 50.8x38.1— 74.7
10DRCW5	10A	12	3.32x2.00x1.50—2.94	84.3x 50.8x38.1— 74.7
20DRCG5	20A	13	5.12x4.12x1.50—3.75	130.0x104.6x38.1— 95.3
*—DRDG3	3, 5, 10A	9	4.33x2.17x1.25—1.58	110.0x 55.1x31.8— 40.1
*—DRDW3	3, 5, 10A	10	3.75x2.17x1.25—1.68	95.3x 55.1x31.8— 40.1
03DPCW5	3A	12	3.73x2.20x1.53—4.15	94.7x 56.9x38.9—105.4
03DPCG5S	3A	11	3.73x2.00x1.76—2.94	94.7x 50.8x44.5— 74.7
03DPCW5S	3A	12	3.32x2.00x1.75—2.94	84.3x 50.8x44.5— 74.7
03DPDG3	3A	9	3.20x2.20x1.75—1.58	81.3x 55.9x44.5— 40.1
03DPDW3	3A	10	2.61x2.20x1.75—1.58	66.3x 55.9x44.5— 40.1
*—ME1	1, 3, 6A	14	1.61x1.9 x1.03—1.53	41.0x 50.0x26.2— 40.1
*—MK1, 2, 3	1, 2, 3A	15	1.26x1.26x1.77—***	32.0x 32.0x45.0—***

* To complete part numbers, prefix two digit current rating, e.g. —DEEG3E with 3A rating would be numbered 03DEEG3H, etc.
** M = Pitch between mounting holes
*** PC3 mounting pitch is 0.75x0.39"/19.0x22.5mm

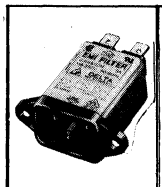


FIG. 1

FIG. 2

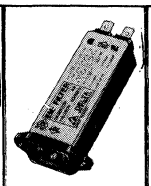


FIG. 3

FIG. 4

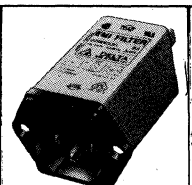
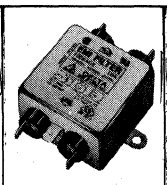


FIG. 5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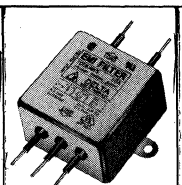
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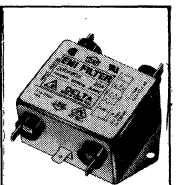
FIG. 8

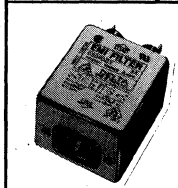
FIG. 9

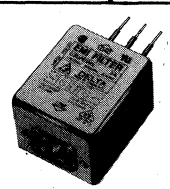
FIG. 10

FIG. 11

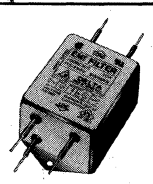
FIG. 12

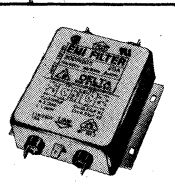
FIG. 13

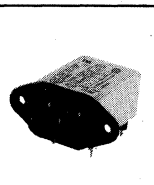
FIG. 14

FIG. 15

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3823 SPINNAKER COURT
FREMONT, CA 94538
TELEPHONE: (415) 770-0660
TELEX: 4992342 DELTAITTHY
TELEFAX: (415) 770-0122

EUROPE:
DELTA ELECTRONIC AG
HARDSTRASSE 72
5430 WETTINGEN, SWITZERLAND
TELEPHONE: (56) 275800
TELEX: 58068A ELBA CH
TELEFAX: (56) 271924

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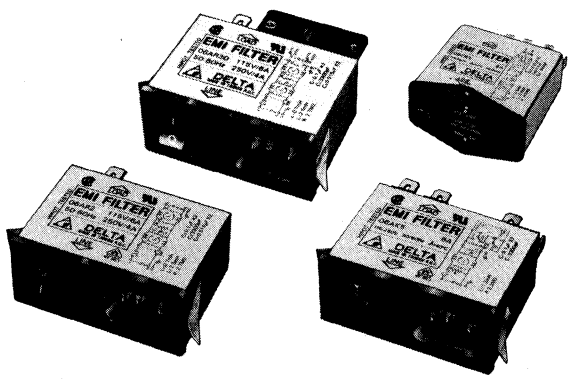
DELTA ELECTRONIC IND. CO., LTD.
9TH FL., ASIA ENTERPRISE CENTER
NO. 602, MIN CHUAN E. RD.
TAIPEI, TAIWAN, R.O.C.
TELEPHONE: (2) 7164822
TELEX: 26524 DELTATRO
TELEFAX: (2) 7169764

DELTA

AK/AR/CK/CR SERIES POWER ENTRY MODULE EMI FILTERS

HPF 0565-3



FEATURES

- Power entry module combines IEC connector, fuse holder, and optional power and voltage selector switches
- AR/CR series offer high performance, dual-stage filter design for superior attenuation of low frequency noise
- Significant cost and space savings over individual components
- Power switches are UL, CSA, VDE approved
- Fuse holder designed for an IEC 5x20mm fuse, with space for one spare
- Safety interlock prevents fuse removal with line plug inserted
- All models are UL, CSA, VDE approved

SPECIFICATIONS

Maximum leakage current, each line-to-ground
@ 115 VAC 60 Hz: 0.25 mA
@ 250 VAC 50 Hz: 0.45 mA
Hipot rating (one minute)
line-to-ground: 2250 VDC
line-to-line: 1450 VDC
Operating frequency: 50-60 Hz
Rated voltage: 115/250 VAC

Minimum insertion loss in dB:
Common mode (L-G) in 50Ω system

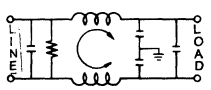
Type	Frequency - MHz					
	.15	.50	1.0	5.0	10	30
06AK	16	25	30	42	50	45
06AR	34	60	60	45	40	30
06AR2D, 3D	34	60	60	45	40	30
06CK	30	40	40	40	40	35
06CR	40	55	55	45	40	32

Differential mode (L-L) in 50Ω system

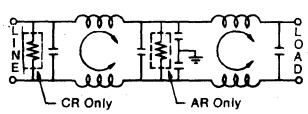
Type	Frequency - MHz					
	.15	.50	1.0	5.0	10	30
06AK	6	30	48	40	40	40
06AR	8	30	65	55	50	45
06AR2D, 3D	10	10	50	50	45	40
06CK	25	50	60	60	45	40
06CR	12	50	60	60	55	45

ELECTRICAL SCHEMATICS

AK, CK Electrical Circuit



AR, CR Electrical Circuit



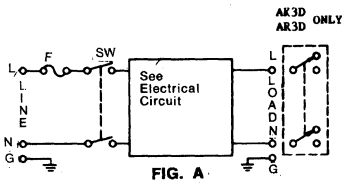


FIG. A

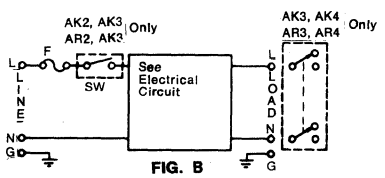


FIG. B

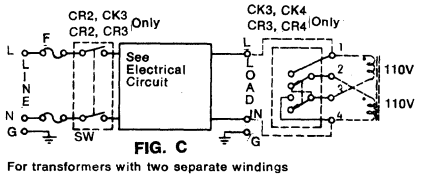
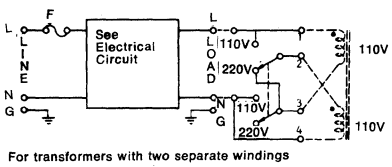


FIG. C

For transformers with two separate windings



For transformers with two separate windings

FIG. D

Delta Part No.[1]		06AK2 06AR2	06AK2D 06AR2D	06AK3 06AR3	06AK3D 06AR3D	06AK4 06AR4	06AK5	−CK2[2] −CR2[2]	−CK3[2] −CR3[2]	−CK4[2] −CR4[2]
IEC Connector		△	△	△	△	△	△	△	△	△
Fuse Holder		△	△	△	△	△	△	△	△	△
Power Switch[3]		SP	DP	SP	DP			DP	DP	
Voltage Selector Switch[4]				REAR	REAR	REAR	FRONT		FRONT	FRONT
Electrical Schematic		B	A	B	A	B	D	C	C	C
Dimensions	L inch	2.38	2.38	2.60	2.60	2.46	2.24	3.51	3.51	3.40
	mm	60.5	60.5	66.0	66.0	62.5	57.0	89.2	89.2	86.4
	W inch	2.65	2.65	2.65	2.65	2.65	2.65	3.05	3.05	3.05
	mm	67.3	67.3	67.3	67.3	67.3	67.3	77.5	77.5	77.5
	H inch	1.15	1.15	1.15	1.15	1.15	1.15	1.97	1.97	1.97
	mm	29.2	29.2	29.2	29.2	29.2	29.2	50.0	50.0	50.0

1. First two digits of a part number indicate its current rating, e.g., 06AK2 = 6A.
2. CK/CR series available in 2A, 3A, 6A and 10A models.
3. Single Pole (SP): Current Rating — 6A/125 VAC, 6A/250 VAC; Max. Inrush Current — 24A
   Double Pole (DP) Current Rating — 6A/125 VAC, 4A/250 VAC; Max. Inrush Current — 51A
4. Current Ratings: Rear Mount — 10A/125 VAC, 5A/250 VAC; For 06AK5 — 6A/125 VAC, 6A/250 VAC; CK/CR series — 15A/125 VAC, 15A/250 VAC

DELTA

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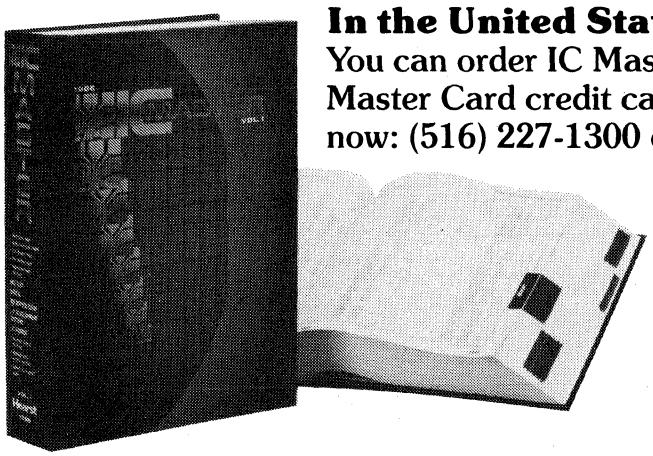

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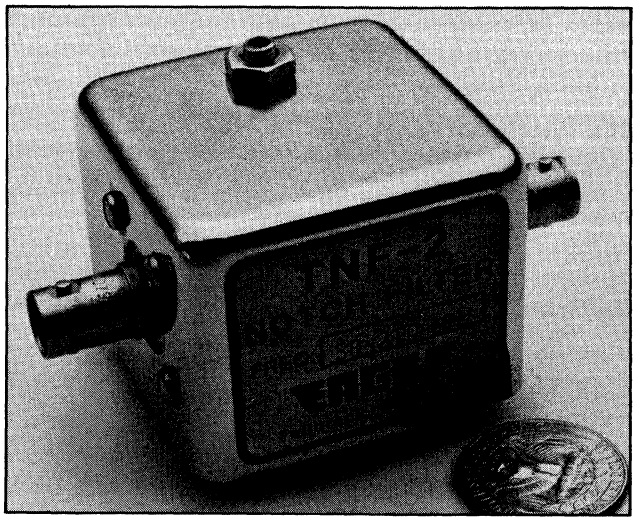

FEATURES

- Easily adjustable, multi-turn, tuning element
- Adequate notch width for AM, FM, and TV signals
- High rejection of notched frequency (typically 25 db or better)
- Low VSWR for more accurate measurements
- 7 Models (9 MHz to 900 MHz) match the band width and notch frequency to your requirements
- 10 Watt Power Rating
- Built to survive in your tool box

SPECIFICATIONS

Mechanical

Dimensions	2.7"W x 1.7" H x 1.6"L
Weight	6 oz.
Construction	Nickel Plated Brass Enclosure, BNC or N Connectors, Stainless Steel Hardware

Electrical

Power Rating	10 Watts
Impedance	50 Ohms 5% (75 ohm available on request)
****Insertion Loss (Max)**	Less than 1db below 1GHz Less than 2db below GHz

Frequency Ranges	Model	Frequency Ranges	Model
9.5 to 18 MHZ	A	50.0 to 210 MHz	D
15.0 to 30 MHz	B	100.0 to 350 MHZ	E
30.0 to 60 MHZ	C	250.0 to 850 MHZ	G

** Insertion loss specifications assume use within the designated frequency ranges for each model.

HLC-700 SERIES

FEATURES

- Highpass, Lowpass, Bandpass and Band Reject
- Standard Or Custom Versions. 1.0 MHZ to 1.0 GHz.
- Power Ratings to 1.0 KW
- Manufactured to Mil Stds.

EAGLE HLC-700 series LC filters are compact, high performance filters. Careful design, the use of silver plated inductors and porcelain capacitors, and modern production techniques yields sharp cutoff with low passband insertion loss. These filters are constructed to be tough, both electrically and mechanically. Cases are heavy gauge nickel plated brass. Connectors and other hardware are also brass or stainless steel. This type of construction leads to filters that are both ESD and EMP resistant. The solder sealed case keeps out foreign materials while insuring the RF integrity of the package. HLC-700 filters are suitable for direct to antenna connection for receiver inputs or medium power transmitter outputs. Connectors of various types are available for easy interconnection to your system. The following table lists some of the filters available in this family:

LOWPASS AND HIGHPASS FILTER SPECIFICATIONS

Model No.	Cutoff Freq MHz	Passband Ripple	Passband Loss Db	Attenuation Curve -20	Attenuation Curve -40	Attenuation Curve -60	Power Pass	Power Stop	Case Size	Max Freq
Lowpass Filters:										
HLC-701L	1-30	<0.3	<0.5	1.15	1.20	1.35	100	25	C	10*Fc
HLC-702L	30-150	<0.4	<0.6	1.15	1.20	1.40	250	50	C	8*Fc
HLC-703L	150-1000	<0.4	<0.7	1.15	1.20	1.40	250	50	C	3*Fc
Highpass Filters:										
HLC-701H	1-30	<0.3	<0.5	0.9	0.8	0.65	100	25	C	500
HLC-702H	30-200	<0.5	<1.0	0.91	0.8	0.66	250	50	C	5*Fc
HLC-703H	200-500	<0.7	<1.0	0.91	0.8	0.66	250	50	C	3*Fc

BANDPASS FILTER SPECIFICATIONS

Model Number	Center Frequency	Insertion Loss	Bandwidth Percent -3 dB	Bandwidth Percent -20 dB	Bandwidth Percent -40 dB	Bandwidth Percent -60 dB	Power Pass	Power Stop	Case Size	Max Freq
HLC-701BXXX-5	1-30 MHz	<2.0 dB	5	7	10	14	25	5	C	150
HLC-702BXXX-5	30-300	<2.0 dB	5	7	10	14	25	5	A	600
HLC-713BXXX-5	300-600	<3.0 dB	5	7	11	*	50	10	A	2000

*Not specified

CASE SIZES

A. 2" Wide x 2" Long x 1.58" High
B. 3" Wide x 6" Long x 2.5" High
C. 2.6" Wide x 4".Long x 1.75" High

Length dimensions do not include the connectors

EAGLE
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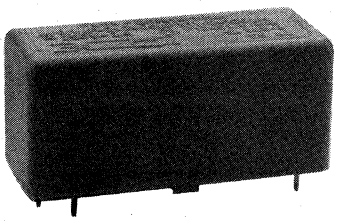
EICHHOFF

Eichhoff offers you advanced technology and custom capability in EMI/RFI power line filters.

PC Series —

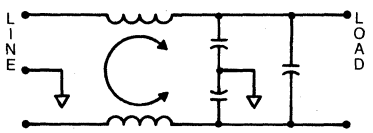


- PC Board Mountable
- Hermetically Sealed in Polyester Resin
- Other insertion loss versions and pin arrangements available

Specifications

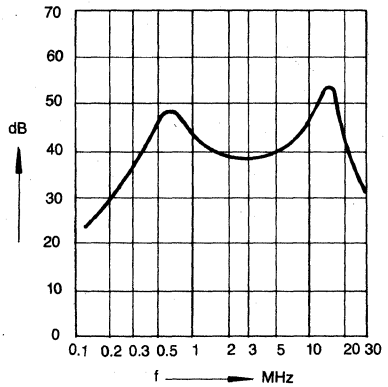
Rated current Need to VDE	Part Number Need	Case Size Need L	W	H
2	PC—F 12.010	1.32	1.14	1.06
4	PC—F 12.011	1.32	1.14	1.06
6	PC—F 12.012	1.79	1.52	1.18
1.6	PC—F 12.401/1	2	.79	.87
2	PC—F 12.401/9	2	.79	.87
2.5	PC—F 12.401/3	2	.79	.87
4	PC—F 12.401/10	2	.79	.87

Electrical Schematic

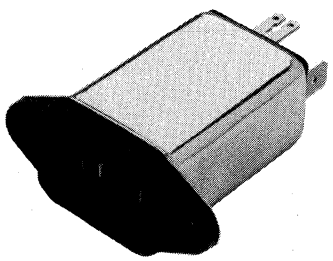


Insertion Loss

Common Mode



PE Series — Power Entry Filter

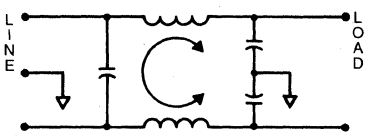


- Faston or solder connections
- Hermetically Sealed in Polyester-Resin
- Other connections, insertion loss versions, and case sizes available

Specifications

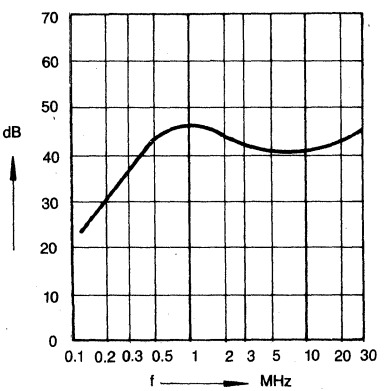
Rated current to VDE	Part Number	Case Size L	W	H
1	PE—F 12124	2.20	1.12	.85
2	PE—F 12129	2.20	1.12	.85
4	PE—F 12135	2.20	1.12	.85
6	PE—F 12137	2.20	1.12	.85

Electrical Schematic

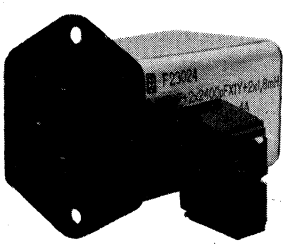


Insertion Loss

Common Mode



PF Series — Power Entry Filter With 1 or 2 Fuses

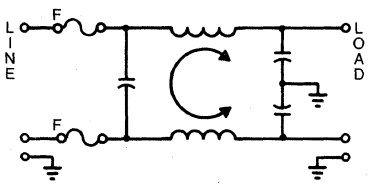


- Faston or solder connections
- Hermetically Sealed in Polyester-Resin
- Other connections, insertion loss versions, and case sizes available

Specifications

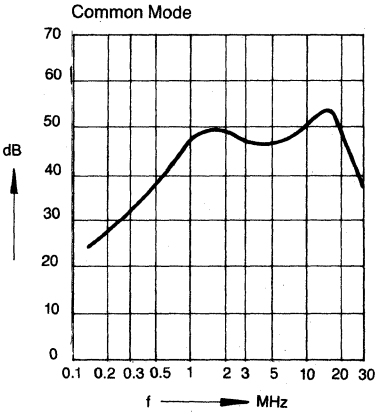
Rated current to VDE	Part Number	Case Size L	W	H
1	PF—F 23021	2.0	1.14	1.30
2	PF—F 23022	2.0	1.14	1.30
3	PF—F 23023	2.0	1.14	1.30
4	PF—F 23024	2.0	1.14	1.30
6	PF—F 23026	2.0	1.14	1.30

Electrical Schematic



Insertion Loss

Common Mode



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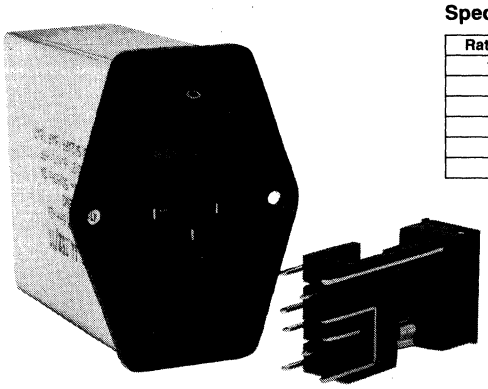
Resin sealed, high performance, high reliability power line filters.
Precise performance within product specifications.
Complete engineering capability for application assistance.

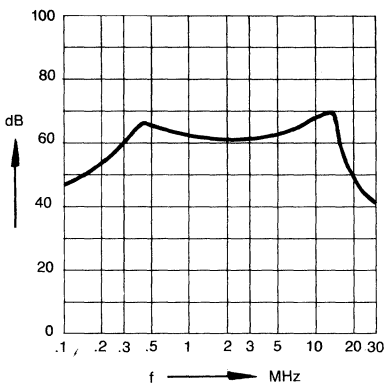
PS Series — Power Entry Filter with Fuse Holder and 1 or 2 Pole Power Switch



Specifications

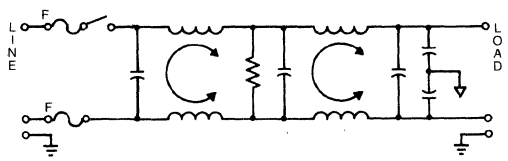
Rated current to VDE (A)	Part Number	Case Size L	W	H
1	PS—F44001	3.62	1.14	2.38
2	PS—F44002	3.62	1.14	2.38
3	PS—F44003	3.62	1.14	2.38
4	PS—F44004	3.62	1.14	2.38
6	PS—F44006	3.62	1.14	2.38

Insertion Loss
Common Mode

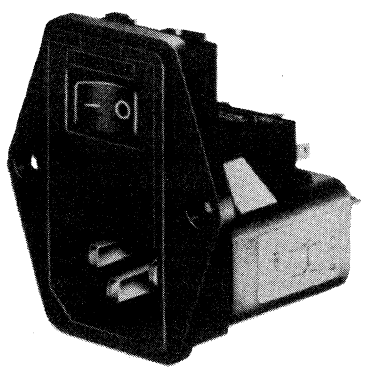


- General Purpose, High Performance and Premium Performance Versions Available
- Faston connection
- Hermetically Sealed in Polyester Resin
- Other insertion loss versions and case sizes available

Electrical Schematic



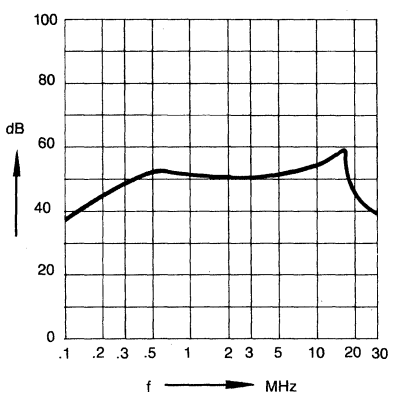
PM Series — Modular Power Entry Filter with Power Switch, Fuse Holder, Voltage Selector (optional)



Specifications

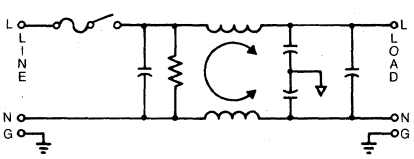
Rated current to VDE (A)	Part Number	Case Size L	W	H
1	PM—F 46..1	2.16	1.12	2.12
2	PM—F 46..2	2.16	1.12	2.12
3	PM—F 46..3	2.16	1.12	2.12
4	PM—F 46..4	2.16	1.12	2.12
6	PM—F 46..6	2.16	1.12	2.12
10	PM—F 46..0	2.16	1.12	2.12

Insertion Loss
Common Mode



- General Purpose and High Performance versions available.
- Faston and solder connections
- Hermetically Sealed in Polyester Resin
- Other connections, insertion loss versions, and case sizes available

Electrical Schematic



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205 Hallene Road
Warwick, RI 02886
Fax (401) 738-7154

(401) 738-1440

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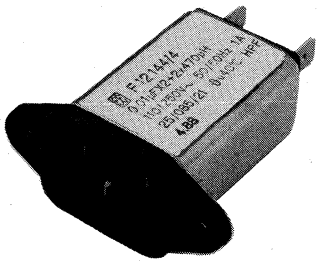
EICHHOFF

Eichhoff offers you advanced technology and custom capability in EMI/RFI power line filters.

EM Series — Filter for UL 544 Electro Medical Equipment

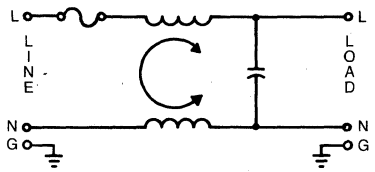


- General Purpose and High Performance versions with 1 or 2 fuses.
- Other insertion loss versions and case designs available
- Faston or solder connections
- Hermetically Sealed in Polyester-Resin

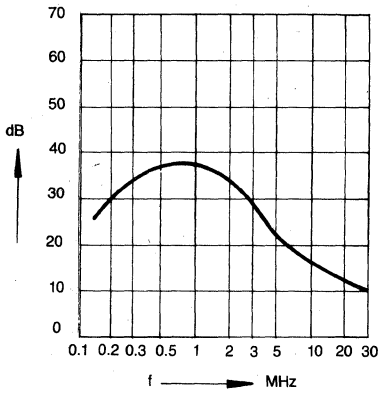
Specifications

Rated current to VDE (A)	Part Number	Case Size		
		L	W	H
1	EM—F 23041	1.70	1.42	1.30
2	EM—F 23042	1.70	1.42	1.30
3	EM—F 23043	1.70	1.42	1.30
4	EM—F 23044	1.70	1.42	1.30
6	EM—F 23046	1.70	1.42	1.30

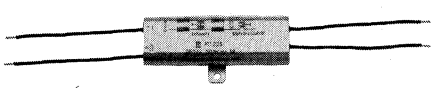
Electrical Schematic



Insertion Loss
Common Mode



SL Series — Power Line Filter

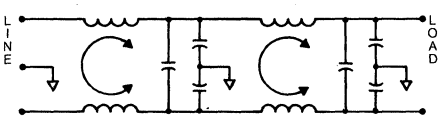


- Compact design
- For usage in small space constraints
- Customized filters available
- Termination options: Leads, fast-on connectors, or combinations thereof
- Polyester resin sealed

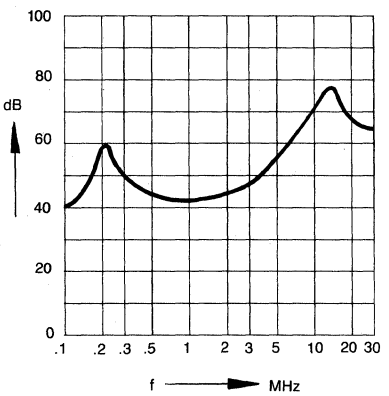
Specifications

Rated current to VDE (A)	Part Number	Case Size		
		L	W	H
1A	SL-F 11.226	.59	1.14	3.5
2A	SL-F 11.180	.59	1.19	3.5
4A	SL-F 11.180/50			

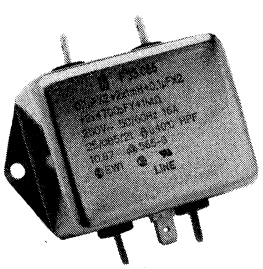
Electrical Schematic



Insertion Loss
Common Mode



GP Series — General Purpose

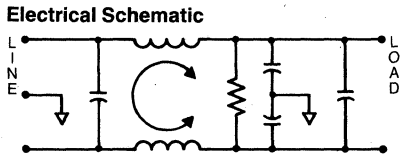


- Faston, Solder, Lead Connection
- Other connections, insertion loss versions and case sizes available. Filters also available for 20A and above.
- Hermetically Sealed in Polyester-Resin

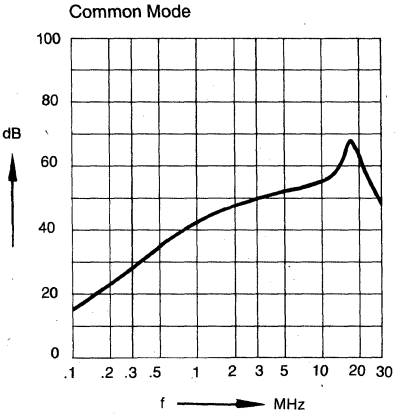
Specifications

Rated current to VDE (A)	Part Number	Case Size		
		L	W	H
1	GP—F 33.051	2.05	1.81	.9
2	GP—F 33.052	2.05	1.81	.9
4	GP—F 33.054	2.05	1.81	.9
6	GP—F 33.056	2.05	1.81	.9
10	GP—F 33.060	2.05	2.05	1.18
16	GP—F 33.066	2.09	2.52	1.54

Electrical Schematic



Insertion Loss
Common Mode



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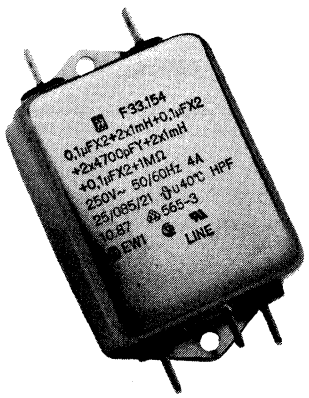
The leading European manufacturer since 1948.
Pioneer in EMI/RFI suppression.
Resin sealed, high performance, high reliability power line filters.
Precise performance within product specifications.
Complete engineering capability for application assistance.

SP Series — For Equipment Using Switching Power Supplies, SCR and T²L Circuits

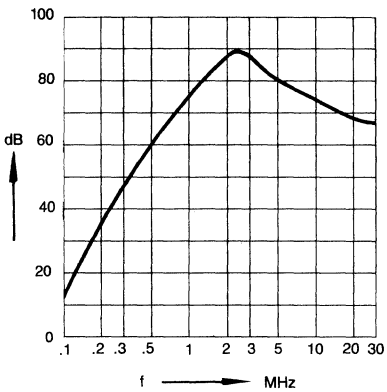


- Faston, Solder, Lead Connection
- Other insertion loss versions and case sizes available
- Hermetically Sealed in Polyester Resin

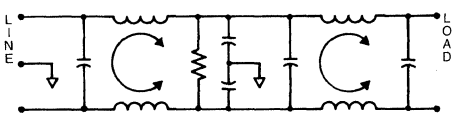
Specifications

Rated current to VDE	Part Number	Case Size		
		L	W	H
1	SP—F 33.151	1.77	2.05	1.18
2	SP—F 33.152	1.77	2.05	1.18
4	SP—F 33.154	2.09	2.52	1.18
6	SP—F 33.156	2.09	2.52	1.18
10	SP—F 33.160	2.09	2.52	1.54
16	SP—F 33.166	3.35	3.90	1.54

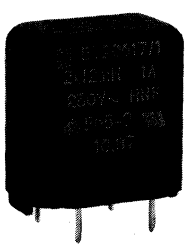
Insertion Loss
Common Mode



Electrical Schematic



CH Line — EMI/RFI Suppression Toroid Choke



- PCB mountable
- Hermetically sealed with Polyester resin
- Other versions available

Specifications

Rated current to VDE (A)	Rated Inductance (mH)	Part Number	Case Size			Rated current to VDE (A)	Rated Inductance (mH)	Part Number	Case Size		
			L	W	H				L	W	H
.5	2×30	CH—BV 20621/15	1.02	.71	1.12	2.0	2×6.8	CH—BV 20614/2	1.22	.71	1.38
1.0	2×12	CH—BV 20617/1	1.02	.71	1.12	2.5	2×5.6	CH—BV 20613/25	1.22	.71	1.38
1.2	2×10	CH—BV 20616/13	1.02	.71	1.12	4.0	2×4.7	CH—BV 20612/4	1.22	.71	1.38
1.6	2×8.2	CH—BV 20615/16	1.02	.71	1.12	6.0	2×1	CH—BV 20604/6	1.22	.71	1.38

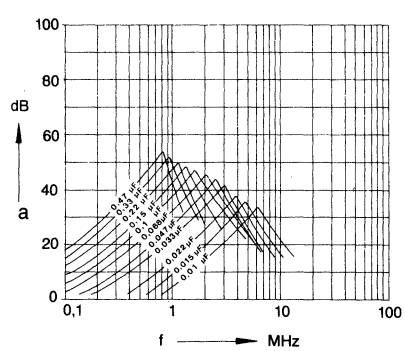
MKT Series — EMI/RFI Film Capacitor, Class X2, 250VAC.

- All materials flame retardant, UL94 V-O
- Different connections available
- Hermetically Sealed in Polyester-Resin

Specifications

Capacitance	W	H	L	Part Number PCB Version
0.010µF	.197	.433	.709	KMT 254/954—310/011
0.015µF	.197	.433	.709	KMT 254/954—315/011
0.022µF	.197	.433	.709	KMT 254/954—322/011
0.033µF	.197	.433	.709	KMT 254/954—333/011
0.047µF	.236	.472	.709	KMT 254/954—347/011
0.068µF	.295	.531	.709	KMT 254/954—368/011
0.1µF	.335	.551	.709	KMT 254/954—410/011
0.15µF	.275	.591	1.02	KMT 254/755—415/011
0.22µF	.394	.709	1.02	KMT 254/755—422/011
0.33µF	.433	.787	1.22	KMT 254/756—433/011
0.47µF	.472	.787	1.22	KMT 254/756—447/011

Insertion Loss



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epc CORPORATION

MANUFACTURERS OF ACTIVE AND PASSIVE FILTERS—DC TO 500MHz.

LOWPASS, HIGHPASS, BANDPASS, BANDREJECT CUSTOM OR STANDARD DESIGNS.

FILTER TYPES

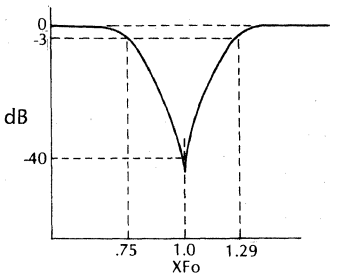
- Elliptic
- Tschebyscheff
- Butterworth
- Bessel
- Gaussian
- Legendre
- Inverted Chebychev
- Audio Frequency
- Equalizers
- Harmonic
- IF
- Video
- Telemetering
- Tone, Telegraph
- Constant group delay
- Wideband Band Pass
- Phase matched
- Attenuation matched

Components manufactured to rigid MIL-STD specifications with operating temperature range from −55°C to + 125°C.

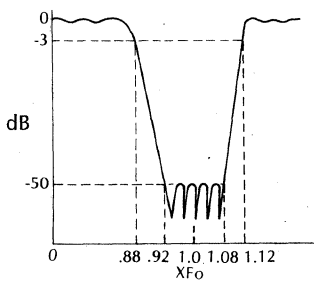
CUSTOM BUILT FILTERS PROMPT DELIVERY

The filters listed here are some of the typical units we build. We can design filters to your exact specifications. Call for more information.

ACTIVE NOTCH FILTER

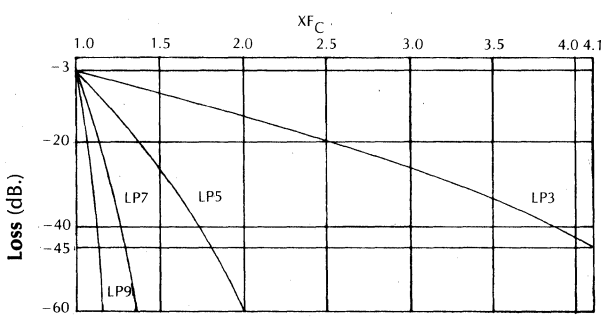


LC BAND REJECT FILTER



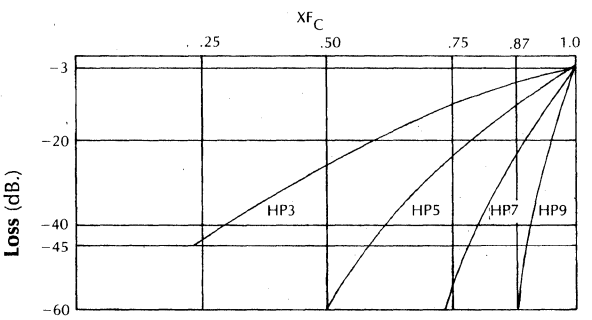
LC LOW PASS SERIES

SERIES TYPE	STOPBAND	MAX. CASE DIMENSIONS
LP3	>45dB @ 4.1 Fc & above	1x1x.6"
LP5	>60dB @ 2 Fc & above	1.25x1.25x.6"
LP7	>60dB @ 1.35 Fc & above	1.5x1.5x.6"
LP9	>60dB @ 1.15 Fc & above	2x1.75x.6"



LC HIGH PASS SERIES

SERIES TYPE	STOPBAND	MAX. CASE DIMENSIONS
HP3	>45dB @ .24 Fc & below	1x1x.6"
HP5	>60dB @ .5 FC & below	1.25x1.25x.6"
HP7	>60dB @ .74 Fc & below	1.5x1.5x.6"
HP9	>60dB @ .87 Fc & below	2x1.75x.6"



LC NARROW BANDPASS SERIES

SERIES TYPE	PERCENT BANDWIDTH (3dB)	PASSBAND 3dB. MAX @	STOPBAND >60dB. @
NB-2	±2	.98 Fo & 1.02 Fo	.85 Fo & below 1.17 Fo & above
NB-3	±3	.97 Fo & 1.03 Fo	.80 Fo & below 1.25 Fo & above
NB-4	±4	.96 Fo & 1.04 Fo	.74 Fo & below 1.35 Fo & above

LC WIDEBAND BANDPASS SERIES

SERIES TYPE	PERCENT BANDWIDTH (3dB)	PASSBAND 3dB. MAX @	STOPBAND >60dB. @
WB-25	25	.87 Fo & 1.14 Fo	.58 Fo & below 1.70 Fo & above
WB-50	50	.78 Fo & 1.28 Fo	.38 Fo & below 2.60 Fo & above
WB-100	100	.62Fo & 1.62 Fo	.21 Fo & below 4.65 Fo & above

CASE DIMENSIONS: 2"x1.75"x.6" MAX

ELECTRONIC PRECISION COMPONENTS CORPORATION

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ESC LC FILTERS •SINCE 1953•

DC to 500 Mhz

Covering a range of DC to 500 Mhz, ESC designs and manufactures a wide variety of LC filters for commercial and military high reliability applications. Starting with computer aided design through final test on ESC's computer controlled Network Analyzer, ESC's long history of quality and experience assures maximum component efficiency and reliability. ESC has established controlled manufacturing facilities with certified operators to produce components to all levels of reliability from missile applications to space probe environments. Conformance to MIL-F-18327 is normal and to MIL-Q-9858A as required.

DUAL-IN-LINE (14 PIN) LC FILTERS-MINIATURE

Size: .76L X .28H, From 1 Khz to 10 Mhz.

- Series DIFL20 - Low Pass, 20db Stopband at $1.4f_c$
- Series DIFL39 - Low Pass, 39db Stopband at $2.5f_c$
- Series DIFLP - Linear Phase, 30db at $5.0f_c$
- Series DIFH20 - High Pass, 20db at $.715f_c$
- Series DIFH39 - High Pass, 39db at $.4f_c$

FLATPACK LC FILTER SERIES-2 Khz TO 50 Khz

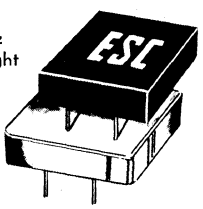
Epoxy molded for P.C. Board mounting, maximum height of .350 and volume of .35 to .55 cubic inches.

- Series FL - Low Pass, 130db/octave roll-off
- Series MFL - Low Pass, 100db/octave roll-off
- Series MFH - High Pass, 100db/octave roll-off
- Series CF - 15% Band Pass
- Series DF - 20% Band Pass
- Series LF - 60% Band Pass

HF-HFL-HIGH FREQUENCY FILTER SERIES-50 Mhz TO 500 Mhz

Hermetically sealed, metal enclosures, Military environment. Size: 2.5 X 1.0 X .30 for HFL-B series and HF Series. Only 2.1 X .65 X .30 for HFL-D Series.

- Series HFL-D - Low Pass, 60db Stopband at $1.4f_c$
- Series HFL-B - Low Pass, 60db Stopband at $1.2f_c$
- Series HF - Band Pass, Bandwidths 2% to 7.5%, 60db stopbands.



FILTER TYPES

- LOW PASS • HIGH PASS • BAND PASS
- BAND REJECT • CONSTANT DELAY
- HIGH ATTENUATION • LINEAR PHASE
- PHASE & AMPLITUDE MATCHED
- DELAY & AMPLITUDE MATCHED
- BUTTERWORTH • CHEBYSCHEV • BESSEL
- CAUER (ELLIPTICAL) • GAUSSIAN AND OTHERS;
- AUDIO • VIDEO • RF • MINIATURE...

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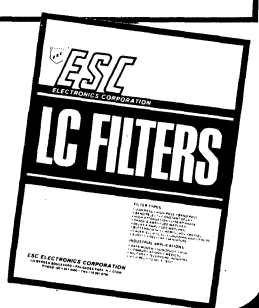


ESC HYBRID/THICK FILM COMPONENTS TO YOUR SPECIFICATIONS!

ESC offers a hybrid/thick film packaging capability as a service that you can employ in repackaging your discrete components into one single configuration. Our standard techniques used are as follows:

1. All components are mounted to a ceramic substrate.
2. Capacitors, when applicable, are COG (NPO) ceramic chip types with tolerance range from ±1% to ±10%.
3. Resistors are thick film and screened on the ceramic substrate and laser trimmed to ±1% tolerance.
4. Inductors are custom designed for economy size and reliability and are wound on low permeability powdered iron magnetic cores exhibiting temperature coefficients of 100 ppm/°C. Inductance tolerances available are from ±1% to ±10%.

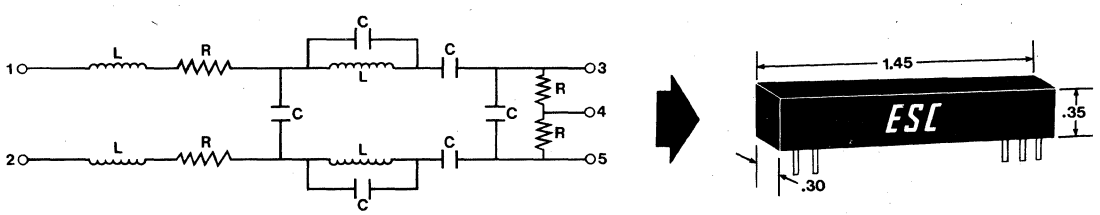
This service is not limited to simple L/R/C networks but also more complicated assemblies such as L/C filters, both unbalanced and balanced configurations.

ESC complies to MIL-I-45208 and if required can perform burn-in temperature cycling and other screening tests when required.

THE NUMEROUS ADVANTAGES TO THIS SERVICE ARE:

- 1. Reduction in PC board real-estate.
- 2. Reduced assembly time.
- 3. Reduction in inventory parts count.
- 4. Use higher level of quality components.
- 5. Component values are not restricted to standard values but are available in an infinite range.
- 6. All final products are 100% functionally tested.
- 7. Low overall cost over discrete components.

SHOWN BELOW IS A TYPICAL CONVERSION ACHIEVEMENT:



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SEE OUR DELAY LINE ADS IN SECTION 2350

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EMI FILTERS

FDK has developed a line of EMI filters based on our long experience in ferrite and switching power supply technology development and manufacturing.
To effectively control noise emission problems, products for a wide variety of applications are available.
All products are UL-recognized.

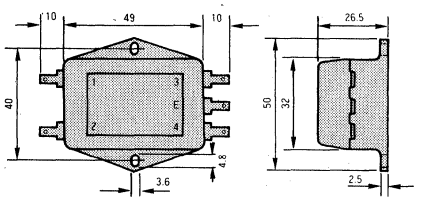
Standard products

Series name	Model name	Rated voltage (V)	Rated current (A)	Withstand voltage (V_{AC})	Features	Shape	Attenuation
MU	NFC2022MU	Single-phase 250V	2	1500V (Line-G)	Plastic case, Faston terminal, Low price	①	ⓐ
	NFC2032MU		3				
PU	NFB2032PU	Single-phase 250V	3	1500V, 1 minute (Line-G)	Inlet socket, Standard size, Faston terminal	②	ⓑ
	NFB2062PU		6				
PB	NFB2012PB		1		Inlet socket, Short size, Soldering terminal	③	ⓒ
	NFB2032PB		3				ⓓ
	NFB2062PB		6				ⓔ
PC	NFB2012PC		1		Inlet socket, Short size, Faston terminal	④	ⓕ
	NFB2032PC		3				ⓖ
	NFB2062PC		6				ⓗ
S	NFC2022SU	Single-phase 250V	2	1500V, 1 minute (Line-case)	Metal case, Lead wire, Low price	⑤	ⓘ
	NFC2052SU		5				ⓙ
A	NFC2052AU	Single-phase 250V	5	1500V, 1 minute (Line-case)	Metal case, Screw terminal	⑥	ⓚ
	NFC2102AU		10				
	NFC2152AU		15				
	NFC2202AU		20				
	NFC2302AU		30				
LU	NFC2302LU	Single-phase 265V	30	1800V_{DC} (Line-G)	For high surge pulse	⑦	ⓛ
	NFC2502LU		50			⑧	
YU	NFB2102YU	Single-phase 250V	10	1500V (Line-G)	For high surge pulse	⑨	ⓜ
	NFB2152YU		15			⑩	ⓝ
	NFB2302YU		30				
3φ NFD-60	NFD4154-60	3-phase 4-wire 420V	15	2600V_{DC} (Line-G)	For European 3-phase Conformity with IEC 380 For large power use	⑪	ⓞ
	NFD4304-60		30			—	
	NFD4504-60		50				
	NFD4704-60		70				

Shapes and dimensions

Unit = mm

①



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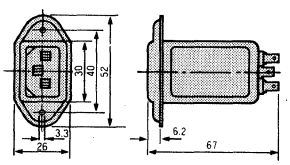

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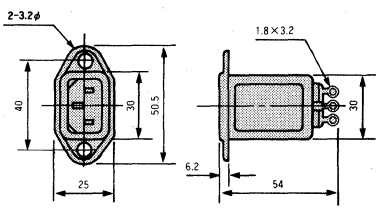

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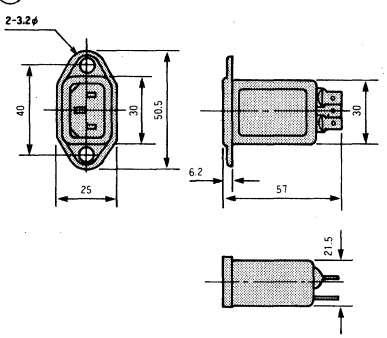

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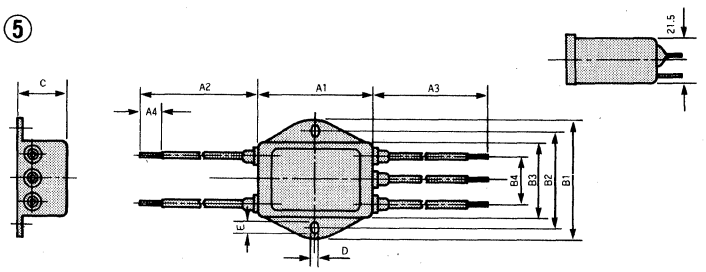
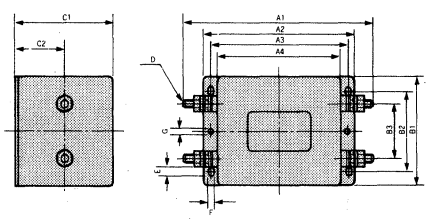


Model No.	Dimensions (mm)										
	A1	A2	A3	A4	B1	B2	B3	B4	C	D	E
NFC2022SU	45	250	250	10	54	45	34	20	22	3.5	4.5
NFC2052SU	53	250	250	10	54	45	34	20	22	3.5	4.5

⑥



Model No.	Dimensions (mm)												
	A1	A2	A3	A4	B1	B2	B3	C1	C2	D	E	F	G
NFC2052AU	97	81	72	63	40	—	24	33	15	M4	—	—	3.5φ
NFC2102AU	113	95	85	75	57	—	36	50	25	M4	—	—	4.5φ
NFC2152AU	128	110	100	90	60	—	36	50	25	M4	—	—	4.5φ
NFC2202AU	137	110	100	90	70	58	40	60	30	M6	4.5	4.5	—
NFC2302AU	137	110	100	90	80	59	40	70	35	M6	5.5	4.5	—

All specifications are subject to change without notice.

FDK
Fuji Electrochemical Co.,Ltd.
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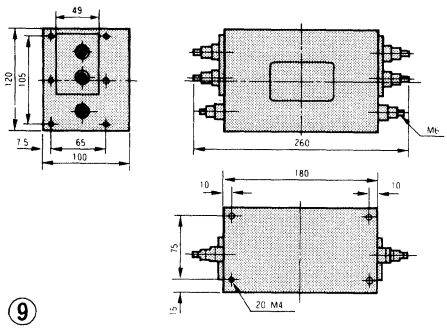
333 Sylvan Avenue, Third Floor, Englewood Cliffs,
New Jersey 07632, U.S.A.
Phone 201-567-1900
Fax. 201-567-2181

EMI FILTERS

Unit = mm

⑦



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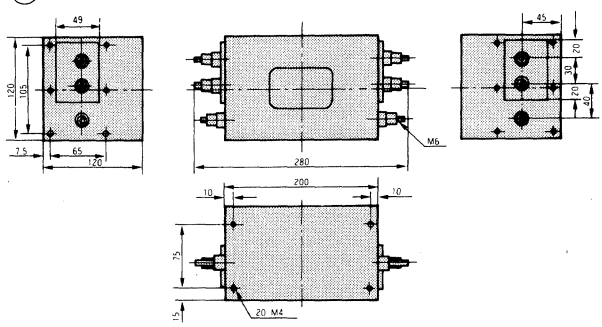

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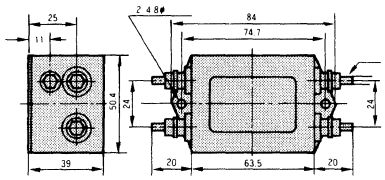

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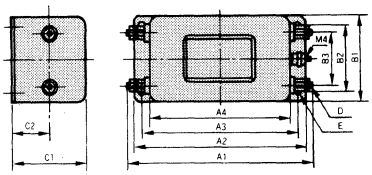
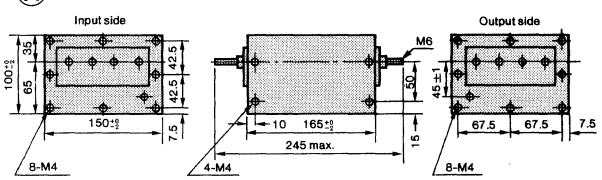
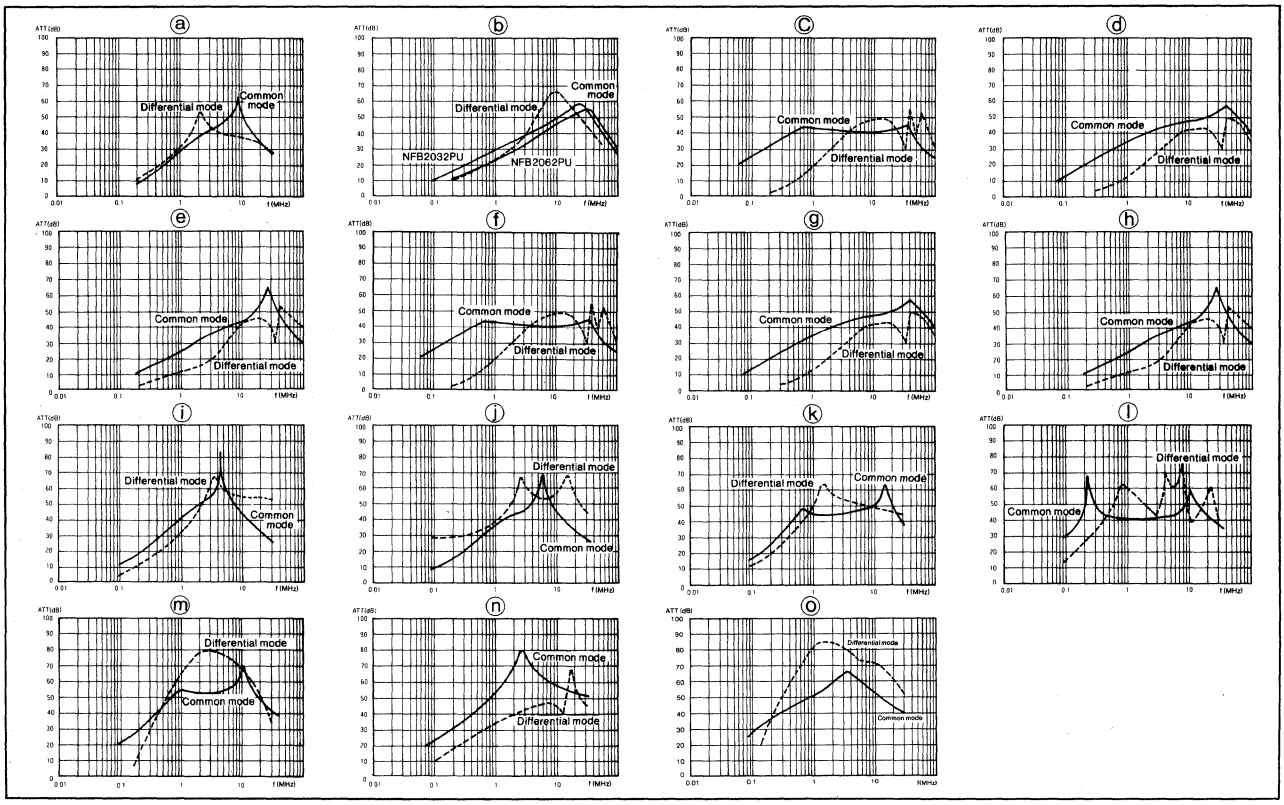


⑪ NFD4154-60



Model name	Dimensions (mm)										
	A1	A2	A3	A4	B1	B2	B3	C1	C2	D	E
NFB2152YU	127	115	105	95	57	45	36	50	25	M4	4.5
NFB2302YU	188	160	144	130	70	58	40	60	30	M6	4.5

Attenuation



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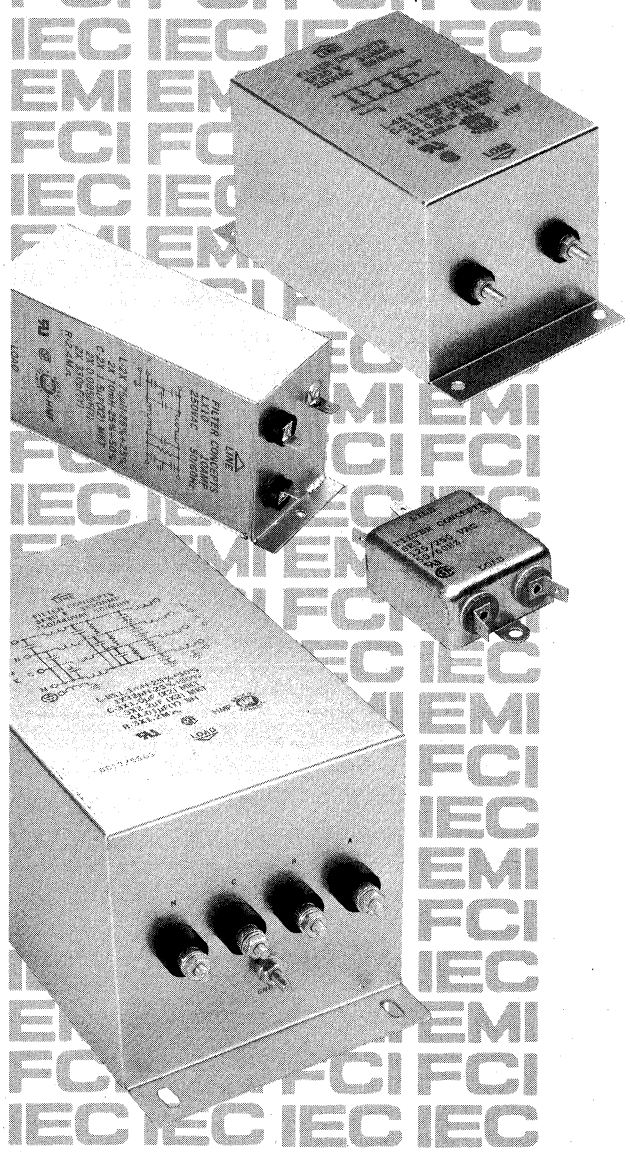
Fax. 201-567-2181

HIGH-PERFORMANCE EMI FILTERS

- Industry's Widest Selection of Standard Power Line EMI Filters for single and 3ϕ applications.
- Custom AC and DC Power Line Filters from 2 to 200 Amps.
- Applications Oriented to solve emission problems in Switch Mode Power Supplies, Motor Controllers, Medical Equipment, etc.



π FILTERS

LE SERIES

LOW LEAKAGE π FILTER

Economical and compact π section filters with a balanced combination of differential (L/L) and a common mode (L/G) performance in a low leakage current design.

LE Series filters are available with the "B" circuit option to increase common mode performance.

Part No.	Current	Case	Leakage
LE5	5A	7/8x1-3/4x3-1/16	0.3mA
LE10	10A	1-1/8x1-3/4x3-1/16	0.3mA
LE15	15A	1-1/2x2x3-11/16	0.3mA
LE20	20A	1-3/4x2-1/8x3-15/16	0.3mA
LE30	30A	2x2-7/8x4-1/4	0.45mA
LE40	40A	1-1/2x4-1/8x5-1/16	0.45mA
LE100	100A	3x5-1/2x8-1/2	0.8mA

Rated Voltage: 250VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	8db	12db	45db	65db	65db	60db
L/G	10db	20db	32db	40db	45db	50db

LF SERIES

HIGH PERFORMANCE π FILTER

Enhanced differential (L/L) and common mode (L/G) insertion loss π filters for FCC and VDE applications using switch mode power conversion.

LF Series filters are available with the "B" circuit option to inhance common mode insertion loss.

Part No.	Current	Case	Leakage
LF2	2A	7/8x1-3/4x3-1/16	0.45mA
LF3	3A	1-1/4x2x3-3/16	0.45mA
LF7	7.5A	1-1/2x2x3-11/16	0.45mA
LF10	10A	1-3/4x2-1/8x3-15/16	0.45mA
LF15	15A	2x2-7/8x4-1/4	0.45mA
LF20	20A	1-1/2x4-1/8x5-1/16	0.8mA
LF40	40A	2-1/2x4-7/16x7-5/16	1.4mA

Rated Voltage: 250VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	8db	33db	60db	60db	60db	60db
L/G	18db	30db	42db	50db	50db	50db

LX SERIES

PREMIUM PERFORMANCE π FILTER

Extended low frequency performance π filters for VDE 0871/B applications using switch mode power conversion.

LX Series filters provide extra insertion loss at 10KHz to 50KHz and are available with the "B" circuit option to increase common mode performance.

Part No.	Current	Case	Leakage
LX1	1.5A	1-1/2x2x3-3/16	0.45mA
LX3	3A	1-7/8x2x3-11/16	0.45mA
LX7	7.5A	2x2-7/8x4-1/4	0.8mA
LX10	10A	2x2-3/4x6-1/8	0.8mA
LX15	15A	3x3x6-1/4	1.5mA
LX20	20A	3x3x8-1/4	1.5mA
LX30	30A	4x4x8-5/8	1.5mA
LX45	45A	4-3/4x5x12-15/16	1.5mA

Rated Voltage: 250VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	45db	65db	65db	65db	65db	60db
L/G	30db	42db	50db	50db	50db	50db

MIL PERFORMANCE

A2T SERIES

MIL STD 461 T FILTER

High attenuation T section filters for use with switch mode power conversion circuits in MIL STD 461 and 462 test environments.

A2T Series filters are available with the "A" circuit option and 50-400Hz operating capacity

Part No.	Current	Case	Leakage
A2T2	2.5A	2x2x5	1.8mA
A2T5	5A	2-3/4x3x5-1/2	1.8mA
A2T10	10A	3x3x8-1/4	1.8mA
A2T15	15A	4x4x8-5/8	2.4mA

Rated Voltage: 250VAC, 50/400Hz
Insertion Loss: (50 ohms, typical)

	.02MHz	.05MHz	.15MHz	1.5Hz	5.0MHz	20MHz
L/L	20db	40db	65db	65db	65db	60db
L/G	20db	50db	65db	65db	65db	60db

D2L SERIES

MIL STD 461 DC FILTER

High attenuation dual L section filter for use with switch mode power conversion circuits in MIL STD 461 and 462 test environments.

D2L Series filters function equally well with balanced or unbalanced load currents in chassis return or floating ground systems.

Part No.	Current	Case
D2L5	5A	1-3/4x2-1/8x3-15/16
D2L10	10A	2x2x5
D2L20	20A	2-3/4x3x5-1/2

Rated Voltage: 60 VDC
Insertion Loss: (50 ohms, typical)

	.02MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	22db	55db	60db	60db	60db	50db

APPLICATION GUIDE

INPUT	FCC/A	FCC/B VDE/A	VDE/B	MIL 461
AC	SE LE 3E 3L	SF LF 3F 3L	SX LX 3X 3V	SW A2T
DC	DC	DC	D2L	D2L

FCI reserves the right to make specification changes without notice. Consult the factory for current information.

FILTER CONCEPTS INC
2624 S. Rousselle St. ▫ Santa Ana, CA 92707 ▫ FAX 714 545 4607 ▫ 714 545 7003

τ FILTERS

SE SERIES
EFFICIENT τ SECTION FILTER

Economical and compact τ section filters with balanced common mode (L/G) and differential (L/L) performance for FCC applications using switch mode power conversion.

SE Series filters are available with the "A" circuit option for enhanced common mode and high frequency performance.

Part No.	Current	Case	Leakage
SE3	3A	7/8×1-3/4×3-1/16	0.8mA
SE7	7.5A	1-1/4×2×3-3/16	0.8mA
SE15	15A	1-1/2×2×3-11/16	0.8mA
SE20	20A	1-3/4×2-1/8×3-15/16	0.8mA
SE30	30A	2×2-7/8×4-1/4	1.4mA
SE45	45A	3×3×6-1/16	1.4mA
SE60	60A	3×3×7-1/4	1.6mA

Rated Voltage: 250VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	7db	15db	50db	60db	55db	50db
L/G	7db	15db	50db	65db	65db	55db

SF SERIES
HIGH PERFORMANCE τ FILTER

Enhanced differential (L/L) and common mode (L/G) performance τ section filters for VDE 0871/A applications using switch mode power conversion.

SF Series filters provide balanced performance with emphasis on 150KHz and above. The "A" circuit option is available to increase common mode performance.

Part No.	Current	Case	Leakage
SF3	3A	1-1/4×2×3-3/16	0.8mA
SF7	7.5A	1-1/24×2×3-11/16	0.8mA
SF10	10A	1-3/4×2-1/8×3-15/16	0.8mA
SF15	15A	2×2-7/8×4-1/4	0.8mA
SF20	20A	1-1/2×4-1/8×5-1/16	1.4mA
SF30	30A	2-3/4×3×5-1/2	1.4mA
SF45	45A	2-3/4×3×8-7/8	1.4mA
SF60	60A	4×4×9-1/4	1.6mA

Rated Voltage: 250VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	15db	45db	60db	60db	65db	60db
L/G	8db	45db	65db	65db	65db	60db

SX SERIES
ENHANCED PERFORMANCE τ FILTER

Extra low frequency attenuation τ section filters for severe switch mode noise in VDE 0871/A applications.

SX Series filters provide up to 15db greater attenuation and are available with the "A" circuit option for enhanced common mode and high frequency performance.

Part No.	Current	Case	Leakage
SX3	3A	1-1/2×2×3-11/16	0.8mA
SX7	7.5A	2×2×5	0.8mA
SX15	15A	2-3/4×3×5-1/2	1.4mA
SX20	20A	2-3/4×3×6-1/4	1.4mA
SX30	30A	2-3/4×3×8-1/4	1.4mA
SX45	45A	4×4×8-5/8	1.8mA
SX60	60A	4-3/4×5×13	1.8mA

Rated Voltage: 250VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	30db	60db	65db	65db	65db	50db
L/G	20db	60db	65db	65db	60db	55db

SW SERIES
WIDE BAND τ FILTER

Extended low and high frequency performance τ section filters for VDE 0871/B and MIL STD 461 type applications.

The SW Series filters provide extended frequency performance and high insertion loss for critical applications while maintaining moderate leakage control.

Part No.	Current	Case	Leakage
SW3	3A	1-3/4×2-1/8×3-15/16	2.4mA
SW5	5A	2×2×5	2.4mA
SW10	10A	2-3/4×3×5-1/2	2.4mA
SW20	20A	2-3/4×3×8-1/4	2.4mA
SW30	30A	4×4×8-5/8	2.4mA

Rated Voltage: 250VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.50MHz	1.5MHz	5.0Hz	50MHz	0.1GHz
L/L	50db	65db	65db	65db	60db	50db
L/G	35db	65db	65db	65db	60db	50db

DC FILTERS

DC SERIES
HIGH PERFORMANCE DUAL π FILTER

Non-polar dual π section filter for input and output filtering of switch mode power supplies.

DC Series filters function equally well with balanced or unbalanced load currents in chassis return or floating ground systems.

Part No.	Current	Case
DC3	3A	1-1/8×1-3/4×3-1/16
DC7	7.5A	1-1/4×2×3-3/16
DC15	15A	1-1/2×2×3-11/16
DC20	20A	1-3/4×2-1/8×3-15/16
DC30	30A	2×2-7/8×4-1/4
DC60	60A	2-3/4×3×6-1/2
DC100	100A	4×4×9-1/4

Rated Voltage: 60VDC
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	40db	60db	60db	60db	60db	55db

DF SERIES
MULTIPLE OUTPUT DC FILTER

Economical DC filter for multiple output switch mode power supplies.

DF Series filters are available in 4 and 6 circuit configurations and can be used to isolate any noisy power bus from sensitive circuitry.

Part No.	Current	Case
DF104	4×10A	1-1/4×2-3/4×3-1/16
DF106	6×10A	1-1/2×3-1/16×3-5/16

Rated Voltage: 60VDC
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	3db	15db	35db	45db	50db	50db
L/G	15db	25db	35db	50db	50db	50db

3∅ FILTERS

3E SERIES
EFFICIENT 3∅ τ FILTER

Economical and compact 3∅ τ section filters with balanced differential (L/L) and common mode (L/G) performance for FCC applications using switch mode power conversion.

The 3E Series filters are available in Wye or Delta configurations and with the "A" circuit option for enhanced common mode and high frequency performance.

Part No.	Current	Case	Leakage
3E15	15 A/PH	3×3×5-1/2	1.2mA
3E20	20A/PH	4×4×6-5/8	1.2mA
3E30	30A/PH	4×4×6-5/8	1.4mA
3E45	45A/PH	4×4×8-5/8	1.6mA
3E60	60A/PH	4-3/4×5×10	1.6mA
3E80	80A/PH	4-3/4×6-1/2×12	2.4mA
3E100	100A/PH	4-3/4×6-1/2×14	2.4mA

Rated Voltage: 250/440VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/N	12db	22db	50db	55db	50db	50db
L/G	3db	25db	55db	60db	50db	50db

3F SERIES
HIGH PERFORMANCE 3∅ τ FILTER

Enhanced differential (L/L) and common mode (L/G) performance 3∅ τ section filters for VDE 0871/A applications using switch mode power conversion.

3F Series 3∅ filters provide balanced performance with emphasis on 150KHz and above. Wye or Delta configurations are available as is the "A" circuit option for enhanced common mode performance.

Part No.	Current	Case	Leakage
3F7	7A/PH	3×3×6-1/4	0.8mA
3F15	15A/PH	4×4×8-5/8	0.8mA
3F30	30A/PH	4-3/4×5×10	1.4mA
3F45	45A/PH	4-3/4×5×13	1.4mA
3F60	60A/PH	4-3/4×6-1/2×14	1.6mA
3F80	80A/PH	4-3/4×6-1/2×14	2.4mA
3F100	100A/PH	5-3/4×7-1/2×17-1/2	2.4mA

Rated Voltage: 250/440VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/N	15db	50db	60db	60db	60db	55db
L/G	10db	50db	65db	65db	65db	60db

3X SERIES
PREMIUM PERFORMANCE 3∅ τ FILTER

3X Series filters provide up to 15db greater attenuation at 150 kHz and are available in Wye or Delta configurations. The "A" circuit option for enhanced common mode and high frequency response is also available.

Part No.	Current	Case	Leakage
3X7	7A/PH	4×4×8-5/8	1.2mA
3X15	15A/PH	4-3/4×5×13	1.2mA
3X30	30A/PH	4-3/4×6-1/2×14	1.6mA
3F40	40A/PH	4-3/4×6-1/2×14	1.6mA

Rated Voltage: 250/440VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/N	30db	65db	65db	65db	60db	55db
L/G	20db	60db	65db	65db	60db	60db

3L SERIES
3∅ π FILTER

Economical and compact 3∅ π section filters for use with switch mode loads of all types.

The low leakage 3L Series is available with a "B" circuit option to increase common mode performance.

Part No.	Current	Case	Leakage
3L15	15A/PH	2-1/4×4-1/4×7	0.8mA
3L30	30A/PH	3×5-1/2×8-1/2	1.2mA

Rated Voltage: 250/440VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/N	20db	35db	60db	60db	60db	55db
L/G	15db	30db	42db	60db	60db	55db

3V SERIES
PREMIUM PERFORMANCE 3∅ π FILTER

Extended low frequency performance for VDE 0871/B type applications powering switch mode power supplies. 3V Series filters provide extra insertion loss in the 10kHz to 50kHz band and are available in the "B" circuit option for increase common mode performance.

Part No.	Current	Case	Leakage
3V16	16A	4×4×10-5/8	1.8mA
3V24	24A	4-3/4×5×14	1.8mA

Rated Voltage: 250/440VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/N	40db	55db	60db	65db	50db	55db
L/G	22db	40db	50db	55db	55db	45db

CORD CONNECTED

CF SERIES
FILTER/CONDITIONER

Cord connected, high energy filter protects and isolates electronic equipment from typical power line transients which saturate the typical OEM level EMI filters. NEMA type input plug and output receptacle interface.

Part No.	Current	Case	Leakage
CF151	15A	2-1/2×4-7/16×5-7/16	1.5mA
CF201	20A	3-3/4×4×11	1.5mA

Rated Voltage: 125VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.02MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	20db	50db	65db	65db	65db	50db
L/G	18db	40db	55db	55db	50db	45db

FCI reserves the right to make specification changes without notice. Consult the factory for current information.

FILTER CONCEPTS

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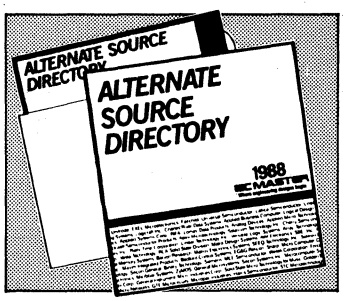

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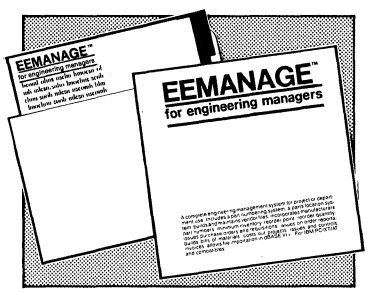

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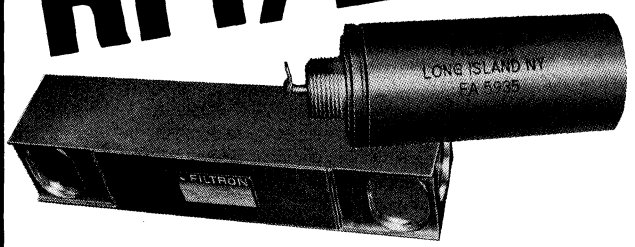

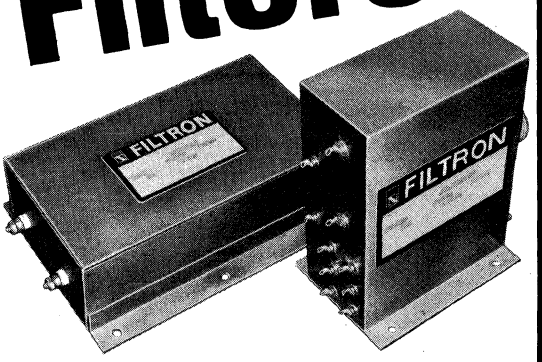

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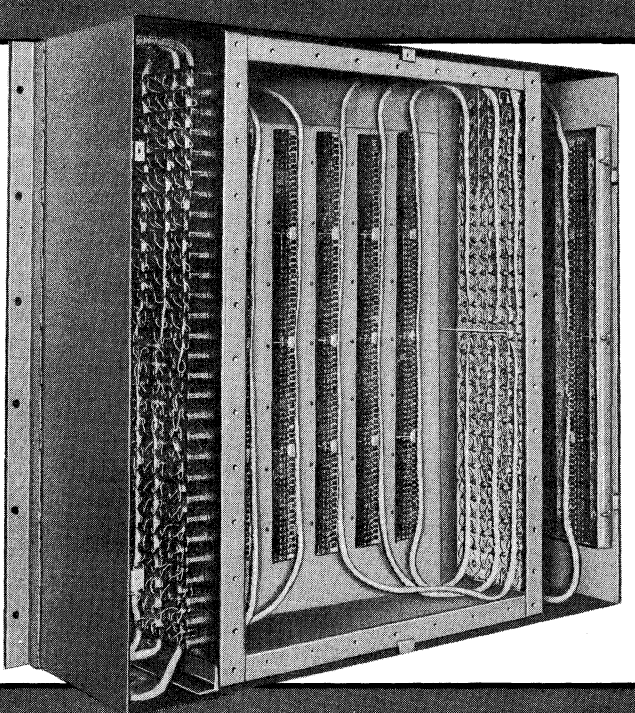

FILTRON

Filtron Co. Inc., Subsidiary of ARX Inc.

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Old Bethpage, NY 11804
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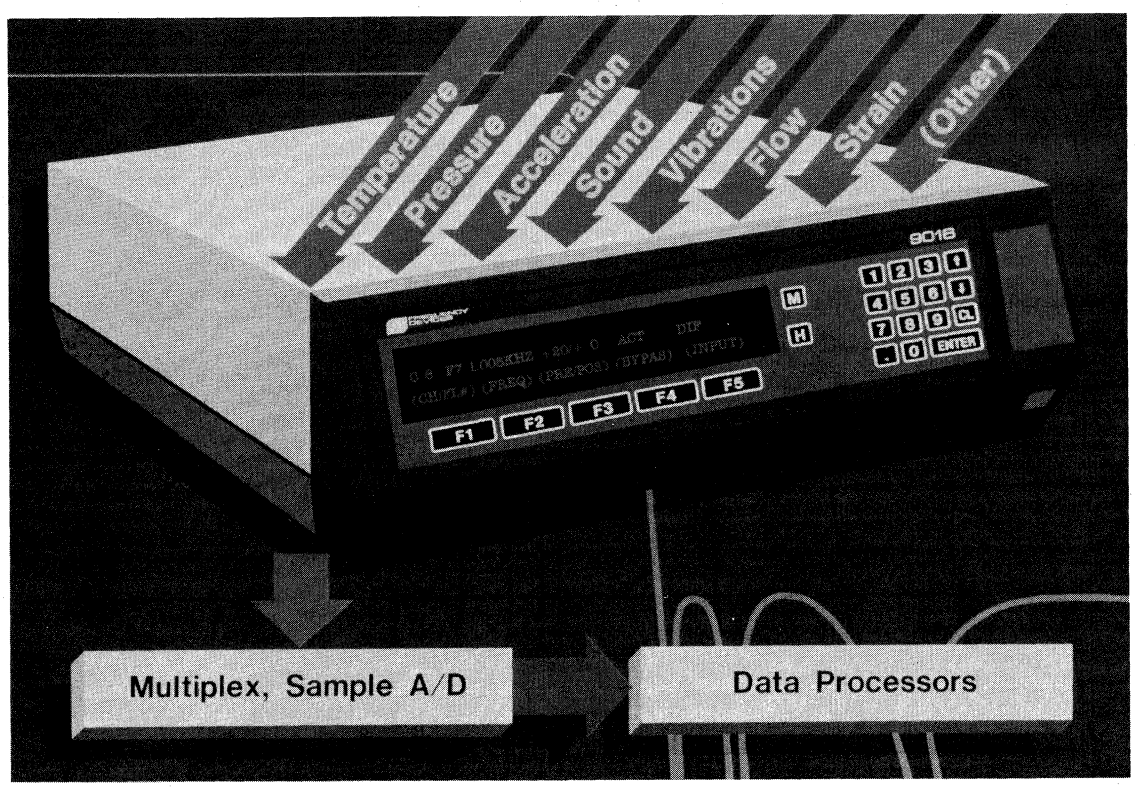
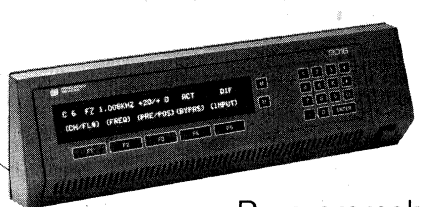
FILTRON

Multi-Channel Filter For Data Acquisition Systems



The Model 9016 Multi-channel Programmable Filter from Frequency Devices allows you to amplify signals, adapt noise bandwidth, and reject out of band frequencies prior to recording or digitizing with unparalleled ease for use and growth potential.



Expandable—Up to 16 single-ended or differential channels

Configurable—Choice of filter transfer functions ■ Butterworth ■ Bessell ■ elliptic ■ linear phase

Agile—Independently set frequency from 0.1 Hz to 102.4 kHz with 3 digit resolution

Adaptable—Pre- and post filter gain, input mode or function bypass for each channel up to 40dB

Versatile—Lowpass Highpass and Bandpass Capability

Efficient—Non-volatile memory stores up to eight set ups per channel

Menu Driven—80 character display for front panel operation, channel status, HELP messages

Programmable—Full remote control via standard PC printer (parallel) interface, or GPIB IEEE-488 option

Call us today for more 9016 information and start making your filtering tasks easy!

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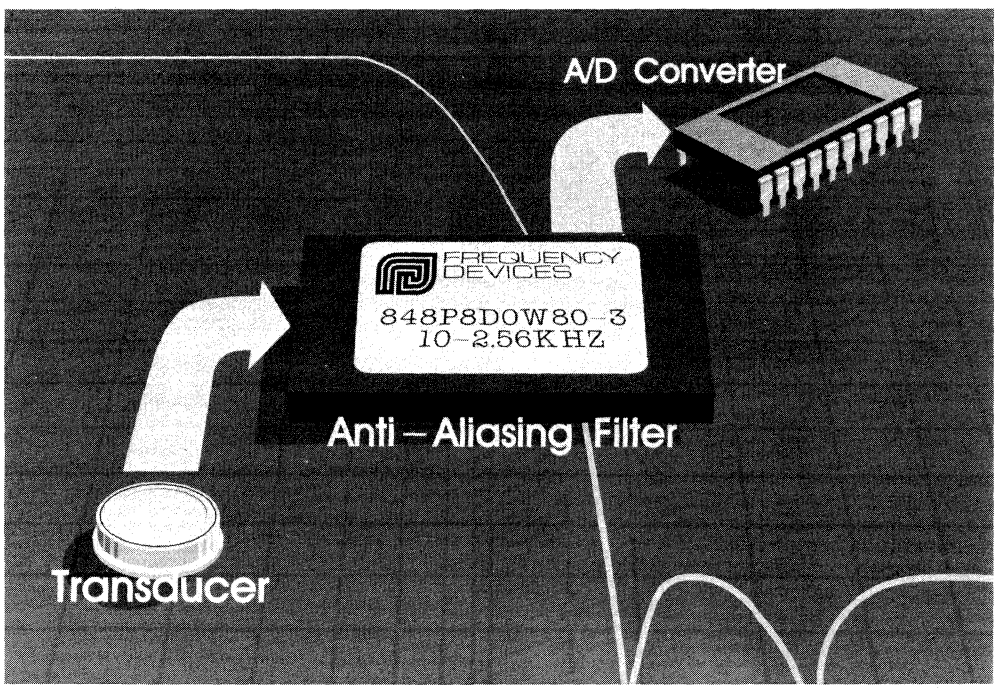
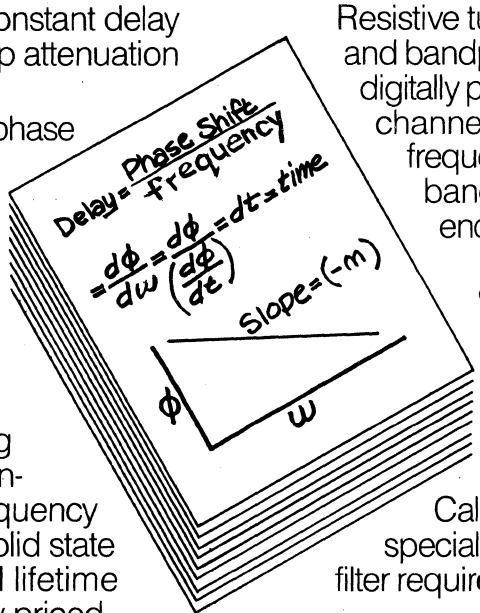
Digitally Programmable Linear Phase Filters for A/D Prefiltering Applications

complete with Internal Interface Latches



848DOW Series combines constant delay of a Bessel filter with the sharp attenuation of a Butterworth filter.

Features: 8 pole, 6 zero linear phase lowpass filters • Digitally programmable corner frequency • 8 bit (256:1) tuning ratio • Internally latched control lines to store frequency selection data • Linear phase response to minimize phase distortion • Sharp roll-off for anti-aliasing • Plug in, ready to use, fully finished, filter module • Five frequency ranges to 51.2Hz • Internal solid state switches extend operational lifetime • Readily available • Sensibly priced



Other Frequency Devices filter products include the following: The 900 series filter instrument...Front panel tunable • Resistive tunable lowpass, highpass and bandpass filters • The 9000 series digitally programmable multi-channel channel filter instrument • Fixed frequency lowpass, highpass and bandpass filters • Touch tone encoders and decoders, FSK, PCM and modem filters • Precision single-phase and quadrature sinewave oscillators

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MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 88/89 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1134, **B**•1098, **C**•1082, **D**•1038
ASCII Code ..... **D**•1073
Batteries, Product Selection Guide ..... **D**•1428
Batteries & Fuel Cells, Characteristics ..... **D**•1454
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1030
Capacitors, Miniglossary ..... **A**•1027
Capacitors, Product Selection Guide .. **A**•1003
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1193
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1760
Connectors, Miniglossary ..... **C**•1374
Connectors, Terminals & Sockets, Product Selection Guide ..... **C**•1127
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide ..... **A**•1331
Delay Lines, Product Selection Guide ..... **A**•1495
Discrete Semiconductors, Product Selection Guide ..... **A**•2113
Displays, Readouts, & CRTs, Product Selection Guide ..... **B**•1033
EBCDIC Code ..... **D**•1162
Encapsulation, Miniglossary ..... **C**•1110
Fans, Blowers, Cooling Equipment & Heat Exchangers, Product Selection Guide ..... **C**•1643
Filters, Product Selection Guide ..... **A**•1633
IC Master ..... **A**•1718
Instruments, Panel Meters, Product Selection Guide ..... **D**•1350
Instruments, Test & Measuring, Product Selection Guide ..... **D**•1190
Interconnection Systems, Product Selection Guide ..... **C**•1719
Keyboards & Keypads, Product Selection Guide ..... **B**•1808
Lamps, Lights, & Inductors, Product Selection Guide ..... **B**•1104
Logofinder & Trademark Directories .... **C**•901
Microwave Components, Product Selection Guide ..... **A**•1761
Military Qualified Products List ..... **B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1181
Opto Semiconductors, Miniglossary .. **B**•1262
Oscilloscopes, Product Selection Guide ..... **D**•1408
Panel Hardware, Product Selection Guide ..... **C**•1603
Potentiometers, Trimmers, Controls & Rheostats, Product Selection Guide ..... **A**•2057
Power Supplies, Miniglossary ..... **D**•1504
Power Supplies, AC, Product Selection Guide ..... **D**•2060
Power Supplies, DC, Product Selection Guide ..... **D**•1497
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide ..... **B**•1297
Relay Contact Forms ..... **B**•1371
Relays, Electromechanical, Miniglossary ..... **B**•1364
Relays, Product Selection Guide ..... **B**•1355
Resistor Color Codes ..... **A**•1911
Resistors, Product Selection Guide .... **A**•1849
Servo Components, Miniglossary ..... **B**•1238, **D**•2176
SI Units, Basic Guide To, ... **A**•1090, **B**•1050, **C**•1092, **D**•1048
Solenoids, Product Selection Guide .... **B**•1612
Switches, Product Selection Guide ..... **B**•1636
Thermal Components, Product Selection Guide ..... **B**•1834
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1842
Thyristors/High Power Diodes, Miniglossary ..... **A**•2145
Trademark & Logofinder Directories .... **C**•901
Transducers & Encoders, Product Selection Guide ..... **B**•1874
Transformers, Product Selection Guide ..... **A**•2153
Voltage Drop Nomograph .. **C**•1912, **D**•2042
Wire & Cable, Product Selection Guide ..... **C**•1763
Wire Guages—Diameter, Area, Copper Weight ..... **C**•1864

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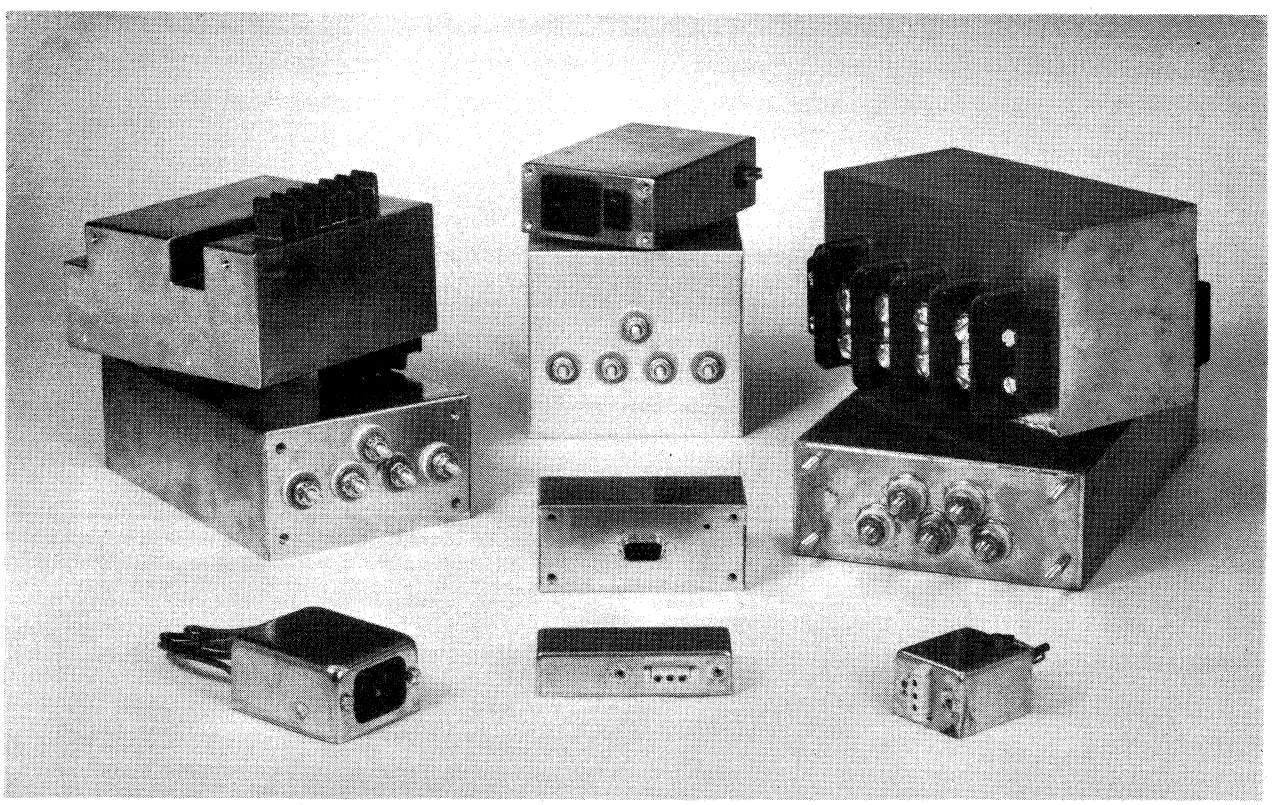

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3 PHASE FILTERS
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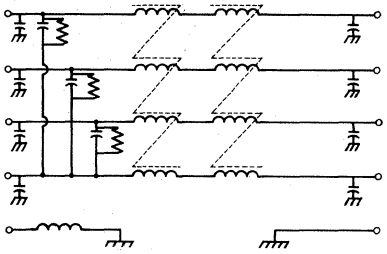
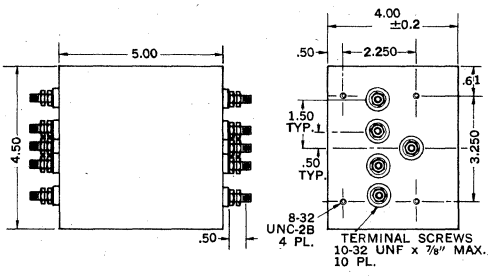
OTHER CONFIGURATIONS AVAILABLE

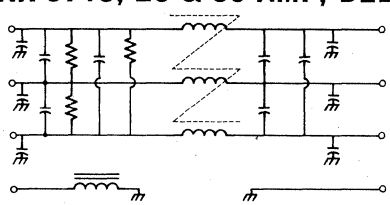
KK-332, 30 AMP, WYE

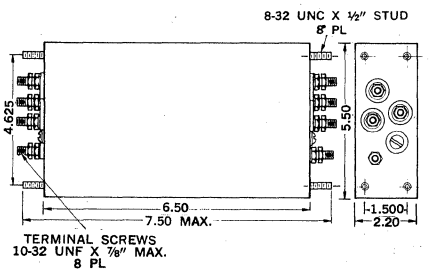




Freq. MHz	Insertion Loss Common - Mode DB	Insertion Loss Diff. Mode DB
.01	0	0
.05	3	9
.10	10	15
.15	16	19
.25	25	23
.50	40	29
1.0	57	36
5.0	60	50
10.0	60	50
30.0	60	50

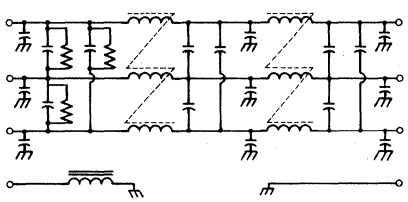
KK-0716, 20 & 30 AMP, DELTA

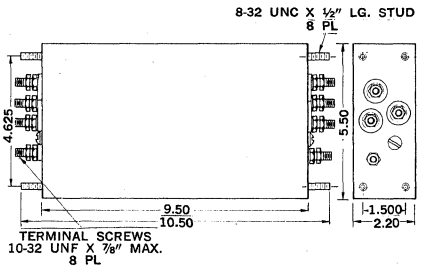




Freq. MHz	Insertion Loss Common - Mode DB	Insertion Loss Diff. Mode DB
.01	0	1
.05	2	11
.10	12	17
.15	20	20
.25	32	25
.50	49	31
1.0	60	37
5.0	60	50
10.0	60	50
30.0	60	50

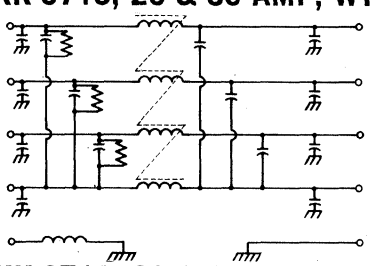
KK-0717, 20 & 30 AMP, DELTA

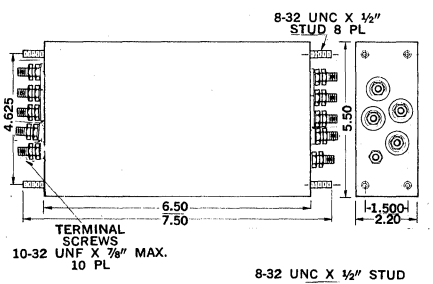




Freq. MHz	Insertion Loss Common - Mode DB	Insertion Loss Diff. Mode DB
.01	0	3
.05	1	14
.10	20	20
.15	35	24
.25	53	28
.50	60	34
1.0	60	40
5.0	60	50
10.0	60	50
30.0	60	50

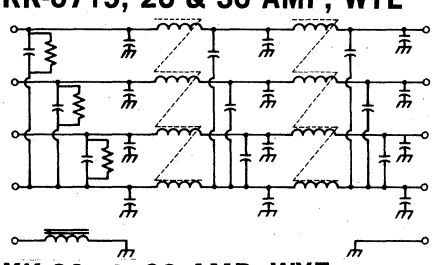
KK-0718, 20 & 30 AMP, WYE

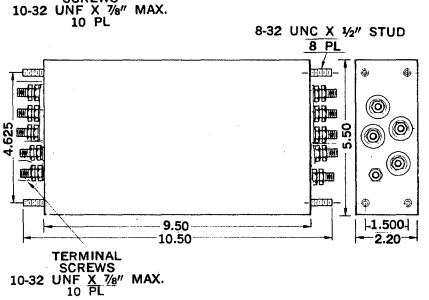




Freq. MHz	Insertion Loss Common - Mode DB	Insertion Loss Diff. Mode DB
.01	0	1
.05	2	11
.10	15	16
.15	24	20
.25	36	24
.50	54	30
1.0	60	36
5.0	60	50
10.0	60	50
30.0	60	50

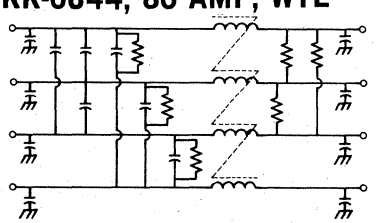
KK-0719, 20 & 30 AMP, WYE

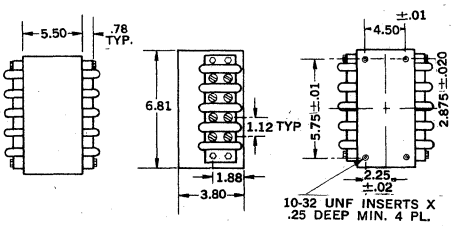




Freq. MHz	Insertion Loss Common - Mode DB	Insertion Loss Diff. Mode DB
.01	0	1
.05	8	11
.10	25	16
.15	40	20
.25	58	24
.50	60	30
1.0	60	36
5.0	60	50
10.0	60	50
30.0	60	50

KK-0644, 80 AMP, WYE





Freq. MHz	Insertion Loss Common - Mode DB	Insertion Loss Diff. Mode DB
.01	0	5
.05	3	17
.10	13	23
.15	24	27
.25	38	31
.50	57	37
1.0	60	43
5.0	60	50
10.0	60	50
30.0	60	50

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UL, CSA, VDE

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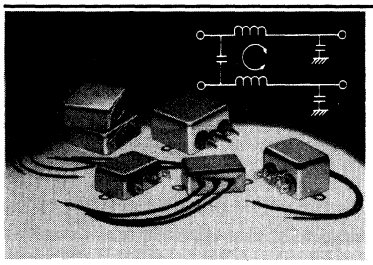
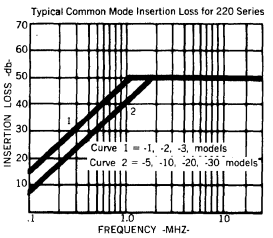
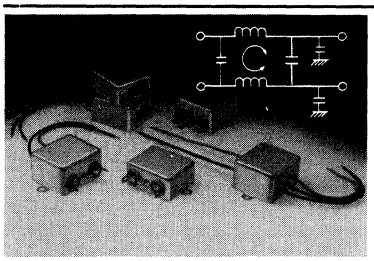


220 Series

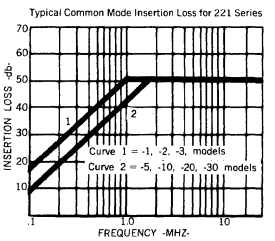
The 220 series is designed to give excellent filtering of "common mode," line-to-ground interference on computer-peripheral and other electronic hardware. Line-to-ground interference is the most common interference experienced and is generally the major source of "interference caused" malfunctions.

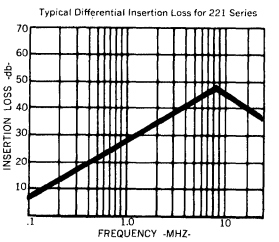


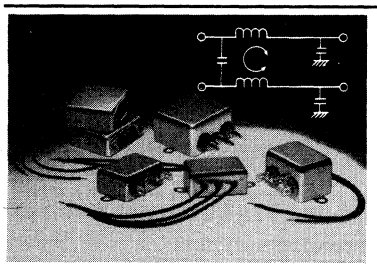


221 Series

The 221 series has the same "common mode" performance as the 220 series but the circuit has been modified to give substantial "differential mode" rejection of noise caused by switching transistors and power supply diodes.

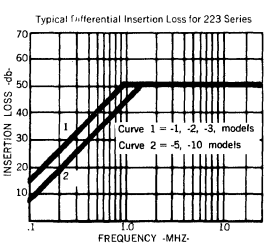


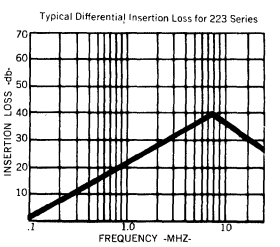


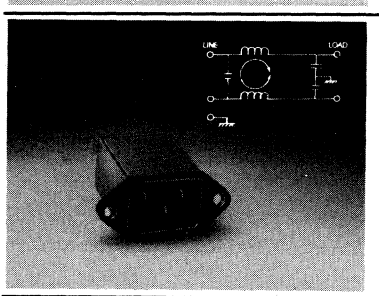


223 Series

The 223 series in intended as an economical compromise between the 220 and 221 series. This filter has the same "common mode" performance as the 220 model with approximately one-half the differential attenuation of the 221 series.

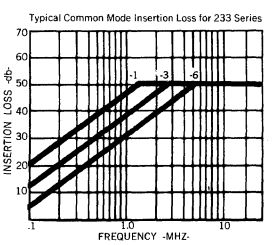


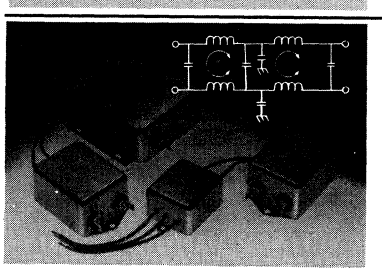




233 Series

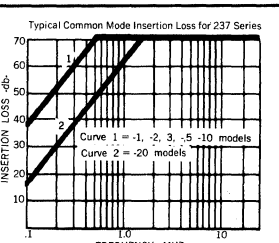
The 233 series filter is a compact filter with an integral IEC connector. This filter gives effective line-to-ground insertion loss and has low leakage current to meet VDE, SEV and other safety organization requirements. If you want an integral filter and connector ask your representative or contact the factory. Many of our other filters can be made available with the IEC connector.

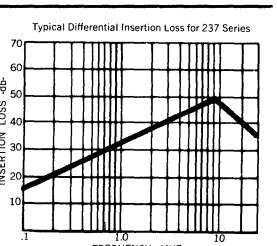


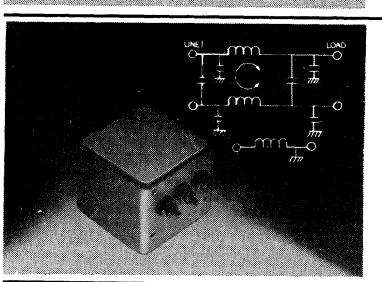


237 Series

This series is a high performance package where filtering requirements are more stringent than those associated with the 220 or 221 series. This package incorporates very high attenuation of both "common mode" and "differential mode" interference yet the cost for such attenuation is moderate.

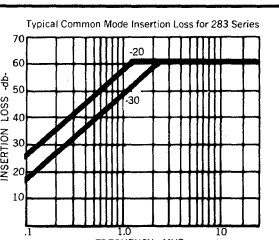


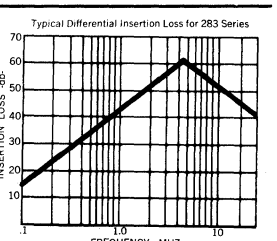




283 Series

The 283 series is a compact single phase high current filter. This filter is rated for 20 and 30 amps and has good common mode and differential mode insertion loss. This filter has a ground coil for high frequency ground isolation which may be included or omitted as desired.

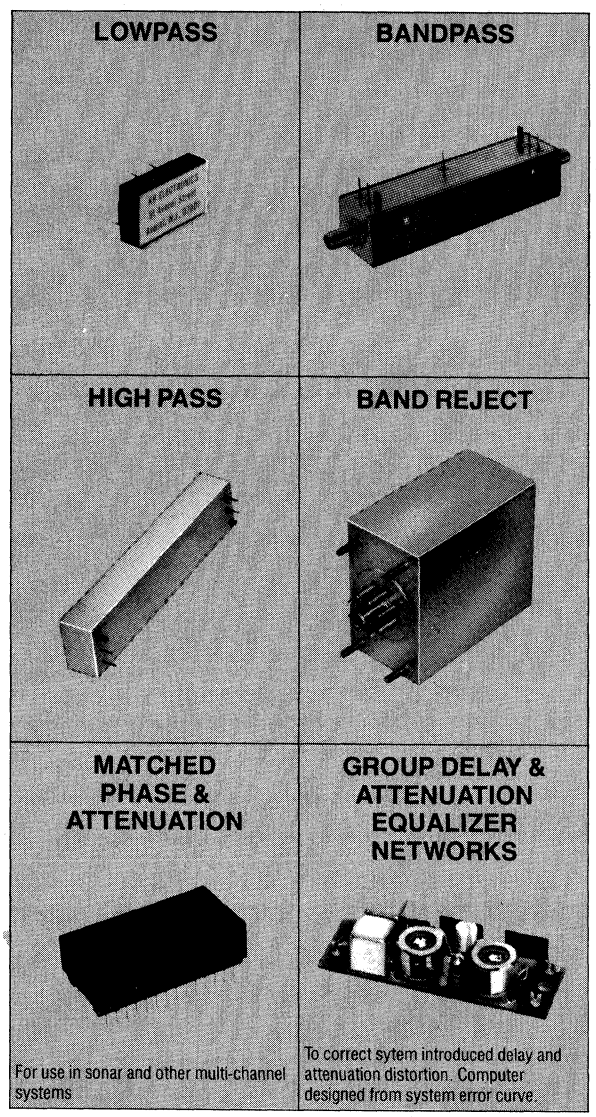




JMK INC. • 15 CALDWELL DRIVE • AMHERST, NH 03031 • (603) 886-4100 • FAX (603) 886-4115

KR ELECTRONICS, INC. 91 Avenel Street, Avenel, New Jersey 07001 • (201) 636-1900

CUSTOM & STANDARD FILTERS



KR Electronics can quickly and accurately design networks to meet your requirements and provide an immediate quotation. Computers are extensively used by our engineers to find the most cost effective solutions which satisfy your system needs. Through the use of circuit analysis programs these networks are evaluated to assure compliance with your specifications. Graphical and tabular data can be generated and supplied to illustrate typical network response. This data can be used to predict system performance.

- Application Assistance
- Immediate Quotation
- Custom and Standard
- MIL-F-18327
- Prototype Service

Thorough analysis of the design before production is used to check all applicable network parameters.

- Attenuation
- Phase/Group Delay
- Impedance
- Transient Response
- Network Sensitivity
- Temperature Analysis

Computer controlled network analyzers assure accurate and repeatable measurements. Automated equipment 100% tests all products, verifying compliance to your specifications.

- 100% Electrical Inspection
- Graphical & Tabular Data
- Attenuation
- Phase/Group Delay
- VSWR/Return Loss
- Impedance

Some of KR's specialized design software include:

- Optimization and design of attenuation equalizers to correct for a prescribed frequency characteristic
- Design of group delay equalized filters yielding constant group delay and linear phase
- Optimization and design of group delay equalizers to correct for a prescribed frequency characteristic

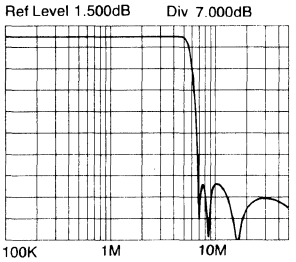
- **Lowpass**
- **Bandpass**
- **Band Stop**
- **Highpass**
- **Notch**
- **Phase Matched**
- **Attenuation Matched**
- **Delay Lines**
- **Video**
- **Anti-Aliasing**
- **SIN(X)/X Corrected**
- **Cable Equalizers**
- **Attenuation Equalizers**
- **Group Delay Equalizers**
- **Linear Phase**
- **Low Transient Response**
- **Bessel**
- **Butterworth**
- **Chebyshev**
- **Elliptic/Cauer**
- **Gaussian**
- **Transitional**
- **Equi-Ripple Phase**

KR ELECTRONICS, INC. 91 Avenel Street, Avenel, New Jersey 07001 • (201) 636-1900

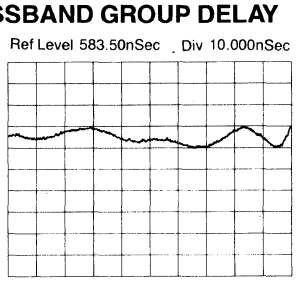
VIDEO & ANTI-ALIASING FILTERS

- Miniature
- Group Delay Equalized
- Flat Passband Response
- SIN(X)/X Compensation Available
- Custom Configurations

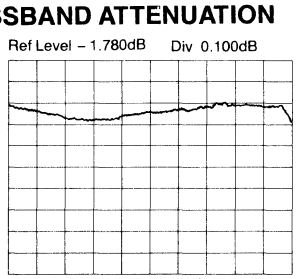
ATTENUATION vs. FREQUENCY



PASSBAND GROUP DELAY



PASSBAND ATTENUATION



Designed and manufactured to meet the stringent requirements of video analog and digital systems, KR Electronics' group delay equalized low-pass filters are optimized for performance and size.

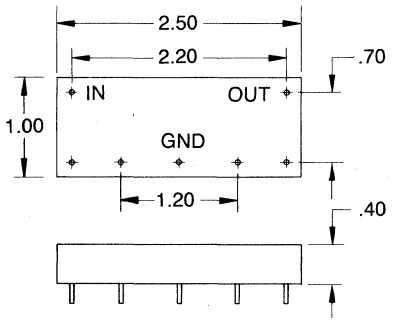
The three primary criteria for video applications are sharp transition, constant group delay and flat passband. The graphs at the left illustrate the typical response of a MDV8B500 filter. The filter makes a transition from the end of the passband to >45 dB at a shape factor of 1.4. To practically eliminate phase distortion, group delay equalizers are used to achieve constant group delay (< ± 10 nsec) over the entire passband. These filters also exhibit flat amplitude response (< ± .1 dB) up to the cutoff frequency. This performance is available in a miniature, low profile, PC board mountable package.

These filters are ideally suited for anti-aliasing in A/D and D/A applications. Various levels of attenuation are available for different resolutions. For filters used after D/A conversion, Sin(X)/X shaping of the passband is available.

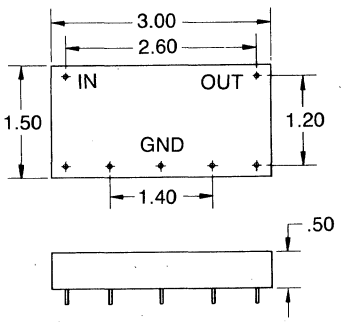
KR Electronics has a strong background in custom design and manufacture. This gives you the flexibility to specify the frequency, shape factor and package configuration that meet your particular requirement.

Model	MDV8B500	DV8B500	SV8B500	SV10B500
Insertion Loss (Ref 100 KHz)	2.2 dB	2.2 dB	2.2 dB	2.8 dB
Passband Ripple	< ± .1 dB	< ± .1 dB	< ± .1 dB	< ± .1 dB
End of Passband (Fc)	5 MHz	5 MHz	5 MHz	5 MHz
≈ 3 dB Frequency	5.56 MHz	5.56 MHz	—	—
≈ 12 dB Frequency	6.015 MHz	6.015 MHz	—	—
Start of Stopband (Fs)	7 MHz	7 MHz	7 MHz	7 MHz
Stopband Attenuation (As)	> 45 dB	> 45 dB	> 54 dB	> 66 dB
Approximate Group Delay	640 nsec	640 nsec	665 nsec	700 nsec
Group Delay Ripple (to Fc)	< ± 10 nsec	< ± 10 nsec	< ± 10 nsec	< ± 15 nsec
Impedance	75Ω	75Ω	75Ω	75Ω
SIN(X)/X Available	Yes	Yes	Yes	Yes
Case Style	E	F	G	G

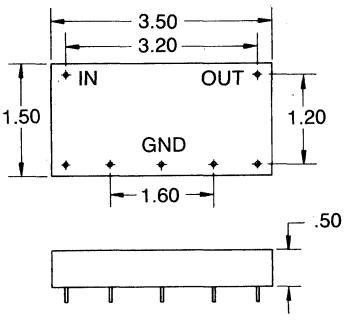
CASE E



CASE F



CASE G

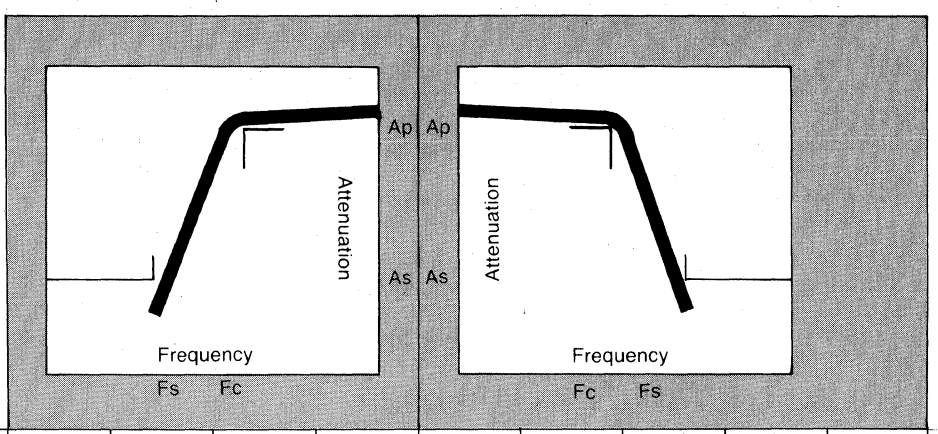


FOR ALL CASES:

Input & Output Lead Diameter: .030" **Ground Lead Diameter: .040"** **Case Material: Diallyl Phthalate**

KR ELECTRONICS, INC. 91 Avenel Street, Avenel, New Jersey 07001 • (201) 636-1900

LOWPASS AND HIGHPASS DIP FILTERS



Series/Filter Type	1 / HP	2 / HP	4 / HP	6 / HP	1 / LP	2 / LP	4 / LP	5 / LP	6 / LP
Insertion Loss	< 1 dB	< 1 dB	< 1 dB	< 1 dB	< 1 dB	< 1 dB	< 1 dB	< 1 dB	< 1 dB
Frequency Range—Fc	2K-5MHz	2K-10MHz	2K-10MHz	2K-5MHz	2K-50MHz	2K-50MHz	2K-10MHz	1M-15MHz	2K-5MHz
Ripple	< ±1 dB	< ±1 dB	< ±1 dB	< ±1 dB	< ±1 dB	< ±1 dB	< ±1 dB	< ±.25 dB	< ±1 dB
Ap—Attenuation at Fc	< 3 dB	< 3 dB	< 3 dB	< 3 dB	< 3 dB	< 3 dB	< 3 dB	< 3 dB	< 3 dB
As—Attenuation at Fs	>20 dB	>39 dB	>40 dB	>60 dB	>20 dB	>39 dB	>40 dB	>50 dB	>60 dB
Shape Factor Fs/Fc	.714	.4	.76	.525	1.4	2.5	1.3	1.25	1.6
Impedance Range	50-5KΩ	50-5KΩ	50-5KΩ	50-5KΩ	50-5KΩ	50-5KΩ	50-5KΩ	50-75Ω	50-5KΩ
Case Style	A	A	C	C	A	A	C	B	C

TO SPECIFY AND ORDER PART:

2 — Series: 1,2,4,5,6

D — Impedance (OHMS):
A– 50 E–1K
B–100 F–2K
C–200 G–5K
D–500 H–75
U–User Specified
All impedances not compatible with all frequency ranges

104 — Frequency Fc (Hz):
First two digits are significant
Last digit is number of zeroes

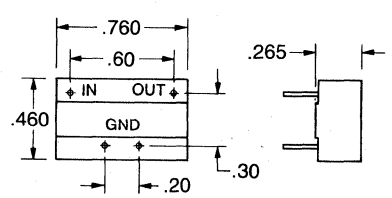
L — Filter Type:
L–Lowpass
H–Highpass

Options

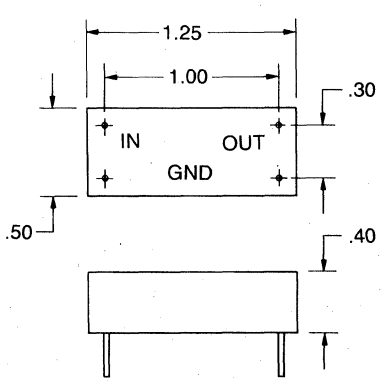
- Ultimate Attenuation (As)
- Passband Ripple
- Shape Factors
- Extended Frequency Range (Fs)
- Case Configurations
- Case Material
- Connectors

For other options consult our engineering staff

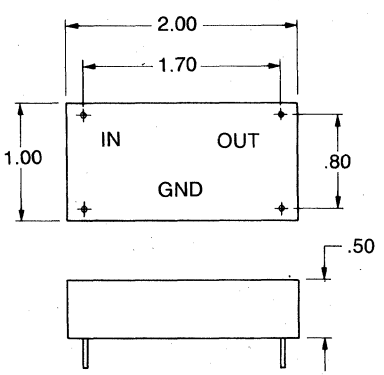
CASE A



CASE B



CASE C



Lead Diameter:
Case A .020″
Case B & C .030″
Lead Length: .20″ Min
Case Material: Diallyl Phthalate

KROHN-HITE CORPORATION
Dept. EM Avon Industrial Park
Avon, Massachusetts 02322
(508) 580-1660
TWX 710-345-0831

Tunable Active Filters

FREQUENCY RANGE	BAND PASS	BAND REJECT	HIGH PASS	LOW PASS	FREQ. ACC.%	ATTENUATION SLOPE dB/OCTAVE	HUM AND NOISE (RMS)	MAXIMUM ATTENUATION (dB)	OUTPUT VOLT/AMPS (RMS)	3dB POINTS	BATTERY KITS	RACK MOUNTING KIT	MODEL	PRICE
.001Hz-99.9kHz			•	•	2	24	500uV	80	5V/50mA	DC-1MHz	BK332	RK-58	3320	1300
.001Hz-99.9kHz	•	•	•	•	2	24,48	500uV	80	5V/50mA	DC-1MHz	BK334	RK-519	3322	2400
.001Hz-99.9kHz			•	•	2	48	500uV	80	5V/50mA	DC-1MHz	BK332	RK-58	3340	1800
.001Hz-99.9kHz	•	•	•	•	2	48,96	500uV	80	5V/50mA	DC-1MHz	BK334	RK-519	3342	3200
.01Hz-99.9kHz			•	•	2	24	500uV	80	5V/50mA	DC-1MHz	BK332	RK-58	3321	1225
.01Hz-99.9kHz	•	•	•	•	2	24,48	500uV	80	5V/50mA	DC-1MHz	BK334	RK-519	3323	2200
.01Hz-99.9kHz			•	•	2	48	500uV	80	5V/50mA	DC-1MHz	BK332	RK-58	3341	1600
.01Hz-99.9kHz	•	•	•	•	2	48,96	500uV	80	5V/50mA	DC-1MHz	BK334	RK-519	3343	2750
.02Hz-20kHz	•	•	•	•	5	6,12,18,24	500uV	80	10V/2mA	DC-1MHz	BK375	RK-519	3750	1600
.2Hz-20kHz	•				5	24	200uV	80	5V/1mA	NA	BK370	RK-38	3700	1075
2Hz-200kHz	•	•	•	•	5	24	200uV	60	5V/10mA	.2Hz-3MHz	N/A	RK-38	3550	1150
10Hz-1MHz	•				5	24	100uV	80	3V/10mA	N/A	N/A	RK-314	3100A	1050
10Hz-3MHz	•				5	24	100uV	80	3V/10mA	N/A	N/A	RK-314	3103A	1150
10Hz-3MHz	•				5	18	100uV	80	3V/10mA	N/A	N/A	RK-314	3103-4A	1150
20Hz-200kHz	•				10	24	200uV	60	5V/3.5mA	N/A	N/A	RK-38	3500	995
20Hz-2MHz			•	•	5	24	100uV	80	3V/10mA	DC-10MHz	N/A	N/A	3200*	850
20Hz-2MHz	•	•	•	•	5	24,48	100uV	80	3V/10mA	DC-10MHz	N/A	N/A	3202*	1495

*RACK MODEL (19" PANEL). ADD SUFFIX 'R' TO MODEL NO.

Programmable Filter Modules

FREQUENCY RANGE	FUNCTIONS LP	FUNCTIONS HP	POLES/ ZEROS	FREQ ACC.%	ATTENUATION SLOPE dB/OCTAVE	NOISE at 1kHz MAX. GAIN (RTI)	MAXIMUM ATTEN. (dB)	OUTPUT VOLTS/AMPS (RMS)	BANDWIDTH	MODEL	PRICE
1Hz-99kHz	•		7/6	2	115	10uV	80	7V/10mA	DC-99kHz	30-1	1245
0.1Hz-9.9kHz	•		7/6	2	115	10uV	80	7V/10mA	DC-9.9kHz	30-2	1295
0.01Hz-990kHz	•		7/6	2	115	10uV	80	7V/10mA	DC-990Hz	30-3	1345
1Hz-99kHz		•	7/6	2	115	100uV	80	7V/10mA	1Hz-500kHz	31-1	1245
0.1Hz-9.9kHz		•	7/6	2	115	100uV	80	7V/10mA	0.1Hz-500kHz	31-2	1295
0.01Hz-990Hz		•	7/6	2	115	100uV	80	7V/10mA	0.01Hz-100kHz	31-3	1345
1Hz-99kHz	•		5/4	2	53	10uV	72	7V/10mA	DC-99kHz	32-1	950
0.1Hz-9.9kHz	•		5/4	2	53	10uV	72	7V/10mA	DC-9.9kHz	32-2	1050
0.01Hz-990Hz	•		5/4	2	53	10uV	72	7V/10mA	DC-990Hz	32-3	1100
0.001Hz-99Hz	•		5/4	2	53	10uV	72	7V/10mA	DC-99Hz	32-4	1150
1Hz-99kHz		•	5/4	2	53	100uV	72	7V/10mA	1Hz-500kHz	33-1	950
0.1Hz-9.9kHz		•	5/4	2	53	100uV	72	7V/10mA	0.1Hz-500kHz	33-2	1050
0.01Hz-990Hz		•	5/4	2	53	100uV	72	7V/10mA	0.01Hz-100kHz	33-3	1100
0.001Hz-99Hz		•	5/4	2	53	100uV	72	7V/10mA	0.001Hz-100kHz	33-4	1150

Programmable Filter Mainframes

	CHARACTERISTICS	STORED SETTING	IEEE-488 PROGRAM	RACK MOUNTING KIT	MODEL	PRICE
IEEE-488	HOLDS UP TO 5 CHANNELS OF ANY COMBINATION LP/HP MODULES	85	•	RK-317	3905	1750
IEEE-488	HOLDS UP TO 16 CHANNELS OF ANY COMBINATION LP/HP MODULES	25	•	RK-817	3916	2495

Distortion Analyzers

FREQUENCY RANGE	INPUT SENSITIVITY VRMS	DISPLAY	DISTORTION RANGE %	VOLTMETER RANGE VRMS	INTERNAL OSCILLATOR	ADDITIONAL FEATURES	RACK MOUNTING KIT	MODEL	PRICE
1Hz-110kHz	1-130	3 DIGIT	.000-12.0	0.1-130	1kHz, 5VRMS	DISTORTION OUTPUT ANALOG OUTPUT	RK-319	6800B*	2000
10Hz-110kHz	0.1-13	3 DIGIT	.000-12.0	.01-13	1kHz, 5VRMS	DISTORTION OUTPUT ANALOG OUTPUT	RK-319	6801B*	2000
IEEE-488 10Hz-110kHz	0.1-130	3 DIGIT	%: .003-50.0 dB: -6 TO -90	0.01-130	1kHz, 5VRMS	FREQUENCY COUNTER IEEE-488 PROGR.	RK-519	**6880A	3500
5Hz-1MHz	0.1-130	3 DIGIT	.000-19.0	1-130	1kHz, 5VRMS	DISTORTION OUTPUT ANALOG OUTPUT	RK-319	6900A*	2400

*OPTIONAL BCD OUTPUT AVAILABLE **1Hz OPTIONAL

Precision Phasemeters

FREQUENCY RANGE	PHASE ACCURACY	RESOLUTION	INPUT WAVEFORMS	INPUT VOLTAGE RANGE	DISPLAY RANGE	RACK MOUNTING KIT	MODEL	PRICE
**10Hz-10MHz	0.1°	0.1°	∿ ⊓ ∿ ⎍	.01-320VRMS	0° TO 360°	RK-316	6600*	2295
**10Hz-10MHz	0.05°	.01°	∿ ⊓ ∿ ⎍	.01-320VRMS	0-360°/ ±180°	RK-316	6610*	2995
IEEE-488 **10Hz-10MHz	0.05°	.01°	∿ ⊓ ∿ ⎍	.01-320VRMS	0-360°/ ±180°	RK-316	6620†•	3695
10Hz-1MHz	0.5°	0.1°	⊓ ∿	.01V-120VRMS	−180° TO +180°	RK-38	6200B*	1100

*OPTIONAL BCD OUTPUT †(AMC) AUTO METER CORRECT •OPTIONAL RS232 REPLACES IEEE-488 **1Hz OPTION

DO YOU WANT
SMALL GOOD PHASE EQUALISED
LOW PASS VIDEO FILTERS

Mattrey

"VERY SMALL" VS SERIES (Size 2.05 x 0.8 x 0.43" DIP)

TYPICAL RESULTS FOR COMPARISON USING ONE FREQUENCY: 4.2MHz

Example	VS	VSA	VSB	VSC	VSD	VSE
End of passband ripple (Fv)	4.2	4.2	4.2	4.2	4.2	4.2
Peak to peak ripple dB	<0.3	<0.25	≤0.1	≤0.3	<0.3	<0.3
3dB point (Nominal)	4.5	4.7	4.83	5.00	4.91	4.6
12dB point (Nominal)	4.80	5.03	5.20	5.63	5.50	4.83
Start of stopband (Fs)	5.57	5.78	6.09	7.35	6.93	5.23
$\frac{Fs}{Fv}$ =	1.32	1.38	1.45	1.75	1.65	1.25
Sin x/x version available	YES	NO	YES	YES	YES	YES
Impedance	75Ω	75Ω	75Ω	75Ω	75Ω	75Ω
Stopband attenuation	>45dB	>45dB	>45dB	>40dB	>40dB	>35dB

All VS, VSA, VSB, VSC, VSD, VSE Filters can be scaled to different frequencies

Minimum passbandwidth approximately 2.0MHz (VSA 1.75MHz)

Maximum passbandwidth approximately 12.0MHz

VERY VERY SHARP CUT "BRICKWALL" SERIES

Part Number	MBW.420B	MBW.449B	MBW.500B	MBW.510B	MBW.540B	MBW.556B	MBW.600B	MBW.640	MBW.680B	MBW.840B
TV System	M-NTSC	M-NTSC	B&G PAL	B&G PAL	–	I PAL	D PAL	D PAL	–	–
'A' End of Passband Ripple	4.20MHz	4.49MHz	5.00MHz	5.10MHz	5.40MHz	5.58MHz	6.00MHz	6.40MHz	6.80MHz	8.40MHz
Passband Ripple p/p	≤0.15dB	≤0.15dB	≤0.15dB	≤0.15dB	≤0.15dB	≤0.15dB	≤0.15dB	≤0.15dB	≤0.15dB	≤0.15dB
Stopband Attenuation	≥40dB	≥40dB	≥40dB	≥40dB	≥40dB	≥40dB	≥40dB	≥40dB	≥40dB	≥40dB
'B'Start of Stopband	4.48MHz	4.78MHz	5.33MHz	5.44MHz	5.76MHz	5.93MHz	6.40MHz	6.85MHz	7.25MHz	8.96MHz
Nominal Propagation Delay ns	1,920	1,800	1,615	1,580	1,495	1,450	1,350	1,260	1,187	960
Group Delay Ripple 20ns p/p to	3.89MHz	4.16MHz	4.63MHz	4.72MHz	5.00MHz	5.15MHz	5.58MHz	5.93MHz	6.30MHz	7.77MHz

FLAT LOSS <5dB. ZERO LOSS BRICKWALL FILTER 1 volt 'IN' 1 volt 'OUT'

"LOW COST" LC 422 SERIES (2.05 x 0.8 x 0.43" DIP)

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LUMINANCE CHANNEL			CHROMINANCE CHANNEL		
	LC422Y	LC422YS		LC422UV	LC422UVS
End of Passband Ripple	5.75MHz	5.57MHz	End of Passband Ripple	2.75MHz	2.75MHz
Passband Ripple(p-p)	<0.3dB	<0.3dB*	Passband Ripple (p-p)	<0.3dB	<0.3dB*
>12dB attenuation at	6.75MHz	6.75MHz*	>6dB attenuation at	3.375MHz	3.375MHz*
Start of Stopband (45dB)	7.6MHz	7.6MHz	Start of Stopband (40dB)	4.0MHz	4.0MHz
Group Delay Ripple Nominal (p-p)	<20ns to 5.20MHz	<25ns to 5.20MHz	Group Delay Ripple Nominal (p-p)	<20ns to 2.65 MHz	<20ns to 2.65MHz*
Nominal Propagation Delay	442ns	442ns	Nominal Propergation Delay	825ns	825ns
Flat Loss at 100kHz	<2.0dB	<6.0dB	Flat Loss at 100kHz	<1.5dB	<4.5dB
*=before sin x/x shaping					

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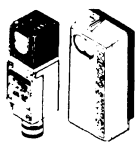
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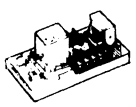
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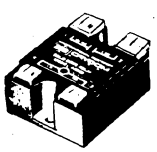
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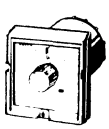
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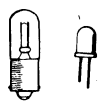
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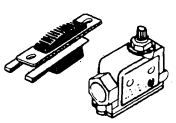
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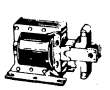
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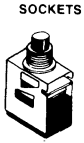
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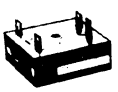
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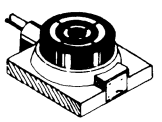
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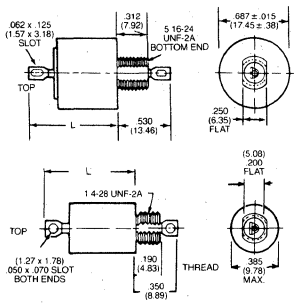
METUCHEN CAPACITORS INC.

EMI/RFI Suppression Filters

FOR ADDITIONAL INFORMATION SEE OUR DATA PAGES IN THE CONNECTOR SECTION, VOLUME C PAGES C•1452-C•1455

Part Number	Rated DC Current	Working Voltage 85°C	Working Voltage 125°C	Elec. CKT	Length "L" ±.030 (.76)	Minimum Insertion Loss (dB) Per MIL-STD 220 75 KHz	150 KHz	300 KHz	1 MHz	10 MHz	1 GHz
L, Pi, T—.687 Dia.											
51-320-024	1 amp	250VDC	-240VAC*	250VDC	L Top	.875 (22.23)	15	30	38	60	70	70
51-320-026	3 amp	250VDC	240VAC*	250VDC	L Top	.875 (22.23)	6	19	25	45	70	70
51-320-028	5 amp	250VDC	240VAC*	250VDC	L Top	.875 (22.23)	6	19	24	37	70	70
51-321-318	3 amp	250VDC	240VAC*	250VDC	Pi	1.170 (29.72)	6	31	55	70	70	70
51-321-610	1 amp	250VDC	240VAC*	250VDC	T	1.170 (29.72)	25	49	60	70	70	70
T, L, Pi—.375 Dia.											
51-351-605	2 amp	150VDC	100VDC		T	1.164 (29.57)	6	25	34	57	70	70
51-353-123	3 amp	150VDC	150VDC		L Top	.728 (18.49)	6	22	29	44	65	70
51-311-322	5 amp	150VDC	100VDC		Pi	.778 (19.76)	—	—	28	65	70	70

* 0-60 Hz

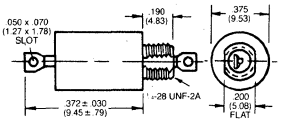


HERMETIC SEAL — FEED THROUGH CAPACITORS

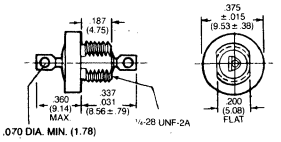
Part Number	Rated DC Current	Working Voltage 85°C	Working Voltage 125°C	Capacitance And/Or Tolerance	Minimum Insertion Loss (dB) Per MIL-STD. 220 75KHz	150KHz	300KHz	1MHz	10MHz	1GHz
54-367-008	15 amp	100VDC	50VDC	1.4μF	20	28	33	44	60	70
54-367-006	15 amp	125VAC*	125VAC*	.25μF	9	14	19	30	50	70
SCI-1020-000	15 amp	—	50VDC	1.4μ REF	15	28	33	44	60	70
51-359-001	15 amp	80VDC	50VDC	1.4μ REF	18	28	33	44	60	70
51-359-007	15 amp	125VAC*	125VAC*	.015μF REF	—	—	—	6	25	50

*0-400 Hz

54-367-008 54-367-006



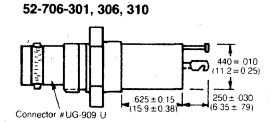
51-359-001 51-359-007 SCI-1020-000



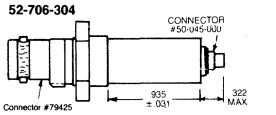
SIGNAL LINE FILTERS

Part Number	Rated DC Current	Working Voltage 85°C	Working Voltage 125°C	Pass Band	Minimum Insertion Loss (dB) Per Standard MIL STD. 220 20MHZ	50MHz	100MHz	1GHz
52-706-306	30 ma.	—	100VDC	DC-1 MHz<2dB	70	70	70	70
52-706-301	30 ma.	—	100VDC	DC-10 MHz<2dB	12	30	48	70
52-706-304	30 ma.	—	100VDC	DC-30 MHz<2dB	—	10	30	60
52-706-310	30 ma.	—	100VDC	DC-33 MHz<2dB	—	—	8	70

52-706-301, 306, 310

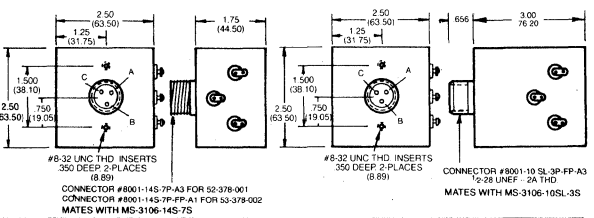


52-706-304

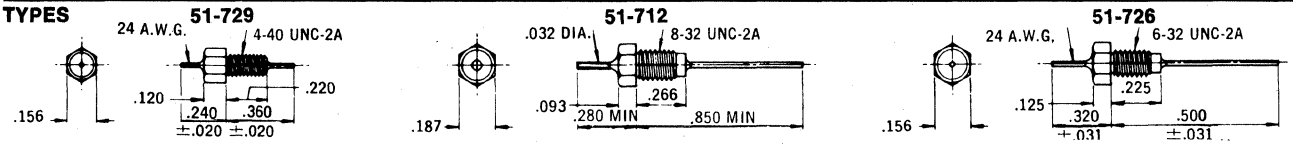


POWER LINE FILTERS

Part Number	Rated DC Current	Working Voltage (60 Hz)	Temp. Range	Minimum Insertion Loss Per MIL STD. 220 50 KHZ	150 KHz	300 KHz	1 MHz	10 MHz	100 MHz	1 GHz
52-378-001	3 amp	240VAC	−55°C to 85°C	40	70	80	80	80	70	60
52-378-002	5 amp	240VAC	−55°C to 85°C	34	64	70	80	80	70	70
52-387-010	10 amp	240VAC	−55°C to 85°C	24	60	70	80	80	70	70



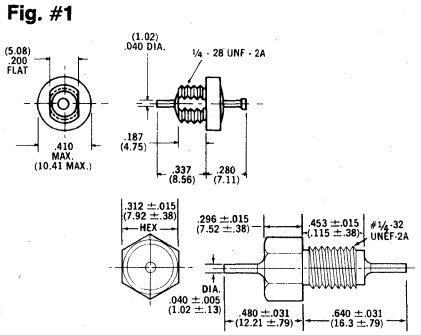
TYPES



Part No.	Rated Ioc in Amps	Working Volts, DC +85 °C	+125 °C	DCR Max.	Capacitance Reference Only μF	Insertion Loss dB 1 MHz	10 MHz	100 MHz	200 MHz	1 GHz
51-729-303	10	200	100	.01	.0015	—	5	42	60	70
51-729-304	10	200	100	.01	.022	7	27	43	50	55
51-726-001	3	200	100	.01	.0015	—	5	42	50	70

Part No.	Rated Ioc in Amps	Working Volts, DC +85 °C	+125 °C	DCR Max.	Capacitance Reference Only μF	Insertion Loss dB 1 MHz	10 MHz	100 MHz	200 MHz	1 GHz
51-726-002	10	200	100	.01	.022	7	27	43	50	60
51-712-001	10	200	100	.01	.0015	—	5	42	50	70
51-712-003	10	200	100	.01	.022	7	27	43	50	60

Fig. #1



100 VDC +85°C L SECTIONS 125 VAC +125°C

Part No.	Rated Ioc	Working Volts +85°C	+125°C	DCR Max.	Capacitance Reference Only	Insertion Loss dB 30 KHz	150 KHz	300 KHz	1 MHz	10 MHz	1 GHz	F I G.
51-717-001	15 amps	100VDC	50VDC	.01	1.4 MFD	15	28	33	44	60	70	1
51-717-007	15 amps	125VAC*	125VAC*	.01	.015 ±20%	—	—	—	6	25	50	1

*0-400 Hz

Part No.	Rated DC Current	WVDC @ 125°C	DCR	CKT	CAP.	Minimum Insertion Loss dB 1 MHz	10 MHz	100 MHz	200 MHz	1 GHz
51-732-001	10A	100	.01	L	.1 μ F	18	65	70	70	10

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METUCHEN CAPACITORS INC.

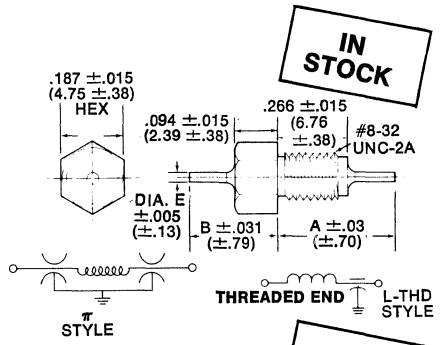
Military Filters

FOR ADDITIONAL INFORMATION SEE OUR DATA PAGES IN THE CONNECTOR SECTION, VOLUME C PAGES C•1452-C•1455

Shown below are a few of the most commonly used Military approved filters. These filters are approved to MIL-F-15733. Metuchen Capacitors stocks several hundred different MIL-F-15733 filters from MIL-F-15733/23 thru MIL-F-15733/70. Those shown below are IN STOCK continuously and offer a wide selection for your various applications. Both hermetic and non-hermetic (resin seal) are listed as well as different electrical configurations—L's and A's and Voltages from 50 VDC to 125 VAC.

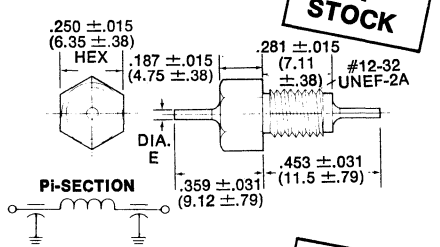
EMI/RFI Suppression Filters
RESIN SEAL

MIL P/N	Capacitance Ref-pf	Rtd. DC Voltage	Rtd. Current (A)	Electrical Circuit	Minimum Insertion Loss (dB) Per Mil-Std 220								A	B	C	E
					100 kHz	1 MHz	5 MHz	10 MHz	50 MHz	100 MHz	200 MHz	1 GHz				
MIL-F-15733/28-0001	1500	100	10	π	—	—	—	—	25	45	60	60	.890	.312	.266	.032
MIL-F-15733/28-0004	25,000	50	10	L-THD	—	10	—	28	—	41	44	60	.890	.312	.266	.040
MIL-F-15733/61-0008	5500	100	10	π	—	—	—	—	50	—	55	70	.500	.312	.266	.032
MIL-F-15733/61-0013	22,000	100	10	L-THD	—	10	22	30	—	50	—	70	.890	.280	.266	.032



8-32 THREAD 3/16 HEX

MIL P/N	Capacitance Ref-pF	Rated Voltage DC	Rated Current (A)	Electrical Circuit	Minimum Insertion Loss (dB) Per Mil-Std 220								E ±.005 (±.13)
					100 kHz	1 MHz	3 MHz	10 MHz	50 MHz	100 MHz	500 MHz	1-10 GHz	
MIL-F-15733/61-0002	1500	200	10	π	—	—	—	—	32	45	70	70	.032 (.81)



12-32 THREAD 1/4 HEX

EMI/RFI Suppression Filters
HERMETIC SEAL

FIG. 1

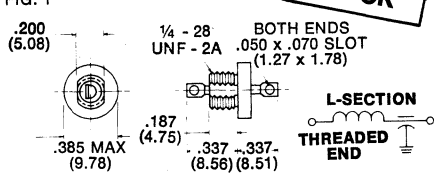
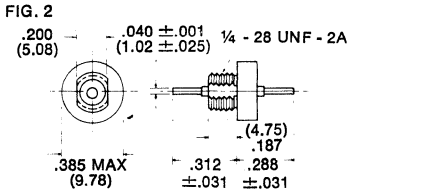
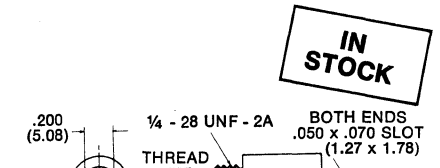


FIG. 2



MIL P/N	Rated Current	Working Volts +125°C	DCR Max. Ω	Reference Capacitance	Insertion Loss (dB) Per Mil-Std-220						
					30 kHz	150 kHz	300 kHz	1 MHz	10 MHz	1 GHz	Fig.
MIL-F-15733/49-0001	15 amps	100 VDC	.01	.68 μf	8	20	28	38	55	70	2
MIL-F-15733/49-0006	15 amps	50 VDC	.01	1.4 μf	15	28	33	44	60	70	1



MIL P/N	Rated Current (Amps)	Filter Circuit	Working Volts 125°C		Max. Voltage Drop	Insertion Loss (dB) Per Mil-Std-220					
			AC	DC		75 kHz	150 kHz	300 kHz	1 MHz	10 MHz	1 GHz
MIL-F-15733/26-0001	1	L-1	125	150	.25	—	13	24	45	80	70
MIL-F-15733/26-0003	1	L-2	125	150	.25	—	13	24	45	80	70
MIL-F-15733/26-0004	3	L-1	125	150	.15	—	8	15	30	68	70
MIL-F-15733/26-0006	3	L-2	125	150	.15	—	8	15	30	68	70
MIL-F-15733/26-0007	5	L-1	125	150	.075	—	8	14	25	58	70
MIL-F-15733/26-0010	5	L-2	125	150	.075	—	8	14	25	58	70

All Feed-thru Capacitors and RFI Filters stocked by MCI are manufactured in the U.S.A. by **Spectrum Control, Inc...**
The world's leading manufacturer of Electro-Magnetic Components. Distributed for Spectrum Control, Inc.

Metuchen Capacitors Inc./139 WHITE OAK LANE/P.O. BOX 499/OLD BRIDGE, N.J. 08857/201-679-3366/FAX 201-679-3222

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
ABS acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CAMAC computer automated measurement and control
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3
KSR keyboard send /receive

L
LC inductance capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIB microcomputer interface board
MIC microwave IC
MIPS million instructions per second
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

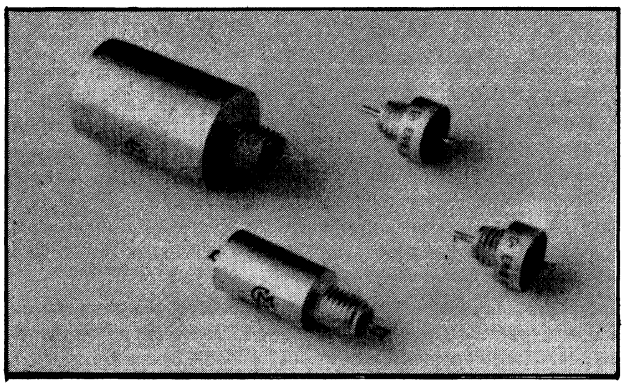
W
WPS word processing software

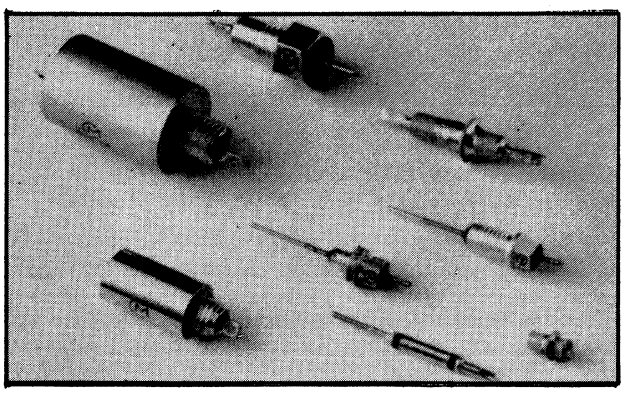
Y
YIG yttrium iron garnet

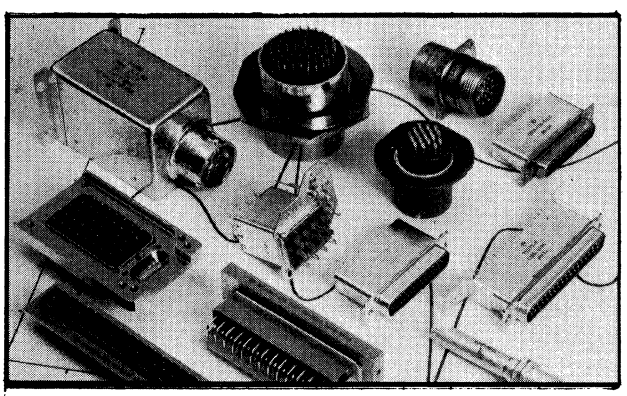
Z
ZIF zero insertion force

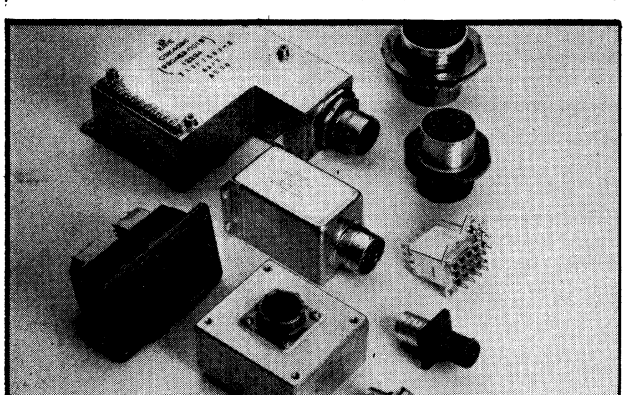
EMI/RFI Filters/Filter Connectors

MURATA ERIE NORTH AMERICA









Murata Erie is an EMI Filter manufacturer dedicated to the design and production of high quality EMI filters and filtering systems for the electronics industry. In-house facilities include a complete design and manufacturing capability for EMI filters, a Quality Assurance System meeting or exceeding the requirements of MIL-Q-9858 and DND-1015, and a fully equipped and qualified calibration laboratory. To compliment this design and manufacturing expertise, Murata Erie has a complete Customer Service and Customer Engineering staff that offers comprehensive customer application assistance.

The products described on this page represent a cross-section of Murata Erie's filter capabilities. Many more styles and variations are also available to meet virtually every industrial and MIL application requirement. For additional information or application assistance, contact your local Murata Erie Sales Office or our Customer Engineering Departments in Trenton, Ontario, Canada at 613-393-2581.

Coaxial Filters

Murata Erie offers a wide selection of coaxial feed-thru EMI/RFI filters in T, L, and P circuit configurations. These filters meet MIL-F-15733. Also offered is a complete line of coaxial AC line filters for 125/240 VAC systems from 60 to 400Hz. A wide selection of units meeting MIL-F-15733 are also available in the line.

Pi Section Filters

Murata Erie produces an extensive range of Pi section EMI filters in both bushing mount and solder in styles. Consisting of two grounded capacitors around a series inductor, the Pi filters enable the designer to realize 60dB/decade of attenuation across the desired range of frequencies. It is the multiple element nature of the Pi circuit that results in the sharp gradient of the insertion loss curve from the cut-off frequency up. A wide selection of filters meeting MIL-F-15733 are included in this line.

Filter Connectors

Murata Erie having been the leader in the EMI filter industry for 50 years, has now expanded its filter-connector line in order to offer you the same unsurpassed high quality product in many connector packages. Because of Murata Erie's unique position in this market, that of being the only filter connector house having complete in-house ceramic capability, we can offer combinations of capacitance values and voltage ratings available no where else in the industry.

Filter connectors meeting MIL-C-26482, 38999, 81659, 83733 and 24308 are included – also, "Tempest" power line filters.

Custom Designed Filter Networks

Murata Erie specializes in developing sophisticated circuit designs and creating high component density packaged networks. Our engineering design teams analyze individual customer problems, design specific components or networks to solve the problem, build prototypes and test the complete system.

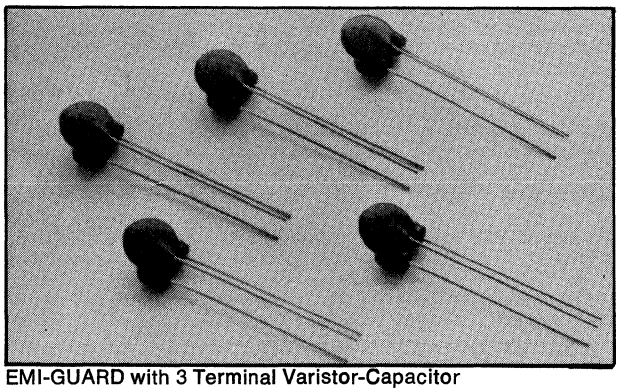
The reliability of every component and network is assured by a comprehensive battery of tests performed under carefully controlled conditions. Then, in-line prototype techniques further validate component performance prior to volume production.

These technical support activities permit Murata Erie to respond to customer needs promptly and efficiently with postitive performance engineered into the customer's system.

MURATA ERIE NORTH AMERICA 2200 Lake Park Dr., Smyrna, Georgia 30080 Tel: (404) 436-1300 Telex: 54-2329 TWX: 810-766-1531

EMI/RFI suppression filters

MURATA ERIE NORTH AMERICA



EMI-GUARD with 3 Terminal Varistor-Capacitor

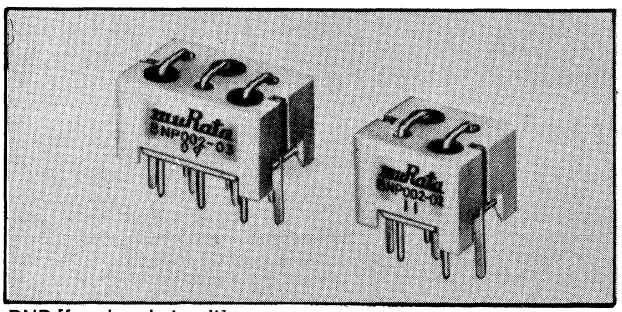
EMI-GUARD DSS710, D 223S 12-22

The DSS710 EMI-GUARD uses a new capacitor element which provides the varistor function. This varistor-capacitor not only works as a bypass capacitor but also lets most high-voltage surges flow to ground.

The varistor-capacitor used in the DSS710 EMI-GUARD has a 3-terminal structure so that its high frequency functions are substantially better than those of conventional capacitors. Furthermore, it is combined with ferrite beads to form a T-shaped filter circuit that more effectively dampens noise.

The DSS710 EMI-GUARD efficiently removes quick-rising surges and high-frequency noise above 50 or 60 MHz which conventional capacitors and varistor-capacitors are incapable of removing.

Varistor capacitors are used even where EMI filters fail. They are self-healing and effective in circuits having 500–600V impulses.

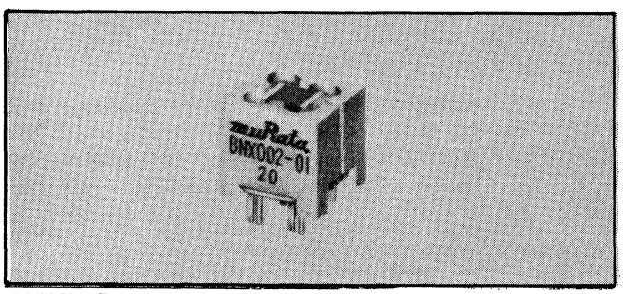


BNP [for signal circuit]

Block Type EMIFIL®, BNP/BNX Series

Murata Erie's new block type EMIFIL BNP/BNX Series completely eliminates noise from extremely wide frequency bands. The BNX is perfect for use in DC power circuits, while the BNP is ideal for eliminating noise in logic signal circuits. Both are designed to perform superbly—the result of Murata Erie's wide expertise in the fields of through-type barrier layer capacitors, monolithic chip capacitors and bead inductors.

Each blcok contains a number of compact EMI-suppression filters. In addition, the input/output terminals and the grounding terminal are aligned in the same direction, thus permitting fast and easy assembly on any type of P.C. board.



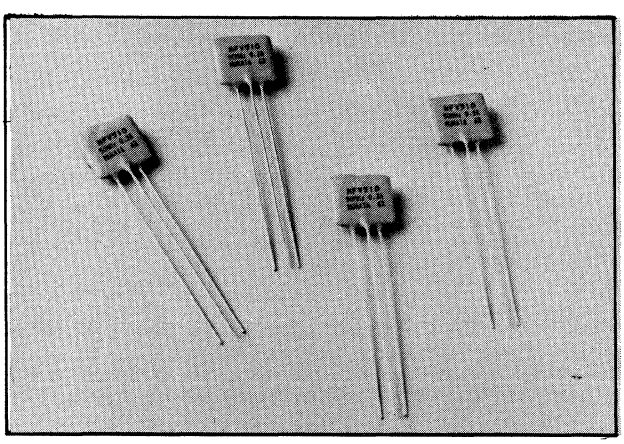
BNX [for DC power supply]

Signal Line Noise Filter, NFV510 Series

The NFV510 series signal line EMIFIL is an efficient noise suppression filter for high-speed digital signal lines where the frequencies of signal components and noise components are very close.

Murata Erie has combined its superior inductor and capacitor technologies with a unique circuit configuration to realize outstanding noise suppression effects.

NFV510 Series EMIFILs meet the noise suppression regulations of FCC, CISPR, and other agencies.

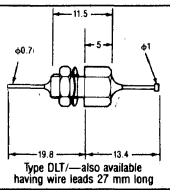
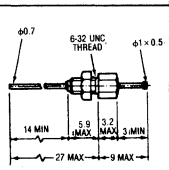
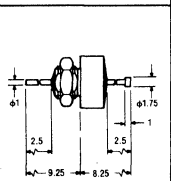
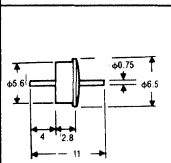
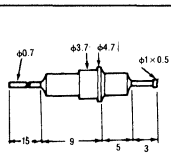
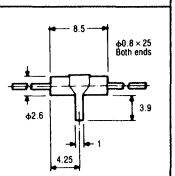


NFV510 series

MURATA ERIE NORTH AMERICA 2200 Lake Park Dr., Smyrna, Georgia 30080 Tel: (404) 436-1300 Telex: 54-2329 TWX: 810-766-1531

OXLEY RFI SUPPRESSION FILTERS

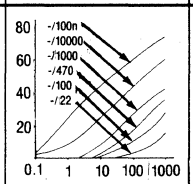
OXLEY SPECIALIZES IN THE DESIGN AND MANUFACTURE OF MILITARY FILTERS— STANDARD, CUSTOM, DISCRETE OR IN ARRAYS.

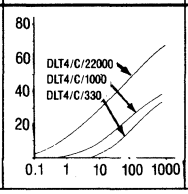
PRODUCT GUIDE	CHASSIS MOUNTING STYLES			SOLDER MOUNTING STYLES		PCB MOUNTING
Series	DLT/—/Ref 1	DLT4/L/—	DLT2/L/—	dBZ/—/Ref 1	SLT/P/—	SLT/P/—/PC2
Configuration		Threaded End	Threaded End			
Construction	Discoidal Monolithic Capacitor	L—C Filter Discoidal Capacitor	L—C Filter Discoidal Capacitor	Discoidal Monolithic Capacitor	Pi-Filter Tubular Capacitor	Pcb mounting Tubular pi-filter
Outline Dimensions (mm)	 Type DLT/—also available having wire leads 27 mm long					
Mounting Hole	4.6mm dia.	3.6mm dia.	6.0mm dia.	5.6mm dia.	3.7mm dia.	—
Capacitance	22pF to 0.1μF in 11 values	300pF to 22000pF in 6 values	1.2μF	22pF to 0.1μF in 11 values	680, 1500 5000pF	1500pF
Rated Voltage	100 Vd.c. (0.1μF:50 Vd.c.)	200 Vd.c.	50 Vd.c.	100 Vd.c. (0.1μF:50 Vd.c.)	200 Vd.c.	200 Vd.c.
Direct Current Rating	10A	10A	15A	10A	10A	10A
Climatic Category	40/100/21	55/125/21	55/125/21	40/100/21	40/85/04	40/85/21
Insulation Resistance	>3000Mohm	>10,000Mohm	>100Mohm	>5000Mohm	>10,000Mohm	>10,000Mohm

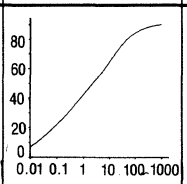
Typical insertion Loss (dB) (50Ω system) per MIL-STD-220A

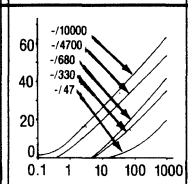
MHz	470	680	1000	10000pF	680	4700	10000pF	1.2μF	47	330pF	680	1500	5000pF	1500pF
0.01	—	—	—	—	—	—	—	9	—	—	—	—	—	—
0.10	—	—	—	1	—	—	1	28	—	—	—	—	—	—
1	—	—	—	8	—	3	8	47	—	—	—	1	4	1
10	3	4	9	27	4	21	28	58	—	2	4	12	25	22
100	20	22	27	44	24	38	48	85	5	18	35	50	70	40
1000	40	40	40	63	38	56	70	90	20	34	70	75	75	—

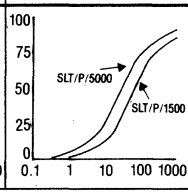
Insertion Loss (dB) vs. Frequency (MHz) db ↑ → MHz

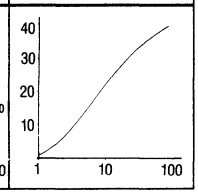






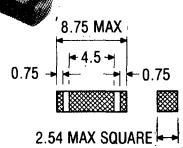






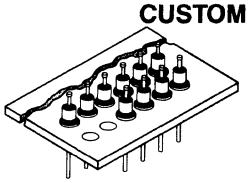
Military Approvals	Listed in QPL 15733, Approval in Progress MIL-F-28861	See Oxley In Product Section B•2440, MIL Components (Page B•1013)
Voltage Conditioning	Where required voltage conditioning (burn-in) is available in accordance with military specifications. Please contact our Technical Sales Department for further details.	

SURFACE MOUNTING PI-FILTER



TYPE SLT/P/1500/SM1
Designed for direct mounting to circuit boards, OXLEY surface mounting pi-section filters are leadless devices offering high insertion loss over a wide frequency range.

CUSTOM FILTER ARRAYS

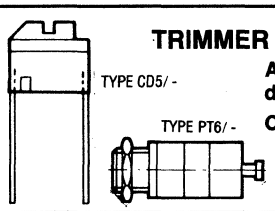


With multi-way feed-through arrays; each feed-through may be customer selected from a range of pi-filters, filter capacitors, unfiltered lead-throughs and grounding terminals.

HIGH STABILITY INDUCTORS

Featuring a precious metal alloy fired to a high purity alumina former, to provide high Q and long term stability.
Inductance range:
.045μH to 1.830μH

TRIMMER CAPACITORS



Air, TFE and ceramic dielectrics
Capacitance ranges:
1.2pF to 40pF

OXLEY INC., 25 BUSINESS PARK DRIVE, PO BOX 814, BRANFORD, CT 06405
TWX. 910-350-6660 • FAX (203) 481-6971 • TEL. (203) 488-1033

PICONICS

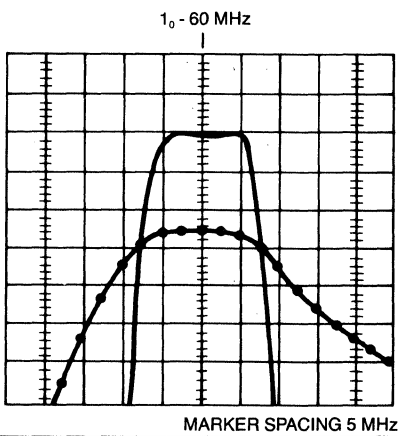
L/C FILTERS

PICONICS is a pioneer in the development of Magnetic Hybrid Components, circuits and Filters. Our 20,000 square foot facility features modern ultra clean production, inspection, and storage facilities. Our on site test and environmental laboratory, includes x-ray, shock, vibration, hermeticity, etc to satisfy necessary military and commercial testing requirements.
We will design and optimize your filter requirements using sophisticated computer programs. Our designs are computer analyzed and optimized prior to assembly. Tuning and testing are achieved with the latest precision equipment.

MINIATURE HYBRID BUTTERWORTH BANDPASS FILTER

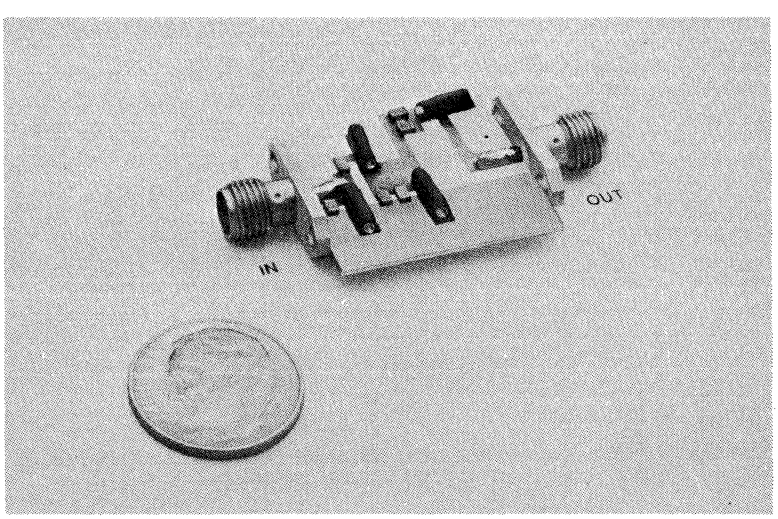
FILTER TYPE	BANDPASS
Filter Characteristic	Butterworth
Number of Poles	4
Center Frequency	60 MHz
Bandwidth −3 dB	30 MHz
Insertion Loss	0.5 dB
Group Delay	25 nsec

PHOTO SCALE	
TOP TRACE	BOTTOM TRACE
Freq Vs Ampl (dB)	Freq Vs Ampl (dB)
Vertical: 1 dB/Div	10 dB/Div
Horizontal: 10 MHz/Div	10 MHz/Div



CONSTRUCTION

CHIP INDUCTORS
AND CAPACITORS
MOUNTED ON
AN ALUMINA SUBSTRATE



L/C filters are specified in either the Frequency or the Time Domain. Frequency Domain filters emphasize passband ripple and stop-band attenuation. Butterworth, Chebyshev, and Elliptic Function filters are included in this category. Time Domain filters emphasize the time-amplitude domain characterized by phase linearity and constant group delay. Bessel, Gaussian and other linear phase designs are included in this category.
Low-pass, Hi-pass, Band-pass, and Band-reject designs are available in frequency ranges to 400 MHz. Special Low-pass and Band-pass filters have been achieved featuring notches placed at desired frequencies in the stop-band to further attenuate undesired or spurious signals.
For those filter applications where size and weight are the prime consideration, PICONICS offers a line of chip inductor-capacitor designs. Low-pass, High-pass, and Band-pass types mounted on alumina substrates are available. For example, a three pole filter has been assembled on a .250 in. sq. substrate. Overall package height is determined by orientation and size of the chip inductors. To meet environmental military applications, filter networks are packaged in metal shielded cases with r.f. connectors. Printed circuit and end terminals are also available. Epoxy encapsulation is optional. For units assembled with chip inductors and capacitors on alumina/ ceramic substrates, shield covers are optional. This is usually determined by the environment surrounding the device.

CALL OR WRITE
FOR COMPLETE
CATALOG AND FOR DESIGN/
APPLICATION ENGINEERING
SUPPORT.

See Section 1800 pg **A•1302** for your INDUCTOR requirements and Section 3130 pg **A•1770** for HYBRIDS.

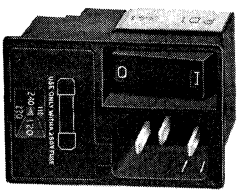
PICONICS, INC. 26 CUMMINGS ROAD, TYNGSBORO, MA 01879 • TEL: (508) 649-7501 • TELEX: 754759 • FAX: 508-649-9643

Power Dynamics, Inc.

P.O. Box 539, 59 Lakeside Avenue, West Orange, NJ 07052 • (201) 736-5722 • FAX: (201) 736-8930 • Telex: 666173 (PDI)

RFI/EMI Filtered Power Entry Modules

HGN-341



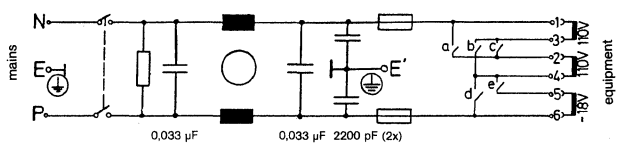
HGN-341 power modules feature IEC Connector, two pole on/off switch, fuse holder that accepts both European 5 x 20mm or 3 AG fuses and a voltage selector with four different voltages. The voltage selector is designed to provide a simple means to change transformer primary connections.
This high performance filter module saves labor cost, is compact and protects electronic equipment from common mode and differential mode interferences.

UL CSA VDE SEV

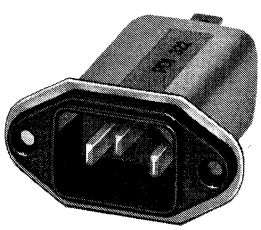
Technical data

Operating voltage	250 V / 50 Hz 110 V / 60 Hz
Rated current	1 A / 2 A / 3 A / 4 A / 6 A
Leakage current	<0,5 mA / 250 VAC
Temperature range	−25° C — +85° C
Test voltage (VDE 0565)	1,8 kV / 50 Hz — 2 s

Circuit



HGN-322



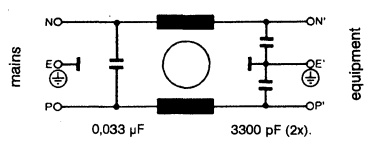
The filter series HGN-322 are designed for optimal results and have a short case-length. Common mode and differential mode noise is attenuated beginning at the low frequency range up to 30MHz. Among other uses these filters protect electronic devices with microprocessors against malfunction.

UL CSA VDE SEV

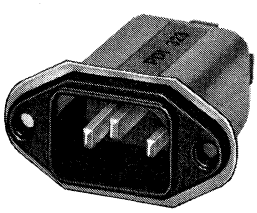
Technical data

Operating voltage	250 V / 50 Hz 110 V / 60 Hz
Rated current	1 A / 3 A / 6 A
Leakage current	<0,5 mA / 250 VAC
Temperature range	−25° C — +85° C
Test voltage (VDE 0565)	1,8 kV / 50 Hz — 2 s

Circuit



HGN-323



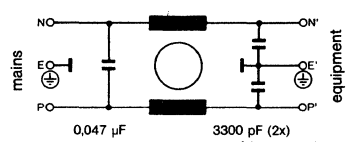
HGN-323 is a general purpose filter designed to provide RFI control of line to ground noise in equipment such as computers, terminals and office equipment. This compact design (1.35 case length)) meets low leakage current VDE and SEV requirements for portable equipment.

UL CSA VDE SEV

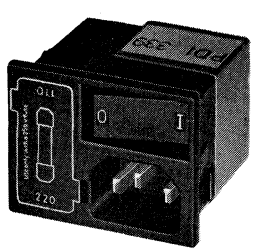
Technical data

Operating voltage	250 V / 50 Hz 110 V / 60 Hz
Rated current	1 A / 3 A / 6 A
Leakage current	<0,5 mA / 250 VAC
Temperature range	−25° C — +85° C
Test voltage (VDE 0565)	1,8 kV / 50 Hz — 2 s

Circuit



HGN-339



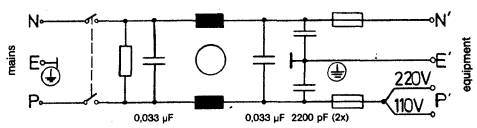
HGN-339 line filter module features a combination IEC Connector, two pole on/off switch and fuse holder that accepts both European 5 x 20mm and 3 AG fuse in-line and/or neutral. In addition the HGN-339 features an integral voltage selector. It is designed for use in equipment intended for export enabling fast change and other mains voltages.

UL CSA VDE SEV

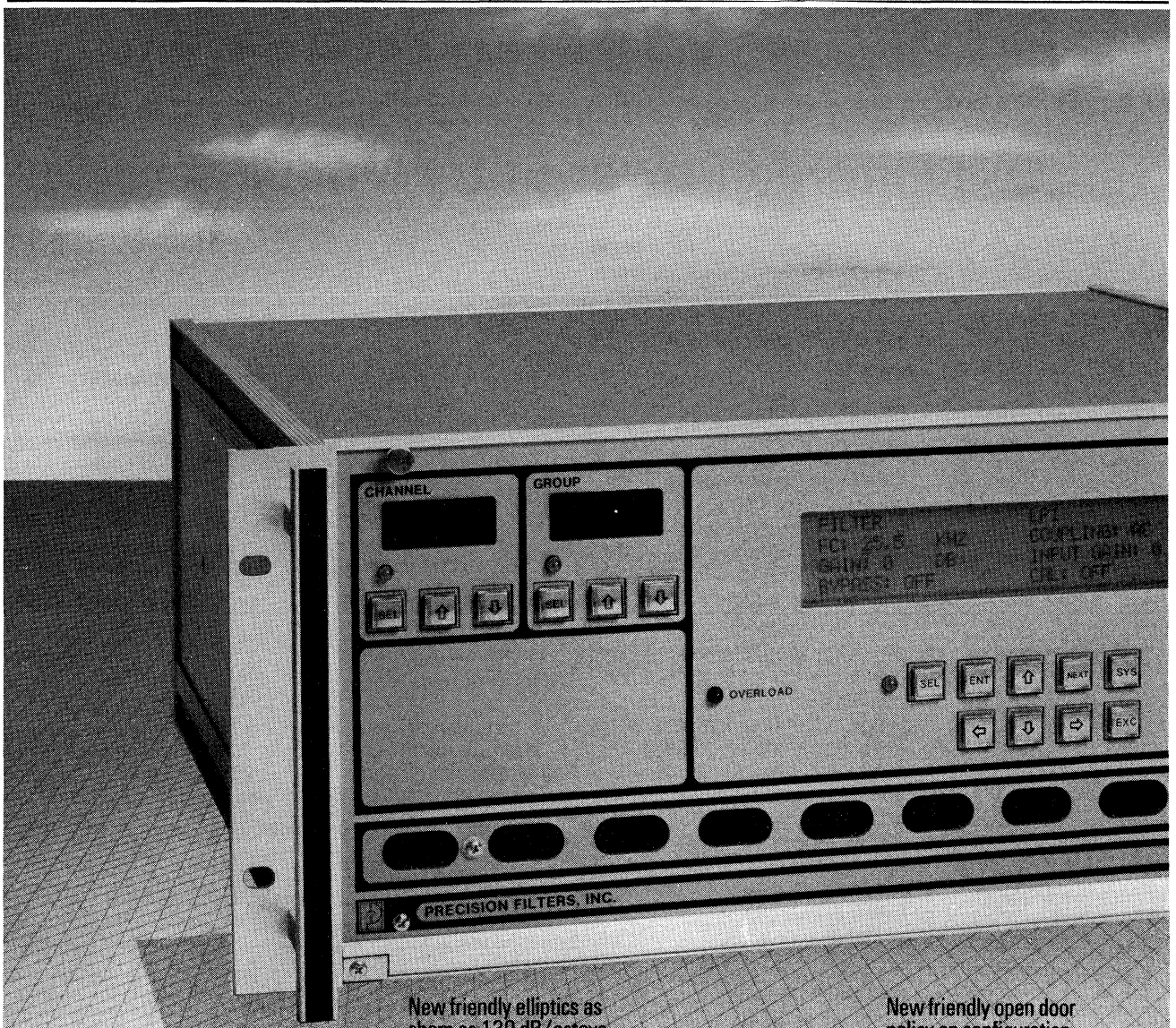
Technical data

Operating voltage	250 V / 50 Hz 110 V / 60 Hz
Rated current	1 A / 2 A / 3 A / 4 A / 6 A
Leakage current	<0,5 mA / 250 VAC
Temperature range	−25° C — +85° C
Test voltage (VDE0565)	1,8 kV / 50 Hz — 2 s

Circuit



Refer to our page in the Connector section for additional Power Dynamics Filter Entry Modules.



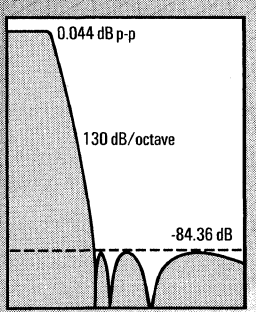
Friendly new 1 MHz filter

We have a tradition of leading the way to higher frequency filters.

Now, we announce the industry's first 1 MHz bandwidth filters for programmable use. 80 dB/octave attenuation. Time delay superior to Bessel. It's the friendly advance you've asked for.

New friendly elliptics as sharp as 130 dB/octave

Precision was first to offer elliptics with 80 dB/octave attenuation. Now, we're first to add the sharper option of 130 dB/octave for frequencies up to 255 kHz.



Passband ripple is 0.044 dB p-p, and there's 1° phase match up to the cutoff frequency.

Filters are offered in a wide variety of types that you can mix or match within the 16 card capacity of the new Precision 6000 mainframe. Filters come one, two or four channels per card, depending on resolution and other performance features.

Friendly is extending your choice to match needs and budget precisely.

New friendly open door policy on configuration

Not only can you mix various types of filters, you can also add a variety of preamps, postamps and gain-ranging amplifiers, as well as frequency band translators. And to that, you can soon add such input conditioning as strain, charge and voltage.

It's a simple matter to select the hardware building blocks. It's simple to configure their control for convenient operation. It's also simple to modify and add to your system as requirements change.

The Precision 6000 starts system friendly and stays system friendly.

WORLD'S FIRST SYSTEM FRIENDLY CONDITIONERS

Now, you can integrate filters, amplifiers, frequency band translators and other signal conditioners *your* way in *your* system about any way *you* wish. You can do it as never before. We've gone beyond user friendly and created system friendly. That's new Precision 6000.

Now, custom systems at friendly off-the-shelf prices

Yesterday's custom systems are configured with today's standard hardware and software. Yesterday's unaffordable becomes very affordable today. Tomorrow's new instruments will operate in today's mainframe. That's system friendly with futures.

Friendly language brings down old barriers

No longer do you have to be concerned about the programming idiosyncrasies of a number of instruments. All Precision 6000 asks is familiarity with a few basics.

You set up from the Precision 6000 front panel with prompting and cuing from its program. You string your set-ups together for the test routine required. One command uploads set-ups to the host computer.

Friendly is letting you all but forget programming, so you can concentrate on measurement problems.

More innovation from the leader

We're adding all the advances announced here to the features Precision has introduced over the last decade. 80 dB/octave attenuation, time delay superior to Bessel, 1° phase match, choice of serial, parallel or GPIB computer interfaces, for example. That's system friendly indeed.

Call friendly 607-277-3550.

Call or write for all the details on Precision 6000 or for our new filter brochure. Telex 646846.

PRECISION FILTERS, INC.
240 Cherry Street, Ithaca, New York 14850

SYSTEM FRIENDLY FILTERS

You asked for higher frequencies, and we now offer a 1 MHz filter. You asked for sharper cutoffs, and we now provide elliptics with 130 dB/octave attenuation for frequencies up to 204.7 kHz. You asked, and we've packed more performance with greater density. We welcome you to the friendliest array of high performance filters ever offered.

You want analog data to come clean before digital conversion.

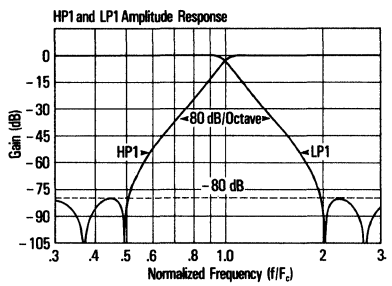
We keep extending your choice of friendly Precision HP, LP, TD, BP, BR, notch, ⅓ octave and anti-alias filters.

All are programmable. Time delay filters superior to Bessel. Elliptics now come as sharp as 130 dB/octave. Frequencies can range as high as 1 MHz. All Precision filters offer the option of fixed frequencies for economy. All have phase match of 1° or better.

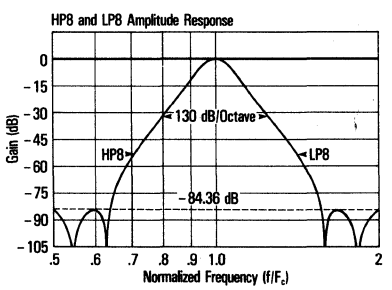
Individually, they provide different cost-performance parameters and options to provide the friendly system you need.

A filter for every need

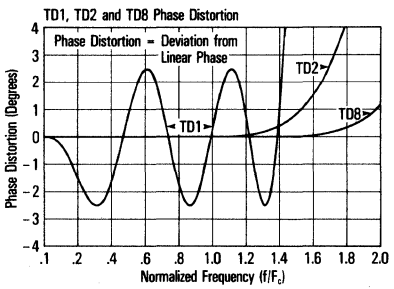
For the frequency domain, there are Cauer (elliptic) high-pass and low-pass filters. The HP1 and LP1 have 0.1 dB p-p pass-band ripple and 80 dB stop-band attenuation with 80 dB/octave attenuation

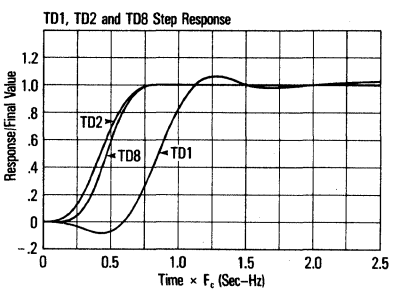


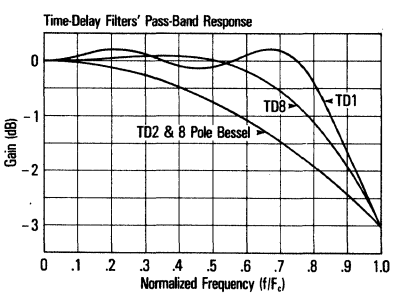
slope. The HP8 and LP8 have 0.044 dB p-p pass-band ripple and 84 dB stop-band attenuation with 130 dB/octave attenuation slope.



For the time domain, there are the TD1, TD2 and TD8 time delay filters — three friendly choices with different trade-offs of phase linearity, transient response and amplitude response. Data shown in these three graphs help select the best time delay filter for your application.

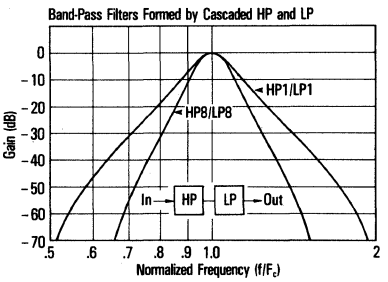




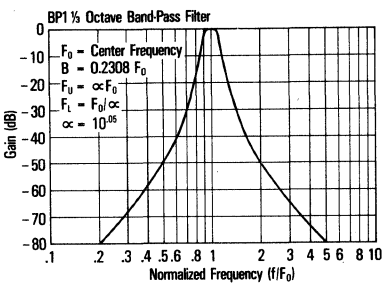


In any case, you get a tightly controlled elliptic or linear phase filter with phase match better than 1° and usually better than ½ °.

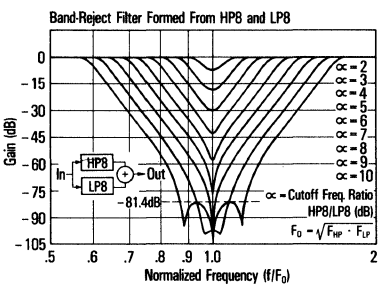
For band-pass operation, cascade a high-pass and low-pass



filter to form a band-pass filter. Or use our BP1 one-third octave band-pass filter



For band-reject operation, parallel the inputs of a high-pass and



low-pass filter and add their outputs to form a band-reject filter.

For tough anti-alias applications, use LP8 filters to provide 80 dB of attenuation at 1.56 times the cutoff frequency.

For lowest cost solutions, we provide fixed frequency filters with blank front panel and no control module.

PRECISION FILTERS, INC.
240 Cherry Street, Ithaca, New York 14850, Tel. 607-277-3550

† See other products in Section 1100.

SYSTEM FRIENDLY FILTERS

Filter Card Selection Guide

	6032	6064B	6602A	6604	6611	6612
Number of channels per system	32	64	32	64	16	32
Number of channels per card	2	4	2	4	1	2
Maximum cutoff frequency (Hz)	102.3k	12,750	204.7k	25,575	1M	204.7k
Minimum cutoff frequency (Hz)	0.32	1.6	0.1	0.1	100	0.1
Phase match (degrees maximum)	1	2	1	1	1 & 3**	1
Amplitude accuracy (dB)	0.1	0.1	0.05	0.1	0.1 & 0.25**	0.1
Cutoff accuracy (%)	¼	1	¼	¼	½	¼
Steps in decade	1000	200	100	100	100	100
Bits in a range	10	8	10	8	7	10
Filters	HP1 LP1 LP2 TD1 TD2	HP1 LP1 LP2 TD1 TD2	HP1 LP1 TD1 TD2 —	HP1 LP1 TD1 TD2 —	HP1 LP1 TD2 — —	HP8 LP8 TD8 — —

* With Option E ** 3° and 0.25 dB on high range

Filter Selection Guide

	HP1	LP1	LP2	TD1	TD2	TD2	HP8	LP8	TD8
Filter type	HP	LP	LP	LP	LP	LP	HP	LP	LP
Function	Cauer	Cauer	Cauer	*	Bessel	Bessel w/zeros	Cauer	Cauer	**
Number of poles, zeros	6p,6z	6p,6z	6p,6z	6p,6z	6p	6p,6z	8p,6z	8p,6z	8p,8z
Pass-band ripple (dB p-p)	0.1	0.1	0.1	0.34	—	—	0.044	0.044	0.2
Pass-band frequency	$1.081F_C$	$0.925F_C$	F_C	$0.769F_C$	—	—	F_C	F_C	$0.569F_C$
Cutoff freq. amp. (dB)	−3.01	−3.01	−0.1	−3.00	−3.01	−3.985	−0.044	−0.044	−3.01
Cutoff freq. phase (degrees)	+358.5	−358.5	−296.7	−305.6	−154.9	−154.9	+410.2	−410.2	−301.88
Stop-band frequency	$0.508F_C$	$1.971F_C$	$1.743F_C$	$3.225F_C$	—	$3.686F_C$	$0.637F_C$	$1.569F_C$	$3.335F_C$
Stop-band attenuation (dB)	80.07	80.07	67.79	70	—	70.14	84.36	84.36	80.28
Attenuation slope (dB/oct.)	81.8	81.8	96.9	41.4	36	37.3	130	130	46.20
1% Settling time (Secs)	$5.21/F_C$	$4.64F_C$	$5.25/F_C$	$2.99/F_C$	$0.719/F_C$	$0.765/F_C$	$9.2/F_C$	$7.11/F_C$	$1.54/F_C$
Zero frequency group delay (Secs)	—	$0.687/F_C$	$0.606/F_C$	$0.849/F_C$	$0.43/F_C$	$0.43/F_C$	—	$0.8203/F_C$	$0.843/F_C$
Rise Time	—	$0.516/F_C$	$0.484/F_C$	$0.379/F_C$	$0.352/F_C$	$0.4/F_C$	—	$0.543/F_C$	$0.383/F_C$

* Equi-ripple phase (±2.5° phase ripple) with 6 zeros. ** Maximal flat time delay with 6 stop-band zeros & 1 pair of pass-band zeros.

Option Selection Guide

OPTION	6032	6064B	6602A	6604	6611	6612
AC coupling, S.E. input	—	—	1	1	1	1
AC coupling, Diff. input	—	—	2	2	2	2
Unbalanced differential input	3	3	—	—	—	—
Differential input	14	14A	D	D	D	D
Programmable ac/dc, S.E. input	20	—	5	5	5	5
Programmable ac/dc, Diff. input	—	—	6	6	6	6
Switched ac/dc coupling	18*	—	—	—	—	—
AC coupled output	—	—	—	—	3	—
Output sense	—	—	4*	4*	0	4*
Differential output	—	—	T	T	T	T
Fixed Diff. input gain (1-10)	8	—	8	8	8	8
Fixed S.E. input gain (1-10)	7	7	7	7	7	7
Switched input gain	17*	—	—	—	—	—
Prog. input gain, 1/10 dB	21*	—	—	—	—	—
Special programmable gain	—	22	—	—	—	—
Prog. S.E. pre-filter gain 0 to 40 dB in 10 dB steps	—	—	A1	A1	—	A1
Prog. Diff. input gain 0 to 40 dB in 10 dB steps	—	—	A2	A2	—	A2
Programmable gain						
−9.9 to 20 dB in 0.1 dB steps	—	—	G	G	—	G
0.5 to 12.75 in 0.05 steps	G	—	—	—	—	—
0 to 30 dB in 2 dB steps	—	G2	—	—	G	—
0 to 45 dB in 3 dB steps	—	G3	—	—	—	—
−12 to 48 dB in 4 dB steps	—	G4	—	—	—	—
0 to 60 dB in 5 dB steps	—	G5	—	—	—	—
Change F_C range	6	6	XF	XF	XF	XF
Delete F_C range	16	16	—	—	—	—
Extra digit of F_C resolution	—	—	—	—	—	—
Low frequency range	—	—	—	—	—	—
Filter bypass	11**	11**	B*	B*	B	B*
Calibration input	—	C	C	C	C	C
Output monitor	M**	M**	M	M	M	M
Overload detector	—	—	O	—	—	O
Programmable Zero Suppress			Z			Z
Current Driver for ICP Transducer			9	9		9

*, ** Only one option allowed

PRECISION FILTERS, INC.
240 Cherry Street, Ithaca, New York 14850, Tel. 607-277-3550

† See other products in Section 1100.

SYSTEM FRIENDLY FILTERS

Filter building blocks

Precision offers a wide variety of filters to meet a wide range of performance-cost requirements.

Precision 6032

- 3 digit frequency resolution
- Two filters per card
- 80 dB/octave attenuation slope
- Your choice of HP1, LP1, LP2, TD1, TD2 filters
- Programmable gain 0.5 to 12.75 in 0.05 steps
- Frequency range, 3200:1
- Maximum frequency, 102.3 kHz
- Minimum frequency, 0.32 Hz

Model number	Freqenucy range (Hz)	Cutoff frequencies (Hz) Step size (Hz)				
		0.01	0.1	1	10	100
6032-1	32-102.3k	—	—	32-1.023k	1.03k-10.23k	10.3k-102.3k
6032-2	3.2-10.23k	—	3.2-102.3	103-1.023k	1.03k-10.23k	—
6032-3	0.32-1.023k	0.32-10.23	10.3-102.3	103-1.023k	—	—

Precision 6064B

- Four filters per card
- 80 dB/octave attenuation slope
- Your choice of LP1, LP2, HP1, TD1, TD2 filters
- Programmbale gain G2: 0 to 30 dB in 2 dB steps, G3: 0 to 45 dB in 3 dB steps, G4: −12 to 48 dB in 4 dB steps, G5: 0 to 60 dB in 5 dB steps
- Frequency range, 160:1
- Maximum frequency, 12.75 kHz
- Minimum frequecny, 1.6 Hz

Frequency range (Hz)		Step size (Hz)	Range and step multiplier, Model 6064B-?-LP1					
Reduced performance	Specified performance		? = 4	5	6	7	8	9
—	105-1275	5	10	—	—	1	—	—
1-7	8-100	1	10	—	—	1	—	—
—	128-510	2	—	10	—	—	1	—
—	50.5-127.5	0.5	—	10	—	—	1	—
—	12.8-50.0	0.2	—	10	—	—	1	—
0.1-3.1	3.2-12.7	0.1	—	10	—	—	1	—
—	64-255	1	—	—	10	—	—	1
—	20.5-63.5	0.5	—	—	10	—	—	1
0.1-1.5	1.6-20.0	0.1	—	—	10	—	—	1

Precision 6602A

- Two filters per card
- 80 dB/octave attenuation slope
- Your choice of LP1, HP1, TD1, TD2 filters
- Programmable gain
  Option A: Input gain 0 to 40 dB in 10 dB steps
  Option G: Output gain −9.9 to 20.0 dB in 0.1 dB steps
- Frequency range, model 6602-A; 204,700:1, models 6602-B/C 102,300:1
- Maximum frequency, 204.7 kHz
- Minimum frequency, 0.1 Hz

Model number	Low range (Hz)			High range (Hz)		
	Min	Max	Step	Min	Max	Step
6602A-A	1	2047	1	2.1k	204.7k	100
6602A-B	1	1023	1	1.1k	102.3k	100
6602A-C	0.1	102.3	0.1	110	10.23k	10
6602A-E	0.1	204.7	0.1	210	20.47k	10

Precision 6604

- Four filters per card
- 80 dB/octave attenuation slope
- Your choice of LP1, HP1, TD1, TD2 filters
- Programmable gain
  Option A: Input gain 0 to 40 dB in 10 dB steps
  Option G: Output gain −9.9 to 20 dB in 0.1 dB steps
- Frequency range, model 6604-A; 25,575:1, model 6604-B: 102,300:1
- Maximum frequency, 25,575 kHz
- Minimum frequency, 0.1 Hz

Model number	Low range (Hz)			High range (Hz)		
	Min	Max	Step	Min	Max	Step
6604-A	1	1023	1	1025	25.575	25
6604-B	0.1	102.3	0.1	110	10,230	10

Precision 6611

- Maximum frequency, 1 MHz
- 80 dB/octave attenuation slope
- Your choice of HP1, LP1, TD2 filters
- Programmable gain, 0 to 21 dB
- Frequency range, 12,700:1
- Minimum frequency, 100 Hz
- One filter per card

Model number	Frequency range (Hz)	Cutoff frequencies (Hz), Step size (Hz)		
		100	1000	10k
6611-A	100-1.27 M	100-12.7k	13k-127k	130k-1.27 M

Precision 6612

- 130 dB/octave attenuation slope
- Your choice of LP8, HP8 or TD8 filters
- Frequency range, 204,700:1
- Maximum frequency, 204.7 kHz
- Minimum frequency, 0.1 Hz
- Phase match (maximum), 1°
- Amplitude accuracy, 0.1 dB
- Two filters per card
- Programmable gain
  Option A: Input gain 0 to 40 dB in 10 dB steps
  Option G: Output gain −9.9 to 20.0 dB in 0.1 dB steps

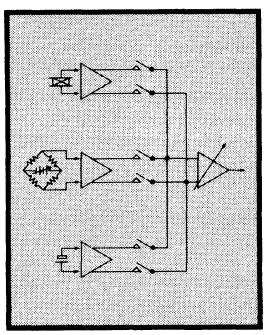
Model number	Low range (Hz)			High range (Hz)		
	Min	Max	Step	Min	Max	Step
6612-A	1	2047	1	2.1k	204.7k	100
6612-B	1	1023	1	1.1k	102.3k	100
6612-C	0.1	102.3	0.1	110	10.23k	10
6612-E	0.1	204.7	0.1	210	20.47k	10

† See other products in Section 1100.

PRECISION FILTERS, INC.
240 Cherry Street, Ithaca, New York 14850, Tel. 607-277-3550

THE MULTIMODE CONDITIONER

PRECISION 316/416



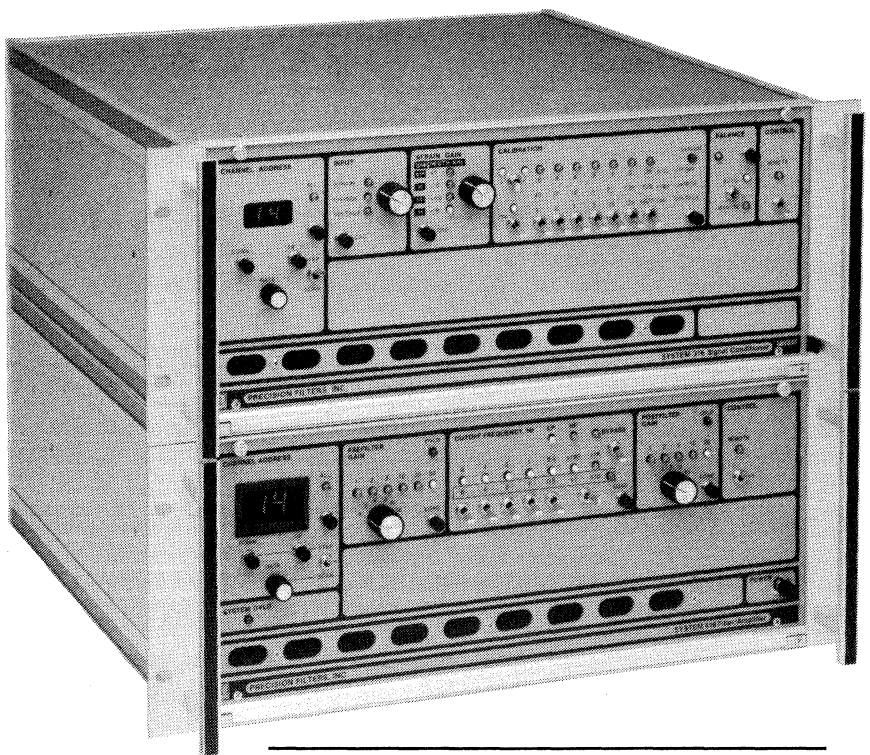
The Precision 316 gives you 16 channels, each with a choice of three types of conditioners—strain, charge and voltage.

To that, we add the Precision 416, which is 16 channels of filter-amplifier. (Detailed information on pages 3-5.)

With the combined Precisions 316/416, you have what you need at your fingertips; calibration, signal selection, auto-balance of strain gages, as well as filter and gain settings.

Human error is prevented and the setup goes quickly, because all these functions are programmable.

Precision 316/416 Conditioners are at work on ballistic ranges, vehicle proving grounds, as well as in structural and vibration testing for large equipment.



In 14″ Of Rack Space You Get:

- 16 programmable charge amplifiers with calibration.
- 16 programmable strain gage amplifiers with auto-balance and calibration; 255 calibration states, which cover numerous gage resistances.
- 16 isolated strain gage excitation supplies: ± 15 V @ 100 mA
- 16 programmable voltage amplifiers: gain 1-1000.
- 16 programmable anti-alias filters: 80 dB/octave attenuation.
- Programmable calibration for every function.
- 16 programmable 1-of-4 balanced input switches that permit selection of charge, strain, voltage or cal signals.

† See other products in Section 1100.

PRECISION FILTERS, INC.

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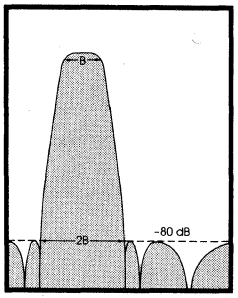
PRECISION 1776 FREQUENCY-BAND TRANSLATORS



SPECTRUM SLICER

Precision System 1776 is the industry's first multi-channel programmable frequency-band translator for signal conditioning.

It draws heavily on our advanced filter technology to provide usefulness not previously associated with frequency-band translators for applications like these:

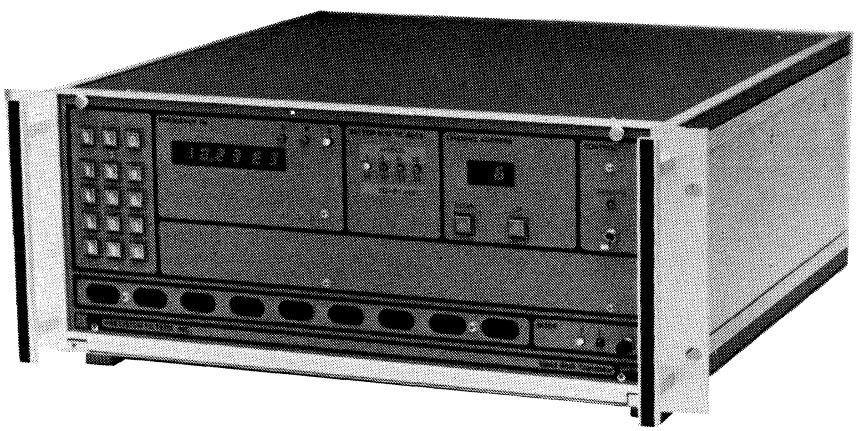
- Super bandpass filter.
- Analog zoom for spectrum analysis, modal analysis and beam forming.

The Precision 1776 cuts far more sharply than any conventional bandpass filter can.

In fact, it's nearly perfect. The system translates band center frequency to zero, passing the signal band through sharp low-pass filters to obtain 80 dB/*bandwidth-octave* skirts. Q's can go higher than 10,000.

From there, the instrument can translate back to the starting band, acting as a super bandpass filter. Or it can translate to any other part of the spectrum.

Configured as a super bandpass filter, the Precision 1776 can have up to eight channels.



SUPER ZOOMER

The Precision 1776 translator also can zoom in to make existing equipment do more work.

Ahead of an FFT spectrum analyzer, the analog zoom extends frequency range while making possible much finer resolution.

For modal analysis and beam forming, the 1776 discards unwanted noise and lowers the sampling frequency. As a result, old limits for computer speed, memory and AD conversion rates are overcome. Sampling rates can be decreased. Dynamic range and signal-to-noise ratio are enhanced.

For analog zoom, a 16 channel configuration is available for this Precision Conditioner.

Precision 1776 Features:

- Programmable center frequency 3.2 Hz—200 kHz.
- Programmable bandwidth: 1 Hz—25 kHz.
- Phase match: 2° maximum, 1° typical.
- Wide dynamic range.
- Low noise: 250 microvolts in 20 MHz BW.
- Interfaces: serial, parallel, GPIB.
- $\frac{-80 \text{ dB bandwidth}}{-3 \text{ dB bandwidth}} < 2$
- Passband ripple: 0.15 dB pk-pk.
- Outband rejection: 80 dB minimum.
- Hum: < -100 dB, re full-scale.
- Noise: < -100 dB, re full-scale.
- Intermodulation: < -80 dB, re full-scale.

† See other products in Section 1100.

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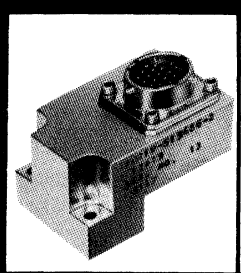
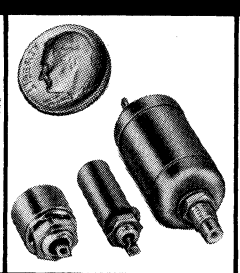
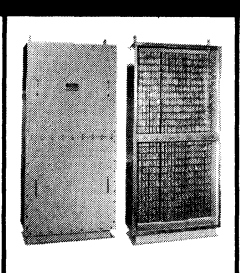
THE LEADING NAME IN RFI/EMC FILTERS



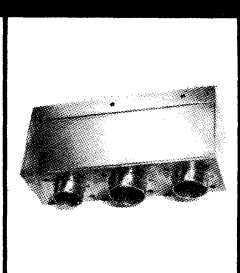
FILTER FOR INSTALLATION IN CRITICAL VOLUME CONFIGURATION



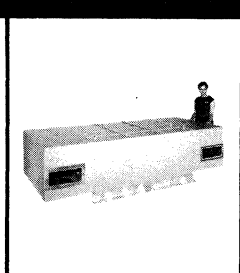
MINIATURE TUBULAR FILTERS



1100 CIRCUIT SIGNAL LINE FILTER CABINET



156 CIRCUIT, HIGH RELIABILITY FILTER PACKAGE FOR AEROSPACE APPLICATION



1300 AMP, 3 PHASE 380 VAC FILTER ASSEMBLY

We've got over 30,000 filter designs on file to meet your basic or most sophisticated needs...

and more parts QPL listed to MIL-F-15733 than any other manufacturer.

The fact that we've got so many filter designs available is only one part of our success story.

Our 27 years of engineering experience and expertise in providing custom engineered filters is the other part.

Our technology has provided our customers with the golden edge in filter performance. We've helped plan and expedite efficient and economical filter systems ... from the simplest to the most intricate.

"Made by RFI" doesn't only tell you who made it, but how well it was made. After all, we sell more than just filters. We sell ideas.

Write for our complete FREE catalog.

RFI Corporation
A KDI COMPANY
100-E PINE AIRE DRIVE, BAYSHORE, LONG ISLAND, N.Y. 11706
(516) 231-6400 TWX 510-227-6233

RTE Aerovox EMI/RFI Filter Products & Power Entry Modules

NEW! A Complete Family of Power Entry Modules for FCC and VDE Applications

FEATURES

- ☐ IEC Connector
- ☐ Fuse Holder
- ☐ Flange or Snap-in Mount
- ☐ 120 VAC / 250 VAC Rated
- ☐ Filter Circuit Shielded in Metal Can
- ☐ 10 KHz - 30 MHz Frequency Response
- ☐ Standard Industry Configurations
- ☐ Safety Agency Approvals

OPTIONS

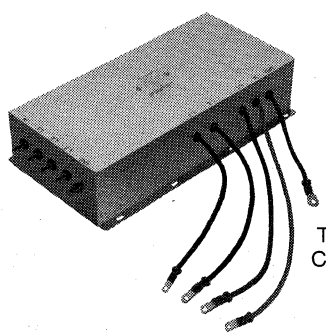
- ☐ SPDT I/O Switch
- ☐ Voltage Selector
- ☐ EMI/RFI Filter Performances
- ☐ 1 - 10 Amp Current Ratings
- ☐ Fastons, Lugs or Lead Terminations
- ☐ North American or Metric Fuse Holders
- ☐ Low Leakage Medical Applications

This new Aerovox family of industry-standard Power Entry Module (PEM) Assemblies is manufactured to meet both Domestic and International quality standards. In their basic form, they serve as power entry devices in electronic equipment, with the added benefit of filtering emissions that are conducted through the power cord. They also offer other convenient features such as IEC Connectors, Fuse Holders, etc., in addition to optional higher levels of filtering to meet specific requirements.

Aerovox manufactures AC Filter products that reduce both Common and Differential Mode conducted emissions. In addition, we have the capability of designing, developing and manufacturing other single and three phase EMI filters for specific OEM applications or to OEM custom, predeveloped specs. Many products in this category are presently in production with UL, CSA and VDE Approvals. We also produce an extensive line of standard agency-approved filter products which are stocked by our national distributor network.

Aerovox also provides a wide array of testing and consulting services either from the factory or in the field, and can develop filters from conducted emission tests or to fit custom applications.

Aerovox presently has two manufacturing operations — one in New Bedford, Mass., to produce custom and special filters for specific applications; the other in Taiwan to produce standard and custom products in volume. All marketing and engineering functions are located in New Bedford, our corporate headquarters.



Three-Phase
Custom Filter

RTE Aerovox®

740 Belleville Ave., New Bedford, MA 02745 U.S.A.
617-994-9661 FAX 617-994-9635

RTE Aerovox

General Purpose 1, 2, 3, 4

The General Purpose 1 EMI Power Line Filters are designed for common mode applications to provide the minimum cost solution for most general purpose applications.

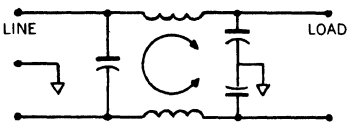
The General Purpose 2 EMI Power Line Filters are an alternate packaged version of the General Purpose 1 Filters utilizing an IEC power line connector to offer direct plug-in capability. As with the General Purpose 1 EMI Filters, these filters are also particularly suited for applications where pulsed, continuous and intermittent EMI interferences are present.

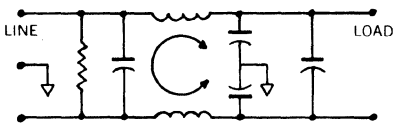
The General Purpose 3 EMI Power Line Filters are packaged in a configuration to include the IEC power line connector in order to offer a direct plug-in capability. They offer improved performance comparable to the Series 1 General Purpose Filters and are effective in applications where line to line and low frequency line to ground noise must be controlled and for upgrading electronic equipment to comply with FCC conductive emmissions standards.

The General Purpose 4 EMI Power Line Filters are designed to provide additional protection from line noise and protection of the line from load generated noise. They are particularly suited for applications where pulsed, continuous and/or intermittent EMI interference is present.

These filters are U.L. recognized, CSA certified, and VDE approved.

GENERAL PURPOSE 1, 2, & 3





GENERAL PURPOSE 4

Operating Specifications

Rated Voltage: 115/250 VAC
Rated Frequency: 50/60 Hz
Rated Temperature: 40°C @ Rated Current

Performance Specifications

Hi Pot Test (one minute)
Line-to-ground 2250VDC Line-to-line 1450VDC
Insulation resistance: 6,000 Mefohms at 100VDC
Maximum leakage current

Line-to-ground	C	D
@ 115 VAC/60 Hz	0.5 mA	0.25 mA
@ 250 VAC/50 Hz	1.0 mA	0.40 mA

CURRENT RATINGS/CASE STYLE

SERIES	GEN 1					GEN 2		GEN 3		GEN 4						
CURRENT RATINGS	1 & 2	3 & 5	10	20	30	1, 3, 6	1, 3, 6	1, 3, 6	1, 3, 6	1 & 2	3 & 5	20	30	3 & 5	10	10
CASE STYLE	11 & 13	11 & 13	11, 13 & 16	11 & 16	66	22, 24	21, 23	21	22	11 & 13	11 & 13	11 & 16	66	17	17	11, 13 & 16
LENGTH	.940	1.25	1.25	2.00	3.75	1.50	1.50	1.50	1.50	1.75	1.75	2.00	3.75	2.50	3.00	2.00
WIDTH	1.75	1.75	1.75	2.00	3.31	1.16	1.16	1.16	1.16	2.00	2.00	2.50	3.31	2.19	2.19	2.00
HEIGHT	0.63	0.75	1.13	1.13	1.50	0.83	0.79	0.79	0.83	0.88	1.13	1.50	1.50	1.25	1.25	1.13

All dimensions in inches.

MINIMUM INSERTION LOSS

GEN 1

Minimum insertion loss in dB: Line-to-ground in 50 ohm circuit.

LEAKAGE CURRENT	CURRENT RATING	FREQUENCY — MHz. .15	.50	1	5	10	30
C	1, 2, 3, 5	15	30	38	50	50	52
	10, 20, 30	6	17	25	40	42	48
D	1, 2, 3, 5	20	31	38	45	45	48
	10, 20	8	21	26	34	37	42

GEN 2

Minimum insertion loss in dB: Line-to-ground in 50 ohm circuit.

LEAKAGE CURRENT	CURRENT RATING	FREQUENCY — MHz. .15	.50	1	5	10	30
D	1	22	35	41	48	50	52
	3	15	25	30	46	50	55
	6	10	21	27	44	48	52

GEN 3

Minimum insertion loss in dB: Line-to-ground in 50 ohm circuit.

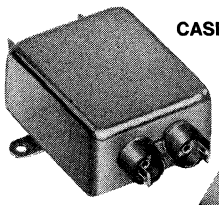
LEAKAGE CURRENT	CURRENT RATING	FREQUENCY — MHz. .15	.50	1	5	10	30
D	1	25	35	40	48	50	54
	3	20	30	35	43	49	53
	6	15	22	28	40	45	50

GEN 4

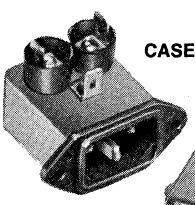
Minimum insertion loss in dB: Line-to-ground in 50 ohm circuit.

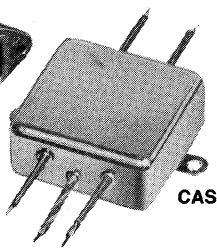
LEAKAGE CURRENT	CURRENT RATING	FREQUENCY — MHz. .15	.50	1	5	10	30
C	1, 2, 3	15	30	40	50	50	50
	5, 10, 20, 30	8	21	28	42	46	50
D	1, 2, 3	15	30	35	45	45	50
	5, 10, 20	8	20	25	38	40	45

CASE STYLE 11

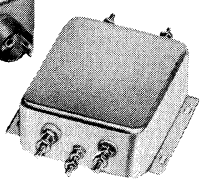


CASE STYLE 22





CASE STYLE 66



CASE STYLE 13

RTE Aerovox
740 Belleville Ave., New Bedford, MA 02745 U.S.A.
617-994-9661 FAX 617-994-9635

RTE Aerovox®

Dual Mode Suppression 1, 2, 3 & 4

Medical 1

The Dual Mode Suppression Filters utilize the same effective general purpose designs for providing control of line-to-ground noise but with additional circuitry to reduce low frequency line-to-line noise and transient. This additional circuitry in the Dual Mode Suppression Filters is a line-to-line filter with high rejection at low frequencies for limiting the line to line noise.

These filters will protect equipment from malfunctions due to conducted interference coming into the equipment from the line. These filters will also provide the needed suppression to allow most equipment to meet FCC and VDE specifications for conducted emissions. Dual Mode Suppression Filters are available in our 1, 2, 3 and 4 configuration and are particularly effective when applied in equipment utilizing switching type power supplies and SCR components.

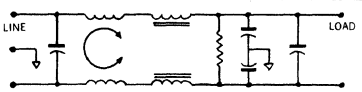
These filters are U.L. recognized, CSA certified, and VDE approved.

Medical 1 Series Underwriters Laboratory medical and dental equipment specification U.L. 544 is applicable to this series. AeroFilter medical filters meet the U.L. specification for patient care equipment of a maximum leakage current of 100 micro amps at 120 VAC, 60 Hz.

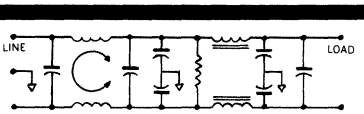
For non-patient equipment, where the maximum leakage current of 500 micro amps at 120 VAC, 60 Hz. is allowed, the General Purpose and High Performance General Purpose Filters have special versions with low leakage requirements to meet the U.L. non-patient equipment standard. The Aerovox Medical Filter 1 has two micro amps maximum leakage current used with hospital grade/low leakage line cord (6 micro amps maximum leakage current).

These filters are U.L. recognized, CSA certified, and VDE approved.

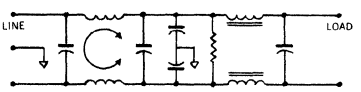
DMS 1 & 4



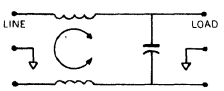
DMS 3



DMS 2



MED 1



Operating Specifications

Rated Voltage: 115/250 VAC
Rated Frequency: 50/60 Hz
Rated Temperature: 40°C @ Rated Current

Performance Specifications

Hi-Pot Test (one minute)
Line-to-ground 2250VDC Line-to-line 1450VDC
Insulation resistance: 6,000 Megohms at 100VDC
Maximum leakage current

Line-to-ground	C	D	F	G
@ 115 VAC/60 Hz	0.50 mA	0.25 mA	2 mA	2 mA
@ 250 VAC/50 Hz	1.00 mA	0.40 mA	3 mA	5 mA

CURRENT RATINGS/CASE STYLE

SERIES	DUAL MODE SUPPRESSION FILTERS 1, 2, 3			DMS 4			AEROFILTER SERIES MEDICAL 1		
CURRENT RATINGS	3	6 & 10	20	3	3	3	6	6	6
CASE STYLE	11	11	61	11, 13	17, 77	18, 88	11	21	22
LENGTH	2.00	2.50	3.75	2.50	3.00	3.00	.940	1.50	1.50
WIDTH	1.75	2.00	3.31	2.00	2.19	2.19	1.75	1.16	1.16
HEIGHT	1.25	1.50	1.50	1.75	1.75	1.75	0.62	0.79	0.83

All dimensions in inches.

DMS 1, 2, 3 & 4

Minimum insertion loss in dB: Line-to-ground in 50 ohm circuit.

LEAKAGE CURRENT	CURRENT RATING	Line-To-Ground FREQUENCY — MHz. .01	.02	.05	.15	.5	1	5	10	30
DMS1	3, 6, 10	—	—	—	13	28	37	32	51	42
C	20	—	—	—	17	32	39	40	44	39
DMS2	3, 6, 10	—	—	—	16	28	41	59	55	48
C	20	—	—	—	14	29	42	61	47	30
DMS3	3	—	—	—	15	25	34	65	65	61
C	6, 10, 20	—	—	—	12	31	33	65	65	56
DMS4 D	3	23	26	36	46	48	43	45	45	45
DMS4 F	3	23	26	37	50	55	55	50	55	55

DMS 1, 2, 3 & 4

Minimum insertion loss in dB: Line-to-line in 50 ohm circuit.

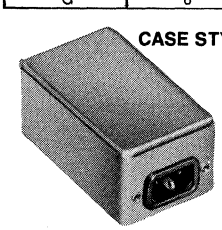
LEAKAGE CURRENT	CURRENT RATING	Line-To-Line FREQUENCY — MHz. .01	.02	.05	.15	.5	1	5	10	30
DMS1	3, 10	—	—	—	40	65	65	55	50	50
C	6, 20	—	—	—	40	65	65	65	53	50
DMS2	3, 10	—	—	—	25	65	65	60	55	50
C	6, 20	—	—	—	40	65	65	65	60	55
DMS3	3, 6, 10	—	—	—	25	65	65	62	55	38
C	20	—	—	—	28	65	65	65	65	65
DMS4 D	3	1	18	41	65	75	75	65	65	60
DMS4 F	3	1	18	41	65	75	75	60	65	65

MED 1

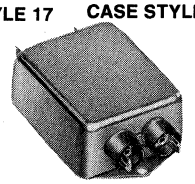
Minimum insertion loss in dB: Line-to-ground in 50 ohm circuit.

LEAKAGE CURRENT	CURRENT RATING	FREQUENCY — MHz. .15	.5	1	5	10	30
G	6	10	18	25	28	26	19

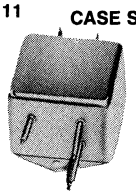
CASE STYLE 17

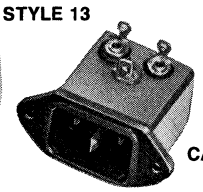


CASE STYLE 11



CASE STYLE 13



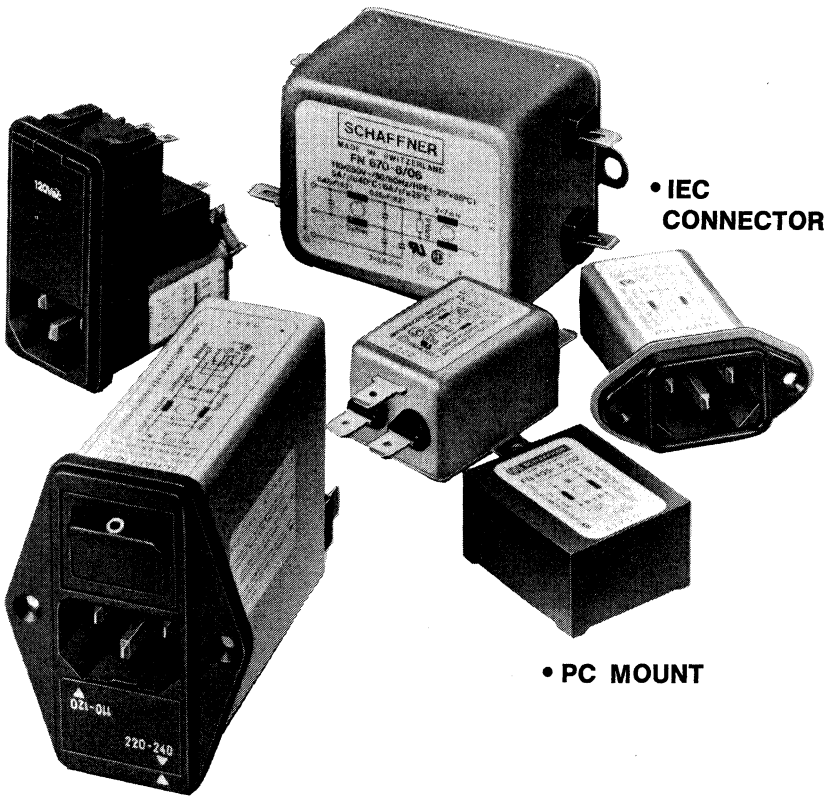


CASE STYLE 24

RTE Aerovox®
740 Belleville Ave., New Bedford, MA 02745 U.S.A.
617-994-9661 FAX 617-994-9635

SCHAFFNER **EMC Inc.** 825 Lehigh Ave., Union, NJ 07083 (201) 851-0644 • Telex 685-3444 • 800/367-5566

• **CHASSIS MOUNTING**



• **IEC CONNECTOR**

• **PC MOUNT**

• **POWER ENTRY MODULE SERIES**

EMI FILTERS

NO ONE ELSE HAS A MORE COMPREHENSIVE PRODUCT LINE, OR MORE RELIABLE PERFORMANCE.

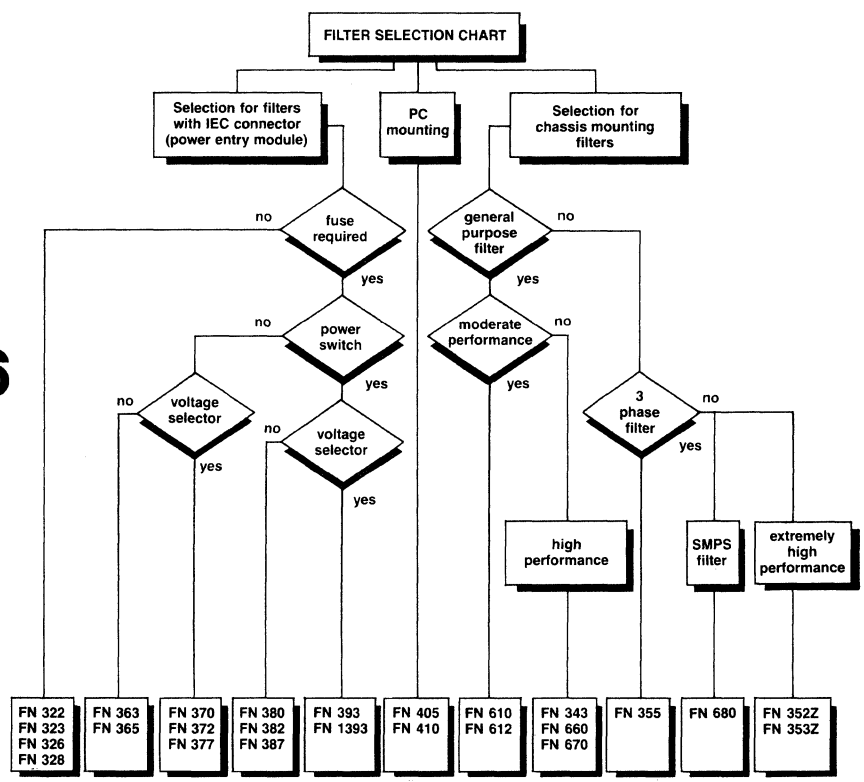
Schaffner is number one in technology, offering the broadest range of filters in the field. Our unique automated manufacturing produces precision-quality parts. Does this cost more? In fact, our automation allows us to price quite competitively.

We have thousands of parts in stock, contributing to our record of on-time delivery. And the parts are approved to meet international standards, ensuring performance anywhere in the world.

For Information

800-367-5566

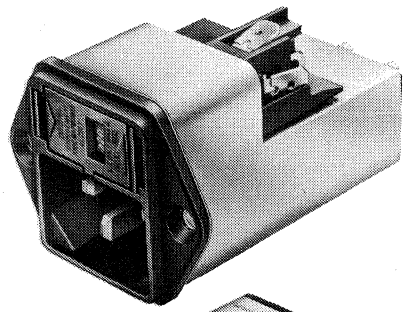
As the world leader in RFI/EMI Filter Technology we have prototype capability here in the U.S.

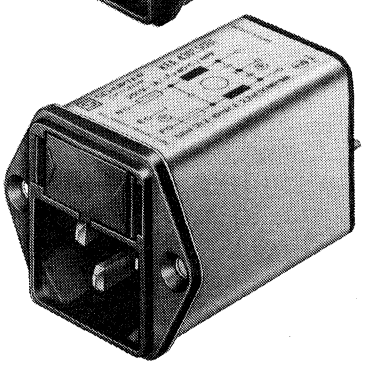


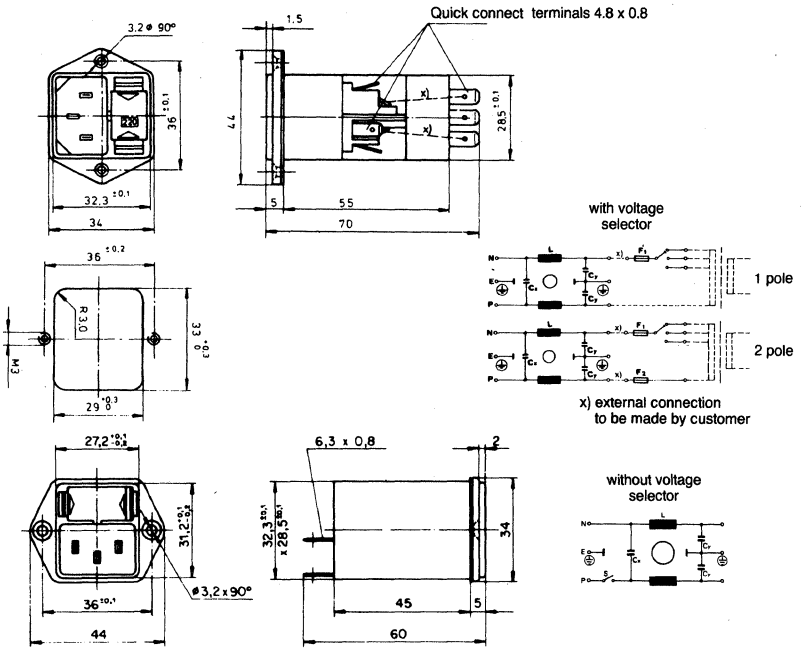
SCHURTER
P.O. Box 750158 • 1016 Clegg Court • Petaluma, CA 94975-0158 • 707-778-6311 • FAX 707-778-6401

POWER ENTRY MODULES WITH RFI FILTER •

KFA ≙ AC Power Connector with 1 or 2 pole fuseholder and optional 3 position voltage selector.
KFB ≙ AC Power Connector with lighted or unlighted on/off line switch.

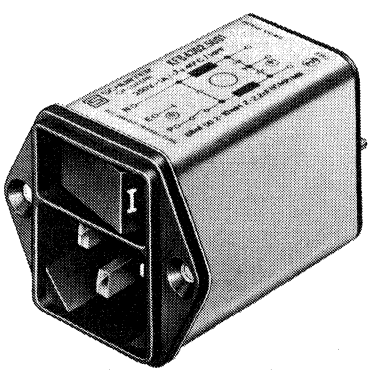


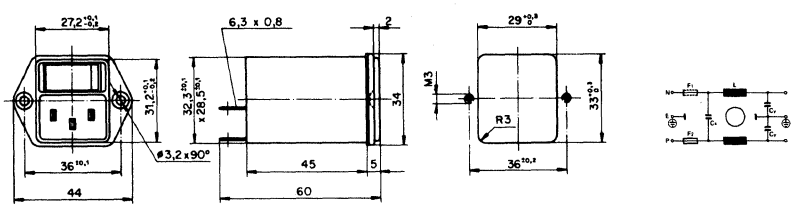




KFA Part Numbers (casing and fusedrawer with voltage selector insert must be ordered separately)

CASING PART NUMBERS						FUSEDRAWER PART NUMBERS		
Protection 1 Pole	Protection 2 Pole	Voltage Selector w/out	Voltage Selector with	Filter 1 A	Filter 2 A	Filter 4 A	Voltage Marking	Protection 1 Pole / 2 Pole
KFA 4301.5051	KFA 4301.5041		•	•			110, 220, 240	4301.1212 / 4301.1012
4301.5052	4301.5042		•		•			
4301.5053	4301.5043		•			•		
4301.5011	4301.5001	•		•			No voltage selector insert. Fusedrawer included with casing part number.	
4301.5012	4301.5002	•			•			
4301.5013	4301.5003	•				•		





KFB Part Numbers

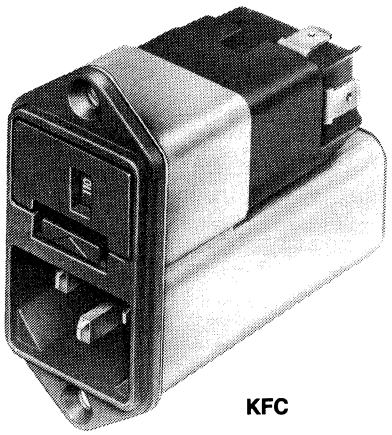
Switch 1 Pole	Filter 1A	Filter 2A	Filter 4A
KFB 4301.5001	•		
4301.5002		•	
4301.5003			•

APPROVALS:	KFA	KFB
UL	1,2,4A/250V	1,2,4A/250V
CSA	pending	pending
VDE	1,2,4A/250V	1,2,4A/250V
SEMKO	1,2,4A/250V	1,2,4A/250V
SEV	1,2,4A/250V	1,2,4A/250V

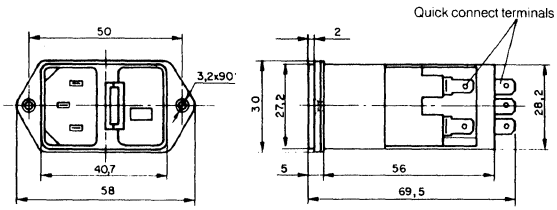
SCHURTER
P.O. Box 750158 • 1016 Clegg Court • Petaluma, CA 94975-0158 • 707-778-6311 • FAX 707-778-6401

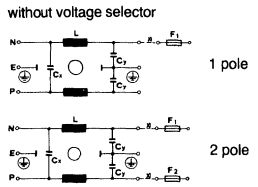
POWER ENTRY MODULES WITH RFI FILTER •

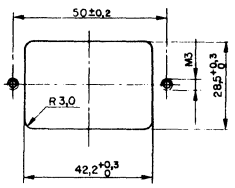
KFC, CD ≙ AC Power Connector with 1 or 2 pole fuseholder for 5 x 20 mm or ¼ x 1¼" fuses and optional 2 or 4 position voltage selector. CD includes on/off line switch.

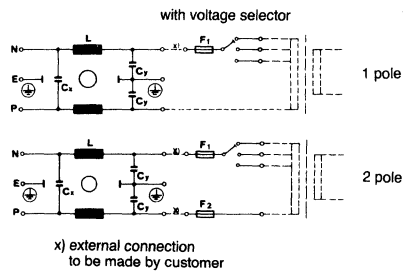


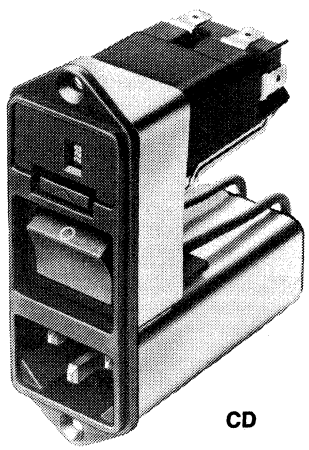
KFC



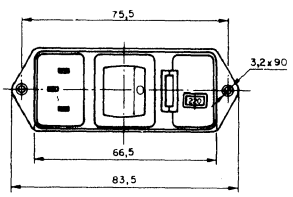


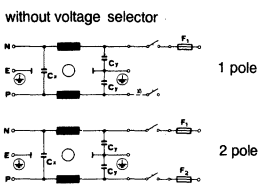


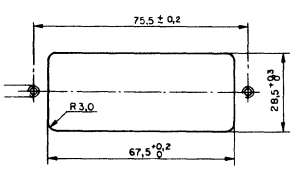


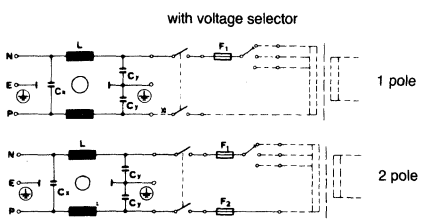


CD









KFC, CD Part Numbers (casing and fusedrawer must be ordered separately)

CASING PART NUMBERS

Protection 1 Pole	Protection 2 Pole	Voltage Selector w/out	Voltage Selector with	Filter 1 A	Filter 2 A	Filter 4 A
KFC 4303.5011	KFC 4303.5001	•		•		
4303.5012	4303.5002	•			•	
4303.5013	4303.5003	•				•
4303.5031	4303.5021		•	•		
4303.5032	4303.5022		•		•	
4303.5033	4303.5023		•			•
CD 11.1501.151	CD 14.1101.151	•		•		
21.1501.151	24.1101.151	•			•	
31.1501.151	34.1101.151	•				•
11.3501.151	14.3101.151		•	•		
21.3501.151	24.3101.151		•		•	
31.3501.151	34.3101.151		•			•

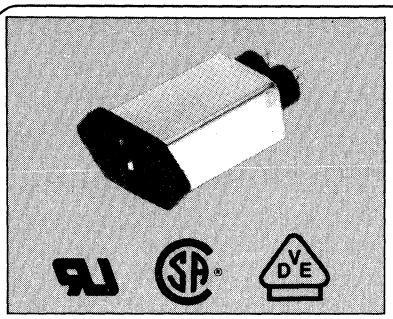
FUSEDRAWER PART NUMBERS

Voltage Marking	Protection 1 Pole 5 x 20 mm	Protection 2 Pole 5 x 20 mm
110, 220,	4303.2114.03	4303.2014.03
blank	4303.2406	4303.2401

Voltage Marking	Protection 1 Pole ¼ x 1¼" mm	Protection 1 Pole ¼ x 1¼" mm
110, 220,	4303.2814.03	4303.2714.03
blank	4303.2907	4303.2902

APPROVAL RATINGS:	KFC	CD
UL	1,2,4A/250V	pending
CSA	pending	pending
VDE	1,2,4A/250V	1,2,4A/250V
SEMKO	1,2,4A/250V	pending
SEV	1,2,4A/250V	1,2,4A/250V

SPRAGUE RELIABLE FILTERS



Sprague High-Frequency Power Line Filters Provide Communications Security

The Sprague 541JX Series of high-frequency power line filters offers an effective countermeasure against commercial electronic spying. These rugged, small profile filters provide the same high performance and dependability for many commercial applications that were previously available only as military components for TEMPEST-compliant equipment.

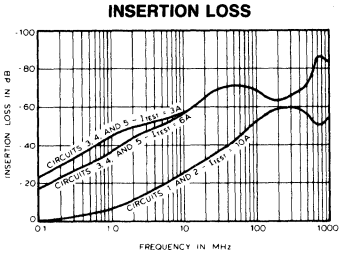
- UL Recognition*
- CSA Certification*
- VDE License**
- Circuit 1: 40+ dB Common-Mode Suppression 40 MHz - 1000 MHz
- Circuit 2: Circuit 1 Common-Mode Performance Plus Moderate Differential Mode Suppression 1 MHz - 30 MHz
- Circuit 3: High-Level Common-Mode Suppression 100 kHz - 1000 MHz
- Circuit 4: Circuit 3 Common-Mode Performance Plus Enhanced Differential Mode Suppression 1 MHz - 30 MHz
- Circuit 5: Premium Differential Mode Suppression 1 MHz - 30 MHz Plus Common-Mode Performance of Circuit 3

RATINGS AND CHARACTERISTICS

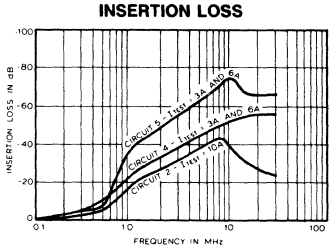
Dielectric Withstanding Voltage (2 seconds)		Current Rating		Circuit
Line-to-Line — 1700 VDC	Part Number	120 VAC	250 VAC	Style
Line-to-Ground — 2700 VDC	541JX0323	3.0 A	3.0 A	3
Voltage Rating	541JX0324	3.0 A	3.0 A	4
120 VAC at 60 Hz	541JX0325	3.0 A	3.0 A	5
250 VAC at 50 Hz	541JX0643	6.0 A	6.0 A	3
Max. Leakage Current	541JX0644	6.0 A	6.0 A	4
0.25 mA at 120 VAC	541JX0645	6.0 A	6.0 A	5
0.5 mA at 250 VAC	541JX1061	10 A	10 A	1
	541JX1062	10 A	10 A	2

*Pending.
**Pending: 250 VAC/50 Hz Ratings.

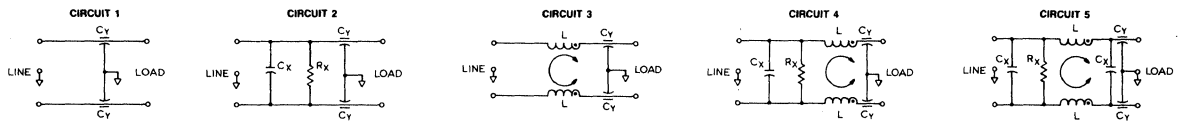
TYPICAL COMMON-MODE INSERTION LOSS

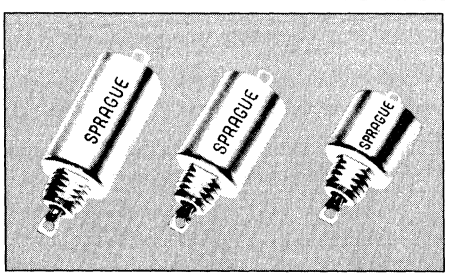


TYPICAL DIFFERENTIAL MODE INSERTION LOSS



For complete information on Series 541JX Power Line Filters, a part of Sprague's reliable FIL-MAG™ Filter and Magnetic Products line, ask your local Sprague sales office or sales representative for Data Sheet 8218 or write Technical Literature Service, Sprague Electric Company, P.O. Box 9102, Mansfield, MA 02048-9102. For applications assistance, call the Sprague Filter Operation at (413) 664-4441.

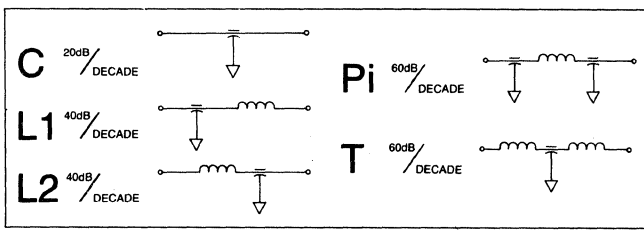




Sprague Ceramic EMI/RFI Filters to MIL-F-28861 Provide Ultra-High Reliability

- Replaces MIL-F-15733
- Product Assurance Level B
- QPL Approved on Slash Sheets 2 and 4
- QPL Pending on Slash Sheets 1, 3, and 5

For complete information on Ceramic EMI/RFI Filters, ask your local Sprague sales office or sales representative for Ceramic Filter Catalog FD-129 or write to Technical Literature Service, Sprague Electric Company, P.O. Box 9102, Mansfield, MA 02048-9102. For application assistance, call the Sprague Filter Operation at (413) 664-4441.



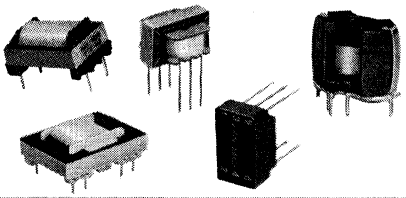
4SF-6111R3V3

SPRAGUE®
THE MARK OF RELIABILITY

PRODUCT LINE SUMMARY

TRANSFORMERS & INDUCTORS FOR TELEPHONE INTERCONNECT. The TTC SERIES meets the high performance requirements of telephone central office, modem, facsimile, and voice communication applications. These **FCC PART 68** coupling, direct connect, hybrid transformers and holding coils **COMPLY WITH UL & MEET FCC PART 68** requirements.

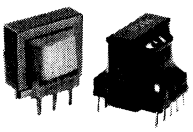
FOR DETAILS SEE A•2396, 2397

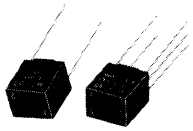


TELECOMMUNICATION TRANSFORMERS for DATA, DIGITAL, LOCAL-AREA-NETWORK & T-1 CARRIER circuit applications. These wide-band & pulse transformers feature low loss & low distortion performance characteristics. Miniature size, & low profiles are achieved with high-perm cores. Many models **MEET FCC PART 68** isolation requirements.

THE ATT SERIES **AUDIO TRANSFORMERS** are a low cost, volume produced series of transformers for impedance matching, isolation & sound distribution applications. The DP SERIES **ENCAPSULATED AUDIO TRANSFORMERS** are cost effective for severe environments & are tested to **MIL-T-27;** several items **MEET FCC PART 68** requirements

FOR DETAILS SEE A•2399



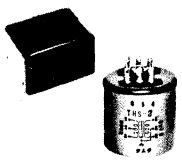


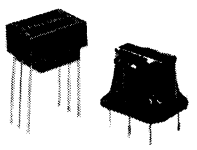
MINIATURE ENCAPSULATED TRANSFORMERS AND INDUCTORS are the smallest (0.31" x 0.41" x 0.465") audio magnetic components available with **1000V R M S HIPOT.** Several models **MEET FCC PART 68 & 1500V R M S HIPOT.** The MET SERIES transformers & MEI SERIES inductors are manufactured to **MEET MIL-T-27** as type TF5S21ZZ.

FOR DETAILS SEE A•2398

PROFESSIONAL AUDIO TRANSFORMER SERIES of high performance audio transformers are widely used in communications, broadcasting, recording & measuring apparatus. These transformers are available with electrostatic and MU-metal shields; lead, solder lug, or PC pin terminations; & open or metal case construction.

FOR DETAILS CONTACT FACTORY





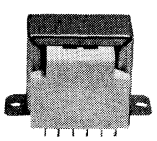
SCR—TRIAC TRIGGER & PULSE—ISOLATION TRANSFORMERS. The STT SERIES is designed for low cost source isolation with **2600V R M S HIPOT** for SCR & TRIAC control circuits. The PHT & G SERIES PULSE TRANSFORMERS offer a wide range of characteristics. Encapsulated for protection against severe environments.

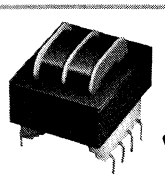
FOR DETAILS SEE A•2399

The PEP **INTERNATIONAL SERIES POWER TRANSFORMERS** have physical barriers between primary & secondary windings. The PEP SERIES incorporates a double protection insulation system and passes **4000V R M S HIPOT.**

UL 1411 RECOGNIZED—FILE NO. E 98949
MEETS CSA, IEC 65 & VDE SAFETY STANDARDS

FOR DETAILS SEE A•2400





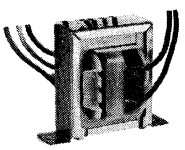
3 FLANGE BOBBIN POWER TRANSFORMERS—80 MODELS IN STOCK. The 3F SERIES POWER TRANSFORMERS are drop-in compatible to all competitors & tube packed for auto-insertion.

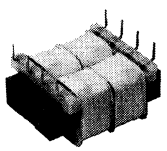
UL1585 CLASS II & III—FILE NO. E 95844
UL GENERAL PURPOSE TRANSFORMER—E 91239
UL CLASS B INSULATION SYSTEM

FOR DETAILS SEE A•2401

CUSTOM OEM POWER & AUDIO TRANSFORMERS—UL RECOGNIZED under **UL1411** and Tamura FILE NO. E 59673. These designed-to-customer performance transformers also **COMPLY WITH CSA, IEC-65, MITI-JIS, & VDE** SAFETY STANDARDS. This series offers many different construction styles and OUTPOWER RATINGS FROM 0.7VA TO 400VA.

FOR DETAILS CONTACT FACTORY



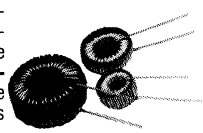


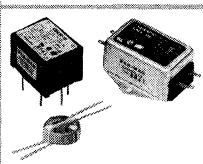
LOW PROFILE—3 FLANGE BOBBIN PC POWER TRANSFORMERS. The 3FL SERIES power transformers are designed and manufactured to comply with **UL** requirements and utilize a **UL CLASS B INSULATION SYSTEM.** Available in 5 power ranges: 2VA, 6VA, 12VA, 24VA & 48VA. These transformers have max. heights above the PC board of 0.65" to 1.375".

FOR DETAILS SEE A•2401

NOISE FILTERING & POWER INDUCTORS for switch-mode power, regulator, control & filtering circuit applications. **SKP SERIES INDUCTORS** for **EMI/RFI** noise absorbing use. **SKL SERIES INDUCTORS** have **SWINGING L** with varying DC. **SKC SERIES INDUCTORS** are wound on gapped toroidal cores & have current ratings from 5 to 50A DC

FOR DETAILS SEE A•1293





EMI/RFI AC LINE FILTERS & COMMON MODE INDUCTORS. This series MEETS **FCC PART 15 & VDE-0871 CLASS A & B** requirements; UL1283 RECOGNIZED under E 92559; CSA CERTIFIED to C22.2 #8; & TUV CERTIFIED to VDE0565, Teil 3. *FOR DETAILS SEE A•1292, 1712, 1713*

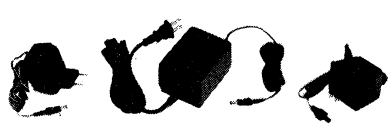
DC-DC CONVERTERS NON-ISOLATION, SINGLE-IN-LINE PACKAGE for POLARITY REVERSING & VOLTAGE BOOSTING use. This series of DC-DC converters is encapsulated for environmental protection & available with single or dual outputs. In four package sizes, they have output power ratings of 0.2, 0.3, 0.5, & 1.0 WATT.

FOR DETAILS SEE D•1986, 1987

ISOLATION SERIES DC-DC CONVERTERS mount on a PC board. These COST EFFECTIVE, LOW PROFILE, SMALL SIZE power modules are ENCAPSULATED SURFACE-MOUNT HIGH-DENSITY HYBRID packaged to guarantee LONG LIFE & HIGH RELIABILITY. Most models in this series of DC-DC converter modules include a NOISE FILTER INDUCTOR & OVERCURRENT PROTECTION.

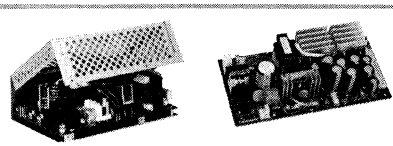
FOR DETAILS SEE D•1986, 1987

DIRECT PLUG-IN AC-DC REGULATED & UNREGULATED POWER SOURCES comply to WORLDWIDE safety agency requirements. This series is available in a variety of output ratings & terminations. Custom logo & multiple listings available. *FOR DETAILS SEE A•2402 and D•1988*



PLUG-IN POWER SOURCES are available in CORD-CORD DESK TOP, UL-CSA PLUG & EUROPEAN PLUG configurations with a variety of output terminations. Includes barrel plug & screw terminal styles. A wide range of output ratings including AC-AC, AC-DC regulated, & AC-DC unregulated models, & OEM CUSTOM designs are available.

The OLYMPIAN SERIES **SWITCHING POWER SUPPLIES** are the highest **WATTS/INCH³ VDE** certified units available. The series is **UL & CSA** approved. The Olympian series features WORLDWIDE AC INPUT with VDE0871 & VDE0875 filtering, SURFACE-MOUNT HYBRID TECHNOLOGY, OVP, ENABLE/INHIBIT, POWER FAIL, **& 80,000 HOURS MTBF.** *FOR DETAILS SEE A•1984, 1985, 1989*



OPEN FRAME POWER SUPPLIES—These LINEAR & SWITCHMODE SERIES meet all international safety and emission standards. They are available in multiple and single output models with WORLDWIDE AC INPUT. **HIGH MTBF** components are used throughout these power supplies for high performance and long operating life.

FOR DETAILS SEE D•1989, 1990, 1991

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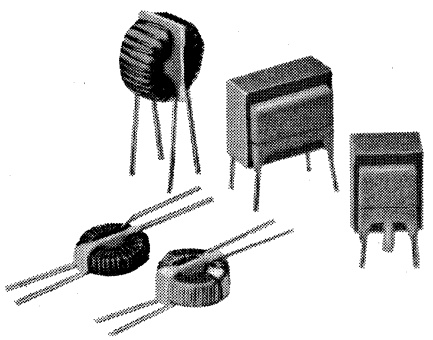
COMMON MODE COILS FOR A.C. LINE & R.F.I. FILTER CIRCUITS



PART NUMBER	AMPS (AC)	"L" (mH)	D.C.R. (OHMS)	FIGURE NUMBER	LEAD DIA.
CMT-01102	1	2	0.25	1	0.40
CMT-01104	1	4	0.35	1	0.40
CMT-01202	2	2	0.15	1	0.55
CMT-01301	3	1	0.10	1	0.70
CMT-02105	1	5	0.40	2	0.40
CMT-02107	1	7	0.50	2	0.40
CMT-02203	2	3	0.20	2	0.55
CMT-02302	3	2	0.10	2	0.70
CMT-03110	1	10	0.55	3	0.40
CMT-03305	3	5	0.15	3	0.70
CMT-03502	5	2	0.04	3	0.95
CMT-03801	8	1	0.02	3	1.20
CME-04103	1	3	0.45	4	0.40
CME-04105	1	5	0.55	4	0.40
CME-04202	2	1.5	0.18	4	0.55
CME-04203	2	2.5	0.22	4	0.55
CME-05107	1	7	0.70	5	0.40
CME-05110	1	10	0.80	5	0.40
CME-05205	2	5	0.30	5	0.55
CME-05303	3	3	0.15	5	0.70

SPECIFICATIONS

- WORKING VOLTAGE: 250VAC
- DIELECTRIC VOLTAGE: 1500VAC
- INSULATION RESISTANCE: 100 Megohms, 500VDC
- TEMPERATURE RISE: 30°C Max.
- OPERATING TEMP. RANGE: -25°C to +85°C

SCHEMATIC DIAGRAM

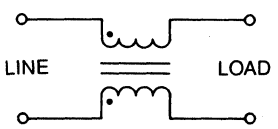
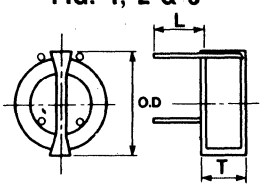


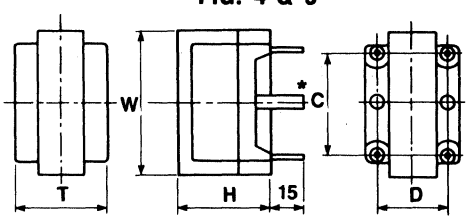
FIG. 1, 2 & 3



(mm)

FIG.	O.D.	T	L ± 3
1	28	12.5	20
2	28	14.5	20
3	32	22	20

FIG. 4 & 5



(mm)

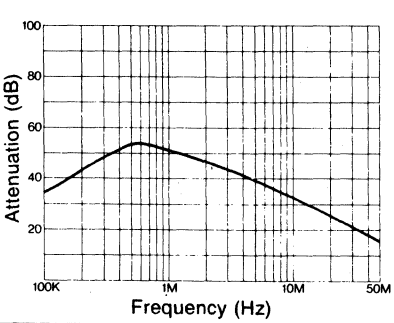
FIG.	W	T	H	C	D
4	28.5	22.5	30	16	17
5	35.5	22.5	30	28	17

*FIG. 4 ONLY (3 mm Dia.)

TYPICAL PERFORMANCE CHARACTERISTICS

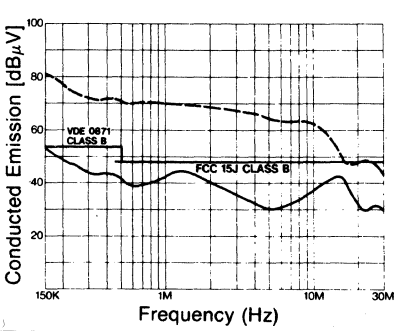
STATIC CHARACTERISTIC

CMT-02105 IN CIRCUIT 1

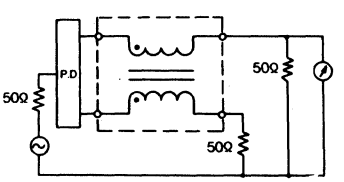


DYNAMIC CHARACTERISTICS

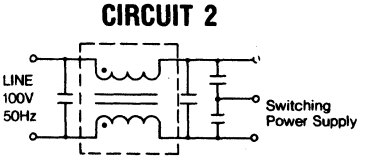
CMT-02105 IN CIRCUIT 2



MEASURING CIRCUIT 1



MEASURING CIRCUIT 2



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TAMURA RFI LINE FILTERS
FCC PART 15J AND VDE-0871, CLASSES A & B

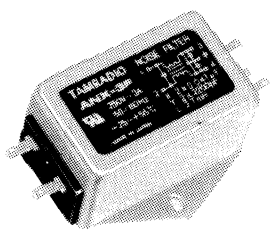


FIG. 1F

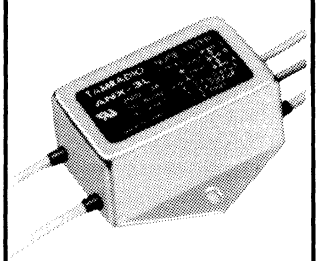


FIG. 1L

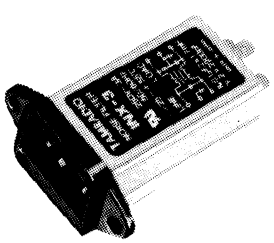


FIG. 2

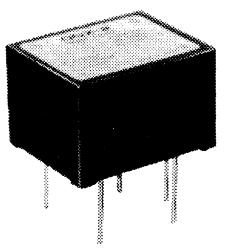


FIG. 3

PART NUMBER	ANX-1*	ANX-3*	ANX-6*	INX-1	INX-3	INX-6	ONX-1	ONX-2	ONX-3
RATED VOLTAGE	250VAC	250VAC	250VAC	250VAC	250VAC	250VAC	250VAC	250VAC	250VAC
RATED CURRENT	1A	3A	6A	1A	3A	6A	1A	2A	3A
FIGURE NUMBER	1*	1*	1*	2	2	2	3	3	3
SCHEMATIC DIAGRAM	I	I	I	II	II	II	I	I	I
LEAKAGE CURRENT	0.5mA MAX 250V, 60Hz			0.5mA MAX 250V, 60Hz			0.5mA MAX 250V, 60Hz		
DIELECTRIC VOLTAGE†	2000VAC 1 minute			1500VAC 1 minute			2000VAC 1 minute		
INSULATION RESISTANCE†	6000 Megohms 250VDC			6000 Megohms 250VDC			6000 Megohms 250VDC		
D.C.R. (MAX Ohms)	0.5	0.15	0.07	0.5	0.2	0.15	0.5	0.2	0.15
ATTENUATION NORMAL MODE 25dB MIN.	0.5 to 20 MHz	0.7 to 20 MHz	1 to 20 MHz	1 to 20 MHz	2 to 20 MHz	3 to 20 MHz	0.3 to 20 MHz	0.4 to 20 MHz	0.5 to 20 MHz
ATTENUATION COMMON MODE 20dB MIN.	0.1 to 10 MHz	0.2 to 10 MHz	0.5 to 10 MHz	0.2 to 20 MHz	0.3 to 20 MHz	2 to 20 MHz	0.1 to 20 MHz	0.2 to 20 MHz	0.3 to 20 MHz
TEMPERATURE RISE	30°C MAX.			30°C MAX.			30°C MAX.		
OPERATING TEMPERATURE	−25°C TO +85°C			−25°C TO +85°C			−25°C TO +85°C		
UL FILE NO.	UL E92559			UL E92559			UL E92559		
CSA CERT. NO.	CSA LR58883			CSA LR58883			CSA LR58883		
TUV LICENSE NO.	TUV R50076			TUV R50108			TUV R50077		

*Insert F for FAST-ON TABS, or insert L for LEAD WIRES.
†Dielectric voltage and I.R. is line to case or ground.

SCHEMATICS

DIAGRAM I

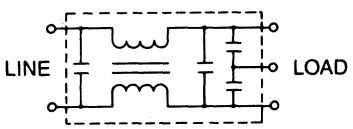


DIAGRAM II

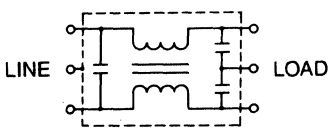
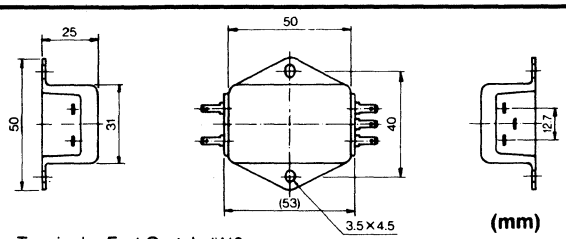


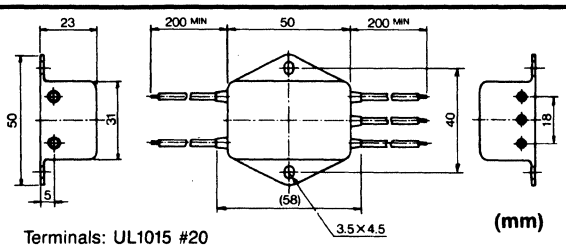
FIG. 1F



(mm)

Terminals: Fast-On tab #110

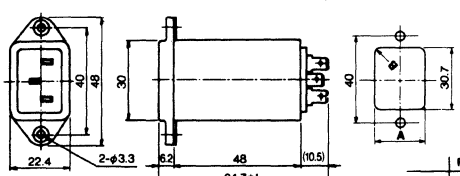
FIG. 1L



(mm)

Terminals: UL1015 #20

FIG. 2

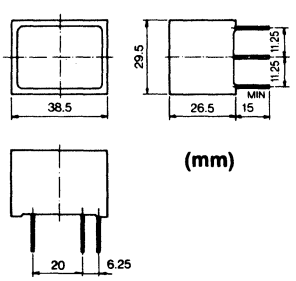


(mm)

	Front of panel	Back of panel
A	21.8	23.2
B	R4	R5.5

Terminals: Fast-On tab #187

FIG. 3



(mm)

Terminals: Pin terminals ø 1.0

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EMI/RFI FILTERS

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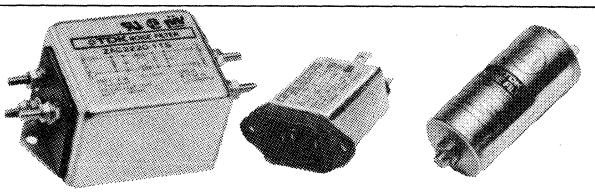
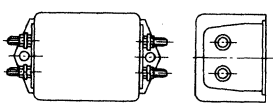
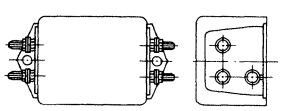
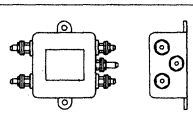
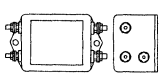
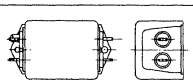
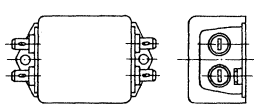
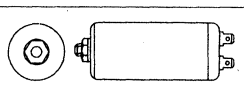
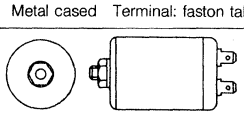
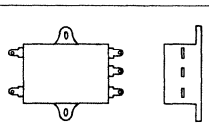
EMI/RFI FILTERS



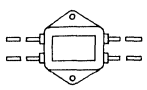
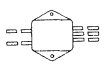
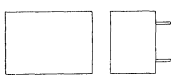
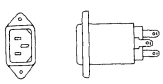
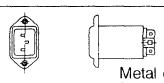
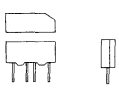
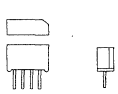
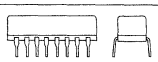
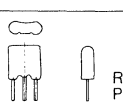
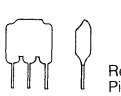
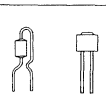
Series name	Exterior view	Function	Part No.	Rated current (A)	Rated voltage (V)	Test voltage (V)	Leakage current (mA)	Weight (g)
ZAP	Metal cased terminal: studs	Prevention of normal and common mode EMI between 0.15 to 30 MHz.	ZAP2205-01	5	AC.250	AC.1500	<1.0 ($^{250V}_{60Hz}$)	370
			ZAP2210-01	10	AC.250	AC.1500	<1.0 ($^{250V}_{60Hz}$)	950
			ZAP2220-01	20	AC.250	AC.1500	<1.0 ($^{250V}_{60Hz}$)	1,200
			ZAP2230-01	30	AC.250	AC.1500	<1.0 ($^{250V}_{60Hz}$)	1,750
ZAR	Metal cased terminal: studs	Prevention of common mode EMI between 0.15 to 300 MHz	ZAR2205-01A	5	AC.250	AC.1500	<1.0 ($^{250V}_{60Hz}$)	400
			ZAR2210-01A	10	AC.250	AC.1500	<1.0 ($^{250V}_{60Hz}$)	1,100
			ZAR2220-01A	20	AC.250	AC.1500	<1.0 ($^{250V}_{60Hz}$)	1,400
			ZAR2230-01A	30	AC.250	AC.1500	<1.0 ($^{250V}_{60Hz}$)	2,200
ZAC	 Metal cased terminal: studs	Prevention of normal and common mode EMI between 0.15 to 30 MHz. UL recognized: —00U UL recognized, TÜV approved. CSA certified: —11	ZAC2205-00U	5	AC.250	AC.1500	<1.0 ($^{250V}_{60Hz}$)	240
			ZAC2206-11	6	AC.250	AC.1500	<1.0 ($^{250V}_{60Hz}$)	270
			ZAC2210-00U	10	AC.250	AC.1500	<1.0 ($^{250V}_{60Hz}$)	250
			ZAC2210-11	10	AC.250	AC.1500	<1.0 ($^{250V}_{60Hz}$)	290
			ZAC2215-00U	15	AC.250	AC.1500	<1.0 ($^{250V}_{60Hz}$)	260
			ZAC2220-11	20	AC.250	AC.1500	<1.0 ($^{250V}_{60Hz}$)	440
			ZAC2220-00U	20	AC.250	AC.1500	<1.0 ($^{250V}_{60Hz}$)	260
ZAG-S		More than 20dB attenuation for high voltage pulse such as 1.2kV, 1μs. UL recognized, TÜV approved, CSA certified.	ZAG2206-11S	6	AC.250	AC.1500	<0.75 ($^{250V}_{60Hz}$)	280
			ZAG2210-11S	10	AC.250	AC.1500	<0.75 ($^{250V}_{60Hz}$)	300
			ZAG2220-11S	20	AC.250	AC.1500	<0.75 ($^{250V}_{60Hz}$)	300
			*ZAG2230-11S	30	AC.250	AC.1500	<0.75 ($^{250V}_{60Hz}$)	480
			ZAG2220-H	20	AC.250	AC.1500	<0.75 ($^{250V}_{60Hz}$)	300
			*Applying for CSA, TÜV.					
ZAG	 Metal cased terminal: studs	Prevention of common mode EMI between 0.15 to 100 MHz and normal mode EMI between 0.15 to 30 MHz. UL recognized.	ZAG2205-11	5	AC.250	AC.1500	<1.0 ($^{250V}_{60Hz}$)	150
			ZAG2210-11	10	AC.250	AC.1500	<1.0 ($^{250V}_{60Hz}$)	160
			ZAG2220-11	20	AC.250	AC.1500	<1.0 ($^{250V}_{60Hz}$)	170
ZAG-P	 Metal cased terminal: studs	Prevention of high voltage pulse EMI. UL recognized.	ZAG2205-11-P	5	AC.250	AC.1500	<1.0 ($^{250V}_{60Hz}$)	280
			ZAG2210-11-P	10	AC.250	AC.1500	<1.0 ($^{250V}_{60Hz}$)	280
			ZAG2220-11-P	20	AC.250	AC.1500	<1.0 ($^{250V}_{60Hz}$)	280
ZHC	 Metal cased terminal: studs	Prevention of normal and common mode EMI between 0.2 to 30 MHz. UL recognized, TÜV approved, CSA cetfified	ZHC2203-11	3	AC.250	AC.1500	<1.0 ($^{250V}_{60Hz}$)	130
			ZHC2206-11	6	AC.250	AC.1500	<1.0 ($^{250V}_{60Hz}$)	250
			ZHC2210-11	10	AC.250	AC.1500	<1.0 ($^{250V}_{60Hz}$)	270
ZHG	 Metal cased Terminal: faston tabs	More than 20dB attenuation for high voltage pulse such as 2kV, 1μs. UL recognized, TÜV approved, CSA certified.	ZHG2203-11S	3	AC.250	AC.1500	<0.75 ($^{250V}_{60Hz}$)	150
			ZHG2206-11S	6	AC.250	AC.1500	<0.75 ($^{250V}_{60Hz}$)	260
			ZHG2210-11S	10	AC.250	AC.1500	<0.75 ($^{250V}_{60Hz}$)	280
			ZHG2203-H	3	AC.250	AC.1500	<0.75 ($^{250V}_{60Hz}$)	150
			ZHG2206-H	6	AC.250	AC.1500	<0.75 ($^{250V}_{60Hz}$)	170
			ZHG2210-H	10	AC.250	AC.1500	<0.75 ($^{250V}_{60Hz}$)	170
ZSB	 Metal cased Terminal: faston tabs	Prevention of normal and common mode EMI between 0.15 to 30 MHz. VDE approved.	ZSB2210-05A	10	AC.250	AC.1500	<1.5 ($^{250V}_{60Hz}$)	120
ZSG	 Metal cased Terminal: faston tabs	Prvention of normal and common mode EMI between 0.15 to 30 MHz. UL recognized, CSA certified.	ZSG1215-06A	15	AC.125	AC.1500	<0.5 ($^{250V}_{60Hz}$)	170
ZCB	 Plastic cased Terminal: faston tabs	Prevention of normal and common mode EMI between 0.15 to 30 MHz. Equally effective in high voltage pusle EMI attenuation to —11S type. UL recognized, TÜV approved, CSA certified.	ZCB2203-11	3	AC.250	AC.1500	<0.75 ($^{250V}_{60Hz}$)	45
			ZCB2206-11	6	AC.250	AC.1500	<0.75 ($^{250V}_{60Hz}$)	45
			ZCB2203-11S	3	AC.250	AC.1500	<0.75 ($^{250V}_{60Hz}$)	55
			ZCB2206-11S	6	AC.250	AC.1500	<0.75 ($^{250V}_{60Hz}$)	60

EMI/RFI FILTERS

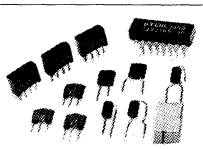
TDK®

TDK CORPORATION OF AMERICA HEAD OFFICE 1600 Feehanville Drive, Mount Prospect, IL 60056, U.S.A. Phone: (312) 803-6100 **CHICAGO REGIONAL OFFICE** Phone: (312) 803-6100 **INDIANAPOLIS REGIONAL OFFICE** Phone: (317) 872-0370 **NEW YORK REGIONAL OFFICE** Phone: (516) 625-0100 **LOS ANGELES REGIONAL OFFICE** Phone: (213) 539-6631 **DETROIT DISTRICT OFFICE** Phone: (313) 353-9393 **NEW JERSEY DISTRICT OFFICE** Phone: (201) 736-0023 **HUNTSVILLE DISTRICT OFFICE** Phone: (205) 539-4551 **GREENSBORO DISTRICT OFFICE** Phone: (919) 292-0012 **DALLAS DISTRICT OFFICE** Phone: (214) 506-9800 **SAN FRANCISCO DISTRICT OFFICE** Phone: (408) 437-9585 **TDK CORPORATION,** TOKYO, JAPAN

EMI/RFI FILTERS

Series name	Exterior view	Function	Part No.	Rated current (A)	Rated voltage (V)	Test voltage (V)	Leakage current (mA)	Weight (g)
ZGB	 Metal cased Lead wires	Prevention of normal mode EMI between 0.15 to 30 MHz. UL recognized: —01U	ZGB22R5-01U	0.5	AC.250	AC.1500	<1.0 ($\frac{250V}{60Hz}$)	75
			ZGB2201-01U	1	AC.250	AC.1500	<1.0 ($\frac{250V}{60Hz}$)	75
			ZGB2202-01U	2	AC.250	AC.1500	<1.0 ($\frac{250V}{60Hz}$)	75
			ZGB2203-01U	3	AC.250	AC.1500	<1.0 ($\frac{250V}{60Hz}$)	75
ZMB	 Platsic cased Lead wires	Prevention of normal mode EMI between 0.15 to 30 MHz. UL recognized: —11 VDE approved: —13	ZMB22R5-11	0.5	AC.250	AC.1500	<1.0 ($\frac{250V}{60Hz}$)	65
			ZMB2201-11	1	AC.250	AC.1500	<1.0 ($\frac{250V}{60Hz}$)	65
			ZMB2202-11	2	AC.250	AC.1500	<1.0 ($\frac{250V}{60Hz}$)	65
			ZMB2203-11	3	AC.250	AC.1500	<1.0 ($\frac{250V}{60Hz}$)	65
			ZMB2201-13	1	AC.250	AC.1500	<0.4 ($\frac{250V}{60Hz}$)	45
			ZMB2203-13	3	AC.250	AC.1500	<0.4 ($\frac{250V}{60Hz}$)	45
ZJG	 Plastic cased Pin terminals	Prevention of normal and common mode EMI between 0.15 to 30 MHz. UL recognized, TÜV approved, CSA certified.	ZJG22R5M-P	0.5	AC.250	AC.1500	<0.5 ($\frac{250V}{60Hz}$)	21
			ZJG2202M-P	2	AC.250	AC.1500	<0.5 ($\frac{250V}{60Hz}$)	30
			ZJG2203M-P	3	AC.250	AC.1500	<0.5 ($\frac{250V}{60Hz}$)	30
			ZJG2206M-P	6	AC.250	AC.1500	<0.5 ($\frac{250V}{60Hz}$)	34
ZUB	 Metal cased Terminal: faston tabs	Prevention of common mode EMI between 1 to 300 MHz. With fuse: —00 —F UL recognized, TÜV approved, CSA certified: —00	ZUB2203-00	3	AC.250	AC.1500	<0.5 ($\frac{250V}{60Hz}$)	50
			ZUB2203-00-F	3	AC.250	AC.1500	<0.5 ($\frac{250V}{60Hz}$)	70
			ZUB2206-00	6	AC.250	AC.1500	<0.5 ($\frac{250V}{60Hz}$)	50
			ZUB2206-00-F	6	AC.250	AC.1500	<0.5 ($\frac{250V}{60Hz}$)	70
ZUG-11	 Metal cased Terminal: faston tabs	Prevention of normal and common mode EMI between 3 to 30 MHz. UL recognized, TÜV approved, CSA certified.	ZUG2203-11	3	AC.250	AC.1500	<0.5 ($\frac{250V}{60Hz}$)	46
			ZUG2206-11	6	AC.250	AC.1500	<0.5 ($\frac{250V}{60Hz}$)	46
ZJK-00	 Resin molded Flat terminal	Prevention of common mode EMI between 0.2 to 200 MHz	ZJK51R1-00	0.1	DC.50	DC.125		1.5
			ZJK51R5-00	0.5	DC.50	DC.125		1.5
			ZJK5103-00	3	DC.50	DC.125		1.5
			ZJK51R1-05	0.1	DC.50	DC.125		0.8
			ZJK51R5-05	0.5	DC.50	DC.125		0.8
			ZJK5103-05	3	DC.50	DC.125		0.8
ZJK-05	 Resin molded Flat terminal	Prevention of common mode EMI between 0.2 to 200 MHz.						
ZJY	 Plastic cased Flat terminal	Impedance Over 200Ω between 20 to 100 MHz.	ZJY51R5-8P	0.5	DC.50	DC.125		1.4
ZJSR	 Resin molded Pin terminal	Prevention of normal mode EMI between 7 to 800 MHz	ZJSR5101-330, 470, 680, 101, 221, 331, 102, 222, 232, 472, 682, 103, 223, 333	1	DC.50	DC.125		1
ZJSC	 Resin molded Pin terminal	Prevention of normal mode EMI between 4 to 1000 MHz	ZJSC-R10-470	5	DC.50	DC.125		1
			ZJSC-R15-121	5	DC.50	DC.125		1
			ZJSC-R47-121	5	DC.50	DC.125		1
			ZJSC-R47-181	5	DC.50	DC.125		1
			ZJSC-R47-391	5	DC.50	DC.125		1
			ZJSC-1R0-103	4	DC.50	DC.125		1
			ZJSC-2R2-101	3	DC.50	DC.125		1
			ZJSC-220-101	1	DC.50	DC.125		1
			ZJSC-470-331	0.6	DC.50	DC.125		1
ZBF	 Round lead terminal	Impedance Over 30Ω between 10 to 1000 MHz	ZBF253S-01	3	DC.50			0.5
			ZBF503S-01	3	DC.50			0.5
			ZBF253D-01	3	DC.50			0.5
			ZBF503D-01	3	DC.50			0.5
			ZBF503S-01TA	3	DC.50			0.5

• *Specifications, materials, etc. are subject to change without notice.*



EMC COMPONENTS Tokin Tokin America Inc.
155 Nicholson Lane, San Jose, California 95134, U.S.A.
Tel: 408-432-8020 Fax: 408-434-0375
Chicago Branch
Presidents Plaza 1, Suite 200N, 8600 W. Bryn Mawr, Chicago, IL 60631
Tel: 312-380-0030 Fax: 312-693-8334

DATA LINE FILTERS

DIP Noise Filters

Model	Circuit Diagram	No. of Terminals/ Circuits	Rated Current per Line (mA)
D-03C/D-03C1	4 cores	16/8 circuits; Common mode	100
D-05N1	8 cores	16P/8 circuits; Normal mode	100
D-07C1	1 core	16P/8 circuits; Common mode	300
D-08C2	1 core	8P/4 circuits; Common mode	2,300
D-08C2A	1 core	8P/4 circuits; Common mode	500
D-16C	1 core	8P/4 circuits; Common mode	500
D-20C	1 core	16P/8 circuits; Common mode	500
D-40C	1 core	6P/3 circuits; Common mode	300
D-42C	1 core	10P/5 circuits; Common mode	300
D-45C	1 core	16P/8 circuits; Common mode	300
D-47C	1 core	20P/10 circuits; Common mode	300
D-55C	1 core	10P/5 circuits; Common mode	300
D-58C	1 core	16P/8 circuits; Common mode	300

Bead Inductors

Model	Type	Packaging	Tape size standard
B-01-AT	Single; axial lead type	5,000/reel	Conforms to EIAJ
B-01-AT1F	Single; axial lead type	2,000/flat	Conforms to EIAJ
B-01-A	Single; axial lead type	—	Conforms to EIAJ
B-01-RT	Single; axial lead type	2,000/reel	Conforms to EIAJ

EMC Beads

Model	Core	Wire	No. of turns	Impedance at 100MHz
B-1	B-20-F-28	Teflon wire (0.26ϕ); single core; white	2T	$\geqq$61Ω
B-3	B-20L-48B	Teflon wire (0.51ϕ); single core; red	2T	$\geqq$96Ω
B-4	B-20L-44	Teflon wire (0.26ϕ); single core; white	2T	$\geqq$220Ω
B-5	B-20L-44	Teflon wire (0.26ϕ); single core; white	3T	$\geqq$400Ω
B-5A	B-20L-44	Teflon wire (0.26ϕ); single core; white	3T	$\geqq$400Ω
B-7	B-20F-28	Teflon wire (0.32ϕ); single core; green	2T	$\geqq$63Ω
B-8	B-20L-48B	Teflon wire (0.4ϕ); single core; blue	2T	$\geqq$107Ω
B-9	B-20L-48B	Teflon wire (0.4ϕ); single core; yellow	3T	$\geqq$239Ω
B-10	B-20L-48B	Teflon wire (0.4ϕ); single core; black	4T	$\geqq$390Ω
B-6-22A	—	Soft copper wire (0.6ϕ)	—	—
B-6-31A	—	Soft copper wire (0.6ϕ)	—	—

Model	Type	Packaging	Tape size standard
B-01-RTF	Single; axial lead type	2,000/flat	Conforms to EIAJ
B-02-R	Double; radial lead type	—	Conforms to EIAJ
B-02-RT	Double; radial lead type	2,000/reel	Conforms to EIAJ
B-03-RT	Double; radial lead type	2,000/reel	Conforms to EIAJ

EMI Cores

ESD-R Series

(mm)

Model	A	B	C	Remarks
ESD-R-14A	14	7	3	
ESD-R-16	16	12	8.4	
ESD-R-19	19	9	11	w/core cap
ESD-R-25	26	14	15	w/core cap
ESD-R-38	39	18	14	w/core cap
ESD-R-47	48	26	16	w/core cap
ESD-R-57	62	32.4	19	w/core cap
ESD-R-10D	9.5	5	10	
ESD-R-12C	12	7	15	
ESD-R-12D	13	5.5	6.5	w/core cap
ESD-R-19D	19	9	11	w/core cap
ESD-R-25D	26	14	15	w/core cap

ESD-RB Series

Model	A	B	C	D	Remarks
ESD-R-19B, 19DB	21.5	8.5	12	18.5	w/core case
ESD-R-25B, 25DB	29.5	13.5	14	23	w/core case
ESD-R-38B	42.5	17.5	15	28	w/core case
ESD-R-47B	51.5	25.5	17	34	w/core case

ESD-FPL Series

Model	a	b	c	d	e
ESD-FPL-16	37±1	25.4±1	12±0.5	12.7±0.5	1.5±0.3
ESD-FPL-34	60±1	48.3±1	12±0.5	12.7±0.5	1.5±0.3
ESD-FPL-50	80±1	68.6±1	12±0.5	12.7±0.5	1.5±0.3
ESD-FPL-60	93±1	81.3±1	12±0.5	12.7±0.5	1.5±0.3

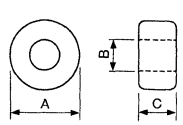
ESD-QR, Q Series

Model	A (max.)	B	Wire size	Remarks
ESD-QR-12	18	28±1	ϕ4, ϕ6	Plastic case; w/hinged clamp
ESD-QR-15	22.5	32±1	ϕ5, ϕ6	Plastic case; w/hinged clamp
ESD-QR-25	32	32±1	ϕ10, ϕ11	Plastic case; w/hinged clamp; w/fixing tab
ESD-QR-25S	25	23	$\leqq\phi$13	Attached with tape; separate type
ESD-QR-45	45	27	$\leqq\phi$26	W/spring clamp; separate type

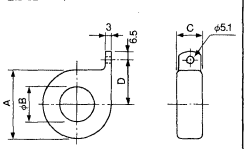
ESD-H Series

Model	A	B	C	D
ESD-H-14U	17.5	7	15±2	5±2
ESD-H-14NU	17.5	7	15^{+5}_{0}	5±2

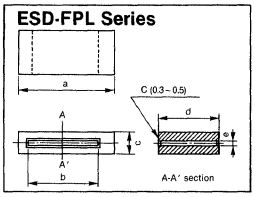
ESD-R Series



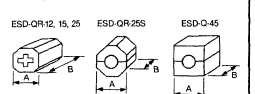
EAD-RB Series



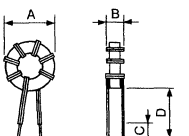
ESD-FPL Series



ESD-QR, ESD-Q Series

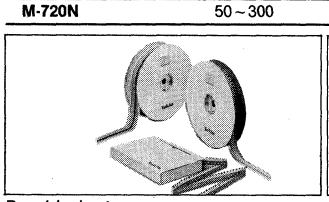


ESD-H Series

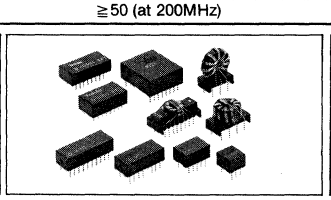


EMC Chip Filters

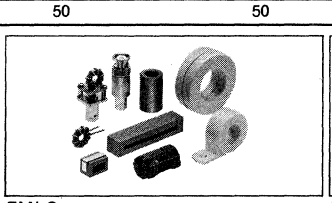
Model	Frequency range (MHz)	Impedace (Ω)	Rated current (mA)	Rated voltage (V)	Insulation resistance (MΩ) at 100V DC; btwn. terminals
M-608	5~200	$\geqq$300 (at 100MHz)	100	50	$\geqq$10
M-614	5~100	$\geqq$700 (at 50MHz)	100	50	$\geqq$10
M-620	5~50	$\geqq$1,000 (at 30MHz)	100	50	$\geqq$10
M-720N	50~300	$\geqq$50 (at 200MHz)	50	50	$\geqq$10



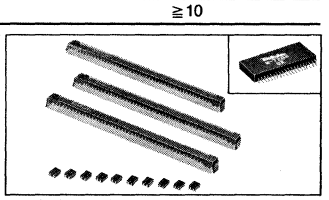
Bead Inductors



DIP Noise Filters



EMI Cores



EMC Chip Filters

TOKO AMERICA FILTERS

Toko's filter choices include LC, digital, helical, ceramic and surface mountable types to meet a wide range of video, audio and communications equipment applications.

HELICAL FILTERS

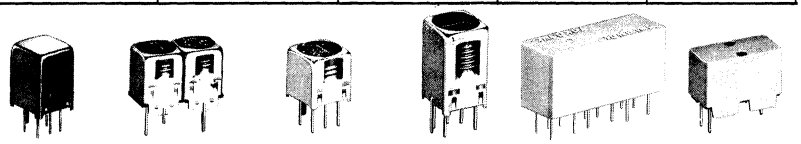
Toko Helical Filters are designed for use with communications equipment operating between 130 MHz and 1.5 GHz, including cellular telephones and business-band transceivers. Compact, double, triple, and quadruple-tuned types are available, with adjustable and screw-type cores for tuning.

Type	5 HW	5 HT	7 HW	7 HT	HRW	CBT	CBW
Center Freq.	365 MHz~1.5 GHz	650 ~ 1.50 GHz	350 MHz~910 MHz	350 MHz~960MHz	350 MHz~520 MHz	100 MHz~220 MHz	100 MHz~220 MHz
Impedance	50Ω	50Ω	50~500Ω	50Ω - 500Ω	50Ω	50Ω-500Ω	50Ω
Ht/Lth/Wd (mm)	9/11.2/6	9/17/6	14.7/15.5/8	14.7/22.9/6	24/32/19	20.6/38.9/13	20.6/26.4/13
Temp. Range	−10° to +60°C	−10°~+60°C	−10°~+60°C	−10°~+60°C	−10°~+60°C	−10°~+60°C	−10°~+60°C

LC FILTERS

With built-in capacitors to save board space and cut development time. Adjustable types are available with 5mm or 7mm coils, as well as several internal capacitance options. If a standard part number does not meet your needs, Toko can supply custom types.

5 mm. FILTERS



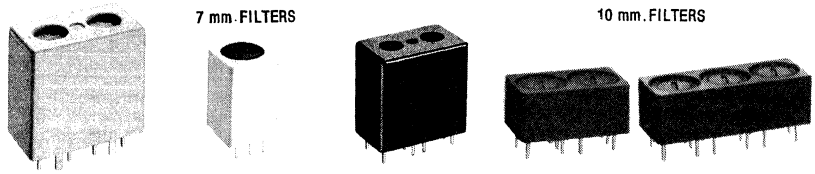
Type	5 VU Series	5 VF Series	5 VL Series	5 VH Series	5 VN Series	5 VFN Series
Freq. Range	100 kHz~10 MHz	0.1~15 MHz	0.1~15 MHz	10~200 kHz	100 kHz~10 MHz	0.1~15 MHz
Impedance	100Ω~10 KΩ	100Ω~10 KΩ	100Ω~10 KΩ	100Ω~10 KΩ	100Ω~10 KΩ	100Ω~10 KΩ
Ht/Lth/Wd (mm)	8/6.1/6.1—8/18/6.1	8.8/12.2/6.1—8.8/29.3/6.1	6.8/6.1/6.1—6.8/18/6.1	9.5/6.1/6.1—9.5/18/6.1	8/6.5/6.5—8/18.5/6.5	8.8/12.5/6.8—8.8/29.8/6.8
Temp. Range	−10°~+60°C	−10°~+60°C	−10°~+60°C	−10°~+60°C	−10°~+60°C	−10°~+60°C
Number of Elements	Single, Dual, Triple	Single, Dual, Triple	Single, Dual, Triple	Single, Dual, Triple	Single, Dual, Triple	Dual, Triple, Quad, Quint

FREE!

Send for new coil and filter catalog filled with over 120 pages of product specifications, features and part numbers.

7 mm. FILTERS

10 mm. FILTERS

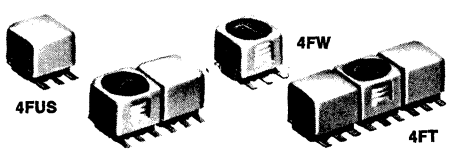


Type	7V Series	.AB▫-07 Series.	LPFS Series
Freq. Range	100 kHz~10 MHz	10 kHz~200 kHz	10 kHz~200 kHz
Impedance	100Ω~10 KΩ	1 KΩ~10 KΩ	1 KΩ~10 KΩ
Ht/Lth/Wd (mm)	14/8/8—16/26/10	13.5/9.2/9—13.5/25/9	21/13.5/13.5—21/33.5/13.5
Temp. Range	−10°~+60°C	−10°C~+60°C	−10°~+60°C
Number of Elements	Dual, Triple	Single, Dual, Triple	Single, Dual, Triple

ABW-10L	ABT-10L
10 kHz~200 kHz	10 kHz~200 kHz
1 KΩ~10 KΩ	1 KΩ~10 KΩ
10/23/13.5	10/34/13.5
−10°~+60°C	−10°~+60°C
Dual	Triple

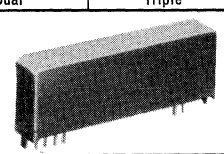
SMT CHIP-TYPE FILTERS

This series of chip type filters are designed for use between 0.1 — 15 kHz. Suggested applications are high, low and bandpass filters, delay lines, equalizers and similar circuit elements.



Useable Frequency Range	0.1~15 MHz
Maximum Inductance	700 μH
Unloaded Q. approx.	40
Internal Capacitor	4~750 pF

ACTIVE DIGITAL AUDIO FILTERS

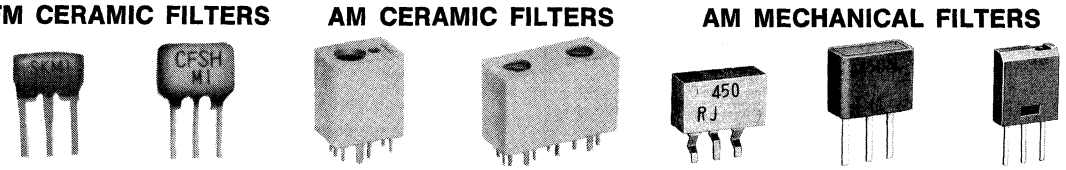


Type	PALH 0900	PALH 1100	PALH 1111
Cut Off Freq.	5 kHz~20 kHz	5 kHz~20 kHz	5 kHz~20 kHz
Impedance	10 KΩ	10 KΩ	10 KΩ
Ht/Lth/Wd	20.5/38.5/13.5	20.5/38.5/13.5	20.5/38.5/13.5
Temp. Range	−10°~+60°C	−10°~+60°C	−10°~+60°C

FM CERAMIC FILTERS

AM CERAMIC FILTERS

AM MECHANICAL FILTERS



Type	CFSK	CFSD	CFMA	CFMQ	CFB	CFMS	CFM2
Freq. Applicable	10.7 MHz	10.7 MHz	455 kHz	455 kHz	450/455 kHz	455 kHz	262/455 KHz
Impedance	330Ω	330Ω	300 KΩ/17 pF/2 KΩ	300 KΩ/17 pF/2 KΩ	3 KΩ	1 KΩ~2 KΩ	1~5.1 K
Ht/Lth/Wd (mm)	6/9/3.5	9/9/4	14/13/10	14/21/9.5	6.5/9.5/4	6.5/8.2/4	9.5/8.2/4
Temp. Range	−20°~+80°C	−20°~+80°C	−10°~+60°C	−10°~+60°C	−10°~+60°C	−10°~+60°C	−10°~+60°C

Toko America, Inc. / 1250 Feehanville Drive, Mount Prospect, IL 60056 / Tel. 312/297-0070 / FAX 312/699-7864
Western Office / 10080 N. Wolfe Rd., SW3-211, Cupertino, CA 95014 / Tel. 408/996-7575 / FAX 408/996-7280
Eastern Office / Danbury Corp. Center, 107 Mill Plain Road, Danbury, CT 06811 / Tel 203/748-6871 / FAX 203/797-1223
S. Eastern Office / Executive Plaza, 555 Sparkman Drive, Suite 820-C, Huntsville, AL 35816 / Tel. 205/830-0952 / FAX 205/830-5399

TRI-MAG, Inc.
P.O. BOX 4079 VISALIA, CA 93278 (209) 651-2222
ITT TELEX: 4994462 CABLE: "TRIMAG" FAX NO: 209-651-0188

NEW

Three-Phase Power Line Filters

FOR Switching Power Supplies TO MEET FCC. VDE LEVEL A AND B

TPY A/TPY B SERIES

THREE PHASE WYE FILTERS WITH CAPABILITIES TO ATTENUATE DIFFERENTIAL AND COMMON MODE NOISE, TO LEVEL A OR B, FROM SWITCHING POWER SUPPLIES. THIS SERIES OF "T" SECTION FILTERS HAS THE EXTENDED LOW FREQUENCY RANGE NECESSARY TO EITHER SUPPRESS SINGLE OR MULTIPLE SWITCHING POWER SUPPLIES IN BALANCED OR UNBALANCED LOAD CONFIGURATIONS.

SIMPLY SPECIFY EITHER TPYA OR TPYB FOR THE CONDUCTED LIMITS THAT YOU WANT TO MEET. THIS SERIES MAY ALSO BE CONNECTED IN A DELTA CONFIGURATION.

Part No.	Current	Case	Leakage*
TPYB7	7.5A/PH	7 x 4 x 4	2.0mA
TPYB15	15A/PH	8 x 5 x 4	2.0mA
TPYB30	30A/PH	12 x 6.5 x 4	2.4mA

Rated Voltage: 420/250 VAC, 47-63 Hz **Insertion Loss:** (50 ohms)
Test Voltage: Line to Line: 1.5KVDC
Line to Gnd: 2.6KVDC

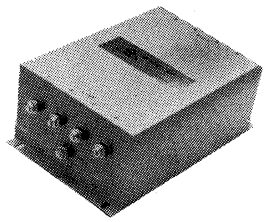
	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	20db	60db	65db	65db	60db	60db
L/L	36db	65db	65db	65db	60db	55db

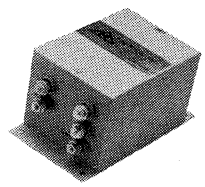
Part No.	Current	Case	Leakage*
TPYA15	15A/PH	7 x 4 x 4	2.0mA
TPYA30	30A/PH	8 x 5 x 4	2.4mA
TPYA45	**45A/PH**	**12 x 6.5 x 4**	**3.0mA**
TPYA60	60A/PH	12 x 6.5 x 4	3.0mA

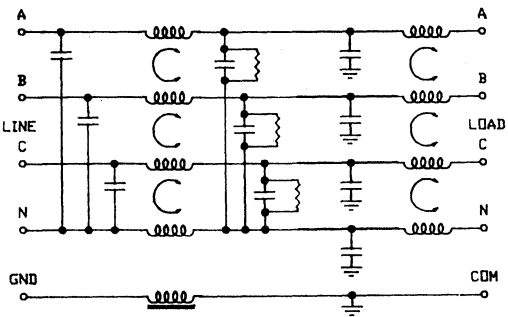
Rated Voltage: 420/250 VAC, 47-63 Hz **Insertion Loss:** (50 ohms)
Test Voltage: Line to Line: 1.5KVDC
Line to Gnd: 2.6KVDC

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	10db	50db	65db	65db	65db	65db
L/L	20db	50db	60db	60db	60db	55db

* EACH LINE TO GND. @ 250VAC







Part No.	Current	Case	Leakage*
TPY20	20A/PH	5 x 4 x 4	2.0mA
TPY30	30A/PH	5 x 4 x 4	2.0mA
TPY45	**45A/PH**	**8 x 5 x 4**	**2.4mA**
TPY60	**60A/PH**	**8 x 5 x 4**	**3.0mA**

Rated Voltage: 420/250 VAC, 47-63 Hz **Insertion Loss:** (50 ohms)
Test Voltage: Line to Line: 1.5KVDC
Line to Gnd: 2.6KVDC

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	12db	30db	55db	60db	50db	50db
L/L	18db	29db	50db	55db	50db	50db

SERIES K FILTERS

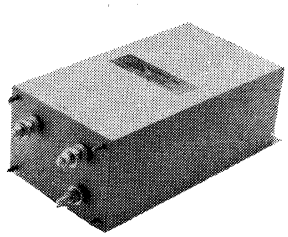
TRI-MAG's "K" SERIES, RFI/EMI, LINE FILTERS HAVE BEEN DESIGNED AND DEVELOPED TO ALLOW ELECTRONIC EQUIPMENT, USING SWITCHING POWER SUPPLIES AND OTHER LOW IMPEDANCE NOISE SOURCES. TO MEET VDE 0871 AND THE RECENTLY ADOPTED FCC REGULATIONS GOVERNING THE INTERFERENCE POTENTIAL OF COMPUTER AND SIMILAR DIGITAL ELECTRONIC EQUIPMENT TO RADIO COMMUNICATIONS.

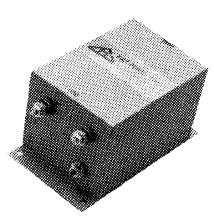
SERIES "K" FILTERS PROVIDE HIGH INSERTION LOSS FOR BOTH LINE-TO-GROUND AND LINE-TO-LINE GENERATED RFI/EMI INTERFERENCE. THESE FILTERS ARE RECOGNIZED BY UNDERWRITERS LABORATORIES, INC. UNDER ITS COMPONENT RECOGNITION SERVICES. OTHER APPROVALS (CSA, VDE, IEC) ARE IN PROCESS.

Part No.	Current	Case	Leakage*
K3	3A	2.5 x 2.0 x 1.5	1.0mA
K10	10A	2.8 x 2.2 x 1.5	1.0mA
K20	20A	3.8 x 3.3 x 1.5	1.0mA
K30	30A	5.5 x 3.0 x 2.7	1.0mA
K45	45A	9.0 x 5.0 x 4.0	1.0mA

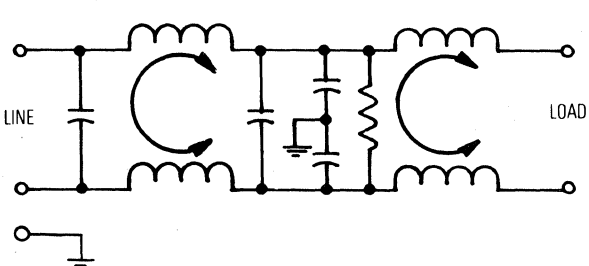
Rated Voltage: 250VAC, 47-63Hz **Insertion Loss:** (50 ohms)
Test Voltage: Line to Line: 1.5KVDC
Line to Gnd: 2.6KVDC

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	20db	60db	65db	65db	65db	60db
L/G	30db	60db	65db	65db	65db	60db





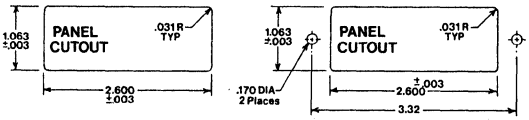
SERIES "K"



TRI-MAG, Inc.
P.O. BOX 4079 VISALIA, CA 93278 (209) 651-2222
ITT TELEX: 4994462 CABLE: "TRIMAG" FAX NO: 209-651-0188

MIF SERIES

MODULAR INTEGRATED FILTERS
(POWER ENTRY MODULE WITH FILTER)



SPEED UP AND SIMPLIFY SYSTEM INTEGRATION

PEND'G

FEATURES:

- IEC CONNECTOR INPUT
- FUSED INPUT POWER
- SPARE FUSE HOLDER
- DPDT ON/OFF SWITCH
- VOLTAGE SELECTION SWITCH
- MINIMUM SPACE REQUIREMENT
- COST SAVING INTEGRATION
- SAFETY INTERLOCK ON FUSE

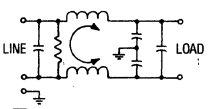
SPECIFICATIONS:

1. **Maximum Leakage Current Each**
   Line-to-Ground @ 115 VAC 60Hz, 0.5mA
   @ 250 VAC 50Hz, 1.0mA
2. **Hipot Rating** (One Minute)
   Line-to-Ground: 2500 VDC
   Line-to-Line: 1500 VDC
3. **Operating Frequency:** 47-63 Hz
4. **Rated Voltage:** 115/250 VAC

SERIES B FILTERS

TRI-MAG PART NO:	B3-12S10EA B6-12S10EA	B3-12VS10E B6-12VS10E	B3-12S10EAVS B6-12S10EAVS	B3-12SF10EA B6-12SF10EA	B3-12SF10EAVS B6-12SF10EAVS	B3-12AVS3 B6-12AVS3	1.75 2.13 Dim. "L"
RATED CURRENT 115VAC	3A/6A	3A/6A	3A/6A	3A/6A	3A/6A	3A/6A	
RATED CURRENT 250VAC	3A/6A	3A/6A	3A/6A	3A/6A	3A/6A	3A/6A	
IEC CONNECTOR	YES	YES	YES	YES	YES	YES	
FUSE HOLDER	YES	YES	YES	YES	YES	YES	
POWER SWITCH (DPDT)	YES	NO	YES	YES	YES	NO	
VOLTAGE SELECTOR SW	NO	YES	YES	NO	YES	YES	

MODEL	FREQUENCY-MHz .15	.20	.50	10.0	20.0
B3	20dB	25dB	35dB	50dB	50dB
B6	20dB	25dB	35dB	50dB	50dB

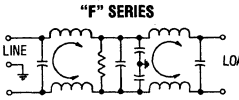


SERIES F G & GB FILTERS

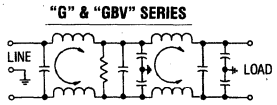
TRI-MAG PART NO:	F6-12S10EA G3-12S10EA GBV3-12S10EA	F6-12VS10E G3-12VS10E ---	F6-12S10EAVS G3-12S10EAVS ---	F6-12SF10EA G3-12SF10EA ---	F6-12SF10EAVS G3-12SF10EAVS ---	2.13 2.13 2.13 Dim. "L"
RATED CURRENT 115VAC	6A/3A	6A/3A	6A/3A	6A/3A	6A/3A	
RATED CURRENT 250VAC	6A/3A	6A/3A	6A/3A	6A/3A	6A/3A	
IEC CONNECTOR	YES	YES	YES	YES	YES	
FUSE HOLDER	YES	YES	YES	YES	YES	
POWER SWITCH (DPDT)	YES	NO	YES	YES	YES	
VOLTAGE SELECTOR SW	NO	YES	YES	NO	YES	

MODEL	FREQUENCY-MHz .15	.20	.50	1.0	10.0	20.0
F6	45dB	50dB	65dB	70dB	70dB	70dB
G3	20dB	20dB	50dB	60dB	70dB	70dB
GBV3	60dB	65dB	70dB	70dB	70dB	70dB

"F" SERIES



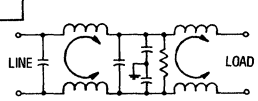
"G" & "GBV" SERIES



SERIES K FILTERS

TRI-MAG PART NO:	K3-12S10EA	K3-12VS10E	K3-12S10EAVS	K3-12SF10EA	K3-12SF10EAVS	2.13 Dim. "L"
RATED CURRENT 115VAC	3A	3A	3A	3A	3A	
RATED CURRENT 250VAC	3A	3A	3A	3A	3A	
IEC CONNECTOR	YES	YES	YES	YES	YES	
FUSE HOLDER	YES	YES	YES	YES	YES	
POWER SWITCH (DPDT)	YES	NO	YES	YES	YES	
VOLTAGE SELECTOR SW	NO	YES	YES	NO	YES	

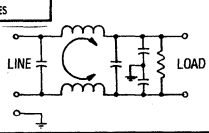
MODEL	FREQUENCY-MHz .15	.50	1.0	5.0	10.0	20.0
K3 LINE TO GROUND	60dB	65dB	65dB	65dB	65dB	65dB
K3 LINE TO LINE	50dB	65dB	65dB	65dB	65dB	65dB



MPA/MPB SERIES

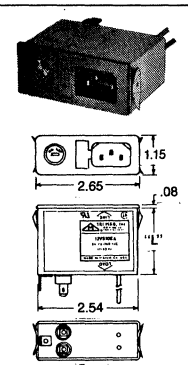
TRI-MAG PART NO:	MPA3-12S10EA MPB3-12S10EA	MPA3-12VS10E MPB3-12VS10E	MPA3-12S10EAVS MPB3-12S10EAVS	MPA3-12SF10EA MPB3-12SF10EA	MPA3-12SF10EAVS MPB3-12SF10EAVS	MPA3-12AVS3 MPB3-12AVS3	1.75 Dim. "L"
RATED CURRENT 115VAC	3A	3A	3A	3A	3A	3A	
RATED CURRENT 250VAC	3A	3A	3A	3A	3A	3A	
IEC CONNECTOR	YES	YES	YES	YES	YES	YES	
FUSE HOLDER	YES	YES	YES	YES	YES	YES	
POWER SWITCH (DPDT)	YES	NO	YES	YES	YES	NO	
VOLTAGE SELECTOR SW	NO	YES	YES	NO	YES	YES	

MODEL	FREQUENCY-MHz .01	.02	.05	.15	.50	1.0	5.0	10.0	30.0
MPA	5dB	15dB	25dB	45dB	65dB	65dB	65dB	65dB	65dB
MPB	15dB	25dB	35dB	55dB	65dB	65dB	65dB	65dB	65dB

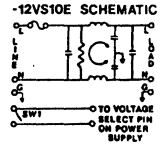


MIF CLIP MOUNT

-12VS10EA	-12AVS3



-12VS10E SCHEMATIC



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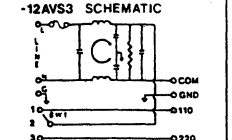
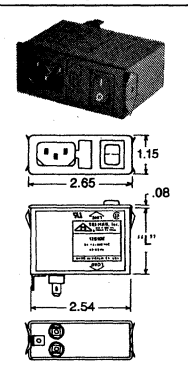
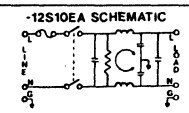


MIF CLIP MOUNT

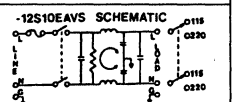
-12S10E -12S10EA	-12S10EAVS



-12S10EA SCHEMATIC

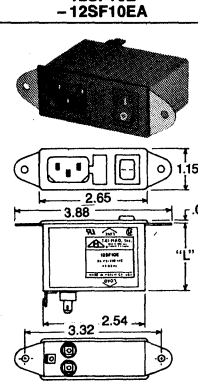


-12S10EAVS SCHEMATIC



MIF FLANGE MOUNT

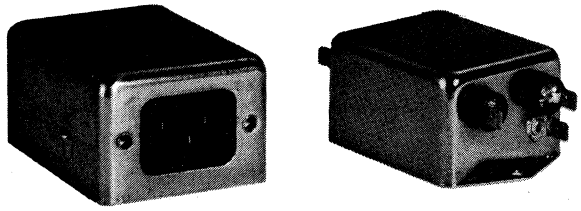
-12SF10E -12SF10EA	-12SF10EAVS

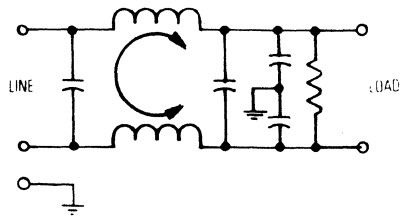


TRI-MAG, Inc.

P.O. BOX 4079 VISALIA, CA 93278 (209) 651-2222
ITT TELEX: 4994462 CABLE: "TRIMAG" FAX NO: 209-651-0188

PA/PB SERIES





THE **TRI-MAG** PA/PB SERIES OF A.C. LINE FILTERS HAVE BEEN DEVELOPED PRIMARILY FOR COMPUTER SYSTEMS THAT USE SWITCHING POWER SUPPLIES. THE CURRENT RATINGS ARE HIGH ENOUGH TO ALLOW DESIGNERS TO PROTECT A COMPLETE COMPUTER SYSTEM FROM EXCEEDING THE CONDUCTED EMISSION LIMITS SPECIFIED EITHER BY FCC OR VDE.

THE PA IS AVAILABLE IN CURRENT RATINGS OF 1, 3, 5, 6 AND 10 AMPS AND THE PB IS AVAILABLE IN 1.3 AND 5 AMPS FOR OPERATION ON A.C. LINES OF 115 TO 250 VOLTS 50/60 Hz.

SPECIFY EITHER PA OR PB FOR THE CONDUCTED LIMITS THAT YOU WANT TO MEET.

Part No.	Current	Case	Leakage
PB1	1	2.5 x 2 x 1.5	1mA
PB3	3	2.5 x 2 x 1.5	1mA
PB5	5	2.8 x 2.2 x 1.5	1mA

Rated Voltage: 250VAC, 47-63Hz **Insertion Loss:** (50 ohms)
Test Voltage: Line to Line: 1.5KVDC
Line to Gnd: 2.6KVDC

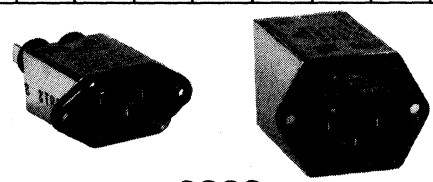
PB	.01MHz	.01MHz	.05MHz	.15MHz	.50MHz	1.0MHz	5.0MHz	10MHz	30MHz
	30db	35db	45db	65db	65db	65d	65db	65db	65db

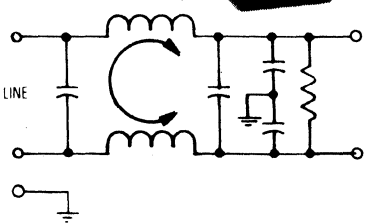
Part No.	Current	Case	Leakage
PA1	1	2.5 x 2 x 1.5	1mA
PA3	3	2.5 x 2 x 1.5	1mA
PA5	5	2.5 x 2 x 1.5	1mA
PA6	6	2.8 x 2.2 x 1.5	1mA
PA10	10	2.8 x 2.2 x 1.5	1mA

Rated Voltage: 250VAC, 47-63Hz **Insertion Loss:** (50 ohms)
Test Voltage: Line to Line: 1.5KVDC
Line to Gnd: 2.6KVDC

PA	.01MHz	.02MHz	.05MHz	.15MHz	.50MHz	1MHz	5MHz	10MHz	30MHz
	25db	30db	40db	60db	65db	65db	65db	65db	65db

MPA/MPB SERIES





THE **TRI-MAG** MPA/MPB SERIES ARE THE "MINI" VERSIONS OF THE PA AND PB. THEY HAVE BEEN DEVELOPED TO SUPPRESS THE CONDUCTED EMISSIONS GENERATED BY SWITCHING POWER SUPPLIES. SINCE THESE SERIES ARE "MINI" IN SIZE AND COST, IT MAKES THEM IDEAL FOR COMPUTER PERIPHERALS.

THE MPA OR MPB IS AVAILABLE IN CURRENT RATINGS OF 2 AMPS FOR OPERATION ON A.C. LINES OF 115 TO 250 VOLTS, 50/60 Hz.

SPECIFY EITHER MPA OR MPB FOR THE CONDUCTED LIMITS THAT YOU WANT TO MEET.

Part No.	Current	Case	Leakage
MPB2-11	2	1.9 x 2.1 x 1.5	1mA
MPB2-12	2	2 x 1.1 x 1.3	1mA

Rated Voltage: 250VAC, 47-63Hz **Insertion Loss:** (50 ohms)
Test Voltage: Line to Line: 1.5KVDC
Line to Gnd: 2.6KVDC

MPB	.01MHz	.02MHz	.05MHz	.15MHz	.50MHz	1MHz	5MHz	10MHz	30MHz
	15db	25db	35db	55db	65db	65db	65db	65db	65db

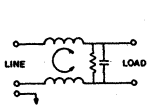
Part No.	Current	Case	Leakage
MPA2-11	2	1.4 x 1.1 x .7	1mA
MPA2-12	2	2 x 1.1 x 1.3	1mA

Rated Voltage: 250VAC, 47-63Hz **Insertion Loss:** (50 ohms)
Test Voltage: Line to Line: 1.5KVDC
Line to Gnd: 2.6KVDC

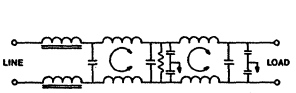
MPA	.01MHz	.02MHz	.05MHz	.15MHz	.50MHz	1MHz	5MHz	10MHz	30MHz
	5db	15db	25db	45db	65db	65db	65db	65db	65db

MEDICAL SERIES

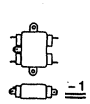
1. **RATED VOLTAGE:** 115/250VAC, 47-63Hz
2. **TEST VOLTAGE:**
   LINE TO GROUND: 2500 VDC
   LINE TO LINE: 1500 VDC
3. **LEAKAGE CURRENT:**
   M=2μA, MA=50μA, MB=100μA



CIRCUIT A



CIRCUIT B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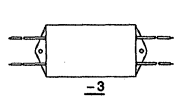
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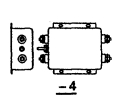
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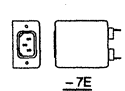
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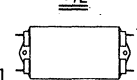
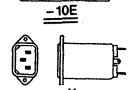

-10E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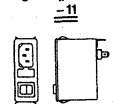
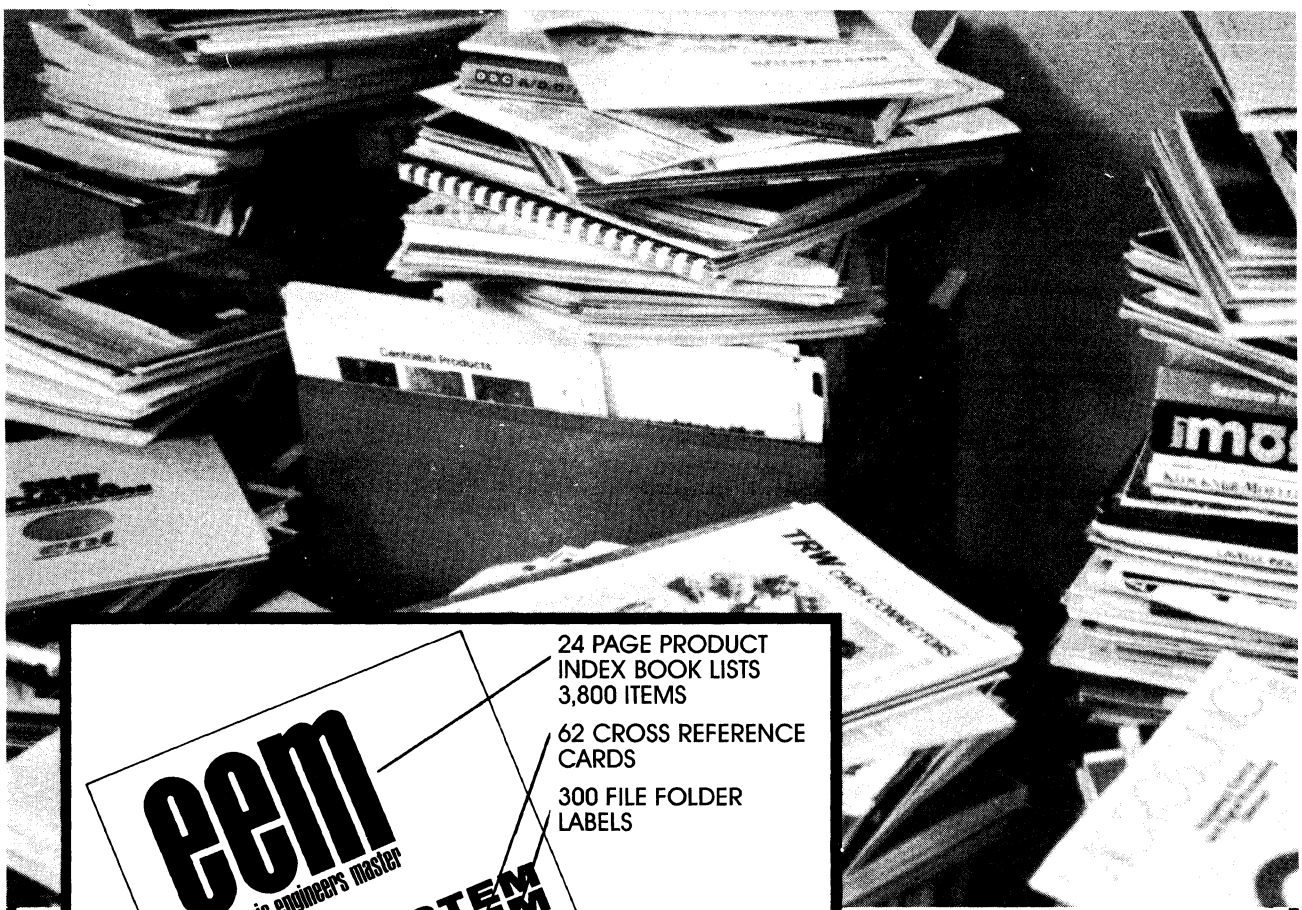

-12S10E

	CIRCUIT	CONFIGURATIONS AVAILABLE						
		-1	-3	-4	-7E	-10E	-11	-12S10E
M3	A	×	–	–	–	×	×	–
M6	A	×	–	–	–	–	×	–
MA3	B	–	×	–	×	×	–	×
MA6	B	–	×	–	×	×	–	–
MA10	B	–	×	–	–	×	–	–
MA15	B	–	–	×	–	–	–	–
MA20	B	–	–	×	–	–	–	–
MB3	B	–	×	–	×	×	–	×
MB6	B	–	×	–	×	×	–	–
MB10	B	–	×	–	–	×	–	–
MB15	B	–	–	×	–	–	–	–
MB20	B	–	–	×	–	–	–	–



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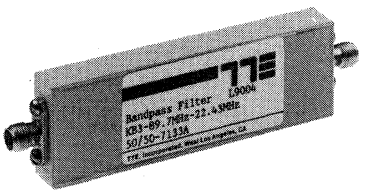
TTE, Incorporated

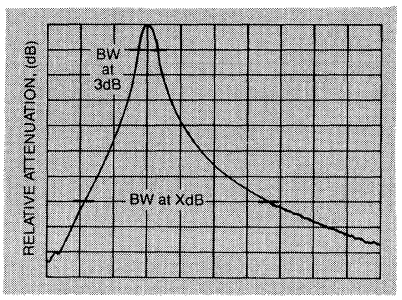
Passive Bandpass Filters

T T E® offers a complete line of Bandpass Filters covering the frequency range of 10Hz to 500MHz. Any 3dB bandwidth from 2% of the center frequency to 100% of the center frequency may be specified. Any number of poles from 1 to 5, and any design type may be specified. The series listed on these pages are typical of the products offered by T T E. To receive the current 56 page catalog call (213) 478-8224, ask for Ext. 10



General Specification

Series Number	: KB3
F_C-Center Frequency Range	: 100Hz to 100MHz
% Bandwidth at 3dB	: from 6% to 100% F_C
Bandwidth Ratio 50dB:3dB	: 10:1
Impedance Range	: 50Ω to 50kΩ
Dynamic Range	: >80dB
Insertion Loss at F_C	: from 2dB to 6dB
VSWR at F_C	: 1.5:1 typically
P_{MAX}	: 20 milliWatts at F_C
E_{MAX}	: 50VDC
Operating Temperature	: –10°C to +80°C typically
Total Harmonic Distortion at F_C	: 0.01%



Part Number Derivation:

KB3 - **XXX** - **XXX** - **XXX/XXX** - **XXX**

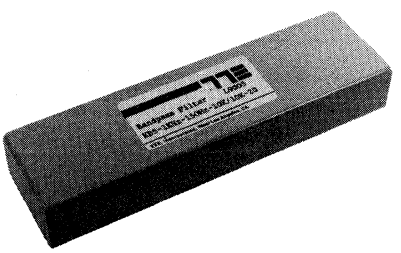
Series Number / *F_C Freq(Hz)* / *3dB BW Freq(Hz)* / *Source/ Load Ω* / *Case Number*

Standard product shipment is within 10 DAYS ARO.

Passive Bandpass Filters

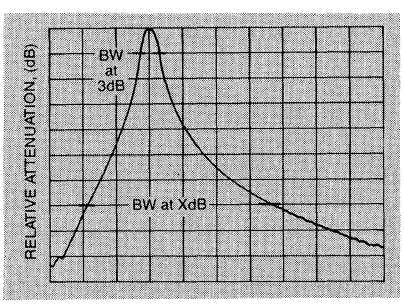
Since its establishment in 1956, T T E continues as a leader in filter design and manufacturing. T T E's reputation for consistent high quality product, reliability, on time delivery, competitive pricing, and customer service is well known.

A very popular series is the KB5. The specifications for that product follow. Typical **price** for this series is **under $100 each** in 100 unit quantities. **Shipment for** quantities of **1 to 10 units** is within **10 DAYS ARO: 100 units within 6 weeks.**



General Specification

Series Number	: KB5
F_C-Center Frequency Range	: 1kHz to 10MHz
% Bandwidth at 3dB	: from 15% to 100% F_C
Bandwidth Ratio 50dB:3dB	: 5:1
Impedance Range	: 50Ω to 50kΩ
Dynamic Range	: >80dB
Insertion Loss at F_C	: from 2dB to 6dB
VSWR at F_C	: 1.5:1 typically
P_{MAX}	: 20 milliWatts at F_C
E_{MAX}	: 50VDC
Operating Temperature	: –10°C to +80°C typically
Total Harmonic Distortion at F_C	: 0.01%



Part Number Derivation:

KB5 - **XXX** - **XXX** - **XXX/XXX** - **XXX**

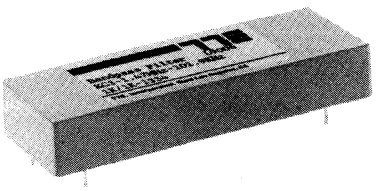
Series Number / *F_C Freq(Hz)* / *3dB BW Freq(Hz)* / *Source/ Load Ω* / *Case Number*

T T E, Incorporated, 11650 W. Olympic Blvd., Los Angeles, CA 90064, (213) 478-8224, FAX (213) 312-1055

TTE, Incorporated

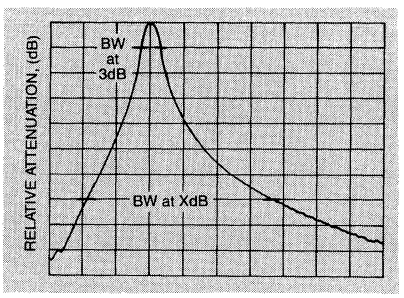
Passive Bandpass Filters

T T E's Chebyshev Bandpass Filters are frequently specified by customers. A main difference between the Chebyshev and Butterworth design is passband ripple. An advantage to the Chebyshev design is its' greater stopband selectivity. Please remember that the stopband characteristics are monotonic for both design types.
Typical **price** for this series is **under $65 each** in 100 unit quantities. **Shipment for** quantities of **1 to 10 units** is within **10 DAYS ARO; 100 units within 6 weeks.**



General Specification

Series Number	: KC3
F_C-Center Frequency Range	: 100Hz to 100MHz
% Bandwidth at 3dB	: from 6% to 100% F_C
Passband Ripple	: 0.5dB
Bandwidth Ratio 60dB:3dB	: 10:1
Impedance Range	: 50Ω to 50kΩ
Dynamic Range	: >80dB
Insertion Loss at F_C	: from 2dB to 6dB
VSWR at F_C	: 1.5:1 typically
P_{MAX}	: 20 milliWatts at F_C
E_{MAX}	: 50VDC
Operating Temperature	: –10°C to +80°C typically
Total Harmonic Distortion at F_C	: 0.01%



Part Number Derivation:

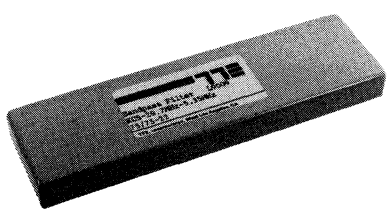
KC3 - **XXX** - **XXX** - **XXX/XXX** - **XXX**

Series Number / *F_C Freq(Hz)* / *3dB BW Freq(Hz)* / *Source/ Load Ω* / *Case Number*

For technical assistance, please call our ENGINEERING HOT LINE (213) 473-0584.

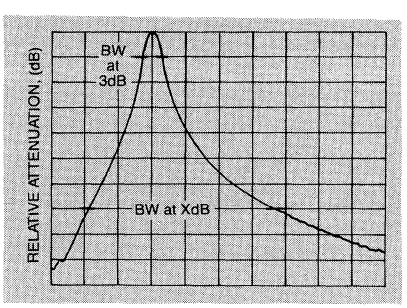
Passive Bandpass Filters

The KC5 is a 5 pole Chebyshev Bandpass Filter. The passband ripple is 1dB peak to valley for this design, however, its' 3dB:50dB bandwidth ratio is a very sharp 5:1.
Typical **price** for this series is **under $100 each** in 100 unit quantities. **Shipment for** quantities of **1 to 10 units** is within **10 DAYS ARO; 100 units within 6 weeks.**



General Specification

Series Number	: KC5
F_C-Center Frequency Range	: 1kHz to 10MHz
% Bandwidth at 3dB	: from 15% to 100% F_C
Passband Ripple	: 1.0dB
Bandwidth Ratio 50dB:3dB	: 4.3:1
Impedance Range	: 50Ω to 50kΩ
Dynamic Range	: >80dB
Insertion Loss at F_C	: from 2dB to 6dB
VSWR at F_C	: 1.5:1 typically
P_{MAX}	: 20 milliWatts at F_C
E_{MAX}	: 50VDC
Operating Temperature	: –10°C to +80°C typically
Total Harmonic Distortion at F_C	: 0.01%



Part Number Derivation:

KC5 - **XXX** - **XXX** - **XXX/XXX** - **XXX**

Series Number / *F_C Freq(Hz)* / *3dB BW Freq(Hz)* / *Source/ Load Ω* / *Case Number*

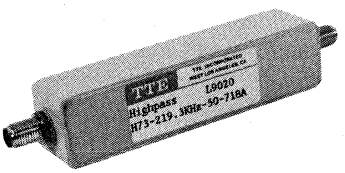
T T E, Incorporated, 11650 W. Olympic Blvd., Los Angeles, CA 90064, (213) 478-8224, FAX (213) 312-1055

TTE, Incorporated

Passive Highpass Filters

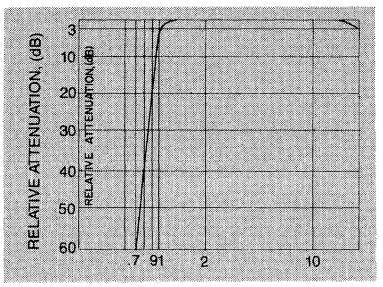
T T E offers a complete line of Passive Highpass Filters covering frequencies from 100Hz to 100MHz. A very popular series, H97, is featured in this section. T T Es' product line includes Bessell, Butterworth, Chebyshev, Elliptical Function and Guassian designs.

Typical **price** for this series is **under $67 each** in 100 unit quantities. **Shipment for** quantities of **1 to 10 units** is within **10 DAYS ARO; 100 units within 4 weeks.**



General Specification

Series Number	: H97
Design Type	: T T E
Frequency Range	: 100Hz to 100MHz
Passband Ripple	: 0.5dB
Cut off Ratio 60dB:3dB	: 0.70
Impedance Range	: 50Ω to 50kΩ
Dynamic Range	: >80dB
Insertion Loss	: 1dB
VSWR	: 1.5:1 typically
P_{MAX}	: 20 milliWatts
E_{MAX}	: 50VDC
Operating Temperature	: –10°C to +80°C typically
Total Harmonic Distortion at F_C	: 0.01%



Part Number Derivation:

H97 - **XXX** - **XXX** - **XXX**

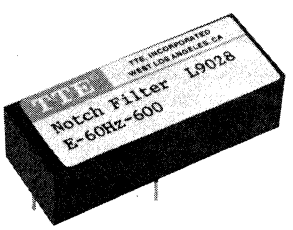
Series Number / *3dB Freq(Hz)* / *Source & Load Ω* \ *Case Number*

Do you require Phase & Amplitude matched Filters? Call (213) 473-0584.

Passive Band Rejection & Notch Filters

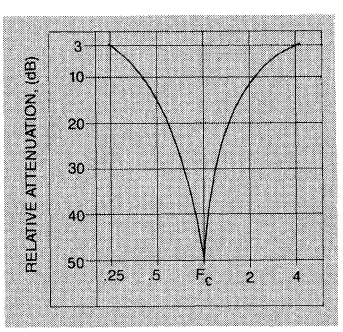
T T E's line of Band Rejection and Notch Filters include Butterworth, Chebyshev and Elliptical Function designs. T T E's Notch Filters include Twin-T and LRC designs. Any number of poles, from 3 to 5, may be specified for the Band Rejection Filters. Any frequency from 1kHz to 10MHz. In this section we are highlighting the economical Twin-T Filter.

Typical **price** for this series is **under $26 each** in 100 unit quantities. **Shipment for** quantities of **1 to 10 units** is within **10 DAYS ARO; 100 units within 4 weeks.**



General Specification

Series Number	: E
Design Type	: Twin-T
Frequency Range	: 10Hz to 100kHz
Minimum Attenuation at F_n	: 50dB
Impedance Range	: 50Ω to 50kΩ
Dynamic Range	: >80dB
Insertion Loss	: from 1dB to 3dB
P_{MAX}	: 20 milliWatts
E_{MAX}	: 50VDC
Operating Temperature	: 20° to +30°C typically



Part Number Derivation:

E - **XXX** - **XXX**

Series Number / *F_n Freq(Hz)* \ *Source/ Load Ω*

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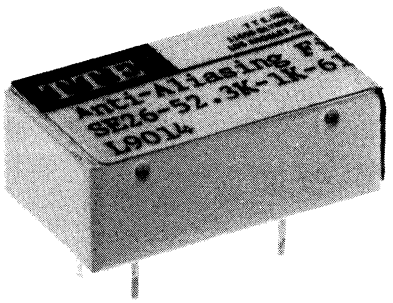
TTE, Incorporated

Passive Anti-Aliasing Filters

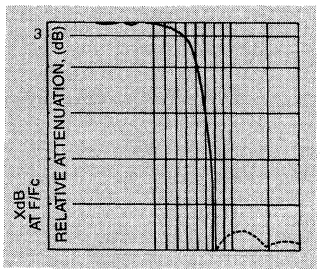
T T E offers a full line of Anti-Aliasing Lowpass Filters. These filters are required when **converting** signals from **A/D or** from **D/A.** T T E **also** offers **SIN X/X, delay equalized, correction filters** for use in signal reconstruction. Series LE1182 is an 11 pole elliptical function filter that is frequently specified by our customers, its' specifications are listed below.

Typical **price** for this series is **under $80 each** in 100 unit quantities. **Shipment for** quantities of **1 to 10 units** is within **10 DAYS ARO; 100 units within 6 weeks.**



General Specification

Series Number	: LE1182
Design Type	: Elliptical Function–
Number of Poles	: 11
Passband Ripple	: 0.5dB
Frequency Range	: 1kHz to 100MHz
Cut-off Ratio 80dB:3dB	: 1:20
Impedance Range	: 50Ω to 50kΩ
Dynamic Range	: >80dB
Insertion Loss at F_C	: 1dB
VSWR at F_C	: 1.5:1 typically
P_{MAX}	: 20 milliWatts
E_{MAX}	: 50VDC
Operating Temperature	: –10°C to +80°C typically
Total Harmonic Distortion at F_C	: 0.01%



Part Number Derivation: **LE1182** - **XXX** - **XXX** - **XXX**

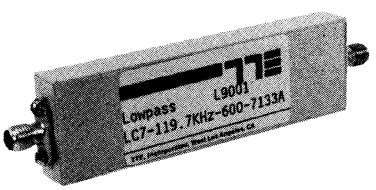
Series Number — *3dB Freq(Hz)* — *Source/ Load Ω* — *Case Number*

T T E manufactures and ships custom designed filters within 10 DAYS ARO.

Passive Lowpass Filters

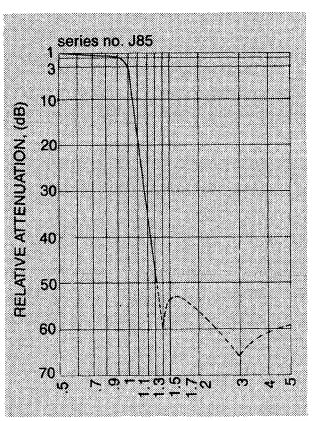
T T E offers a complete line of Passive Lowpass Filters covering frequencies from 10Hz to 250MHz. A very popular series, J85, is featured in this section. T T E's product line includes Bessell, Butterworth, Chevyshev, Elliptical Function and Guassian designs all of which are featured in T T E's 56 page catalog. To receive your copy call (213) 478-8224 extension 10.

The **prices range** from **$40 to $80 each** in 100 unit quantities. **Shipment for** quantities of **1 to 10 units** is within **10 DAYS ARO; 100 units within 4 weeks.**



General Specification

Series Number	: J85
Design Type	: T T E
Frequency Range	: 10Hz to 100MHz
Passband Ripple	: 0.5dB
Cut off Ratio 50dB:3dB	: 1.27
Impedance Range	: 50Ω to 50kΩ
Dynamic Range	: >80dB
Insertion Loss	: 1dB
VSWR	: 1.5:1 typically
P_{MAX}	: 20 milliWatts
E_{MAX}	: 50VDC
Operating Temperature	: –10°C to +80°C typically
Total Harmonic Distortion at F_C	: 0.01%



Part Number Derivation: **J85** - **XXX** - **XXX** - **XXX**

Series Number — *3dB Freq(Hz)* — *Source/ Load Ω* — *Case Number*

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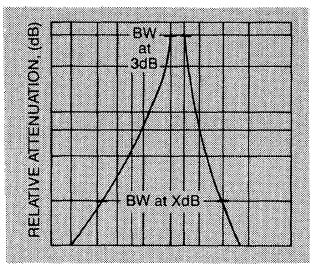
TTE, Incorporated

Active Bandpass Filters

T T E's line of Active Bandpass Filters cover the frequency range of 1Hz to 500kHz. Any 3dB bandwidth from 1% of the center frequency to 100% of the center frequency may be specified. Any number of poles, from 1 to 3, may be specified. The series listed here is typical of the products offered by T T E. To receive our current 56 page catalog call (213) 478-8224, ask for Ext. 10.

General Specification

Series Number	: ABB2
F_C-Center Frequency Range	: 1Hz to 100kHz
% Bandwidth at 3dB	: from 1% to 100% F_C
Bandwidth Ratio 24dB:3dB	: 4.3:1
Input Impedance	: $10^{12}\Omega$'s
Output Impedance:	: 100Ω's
Offset Voltage	: 5 millivolts typically
Offset Drift	: 10μVRMS
Noise	: 75μVRMS
Total Harmonic Distortion	: 0.02%
Power Supply Voltage	: ±12VDC to ±15VDC
Maximum Input signal	: 7.5VRMS
Supply Current	: 16.8mA
Input bias current	: 50pA



Part Number Derivation:

ABB2 - **XXX** - **XXX**

Series Number — *F_C Freq(Hz)* — *3dB BW (in Hertz)*

T T E's Active Filters are also available in Phase and Amplitude matched sets.

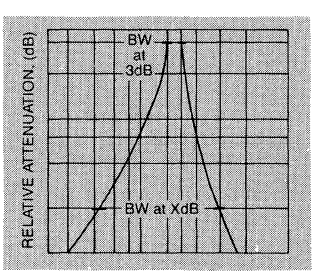
Active Bandpass Filters

T T E's line of Active Bandpass Filters includes the ABB3. This product is a 3 pole Butterworth Bandpass Filter. All T T E active filters feature inputs and outputs that are buffered to provide circuit isolation. The standard output gain is unity, however, gains of up to 20dB may be specified.

Typical **price** for this series is **under $83 each** in 100 unit quantities. **Shipment for** quantities of **1 to 10 units** is within **10 DAYS ARO; 100 units within 6 weeks.**

General Specification

Series Number	: ABB3
F_C-Center Frequency Range	: 1Hz to 100kHz
% Bandwidth at 3dB	: from 1% to 100% F_C
Bandwidth Ratio 36dB:3dB	: 4.3:1
Input Impedance	: $10^{12}\Omega$'s
Output Impedance:	: 100Ω's
Offset Voltage	: 5 millivolts typically
Offset Drift	: 10μVRMS
Noise	: 75μVRMS
Total Harmonic Distortion	: 0.02%
Power Supply Voltage	: ±12VDC to ±15VDC
Maximum Input signal	: 7.5VRMS
Supply Current	: 16.8mA
Input bias current	: 50pA



Part Number Derivation:

ABB3 - **XXX** - **XXX**

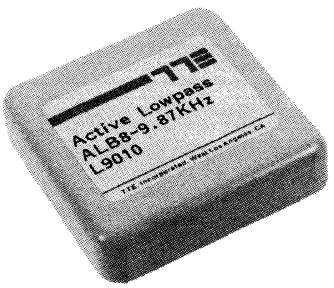
Series Number — *F_C Freq(Hz)* — *3dB BW (in Hertz)*

TTE, Incorporated

Active Lowpass Filters

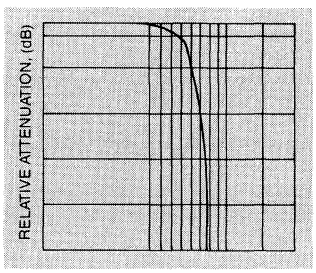
T T E's comprehensive line of Active Lowpass Filters are available for any frequency from 0.1Hz to 1MHz. The design types currently available include Bessell, Butterworth, Chebyshev and Gaussian.

The series featured in this section is ALB8. This is an 8 pole Butterworth filter. Typical **price** for this series is **under $54 each** in 100 unit quantities. **Shipment for** quantities of **1 to 10 units** is within **10 DAYS ARO; 100 units within 4 weeks.**



General Specification

Series Number	: ALB8
F_C-Frequency Range	: 1Hz to 100kHz
Cut-Off Ratio 50dB:3dB	: 1.65:1
Input Impedance	: $10^{12}\Omega$'s
Output Impedance:	: 100Ω's
Offset Voltage	: 5 millivolts typically
Offset Drift	: 10μVRMS
Noise	: 75μVRMS
Total Harmonic Distortion	: 0.02%
Power Supply Voltage	: ±12VDC to ±15VDC
Maximum Input signal	: 7.5VRMS
Supply Current	: 16.8mA
Input bias current	: 50pA



Part Number Derivation: **ALB8** - **XXX**

Series Number / *F_C–3dB Freq(Hz)*

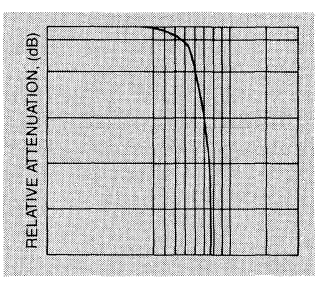
T T E does not have a minimum order.

Active Lowpass Filters

T T E's comprehensive line of Active Lowpass Filters are available for any frequency from 0.1Hz to 1MHz. The series discussed here is the ALC10. This is a 10 pole Chebyshev design with 0.5dB passband ripple. Typical **price** for this series is **under $71 each** in 100 unit quantities. **Shipment for** quantities of **1 to 10 units** is within **10 DAYS ARO; 100 units within 6 weeks.**

General Specification

Series Number	: ALC10
F_C-Frequency Range	: 1Hz to 100kHz
Cut-Off Ratio 60dB:3dB	: 1.6:1
Input Impedance	: $10^{12}\Omega$'s
Output Impedance:	: 100Ω's
Offset Voltage	: 5 millivolts typically
Offset Drift	: 10μVRMS
Noise	: 75μVRMS
Total Harmonic Distortion	: 0.02%
Power Supply Voltage	: ±12VDC to ±15VDC
Maximum Input signal	: 7.5VRMS
Supply Current	: 16.8mA
Input bias current	: 50pA



Part Number Derivation: **ALC10** - **XXX**

Series Number / *F_C–3dB Freq(Hz)*

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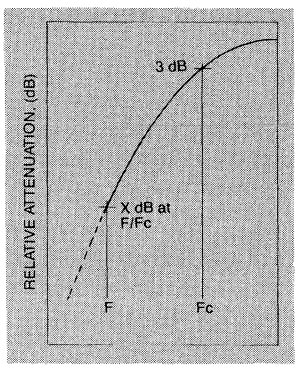
TTE, Incorporated

Active Highpass Filters

T T E's comprehensive line of Active Highpass Filters are available for any frequency from 0.1Hz to 1MHz. The series discussed here is the AHB10. This is a 10 pole Butterworth design. Typical **price** for this series is **under $71 each** in 100 unit quantities. **Shipment for** quantities of **1 to 10 units** is within **10 DAYS ARO; 100 units within 4 weeks.**

General Specification

Series Number	: AHB10
F_C-Frequency Range	: 1Hz to 100kHz
Cut-Off Ratio 60dB:3dB	: 0.5:1
Input Impedance	: $10^{12}\Omega$'s
Output Impedance:	: 100Ω's
Offset Voltage	: 5 millivolts typically
Offset Drift	: 10μVRMS
Noise	: 75μVRMS
Total Harmonic Distortion	: 0.02%
Power Supply Voltage	: ±12VDC to ±15VDC
Maximum Input signal	: 7.5VRMS
Supply Current	: 16.8mA
Input bias current	: 50pA



Part Number Derivation: **AHB10** - **XXX**

Series Number — *F_C–3dB Freq(Hz)*

No set-up charge for STANDARD OR MODIFIED STANDARD products.

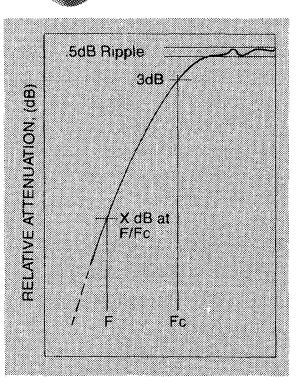
Active Highpass Filters

T T E's comprehensive line of Active Highpass Filters are available for any frequency from 0.1Hz to 1MHz. The design types currently available include Bessell, Butterworth and Chebyshev.

The series featured in this section is AHC8. This is an 8 pole Chebyshev filter. Typical **price** for this series is **under $54 each** in 100 unit quantities. **Shipment for** quantities of **1 to 10 units** is within **10 DAYS ARO; 100 units within 4 weeks.**

General Specification

Series Number	: AHC8
F_C-Frequency Range	: 1Hz to 100kHz
Cut-Off Ratio 50dB:3dB	: 1.65:1
Input Impedance	: $10^{12}\Omega$'s
Output Impedance:	: 100Ω's
Offset Voltage	: 5 millivolts typically
Offset Drift	: 10μVRMS
Noise	: 75μVRMS
Total Harmonic Distortion	: 0.02%
Power Supply Voltage	: ±12VDC to ±15VDC
Maximum Input signal	: 7.5VRMS
Supply Current	: 16.8mA
Input bias current	: 50pA



Part Number Derivation: **AHC8** - **XXX**

Series Number — *F_C–3dB Freq(Hz)*

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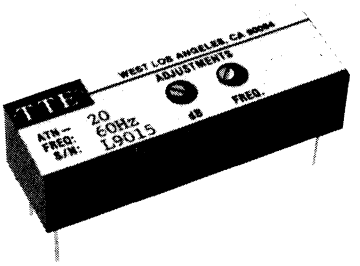
TTE, Incorporated

Active Notch Filters

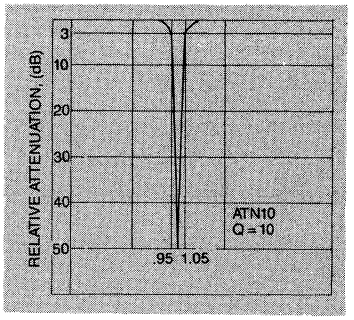
T T E's line of Active Notch Filters includes the ATN. The ATN series are tunable, Twin-T, Filters. The inputs and outputs of these units are buffered to provide isolation. The output gain is unity, however, gains of up to 20dB may be specified.

Typical **price** for this series is **under $41 each** in 100 unit quantities. **Shipment for** quantities of **1 to 10 units** is within **10 DAYS ARO; 100 units within 4 weeks.**



General Specification

Series Number	: ATN
F_n-Frequency Range	: 1Hz to 10kHz
Minimum Attenuation at F_n	: 40dB
% Bandwidth at 3dB	: from 5% to 20% F_n
Input Impedance	: $10^{12}\Omega$'s
Output Impedance:	: 100Ω's
Offset Voltage	: 5 millivolts typically
Offset Drift	: 10μVRMS
Noise	: 75μVRMS
Total Harmonic Distortion	: 0.02%
Power Supply Voltage	: ±12VDC to ±15VDC
Maximum Input signal	: 7.5VRMS
Supply Current	: 16.8mA
Input bias current	: 50pA



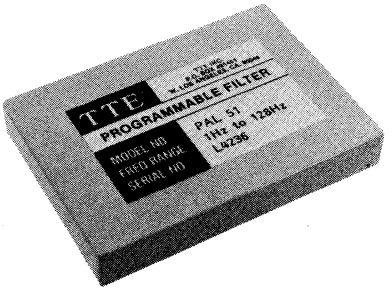
Part Number Derivation: **ATN** - **XXX** - **XXX**

Series Number — *F_c Freq(Hz)* — *3dB BW (in Hertz)*

Send your spec.'s today, via FAX, for instant response; FAX (213) 312-1055.

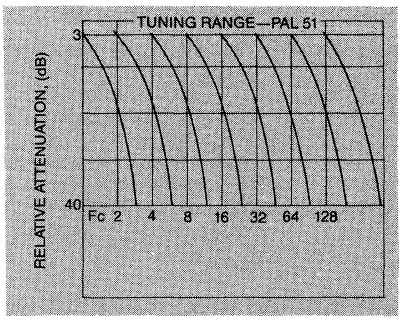
Programmable Lowpass Filters

T T E's programmable lowpass filter is a 5 pole design, available in either a Butterworth or chebyshev characteristic. This is a fixed tuned unit that operates at harmonics of a specified frequency. For example if the specified cut-off frequency is 1Hz then the filter will have 7 additional cut-off frequencies located at 2Hz, 4Hz, 8Hz, 16Hz, 32Hz, 64Hz, 128Hz and 256Hz. The cut-off frequency is externally programmed. The frequency selection is achieved using binary codes external to the filter. The frequencies are selected by applying a voltage to, or grounding one or more of three specific terminals. Another version of this unit is available. It is comprised of 5 independant filters. Choosing this option the designer may select up to 5 specific cut-off frequencies, and up to 3 different design characteristics.



General Specification

Series Number	: PALF51
F_C-Frequency Range	: 1Hz to 1kHz
Tuning Range	: 128:1
Input Impedance	: $10^{12}\Omega$'s
Output Impedance:	: 50Ω's
Input Offset Voltage	: 5 millivolts typically
Input bias current	: 200pA
Input AC signal	: ±7.5V maximum
Noise (DC to 128kHz)	: 300μVRMS
Supply Current	: 50mA
Supply Voltage	: ±15v



Part Number Derivation: **PALF51** - **XXX**

Series Number — *F_C–3dB Freq(Hz)*

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TUSONIX

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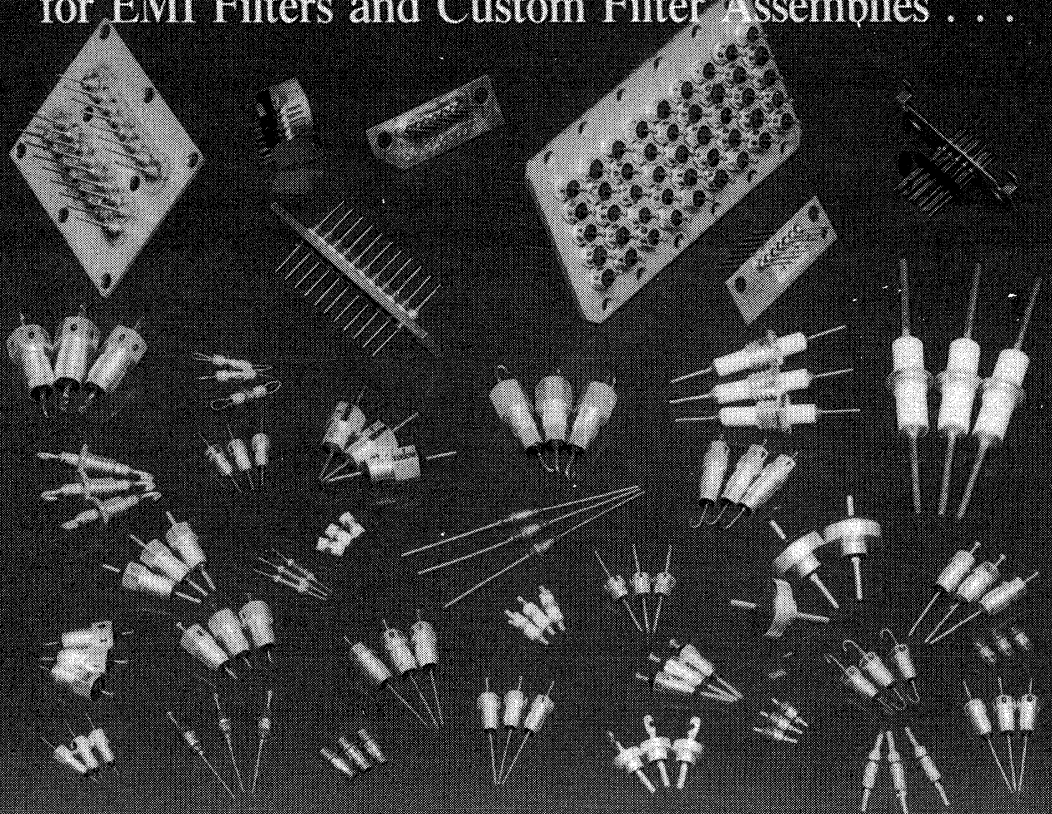

Tusonix, as a QPL source, is proud of its JIT performance

Miniature EMI/RFI ceramic filters and filter capacitors attenuate most frequency ranges in a wide variety of QPL approved styles. Most are available from stock in production quantities, ready for immediate shipment.

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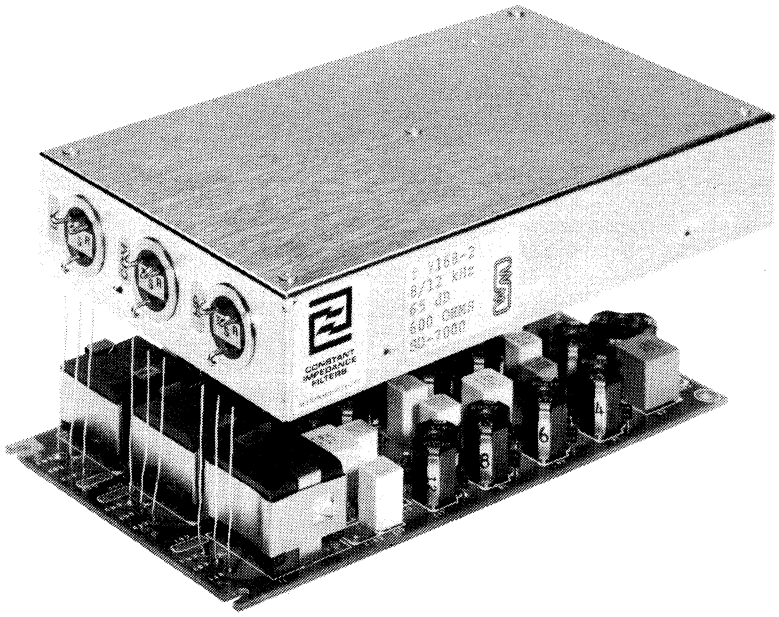

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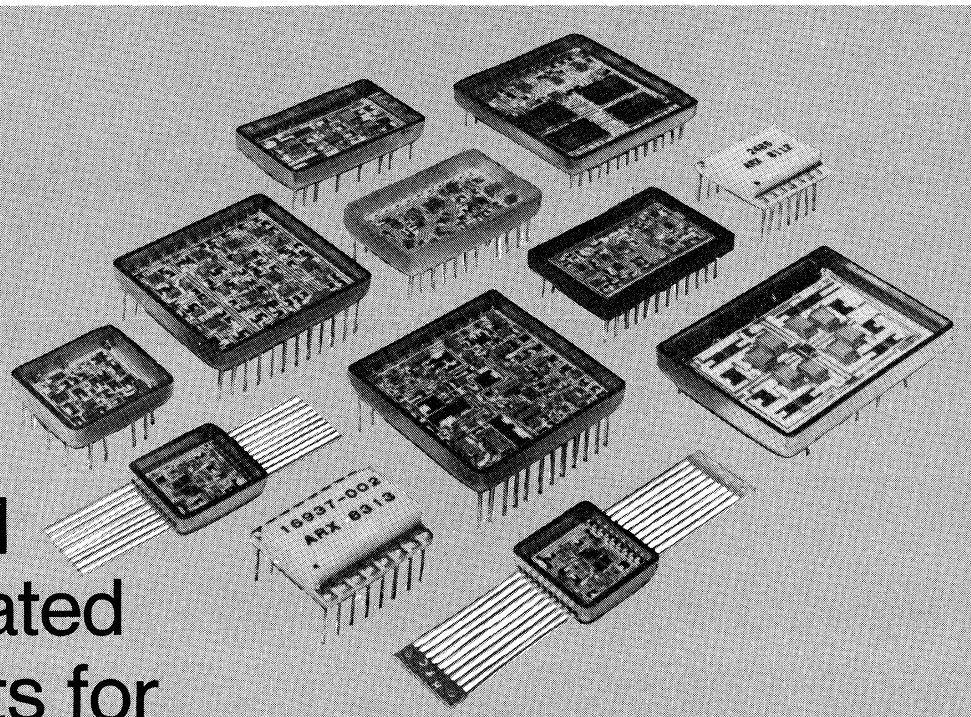

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Aeroflex designs, develops and manufactures custom hybrids for both military and industrial customers. We are qualified for use on B-1B, B-52, F-15, F-16, LAMPS MKIII, AMRAAM, LANTIRN plus numerous other ground and airborne systems and medical and communications equipment.

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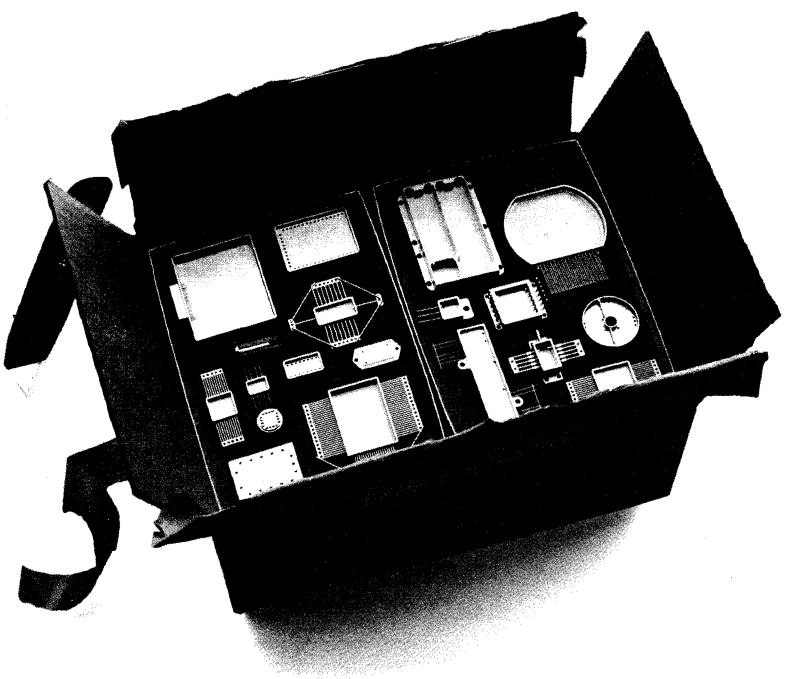

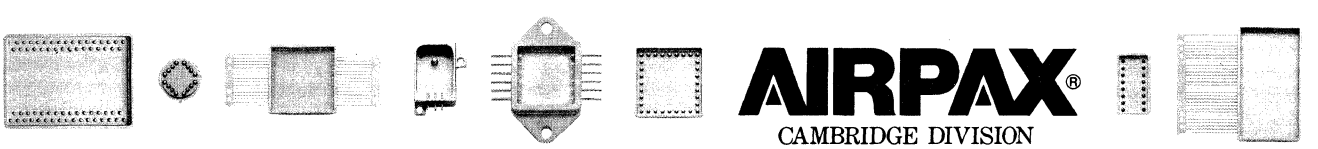

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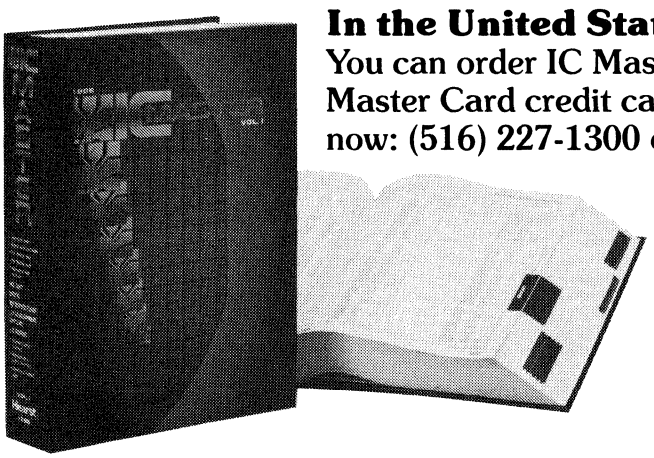

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ANALOG

Quad Line Driver — AM26LS31CC

Description

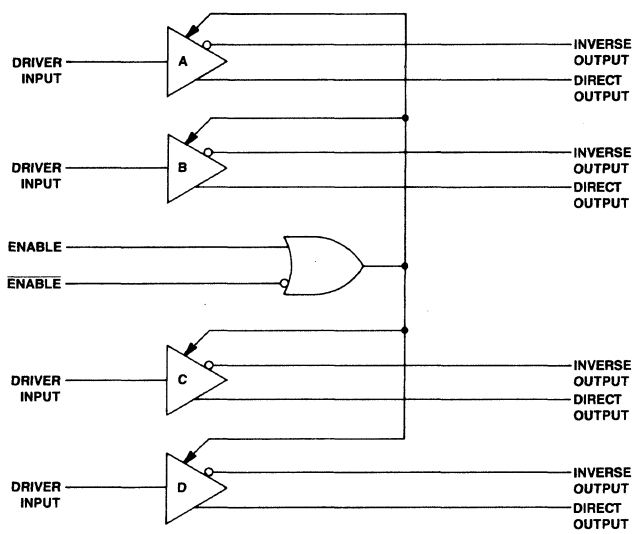
The AM26LS31CC Quad Line Driver is an integrated circuit (IC) consisting of four independent line drivers with a common control for both ENABLE, $\overline{\text{ENABLE}}$. It provides high-speed differential drive to transmission lines having an impedance of at least 100 ohms. Each of the four drivers has a complementary 3-state output. The AM26LS31CC requires only a 5 volt supply (±10%) for operation.

Electrical Characteristics

T_A = 25°C unless otherwise specified

Parameter		Min	Max	Unit
Power Supply Voltage, Operating		4.5	5.5	V
Output Voltage (V+ = 4.5 V, Io = 20 mA)	High	2.5	3.5	V
(V_{IH} = 2.0 V, V_{IL} = 0.8 V)	Low	0.05	0.5	V
Input Clamp Voltage (V+ =4.5 V, I_{IN} = −18 mA)		0	−1.5	V
Power Supply Current, No Load (V+ = 5.5 V, V_{IN} = 0)		45	90	mA
Power Supply Current, Disabled (V+ = 5.5 V, V_{IN} = 2.0 V)		20	40	mA
Output Current, Disabled (V_O = 0.5 V or 2.5 V)		—	±20	μA
Output Current, Power Off (V_O = −0.25 or +6.0 V)		—	±100	μA
Output Current, Short Circuit (V+ = 5.5 V)		—	−150	mA
Input Current, Low (V_{IN} = 0.4 V)		0	−0.36	mA
Input Current, High (V_{IN} = 2.7 V)		—	±20	μA
Input Current, Reverse (V_{IN} = 7.0 V)		0	0.1	mA

AM26LS31CC Functional Diagram



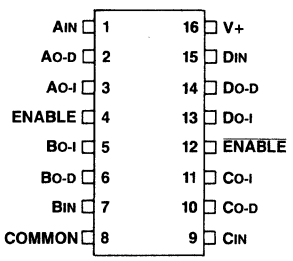
Features

- Meets EIA RS-422A requirements
- Propagation delay is less than 20 ns
- Power supply current is reduced to less than 40 mA when device is disabled
- TTL-compatible ENABLE, $\overline{\text{ENABLE}}$ inputs
- ENABLE, $\overline{\text{ENABLE}}$ to output delay is less than 40 ns
- Output skew (time delay between direct output and inverse output) is typically 2 ns
- Direct replacement for industry-standard differential line drivers

Maximum Ratings

Rating	Value	Unit
Power Supply Voltage (V+)	7.0	V
Input Operating Voltages, V+, Driver Inputs, (ENABLE, $\overline{\text{ENABLE}}$)	5.5	V
Ambient Operating Temperature Range	0 to +70	°C
Storage Temperature Range	−40 to +125	°C
Driver Output Current	±35	mA
Pin Temperature (Soldering, 15 sec)	300	°C

16-Pin Plastic DIP



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ANALOG

Quad Line Receivers — AM26LS32CC, AM26LS33CC

Description

The AM26LS32CC and AM26LS33CC Quad Line Receivers are general purpose quad line receivers for balanced and unbalanced data transmission. A TTL-compatible ENABLE, $\overline{\text{ENABLE}}$ is common to all four receivers in the device package. The ENABLE, $\overline{\text{ENABLE}}$ allows the output to assume a high impedance state for output busing. Each device is encapsulated in a 16-pin plastic DIP and designed to meet industry-standard EIA RS-422A specifications for the AM26LS32CC and EIA RS-423A specifications for the AM26LS33CC.

Features

- Meets EIA RS-422A/423A specifications
- Four independent receivers with common strobe TTL-compatible input
- ESD protection on receiver inputs
- Requires only a single 5 V (±10%) power supply
- Input sensitivity:
  AM26LS32CC ±200 mV
  AM26LS33CC ±500 mV
- Minimum input hysteresis:
  AM26LS32CC ±15 mV
  AM26LS33CC ±30 mV
- Internal fail safe forces the output high for an open input condition
- Typical propagation delay of 17 ns
- Direct replacement for industry-standard differential line receivers

Maximum Ratings

Rating	Value	Unit
Supply Voltage (V+)	7.0	V
Control Input Voltage (ENABLE, $\overline{\text{ENABLE}}$)	7.0	V
Input Common Mode Range	±25	V
Input Differential Voltage	±25	V
Storage Temperature Range	−40 to +125	°C
Power Dissipation (Package Limitation)	400	mW
Pin Temperature (Soldering, 15 sec)	300	°C

Characteristics

Characteristic and Conditions			Min	Max	Unit
Differential Input Threshold Voltage	I_O = −0.4 mA, V_{OH} ≥2.7 V				V
	AM26LS32CC, −7.0 V < V_{CM} < 7.0 V		—	0.2	
	AM26LS33CC, −15.0 V < V_{CM} < 15.0 V		—	0.5	
	I_O = 4.0 mA, V_{OL} ≤0.5 V				
	AM26LS32CC, −7.0 V < V_{CM} < 7.0 V		—	−0.2	
	AM26LS33CC, −15.0 V < V_{CM} < 15.0 V		—	−0.5	
Dynamic Input Resistance	−15.0 V < V_{CM} < 15.0 V One input ac GND		6.0	—	kΩ
Input Current	V_{IN} = 15.0 V		—	2.3	mA
	V_{IN} = −15.0 V		—	−2.8	
Input Hysteresis Voltage	V+ = 5.0 V, T_A = 25°C	AM26LS32CC, V_{CM} = ±7.0 V	±15	—	mV
		AM26LS33CC, V_{CM} = ±15.0 V	±30	—	
High Level Output Voltage	V+ = 4.5 V, V_{ID} = 1.0 V $V_{\overline{EN}}$ = 0.8 V I_{OH} = −440 μA		3.6	—	V
Low Level Output Voltage	V+ = 4.5 V V_{ID} = 0.8 V	I_{OL} = 5.0 mA	—	0.4	
	$V_{\overline{EN}}$ = 0.8 V	I_{OL} = 8.0 mA	—	0.45	

AT&T

ANALOG

Octal High-Voltage MOSFET Arrays

Monolithic N-Channel and P-Channel Enhancement-Modes — Advanced Information

Description

The AT&T MOSFET Arrays contain eight P-Channel DMOS drivers (AP0130NA) and eight N-Channel DMOS drivers (AN0130NA) configured with common-source, open drain, and ESD protection gates. The device interfaces with MOS logic inputs to outputs capable of withstanding 300 volts, sinking 15 and 30 mA respectively.

Typical Characteristics	AN0130NA N-Channel	AP0130NA P-Channel
BV_{DS}	350 V	380 V
$R_{DS(ON)}$	300 Ω	600 Ω

Features

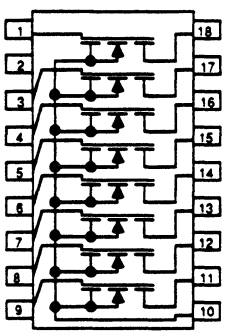
- On-chip ESD protection
- Operating voltage up to 300 V
- Processed with BCDMOS technology
- Freedom from secondary breakdown
- Interfaces directly to CMOS logic
- PIN compatible with industry standard driver arrays
- Low crosstalk between channels

Maximum Ratings

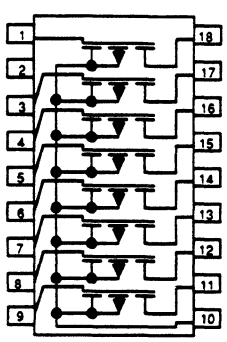
At 25°C unless otherwise specified

	AN0130NA N-Channel		AP0130NA P-Channel	
Rating	**Value**	**Unit**	**Value**	**Unit**
Ambient Operating Temperature Range	−40 to +85	°C	−40 to +85	°C
Drain Current, dc	30	mA	−15	mA
Drain Current, Pulsed (t_P=200 μs; duty cycle=2%)	75	mA	−40	mA
Gate-to-Source Voltage	±20	V	±20	V
Drain-to-Source Voltage	300	BV_{DS}	300	BV_{DS}

AN0130NA Functional and Pin Configuration



AP0130NA Functional and Pin Configuration



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ANALOG

Telephone Ringing Detector — LB1006AB

Description

The LB1006AB Telephone Ringing Detector provides ringing detection functions from the Tip-Ring pair of a telephone loop. This device provides a nominal output current (up to approximately 1 mA) for two types of output drivers. The output can be connected to either an opto-isolator device or to a logic interface with a microprocessor.

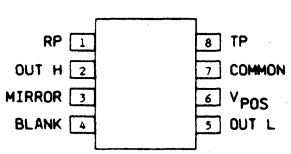
Applications

The LB1006AB Detector derives its power by rectifying the ac ringing signal from the Tip-Ring pair of a telephone loop. It operates over widely varying ringing waveforms (15 to 68 Hz at 40 to 150 Vrms). It uses this derived power to activate ringing-detector logic, and then transfers most of this power to an output current driver. There is essentially no loading under non-ringing conditions. This device has two outputs, OUT H and OUT L. The OUT H output is used to source output current when ringing is detected. The OUT L output becomes functional when the OUT H output is connected to the mirror input. The OUT L output will sink current when ringing is detected (see Simplified Output Diagram). This device does not have to depend upon power derived from the Tip-Ring inputs to become operational. Connecting an external voltage source to V+ will also allow the device to operate in what is described as "stand alone applications." Applications for the two types of outputs (source or sink current) are shown in the Application Diagrams.

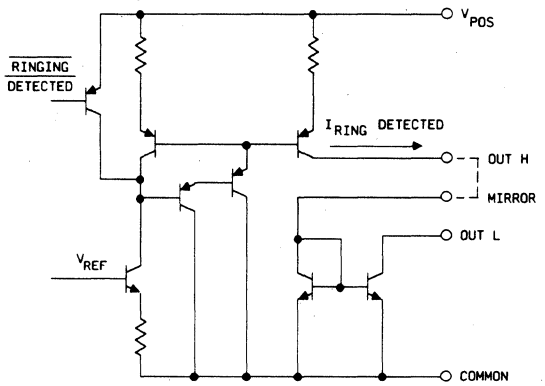
Features

- Provides an inexpensive means of ringing detection
- Operates on less than 1.0 mA from the telephone loop
- Internal polarity guard and 2000 V lightning surge protection
- Immune to rotary dial pulsing (bell tap)
- Meets both Type A and B ringing requirements (40 Vrms <V_{IN} <150 Vrms, 15 Hz <fin <68 Hz) as specified by EIA RS-470 and FCC Part 68
- Ringer equivalency: 0.8 B when configured as shown in the Application Diagrams

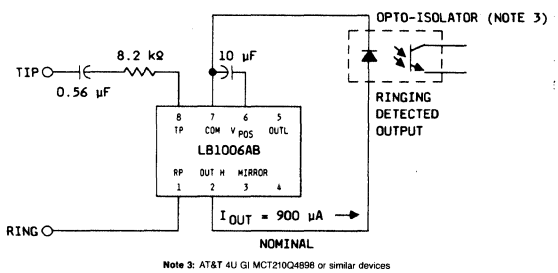
8-Pin Plastic DIP



Simplified Output Diagram

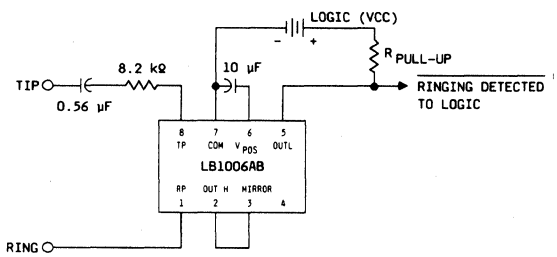


Typical Application for Opto-isolator Drive



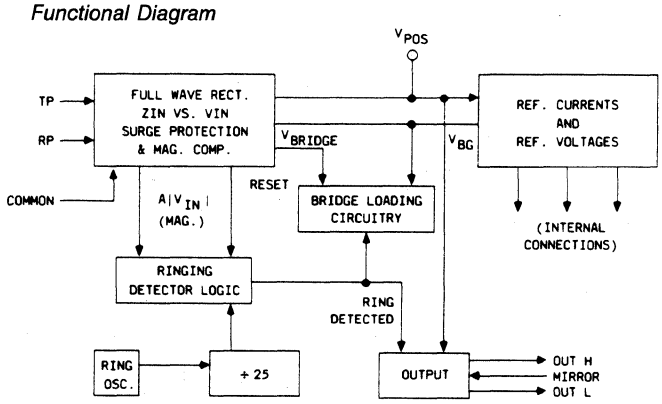
Note 3: AT&T 4U GI MCT210Q4B98 or similar devices

Typical Application for Interface Direct to Logic



CAUTION: Care must be taken when interfacing to a load which is referenced to earth ground (see APPLICATIONS text for further details).

Functional Diagram



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ANALOG

Keyboard Controlled Single-Chip Telephone IC — LB1008AE

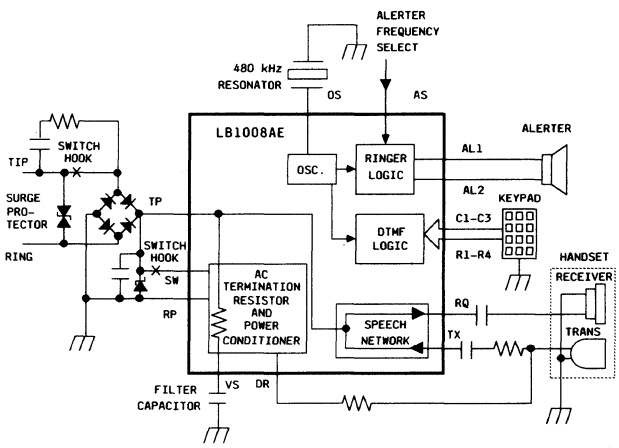
Description

The LB1008AE integrated circuit requires only a few external components to provide all of the touch-tone electronic functions. This integrated circuit furnishes ac and dc loop termination for both switchhook states, transmits and receives voice signals to the central office, provides dual-tone multi-frequency (DTMF) signals to the central office, and properly distinguishes between spurious noise and genuine ringing signals, providing a distinctive, audible alerter output.

Features

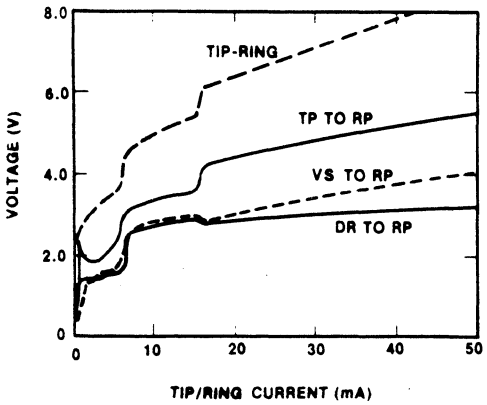
- An alerter select function of 1800/2250 Hz or 1200/1500 Hz
- Capable of speech transmission down to 3.0 mA loop current
- Compatible with electret and carbon microphones
- Signal ground pin eliminates external capacitor for dial-in-handset designs
- 700 ohm line matching impedance, 600 ohm receiver impedance
- Provides a power port for driving an LED

LB1008AE Functional Diagram (4-Wire Handset Interface)

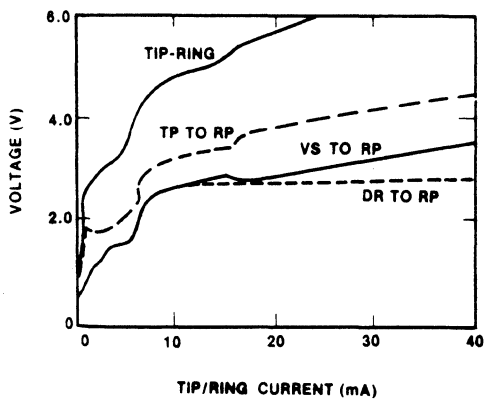


Characteristics

Typical V-I Characteristics (Dial Mode)



Typical V-I Characteristics (Speech Mode)



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ANALOG
Battery Feed — LB1011AB

Description

The LB1011AB integrated circuit is an electronic battery-feed circuit which supplies dc currents to a telephone line with minimal loading on the ac signals. The LB1011AB is integrated as two complementary chips to supply dc currents of both negative and positive polarities to either balanced or unbalanced lines. In the balanced line application, this device helps suppress undesirable common-mode signals.

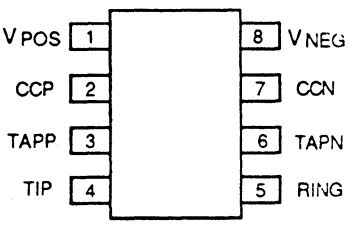
Maximum Ratings

Rating	Value	Unit
Ambient Operating Temperature Range	−20 to +70	°C
Storage Temperature Range	−40 to +125	°C
Pin Temperature (Soldering, 15 sec)	300	°C
Operating Voltages (dc Voltage Drop)	−4.00 to +4.85	V

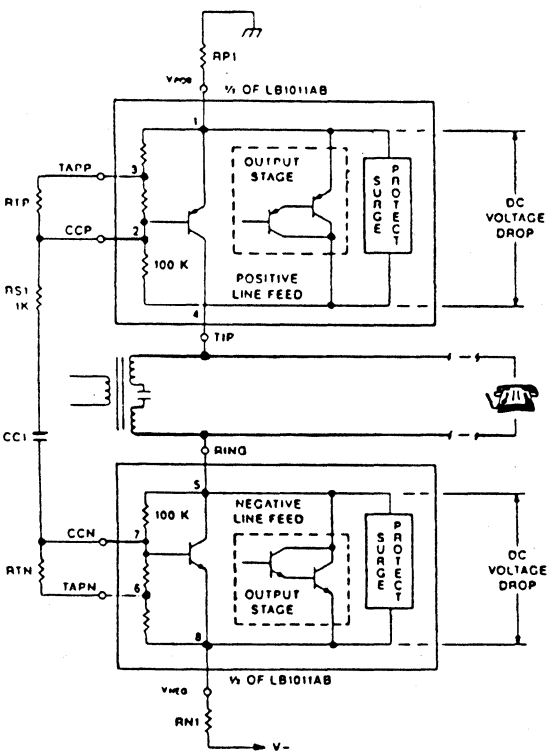
Features

- Basic battery-feed function at a low cost
- High ac-impedance characteristics for balanced-line, differential-mode, voice-band signals
- Full internal lightning surge protection
- dc voltage drops can be adjusted to accommodate different peak signal levels

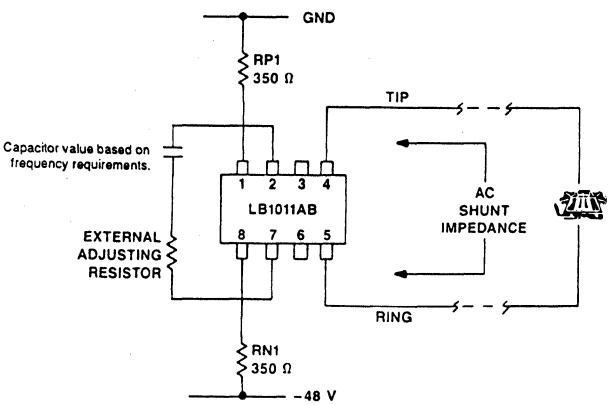
8-Pin Plastic DIP



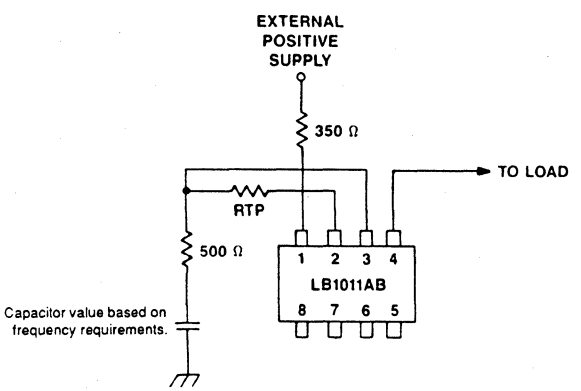
Functional Diagram



Battery Feed Application Diagram (Balanced Configuration)



ac Blocking, dc Current Feed Applications



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ANALOG
Battery Feed — LB1012AD

Description

The LB1012AD integrated circuit device is an electronic battery-feed circuit which supplies a controlled dc current to the Tip-Ring pair of a telephone system. The battery-feed circuitry presents a low impedance to dc current, while presenting a high impedance to the ac signal. The LB1012AD device contains input and output ports for voice-frequency signals and a hook-status output signal.

Features

- Drives loop lengths up to 1300 ohms
- Common-mode rejection (longitudinal balance) better than 60 dB (ac)
- Longitudinal balance and amplifier gains are laser-trimmed
- TTL-compatible "hook status" indicator
- Proper line matching can be provided with a 50:1 scaled network; 30k ohms provide a 600 ohm termination
- 18-pin plastic power DIP

Electrical Characteristics

V– = –53 V and T_A = 25°C unless otherwise specified

The characteristics shown below are expressed in circuit functional terms. They are insured as the result of production testing measurements.

Characteristics	Min	Max	Unit
Power Supply Current, OFF-HOOK (V– = –53 to –60 V), (Loop = 275 Ω)	43	49.5	mA
Power Supply Current, ON-HOOK (V– = –48 V), (Loop = Open Circuit)	0.2	3.5	mA
Ringing Current Capability, RING Lead Open	100	—	mA
TIP Current for Power Gate Threshold	3.0	8.0	mA
Loop Current for Hook Status Threshold (Loop = 500 Ω)	11	16	mA
Loop Current: 150 Ω	38.3	41.3	mA
500 Ω	38.5	41.5	mA
800 Ω	30.5	34.5	mA
1300 Ω	19.0	23.0	mA
Transmit Loop Current Gain, IAC IN to TIP-RING	95.5	101	—
Receive Voltage Gain, TIP-RING to VAC OUT	0.476	0.506	—
Longitudinal Balance (ac) (Common-Mode Current <10 mA)	60	—	dB
Power-Supply Rejection: (Loop = 400 Ω)	52	—	dB
Noise Voltage, TIP/RING: (Loop = 500 Ω)	—	8.0	dBrnc
IAC IN, Input Resistance	—	100	Ω
VAC OUT, Output Resistance: (2.0 kΩ between VAC OUT & GND)	—	50	Ω
Longitudinal Resistance	50	100	Ω
TIP-TO-RING Shunt Resistance: (ΔLoop = 150 Ω – 400 Ω)	30	—	kΩ
Input Current Capability of "IAC IN" without Clipping	—	100	μA p-p
Output Voltage Capability of "VAC OUT" without Clipping	—	2.0	V p-p

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ANALOG

ALA201/202 UHF Linear Arrays

Description

The ALA201/202 UHF Linear Arrays are semi-custom integrated circuits consisting of vertical NPN and PNP transistors, programmable and fixed capacitors, and implanted boron resistors. Designed on a regular grid system, the array provides easy interconnection for the designer. The ALA201/202 UHF Linear Arrays are fabricated in a complementary bipolar integrated circuit (CBIC) process that offers the advantages of similar NPN and PNP transistor characteristics at very high speeds. Typical f_T of 4.5 GHz for the NPN and 3.75 GHz for the PNP transistors (V_{CE} = 6 volts and I_C = 3 mA) with high current drive capability (8 mA for the NPN and PNP 1X transistors) is unique to these linear arrays.

Dual-layer and thick metal are typically used for most applications; however, single-layer metal may be used upon special request. The bottom and top metal layers have a low sheet resistance of about 0.03 ohm/sq. and a current capacity of 2 mA/μm of metal width. The standard 6 μm bottom and 10 μm top metal linewidths are capable of carrying a maximum of 12 and 20 mA dc current, respectively. For cases where high-current must be carried, a thicker gold layer called "thick metal" is available with a sheet resistance of about 0.004 ohms/sq. and a current capacity of 14 mA/μm of metal width. The ALA201 device is divided into 6 modules consisting of 5 standard and 1 power module. The ALA202 device is divided into 12 modules consisting of 9 standard, 2 power, and 1 input module. All modules are symmetrically located within the array for easy layout. The modules, being on a regular grid system, allow the user to interconnect components by drawing lines on a clearly defined grid marked on a layout sheet.

For more detailed information regarding ordering procedures, design kits, and packaging for the ALA201/202 UHF Linear Arrays, refer to the Semi-Custom Linear Array brochure.

Features

- Quick design turnaround
- Custom circuitry at low cost
- High performance
- Design proprietorship
- High probability of success
- High reliability

Electrical Characteristics

T_A = 25°C unless otherwise specified

NPN dc Parameters

Symbol	Measurement/Condition	Min	Typ	Max	Unit
h_{FE}*	I_C = 1 mA, V_{CE} = 2 V	80	110	—	—
f_T	I_C = 1 mA, V_{CE} = 2 V	—	3.5	—	GHz
V_A (early voltage)	I_C = 1 mA, V_{CE} = 2, 4 V	20	40	—	V
$V_{CE(sat)}$	I_C = 1 mA, I_B = 100 μA	—	.13	.35	V
V_{BE}**	I_E = 1 mA, V_{CE} = 2 V	.720	.775	.820	V
BV_{CEX}	I_C = 100 μA, I_B = 0.1 μA	12	18	—	V
I_{EBO}	V_{EB} = 2 V, I_C = 0	—	.02	1	μA
BV_{CBO}	I_C = 1 μA	20	30	—	V
BV_{CSO} (collector substrate breakdown)	I_C = 1 μA	20	60	—	V
I_{CES}	V_{CE} = 5 V	—	1	—	nA
I_{CBO}	V_{CB} = 10 V, I_E = 0	—	1	—	nA
BV_{EBO}	I_E = 10 μA	4.7	5.3	5.9	V

PNP dc Parameters

Symbol	Measurement/Condition	Min	Typ	Max	Unit
h_{FE}*	I_C = 1 mA, V_{CE} = 2 V	25	40	—	—
f_T	I_C = 1 mA, V_{CE} = 2 V	—	2.5	—	GHz
V_A (early voltage)	I_C = 1 mA, V_{CE} = 2, 4 V	8	11	—	V
$V_{CE(sat)}$	I_C = 1 mA, I_B = 100 μA	—	.13	.35	V
V_{BE}**	I_E = 1 mA, V_{CE} = 2 V	.730	.780	.830	V
BV_{CEX}	I_C = 100 μA, I_B = 0.1 μA	11	14	—	V
I_{EBO}	V_{EB} = 2 V, I_C = 0	—	.01	1	μA
BV_{CBO}	I_C = 1 μA	16	19	—	V
BV_{CSO} (collector substrate breakdown)	I_C = 1 μA	20	40	—	V
I_{CES}	V_{CE} = 5 V	—	1	—	nA
I_{CBO}	V_{CB} = 10 V, I_E = 0	—	1	—	nA
BV_{EBO}	I_E = 10 μA	5.0	5.4	6.7	V

* h_{FE} matching of adjacent transistors of the same type is within ±5%.
** V_{BE} matching of adjacent transistors of the same type is within ±1.5 mV.

For additional information, contact your AT&T Account Manager, or call:
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AT&T

ANALOG

ALA201/202 UHF Linear Arrays

Resistor Data (ALA201) T_A = 25°C

Value (Ω)	Tol (%)	Type	TCR PPM/°C	Total
50	±20	BI*	+1300	40
100	±20	BI*	+1300	240
200	±20	BI*	+1300	40
1000	±20	BI**	+1100	20
2000	±20	BI**	+1100	120
4000	±20	BI**	+1100	20

Capacitor Data (ALA201)

Type	Cap (pF)	Tol (%)	Total
Programmable	0.75 to 3.35	±20	5
Fixed	1.0	±20	10
Programmable	1.0 to 32	±20	6

Component Totals (ALA201)

Component	Type	Total	Standard	Power
Transistors				
NPN	1X	47	9	2
NPN	2X	12	2	2
NPN	5X	7	1	2
NPN	15X	2	—	2
PNP	1X	27	5	2
PNP	2X	12	2	2
PNP	5X	2	—	2
PNP	15X	2	—	2
Resistors*	50 Ω	40	8	—
	100 Ω	240	40	40
	200 Ω	40	8	—
Resistors**	1000 Ω	20	4	—
	2000 Ω	120	20	20
	4000 Ω	20	4	—
Capacitors	0.75 to 3.35 pF	5	1	—
	1.0 pF	10	2	—
	1.0 to 32 pF†	6	—	—
Bonding Pads	—	36	—	—

* Denotes a 50 ohm/sq. implanted boron resistor.
** Denotes a 1080 ohm/sq. implanted boron resistor.
† These capacitors are located on the border of the overall die.

Note: Matching of adjacent resistors of similar type is within ±1%.

Resistor Data (ALA202) T_A = 25°C

Value (Ω)	Tol (%)	Type	TCR PPM/°C	Total
50	±20	BI*	+1300	80
100	±20	BI*	+1300	480
200	±20	BI*	+1300	80
1000	±20	BI**	+1100	40
2000	±20	BI**	+1100	240
4000	±20	BI**	+1100	40

Capacitor Data (ALA202)

Type	Cap (pF)	Tol (%)	Total
Programmable	0.75 to 3.35	±20	10
Fixed	1.0	±20	20
Programmable	1.0 to 32	±20	8

Component Totals (ALA202)

Component	Type	Total	Standard	Input	Power
Transistors					
NPN	1/3X	2	—	2	—
NPN	1X	92	9	7	2
NPN	2X	24	2	2	2
NPN	5X	14	1	1	2
NPN	15X	4	—	—	2
PNP	1/3X	2	—	2	—
PNP	1X	52	5	3	2
PNP	2X	24	2	2	2
PNP	5X	4	—	—	2
PNP	15X	4	—	—	2
Resistors*	50 Ω	80	8	8	—
	100 Ω	480	40	40	40
	200 Ω	80	8	8	—
Resistors**	1000 Ω	40	4	4	—
	2000 Ω	240	20	20	20
	4000 Ω	40	4	4	—
Capacitors	0.75 to 3.35 pF	10	1	1	—
	1.0 pF	20	2	2	—
	1.0 to 32 pF†	8	—	—	—
Bonding Pads	—	48	—	—	—

* Denotes a 50 ohm/sq. implanted boron resistor.
** Denotes a 1080 ohm/sq. implanted boron resistor.
† These capacitors are located on the border of the overall die.

Note: Matching of adjacent resistors of similar type is within ±1%.

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ANALOG

ALA300/301 90 Volt Linear Arrays

Description

The ALA300 and ALA301 Linear Arrays provide design engineers the means to obtain 90 volt, semi-custom integrated circuits. The single-module array (ALA300) consists of 13 vertical NPN and 15 vertical PNP transistors, three 6 pF capacitors, and 1k diffused and 10k non-implanted resistor banks. The quad-module array (ALA301) is identical to the single-module array (ALA300), but has four times the number of components.

These linear arrays are fabricated using the complementary bipolar integrated circuit (CBIC) process that offers the advantages of vertical NPN and PNP transistors. CBIC technology offers the advantage of designing high-performance circuits with less design complexity. A minimum collector-to-emitter, reverse breakdown voltage of 90 volts is guaranteed for both transistors. Typical peak f_T of 350 MHz for NPN and 300 MHz for PNP transistors and 5 mA current drive capability for the minimum area transistors are unique for these linear arrays.

Two-level metal is used for interconnections. Upon request a thick-metal interconnect is also available to provide higher current capacity. The top and bottom metal layers have a low sheet resistance of <0.03 ohms/sq and <1.0 ohms/sq with a current capacity of 2.0 mA/micron and 60 μA/micron of metal width, respectively. The thicker metal interconnect has a sheet resistance of <0.003 ohms/sq and a current capacity of 20 mA/micron of metal width.

Features

- High-frequency performance, typical f_T of 350 MHz for NPN and 300 MHz for PNP transistors
- 90 volt capability
- Low development costs
- Quick design turnaround, typically four weeks from design approval
- Complementary vertical NPN and PNP transistors
- Two-level metal interconnect
- 1k and 10k resistor banks
- All I/O ESD protected
- Available in chip form and a variety of standard packages

Component Totals

Component Type	ALA300	ALA301
NPN	13	52
PNP	15	60
Resistors	108	432
Capacitors	3	12
Diodes	1	4
Bonding Pads	30	32

Electrical Characteristics

T_A = 25°C unless otherwise specified

		NPN			PNP			
Symbol	**Measurement Condition**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Unit**
h_{FE}	I_C = 1 mA, V_{CE} = 3 V	50	110	175	40	80	150	—
f_T	I_C = 500 μA, V_{CE} = 10 V	—	350	—	—	300	—	MHz
V_A (Early Voltage)	I_C = 100 μA, V_{CE} = +5 V	65	150	300	40	125	200	V
$V_{CE(sat)}$	I_C = 1 mA, I_B = 500 μA	60	100	150	150	175	220	mV
V_{BE}	I_E = 1 mA, V_{CE} = 3 V	700	750	800	700	750	800	mV
BV_{CEO}	I_C = 1 mA	90	110	125	90	115	140	V
BV_{EBO}	I_E = 10 μA	7.50	8.00	8.50	8.65	8.85	9.20	V
BV (Collector Substrate Breakdown)	I_C = 1 mA	190	200	210	95	100	105	V
I_{CEO}	V_{CE} = 80 V, I_B = 0	150	250	350	60	70	150	nA
I_{CBO}	V_{CB} = 80 V, I_E = 0	1	2	3	2	3	4	nA

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ANALOG

ALA400/401 Linear Array Family

Description

The ALA400/401 Linear Array Family is fabricated using the complementary bipolar integrated circuit (CBIC) process that offers the advantages of vertical NPN and vertical PNP transistors. CBIC technology offers the advantage of designing high-performance circuits with less design complexity. A minimum collector-to-emitter, reverse breakdown voltage of 33 volts is guaranteed for both transistors.

Typical peak f_T of 350 MHz for NPN and 300 MHz for PNP transistors and 2 mA current drive capability for the 1 X transistors are unique for these linear arrays. Current drive capability for the other on-chip transistors is linear, e.g., 2 X = 4 mA, 3 X = 6 mA, etc. Pinch-off voltage for JFETs is 1 to 2 volts. I_{DSS} is about 1.0 mA.

The ALA400 Linear Array is divided into 16 modules, consisting of 12 standard, 2 power and 2 JFET modules. The ALA401 Linear Array is divided into 9 modules, consisting of 7 standard and 2 power modules. All modules are symmetrically located within the array for ease of design layout. Because the modules are on a regular grid system, the user interconnects components by drawing lines on a clearly defined grid, marked on a layout sheet.

Two-level metal is used for interconnections. Upon request, a thick-metal interconnect is also available to provide higher current capacity. The top metal layer has a low sheet resistance of <0.03 Ω/sq. and a current capacity of 2.0 mA/micron metal width. The bottom metal layer has a sheet resistance of <1.0 Ω/sq. and a current capacity of 200 μA/micron of metal width. The thicker metal interconnect has a sheet resistance of <0.003 Ω/sq. and a current capacity of 20 mA/micron of metal width.

Features

- High-frequency performance, typical f_T of 350 MHz for NPN and 300 MHz for PNP transistors
- 33 volt capability
- Low development costs
- Quick design turnaround, typically six to eight weeks from design approval
- Complementary vertical NPN and PNP transistors
- Two-level metal interconnect
- All I/O ESD protected

Component Totals (ALA400)

Component	Type	Total	Standard	JFET	Power
NPN	1 X	70	5	5	—
NPN	2 X	12	1	—	—
NPN	3 X	14	1	—	2
NPN	38 X	4	—	—	2
PNP	1 X	70	5	5	—
PNP	2 X	12	1	—	—
PNP	3 X	14	1	—	2
PNP	63 X	4	—	—	2
Resistors*	500 Ω	104	8	4	—
	1 kΩ	168	12	12	—
Resistors**	5 kΩ	216	16	8	4
	10 kΩ	168	12	12	—
Capacitors	—	14	1	1	—
JFETs	—	4	—	2	—
Bonding Pads	—	44	—	—	—

* Denotes a 200 ohm/sq. implanted boron resistor.
** Denotes a 2000 ohm/sq. implanted boron resistor.

Component Totals (ALA401)

Component	Type	Total	Standard	Power
NPN	1 X	50	5	4
NPN	3 X	16	2	1
NPN	38 X	2	—	1
PNP	1 X	50	5	4
PNP	3 X	16	2	1
PNP	63 X	2	—	1
Resistors*	100 Ω	42	6	—
	500 Ω	72	8	8
	1 kΩ	64	8	4
Resistors**	5 kΩ	132	16	10
	10 kΩ	100	12	8
Capacitors	—	7	1	—
Bonding Pads	—	38	—	—

* Denotes a 200 ohm/sq. implanted boron resistor.
** Denotes a 2000 ohm/sq. implanted boron resistor.

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AT&T

ANALOG

ALA400/401 Linear Array Family

Electrical Characteristics T_A = 25°C

NPN1X Transistor

Symbol	Measurement Condition	Min	Typ	Max	Unit
h_{FE}*	I_C = 1 mA, V_{CE} = 2.5 V	40	85	250	—
I_C	80% of peak h_{FE}	—	2	—	mA
BV_{CEO}	I_C = 1 mA	33	38	—	V
BV_{CBO}	I_C = 10 μA	33	50	—	V
BV_{EBO}	I_C = 10 μA	7.7	8.2	8.7	V
V_{BE}**	I_E = 100 μA	—	743	—	mV
R_{sat}	h_{FE} = 2	—	37	—	Ω
$V_{CE\ (sat)}$	I_C = 1 mA, h_{FE} = 2	—	70	150	mV
V_A (early voltage)	I_C = 500 μA	65	225	—	V
f_T	V_{CE} = 10 V	—	350	—	MHz

* h_{FE} match of same type adjacent transistors is within 5%.
** V_{BE} match of same type adjacent transistors is within 1.5 mV.

PNP1X Transistor

Symbol	Measurement Condition	Min	Typ	Max	Unit
h_{FE}*	I_C = 1 mA, V_{CE} = 2.5 V	40	110	250	—
I_C	80% of peak h_{FE}	—	.800	—	mA
BV_{CEO}	I_C = 1 mA	33	47	—	V
BV_{CBO}	I_C = 10 μA	33	48	—	V
BV_{EBO}	I_C = 10 μA	7.7	8.2	8.7	V
V_{BE}**	I_E = 100 μA	—	748	—	mV
R_{sat}	h_{FE} = 2	—	127	—	Ω
$V_{CE\ (sat)}$	I_C = 1 mA, h_{FE} = 2	—	140	250	mV
V_A (early voltage)	I_C = 500 μA	45	60	—	V
f_T	V_{CE} = 10 V	—	300	—	MHz

* h_{FE} match of same type adjacent transistors is within 5%.
** V_{BE} match of same type adjacent transistors is within 1.5 mV.

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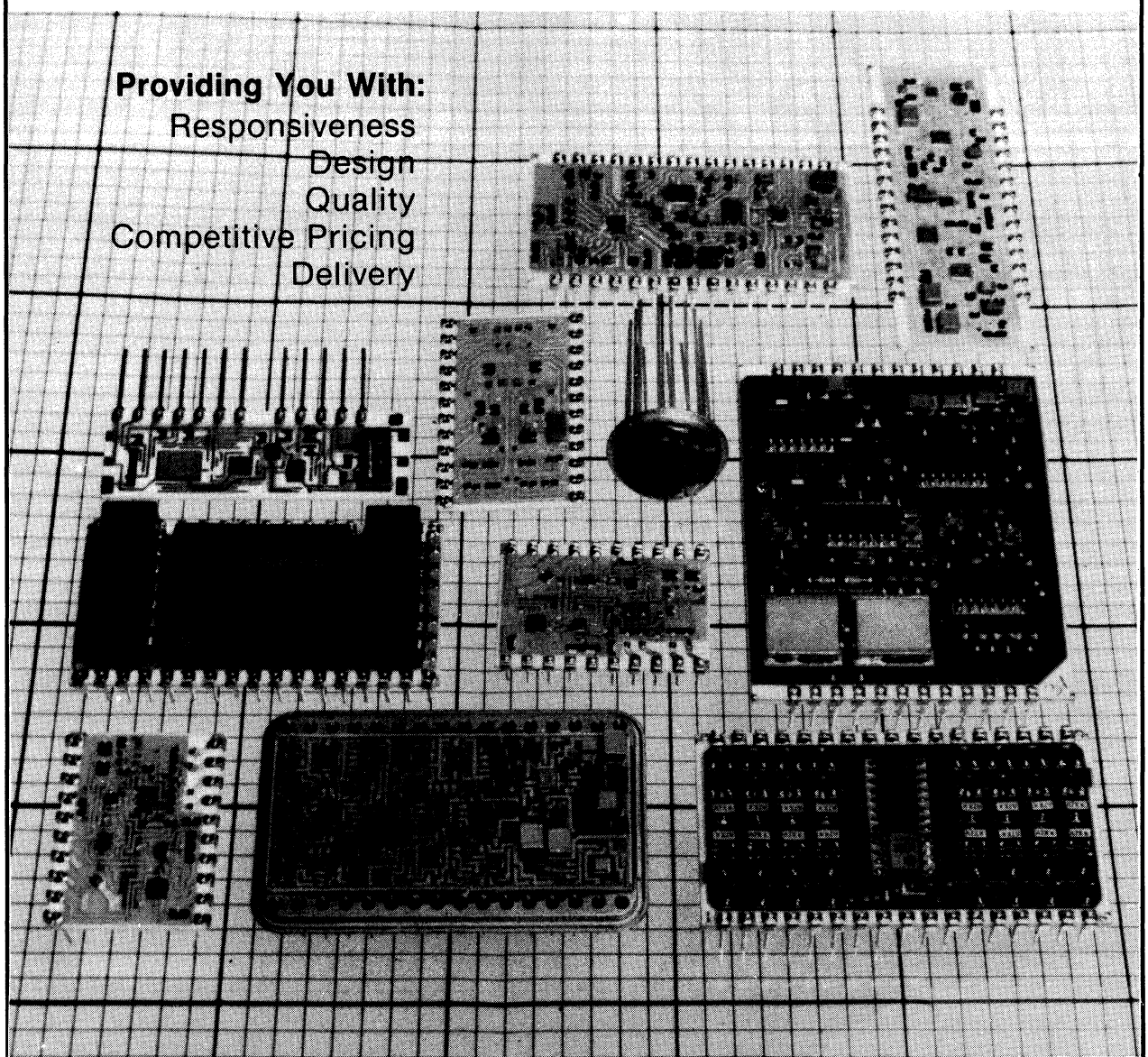

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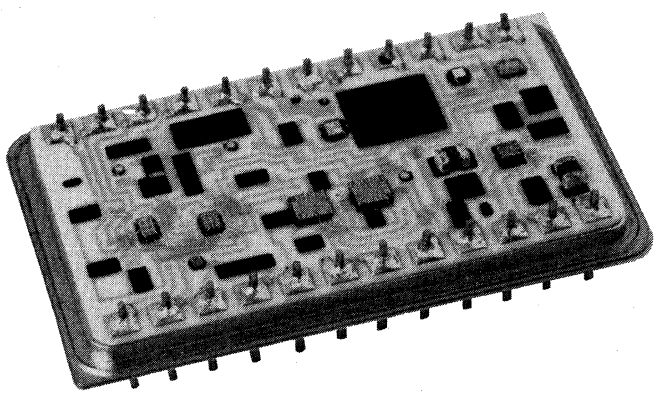

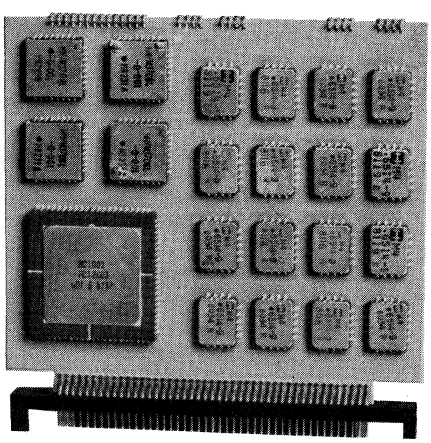

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PRODUCT NO.	DESCRIPTION	REPLACES PRODUCT NO.
Operational Amplifiers:		
CTS 0004	High Voltage Operational Amplifier	National LH 0004/883B
CTS 0021 H/B	Power Operational Amplifier	National LH 0021/883B
CTS 0024	High Slew Operational Amplifier	National LH 0024/883B
CTS 0032	Ultrafast FET Operational Amplifier	National LH 0032/883B
CTS 0041 H/B	Power Operational Amplifier	National LH 0041/883B
CTS 0042	Low Cost FET Operational Amplifier	National LH 0042/883B
CTS 101A H/B	High Performance Operational Amplifier	National LH 101/883B
CTS 2101	Dual High Performance Operational Amplifier	National LH 2101/883B
CTS 108A H/B	Super Beta Operational Amplifier	National LH 108/883B
CTS 2108	Dual Super Beta Operational Amplifier	National LH 2108/883B
CTS 111 H/B	Operational Amplifier	National LH 111/883B
CTS 2111	Dual Voltage Comparator	National LH 2111/883B
CTS 861	Log IF Amplifier	Plessy SL 521
Buffers:		
CTS 0002	Current Amplifier	National LH 0002/883B
CTS 0033	Fast Buffer Amplifier	National LH 0033/883B
Sample & Hold Amplifiers:		
CTS 0023	Sample & Hold Circuit	National LH 0023/883B
MOS Clock Drivers:		
CTS 0007	DC Coupled MOS Clock Driver	National MH 0007/883B
CTS 0009	Two Phase MOS Clock Driver	National MH 0009/883B
Digital Drivers:		
CTS 0006 H/B	Current Driver	National DH 0006/883B
CTS 0008 H/B	High Voltage Current Driver	National DH 0008/883B
CTS 0034	High Speed Dual Level Translator	National DH 0034/883B

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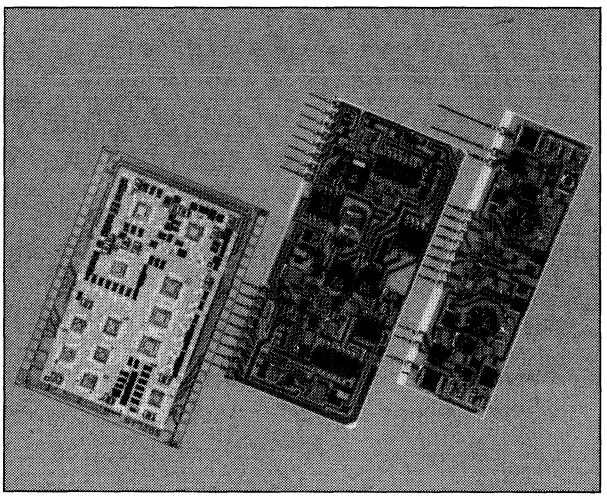


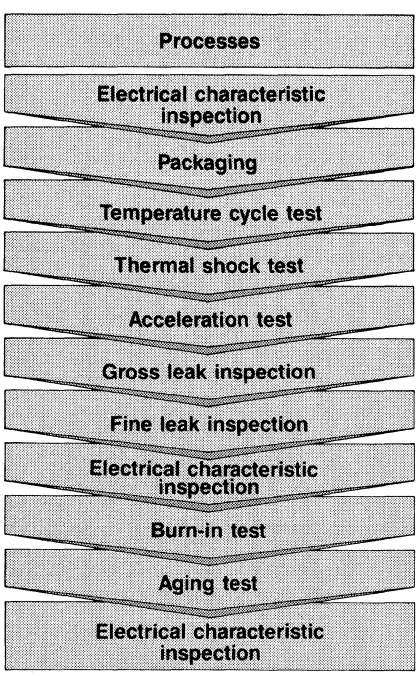
1. Application
2. Circuit (circuit diagram and materials & components list), power consumption, frequency, and other specifications
3. Test conditions
4. Quality assurance conditions (for environmental testing and other pertinent testing)
5. Required size and configuration
6. Estimated quantity
7. Development schedule:

	Day	Month	Year
ES (Engineering sample)			
Evaluation			
CS (Consumer sample)			
Evaluation			
Begin mass production			

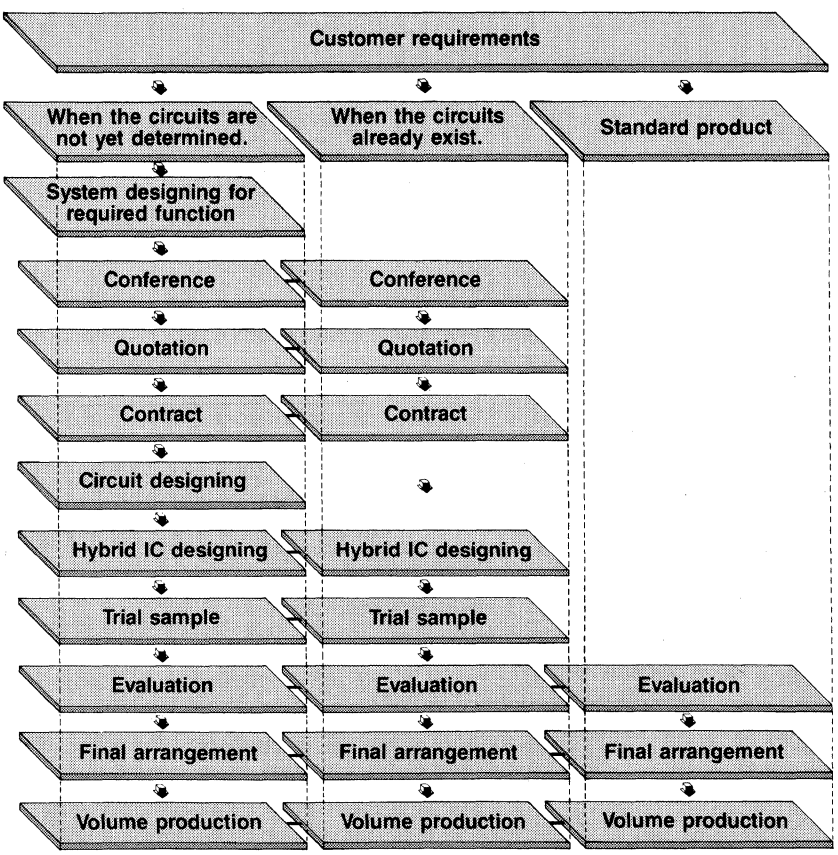
8. Prèferable price (development costs and mass production price)

Quality assurance tests

All of FDK's thick film hybrid ICs must pass strict testing standards before they can be shipped to customers. The testing processes are outlined below.



Development steps



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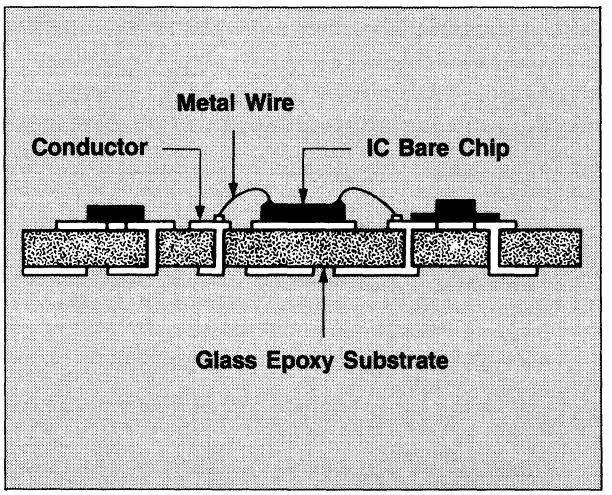
THICK FILM HYBRID ICs

FDK's advanced technology

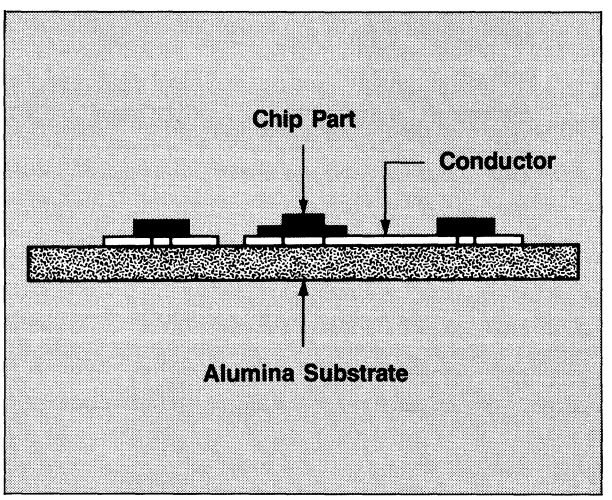


COB (Chip-On-Board) technology

COB technology that achieves greater integration than was previously possible is utilized to bond bare chips directly to a glass epoxy substrate. With this technology, it is also possible to package CPU, custom ICs and memory devices. Thus, long or large products which are impossible to produce using alumina substrates can be made—e.g., thermal heads, contact sensors and other parts used in facsimile and similar machines.

User Benefits

- Reduction of product size and weight, made possible by larger-scale integration
- Low cost
- High mechanical strength

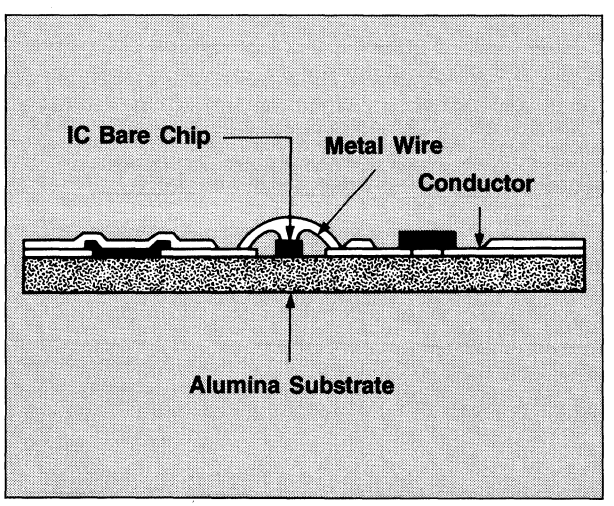


SMT (Surface Mount Technology)

With this technology, hybrid ICs are made by automatically mounting chip parts onto various types of substrates. Because parts are abundantly available and automatic mounting is possible, this technology is suited for use in mass production of hybrid ICs.

User Benefits

- Low cost
- Ease of customization
- Availability of various circuit functions



Chip & wire technology

With chip & wire technology, bare chips are mounted on various substrates, including alumina and aluminum, and packaged by wire bonding. Hybrid ICs produced by this technology, the most mature and time-tested of the three, are widely used in applications ranging from industrial products to consumer electronics.

User Benefits

- Large scale of integration
- High reliability
- Ease of customization
- Total cost reduction

FDK
Fuji Electrochemical Co.,Ltd.
Tokyo, Japan

FDK AMERICA, INC.
17326 Edwards Road, A-130, Cerritos, California
90701, U.S.A.
Phone 213-404-1770 Telex 18-1998(FEC CALIF LA)
Fax. 213-404-2850

FDK AMERICA, INC. EAST REGION OFFICE
333 Sylvan Avenue, Third Flóor, Englewood Cliffs,
New Jersey 07632, U.S.A.
Phone 201-567-1900
Fax. 201-567-2181

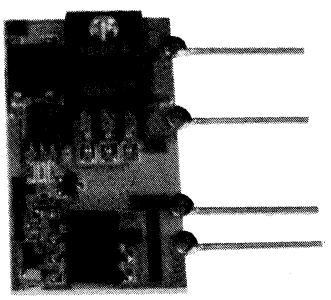
GORDOS

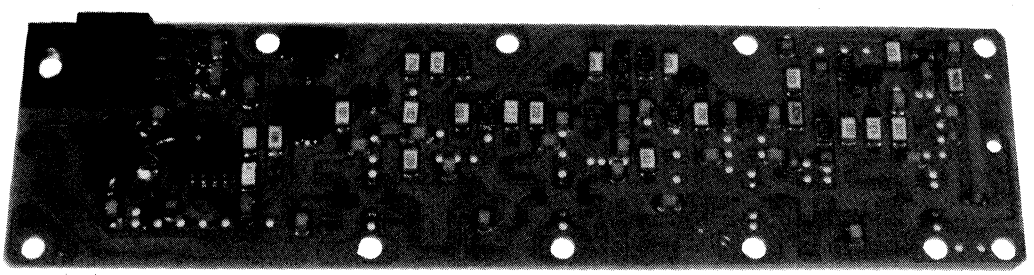
CUSTOM HYBRID CIRCUITS

ADVANCED THICK-FILM HYBRID CIRCUITS FROM GORDOS— A LEADER IN POWER HANDLING AND THERMAL MANAGEMENT

If one of your designs requires greater levels of reliability or miniaturization, talk with a Gordos Representative about the advantages of hybrid construction:

- More precise, flexible design through specification of optimum component values.
- Fewer discrete interconnections and parts.
- Reduced physical dimensions and weight.
- Less parasitic coupling resistance.
- Improved thermal tracking, dissipation, and stability.
- Better noise immunity, even in harsh signal environments.
- High volume production with tighter manufacturing tolerances.
- High dielectric isolation.
- Functional trimming of individual circuits for improved performance and accuracy in the field.
- Better repeatability (electrical uniformity) from circuit to circuit.
- Superior reliability, even when subjected to severe physical or thermal shock or vibration.
- Lower individual part cost due to high-yield semi-automated production.





Engineering

- In-depth resources in analog, digital and packaging design
- Dedicated to excellence — proven by design performance
- CAD-CAM systems for efficiency
- Environmental testing of prototypes insures that design criteria are met

Pre-production

- Large scale artwork allows uncompromising accuracy
- In-house photographic reduction and film processing yield optimum detail
- High resolution screen fabrication system assures ultimate precision

Manufacturing

- Automated, environmentally controlled screen printing and firing process guarantees uniformity
- Microprocessor controlled, multi-zone conveyer furnaces for precise curing
- Computerized laser trimming of resistors for optimum circuit performance
- High speed robotics assure error free placement of surface mounted components
- Precisely controlled vapor phase soldering guarantees reliable solder connections
- Fast turnaround.

Quality

- For high reliability applications pre-screening of components is available
- Computerized, multi-stage testing controls quality at every manufacturing stage
- Burn-in and 100% load testing assure a flawless finished product

Whether your needs are design-to-spec or built-to-print, we pledge that we will provide you with the finest engineering, manufacturing, quality assurance and customer service in the industry. Contact Gordos today. Put a winner to work for you.

1000 N. SECOND ST., ROGERS, AR 72756 USA / TEL: 800-643-3500, 501-636-5000 / TWX: 910-720-7998 / FAX: 501-636-2305

HEI inc.
HYBRID ELECTRONICS DIVISION

CUSTOM HYBRID MICROELECTRONICS DESIGN AND PRODUCTION SERVICES

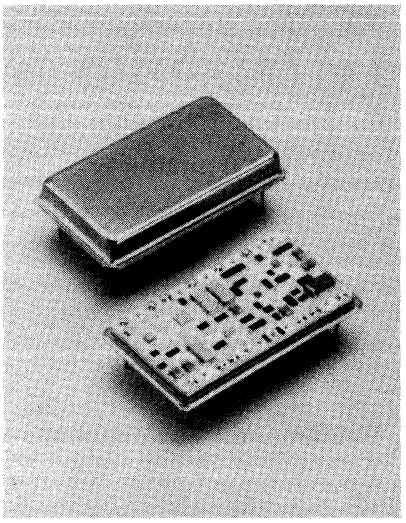
HEI, Inc. has over twenty years experience as a manufacturer of high quality hybrid thick film circuits. The company specializes in short-to-medium length production runs of high density custom devices. HEI offers customers the advantages of close liaison and personal attention, from original specification through test and shipping of design-disclosed circuits.

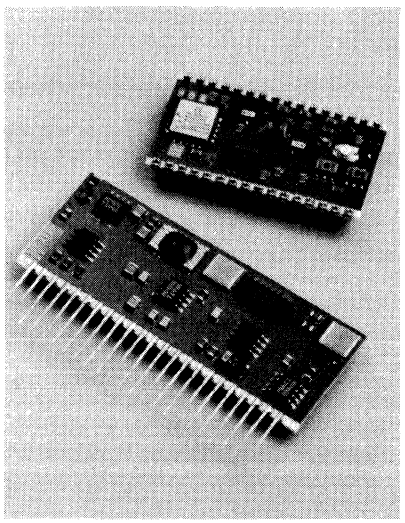
The company has extensive experience in the design and manufacturing of a variety of hybrid circuits from simple to complex.

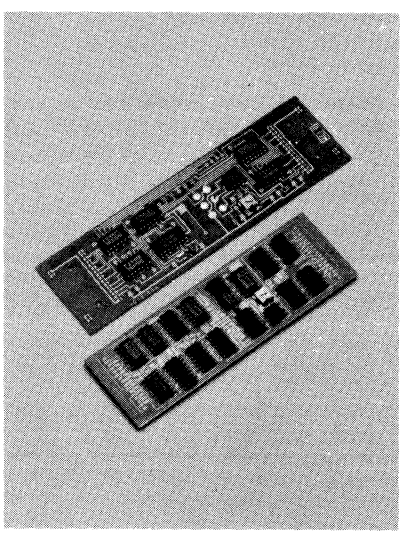
HEI sales engineers assist customers in evaluating the feasibility of satisfying circuit needs with hybrid production. This consultation service includes careful design planning in order to meet performance specifications with maximum production economy. HEI works to maintain optimum customer response times, with typical quote timing of 2 weeks and prototype delivery within 10 weeks.

Capabilities include chip-and-wire and surface-mount technologies, using statistical manufacturing process control and full automation from printing through final test. HEI is a recognized ship-to-stock supplier.

The very latest in equipment and process technology is used to give customers consistent high quality products while maintaining the hybrid circuit advantages of low start-up cost, ease of change and lower per-piece cost, even in short-run quantities. HEI capabilities, while sophisticated, are constantly being improved and upgraded.







FREE

HYBRID ANSWERS

When is it practical to develop a custom hybrid? What about my specific circuit requirements? What are the costs, and how long does it take?

Get fast answers to these important hybrid questions with HEI's Express Quote Service. Call, write or FAX today for your HEI Express Quote Kit, and we'll respond promptly with clear answers and without obligation.

HEI inc.
HYBRID ELECTRONICS DIVISION
Box 5000
1495 Steiger Lake Lane
Victoria, MN 55386
Phone: 612-443-2500
FAX: 612-443-2668

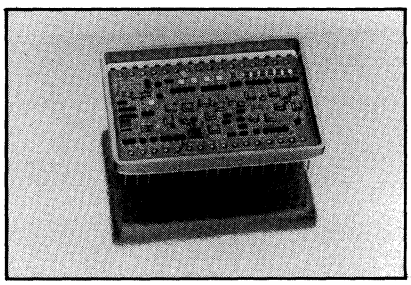
Hybridyne Inc.

- CUSTOM THICK FILM HYBRIDS
- CUSTOM THICK FILM SUBTRATES
- CERAMIC PACKAGING LIDS
- PRECISION SCREEN MANUFACTURE

FACILITY

Hybridyne's 30,000 sq. ft. facility located in Tucson, Arizona, houses all the necessary expertise and equipment needed to provide our customers with solutions to their particular problems. Our autonomous approach to the manufacture of our custom products emphasizes in house control over the critical phases of design, artwork generation, screen fabrication, all manufacturing processes, and electrical and environmental testing. We have invested in a staff that provides the necessary experience in the design phases of a project along with the skill to control the manufacture to all specifications developed. State of the art equipment has been purchased as well as the fabrication of an ultra-clean room environment to facilitate complex hybrid assembly operations. All together this allows Hybridyne to generate products with the highest quality standards, in the shortest possible time frame, for a very competitive price.

CUSTOM THICK FILM HYBRIDS



Features

- EXPERIENCED DESIGN ENGINEERING
- SEGREGATED CLEAN ROOM ENVIRONMENT
- ADVANCED THICK FILM TECHNOLOGY
- AUTOMATED HYBRID ASSEMBLY
- SELECTION OF PACKAGING TECHNOLOGIES
- ELECTRICAL–ENVIRONMENTAL TESTING

Design–Artwork Capacity

- Knowledgeable Design Engineers
- Complete Component Selection Service
- Custom Electrical Test Equipment Design and Fabrication
- CAD System
- Step and Repeat Equipment
- Photo Reduction Equipment

Advanced Thick Film Manufacture

- Complete Screen Manufacture Capacity
- Segregated Clean Room Printing Environment
- Automatic and Manual Screen Printing Equipment
- Through hole and Edge Around Printing Capacity
- Computerized CO_2 Laser for Scribe and Drill
- Automatic YAG Laser for Precision Resistor Trimming

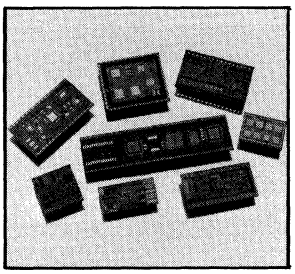
Hybrid Assembly–Environmental Screening

- Segregated Clean Room Environment
- Automatic Continuity–Isolation Test Equipment
- Die Attach (Epoxy, Solder, Eutectic)
- Automatic and Manual Wire Bonding Equipment (Gold and Aluminum Wire)
- Active and Functional YAG Laser Trim
- Temp cycling–Thermal Shock–Stabilization Bake
- Gross and Fine Leak Testing Equipment

PRECISION SCREENS

- Meshes from 48–400 (wires per inch)
- Direct Emulsion
- Variety of Frame Sizes

CUSTOM THICK FILM SUBSTRATES



Features

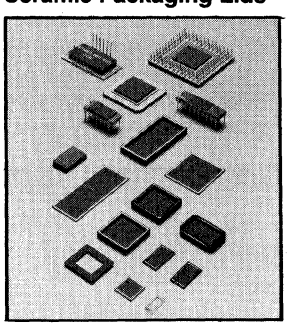
- HIGH VOLUME CAPACITY
- FAST TURNAROUND
- LOW COST
- SINGLE OR MULTILAYER CIRCUITS
- METALLIZATION–RESISTORS–CAPACITORS
- SUBSTRATE DRILLING AND SCRIBING

Capabilities

- Single layers utilizing high density design (5 mil lines-spaces min.)
- Multilayer circuits up to 7 metal layers
- Chip Resistors utilizing Gold terminations for Wire Bonding (10Ω–100MΩ) range
- Thick Film Resistors 1Ω–500MΩ range, tolerances as low as ±.1% range
- Printing in multiple-up arrays utilizing laser scribing for low cost

CERLIDS

Ceramic Packaging Lids



Features

- HIGH VOLUME CAPACITY
- LOW COST–FAST TURNAROUND
- FLAT OR PRESSED (TUB) VARIETY OF AL_2O_3
- THREE SEALANTS AVAILABLE: SOLDER, GLASS OR EPOXY
- NO PREFORMS–SEALANT ATTACHED TO LID
- MILITARY STANDARD PERFORMANCE

10 UC Solder Seal

- Hermetic Seal
- Non precious metal for 60-80% savings over gold plated lids
- 310–325°C peak seal temperature

TG370 Glass Seal

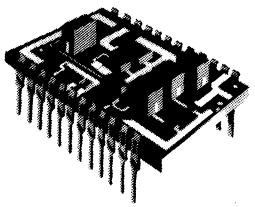
- Hermetic Seal
- Elimination of Package Seal Ring
- Low Glass Sealing Temperature (405°C Peak)

200 UC Epoxy Seal

- Non-Hermetic Applications
- Low Curing Temperature (150°C for one hour)
- Strip and Reapply Service

2155 N. Forbes Blvd. • Tucson, Arizona 85745 • Phone 602/629-0001 • Fax 602/791-3899

IRC'S COMPLETE CUSTOM CIRCUIT MANUFACTURING SERVICES



IRC, Inc., with multi-plant manufactuing facilities in Boone, North Carolina, Newland, North Carolina and Corpus Christi, Texas, is one of the leading producers of quality resistors, resistor networks, custom thick and thin film hybrid circuits, and custom assemblies. IRC's sister company, Welwyn Microcircuits, is Europe's largest independent designer and manufacturer of custom hybrid circuits.

CAPABILITIES

- *Cost-Effective Design Layout.*
  Using state-of-the art CAD systems, our designers can work from your circuit prints, or create totally new hybrid circuits for your systems.
- *Large-Area Printing.*
  Thin-film sputter deposition or thick-film screen printing techniques are performed in a class 10,000 clean room.
- *Passive and Active Laser Trimming.*
- *Automatic Placement Machines.*
  Complete surface mount capability to automatically place all passive and active components with maximum economy.
- *Automatic Chip-and-Wire Bonding.*
- *Complete Testing.*
  Automated test equipment assures ultimate circuit quality to meet prescribed military, or customer specifications.

PRODUCTS

1. Thick-film hybrid.
2. Thin-film hybrid.
3. Through-hole hybrid.
4. Chip and wire hybrid.
5. Stacked-Multilevel hybrid.
6. Hermetic seal hybrid.
7. Precision thin-film resistor networks.
8. Thick film molded networks.
9. Surface-mountable resistor networks.
10. Battery feed networks.
11. High voltage bleeder and divider networks.
12. Resistor substrates.
13. Custom switch assemblies.
14. Special subassemblies.

IRC

A member of the Crystalate Group

INTERNATIONAL RESISTIVE COMPANY, INC.
P.O. BOX 1860, GREENWAY ROAD • BOONE, NC 28607.1860
(704) 264-8861 or **1-800-255-4-IRC** • TLX: 46.9902 • FAX: (704)264-8861 ext. 357

Integrated Circuits Incorporated

CUSTOM HYBRID CIRCUITS

Producing high quality custom hybrid circuits is an art no one learns overnight. And producing circuitry consistently recognized as the finest in the industry takes years.

That's the secret behind the success of Integrated Circuits Incorporated. Building custom thick-film hybrid circuits has been our specialty since 1969. And we've used all of that experience to perfect our expertise in not only technical capabilities and quality, but also in program management and customer coordination.

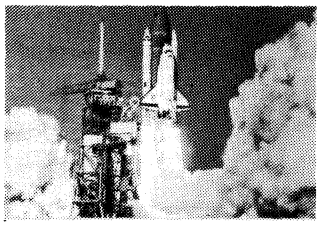
We can design a circuit to your specification, or convert your circuit to a miniature hybrid design. Either way, it must pass the rigid quality assurance requirements basic at ICI - MIL-I-45208, MIL-STD-883, MIL-M-38510, and MIL-Q-9858 as applicable.

For military, airborne or industrial requirements, you'll find ICI to be responsive, capable and reliable.

Integrated Circuits Incorporated

10301 Willows Road
Redmond, Washington 98052
(206) 882-3100
FAX: (206) 882-1990
(800)822-8782

WHATEVER YOUR NEED ICI CAN MEET IT



Space

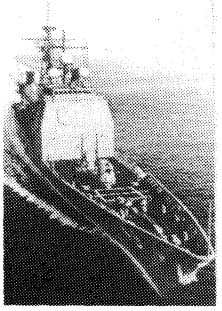
ICI hybrids have flown into space aboard NASA's space shuttle.

Experience Counts

Since 1969, ICI has produced custom hybrid microcircuits for a wide range of applications; everything from disk drives to satellites. ICI's capabilities and experience can meet your needs, whether you need a full MIL-Spec hybrid or a high-volume commercial hybrid.

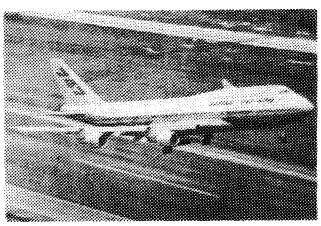
Full MIL-Spec Compliance

MIL-STD-1772 QUALIFICATION puts ICI in an elite class of hybrid facilities capable of meeting all of the requirements of MIL-STD-883C and MIL-M-38510H. ICI meets the military's stringent standards and we guarantee the highest quality levels possible in custom hybrids built to Class B requirements. ICI can go all the way to meet your MIL-Spec needs.



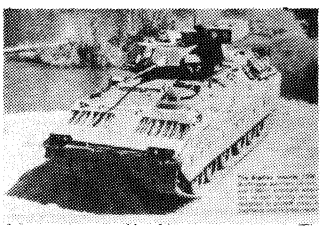
Navy

The Navy's Aegis class cruisers use ICI hybrids in radar and communication systems, as well as in the Vertical Launch System and SM-2 surface to air missiles.



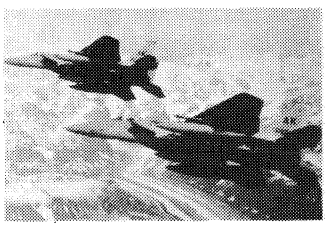
Commercial Aircraft

ICI hybrids are used in cockpit instrumentation and power control systems. Advanced avionics on the 747-400, 737-300, and MD-11 depend upon ICI hybrids.



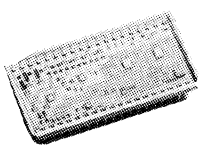
Army

ICI meets rugged military needs in the hybrids used in the TOW missile night sight on the Army's Bradley fighting vehicle. M-1 main battle tank and MLRS system rely upon ICI products.



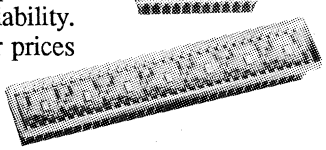
Military Aircraft

Since 1973, ICI hybrids have been part of the sophisticated avionics of the F-15 fighter aircraft. ICI hybrids are aboard the B-1, F-14, F-16, and F/A-18 aircraft.



Commercial Quality

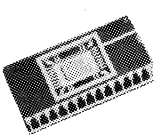
ICI builds all hybrids in the same MIL-STD-1772 qualified facility, providing commercial-grade hybrids with a high level of quality and reliability. Yet, ICI's location and volume production keep our costs and your prices low. The best for less in commercial quality.



Special Requirements

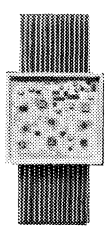
Custom Chip Packaging

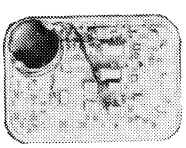
If you need a special package or special testing for a single-chip circuit, ICI can meet your needs.



Magnetics

Since 1971, ICI has incorporated magnetics in hybrids. ICI is one of the few companies able to mix thick film and transformer technologies into one hybrid device such as this DC-DC converter used in guided munitions.





For more information, call toll free

800-822-8782

ICI Integrated Circuits Incorporated

10301 Willows Road
Redmond, WA 98052
206-882-3100

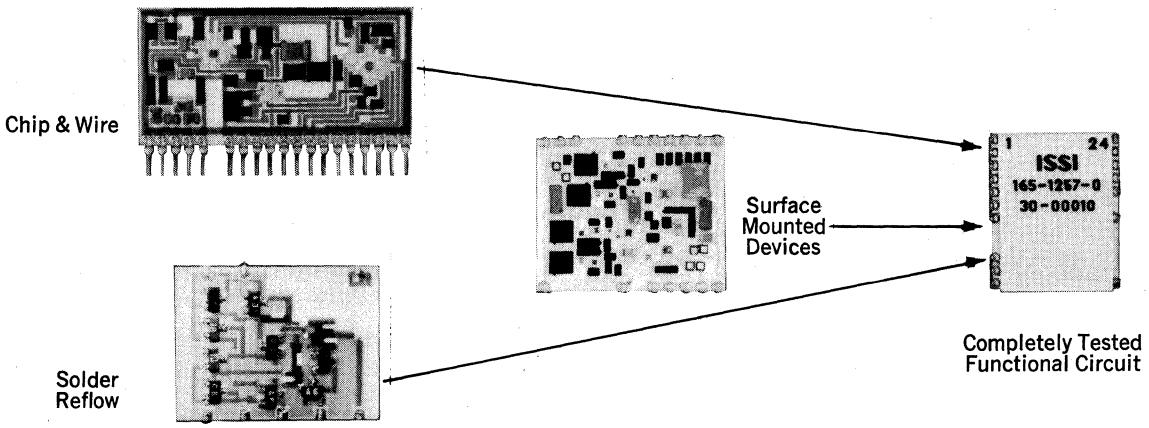
INTERNATIONAL SENSOR SYSTEMS, INC.

P.O. Box 345
Industrial Park
AURORA, NEBRASKA 68818

Telephone (402) 694-6111
EasyLink 62942952
FAX (402) 694-6180

HYBRID THICK FILM PRODUCTS AND SERVICES

Custom and Surface Mount Packages



CUSTOM PACKAGES

- Single In-line (SIP)
  - High Temp Solder
  - Low Temp Solder
- Hybrid
  - Flat Packs
- Dual In Line (DIP)
- Surface Mount
  - PCB Base
  - Ceramic Base
  - (See opposite page for details)
- Multi-layer Circuit
- Encapsulated
- X-tal Can Covers
- Ceramic Cover
  - High Temperature Sealant
  - Low Temperature Sealant
- Plastic Covers

CUSTOM COMPONENTS

- Custom Thick Film Metallized Substrates, Pd Ag, Pt Ag, Au, Pt Au, Dielectric, Glaze
- Networks, Specialized Resistor
  - Resistor-Capacitor
  - Resistor-Capacitor-Inductor
  - EMI/RFI Shielded
- Special Devices
- Amplifiers
- Oscillators
- Time Base Modules
- A-D, D-A Converters
- Fiber Optic
  - (Transceivers, Bar Code Readers)
- Solid State Relays
- Microwave
- Control Circuit
- Display Panels

TECHNICAL SERVICES

- Circuit Design
- Circuit Layout (Includes conversion to Thick Film)
- Material Selection
- Create Rubyliths
- Component Specification
- Tooling
- Product Testing
- Build to Print

TECHNICAL CAPABILITIES

- Solder Reflow
  - IC Packages, Discrete Components (Capacitors, Bridges, L E.D.'s etc.)
- Chip and Wire
  - All Component Chips
  - All Available Integrated Circuits
  - Thermo-Compression Bonding (Au Wire)
  - Thermo Sonic Bonding (Au Wire)
  - Ultrasonic Bonding (Al Wire)
- Special Static Handling
- Resistance & Capacitance Trimmed (Active and Passive)

MILITARY SPECIFICATION CAPABILITIES

- MIL-I-45208 Inspection Systems Requirements
- MIL-STD-45662 Calibration System Requirements
- MIL-STD-883 Test Methods and Procedures for Microelectronics
- Certificate of Compliance furnished upon Request

PO BOX 345, INDUSTRIAL PARK
AURORA, NE 68818
TELEPHONE (402) 694-111
EASYLINK 62942952

INTERNATIONAL SENSOR SYSTEMS, INC.

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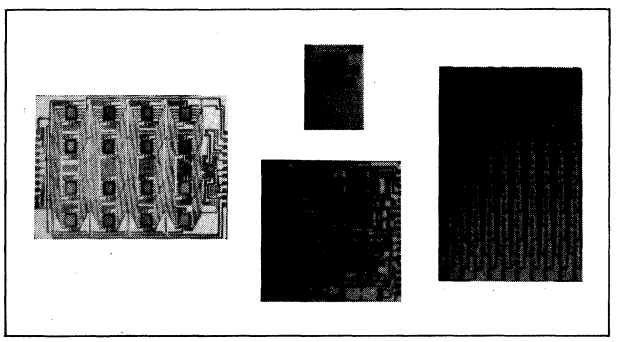
Industrial Park
AURORA, NEBRASKA 68818

Telephone (402) 694-6111
EasyLink 62942952
FAX (402) 694-6180

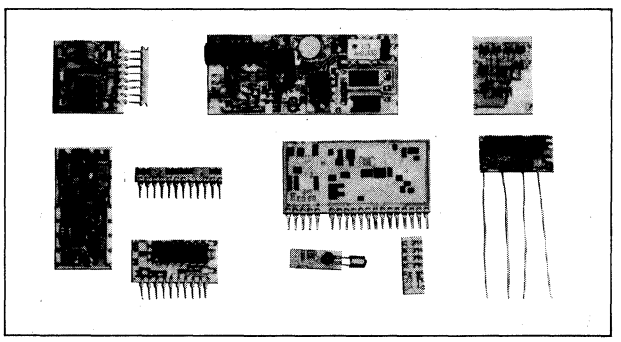
HYBRID THICK FILM TECHNOLOGY

FEATURES

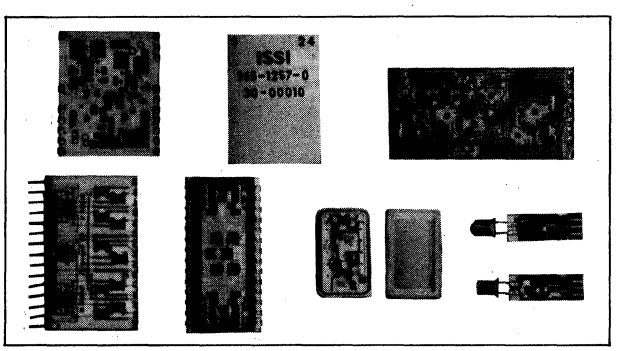
- one time insertion costs
- functional modularity
- high quality components
- compact
- low profile
- low mass
- high performance
- small
- extreme temperature operating range
- military specification capabilities



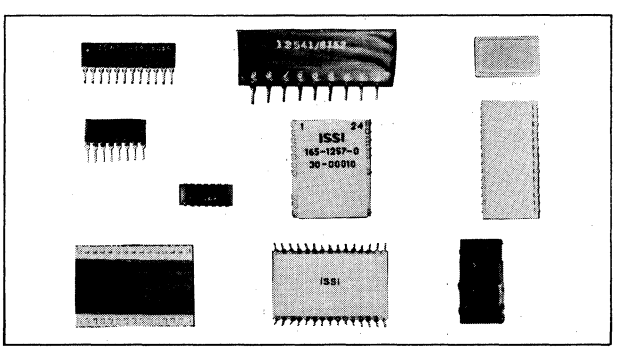
METALIZED SUBSTRATES — Simple or complex, single or multi-layer conductor patterns with Pd. Ag (Palladium Silver), Pt. Ag. (Platinum Silver), Au, (Gold), Pt. Au. (Platinum Gold) inks. Insulation with high temperature glass dielectric or low temperature glaze. Film Resistors from 1 ohm to 150 megohm, tolerances to ±0.1%, T.C.R. to 50 ppm, 1/10 w to 10 watt power dissipation, laser or abrasive trimming.



SOLDER REFLOW TECHNOLOGY — Compact networks with thick film resistors, IC packages, chip capacitors, inductors, discrete components, SOT package, diode bridge assembly, high and low temperature solder, standard or custom pinouts. Special devices with photo-transistors, LED's and functional sub-assemblies.



CHIP AND WIRE TECHNOLOGY — Microcircuit assembly of functional thin film integrated circuit or component chips into operational devices. All available IC & component chips assembled to a thick film circuit by solder or epoxy bonding. Chips wired into circuit with either gold or aluminum wire. (Thermocompression or thermosonic wire bonding). Special handling for static control. Components actively or passively trimmed to guarantee functional specifications.



CUSTOM PACKAGES — Single-in-line or Dual-in-line pinout packages, conformally coated, metal can, plastic or ceramic covered and sealed. Customer markings as well as manufacturer's identification for traceability. Leak tested, temperature cycling and burn-in before final test to insure reliability. Heat sink attached to either alumina or beryllium oxide to obtain maximum power dissipation.

* NOW AVAILABLE: SURFACE MOUNT PACKAGES.

TECHNICAL SERVICES

• Circuit design • layout (including conversion of existing circuitry to thick film technology) • material selection • rubylith production • screen fabrication • product tooling • product testing • and building to print. Testing includes functional electrical and mechanical parameters • burn-in • leak testing • and temperature cycling.

APPLICATIONS

• Memory • logic • linear circuits • A-D • D-A • timing • filters • isolation • pulse shaping • impedance matching • signal generation • switching • sequencing • and many other medium range energy dissipation functions or a combination thereof.

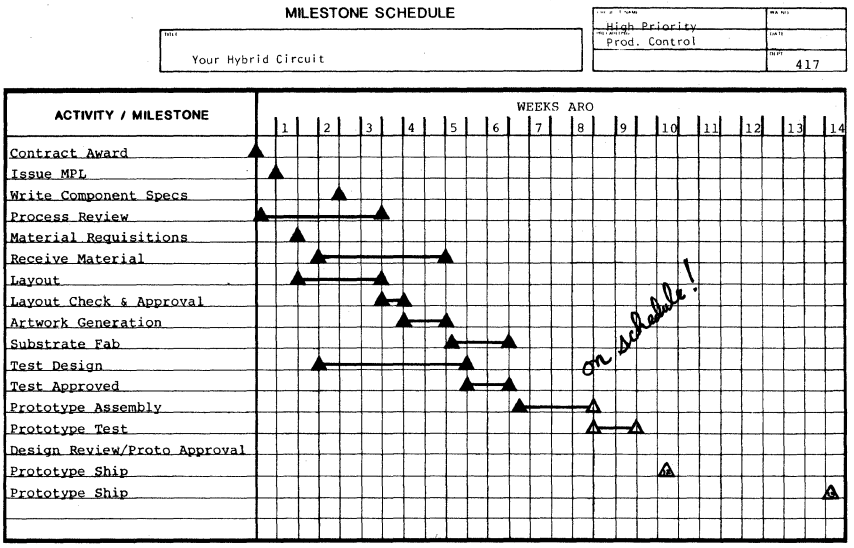
ISSI MILITARY SPECIFICATION CAPABILITIES

MIL-I-45208 Inspection System Requirements
MIL-STD-45662 Calibration System Requirements
MIL-STD-883 Test Methods & Procedures for Microelectronics
Certificate of Compliance furnished upon request.

LEACH® CONTROL PRODUCTS DIVISION — MICROELECTRONICS

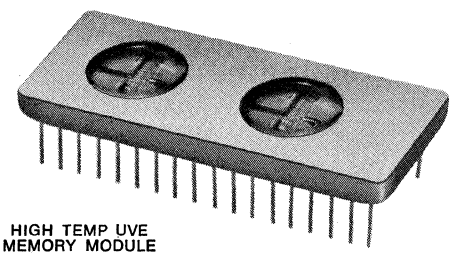
FAST TURNAROUND TIME

From contract award to prototype or production, delivery is among the shortest in the industry. **LEACH** has delivered functional military microcircuits in 8 weeks! Quick-response deliveries are made possible by planned factory excess capacity, computer-aided design and layout, close coordination with engineering counterparts at our customer's facility, and an emphasis on project planning.



SPECIALISTS IN HARSH ENVIRONMENT HYBRIDS

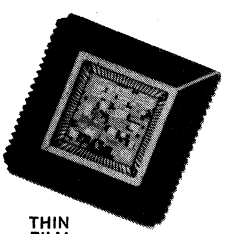
We have designed and delivered hybrids to the rigorous Class S (space) requirements; for downhole applications where hybrids experience temperatures exceeding 200°C; to withstand the high-impact of "smart munitions" systems, and, as a matter of routine, to meet or exceed the specified screening requirements of military (Class B) hybrids.



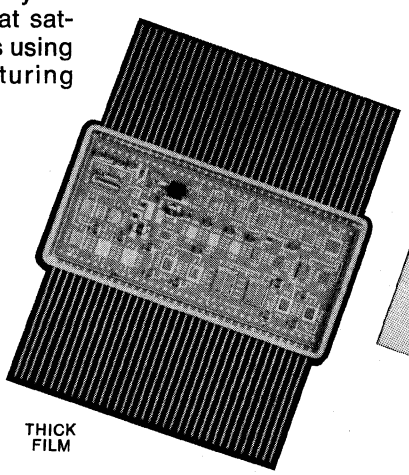
HIGH TEMP UVE MEMORY MODULE

FULL RANGE OF MICROELECTRONICS CAPABILITIES

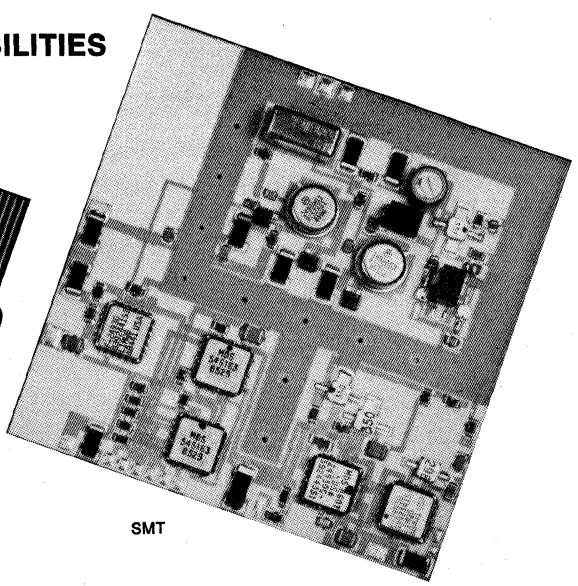
Design and process flexibility insure delivery of hybrids that satisfy your spec requirements using cost effective manufacturing methods.



THIN FILM



THICK FILM



SMT

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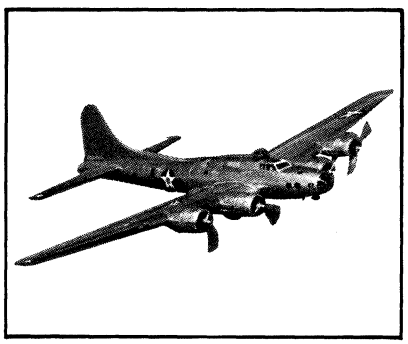
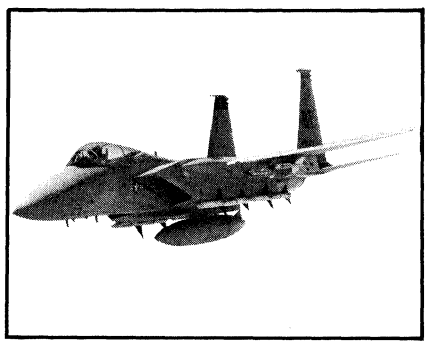
LEACH® CONTROL PRODUCTS DIVISION MICROELECTRONICS





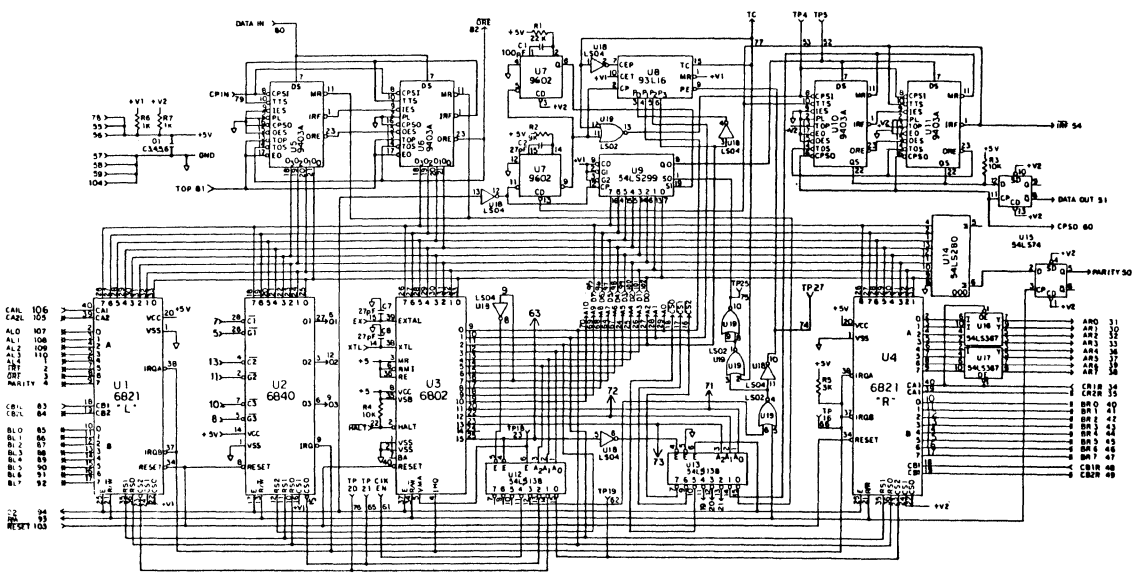
QUALITY PRODUCTS FOR 67 YEARS!

LEACH CORPORATION, a leader in electronics for more than 67 years, has the commitment, experience, and organizational resources to provide high quality, high reliability hybrids. LEACH products have been aboard virtually every major airborne military and commercial program including aircraft, missiles, satellites, and shipboard systems.

Our quality assurance program corresponds with the requirements of MIL-Q-9858A and we are in the DESC queue for certification to MIL-STD-1772.

"GIVE US YOUR TOUGHEST CIRCUIT PROBLEM"

LEACH Microelectronics wants to help you solve your design and miniaturization problems. Let us review your system schematics and make specific component, and packaging recommendations. We can help you achieve a viable solution with Hybrid Microelectronics.



For more information contact Bruce Armstrong
LEACH Microelectronics
6900 Orangethorpe Ave.
Buena Park, CA 90620.
Telephone (714) 739-0770.

LEACH MICROELECTRONICS

"ON TIME & ON TARGET"

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DRAM & SRAM MEMORY MODULES

TEL: (619) 292-1151
FAX: (619) 292-0774

SIMM & DRAM PACKAGES
FAST 1 MEGABIT STATIC

DYNAMIC 60, 80, 100, 120ns

PART NUMBER	ORGANIZATION	FIG.	PART NUMBER	ORGANIZATION	FIG.
MXD90256SM	256K × 9 SIMM	—	MXD91000SM	1 MEG × 9 SIMM	—
MXD80256SM	256K × 8 SIMM	—	MXD81000SM	1 MEG × 8 SIMM	—
MXD40256SP	256K × 4 SIP	—	MXD41000SP	1 MEG × 4 SIP	—
MXD10256ZJ	256K × 1 ZIP	—	MXD11000ZJ	1 MEG × 1 ZIP	—
MXD90256SMD	256K × 9 SIMM	2	MXD91000SMD	1 MEG × 9 SIMM	4
MXD80256SMD	256K × 8 SIMM	1	MXD81000SMD	1 MEG × 8 SIMM	3
MXD10256ZD	256K × 1 ZIP	—	MXD11000ZD	1 MEG × 1 ZIP	—
MXD10256ZD	256K × 1 ZIP	6	MXD11000ZD	1 MEG × 1 ZIP	5

STATIC 35–150ns

PART NUMBER	ORGANIZATION	FIG.
MXS32032LZ	32K × 32 ZIP	7
MXS80128SD	128K × 8 DIP	11
MXS80128SZ	128K × 8 ZIP	10
MXS80128LD	128K × 8 DIP	9
MXS80128LZ	128K × 8 ZIP	8

VIDEO 100 & 120ns

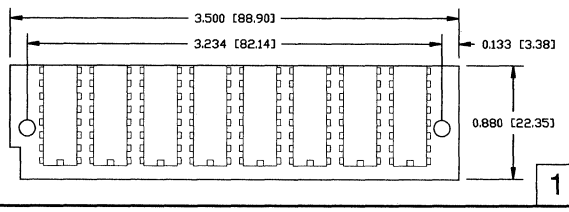
PART NUMBER	ORGANIZATION	FIG.
MXV40064ZD	64K × 4 ZIP	12

NOVRAM 200ns

PART NUMBER	ORGANIZATION	FIG.
MXN80001PD	1K × 8 DIP	—

AVAILABLE IN MILITARY & COMMERCIAL GRADES
CUSTOM MODULE DESIGN OUR SPECIALTY
CALL (619) 292-1151 TODAY FOR MORE INFORMATION

MXD80256SMD



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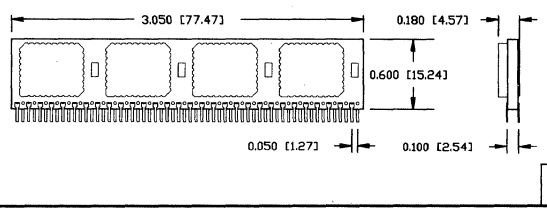
MXS32032LZ



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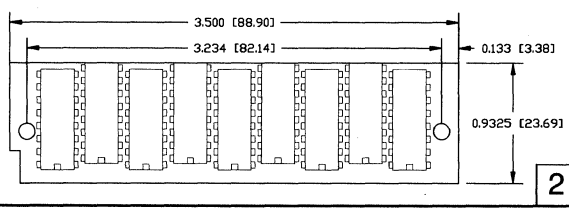
MXD90256SMD



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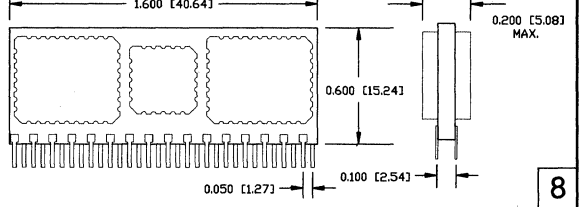
MXS80128LZ



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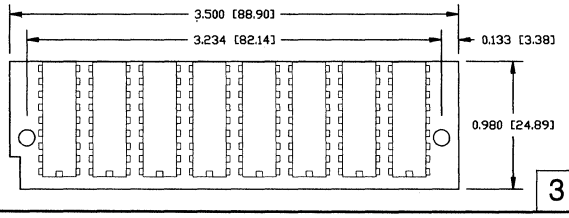
MXD81000SMD



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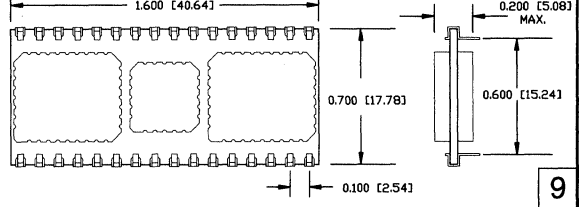
MXS80128LD



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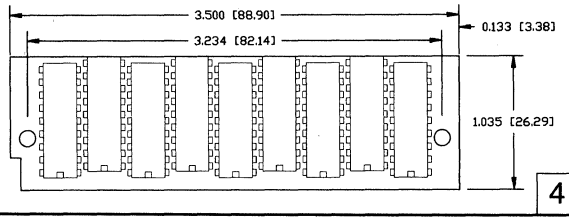
MXD91000SMD



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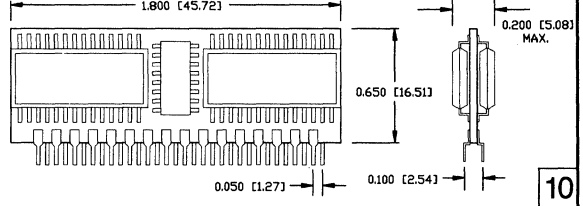
MXS80128SZ



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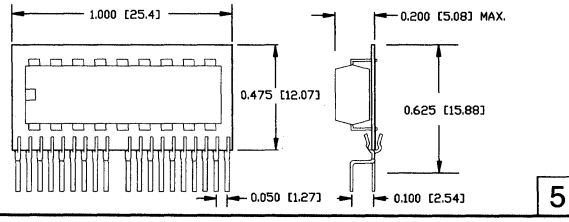
MXD11000ZD



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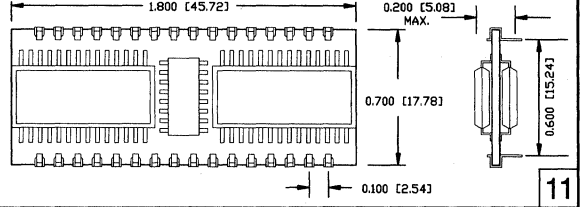
MXS80128SD



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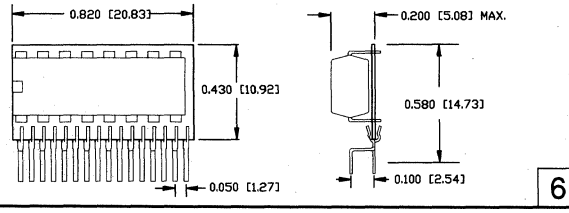
MXD10256ZD



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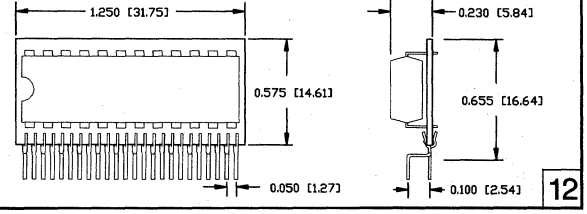
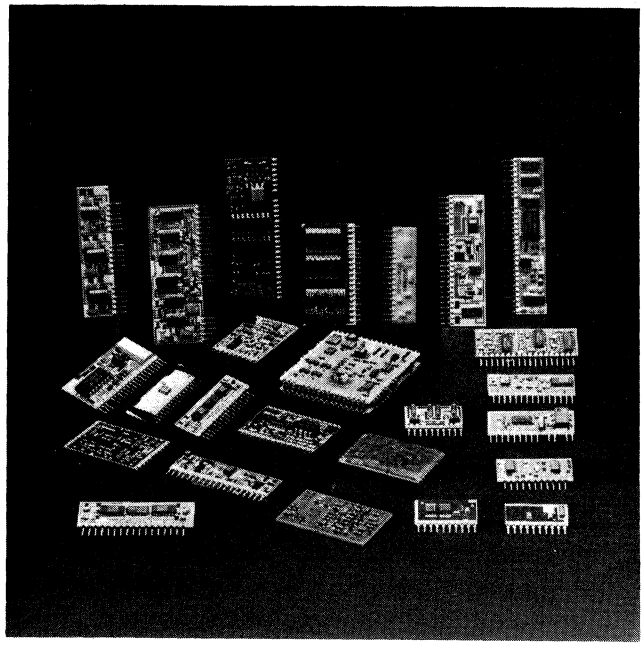
MXV40064ZD



12

CIRCUIT SYSTEMS

THE QUESTION?



THE ANSWER... MEPCO/CENTRALAB!

QUALITY AND DELIVERY...HAND IN HAND

CUSTOM PACKAGES
- SINGLE IN LINE
- DUAL IN LINE
- SURFACE MOUNT
  - PC BOARD
  - CERAMIC
- LEADED DEVICES
- MULTI-LAYER CIRCUITS
- ENCAPSULATION
- CAN PACKAGES
- HERMETIC SEAL

TECHNICAL CAPABILITIES
- COMPUTER AIDED DESIGN
- IR SOLDERING WITH IN LINE CLEANING
- VAPOR PHASE SOLERING
- FUNCTIONAL ADJUST
- CHIP AND WIRE
- BURN-IN
- TEMPERATURE CYCLING
- LASER DRILLED VIAS
- INTEGRATED ASSEMBLY
- DIE BONDING
- EUTECTIC BONDING
- COMPUTER TESTING
- PRECISION MULTILAYER SCREENING

PRODUCT APPLICATIONS
- AUTOMOTIVE
- COMPUTER
- CONSUMER
- INDUSTRIAL
- TELECOMMUNICATIONS
- MILITARY
- MEDICAL

MEPCO/CENTRALAB
2601 S. MOORLAND RD.
NEW BERLIN, WI 53151
(414) 785-6359
ALL INQUIRIES

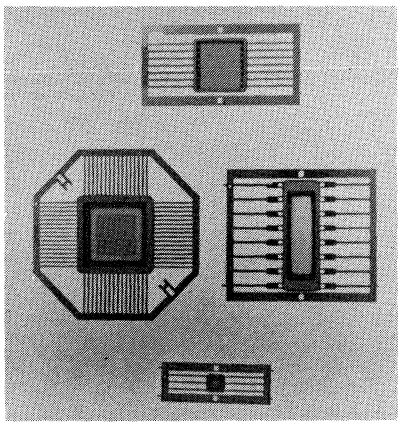
INTERCONICS
1515 S. SIXTH ST.
HOPKINS, MN 55343
(612) 933-4600

MEPCO/CENTRALAB
A NORTH AMERICAN PHILIPS COMPANY

HERMETIC PACKAGES FOR HYBRID MICROCIRCUITS

MINI-SYSTEMS, INC.
Electronic Package Division, 168 East Bacon St., P.O. Box 1597, Plainville, MA 02762
Telephone: (508) 695-2000 • Telex: 510-600-4340 • FAX 508-695-8758

GLASS FLATPACKS & CHIP-CARRIERS



- Most economical means of hermetically enclosing small hybrids
- Easily and economically customized to your needs
- Meet MIL-M-38510 requirements
- Sealed by reflow soldering with combination lids

SELECTION GUIDE

Case Size: Flatpack — case sizes ⅛″ x ⅛″ to 1″ x 1″; Dual-In-Line — case size ¼″ x ¾″

Glass Free Area: Flatpack — .040″ x .070″ to .810″ x .810″

Number of Leads: 1 to 84, depending on case size

Lead Centers: .050″, .040″, .030″, or as specified

Configuration: Leads and pads on 2 sides; Leads on 2 sides; Pads on 4 sides; Leads and pads on 4 sides

Base Material: Metal, ceramic, or beryllia

Plating: Gold or Nickel, all over or selective

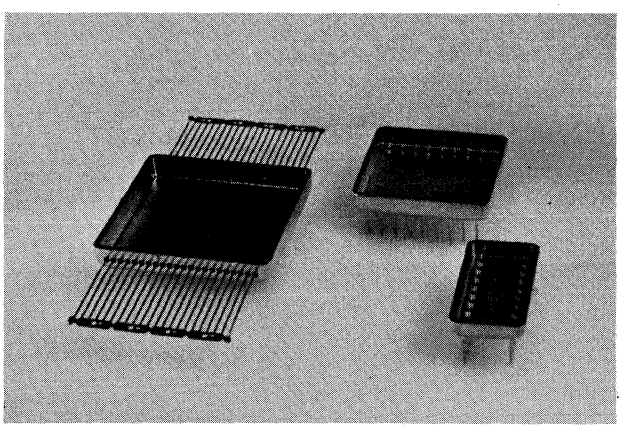
AVAILABILITY

Popular Packages — 2 weeks

Custom Packages — 8 weeks

WRITE FOR OUR DETAILED CATALOG

METAL PLUG-INS AND FLATPACKS



- Strongest and most reliable means of enclosing all size hybrids
- Package variations available built to your requirements
- Meet MIL-M-38510 Class S and all highest reliability requirements
- Sealed by seam welding with stepped lids or reflow combination lids

SELECTION GUIDE

Case Size: Plug-In and Flatpack case sizes ranging from .380″ x .625″ to 1.970″ x 2.970″

Number Pins/Leads: 1 to 188, depending on case size

Pin/Lead Centers: .100″ Plug-In; .050″ Flatpack

Configuration: Pins/Leads on 1, 2, 3, or 4 sides

Plating: Gold or Nickel, all over or selective

AVAILABILITY

Tooled Packages — 4 weeks

Custom Packages — 10 weeks

WRITE FOR OUR DETAILED CATALOG

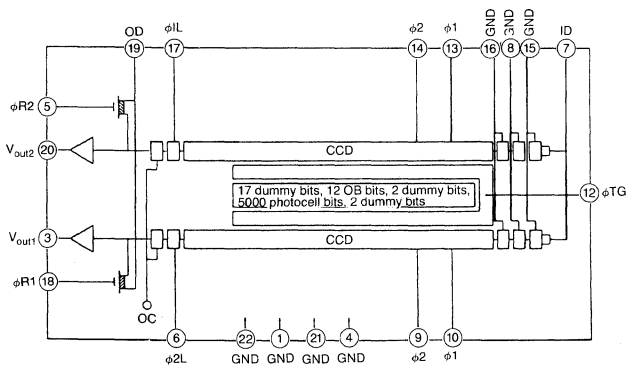
NEC Electronics Inc.
401 Ellis St., Mountain View, CA 94039 • 415/960-6000

CHARGE COUPLED DEVICES

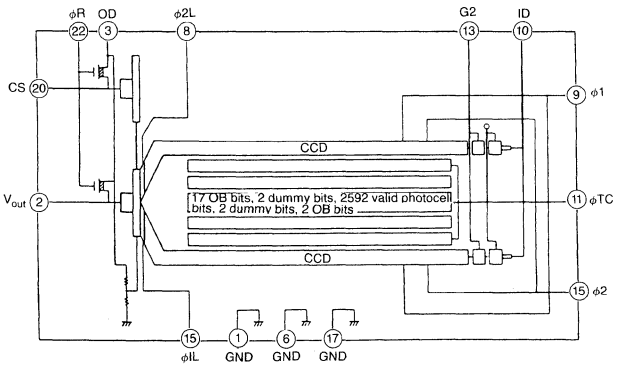
Line Arrays

Device Number	Number of Pixels	Pixel Size "μ"	Chip Size "mm"	Transfer Rate MHz	Package	Block Diagram
μPD3571D	5000	7×7	1×38	24.0	22-Pin Cerdip	1
μPD3573D	2048	14×14	1×30.5	5-10.0	22-Pin Cerdip	2
μPD3574D	2592	11×11	1×30.5	10	22-Pin Cerdip	3
μPD3575D	1024	14×14	1.2×15.6	3	20-Pin Cerdip	4

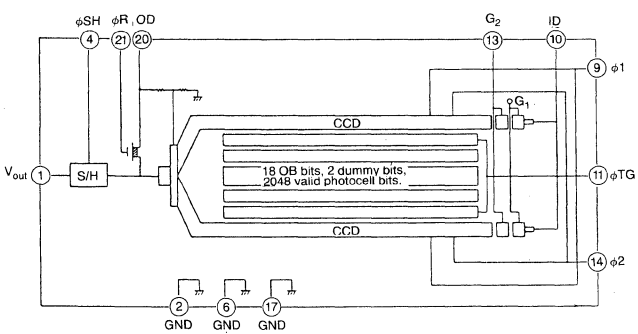
Support chips are available for all array areas including Clock Generator, CCD Driver, Vertical Driver and Sample & Hold I.C.s.



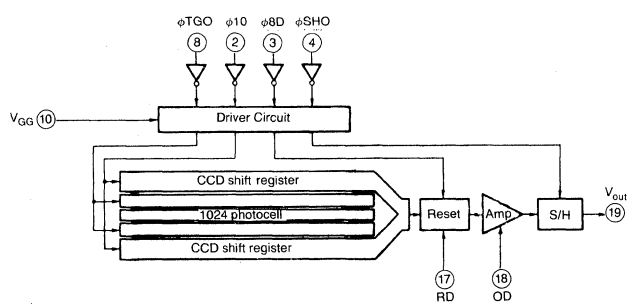
Block Diagram 1



Block Diagram 3



Block Diagram 2



Block Diagram 4

Specifications are subject to change without notice.

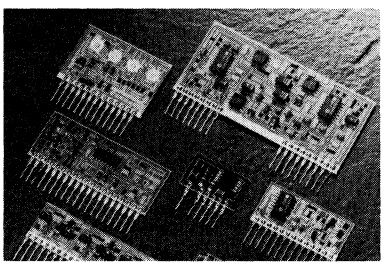
THICK FILM HYBRID CIRCUITS

NEW

NMB TECHNOLOGIES

NMB Technologies' Hybrid ICs enable design miniaturization, system cost reduction and higher performance.

FEATURES



These hybrid circuits are designed and produced using the latest, advanced techniques based upon decades of experience with hybrid circuits.

- High volume production
- SIP and DIP packaging
- Chip-on-board capability
- Double sided component mounting
- High density circuitry
- Resin coatings or ceramic packages

BENEFITS

- These Hybrid ICs are designed by using computer aided design systems (CAD)
- Standard substrates are large enough to satisfy many requirements
- Automated production line yields high quality products
- Advantages of the Hybrid ICs over discrete circuitry and monolithic ICs include compact size, greater functionality and cost reduction
- In-circuit laser trimming guarantees output performance to specifications

APPLICATIONS

CIRCUITRY

- Digital control circuits
- Memory and peripheral circuits
- Microprocessor peripheral circuits
- Motor controllers
- Stepping motor drivers
- PDP, fluorescent display tube drivers
- Various types of amplifiers

DEVICES

- Computer and peripherals
- Medical equipments
- Measurement equipments
- Controllers for industrial use
- Communication equipments
- Automobile electronics
- Electronic musical instruments

STANDARD PRODUCT CONSTRUCTION

		Hybrid IC
Substrate		Alumina substrate (96% Al_2O_3) Thickness: 0.635, 0.8, 1.0 (mm) Printed wiring board – PCB, FPC Metal-core substrate
Thick Film Substrate	Conductor	Silver/Palladium (Ag/Pd) Gold (Au) Silver (Ag)
	Crossover	Glass
	Overcoat	Glass
	Resistance	Ruthenium oxide (RuO_2) Resistance: 5Ω - 10 MΩ Accuracy: ±1 - ±10% TCR: 100ppm Rated power: 1/8W - 1/2W Noise: 2μV/V

		Hybrid IC
Mounted Components	Semi-conductor	• Transistor • Diode • Photo-isolator • MOSFET • Linear IC • Digital IC, etc. • Surface mounted components (SMC) • Bare chips
	Condensor	• Ceramic chip capacitors • Tantalum chip capacitors • Aluminum-electrolytic chip capacitors • Film chip capacitors
	Resistor	Thick film printed resistors are standardized, but surface mounting of chip resistors are also possible.
	Others	Other components: • Inductors • Transducers • Oscillators • Variable resistors
Packaging		[SIP / DIP] [Resin coating / Ceramic lids]

NMB || NMB TECHNOLOGIES INCORPORATED
SEMICONDUCTOR DIVISION

For complete specifications and pricing, contact
NMB TECHNOLOGIES INCORPORATED
9730 Independence Ave., Chatsworth, CA 91311 • Telephone: (818) 341-3355
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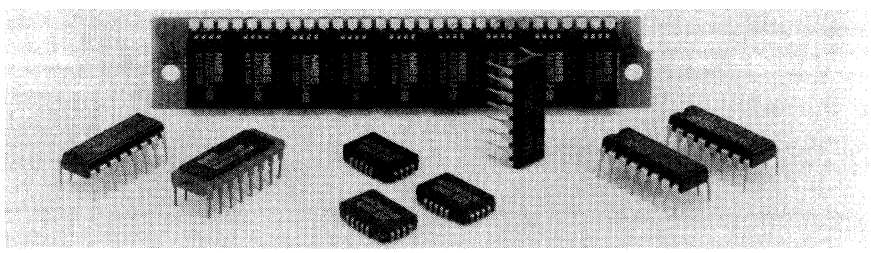
NEW

HIGH SPEED DRAMS

NMB TECHNOLOGIES

Now – Highest speed AND production – 60/70/80ns 1Mb and 256K FutureFast™ DRAMS.

FEATURES



- CMOS Technology
- Variety of Packages and Modes
- Wide Operating Margins
- Advanced Processing and Testing
- Absolute Reliability
- Very High Speed
- Volume Production
- State-of-the-art Design

AAA2800 256K DRAM

- **Access Time:** 60, 70, 80 ns
- **Organization:** 256K×1
- **Modes:** Fast Page, Static Column
- **Packages:** P-DIP, C-DIP, PLCC, SIMM
- **Status:** Production: Now

PARAMETER	SYMBOL	256K x 1		
Max. $\overline{RAS}$ Access Time	^tRAC	60 ns	70 ns	80 ns
Max. Column Address Access Time	^tCAA	32	35	40
Min. Read/Write Cycle Time	^tRC	121	136	151
Static Column Mode Read Cycle Time	^tSRC	35	40	45
Static Column Mode Write Cycle Time	^tSWC	35	38	40
Fast Page Mode Cycle Time	^tPC	37	41	46

AAA1M100 1Mb DRAM

- **Access Time:** 100, 120 ns
- **Organization:** 256K×4; 1Mb×1
- **Modes:** Fast Page, Static Column, Nibble (1Mb×1 only)
- **Packages:** P-DIP, C-DIP, ZIP, SOJ, SIMM
- **Status:** Production: 4Q1988

PARAMETER	SYMBOL	1Mb x 1		256K x 4	
Max. $\overline{RAS}$ Access Time	^tRAC	100 ns	120 ns	100 ns	120 ns
Max. Column Address Access Time	^tCAA	50	60	50	60
Min. Read/Write Cycle Time	^tRWC	225	260	260	300
Static Column Mode Cycle Time	^tSRC, ^tSWC	55	65	55	65
Fast Page Mode Cycle Time	^tPC	55	55	55	65

AAA1M200 1Mb DRAM

- **Access Time:** 60, 70, 80 ns
- **Organization:** 256K×4; 1Mb×1
- **Modes:** Fast Page, Static Column, Nibble (1Mb×1 only)
- **Packages:** P-DIP, C-DIP, ZIP, SOJ, SIMM
- **Status:** Production: 1Q1989

PARAMETER	SYMBOL	1Mb x 1			256K x 4		
Max. $\overline{RAS}$ Access Time	^tRAC	60 ns	70 ns	80 ns	60 ns	70 ns	80 ns
Max. Column Address Access Time	^tCAA	30	35	40	30	35	40
Min. Read Cycle Time	^tRC	100	115	130	100	115	130
Static Column Mode Cycle Time	^tSRC, ^tSWC	35	40	45	35	40	45
Fast Page Mode Cycle Time	^tPC	40	45	50	40	45	50

*Specificiations subject to change without notice.

NMB TECHNOLOGIES INCORPORATED

SEMICONDUCTOR DIVISION

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MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 88/89 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1134, **B**•1098, **C**•1082, **D**•1038
ASCII Code ..... **D**•1073
Batteries, Product Selection Guide ..... **D**•1428
Batteries & Fuel Cells, Characteristics ..... **D**•1454
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1030
Capacitors, Miniglossary ..... **A**•1027
Capacitors, Product Selection Guide .. **A**•1003
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1193
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1760
Connectors, Miniglossary ..... **C**•1374
Connectors, Terminals & Sockets, Product Selection Guide ..... **C**•1127
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide ..... **A**•1331
Delay Lines, Product Selection Guide ..... **A**•1495
Discrete Semiconductors, Product Selection Guide ..... **A**•2113
Displays, Readouts, & CRTs, Product Selection Guide ..... **B**•1033
EBCDIC Code ..... **D**•1162
Encapsulation, Miniglossary ..... **C**•1110
Fans, Blowers, Cooling Equipment & Heat Exchangers, Product Selection Guide ..... **C**•1643
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IC Master ..... **A**•1718
Instruments, Panel Meters, Product Selection Guide ..... **D**•1350
Instruments, Test & Measuring, Product Selection Guide ..... **D**•1190
Interconnection Systems, Product Selection Guide ..... **C**•1719
Keyboards & Keypads, Product Selection Guide ..... **B**•1808
Lamps, Lights, & Inductors, Product Selection Guide ..... **B**•1104
Logofinder & Trademark Directories .... **C**•901
Microwave Components, Product Selection Guide ..... **A**•1761
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Potentiometers, Trimmers, Controls & Rheostats, Product Selection Guide ..... **A**•2057
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Power Supplies, DC, Product Selection Guide ..... **D**•1497
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Voltage Drop Nomograph .. **C**•1912, **D**•2042
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Wire Guages—Diameter, Area, Copper Weight ..... **C**•1864

Seiko Instruments

INTEGRATED CIRCUITS

Seiko Instruments offers a wide variety of high quality, accurate, competitively priced line of ICs. IC technology used in every industry from office automation to household appliances. For the world's finest IC technology, call your Seiko representative today.

VOLTAGE REGULATOR

The S-802 and S-812 Series are CMOS voltage regulators. Both Series are the fixed type which the output voltage is internally fixed. The S-802 Series is a negative voltage regulator and the S-812 is a positive voltage regulator. SOT-89 package available for surface mount.

Features
- ☐ Low current consumption
- ☐ Low input/output voltage difference
- ☐ Low temperature coefficient of output voltage (±0.38 mV/°C for the S-81230AG typ.)
- ☐ Wide operating voltage range
- ☐ Good input stability (0.1%/V typ.)

Applications
- ☐ Automobile voltage regulator
- ☐ High stability standard voltage
- ☐ Constant voltage power supply for battery-powered equipment, communications equipment, video equipment, and other equipments which require voltage temperature control

TO-92

SOT-89

Specifications

Model No.	Output Voltage (V)	Output Current (mA) Typ.	Load Stability (mV) Typ.	Input/Output Voltage Difference (mV) Typ.	Current Consumption (μA) Typ.	Input Voltage (V) Max.	Absolute Maximum Rating (V)
S-80230AG	−3±5%	30 (V_{IN} = −5 V)	60 (1_{OUT} = 1 to 20 mA)	60 (1_{OUT} = 1 mA)	2.5	−10	−12
S-80250AG	−5±5%	50 (V_{IN} = −7 V)	40 (1_{OUT} = 1 to 40 mA)	30 (1_{OUT} = 1 mA)	3.0	−10	−12
S-81211AG	1.1±5%	3 (V_{IN} = 1.5 V)	100 (1_{OUT} = 40 to 500 μA)	250	2.2	10	12
S-81225AG	2.5±5%	25 (V_{IN} = 4.5 V)	80 (1_{OUT} = 1 to 10 mA)	100	2.5	10	12
S-81230AG	3±5%	30 (V_{IN} = 5 V)	60 (1_{OUT} = 1 to 20 mA)	60 (1_{OUT} = 1 mA)	2.5	10	12
S-81250AG	5±5%	50 (V_{IN} = 7 V)	40 (1_{OUT} = 1 to 40 mA)	30 (1_{OUT} = 1 mA)	3.0	10	12
S-81250HG	5±5%	50 (V_{IN} = 7 V)	40 (1_{OUT} = 1 to 40 mA)	30 (1_{OUT} = 1 mA)	3.0	12	18
S-81350AG	5±5%	40 (V_{IN} = 5.2 V)	80 (1_{OUT} = 1 to 60 mA)	200 (1_{OUT} = 40 mA)	25	8	10

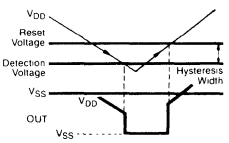
VOLTAGE DETECTOR

The S-805 Series is a fixed type CMOS voltage detector with the detection voltage internally fixed. SOT-89 package available to surface mount.

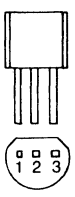
Features
- ☐ Low current consumption
- ☐ Low voltage drive
- ☐ Built-in stable detection standard voltage supply
- ☐ Good hysteresis characteristics
- ☐ Excellent detection voltage temperature characteristics

Applications
- ☐ Battery checker
- ☐ Window comparator
- ☐ Recharger monitor
- ☐ Level selector
- ☐ Power failure detector
- ☐ Store-signal detector for non-volatile RAM

Operation Timing Chart



Pin Arrangement



TO-92

1 OUT
2 V_{DD}
3 V_{SS}

BOTTOM VIEW

Specifications

Model No.	Detection Voltage (V)	Output State	Hysteresis Width (V)	Current Consumption (μA) Typ.	Output Current	Operation Voltage (V)
S-8051ANB	0.995 to 1.105	Nch open drain	(Typical detection voltage) x 0.05	1.4 (V_{DD} = 1.5 V)	Nch Typ. I_{OUT} (mA) / V_{DD} (V): 0.25 / 0.95; 0.50 / 1.20; 3.70 / 2.40; 7.00 / 3.60; V_{DS} = 0.5 V	0.9 to 5.0
S-8051ANR	1.095 to 1.205					1.0 to 5.0
S-8051HN	1.795 to 2.005			1.8 (V_{DD} = 3.0 V)		1.5 to 10
S-8052ANB	1.995 to 2.205					
S-8052ALB	1.995 to 2.205	CMOS				
S-8052ALR	2.195 to 2.405					
S-8052ALO	2.395 to 2.605					
S-8052ALY	2.595 to 2.805			2.2 (V_{DD} = 4.5 V)		
S-8053ALB	2.795 to 3.105				Pch Min. I_{OUT} (mA) / V_{DD} (V): 0.04 / 4.5; 1.0 / 8.0; V_{DS} = 2.1 V	1.6 to 10
S-8053HLB	2.895 to 3.105					
S-8053ALR	3.095 to 3.405			2.6 (V_{DD} = 6.0 V)		
S-8054ALB	3.995 to 4.305					
S-8054ALR	4.295 to 4.605					
S-8054ALO	4.595 to 4.905					
S-8054ALY	4.895 to 5.205					
S-8053ANO	3.395 to 3.705	Nch open drain		2.2 (V_{DD} = 4.5 V)		
S-8054HN	3.80 to 4.20			2.6 (V_{DD} = 6.0 V)		

NON-VOLATILE MEMORY/ NON-VOLATILE RAM

The non-volatile RAM (NV RAM) is a non-volatile CMOS memory combining a static CMOS RAM and a E²PROM as its back-up on a 1-to-1 basis. Since the RAM is an asynchronous CMOS static RAM, it exhibits low current consumption.

Features
- ☐ Single 5V power supply. All inputs and outputs are TTL compatible
- ☐ Store and recall are controlled by a narrow signal width: > 100ns
- ☐ E²PROM rewritings: 10^4 times
- ☐ E²PROM memory preservability: 10 years
- ☐ Erroneous storage prevention function: Approx. 3.5 V max.
- ☐ Autorecall function at power up
- ☐ Tri-state output

Applications
- ☐ Constant setting
- ☐ Data memory
- ☐ Rewritable programs and firmware
- ☐ System configuration setting
- ☐ System parameters and part No. setting
- ☐ System status monitor

Specifications

Model No.	Memory Size (bit)	Organization	Operating Voltage Range (V)	Current Consumption (mA) Operating (max.)	Current Consumption (mA) Standby (max.)	Static RAM Operation (ns) Read Cycle Time (min.)	Static RAM Operation (ns) Access Time (max.)	Static RAM Operation (ns) Write Cycle Time (min.)	Static RAM Operation (ns) Write Pulse Width (min.)	Store Operation (ns) Store Time (max.)	Store Operation (ns) Store Pulse Width (min.)	Array Recall Operation (ns) Recall Cycle Time (min.)	Array Recall Operation (ns) Recall Pulse Width (min.)	Package
S-2210R	256	64x4	5±10%	40	0.03	300	300	300	150	$10x10^6$	200	1400	300	18 DIP
S-2212R	1k	256x4	5±10%	50	0.03	300	300	300	150	$10x10^6$	200	1400	300	18 DIP
S-2444R	256	16x16	5±10%	20	0.03	1000	750	1000	—	$10x10^6$	200	2500	500	8 DIP
S-2445I/IF	256	16x16	5±10%	12	0.04	1000	750	1000	—	$12x10^6$	200	2500	500	8DIP,8SOP
S-2430I/IF	64	8x8	5±10%	16	0.04	1000	750	1000	—	$12x10^6$	200	2500	500	8DIP,8SOP

S-2444R, S-2445I/IF, S-2430I are bit-serial type models. S-2445I/IF, S-2430I/IF are serial-port direct types.

OTHER PRODUCTS

- ☐ NV RAMs—64 bit (8 x 8), 256 bit (16 x 16), (64 x 4), 1k bit (256 x 4)
- ☐ E² PROMs—128 bit (16 x 8), 768 bit (sequential), 1024 bit (64 x 16), (128 x 8)
- ☐ Hall ICs
- ☐ Temperature sensors
- ☐ Timers
- ☐ Special purpose, low power CMOS

CMOS LSI FOR TELEPHONE

Model No.	Application	Main Functions and Features		Package
S-7230A2/B2	PULSE/DTMF switchable dialer	☐ 32 digits redial function ☐ Auto-pause and key-in tone functions ☐ PULSE←DTMF switchable. 3.58 MHz crystal used	☐ DTMF/out pulse mixed dialing ☐ Low standby current: 0.1 μA Max. (V_{DD} = 3.5 V)	22 pin DIP 24 pin SOP
S-7235A/B S-7237	PULSE/DTMF switchable dialer	☐ 32 digits redial function ☐ Auto-pause and key-in tone functions ☐ PULSE←DTMF switchable, 3.58 MHz crystal used	☐ DTMF/out pulse mixed dialing ☐ Low standby current: 0.1 μA Max. (V_{DD} = 3.5 V) ☐ Selectable input from either 8-bit keyboard or 4-bit CPU	22 pin DIP 24 pin SOP
S-7235C				18 pin DIP
S-7283A	One-touch dial controller	☐ Directly controls the S-7230A2/B2 (switchable dialer)	☐ Built-in 10 stations repertory memory. One-touch dial function.	28 pin DIP
S-7241 Series	Switchable one-touch dialer	☐ 20 stations one-touch dial function. ☐ Auto-pause and key-in tone functions	☐ Memory registration control terminal	28 pin DIP 28 pin SOP

Seiko Instruments USA, Inc., Electronic Components Division, 2990 W. Lomita Blvd., Torrance, CA 90505 (213) 517-7770 FAX: (213) 517-7792

SHARP

511/1K/2K × 9 Bit FIFO

LH5496/97/98

33 MHz TTL-Compatible FIFO
Fast Performance—20ns Access, 30 ns Cycle
Low Active Current—100mA @ 33 MHz
Fully Static CMOS Memory Array
Full Asynchronous Read & Write Operation

Description

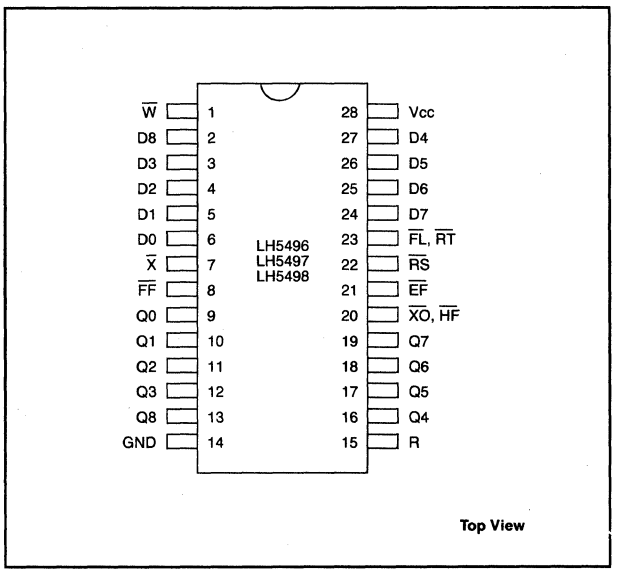
The LH5496/97/98 are dual port memories with internal address generation to implement a First-In-First-Out algorithm. Through their advanced dual port architecture, they provide fully asynchronous read/write operation. Empty, Full, and Half-full status flags are provided to prevent data overflow and underflow. In addition, internal logic is provided for unlimited expansion in both word size and depth.

Read and write operations automatically access sequential locations in memory in such a way that data is read out in the same order that it is written in, that is, on a First-In-First-Out basis. Since the address sequence is internally predefined, no external address information is required for the operation of this device. A ninth data bit is provided for parity or control information often needed in communications applications.

Empty, Full, and Half-full status flags monitor the extent to which data has been written into the FIFO, and prevent improper operations (i.e. READ if the FIFO is empty, or WRITE if the FIFO is full). A retransmit feature resets the READ address pointer to its initial position, thereby allowing repeated readout of the same data. Expansion-in and Expansion-out pins implement an expansion scheme that allows individual FIFOs to be cascaded to arbitrary depth without incurring additional latency (bubblethrough) delays.

These FIFOs are designed for applications requiring simultaneous and asynchronous read/write capabilities. Typical uses for these devices are found in communications, multiprocessing, and rate buffering applications.

Pin Connections



Features

- 512 x 9, 1K x 9 or 2K x 9 First-In First-Out (FIFO) buffer memory
- 33 MHz Read and Write Rates
- Expandable in Word Width and Stack Depth
- Empty, Half-Full, and Full Status Flags
- Retransmit Capability
- TTL-Compatible
- Packaging: 600-mil 28-pin Plastic DIP, 600-mil 28-pin Side Brazed Ceramic DIP
- Future Packaging Availability: 32-pin PLCC, 32-pin Leadless Chip Carrier, 300-mil 28-pin Plastic DIP
- Pin and functional compatibility with
  - IDT7201/2/3
  - MK4501

SHARP ELECTRONICS CORP., Electronic Components Div., Sharp Plaza, Mahwah, NJ 07430-2135•201/529-8757 • Telex: 426903 (SHARPAM MAWA) • Fax: 201/529-8759

SHARP

64K × 4 CMOS Static RAM

LH52252

Description

The LH52252 is a high speed 262,144 bit static RAM organized as 64K × 4. A fast, efficient design is obtained with a CMOS periphery and a matrix constructed with polysilicon load memory cells.

This RAM is fully static in operation. The Chip Enable ($\overline{E}$) gates power to the chip when $\overline{E}$ is high. Standby power drops to its lowest level (I_{SB1}) when $\overline{E}$ is raised to within 0.2V of Vcc.

Write cycles occur when both $\overline{E}$ and Write Enable ($\overline{W}$) are low. Data is transferred from the DQ pins to the memory location specified by the 16 address lines.

Read cycles occur when $\overline{E}$ is low and $\overline{W}$ is high. A Read Cycle will begin upon an address transition, on a falling edge of $\overline{E}$, or on a rising edge of $\overline{W}$.

High frequency design techniques should be employed to obtain the best performance from this device. Solid, low impedance power and ground planes, with high frequency decoupling capacitors, are desirable. Series termination of the inputs should be considered when transmission line effects occur.

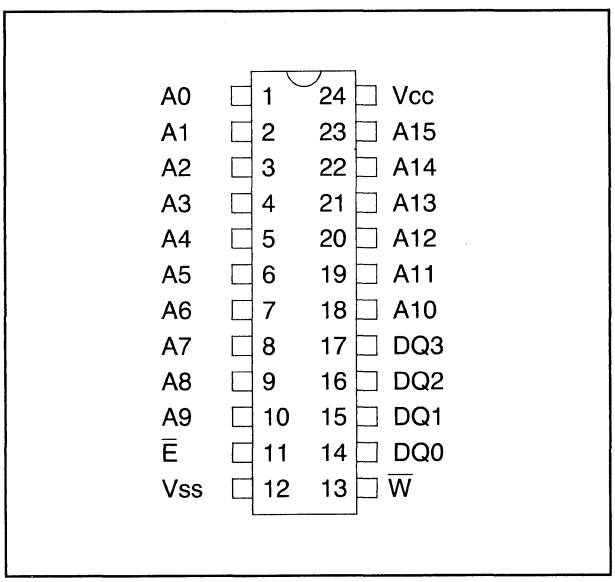
Truth Table

$\overline{E}$	$\overline{W}$	Mode	DQ	Icc
H	X	Not Selected	High Z	Standby
L	H	Read	Data Out	Active
L	L	Write	Data In	Active

Features

- Fast Access Times 25/35/45/55 ns
- Space Saving 300 Mil DIP
- JEDEC Standard Pinout
- Low Power Standby When Deselected
- TTL Compatible I/O
- 5V ± 10% Supply
- Fully Static Operation
- Common I/O for Low Pin Count

Pin Diagram



PIN Identification

A_0–A_{15}: Address Inputs
DQ_0–DQ_3: Data Inputs/Outputs
$\overline{E}$: Chip Enable
$\overline{W}$: Write Enable
Vcc: Positive Power Supply
Vss: Ground

SHARP

CMOS 1048576-Bit Dynamic Random Access Memory

LH64258-10/-12/-15

Description

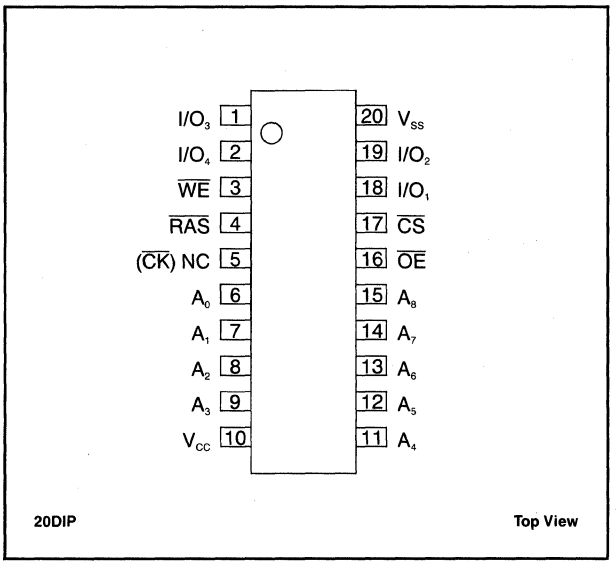
The LH64258 is 262,144 words × 4 bits Dynamic Random Access Memories fabricated on SHARP's advanced CMOS double-level polysilicon gate technology. With its address inputs multiplexed and packaged in the standard 300 mil wide 20 pin DIP, it is easy to realize memory systems with high speed, low power dissipation and large memory capacity. The LH64258 operates on single +5V power supply and the built-in biasing voltage generator circuit.

The LH64258 allows static column mode operation.

Features

- 262,144 word × 4 bits
- Standard 20 pin DIP
- Access time (MAX.)
  100ns (LH64258-10)
  120ns (LH64258-12)
  150ns (LH64258-15)
- Cycle time (MIN.)
  160ns (LH64258-10)
  190ns (LH64258-12)
  240ns (LH64258-15)
- Static column mode operation
- Power supply +5V ± 10%
- Power consumption (MAX.)
  330mW (LH64258-10 operating t_{RC} = 190ns)
  275mW (LH64258-12 operating t_{RC} = 220ns)
  220mW (LH64258-15 operating t_{RC} = 260ns)
  11mW (stand-by)
- All inputs and outputs are TTL compatible
- $\overline{OE}$ = Don't care in early write operation
- Effective $\overline{RAS}$ time-out function (is is easy to set up the rising time of $\overline{RAS}$ at minimum cycle using $\overline{RAS}$ time-out function)
- $\overline{RAS}$ only refresh, Hidden refresh and $\overline{CS}$ before $\overline{RAS}$ refresh capability
- On-chip refresh counter
- 512 refresh cycle (refresh period (MAX.) = 8ns)

Pin Connections



PIN Description

Signal	Pin name
$A_0 \sim A_8$	Address input
$\overline{RAS}$	Row address strobe
$\overline{CS}$	Chip select enable
$\overline{WE}$	Write enable
$\overline{OE}$	Output enable
$I/O_1 \sim I/O_4$	Data input/output
V_{CC}	Power supply (+5V)
V_{SS}	Power supply (0V)

SPRAGUE PERIPHERAL POWER & DISPLAY DRIVERS

in order of (1) output current, (2) output voltage, and (3) number of drivers

OUTPUTS*			FEATURES							
mA	V	#	SERIAL INPUT	LATCHED DRIVERS	DIODE CLAMP	SAT. OUT.	INTERNAL PROTECT.	PART NUMBER	HERM. AVAIL.	SMD AVAIL.
SINK DRIVERS										
25	20	16	—	✓	✓	✓	—	UCN5881EP	—	✓
100	**30**	**32**	✓	✓	—	—	—	**UCN5833A**	—	✓
	40	**8**	—	—	—	✓	—	**UDN2595A†**	—	✓
	40	**32**	✓	✓	—	✓	—	**UCN5832A**	—	✓
	225	**32**	✓	—	TFEL DISPLAY ROW DRIVER			**UCN5851/52A**	✓	✓
250	70	4	—	—	✓	✓	—	SERIES UHP400†	✓	—
	150	7	—	—	✓	—	—	SERIES ULN7000A	—	—
300	**50**	**8**	—	—	✓	✓	—	**UDN2596/98A**	—	—
	80	**2**	—	—	—	✓	—	**SERIES UDN3610M**	✓	—
	80	**2**	—	—	✓	✓	—	**SERIES UDN5710M**	✓	—
	80	**4**	—	—	✓	✓	—	**SERIES UDN5700A**	✓	✓
350	50	4	—	✓	✓	—	—	UCN5800A	✓	✓
	50	7	—	—	✓	—	—	SERIES ULN2000A	✓	✓
	50	8	—	—	✓	—	—	SERIES ULN2800A	✓	✓
	50	8	—	✓	✓	—	—	UCN5801A	✓	✓
	60	16		4 TO 16-LINE LATCHED DECODE/DRIVER				UCN5816A	—	✓
	70	2	—	—	✓	✓	—	SERIES UDN5720M	—	—
	95	7	—	—	✓	—	—	SERIES ULN2020A	✓	✓
	95	8	—	—	✓	—	—	SERIES ULN2820A	✓	✓
	100	8	✓	✓	—	—	—	SERIES UCN5820A	✓	✓
	100	8	✓	✓	✓	—	—	SERIES UCN5840A	—	✓
	150	4	—	✓	✓	—	—	UCN5900A	✓	—
	150	8	—	✓	✓	—	—	UCN5901A	✓	—
500	**50**	**7**	—	—	✓	—	—	**SERIES ULN2010A**	✓	✓
	50	**8**	—	—	✓	—	—	**SERIES ULN2810A**	✓	✓
600	70	2	—	—	✓	✓	—	SERIES UDN5740/50M	—	—
700	**60**	**4**	—	—	✓	✓	✓	**UDN2543B**	—	—
750	50	8	—	—	✓	✓	—	UDN2597/99A	—	—
1000	**70**	**2**	—	—	✓	✓	—	**UDN5725M**	—	✓
1250	20	4		STEPPER MOTOR TRANSLATOR/DRIVER			✓	UCN4204B	—	—
	50	4		STEPPER MOTOR TRANSLATOR/DRIVER			✓	UCN5804B	—	—
	60	4	—	—	✓	✓	—	UDN2540B	—	—
	80	4	—	✓	✓	—	—	UCN5813/14B†	—	—
1500	**80**	**2**	—	—	✓	—	—	**ULN2061/62M**	—	✓
	80	**4**	—	—	✓	—	—	**SERIES ULN2064/65B**	✓	✓
1750	80	4	✓	✓	✓	—	✓	UCN5825/26B	—	—
2000	**80**	**4**	—	—	✓	—	✓	**UDN2545B**	—	—
3000	90	4	—	—	✓	—	—	UDN7078W	—	—
4000	**80**	**4**	—	—	✓	—	—	**UDN2878/79W**	—	—
SOURCE DRIVERS										
−25	80	8	—	✓	—	—	—	UCN5815A†	✓	✓
	80	10	✓	✓	—	—	—	UCN5810AF†	✓	✓
	80	12	✓	✓	—	—	—	UCN5811A†	—	—
	80	20	✓	✓	—	—	—	UCN5812AF†	✓	✓
	80	32	✓	✓	—	—	—	UCN5818AF†	✓	✓
	115	6	—	—	—	—	—	UDN6116A†	—	—
	115	8	—	—	—	—	—	UDN6118/28A†	—	✓
−120	**±25**	**8**	—	—	✓	✓	—	**UDN2585A**	—	✓
	30	**8**	—	—	✓	✓	—	**UDN2985/86A**	—	—
	50	**8**	✓	✓	✓	✓	—	**UCN5895A**	—	✓
−350	35	8	—	—	✓	—	✓	UDN2987A	—	—
	−80	8	—	—	✓	—	—	UDN2580/88A†	✓	✓
	80	8	—	—	✓	—	—	UDN2981-84A	✓	✓
	80	8	✓	✓	✓	—	—	UCN5890/91A	—	—
−4000	**60**	**4**	—	—	✓	—	—	**UDN2944W**	—	—
SOURCE/SINK DRIVERS										
±20	80	32	✓		TF EL DISPLAY COLUMN DRIVER			UCN5853/54A†	—	✓
±40	**150**	**10**	✓	✓	—	—	—	**UCN5910A**	✓	—
±500	40	4	DUAL FULL-BRIDGE		✓	—	—	UDN2993B	—	✓
	45	4	DUAL PWM BRIDGE		✓	✓	✓	UDN2916B	—	✓
±800	**30**	**3**	**HALF-BRIDGE**		✓	✓	—	**UDN2933/34B**	✓	✓
±1000	28	1	POWER OP AMP		✓	—	—	ULN3751Z	—	—
	40	2	DUAL POWER OP AMP		✓	—	—	ULN3753/55B/W	—	—
	45	4	STEPPER MOTOR TRANSLATOR/DRIVER				✓	UCN5871B	—	✓
±2000	**12**	**3**	**HALF-BRIDGE**		✓	✓	✓	**UDN2906W**	—	✓
	15	**3**	**HALF-BRIDGE**		✓	✓	✓	**UDN2931B/W**	—	✓
	35	**1**	**HALF-BRIDGE**		✓	—	✓	**UDN2935/50Z**	—	—
	50	**2**	**PWM FULL-BRIDGE**		✓	—	✓	**UDN2953B/54W**	—	—
	50	**4**	**DUAL FULL-BRIDGE**		✓	—	✓	**UDN2998W**	—	—
±3000	45	2	PWM CONTROL		✓	—	✓	UDN2962B/W	—	✓
	45	2	—	—	✓	—	✓	UDN2974W	—	—
	45	3	3-PHASE BRUSHLESS CONTROL/DRIVER				✓	UDN2936/37W	—	—
±4000	**50**	**2**	**PWM CONTROL**		✓	—	✓	**UDN2965W-2**	—	—
±8000	50	1	HALF-BRIDGE		✓	—	✓	UDN2951Z/55W	—	—

*Current is maximum tested condition, voltage is absolute maximum rating. †Output ratings shown are for selected units (suffix −1).

For application engineering assistance, write or call Sprague Electric Company, Semiconductor Group, Power Integrated Circuits Division, 115 Northeast Cutoff, Box 15036, Worcester, MA 01615. Tel. 508/853-5000.

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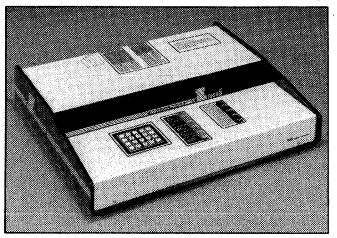
WHEN ONLY THE BEST WILL DO



Z-1000B UNIVERSAL PROGRAMMER

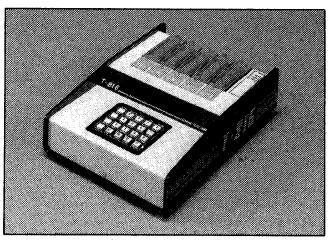
EPROM ■ EEPROM ■ BIPOLAR PROM ■ PROGRAMMABLE LOGIC ■ MICROCOMPUTERS

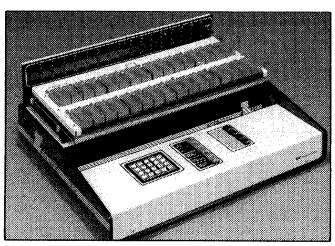
- Stand alone or PC/AT menu driven software via RS-232 ■ Self calibrating
- Easy device updating using EPROM firmware ■ Intelligent quick pulse programming
- Built to MIL-I-45208 ■ 64K x 8 DATA RAM standard expandable to 256K x 8
- Dual port RS-232 ■ Supports over 2000 different devices, growing by 50 or more per month
- No personality modules ■ Built in measurement subsystem with 0.05% REF

T-816 PORTABLE PROGRAMMER

EPROM ■ EEPROM ■ MICROCOMPUTERS ■ EIGHT AND SIXTEEN BIT

- Two 8 bit EPROMs at a time or one sixteen bit at a time
- Programs AMD, Intel and Hitachi 8 and 16 bit microcomputers
- Built-in optional 8 and 16 bit PROM emulator ■ Built-in 1.2 A hour NICAD battery
- RS-232 ■ Built to MIL-I-45208 ■ Stand alone or PC/AT menu driven software via RS-232
- Easy device updating using EPROM firmware





Z-3000 HIGH VOLUME GANG/SET PROGRAMMER

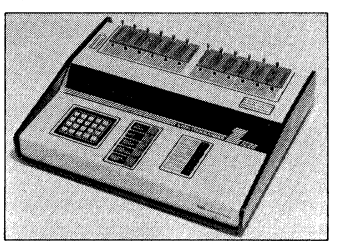
EPROM ■ EEPROM ■ INTEL, HITACHI AND MOTOROLA MICROCOMPUTERS

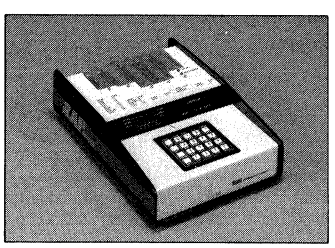
- Programs 32 EPROMs or 16 microcomputers at a time ■ Dual RS-232 ports
- Programs over 1000 MEGA PROMs per hour ■ Self calibrating
- Easy device updating using EPROM firmware ■ Easy to use editor with English prompts
- 256K x 8 DATA RAM expandable to 1024K x 8 ■ Built to MIL-I-45208
- In set mode program up to 8 different data blocks, 4 sets at a time

Z-1200B LOW COST GANG/SET PROGRAMMER

EPROM ■ EEPROM

- In gang mode up to 12 devices at a time
- In set mode program up to four different data blocks, 3 sets at a time
- Dual RS-232 Ports ■ Self calibrating ■ 64K x 8 DATA RAM expandable to 1024K x 8
- Easy device updating using EPROM firmware ■ Built to MIL-I-45208
- Easy to use editor with English like prompts





ZAP-68 PORTABLE PROGRAMMER

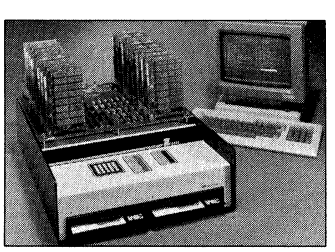
EPROMS UP TO 27128 ■ MOTOROLA'S 68701/68705 P3/R3/U3

- Built in eight bit PROM simulator ■ Battery operated or plug-in charger power pack
- Automatic self test ■ RS-232 ■ Built to MIL-I-45208
- Easy operation with 8 character alphanumeric display and prompt lights
- Full operating instructions printed on the bottom cover

Z-2500B IN-CIRCUIT MEMORY AND LOGIC PROGRAMMER

EPROM ■ EEPROM ■ LOGIC AND MICROCOMPUTERS IN-CIRUCIT

- Can program up to 32 cards simultaneously
- Uses device manufacturers approved fast programming algorithms
- No limit to the number of devices or size of data base
- Self calibrating using built-in measurement subsystem with 0.05% REF
- User friendly menu driven terminal control ■ Built custom to your application
- Built to MIL-I-45208



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SUNRISE ELECTRONICS, INC.

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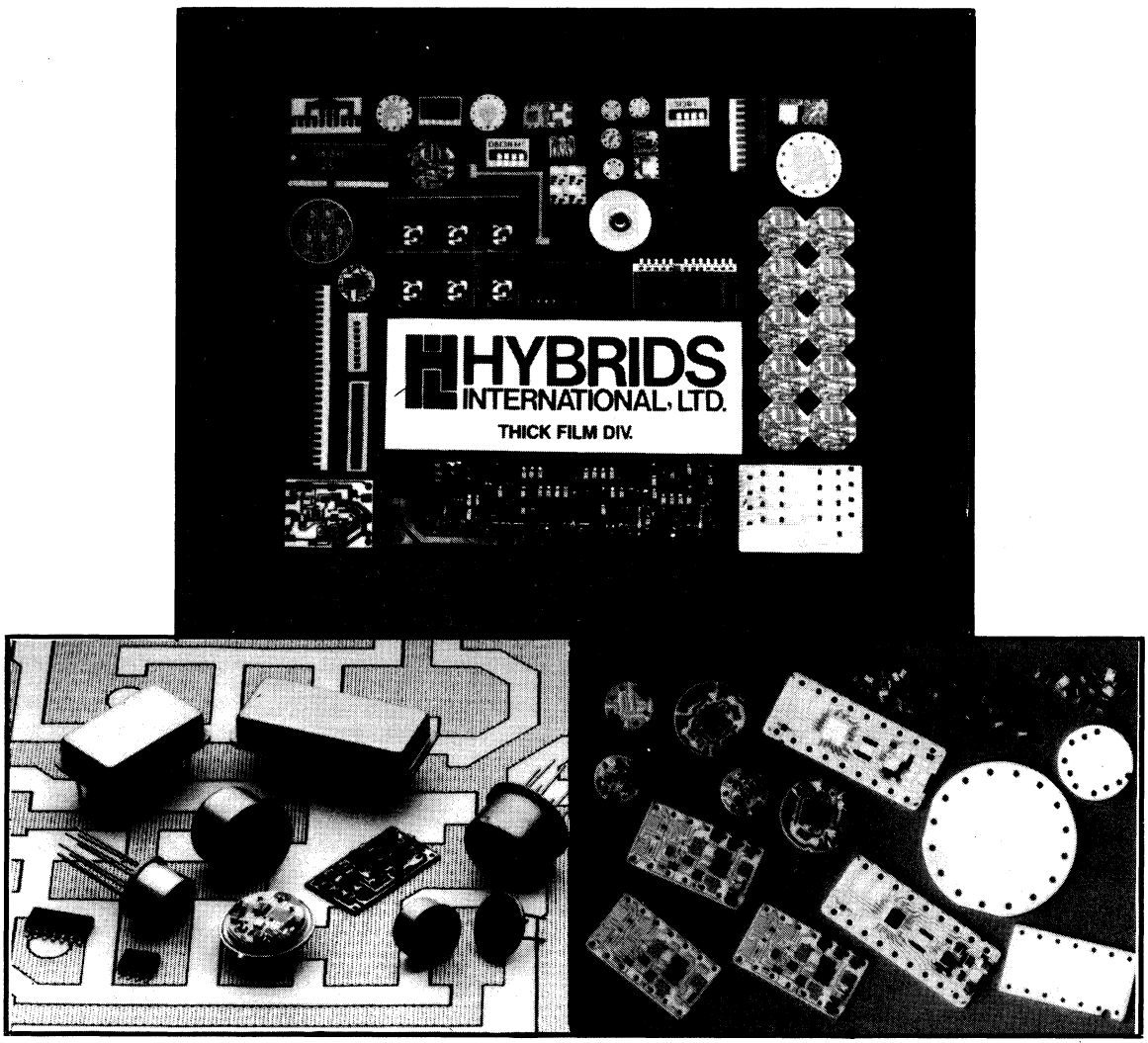

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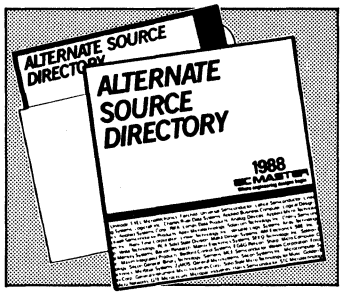

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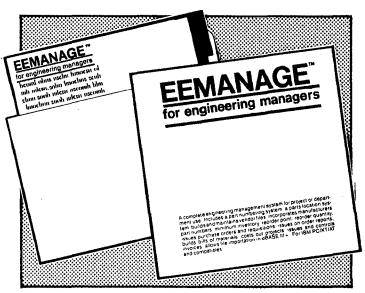
Developed by the publishers of EEM/ Electronic Engineers Master, EEMANAGE is a software program designed to make life easier for engineers and engineering managers.



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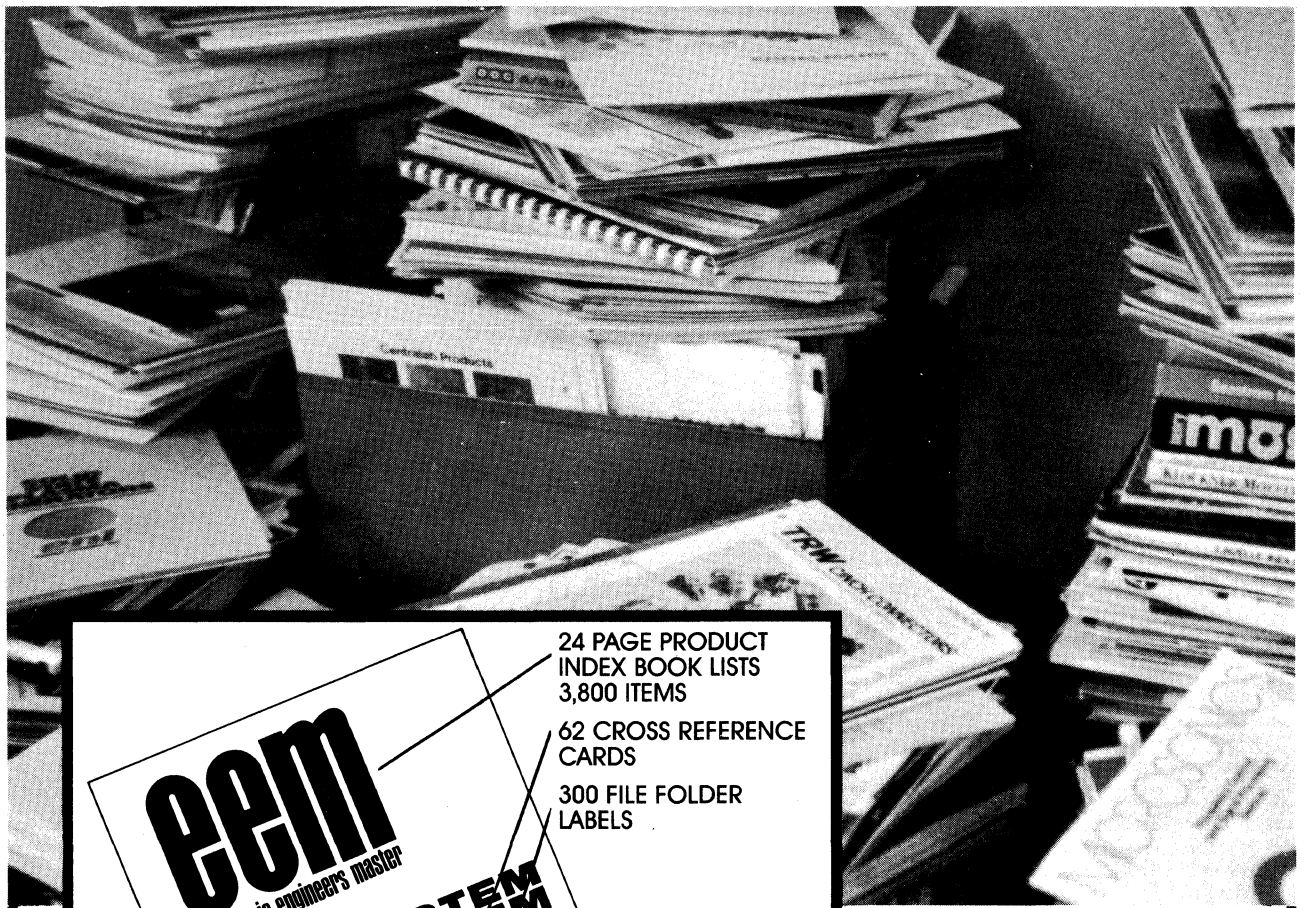
MICROWAVE COMPONENTS

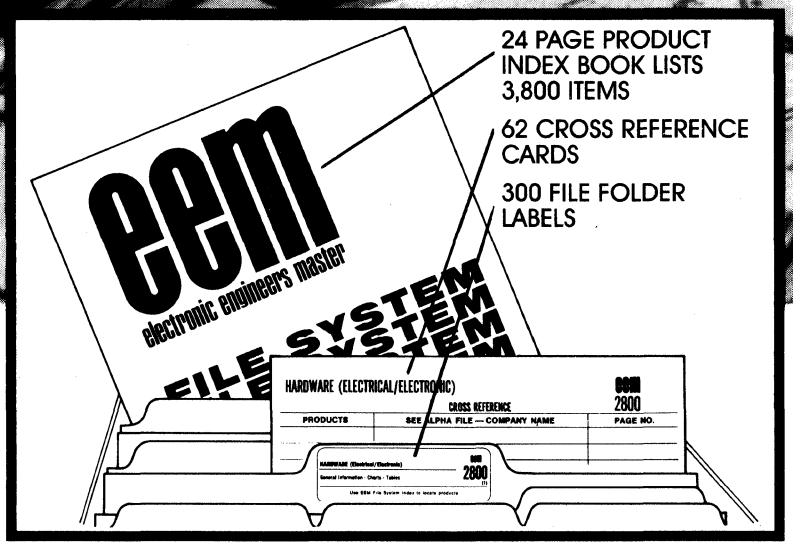
Manufacturer	Starting EEM Page No	Terminations			RF Switches			Phase Shifters	Mixers	Oscillators	RF relays	Phase Detectors
		Antenna	Coaxial	Feedthru	Diodes	Transfer	MIC					
Applied Research	A•1764		¤									
Daico Industries	A•1766				¤§*	¤§*	¤§*	¤§*				
Elcom Systems	A•1768		¤	¤					¤			
FDK America	A•1769				¤							
General Microwave	A•1770				¤		¤		¤			
Matrix Systems	A•1773										¤	
Mini-Circuits	A•1774	¤		¤	¤	¤			¤	¤		¤
Murata Erie	A•1838	¤									¤	
NTK Technical	A•1772									¤		
Penstock	A•1844		¤*	¤*	¤*		¤*		¤*	¤*		
Trak Microwave	A•1839									¤§*		
TRM, Inc.	A•1845											¤

*Mil Spec. § Surface Mount

Manufacturer	Starting EEM Page No.	Attenuators					Couplers	Power Distributors		Filters	
		Fixed	Variable	Step	Coaxial	Program-mable		Microwave	UHF/VHF	Waveguide	Coax
Amitron	A•1763	¤									
Applied Research	A•1764	¤					¤			¤	¤
Daico Industries	A•1766				¤§*	¤§*					
Elcom	A•1768	¤			¤				¤		
FDK America	A•1769							¤		¤	
General Microwave	A•1770					¤*	¤				
Kay Elemetrics	A•1771		¤	¤§		¤					
Matrix Systems	A•1773				¤						
Mini-Circuits	A•1774	¤			¤	¤	¤	¤	¤		
Murata Erie	A•1838									¤	
Penstock, Inc.	A•1844	¤*			¤*		¤	¤§*	¤§*		¤§*
Trak Microwave	A•1839				¤						
TRM, Inc.	A•1845						¤*				

* Mil. Spec. §Surface Mount





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Are your catalog files organized? Can you find any given catalog in a matter of seconds? If your answer is "Yes," you probably already have the EEM File System. But, if you said "No," you really ought to look into this simple system. It will save hours of time and tons of aggravation.

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The EEM File System is shipped in one neat package. The package contains everything you need to set up your very own filing system. Best of all, it's easy to get and very affordable. Send a check or money order for $25.00 and EEM will pay the postage and sales tax. If you must use a purchase order, please add $5.00 for postage and handling. An invoice will accompany your System.

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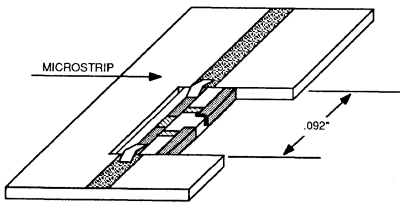
THICK FILM MICROWAVE COMPONENTS
CHIP ATTENUATORS



01 — STANDARD FEATURES INCLUDE:

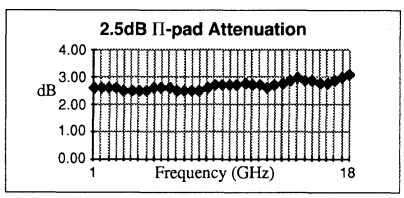
- Chip construction designed for MIC assembly
- Ground plane metalization suitable for soldering or epoxying
- Wire or ribbon bondable gold top conductor lines
- Size: Length .092"
  Width <.045"
  Thickness .010"

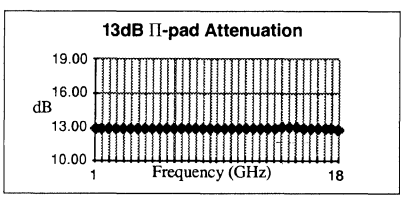
ORDERING INSTRUCTIONS FOR Π-PADS:

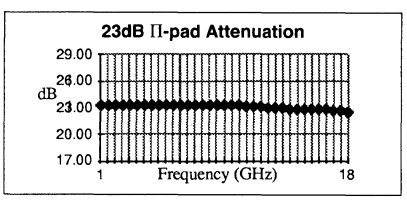
Amitron Part Number = AMP-XX.XdB-01
AMP = Amitron Π-pad
XX.X = Desired Attenuation
01 = Standard Features

ATTENUATOR PERFORMANCE

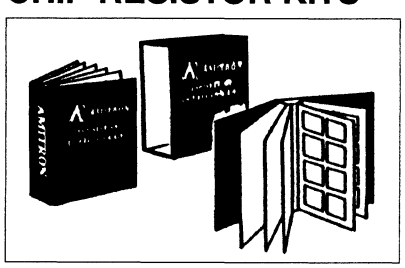
AMITRON has manufactured Π-pads up to 45 dB.
High power balanced attenuators, 4 watts average handling power capability available.





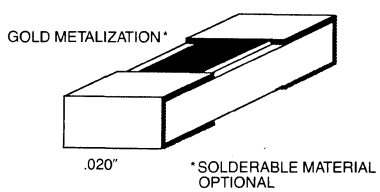


CHIP RESISTOR KITS



AMITRON Engineering Chip Resistor Kits provide a variety of resistor values allowing engineers the flexibility to more readily develop new designs or modify existing circuits. Standard Kits include resistors with 30 different values ranging from 1 ohm to 820K ohms, 20 resistors per value packaged in separate containers. Resistor sizes = .020" width × .040" length × .015" thick with gold metalization pads for aluminum gold wire bonding.

STANDARD KIT RESISTOR STYLE



RESISTOR SPECIFICATIONS:

Resistance Values (ohms): Tolerance ±5%

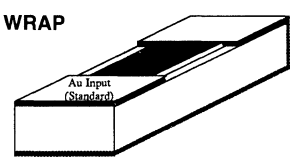
1	10	100	1.0K	10K	100K
1.8	18	180	1.8K	18K	180K
3.3	33	330	3.3K	33K	330K
4.7	47	470	4.7K	47K	470K
8.2	82	820	8.2K	82K	820K

Temperature Coefficient of Resistance (TCR) ±200 PPM from −55°C to +125°C.
Power Rating 50 milliwatts (without heat sinking).

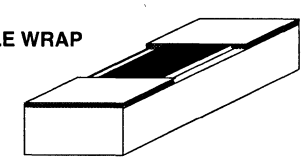
OPTIONS:

- Additional Values to megs ohm range at $50 per package of 20 after purchase of initial kit
- Solder Tinning
- Dual Wrap or Single Wrap Chip Resistor Styles:

DUAL WRAP



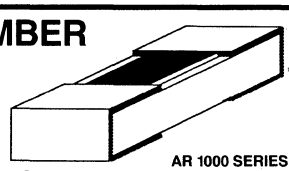
SINGLE WRAP



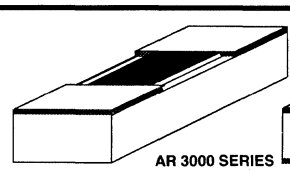
CHIP RESISTOR PART NUMBER GUIDE

AR XXXX / X / 000-0 / XX / X

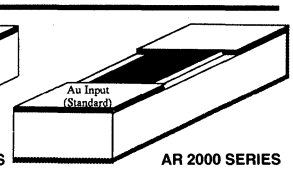
- **CHIP DESIGN:**
  X XXX
  - Chip Size (see charts)
  - Resistor Metalization:
    1 = standard resistor
    2 = dual wrap resistor
    3 = single wrap resistor
- **TERMINATION METALIZATION**
  Q = Palladium/Silver
  R = Platinum/Gold
  S = Platinum/Palladium/Gold
  T = Gold
- **OPTIONS:**
  O = No options
  T = SN62 solder tinning
  M = Back Metalization
  UP = Unpassivated
  R = Pt/Au Input metalization
- **TOLERANCE (+/−):**
  D5 = .5%
  01 = 1%
  02 = 2%
  05 = 5%
  10 = 10%
- **RESISTANCE SPECIFICATIONS:**
  First three (3) digits represent significant figures, digit after the dash (−) specifies the number of zeros. If fractional values of an Ω are required, the letter "D" shall be substituted for one of the significant digits and succeeding digits of the group shall represent significant figures.



AR 1000 SERIES



AR 3000 SERIES



AR 2000 SERIES

NO WRAP

AMITRON Series	Width +/−.003"	Length +/−.003"	Thickness +/−.002"
AR1001	.020	.040	.010
AR1002	.025	.050	.010
AR1003	.050	.050	.010
AR1004	.025	.100	.010
AR1005	.050	.075	.010
AR1006	.100	.050	.010
AR1007	.020	.020	.010
AR1008	.100	.100	.020
AR1009	.050	.050	.020
AR1010	.120	.240	.030

SINGLE WRAP

AMITRON Series	Width +/−.003"	Length +/−.003"	Thickness +/−.002"
AR3001	.020	.030	.015
AR3002	.020	.040	.015
AR3003	.025	.045	.010
AR3004	.025	.045	.015
AR3005	.055	.065	.015
AR3006	.055	.065	.025
AR3007	.025	.045	.025
AR3008	.020	.040	.010
AR3009	.050	.065	.025
AR3010	.102	.110	.010
AR3011	.050	.050	.020
AR3012	.020	.040	.025
AR3013	.055	.065	.010
AR3014	.025	.045	.025

DUAL WRAP

AMITRON Series	Width +/−.003"	Length +/−.003"	Thickness +/−.002"
AR2001	.020	.030	.015
AR2002	.020	.040	.015
AR2003	.030	.050	.015
AR2004	.050	.050	.015
AR2005	.050	.075	.015
AR2006	.050	.100	.015
AR2007	.050	.150	.015
AR2008	.100	.100	.015
AR2009	.050	.030	.015
AR2010	.015	.040	.010

The above configurations are only a sample of resistor sizes available. Please call for additional part numbers to meet your design requirements. As with the above standard chips (AR1000, 2000, 3000), AMITRON will supply special configurations, such as the AR4000 series (partial wraps), upon request.

APPLIED RESEARCH

A DIVISION OF SERVO CORPORATION OF AMERICA
DEPT. EM, 111 NEW SOUTH ROAD, HICKSVILLE, NY 11802 (516) 938-9700

Over 30 Years as a Supplier to the Military/Industrial RF Markets.

RF FILTERS, MULTIPLEXERS, CONVERTERS, POWER AMPLIFIERS, MULTIPLIERS, SIGNAL SOURCES, MULTICOUPLERS and COMPLETE RF SYSTEMS.

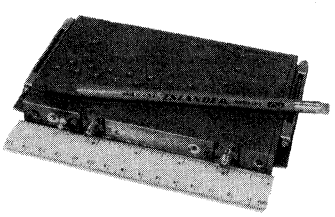
MULTIPLIERS

FREQUENCY GENERATION THROUGH MULTIPLICATION OR PHASE-LOCK TECHNIQUES/VHF to Ku-Band (10 MHz to 1.5 GHz)

Applied Research offers many proven designs using either technique or combinations. And we're capable of meeting your exact requirements, precisely.

Our Phase-lock loops, comprised of I.C. components, together with RF devices, yield outputs of up to 10 watts at microwave frequencies. And our multipliers are available as passive devices or in combination with amplifiers having multiplication factors of from 2 to 2000. In combination with varactor multiplier devices output in Ku-band can be obtained.

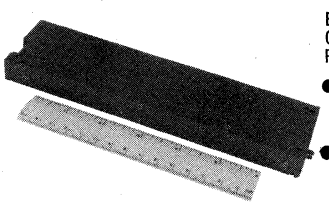
What's more, we can supply crystal oscillators or internal drivers to provide a self-contained source.



Frequency sources with mutiplication up to 29 and multiples thereof are available deriving signals in the L, S, and C-bands.

ELECTRICAL CHARACTERISTICS (TYPICAL)

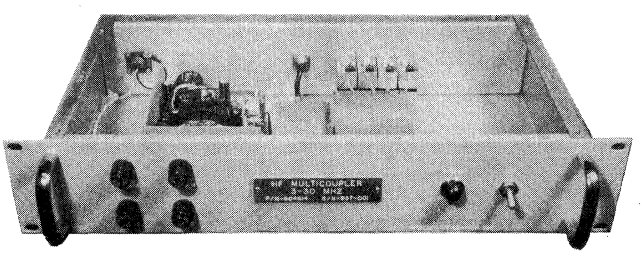
- Input Frequency: 100 MHz ±10 MHz
- Output Frequency:
  Type-1, 6400 MHz (X64)
  Type 2, 5800 MHz (X58)
- RF Power
  Input Power: +5 dBm, ±3 dB
  Output Power: +5 dBm, ±2 dBm over temperature
- Discrete spurious outputs: Harmonics below −60 dBc, others at a maximum of −60 dBc.
- Temperature: −54°C to +85°C



ELECTRICAL CHARACTERISTICS C-BAND PASSIVE BROADBAND HIGH POWER MULTIPLIERS

- Input Power: +40 dBm
  Output Power: +32.6 dBm ±0.5 dB
- Spurious Response: >−70 dBc inband
  Bandwidth: 5.9 to 6.4 GHz

MULTICOUPLERS



Multicoupler Model HFM-2 (TX)-230-8-40 is one of a series of multicouplers designed and manufactured by Applied Research Inc. This model, operating over a frequency range of 2 to 32 MHz, has 8 to 32 independent outputs for inputs of up to +20 dBm.

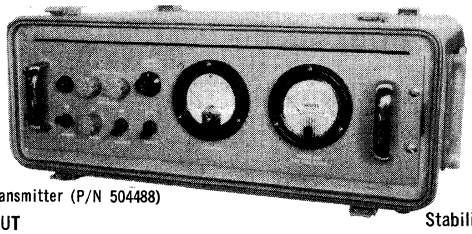
PERFORMANCE SPECIFICATIONS
Frequency Range: 0.5 to 32 MHz
Number of Outputs: Up to 32
Isolation Between Outputs: To be specified by customer — Up to 70 db.
Overall Gain (Input to Output): 0 dB
Connectors: To be specified by customer.

The HFM Series covers the frequency range of 0.5 MHz to the Telemetery Bands, and has been designed for applications where weight and space are critical such as submarine, shipboard, or mobile installations.

MODEL	NO. OF OUTPUTS	FREQUENCY RANGE
HFM-2(TX)0532 8/40	6 to 32	500 KHz-32 MHz
HFM-2(TX)232 8/40	6 to 32	2 MHz-32 MHz
HFM-2(TX)140 12/40	6 to 32	10 MHz-400 MHz
HFM-2(TX)2410 8/40	6 to 32	20 MHz-1100 MHz
HFM-2(TX)1415 6/50	6 to 32	1400 MHz-1600 MHz
HFM-2(TX)2223 8/50	6 to 32	2200 MHz-2300 MHz
HFM-2(TX)1423 8/50	6 to 32	1400 MHz-2300 MHz

SOLID STATE TRANSMITTERS and POWER AMPLIFIERS in P, L, S and C BANDS.

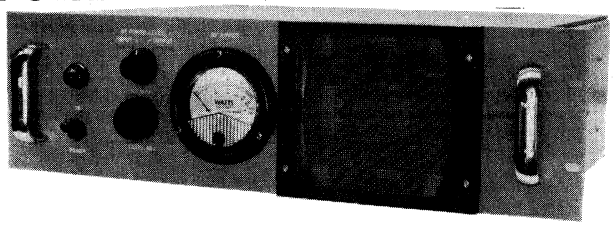
TRANSMITTERS



Transmitter (P/N 504488)

RF OUTPUT
Range: 400-550 MHz
Control: Field Tuneable in 0.5 MHz increments
DC/AC Power: 24-30 volts at 9 amperes/115/230 VAC 5/2 Amps
Stability: ±0.005%
Power: 30 watts, minimum
MODULATION: Frequency Modulation

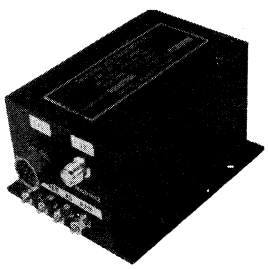
POWER AMPLIFIERS



200 Watt RF Power Amplifier (P/N 504495)

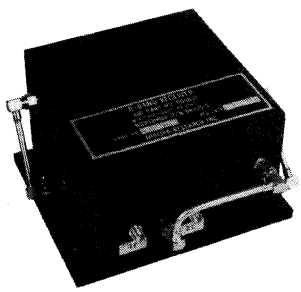
Frequency Range: 400 to 550 MHz

AEROSPACE COMPONENTS



L-BAND TRANSMITTER

Frequency: Tunable, 1650-1670 MHz
Power Output: +28 dBm min.
Modulation: FM; 1-35 KHz
Stability: ±3 MHz
Power Input: +22 to +34 VDC, .75A max.
Weight: 1 kg max.

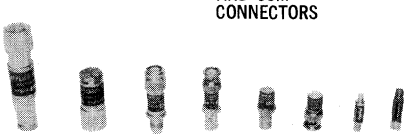


G-BAND RECEIVER

Frequency: 4.4 to 5.0 GHz*
Stability: ±.005%
Sensitivity: −90 dBm for 10 dB S/N and ±250 KHz deviation
IF Bandwidth: 1 MHz nominal
Power Input: +21 to 30 volts, .75A max.
Weight: 3.5 lbs. max.
* Factory set

FIXED PAD ATTENUATORS & TERMINATIONS (DC-2GHz)

FOR TYPES BNC, TNC, C, N, AND OSM CONNECTORS



Integrated line of fixed pad attenuators, terminations, and impedance-matching transformers provides means for rapid and accurate division of voltages over the frequency range of DC-2 GHz, and for the matching of different impedances with minimum loss over a broad frequency band. The unit cost is within the practical price range of the large and small equipment user, as well as the research and experimental user.

GENERAL CHARACTERICTICS
Frequency Range: DC-2 GHz
VSWR: 1.25:1
Attenuation Accuracy:
−0.1 dB +0.3 dB for values of 1 to 12 dB
−0.2 dB +0.5 dB for values of 15 to 20 dB
Impedances (Nominal): 50, 75 90 ohms
Attenuation Values:
1, 2, 3, 4, 6, 10, 12, 15, 20 dB (standard).
Other values up to 30 dB Special

TELEMETRY CONVERTERS

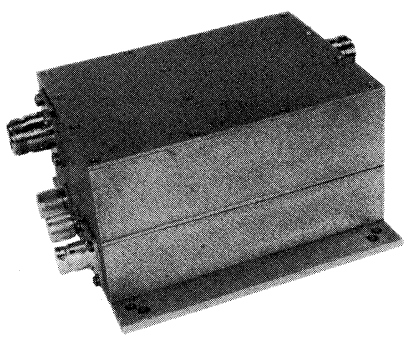
Down converters for military and commercial application are available throughout the frequency range from VHF to K-band. Applied Research manufacturers the filters, oscillator sources, the IF amplifiers, and complete packages that are associated with down converters.

These units permit the ready adapting of existing UHF telemetry receiving equipment for use in the 1435 to 1540 and 2200 to 2300 MHz telemetry band with high conversion gain.

GENERAL CHARACTERISTICS
Long Term Stability: Better than ±.1 PPM over temperature range
Image Rejection: >50 dB
Noise Figure: Better than 5 dB for 100 mc bandwidth (2.2 to 2.3 GHz)

Converters meeting special requirements which include group delay or phase and amplitude characteristics can be designed to meet special needs.

MULTIPLEXERS



State of the Art Multiplexers, applying Applied Research Inc.'s experience in the design and manufacture of NOTCH FILTERS, BANDPASS FILTERS, and BAND REJECT FILTERS allows for the ultimate in performance.

TYPICAL TRIPLEXER CHARACTERISTICS
Frequency Range: 5 kHz to 500 MHz
Frequency Breaks: 500 kHz and 32 MHz
Passband Attenuation: 1.5 dB maximum
Crossover Losses: 4.5 dB maximum
Reject Characteristics: 42 dB minimum, other bands
Ripple: 0.5 dB peak to peak maximum
Impedance: All ports shall be 50 ohms unbalanced
VSWR: 1.5:1 maximum, 2:1 through crossover

APPLIED RESEARCH

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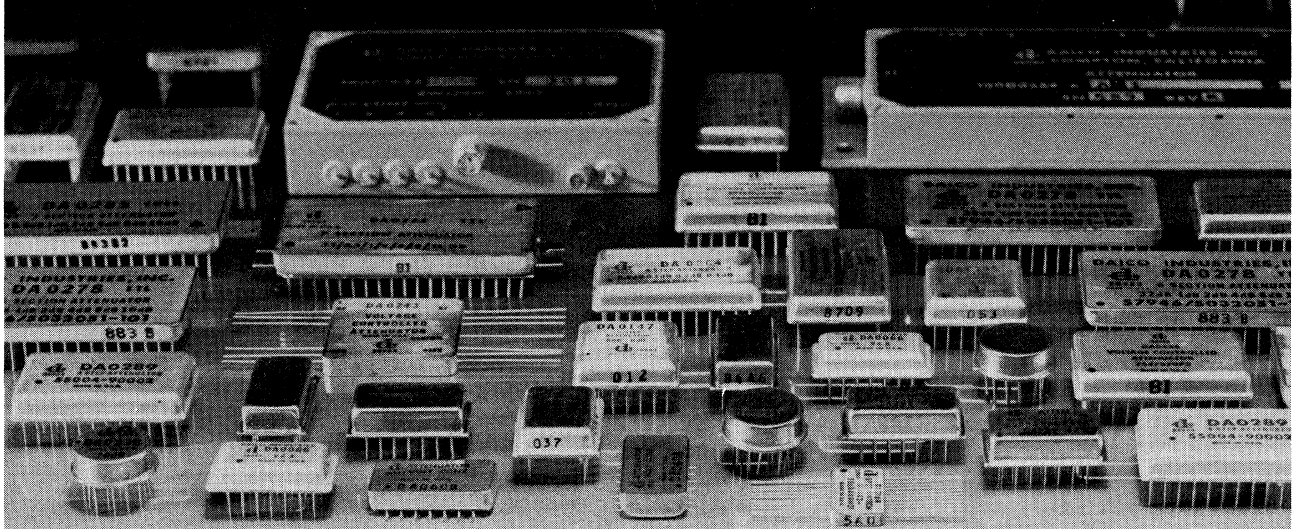
DAICO MILITARY TOUGH ATTENUATORS

IF/RF VOLTAGE CONTROLLED & DIGITAL



ATTENUATORS

Number Steps (Bits)	Attenuation LSB/Range (dB)	Frequency (MHz)	Part #	Max. Switching Speed (μ/sec)	Typ/Max. Insertion Loss (dB)	Max. RF Operating Power (dBm)	DC Power (V/mA)	Control	Package
1	4	50-500	DA0240-4	10.0	0.8 / 1.2	+10	+15 / 12	CMOS	T08
1	8	50-500	DA0240-8	10.0	0.8 / 1.2	+10	+15 / 12	CMOS	T08
1	16	50-500	DA0240-16	10.0	0.8 / 1.2	+10	+15 / 12	CMOS	T08
5	1 / 31	100-1000	DA0660	3.0	5.5 / 6.0	+10	+ 5 / 25	TTL	24 PIN DIP
5	2 / 62	100-1000	DS0661	3.0	7.0 / 7.5	+10	+ 5 / 25	TTL	24 PIN DIP
6	1 / 63	30-300	DA0204	1.0	3.8 / 4	+10	+ 5 / 250	TTL	38 PIN DIP
6	1 / 63	40-150	DA0296	0.050	5 / 8	+10	+ 5 / 660	TTL	38 PIN DIP
7	0.5 / 63.5	30-500	DA0285	20.0	4.8 / 6	+10	+15 / 50	CMOS	38 PIN DIP
7	0.5 / 63.5	30-500	DA0295	20.0	4.2 / 6	+10	+ 5 / 85	TTL	38 PIN DIP
7	0.5 / 63.5	45-250	DA0617	0.035	7 / 8	+10	+ 5 / 640	TTL	38 PIN DIP

VOLTAGE CONTROLLED ATTENUATORS

Min. Attenuation	Frequency (MHz)	Part Number	Control Voltage	Max. Insertion Loss (dB)	Linearity (dB)	Attenuation slope (dB/V)	DC Power (V/mA)	RF operating power (dBm)	Package
18	20-300	DA0035	0-5	1.5	±0.8	6.5	±15 / 25	+10	14 PIN DIP
40	20-300	DA0098	0-5	2.0	±2.0	15.0	±15 / 60	+10	14 PIN DIP
20	100-500	DA0638	+5 / −5V	3.0	*N/A*	*2.8*	+15 / 50	+10	24 PIN DIP

DAICO manufactures a multitude of solid-state digital and voltage-controlled attenuators to meet your design needs. Thin-film hybrid technology assures maximum accuracy and reliability for the toughest military applications. Relay attenuators are also offered for applications where insertion loss, intermod performance and power are of primary concern.

Special features such as phase compensation (constant insertion phase), high switching speed, and low switching transients for the most demanding radar, EW, and C³I systems are available.

Daico attenuators are available in MIC — including SURFACE MOUNT — and connectorized packages.

Call Daico for applications assistance, custom device information, and a prompt response. Write for catalog.

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2139 East Del Amo Blvd., Compton, CA 90220
Telephone 213/631-1143 FAX 213/631-8078

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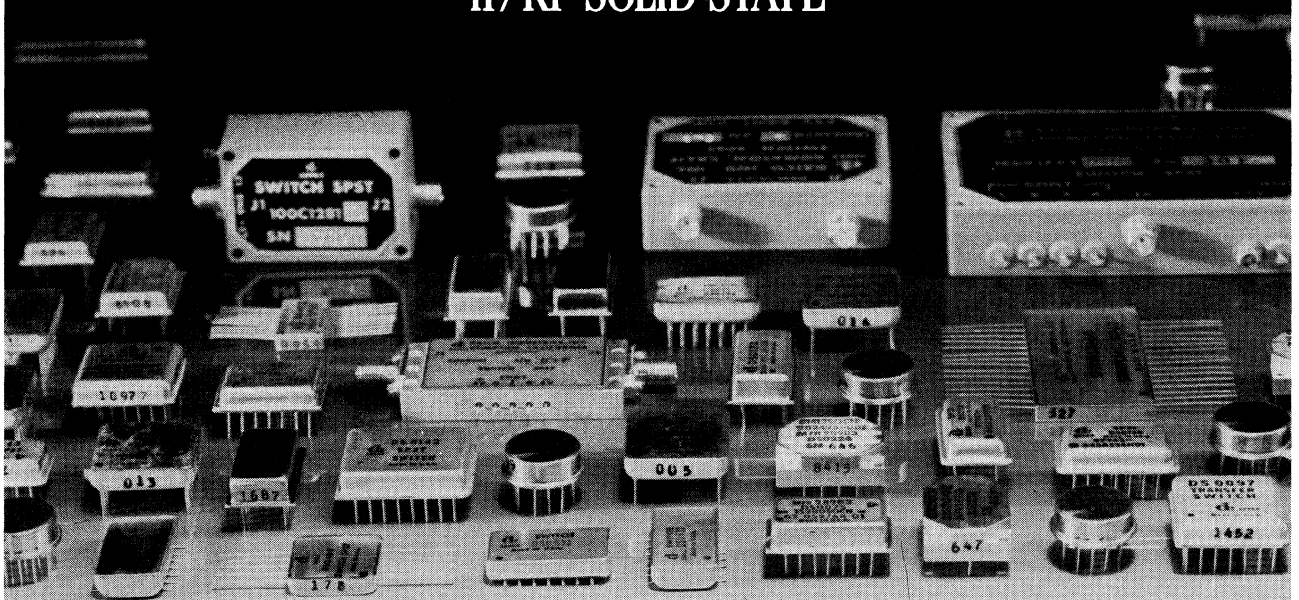
DAICO MILITARY TOUGH SWITCHES

IF/RF SOLID-STATE



SWITCHES

Number of Throws	Frequency (MHz)	Part Number	Typ/Max. Insertion Loss (dB)	Typ/Min. Isolation (dB)	Max. Switching Speed μ/seconds	Control	Max. dc Power (V/ma)	Max. RF Oper. (dBm)	Package Type
SPST	10-200	DS0050	1.2/1.5	62/50	0.025	TTL	5/150	+10	14 PIN DIP
SPST	400-450	DS0411	0.6/1.2	65/60	0.5	TTL	5/110	+13	14 PIN DIP
SP2T	5-200	DS0492	0.5/0.8	52/40	20.0	TTL	+5, −15/30	+30	14 PIN DIP
SP2T	20-2000	DS0612	1.6/2.3	45/50	10.0	TTL	+ 5/3	+10	14 PIN DIP
SP2T	5-2000	DS0602	1.6/2.0	45/40	0.050	TTL	+5/2	+10	14 PIN DIP
SP2T	200-900	DS0432	0.5/0.8	45/35	1.5	TTL	+5, −15/30	+35	14 PIN DIP
SP3T	50-500	DS0073	0.8/1.0	45/40	2.0	CMOS	+12/5	+10	0.8 sq 24 PIN
SP4T	10-500	DS0085	0.6/0.8	40/25	35.0	CMOS	+15/6	+10	14 PIN DIP
SP4T	10-1000	DS0644	0.6/1.0	58/50	3.0	TTL	+ 5/23	+10	24 PIN DIP
SP5T	200-800	DS0475	0.6/1.0	50/40	1.0	TTL	± 5/27	+10	24 PIN DIP
SP6T	100-600	DS0506	0.6/1.0	56/50	1.0	TTL	± 5/40	+20	38 PIN DIP
SP8T	100-1100	DS0518	1.1/1.6	45/35	1.0	TTL	± 5/45	+13	24 PIN DIP
XFER	15-45	DS0097	.5/1.0	60/50	10.0	CMOS	+ 5/20	+10	0.8 sq 24 PIN
XFER	70-1000	DS0319	1.25/1.5	60/40	10.0	CMOS	+15/15	+10	18 PIN DIP
SPST	20-2000	CDS0621	0.7/1.0	75/60	3.0	TTL	+ 5/12	+10	SMA CONN.
SP2T	20-2000	CDS0622	0.7/1.0	75/60	3.0	TTL	+ 5/12	+10	SMA CONN.
SP4T	20-2000	CDS0624	0.9/1.2	67/55	3.0	TTL	+ 5/30	+10	SMA CONN.

DAICO manufactures a multitude of IF/RF solid-state switches to meet your design needs. These include PIN diode, Schottky diode and GaAs FET technologies with integrated drivers in thin-film hybrid MICs for survival in the toughest military environments. Relay switches are available for applications where insertion loss and intermod performance are of primary concern.

SPST blanking switches to miniature SP8T switches are available with low switching transients, fast switching speed, high intercept points, phase matched ports for the most demanding radar, EW, and C³I systems.

Daico switches are available in MIC — including SURFACE MOUNT — and connectorized packages.

Call Daico for applications assistance, custom device information, and a prompt response. Write for catalog.

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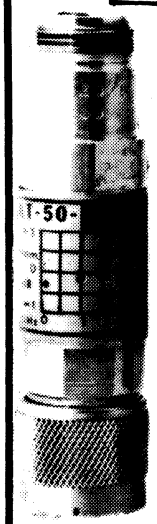
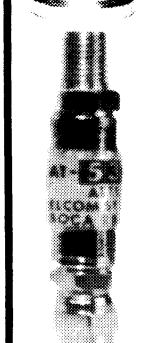
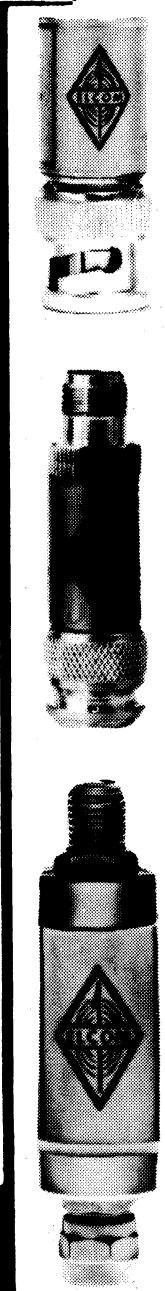
LOWEST PRICED, HIGHEST QUALITY ATTENUATORS – BNC $11.00 1-9 EA, SMA $14.40 10 EA AND TERMINATIONS – BNC $5.60 10 EA., SMA $5.60 10 EA., MIL. HI-REL. NETWORKS



Model Number (2)	Impedance Ohms (Power W)	Frequency Range	UNIT PRICE (4) EFFECTIVE 9-15-86 BNC	TNC	N	SMA	UHF	PC
Fixed Attenuators, 1 to 20 dB:								
AT-50(3)	50 (.5W)	DC-1.5GHz	14.00	20.00	20.00	18.00	—	—
AT-51	50 (.5W)	DC-1.5GHz	11.00	15.00	15.00	14.00	—	12.00
AT-52	50 (1W)	DC-1.5GHz	14.50	20.50	20.50	19.50	—	—
AT-53	50 (.25W)	DC-3.0GHz	14.00	17.00	—	15.00	—	—
AT-54	50 (.25W)	DC-4.2GHz	—	—	—	18.00	—	—
AT-55	50 (.25W)	DC-4.2GHz	—	—	—	14.40 (10 Pc.)	—	—
AT-75 or AT-90	75 or 93 (.5W)	DC-1.5GHz (750MHz)	11.50	20.00	20.00	18.00	—	—
Detector, Mixer, Zero Bias Schottky:								
CD-51, 75	50, 75	.01-4.2GHz	54.00	—	—	54.00	—	—
DM-51	50	.01-4.2GHz	—	—	—	64.00	—	—
Resistive Impedance Transformers, Minimum Loss Pads:								
RT-50/75	50 to 75	DC-1.5GHz	10.50	19.50	19.50	17.50	—	—
RT-50/93	50 to 93	DC-1.0GHz	13.00	19.50	19.50	17.50	—	—
Terminations:								
CT-50 (3)	50 (.5W)	DC-4.2GHz	11.50	15.00	15.00	17.50	—	—
CT-51	50 (.5W)	DC-4.2GHz	9.50	12.00	10.50	9.50	—	—
CT-52	50 (1W)	DC-2.5GHz	10.50	15.00	15.00	13.00	15.50	—
CT-53/M	50 (.5W)	DC-4.2GHz	5.60 (10 Pc.)	—	—	5.60 (10 Pc.)	—	—
CT-54	50 (2W)	DC-2.0GHz	14.00	15.00	15.00	17.50	—	—
CT-75	75 (.25W)	DC-2.5GHz	10.50	15.00	15.00	13.00	15.50	—
CT-93	93 (.25W)	DC-2.5GHz	13.00	15.00	—	15.00	15.50	—
Mismatched Terminations, 1.05:1 to 3:1, Open Circuit, Short Circuit:								
MT-51	50	DC-3.0GHz	45.50	45.50	45.50	45.50	—	—
MT-75	75	DC-1.0GHz	—	—	45.50	—	—	—
Feed thru Terminations, shunt resistor:								
FT-50	50	DC-1.0GHz	10.50	19.50	19.50	17.50	—	—
FT-75	75	DC-500MHz	10.50	19.50	19.50	17.50	—	—
FT-90	93	DC-150MHz	13.00	19.50	19.50	17.50	—	—
Directional Coupler, 30 dB:								
DC-500	50	250-500MHz	60.00	—	84.00	—	—	—
Resistive Decoupler, series resistor or Capactive Coupler, series capacitor:								
RD or CC-1000	1000 (1000PF)	DC-1.5GHz	12.00	18.00	18.00	17.00	—	—
Adapters:								
CA-50 (N to SMA)	50	DC-4.2GHz	13.00	13.00	13.00	13.00	—	—
Inductive Decouplers, series inductor:								
LD-R15	0.17uH	DC-500MHz	12.00	18.00	18.00	17.00	—	—
LD-6R8	6.8uH	DC-55MHz	12.00	18.00	18.00	17.00	—	—
Fixed Attenuator Sets, 3, 6, 10, and 20 dB, in plastic case:								
AT-50-SET (3)	50	DC-1.5GHz	60.00	84.00	84.00	76.00	—	—
AT-51-SET	50	DC-1.5GHz	48.00	64.00	64.00	60.00	—	—
Reactive Multicouplers, 2 and 4 output ports:								
TC-125-2	50	1.5-125MHz	64.00	—	67.00	67.00	—	—
TC-125-4	50	1.5-125MHz	67.00	—	81.50	81.50	—	—
Resistive Power Dividers, 3, 4 and 9 ports:								
RC-3-50	50	DC-2.0GHz	64.00	84.00	—	64.00	—	—
RC-4-50	50	DC-500MHz	64.00	84.00	—	64.00	—	—
RC-8-50	50	DC-500MHz	—	—	—	84.50	—	—
RC-3-75, 4-75	75	DC-500MHz	64.00	84.00	—	64.00	—	—
Double Balanced Mixers:								
DBM-1000	50	5-1000MHz	61.00	—	71.00	61.00	—	34.00
DBM-500PC	50	2-500MHz	—	—	—	—	—	34.00
RF Fuse, 1/8 Amp. and 1/16 Amp.:								
FL-50	50	DC-1.5GHz	12.00	18.00	45.50	17.00	—	—
FL-75	75	DC-1.5GHz	12.00	18.00	—	17.00	—	—

NOTE: 1) Critical parameters fully tested and guaranteed. Fabricated from Mil. Spec. High-Rel. resistors. Schottky diodes. Mil. Spec. plated parts, and connectors in nickel, silver, and gold. 2) See catalog for complete Model Number. Specify connector sexes. Specials available. 3) Calibration marked on label of unit. 4) Price subject to change without notice. Shipping $5.00 Domestic or $25.00 Foreign on Prepaid Orders. (C) 1986B Delivery is stock to 30 days ARO





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MIC & WAVE GUIDE CIRCULATORS/ISOLATORS

Applying microwave ferrites and using its thin or thick film technology, FDK has developed a wide variety of compact, low-cost circulators/isolators ranging from microwave to semi-millimeter wave band in response to the growing demand for smaller, higher-performance microwave equipment.

Applications

Microwave multiplex wireless communications equipment, radars, satellite communications, satellite broadcasting, measuring instruments.

Substrate type MIC circulators/isolators

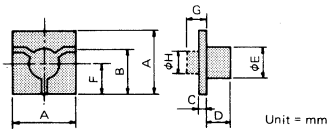
Model name		CK-□3D	CK-□4LD	CK-□4UD	CK-□5D	CK-□6LD	CK-□6UD	CK-□7LD	CK-□7UD	CK-□8LD	CK-□8UD	CK-□9D	CK-□12D	CK-□13D	CK-□20	CK-□22	CK-□26	CK-□29
Frequency f(GHz)		2.7 to 3.2	3.6 to 4.2	4.4 to 5.0	5.0 to 5.9	5.9 to 6.5	6.4 to 7.1	7.1 to 7.5	7.4 to 7.8	7.7 to 8.3	8.2 to 8.5	9.0 to 9.6	10.5 to 13.0	11.7 to 14.5	17.7 to 21.2	21.3 to 23.6	25 to 28	27 to 31
Electrical characteristics	Isolation(dB min.)	20	20	20	20	20	20	20	20	20	20	20	18	18	17	17	17	17
	Insertion loss(dB max.)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8
	V.S.W.R (Zo=50Ω)	1.2	1.2	1.2	1.25	1.2	1.2	1.2	1.2	1.2	1.2	1.25	1.25	1.25	1.3	1.3	1.3	1.3
Handling power(W CW max.)		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	5.0	5.0	5.0	5.0
Power absorption(W CW max.)		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	—	—	—	—
Temp. range(°C)		−10 to +60	−10 to +60	−10 to +60	−10 to +60	−10 to +60	−10 to +60	−10 to +60	−10 to +60	−10 to +60	−10 to +60	−10 to +60	−10 to +60	−30 to +70	−10 to +60	−10 to +60	−10 to +60	−10 to +60
Dimensions	A	25	19	19	15.3	15.3	15.3	15.3	15.3	15.3	15.3	9	7	7	6	5	5	5
	B	19	14.9	14.9	10.6	10.6	10.6	10.6	10.6	10.6	10.6	6.5	5.5	5.5	4.4	3.4	3.4	3.4
	C	1	1	1	0.65	0.65	0.65	0.65	0.65	0.65	0,65	0.65	0.65	0.65	0.38	0.38	0.38	0.254
	D	5.5	4	4	5	5	5	5	5	5	5	4	4	4	4	3.5	4	4
	E	18	11.5	11.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	5.5	4.2	4.2	4.2	3.5	3.2	3.2
	F	13.5	10.6	10.6	8	8	8	8	8	8	8	4.5	4	4	3	2.5	2.5	2.5
	G	3.3	2.2	2.2	—	—	—	—	—	—	—	—	2.45	2.45	1.68	2.88	1.68	1.554
	H	12	10	7	—	—	—	—	—	—	—	—	3	3	1.5	3.5	1	1

Item naming

CK-□6LD

Isolator
(Circulator: No marking)

Shape and dimensions

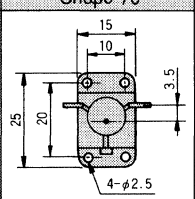
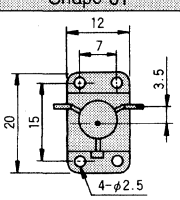
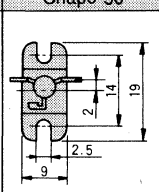
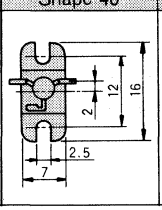
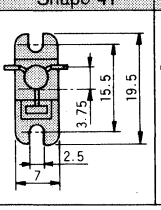
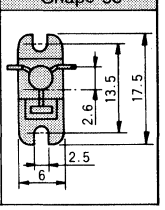


Unit = mm

Carrier type MIC isolators

Models CK-□○○○○○	Frequency range (GHz)	Isolation (dB)	Insertion loss (dB)	V.S.W.R. (50Ω)	Handling power (W.CW)	Power absorption (W.CW)	Operating temp. range (°C)	Carrier shape
03906	3.6~4.2	20min.	0.4max.	1.2max.	10	2	−10~60	70
04708	4.3~5.1	20min.	0.4max.	1.2max.	10	2	−10~60	70
05509	5.0~5.9	20min.	0.4max.	1.2max.	10	2	−10~60	70
06514	5.8~7.2	20min.	0.4max.	1.2max.	10	2	−10~60	61
07013	6.3~7.6	20min.	0.4max.	1.2max.	10	2	−10~60	61
07915	7.1~8.6	20min.	0.4max.	1.2max.	10	2	−10~60	61
09623	8.4~10.7	18min.	0.5max.	1.25max.	10	2	−10~60	50
11825	10.5~13.0	18min.	0.5max.	1.25max.	Shape 40:1 Shape 41:5	Shape 40:0.25 Shape 41:1	−30~70	40 41
13128	11.7~14.5	18min.	0.5max.	1.25max.			−30~70	
15009	14.5~15.4	18min.	0.5max.	1.25max.			−30~70	
19535	17.7~21.2	17min.	0.8max.	1.3max.	5	1	−30~70	35

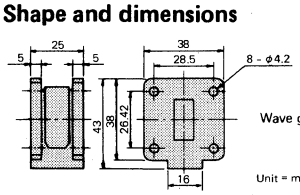
Shapes and dimensions

Carrier shape	Shape 70	Shape 61	Shape 50	Shape 40	Shape 41	Shape 35
Unit=mm						

Wave guide isolators

Model name		CG-14D
Frequency f(GHz)		14 to 14.5
Electrical characteristics	Isolation(dB min.)	18
	Insertion loss(dB min.)	0.2
	V.S.W.R.	1.2
Handling power(W CW max.)		5
Power absorption(W CW max.)		1
Temp. range(°C)		−40 to +80

Shape and dimensions



Wave guide IEC R120
EIA WR75

Unit = mm

All specifications are subject to change without notice.

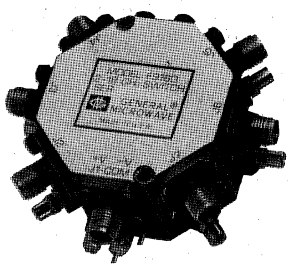
FDK
Fuji Electrochemical Co.,Ltd.
Tokyo, Japan

FDK AMERICA, INC.
17326 Edwards Road, A-130, Cerritos, California
90701, U.S.A.
Phone 213-404-1770 Telex 18-1998(FEC CALIF LA)
Fax. 213-404-2850

FDK AMERICA, INC. EAST REGION OFFICE
333 Sylvan Avenue, Third Floor, Englewood Cliffs,
New Jersey 07632, U.S.A.
Phone 201-567-1900
Fax. 201-567-2181

PIN DIODE CONTROL DEVICES FROM GENERAL MICROWAVE

PIN Diode Switches and Drop-In Modules 0.2-40 GHz

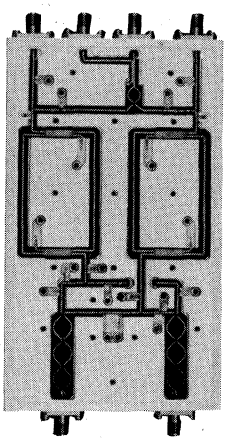


General Microwave's complete line of high performance broadband switches, with and without integral drivers, are available in three basic series.

- Ultra Broadband Series: 0.2 to 18 GHz, SPST to SP5T
- Multi Octave Band - Miniature Series: SPST to SP7T; 0.2 to 4 GHz (Series 92), 1-18 GHz (Series 91). SPST to SP2T; 18 to 40 GHz (Series 90).
- Octave Band - High Speed Series: 10 nsec switching speed, 2-18 GHz; SP2T

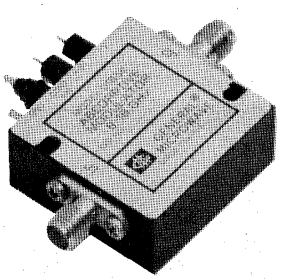
Many models of each type are available to satisfy most requirements. Non-reflective switches, space qualified units and other special designs are also available.

MIC Assemblies



General Microwave MIC assemblies can combine: • Frequency Translators • High Speed Digitally Controlled Attenuators • Power Combiners and Dividers • High Speed Switches • Mixers • Amplifiers • Isolators • Directional Couplers • Phase Modulators • Filters and other signal conditioning and processing devices.

PIN Diode Modulators/ Attenuators, 0.2-40 GHz



General Microwave's Series of PIN diode modulators/attenuators provide octave-band and greater than octave-band performance from 0.2 to 40 GHz. All at low cost.

Series	Bandwidth	Atten. Range (dB)	Features
D195	Octave	60	Linear VVA
D196	Multi-octave	60	Linear VVA
195	Octave	60	CCA
D197	3:1	45	Phase Invarient

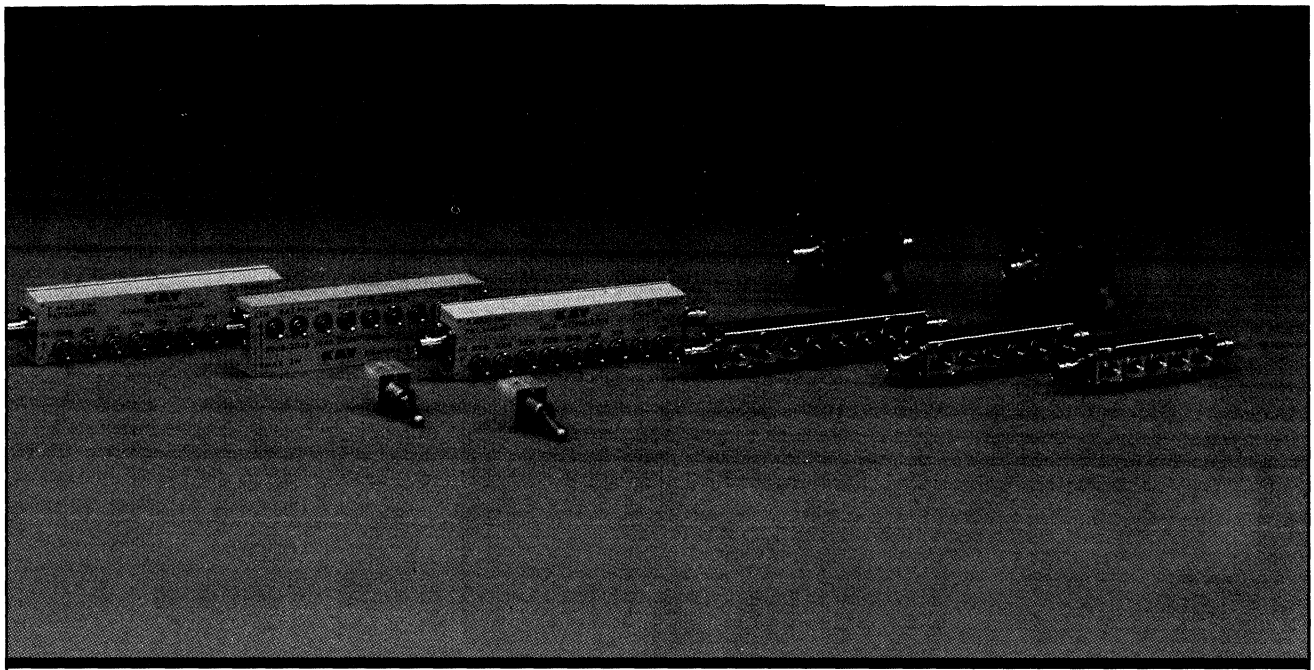
Digitally Programmable PIN Diode Attenuators

General Microwave's Series of Digitally Programmable PIN Diode Attenuators provide octave-band and greater than octave-band performance from 0.2 to 18 GHz with wide programming flexibility. All at low cost. Their compact, rugged packages are well suited to military applications. They are available in drop-in module type configurations and hermetically sealed packages. Nanosecond switching speed modules are also available.

Series	Bandwidth	Atten. Range (dB)	LSB (dB)
329	Octave	80 & 120	0.1
345	Octave	60	0.25
346	Multi-octave	60	0.25
3250	Ultra-broadband	60	1.0
347	3:1 Phase Invarient	45	0.25

GENERAL MICROWAVE

5500 New Horizons Boulevard • Amityville, New York 11701
Tel: 516-226-8900 • Telex: 310-287780 • DDD: 516-226-8967 • FAX: 516-226-8966



Looking for Attenuators?

Kay Elemetrics Corp. offers a complete line of Programmable, In-Line, Toggle Switch and Continuously Variable Attenuators. We can supply you with the right model to fit your specific application.

If you don't see an attenuator that fits your requirements call us. Kay can design an Attenuator to fit your specific OEM needs. We have designed over 250 Attenuators in the past. Listed below are some typical Attenuator models.

Model #	Imped. Ω	Freq. Range	Atten. Range	Steps
Programmable				
1/4450	50Ω	DC-1000MHz	0-16.5dB	.1dB
4460	50Ω	DC-1500MHz	0-31dB	1dB
4480	50Ω	DC-1500MHz	0-63dB	1dB
4450	50Ω	DC-1500MHz	0-127dB	1dB
4440	50Ω	DC-1500MHz	0-130dB	10dB
1/4457	75Ω	DC-750MHz	0-16.5dB	.1dB
4467	75Ω	DC-1000MHz	0-31dB	1dB
4487	75Ω	DC-1000MHz	0-63dB	1dB
4457	75Ω	DC-1000MHz	0-127dB	1dB
In-Line				
837	50Ω	DC-1500MHz	0-102.5dB	1dB
839	50Ω	DC-2GHz	0-101dB	1dB
1/839	50Ω	DC-1GHz	0-22.1dB	1dB
860	50Ω	DC-1500MHz	0-132dB	1dB
847	75Ω	DC-1GHz	0-102.5dB	1dB
849	75Ω	DC-1GHz	0-101dB	1dB
1/849	75Ω	DC-750MHz	0-22.1dB	1dB
870	75Ω	DC-1GHz	0-132dB	1dB
Continuously Variable				
0/400	50Ω	DC-500MHz	1-13dB	—
0/410	75Ω	DC-400MHz	2-14dB	—

For a complete catalog and price list or to place an order call Vernon Hixson at (201) 227-2000, ext. 104.

KAY

Kay Elemetrics Corp.
12 Maple Avenue
Pine Brook, NJ 07058

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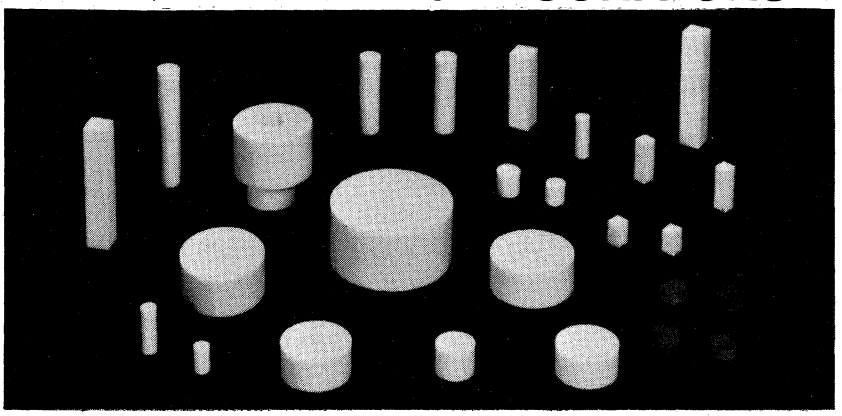
TWX: 710-734-4347
FAX: (201) 227-7760

NTK

TECHNICAL CERAMICS

NGK SPARK PLUGS (U.S.A.) INC.
99 Morris Ave., Springfield, NJ 07081 Phone: (201) 376-6070
DALLAS OFFICE Telephone: (214) 235-8332, 1701 No. Greenville Ave., Suite 205, Richardson, TX 75081
PHOENIX OFFICE Telephone: (602) 820-4900, 1930 South Alma School Rd., Suite B208, Mesa, AZ 85202

NTK DIELECTRIC RESONATORS

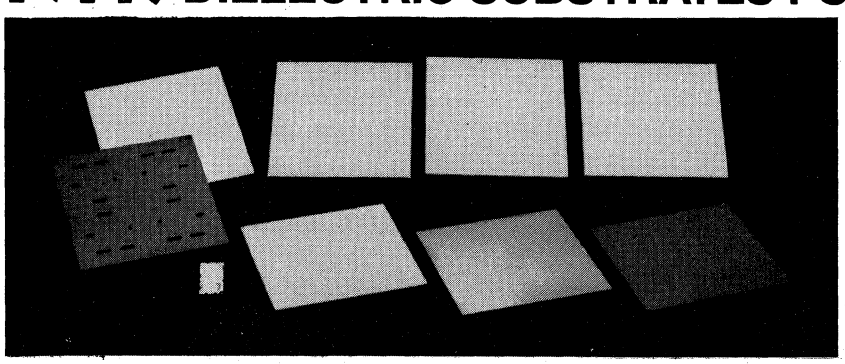


FEATURES
- High Q
- Broad range of dielectric constant
- Optional T.C.'s
- Optional T.C. tolerances

APPLICATIONS
- DRO
- Filter

Characteristics Notation	F	K	A	O
Relative dielectric constant K	34 ~ 36	90 ~ 93	11 ~ 13	6.2
Temp. coeff. of freq. π f (ppm/°C)	+2 ~ +10	±0	−10 ~ +10	−45
Q (= 1/tan δ) (Measurement frequency)	8000 (8GHz)	2100 (2.3GHz)	18000 (13GHz)	1200 (7GHz)
Volume resistivity (Ω•cm) (25°C)	8×10^{14}	7.6×10^{14}	1.1×10^{14}	5×10^{15}
Linear expansion coeff. (ppm/°C) (30 ~ 400°C)	9.5	8.5	8.2	3.0
Density (g/cm³)	4.5	5.6	3.93	2.56
Bending strength (kg/cm²)	1500	1500	3900	1700
Thermal conductivity (cal/cm-sec.°C)	0.0044	0.0039	0.06	0.0060
Water absorption (%)	<0.01	<0.01	<0.01	<0.01

NTK DIELECTRIC SUBSTRATES FOR MICROWAVE USE



FEATURES
- Surface finish to .2 microns
- Available with plating
- High Q
- Excellent uniformity
- Wide range of available thickness

APPLICATIONS
- Microwave substrates
- Precision capacitors
- Stripline filters

Material designation	Temperature coefficient designation	Dielectric constant K	Temperature coefficient of dielectric constant (ppm/°C)	Expansion coefficient (ppm/°C)
F	LC	34 ± 1	0 ± 30	10
K	LC	90 ± 1	0 ± 30	8
A	LD	12 ± 1	0 ± 30	7.6

MATRIX
SYSTEMS CORPORATION
5177 NORTH DOUGLAS FIR ROAD
CALABASAS, CALIFORNIA 91302
(818) 992-6776 • TWX 910-494-4975
FAX (818) 992-8521

Coaxial Relay Module 7000 Series

7100 — Standard

7200 — Self-terminating

7300 — High isolation

7400 — Highest isolation

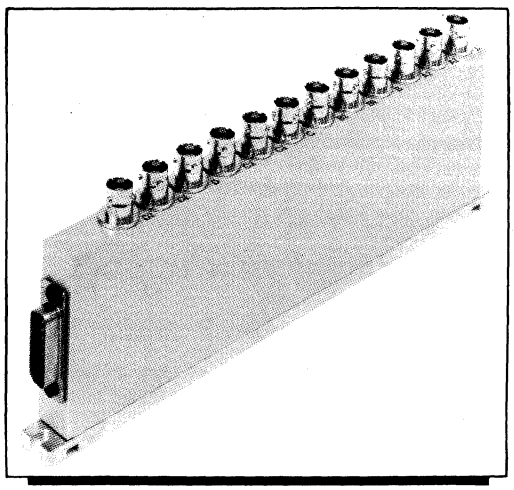
7500 — High power

7600 — Highest isolation self-terminating

7700 — Mercury wetted contacts

7800 — Twinax

7900 — Triax



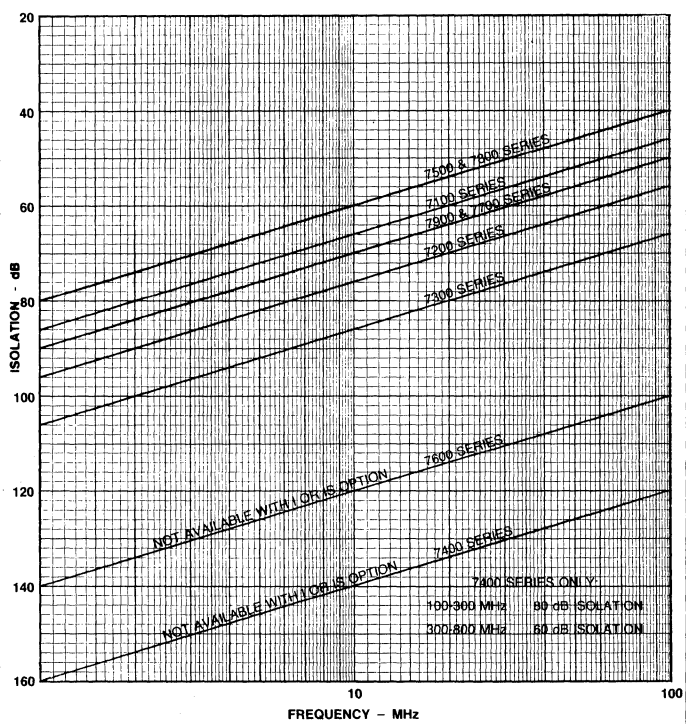
FEATURES:

- DC up to 800 MHz depending on number of throws
- Two to twenty-four throws
- Continuous shield continuity
- Rugged machined aluminum housing
- Crosstalk always lower than isolation
- Switchpoints individually field replaceable
- Extremely low EMI
- Low VSWR
- Matrix configuration easily assembled using 9000 series cross straps
- Signal circuits isolated from control circuitry

MATRIX 7000 Series Relay Modules are designed to maintain coaxial switching continuity over a wider range of critical and high environmental applications. The Relay housings are constructed of precision machined aluminum alloy for structural integrity and hard anodized for durability. All signal shield paths are silver plated with covers gasketed for maximum EMI protection. The basic reed switch elements are hermetically sealed in nitrogen filled gas envelopes and employ rhodium plated contacts to insure non-stick operation. Applications for MATRIX 7000 Series include:

— R.F. and I.F switching where a low VSWR is required.
— CCTV, base band video and pulse switching where low phase distortion and high pulse fidelity are required.
— Applications requiring a high degree of shielding integrity and low contact and induced noise such as pre amp input switching or the switching of high impedance operational amplifier inputs.

Matrix and hybrid switching systems are easily constructed by using Series 9000 (no output), 9100 (one output) or 9200 (two output) push-on cross straps which mate with the BNC connectors on the switch modules. The cross strap output connectors are BNC female type UG 1094/U. The model number of the cross strap is assigned by replacing the two zeros of the series number with the number of inputs desired. For example, a Model 9108 has eight inputs and one output.



MODEL NUMBER ASSIGNMENT

7 X XX — X

Series
Number of throws (N)
Options:
Coil suppression diodes with:
Coil common negative — D
Coil common positive — DR
TNC connectors — T
SMA connectors — S
Self-terminating — Ohms
Insulated shield — I
Insulated and
Switched shield — IS
Expander output — E
Chassis mount — C
Optional voltage — See Factory

SPECIFICATIONS

FREQUENCY RANGE:	(−1dB) 1310 ÷ (N −.13) MHz where N = Number of Throws
FREQUENCY RANGE:	(−3dB) 1760 ÷ (N +.2) MHz where N = Number of Throws
CHARACTERISTIC IMPEDANCE:	50 ohms - 75 ohm optional
SWITCHING CONFIGURATION:	Single or double pole, two thru twenty-four throws
SWITCHING SPEED:	One mS dry contact, three mS mercury wetted
ISOLATION:	See graph See factory for -I or -IS option
CONTROL - CONNECTOR:	28 VDC, 30 mA- D type-mate supplied
SIGNAL CONNECTOR:	BNC, Twinax, Triax, TNC, SMA or F type optional
OPERATING TEMPERATURE AND HUMIDITY RANGE:	−30°F to +150°F, 0 to 98 percent R.H.
OPERATING SHOCK AND VIBRATION:	50 G's - 1 mS, 2 G's p-p 20-2000 Hz
DIMENSIONS:	.625" W × 3.25" H × 1.44" + (.625" × number of throws)
MOUNTING:	Three 6-32 tapped holes in base or option - C

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the most comprehensive compilation of mixer data and design information ever published in one volume

our new 212-page RF/IF signal-processing handbook, Vol. 1

ordering information

Federal supply code: 15542

how to order

Your local representative or distributor is the contact for both sales and service assistance for products listed in this catalog. These local offices have the latest price and delivery information on all models. They can also provide details on ordering procedures, service information and application engineering data. Your order may be sent directly to Mini-Circuits or to any of the local sales offices listed.
Prices listed in this catalog are domestic F.O.B. Brooklyn, New York. Mini-Circuits reserves the right to change specifications, models, prices, or designs without prior notice and without liability for such changes. Minimum order $50.00

shipping instructions

Shipments can be made by either air or surface carriers. If specific shipping instructions do not accompany the order, Mini-Circuits will specify the carrier to be used. For air shipments, Mini-Circuits has arranged for substantial discounts with Federal Express.

terms

Net 30 days from date of invoice. If credit is not established with Mini-Circuits, shipments will be made C.O.D. (cash on delivery) or prepaid. If prepaying, please include freight.

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Scientific Components Corporation, Mini-Circuits division, warrants each product manufactured by Mini-Circuits to meet all published specifications and to be free from defects in material and workmanship. The Company's liability under this warranty is limited to repair, adjustment and/or replacement of defective parts returned, freight paid by Buyer, to the factory within a period of one year from date of shipment from the factory unless a shorter period is specified. International customers may ship to the Company's nearest Distributor.
Damage by misuse or abnormal conditions of operation, or evidence of partial or complete disassembly voids this warranty.
SINCE MINI-CIRCUITS HAS NO CONTROL OVER CONDITIONS OF USE, NO WARRANTY IS MADE OR IMPLIED AS TO SUITABILITY FOR CUSTOMER'S INTENDED USE, BEYOND SUCH PERFORMANCE SPECIFICATIONS AS ARE MADE A PART OF THE PURCHASE ORDER. Equipment shipped F.O.B. Mini-Circuits' plant shall become the property of the Buyer upon delivery to carrier. Damage in shipment should be handled by the Buyer directly with the carrier by immediately requesting carrier's inspection upon evidence of damage in shipment.
A fee will be charged to the Buyer to cover the costs of inspection and test of units returned under this warranty and subsequently found to meet specifications or to be faulty for reasons which are not Mini-Circuits' responsibility. This warranty excludes all other warranties expressed or implied. Mini-Circuits shall not be liable for any special, indirect or consequential damages.

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FAX (718) 332-4661 TELEX 6852844 or 620156

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*For performance data not given please consult factory.

Mini-Circuits

how to use this guide

Over 1,000 RF/microwave signal-processing components are available to the design engineer from Mini-Circuits. This guide has been organized to simplify the process of selecting the component best suited to your application. SECTION 1 GIVES A LISTING OF ALL THE PRODUCT FAMILY GROUPS—from frequency mixers to power splitters to RF transformers—plus warranty and ordering details.

LOOKING FOR DATA ON A SPECIFIC MODEL? The model index contains a list of all models in alphabetical/numerical order with reference to specification and data pages.

FOR A CONCISE PRODUCTION/TEST FLOW DIAGRAM see section 1, illustrating Mini-Circuits quality-control procedures; and detailed information on our Hi-Rel, MIL, and TX products for your military, space or rugged industrial applications.

SPECIFICATION PAGES. Each specification page is organized by series within the product line and by models within the series. Information given includes National Stock Numbers (NSN), equivalent MIL—part numbers, pin connection designations, case styles, and notes to the tables.

Full specifications for each model are given in table form. The various models within a series differentiate from each other by the frequency range they cover.

Mixer selection is primarily determined by the mixer level suitable for the application. Therefore, frequency mixers are organized in sequence of mixer level—Level 7, 10, 13, 17, 17S, 23, 23S and 27. A Level 7 mixer operates with +7 dBm LO drive, a Level 13 mixer operates with +13 dBm LO drive, etc. For each level mixer, a maximum RF input level for linear operation is specified.

CASE STYLES AND DIMENSIONS ARE EASY TO FIND . . . Each series has a particular case style. The specification page includes a photo and a reference number to the particular dimensions and outline drawing of the case. Turn to section 1, for case style dimensions, tolerances, bracket options, case material and finishes.

NEED MINI-CIRCUITS' COMPONENTS IN A HURRY? Refer to the rep listing for Mini-Circuits' International network of sales representatives and distributors ready to serve your needs, supply your orders, and answer your questions promptly and courteously.

FREE New 212-page RF/IF Signal processing handbook loaded with application-oriented articles on mixer selection, two-tone third-order testing, computer-aided performance data (CAPD) benefits, plus a handy question-and-answer discussion on the most commonly-asked questions about mixers and phase detectors. Also . . . the most complete collection of data on mixers ever made available to design engineers.

Just call or write your nearest sales representative or distributor or our factory.

Someone has to be best.

It's always been that way.
In politics, in sports, in business. Someone who's more aggressive, more courageous, more dedicated.

Take Mini-Circuits, for example, supplying RF signal-processing components worldwide.

While other companies boasted about their product reliability, we worked at it ... pioneering HTRB (high-temperature, reverse-bias) testing to screen potentially faulty mixer diodes; performing burn-in, thermal shock, and fine and gross leak testing on standard off-the-shelf units; innovating powerful in-house quality-control techniques such as mandatory requirements of unit-to-unit electrical performance repeatability. And we were the first (and still only) manufacturer of double-balanced mixers with a 3-year guarantee.

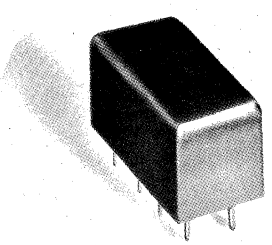
While others limited their standard catalog product line, we steadily added so today we offer the world's widest variety of off-the-shelf, immediate delivery products designed to perform to ***your*** specs. And this put an end to expensive, "custom" parts with their lengthy delivery delays.

While other RF signal-processing manufacturers were satisfied to offer limited data, Mini-Circuits invested six engineering man years in order to provide customers with exclusive Computer-Automated Performance Data (CAPD) ... the most detailed information ever published for standard catalog items.

While other firms were increasing prices and debating the wisdom of applying computer-aided systems for parts procurement, delivery scheduling, and automating manufacturing and test, we were busy putting such systems into operation. As a consequence, more than 95% of our product line has not been given a price increase during the past ten years. We can't guarantee how long this price freeze will continue, but we pledge our commitment to further maximize all of our products price/performance goals.

Quality, performance, delivery, and low cost. Mini-Circuits ... dedicated to finding new ways and setting higher standards.

Mini-Circuits



Mini-Circuits P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Domestic and International Telexes: 6852844 or 620156

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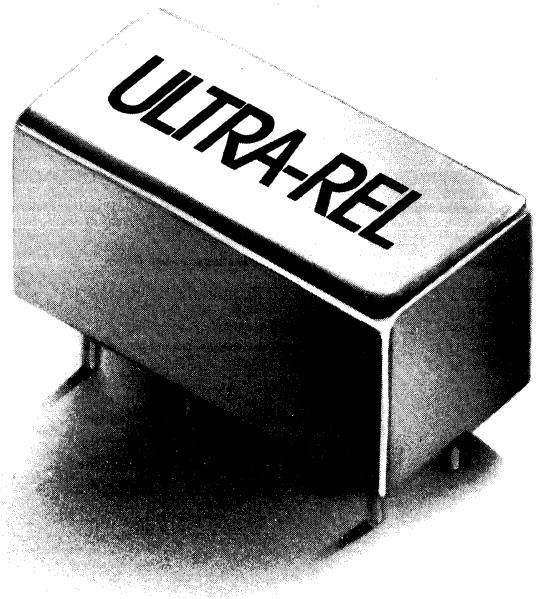

The Most Reliable Mixers Anywhere.

Ultra-Rel™ Mixers with a 5 year Guarantee At No Extra Cost.

Our secret to this reliability breakthrough is an Ultra-Rel diode capable of withstanding considerably more punishment than specified by MIL-STD-883; the result of an intensive two-year, one million dollar joint development program by Hewlett-Packard and Mini-Circuits. And since mixer reliability is primarily determined by the reliability of the diodes in the assembly, the more reliable the diodes, the more reliable the mixer. That's the key:

Based on a major technological advance in the processing of monolithic devices, these new Ultra-Rel diodes achieve an order of magnitude improvement in reliability over currently-available Schottky diodes.

To put it bluntly, these new Ultra-Rel diodes can meet and exceed MIL-STD-883 tests with ease. MIL-STD-883 calls for diodes to be temperature stressed for 25 cycles -65° C to +125° C; Ultra-Rel diodes have no trouble with 200 cycles from -65° C to +175° C. And the Ultra-Rel devices can withstand up to ten times the mechanical pull test requirement of MIL-STD-883.

Only Mini-Circuits' Ultra-Rel mixers include Ultra-Rel diodes, no one else has them. And no one else offers a five-year guarantee. Look for the Ultra-Rel Stamp on your mixer... don't settle for anything less.

True... few of your applications will dictate such demanding levels of endurance. But consider the enhanced reliability and significantly extended MTBF gained by specifying Mini-Circuits' Ultra-Rel mixers in your systems design. In today's tough competitive environment, your trouble-free systems are your best salesmen.

So, think long-life performance... specify Ultra-Rel mixers. To select the specific mixer to meet your electrical performance requirements, see the detailed specs in Vol. 1 or 2 of our RF/IF Signal Processing Handbooks.

finding new ways...
setting higher standards

Mini-Circuits
A Division of Scientific Components Corporation
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500
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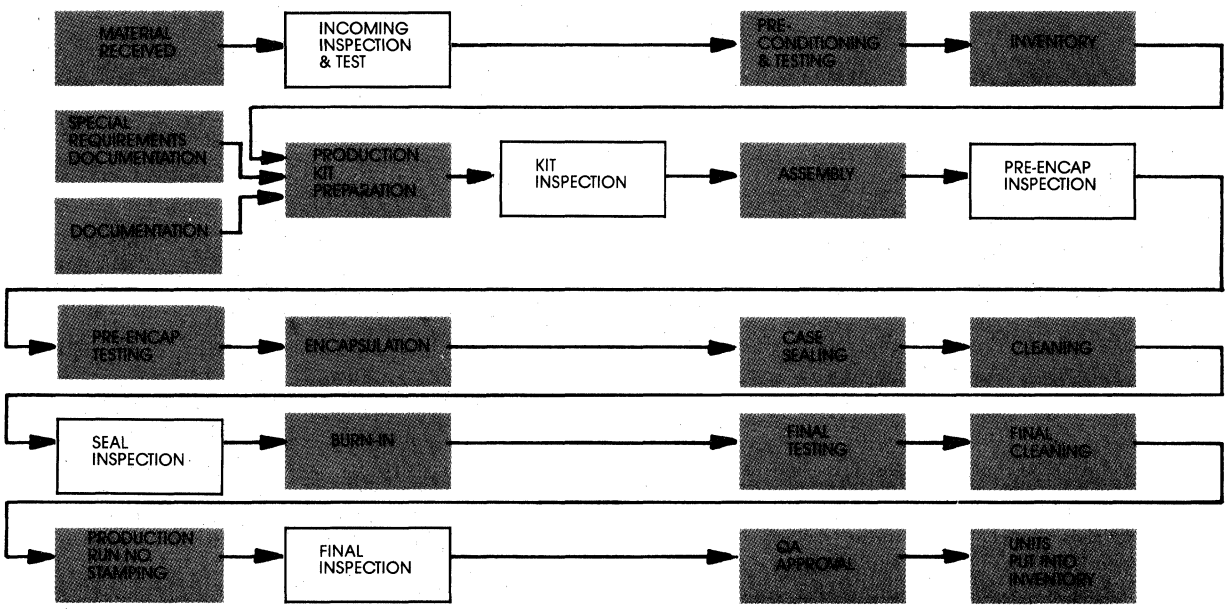
C124 REV.ORIG. 6

Mini-Circuits guarantees quality

We guarantee our customers 0.1% AQL; no rejects . . . not even one on every order of 1,000 units. We ship millions of RF-signal processing components for thousands of military programs in the U.S. and over 20 foreign countries, to tight quality-control specs. Specify Mini-Circuits' RF-signal processing components and reduce incoming inspection costs while production yield improves.

how Mini-Circuits achieves high reliability



environmental specifications

Description

All MCL components are manufactured under exacting quality assurance and control standards. They will meet or exceed published specifications over the operating temperature range of −54° to +100°C, and after being subjected to any or all of the following physical or environmental tests of MIL-STD 202E which are applicable.

Test	Method
Temperature cycling −65°C to +125°C	102C
Altitude 656,000 feet	105G
Humidity: 90% RH, 65°C (note 2)	106
Thermal shock −65°C to +125°C	107B
Seal: less than 10^5 Atm cc/sec (note 1, 2)	112A
Drop: random, 45 min.	203
Vibration: 2 to 2000 cps, 20g, 12 hrs.	204D
Solder heat: 260°C, 10 sec (note 1)	210B
Solderability: 95% coverage (note 1)	208
Terminal tensile strength: 4½ lbs., 10 sec (note 1)	211A
Terminal fatigue: 2 lbs., 3 cycles (note 1)	211C
Mechanical shock: 100g, 6 ms	213 I
Solvent resistance: alcohol, trichlorethan, freon	215

note 1: These specifications do not apply to coaxial connector models.
note 2: Exceptions are non-hermetic case styles W38, ×65, AA46, KK81, and as noted on specification sheet.

absolute maximum ratings

operating and storage temperature	−55°C to +100°C
pin temperature (10 secs)	+260°C

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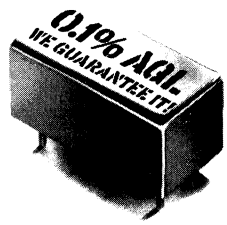
AQL (acceptable quality level)



Subsystem and systems manufacturers improve production yield by screening out defective components before they can be fed into the production cycle. A brute-force approach, often taken, involves 100% testing of each component at incoming inspection; it's a costly, time-consuming process.

Another method is to work with a modern statistical sampling acceptance plan, based on clearly-defined probability principles, which have been converted into formulas and charts or tables. An acceptable sampling table may be defined as a specific set of procedures in which lot size, sample size and acceptance criteria are related. One quality index used with statistical sampling tables is Acceptable Quality Level (AQL) which may be defined as the maximum percentage of units that do not meet requirements in a lot which, for the purpose of acceptance sampling, can be considered satisfactory as a process average. For example, using an AQL level of 1% for a lot size of 125 units; 4 or more rejects out of the 125 sample size is cause to reject the entire lot. Tables using AQL as its index offer high assurance of the acceptance of a lot when process quality is equal to or better than the specified AQL.

Mini-Circuits, the world's largest manufacturer of RF signal-processing components, has extensive experience with incoming components and is concerned with the mounting costs of incoming inspection and, even worse, the staggering cost of locating a defective part after it has been assembled into a subsystem or system. As a rule of thumb, if it costs 50 cents to find a component at the incoming inspection stage, it will cost five dollars to locate and replace it at the subassembly stage. Should the defective component somehow not be caught during subassembly test, it may be found (hopefully) during final system checkout at the factory with troubleshooting costs close to $50.00. However, should the system be shipped and show up as inoperative at the customer's site, the cost to the manufacturer could reach $500.00.

That's why Mini-Circuits doesn't go along with 1% AQL, commonly offered by parts manufacturers. Our customers deserve better. So we guarantee 0.1% AQL. Simply stated, it means no rejects are allowed in every shipment of 1,000 units. We're convinced our automated manufacturing systems, quality control procedures, and computer-automated testing are fully capable of meeting such a challenge.

reliability and quality control

All Mini-Circuits' RF signal-processing components are subjected to rigid quality control procedures starting from raw material procurement through product production and final inspection; the objective—to supply our customers with the finest RF signal-processing components available. Here's a list of some of the procedures taken to insure high-quality performance and product reliability.

A. 100% testing of each unit in process.
B. 100% testing of each completed unit.
C. 100% inspection of every solder connection.
D. All transformers bonded to the header for protection against severe shock and vibration.
E. All resistors and capacitors bonded to the header for severe shock and vibration protection.
F. Resistor power dissipation derated more than 50%.
G. All components rated for greater than +125°C.
H. All transformer leads double wrapped.
I. Heavy coated wire insulation for HiPot/altitude.
J. Completely encapsulated for protection against mechanical shock/vibration and temperature shock.
K. Permanent case marking of model number.
L. Cupro-Nickel case for long-lasting finish especially under salt atmosphere conditions.

hi-rel power splitter/combiners

To assure high quality and long-term reliability, Mini-Circuits' Hi-Rel power splitter/combiners are subjected to:

1) bake-in for 96 hours at 100°C
2) thermal shock per MIL-STD-202, Method 107
3) gross and fine leak tests, per MIL-STD-202, Test Method 112B, Condition A and C

4) burn-in; units will be operated at rated RF power and temperature in accordance with customer requirements. Please consult factory.

mil-components

Mini Circuits screens MIL-power splitter/combiners to MIL-P-23971 Group A and Group B electrical tests; in Group A, 100% of the lot quantity is tested. In Group B, tests are performed on units selected from Group A according to the sampling plan of MIL-STD 105 special inspection level S-3.

After each unit undergoes an environmental MIL-stress the units are electrically tested to ensure compliance with the applicable MIL specification and customer drawing. These tests generally include insertion loss, isolation, amplitude balance, VSWR, and phase balance.

MCL MIL components which undergo Group A and Group B of MIL-P-23971 are marked with the Mini-Circuits model number followed by /MIL.

When the military part number marking is required, the units must be on the QPL list or must be manufactured from a lot for which first article inspection has been performed. In this case, please contact the factory for pricing and contract requirement review.

8

case style outline dimensions (inch mm)

case no.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	wt. grams.	NOTES*
A01	.770 19.56	.800 20.32	.385 9.78	.400 10.16	.370 9.40	.400 10.16	.200 5.08	.20 5.08	.14 3.56	.031 .79									5.2	A1, B3
A03	.480 12.20	.500 12.70	.390 9.91	.405 10.29	.210 5.34	.230 5.85	.100 2.54	.20 5.08	.14 3.56	.020 .51									2.3	A1, B4
A04	.770 19.56	.800 20.32	.200 5.08	.210 5.33	.370 9.40	.400 10.16	.200 5.08	.20 5.08	.14 3.56	.031 .79									3.7	A1, B3
A05	.770 19.56	.800 20.32	.240 6.10	.250 6.35	.370 9.40	.400 10.16	.200 5.08	.20 5.08	.14 3.56	.031 .79									3.7	A1, B3
A06	.770 19.56	.800 20.32	.285 7.24	.310 7.88	.370 9.40	.400 10.16	.200 5.08	.20 5.08	.14 3.56	.031 .79									5.2	A1, B3
A11	.480 12.20	.500 12.70	.240 6.10	.255 6.48	.210 5.34	.230 5.85	.100 2.54	.20 5.08	.14 3.56	.020 .51									1.9	A1, B4
B02	.480 12.20	.500 12.70	.240 6.10	.255 6.48	.210 5.34	.230 5.85	.16 4.07	.100 2.54	.14 3.56	.20 5.08	.020 .51								1.9	A1, B4
B13	.480 12.20	.500 12.70	.390 9.91	.405 10.29	.210 5.34	.230 5.85	.16 4.07	.100 2.54	.14 3.56	.20 5.08	.020 .51								2.3	A1, B4
C07	.770 19.56	.810 20.58	.380 9.66	.410 10.42	.030 .77	.200 5.08	.20 5.08	.14 3.56											11.0	A1
D08	1.000 25.40	1.025 26.04	.390 9.91	.430 10.93	.500 12.70	.525 13.34	.025 .64	.300 7.62	.200 5.08	.09 2.29	.13 3.31	.150 3.81	.20 5.08	.14 3.56					8.5	A1
D09	1.000 25.40	1.025 26.04	.240 6.10	.280 7.12	.500 12.70	.525 13.34	.025 .64	.300 7.62	.200 5.08	.09 2.29	.13 3.31	.150 3.81	.20 5.08	.14 3.56					7.5	A1
E10	1.540 39.12	1.620 41.15	.380 9.66	.410 10.42	.770 19.56	.810 20.58	.030 .77	.200 5.08	.10 2.54	.20 5.08	.14 3.56								23.0	A1
F14	2.00 50.80	2.00 50.80	.75 19.05	1.00 25.40	.25 6.35	1.500 38.10	.125 3.18	.39 9.91	1.00 25.40	.50 12.70	1.00 25.40								170.0	A10 C1, D2
F53	2.00 50.80	2.00 50.80	.75 19.05	1.00 25.40	.13 3.31	1.750 44.45	.125 3.18	.39 9.91	1.00 25.40	.50 12.70	1.00 25.40								170.0	A10 C1, D2
G15	1.25 31.75	1.25 31.75	.75 19.05	.63 16.01	.38 9.66	.63 16.01	— —	.800 20.32	.800 20.32	.76 19.31	.125 3.18	1.688 42.88	2.18 55.38	.75 19.05	.07 1.78				85.0	A10 B1, D1
H16	1.25 31.75	1.25 31.75	.75 19.05	.63 16.01	.38 9.66	1.000 25.40	.125 3.18	1.000 25.40	— —	— —	.125 3.18	1.688 42.88	2.18 55.38	.75 19.05	.07 1.78				70.0	A10, B1, D2, D3, D4
J17	1.25 31.75	1.25 31.75	.75 19.05	.63 16.01	.38 9.66	1.000 25.40	.125 3.18	1.000 25.40	— —	— —	.125 3.18	1.688 42.88	2.18 55.38	.75 19.05	.07 1.78				75.0	A10, B1, D2, D3
K18	1.25 31.75	1.25 31.75	.75 19.05	.63 16.01	.38 9.66	1.000 25.40	.125 3.18	1.000 25.40	— —	— —	.125 3.18	1.688 42.88	2.18 55.38	.75 19.05	.07 1.78				70.0	A10, B1 C1, D2, D3
L19	1.50 38.10	1.13 28.70	.97 24.64	.50 12.70	.155 3.94	2.345 59.57	.138 3.51	.987 25.07	2.50 63.50	.10 2.54	.31 7.88	1.19 30.23	— —	.66 16.77	— —	— —	.150 3.81		37.0	A6, A11, B2 D6
L20	2.25 57.15	1.38 35.05	1.21 30.74	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.10 2.54	.40 10.16	1.86 47.25	— —	.64 16.26	— —	— —	.150 3.81		74.0	A6, A11, B2 D5
M21	1.50 38.10	1.13 28.70	.97 24.64	.50 12.70	.155 3.94	2.345 59.57	.138 3.51	.987 25.07	2.50 63.50	.10 2.54	.31 7.88	.75 19.05	1.19 30.23	.66 16.76	— —	— —	.150 3.81		40.0	A6, A11, B2 C1, D6
M22	2.25 57.15	1.38 35.05	1.21 30.74	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.10 2.54	.40 10.16	1.15 29.21	1.86 47.25	.64 16.26	— —	— —	.150 3.81		74.0	A6, A11, B2 C1, D5
M23	2.25 57.15	1.38 35.05	1.21 30.74	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.10 2.54	.63 16.00	1.06 26.93	1.63 41.40	.69 17.53	— —	— —	.150 3.81		70.0	A6, A11, B2, C1, D6
N24	1.50 38.10	1.13 28.70	.97 24.64	.50 12.70	.155 3.94	2.345 59.57	.138 3.51	.987 25.07	2.50 63.50	.10 2.54	.32 8.13	.75 19.05	1.18 29.97	.31 7.88	.56 14.23	.81 20.58	.150 3.81		45.0	A6, A11 B2, D6
N27	2.25 57.15	1.38 35.05	1.21 30.74	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.10 2.54	.48 12.19	1.13 28.70	1.78 45.21	.36 9.14	.69 17.53	1.01 25.65	.150 3.81		92.0	A6, A11 B2, D7
P25	2.25 57.15	1.38 35.05	1.21 30.74	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.10 2.54	.78 19.81	1.47 37.34	— —	.38 9.65	1.00 25.40	— —	.150 3.81		86.0	A6, A11 B2, D7
P26	1.50 38.10	1.13 28.70	.97 24.64	.50 12.70	.155 3.94	2.345 59.57	.138 3.51	.987 25.07	2.50 63.50	.10 2.54	.50 12.70	1.00 25.40	— —	.31 7.88	.81 20.58	— —	.150 3.81		42.5	A6, A11 B2, D6
Q28	4.06 103.13	1.60 40.64	1.50 38.10	3.56 90.43	.25 6.35	.88 22.35	.36 9.15	.160 4.07	.4 10.16	.69 17.53	.58 14.73	.66 16.77	3.13 79.50	.8 20.32	.06 1.53				300.0	A10 D9

tolerance x ± .1 xx ± .03 xxx ± .015 **oz. = grams x.0353**

* NOTES:

A. MATERIAL AND FINISH

A1. Header material C.R.S.; Pin material; #52 alloy. Finish; electro tin, hot-oil flowed. Cover material; cupro-nickel.

A6. Case material; aluminum alloy. Finish; baked blue enamel over iridite.

A10. Case material; aluminum alloy. Finish, baked grey enamel.

A.11 Case material; aluminum alloy. Finish, blue anodized.

B. MOUNTING

B1. Mounting bracket available on request. Add suffix B to part number.

B2. Mounting bracket available on request. For bracket mounted on connector end add suffix B to part number and $3.50 to unit cost. For bracket mounted on the rear, add suffix BR to part number and add $1.50 to unit cost.

B3. Insulated spacer available. Request P/N B14-045-01.

B4. Insulated spacer available. Request P/N B14-047-01.

C. MARKING

C1. For port markings 1, 2, and 3 see specification data sheet.

D. CONNECTORS

D1. Connectors: SMA Standard. BNC on request (no charge). Male SMA on request, consult factory.

D2. Connectors: please specify, unless otherwise noted; BNC is standard, TNC, SMA and Type N, consult factory. (ZAPD −4 units not available with BNC; FT and FTB units not available with SMA).

D3. For Type N or TNC connectors this dimension, "C*", changes from 0.75 to 0.94 inches.

D4. FTB Models for Balanced port, Isolated female BNC connector only.

D5. Connectors: BNC standard, TNC consult factory.

D6. Connectors: Female SMA only. Male SMA available on request, consult factory.

D7. Connectors: BNC only.

D9. Connectors: BNC standard, TNC or Female SMA on request, consult factory

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& outline drawings

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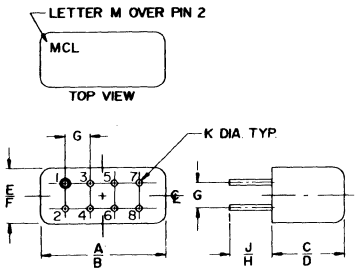
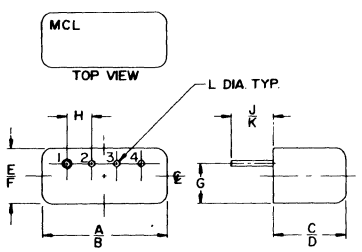
A



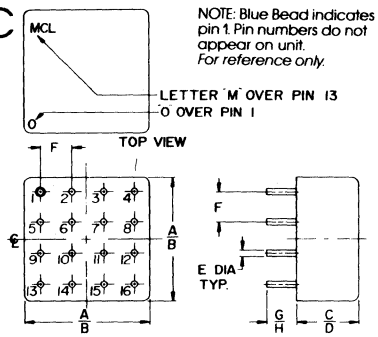
NOTE: Blue Bead indicates pin 1.
Pin numbers do not appear on unit.
For reference only.

B



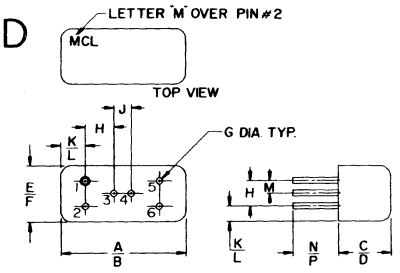
NOTE: Blue Bead indicates pin 1.
Pin numbers do not appear on unit.
For reference only.

C



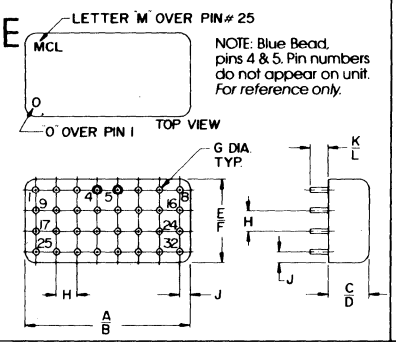
NOTE: Blue Bead indicates pin 1. Pin numbers do not appear on unit.
For reference only.

D



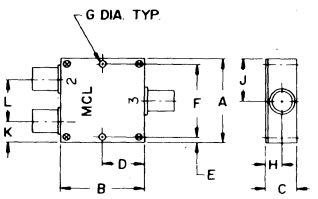
NOTE: Blue Bead indicates pin 1.
Pin numbers do not appear on unit.
For reference only.

E

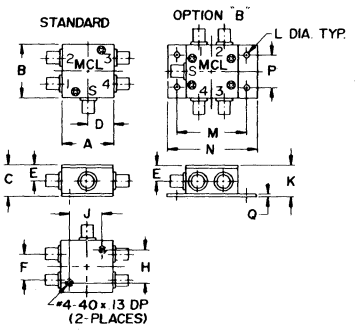


NOTE: Blue Bead, pins 4 & 5. Pin numbers do not appear on unit.
For reference only.

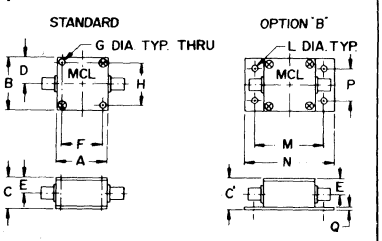
F



G



H



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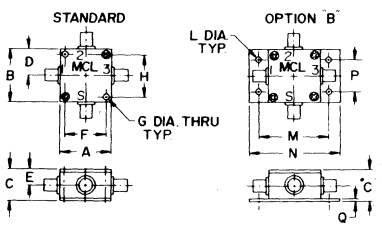
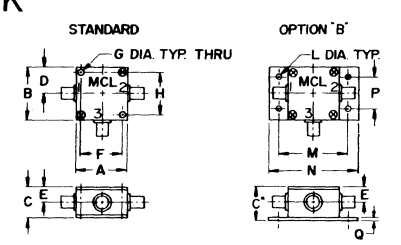
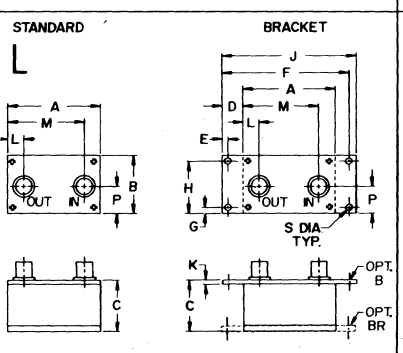


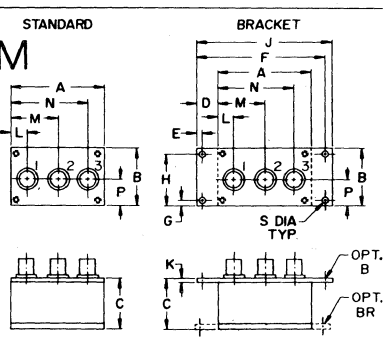
K



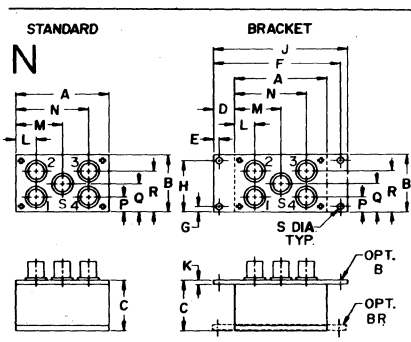
L



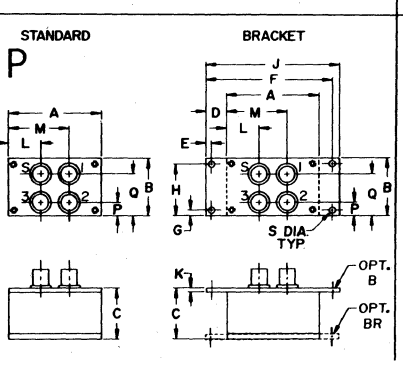
M



N



P



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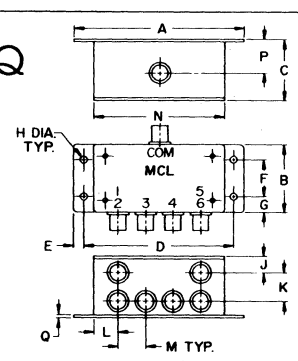


case style outline dimensions (inch / mm)

case no.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	wt. grams.	NOTES*
R29	.406 103.13	.160 40.64	.150 38.10	.356 90.43	.25 6.35	.88 22.35	.36 9.15	.160 4.07	.4 10.16	.69 17.53	.58 14.73	.66 16.77	.313 79.50	.8 20.32	.06 1.53				300.0	A10, C2, D9
R30	.669 169.93	.160 40.64	.150 38.10	.622 157.99	.25 6.35	.88 22.35	.36 9.15	.160 4.07	.40 10.16	.69 17.53	.55 13.97	.66 16.77	.572 145.29	.81 20.58	.06 1.53				500.0	A5, C2, D9
R31	.931 236.98	.160 40.64	.150 38.10	.884 224.54	.25 6.35	.88 22.35	.36 9.15	.160 4.07	.40 10.16	.69 17.53	.54 13.72	.66 16.77	.834 211.84	.81 20.58	.06 1.53				700.0	A5, C2, D9
R67	.669 169.93	.160 40.64	.150 38.10	.622 157.99	.25 6.35	.88 22.35	.36 9.15	.160 4.07	.40 10.16	.69 17.53	1.22 30.99	.66 16.77	.572 145.29	.81 20.58	.06 1.53				500.0	A5, C2, D9
S32	3.75 95.25	2.00 50.80	1.8 45.7	.19 4.83	3.375 85.73	.19 4.83	1.625 41.28	.156 3.97	.6 15.24	.4 10.16	.5 12.7	1.30 33.02	.09 2.29	.38 9.65	3.00 76.20	.30 7.62	2.60 66.04		220.0	A7, D16
T34	4.75 120.65	2.00 50.80	2.21 56.14	.19 4.83	4.375 111.13	.23 5.84	1.540 39.12	.144 3.66	.58 14.73	.34 8.64	.50 12.70	1.50 38.10	1.00 25.40	.09 2.29	.38 9.65	4.00 101.60	.30 7.62	2.60 66.04	440.0	A7, A8, D16
T35	4.75 120.65	2.00 50.80	2.46 62.49	.19 4.83	4.375 111.13	.23 5.84	1.540 39.12	.144 3.66	.58 14.73	.34 8.64	.50 12.70	1.50 38.10	1.00 25.40	.09 2.29	.38 9.65	.400 101.60	1.50 38.10	5.00 127.00	700.0	A7, A8, D16
U36	7.00 177.80	3.25 82.55	2.13 54.10	.25 6.35	6.500 165.10	.38 9.65	2.500 63.50	.156 3.97	.88 22.35	.73 18.54	.63 16.01	1.13 28.70	2.23 56.64	.125 3.18	.50 12.70	6.00 152.40			900.0	A7, A8, D6
U111	7.00 177.80	3.25 82.55	3.13 79.50	.25 6.35	6.500 165.10	.38 9.65	2.500 63.50	.156 3.97	.88 22.35	.43 10.92	.63 16.01	1.00 25.40	2.63 66.80	.125 3.18	.50 12.70	6.00 152.40	2.23 56.64		1100.0	A8 D6
V37	.83 21.08	.83 21.08	.75 19.05	.37 9.40	.42 10.67	1.25 31.75	.100 2.54	1.150 29.21	.095 2.41	.735 18.67	.21 5.33	.106 2.69	.06 1.52						34.0	A10, C1, D17
W38	.30 7.62	.27 6.86	.23 5.84	.010 .25	.042 1.07	.020 .51	.100 2.54	.05 1.27	.09 2.29	.37 9.40	.036 .91								.50	A3
X65	.30 7.62	.27 6.86	.23 5.84	.010 .25	.042 1.07	.020 .51	.100 2.54	.05 1.27	.04 1.02	.12 3.05	.300 7.62	.35 8.89							.50	A3
Y39	1.25 31.75	1.25 31.75	.75 19.05	.63 16.01	.36 9.15	1.000 25.40	1.000 25.40	.125 3.18	.125 3.18	.46 11.69	2.18 55.38	1.688 42.88	.07 1.78	.750 19.05	.50 12.70	.80 20.32	.45 11.43	.29 7.37	50.0	A4, A7, B1, D6
Z40	7.06 179.32	3.13 79.50	.88 22.35	.250 6.35	1.750 44.45	5.310 134.87	6.810 172.97	.312 7.92	2.875 73.03	.144 3.66	3.53 89.66	.44 11.18	.415 10.54	.89 22.61					800.0	A10, D11
AA46	.830 21.08	.580 14.73	.265 6.73	.13 3.30	.415 10.54	.340 8.64	.025 .64	.50 12.70											6.4	A2
BB48	.50 12.70	.39 9.91	.225 5.72	.025 .64	.07 1.79	.100 2.54	.250 6.35	.350 8.89	.06 1.53	.31 7.87									3.0	A1
CC51	2.00 50.80	2.00 50.80	.75 19.05	.938 23.83	.13 3.30	1.750 44.45	.125 3.18	.375 9.53	1.00 25.40	1.25 31.75									120.0	A10, D11
DD52	2.00 50.80	2.00 50.80	.75 19.05	.900 22.86	.156 3.96	1.688 42.88	.125 3.18	.392 9.96	1.00 25.40	.50 12.70	1.00 25.40	1.25 31.75							225.0	A10, D11
EE54	3.50 88.90	2.13 54.10	.88 22.35	.250 6.35	1.750 44.45	3.250 82.55	.250 6.35	1.813 46.05	.125 3.18	.44 11.18	.415 10.54	.89 22.61							250.00	A10, D11
FF55	1.40 35.56	.58 14.73	.73 18.54	2.59 65.79	— —														40.0	A9, D12
FF56	.98 24.89	.43 10.92	.47 11.94	1.70 43.18	— —														18.0	A9, D13
FF57	1.54 39.12	.72 18.29	.81 20.58	3.05 77.47	.82 20.83														90.0	A9, D14
FF58	1.40 35.56	.58 14.73	.61 15.50	2.59 65.79	.64 16.26														45.0	A9, D15
FF99	1.27 32.26	.72 18.29	.47 11.94	1.98 50.29															42.0	A9, D13

tolerance x ± .1 xx ± .03 xxx ± .015 **oz. = grams x.0353**

*NOTES:

A. MATERIAL AND FINISH

A1. Header material C.R.S. Pin material; #52 alloy. Finish; electro tin, hot oil flowed. Cover material; cupro-nickel.

A2. Case material; C.R.S. Pin material; #52 alloy. Cover material; stainless steel. Finish; gold flash per MIL-G-45204.

A3. Case material; epoxy. Pin material, iron-nickel alloy. Finish; bright tin-plate

A4. Case material; aluminum alloy. Finish; iridite per MIL-C-5541.

A5. Case material; C.R.S. Finish; baked grey enamel over hot-tin dip.

A7. Case material; aluminum alloy. Finish; case black enamel. Heat sink; black anodize.

A8. Case material; aluminum alloy. Finish; case iridite. Heat sink, black anodize.

A9. Case material; brass. Finish; nickel plate.

A10. Case material; aluminum alloy. Finish, baked grey enamel.

B. MOUNTING

B1. Mounting bracket available on request. Add suffix B to part number

C. MARKING

C1. For port markings 1, 2, and 3 see specification data sheet.

C2. Consecutive marking, n = no. of way power-splitter.

D. CONNECTORS

D6. Connectors: Female SMA only. Male SMA available on request, consult factory.

D9. Connectors: BNC standard, TNC or Female SMA on request, consult factory.

D11. Connectors: Please specify: Type N or SMA.

D12. Connectors: Male BNC, Female BNC standard. Other combinations with SMA available on request, consult factory.

D13. Connectors: Male SMA, Female SMA only.

D14. Connectors: Male N, Female N standard. Combinations with BNC, SMA, TNC available on request, consult factory.

D15. Connectors: Male TNC, Female TNC only.

D16. Connectors: please specify, unless otherwise noted SMA is standard for model ZHL-2-12 for all other models BNC is standard, TNC, N, or SMA available on request, consult factory.

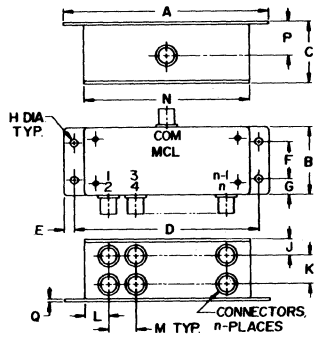
D17. Connectors: Female SMA only.

Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

& outline drawings

Mini-Circuits

R



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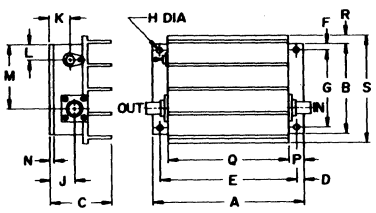

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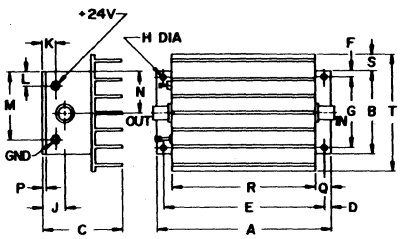

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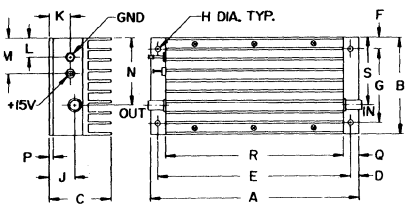

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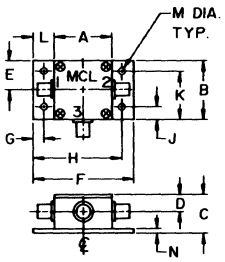

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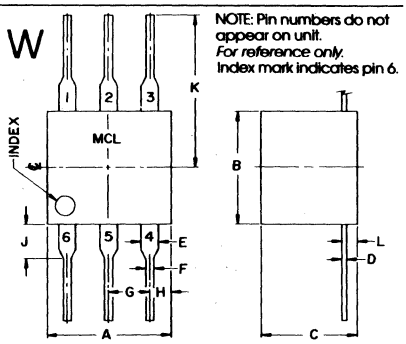

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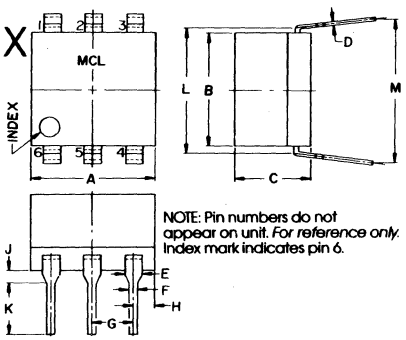

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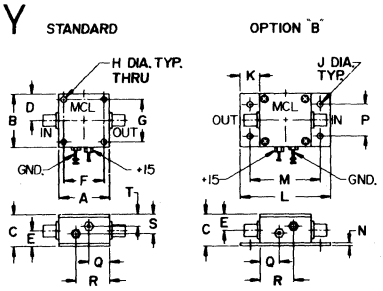

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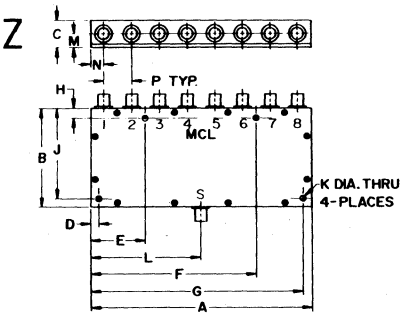

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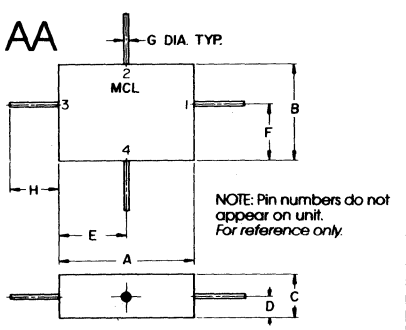

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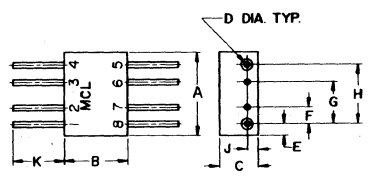

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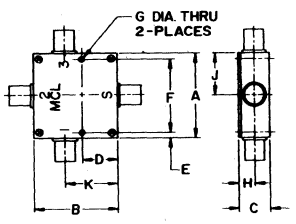

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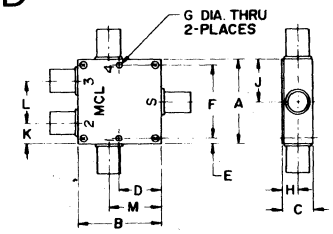

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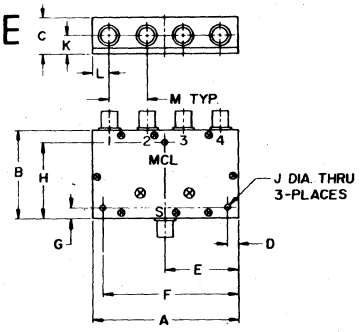

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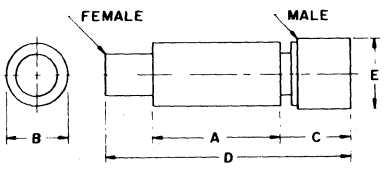


case style outline dimensions (inch / mm)

case no.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	wt. grams.	NOTES*
GG60	2.31 58.68	1.20 30.48	.60 15.24	.125 3.18	2.062 52.38	.30 7.62	.53 13.46	.63 16.00											75.0	A10, D10
HH68	9.31 236.47	1.60 40.64	3.57 90.68	8.84 224.54	.25 6.35	.88 22.35	.36 9.14	.160 4.06	.34 8.37	.69 17.53	.54 13.72	.66 16.76	8.34 211.84	.33 8.38	.06 1.52				1090.0	A5, D10
JJ77	1.50 38.10	1.13 28.70	.97 24.64	.50 12.70	.155 3.94	2.345 59.57	.14 3.55	.850 21.60	2.50 63.50	.10 2.54	.44 11.17	.75 19.05	.63 16.00	.37 9.39	.54 13.71	.43 10.92	.150 3.81	.73 18.54	50.0	A6, A11, D17
KK81	.30 7.62	.27 6.86	.23 5.84	.010 .25	.042 1.07	.020 .51	.100 2.54	.05 1.27	.05 1.27	.035 .88	.036 .91	.26 6.60	.575 14.60						.50	A3
LL85	1.43 36.32	.58 14.73	.75 19.05																21.5	A9, D18
LL86	1.19 30.23	.58 14.73	.51 12.95																14.0	A9, D19
LL87	1.43 36.32	.82 20.83	.68 17.27																48.5	A9, D20
LL88	1.43 36.32	.61 15.49	.75 19.05																24.0	A9, D21
MM91	2.25 57.15	1.38 35.05	1.21 30.73	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.10 2.54	.80 20.32	.42 10.67	1.60 40.64	.60 15.24	1.20 30.48	.50 12.70	.80 20.32	.150 3.81	80.0	A6, A11, D17
NN92	3.66 92.96	3.25 82.55	2.13 54.10	.25 6.35	3.16 80.26	.38 9.65	2.50 63.50	.156 3.96	.72 18.29	.64 16.26	.74 18.80	1.78 45.21	2.30 58.42	.125 3.18	.50 12.70	2.66 67.56			440.0	A7, A8, D6
PP94	.360 9.14	.250 6.35	.25 6.35	.016 .41	.020 .51	.04 1.02	.200 5.08												1.5	A12, C3
QQ95	.500 12.70	.250 6.35	.25 6.35	.016 .41	.020 .51	.04 1.02	.300 7.62	.150 3.81	.150 3.81	.075 1.91									3.5	A12, C3
QQ96	.600 15.24	.250 6.35	.25 6.35	.016 .41	.020 .51	.04 1.02	.400 10.16	.200 5.08	.200 5.08	.100 2.54									4.0	A12, C3
RR93	4.06 103.13	1.60 40.64	2.125 53.98	3.56 90.43	.25 6.35	.88 22.35	.36 9.15	.160 4.07	.4 10.16	.69 17.53	.58 14.73	.66 16.77	3.13 79.50	.8 20.32	.06 1.53	.33 8.38			350.0	A5, A10 D9
SS98	1.25 31.75	1.5 39.62	.75 19.05	.63 16.00	.39 9.91	1.50 38.10	1.000 25.40	— —	.125 3.18	.46 11.69	2.18 55.38	1.688 42.88	.07 1.78	.750 19.05	.50 12.70	.80 20.32	.45 11.43	.29 7.37	85.0	A8, B1, D6
TT100	.250 6.35	.310 (7.87)	.20 5.08	.100 2.54	.050 1.27	.035 .89	.040 1.02	.070 1.78											.50	
UU102	3.50 88.90	2.00 50.80	.50 12.70	.150 3.81	3.350 85.09	1.00 25.4	.125 3.18	1.75 44.45	.20 5.08	.55 13.97									120.0	A10, C2 D17
VV105	.085 2.16	.060 1.52	.020 .51	.006 .15	.020 .51	.46 11.68													.015	A14, C4
XX112	.18 4.57	.06 1.52	.21 5.33	.40 10.16	.30 7.62	0.50 1.27	.015 .38	.005 .13	.003 .08										.15	

tolerance x ± .1 xx ± .03 xxx ± .015 **oz. = grams x.0353**

A. MATERIAL AND FINISH

A3. Case material, epoxy. Pin material; iron-nickel alloy. Finish; bright tin-plate per MIL-T-10727.

A5. Case material; C.R.S. Finish; baked grey enamel over hot-tin dip.

A6. Case material; aluminum alloy. Finish; baked blue enamel over iridite.

A7. Case material, aluminum alloy. Finish, case black enamel. Heat sink, black anodize.

A8. Case material; aluminum alloy. Finish; case iridite. Heat sink, black anodize.

A9. Case material, brass. Finish; nickel plate.

A10. Case material; aluminum alloy Finish, baked grey enamel.

A11. Case material; aluminum alloy. Finish, blue anodized.

A12. Header finish; gold plate per MIL-G-45204. Case material; cupro-nickel.

A13. Case material; plastic. Lead finish, Tin plate.

C. MARKING

C2. Consecutive marking n=no. of way power splitter.

C3. For Pin designations see specification data sheet.

C4. RF Input lead (1) identified by diagonally cut lead. Model dash number identified by color dot on case. See Specification Data Sheet.

D. CONNECTORS

D6. Connectors. Female SMA only. Male SMA available on request, consult factory.

D9. Connectors BNC standard. TNC or Female SMA on request, consult factory.

D10. Connectors. BNC standard. SMA on request, consult factory.

D17. Connectors. Female SMA only.

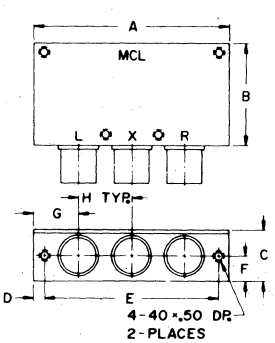
D18. Connectors. Male BNC only.

D19. Connectors. Male SMA only.

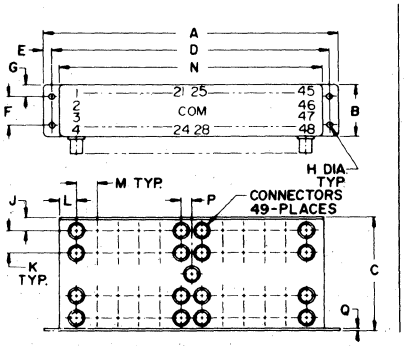
D20. Connectors. Male Type N only.

D21. Connectors. Male TNC only.

GG



HH



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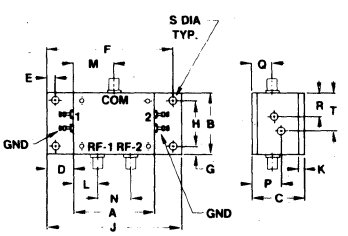


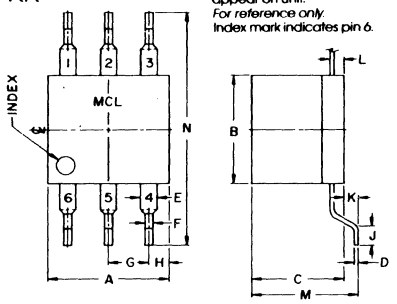
Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

& outline drawings

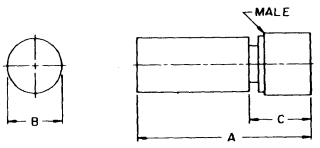
Mini-Circuits

KK

NOTE: Pin numbers do not appear on unit. *For reference only.* Index mark indicates pin 6.



LL



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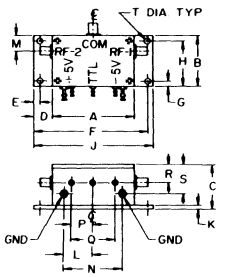

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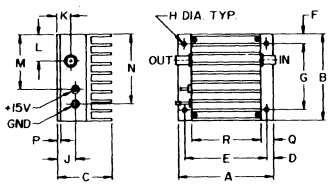
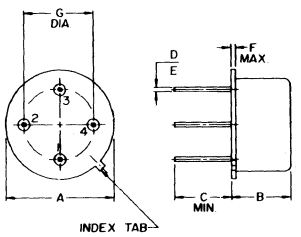


PP

NOTE: Pin numbers do not appear on unit. *For reference only.*



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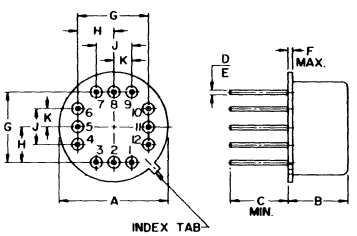
NOTE: Pin numbers do not appear on unit. *For reference only.*



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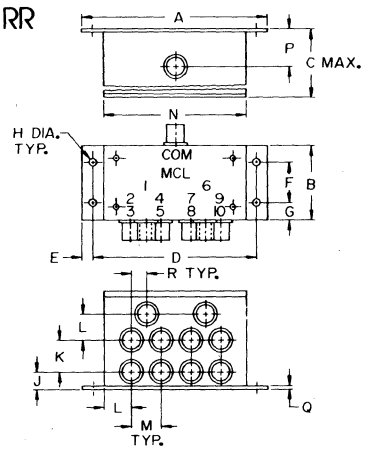

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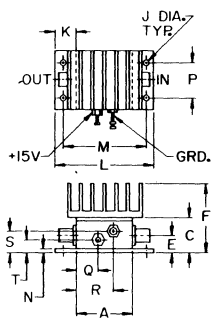

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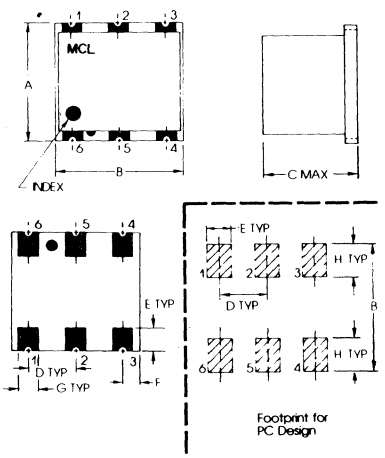

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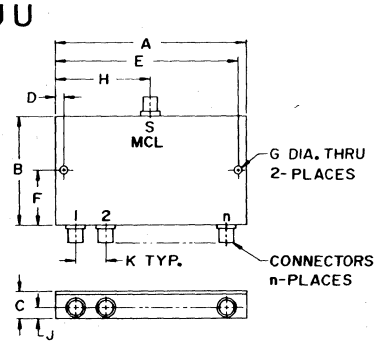

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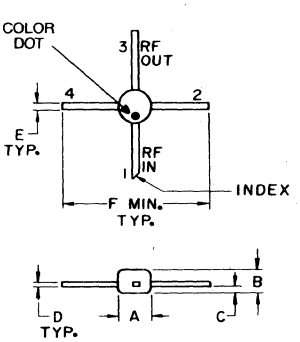

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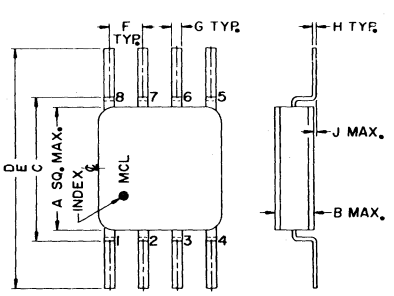


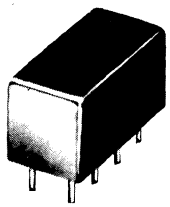
load insensitive

Frequency Mixers

LEVEL 7 (+ 7 dBm LO, up to +1dBm RF)

case style selection

outline drawings see table of contents



UNCL-X

MODEL NO.	FREQUENCY MHz LO/RF	IF	CONVERSION GAIN, dB Mid Band Typ	Min	TOTAL RANGE Typ	Min	LO-RF ISOLATION, dB L Typ	Min	M Typ	Min	U Typ	Min	LO-IF ISOLATION, dB L Typ	Min	M Typ	Min	U Typ	Min	INPUT POWER @ 1dB Comp Typ	DC POWER VOLT	CURRENT Typ mA	PRICE $ Ea	Qty
UNCL-X1 case A01	UNCL-XI	1-500	10-500	1	−1.0	0.5	−1.0	60	40	30	25	25	20	50	30	30	20	26	18	1	12	36	19.95	(1-9)

FEATURES

- 1 to 500 MHz
- 2-tone 3rd-order 1M insensitive to IF load
- conversion gain
- VSWR 1.2:1 IF/RF parts

PIN CONNECTIONS

RF	—	PIN 8
LO	—	PIN 7
IF	—	PIN 1
DC	—	PIN 4
GND	—	PINS 3,5,6
NOT USED	—	PIN 2

computer-automated performance data

typical production unit / for data of other models consult factory

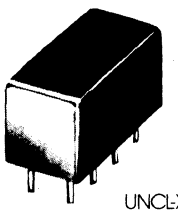
RF (MHz)	LO (MHz)	CONVERSION GAIN	ISOLATION (db) L-R	L-I	RETURN LOSS (dB) MHz	RF	IF	LO
1.000	31.000	.90	47.90	44.90	5.000	21.80	21.20	7.40
2.000	32.000	1.51	47.90	44.90	10.000	26.90	22.70	7.50
10.000	40.000	2.04	45.50	42.50	55.000	37.10	23.90	7.80
20.000	50.000	2.00	43.00	39.50	105.000	34.00	23.00	8.00
86.667	116.670	1.91	39.30	36.40	155.000	30.40	22.30	7.90
153.330	183.330	2.01	34.70	33.30	205.000	27.80	21.50	7.70
220.000	250.000	2.04	31.50	31.20	250.000	24.70	20.80	7.70
250.000	280.000	2.07	30.30	30.50	255.000	23.60	20.70	7.70
286.670	316.670	2.01	29.10	29.20	305.000	25.60	19.60	7.30
353.340	383.340	1.93	27.10	27.20	355.000	23.90	19.10	7.30
420.000	450.000	1.69	25.60	24.80	405.000	22.80	20.10	6.80
500.000	530.000	1.47	24.40	23.20	455.000	21.20	18.40	6.70
553.340	583.340	1.36	23.40	21.80	500.000	20.10	18.50	6.50
620.000	650.000	1.15	22.40	20.00	505.000	20.10	18.30	6.50
686.670	716.670	1.13	21.90	19.60	555.000	19.10	18.10	6.00

Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

1 to 500 MHz

Mini-Circuits

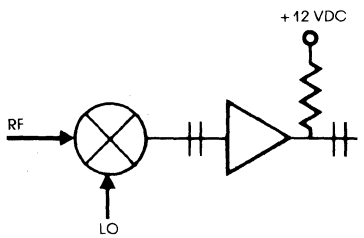
LEVEL 13 (+ 13 dBm LO, up to 9dBm RF)



UNCL-XMH

MODEL NO.	FREQUENCY MHz LO/RF	IF	CONVERSION GAIN, dB Mid Typ	Band Min	TOTAL RANGE Typ	Min	LO-RF ISOLATION, dB L Typ	L Min	M Typ	M Min	U Typ	U Min	LO-IF ISOLATION, dB L Typ	L Min	M Typ	M Min	U Typ	U Min	INPUT POWER @ 1dB Comp Typ	DC POWER VOLT Typ	DC POWER CURRENT Typ Ea	PRICE $ Ea	PRICE $ Qty
UNCL-X1MH case A01	UNCL-X1MH	1-500	10-500	2.5	0.5	2.0	0	60	40	35	25	30	20	50	30	25	18	18	14	7	12	60	23.95	(1-9)

schematic



NOTES:
1. For quality control procedures, environmental specifications, see Table of Contents.
2. Absolute Maximum Ratings, see Table of Contents.
3. Prices and specifications subject to change without notice.

RF (MHz)	LO (MHz)	CONVERSION GAIN	ISOLATION (db) L-R	ISOLATION (db) L-I
1.000	31.000	2.28	63.40	38.30
2.000	32.000	2.66	63.40	38.30
10.000	40.000	3.02	49.50	32.80
20.000	50.000	3.03	43.10	30.10
86.667	116.670	2.86	39.30	28.70
153.330	183.330	2.87	33.90	27.80
220.000	250.000	2.71	30.20	27.90
250.000	280.000	2.77	28.60	27.60
286.670	316.670	2.66	27.40	26.70
353.330	383.330	2.49	25.10	24.30
420.000	450.000	2.27	23.30	22.00
520.000	550.000	2.06	21.10	19.40
553.330	583.330	1.95	20.40	18.30
620.000	650.000	1.79	19.50	16.40
686.670	716.670	1.58	18.80	15.50

RETURN LOSS (dB) MHz	RF	IF	LO
1.000	13.10	15.30	
3.000			9.00
5.000	22.40	20.00	8.80
7.000			8.90
10.000	25.70	20.90	8.90
60.000	30.20	23.80	
100.000			9.30
110.000	29.30	23.90	9.40
160.000	29.00	24.00	
200.000			9.40
210.000	28.70	23.80	9.40
250.000			9.20
260.000	28.90	24.40	
300.000			9.30
310.000	29.80	23.90	
360.000	29.80	24.00	
400.000			8.90
410.000	30.70	23.60	8.80
460.000	29.70	24.00	
500.000			8.80
510.000	36.30	22.70	8.70
560.000	22.80	22.70	
610.000	22.70	20.90	8.60

In Stock...Immediate Delivery

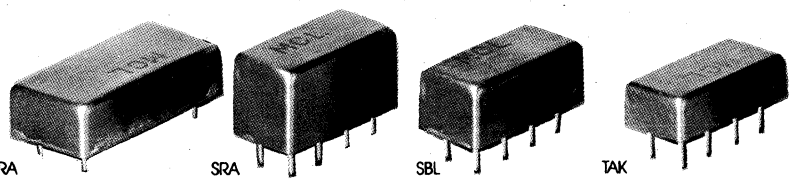
most widely-used

Frequency Mixers

LEVEL 7 (+7 dBm LO, up to +1 dBm RF)

case style selection

outline drawings see pages 4-9



	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m Typ.	Mid-Band m Max.	Total Range Typ.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	LO-IF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	PRICE, $ Ea.	Qty.
GRA case D09	GRA-1	.5-500	DC-500	5.5	7.0	6.5	8.5	50	45	45	30	35	25	45	35	40	25	30	20	12.95	(6-49)
	GRA-3	.025-200	DC-200	5.5	7.5	6.5	8.5	60	50	45	35	35	25	45	35	40	30	30	20	15.95	(6-49)
	GRA-6	.003-100	DC-100	5.5	7.5	6.5	8.5	60	50	45	30	35	25	60	45	40	25	30	20	22.95	(5-24)
	GRA-8	.0005-10	DC-10	6.5	7.5	7.0	8.5	60	50	50	40	45	35	60	50	50	40	45	35	25.95	(5-24)
SRA case A01	●SRA-1	.5-500	DC-500	5.5	7.0	6.5	8.5	50	45	45	30	35	25	45	35	40	25	30	20	11.95	(1-49)
	SRA-1TX	.5-500	DC-500	5.5	7.0	6.5	8.5	50	45	45	30	35	25	45	35	40	25	30	20	49.95	(1-49)
	SRA-1W	1-750	DC-750	5.5	7.5	6.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	14.95	(5-24)
	SRA-1-1	1-500	DC-500	5.5	7.5	6.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	13.95	(5-24)
	SRA-2	1-1000	.5-500	5.5	7.5	6.5	8.5	45	30	35	20	30	20	45	30	30	20	30	20	14.95	(5-24)
	SRA-2CM	5-1000	DC-1000	6.0	7.0	6.5	8.5	60	50	35	30	30	25	50	45	30	25	25	20	14.95	(1-49)
	SRA-3	.025-200	DC-200	5.5	7.5	6.5	8.5	60	50	45	35	35	25	45	35	40	30	30	20	14.95	(5-24)
	SRA-4	5-1250	.5-500	5.5	7.5	6.5	8.5	50	40	40	20	30	20	50	40	40	20	30	20	16.95	(5-24)
	* SRA-5	5-1500	10-600	7.0	8.0	7.5	8.5	50	45	35	30	30	20	45	40	30	25	25	15	21.95	(5-24)
	SRA-6	.003-100	DC-100	5.5	7.5	6.5	8.5	60	50	45	30	35	25	60	45	40	25	30	20	21.95	(5-24)
	SRA-8	.0005-10	DC-10	6.5	7.5	7.0	8.5	60	50	50	40	45	35	60	50	50	40	45	35	26.95	(5-24)
case A06	SRA-11	5-2000	10-600	7.0	8.5	7.5	9.0	50	45	35	25	30	20	45	40	30	20	25	15	26.95	(5-24)
	SRA-12	800-1250	50-90	—	—	6.0	7.5	32	25	35	25	35	25	30	20	30	20	30	20	24.95	(5-24)
	SRA-2000	100-2000	DC-600	6.0	9.5	7.0	9.5	—	—	37	20	—	—	—	—	—	—	30	20	31.95	(1-24)
	NEW SRA-2400	750-2400	DC-400	—	—	6.7	9.0	30	20	30	20	30	20	30	8	30	8	30	8	19.95	(1-24)
	NEW SRA-3500	500-3500	DC-1000	—	—	7.5	9.5	30	17	30	17	30	17	20	8	20	8	20	8	34.95	(1-24)
□ SBL case A06	SBL-1	1-500	DC-500	5.5	7.0	6.5	8.0	60	45	45	35	40	25	45	35	40	25	30	20	4.50	(10-49)
	SBL-1X	10-1000	5-500	6.0	7.5	7.0	8.0	50	40	40	30	30	20	50	45	40	35	35	25	5.95	(10-49)
	SBL-1Z	10-1000	DC-500	6.5	7.5	7.0	9.0	50	40	35	25	25	20	40	25	25	18	19	15	6.95	(10-49)
	SBL-1-1	0.1-400	DC-400	5.5	7.0	6.0	8.0	50	45	45	30	35	25	45	30	40	25	30	20	6.50	(10-49)
	SBL-3	.025-200	DC-200	5.5	7.5	6.0	8.5	55	50	45	30	35	25	45	35	40	30	30	20	7.50	(10-49)
	NEW SBL-11	5-2000	10-600	7.0	8.5	7.5	9.0	50	45	35	25	30	20	45	40	30	20	25	15	16.95	(5-49)
TAK case A04	TAK-5	01-250	DC-250	5.5	7.0	6.5	8.5	60	50	50	35	40	35	55	45	45	30	35	25	18.95	(1-4)
	TAK-5R	05-200	DC-200	5.5	6.5	6.5	8.0	55	50	45	35	45	35	50	45	40	30	40	30	15.95	(5-24)
	TAK-6	.5-600	DC-600	5.5	7.5	6.5	8.5	60	50	50	30	40	25	55	45	45	30	30	20	18.95	(1-4)
	TAK-6R	.5-600	DC-600	6.0	7.0	6.5	8.0	55	50	45	40	35	30	45	40	40	25	30	25	15.95	(5-24)
	TAK-7	2-1000	5-500	5.5	7.5	6.5	8.5	45	30	35	20	30	20	45	30	35	20	30	20	20.95	(1-4)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

m = mid band (2f_L to f_U/2)

* SRA-5 case style is A06.

● HTRB tested, 3 year guarantee

□ NON-HERMETIC

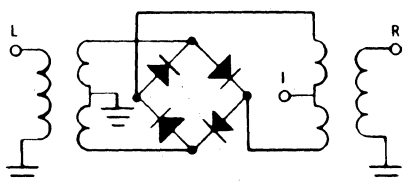
1 For quality control procedures, environmental specifications, and Hi-Rel, MIL and TX description see Table of Contents.

2 Absolute Maximum Ratings: RF power 50 mW, peak IF current 40 mA, see Table of Contents.

3 PAM-42 protected under patent 4,430,758.

4 Prices and specifications subject to change without notice.

schematic



pin connections

see case style outline drawing

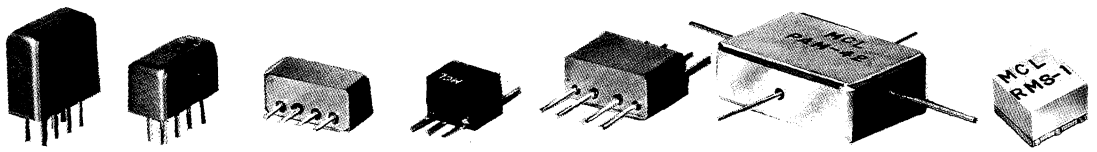
Series	GRA	SRA					SBL				TAK			
models	all models	−1 −1TX −1−1 −3	−2 −4	−6 −8	−1W −2CM	−5 −11 −12 −2000 −2400† −3500†	−1 −1−1 −3	−1X	−1Z	−11	−5 −6	−7	−5R	−6R
LO	1	8	8	8	8	8	8	8	1	8	8	8	8	1
RF	6	1	3,4	1	1	1	1	3,4	8	1	1	3,4	1	8
IF	4	3,4*	1	3,4*	3,4*	3	3,4*	1	3	3	3,4*	1	3,4*	5,6*
GND	2,3,5	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7		2,5,6,7	2,5,6,7	2,5,6,7	2,3,4,7
CASE GND	—	2	2,5,6,7	—	2,5,6,7	2,5,6,7	—	2,5,6,7	2,5,6,7		2	2,5,6,7	—	3,4,7

*pins must be connected together externally † (LO = 1, RF = 8)

Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

500 Hz to 4.2 GHz

Mini-Circuits



SAM TSM TFM *ASK LMX PAM RMS

	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m Typ.	Max.	Total Range Typ.	Max.	LO-RF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	LO-IF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	PRICE, $ Ea.	Qty.
SAM case A03	SAM-1	1-600	DC-600	5.5	7.0	6.5	8.5	55	45	45	30	35	20	50	40	40	25	30	20	15.95	(1-24)
	SAM-2	1-1000	DC-1000	6.0	7.5	7.0	9.5	55	45	40	25	35	20	50	40	40	25	30	25	17.95	(1-24)
	SAM-3	0.1-500	DC-500	5.5	7.0	6.5	8.5	60	50	50	35	35	30	50	40	45	30	30	20	17.95	(1-24)
	SAM-4	5-1250	0.5-1000	6.5	8.5	6.5	8.5	55	40	35	25	30	20	50	40	35	25	30	20	19.95	(1-24)
	SAM-5	5-1500	0.5-1000	6.5	7.5	6.5	8.5	55	40	35	25	30	20	50	40	35	25	30	20	24.95	(1-24)
TSM case A11	TSM-1	1-600	DC-600	6.0	7.5	6.5	8.5	60	45	45	35	35	25	55	45	40	30	35	25	17.95	(5-24)
	TSM-2	1-1000	DC-1000	6.0	7.5	7.0	10.0	55	45	40	20	35	18	50	40	40	20	25	18	18.95	(1-24)
	TSM-3	0.1-500	DC-500	5.3	7.5	6.5	8.5	60	50	50	35	35	25	55	45	45	30	35	25	19.95	(5-24
	†TSM-5	5-1500	DC-1000	6.5	8.5	8.0	9.5	60	45	35	25	30	25	60	45	35	25	25	16	23.95	(1-24)
TFM case B02	TFM-2	1-1000	DC-1000	6.0	7.5	7.0	8.5	50	45	40	25	30	25	45	40	35	25	25	20	11.95	(1-49)
	†TFM-2P	1-1000	DC-1000	6.0	7.5	7.0	8.5	50	45	40	25	30	25	45	40	35	25	25	20	11.95	(1-49)
	TFM-3	0.04-400	DC-400	5.3	7.0	6.0	8.0	60	50	50	35	35	25	55	40	45	30	35	25	19.95	(5-49)
	TFM-4	5-1250	DC-1250	6.0	7.5	7.5	8.5	50	45	40	30	30	25	45	40	35	25	25	20	21.95	(5-49)
	TFM-5	5-1500	DC-1000	6.5	8.5	8.0	9.5	60	45	35	25	30	25	60	40	35	15	25	14	23.95	(5-49)
case B13	TFM-11	1-2000	5-600	7.0	8.5	7.5	9.0	50	45	35	25	25	10	45	40	27	20	25	20	39.95	(1-24)
	TFM-12	800-1250	50-90	—	—	6.0	7.5	35	25	35	25	35	25	30	20	30	20	30	20	39.95	(1-24)
	NEW TFM-2400	750-2400	DC-400	—	—	6.7	9.0	30	20	30	20	30	20	30	10	30	10	30	10	24.95	(1-24)
*ASK case W38	ASK-1	1-600	DC-600	5.5	7.0	6.0	8.5	50	30	35	25	30	20	45	35	30	20	25	15	5.95	(10-49)
	NEW ASK-2	1-1000	DC-1000	7.0	8.0	8.0	9.8	60	40	35	18	26	16	50	30	25	17	15	10	6.95	(10-49)
LMX case BB48	LMX-3	0.04-400	DC-400	5.3	7.0	6.0	8.0	60	50	50	35	35	25	45	40	35	25	25	20	21.95	(1-24)
	LMX-113	5-1000	DC-1000	6.5	7.0	7.0	8.0	50	40	40	25	35	25	45	35	35	30	30	20	14.95	(6-24)
	LMX-124	0.5-500	DC-500	5.5	6/5	6.0	7.0	50	40	45	25	45	22	45	40	40	30	30	20	22.95	(6-24)
	LMX-149	10-1500	DC-1500	6.0	7.0	6.0	10.0	55	40	45	35	30	20	50	40	40	25	20	12	24.95	(6-24)
PAM case AA46	PAM-42	2.0-4.2GHz	DC-1.3GHz	—	—	7.0	8.5	—	—	25 (typ)	17 (min)	—	—	—	—	18 (typ)	10 (min)	—	—	26.95	(1-24)
†RMS case TT-100	RMS-1	0.5-500	DC-500	5.5	7.0	6.2	8.5	55	50	33	25	27	20	55	45	30	23	24	19	6.95	(10-49)
	RMS-2	5-1000	DC-1000	6.5	8.0	7.0	9.5	60	40	40	20	25	18	55	30	30	20	20	12	7.95	(10-49)
	◊RMS-1R	0.5-500	DC-500	5.5	7.0	6.2	8.5	55	50	33	25	27	20	55	45	30	23	24	19	11.95	(10-49)
	NEW RMS-5	5-1500	DC-1000	6.5	7.5	7.5	9.5	60	40	40	20	30	18	55	30	30	18	15	8	11.95	(10-49)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

m = mid band (2f_L to f_U/2)

* Surface mounting available, see case KK81
Plug-in mounting available, see case X65

† Phase Detection, Polarity Positive

◊hermetically sealed diodes

MIL-M-28837/1A, NSN GUIDE

MCL NO.	NSN	MIL-M-28837/1A*
GRA-1		07 N
GRA-1 HI-REL		07 S
GRA-3	5895-01-169-1815	
GRA-8	5895-01-217-5627	
SAM-1	5895-01-117-2926	
SAM-1TX	5840-01-196-4765	
SAM-2	5985-01-165-6621	
SAM-3	5895-01-062-9973	
SAM-5	5895-01-036-9507	
SBL-1	9058-00-256-6818	
SBL-1X	5895-01-179-8084	
SRA-1	6625-00-008-8272	03 N
SRA-1 HI-REL		03 S
SRA-1-1	5962-01-113-5431	
SRA-1-TX	5895-01-163-9247	03 S
SRA-1-1-TX	5895-01-151-6753	
SRA-11-TX	5895-01-163-9248	
SRA-1W		09 N
SRA-1W HI-REL		09 S
SRA-3	5895-01-021-5914	
SRA-4	5826-01-155-6545	
SRA-6	5895-01-124-0117	
SRA-8	5985-01-081-0977	12 N
SRA-8 HI-REL		12 S
TAK-5R		01 N
TAK-5R HI-REL		01 S
TAK-6R		02 N
TAK-6R HI-REL		02 S
TFM-2-408	5821-01-076-2497	
TFM-2	5821-01-135-1852	
TFM-3	5840-01-112-0031	
TFM-12	5821-01-179-5686	
TSM-1	5895-01-121-7958	

*units are not QPL-listed

SAM			TSM	TFM	ASK	LMX	PAM	RMS
-1 -3	-4 -5	-2	all models■ (△)	all models	all models	all models	all models	all models
8	8	8	8	4	1	8	3	1
1	3,4	1	1	1	4	5	1	4
3,4*	1	3,4*	3,4*	2	5	4	4	5
2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	3	2,3,6	2,3,6,7	2	2,3,6
2	2,5,6,7	2,5,6,7	2	3	—	2,3,6,7	2	—

△ TSM-5, CASE GROUND 2,7

■ TFM-2400, TFM-5 LO = 1; RF = 4

In Stock...Immediate Delivery

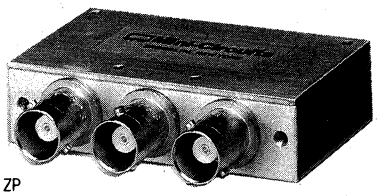
widest-variety of connector types

Frequency Mixers

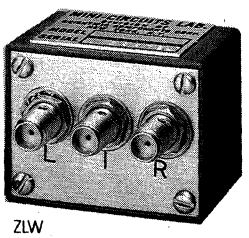
LEVEL 7 (+7 dBm LO, up to +1 dBm RF)

case style selection

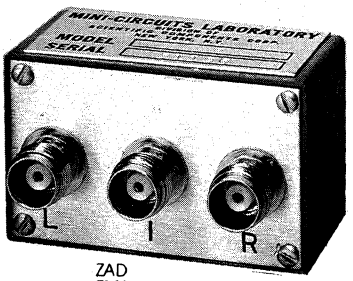
outline drawings see pages 4-9



ZP



ZLW



ZAD
ZMA

	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m Typ.	Mid-Band m Max.	Total Range Typ.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	LO-IF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	PRICE, $ Ea.	Qty.
ZP case GG60	**ZP10514**	.2-500	DC-500	5.5	7.0	6.5	8.5	55	45	50	35	35	30	50	40	36	30	30	20	51.95	(1-49)
ZLW case M21	**ZLW-1**	.5-500	DC-500	5.5	7.0	6.5	8.5	50	45	45	30	35	25	45	35	40	25	30	20	39.95	(4-24)
	ZLW-1W	1-750	DC-750	5.5	7.5	6.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	44.95	(4-24)
	ZLW-1-1	.1-500	DC-500	5.5	7.5	6.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	41.95	(4-24)
	ZLW-2	1-1000	DC-1000	6.0	7.5	7.0	9.5	55	45	40	25	35	20	50	40	40	25	30	20	44.95	(4-24)
	ZLW-3	.025-200	DC-200	5.5	7.5	6.5	8.5	60	50	45	35	35	25	45	35	40	30	30	20	41.95	(4-24)
	ZLW-5	5-1500	10-600	6.5	7.5	6.5	8.5	55	40	35	25	30	20	50	40	35	25	30	20	51.95	(4-24)
	ZLW-6	.003-100	DC-100	5.5	7.5	6.5	8.5	60	50	45	30	35	25	60	45	40	25	30	20	49.95	(4-24)
	ZLW-8	.0005-10	DC-10	6.5	7.5	7.0	8.5	60	50	50	40	45	35	60	50	50	40	45	35	54.95	(4-24)
	ZLW-11	5-2000	10-600	7.0	8.5	7.5	9.0	50	45	35	25	30	20	45	40	30	20	25	15	61.95	(4-24)
	ZLW-12	800-1250	50-90	—	—	6.0	7.5	35	25	35	25	35	25	30	20	30	20	30	20	61.95	(4-24)
ZAD case M22	**ZAD-1**	.5-500	DC-500	5.5	7.0	6.5	8.5	50	45	45	30	35	25	45	35	40	25	30	20	29.95	(4-24)
	ZAD-1W	1-750	DC-750	5.5	7.5	6.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	34.95	(4-24)
	ZAD-1-1	.1-500	DC-500	5.5	7.5	6.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	31.95	(4-24)
	ZAD-2	1-1000	.5-500	5.5	7.5	6.5	8.5	45	30	35	20	30	20	45	30	35	20	30	20	39.95	(4-24)
	ZAD-3	.025-200	DC-200	5.5	7.5	6.5	8.5	60	50	45	35	35	25	45	35	40	30	30	20	31.95	(4-24)
	ZAD-4	5-1250	.5-500	5.5	7.5	6.5	8.5	50	40	40	20	30	20	50	40	40	20	30	20	41.95	(4-24)
	ZAD-6	.003-100	DC-100	5.5	7.5	6.5	8.5	60	50	45	30	35	25	60	45	40	25	30	20	39.95	(4-24)
	ZAD-8	.0005-10	DC-10	6.5	7.5	7.0	8.5	60	50	50	40	45	35	60	50	50	40	45	35	44.95	(4-24)
	ZAD-11	5-2000	10-600	7.0	8.5	7.5	9.0	50	45	35	25	30	20	45	40	30	20	25	15	51.95	(4-24)
	ZAD-12	800-1250	50-90	6.0	7.5	6.0	7.5	35	25	35	25	35	25	30	20	30	20	30	20	51.95	(4-24)

L = low range (f_L to 10 f_L) **M** = mid range (10f_L to f_U/2) **U** = upper range (f_U/2 to f_U)
m = mid band (2f_L to f_U/2)

single-balanced (1 to 3 GHz)

	MODEL NO.	LO/RF f_L-f_U	IF	Mid-Band m* Typ.	Mid-Band m* Max.	Total Range Typ.	Total Range Max.	L* Typ.	L* Min.	M* Typ.	M* Min.	U* Typ.	U* Min.	L* Typ.	L* Min.	M* Typ.	M* Min.	U* Typ.	U* Min.	Ea.	Qty.
ZMA case M23	**ZMA-2***	1-2.5GHz	DC-150	7.0	8.5	8.0	9.0	25	20	22	17	20	15	50	35	40	30	35	25	63.95	(1-9)
	ZMA-3*	1.4-3.0GHz	DC-500	6.5	8.0	7.0	9.0	25	20	28	18	23	15	50	35	50	30	50	30	67.95	(1-9)

***m** = 500MHz ***L** = f_L to (f_L + 500) ***M** = (f_L + 500) to (f_U − 500) ***U** = f_U to (f_U − 500)

NOTES:

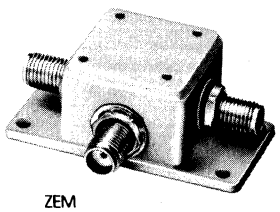
1. For quality control procedures, environmental specifications, and Hi-Rel, MIL and TX description see Table of Contents.
2. Absolute Maximum Ratings: RF Power 50 mW, peak IF current 40 mA.
3. For connector types and case mounting options, see case style outline drawing, see Table of Contents.
4. Prices and specifications subject to change without notice.

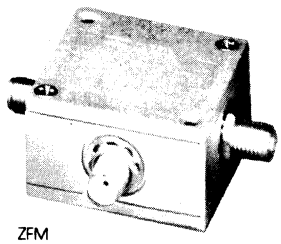
△ Available only with SMA connectors.

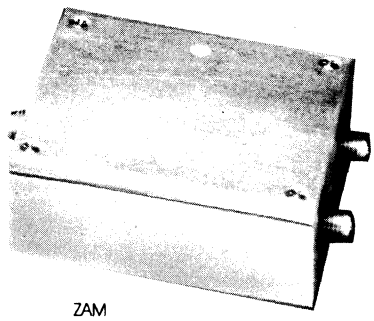
Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

500 Hz to 4.2 GHz

Mini-Circuits


ZEM


ZFM

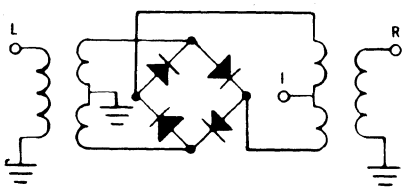

ZAM

	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m Typ.	Mid-Band m Max.	Total Range Typ.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	LO-IF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	PRICE, $ Ea.	Qty.
ZEM case V37	**ZEM-2B**	10-1000	DC-1000	6.0	7.0	6.5	8.5	55	50	30	25	25	20	55	45	30	20	25	20	49.95	(4-24)
	ZEM-4300 NEW	300-4300	DC-1000	—	—	7.5	9.5	40	20	—	—	30	17	15	8	—	—	15	8	71.95	(1-24)
ZFM case K18	**ZFM-1W**	10-750	DC-750	6.0	7.0	6.2	8.0	50	45	45	30	35	25	45	40	40	25	27	20	41.95	(4-24)
	ZFM-2	1-1000	DC-1000	6.0	7.5	7.0	8.5	50	45	40	25	30	25	45	40	35	25	25	20	43.95	(1-24)
	ZFM-3	04-400	DC-400	5.3	7.0	6.0	8.0	60	50	50	35	35	25	55	40	45	30	35	25	51.95	(1-24)
	ZFM-4	5-1250	DC-1250	6.0	7.5	7.5	8.5	50	45	40	30	30	25	45	40	35	25	25	20	51.95	(1-24)
	ZFM-11	1-2000	5-600	7.0	8.5	7.5	9.0	50	45	35	25	25	20	45	40	27	20	25	20	81.95	(1-24)
	ZFM-12	800-1250	50-90	—	—	6.0	7.5	35	25	35	25	35	25	30	20	30	20	30	20	71.95	(1-24)
△	**ZFM-2000**	100-2000	DC-600	6.0	9.5	7.0	9.5	—	—	37	20	—	—	—	—	—	—	30	20	61.95	(1-24)
△	**ZFM-4212**	2000-4200	DC-1300	—	—	7.0	8.5	—	—	25	17	—	—	—	—	18	10	—	—	39.95	(1-9)
ZAM case F14	**ZAM-42**	1500-4200	DC-500	—	—	7.0	8.5	25	14	25	14	25	14	18	10	18	10	18	10	39.95	(1-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

m = mid band (2f_L to f_U/2)

schematic



MIL-M-28837/1A, NSN GUIDE

MCL NO.	NSN
ZAD-1B	5895-00-280-7750
ZAD-4B	5895-01-127-0376
ZAD-6B	5865-21-200-6364
ZEM-2B	5840-01-235-7834
ZFM-2	4935-01-230-3782
ZFM-3 (SMA)	5985-01-214-7362
ZFM-12-1	5825-01-127-3377
ZLW-1W	5840-00-607-7010
ZLW-2B	6920-01-037-1974
ZLW-5-1	4920-01-017-2753
ZMA-3	5865-01-064-0212

coaxial connections

see case style outline drawing

Series	ZP	ZLW	ZAD (ex-2, -4)	ZAD -2, -4	ZMA	ZEM	ZFM	ZAM
models	all models	all models	all models	all models	all models	all models	all models	all models
L	L	1	1	1	1	1	1	2
R	R	3	3	2	2	2	2	1
I	X	2	2	3	3	3	3	3

In Stock...Immediate Delivery

broadband, high dynamic range

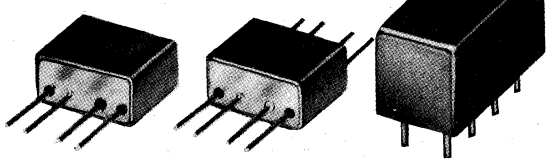
Frequency Mixers

LEVEL 10 (+10dBm LO, up to +5dBm RF)

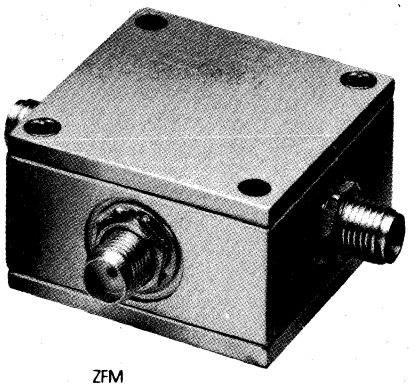
50 KHz to 3 GHz

case style selection

outline drawings see pages 4-9



TFM LMX SRA



ZFM

	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	FREQUENCY MHz IF	CONVERSION LOSS dB Mid-Band m Typ.	Mid-Band m Max.	Total Range Typ.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	LO-IF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	PRICE, $ Ea.	Qty.
TFM case B13	**TFM-15**	10-3000	10-800	6.3	8.0	6.5	8.5	35	25	35	25	35	25	30	20	30	20	30	20	49.95	(1-9)
	TFM-150*	10-2000	DC-1000	6.0	8.0	6.5	8.0	32	25	35	25	35	25	33	20	30	20	30	20	39.95	(1-9)
LMX case BB48	**LMX-123**	10-3000	10-3000	7.5	8.0	7.5	8.5	35	25	35	20	30	15	35	25	30	25	30	20	59.95	(6-24)
	LMX-148	10-1500	DC-1500	6.0	7.0	6.0	10	45	40	35	30	25	20	40	35	35	25	20	12	24.95	(6-24)
SRA case A01	**SRA-2CR**	10-1000	5-500	6.0	7.5	7.0	8.0	50	40	40	30	30	20	40	25	30	18	25	15	16.95	(1-49)
	SRA-215	.05-1500	.05-500	6.0	7.5	7.0	9.0	25	20	35	25	30	20	25	20	35	25	25	15	23.95	(5-24)
	SRA-220	.05-2000	.05-500	6.0	8.0	7.0	9.0	25	20	40	30	30	20	25	20	40	30	25	15	26.95	(5-24)
ZFM case K18	**ZFM-15**	10-3000	10-800	6.3	8.0	6.5	8.5	35	25	35	25	35	25	30	20	30	20	30	20	79.95	(1-9)
	ZFM-150	10-2000	DC-1000	6.0	8.0	6.5	8.0	32	25	35	25	35	20	33	20	30	20	25	20	59.95	(1-9)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

m = mid band (2f_L to f_U/2)

harmonic attenuation

MODEL TFM-15

Harmonics RF Order	RF CAL	1	2	3	4	5	6	7	8	9	10
1	0	0	31	17	42	32	48	47	52	65	59
2	83	38	45	39	48	46	76	69	70	64	71
3	87	39	49	37	52	42	57	63	65	65	65
4	89	64	60	58	56	59	60	62	69	74	70
5	90	74	69	59	72	55	74	58	71	67	72
6	83	83	76	74	67	69	67	72	70	74	78
7	83	76	83	81	79	69	71	66	70	69	77
8	84	75	76	81	82	77	77	80	78	78	77
9	84	77	76	75	82	80	81	82	80	79	80
10	81	76	76	74	75	80	81	81	81	80	81

Harmonic LO Order

Model: TFM
LO = +10 dBm, 969.01 MHz
RF = 0 dBm, 999.1 MHz

NSN GUIDE

MCL NO.	NSN
ZFM-150	5895-01-217-6878

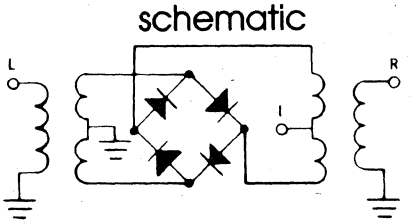
NOTES:

■ NON-HERMETIC

* Below 10 MHz IF, conversion loss increases up to 6dB higher as frequency decreases to DC.

1. For quality control procedures, environmental specifications, and Hi-Rel, MIL and TX description see Table of Contents.
2. Absolute Maximum Ratings, RF power 50 mW/level 10, 200 mW/level 13, peak IF current 40 mA, see Table of Contents.
3. For connector types and case mounting options, see case style outline drawings, see Table of Contents.
4. Prices and specifications subject to change without notice.

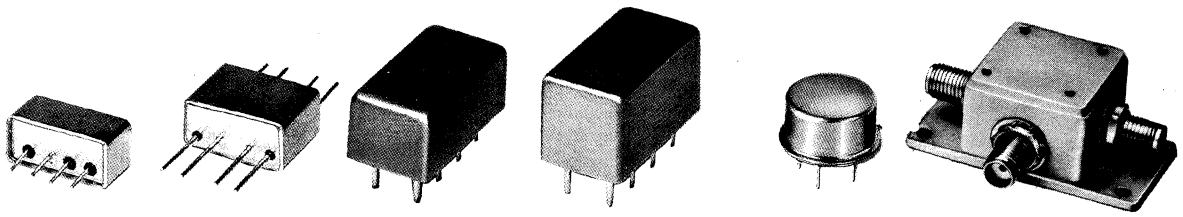
schematic



Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

Mini-Circuits

LEVEL 13 (+13dBm LO, up to +9dBm RF)
25 KHz to 4.2 GHz



TFM-MH LMX-MH SBL-MH SRA-MH ROK-MH ZEM-MH

	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m Typ.	Mid-Band m Max.	Total Range Typ.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	LO-IF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	PRICE, $ Ea.	Qty.
TFM-MH case B02	TFM-1MH	2-500	DC-500	6.0	7.5	7.0	8.5	50	45	40	30	30	20	45	40	35	25	25	20	21.95	(5-24)
	TFM-3MH	1-250	DC-250	5.0	7.0	6.0	8.5	50	45	40	30	28	23	45	40	35	25	26	20	21.95	(5-24)
case B13	TFM-12MH	0.5-2000	0.2-600	5.8	8.0	7.2	9.5	60	45	35	30	30	25	55	40	30	25	25	20	44.95	(1-24)
	TFM-42MH	10-4200	10-1000	7.3	8.5	7.5	11	35	25	40	25	35	25	35	20	35	25	27	20	59.95	(1-24)
LMX-MH case BB48	LMX-125MH	0.5-500	DC-500	6.0	7.0	7.0	9.0	45	40	45	40	40	30	45	40	40	35	35	25	54.95	(6-24)
■ SBL-MH case A06	SBL-1MH	1-500	DC-500	5.5	7.5	6.5	8.5	50	35	45	30	35	25	45	30	40	25	30	20	9.50	(10-49)
	SBL-1ZMH	2-1100	DC-500	6.5	8.0	7.0	9.0	50	40	40	30	30	20	40	30	25	20	25	15	10.95	(5-49)
SRA-MH case A01	SRA-1MH	.5-500	DC-500	5.5	7.0	6.5	8.5	50	45	45	30	35	25	45	35	40	25	30	20	13.95	(5-24)
	SRA-3MH	.025-200	DC-200	5.5	7.5	6.5	8.5	60	50	45	35	35	25	45	35	40	30	30	20	15.95	(5-24)
	SRA-2010MH	10-2000	DC-600	7.4	8.5	7.8	9.0	50	45	45	30	40	30	45	45	35	30	35	25	34.95	(1-24)
ROK-MH case QQ96	ROK-186MH	5-2500	10-1000	6.4	8.5	7.0	9.5	33	25	35	25	25	20	33	20	31	25	27	20	42.95	(1-24)
NEW ZEM-MH case V37	ZEM-4300MH	300-4300	DC-1000	—	—	7.0	8.5	40	20	—	—	40	20	14	7	—	—	12	7	81.95	(1-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

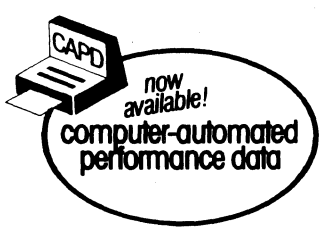
m = mid band (2f_L to f_U/2)

pin and coaxial connections

see case style outline drawing

Series	TFM	LMX	SRA	ZFM	TFM-MH		LMX-MH	SBL-MH		SRA-MH		ROK-MH
Models	all models	all models	all models except −2CR**	all models	-1MH -3MH -12MH	-42MH	all models	-1MH	-1ZMH	-1MH -3MH	-2010MH	all models
LO	1	8	8	1	4	1	8	8	1	8	8	5
RF	4	5	1	2	1	4	5	1	8	1	1	11
IF	2	4	3	3	2	2	4	3,4*	3	3,4*	3	2
GND	3	1,2,3,6,7	2,5,6,7	—	3	3	1,2,3,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	GND } 8,1,3,4,6 7,9,10,12
CASE GND	3	1,2,3,6,7	2,5,6,7	—	3	3	1,2,3,6,7	—	2,5,6,7	2	2,5,6,7 4 open	

*pins must be connected together externally **model SRA−2CR LO is pin 1, RF is pin 8



In Stock...Immediate Delivery

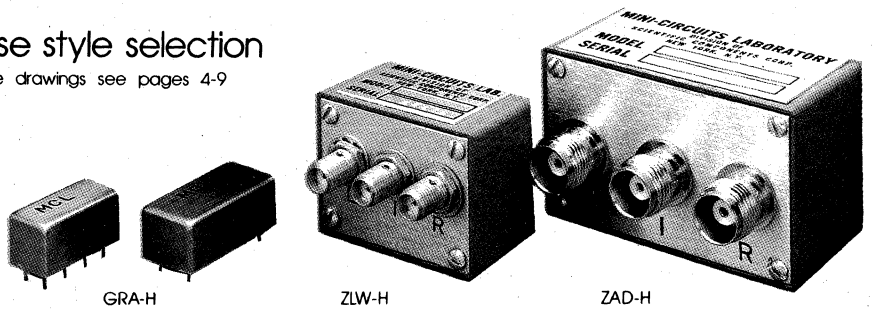
very high dynamic range

Frequency Mixers

LEVEL 17 (+17 dBm LO, up to +10 dBm RF)

case style selection

outline drawings see pages 4-9



SRA-H GRA-H ZLW-H ZAD-H

	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m Typ.	Mid-Band m Max.	Total Range Typ.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	LO-IF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	PRICE, $ Ea.	Qty.
SRA-H case A01	● SRA-1H	.5-500	DC-500	5.5	7.5	6.5	8.5	55	45	45	30	35	25	45	35	40	30	30	20	17.95	(5-24)
	● SRA-1WH	1-750	DC-750	5.5	7.5	6.5	8.5	50	40	45	25	35	25	45	35	40	30	30	20	21.95	(5-24)
	● SRA-2H	2-1000	DC-1000	6.0	7.5	8.5	10	50	40	35	25	35	25	45	30	30	20	25	20	29.95	(5-24)
	● SRA-3H	.05-200	DC-200	5.5	7.0	5.5	7.5	50	45	40	30	35	25	45	35	40	30	30	20	19.95	(5-24)
	SRA-11H	10-3000	10-1000	8.0	10	10	12	27	20	25	18	23	16	27	20	25	18	23	16	39.95	(1-24)
	SRA-173H	5-1200	DC-1200	6.0	7.0	7.0	8.5	40	35	35	25	35	20	40	35	35	20	30	20	29.95	(1-5)
GRA-H case D08	GRA-1H	.5-500	DC-500	5.5	7.5	6.5	8.5	55	45	45	30	35	25	45	35	40	30	30	20	18.95	(5-24)
	GRA-3H	.05-200	DC-200	5.5	7.0	5.5	7.5	55	45	45	30	35	25	45	35	40	30	30	20	20.95	(5-24)
	GRA-6H	.01-50	DC-50	5.5	6.0	5 5	7.0	50	45	45	30	35	25	50	40	47	35	32	25	26.95	(5-24)
ZLW-H case M21	● ZLW-1H	.5-500	DC-500	5.5	7.5	6.5	8.5	55	45	45	30	35	25	45	35	40	30	30	20	45.95	(4-24)
	● ZLW-1WH	1-750	DC-750	5.5	7.5	6.5	8.5	50	45	45	25	35	25	45	35	40	25	30	20	49.95	(4-24)
	● ZLW-2H	2-1000	DC-1000	6.0	7.5	8.5	10	50	40	35	25	35	25	45	35	30	20	25	20	59.95	(4-24)
	● ZLW-3H	.05-200	DC-200	5.5	7.0	5.5	7.5	55	45	45	30	35	25	45	35	40	30	30	20	47.95	(4-24)
	ZLW-11H	10-3000	10-1000	8.0	10	10	12	27	20	25	18	23	16	27	20	25	18	23	16	91.95	(4-24)
ZAD-H case M22	● ZAD-1H	.5-500	DC-500	5.5	7.5	6.5	8.5	50	45	45	30	35	25	45	35	40	30	30	20	35.95	(4-24)
	● ZAD-1WH	1-750	DC-750	5.5	7.5	6.5	8.5	50	45	45	25	35	25	45	35	40	25	30	20	39.95	(4-24)
	● ZAD-2H	2-1000	DC-1000	6.0	7.5	8.5	10	50	40	35	25	35	25	45	35	30	20	25	20	49.95	(4-24)
	● ZAD-3H	.05-200	DC-200	5.5	7.0	5.5	7.5	55	45	45	30	35	25	45	35	40	30	30	20	37.95	(4-24)
	ZAD-11H	10-3000	10-1000	8.0	10	10	12	27	20	25	18	23	16	27	20	25	18	23	16	81.95	(4-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

m = mid band (2f_L to f_U/2)

NOTES:

● HTRB tested

1. For quality control procedures, environmental specifications, and Hi-Rel, MIL and TX description see Table of Contents.
2. Absolute Maximum Ratings, RF power 200 mW, peak IF current 40 mA, see Table of Contents.
3. For connector types and case mounting options, see case style outline drawings, see Table of Contents.
4. Prices and specifications subject to change without notice.

MIL-M-28837/1A, NSN GUIDE

MCL NO.	NSN	MIL-M-28837/1A*
GRA-1H		06N
GRA-1H HI-REL		06S
GRA-1H		10N
GRA-1H		10S
GRA-3H	5895-01-171-0974	05N
GRA-3H Hi-Rel		05S
SRA-1H	6625-00-594-0223	08N
SRA-1 Hi-Rel		08S
SRA-1WH	5840-00-576-0716	
SRA-2H	5895-01-063-1078	
SRA-3H	5895-01-117-4537	
SRA-11H	5895-01-192-0173	
SRA-11H-TX	5895-01-137-9278	
ZAD-1WH	5895-01-045-4647	
ZAD-3H	5895-01-149-0771	
ZLW-1H	5985-01-080-7637	
ZLW-1H-B	5962-045-7500	

*units are not QPL-listed

pin and coaxial connections

see case style outline drawing

Series	SRA					GRA-H	ZLW-H	ZAD-H
Models	-1H -3H	-1WH -2H	-11H	-173H Configuration 1	-173H Configuration 2	all models	all models	all models
LO	8	8	8	3,4*	8	1	1	1
RF	1	1	1	1	1	6	3	3
IF	3,4*	3,4*	3	8	3,4*	4	2	2
GND	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,3,5	—	—
CASE GND	2	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	—	—	—

*pins must be connected together externally

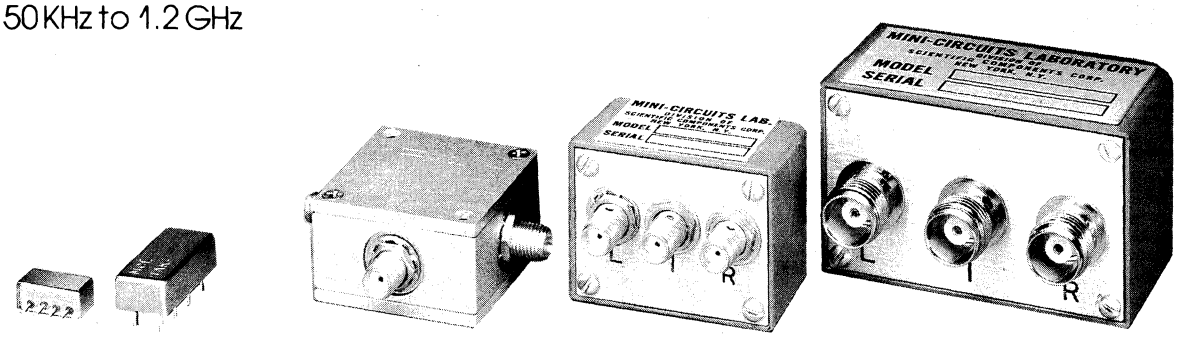
Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

very low distortion

LEVEL 17S (+17dBm LO, up to +14dBm RF)

50 KHz to 1.2 GHz

Mini-Circuits



TFM-H TAK-H ZFM-H ZLW-SH ZAD-SH

	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	FREQUENCY MHz IF	CONVERSION LOSS dB Mid-Band m Typ.	Mid-Band m Max.	Total Range Typ.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	LO-IF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	PRICE, $ Ea.	Qty.
TFM-H case B02	TFM-1H	2-500	DC-500	6.0	7.5	7.0	8.5	50	45	40	30	30	20	45	40	35	25	25	20	23.95	(5-24)
	TFM-2H	5-1000	DC-1000	6.2	7.0	7.0	10	50	45	40	30	30	20	45	40	35	25	25	17	31.95	(5-24)
	TFM-3H	.1-250	DC-250	5.0	7.0	6.0	8.5	50	45	40	30	28	23	45	40	35	25	26	20	23.95	(5-24)
case B13	TFM-4H	5-1200	DC-1200	6.5	8.0	7.0	9.0	50	40	35	25	30	20	50	40	35	20	30	20	33.95	(5-24)
TAK-H case A05	TAK-1H	2-500	DC-500	6.0	7.5	7.0	8.5	50	40	40	30	30	25	45	35	35	25	25	20	19.95	(5-24)
	TAK-1WH	5-750	DC-750	6.2	7.5	7.0	9.0	50	40	40	30	30	25	45	35	35	25	30	20	23.95	(5-24)
	TAK-3H	.05-300	DC-300	5.0	7.0	6.0	8.5	55	45	40	30	30	25	50	40	35	25	25	20	21.95	(5-24)
ZFM-H case K18	ZFM-1H	2-500	DC-500	6.0	7.5	7.0	8.5	50	45	40	30	30	25	45	35	35	25	25	20	53.95	(1-24)
	ZFM-2H	5-1000	DC-1000	6.2	7.0	7.0	10	50	40	40	30	30	20	45	40	35	25	25	17	61.95	(1-24)
	ZFM-3H	05-300	DC-300	5.0	7.0	6.0	8.5	55	45	40	30	30	25	50	40	35	25	25	20	54.95	(1-24)
	ZFM-4H	5-1200	DC-1200	6.5	8.0	7.0	9.0	50	40	35	25	30	20	50	40	35	20	30	20	63.95	(1-24)
ZLW-SH case M21	ZLW-1SH	2-500	DC-500	6.0	7.5	7.0	8.5	50	40	40	30	30	25	45	35	35	25	25	20	50.95	(4-24)
	ZLW-1WSH	5-750	DC-750	6.2	7.5	7.0	9.0	50	45	40	30	30	20	45	40	35	25	30	20	54.95	(4-24)
	ZLW-3SH	05-300	DC-300	5.0	7.0	6.0	8.5	55	45	40	30	30	25	50	40	35	25	25	20	52.95	(4-24)
ZAD-SH case M22	ZAD-1SH	2-500	DC-500	6.0	7.5	7.0	8.5	50	40	40	30	30	25	45	35	35	25	25	20	40.95	(4-24)
	ZAD-1WSH	5-750	DC-750	6.2	7.5	7.0	9.0	50	45	40	30	30	20	45	40	35	25	30	20	44.95	(4-24)
	ZAD-3SH	05-300	DC-300	5.0	7.0	6.0	8.5	55	45	40	30	30	25	50	40	35	25	25	20	42.95	(4-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

m = mid band (2f_L to f_U/2)

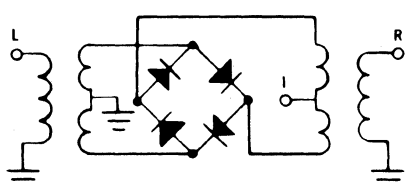
Two-Tone 3rd order IM below IF

each tone (0 dBm, 200 and 202 mHz), LO (+17 dBm, 180 MHz)
all models 60 dB typ. 55 dB min.
except 55 dB typ. 45 dB min. for TFM-3H, TAK-3H, ZFM-3H, ZLW-3SH, ZAD-3SH

NOTES:

1. For quality control procedures, environmental specifications, and Hi-Rel, MIL and TX description see Table of Contents.
2. Absolute Maximum Ratings, RF power 200 mW, peak IF current 40 mA, see Table of Contents.
3. For connector types and case mounting options, see case style outline drawings, Table of Contents.
4. Prices and specifications subject to change without notice.

schematic



pin and coaxial connections

see case style outline drawing

Series	TFM-H	TAK-H		ZFM-H	ZLW-SH	ZAD-SH
Models	all models	-1H -3H	-1WH	all models	all models	all models
LO	4	8	8	1	1	1
RF	1	1	1	2	3	3
IF	2	3,4*	3,4*	3	2	2
GND	3	2,5,6,7	2,5,6,7	—	—	—
CASE GND	3	2	2,5,6,7	—	—	—

*pins must be connected externally

MIL-M-28837/1A, NSN GUIDE

MCL NO.	NSN	MIL-M-28837/1A*
TAK-1H	5895-01-167-9721	
TAK-1WH	5895-01-189-9481	
TFM-1H	5895-01-129-0110	
TFM-2H	5985-01-235-1274	

In Stock...Immediate Delivery

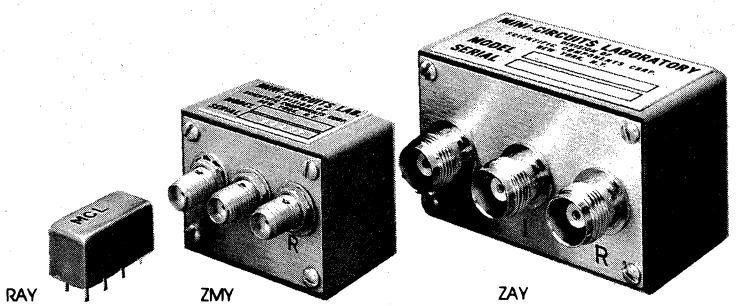
ultra-low distortion

Frequency Mixers

LEVEL 23 (+23dBm LO, up to +15dBm RF)
10 KHz to 1 GHz

case style selection

outline drawings see pages 4-9



	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m Typ.	Mid-Band m Max.	Total Range Typ.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	LO-IF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	PRICE, $ Ea.	Qty.
RAY case A01	●RAY-1	5-500	DC-500	6.0	7.5	7.5	8.5	55	45	40	30	30	25	55	45	40	30	30	20	34.95	(4-9)
	●RAY-2	10-1000	DC-1000	7.0	8.5	8.5	10	50	35	40	30	35	25	50	35	35	25	25	20	54.95	(4-9)
	●RAY-3	.07-200	DC-200	6.0	7.5	6.5	8.0	55	45	40	30	30	25	55	45	40	30	30	20	34.95	(4-9)
	RAY-6	0.01-50	DC50	5.5	7.5	6.5	8.5	60	50	45	30	35	25	60	45	40	25	30	20	41.95	(4-24)
	RAY-11 NEW	100-2500	DC-500	6.5	9.0	7.0	9.0	35	25	32	25	32	25	14	10	20	10	20	10	64.95	(1-24)
ZMY case M21	●ZMY-1	5-500	DC-500	6.0	7.5	7.5	8.5	55	45	40	30	30	25	55	45	40	30	30	20	57.95	(1-9)
	●ZMY-2	10-1000	DC-1000	7.0	8.5	8.5	10	50	35	40	30	35	25	50	35	35	25	25	20	77.95	(1-9)
	●ZMY-3	.07-200	DC-200	6.0	7.5	6.5	8.0	55	45	40	30	30	25	55	45	40	30	30	20	57.95	(1-9)
ZAY case M22	●ZAY-1	5-500	DC-500	6.0	7.5	7.5	8.5	55	45	40	30	30	25	55	45	40	30	30	20	47.95	(1-9)
	●ZAY-2	10-1000	DC-1000	7.0	8.5	8.5	10	50	35	40	30	35	25	50	35	35	25	25	20	67.95	(1-9)
	●ZAY-3	.07-200	DC-200	6.0	7.5	6.5	8.0	55	45	40	30	30	25	55	45	40	30	30	20	47.95	(1-9)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

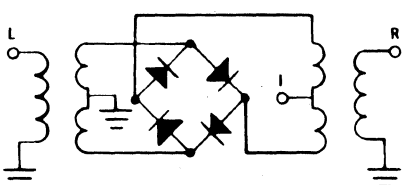
m = mid band (2f_L to f_U/2)

NOTES:

● HTRB tested

1. For quality control procedures, environmental specifications, and Hi-Rel, MIL and TX description see Table of Contents.
2. Absolute Maximum Ratings; RF power 350 mW for level 23, 23S and 500 mW for level 27. Peak IF current 40 mA.
3. For connector types and case mounting options, see case style outline drawing, see Table of Contents.
4. Prices and specifications subject to change without notice.

schematic



pin and coaxial connections

see case style outline drawing

Series	RAY				ZMY	ZAY	SAY	ZFY	VAY
Models	−1 −3	−2	−6	−11	all models	all models	all models	all models	all models
LO	8	8	8	1	1	1	8	1	8
RF	1	1	1	8	3	3	1	2	1
IF	3,4*	3,4*	3,4*	3	2	2	3	3	3
GND	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	—	—	2,5,6,7	—	2,5,6,7
CASE GND	2	2,5,6,7	—	2,5,6,7	—	—	2,5,6,7	—	2,5,6,7

*pins must be connected externally

MIL-M-28837/1A, NSN GUIDE

MCL NO.	NSN	MIL-M-28837/1A*
RAY-1	5825-01-105-6188	04N
RAY-1 Hi-Rel		04S
RAY-2	5895-01-111-7368	
RAY-3	5895-01-064-5082	
ZMY-2	4935-01-080-7636	
SAY-11	5895-01-199-3893	
VAY-1	5985-01-232-5890	
ZMY-1B	5840-01-213-3888	

*units are not QPL listed

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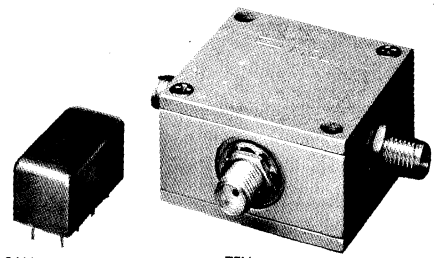
FAX (718) 332-4661 TELEX 6852844 or 620156

Mini-Circuits

LEVEL 23S (+23dBm LO, up to +20dBm RF)
100 KHz to 2.4 GHz



SAY ZFY

	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	FREQUENCY MHz IF	CONVERSION LOSS dB Mid-Band m Typ.	Mid-Band m Max.	Total Range Typ.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	LO-IF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	PRICE, $ Ea.	Qty.
SAY case A01	SAY-1	0.1-500	.01-500	5.3	6.0	5.3	7.5	40	20	46	35	40	30	37	23	46	35	40	30	54.95	(1-9)
	SAY-2	0.1-1000	.01-500	5.3	7.5	7.5	9.5	40	20	40	30	30	25	37	23	40	25	25	20	59.95	(1-9)
	SAY-11	10-2400	5-1000	7.0	8.5	8.0	10	28	20	26	20	25	20	28	20	26	20	25	20	64.95	(1-9)
ZFY case K18	ZFY-1	0.1-500	.01-500	5.3	6.0	5.3	7.5	40	20	46	35	40	30	37	23	46	35	40	30	74.95	(1-9)
	ZFY-2	0.1-1000	.01-500	5.3	7.5	7.5	9.5	40	20	40	30	30	25	37	23	40	25	25	20	79.95	(1-9)
	ZFY-11	10-2400	5-1000	7.0	8.5	8.0	10	28	20	26	20	25	20	28	20	26	20	25	20	84.95	(1-9)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)
m = mid band (2f_L to f_U/2)

LEVEL 27 (+27dBm LO, up to +24dBm RF)
50 KHz to 500 MHz

VAY-1

	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	FREQUENCY MHz IF	CONVERSION LOSS dB Mid-Band m Typ.	Mid-Band m Max.	Total Range Typ.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	LO-IF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	PRICE, $ Ea.	Qty.
VAY-1 case A01	VAY-1	.05-500	.02-500	6.0	7.5	7.5	8.5	47	40	46	35	35	25	47	40	46	35	35	25	74.95	(1-9)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)
m = mid band (2f_L to f_U/2)

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power splitters combiners

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2KHz to 4.2GHz from $9.95

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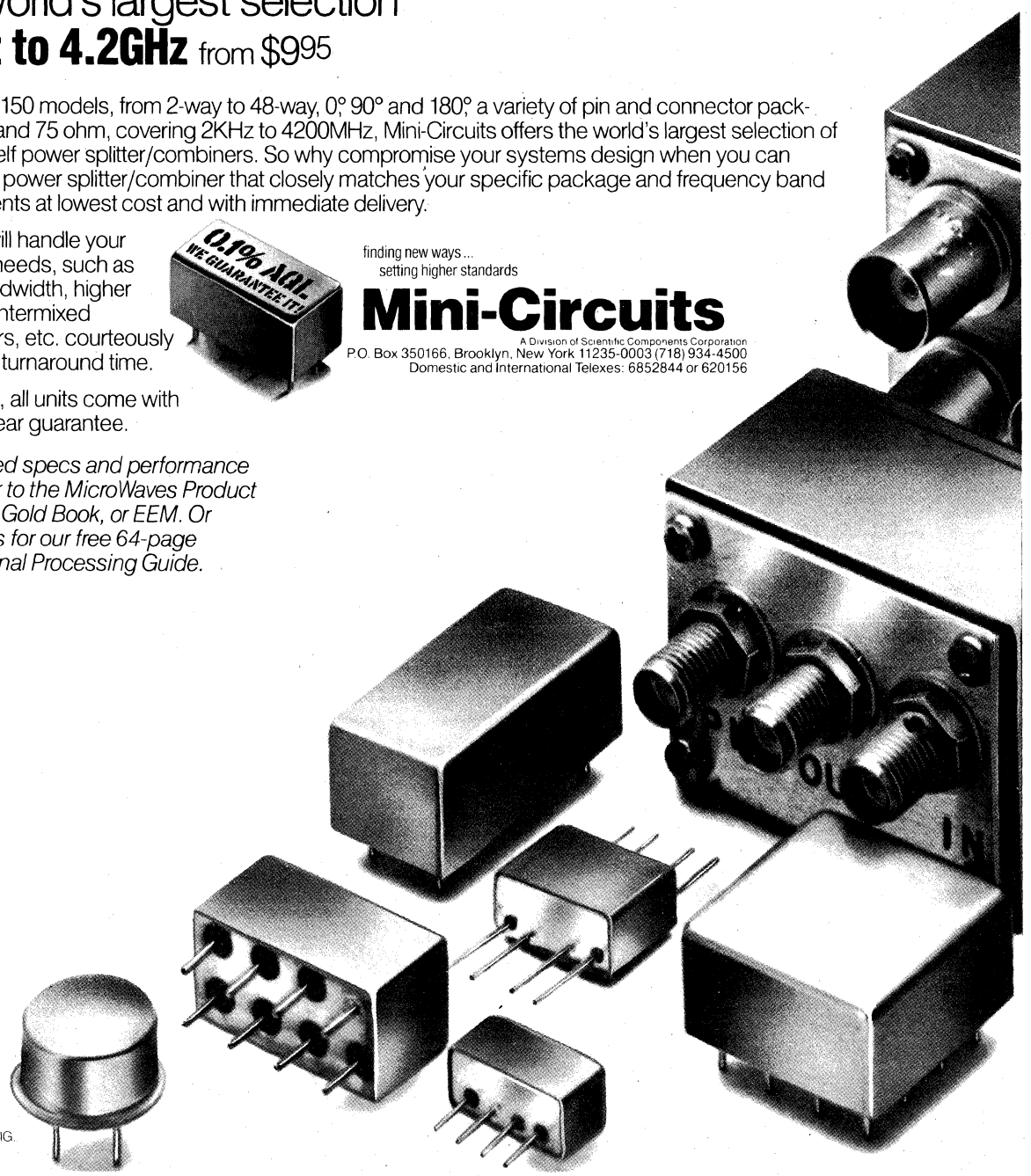
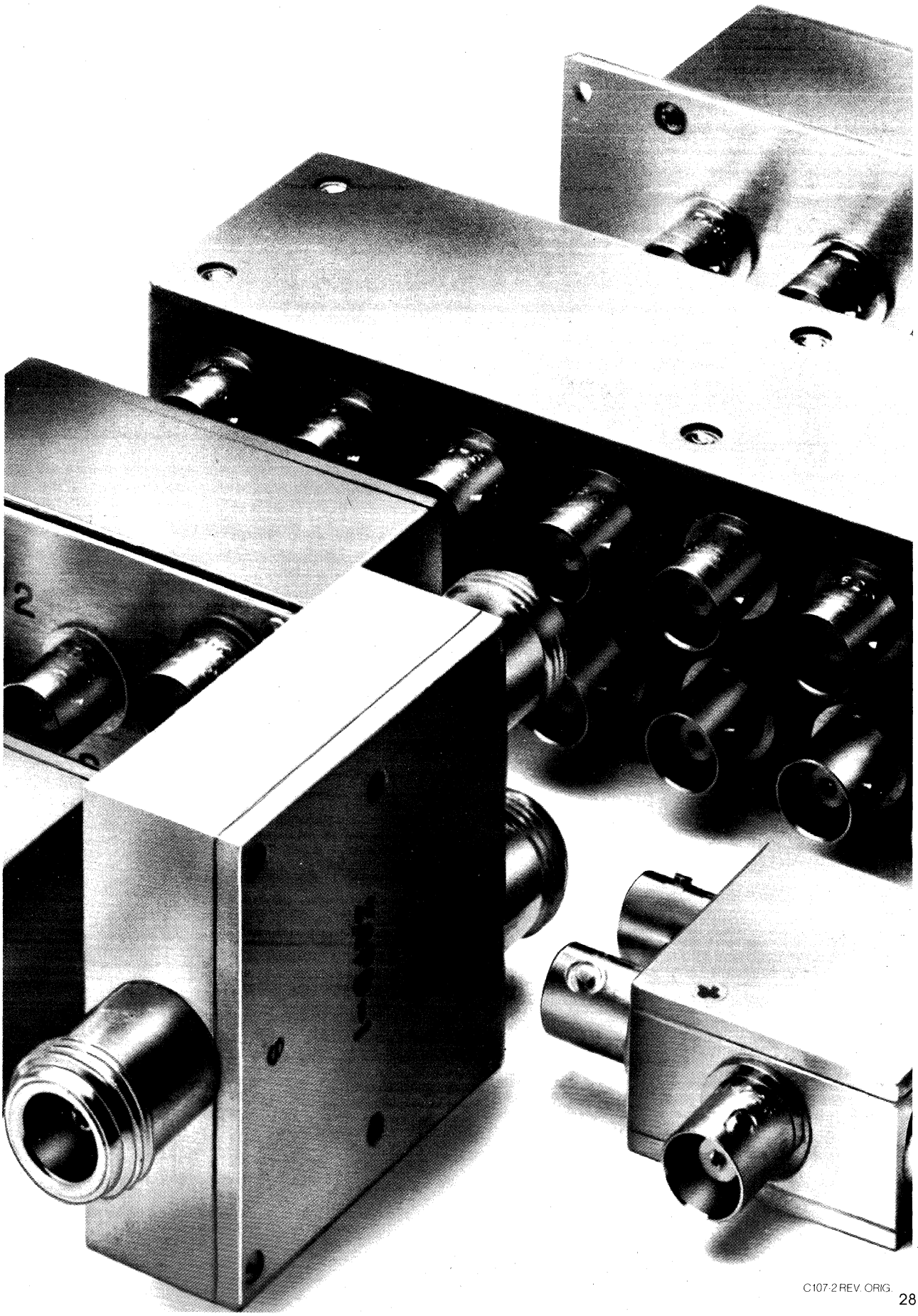


C107-1 REV. ORIG.



C107-2 REV. ORIG.

28

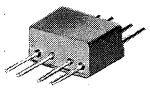
Power Splitter/Combiners

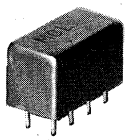
2 WAY-0°

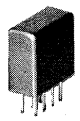
DC to 4.2 GHz

case style selection

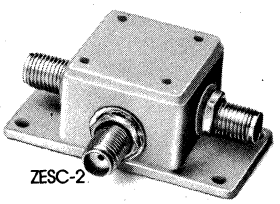
outline drawings see pages 4-9


LPS


PSC-2


MSC-2

TSC-2

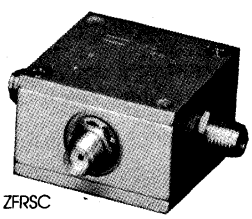

ZESC-2

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 3dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE, $ Ea.	Qty.
LPS case BB48	**LPS-109**	10-500	35	25	30	25	30	25	0.3	0.5	0.4	0.6	0.5	1.1	2.0	3.0	2.0	0.15	0.2	0.3	15.95	(5-24)
PSC-2 case A01	**PSC-2-1**	0.1-400	20	15	25	20	25	20	0.2	0.6	0.4	0.75	0.6	1.0	2.0	3.0	4.0	0.15	0.2	0.3	9.95	(6-49)
	PSC-2-1W	1-650	25	20	35	20	25	20	0.3	0.6	0.5	0.9	0.7	1.0	2.0	3.0	4.0	0.15	0.2	0.3	14.95	(6-49)
	PSC-2-2	0.004-60	27	20	30	20	27	20	0.3	0.6	0.3	0.6	0.6	1.0	2.0	3.0	4.0	0.15	.25	0.3	19.95	(6-49)
	PSC-2-4	10-1000	30	25	25	20	25	20	0.6	1.0	0.6	1.2	0.7	1.2	2.0	8.0	20	0.15	0.2	0.4	19.95	(6-49)
	PSC-2-45	700-900	—	—	20	17	—	—	—	—	0.2	0.4	—	—	—	3	—	—	0.2	—	18.95	(6-49)
	■ **PSC-2375**	55-85	—	—	35	25	—	—	—	—	0.3	0.5	—	—	—	1.0	—	—	0.1	—	19.95	(6-24)
	■ **PSC-2-1-75**	0.25-300	20	15	30	20	20	15	0.4	0.75	0.4	0.75	0.4	1.0	2.0	3.0	5.0	0.15	0.2	0.3	11.95	(6-49)
	■ **PSC-2-4-752**	10-850	31	20	32	23	23	15	0.3	0.5	0.4	0.6	0.5	1.0	2	5	10	0.1	0.2	0.5	19.95	(6-49)
MSC-2 case A03	**MSC-2-1**	0.1-450	20	15	30	20	30	20	0.3	0.5	0.4	0.75	0.6	1.0	2.0	3.0	4.0	0.15	0.2	0.3	16.95	(5-24)
	MSC-2-1W	2-650	22	18	30	20	22	18	0.3	0.5	0.5	0.8	0.8	1.2	1.0	2.0	4.0	0.3	0.2	0.3	17.95	(5-24)
TSC-2 case B02	**TSC-2-1**	1-400	30	25	30	25	30	20	0.25	0.5	0.4	0.75	0.8	1.0	2.0	3.0	4.0	0.15	0.2	0.6	13.95	(5-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

2 WAY-0° RESISTIVE

DC to 4.2 GHz


ZFRSC

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB *L Typ.	M Typ.	U Typ.	INSERTION LOSS, dB Above 6dB *L Typ.	*L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees *L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB *L Max.	M Max.	U Max.	PRICE, $ Ea.	Qty.
ZFRSC case K18	† **ZFRSC-42**	DC-4200	6.2	6.5	7.0	0.1	0.2	0.1	0.5	0.4	1.4	1	3	5	0.1	0.2	0.5	59.95	(1-9)
	■ **ZFRSC-2075**	DC-2000	6.2	6.6	7.0	0.1	0.2	0.3	0.6	0.5	1.4	1	2	5	0.1	0.2	0.5	59.95	(1-9)
	▲ **ZFRSC-2050** NEW	DC-2000	6.2	6.6	7.0	0.1	0.2	0.3	0.6	0.5	1.4	1	2	5	0.1	0.2	0.5	59.95	(1-9)

*L = DC-100MHz M = mid range (100MHz to f_U/2) U = upper range (f_U/2 to f_U)

Above models are resistive power dividers to enable frequency coverage from dc to the highest rated frequency. Since resistive power dividers do not provide a high degree of isolation (basically isolation equals the insertion loss between ports), an amplifier such as Mini-Circuits' ZFL series is recommended when high isolation is required. Matched power rating 0.75W, internal load dissipation 0.375W.

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50 ohms and 75 ohms

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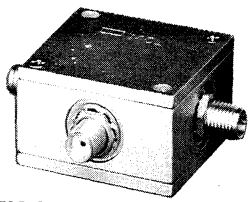
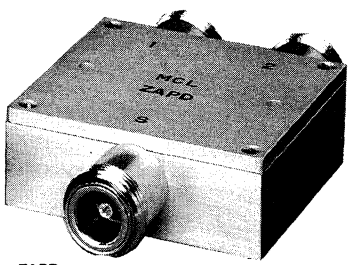
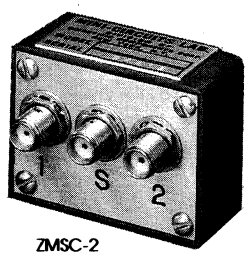
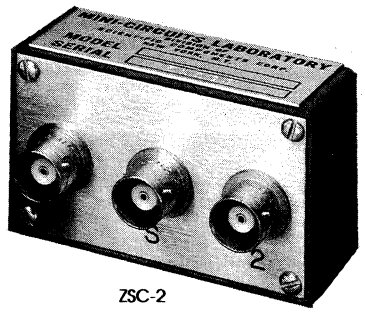

ZFSC-2



ZAPD



ZMSC-2



ZSC-2

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 3dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE, $ Ea.	Qty.
ZFSC-2	ZFSC-2-1	5-500	30	25	28	20	25	20	0.2	0.5	0.3	0.6	0.6	0.8	2.0	4.0	4.0	.15	.15	0.3	31.95	(4-24)
case K18	■ ZFSC-2-1-75	0.25-300	20	15	30	25	20	20	0.4	0.75	0.4	0.75	0.4	1.0	2.0	3.0	5.0	.15	0.2	0.3	32.95	(4-24)
	ZFSC-2-1W	1-750	30	20	28	20	25	20	0.2	0.5	0.4	0.8	0.8	1.0	2.0	4.0	4.0	.15	.15	0.3	35.95	(4-24)
	ZFSC-2-2	10-1000	30	20	25	20	23	18	0.2	0.5	0.5	1.0	0.9	1.2	2.0	4.0	4.0	.15	.15	0.3	39.95	(4-24)
	ZFSC-2-4	0.2-1000	20	15	25	20	23	18	0.2	0.5	0.5	1.0	0.9	1.2	2.0	4.0	4.0	.15	.15	0.3	44.95	(4-24)
	ZFSC-2-5	10-1500	25	15	30	20	25	18	0.25	0.6	0.5	1.0	0.8	1.5	5.0	8.0	10.0	.15	0.2	0.5	49.95	(4-24)
	△ZFSC-2-6	0.002-60	27	20	30	20	27	20	0.3	0.6	0.3	0.6	0.6	1.0	2.0	3.0	4.0	.15	0.2	0.3	36.95	(4-24)
	ZFSC-2-6-75	0.004-60	30	20	35	20	25	20	0.5	0.8	0.4	0.8	0.7	1.0	1.0	2.0	3.0	.15	0.2	0.3	38.95	(4-24)
	ZFSC-2-11	10-2000	14	10	16	14	20	15	1.2	1.5	1.2	1.5	1.0	2.2	1	2	4	0.2	0.3	0.5	59.95	(1-24)
NEW	‡ZFSC-2-2500	10-2500	16	11	17	14	17	14	0.5	0.8	0.6	1.4	0.8	1.5	1	4	8	0.2	0.3	0.4	69.95	(1-24)
ZESC-2																						
case V37	ZESC-2-11 NEW	10-2000	19	10	18	13	20	11	0.5	0.9	0.5	1.0	0.6	1.2	1	3	6	0.2	0.3	0.5	64.95	(1-24)
		GHz																				
ZAPD	ZAPD-1	0.5-1.0	25	19	25	19	25	19	0.25	0.6	0.25	0.6	0.25	0.6	—	1	—	—	0.2	—	39.95	(1-9)
case F14	ZAPD-2	1.0-2.0	25	19	25	19	25	19	0.25	0.6	0.25	0.6	0.25	0.6	—	2	—	—	0.2	—	39.95	(1-9)
	ZAPD-4	2.0-4.2	25	19	25	19	25	19	0.4	0.8	0.4	0.8	0.4	0.8	—	6	—	—	0.4	—	44.95	(1-9)
case F53	ZAPD-21	0.5-2.0	25	18	—	—	25	18	0.25	0.8	—	—	0.25	1.0	—	3	—	—	0.2	—	49.95	(1-9)
		MHz																				
ZMSC-2	ZMSC-2-1	0.1-400	20	15	25	20	25	20	0.2	0.5	0.4	0.75	0.6	1.0	2.0	3.0	4.0	.15	0.2	0.3	37.95	(4-24)
case M21	ZMSC-2-1W	1-650	25	20	35	20	25	20	0.3	0.5	0.5	0.8	0.7	1.0	2.0	3.0	4.0	.15	0.2	0.3	42.95	(4-24)
	△ZMSC-2-2	0.002-60	27	20	30	20	27	20	0.3	0.6	0.3	0.6	0.6	1.0	2.0	3.0	4.0	.15	.25	0.3	47.95	(4-24)
ZSC-2	ZSC-2-1	0.1-400	20	15	25	20	25	20	0.2	0.5	0.4	0.75	0.6	1.0	2.0	3.0	4.0	.15	0.2	0.3	27.95	(4-24)
case M22	ZSC-2-1W	1-650	25	20	35	25	25	20	0.3	0.5	0.5	0.8	0.7	1.0	2.0	3.0	4.0	.15	0.2	0.3	32.95	(4-24)
	△ZSC-2-2	0.002-60	25	20	30	20	27	20	0.3	0.6	0.3	0.6	0.6	1.0	2.0	3.0	4.0	.15	.25	0.3	37.95	(4-24)
NEW	▲ZSC-2-2-75	0.002-60	25	20	30	20	27	20	0.3	0.6	0.3	0.6	0.6	1.0	2.0	3.0	4.0	.15	.25	0.3	37.95	(4-24)
	ZSC-2-4	10-1000	25	20	35	20	25	20	0.2	0.5	0.5	0.8	0.7	1.3	2.0	4.0	6.0	.15	0.2	0.3	37.95	(4-24)
	■ ZSC-2375	55-85	35	25	35	25	35	25	0.3	0.5	0.3	0.5	0.3	0.5	—	1.0	—	—	0.1	—	37.95	(4-24)
	■ ZSC-2-1-75	0.25-300	20	15	30	20	20	15	0.4	0.75	0.4	0.75	0.4	1.0	2.0	3.0	5.0	.15	0.2	0.3	29.95	(4-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

NOTES:

■ Denotes 75 ohm models, 75 ohm BNC connectors are standard
† Available only with SMA connectors.
△ Isolation specified to 0.004 MHz.
▲ Available only with BNC connectors.

1. For Quality Control procedures, see Table of Contents.
2. For environmental specifications, see Table of Contents.
3. Absolute Maximum Ratings. Matched power rating ZAPD, 10W all other models 1 W internal load dissipation 0.125W.
4. For connector types and case mounting options, see case style outline drawing.
5. Prices and specifications subject to change without notice.

‡Available only with SMA connectors.

pin and coaxial connections

see case style outline drawing

Series	Sum Port	Port 1	Port 2	Ground
LPS	1	4	5	2,3,6,7,8
PSC-2	1	5	6	2,3,4,7,8
MSC-2	1	5	6	2,3,4,7,8
TSC-2	1	2	4	3
ZFSC-2	3	1	2	—
ZAPD-2	3	1	2	—
ZMSC-2	2	1	3	—
ZSC-2	2	1	3	—

MIL-P-23971/15, NSN GUIDE

MCL NO.	NSN	MIL-P-23971/15*
MSC-2-1	6625-01-124-8595	02
PSC-2-1	5820-00-548-0739	01
PSC-2-1W	5895-01-190-7701	
PSC-2-2	5825-01-044-8944	
PSC-2-4	6625-01-230-0492	
ZAPD-2 (SMA)	5985-01-229-7431	
ZAPD-4	6625-01-173-1887	
ZFSC-2-1	6625-01-139-3499	
ZFSC-2-1W (SMA)	6625-01-200-5094	
ZFSC-2-2A	6625-02-079-7021	
ZFSC-2-4A	5825-01-226-7956	
ZMSC-2-1W	5895-01-127-0232	
ZSC-2-1-BNC	5895-01-036-6254	
ZSC-2-1B	5820-00-270-3055	
ZSC-2-1-B-TNC	5820-01-109-3706	
ZSC-2-1-75B	5821-01-136-8182	
ZSC-2-2-75B	5915-01-012-8162	

*units are not QPL listed

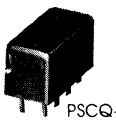
Power Splitter/Combiners

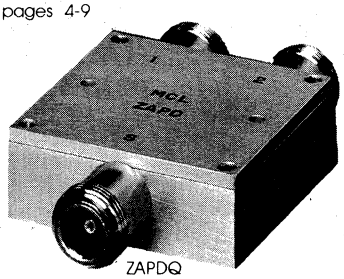
2 WAY-90°

1.4 MHz to 4.2 GHz

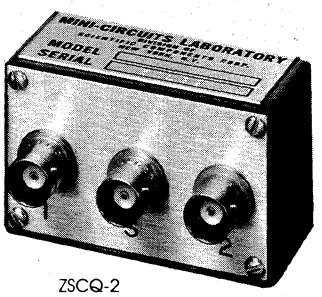
case style selection

outline drawings see pages 4-9


PSCQ-2


ZAPDQ

ZMSCQ-2


ZSCQ-2

	MODEL NO.	FREQ. RANGE MHz	ISOLATION dB Typ.	ISOLATION dB Min.	INSERTION LOSS dB Avg. of Coupled Outputs less 3 dB Typ.	INSERTION LOSS dB Avg. of Coupled Outputs less 3 dB Max.	PHASE UNBALANCE Degrees Max.	AMPLITUDE UNBALANCE dB Max.	PRICE $ Ea.	PRICE $ Qty.
PSCQ-2 case A01	**PSCQ-2-1.25**	1.13-1.38	29	25	0.4	0.7	3.0	1.2	12.95	(5-49)
	PSCQ-2-1.5	1.4-1.7	29	25	0.4	0.7	3.0	1.2	12.95	(5-49)
	PSCQ-2-3.4	3.0-3.8	30	25	0.4	0.7	3.8	1.2	16.95	(5-49)
	PSCQ-2-6.4	5.8-7.0	30	25	0.4	0.7	3.0	1.2	12.95	(5-49)
	PSCQ-2-7.5	7.0-8.0	35	25	0.4	0.7	3.0	1.2	12.95	(5-49)
	PSCQ-2-10.5	9.0-11.0	25	20	0.4	0.7	3.0	1.2	12.95	(5-49)
	PSCQ-2-13	12-14	29	25	0.4	0.7	3.0	1.2	12.95	(5-49)
	PSCQ-2-14	12-16	30	25	0.3	0.6	3.0	1.8	16.95	(5-49)
	PSCQ-2-17.5	16-19	28	25	0.6	0.7	3.0	1.6	12.95	(6-49)
	PSCQ-2-21.4	20-23	30	25	0.4	0.7	3.0	1.2	12.95	(5-49)
	PSCQ-2-26	14-30	25	20	0.4	0.7	3.0	1.5	19.95	(5-49)
	PSCQ-2-50	25-50	30	20	0.3	0.7	3.0	1.5	19.95	(5-49)
	PSCQ-2-70	40-70	30	20	0.3	0.7	3.0	1.5	19.95	(5-49)
	PSCQ-2-70N	66-74	22	19	0.2	0.5	0.8	0.4	24.95	(5-49)
	PSCQ-2-90	55-90	30	20	0.3	0.7	3.0	1.2	19.95	(5-49)
	PSCQ-2-120	80-120	25	18	0.3	0.7	3.0	1.5	19.95	(5-49)
	PSCQ-2-180	120-180	23	15	0.3	0.7	4.0	1.2	19.95	(5-49)
	PSCQ-2-250	150-250	30	22	0.4	0.8	4.0	1.5	19.95	(5-49)
	PSCQ-2-400	250-400	23	16	0.5	0.9	4.0	1.5	19.95	(5-49)
	PSCQ-2-450	350-450	23	16	0.5	0.9	5.0	1.5	19.95	(5-49)
	PSCQ-2-550	450-550	19	15	0.4	0.7	5.0	1.5	19.95	(5-49)
ZAPDQ case F14	**ZAPDQ-2**	1000-2000	22	16	0.4	1.4	6.0	0.8	59.95	(1-9)
	ZAPDQ-4	2000-4200	22	16	0.4	0.9	5.0	1.0	59.95	(1-9)
ZMSCQ-2 case M21	**ZMSCQ-2-50**	25-50	30	20	0.3	0.7	3.0	1.5	49.95	(4-24)
	ZMSCQ-2-90	55-90	30	20	0.3	0.7	3.0	1.2	49.95	(4-24)
	ZMSCQ-2-180	120-180	23	15	0.3	0.7	4.0	1.2	49.95	(4-24)
ZSCQ-2 case M22	**ZSCQ-2-50**	25-50	30	20	0.3	0.7	3.0	1.5	39.95	(4-24)
	ZSCQ-2-90	55-90	30	20	0.3	0.7	3.0	1.2	39.95	(4-24)
	ZSCQ-2-180	120-180	23	15	0.3	0.7	4.0	1.2	39.95	(4-24)

Models available at frequencies other than shown in chart above. Please consult factory.

NOTES:

■ Denotes 75 ohm models, 75 ohm BNC connectors are standard.

1. For Quality Control procedures and reliability, see section 1.
2. For environmental specifications see section 1.
3. Absolute Maximum Ratings, Matched power rating ZAPDQ(10W), all other models (1W), Internal load dissipation (0.125W), see section 1.
4. For connector types and case mounting options, see case style outline drawings.
5. Prices and specifications subject to change without notice.

pin and coaxial connections

see case style outline drawing

Series	Sum Port	Port 1	Port 2	Ground	Terminate 50 ohms
PSCQ-2	1	2	5	3,4,7,8	6
PSCJ-2	1	5	6	2,3,4,7,8	—
ZAPDQ	3	1	2	—	—
ZMSCQ-2	2	1	3	—	—
ZSCQ-2	2	1	3	—	—
ZFSCJ-2	3	1	2	—	—
ZMSCJ-2	2	1	3	—	—
ZSCJ-2	2	1	3	—	—

MCL NO. PSCQ-2-180

NSN 5945-01-186-4456

Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

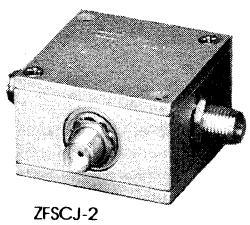
50 ohms and 75 ohms

Mini-Circuits

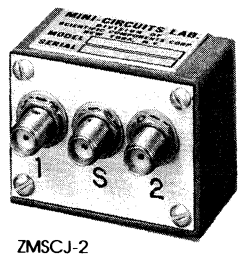
2 WAY-180°

10KHz to 2000 MHz

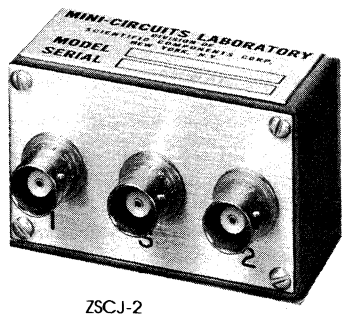
PSCJ-2



ZFSCJ-2



ZMSCJ-2



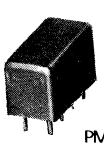
ZSCJ-2

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 3dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE, $ Ea.	Qty.
PSCJ-2	**PSCJ-2-1**	1-200	35	30	35	25	30	23	.75	1.0	0.5	0.8	.75	1.2	2.0	2.5	4.0	.15	.15	0.3	19.95	(5-49)
case A01	**PSCJ-2-2**	0.01-20	35	25	30	25	25	18	0.3	0.8	0.2	0.5	0.3	0.6	1.0	2.0	2.5	0.1	0.1	0.2	29.95	(5-49)
	■**PSCJ-2-1-75**	1-200	35	30	31	25	26	20	0.6	1.2	0.8	1.2	1.2	1.6	2.0	4.0	6.0	.15	0.2	0.5	19.95	(5-49)
ZFSCJ-2	**ZFSCJ-2-1**	1-500	30	20	33	25	30	18	1.0	1.5	1.0	1.5	1.0	1.5	2.0	4.0	6.0	.15	0.2	0.5	49.95	(4-24)
	ZFSCJ-2-4 **NEW**	50-1000	30	20	—	—	25	18	1.2	1.9	—	—	1.6	2.4	6	—	7	0.6	—	0.6	59.95	(4-24)
case K18	**ZFSCJ-2-3**	5-300	30	20	33	25	30	18	1.0	1.5	1.0	1.5	1.0	1.5	2.0	4.0	6.0	.15	0.2	0.5	39.95	(4-24)
ZMSCJ-2	**ZMSCJ-2-1**	1-200	35	30	35	25	30	23	.75	1.0	0.6	0.8	.75	1.2	2.0	2.5	4.0	.15	.15	0.3	47.95	(4-24)
case M21	**ZMSCJ-2-2**	0.01-20	35	25	30	25	25	18	0.3	0.8	0.2	0.5	0.3	0.6	1.0	2.0	2.5	0.1	0.1	0.2	57.95	(4-24)
ZSCJ-2	**ZSCJ-2-1**	1-200	35	30	35	25	30	23	.75	1.0	0.6	0.8	.75	1.2	2.0	2.5	4.0	.15	.15	0.3	37.95	(4-24)
case M22	**ZSCJ-2-2**	0.01-20	35	25	30	25	25	18	0.3	0.8	0.2	0.5	0.3	0.6	1.0	2.0	2.5	0.1	0.1	0.2	47.95	(4-24)
ZAPDJ-2																						
case F14	ZAPDJ-2	1000-2000	—	—	22	18	—	—	1.3	1.8	1.3	1.8	1.3	1.8	6	6	6	0.8	0.8	0.8	64.95	(1-9)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

2 WAY-0°/180°

5 to 200 MHz



PMT

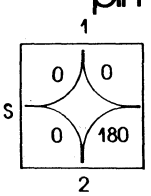
	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION[1] dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB[2] Above 3dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE[3] dB L Max.	M Max.	U Max.	PRICE, $ Ea.	Qty.
PMT	**PMT-1**	5-200	22	20	24	20	24	18	0.8	1.0	0.9	1.1	1.0	1.5	2	4	8	0.1	0.2	0.5	19.95	(5-49)
case A01	■ **PMT-1-75**	5-200	22	18	22	18	22	18	1.0	1.3	1.0	1.4	1.0	1.5	2	4	8	0.1	0.2	0.5	19.95	(5-49)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

NOTES:

1. S-J ports, typical isolation is 40dB.
2. For in-phase ports, typ insertion loss is 0.2dB.
3. Input S or J ports, output ports 1 and 2.

pin connections



S PORT	1
J PORT	4
1 PORT	2
2 PORT	3
case ground	5,6,7,8

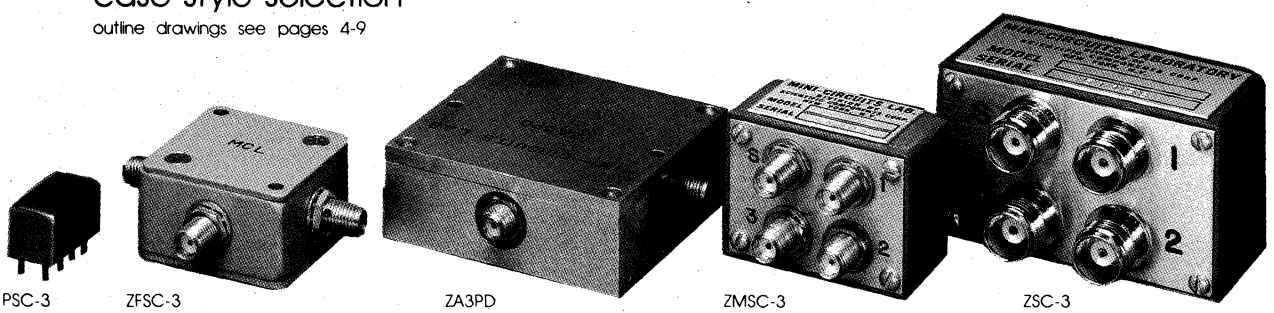
Power Splitter/Combiners

3 WAY-0°

10 KHz to 4.2 GHz

case style selection

outline drawings see pages 4-9



PSC-3 ZFSC-3 ZA3PD ZMSC-3 ZSC-3

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 4.8dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE, $ Ea.	Qty.
PSC-3 case A01	• PSC-3-1	1-200	45	30	40	30	40	25	0.6	1.0	0.4	0.7	0.6	1.0	1.0	2.0	4.0	.15	0.2	0.3	19.95	(5-49)
	PSC-3-1W	5-500	25	20	31	15	25	15	0.4	0.8	0.4	1.4	0.8	1.4	6.0	14.	20.	0.1	0.3	0.6	29.95	(5-49)
	PSC-3-2	0.01-30	35	30	40	25	30	25	.25	.45	.15	0.45	.45	.75	1.0	2.0	4.0	0.2	0.3	0.4	29.95	(5-49)
	■ PSC-3-1-75	1-200	35	23	35	25	35	25	0.6	1.0	0.3	0.7	0.6	1.0	2.0	3.0	4.0	.15	0.2	0.3	20.95	(5-49)
	■ PSC-3-1-75-2	10-300	28	20	25	20	28	20	0.2	0.4	0.3	0.5	0.4	0.7	2.0	3.0	4.0	.15	0.2	0.3	22.95	(5-49)
	PSC-3-13	1-200	45	35	45	30	37	30	.25	0.5	.35	0.6	.35	0.6	1.0	3.0	4.0	0.1	0.2	0.2	24.95	(5-49)
ZFSC-3 case J17	ZFSC-3-1	1-500	30	20	30	20	25	18	0.4	.75	0.5	0.9	0.8	1.2	2.0	3.0	4.0	0.2	0.3	0.4	39.95	(4-24)
	ZFSC-3-1W	2-750	30	20	30	20	25	18	0.4	.75	0.5	1.0	1.0	1.6	3.0	5.0	7.0	0.2	0.3	0.5	41.95	(4-24)
	ZFSC-3-13	1-200	45	30	48	35	37	30	.25	0.5	.35	0.6	.35	0.6	1.0	3.0	5.0	0.1	0.2	0.2	39.95	(4-24)
	ZFSC-3-4	1-1000	35	20	20	18	20	17	0.2	0.5	0.7	1.4	1.0	2.0	3.0	6.0	10.	0.2	0.4	0.9	49.95	(4-24)
		GHz																				
ZA3PD case CC51	ZA3PD-1	0.5-1.0	20	14	20	14	20	14	0.3	0.6	0.3	0.6	0.3	0.6	—	—	—	0.4	0.4	0.4	79.95	(1-9)
	ZA3PD-1.5	0.75-1.5	20	14	20	14	20	14	0.3	0.7	0.3	0.7	0.3	0.7	—	—	—	0.4	0.4	0.4	79.95	(1-9)
	ZA3PD-2	1-2	20	15	20	15	20	15	0.3	0.6	0.3	0.6	0.3	0.6	—	—	—	0.3	0.3	0.3	79.95	(1-9)
	ZA3PD-4	2-4.2	18	14	18	14	18	14	0.7	1.0	0.7	1.0	0.7	1.0	—	—	—	0.9	0.9	0.9	79.95	(1-9)
		MHz																				
ZMSC-3 case P26	ZMSC-3-1	1-200	45	35	40	25	40	25	0.3	0.5	0.4	0.7	0.6	1.0	1.0	2.0	4.0	.15	0.2	0.3	47.95	(4-24)
	ZMSC-3-2	0.01-30	35	30	40	25	30	25	.25	.45	.15	0.45	.45	.75	1.0	2.0	4.0	0.2	0.3	0.4	57.95	(4-24)
ZSC-3 case P25	ZSC-3-1	1-200	45	30	40	25	40	25	0.3	0.5	0.4	0.7	0.6	1.0	1.0	2.0	4.0	.15	0.2	0.3	37.95	(4-24)
	ZSC-3-2	0.01-30	35	30	40	25	30	25	.25	.45	.15	0.45	.45	.75	1.0	2.0	4.0	0.2	0.3	0.4	47.95	(4-24)
	■ ZSC-3-1-75	1-200	35	30	35	25	35	25	0.6	1.0	0.4	0.7	0.6	1.0	2.0	3.0	4.0	.15	0.2	0.3	38.95	(4-24)
	■ ZSC-3-2-75	0.02-20	35	30	35	25	30	20	0.2	0.5	.25	0.6	.45	.75	2.0	3.0	4.0	0.2	0.3	0.4	48.95	(4-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

MIL-P-23971/15, NSN GUIDE

MCL NO.	NSN	MIL-P-23971/15*
PSC-3-1	5820-01-015-6027	
ZFSC-3-1	6625-01-235-6873	
ZSC-3-1B	5820-01-008-9566	
ZSC-3-2B	5825-01-120-9320	
PSC-4-1	5821-01-065-0106	-10
PSC-4-2	5825-01-044-8945	
PSC-4-3	5825-01-105-6189	-11
ZFSC-4-1A	5825-01-227-6681	
ZSC-4-1B	5820-00-270-3056	
ZSC-4-2B	5820-01-120-5238	
ZSC-4-3B	6920-01-038-8553	

*units are not QPL listed

pin connections

see case style outline drawing

Series	Sum Port	Port 1	Port 2	Port 3	Port 4	Ground
PSC-3 except PSC-3-1W, PSC-3-1-75-2	6	1	2	5	—	3,4,7,8
PSC-3-1W PSC-3-1-75-2	1	5	7	8	—	2,3,4,6
PSC-4	4	7	8	1	2	3,5,6
PSC-4A	2	8	12	5	9	1,3,4,6,7,10 11,13,14,15,16

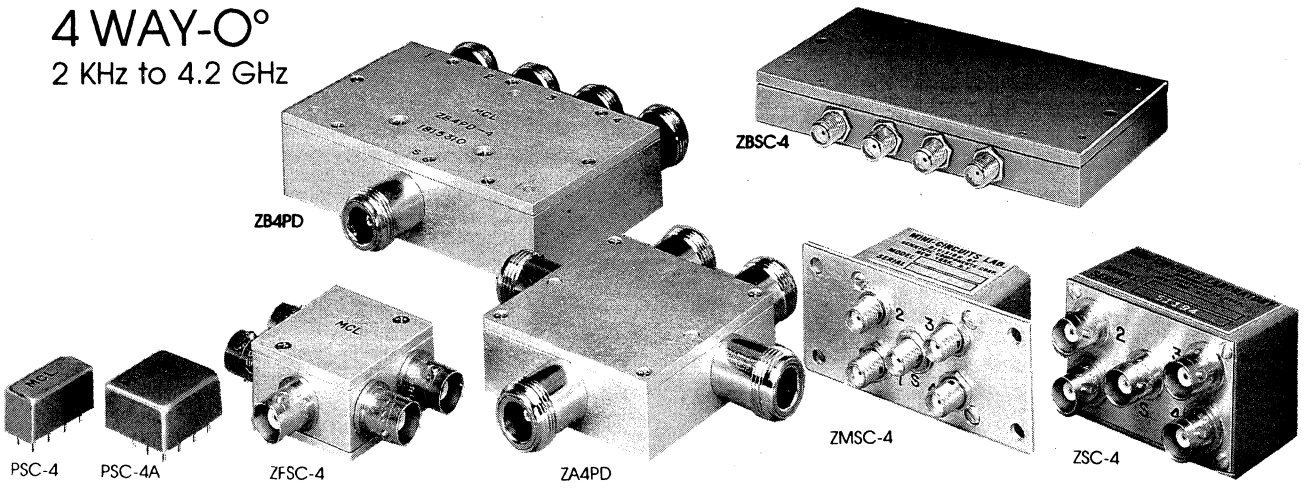
Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

50 ohms and 75 ohms

Mini-Circuits

4 WAY-0°

2 KHz to 4.2 GHz



	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 6dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE, $ Ea.	Qty.
PSC-4	PSC-4-1	0.1-200	33	20	30	20	27	20	0.4	0.6	0.5	.75	0.7	1.0	4.0	6.0	8.0	.15	.20	.25	28.95	(6-49)
case A01	■ PSC-4-1-75	1-200	30	20	25	20	25	20	0.4	0.7	0.5	0.9	0.7	1.2	4.0	6.0	10.0	.15	.20	0.3	24.95	(6-49)
	PSC-4-3	0.25-250	33	20	30	20	27	20	0.4	0.7	0.5	.75	0.7	1.2	4.0	6.0	8.0	.15	.20	.25	23.95	(6-49)
	PSC-4-6	0.01-40	35	18	32	25	25	18	0.4	0.8	0.3	0.5	0.5	1.0	4.0	6.0	8.0	.10	.15	.20	29.95	(6-49)
PSC-4A	PSC-4A-4	10-1000	25	20	21	15	18	15	0.5	0.8	0.8	1.8	1.5	2.5	4.0	16.0	20.0	0.2	0.5	0.7	49.95	(6-49)
case C07	■ PSC-4A-475	10-800	30	20	33	20	25	20	0.4	0.7	0.6	0.9	1.2	1.6	—	—	—	0.2	0.4	0.8	49.95	(6-49)
ZBSC-4																						
case UU102	ZBSC-413	10-800	26	20	18	15	18	15	0.6	1.0	1.0	1.5	1.6	2.0	4.0	8.0	8.0	0.2	0.4	0.6	99.95	(1-9)
ZFSC-4	ZFSC-4-1	1-1000	25	20	23	18	20	15	0.4	1.2	0.6	1.5	1.6	2.5	4.0	8.0	8.0	0.2	0.4	0.7	89.95	(1-4)
case G15	ZFSC-4-1W	10-500	23	20	23	20	23	20	0.6	1.5	0.6	1.5	0.6	1.5	4.0	8.0	8.0	0.2	0.3	0.4	74.95	(1-4)
	ZFSC-4-3	10-300	32	28	38	30	38	30	0.5	0.8	0.6	0.9	0.9	1.2	4.0	6.0	8.0	0.1	0.1	0.2	69.95	(1-4)
	■ ZFSC-4375	50-90	34	30	34	30	34	30	0.3	0.8	0.3	0.8	0.3	0.8	4.0	6.0	8.0	0.15	0.15	0.15	89.95	(1-4)
	* ▲■ ZFSC-4-2-75-1	200-800	25	20	—	—	25	20	0.8	1.6	—	—	1.0	1.6	4.0	16.0	20.0	0.2	—	0.4	74.95	(1-4)
	■ ZFSC-4-175	10-1000	35	25	38	20	22	18	0.5	0.8	0.6	1.2	0.9	2.0	—	—	—	0.2	0.3	0.6	89.95	(1-4)
ZMSC-4	ZMSC-4-1	0.1-200	33	20	30	20	27	20	0.4	0.6	0.5	.75	0.7	1.0	1.0	2.0	3.0	.15	.20	.25	56.95	(4-24)
case N24	ZMSC-4-2	0.002-20	30	20	33	25	33	25	.45	.75	0.3	0.5	0.7	1.0	4.0	6.0	8.0	.15	.20	.25	69.95	(4-24)
	ZMSC-4-3	0.25-250	33	20	30	20	27	20	0.4	0.7	0.5	.75	0.7	1.2	4.0	6.0	10.0	.15	.20	.25	53.95	(4-24)
ZSC-4	ZSC-4-1	0.1-200	33	20	30	20	27	20	0.4	0.6	0.5	.75	0.7	1.0	4.0	6.0	8.0	.15	.20	.25	46.95	(4-24)
case N27	■ ZSC-4-1-75	1-200	30	20	25	20	25	20	0.4	0.7	0.5	0.8	0.7	1.2	0.4	6.0	10.0	.15	.20	0.3	46.95	(4-24)
	ZSC-4-2	0.002-20	30	20	33	25	33	25	.45	.75	0.3	0.5	0.7	1.0	4.0	6.0	8.0	.15	.20	.25	69.95	(4-24)
	ZSC-4-3	0.25-250	33	20	30	20	27	20	0.4	0.7	0.5	.75	0.7	1.2	4.0	6.0	10.0	.15	.20	.25	43.95	(4-24)
		GHz																				
ZA4PD	ZA4PD-2	1-2	25	16	25	16	25	16	0.3	1.0	0.3	1.0	0.3	1.0	—	6.0	—	0.7	0.7	0.7	79.95	(1-9)
case DD52	ZA4PD-4	2-4.2	25	16	25	16	25	16	0.5	1.0	0.3	1.0	0.3	1.0	—	16.0	—	0.8	0.8	0.8	79.95	(1-9)
ZB4PD	ZB4PD-42	1.7-4.2	23	16	23	16	23	16	0.5	1.4	0.5	1.4	0.5	1.4	—	8.0	—	0.8	0.8	0.8	99.95	(1-9)
case EE54	ZB4PD-4	3.7-4.2	24	15	24	15	24	15	0.6	1.1	0.6	1.1	0.6	1.1	—	8.0	—	0.8	0.8	0.8	89.95	(1-9)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2)

* L = low range (f_L to f_U/2) U = upper range (f_U/2 to f_U)

NOTES:

■ Denotes 75 ohm models, 75 ohm BNC connectors are standard.

● Model PSC-3-1 manufactured under license protected by patent 3,428,920.

▲ On Model ZFSC-4-2-75-1, up to 15V and 15mA DC may be passed from input to all outputs.

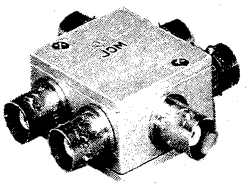
1. For quality control procedures, see Table of Contents.
2. For environmental specifications, see Table of Contents.
3. Absolute Maximum Ratings;
   Matched power rating ZA3PD, ZA4PD, ZB4PD (10W.)
   all other models (1W)
   Internal load dissipation
   all 3-way models (0.375W) all 4-way models (0.25W)
4. For connector types and case mounting options; see case style outline drawing.
5. Prices and specifications subject to change without notice.
6. All 3-way power dividers with exception of ZA3PD are licensed under U.S. Patent 3,428,920; reissued as RE 27,299.

In Stock...Immediate Delivery

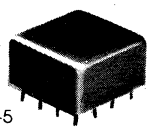
Power Splitter/Combiners

5 WAY-0°

1 MHz to 300 MHz



ZFSC-5



PSC-5

case style selection

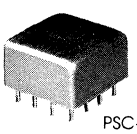
outline drawings see pages 4-9

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 7.0dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE $ Ea.	Qty.
PSC-5	PSC-5-1	1-300	25	20	23	18	20	17	0.2	0.5	0.6	1.0	1.5	2.0	2.0	4.0	8.0	0.2	0.3	0.6	59.95	(1-5)
case C07 ■	PSC-5-1-75	1-300	35	20	30	18	25	17	0.4	0.6	0.6	0.9	0.9	1.3	2.0	4.0	8.0	0.2	0.3	0.6	59.95	(1-5)
ZFSC-5																						
case G15	ZFSC-5-1 NEW	1-300	25	20	23	18	20	17	0.2	0.5	0.6	1.0	1.5	2.0	2.0	4.0	8.0	0.2	0.3	0.6	89.95	(1-5)

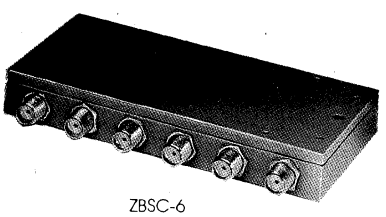
L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

6 WAY-0°

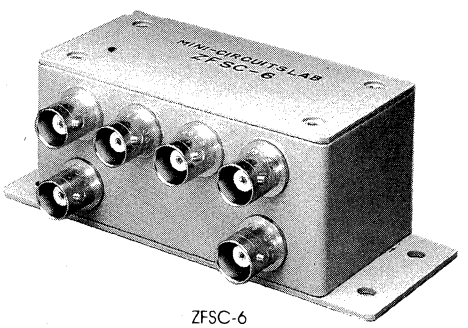
1 MHz to 500 MHz



PSC-6



ZBSC-6



ZFSC-6

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 7.8dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE, $ Ea.	Qty.
PSC-6	PSC-6-1	1-175	30	24	26	18	26	18	0.5	0.8	0.7	1.0	1.0	1.5	4.0	6.0	12.0	0.2	0.4	0.8	68.95	(1-5)
case C07 ■	PSC-6-1-75	1-300	35	25	30	23	25	18	0.4	0.6	0.9	0.9	0.6	1.3	2.0	4.0	8.0	0.2	0.3	0.6	78.95	(1-5)
ZBSC-6	ZBSC-611	10-200	28	22	26	20	23	20	0.5	0.8	0.7	1.0	0.9	1.2	4.0	5.0	6.0	0.2	0.3	0.5	114.95	(1-4)
case UU102	ZBSC-615 NEW	1-500	30	25	26	18	24	18	0.5	0.8	0.7	1.2	1.0	2.2	4.0	5.0	20	0.2	0.4	1.2	119.95	(1-4)
ZFSC-6	ZFSC-6-1	1-175	27	22	26	20	26	20	0.75	1.0	0.75	1.2	0.8	1.2	2.0	6.0	12.0	0.2	0.4	0.6	89.95	(1-4)
case Q28 ■	ZFSC-6-1-75	1-200	30	25	30	22	20	18	0.75	1.0	0.75	1.0	0.9	1.2	2.0	6.0	12.0	0.2	0.4	0.6	89.95	(1-4)
	ZFSC-6-110	1-500	35	25	26	20	25	20	0.5	0.8	0.6	1.1	1.0	1.7	2.0	6.0	12.0	0.3	0.3	0.8	99.95	(1-4)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

pin connections

see case style outline drawing

Series	Sum Port	Port 1	Port 2	Port 3	Port 4	Port 5	Port 6	Ground	Not Used
PSC-5	1	4	8	12	16	15	—	2,5,7,11,13,14	3,6,9,10
PSC-6	1	3	4	8	12	16	15	2,5,7,11,13,14	6,9,10

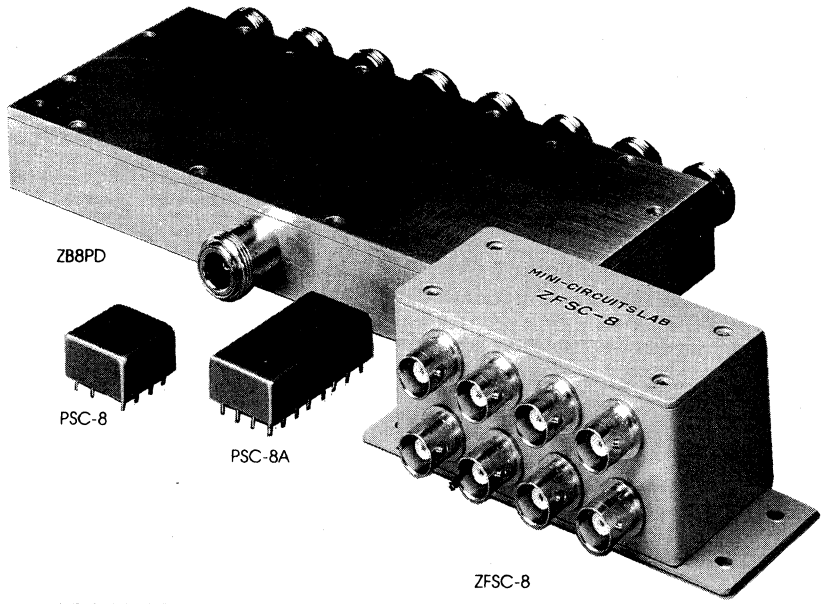
Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

50 ohms and 75 ohms

Mini-Circuits

8 WAY-0°

10 KHz to 4.2 GHz



	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 9dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE, $ Ea.	Qty.
PSC-8	PSC-8-1	0.5-175	30	25	30	20	25	18	0.8	1.2	0.8	1.2	1.0	1.6	1.0	2.5	5.0	0.2	0.3	0.5	68.95	(1-5)
case C07	■ PSC-8-1-75	0.5-175	25	20	30	20	25	20	0.5	1.0	0.6	1.1	0.7	1.3	1.0	2.5	5.0	0.2	0.2	0.3	69.95	(1-5)
	PSC-8-6	0.01-10	40	20	40	25	28	23	0.3	0.7	0.5	1.0	0.6	1.1	1.0	2.5	4.0	0.1	0.2	0.3	79.95	(1-5)
PSC-8A	PSC-8A-4	5-500	25	20	23	18	20	15	0.7	1.2	1.0	1.8	1.4	2.5	3.0	8.0	16.0	0.2	0.3	0.5	89.95	(1-4)
case E10	■ PSC-8A4-75	1-300	26	20	30	25	30	23	0.8	1.2	0.7	1.1	0.9	1.3	1.0	3.0	8.0	0.2	0.2	0.4	79.95	(1-4)
ZFSC-8	ZFSC-8-1	0.5-175	30	25	30	20	25	18	0.8	1.2	0.8	1.2	1.0	1.6	1.0	2.5	5.0	0.2	0.2	0.3	89.95	(1-4)
case R29	■ ZFSC-8-1-75	0.5-175	25	20	30	20	25	20	0.5	1.0	0.6	1.1	0.7	1.3	1.0	2.5	5.0	0.2	0.3	0.5	90.95	(1-4)
	■ ZFSC-82-75	10-900	35	17	23	17	15	10	0.6	0.9	0.9	1.6	1.6	2.7	2.0	4.0	10.0	0.2	0.5	1.2	139.95	(1-4)
	■ ZFSC-84-75	1-300	26	20	30	25	30	23	0.8	1.5	0.7	1.1	0.9	1.5	1.0	3.0	8.0	0.2	0.2	0.4	119.95	(1-4)
	■ ZFSC-8375	50-90	30	25	30	25	25	25	1.0	1.0	1.0	1.3	1.3	1.3	2.0	2.0	2.00	0.2	0.2	0.2	119.95	(1-4)
	ZFSC-8-4	5-700	35	20	25	17	20	17	0.8	1.2	1.2	1.8	1.8	2.5	2.0	5.0	15.0	0.2	0.4	0.7	129.95	(1-4)
	ZFSC-8-43	10-1000	23	20	25	20	26	20	1.0	1.6	1.4	1.8	2.1	2.9	5.0	10.0	20.0	0.2	0.4	0.7	139.95	(1-4)
	ZFSC-8-6	0.01-10	35	20	40	25	35	25	0.3	0.7	0.2	0.6	0.3	0.7	1.0	2.0	3.0	0.1	0.2	0.3	109.95	(1-4)
		GHz																				
ZB8PD	ZB8PD-2	1-2	24	17	24	17	24	17	0.8	1.3	0.8	1.3	0.8	1.3	—	—	18	0.8	0.8	0.8	149.00	(1-9)
case Z40	ZB8PD-4	2-4.2	23	16	23	16	23	16	0.8	1.8	0.8	1.8	0.8	1.8	10	10	10	0.9	0.9	0.9	149.00	(1-9)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

NOTES:

■ Denotes 75 ohm models, 75 ohm BNC connectors are standard.

1. Matched power rating, 1 watt. internal load dissipation, 0.62 watts, 0.5 watts for 5 and 6 way.
2. Refer to table of contents for quality control procedures, environmental specifications, and absolute maximum ratings.
3. For connector types, see case style outline drawing.
4. Prices and specifications subject to change without notice.

MIL-P-23971/15, NSN GUIDE

MCL NO.	NSN
ZFSC-6-1	5820-01-225-6965
ZFSC-8-1	5820-01-136-7244

pin connections

see case style outline drawing

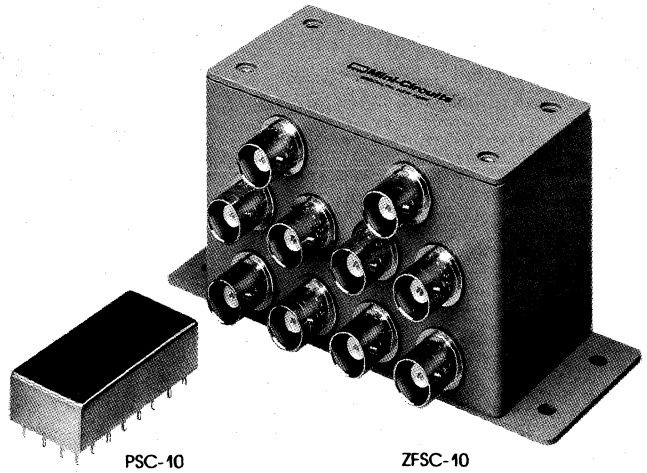
Series	Sum Port	Port 1	Port 2	Port 3	Port 4	Port 5	Port 6	Port 7	Port 8	Port 9	Port 10	Port 11	Port 12	Ground	Do Not Use
PSC-8	2	1	5	9	13	16	12	8	4	—	—	—	—	3,6,7,14,15	10-11
PSC-8A	29	7	16	31	24	9	2	26	17	—	—	—	—	All other pins	—
PSC-10-1	29	7	16	31	24	9	2	26	17	4	5	—	—	All other pins	15
PSC-12-1	5	7	8	1	2	31	32	25	26	22	30	19	27	All other pins	11,14,21

In Stock...Immediate Delivery

Power Splitter/Combiners

10 WAY–0°
0.5 to 150 MHz

case style selection
outline drawings see pages 4-9

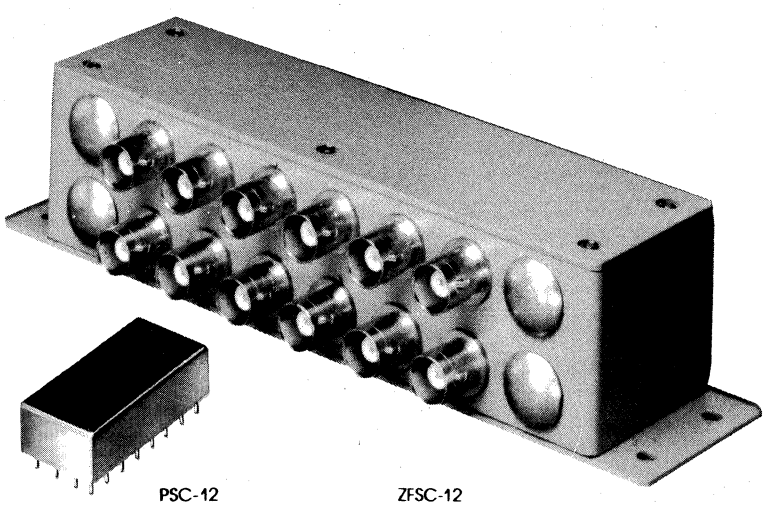


PSC-10 ZFSC-10

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 10 dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE, $ Ea.	Qty.
PSC-10 case E10	PSC-10-1	1–150	36	23	27	23	23	18	0.3	0.6	0.4	0.8	1.0	1.3	1	4	10	0.1	0.2	0.3	78.95	(1–5)
ZFSC-10 case RR93	ZFSC-10-1	0.5–100	28	20	30	24	27	20	0.5	0.8	0.4	1.0	0.8	1.5	2	6	10	0.2	0.3	0.4	119.95	(1–4)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

12 WAY-0°
1 MHz to 500 MHz



PSC-12 ZFSC-12

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ	L Min	M Typ	M Min	U Typ	U Min	INSERTION LOSS, dB Above 10.8dB L Typ	L Max	M Typ	M Max	U Typ	U Max	PHASE UNBALANCE Degrees L Max	M Max	U Max	AMPLITUDE UNBALANCE dB L Max	M Max	U Max	PRICE, $ Ea	Qty
PSC-12 case E10	PSC-12-1	1–200	35	30	27	20	21	18	0.5	0.8	0.8	1.2	1.0	1.4	1	4	6	0.2	0.4	0.7	88.95	(1-5)
ZFSC-12 case R67	ZFSC-12-1	1 200	30	25	35	20	28	20	0 8	1 2	1 1	1 4	1 3	1 6	4.0	8.0	16.0	0 1	0 2	0 3	174 95	(1-4)
	ZFSC-12-11	10 300	28	20	33	25	28	20	1 1	1 3	1 1	1 5	1 5	1 8	2 0	4 0	6 0	0 2	0 3	0.4	174 95	(1-4)
	■ ZFSC-12-1-75	10–200	35	27	—	—	27	20	0.5	0.8	—	—	0.8	1.3	—	—	—	0.25	—	0.4	179.95	(1–4)
	■ ZFSC-12-175	10–500	23	20	24	20	22	18	0.9	1.2	1.0	1.3	1.2	1.6	—	—	—	0.4	0.5	0.8	199.95	(1–4)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

pin connections
see case style outline drawings and table on previous page

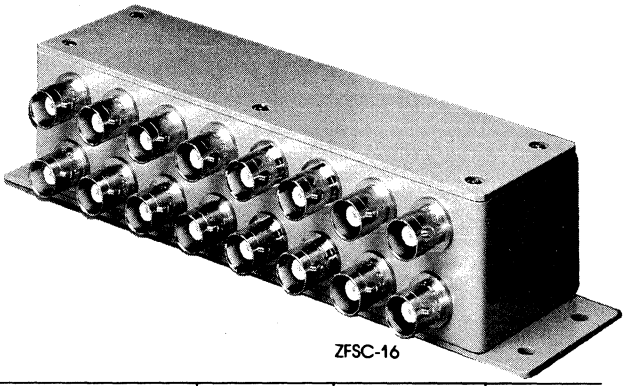
Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

50 ohms and 75 ohms

Mini-Circuits

16 WAY-O°

10 KHz to 200 MHz



ZFSC-16

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 12dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE, $ Ea.	Qty.
ZFSC-16 case R30	ZFSC-16-1	0.5-125	30	24	25	18	20	15	1.0	1.2	1.1	1.3	1.2	1.4	1.0	3.0	5.0	0.1	0.2	0.5	174.95	(1-4)
	■ ZFSC-16-1-75	1-150	30	25	30	25	25	20	0.8	1.1	0.7	1.1	1.0	1.3	1.0	3.0	5.0	0.1	0.2	0.4	182.95	(1-4)
	ZFSC-16-3	1-30	45	35●	45	40●	41	40●	0.5	0.9	0.5	0.9	0.5	0.9	1.0	2.0	3.0	0.1	0.1	0.1	174.95	(1-4)
	■ ZFSC-16-675	0.01-25	25	20	40	25	25	20	0.8	1.1	0.4	0.8	1.0	1.6	1.0	3.0	5.0	0.1	0.2	0.4	189.95	(1-4)
	ZFSC-16-12	0.1-200	33	20	27	20	26	20	0.6	1.5	0.7	1.0	0.9	1.2	2.0	6.0	9.0	0.4	0.2	0.4	189.95	(1-4)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

MIL-P-23971, *NSN GUIDE

MCL NO.	NSN
ZFSC-16-1	5820-01-120-9321

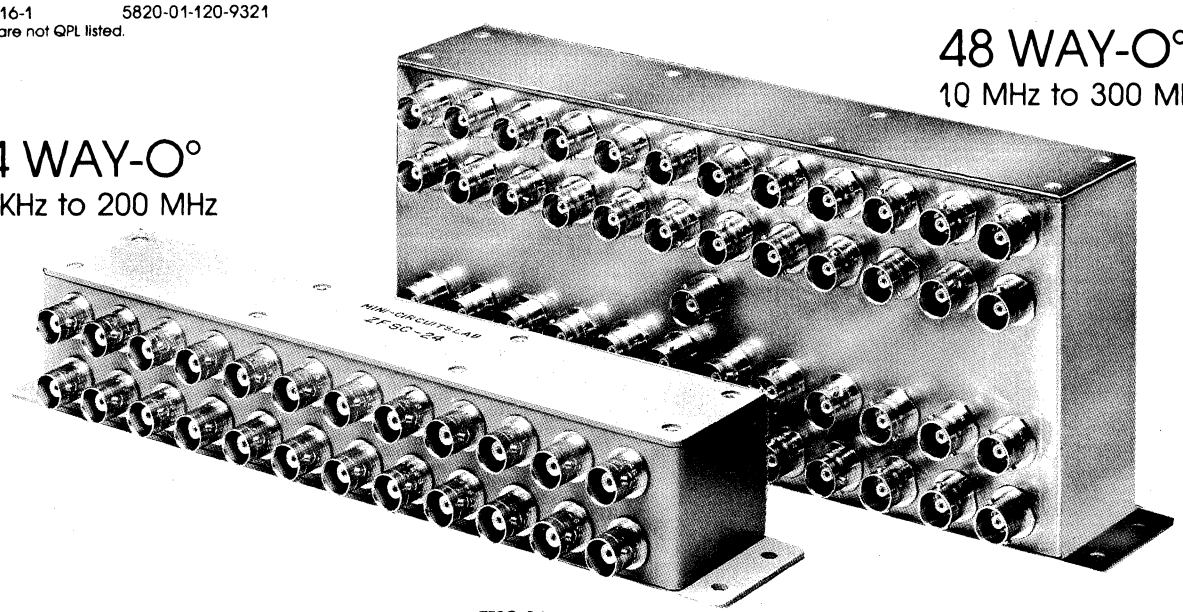
*Units are not QPL listed.

48 WAY-O°

10 MHz to 300 MHz

24 WAY-O°

25 KHz to 200 MHz



ZFSC-24 ZFSC-48

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB 24 way (above 13.8dB) 48 way (above 16.8dB) L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE, $ Ea.	Qty.
ZFSC-24 case R31	ZFSC-24-1	0.2-100	25	20	25	20	25	20	1.0	2.0	1.0	2.0	1.0	2.0	0.2	0.4	0.5	264.95	(1-4)
	ZFSC-24-11	1-200	33	25	22	20	20	17	0.9	1.7	1.0	1.8	1.3	2.2	0.2	0.8	0.8	274.95	(1-4)
	ZFSC-24-6	0.025-50	30	25	39	28	30	22	0.4	1.0	0.4	1.0	0.6	1.5	0.2	0.3	0.7	274.95	(1-4)
ZFSC-48 case HH68	ZFSC-48-1	10-300	30	25	28	20	23	20	1.0	1.5	1.8	2.2	2.0	2.5	0.6	0.7	0.9	595.00	(1-4)
	■ ZFSC-48-1-75	10-300	30	25	28	20	23	20	1.2	2.0	2.1	2.5	2.3	3.0	0.6	0.7	1.0	595.00	(1-4)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

NOTES:

■ Denotes 75 ohm models, 75 ohm BNC connectors are standard.
● Opposite Ports 28dB

1. Matched power rating, 1 watt
   Internal load dissipation, 0.87 watt.
2. Refer to table of contents for quality control procedures, environmental specifications, and absolute maximum ratings.
3. For connector types, see case style outline drawing.
4. Prices and specifications subject to change without notice.

In Stock...Immediate Delivery

broadband "plug-in"

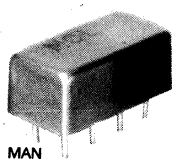
Amplifiers

50 ohms

96 hr. burn-in
0.5 to 1000MHz

case style selection

outline drawings see pages 4-9



MAN

	MODEL NO.	FREQUENCY MHz		GAIN, dB			MAX. POWER OUTPUT, dBm (1 dB compression)			DYNAMIC RANGE		VSWR		DC POWER		PRICE, $	
					FLATNESS MAX.					NF	Intercept point, dBm						
		f_L	f_U	Min.	Mid Range m	Total Range	L_W	U	Input (no damage)	dB Typ	3 Order Typ.	In	Out	Voltage V.	Current mA	Ea.	Qty.
MAN	MAN-1	0.5	500	28	±0.5	±1.0	+8	−8	+15	4.5	18	1.8	1.8	12	60	13.95	5-24
case A05	MAN-2	0.5	1000	18	±0.5	±1.5	+9	+7	+15	6.0	19	1.8	1.8	12	85	15.95	5-24
	MAN-1LN	0.5	500	28	±0.5	±1.0	+8	+8	+15	2.8	18	1.8	1.8	12	60	15.95	5-24
	MAN-1HLN	10	500	10	±0.5	±0.8	+15	+16	+15	3.7	30	1.8	1.8	12	70	15.95	5-24
	*MAN-1AD	5	500	16	±0.5	±1.0	+7	+6	+15	7.2	20	1.6	1.7	12	85	24.95	5-24

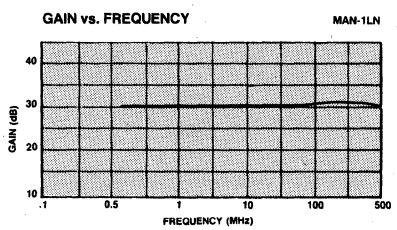
*Difference between isolation & gain 25 dB Typ.

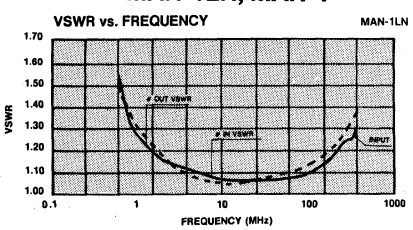
L_w = Low Range (f_L to $f_{U/2}$) m = Mid Range (2 f_L to $f_{U/2}$) U = Upper Range ($f_{U/2}$ to fu)

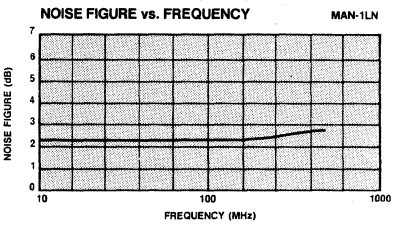
Pin Configuration: RF-IN–**1**; RF-OUT–**8**; 12V–**5**; CASE GND–**2, 3, 4, 6**; NOT USED–**7**

NOTES:
1. For quality control procedures, environmental specifications, see Table of Contents.
2. Absolute Maximum Ratings, see Table of Contents.
3. Prices and specifications subject to change without notice.

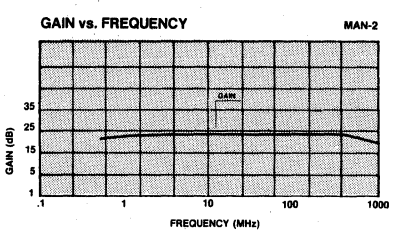
MAN-1LN, MAN-1

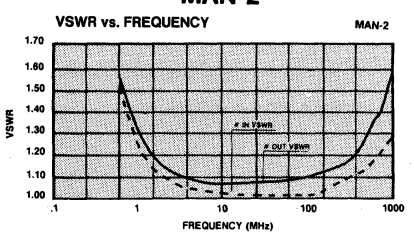


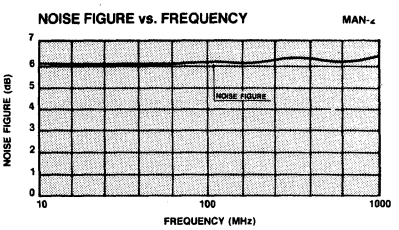




MAN-2







MAN-1

FREQ. (MHz)	GAIN (dB)	RETURN LOSS in	RETURN LOSS out
.40	30.85	10.53	12.65
1.02	31.72	17.79	17.73
4.75	31.95	25.40	27.46
11.94	31.99	26.23	30.04
30.00	32.03	25.72	30.35
75.36	32.06	24.33	28.04
101.65	32.09	23.32	26.54
140.32	32.18	21.71	24.15
255.34	32.13	18.07	20.15
352.47	32.01	15.77	17.96
497.88	31.37	13.88	21.18
641.39	30.00	14.95	14.54
753.57	28.51	15.62	13.46
885.36	27.18	14.65	14.89
1194.32	24.00	16.07	16.93

MAN-2

FREQ. (MHz)	GAIN (dB)	RETURN LOSS in	RETURN LOSS out
.41	22.01	10.75	10.29
1.06	23.09	13.62	12.86
5.21	23.36	18.82	16.91
13.71	23.40	24.36	23.81
35.25	23.41	29.78	27.15
90.60	23.41	36.43	28.22
125.06	23.41	40.92	28.35
249.53	23.38	37.86	27.14
321.46	23.37	36.58	26.83
443.73	23.31	31.92	24.81
497.88	23.31	30.14	22.94
612.52	23.13	25.38	19.88
753.57	22.57	22.34	16.97
845.51	22.22	21.23	16.23
1167.14	20.60	22.29	14.55

MAN-1LN

FREQ. (MHz)	GAIN (dB)	RETURN LOSS in	RETURN LOSS out	NF (dB)
.40	30.85	10.53	12.65	
1.02	31.72	17.79	17.73	
4.75	31.95	25.40	27.46	
11.94	31.99	26.23	30.04	2.17
30.00	32.03	25.72	30.35	2.25
75.36	32.06	24.33	28.04	2.31
101.65	32.09	23.32	26.54	2.43
140.32	32.18	21.71	24.15	2.43
255.34	32.13	18.07	20.15	2.52
352.47	32.01	15.77	17.96	2.59
497.88	31.37	13.88	21.18	2.70
641.39	30.00	14.95	14.54	2.68
753.57	28.51	15.62	13.46	2.76
885.36	27.18	14.65	14.89	2.90
1194.32	24.00	16.07	16.93	3.03

Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

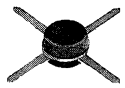
broadband "drop-in"

Mini-Circuits

Monolithic Amplifiers

50 ohms, up to +11 dBm out

dc to 2 GHz



MAR

	Model No.	Color Dot	FREQ. MHz	GAIN, dB Typical (at MHz) 100	500	1000	2000	(Note 4) MIN	MAXIMUM POWER, dBm Output (1dB) Compression	Input (no damage)	DYNAMIC RANGE Intercept pt. dBm NF dB Typ.	3rd Order Typ.	VSWR In	Out	MAXIMUM RATING (25°C) I(mA)	P(mW)	DC POWER at Pin 3 Current (mA)	Volt. Typ.	PRICE $ Ea.	Qty
MAR case VV105	MAR-1	Brown	DC-1000	18.5	17.5	15.5	—	13.0	0	+10	5.0	15	1.5:1	1.5:1	40	100	17	5	0.99	(100)
	MAR-2	Red	DC-2000	13	12.8	12.5	11	8.5	+ 3	+15	6.5	18	1.3:1	1.6:1	60	325	25	5	1.50	(25)
	MAR-3	Orange	DC-2000	13	12.8	12.5	10.5	8.0	▲+ 8	+15	6.0	23	1.6:1	1.6:1	70	400	35	5	1.70	(25)
	MAR-4	Yellow	DC-1000	8.2	8.2	8.0	—	7.0	+11	+15	7.0	27	1.9:1	2:1	85	500	50	5	1.90	(25)
	MAR-6	White	DC-2000	20	19	16	11	9	0	+15	2.8	15	2:1	1.8:1	50	200	16	3.5	1.29	(25)
	MAR-7	Violet	DC-2000	13.5	13.1	12.5	10.5	8.5	+ 4	+15	5.0	20	2:1	1.5:1	60	275	22	4	1.90	(25)
	□ MAR-8	Blue	DC-1000	33	28	23	—	19	+10	+15	3.5	27	—	—	65	500	36	7.5	2.20	(25)

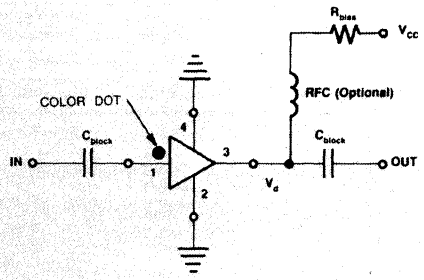
NOTES:

▲ +4 dBm (1-2 GHz)

□ MAR-B stable for source load VSWR < 3.0:1

1. Operating temperature −20°C to +85°C
   Storage temperature −55°C to +100°C
2. With no load output, derate maximum input power (no damage) by 10dB.
3. Price and specifications subject to change without notice.
4. Minimum gain at highest frequency point and over full temperature range.

Typical Biasing Configuration



designers amplifier kit, DAK-2

5 of each model, total 35 amplifiers

only $59.95

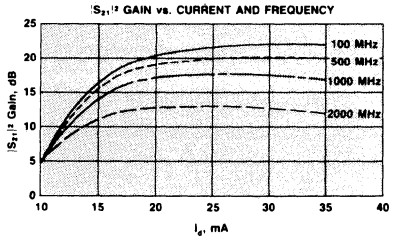
Also, for your design convenience, Mini-Circuits offers chip coupling capacitors at 12 cents each.*

Size (mils)	Tolerance	Temperature Characteristic	Value
80 × 50	5%	NPO	10, 22, 47, 68, 100, 470, 680, 1000 pf
80 × 50	10%	X7R	2200, 4700, 6800, 10,000 pf
120 × 60	10%	X7R	.022, .047, .068, .1 μf

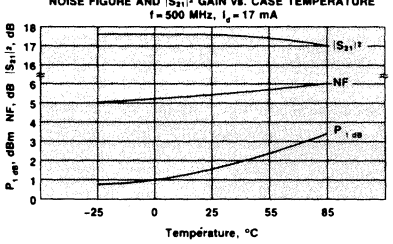
*Minimum Order 50 per Value

MAR-1 (T_A = 25°C, I_d = 17 mA)

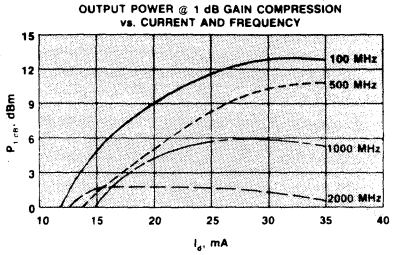
$|S_{21}|^2$ GAIN vs. CURRENT AND FREQUENCY



OUTPUT POWER @ 1 dB GAIN COMPRESSION, NOISE FIGURE AND $|S_{21}|^2$ GAIN vs. CASE TEMPERATURE
f = 500 MHz, I_d = 17 mA



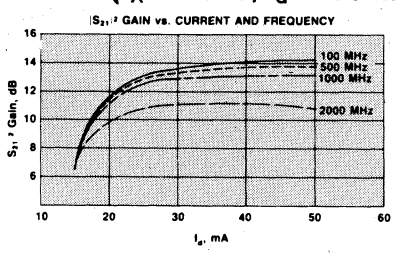
OUTPUT POWER @ 1 dB GAIN COMPRESSION vs. CURRENT AND FREQUENCY

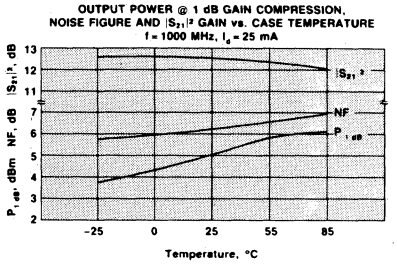


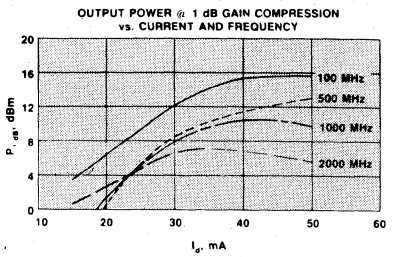
Freq. MHz	S_{11} (Input Return Loss) dB	Mag	Ang	S_{21} (Power Gain) dB	Ang	S_{12} (Isolation Out-In) dB	Mag	Ang	S_{22} (Output Return Loss) dB	Mag	Ang
100	−23.10	0.07	164	18.5	171	−21.94	0.08	4	−23.10	0.07	−14
500	−24.44	0.06	106	17.5	141	−21.94	0.08	15	−23.10	0.07	−68
1000	−24.44	0.06	72	15.5	111	−20.00	0.10	24	−20.92	0.09	−124
1500	−27.96	0.04	59	13.7	87	−17.72	0.13	26	−20.00	0.10	−161
2000	−24.44	0.06	149	12.3	67	−15.92	0.16	21	−15.92	0.16	−177
2500	−20.00	0.10	142	10.6	49	−14.89	0.18	18	−15.92	0.16	155
3000	−18.42	0.12	139	9.3	34	−13.98	0.20	12	−16.48	0.15	144
3500	−13.98	0.20	129	7.9	19	−13.15	0.22	5	−15.92	0.16	135
4000	−11.06	0.28	120	6.6	3	−12.04	0.25	−4	−15.39	0.17	127

In Stock...Immediate Delivery

MAR-2 (T_A = 25°C, I_d = 25 mA)

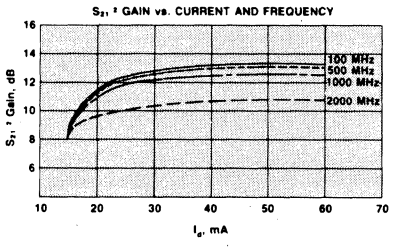


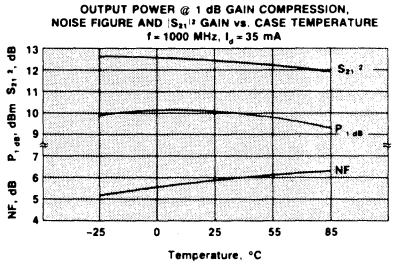


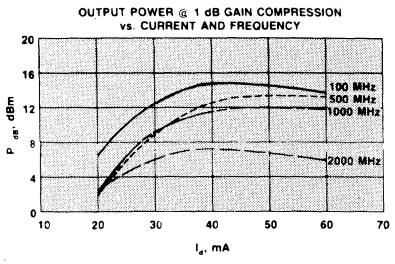


Freq. MHz	S_{11} (Input Return Loss)			S_{21} (Power Gain)		S_{12} (Isolation Out-In)			S_{22} (Output Return Loss)		
	dB	Mag	Ang	dB	Ang	dB	Mag	Ang	dB	Mag	Ang
100	−18.42	0.12	173	13.0	174	−18.42	0.12	1	−17.72	0.13	−8
500	−19.17	0.11	154	12.8	156	−18.42	0.12	5	−18.42	0.12	−38
1000	−20.00	0.10	130	12.5	131	−17.72	0.13	7	−18.42	0.12	−75
1500	−21.94	0.08	120	11.8	109	−17.08	0.14	10	−18.42	0.12	−112
2000	−24.44	0.06	126	11.0	90	−16.48	0.15	9	−17.72	0.13	−121
2500	−20.92	0.09	147	10.4	67	−15.39	0.17	6	−17.72	0.13	−165
3000	−17.08	0.14	147	9.4	46	−14.42	0.19	−1	−17.72	0.13	171
3500	−13.56	0.21	136	8.2	30	−13.98	0.20	−5	−17.72	0.13	155
4000	−11.37	0.27	123	7.3	14	−13.56	0.21	−10	−18.42	0.12	142

MAR-3 (T_A = 25°C, I_d = 35 mA)

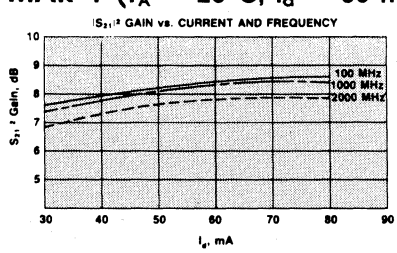


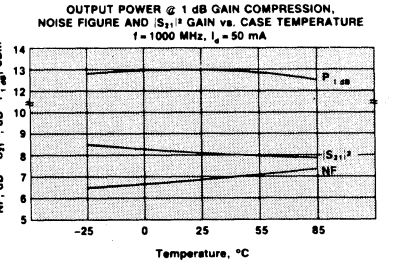


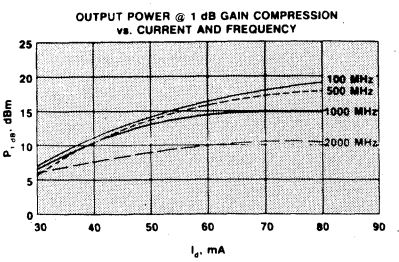


Freq. MHz	S_{11} (Input Return Loss)			S_{21} (Power Gain)		S_{12} (Isolation Out-In)			S_{22} (Output Return Loss)		
	dB	Mag	Ang	dB	Ang	dB	Mag	Ang	dB	Mag	Ang
100	−23.10	0.07	172	13.0	174	−18.42	0.12	1	−16.48	0.15	−11
500	−24.44	0.06	156	12.8	152	−18.42	0.12	5	−15.92	0.16	−45
1000	−26.02	0.05	146	12.5	128	−17.72	0.13	10	−14.98	0.18	−88
1500	−27.96	0.04	172	11.8	103	−17.08	0.14	12	−13.56	0.21	−120
2000	−24.44	0.06	173	10.5	83	−14.98	0.18	11	−12.04	0.25	−142
2500	−15.39	0.17	175	10.3	59	−14.42	0.19	5	−11.70	0.26	−173
3000	−12.40	0.24	157	9.1	38	−13.98	0.20	−0	−12.04	0.25	168
3500	−9.90	0.32	140	7.8	21	−13.56	0.21	−6	−12.04	0.25	152
4000	−8.18	0.39	124	6.5	3	−13.15	0.22	−14	−12.04	0.25	138

MAR-4 (T_A = 25°C, I_d = 50 mA)







Freq. MHz	S_{11} (Input Return Loss)			S_{21} (Power Gain)		S_{12} (Isolation Out-In)			S_{22} (Output Return Loss)		
	dB	Mag	Ang	dB	Ang	dB	Mag	Ang	dB	Mag	Ang
100	−14.42	0.19	177	8.2	174	−15.92	0.16	0	−20.00	0.10	−14
500	−14.89	0.18	169	8.2	156	−15.92	0.16	1	−17.72	0.13	−54
1000	−15.39	0.17	159	8.1	135	−15.92	0.16	3	−14.89	0.18	−94
1500	−15.39	0.17	157	8.0	112	−15.39	0.17	4	−12.40	0.24	−121
2000	−14.42	0.19	151	7.7	90	−14.42	0.19	3	−11.06	0.28	−145
2500	−12.40	0.24	159	7.6	69	−13.98	0.20	−1	−9.37	0.34	−165
3000	−10.17	0.31	151	6.9	46	−13.15	0.22	−6	−9.12	0.35	176
3500	−8.18	0.39	139	6.0	27	−12.77	0.23	−11	−8.64	0.37	160
4000	−6.74	0.46	126	4.9	8	−12.04	0.25	−23	−8.40	0.38	147

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MAR-6 (T_A = 25°C, I_d = 16 mA)

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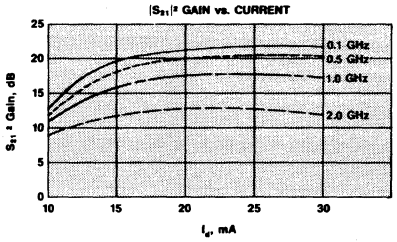
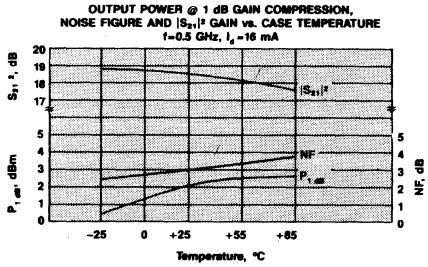
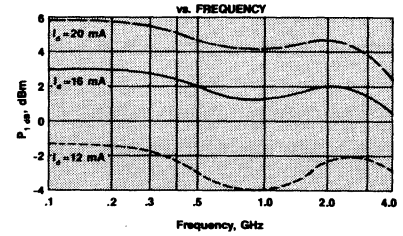
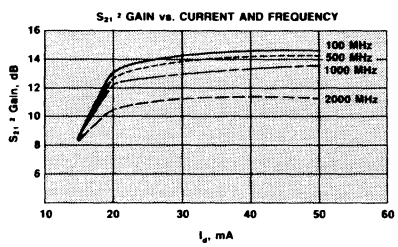


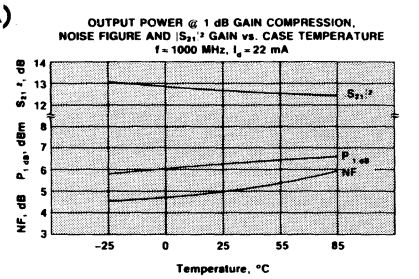


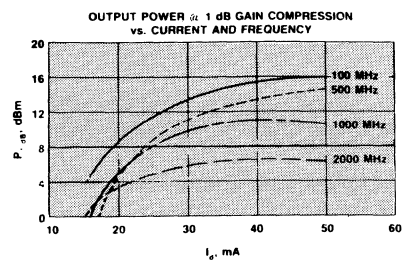


Freq. GHz	S_{11} (Input Return Loss)			S_{21} (Power Gain)			S_{12} (Isolation Out-In)			S_{22} (Output Return Loss)		
	dB	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang
0.1	27.96	.04	171	20.1	10.09	171	−22.5	.075	5	−27.96	.04	−30
0.5	26.02	.05	−105	18.7	8.57	138	−21.3	.086	21	−20.00	.10	−104
1.0	17.72	.13	−118	16.4	6.57	107	−18.8	.115	28	−17.08	.14	−150
1.5	13.56	.21	−140	14.1	5.06	84	−17.1	.140	28	−16.48	.15	180
2.0	10.75	.29	−163	12.0	3.98	65	−15.8	.163	26	−15.92	.16	157
2.5	9.37	.34	−176	10.3	3.26	55	−15.2	.174	28	−15.92	.16	150
3.0	7.74	.41	169	8.7	2.71	42	−14.8	.181	25	−16.48	.15	143
3.5	6.74	.46	157	7.2	2.31	30	−14.2	.194	22	−17.72	.13	144
4.0	6.20	.49	146	6.1	2.01	18	−13.8	.203	20	−20.00	.10	156

MAR-7 (T_A = 25°C, I_d = 22 mA)

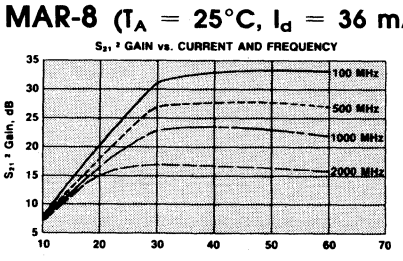


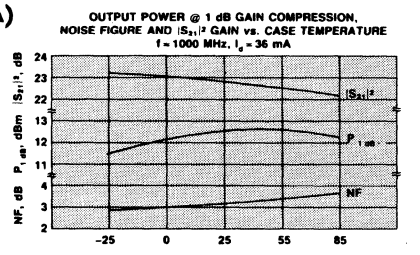


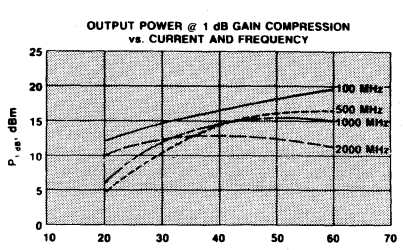


Freq. MHz	S_{11} (Input Return Loss)			S_{21} (Power Gain)		S_{12} (Isolation Out-In)			S_{22} (Output Return Loss)		
	dB	Mag	Ang	dB	Ang	dB	Mag	Ang	dB	Mag	Ang
100	26.02	0.05	169	13.5	173	−19.17	0.11	1	−17.08	0.14	−7
500	30.46	0.03	133	13.1	150	−18.42	0.12	6	−17.72	0.13	−41
1000	40.00	0.01	58	12.5	122	−17.72	0.13	10	−19.17	0.11	−94
1500	24.44	0.06	−113	11.8	95	−16.48	0.15	10	−17.72	0.13	−148
2000	16.48	0.15	−144	10.5	70	−15.39	0.17	7	−15.39	0.17	174
2500	11.37	0.27	−165	9.6	48	−14.89	0.18	1	−14.42	0.19	154
3000	8.64	0.37	169	8.1	27	−13.98	0.20	−6	−14.89	0.18	144
3500	6.94	0.45	150	6.5	10	−14.42	0.19	−11	−15.39	0.17	144
4000	5.98	0.51	134	5.0	−4	−14.42	0.19	−15	−15.39	0.17	152

MAR-8 (T_A = 25°C, I_d = 36 mA)







Freq. MHz	S_{11} (Input Return Loss)			S_{21} (Power Gain)		S_{12} (Isolation Out-In)			S_{22} (Output Return Loss)			K
	dB	Mag	Ang	dB	Ang	dB	Mag	Ang	dB	Mag	Ang	
100	−15.92	0.61	−21	33.0	162	−40.00	0.01	38	−4.73	0.58	−24	0.79
500	−8.18	0.39	−77	27.8	109	−27.96	0.04	52	−9.37	0.34	−96	0.75
1000	−11.37	0.27	−113	23.0	80	−24.44	0.06	51	−13.56	0.21	−147	0.89
1500	−11.70	0.26	−139	19.4	62	−21.94	0.08	46	−14.89	0.18	174	0.96
2000	−10.46	0.30	−155	16.9	47	−20.00	0.10	41	−15.39	0.17	153	0.97
2500	−9.63	0.33	−180	14.8	32	−18.42	0.12	32	−14.42	0.19	127	1.01
3000	−8.87	0.36	167	12.9	20	−17.72	0.13	27	−17.08	0.14	111	1.07
3500	−7.54	0.42	153	11.4	6	−17.08	0.14	21	−17.72	0.13	107	1.06
4000	−6.94	0.45	141	9.8	−5	−16.48	0.15	14	−19.17	0.11	106	1.10

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broadband linear
Power Amplifiers

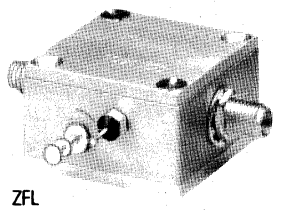
50 ohms

up to 100mW (+20 dBm)

50 KHz to 2000 MHz

case style selection

outline drawings section 1



ZFL

	MODEL NO.	FREQUENCY MHz	GAIN, dB			MAXIMUM POWER, dBm		DYNAMIC RANGE		VSWR		DC POWER		PRICE $	
			Min.	Flatness Max.	Control range	Output (1dB) Compression	Input (no damage)	NF, dB Typ.	Intercept pt., dBm 3rd order	In	Out	Volt.	Current	Ea.	Qty.
ZFL	ZFL-500	0.05-500	20	±1.0	—	+9	+5	5.3	+18	1.9	1.9	+15	85mA	69.95	(1-24)
	ZFL-500 HLN	10-500	19	±0.4	—	+16	+15	3.8	+3.0	1.5	1.5	+1.5	110mA	99.95	(1-24)
	▲ ZFL-500LN	0.1-500	24	±0.3	—	+5	+5	3.1	+14	1.5:1	1.6	+15V	60mA	79.95	(1-24)
	ZFL-750	0.2-750	18	±0.5	—	+9	+5	6.0	+18	1.5:1	2:1	+15V	90mA	74.95	(1-24)
	■ ZFL-1000	0.1-1000	17	±0.6	—	+9	+5	6.0	+18	1.5:1	2:1	+15V	105mA	79.95	(1-24)
case Y 39	ZFL-1000G	10-1000	17	±1.5	30	+3	0	12	+13	2:1	2:1	+15V	100mA	199.00	(1-9)
	ZFL-1000LN	0.1-1000	20	±0.5	—	+3	+5	3.4	+14	1.5	2:1	+15V	60mA	89.95	(1-24)
	ZFL-2000	10-2000	20	±1.5	—	+17•	+5	7.0	+25	2:1	2:1	+15V	100mA	219.00	(1-9)
case SS98	ZFL-1000H	10-1000	28	±1.0	—	+20	+5	5	+33	2:1	2:1	15	150mA	219.00	(1-9)
case SS98	ZFL-1000VH	10-1000	20	±1	—	+26*	+15	4.5	+38	1.8	2.0	+15	320mA	229.00	(1-9)

NOTES:

• +15dBm below 1000 Mhz.
■ ZFL-1000 output VSWR 2.8:1 maximum over 750-1000 MHz; 1 dB compression + 7 dBm 500-1000 MHz
▲ VSWR 1.6 maximum from 0.1 to 0.2 MHz.
1. Operating temperature is −55°C to +71°C except the ZFL-2000 is −55°C to +100°C. When models ZFL-1000H and ZFL-2000 are mounted to chassis using a thermoconductive paste, their operating temperature range will be increased.
2. With no load output, derate maximum input power (no damage) by 10 dB.
3. Prices and specifications subject to change without notice.
* Above 500 MHz, 24 dBm

NSN GUIDE

MCL NO.	NSN
ZFL-2000	5895-01-220-2213

ZFL-500

FREQ. (MHz)	GAIN, dB FORWARD	GAIN, dB REVERSE	LINEARITY Comp. (dB)	LINEARITY P_{out} (dBm)	NOISE FIGURE (dB)	VSWR in	VSWR out
.050	22.8	37.70	0.6	10.6	—	—	—
.104	22.9	38.80	0.6	10.9	—	1.33	1.09
.217	23.0	38.70	.7	11.0	—	1.33	1.09
.453	23.4	38.60	.8	11.4	—	1.34	1.08
.943	23.3	38.50	.7	11.3	—	1.35	1.09
1.966	23.4	38.30	.8	11.4	6.0	1.35	1.07
4.098	23.5	38.30	.8	11.4	5.9	1.35	1.09
8.541	23.5	38.20	.8	11.4	5.9	1.35	1.07
10.910	23.4	38.30	.8	11.4	6.0	1.37	1.08
22.738	23.4	38.20	.8	11.4	5.9	1.36	1.09
47.389	23.5	38.10	.8	11.4	5.8	1.36	1.07
98.767	23.6	38.00	.9	11.6	5.9	1.37	1.07
126.160	23.8	38.00	.8	11.7	5.9	1.38	1.07
161.151	23.7	38.00	.9	11.6	5.8	1.38	1.09
205.846	23.7	38.00	.9	11.6	5.8	1.36	1.10
262.938	23.6	38.00	.9	11.6	5.8	1.39	1.09
335.865	23.5	37.70	.8	11.4	5.7	1.41	1.08
429.019	23.1	37.20	.9	11.0	5.6	1.44	1.08
548.008	22.5	36.00	.7	11.4	5.6	1.50	1.11
700.000	21.4	34.90	.5	9.3	5.8	1.56	1.16

ZFL-500-LN

FREQ (MHz)	GAIN (dB)	LINEARITY Comp (dB)	LINEARITY P_{out} (dBm)	NOISE FIGURE	RETURN LOSS in	RETURN LOSS out
.100	30.90	0.72	7.65	—	33.84	16.81
.300	30.83	.89	7.62	—	27.01	16.81
.506	30.81	.87	7.92	—	26.10	17.15
1.100	30.80	.86	7.99	—	25.48	17.35
2.390	30.77	.83	7.77	—	25.30	17.43
5.190	30.76	.81	7.45	—	25.25	17.53
10.130	30.76	.80	7.39	2.52	25.19	17.56
24.460	30.74	.77	7.36	2.47	25.25	17.55
40.490	30.75	.76	7.35	2.50	25.09	17.63
50.120	30.70	.75	7.24	2.52	24.96	17.70
100.720	30.71	.72	7.16	2.56	24.00	18.01
190.970	30.67	.67	6.97	2.57	21.77	19.07
250.520	30.72	.67	6.91	2.59	20.21	20.28
322.330	30.75	.62	6.77	2.57	18.43	22.69
503.450	30.68	.56	6.52	2.65	15.38	23.08

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Mini-Circuits

ZFL-750

FREQ (MHz)	GAIN (dB)	LINEARITY Comp (dB)	LINEARITY P_{out} (dBm)	NOISE FIGURE	RETURN LOSS in	RETURN LOSS out
0.100	19.63	0.96	10.68	—	22.92	28.41
0.200	19.89	0.94	10.70	—	22.92	28.41
0.300	19.91	1.16	11.45	—	25.71	35.78
10.300	19.96	1.08	11.08	6.21	27.16	32.20
110.270	19.92	1.16	10.65	6.06	25.45	32.80
195.240	19.91	1.06	10.37	6.00	23.54	30.92
305.210	19.90	.74	9.82	6.16	21.66	27.51
400.180	19.91	.77	9.71	6.10	21.73	23.63
500.150	20.03	.67	9.40	6.14	23.07	20.01
610.120	20.20	.58	9.05	6.12	28.88	16.05
667.600	20.34	.44	8.35	—	34.56	14.33
700.090	20.35	.44	8.35	6.01	34.61	13.48
750.080	20.41			6.06	29.25	12.33
917.520	20.19			6.06	20.36	9.54
1000.000	19.90			6.13	18.64	8.97

ZFL-1000

FREQ (MHz)	GAIN (dB)	LINEARITY Comp (dB)	LINEARITY P_{out} (dBm)	NOISE FIGURE	RETURN LOSS in	RETURN LOSS out
0.100	19.63	0.96	10.68	—	22.92	28.41
0.200	19.89	0.94	10.70	—	22.92	28.41
0.300	19.91	1.16	11.45	—	25.71	35.78
10.300	19.96	1.08	11.08	6.21	27.16	32.20
110.270	19.92	1.16	10.65	6.06	25.45	32.80
195.240	19.91	1.06	10.37	6.00	23.54	30.92
305.210	19.90	.74	9.82	6.16	21.66	27.51
400.180	19.91	.77	9.71	6.10	21.73	23.63
500.150	20.03	.67	9.40	6.14	23.07	20.01
610.120	20.20	.58	9.05	6.12	28.88	16.05
667.600	20.34	.44	8.35	—	34.56	14.33
700.090	20.35	.44	8.35	6.01	34.61	13.48
750.080	20.41			6.06	29.25	12.33
917.520	20.19			6.06	20.36	9.54
1000.000	19.90			6.13	18.64	8.97

ZFL-1000G

FREQUENCY (MHz)	GAIN, dB 0V	1V	1.4V	1.87V
10.000	26.99	20.12	10.35	.87
39.750	27.67	20.03	9.46	.61
69.500	27.66	19.75	8.90	−1.38
99.250	27.61	19.58	8.61	−1.74
129.000	27.51	19.41	8.37	−2.03
158.750	27.42	19.29	8.21	−2.23
188.500	27.31	19.17	8.05	−2.39
218.250	27.21	19.07	7.92	−2.49
248.000	27.12	18.98	7.83	−2.62
277.750	27.06	18.92	7.76	−2.63
307.500	27.01	18.87	7.68	−2.73
396.750	26.71	18.61	7.49	−2.81
456.250	26.59	18.45	7.34	−2.93
545.500	26.44	18.20	7.12	−2.98
634.750	26.36	17.98	6.91	−3.07
724.000	26.30	17.77	6.71	−3.11
813.250	26.33	17.61	6.54	−3.11
902.500	26.16	17.43	6.35	−3.09
991.750	25.75	17.20	6.15	−3.13
1021.500	25.51	17.08	6.06	−3.18

ZFL-1000LN

FREQ (MHz)	GAIN (dB)	LINEARITY Comp (dB)	LINEARITY P_{out} (dBm)	NOISE FIGURE	RETURN LOSS in	RETURN LOSS out
0.100	22.93	1.42	5.66	—	21.51	19.99
1.000	24.50	1.35	5.73	—	31.01	35.40
5.010	24.48	1.28	5.70	—	31.98	42.86
10.520	24.48	1.25	5.60	2.67	31.97	48.17
47.030	24.44	1.28	5.40	2.70	32.34	47.40
100.000	24.41	1.16	5.42	2.85	31.56	48.92
201.500	24.18	1.14	5.98	2.85	30.62	41.18
252.250	24.19	1.10	6.07	2.95	31.01	34.22
303.000	24.16	1.03	6.01	2.92	29.01	27.61
498.750	24.19	.71	5.92	2.96	28.71	24.55
600.250	24.27	.64	6.10	2.95	28.50	21.00
701.750	24.33	.54	5.93	2.97	29.19	19.66
803.250	24.40	.50	5.96	3.02	30.28	16.43
897.500	24.41	.48	5.86	3.03	28.64	14.35
999.000	24.26	.44	5.71	3.05	25.58	11.97

ZFL-1000H

FREQ. (MHz)	GAIN, dB FORWARD	REVERSE	LINEARITY Comp. (dB)	LINEARITY P_{out} (dBm)	NOISE FIGURE (dB)	VSWR in	VSWR out
10.000	31.15	48.0	1.02	20.13	5.63	1.36	1.33
84.500	31.04	49.3	.97	20.09	5.32	1.39	1.31
121.750	31.04	48.2	.95	20.09	4.57	1.45	1.36
159.000	31.04	48.0	.94	20.09	4.37	1.47	1.36
196.250	31.06	47.6	.96	20.08	4.23	1.39	1.38
233.500	31.07	48.4	.95	20.08	4.23	1.39	1.30
270.750	31.06	47.4	.94	20.08	4.31	1.33	1.37
308.000	31.07	47.2	.95	20.06	4.32	1.40	1.30
382.500	31.15	46.8	1.00	20.09	4.32	1.40	1.32
494.250	31.20	48.4	.97	20.16	4.34	1.31	1.39
606.000	31.09	48.0	.89	20.13	4.33	1.41	1.38
680.500	30.84	48.0	.77	20.00	4.33	1.42	1.50
792.250	30.65	49.3	.53	20.01	4.29	1.36	1.40
904.000	30.86	48.1	.31	20.22	4.18	1.45	1.44
1015.800	31.82	45.9	.36	21.17	4.22	1.39	1.38
1127.500	32.18	43.5	.61	21.37	4.30	1.26	1.91
1239.300	31.03	36.8	.49	20.17	4.29	1.44	2.10
1313.800	31.08	42.0	.49	20.48	4.34	1.29	2.12
1388.300	31.02	42.5	.56	20.43	4.38	1.84	2.02
1500.000	29.31	43.2	.26	19.06	4.19	3.42	1.48

ZFL-2000

FREQ. (MHz)	GAIN, dB FORWARD	REVERSE	LINEARITY Comp. (dB)	LINEARITY P_{out} (dBm)	NOISE FIGURE (dB)	VSWR in	VSWR out
10.00	22.68	33.41	1.26	15.44	4.1	1.44	1.28
105.42	22.58	33.31	1.26	15.35	4.1	1.46	1.21
200.83	22.60	33.35	1.30	15.32	4.1	1.44	1.13
296.25	22.48	33.37	1.28	15.24	4.1	1.35	1.09
391.67	22.32	33.45	1.05	15.19	4.0	1.24	1.13
487.08	21.96	33.60	0.92	15.11	3.9	1.18	1.14
582.50	21.63	34.05	0.80	14.74	4.3	1.21	1.18
677.92	21.60	34.33	0.82	14.86	4.4	1.37	1.24
773.33	22.03	34.03	0.74	15.28	4.5	1.48	1.30
868.75	22.42	33.59	0.71	15.74	4.7	1.53	1.36
964.17	22.64	33.12	0.62	15.98	4.8	1.49	1.45
1059.40	22.89	32.74	0.68	16.25	4.9	1.39	1.59
1154.70	23.14	32.22	0.79	16.42	5.1	1.25	1.71
1250.20	23.44	31.64	0.88	16.54	5.2	1.05	1.76
1345.80	23.34	31.15	0.73	16.57	5.2	1.19	1.67
1441.00	23.18	30.81	0.63	16.55	5.3	1.44	1.52
1535.90	22.96	30.64	0.49	16.45	5.3	1.64	1.31
1631.50	22.64	30.73	0.38	16.22	5.2	1.77	1.10
1726.90	22.32	30.57	0.33	15.97	5.0	1.78	1.11
1822.20	22.08	30.05	0.26	15.80	5.1	1.67	1.28
1917.60	21.70	29.21	0.00	15.67	5.2	1.54	1.43
2014.80	21.03	29.26	0.46	15.58	5.4	1.55	1.53
2108.20	20.24	28.70	0.89	15.20	5.6	1.97	1.57
2204.00	19.23	28.44	1.17	14.47	5.9	2.93	1.48
2299.70	18.26	28.28	1.11	13.35	5.3	4.15	1.29

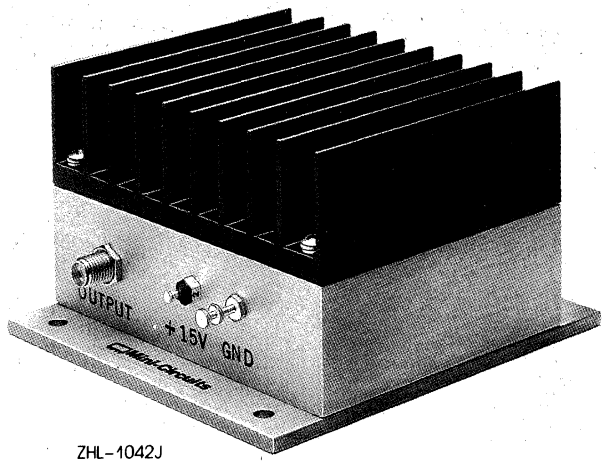
In Stock...Immediate Delivery

broadband linear
Power Amplifiers

50 ohms

up to 100mW (+20 dBm)
10 MHz to 4.2 GHz

case style selection
outline drawings see pages 4-9



ZHL-1042J

MODEL NO.		FREQUENCY GHz	GAIN, dB Min.	GAIN, dB Flatness Max	MAXIMUM POWER, dBm Output (1dB) Compression	MAXIMUM POWER, dBm Input (no damage)	DYNAMIC RANGE NF, dB Typ.	DYNAMIC RANGE Intercept pt., dBm 3rd order Typ.	VSWR In	VSWR Out	DC POWER Volt.	DC POWER Current	PRICE $ Ea.	PRICE $ Qty.
ZHL-1042J case NN 92	ZHL-1042J	0.01-4.2	25	±1.5	+20	+10	4.5	+30	2.5:1	2.5:1	15	0.300A	495	(1-9)

ZHL-1042J computer-automated performance data
typical production unit / for data of other models consult factory

FREQUENCY (MHz)	GAIN, dB FORWARD	GAIN, dB REVERSE	LINEARITY Comp. (dB)	LINEARITY P_{out} (dBm)	NOISE FIGURE (dB)	VSWR in	VSWR out
10.000	28.98	52.6	.94	21.95	18.7	1.19	1.20
114.750	28.34	54.7	.80	21.33	7.1	1.28	1.22
219.500	28.31	54.1	.76	21.29	5.5	1.21	1.17
324.250	28.20	53.6	.73	21.18	4.7	1.25	1.22
429.000	28.05	56.8	.70	21.05	4.5	1.29	1.39
533.750	27.86	56.6	.70	20.82	4.4	1.31	1.40
630.500	27.65	56.6	.75	20.56	4.4	1.29	1.48
743.250	27.34	56.7	.82	20.18	4.4	1.25	1.58
848.000	27.05	58.2	.83	19.80	4.5	1.28	1.69
952.750	26.88	57.1	.88	19.51	4.7	1.23	1.76
1057.500	26.82	57.9	.93	19.39	4.7	1.22	1.74
1162.300	26.87	55.2	.94	19.42	4.7	1.33	1.70
1267.000	26.98	52.5	.94	19.57	4.5	1.56	1.65
1476.500	27.13	53.4	.82	19.89	4.6	1.67	1.38
1686.000	27.07	51.7	.70	19.71	4.8	1.56	1.19
1895.500	27.31	51.8	.62	19.57	4.9	1.38	1.23
2105.000	27.75	50.6	.54	20.50	5.2	1.18	1.25
2314.500	28.08	52.0	.40	20.98	5.6	1.19	1.30
2524.000	28.39	50.7	.38	21.33	5.3	1.18	1.37
2838.300	28.23	50.8	.31	21.06	5.2	1.19	1.52
3047.800	28.34	52.0	.54	21.00	5.2	1.19	1.60
3257.300	28.62	50.8	.79	21.17	5.2	1.29	1.62
3466.800	28.58	53.0	.90	20.94	5.7	1.66	1.60
3676.300	28.49	53.1	.89	20.79	5.9	1.86	1.57
3781.000	28.42	53.8	.90	20.72	6.3	1.83	1.59
3885.800	28.39	53.2	.88	20.66	6.3	1.57	1.55
3990.500	28.40	54.1	.95	20.62	6.3	1.23	1.60
4200.000	27.50	53.0	1.10	20.00	6.4	1.66	1.60

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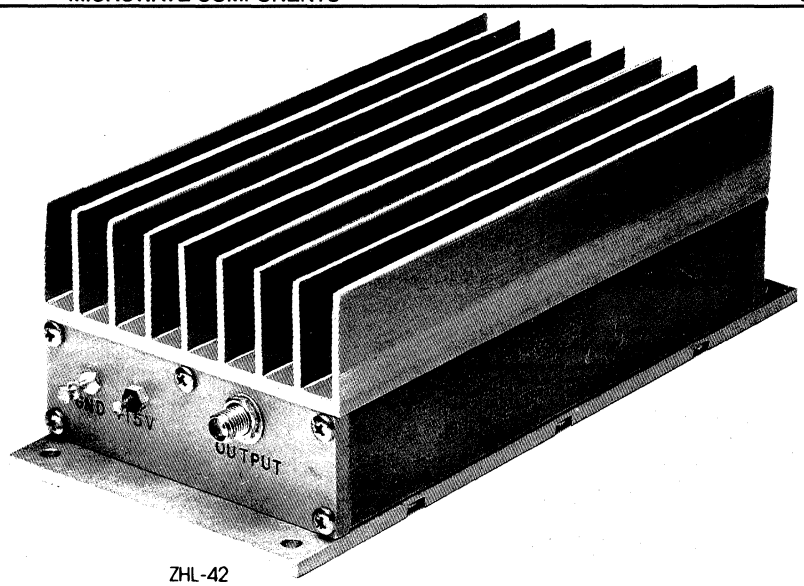
FAX (718) 332-4661 TELEX 6852844 or 620156

up to 1 Watt (+30 dBm)

10 MHz to 4.2 GHz



ZHL-42

	MODEL NO.	FREQUENCY GHz	GAIN, dB Min.	GAIN, dB Flatness Max	MAXIMUM POWER, dBm Output (1dB) Compression	MAXIMUM POWER, dBm Input (no damage)	DYNAMIC RANGE NF, dB Typ.	DYNAMIC RANGE Intercept pt., dBm 3rd order Typ.	VSWR In	VSWR Out	DC POWER Volt.	DC POWER Current	PRICE $ Ea.	PRICE $ Qty.
ZHL-42 case U 36	ZHL-42	0.7-4.2	30	±1.0	+29	+10	10	+38	2.5:1	2.5:1	15	0.69A	895	(1-9)
	ZHL-4240	0.7-4.2	40	±1.5	+29	0	4	+38	2.5:1	2.5:1	15	0.7A	1395	(1-9)
	ZHL-42W	0.01-4.2	30	±1.5	+29*	+10	8**	+38	2.5:1	2.5:1	15	0.75A	1,095	(1-9)

NOTES:

1. Operating temperature −20°C to +65°C
   Storage temperature −55°C to +100°C
2. With no load output, derate maximum input power (no damage) by 10dB.
3. Prices and specifications subject to change without notice.

* +28 dBm, 10 MHz to 700 MHz, 3500 MHz to 4200 MHz

** Below 100 MHz increases to 15 dB at 10 MHz

FEATURES

- up to 1w, covers 700 MHz to 4.2 GHz
- ultra-linear Class A design provides unconditional stability
- any load impedance can be connected without concern for damage or oscillation
- ideally suited for TACAN, mobile radio, telemetry, anti-collision, and satellite communications systems
- use to boost signal/sweep generator output, achieve broadband isolation, and provide up to four test set ups with a four-way splitter
- exceptionally low price
- one-year guarantee
- immediate delivery

ZHL-42

FREQ. (MHz)	GAIN, dB Forward	GAIN, dB Reverse	LINEARITY Comp. (dB)	LINEARITY P_{out} (dBm)	NOISE FIGURE (dB)	VSWR in	VSWR out
700.25	33.56	47.42	1.18	28.91	7.3	1.57	1.98
845.84	33.44	47.61	1.05	28.82	7.17	1.54	1.67
991.85	33.61	47.66	0.86	29.29	7.17	1.51	1.42
1137.60	34.37	47.97	0.93	29.98	7.17	1.46	1.37
1283.50	34.54	47.96	0.61	30.42	7.20	1.43	1.36
1429.70	34.09	48.08	0.07	30.65	7.17	1.60	1.33
1575.50	34.06	48.00	0.16	30.53	7.19	1.67	1.47
1720.90	34.65	48.03	0.80	30.65	7.21	1.72	1.43
1866.60	35.05	48.15	1.41	30.46	7.24	1.62	1.32
2013.10	35.42	48.30	1.75	30.57	7.28	1.57	1.20
2158.00	35.21	48.36	1.40	30.53	7.33	1.47	1.21
2304.20	34.72	48.35	1.30	30.13	7.42	1.48	1.16
2448.60	34.42	48.27	1.22	29.77	7.39	1.49	1.15
2595.20	34.55	48.36	1.05	29.91	7.38	1.51	1.18
2741.40	33.78	48.26	0.31	30.01	7.38	1.37	1.24
2887.60	34.03	48.29	0.32	30.35	7.39	1.34	1.52
2999.40	34.25	48.39	0.49	30.38	7.40	1.28	1.94
3033.30	34.05	48.50	0.29	30.50	7.41	1.24	1.99
3179.70	33.85	48.35	0.36	30.27	7.43	1.24	1.74
3324.30	34.01	48.62	0.77	30.04	7.43	1.30	1.56
3470.30	34.34	48.51	0.79	30.19	7.47	1.39	1.43
3616.70	34.49	48.76	1.07	29.91	7.52	1.58	1.28
3763.00	34.65	48.61	0.72	29.73	7.58	1.67	1.11
3909.00	32.36	48.49	0.33	29.69	7.62	1.54	1.21
4053.50	33.32	48.74	0.05	30.30	7.96	1.39	1.39
4199.90	34.60	48.69	0.08	30.04		1.44	1.84

ZHL-4240

700.00	45.20		1.18	28.91	3.9	1.23	1.65
875.00	45.38		1.05	28.82	3.9	1.20	1.29
1050.00	44.65		0.86	29.29	3.9	1.23	1.22
1225.00	44.40		0.93	29.98	3.8	1.22	1.37
1400.00	44.47		0.61	30.42	3.8	1.34	1.33
1575.00	44.93		0.07	30.65	3.8	1.50	1.20
1750.00	45.46		0.80	30.65	3.9	1.30	1.20
1925.00	45.48		1.75	30.57	3.9	1.26	1.22
2100.00	44.99		1.30	30.13	3.9	1.23	1.22
2275.00	44.57		1.22	29.77	3.8	1.40	1.18
2450.00	44.37		1.05	29.91	3.6	1.49	1.20
2625.00	44.45		0.31	30.01	3.6	1.64	1.41
2800.00	44.70		0.32	30.35	3.6	1.59	1.76
2975.00	44.88		0.49	30.38	3.6	1.52	1.90
3150.00	45.64		0.36	30.27	3.6	1.32	1.98
3325.00	46.25		0.77	30.04	3.6	1.28	1.73
3500.00	45.92		0.79	30.19	3.6	1.37	1.32
3675.00	45.19		1.07	29.91	3.8	1.41	1.24
3850.00	44.85		0.33	29.69	3.8	1.55	1.48
4025.00	45.18		0.05	30.30	3.8	1.41	1.55
4200.00	46.71		0.08	30.04	4.1	1.66	1.95

Mini-Circuits

broadband linear

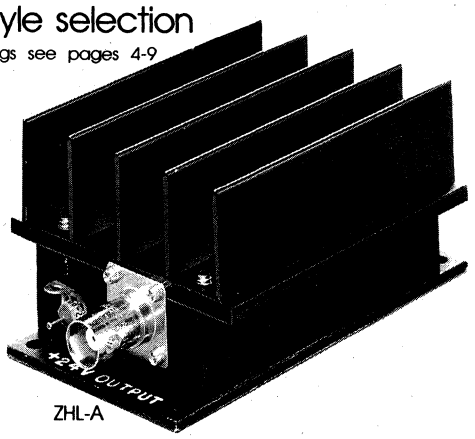
Power Amplifiers

up to 1 Watt (+30 dBm)

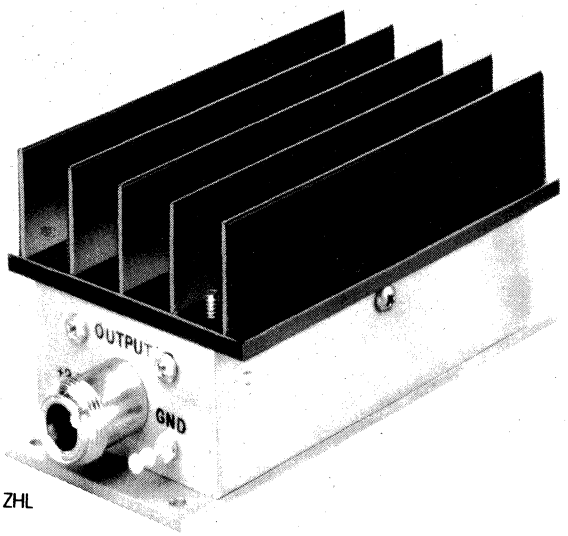
50 KHz to 1200 MHz

case style selection

outline drawings see pages 4-9



ZHL-A



ZHL

	MODEL NO.	FREQUENCY MHz	GAIN, dB Min.	GAIN, dB Flatness Max.	MAXIMUM POWER, dBm Output (1dB) Compression	MAXIMUM POWER, dBm Input (no damage)	DYNAMIC RANGE NF, dB Typ.	DYNAMIC RANGE Intercept pt., dBm 3rd order Typ.	VSWR In	VSWR Out	DC POWER Volt.	DC POWER Current	PRICE $ Ea.	PRICE $ Qty.
ZHL-A case S 32	**ZHL-1A**	2-500	16	±1.0	+28	+20	11	+38	2:1	2:1	+24V	0.6A	199	1-9
	ZHL-3A	0.4-150	24	±1.0	+29.5	+10	11	+38	2:1	2:1	+24V	0.6A	199	1-9
	ZHL-32A	0.05 -130	25	±1.0	+29	+10	10	+38	2:1	2:1	+24V	0.6A	199	1-9
ZHL case T 34	**ZHL-2**	10-1000	16	±1.0	+29	+20	18	+38	2:1	2:1	+24V	0.6A	349	1-9
	ZHL-2-8	10-1000	27	±1.0	+29	+10	10	+38	2:1	2:1	+24V	0.6A	474	1-9
	ZHL-2-12 *	10-1200	24	±1.0	+29*	+10	10	+38	2:1	2:1	+24V	0.75A	625	1-9

* + 28.5 dBm maximum output 1000 to 1200 MHz available only with SMA

NOTES:
1. Operating temperature −20°C to +65°C.
   Storage temperature −55°C to +100°C.
2. With no load on output, derate maximum input power (no damage) by 10dB.
3. Prices and specifications subject to change without notice.

NSN GUIDE

ZHL-1A	6130-01-088-2322
ZHL-3A	5895-01-194-1718
ZHL-32A	5895-01-238-7973

FEATURES

- up to 1w, covers 50 KHz to 1200 MHz
- ultra-linear Class A design provides unconditional stability
- any load impedance can be connected without concern for damage or oscillation
- ideally suited for TACAN, mobile radio, telemetry, anti-collision, and satellite communications systems
- use to boost signal/sweep generator output, achieve broadband isolation, and provide up to four test set ups with a four-way splitter
- exceptionally low price
- one-year guarantee

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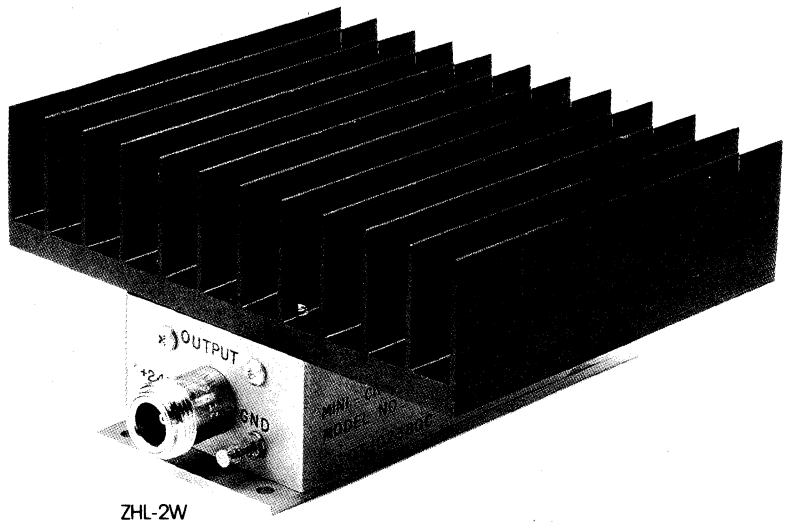
broadband linear
Power Amplifiers
up to 2 Watts (+33 dBm)
5 MHz to 800 MHz



ZHL-2W

	MODEL NO.	FREQUENCY MHz	GAIN, dB Min.	GAIN, dB Flatness Max.	MAXIMUM POWER, dBm Output (1dB) Compression	MAXIMUM POWER, dBm Input (no damage)	DYNAMIC RANGE NF, dB Typ.	DYNAMIC RANGE Intercept pt., dBm 3rd order Typ.	VSWR In	VSWR Out	DC POWER Volt.	DC POWER Current	PRICE $ Ea.	PRICE $ Qty.
ZHL-2W case T 35	ZHL-1-2W	5-500	29	±1.0	+33	+10	12	+44	2:1	2:1	+24V	0.9A	495	1-9
	ZHL-7-2W	600-800	28	±1.0	+33	+10	12	+43	2:1	2:1	+24V	0.9A	525	1-9

NOTES:

1. Operating temperature −20°C to +65°C.
   Storage temperature −55°C to +100°C.
2. With no load on output, derate maximum input power (no damage) by 10dB.
3. Prices and specifications subject to change without notice.

ZHL-1-2W

FREQ. (MHz)	GAIN, dB FORWARD	GAIN, dB REVERSE	LINEARITY Comp. (dB)	LINEARITY P_{out} (dBm)	VSWR in	VSWR out
5.00	32.25	58.70	0.25	32.86	1.46	1.65
031.05	31.64	58.90	0.26	32.74	1.39	1.67
057.10	31.58	58.60	0.36	32.70	1.38	1.70
083.15	31.59	58.40	0.42	32.58	1.36	1.74
109.20	31.51	57.50	0.39	32.56	1.33	1.80
135.25	31.43	57.40	0.51	32.48	1.28	1.85
161.30	31.49	56.50	0.52	32.49	1.22	1.91
187.35	31.46	56.20	0.61	32.39	1.15	1.99
213.40	31.39	55.70	0.60	32.38	1.08	2.05
239.45	31.39	55.50	0.62	32.38	1.03	2.07
265.50	31.32	55.10	0.66	32.34	1.12	2.03
291.55	31.25	55.10	0.64	32.31	1.24	1.89
317.60	31.22	55.20	0.64	32.38	1.36	1.67
343.65	31.11	55.20	0.70	32.33	1.49	1.43
369.70	30.89	55.10	0.58	32.35	1.59	1.20
395.75	30.74	55.60	0.66	32.43	1.67	1.04
421.80	30.70	55.10	0.67	32.41	1.73	1.24
447.85	30.73	54.40	0.64	32.38	1.78	1.49
473.90	31.07	53.50	0.77	32.31	1.83	1.76
500.00	31.95	52.10	1.00	32.02	1.90	1.99

ZHL-7-2W

FREQ. (MHz)	GAIN, dB FORWARD	GAIN, dB REVERSE	LINEARITY Comp. (dB)	LINEARITY P_{out} (dBm)	VSWR in	VSWR out
600.00	30.93	54.30	.77	33.41	1.46	1.34
610.00	31.03	54.60	.79	33.50	1.41	1.29
620.00	31.09	53.50	.74	33.61	1.39	1.28
630.00	31.17	53.40	.74	33.70	1.37	1.28
640.00	31.24	53.00	.72	33.78	1.37	1.29
650.00	31.29	53.40	.67	33.88	1.35	1.33
660.00	31.35	53.50	.63	33.97	1.35	1.32
670.00	31.40	53.80	.61	33.99	1.36	1.34
680.00	31.48	54.00	.63	34.09	1.35	1.35
690.00	31.57	54.80	.65	34.16	1.35	1.30
700.00	31.63	54.70	.62	34.28	1.35	1.32
720.00	31.83	54.60	.62	34.48	1.34	1.32
730.00	31.91	54.00	.65	34.54	1.35	1.31
740.00	32.01	52.80	.66	34.63	1.36	1.28
750.00	32.08	52.20	.69	34.67	1.36	1.28
760.00	32.18	51.80	.80	34.66	1.39	1.28
770.00	32.21	50.80	.82	34.66	1.44	1.26
780.00	32.24	49.60	.87	34.64	1.49	1.30
790.00	32.19	49.10	.91	34.53	1.53	1.36
800.00	32.03	48.30	.94	34.33	1.53	1.52

In Stock...Immediate Delivery

wideband RF Transformers

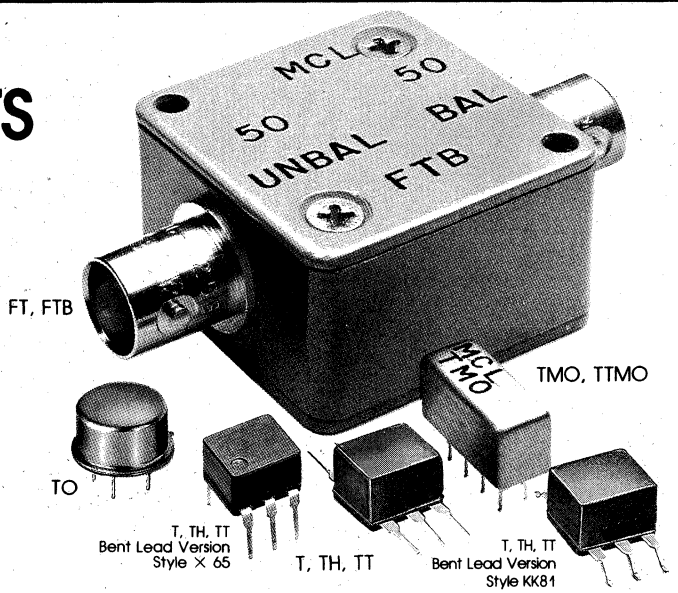
3KHz to 800MHz

case style selection

outline drawings see section 1

T, TH, TT: Case W38, X65, KK81*
TMO: Case A11
† TMO, TTMO: Case A03
FT, FTB: Case H16
TO: Case PP94

*KK81 is Surface Mounting



For PC applications, select from the low-cost, plastic-case T series (small enough to be inserted into a standard 1/3 DIP socket), or the hermetically-sealed RFI shielded TMO metal-case series (requiring less PC area than a flatpack or TO-5 can), or the plastic-case T-H series designed to handle up to 100 mA in the primary winding without appreciable saturation or change in RF characteristics.

Transformer core saturation is influenced by (1) dc current through the winding, (2) RF input power, and (3) frequency of operation. These three variables interact to affect the point at which saturation occurs, see Figs. (1) and (2). These curves show the point where distortion occurs, by visual observation.

Now comparing the T-H series to the conventional T-series in Figs. (1) and (2), note that saturation effects are negligible with the T16-1H; so for wide dynamic range applications, specify the T-H series.

These transformers may be operated as low as 12.5 ohms at the primary with essentially the same impedance matching ratio and only a slight change in frequency response.

For each RF transformer model, the minimum and maximum frequency is given for the insertion loss at the 3 dB, 2 dB and 1 dB points, as shown in Fig. (3) and listed in the data chart. For example, the T1-1 insertion loss is 1 dB from 2 to 50 MHz and 3 dB from 0.15 to 400 MHz.

Coaxial connector models are available from 10 KHz to 500 MHz and are offered with 50 ohm and 75 ohm impedances; 75 ohm connectors are used at 75 ohm ports. The FT 1.5-1, with unbalanced input and output, is especially useful for 50 ohm to 75 ohm matching applications. The FTB series with unbalanced output and balanced input (connector ground insulated from the case) helps eliminate ground loop problems, especially when long cable runs are involved.

performance saturation curves T, TH series

(RF power & DC current at which signal saturation begins)

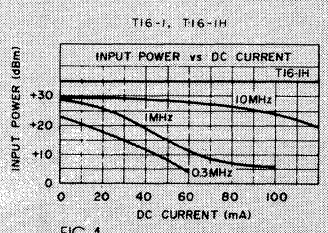


FIG. 1

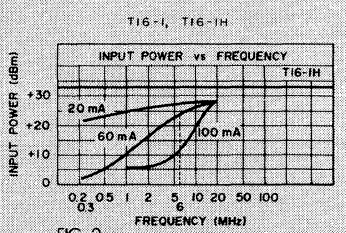


FIG. 2

frequency response curve

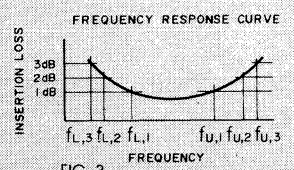


FIG. 3

pin connections see case style outline drawings.

CONFIGURATION CODE	*A		*B		C,E			D		F
CONFIGURATION	DC Isolated Center-Tap Secondary		DC Isolated Center-Tap Primary, Secondary		DC Isolated			Unbalanced Primary, Secondary		Windings Open
SERIES	T, TH	TMO	TT	TTMO	T, TH	TO	TMO	T	TMO	T
Primary DOT	4	1	4	1	4	1	1	6	1	X1 Y2 Z3
Primary	6	5	6	5	6	2	5	3◊	6◊◊	X6 Y5 Z4
Primary CT	—	—	5	3	—	—	—	—	—	
Secondary DOT	3	2	3	2	3	4	2	1	2	
Secondary	1	6	1	6	1	3	6	3◊	6◊◊	
Secondary CT	2	4	2	4	—	—	—	—	—	
Case Gnd.	—	7,8	—	7,8	—	—	7,8	—	7,8	

◊pin 3 must be grounded
◊ ◊pin 6 must be grounded

● 50 ohms pin 3 and 4 must be grounded to ensure proper electrical performance.

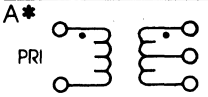
Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

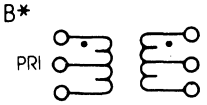
Mini-Circuits

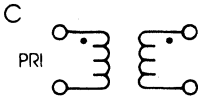
12.5 to 800 ohms

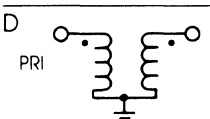
case style number see opposite page.

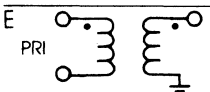
		MODEL NO.	Ω RATIO	FREQUENCY MHz	INSERTION LOSS 3dB MHz	INSERTION LOSS 2dB MHz	INSERTION LOSS 1dB MHz	PRICE $ Ea.	PRICE $ Qty.
A*	T	T1-1T	1	.05-200	.05-200	.08-150	.2-80	3.95	(10-49)
		T1-6T	1	.003-300	.003-300	.01-150	.02-50	5.95	(10-49)
		T2-1T	2	.07-200	.07-200	.1-100	.5-50	4.25	(10-49)
		T2.5-6T	2.5	.01-100	.01-100	.02-50	.05-20	4.25	(10-49)
		T3-1T	3	.05-250	.05-250	.1-200	.5-70	3.95	(10-49)
		T4-1	4	.2-350	.2-350	.35-300	2-100	2.95	(10-49)
		T4-6T	4	.02-250	.02-250	.05-150	0.1-100	3.95	(10-49)
		T5-1T	5	.3-300	.3-300	.6-200	.5-100	4.25	(10-49)
		T8-1T	8	.03-140	.03-140	.10-90	1-60	6.95	(10-49)
		T13-1T	13	.3-120	.3-120	.7-80	5-20	4.25	(10-49)
		T16-6T	16	.03-75	.03-75	.06-30	.1-20	4.95	(10-49)
	▲TH	T4-1H	4	10-350	10-350	15-300	25-200	4.95	(10-49)
	TMO	TMO1-1T	1	.05-200	.05-200	.08-150	.2-80	6.45	(10-49)
		TMO2-1T	2	.07-200	.07-200	.1-100	.5-50	6.75	(10-49)
		† TMO2.5-6T	2.5	.01-100	.01-100	.02-50	.05-20	6.75	(10-49)
		† TMO3-1T	3	.05-250	.05-250	.1-200	.5-70	6.45	(10-49)
		TMO4-1	4	.2-350	.2-350	.35-300	2-100	4.95	(10-49)
		TMO5-1T	5	.3-300	.3-300	.6-200	5-100	6.75	(10-49)
		TMO13-1T	13	.3-120	.3-120	.7-80	5-20	6.75	(10-49)
B*	TT	TT1-6	1	.004-500	.004-500	.02-200	.1-50	5.95	(10-49)
		TT1.5-1	1.5	.075-500	.075-500	.2-100	1-50	4.95	(10-49)
		TT2.5-6	2.5	.01-50	.01-50	.025-25	.05-10	5.25	(10-49)
		TT4-1	3	.05-200	.05-200	.2-50	1-30	4.95	(10-49)
		NEW TT4-1A	4	0.1-300	0.1-300	0.2-250	0.3-180	6.95	(10-49)
		TT25-1	25	.02-30	.02-30	.05-20	.1-10	7.95	(10-49)
		TTMO-25-1	25	.02-30	.02-30	.05-20	.1-10	11.95	(10-49)
	TTMO	TTMO1-1	1	.005-100	.005-100	.01-75	.05-40	10.95	(10-49)
		NEW TTMO4-1A	4	0.1-300	0.1-300	0.2-250	0.3-180	11.95	(10-49)
C	T	T1-1	1	.15-400	.15-400	.35-200	2-50	2.95	(10-49)
		NEW T1.18-3	1.18	0.01-250	0.01-250	0.02-200	0.03-50	4.95	(10-49)
		T1-6	1	.01-150	.01-150	.02-100	.05-50	4.95	(10-49)
		T1.5-1	1.5	1-300	1-300	.2-150	.5-80	3.95	(10-49)
		T1.5-6	1.5	.02-100	.02-100	.05-50	0.1-25	4.95	(10-49)
		T2.5-6	2.5	.01-100	.01-100	.02-50	.05-20	3.95	(10-49)
		T4-6	4	.02-200	.02-200	.05-150	.1-100	3.95	(10-49)
		T9-1	9	.15-200	.15-200	.3-150	2-40	3.45	(10-49)
		T16-1	16	.3-120	.3-120	.7-80	5-20	3.95	(10-49)
		T36-1	36	.03-20	.03-20	.05-10	.1-5	5.95	(10-49)
	TO	TO-75	1	10-500	—	10-500	40-250	5.95	(10-49)
	▲TH	T1-1H	1	8-300	8-300	10-200	25-100	4.95	(10-49)
		T9-1H	9	2-90	2-90	3-75	6-50	5.45	(10-49)
		T16-1H	16	7-85	7-85	10-65	15-40	5.95	(10-49)
	TMO	● NEW TMO1-02	1	1-800	1-800	2-500	—	8.95	(10-49)
		TMO1-1	1	15-400	15-400	35-200	2-50	4.95	(10-49)
		TMO1.5-1	1.5	1-300	1-300	2-150	.5-80	6.75	(10-49)
		† TMO2.5-6	2.5	.01-100	.01-100	.02-50	.05-20	6.45	(10-49)
		† TMO4-6	4	.02-200	.02-200	.05-150	.1-100	6.45	(10-49)
		TMO6-1	6	3-200	3-200	5-150	5-50	6.45	(10-49)
		TMO9-1	9	15-200	15-200	3-150	2-40	6.45	(10-49)
		TMO16-1	16	3-120	3-120	.7-80	5-20	6.45	(10-49)
D	T	T2-1	2	.050-600	.050-600	.1-400	.5-200	3.45	(10-49)
		T3-1	3	5-800	5-800	2-400	—	3.95	(10-49)
		T4-2	4	2-600	2-600	5-500	2-250	3.45	(10-49)
		T8-1	8	15-250	15-250	25-200	2-100	3.45	(10-49)
		T14-1	14	2-150	2-150	5-100	2-50	4.25	(10-49)
	TMO	TMO2-1	2	.050-600	.050-600	.1-400	.5-200	5.95	(10-49)
		TMO3-1	3	5-800	5-800	2-400	—	6.95	(10-49)
		TMO4-2	4	2-600	2-600	5-500	2-250	5.95	(10-49)
		TMO8-1	8	15-250	15-250	25-200	2-100	5.95	(10-49)
		TMO14-1	14	2-150	2-150	5-100	2-50	6.75	(10-49)
	FT	FT1.22-1	1.22	.005-100	.005-100	.01-50	.05-25	29.95	(1-4)
		FT1.5-1	1.5	1-400	1-400	5-200	1-100	29.95	(1-4)
E	FTB	FTB1-1	1	2-500	2-500	5-300	1-100	29.95	(1-4)
		FTB1-6	1	.01-125	.01-125	.05-50	.1-25	29.95	(1-4)
		■ FTB1-1-75	1	5-500	5-500	5-300	10-100	29.95	(1-4)
F	T	T-622	1	0.1-200	0.1-200	0.5-100	5-80	2.95	(10-49)
		T-626	1	0.01-10	0.01-10	.02-5	.04-2	3.45	(10-49)

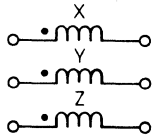












* FOR A AND B CONFIGURATIONS

Maximum Amplitude Unbalance	Maximum Phase Unbalance
0.1 dB over 1 dB frequency range	1.0° over 1 dB frequency range
0.5 dB over entire frequency range	5.0° over entire frequency range

NSN GUIDE

MCL NO.	NSN
FTB1-1-75	5950-01-132-8034
FTB1-6	5950-01-225-8773
T1-1	5950-10-128-3745
T1-1T	5950-01-153-0668
T2-1	5950-01-106-1218
T3-1T	5950-01-153-0298
T4-1	5950-01-024-7626
T9-1	5950-01-105-8153
T16-1	5950-01-094-7439

MCL NO.	NSN
TMO1-1	5950-01-178-2612
TMO2-1	5950-01-183-6414
TMO2.5-6	5950-01-215-4038
TMO2.5-6T	5950-01-215-8697
TMO3-1T	5950-01-168-7512
TMO4-1	5950-01-067-1012
TMO4-2	5950-01-091-3553
TMO4-6	5950-01-132-8102
TMO5-1T	5930-01-183-0779
TMO9-1	5950-01-141-0174
TMO16-1	5950-01-138-4593

NOTES:

▲ Insertion loss referenced to mid-band loss.

■ Denotes 75 ohm models. For coax connectors, 75 ohm BNC is standard.

1. For quality control procedures and environmental specifications, absolute maximum ratings see section 1. Except for T, TT and T H series, Temperature range is −20°C to +85°C.
2. Absolute maximum ratings; RF power 250 mW, DC current 30 mA.
3. For connector types and case mounting options, see case style outline drawing
4. Prices and specifications subject to change without notice.

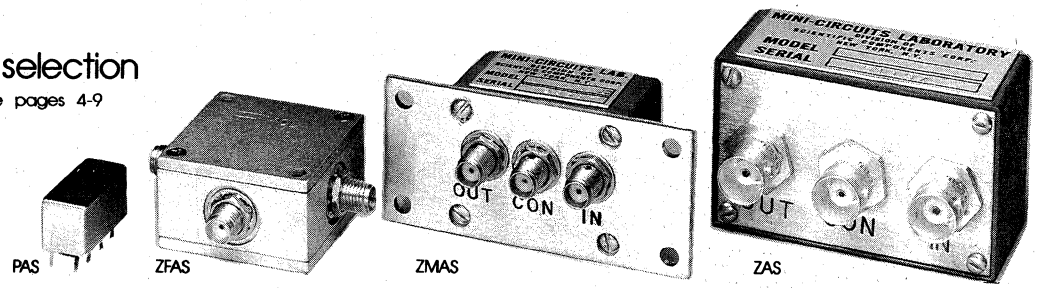
low current, low voltage

Electronic Attenuators/Switches

1.4 to 60 dB 1 MHz to 2.5 GHz

case style selection

outline drawings see pages 4-9



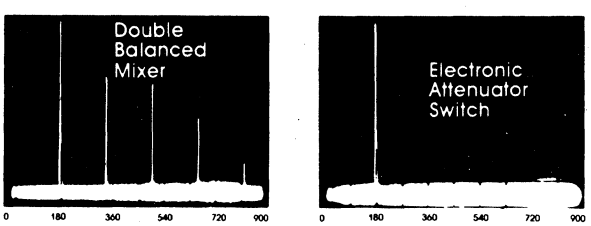
	MODEL NO.	FREQUENCY MHz IN f_L-f_U	FREQUENCY MHz CON	INSERTION LOSS dB Mid-Band m Typ.	Mid-Band m Max.	Total Range Typ.	Total Range Max.	IN-OUT ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	IN-CON ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	PRICE, $ Ea.	Qty.
PAS case A01	PAS-1	5-450	DC-0.05	3.5	4.0	3.5	4.7	65	50	45	35	35	25	35	25	25	15	20	10	27.95	(5-24)
	PAS-2	10-1000	DC-0.05	4.0	6.0	6.5	8.5	50	40	40	30	35	25	30	20	17	10	17	10	37.95	(5-24)
	PAS-3	1-200	DC-0.05	1.4	2.0	1.6	2.5	65	50	50	40	50	35	35	25	20	10	15	10	28.95	(5-24)
ZFAS case K18	ZFAS-15	10-2500	DC-200	3.5	4.5	3.5	7.0	20	18	35	25	30	20	19	15	28	20	20	15	89.95	(1-4)
ZMAS case M21	ZMAS-1	5-450	DC-0.05	3.5	4.0	3.5	4.7	65	50	55	45	35	25	35	25	25	15	20	10	55.95	(4-24)
	ZMAS-3	1-200	DC-0.05	1.4	2.0	1.6	2.5	65	50	50	40	50	35	35	25	20	10	15	10	56.95	(4-24)
ZAS case M22	ZAS-1	5-450	DC-0.05	3.5	4.0	3.5	4.7	65	50	55	45	35	25	35	25	25	15	20	10	45.95	(4-24)
	ZAS-3	1-200	DC-0.05	1.4	2.0	1.6	2.5	65	50	50	40	50	35	35	25	20	10	15	10	46.95	(4-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

m = mid band (2f_L to f_U/2)

typical harmonic spectrum comparing attenuators

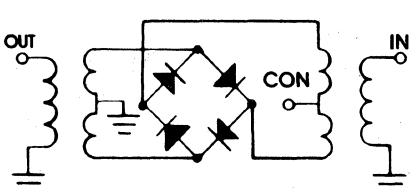
Double Balanced Mixer Vs. Electronic Attenuator



NOTES:

1. Maximum RF input power, 1 watt no damage, 100 mW operating.
   Maximum control current 20 mA.
2. Refer to table of contents for quality control procedures, environmental specifications, absolute maximum ratings, and hi-rel testing.
3. For connector types and case mounting options, see case style outline drawings.
4. Prices and specifications subject to change without notice.

schematic



pin and coaxial connections

see case style outline drawings

Series	PAS		ZFAS	ZMAS	ZAS
Models	−1 −3	−2	all models	all models	all models
OUT	8	8	1	1	1
IN	1	1	2	3	3
CONTROL	*3,4	*3,4	3	2	2
GND	2,5,6,7	2,5,6,7	—	—	—
CASE GND	2	2,5,6,7	—	—	—

*pins 3 and 4 must be connected together externally

NSN GUIDE

MCL NO.	NSN
PAS-2	5895-01-192-0100
PAS-3	5895-01-067-3035
ZMAS-1	5895-01-140-4291

Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

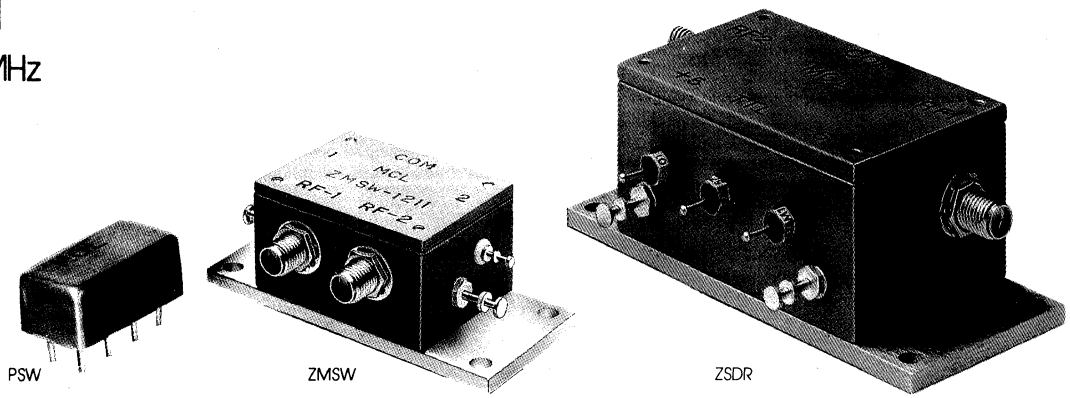
pin diode

Mini-Circuits

Switches, Switch/Drivers

SPST/SPDT

10 to 2500 MHz



	MODEL NO.		TYPE	FREQUENCY MHz f_L-f_U	INSERTION LOSS dB low-band lw Typ.	lw Max.	Upper band U Typ.	U Max.	IN-OUT ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	PRICE, $ Ea.	Qty.
PSW case A06	**PSW-1111**		SPST	10-2500	1.1	1.7	1.7	2.7	50	40	35	30	28	22	29.95	(6-24)
	PSW-1211		SPDT	10-2500	1.1	1.7	1.7	2.7	50	40	35	30	28	22	29.95	(6-24)
ZMSW case JJ77	**ZMSW-1111**		SPST	10-2500	1.1	1.7	1.7	2.7	50	45	35	30	28	22	59.95	(1-4)
	ZMSW-1211		SPDT	10-2500	1.1	1.7	1.7	2.7	50	45	35	30	28	22	59.95	(1-4)
ZSDR case MM91	ZSDR-1211	**NEW**	SPDT	10-2500	1.1	1.7	1.7	2.7	50	40	35	30	28	22	89.95	(1-4)

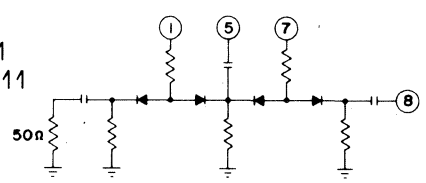
L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

lw = low-band (f_L to f_U/2)

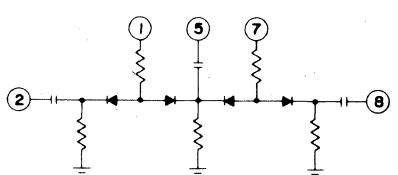
NOTES:

1. Refer to table of contents for quality control procedures, environmental specifications, absolute maximum ratings, and hi-rel testing.
2. For PSW and ZMSW models
   a) VSWR 1.5 max. ("on" state)
   b) Switching speed 4μ sec. max., 2μ rise time.
   c) Maximum RF input + 20 dBm
   d) Control voltage + 5V (5mA max.) on condition
      0V off condition
3. Prices and specifications subject to change without notice.

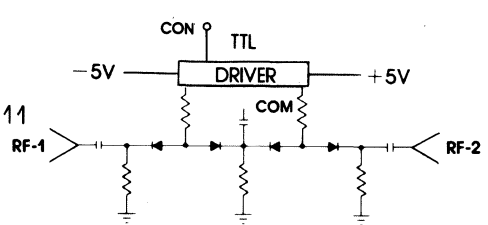
Model
PSW-1111
ZMSW-1111



Model
PSW-1211
ZMSW-1211



Model
ZSDR-1211



pin connections

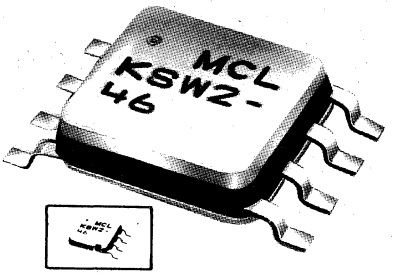
see case style outline drawings

Series	PSW	
Models	1111	1211
RF COMMON	5	5
RF-1 port	8	2
RF-2 port	—	8
CONTROL RF-1	7	1
CONTROL RF-2	—	7
CONTROL 50 ohm TERMINATION	1	—
GND	2,4	4
CASE GND	3,6	3,6

TTL LOGIC

TTL-0:	RF-1/ON	RF-2/OFF
TTL-1:	RF-1/OFF	RF-2/ON

GaAs <5 nsec
Switches
SPDT
dc to 4.6 GHz



1.5 ACTUAL SIZE

pin connections
see case style outline drawings

KSW

	MODEL NO.	FREQ. GHz	INSERTION LOSS, dB FREQUENCY BAND A Typ.	A Max.	B Typ.	B Max.	C Typ.	C Max.	1 dB COMPRESSION FREQUENCY BAND A Typ.	B Typ.	C Typ.	IN-OUT ISOLATION, dB A Typ.	A Min.	B Typ.	B Min.	C Typ.	C Min.	PRICE. $ Ea.	Qty.
KSW case XX112	KSW-2-46	DC-4.6	0.9	1.1	1.0	1.3	1.3	1.7	+10dBm	+17dBm	+27dBm	60	50	45	40	30	23	32.95	1-24
	KSWA-2-46	DC-4.6	0.8	1.1	0.9	1.3	1.5	2.6	+10dBm	+17dBm	+27dBm	60	50	50	40	30	25	48.95	1-24
ZFSW case G15	ZFSW-2-46	DC-4.6	0.9	1.1	1.0	1.3	1.3	1.7	+10dBm	+17dBm	+27dBm	60	50	45	40	30	23	72.95	1-24
	ZFSWA-2-46	DC-4.6	0.8	1.1	0.9	1.3	1.5	2.6	+10dBm	+17dBm	+27dBm	60	50	50	40	30	25	88.95	1-24

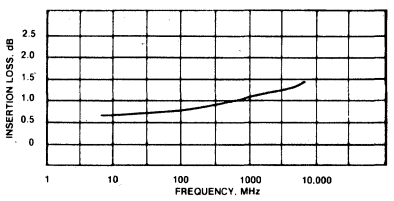
A = DC to 200MHz B = 200MHz to 1000MHz C = 1000MHz to 4600MHz

NOTES:
1. To ensure proper performance, connect case to pc board. Ground and interconnect top and bottom of pc board. Ground very close to case position.
2. Control voltage −8V on
   Logic 0V off
3. All specifications, except compression, apply for control voltage −8V to −5V (2.5 mA typ.).
4. Control voltage −10V max.
5. Switching speed: Rise time 2 nanosec typ., Fall time 2 nanosec typ.
6. VSWR 1.3 to 1 typical over most of frequency range.
7. Maximum RF input for no damage +27dBm below 500 MHz, +31dBm above 500 MHz.

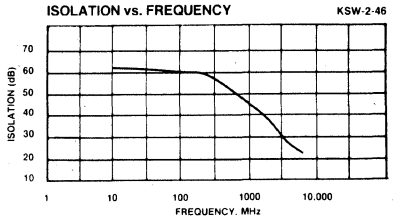
MTBF: 15 million hours at 55°C

PIN	FUNCTION
1	Control 2
2	RF-IN
3	Control 1
4	Ground
5	RF Out 1
6	Ground
7	Ground
8	RF Out 2

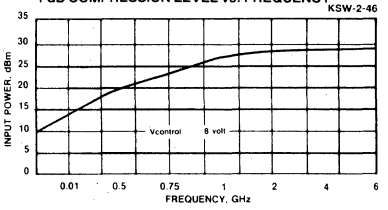
INSERTION LOSS vs. FREQUENCY KSW-2-46



ISOLATION vs. FREQUENCY KSW-2-46



1 dB COMPRESSION LEVEL vs. FREQUENCY KSW-2-46



computer-automated performance data
typical production unit / for data of other models consult factory

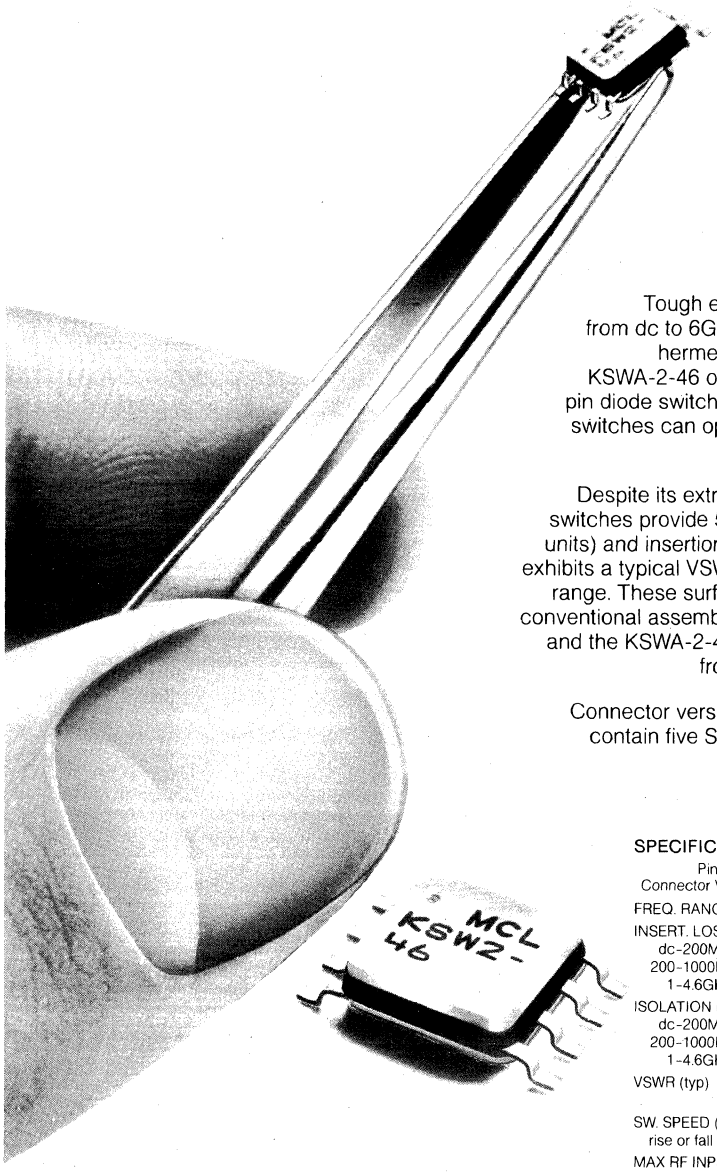
KSW-2-46

FREQUENCY (MHz)	INSERTION LOSS (dB) S-1	S-2	ISOLATION, dB S-1	S-2
10.00	.81	.64	62.75	60.59
159.75	0.89	.75	60.30	61.10
459.25	.99	.85	51.09	51.88
758.75	1.04	.92	46.67	47.70
1058.30	1.14	1.00	43.58	44.26
1507.50	1.07	.95	39.31	40.00
2106.50	1.18	1.04	35.17	35.56
2555.80	1.25	1.11	33.09	33.42
3005.00	1.22	1.07	30.44	30.85
3604.00	1.43	1.29	28.84	29.18
4053.30	1.33	1.18	27.65	28.05
4652.30	1.37	1.39	26.30	26.47
5101.50	1.75	1.54	27.53	27.48
5550.80	1.48	1.35	26.81	27.02
6000.00	1.71	1.59	27.36	27.50

Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

tiny SPDT switches

absorptive... reflective



dc to 4.6GHz from $32.95 (1-24)

Tough enough to pass stringent MIL-STD-883 tests, useable from dc to 6GHz and smaller than most RF switches, Mini-Circuits' hermetically-sealed (reflective) KSW-2-46 and (absorptive) KSWA-2-46 offer a new, unexplored horizon of applications. Unlike pin diode switches that become ineffective below 1MHz, these GaAs switches can operate down to dc with control voltage as low as -5V, at a blinding 2ns switching speed.

Despite its extremely tiny size, only 0.185 by 0.185 by 0.06 in., these switches provide 50dB isolation (considerably higher than many larger units) and insertion loss of only 1dB. The absorptive model KSWA-2-46 exhibits a typical VSWR of 1.5 in its "OFF" state over the entire frequency range. These surface-mount units can be soldered to pc boards using conventional assembly techniques. The KSW-2-46, priced at only $32.95, and the KSWA-2-46, at $48.95, are the latest examples of components from Mini-Circuits with unbeatable price/performance.

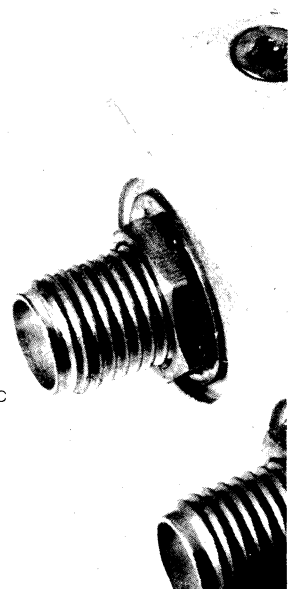
Connector versions, packaged in a 1.25 x 1.25 x 0.75 in. metal case, contain five SMA connectors, including one at each control port to maintain 3ns switching speed.

Switch fast... to Mini-Circuits' GaAs switches.

SPECIFICATIONS

Pin Model / Connector Version		KSW-2-46 ZFSW-2-46		KSWA-2-46 ZFSWA-2-46	
FREQ. RANGE		dc-4.6 GHz		dc-4.6 GHz	
INSERT. LOSS (db)		typ	max	typ	max
dc-200MHz		0.9	1.1	0.8	1.1
200-1000MHz		1.0	1.3	0.9	1.3
1-4.6GHz		1.3	1.7	1.5	2.6
ISOLATION (dB)		typ	min	typ	min
dc-200MHz		60	50	60	50
200-1000MHz		45	40	50	40
1-4.6GHz		30	23	30	25
VSWR (typ)	ON	1.3:1		1.3	
	OFF	—		1.4	
SW. SPEED (nsec) rise or fall time		2(typ)		3(typ)	
MAX RF INPUT (bBm)					
up to 500MHz		+17		+17	
above 500MHz		+27		+27	
CONTROL VOLT.		-5V on, OV off		-5V on, OV off	
OPER/STOR TEMP.		-55° to +125°C		-55° to +125°C	
PRICE (1-24)		**$32.95**		**$48.95**	
		$72.95		**$88.95**	

C 117 REV D



finding new ways...
setting higher standards

Mini-Circuits
A Division of Scientific Components Corporation
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500
Fax (718) 332-4661 Domestic and International Telexes: 6852844 or 620156

54

Mini-Circuits

high rejection of 1st and 3rd harmonics

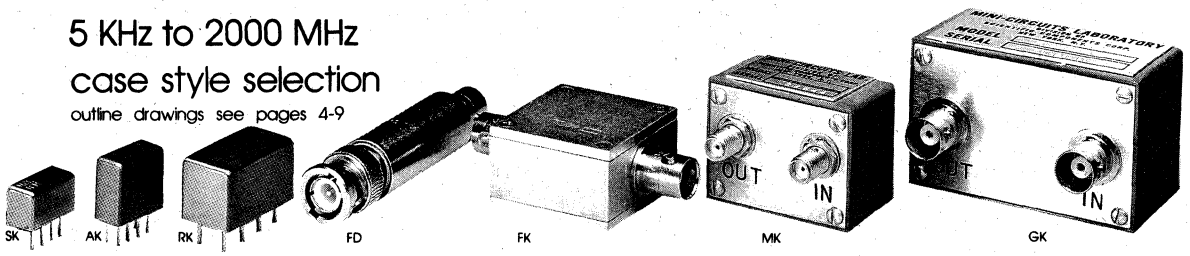
Frequency Doublers

input power 0 to +20dBm

5 KHz to 2000 MHz

case style selection

outline drawings see pages 4-9



	MODEL NO.	FREQUENCY MHz Input	FREQUENCY MHz Output	RF INPUT PWR. dBm Min.	RF INPUT PWR. dBm Max.	CONVERSION LOSS, dB Input freq.	CONVERSION LOSS, dB Typ.	CONVERSION LOSS, dB Max.	*HARMONIC OUTPUT, dB F1 Typ.	F1 Min.	F3 Typ.	F3 Min.	F4 Typ.	F4 Min.	PRICE, $ Ea.	Qty.
SK case B02	SK-2	1-500	2-1000	1	15	1-100	13.0	15.0	40	30	50	40	16	12	21.95	(5-24)
						100-300	13.5	15.5	25	20	40	30	16	12		
						300-500	14.0	16.5	20	15	30	25	16	12		
AK case A03	AK-2	1-500	2-1000	1	15	1-100	13.0	15.0	40	30	50	40	16	12	19.95	(5-24)
						100-300	13.5	15.5	25	20	40	30	16	12		
						300-500	14.0	16.5	20	15	30	25	16	12		
RK case A01	RK-2	1-500	2-1000	1	15	1-100	13.0	15.0	40	30	50	40	16	12	15.95	(5-24)
						100-300	13.5	15.5	25	20	40	30	16	12		
						300-500	14.0	16.5	20	15	30	25	16	12		
	RK-3	0.05-150	0.1-300	0	13	0.05- 50	11.0	13.0	40	30	45	30	16	12	14.95	(5-24)
						50-150	11.5	15.0	35	20	40	20	16	12		
	RK-6	0.005-25	0.01-50	0	10	0.005-1	11.0	13.0	40	30	45	30	16	12	21.95	(5-24)
						1-25	11.5	15.0	35	20	40	20	16	12		
FD case FF55	FD-2	1-500	2-1000	1	15	1-100	13.0	15.0	40	30	50	40	16	12	32.95	(1-4)
						100-300	13.5	15.5	25	20	40	30	16	12		
						300-500	14.0	16.5	20	15	30	25	16	12		
FK case H16	FK-5	10-1000	20-2000	**10	20	10-600	13.0	15.0								
						600-1000	14.0	17.0	20	15	25	20	—	—	59.95	(1-4)
MK case L19	MK-2	1-500	2-1000	1	15	1-100	13.0	15.0	40	30	50	40	16	12	42.95	(1-4)
						100-300	13.5	15.5	25	20	40	30	16	12		
						300-500	14.0	16.5	20	15	30	25	16	12		
	MK-3	0.05-150	0.1-300	0	13	0.05-50	11.0	13.0	40	30	45	30	16	12	37.95	(1-4)
						50-150	11.5	15.0	35	20	40	20	16	12		
	MK-5	10-1000	20-2000	**10	20	10-600	13.0	15.0							67.95	(1-4)
						600-1000	14.0	17.0	20	15	25	20	—	—		
GK case L20	GK-2	1-500	2-1000	1	15	1-100	13.0	15.0	40	30	50	40	16	12	32.95	(1-4)
						100-300	13.5	15.5	25	20	40	30	16	12		
						300-500	14.0	16.5	20	15	30	25	16	12		
	GK-3	0.05-150	0.1-300	0	13	0.05- 50	11.0	13.0	40	30	45	30	16	12	30.95	(1-4)
						50-150	11.5	15.0	35	20	40	20	16	12		
	GK-5	10-1000	20-2000	**10	20	10-600	13.0	15.0								
						600-1000	14.0	17.0	20	15	25	20	—	—	57.95	(1-4)

*Harmonic Output below power of F2.
**ABOVE 700 MHz, min. input power +13dBm

NOTES:

1. Maximum RF input power, 200mW.
2. Refer to table of contents for quality control procedures; environmental specifications, absolute maximum ratings, and hi-rel testing.
3. For connector types and case mounting options, see case style outline drawings.
4. Prices and specifications subject to change without notice.

NSN GUIDE

MCL NO.	NSN
AK-2	5895-01-131-4569
RK-3	5895-01-143-3726
RK-3-TX	5895-01-160-8656
FK-5	5985-01-204-9746

pin connections

see case style outline drawing

Series	SK	RK			AK
Models	all models	-2	-3	-6	all models
IN	*1,2	*1,3,4	*1,3,4	*1,3,4	*1,3,4
OUT	4	8	8	8	8
GND	3	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7
CASE GND	3	2,5,6,7	2	—	2,5,6,7

*pins must be connected together externally

applications

- Wideband frequency multiplier chains
- Low spurious frequency multiplier chains
- FM, PM modulation chains
- Double frequency range of signal generators

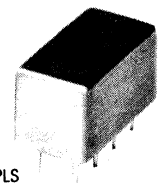
broadband, minimal phase change Limiters

Mini-Circuits

50 ohms

+3 to +20 dBm input

3 KHz to 900 MHz



PLS

case style selection

outline drawings see pages 4-9

	Model No.	FREQUENCY MHz f_L f_U	INPUT dBm Min.	INPUT dBm Max.	*OUTPUT dBm Typ.	CONTROL CURRENT (mA) Typ.	LIMITING Input range, dBm	LIMITING Δ Output/Δ 1dB Input amp, dB	LIMITING Δ Output/Δ 1dB Input phase, deg.	PRICE, $ Ea.	PRICE, $ Qty.
PLS case A01	PLS-1	0.1-150	6	20	−4.0	3	6 to 10	0.1	0.8	18.95	5-49
							10 to 16	0.15	0.8		
							16 to 20	0.15	0.7		
	PLS-2	100-900	3	15	−5.0	5	3 to 8	0.2	2.0	18.95	5-49
							8 to 12	0.4	2.0		
							12 to 15	0.2	2.0		
	PLS-6	0.003-1	6	20	3.0	5	6 to 10	0.2	1.0	29.95	5-49
							10 to 16	0.1	1.0		
							16 to 20	0.2	1.5		

* Typical output level at typical control current. Level may be changed by varying current.

pin connections

see case style outline drawing

Series	PLS		
Model	−1	−2	−6
INPUT	1	1	1
OUTPUT	8	8	8
CONTROL	*3,4	*3,4	*3,4
GND.	2,5,6,7	2,5,6,7	2,5,6,7
CASE GND.	2	2,5,6,7	—

*Pins must be externally connected together

NOTES:

1. Maximum RF input power, 100mW. Maximum control current, 10 mA.
2. Refer to table of contents for quality control procedures; environmental specifications, absolute maximum ratings, and hi-rel testing.
3. Prices and specifications subject to change without notice.

NSN GUIDE

MCL NO.	NSN
PLS-1	5895-01-105-7820

PLS-1 LIMITING

computer-automated performance data

typical production unit / for data of other models consult factory

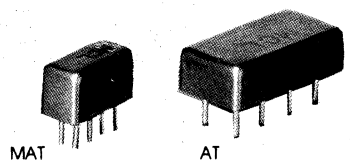
MHz	Output (20 dBm IN)	Output (16 dBm IN)	Output (10 dBm IN)	Output (6 dBm IN)	Delta, Out (20 to 16 dBm IN)	Delta, Out (16 to 10 dBm IN)	Delta, Out (10 to 6 dBm IN)
.100	−1.36	−1.47	−1.77	−2.15	.11	.30	.38
7.990	−.77	−1.02	−1.28	−1.65	.25	.26	.37
15.880	−.81	−.97	−1.35	−1.65	.16	.38	.30
23.769	−.79	−.95	−1.35	−1.64	.16	.40	.29
31.658	−.77	−.94	−1.38	−1.54	.17	.44	.16
39.547	−.71	−.93	−1.34	−1.47	.22	.41	.13
47.437	−.86	−1.08	−1.41	−1.46	.22	.33	.05
55.327	−.88	−1.03	−1.40	−1.73	.15	.37	.33
63.217	−.86	−1.05	−1.48	−1.63	.19	.43	.15
71.105	−1.02	−1.01	−1.42	−1.78	−.01	.41	.36
78.995	−1.05	−1.05	−1.37	−1.57	0.00	.32	.20
86.884	−.95	−1.08	−1.49	−1.78	.13	.41	.29
94.775	−.98	−1.12	−1.40	−1.73	.14	.28	.33
102.661	−1.06	−1.15	−1.50	−1.59	.09	.35	.09
110.551	−1.14	−1.29	−1.58	−2.32	.15	.29	.74
118.440	−1.09	−1.19	−1.58	−1.98	.10	.39	.40
126.330	−1.03	−1.21	−1.53	−1.65	.18	.32	.12
134.221	−1.10	−1.31	−1.59	−2.28	.21	.28	.69
142.111	−1.19	−1.44	−1.70	−1.98	.25	.26	.28
150.000	−1.16	−1.47	−1.72	−2.07	.31	.25	.35

REMARK: Control Current: 5.6mA

rugged, one-piece design

Fixed Attenuators

1 to 40 dB
DC to 1500 MHz



case style selection

outline drawings see pages 4-9

	MODEL NO.	FREQUENCY Range, MHz	ATTENUATION dB Flatness, max. Nom.	L	M	U	VSWR max. L	M	U	PRICE $ Ea. Qty. (10-49)
MAT case A11	MAT-1	DC-1500	1±0.2	0.3	0.4	0.5	1.3	1.5	1.7	3.95
	MAT-2	DC-1500	2±0.2	0.3	0.4	0.8	1.3	1.5	1.7	3.95
	MAT-3	DC-1500	3±0.2	0.3	0.6	1.0	1.3	1.5	1.7	3.95
	MAT-4	DC-1500	4±0.2	0.3	0.6	1.0	1.3	1.5	1.7	3.95
	MAT-5	DC-1500	5±0.3	0.3	0.6	1.0	1.3	1.5	1.7	3.95
	MAT-6	DC-1500	6±0.3	0.3	0.6	1.0	1.3	1.5	1.7	3.95
	MAT-7	DC-1500	7±0.3	0.3	0.6	1.0	1.3	1.5	1.7	3.95
	MAT-8	DC-1500	8±0.3	0.3	0.6	1.0	1.3	1.5	1.7	3.95
	MAT-9	DC-1500	9±0.4	0.3	0.6	1.0	1.3	1.5	1.7	3.95
	MAT-10	DC-1500	10±0.4	0.3	0.6	1.0	1.3	1.5	1.7	3.95
	MAT-12	DC-1500	12±0.4	0.3	0.6	1.0	1.3	1.5	1.7	3.95
	MAT-15	DC-1500	15±0.4	0.4	0.7	1.1	1.3	1.5	1.7	3.95
	MAT-20	DC-1500	20±0.5	0.4	0.8	1.3	1.3	1.6	1.8	3.95
	MAT-30	DC-1000	30±0.5	0.5	1.0	—	1.3	1.6	—	3.95
	MAT-40	DC-500	40±0.6	1.0	—	—	1.5	—	—	3.95
AT A04	AT-1	DC-1500	1±0.2	0.3	0.4	0.5	1.3	1.5	1.7	2.95
	AT-2	DC-1500	2±0.2	0.3	0.4	0.8	1.3	1.5	1.7	2.95
	AT-3	DC-1500	3±0.2	0.3	0.6	1.0	1.3	1.5	1.7	2.95
■	AT-3-75	DC-500	3±0.2	0.9	—	—	2.0	—	—	2.95
	AT-4	DC-1500	4±0.2	0.3	0.6	1.0	1.3	1.5	1.7	2.95
	AT-5	DC-1500	5±0.3	0.3	0.6	1.0	1.3	1.5	1.7	2.95
	AT-6	DC-1500	6±0.3	0.3	0.6	1.0	1.3	1.5	1.7	2.95
■	AT-6-75	DC-500	6±0.3	1.0	—	—	2.0	—	—	2.95
	AT-7	DC-1500	7±0.3	0.3	0.6	1.0	1.3	1.5	1.7	2.95
	AT-8	DC-1500	8±0.3	0.3	0.6	1.0	1.3	1.5	1.7	2.95
	AT-9	DC-1500	9±0.4	0.3	0.6	1.0	1.3	1.5	1.7	2.95
	AT-10	DC-1500	10±0.4	0.3	0.6	1.0	1.3	1.5	1.7	2.95
■	AT-10-75	DC-500	10±0.4	1.0	—	—	2.0	—	—	2.95
	AT-12	DC-1500	12±0.4	0.3	0.6	1.0	1.3	1.5	1.7	2.95
	AT-15	DC-1500	15±0.4	0.4	0.7	1.1	1.3	1.5	1.7	2.95
■	AT-15-75	DC-1000	15±0.4	0.8	1.2	—	1.5	2.0	—	2.95
	AT-20	DC-1500	20±0.5	0.4	0.8	1.3	1.3	1.6	1.8	2.95
■	AT-20-75	DC-500	20±0.5	1.1	—	—	2.0	—	—	2.95
	AT-30	DC-1000	30±0.5	0.5	1.0	—	1.3	1.6	—	2.95
	AT-40	DC-500	40±0.6	1.0	—	—	1.5	—	—	2.95

L = DC-500 MHz **M** = DC-1000 MHz **U** = DC-1500 MHz

designers kits available

KIT NO.	MODEL TYPE	No. of Units in Kit	DESCRIPTION	PRICE $ per kit
KAT-1	AT	16	4 of each 3, 6, 10, 20 dB	39.95
KAT-2	AT	15	1 of each 1 to 40 dB	
KMAT-1	MAT	14	2 of each 3, 6, 9, 10, 12, 15, 20 dB	39.95
KMAT-2	MAT	15	1 of each 1 to 40 dB	

NSN GUIDE

MCL NO.	NSN
SAT-6	5985-01-237-5343
SAT-30	5985-01-190-6838

NOTES:

■ Denotes 75 ohm models, connectors available in 75 ohm BNC only.

1. For quality control procedures, environmental specifications, and Hi-Rel description see Table of Contents.
2. Absolute maximum ratings see section 1. In addition, maximum RF power
   1 watt for AT, CAT, NAT, TAT;
   ½ watt for MAT, SAT,
   ¼ watt for Terminations
3. Models are available with male/female coax connectors. For other configurations and inter-series versions consult factory. See case style outline drawings.
4. Prices and specifications subject to change without notice.

pin connections

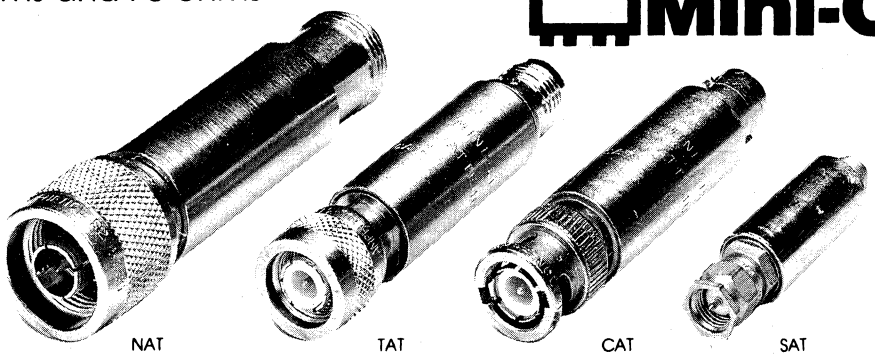
see case style outline drawing

SERIES	In	Out	Ground
MAT	1	8	2,3,4,5,6,7
AT	1	8	2,3,4,5,6,7

Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

50 ohms and 75 ohms

Mini-Circuits



NAT TAT CAT SAT

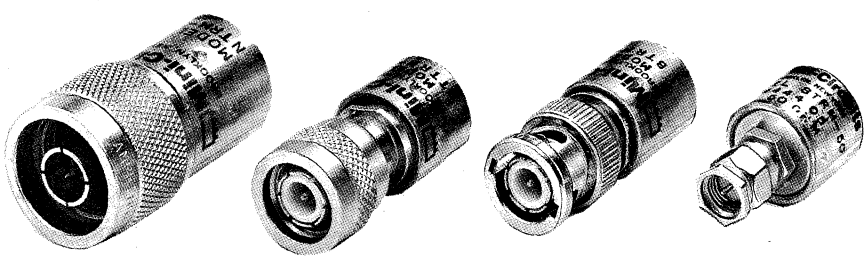
	*MODEL NO.	FREQUENCY RANGE, MHz	ATTENUATION, dB Nom.	Flatness, max. L	M	U	VSWR, max. L	M	U	PRICE $, ea qty (1-49) NAT	CAT
	_AT-1	DC-1500	1±0.2	0.3	0.4	0.5	1.3	1.5	1.7	19.95	14.95
	_AT-2	DC-1500	2±0.2	0.3	0.4	0.8	1.3	1.5	1.7	19.95	14.95
	_AT-3	DC-1500	3±0.2	0.3	0.6	1.0	1.3	1.5	1.7	19.95	14.95
*NAT case FF57	■ CAT-3-75	DC- 500	3±0.2	0.9	—	—	2.0	—	—	—	14.95
	_AT-4	DC-1500	4±0.2	0.3	0.6	1.0	1.3	1.5	1.7	19.95	14.95
	_AT-5	DC-1500	5±0.3	0.3	0.6	1.0	1.3	1.5	1.7	19.95	14.95
	_AT-6	DC-1500	6±0.3	0.3	0.6	1.0	1.3	1.5	1.7	19.95	14.95
*TAT case FF58	■ CAT-6-75	DC- 500	6±0.3	1.0	—	—	2.0	—	—	—	14.95
	_AT-7	DC-1500	7±0.3	0.3	0.6	1.0	1.3	1.5	1.7	19.95	14.95
	_AT-8	DC-1500	8±0.3	0.3	0.6	1.0	1.3	1.5	1.7	19.95	14.95
	_AT-9	DC-1500	9±0.4	0.3	0.6	1.0	1.3	1.5	1.7	19.95	14.95
	_AT-10	DC-1500	10±0.4	0.3	0.6	1.0	1.3	1.5	1.7	19.95	14.95
*CAT case FF55	■ CAT-10-75	DC- 500	10±0.4	1.0	—	—	2.0	—	—	—	14.95
	_AT-12	DC-1500	12±0.4	0.3	0.6	1.0	1.3	1.5	1.7	19.95	14.95
	_AT-15	DC-1500	15±0.4	0.4	0.7	1.1	1.3	1.5	1.7	19.95	14.95
	■ CAT-15-75	DC-1000	15±0.4	0.8	1.2	—	1.5	2.0	—	—	14.95
	_AT-20	DC-1500	20±0.5	0.4	0.8	1.3	1.3	1.6	1.8	19.95	14.95
	■ CAT-20-75	DC- 500	20±0.5	1.1	—	—	2.0	—	—	—	14.95
	_AT-30	DC-1000	30±0.5	0.5	1.0	—	1.3	1.6	—	19.95	14.95
	_AT-40	DC- 500	40±0.6	1.0	—	—	1.5	—	—	19.95	14.95
	*Add prefix letter N, T, or C to—AT where applicable									SAT	
SAT case FF56	SAT-1	DC-1500	1±0.2	0.3	0.4	0.5	1.3	1.5	1.7	17.95	
	SAT-2	DC-1500	2±0.2	0.3	0.4	0.8	1.3	1.5	1.7	17.95	
	SAT-3	DC-1500	3±0.2	0.3	0.6	1.0	1.3	1.5	1.7	17.95	
	SAT-4	DC-1500	4±0.2	0.3	0.6	1.0	1.3	1.5	1.7	17.95	
	SAT-5	DC-1500	5±0.3	0.3	0.6	1.0	1.3	1.5	1.7	17.95	
	SAT-6	DC-1500	6±0.3	0.3	0.6	1.0	1.3	1.5	1.7	17.95	
	SAT-7	DC-1500	7±0.3	0.3	0.6	1.0	1.3	1.5	1.7	17.95	
	SAT-8	DC-1500	8±0.3	0.3	0.6	1.0	1.3	1.5	1.7	17.95	
	SAT-9	DC-1500	9±0.4	0.3	0.6	1.0	1.3	1.5	1.7	17.95	
	SAT-10	DC-1500	10±0.4	0.3	0.6	1.0	1.3	1.5	1.7	17.95	
	SAT-12	DC-1500	12±0.4	0.3	0.6	1.0	1.3	1.5	1.7	17.95	
	SAT-15	DC-1500	15±0.4	0.4	0.7	1.1	1.3	1.5	1.7	17.95	
	SAT-20	DC-1500	20±0.5	0.4	0.8	1.3	1.3	1.6	1.8	17.95	
	SAT-30	DC-1000	30±0.5	0.5	1.0	—	1.3	1.6	—	17.95	
	SAT-40	DC- 500	40±0.6	1.0	—	—	1.5	—	—	17.95	

L = DC-500 MHz M = DC-1000 MHz U = DC-1500 MHz

Terminations 50 ohms DC to 2000 MHz

case style selection

outline drawings see pages 4-9



NTRM TTRM BTRM STRM

For Notes see opposite page

	MODEL NO.	IMPEDANCE, OHMS	FREQUENCY RANGE, MHz	RETURN LOSS, dB, MIN. DC-500	DC-1000	DC-2000	PRICE $ ea. qty (1-24)
case LL85	BTRM-50	50	DC-2000	35	30	21	7.95
case LL88	TTRM-50	50	DC-2000	30	26	21	8.95
case LL86	STRM-50	50	DC-2000	40	35	26	7.95
case LL87	NTRM-50	50	DC-2000	35	30	21	7.95

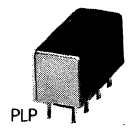
In Stock...Immediate Delivery

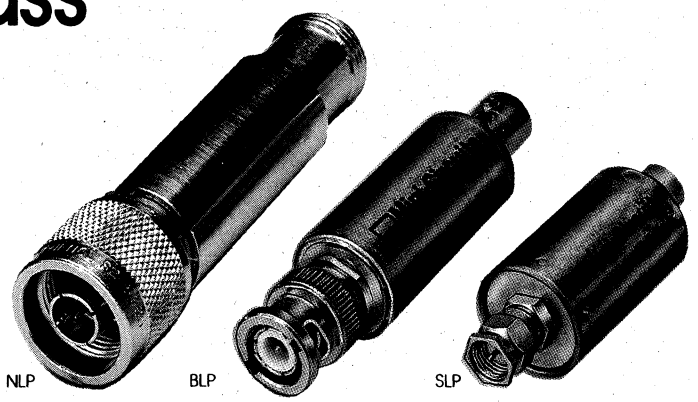
Filters, low pass

dc-3GHz

case style selection

outline drawings see pages 4-9


PLP

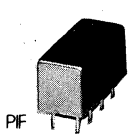

NLP BLP SLP

	MODEL NO.		PASSBAND, MHz (loss <1dB) Min.	fco, MHz (loss 3dB) Nom.	STOP BAND, MHz (loss>20dB) Max.	(loss>40dB) Max.	Min.	VSWR, Passband Typ.	Stopband Typ.	PRICE $ (Note 4) Ea.	Qty.
PLP case A01	PLP-10.7		DC-11	14	19	24	200	1.7	18	9.95	6-49
	PLP-21.4	NEW	DC-22	24.5	32	41	200	1.7	18	9.95	6-49
	PLP-30	NEW	DC-32	35	47	61	200	1.7	18	9.95	6-49
	PLP-50		DC-48	55	70	90	200	1.7	18	9.95	6-49
	PLP-70		DC-60	67	90	117	300	1.7	18	9.95	6-49
	PLP-100		DC-98	108	146	189	400	1.7	18	9.95	6-49
	PLP-150		DC-140	155	210	300	600	1.7	18	9.95	6-49
	PLP-200		DC-190	210	290	390	800	1.7	18	9.95	6-49
	PLP-250		DC-225	250	320	400	1200	1.7	18	9.95	6-49
	PLP-300		DC-270	297	410	550	1200	1.7	18	9.95	6-49
	PLP-450		DC-400	440	580	750	1800	1.7	18	9.95	6-49
	PLP-550		DC-520	570	750	920	2000	1.7	18	9.95	6-49
	PLP-600		DC-580	640	840	1120	2000	1.7	18	9.95	6-49
	PLP-750		DC-700	770	1000	1300	2000	1.7	18	9.95	6-49
	PLP-850		DC-780	850	1100	1400	2000	1.7	18	9.95	6-49
	PLP-1000		DC-900	990	1340	1750	2000	1.7	18	9.95	6-49
*BLP case FF55 *NLP case FF57	_LP-10.7		DC-11	14	19	24	200	1.7	18	24.95	1-49
	_LP-21.4	NEW	DC-22	24.5	32	41	200	1.7	18	24.95	1-49
	_LP-30	NEW	DC-32	35	47	61	200	1.7	18	24.95	1-49
	_LP-50		DC-48	55	70	90	200	1.7	18	24.95	1-49
	_LP-70		DC-60	67	90	117	300	1.7	18	24.95	1-49
	_LP-100		DC-98	108	146	189	400	1.7	18	24.95	1-49
	_LP-150		DC-140	155	210	300	600	1.7	18	24.95	1-49
	_LP-200		DC-190	210	290	390	800	1.7	18	24.95	1-49
*SLP case FF99	_LP-300		DC-270	297	410	550	1200	1.7	18	24.95	1-49
	_LP-450		DC-400	440	580	750	1800	1.7	18	24.95	1-49
	_LP-550		DC-520	570	750	920	2000	1.7	18	24.95	1-49
	_LP-600		DC-580	640	840	1120	2000	1.7	18	24.95	1-49
	_LP-750		DC-700	770	1000	1300	2000	1.7	18	24.95	1-49
	_LP-850		DC-780	850	1100	1400	2000	1.7	18	24.95	1-49
	_LP-1000		DC-900	990	1340	1750	2000	1.7	18	24.95	1-49

***Add prefix letter B, N, or S to _LP where applicable**

50 ohm impedance over pass and stopband

Filters, bandpass


PIF

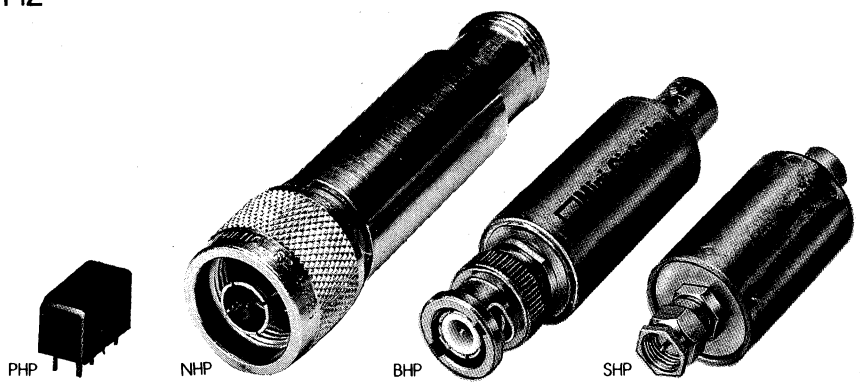
	MODEL NO.	CENTER FREQ. MHz F0	PASS BAND MHz (loss < 1 dB) Max. F1	Min. F2	STOP BAND, MHz (loss > 10 dB) Min. F3	Max. F4	(loss > 20 dB) Min. F5	Max. F6	VSWR, 1.3:1, Typ. TOTAL BAND, MHz	PRICE $ Ea.	Qty.
PIF case A01	PIF-30	30	25	35	7	120	1.9	210	DC-330	12.95	6-49
	PIF-40	42	35	49	10	168	2.6	300	DC-400	12.95	6-49
	PIF-50	50	41	58	11.5	200	3.1	350	DC-440	12.95	6-49
	PIF-60	60	50	70	14	240	3.8	400	DC-500	12.95	6-49
	PIF-70	70	58	82	16	280	4.4	490	DC-550	12.95	6-49

Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

Filters, high pass

Mini-Circuits

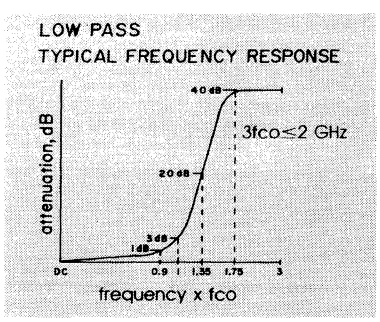
dc–3GHz

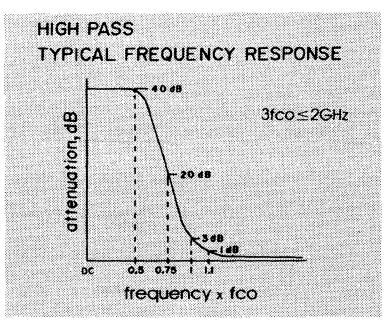


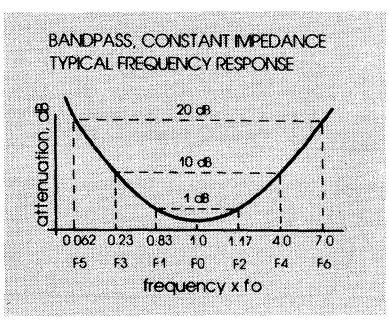
	MODEL NO.		PASSBAND, MHz (loss <1dB) Max.	Min.	fco, MHz (loss 3dB) Nom.	STOP BAND, MHz (loss>20dB) Min.	(loss>40dB) Min.	VSWR Passband Typ.	Stopband Typ.	PRICE $ (Note 4) Ea.	Qty.
PHP case A01	PHP-50		41	200	37	26	20	1.5	17	12.95	6-49
	PHP-100		90	400	82	55	40	1.5	17	12.95	6-49
	PHP-150		133	600	120	95	70	1.8	17	12.95	6-49
	PHP-200		185	800	164	116	90	1.6	17	12.95	6-49
	PHP-250	NEW	225	1200	205	150	100	1.3	17	12.95	6-49
	PHP-300		290●	●1200	245	190	145	1.7	17	12.95	6-49
	PHP-400		395	1600	360	290	210	1.7	17	12.95	6-49
	PHP-500		500	1600	454	365	280	1.9	17	12.95	6-49
	PHP-600		600	1600	545	440	350	2.0	17	12.95	6-49
	PHP-700		700	1800	640	520	400	1.6	17	12.95	6-49
	PHP-800		780	2000	710	570	445	2.1	17	12.95	6-49
	PHP-900		910	2100	820	660	520	1.8	17	12.95	6-49
	PHP-1000		1000	2200	900	720	550	1.9	17	12.95	6-49
*BHP case FF55	_HP-50		41	200	37	26	20	1.5	17	27.95	(1-49)
	_HP-100		90	400	82	55	40	1.5	17	27.95	(1-49)
*NHP case FF57	_HP-150		133	600	120	95	70	1.8	17	27.95	(1-49)
	_HP-200		185	800	164	116	90	1.6	17	27.95	(1-49)
	-HP-250	NEW	225	12.00	205	150	100	1.3	17	27.95	(1-49)
*SHP case FF99	_HP-300		290●	●1200	245	190	145	1.7	17	27.95	(1-49)
	_HP-400		395	1600	360	290	210	1.7	17	27.95	(1-49)
	_HP-500		500	1600	454	365	280	1.9	17	27.95	(1-49)
	_HP-600		600	1600	545	440	350	2.0	17	27.95	(1-49)
	_HP-700		700	1800	640	520	400	1.6	17	27.95	(1-49)
	_HP-800		780	2000	710	570	445	2.1	17	27.95	(1-49)
	_HP-900		910	2100	820	660	520	1.8	17	27.95	(1-49)
	_HP-1000		1000	2200	900	720	550	1.9	17	27.95	(1-49)

● insertion loss 1.5 dB max.

***Add prefix letter B, N, or S to _HP where applicable**







NOTES:

1. For quality control procedures, environmental specifications, and Hi-Rel description see Table of Contents.
2. Absolute maximum ratings see section 1. In addition, maximum RF power 1/2 watt.
3. Models are available with male/female coax connectors. For other configurations and inter-series versions consult factory. See case style outline drawings.
4. For N prefix add $3, S prefix add $2 to price shown. Prices and specifications subject to change without notice.

pin connections

see case style outline drawing

SERIES	In	Out	Ground
PLP	1	8	2,3,4,5,6,7
PHP	1	8	2,3,4,5,6,7
PIF	1	6	2,3,4,5,7,8

In Stock...Immediate Delivery

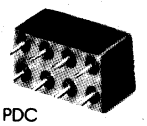
very broadband
Directional Couplers

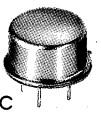
6 to 30dB
10KHz to 2000 MHz

case style selection

outline drawings see pages 4-9

TDC


PDC


TODC

	MODEL NO.	FREQUENCY MHz f_L-f_U	COUPLING dB Nom.	COUPLING dB Flatness	MAINLINE LOSS* dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	DIRECTIVITY dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	VSWR Typ.	POWER INPUT, W L Max.	POWER INPUT, W M,U Max.	PRICE, $ Ea.	PRICE, $ Qty.
TDC case B02	TDC-6-1	10-400	6.3±0.4	±0.4	2.0	2.4	2.0	2.4	2.0	2.5	36	30	30	25	20	15	1.5	1	2	19.95	(5-49)
	TDC 10-1	1-400	10.0±0.5	±0.5	1.2	1.5	1.0	1.3	1.2	1.5	35	25	30	20	20	15	1.5	1	2	15.95	(5-49)
	TDC-10-2 NEW	5-1000	11 ± 0.5	±0.6	1.4	1.8	1.5	1.8	1.6	2.0	50	35	25	20	20	15	1.5	0.5	0.5	21.95	(5-49)
PDC case A01	PDC-10-1	0.5-500	11.5±0.5	±0.6	0.85	1.3	0.65	1.0	0.85	1.3	32	25	32	25	22	15	1.2	1.5	3	11.95	(5-49)
	△PDC-10-2	250-1000	10.5±0.5	±0.6	1.4	1.6	—	—	1.6	2.0	30	25	30	20	25	15	1.5	—	5	27.95	(5-49)
	PDC-10-5 NEW	1-2000	10.5 ± 0.5	±1.0	1.2	1.9	1.3	1.9	2.0	2.5	38	25	30	18	22	18	1.3	0.5	0.5	34.95	(5-49)
	PDC-10-6	0.005-20	11±0.5	±0.5	0.4	1.2	0.4	0.8	0.4	1.0	40	30	40	30	35	25	1.3	1.5	3	19.95	(5-49)
	▲PDC-10-21	1-1000	11±0.5	±0.5	1.2	1.7	1.2	1.7	1.6	2	40	30	25	20	25	20	1.2	1	2	24.95	(5-49)
	PDC-10-22	5-750	11±0.5	±0.5	1.1	1.6	1.2	1.7	1.6	1.9	35	30	25	20	25	20	1.25	1	2	19.95	(5-49)
	PDC-10-54 NEW	10-1500	10.5 ± 0.5	±0.7	1.2	1.8	1.3	1.9	1.6	2.3	35	25	28	23	28	23	1.3	0.5	0.5	29.95	(5-49)
	PDC-15-6	0.01-35	15±0.5	±0.5	0.3	0.6	0.2	0.4	0.3	0.6	38	30	35	25	28	20	1.15	2	4	19.95	(5-49)
	PDC-15-21	1-500	14.7±0.5	±0.6	0.7	1.1	0.7	1.1	0.8	1.2	35	30	35	30	30	23	1.4	1	2	19.95	(5-49)
	†PDC-20-1	25-400	21±0.75	±0.5	0.2	0.25	0.3	0.35	0.35	0.5	25	20	35	25	25	20	1.25	3	5	19.95	(5-49)
	PDC-20-1W	10-700	19.2±0.5	±0.5	0.25	0.5	0.4	0.7	0.7	1.1	34	30	27	23	23	20	1.4	1	2	19.95	(5-49)
	PDC-20-3	0.2-250	19.5±0.5	±0.5	0.35	0.6	0.25	0.5	0.35	0.6	36	30	33	25	25	20	1.2	1.5	4	13.95	(5-49)
	◊◊ PDC-20-38 NEW	0.2-250	19.5 ± 0.5	±0.5	0.3	0.6	0.25	0.5	0.35	0.6	47	40	40	25	30	20	1.1	1.5	4	15.95	(5-49)
	■PDC-10-1-75	1-250	10.5±0.5	±0.75	1.1	1.5	1.1	1.5	1.1	1.5	30	20	30	20	30	20	2	2	4	12.95	(5-49)
	■PDC-10-6-75	0.2-100	10.0±0.5	±0.2	1.2	1.6	0.9	1.2	0.9	1.3	50	30	40	25	37	25	1.5	1	2	14.95	(5-49)
	■PDC-15-6-75	0.02-35	14.5±0.5	±0.5	0.3	0.7	0.3	0.7	0.3	0.7	35	20	35	20	35	20	1.3	1.5	4	20.95	(5-49)
	■PDC-20-3-75	1-150	19.5±0.5	±0.75	0.35	0.8	0.35	0.8	0.35	0.8	25	20	25	20	25	20	2	2	4	12.95	(5-49)
TODC case QQ96	TODC-10-1	10-400	11.5±0.5	±0.5	1.2	1.5	1.0	1.3	1.2	1.5	35	25	30	20	25	20	1.5	0.5	1	15.95	(5-49)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

NOTES:

△ L = f_L − 2f_L, M=0
* Includes theoretical power loss at coupled port.
■ Denotes 75 ohm models, available only with 75 ohm BNC
◊ bi directional, L = 30 to 100 MHz
◊◊ bi directional
† Models PDC-20-1, ZDC-20-1, ZMDC-20-1:
L = 25-50 MHz, M = 50-300 MHz, U = 300-400 MHz
● Model ZFDC-20-5: above 1000 MHz, coupling flatness ±1.5dB
▲ Models PDC-10-21, ZFDC-10-21: Upper range coupling ±0.75dB

1. For quality control procedures, see Table of Contents.
2. For environmental specifications, see Table of Contents.
3. For connector types and case mounting options, see case style outline drawing.
4. Prices and specifications subject to change without notice.
5. All models are licensed under U.S. Patent 3,426,298.
6. For Model PDC-20-38, bidirectional

MIL-C-15370/18, NSN GUIDE

MCL NO.	NSN	MIL-C-15370/18*
PDC-10-1	5985-01-178-4406	002
PDC-10-2		008
PDC-10-21	5985-01-130-0177	003
PDC-10-22	5985-01-190-7738	
PDC-15-6	5985-01-147-0160	
PDC-20-3	5985-01-076-8477	001
TDC-10-1	5985-01-226-3428	
ZDC-10-1-BNC	5985-01-125-3467	
ZDC-20-1	5985-01-178-4405	
ZDC-20-3-BNC	5985-01-096-5007	
ZFDC-10-1	5985-01-179-5122	
ZFDC-10-2	5985-01-208-5694	
ZFDC-20-3	5985-01-146-0478	
ZFDC-20-5	5985-01-097-2192	
ZMDC-20-3	5985-01-193-8515	

*units are not QPL listed

pin and coaxial connections

see case style outline drawing

Series	In	Out	Cpl_{in}	NOTE 6 Cpl_{out}	Case Ground	Not Used
TODC	5	8	2	—	all others	11
PDC	1	4	3	6	2,5,7,8	6
TDC	1	2	4	—	3	—
ZEDC	1	2	3	—	—	—
ZMDC	3	2	1	—	—	—
ZDC	3	2	1	—	—	—
ZFDC (except 20−4, −5)	1	2	3	—	—	—
ZFDC 20−4, −5	3	1	2	—	—	—

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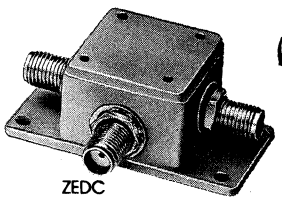
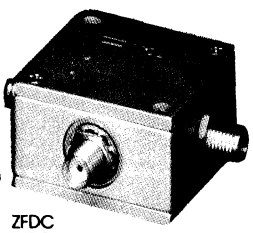
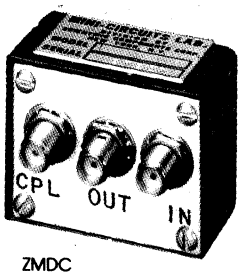
FAX (718) 332-4661 TELEX 6852844 or 620156

50 ohms and 75 ohms

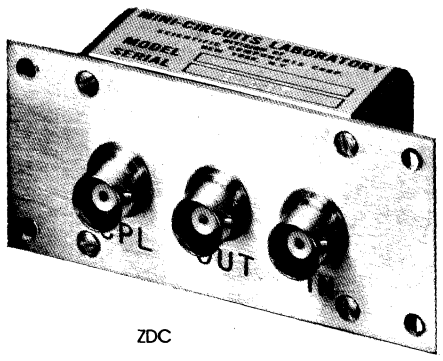
Mini-Circuits


ZEDC


ZFDC
ZFDC-H



ZMDC



ZDC

	MODEL NO.	FREQ. MHz f_L-f_U	COUPLING dB Nom.	COUPLING dB Flatness	MAINLINE LOSS* dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	DIRECTIVITY dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	VSWR Typ.	POWER INPUT, W L Max.	POWER INPUT, W M,U Max.	PRICE, $ Ea.	PRICE, $ Qty.
ZEDC case V37	ZEDC-10-2B	1-1000	11±0.5	±0.75	1.3	1.5	1.5	1.8	1.5	1.8	35	30	30	20	18	13	1.3	1.5	3	54.95	(4-24)
	ZEDC-15-2B	1-1000	15±0.5	±0.5	0.5	1.0	0.8	1.2	1.0	1.4	35	30	30	25	25	15	1.15	1.5	3	54.95	(4-24)
ZFDC case K18	ZFDC-10-1	1-500	10.5±0.25	±0.6	1.0	1.3	0.8	1.1	1.0	1.3	32	25	33	25	22	15	1.2	1.5	3	29.95	(4-24)
	ZFDC-10-2	10-1000	10.75±0.5	±0.5	1.5	2.0	1.2	1.6	1.5	2.0	35	28	30	25	27	20	1.5	1.5	3	39.95	(4-24)
	ZFDC-10-6	0.005-20	11±0.5	±0.5	0.4	1.2	0.4	0.8	0.4	1.0	40	30	40	30	35	25	1.3	1.5	3	38.95	(4-24)
	▲ZFDC-10-21	1-1000	11±0.5	±0.5	1.2	1.7	1.2	1.7	1.6	2.0	40	30	25	20	25	20	1.2	1	2	44.95	(4-24)
	■ZFDC-10-21-75	10-750	11±0.5	±0.75	1.5	1.8	1.5	1.9	1.7	2.1	36	30	30	20	26	20	1.4	1	2	44.95	(4-24)
	ZFDC-10-22	1-750	11±0.5	±0.5	1.1	1.6	1.2	1.7	1.4	1.9	35	30	25	20	25	20	1.25	1	2	34.95	(4-24)
	ZFDC-15-5	1-2000	15.5±0.5	±1.0	1.0	1.8	1.2	1.8	1.3	2.3	30	20	25	20	18	11	1.3	0.5	2	79.95	(1-4)
	ZFDC-15-6	0.03-35	15±0.5	±0.5	0.3	0.6	0.2	0.4	0.3	0.6	38	30	35	25	28	20	1.15	2	4	34.95	(4-24)
	■ZFDC-15-6-75	0.02-35	14.5±0.5	±0.5	0.3	0.7	0.3	0.7	0.3	0.7	35	20	35	20	35	20	1.3	1.5	4	35.95	(4-24)
	ZFDC-20-3	0.2-250	19.5±0.5	±0.25	0.35	0.6	0.25	0.5	0.35	0.6	36	25	33	25	25	20	1.2	1.5	4	29.95	(4-24)
	■ZFDC-20-3-75	10-250	19.3±0.5	±0.3	0.25	0.4	0.3	0.5	0.4	0.6	29	25	29	25	28	24	1.2	1	2	35.95	(4-24)
	ZFDC-20-4	1-1000	19.5±0.5	±0.5	1.2	1.5	0.6	0.8	1.2	1.5	36	28	27	20	23	18	1.1	.5	2	59.95	(1-4)
	●ZFDC-20-5	0.1-2000	19.5±0.5	±0.5	0.3	1	0.7	1.4	1.5	2.3	30	20	27	20	22	10	1.2	.5	2	79.95	(1-4)
	■ZFDC-3375	0.2-200	30.5±0.5	±0.6	0.5	0.8	0.6	0.9	0.7	1.0	30	25	25	20	19	15	1.6	.5	2	31.95	(4-24)
ZFDC-H case J17	◊ZFDC-20-1H	30-400	20.5±0.5	±0.4	0.15	0.3	0.15	0.3	0.3	0.4	30	25	30	25	30	23	1.2	25	25	59.95	(1-4)
ZMDC case M21	ZMDC-10-1	0.5-500	11.5±0.5	±0.6	0.85	1.3	0.65	1.0	0.85	1.3	32	25	32	25	22	15	1.2	1.5	3	39.95	(4-24)
	ZMDC-10-2	250-1000	10.5±0.5	±0.5	1.1	1.4	—	—	1.6	1.9	40	30	30	20	20	15	1.5	—	5	47.95	(4-24)
	ZMDC-15-6	.01-35	15±0.5	±0.5	0.4	0.6	0.2	0.4	0.4	0.6	38	30	35	25	28	20	1.15	2	4	47.95	(4-24)
	†ZMDC-20-1	25-400	21±0.75	±0.5	0.2	0.25	0.3	0.35	0.35	0.5	25	20	35	25	25	20	1.25	3	5	47.95	(4-24)
	ZMDC-20-3	0.2-250	19.5±0.5	±0.5	0.35	0.5	0.25	0.5	0.35	0.6	36	30	33	25	25	20	1.2	1.5	4	39.95	(4-24)
	ZMDC-30-1	0.1-250	30±0.5	±0.5	0.4	0.6	0.5	0.8	0.55	0.85	23	18	20	15	17	10	1.5	1.0	3	39.95	(4-24)
ZDC case M22	ZDC-10-1	0.5-500	11.5±0.5	±0.6	0.85	1.3	0.65	1.0	0.85	1.3	32	25	32	25	22	15	1.2	1.5	3	29.95	(4-24)
	▲ZDC-10-2	250-1000	10.5±0.5	±0.5	1.1	1.4	—	—	1.6	1.9	40	25	—	—	20	15	1.5	—	4	37.95	(4-24)
	ZDC-15-2	0.5-250	15±0.5	±0.5	0.8	1.2	0.7	1.0	0.9	1.2	32	28	32	28	32	28	1.4	1.5	3	37.95	(4-24)
	ZDC-15-6	.01-35	15±0.5	±0.5	0.3	0.6	0.2	0.4	0.3	0.6	38	30	35	25	28	20	1.15	2	4	37.95	(4-24)
	†ZDC-20-1	25-400	20±0.5	±0.5	0.2	0.25	0.3	0.35	0.35	0.5	25	20	35	25	25	20	1.25	3	5	37.95	(4-24)
	ZDC-20-3	0.2-250	19±0.5	±0.5	0.35	0.6	0.25	0.5	0.35	0.6	36	30	33	25	25	20	1.2	1.5	4	29.95	(4-24)
	■ZDC-10-1-75	1-250	10.5±0.5	±0.75	1.1	1.5	1.1	1.5	1.1	1.5	30	20	30	20	30	20	2	2	4	29.95	(4-24)
	■ZDC-15-6-75	.02-35	14.5±0.5	±0.6	0.3	0.6	0.2	0.4	0.4	0.6	35	30	35	25	28	20	1.5	2	4	38.95	(4-24)
	■ZDC-20-3-75	1-150	19.5±0.5	±0.75	0.35	0.8	0.35	0.8	0.35	0.8	25	20	25	20	25	15	2	2	4	30.95	(4-24)
	■ZDC-2375	50-100	10.5±0.3	0.2	—	—	—	—	1.1	1.3	—	—	—	—	35	30	1.3	—	4	38.95	(4-24)
	■ZDC-20-3-75-1	55-90	18.6±0.5	±0.3	0.4	0.6	0.4	0.6	0.4	0.6	35	30	35	30	35	30	1.2	—	4	38.95	(4-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

computer-automated performance data

typical production unit / for data of other models consult factory

PDC-10-1

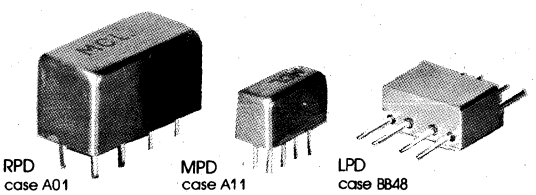
FREQUENCY (MHz)	MAINLINE LOSS (dB)	COUPLING (dB)	DIRECTIVITY (dB)	VSWR IN	VSWR OUT	VSWR CPL
.50	.73	11.17	37.21	1.11	1.13	1.09
26.789	.62	11.50	36.92	1.10	1.13	1.06
53.078	.66	11.49	36.96	1.09	1.13	1.08
105.656	.72	11.52	36.48	1.06	1.14	1.09
158.234	.74	11.52	35.07	1.04	1.14	1.12
210.812	.81	11.60	32.60	1.02	1.15	1.12
263.39	.84	11.59	30.32	1.01	1.15	1.12
315.968	.92	11.56	27.36	1.01	1.15	1.13
368.546	.95	11.50	24.22	1.01	1.15	1.15
421.124	1.02	11.49	21.84	1.01	1.14	1.17
500.00	1.12	11.43	18.71	1.01	1.12	1.22

In Stock...Immediate Delivery

highest figure of merit

Phase Detectors

1000mV DC output, +7dBm RF
1MHz to 200 MHz



RPD case A01 MPD case A11 LPD case BB48

case style selection
outline drawings see pages 4-9

description

These new high efficiency phase detectors are the only units in the world offering a figure-of-merit greater than 125 from only $15.95.

The figure-of-merit M or efficiency of a phase detector can be defined as the ratio of maximum DC output voltage (in mV) divided by the RF power (in dBm). The maximum DC output from these units is 1000 mV with +7 dBm applied to the LO and RF ports, and DC offset is typically 400 microvolts. Thus, its figure-of-merit M is 143, which indicates a highly efficient phase detector. For comparison, a double-balanced mixer used as a phase detector offers 350 mV DC output with the same LO and RF inputs for a figure-of-merit M of 50.

Both the RPD and MPD are packaged in a hermetically-sealed EMI-shielded metal case. The miniature RPD measures 0.4 x 0.8 x 0.4 in. and the micromin MPD only 0.2 x 0.5 x 0.25 in.

So when your system requires a high output phase detector, specify the new RPD or MPD series.

applications

- Radar
- ECM Systems
- Test Instruments
- Phase-lock loops

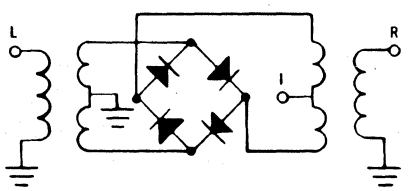
cost (5-24)

RPD-1 $15.95	MPD-1 $18.95	LPD-1 $21.95
RPD-2 $17.95	MPD-2 $20.95	

specifications

	LPD-1 MPD-1 RPD-1	RPD-2	MPD-2
FREQUENCY RANGE (MHz):			
L and R ports	1-100	5-150	10-200
Output port	DC-50	DC-50	DC-50
SCALE FACTOR (mV/degree)	8	8	8
IMPEDANCE (ohms)			
L and R ports	50	50	50
I port	500	500	500
L and R SIGNAL LEVELS	+7 dBm	+7 dBm	+7 dBm
ISOLATION, L-R, min.	40 dB	40 dB	40 dB
MAX. DC OUTPUT (mV)			
Typ.	1000	1000	1000
Min.	750	750	750
OUTPUT POLARITY (L and R in-phase)	neg	neg	neg
DC OUTPUT OFFSET (mV)			
Typ.	0.2	0.3	0.3
Max.	1	1	1
FIGURE-OF-MERIT, M	143 typ.	143 typ.	143 typ.

NOTES:
1. Maximum RF input power, 50mW. peak IF current, 20mA.
2. Refer to section 1 for quality control procedures, environmental specifications, absolute maximum ratings, and hi-rel testing.
3. Prices and specifications subject to change without notice.

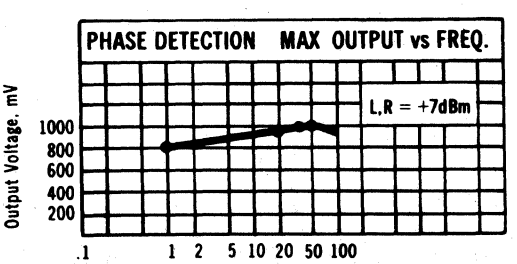


pin connections
see case style outline drawing

Series		RPD	MPD	LPD
REF.	L	8	8	8
RF in:	R	1	1	5
DC out:	I	*3,4	*3,4	4
GND.		2,5,6,7	2,5,6,7	1,2,3,6,7
CASE GND.		2	2	1,2,3,6,7

*pins must be externally connected together

Model RPD-1



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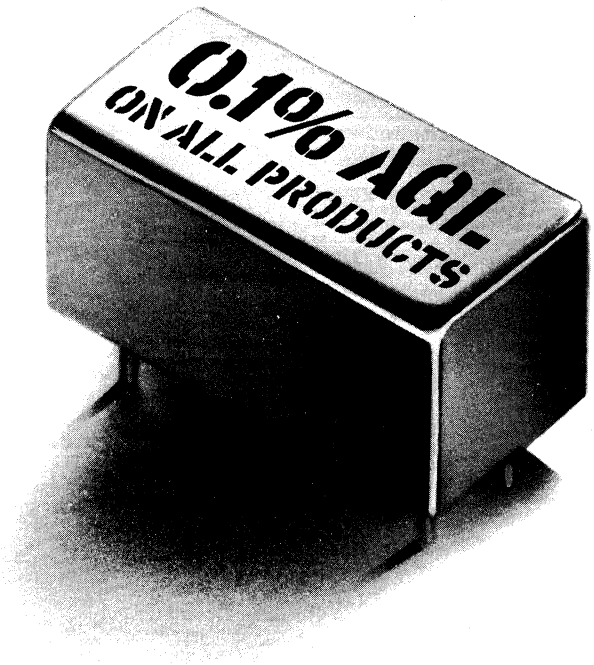


We Guarantee Quality

Many manufacturers talk about quality rarely defining specific terms or numbers.

Mini-Circuits guarantees quality . . . clearly defined. Some manufacturers are content, and even boast, of their 1.0% Acceptable Quality Level (AQL). But a 1.0% AQL means it is o.k. to pass a 1,000 lot size even if 3 rejects are found in a sample lot of 125 units. Mini-Circuits considers 1.0% AQL dangerously inadequate for today's systems designers. Just one defective mixer or coupler appearing at the final test of a system can cause extensive delays and excess costs.

So we at Mini-Circuits guarantee our customers 0.1% AQL; no rejects ... not even one ... on every order shipped. If you encounter one failure, repack the entire lot and ship it back to us, collect. We will 100% retest every unit and return the entire order promply, postage prepaid.

It could cost us a lot of money. But we are not worried. We ship millions of RF signal-processing components, for thousands of military programs in the U.S. and over 20 foreign countries, to tight quality-control specs.

We have utmost confidence in our automated assembly system, our practice of 100% screening each diode, microscopic inspection of all solder connections, screening (burn-in, thermal shock, and gross/fine leak tests), complete encapsulation for shock and vibration, and thorough testing of each completed unit.

We encourage you to add a 0.1% AQL on all of your specs, drawings and purchase orders. You are entitled to such quality. Mini-Circuits will meet the 0.1% AQL spec now. And we will continue our quest to even further improve quality.

finding new ways...
setting higher standards

Mini-Circuits

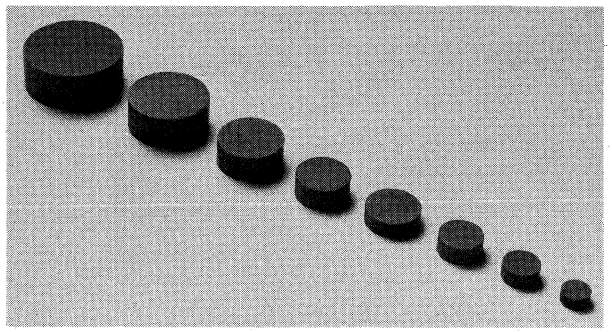
A Division of Scientific Components Corporation
World's largest manufacturer of Double Balanced Mixers
P.O. Box 166, Brooklyn, New York 11235 (718) 934-4500
Domestic and International Telex 125460 International Telex 620156

C102 Rev. Orig.

64

dielectric resonators

MURATA ERIE NORTH AMERICA



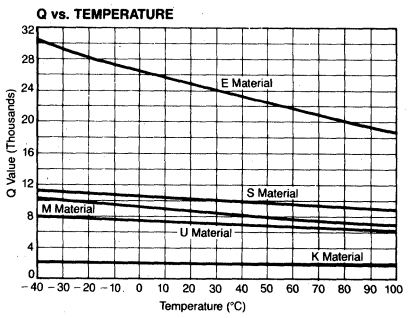
FEATURES

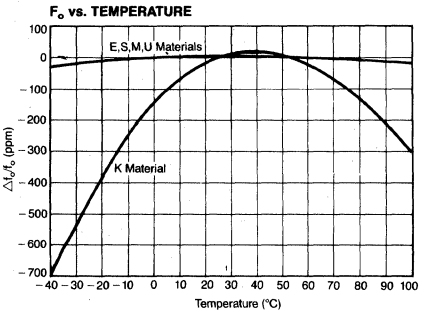
- High Q
- High Dielectric Constant
- Wide temperature compensation range
- Temperature stability: to ±0.5ppm/°C
- Wide frequency range of use

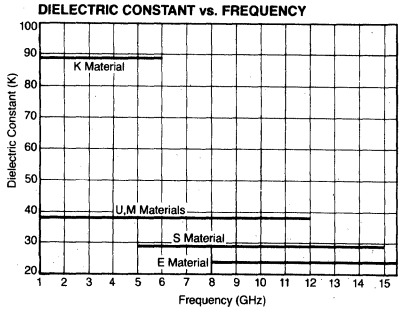
APPLICATIONS

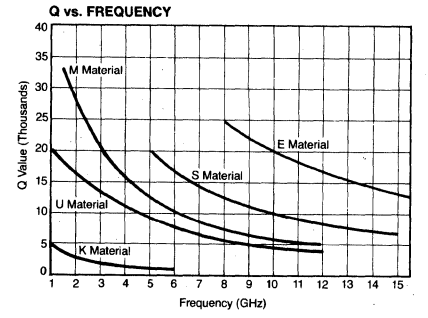
- DRO (Dielectric Resonator Oscillators)
  - DBS (Direct Broadcasting Satellites)
  - TVRO (Satellite TV Receiving—Only) earth stations
  - Microwave Oscillators
- Filters

CODE	Temp. Coeff TC ppm/°C	E-Mat'l Dielectric Constant	S-Mat'l Dielectric Constant	M-Mat'l Dielectric Constant	U-Mat'l Dielectric Constant	K-Mat'l Dielectric Constant
C	0	24.2±0.5	28.6±0.5	37.8±0.5	37.3±0.5	89.0±0.5
D	2	24.4±0.5	29.2±0.5	37.9±0.5	37.7±0.5	89.3±0.5
E	4	24.7±0.5	29.7±0.5	38.0±0.5	38.0±0.5	89.6±0.5
F	6	24.9±0.5	30.1±0.5	38.1±0.5	38.4±0.5	89.9±0.5

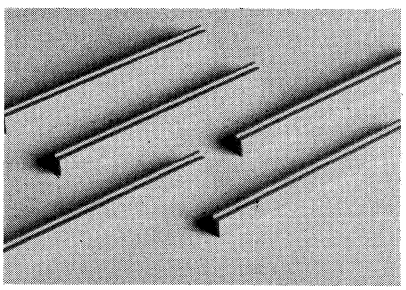








microwave dielectrics



FEATURES

- Exceptional high frequency performance
- Extremely high Q's
- Flat dieletric constants
- Lot-to-lot repeatability
- Applications up to 90 GHz
- Excellent thermal characteristics
- Low expansion rates
- Dielectric constants from 6 to 140
- Minimal loss characteristic change with temperature
- Excellent retrace
- High thermal conductivity
- Excellent insulation characteristics
- High mechanical strength
- Good machining properties
- Excellent chemical resistance

TYPICAL APPLICATIONS

- Microwave Substrates (HMIC)
- Waveguide Phase Correction
- Phased Array Radar Cells
- Waveguide Loads • Heat Sinks

Note: Typical Performance Characteristics are the same as shown above.

MURATA ERIE NORTH AMERICA 2200 Lake Park Dr., Smyrna, Georgia 30080 Tel: (404) 436-1300 Telex: 26-1301 FAX: 404-436-3030

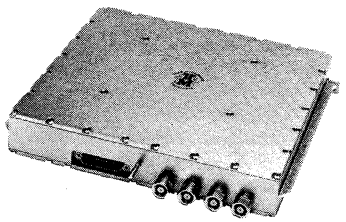
TRAK MICROWAVE

Synthesizers

4002 Series Narrowband Indirect Synthesizer

Frequency Accuracy	5 ppm
Switching Speed	25 μ sec max.
RF Output Power	+ 20 dBm min.
Harmonics	> 30 dBc
Spurious	> 50 dBc

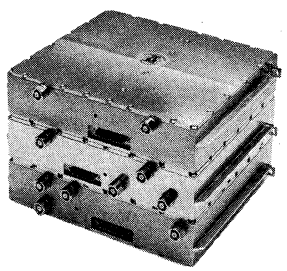
Model No.	Frequency Range	Step Size (MHz)	Size (inches, nom)	DC Power (Watts)
4002-1010	0.5 GHz to 1 GHz in any 50 MHz Band	1	8.0"x6.0"x1.5"	15
4002-1100	1 GHz to 2 GHz in any 100 MHz Band	1	8.0"x6.0"x2.5"	20
4002-1310	2 GHz to 4 GHz in any 200 MHz Band	2	8.0"x6.0"x2.5"	20
4002-1910	4 GHz to 12 GHz in any 200 MHz Band	4	8.0"x6.0"x2.5"	25
4002-1210	12 GHz to 16 GHz in any 200 MHz Band	8	8.0"x6.0"x2.5"	30



4003 Series Wideband Indirect Synthesizer

Frequency Accuracy	5 ppm
Speed	100 μ sec max.
RF Output Power	+ 20 dBm min.
Harmonics	> 30 dBc
Spurious	> 50 dBc

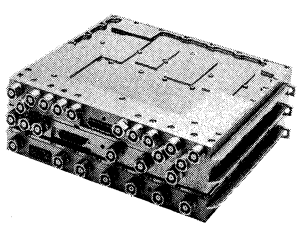
Model No.	Frequency Range (GHz)	Step Size (MHz)	Size (inches, nom)	DC Power (Watts)
4003-1110	0.5 to 2	1	8.0"x6.0"x2.5"	20
4003-1300	2 to 4.5	1	8.0"x6.0"x1.5"	20
4003-1600	4 to 9	2	8.0"x6.0"x2.5"	20
4003-1202	8 to 15	4	8.0"x6.0"x4.0"	20
4003-1201	2 to 18	5	8.0"x6.0"x4.0"	30
4003-1310	0.5 to 4.5	1	8.0"x6.0"x2.5"	25
4003-1210	0.5 to 18	5	8.0"x6.0"x5.0"	35



4004 Series Narrowband Direct Synthesizer

Frequency Accuracy	20 ppm
Switching Speed	250 nanosec max.
RF Output Power	+ 24 dBm min.
Harmonics	> 30 dBc

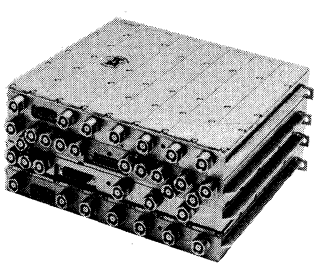
Model No.	Frequency Range (GHz)	Step Size (MHz)	Size (inches, nom)	DC Power (Watts)	Spurs (dBc)
4004-1310	1.5 to 2.5	2	8.0"x6.0"x4.0"	45	>55
4004-1000	0.5 to 1.0	1	8.0"x6.0"x4.0"	35	>60
4004-1110	1.0 to 1.5	1	8.0"x6.0"x4.0"	40	>60
4004-1102	0.5 to 2.0	4	8.0"x6.0"x5.0"	50	>55
4004-1610	2.0 to 5.0	4	8.0"x6.0"x5.0"	50	>55



4005 Series Wideband Direct Synthesizer

Frequency Accuracy	20 ppm
Switching Speed	250 nanosec max.
RF Output Power	+ 10 dBm
Harmonics	> 20 dBc
Spurious	> 45 dBc

Model No.	Frequency Range (GHz)	Step Size (MHz)	Size (inches, nom)	DC Power (Watts)
4005-1210	1–16	25	8.0"x6.0"x5.0"	25
4005-1211	8–18	25	8.0"x6.0"x5.0"	25
4005-1202	2–18	25	8.0"x6.0"x5.0"	30
4005-1203	6–18	25	8.0"x6.0"x5.0"	30



Specifications subject to change without notice.

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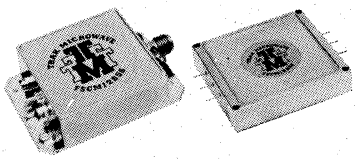
TRAK MICROWAVE

Oscillators & IF Amplifiers

60 MHz - 18 GHz Miniature Crystal Controlled Oscillators and Oscillator/Multipliers



ELECTRICAL PARAMETERS (general)
Frequency set accuracy at room temperature: ±0.001%
Frequency stability: ±0.003%
Aging rate: ±0.0005% per year
Power variation with temperature: ±2 dB

Power supply: +15 VDC (other voltages optional)
Load VSWR: 1.5:1 maximum
Temperature Range: -55 to +85° C. (to +125° C with degradation)
Contact factory for other frequencies and/or power levels. (A 1 watt output series is available.)

10 MILLIWATTS MINIMUM OUTPUT

FREQUENCY RANGE	CURRENT mA, nom. at +15 VOLTS	P.C. BOARD MOUNT MODEL NUMBER	MICROSTRIP MODEL NUMBER	BASE PLATE MOUNT MODEL NUMBER	HARMONICS OF CRYSTAL OSCILLATOR UP TO 2nd HARMONIC OF OUTPUT FREQUENCY
60 - 120 MHz	25	5040 - 1056	5140 - 1057	5040 - 1057	> 30 dBc
121 - 240 MHz	35	5041 - 1056	5141 - 1057	5041 - 1057	> 30 dBc
241 - 360 MHz	35	5042 - 1056	5142 - 1057	5042 - 1057	> 30 dBc
361 - 720 MHz	50	5043 - 1056	5143 - 1057	5043 - 1057	> 30 dBc
721 - 1200 MHz	50	5044 - 1056	5144 - 1057	5044 - 1057	> 30 dBc
1.2 - 1.7 GHz	60	-	-	5044 - 1110	> 40 dBc
1.7 - 2.0 GHz	65	-	-	5044 - 1111	> 40 dBc
2.0 - 2.3 GHz	65	-	-	5044 - 1310	> 40 dBc
2.3 - 2.5 GHz	75	-	-	5044 - 1313	> 40 dBc
2.5 - 4.0 GHz	100	-	-	5044 - 1311	> 40 dBc
4.0 - 6.0 GHz	110	-	-	5044 - 1611	> 40 dBc
6.0 - 8.0 GHz	110	-	-	5044 - 1615	> 40 dBc
8.0 - 10.0 GHz	120	-	-	5045 - 1911	> 40 dBc
10.0 - 12.0 GHz	140	-	-	5045 - 1913	> 40 dBc
12.0 - 18.0 GHz	150	-	-	5045 - 1240	> 40 dBc

100 MILLIWATTS MINIMUM OUTPUT

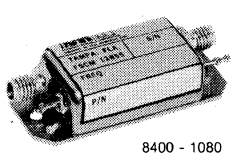
FREQUENCY RANGE	CURRENT mA, nom. at +15 VOLTS	P.C. BOARD MOUNT MODEL NUMBER	MICROSTRIP MODEL NUMBER	BASE PLATE MOUNT MODEL NUMBER	HARMONICS OF CRYSTAL OSCILLATOR UP TO 2nd HARMONIC OF OUTPUT FREQUENCY
60 - 120 MHz	40	5040 - 1086	5140 - 1087	5040 - 1087	> 20 dBc
121 - 240 MHz	50	5041 - 1086	5141 - 1087	5041 - 1087	> 20 dBc
241 - 360 MHz	50	5042 - 1086	5142 - 1087	5042 - 1087	> 20 dBc
361 - 720 MHz	70	5043 - 1086	5143 - 1087	5043 - 1087	> 20 dBc
721 - 1200 MHz	70	5044 - 1086	-	5044 - 1087	> 20 dBc
1.2 - 1.7 GHz	80	-	-	5044 - 1120	> 40 dBc
1.7 - 2.0 GHz	90	-	-	5044 - 1121	> 40 dBc
2.0 - 2.3 GHz	90	-	-	5044 - 1320	> 40 dBc
2.3 - 2.5 GHz	100	-	-	5044 - 1321	> 40 dBc

AVAILABLE OPTIONS:

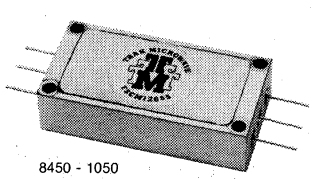
- Gating
- Heater Control
- Frequency Trim
- One watt versions are available

NOTE: Size may vary with options.
Contact Factory.

Wide Dynamic Range Low Noise IF Amplifier Series



8400 - 1080



8450 - 1050

	Model 8450 - 1050	Model 8400 - 1080
Frequency Range	Customer Specified 20 - 300 MHz	Customer Specified 20 - 150 MHz
3dB Bandwidth	10% of center frequency, nominal	10 MHz, nominal
Size	1.50 × .75 × .35 inches, nominal	1.28 × .71 × .05 inches, nominal
Weight	0.4 ounces, nominal	1 ounce, nominal
Connections	.020 diameter pins	SMA female

The following specifications apply to *both* models.

Bandpass Ripple	1 dB, typical
Skirt Selectivity	12 dB/octave, typical
Gain	70 ± 3 dB
Noise Figure	3 dB maximum
Input Impedance	50 ohms, nominal
1 dB Compression Point	0 dBm minimum
3rd Order Intercept Point	+10 dBm, nominal
Input Dynamic Range (with AGC)	80 dB minimum
AGC Range	60 dB minimum
AGC Voltage	0 to +5 volts
Temperature Range	-54° C to +85° C

Specifications subject to change without notice.

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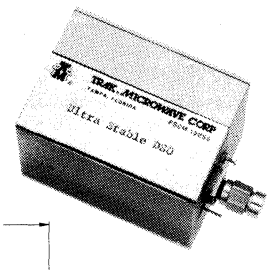
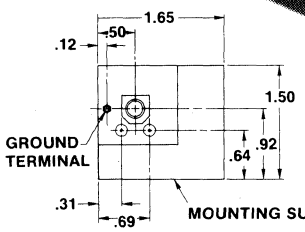
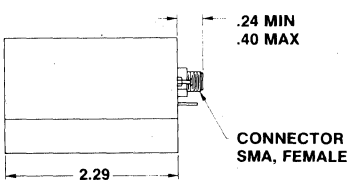
TRAK MICROWAVE

Dielectrically Stabilized Oscillators (DSO's)

Ultra Stable DSO Series







ELECTRICAL SPECIFICATIONS

Frequency Range	Factory preset between 8 and 18 GHz
Frequency Stability	±500 KHz maximum, including frequency set accuracy, aging and temperature.
Power variation with temperature	±1.5 dB maximum
Power Output	+16 dBm minimum, +18 dBm typical
Spurs	< -70 dBc maximum, ≤-80 dBc typical
Pulling (into a 3:1 load)	< 150 KHz peak to peak
Pushing	< 2 KHz/volt
Phase Noise SSB	-90 dBc/Hz at 100 KHz from carrier
Power Supply	+15 VDC at 300 mA maximum, 250 mA typical

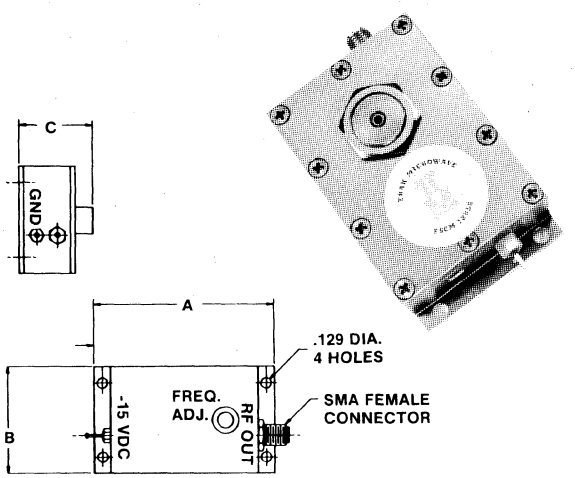
ENVIRONMENTAL CONDITIONS

Operating Temperature Range	-54°C to +85°C
Altitude	70,000 feet
Vibration	20 g, sine

MECHANICAL SPECIFICATIONS

Size	2.29 × 1.65 × 1.5 inches (58 × 42 × 38 mm) nominal excluding projections.
Weight	4.5 ounces (128 grams), nominal

6600 Series Bipolar Transistor DSO's



Power Supply:	-15 VDC @ 40 mA nominal
Frequency Stability:	10ppm/°C, maximum 5ppm/°C, typical
Temperature:	-54 to +95°C.

MODEL NUMBER	FREQUENCY RANGE (GHz)	OUTPUT POWER (mw Min.)	SECOND HARMONIC (dBc Min.)	SIZES, INCHES NOMINAL, A B C
6600 - 1352	2.85 - 2.90	30	25	3.5 x 2.2 x 1.06
6600 - 1353	2.90 - 3.00	30	25	3.5 x 2.2 x 1.06
6600 - 1310	3.00 - 3.10	30	25	2.7 x 1.7 x .92
6600 - 1312	3.10 - 3.20	30	25	2.7 x 1.7 x .92
6600 - 1313	3.20 - 3.30	30	25	2.7 x 1.7 x .92
6600 - 1314	3.30 - 3.45	30	25	2.7 x 1.7 x .92
6600 - 1315	3.45 - 3.65	30	25	2.7 x 1.7 x .92
6600 - 1300	3.65 - 3.95	30	25	2.7 x 1.7 x .82
6600 - 1660	3.95 - 4.25	30	25	2.7 x 1.7 x .82
6600 - 1610	4.25 - 4.65	30	25	2.5 x 1.5 x .82
6600 - 1611	4.65 - 5.05	30	25	2.5 x 1.5 x .82
6600 - 1612	5.05 - 5.45	30	25	2.5 x 1.5 x .82
6600 - 1613	5.40 - 5.90	30	25	2.5 x 1.5 x .82
6600 - 1614	5.60 - 6.10	30	25	2.5 x 1.5 x .82
6600 - 1615	5.70 - 6.20	30	25	2.5 x 1.5 x .82
6600 - 1616	5.90 - 6.40	30	25	2.5 x 1.5 x .82
6600 - 1617	6.40 - 6.90	30	25	2.5 x 1.5 x .82
6600 - 1619	6.80 - 7.20	30	25	2.5 x 1.5 x .82
6600 - 1618	7.00 - 7.40	15	25	2.2 x 1.3 x .78
6600 - 1661	7.40 - 7.80	15	25	2.2 x 1.3 x .78
6600 - 1662	7.60 - 8.00	15	25	2.2 x 1.3 x .78
6600 - 1910	8.00 - 8.40	15	25	2.2 x 1.3 x .78
6600 - 1906	8.20 - 8.60	15	25	2.2 x 1.3 x .78
6600 - 1911	8.60 - 9.00	15	25	2.2 x 1.3 x .78
6600 - 1907	8.90 - 9.30	15	25	2.2 x 1.3 x .78
6600 - 1912	9.10 - 9.50	15	25	2.2 x 1.3 x .78

Specifications subject to change without notice.

NOTE: Contact factory regarding improved stability requirements.
Other models available.

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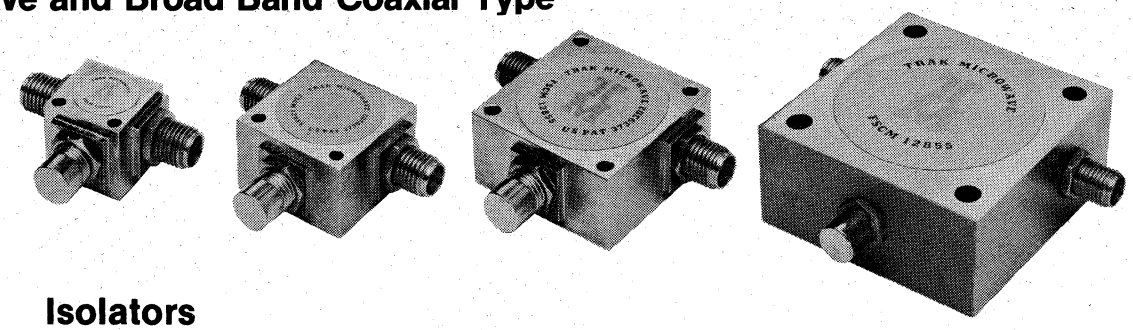
TRAK MICROWAVE

Circulators & Isolators

Octave and Broad Band Coaxial Type

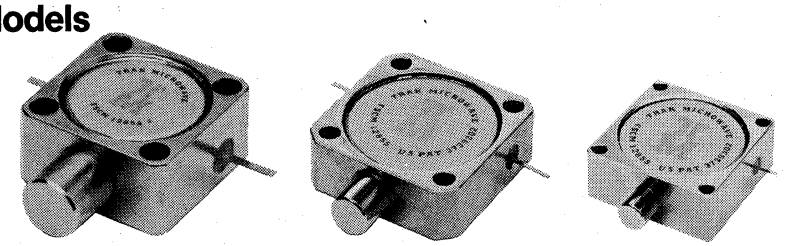


Isolators

FREQUENCY RANGE (GHz)	MODEL NUMBER	ISOLATION dB min.	INSERTION LOSS dB max.	VSWR max.	OPERATING TEMP. °C.	PEAK POWER KW	AVERAGE POWER WATTS	HEAT SINK TEMP. °C.	SIZE (INCHES NOMINAL) L W H
1.0 - 2.0	60A1101*	15	0.6	1.40	0 to +50	0.1	1.0	+50	1.60 × 1.60 × 0.75
2.0 - 4.0	60A3001*	18	0.5	1.30	-10 to +70	0.1	1.0	+70	1.00 × 1.00 × 0.50
2.0 - 6.0	60A3401*	12	1.0	1.65	-10 to +60	0.1	1.0	+60	1.00 × 1.00 × 0.50
2.6 - 5.2	60A3011*	18	0.5	1.30	-25 to +80	0.1	1.0	+80	1.00 × 1.00 × 0.50
3.0 - 6.0	60A6301*	18	0.5	1.40	-45 to +85	0.1	1.0	+85	0.75 × 0.75 × 0.50
4.0 - 8.0	60A6001*	18	0.5	1.30	-45 to +95	0.1	3.0	+95	0.75 × 0.75 × 0.50
5.0 - 10.0	60A6071*	18	0.5	1.30	-55 to +95	0.1	2.0	+95	0.75 × 0.75 × 0.50
6.0 - 12.0	60A9201*	16	0.7	1.35	-55 to +95	0.1	1.0	+95	0.75 × 0.75 × 0.50
6.0 - 18.0	60A2601*	12	1.0	1.67	-40 to +80[2]	0.1	3.0	+80	0.50 × 0.50 × .375
6.5 - 18.0	60A2701*	14	1.0	1.50	-54 to +95	0.1	3.0	+95	0.50 × 0.50 × .375
7.0 - 18.0	60A2171	13	0.75	1.58	-40 to +65	0.5	3.0	+65	0.50 × 0.50 × .375
7.5 - 18.0	60A2301*	14	0.9	1.50	-54 to +95	0.5	3.0	+85	0.50 × 0.50 × 0.50
8.0 - 12.4	20B9201*	20	0.5	1.30	-55 to +95	0.1	3.0	+95	0.50 × 0.50 × 0.50
8.0 - 16.0	60A2001*	17	0.5	1.35	-40 to +95	0.5	3.0	+95	0.50 × 0.50 × 0.50
8.0 - 16.0	60A2501	17	0.5	1.35	-40 to +95	0.1	3.0	+95	0.50 × 0.50 × .375
8.0 - 18.0	60A2051*	14	0.6	1.50	-54 to +95	0.5	3.0	+95	0.50 × 0.50 × 0.50
8.0 - 20.0	60A2401*	12	1.0	1.67	-40 to +80	0.1	1.0	+80	0.50 × 0.50 × .375
12.0 - 18.0	20B2201*	18	0.5	1.30	-55 to +110	0.5	3.0	+110	0.50 × 0.50 × 0.50
18.0 - 22.0	20A8021*	18	0.7	1.30	-54 to +95	0.5	1.0	+95	0.50 × 0.50 × .375
18.0 - 26.5	60A8101*	14	1.0	1.50	-54 to +95	0.1	1.0	+95	0.50 × 0.50 × .375

*These units are normally available from stock or from our distributors.
NOTES:
(1) Circulators are also available.
(2) The insertion loss for Model 60A2601 is 1.5 dB maximum from -54°C to +95°C. Other specifications are unchanged over this temperature range.
Specifications subject to change without notice.

Drop-In Broad Band Models



Isolators

FREQUENCY RANGE (GHz)	MODEL NUMBER	ISOLATION dB min.	INSERTION LOSS dB max.	VSWR max.	OPERATING TEMP. °C.	PEAK POWER KW	AVERAGE POWER WATTS	HEAT SINK TEMP. °C.	SIZE (INCHES NOMINAL) L W H
2.0 - 4.0	69A3101*	16	0.6	1.40	-10 to +70	0.1	1.0	+70	.875 × .875 × .345
2.5 - 5.0	69A3181	16	0.6	1.40	-10 to +85	0.1	1.0	+70	.875 × .875 × .345
2.6 - 5.2	69A3111*	16	0.6	1.40	-25 to +85	0.1	1.0	+85	.875 × .875 × .345
		16	0.7	1.40	-54 to +95	0.1	1.0	+95	.875 × .875 × .345
3.0 - 6.0	69A6201*	16	0.6	1.40	-25 to +85	0.1	1.0	+85	.875 × .875 × .345
4.0 - 8.0	69A6001*	16	0.6	1.40	-40 to +85	0.1	1.0	+85	0.75 × 0.75 × 0.25
4.7 - 10.0	69A6051	12	1.0	1.50	-40 to +85	0.1	1.0	+85	0.75 × 0.75 × 0.25
5.0 - 10.0	69A6101*	16	0.6	1.40	-30 to +70	0.1	1.0	+70	0.75 × 0.75 × 0.25
6.0 - 18.0	69A2601*[2]	10	1.2	2.0	-40 to +80	0.1	1.0	+80	0.50 × 0.50 × 0.20
7.5 - 18.0	69A2041*	12	1.0	1.65	-40 to +80	0.1	1.0	+80	0.50 × 0.50 × 0.25
8.0 - 12.0	69A9201*	17	0.6	1.40	-40 to +85	0.1	1.0	+85	0.50 × 0.50 × 0.25
8.0 - 16.0	69A9301*	14	0.8	1.50	-40 to +85	0.1	1.0	+85	0.50 × 0.50 × 0.25
8.0 - 18.0	69A2031*	13	1.0	1.60	-40 to +80	0.1	1.0	+80	0.50 × 0.50 × 0.25
12.0 - 18.0	69A2201*	17	0.7	1.50	-55 to +100	0.1	1.0	+95	0.50 × 0.50 × 0.25

*These units are normally available from stock or from our distributors.
NOTES: (1) Circulators are also available. (2) For Model 69A2601 only, the insertion loss is 1.5 dB maximum from -54°C to +95°C.
Specifications subject to change without notice.

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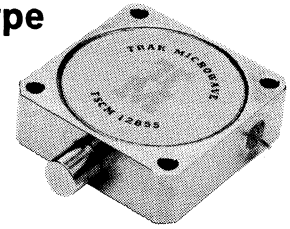
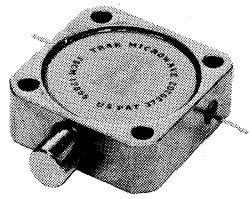
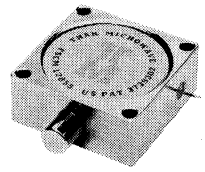
TRAK MICROWAVE

Circulators & Isolators

Drop-In Type

Isolators

FREQUENCY RANGE (GHz)	MODEL NUMBER	BANDWIDTH %	ISOLATION dB min.	INSERTION LOSS dB max.	VSWR max.	OPERATING TEMP. °C.	PEAK POWER KW	AVERAGE POWER WATTS	HEAT SINK TEMP. °C.	SIZE (INCHES NOMINAL) L W H
0.5 - 0.7	29*0401	3	20	0.7	1.25	-54 to +95	0.1	1.0	+95	1.00 × 1.00 × 0.30
0.7 - 1.0	29*0501	5	20	0.6	1.25	-54 to +95	0.1	1.0	+95	1.00 × 1.00 × 0.30
1.0 - 1.3	29*1401	10	20	0.5	1.25	-54 to +95	0.1	1.0	+95	1.00 × 1.00 × 0.30
1.3 - 1.65	29*1501	10	20	0.5	1.25	-54 to +95	0.1	1.0	+95	1.00 × 1.00 × 0.30
1.65 - 2.0	29*1601	5	20	0.5	1.25	-54 to +95	0.1	1.0	+95	0.75 × 0.75 × 0.25
2.0 - 2.5	29*3401	5	20	0.5	1.25	-54 to +95	0.1	1.0	+95	0.75 × 0.75 × 0.25
2.5 - 3.7	29*3501	10	20	0.6	1.25	-54 to +95	0.1	1.0	+95	0.75 × 0.75 × 0.25
2.5 - 3.7	29*3601	5	18	0.6	1.30	-54 to +95	0.1	1.0	+95	0.50 × 0.50 × 0.25
3.7 - 4.6	29*6401	5	18	0.6	1.30	-54 to +95	0.1	1.0	+95	0.50 × 0.50 × 0.25
4.6 - 6.2	29*6501	10	18	0.6	1.30	-54 to +95	0.1	1.0	+95	0.50 × 0.50 × 0.25
6.2 - 8.0	29*6601	10	18	0.6	1.35	-54 to +95	0.1	1.0	+95	0.50 × 0.50 × 0.25
8.0 -10.0	29*9401	10	18	0.6	1.35	-54 to +95	0.1	1.0	+95	0.50 × 0.50 × 0.25
10.0 - 12.0	29*9501	10	18	0.6	1.35	-54 to +95	0.1	1.0	+95	0.50 × 0.50 × 0.25
12.0 - 15.0	29*2401	10	17	0.6	1.45	-54 to +95	0.1	1.0	+95	0.50 × 0.50 × 0.25
15.0 - 18.0	29*2501	10	17	0.6	1.45	-54 to +95	0.1	1.0	+95	0.50 × 0.50 × 0.25

*Specify center frequency when ordering. Model designation will be completed by TRAK.
NOTES:
(1) Circulators are also available.
(2) If your lower frequency limit is below the lower limit stated for a particular model, select the preceding model. If your upper frequency limit will exceed 12 GHz, select the next higher frequency model.

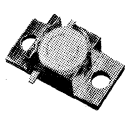
μicrOpuck® Circulators & Isolators

The Micropuck® family of circulators and isolators was designed to maximize the use of isolators and circulators in stripline and microstrip applications. They are easy-to-mount devices with magnetic shielding which prevents detuning or changes in performance when operating in magnetic fields or in close proximity to ferrous metals. The round design and tab lead configuration allow installation at a reduced cost, replacing milling operations with a simple drilled hole.

The Micropuck® isolator is also available in a flange mount similar to the mounting used on some power transistors. This construction has input and output tabs located 180° from each other as opposed to the 120° separation of the round version. This provides an alternative choice for system designers who prefer the screw-down mounting and can allow the extra space it requires.

Specifications for these microminiature ferrite devices are as good as you'll find anywhere. Look at the data and call our ferrite sales group or local representative.

Flange Mount Micropuck® Isolators



MODEL NUMBER	FREQUENCY RANGE (GHz)	BANDWIDTH %	ISOLATION dB min.	INSERTION LOSS dB max.	VSWR max.	OPERATING TEMP. °C.	PEAK POWER WATTS	AVERAGE POWER WATTS	HEAT SINK TEMP. °C.	SIZE (INCHES NOMINAL) L W H
F9*6101	4.0 - 8.0	10	20	0.5	1.25	-54 to +95	50	.7	95	.62 × .375 × .21
F9*9001	8.0 - 12.0	10	20	0.4	1.25	-54 to +95	50	.5	95	.50 × .25 × .18
F9*2001	12.0 - 18.0	10	17	0.5	1.35	-54 to +95	50	.5	95	.50 × .25 × .18
F9A6141	3.7 - 4.3	FULL BAND	15	0.6	1.45	-30 to +70	50	.7	70	.62 × .375 × .21
F9A9101**	8.0 - 12.0	FULL BAND	16	0.7	1.45	-54 to +95	50	.7	95	.62 × .375 × .21
F9A2201**	12.0 - 18.0	FULL BAND	17	0.7	1.50	-55 to +100	50	.5	95	.50 × .25 × .18

Micropuck® Circulators

MODEL NUMBER	FREQUENCY RANGE (GHz)	BANDWIDTH %	ISOLATION dB min.	INSERTION LOSS dB max.	VSWR max.	OPERATING TEMP. °C.	PEAK POWER WATTS	AVG. POWER WATTS	HEAT SINK TEMP.	SIZE DIA. INCH	SIZE HEIGHT INCH
79*6101	4.0 - 8.0	10	18	.5	1.30	-54 to +95	50	25	50	.375	.200
79*9001	8.0 - 12.0	10	18	.4	1.30	-54 to +95	50	20	50	.250	.156
79*2001	12.0 - 18.0	10	17	.5	1.35	-54 to +95	50	20	50	.250	.156
79A9101**	8.0 - 12.0	FULL BAND	16	.7	1.45	-54 to +95	50	20	50	.375	.200

Micropuck® Isolators

89*6101	4.0 - 8.0	10	20	.5	1.25	-54 to +95	50	.7	95	.375	.200
89*9001	8.0 - 12.0	10	20	.4	1.25	-54 to +95	50	.5	95	.250	.156
89*2001	12.0 - 18.0	10	17	.5	1.35	-54 to +95	50	.5	95	.250	.156
89A2201**	12.0 - 18.0	FULL BAND	17	.7	1.50	-54 to +100	50	.5	95	.250	.156
89A9101**	8.0 - 12.0	FULL BAND	16	.7	1.45	-54 to +95	50	.7	95	.375	.200

*Specify center frequency when ordering. Model designation will be completed by TRAK. **These units are normally available from stock or from our distributors.
NOTES: (1) Upper frequency limit cannot exceed 18 GHz. (2) If your lower frequency limit is below the lower limit stated for a paticular model, select the preceding model. If your upper frequency limit will exceed 12 GHz, select the next higher frequency model.
Specifications subject to change without notice.

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Under 1 GHz	1 to 26.5 GHz	Above 26.5 GHz	Commercial	Industrial/Military		
X	X	X	X	X	**ADAPTERS (IN SERIES & BETWEEN SERIES)**	Amphenol, EZ Form, Huber + Suhner, Kings, Omni Spectra, Weinschel
X	X		X	X	**AMPLIFIERS**	Avantek, Comlinear, Mini-Circuits, Penstock Engineering Labs
X	X	X	X	X	**ATTENUATORS**	Avantek, Daico, Mini-Circuits, Omni Spectra, Weinschel
X	X	X	X	X	**ATTENUATORS, DROP-IN**	Omni Spectra
X	X		X	X	**BARRETTER MOUNTS**	Weinschel
X	X	X	X	X	**CABLE ASSEMBLIES**	EZ Form, Huber + Suhner, Penstock Engineering Labs
X	X	X	X	X	**CABLE ASSEMBLIES, INSTRUMENTATION GRADE**	Huber + Suhner
			X	X	**CABLE HARDWARE**	Dek, Inc.
X	X	X	X	X	**CHIP ATTENUATORS**	Omni Spectra
X	X		X	X	**CHIP CAPACITORS**	AVX
			X	X	**CLIPS & WIRE TIES**	Dek, Inc.
X	X	X	X	X	**CONNECTORS**	Amphenol, Kings, Omni Spectra
			X	X	**CONNECTOR CAPS & TUBES**	Sinclair & Rush
X	X		X	X	**CUSTOM ENGINEERING**	Penstock Engineering Labs
X	X		X	X	**DC BLOCKS**	Omni Spectra
X	X	X	X	X	**DELAY LINES**	EZ Form
X	X	X	X	X	**DIRECTIONAL COUPLERS**	Mini-Circuits, Omni Spectra
X	X	X	X	X	**DOUBLE RIDGED WAVEGUIDE ADAPTERS**	Omni Spectra
X	X		X	X	**EMI/RFI FILTERS**	Tusonix
X	X		X	X	**FEED THRU CAPACITORS**	Tusonix
X	X		X	X	**FILTER CAPACITORS**	Tusonix
X	X		X	X	**FILTERS**	Mini-Circuits
X	X	X	X	X	**FLEX CABLE**	EZ Form, Huber + Suhner, Penstock Engineering Labs
X	X		X	X	**FREQUENCY DOUBLERS**	Mini-Circuits
X	X		X	X	**GAIN EQUALIZERS**	Omni Spectra
			X	X	**HEAT SHRINKABLE TUBING**	Sinclair & Rush
X	X		X	X	**LIMITERS**	Avantek, Mini-Circuits
X	X		X	X	**LINE STRETCHERS**	Omni Spectra
X	X		X	X	**LOADS**	Weinschel
X	X		X	X	**MIXERS**	Avantek, Mini-Circuits
X	X		X	X	**MMIC COMPONENTS**	Avantek, Mini-Circuits
X	X		X	X	**MONITOR TEE/DC BLOCKS**	Omni Spectra
X	X		X	X	**NOISE SUPPRESSORS**	Weinschel
X	X		X	X	**OSCILLATORS**	Avantek
X	X	X	X	X	**PHASE DETECTORS**	Mini-Circuits, Omni Spectra
X	X	X	X	X	**POWER DIVIDERS**	Omni Spectra, Weinschel
X	X	X	X	X	**POWER SPLITTERS/ COMBINERS**	Mini-Circuits, Omni Spectra, Weinschel
X	X		X	X	**RF SAMPLERS**	Omni Spectra
X	X		X	X	**SEMICONDUCTORS**	Avantek
X	X	X	X	X	**SEMI-RIGID CABLE**	EZ Form, Precision Tube
X	X		X	X	**STANDOFF CAPACITORS**	Tusonix
X	X		X	X	**STUB COAXIAL TUNERS**	Omni Spectra
X	X		X	X	**SUB-ASSEMBLIES**	Penstock Engineering Labs
X	X	X	X	X	**SUBSTRATES**	Omni Spectra
X	X		X	X	**SWITCHES**	Avantek, Daico, Mini-Circuits, Penstock Engineering Labs, Weinschel
X	X	X	X	X	**TERMINATIONS**	Amphenol, Mini-Circuits, Omni Spectra, Weinschel
			X	X	**TOOLS FOR CABLES & CONNECTORS**	Huber + Suhner, Omni Spectra, Seven Associates, Utica, Western Electronic Products Co.
X			X	X	**TRANSFORMERS**	Mini-Circuits
X	X		X	X	**TRANSISTORS**	Avantek
X	X		X	X	**TRIMMER CAPACITORS**	Tusonix
X	X	X	X	X	**VALUE ADDED ENGINEERING**	Penstock Engineering Labs
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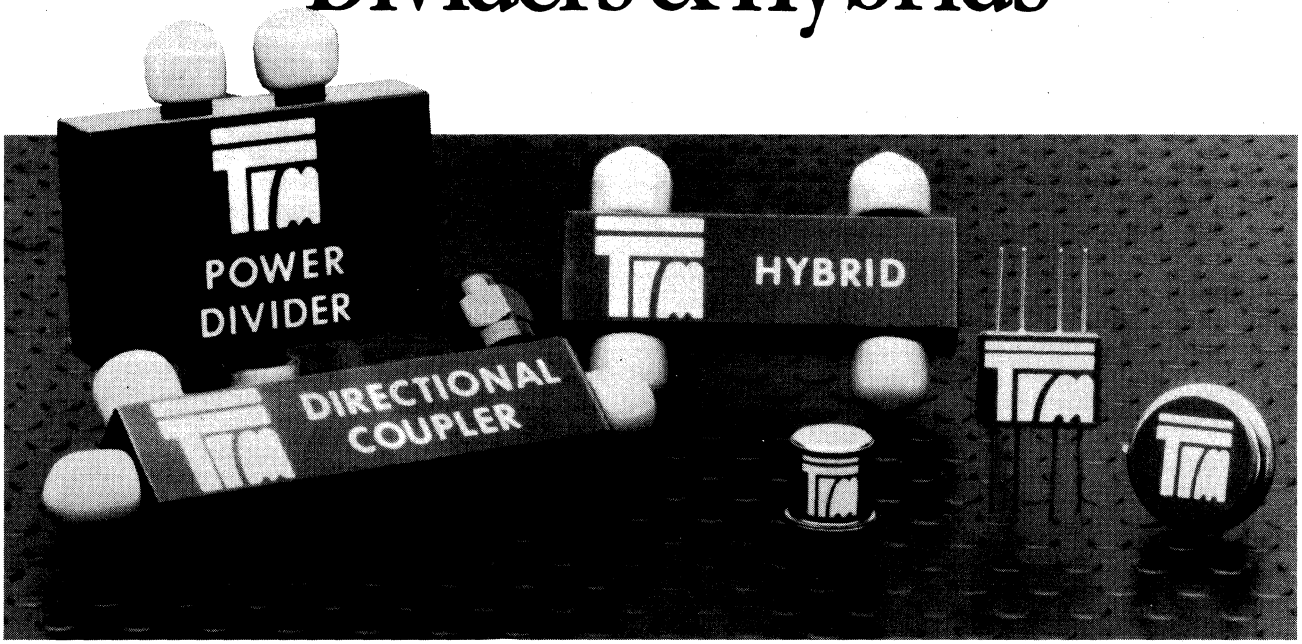

DCS 2023 Directional Coupler	DMS 285 Power Divider	HQ 132 Series 90° Hybrid
2–8 GHz	1–20 GHz	Octave Increments between 20 and 400 MHz
20 dB Coupling	< 1.0 dB Insertion Loss	.5 dB Insertion Loss
± .5 dB Coupling Flatness	.4 dB Amplitude Balance	.75 dB Amplitude Balance
.5 dB Insertion Loss	4° Phase Balance	3° Phase Balance
20 dB Directivity	15 dB Isolation (midband)	20 dB Isolation
1.3:1 VSWR	1.5:1 VSWR (midband)	1.2:1 VSWR
1.78″ x .50″ x .38″ Size	1.75″ x .44″ x .44″ Size	⅜″ x ½″ Flatpack

All specifications above are guaranteed max/min.

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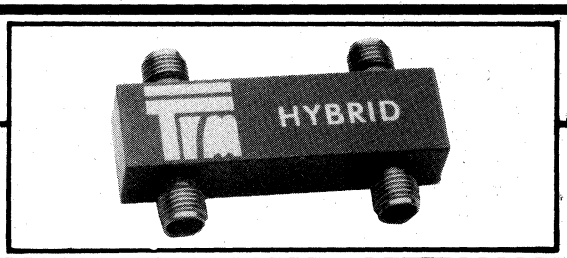
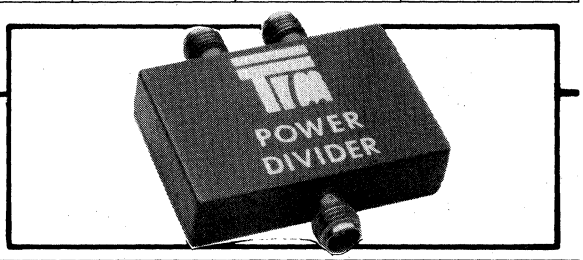


HYBRIDS

MODEL	FREQUENCY RANGE	INSERTION LOSS (dB MAX.)	ISOLATION (dB MIN.)	VSWR (MAX.)	AMPLITUDE BALANCE (dB MAX.)	PHASE BALANCE (DEG. MAX.)	INPUT POWER (WATTS MAX.)
90 DEGREE HYBRIDS (20 MHz–18 GHz)							
HQ 5113	2-8 GHz	0.75	15	1.60:1	1.50	5	30
	8-12.4 GHz	1.00	15	1.60:1	1.50	5	30
	12.4-18 GHz	1.50	15	1.60:1	1.50	5	30
180 DEGREE HYBRIDS (.02 MHz–8 GHz)							
HS 505	1-2 GHz	0.40	20	1.35:1	1.00	5	50



POWER DIVIDERS

MODEL	FREQUENCY RANGE	INSERTION LOSS (dB MAX.)	ISOLATION (dB MIN.)	VSWR IN (MAX.)	VSWR OUT (MAX.)	AMPLITUDE BALANCE (dB MAX.)	PHASE BALANCE (DEG. MAX.)	INPUT POWER (WATTS MAX.)
2-WAY TO-8 POWER DIVIDERS (.2–500 MHz): Also available in 3-Way and 4-Way								
DL 222	.2-200 MHz	0.50	26	1.30:1	1.30:1	0.20	2	1.5
2-WAY TO-5 POWER DIVIDERS (.2–500 MHz)								
DL 5223	5-500 MHz	0.60	30	1.30:1	1.30:1	0.20	2	1.5
2-WAY FLATPACK POWER DIVIDERS (.2–2000 MHz): Also available in 3-Way and 4-Way								
DL 233	5-500 MHz	0.50	26	1.30:1	1.30:1	0.20	2	1.5
2-WAY POWER DIVIDERS (3 KHz–18 GHz): Also available in 3-Way, 4-Way, 6-Way and 8-Way								
DL 200	3 KHz-20 MHz	1.00	26	1.50:1	1.50:1	0.40	2	10
DMS 206	2-4 GHz	0.40	23	1.20:1	1.20:1	0.20	2	30
2-WAY BROADBAND POWER DIVIDERS (.5–26.5 GHz): Also available in 3-Way, 4-Way and 8-Way								
DMS 265	2-2.5 GHz	0.30	15	1.50:1	1.20:1	0.30	2	10
	2.5-20 GHz	1.00	20	1.30:1	1.30:1	0.40	4	10
	20-26.5 GHz	1.50	15	1.50:1	1.50:1	0.40	6	10
2-WAY NARROW-BAND POWER DIVIDER (Fc 100–2000 MHz): Also available in 3-Way and 4-Way								
DM 201	100-2000 MHz (Fc ±15%)	0.20	20	1.30:1	1.30:1	0.20	2	60

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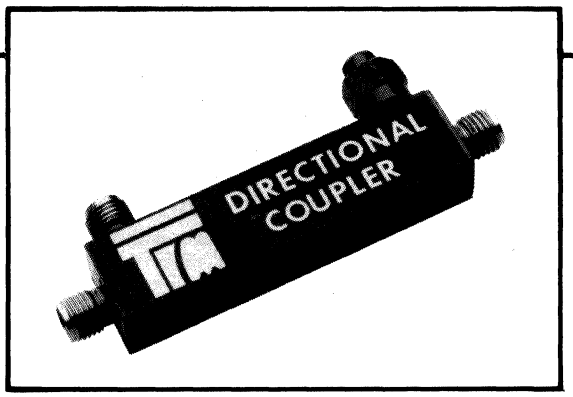
DIRECTIONAL COUPLERS



MODEL NO.	FREQUENCY RANGE	NOMINAL COUPLING (dB)	COUPLING VARIATION ± (dB)	DIRECTIVITY (dB MIN.)	VSWR (MAX.) MAIN	VSWR (MAX.) SEC.	INSERTION LOSS (dB MAX.)
MINIATURE DIRECTIONAL COUPLER (10–1000 MHz)							
DC 133	10-500 MHz	10.8 ± .5	0.50	20	1.50:1	1.50:1	1.00
BROADBAND DIRECTIONAL COUPLERS (.1–2000 MHz)							
DC 202	.1-5 MHz	20 ± 1.0	0.50	30	1.30:1	1.30:1	0.50
DIRECTIONAL COUPLERS (.125–18 GHz)							
DCS 601	.125-.250 GHz	6 ± .5	0.50	25	1.10:1	1.10:1	0.10
DCS 204	.5-1 GHz	20 ± .5	1.00	25	1.15:1	1.15:1	0.20
DCS 309	6-11 GHz	30 ± .5	0.50	18	1.30:1	1.30:1	0.30
DCS 111	7-18 GHz	10 ± .5	0.60	12	1.45:1	1.50:1	0.60
MULTI-OCTAVE DIRECTIONAL COUPLERS (.5–18 GHZ)							
DCS 1070	.5-4 GHz	10 ± .5	1.00*	15	1.50:1	1.50:1	1.50
DCS 2023	2-8 GHz	20 ± .5	0.50	20	1.30:1	1.30:1	0.50
DUAL DIRECTIONAL COUPLERS (.225–8 GHz)							
DDS 308	4-8 GHz	30 ± .5	1.00	18	1.35:1	1.35:1	0.60

*Frequency Sensitivity (± dB Max.)

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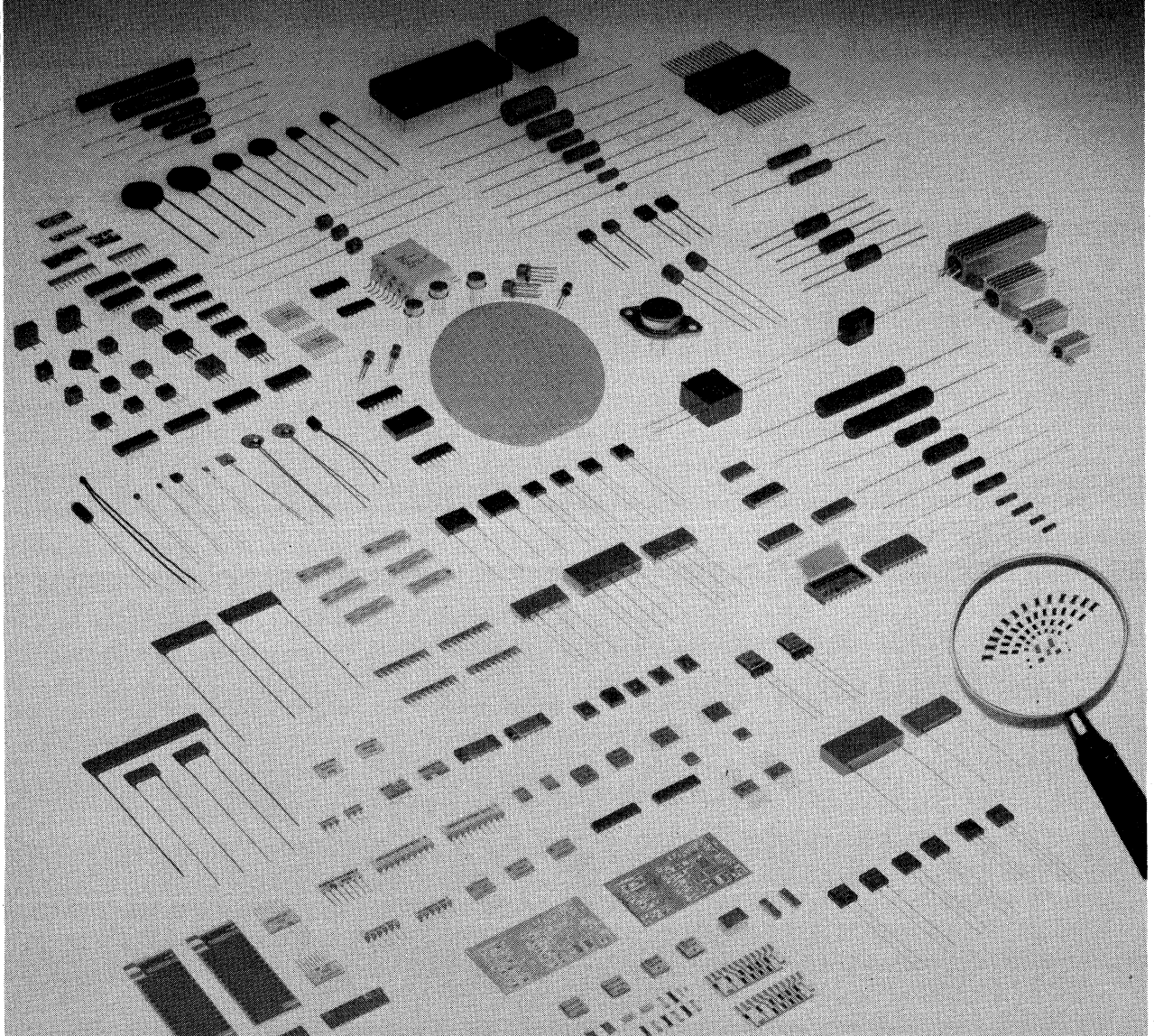
TECHNO
7803 Lemona Ave. Van Nuys, CA 91405
(818)781-1642 FAX: 818-781-8647

OHMTEK
2160 Liberty Dr. Niagara Falls, NY 14305
(716)283-4025 TWX 710 524 1653
FAX: 716-283-5932



See EEM Pages A•2020-2030, A•2099, B•1870-1871

SFERNICE, INC.

RESISTORS

Manufacturer	Starting Page No. A-	Bulk Ceramic	Ceramic Core	Cermet	Carbon Comp.	Film		Wirewound	Power			Foil	Fused	Chip	Networks	Precision	Features			Varistors
						Metallized & Nonmetallized	Carbon		2W<R≤5W	5 to 15W	>15W						High Voltage >1000V	Noninductive	Flame Retardant	
Allen-Bradley	1854				¤*	¤			¤	¤	¤			¤§	¤§*	¤§		¤§	¤§	
Robert G. Allen	1868	¤§	¤	¤	¤		¤	¤	¤	¤	¤		¤	¤§	¤§	¤	¤	¤	¤	
Angstrom/Vishay	1852					¤*			¤*						¤*	¤*				
Bourns	1870			¤*										¤	¤*§					
Bradford Elctrns.	1872					¤§*			¤*					¤§	¤	¤§*		¤*	¤	
Caddock Elctrns.	1878		¤			¤			¤	¤	¤			¤	¤	¤	¤	¤	¤	
Colber Corp.	1902		¤	¤*		¤*	¤	¤	¤	¤	¤		¤			¤§		¤	¤	
CTS Corporation	1904				¤	¤	¤		¤	¤	¤				¤§					
Dale Electronics	1914		¤*			¤§*		¤§*	¤§*	¤*	¤*			¤§*	¤§*	¤§*	¤*	¤	¤	
Elliot/Vishay	1934							¤*							¤	¤*				
Electro Films	1932					¤*			¤	¤	¤			¤§*	¤§*	¤				
General Resistance	1941							¤*							¤	¤*		¤*		
Huntington Electric	1942		¤					¤	¤	¤	¤									
International Mfg. Svcs.	1936													¤§	¤§	¤	¤			
International Resistive	1937		¤*					¤*	¤*	¤*	¤*		¤			¤*		¤*	¤*	
International Resistive	1937					¤		¤	¤	¤	¤			¤		¤§			¤	
Julie Research	1961							¤*			¤*				¤*	¤*	¤*			
K & M Electronics	1943										¤				¤	¤	¤			
Kelvin	1944							¤*	¤*	¤*	¤*				¤§*	¤§*		¤		¤
KOA Speer	1946			¤	¤	¤§	¤§		¤	¤	¤		¤	¤§	¤§	¤			¤	
KRL/Bantry	1951		¤*			¤*		¤*		¤*	¤		¤	¤§*	¤§*	¤*	¤*	¤	¤	
Maida	1954																			¤
Memcor-Truohm	1956		¤					¤												
Mepco/Centralab	1957			¤*		¤	¤				¤			¤§	¤*	¤*		¤		¤
Micro-Ohm	1962		¤*	¤	¤	¤*	¤	¤*	¤*	¤	¤*		¤	¤§	¤*	¤*	¤*	¤*-	¤*	
Mills Resistor	1968		¤					¤	¤	¤					¤	¤		¤	¤	

RESISTORS (cont'd)

Manufacturer	Starting Page No. A-	Bulk Ceramic	Ceramic Core	Cermet	Carbon Comp.	Film		Wirewound	Power			Foil	Fused	Chip	Networks	Precision	Features			Varistors
						Metallized & Nonmetallized	Carbon		2W<R<5W	5 to 15W	>15W						High Voltage >1000V	Noninductive	Flame Retardant	
Milwaukee Resistor	1970		¤					¤			¤*							¤		
Mini-Systems	1975			¤§*					¤§*	¤§*	¤§*			¤§*	§¤*	§¤*	¤§*	¤§*		
Murata Erie	1976			¤					¤						¤				¤	
Nytronics	1979		¤*					¤*		¤*						¤		¤*		
Ohmite	1980		¤*	¤	¤	¤	¤	¤*§	¤	¤*	¤*			¤§*	¤	¤	¤*	¤	¤*§	
Ovenaire-Audio	1996						¤										¤	¤		
Pacific Resistor	1998							¤*	¤*	¤*	¤*							¤*		
Piconics	2001					¤§*			¤§*	¤§*				¤§*	¤§*	¤§*				
Precision Resistive Prods,	2002		¤			¤*										¤*				
Precision Resistor Co.	2004							¤*	¤	¤						¤*		¤		
Raltron	2009														¤					
RCD Comps.	2010	¤§	¤§*	¤		¤§*	¤§	¤§*	¤§*	¤§*	¤	¤§*	¤§*	¤§*	¤§*	¤§*	¤	¤§*	¤§*	
RCL/Shallcross	2012		¤	¤		¤		¤*	¤*	¤*	¤*		¤		¤§	¤*	¤*	¤*	¤	¤
Resistors, Inc.	2019							¤		¤	¤					¤		¤		
Sfernice/Ohmtek	2020			¤§*										¤*	¤§*	¤				
Sfernice/Techno	2026														¤*					
Sfernice//Tel-Labs	2030							¤*												
Sfernice/Ultronix	2027							¤*	¤	¤	¤	¤*				¤*				
Sprague Electric	2031														¤§					
Standard Oil	2032	¤								¤	¤						¤*	¤*		
State of the Art	2034													¤§*	¤					
Vermont Prec. Res.	2038		¤			¤		¤	¤	¤	¤					¤		¤	¤	
Victoreen	2040								¤	¤	¤					¤	¤	¤		
Vishay	2046		¤*			¤*		¤*	¤*	¤	¤	¤§*		¤§	¤§	¤§*		¤		

* Mil. Spec. § Surface Mount

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

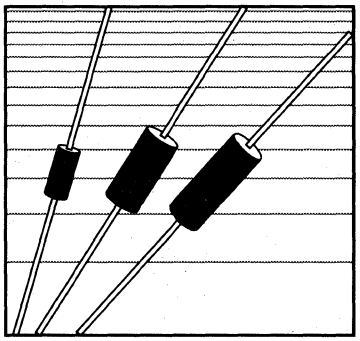
WHERE TO FIND THEM IN THE 88/89 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1134, **B**•1098, **C**•1082, **D**•1038
ASCII Code ..... **D**•1073
Batteries, Product Selection Guide ..... **D**•1428
Batteries & Fuel Cells, Characteristics ..... **D**•1454
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1030
Capacitors, Miniglossary ..... **A**•1027
Capacitors, Product Selection Guide ..... **A**•1003
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1193
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1760
Connectors, Miniglossary ..... **C**•1374
Connectors, Terminals & Sockets, Product Selection Guide ..... **C**•1127
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide ..... **A**•1331
Delay Lines, Product Selection Guide ..... **A**•1495
Discrete Semiconductors, Product Selection Guide ..... **A**•2113
Displays, Readouts, & CRTs, Product Selection Guide ..... **B**•1033
EBCDIC Code ..... **D**•1162
Encapsulation, Miniglossary ..... **C**•1110
Fans, Blowers, Cooling Equipment & Heat Exchangers, Product Selection Guide ..... **C**•1643
Filters, Product Selection Guide ..... **A**•1633
IC Master ..... **A**•1718
Instruments, Panel Meters, Product Selection Guide ..... **D**•1350
Instruments, Test & Measuring, Product Selection Guide ..... **D**•1190
Interconnection Systems, Product Selection Guide ..... **C**•1719
Keyboards & Keypads, Product Selection Guide ..... **B**•1808
Lamps, Lights, & Inductors, Product Selection Guide ..... **B**•1104
Logofinder & Trademark Directories ..... **C**•901
Microwave Components, Product Selection Guide ..... **A**•1761
Military Qualified Products List ..... **B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1181
Opto Semiconductors, Miniglossary ..... **B**•1262
Oscilloscopes, Product Selection Guide ..... **D**•1408
Panel Hardware, Product Selection Guide ..... **C**•1603
Potentiometers, Trimmers, Controls & Rheostats, Product Selection Guide ..... **A**•2057
Power Supplies, Miniglossary ..... **D**•1504
Power Supplies, AC, Product Selection Guide ..... **D**•2060
Power Supplies, DC, Product Selection Guide ..... **D**•1497
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide ..... **B**•1297
Relay Contact Forms ..... **B**•1371
Relays, Electromechanical, Miniglossary ..... **B**•1364
Relays, Product Selection Guide ..... **B**•1355
Resistor Color Codes ..... **A**•1911
Resistors, Product Selection Guide ..... **A**•1849
Servo Components, Miniglossary ..... **B**•1238, **D**•2176
SI Units, Basic Guide To, ... **A**•1090, **B**•1050, **C**•1092, **D**•1048
Solenoids, Product Selection Guide ..... **B**•1612
Switches, Product Selection Guide ..... **B**•1636
Thermal Components, Product Selection Guide ..... **B**•1834
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1842
Thyristors/High Power Diodes, Miniglossary ..... **A**•2145
Trademark & Logofinder Directories ..... **C**•901
Transducers & Encoders, Product Selection Guide ..... **B**•1874
Transformers, Product Selection Guide ..... **A**•2153
Voltage Drop Nomograph ..... **C**•1912, **D**•2042
Wire & Cable, Product Selection Guide ..... **C**•1763
Wire Guages—Diameter, Area, Copper Weight ..... **C**•1864

ANGSTROHM

PRECISION METAL FILM RESISTORS

■ Established Reliability ■ Hermetically-sealed
■ MIL-R-55182, Style RNR/RNN ■ Characteristics C and E



For the ultimate in reliability, stability and uniformity of construction, ANGSTROHM hermetically-sealed metal film resistors are unquestionably first-choice. ANGSTROHM has accumulated over 1.234 billion unit failure rate hours to MIL-R-55182 on the RNR/RNN style, characteristics C and E, without a single failure. The true glass-to-metal hermetically-sealed enclosure seals the resistor element in an inert gas atmosphere and protects it from virtually all adverse environmental influences. The glass enclosure will withstand in excess of 3000 p.s.i. external pressure without leakage. The reliability and stability of ANGSTROHM hermetically-sealed resistors have been established by their use in nearly every military, missile, aerospace, and oceanography program having the most demanding applications and the most hostile environments.

FEATURES

- Qualified to MIL-R-55182 Characteristics C and E
- Performance far exceeds the requirements of MIL-R-55182
- Excellent long term stability
- Highest reliability
- Hermetic glass enclosure is impervious to harmful environments
- Inert gas filled
- Very low noise
- Excellent high frequency performance

GENERAL SPECIFICATIONS

- **Resistance Range**: 10.0Ω to 7.5M (see Table below) Standard values should be selected from the Standard Resistance Value Table in the ANGSTROHM Precision Metal Film catalog.
- **Tolerance**: ±0.1% (B), ±0.5% (D), ±1.0% (F)
- **Temperature Characteristics**: ±25ppm/°C (Characteristic E), ±50ppm/°C (Characteristic C)
- **Power Ratings**: 1/10, 1/8, 1/4, and 1/2 watt @125°C 1/8, 1/4, 1/2, and 3/4 watt @ 70°C
- **Power Derating**: For ambient temperatures above 125°C, see Power Derating Curve.
- **Life Failure Rate**: M, P, R, S
- **Voltage Rating**: Applied voltage shall not exceed $\sqrt{\text{Power Rating x Resistance Value}}$ or the Maximum Voltage Rating (per Table) whichever is lesser.

STYLE SELECTION ELECTRICAL SPECIFICATIONS

Military Style	ANGSTROHM Type	Military Power Rating		Maximum Working Voltage	Temperature[1] Characteristic (ppm/°C)	Resistance Tolerance (%)	Qualified[2] Resistance Range		Life Failure Rate
		125°C	70°C				Min.	Max.	
RNR55 RNN55	HT/HS/HN55 HN55	1/10	1/8	200	C = ±50 E = ±25	B = ±0.1 D = ±0.5 F = ±1.0	10.0Ω	1.21M	M, P, R, S
RNR57 RNN57	HT/HS/HN57 HN57	1/8	1/4	250	C = ±50 E = ±25	F = ±1.0	49.9Ω	200K	M, P, R, S
RNR60 RNN60	HT/HS/HN60 HN60	1/8	1/4	250	C = ±50 E = ±25	B = ±0.1 D = ±0.5 F = ±1.0	10.0Ω	2.49M	M, P, R, S
RNR65 RNN65	HT/HS/HN65 HN65	1/4	1/2	300	C = ±50 E = ±25	B = ±0.1 D = ±0.5 F = ±1.0	24.9Ω	4.99M	M, P, R, S
RNR70 RNN70	HT/HS/HN70 HN70	1/2	3/4	350	C = ±50 E = ±25	B = ±0.1 D = ±0.5 F = ±1.0	24.9Ω	7.5M	M, P, R, S

1. Temperature Characteristics C and E designate hermetically-sealed enclosure.
2. Standard resistance values should be selected from the Standard Resistance Values Table found in the ANGSTROHM Precision Metal Film Catalog. Other values available on special order.

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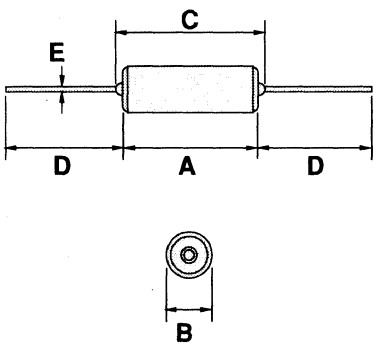
ANGSTROHM

PRECISION METAL FILM RESISTORS

OUTLINE DRAWING (HN, HS, HT)

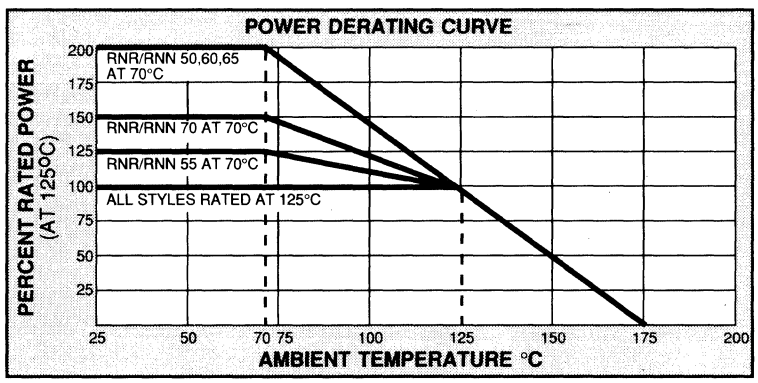


DIMENSIONS (PER MIL-R-55182)						
Military Style (RNR/RNN)	A Body Length	B Body Diameter	C Clean Lead to Clean Lead (Max.)	D Lead Length (±0.125/3.18)	E Lead Diameter (±0.002/.05)	Approx. Weight (Grams)
55	$\frac{0.250^{+0.031}_{-0.045}}{6.35^{+0.79}_{-1.17}}$	$\frac{0.109 \pm 0.031}{2.77 \pm 0.79}$	$\frac{0.379}{9.63}$	$\frac{1.500}{38.10}$	$\frac{0.025}{0.64}$	0.314
57	$\frac{0.281 \pm 0.062}{7.14 \pm 1.57}$	$\frac{0.155 \pm 0.015}{3.94 \pm 0.38}$	$\frac{0.467}{11.86}$	$\frac{1.25}{31.75}$	$\frac{0.020}{0.51}$	0.317
60	$\frac{0.375 \pm 0.062}{9.53 \pm 1.57}$	$\frac{0.125^{+0.040}_{-0.031}}{3.18^{+1.02}_{-0.79}}$	$\frac{0.561}{14.25}$	$\frac{1.500}{38.10}$	$\frac{0.025}{0.64}$	0.485
65	$\frac{0.625^{+0.031}_{-0.094}}{15.88^{+0.79}_{-2.39}}$	$\frac{0.188^{+0.062}_{-0.031}}{4.78^{+1.57}_{-0.79}}$	$\frac{0.780}{19.81}$	$\frac{1.500}{38.10}$	$\frac{0.025}{0.64}$	0.950
70	$\frac{0.750^{+0.125}_{-0.062}}{19.05^{+3.18}_{-1.57}}$	$\frac{0.250^{+0.078}_{-0.031}}{6.35^{+1.96}_{-0.79}}$	$\frac{0.939}{23.85}$	$\frac{1.500}{38.10}$	$\frac{0.032}{0.81}$	1.300

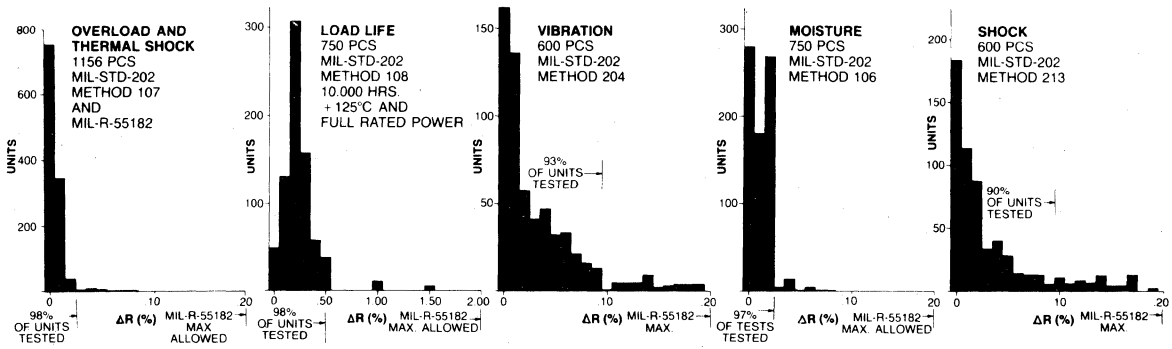
1. Dimensions shown are maximum allowable per MIL-R-55182. For dimensions, refer to "H" series, Commercial Metal Film Resistors, in the ANGSTROHM Precision Metal Film Catalog.

POWER RATING

Resistors shall have a power rating based on continuous full load operation at 125°C. For temperatures above 125°C, the load shall be derated per the Power Derating Curve for all styles. For power rating at temperatures below 125°C (down to 70°C) the load may be increased per the Power Derating Curve for the particular style selected. In no case should the voltage exceed the maximum voltage rating per the Style and Electrical Specifications table for types HN, HS and HT, in the ANGSTROHM Precision Metal Film Resistors Catalog.



TYPICAL PERFORMANCE CHARACTERISTICS TO MIL-R-55182 (MIL-STD-202)



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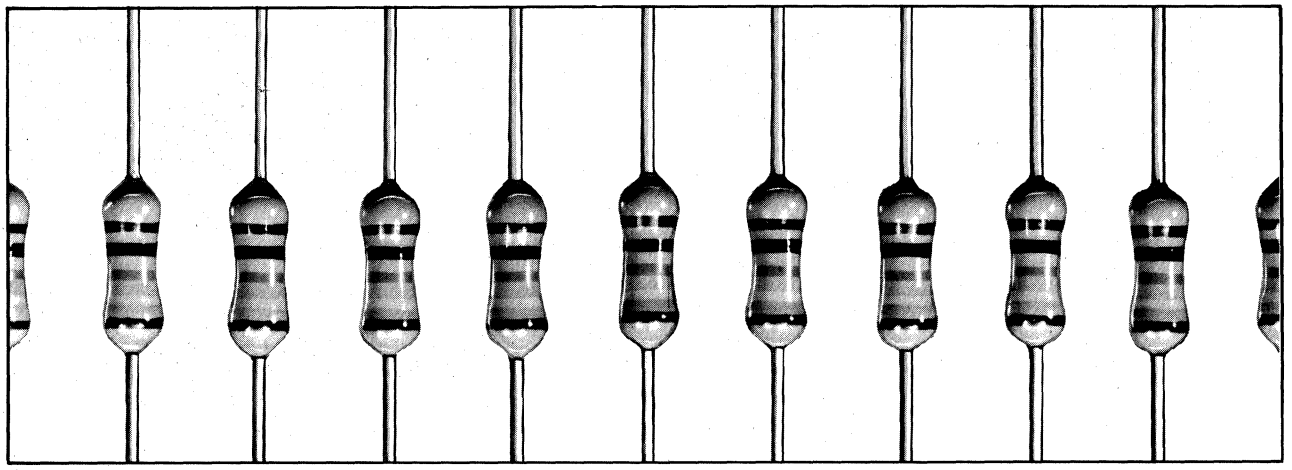
TYPE RNK

Metal Film Fixed Resistor



Outstanding Characteristics

- **Metal Film Performance** – Nichrome resistance element provides stable performance. Performance characteristics meet or exceed MIL-R-10509 (Characteristic D).
- **Tight Temperature Coefficient** – TCR is less than 100% PPM/°C over the full range of values.
- **Full Range of Values** – Available in standard preferred number values (E96 Series). 10 ohms to 1 megohm.
- **Color Band Marking** – Easy to identify after mounting.
- **Standard Tape Reel Packaging** – Meets all requirements of EIA standard RS-296-D, Class I tape reel packaging.
- **For More Information Ask For Publication ROFR**

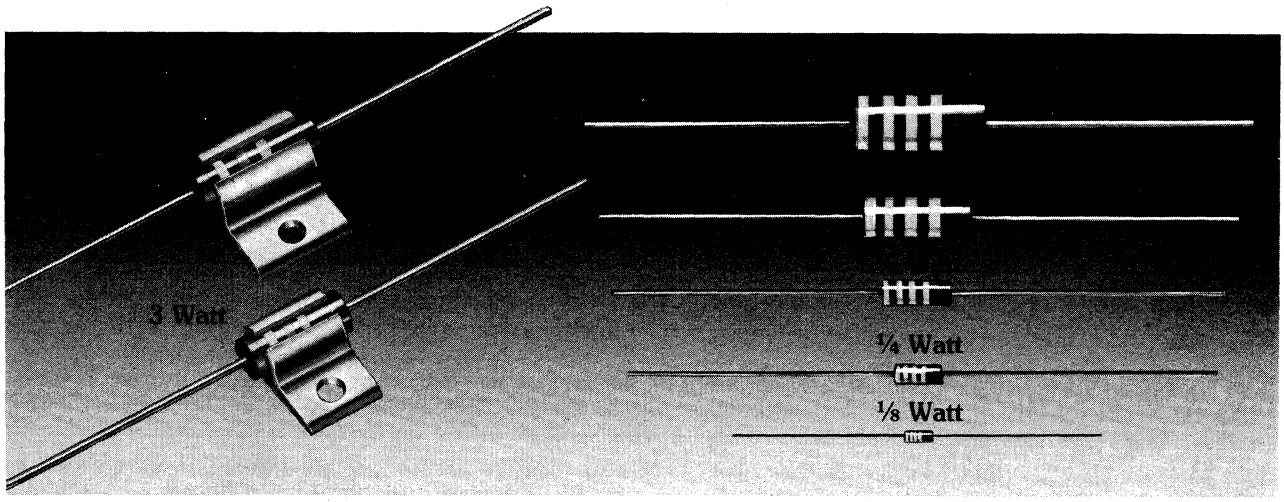
Ratings

Nominal Resistance Range Standard Preferred Values	10 ohms to 1 megohm E96 series for 1%
Standard Tolerance	±1%
Power Rating	1/4 watt at 70°C
Maximum Ambient Temperature Power rating derated linearly to zero at this temperature	155°C
Rated Continuous Working Voltage (RCWV) Based on nominal resistance (R) in ohms	0.25 x R or 250 volts, whichever is less
Dielectric Withstanding Voltage Atmospheric pressure Reduced pressure	±0.25% max. ΔR 500 VRMS 250 VRMS
Insulation Resistance	10,000 megohms, minimum

Available in standard values from stock at electronic distributors on reels of 2500 or in boxes of 500.

Hot-Molded Carbon Composition Fixed Resistors

(⅛W through 4W @ 70°C)



KEY CHARACTERISTICS

- **MIL-SPEC Reliability**
- **Pulse Withstanding**
- **Power Dissipation**
- **High Frequency Stability**
- **Low Inductance**
- **Rugged Construction**
- **Dependable Performance**
- **Ultra-High Resistance Values**
- **For More Information Ask For Publication ROFR**

Features and Benefits

Uniform Quality — Consistent performance for over 50 years! Same quality built into all parts – regardless of value, rating or tolerance. MIL-SPEC and Industrial grade parts are made using the same process.

Reliable — Recognized as the **most** reliable of all electronic components, Allen-Bradley Hot-Molded Carbon Composition resistors provide freedom from catastrophic failure when used within ratings.

Predictable performance — Because of their outstanding uniformity, Allen-Bradley Hot-Molded Carbon Composition resistors exhibit consistent responses to environment and loading.

Conservative ratings — All performance specifications are based on extensive testing and massive field experience.

Rugged construction — The solid, integral structure, combining leads, insulation, and resistance material in the exclusive Allen-Bradley hot-molding process provides exceptional strength and resistance to damage in automatic handling machinery.

Wide range of values — Available in standard EIA resistance values from 1 ohm to 100 megohms. Special values available on request.

High resistance values — Resistance values from 100 megohms to 1 million megohms (1 teraohm) are available on special order in Types BB, CB, and EB.

Solderable/weldable leads — Hot solder coated leads remain easy to solder even after long periods in stock. The oxygen-free copper leads are readily weldable and allow considerable weld-schedule latitude. Stocking of resistors with two different lead materials is unnecessary.

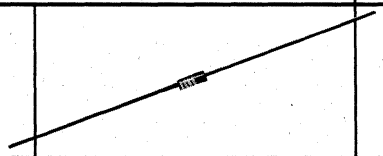
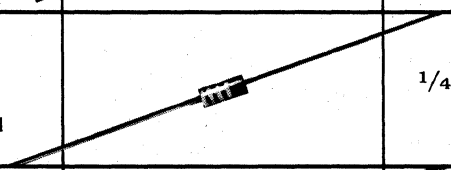
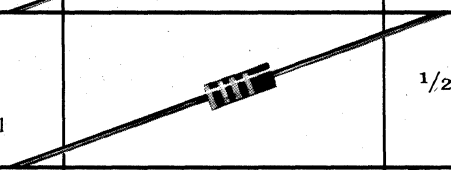
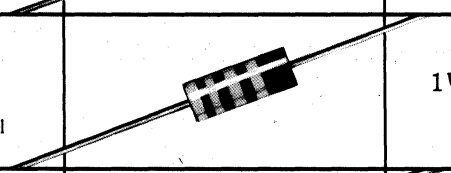
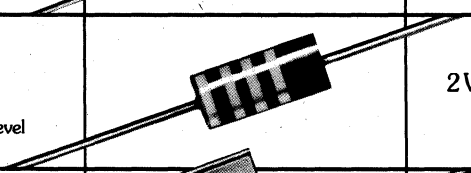
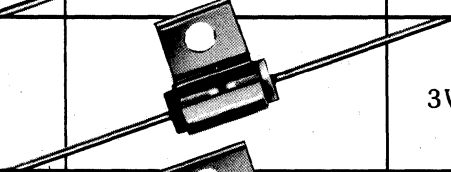
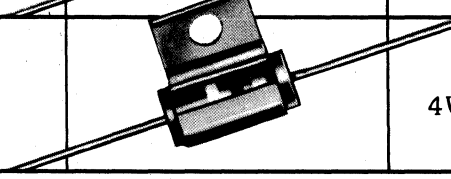
Tracking — Allen-Bradley resistors exhibit extremely uniform tracking characteristics. For example, in flip-flop circuits, resistors used in pairs which are drawn from the same package or reel (a normal mass production practice) will track with each other throughout changes of temperature, humidity, and load. This assures reliable circuit performance throughout the design life of the equipment.

Durable color coding — Baked-on color code paints are resistant to solvents, and also resist the abrasion and chipping associated with automatic handling. They remain bright and easily readable even after long periods of use.

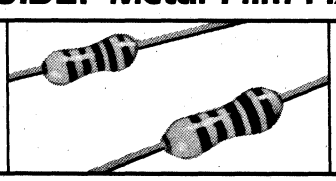
Temperature stable — Between 0° C and 85° C, Allen-Bradley Hot-Molded Carbon Composition resistors exhibit a very low temperature characteristic, typically less than two percent deviation from room temperature values, less in low resistance values.

Fixed Resistors

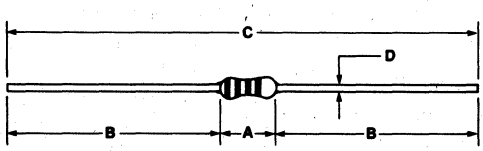
SELECTOR GUIDE: Hot-Molded Carbon Composition Fixed Resistors

Type		Power at 70°	Resistance Range [1] [2]	Tolerance	Voltage Rating (RMS or DC [3] E(Max) = $\sqrt{PR}$
Industrial Grade **BB** Military Grade **RC05** Military Grade-S Level **RCR05**		1/8 Watt	2.7 Ohms to 100 Megohms	±5, 10, 20%	150V
			2.7 Ohms to 22 Megohms	±5, 10%	
Industrial Grade **CB** Military Grade **RC07** Military Grade-S Level **RCR07**		1/4 Watt	2.7 Ohms to 100 Megohms	±5, 10, 20%	250V
			2.7 Ohms to 22 Megohms	±5, 10%	
Industrial Grade **EB** Military Grade **RC20** Military Grade-S Level **RCR20**		1/2 Watt	1.0 Ohm to 100 Megohms	±5, 10, 20%	350V
			1.0 Ohm to 22 Megohms	±5, 10%	
Industrial Grade **GB** Military Grade **RC32** Military Grade-S Level **RCR32**		1 Watt	1.0 Ohm to 100 Megohms	±5, 10, 20%	500V
			1.0 Ohm to 22 Megohms	±5, 10%	
Industrial Grade **HB** Military Grade **RC42** Military Grade-S Level **RCR42**		2 Watts	10 Ohms to 100 Megohms	±5, 10, 20%	750V
			10 Ohms to 22 Megohms	±5, 10%	500V
Industrial Grade **GM**		3 Watts	1.0 Ohm to 22 Megohms	±5, 10%	500V
Industrial Grade **HM**		4 Watts	10 Ohms to 22 Megohms	±5, 10%	750V

SELECTOR GUIDE: Metal Film Fixed Resistors

General Purpose **RNK**		1/4 Watt	10 Ohms to 1 Megohm (E96 Series)	1%	250V

Metal Film Resistor



[1] **Ultra-High Resistance Values**—Resistance values into the teraohm (million megohm) range are available in the Industrial Grade BB, CB, and EB products. Contact the factory for information.

[2] **Non-Standard Resistance Values** — Both standard and non-standard EIA resistance values are available in all wattage ratings. Contact the factory for assistance with non-standard values.

[3] Voltage ratings (RMS or DC) listed above are rated continuous working voltages (RCWV) at sea level. Use the equation E(max) = $\sqrt{PR}$ to determine the maximum RCWV for any specific resistance value. In no case should it exceed those values listed above in a circuit application.

Hot-Molded Carbon Composition Fixed Resistors

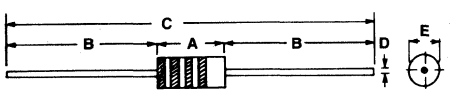
Maximum Ambient Temperature	Dimensions in Inches (millimeters)									Unit Weight (nominal)
	A	B	C (nominal)	D	E	F	G	H	J	
+130°C	0.145 ± .015 (3,68 ± 0,38)	1.000 ± .125 (25,40 ± 3,18)	2.145 (54,48)	0.015 ± .003 (0,38 ± 0,08)	0.062 ± .004 (1,57 ± 0,10)					0.077gm
+150°C	0.250 ± .015 (6,35 ± 0,38)	1.500 ± .125 (38,10 ± 3,18)	3.250 (82,55)	0.025 ± .002 (0,64 ± 0,05)	0.090 ± .008 (2,29 ± 0,20)					0.28gm
+150°C	0.375 ± .031 (9,53 ± 0,79)	1.500 ± .125 (38,10 ± 3,18)	3.375 (85,73)	0.033 ± .002 (0,84 ± 0,05)	0.140 ± .008 (3,56 ± 0,20)					0.61gm
+150°C	0.562 ± .031 (14,27 ± 0,79)	1.500 ± .125 (38,10 ± 3,18)	3.562 (90,47)	0.041 ± .002 (1,04 ± 0,05)	0.225 ± .008 (5,72 ± 0,20)					1.45gm
+150°C	0.688 ± .031 (17,48 ± 0,79)	1.500 ± .125 (38,10 ± 3,18)	3.688 (93,68)	0.045 ± .003 (1,14 ± 0,08)	0.312 ± .008 (7,92 ± 0,20)					2.80gm
+150°C	0.562 ± .031 (14,27 ± 0,79)	1.500 ± .125 (38,10 ± 3,18)	3.562 (90,47)	0.041 ± .002 (1,04 ± 0,05)	0.225 ± .008 (5,72 ± 0,20)	0.305 ± .010 (7,75 ± 0,25)	0.438 ± .016 (11,13 ± 0,41)	0.656 ± .016 (16,66 ± 0,41)	0.167 ± .010 (4,24 ± 0,25)	4.70gm
+150°C	0.688 ± .031 (17,48 ± 0,79)	1.500 ± .125 (38,10 ± 3,18)	3.688 (93,68)	0.045 ± .003 (1,14 ± 0,08)	0.312 ± .008 (7,92 ± 0,20)	0.391 ± .010 (9,93 ± 0,25)	0.562 ± .016 (14,27 ± 0,41)	0.766 ± .016 (19,46 ± 0,41)	0.156 ± .010 (3,96 ± 0,25)	8.00gm

Metal Film Fixed Resistors

+155°C	0.264 (6,71) Max.	1.1 (27,94) Min.	2.464 (62,59)	0.024 ± .002 (0.61 ± 0,05)	0.098 (2,49) Max.					0.1gm

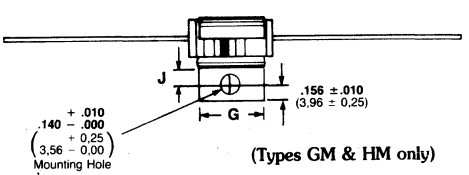
Hot-Molded Carbon Composition Resistors

Standard Resistors



(All Types – Ratings 1/8w through 2w)

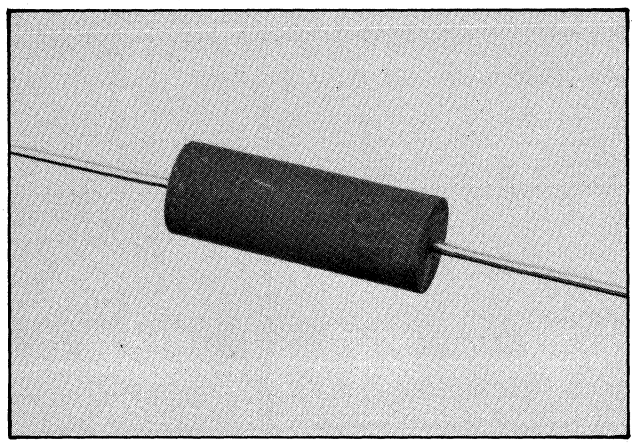
Metal Clad Resistors



(Types GM & HM only)

TYPE WL
Metal Element Resistors

3 and 5 Watts (25°C)
±5%, ±3%, ±0.5%



FEATURES

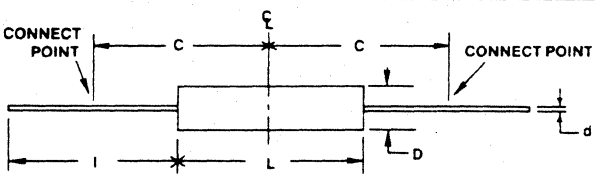
- Ultra Low Resistance Values
- High Stability Over Life
- Low Temperature Coefficient of Resistance
- Inherently Non-Inductive
- Interchangeable

APPLICATIONS

Switching and Linear Power Supplies, Instruments, Current Sensing Circuits, Regulators.

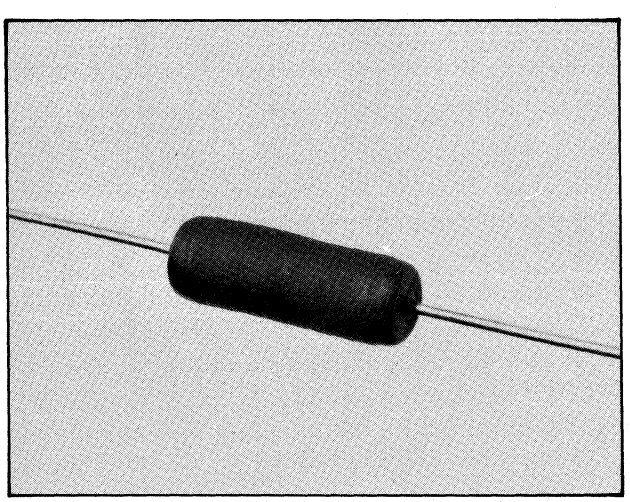
DIMENSION SPECIFICATIONS – Inches (Millimeters)

WL	L	D	C	I	d
3W	0.560 ± 0.010 (14.224 ± 0.254)	0.210 ± 0.010 (5.334 ± 0.254)	0.655 (16.64)	1.375 ± 0.125 (34.925 ± 3.175)	0.032 ± 0.002 (0.813 ± 0.051)
5W	0.920 ± 0.010 (23.368 ± 0.254)	0.330 ± 0.010 (8.382 ± 0.254)	0.835 (21.209)	1.250 ± 0.125 (31.750 ± 3.175)	0.040 ± 0.002 (1.016 ± 0.051)



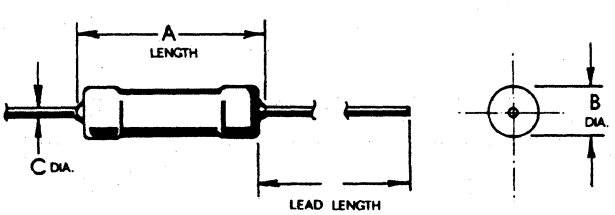
TYPE WW
Silicone Coated Wirewound Power Fixed Resistors

(0.4W through 12W @ 25°C)



FEATURES:

- The WW Types meet or exceed the applicable requirements of MIL-R-26 as general purpose wirewound power resistors.
- Miniature size vs. high power levels.
- 25 Styles to choose from, ranging from 0.4 to 12 watts.
- Highest thermal conductivity, centerless ground ceramic cores for optimum heat distribution and dissipation.
- Resistance element coated with a high temperature coating material with exceptional resistance to common circuit board cleaning solvents.
- All welded construction.
- Weldable and Solderable leads.
- Non-inductive windings available.



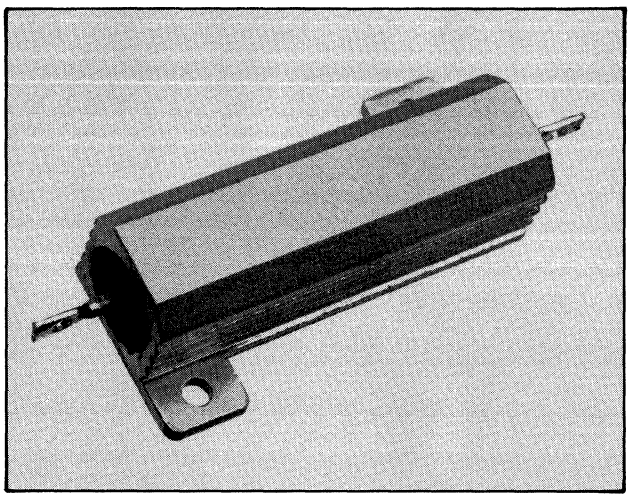
1.375″ (34.9mm) Minimum

ALLEN-BRADLEY
Electronic Components Division
El Paso, Texas 79936

A-B QUALITY

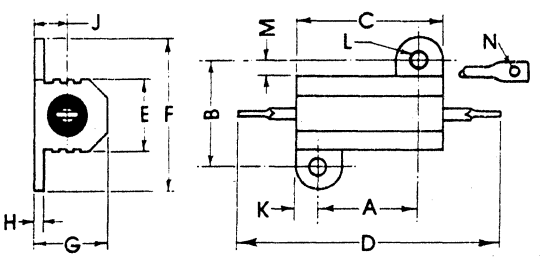
TYPE WA Aluminum Housed Chassis Mount

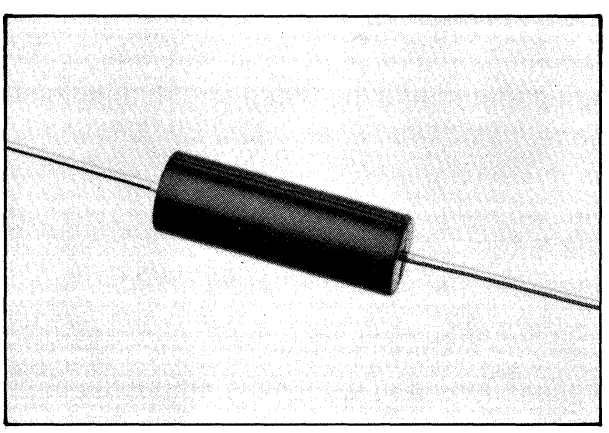
5, 10, 25, 50 Watt @ 25°C
± 1 % TOLERANCE
0.1 Ohm to 180K



FEATURES

- Molded and welded construction
- Screw mounts on chassis
- Exceptionally high stability at all conventional power ratings
- Utilize heat-sink effect of chassis
- Clearly marked on top surface of housing for ease of identification after mounting
- Exceeds MIL-R-18546
- Complete protection against environment
- Non-inductive windings available.



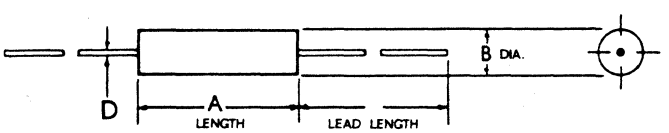


TYPE WB Precision Resistors

0.1 Watt through 2.0 Watt @25°C

FEATURES

- Resistance Temperature Coefficient for all WB styles, <1 Ω = ±90PPM/°C; 1 to 10 Ω = ±50PPM/°C; >10Ω = ±20PPM/°C.
- Lead Length: 1½" minimum (38.1)
- Maximum wattage rating is at −55°C through +125°C. See Fig. A, for Wattage Derating Curves.
- Automated, precision windings, protected by silastic undercoat.
- Non-stress encapsulation
- Welded terminations

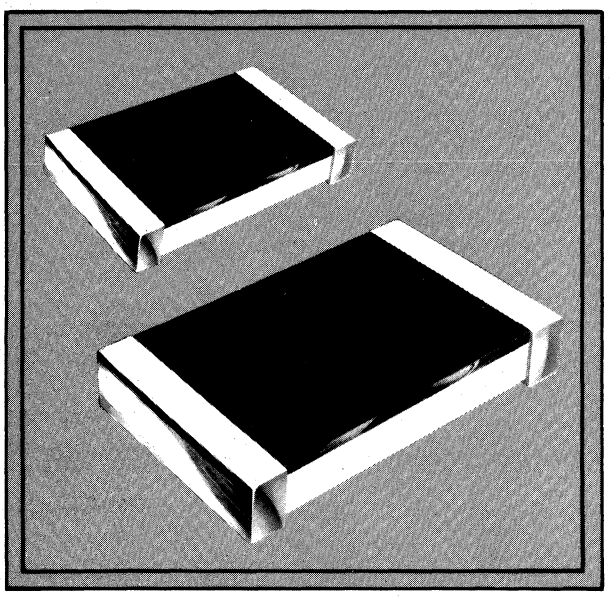


1.5"
LEAD LENGTH
MIN.

ALLEN-BRADLEY
Electronic Components Division
El Paso, Texas 79936

TYPES AC, BC

Thick Film Chip Resistors



Type AC – 1/10 Watt at 70°C
Type BC – 1/8 Watt at 70°C
±5%, 300 PPM/°C
±2%, ±5%, 200 PPM/°C
±1%, 100 PPM/°C
Zero Ohm Jumper

FEATURES

- **Standard Sizes:**
  AC – 2.10 × 1.25 × 0.5mm (0805)
  BC – 3.20 × 1.60 × 0.6mm (1206)
- **Thick Film Resistance Element**
- **High Purity Alumina Substrate**
- **Glass Passivated**
- **Laser Trimmed**
- **Tight TCR**
- **Wrap-Around Termination**
- **Inner Electrode Protection**
- **Wave or Reflow Solderable**
- **Surface Mountable**
- **Nickel Barrier Construction**

For more information ask for Publication RORN.

Outstanding Characteristics

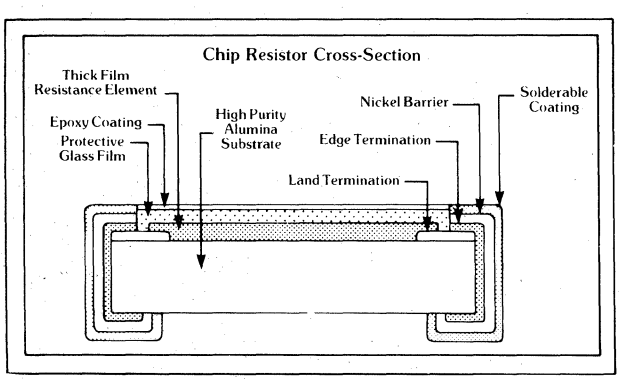
Small standard size — Utilizes the internationally standardized 3.20×1.60×0.6 mm and 2.10×1.25×0.5 mm sizes. Compatible with automatic placement equipment for surface mount assemblies and hybrid circuits.

Proven technology — Thick film resistance element on high purity alumina substrate. Over 20 years of technological experience in ink formulation and thick film resistor manufacturing.

Precision performance — Excellent performance characteristics provided by the thick film resistance material, resulting in tight tolerance, tight TCR and outstanding environmental performance.

Cost effective — Enables size reduction, weight reduction, reduced total material cost and reduced assembly cost.

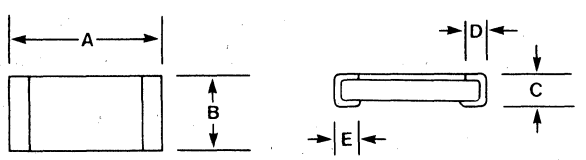
High reliability — Automated manufacturing and process control, 200% electrical inspection and packaging integrity assure high reliability.



DIMENSIONS

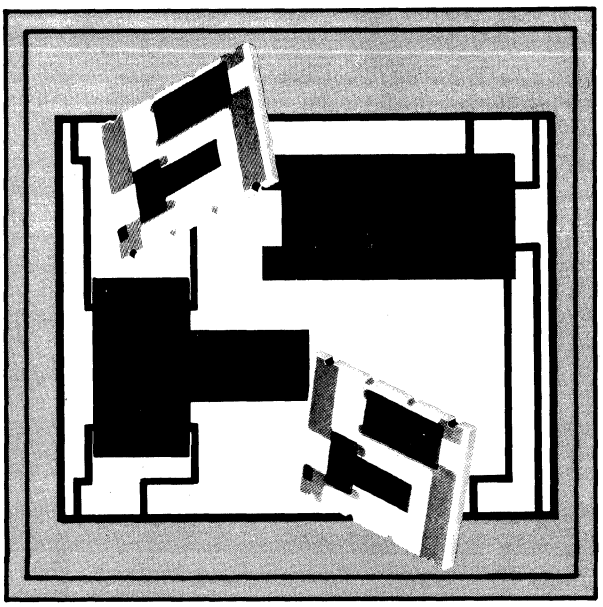
Chip

Dimension	A	B	C	D	E
Type AC	2.1±.15	1.25±.15	.5±.15	.38±.13	.38±.13
Type BC	3.2±.15	1.6±.15	.6±.15	.38±.13	.38±.13



SERIES 800

SARA Surface Attachable Resistor Arrays



125mW at 70°C
10 Ohms to 10 Megohms
± 2% Tolerance
± 200 ppm/°C TCR
± 100 ppm/°C TCR Tracking

FEATURES

- **Alumina Substrate**
- **Thick Film Resistor Element**
- **Environmental Protection Layer**
- **Surface Mount**
- **Standard and Custom Circuitry**
- **User Trimmable**
- **Standard and Custom Substrate**
- **Footprints Compatible with DIP and SOIC**
- **Exclusive Allen-Bradley Cermet Ink Performance**

For more information ask for Publication RORN.

Outstanding Characteristics

Surface mountable — Solder bumped termination pads allow surface mount to alumina, glass epoxy PWB's or porcelainized metal. Compatible with automatic placement equipment.

Proven technology — Thick film resistance elements on 96% minimum alumina substrate. Over 20 years of technological and manufacturing experience.

Precision performance — Tight performance characteristics provided by the thick film resistance material resulting in tight tolerance and tight TCR.

Cost effective — Enables size and weight reduction with lower assembly cost.

Electrical Specifications

Nominal resistance range — 10 Ohms to 10 Megohms

Resistor tolerance — Absolute ± 2% Standard
± 1% Available
Ratio ± 1% Standard
± .5% Available

Temperature coefficient of resistance (TCR) —
± 200 ppm/°C Standard
± 100 ppm/°C Available

TCR tracking — ± 100 ppm/°C Standard
± 50 ppm/°C Available

Power dissipation rating individual resistors — 125mW at 70°C

Temperature range of operation —
Industrial 0° to 70°C
Automotive -40°C to 85°C
Military -55°C to 125°C

Package power ratings — [1]

SARA Footprint	Package Power on Glass Epoxy PWB to 70°C
8 pin SOIC	.25W
14 pin SOIC	.40W
16 pin SOIC	.50W
8 pin DIP	.30W
14 pin DIP	.50W
16 pin DIP	.60W

(Ratings apply to devices meeting standard DIP and SOIC footprints)

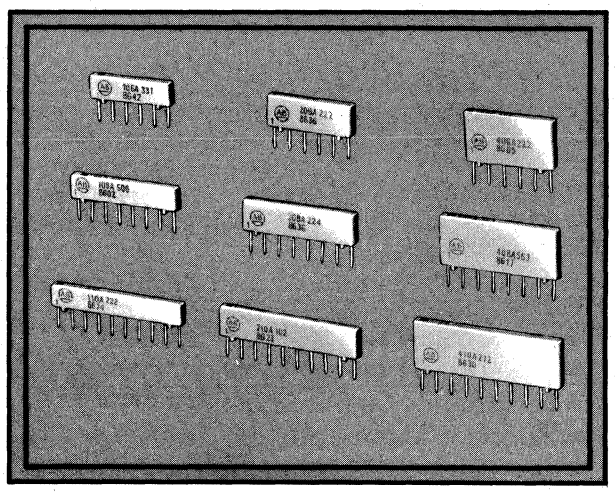
[1] At 70°C power derates linearly from full rated power to 0 wattage at +125°C.

Rated continuous working voltage (RCWV) — Based on nominal resistance (R) in ohms is individual Resistor $\sqrt{\text{Power Rating X R}}$ or 100 volts, whichever is less.

Temperature range of storage — -65°C to 150°C

SERIES 100, 200, 400

Cermet Resistor Networks



I-SIP Single In-Line Package

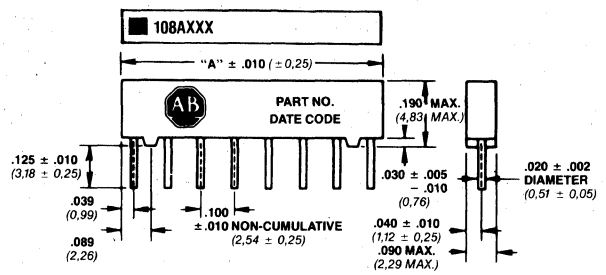
FEATURES

- **Solid Ceramic Body, with V-Groove**
- **Triple-Strength Leads**
- **0.100 Inch (2,54mm) Lead Spacing**
- **Three Package Heights (0.190 in., .250 in., 0.350 in.)**
- **6, 8 and 10 Pins**
- **Automatically Insertable**
- **Permanent Laser Marking**
- **Part Markings – Side and Top**
- **Exclusive Allen-Bradley Cermet Ink Performance**

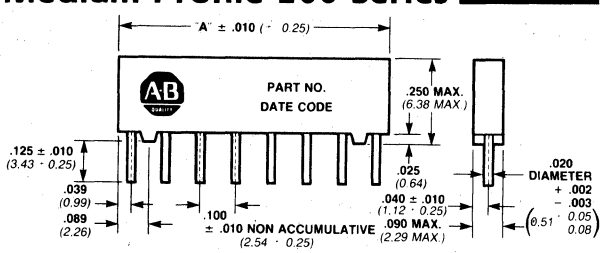
For more information ask for Publication RORN.

DIMENSIONS

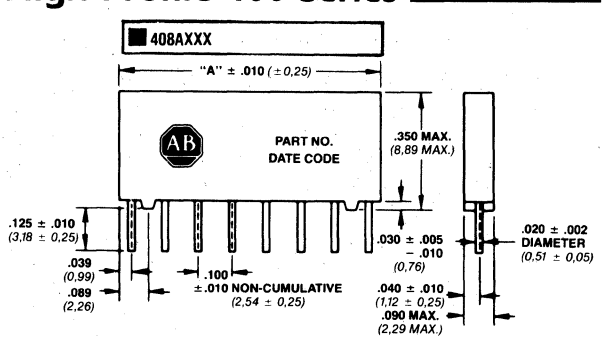
Low Profile 100 Series



Medium Profile 200 Series



High Profile 400 Series



TOLERANCES

Dimensional Tolerance ±.005 (0,13)
Angular Tolerance ±5° Except as Specified.

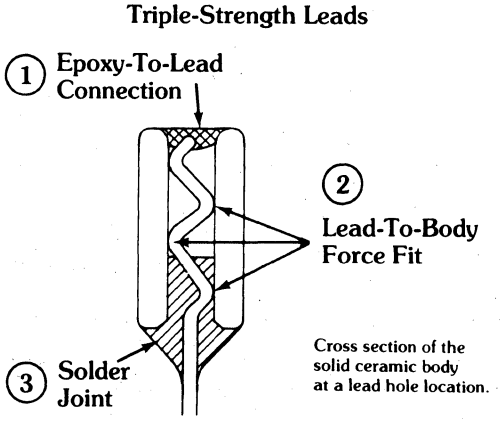
Applications

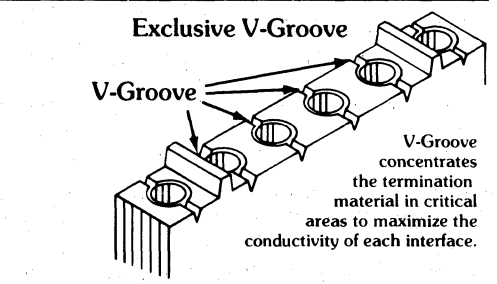
- Pull-up and pull-down arrays
- Transmission line terminators
- Current limiting resistors
- ECL termination networks
- A wide array of custom designs

For Applications Information refer to the following Allen-Bradley Application Notes:

- Digital System Resistor Arrays: EC5410-4.1
- ECL Terminator Networks: EC5410-4.2
- Resistive Attenuator Pads: EC5410-4.3

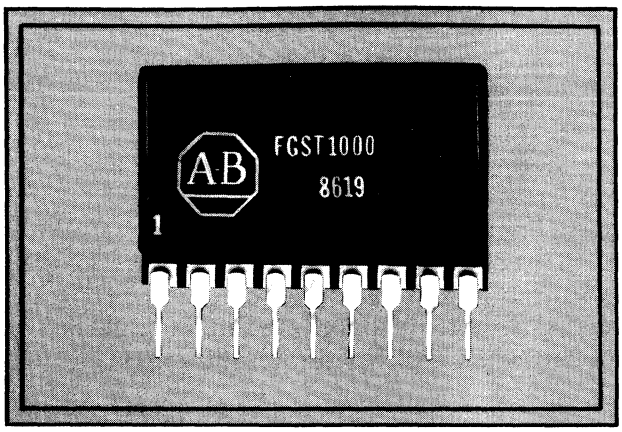
Rugged New Package





SERIES FGST1000, FGST1001

Precision Voltage Divider



Standard
Thin Film Resistor Networks

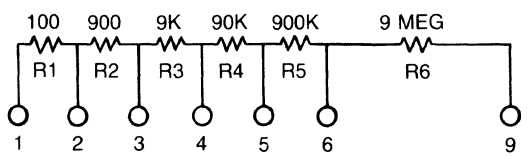
FEATURES

- **10 Megohms Range**
- **6 Decades Attenuation**
- **0.033% or 0.05% Resistance Ratio Match**
- **0 to 1000 Volts**
- **Operating Temperature – 0°C to 70°C**
- **Storage Temperature – 65°C to 150°C**

For more information ask for Publication RORN.

SPECIFICATIONS

Network Schematic

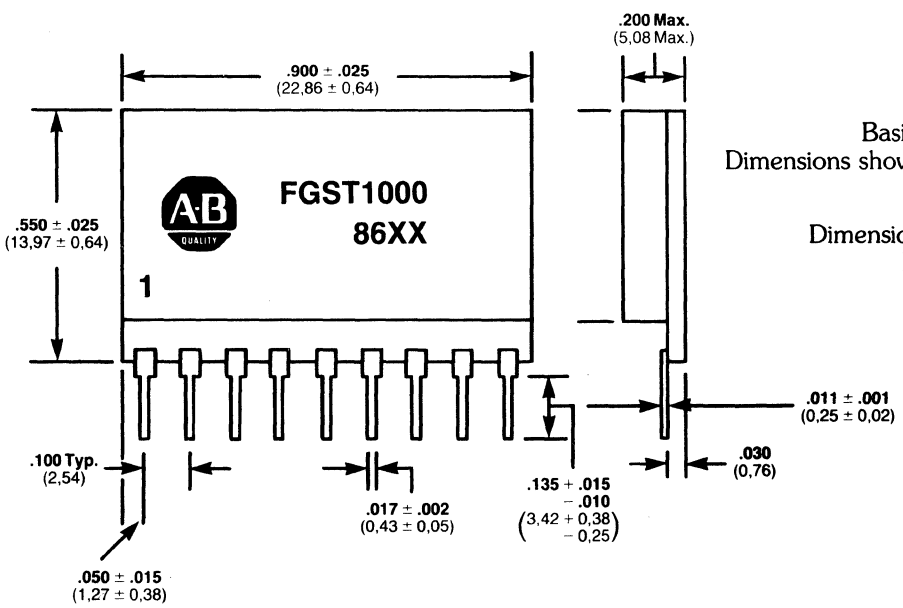


Applications

- Input attenuation
- Range selection
- Digital instrumentation
- Digital voltmeters
- Digital multimeters

DIMENSIONS

Series FGST1000 or FGST1001



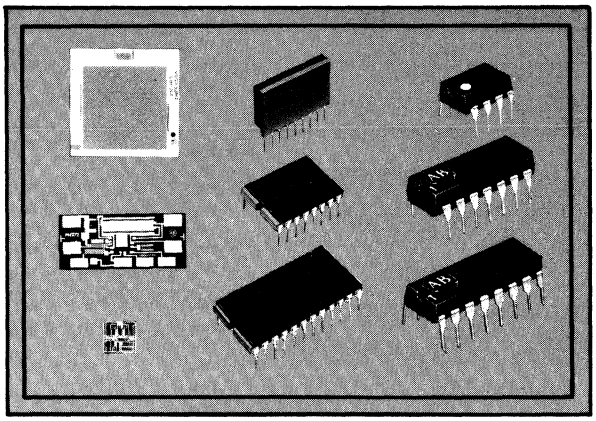
Basic dimensions in inches.
Dimensions shown in parentheses are in millimeters.

TOLERANCE
Dimensional Tolerance ±.015 (0,38)
Except at Specified.

NOT TO SCALE

SERIES FC, FG

Custom Thin Film Precision Resistor Networks



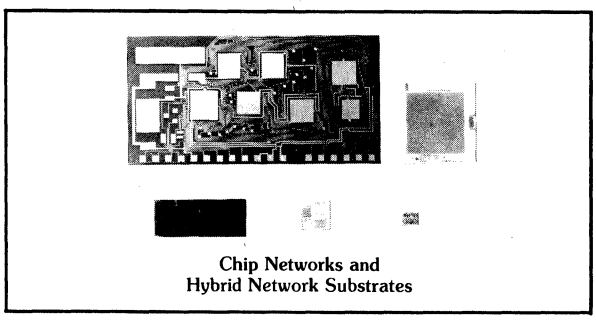
FEATURES

- 1K Ohms to 10 Megohms
- ±0.015% Tolerance
- ±0.15% Ratio
- ±25 ppm/°C TCR. = 10 ppm available
- ±5 ppm/°C TCR Tracking
- SIP Package (ceramic)
- DIP Packages (molded and ceramic)
- Surface Mount Packages (ceramic)
- Chip Resistor Networks (alumina or glass)
- Hybrid Network Substrates (alumina or glass)

For more information ask for Publication RORN.

SPECIFICATIONS

Chip and Hybrid Network Substrate



Chip Networks and Hybrid Network Substrates

Hybrid network substrates — Allen-Bradley hybrid network substrates contain resistors, bonding pads and interconnections used in producing hybrid networks. Allen-Bradley does not manufacture complete hybrid circuits, but does manufacture the basic hybrid network substrates.

Termination and bonding pad material — Gold, with a minimum thickness of 5000A, is used for all termination pads, bonding pads and interconnections. This material is compatible with ultrasonic and thermocompression bonding methods for attaching gold or aluminum wire, integrated circuit dice, LID's or beam leaded IC's. Chip capacitors can be attached by reflow solder methods.

Substrate material — Glass: Corning 7059 glass (Barium Alumino Silicate - electrically inert [Alkali-free]) .032 ±.005 inch (0,81 ±0,13mm) thick. Ceramic: 99.5% Alumina, .010 ±.001 inch (2,54 ±0,3mm) thick.

User trimmable option — Chip and hybrid network resistors can be trimmed to tolerance by Allen-Bradley or, if needed, resistors can be designed for active trimming by the user during final hybrid assembly operations to meet predetermined functional requirements.

Applications

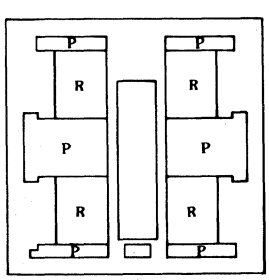
These precision networks are ideally suited for use on any electronic equipment requiring close tolerances and/or low temperature coefficient resistors. Some of these applications are listed below.

- Ladder networks
- Digital multimeters
- Current summing applications
- Precision attenuators
- A/D and D/A converters
- Communication equipment
- Precision voltage dividers
- Telemetry equipment
- Coding and decoding circuitry
- Measurement bridges
- Paging systems

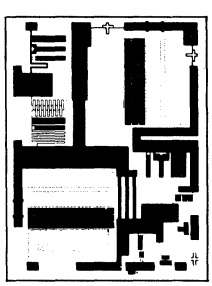
For application information refer to the following Allen-Bradley Application Notes:

- R/2R Ladder Networks: EC5510-4.2
- Voltage Divider Networks: EC5515-4.2

For handling and soldering procedures refer to Allen-Bradley Product Data EC5570-5.1.



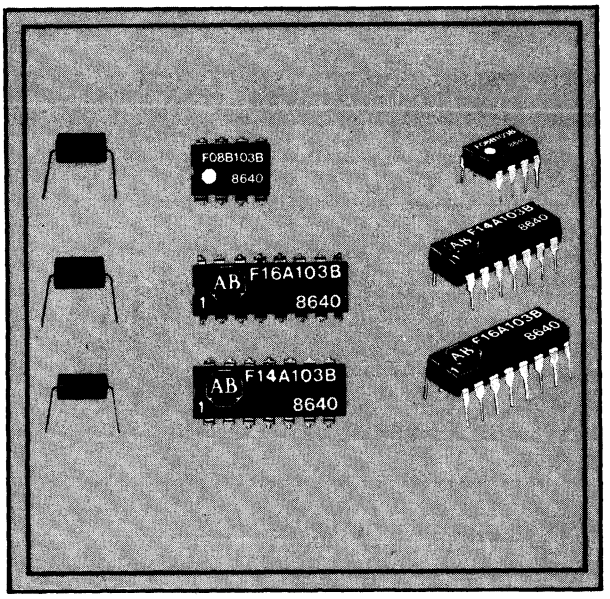
Chip Network



Hybrid Network Substrate

SERIES F08, F14, F16

Thin Film Resistor Networks



DIP

Dual In-Line Package

FEATURES

- 99.5% Alumina Substrate
- Molded Epoxy DIP Package
- 0.100 Inch (2.54mm) Lead Spacing
- Low Profile
- 8.14 and 16 Pin Construction
- Automatically Insertable
- Meets Specifications of Characteristic V of MIL-R-83401

For more information ask for Publication RORN.

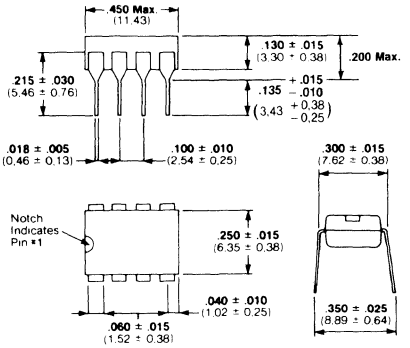
SPECIFICATIONS

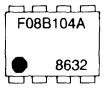
Standard Network Applications

NETWORK	
F14A F16A	F08B F14B F16B
APPLICATIONS	
Pull-Up Resistor Arrays for Open TTL Gates	Matched Pairs
Parallel High Speed Circuitry	Current Limiting
Wired OR Configurations	Transmission Line Termination
Pull-Down Applications	Power Gate Pull-Up
TTL-MOS Interfacing	Logic Level Translation
Digital Pulse Squaring	

DIMENSIONS

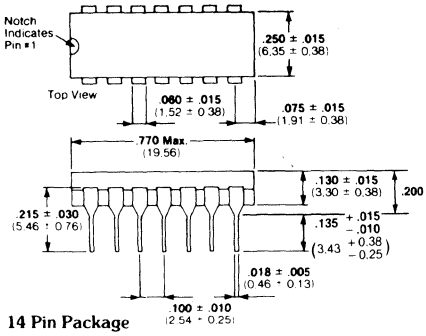
Series F08B





Standard Marking
A-B Part Number
Date Code
Pin #1

Series F14A, F14B, F16A, and F16B

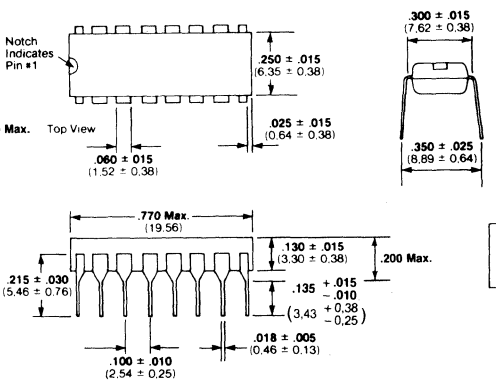


14 Pin Package

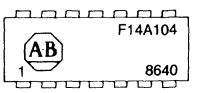
Basic dimensions in inches.
Dimensions shown in parentheses are in millimeters.

TOLERANCES
Dimensional Tolerance ±.005 (0,13)
Angular Tolerance ±5% Except as Specified.

NOT TO SCALE



16 Pin Package



Standard Marking
A-B Logo
A-B Part Number
Date Code
Pin #1

The Resistorsource!

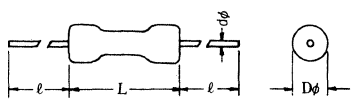
RESISTORS

Flame-Proof Metal Oxide Film Resistors

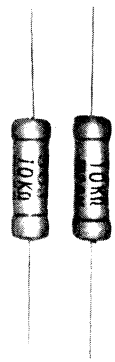
Standard Size

Axial-lead type

Model	Rated power (W)	Resistance range (Ω)	Tolerance	DIMENSIONS L (mm)	Dϕ (mm)	ℓ (mm)	dϕ (mm)	Remark
RNU 1/2	1/2	0.1~9.1	J	9±1	3.5±1	30±3	0.65±0.1	dϕ =0.8 for miniaturized resistors
RSU 1/2		10~20 K						
RNU 1	1	0.1~9.1	J	12^{+1}_{-2}	4±1	38±3	0.8±0.1	
RSU 1		10~100 K						
RNU 2	2	0.1~9.1	J	16^{+1}_{-2}	6±1	38±3	0.8±0.1	
RSU 2		10~100 K						
RNU 3	3	0.1~9.1	J	26^{+1}_{-2}	8.5±1	38±3	0.8±0.1	
RSU 3		10~150 K						



Axial lead type

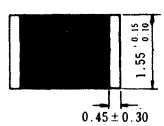


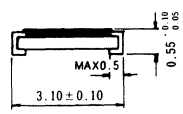
See the spec. for taping

Thick Film Chip RESISTORS (FCR-125)

■ **DIMENSIONS**

Item	Specifications	Remarks
Rated power	0.125W	Ambient temp.: 70°C
Max. working voltage	200V	
Resistance range	100Ω~10MΩ	As a standard, E-24 step
Tolerance of resistance	±2, 5, 10, 20%	





RESISTOR PRODUCTS

Carbon Comp
1/8w, 1/4w, 1/2w
Carbon Film
1/8w, 1/4w, 1/2w, 1w, 2w
Metal Film
1/8w, 1/4w, 1/2w, 1w, 2w
Metal Oxide
1/4w, 1/2w, 1w, 2w, 3w, 5w

Metal Plate
2w, 5w
Precision Wirewound
Tol. to .005%
Temp. Coeficiant to 1PPM

Wirewounds
1w to 1000 watts
Chip Resistors
1/8w, 1/4w, 1/2w, 1w, 2w
Variable Resistors
UL, CSA Approved

Networks
Sips
Dips
Custom Type
Hybrid Circuits
Flameproof

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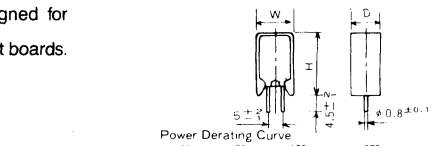
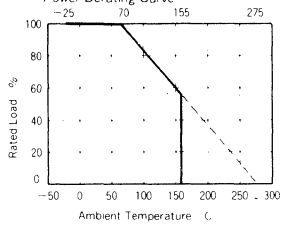
CERAMIC INSULATED RESISTORS (STANDARD)

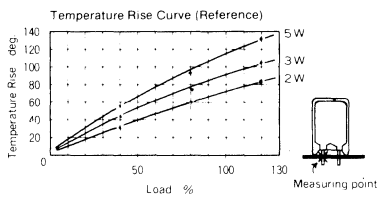
●MNS ●MNR

This radial lead type is designed for saving space on printed circuit boards.



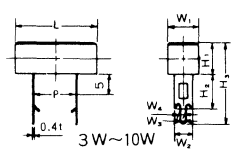
Rated Power (W)	Dimensions (m/m)			Resistance Range (Ω)		Weight (g)
	W	D	H	MNS	MNR	
2	11 ± 1	7 ± 1	20.5 ± 1.5	0.1 ~ 200	100 ~ 13 K	3.7
3	12 ± 1	8 ± 1	25 ± 1.5	0.1 ~ 360	100 ~ 22 K	5.3
5	13 ± 1	9 ± 1	25.5 ± 21.5	0.1 ~ 510	100 ~ 27 K	6.4

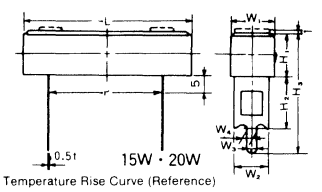




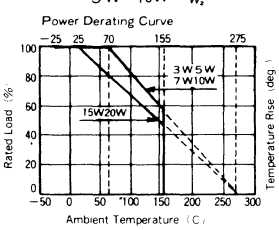
●MPS ●MPR

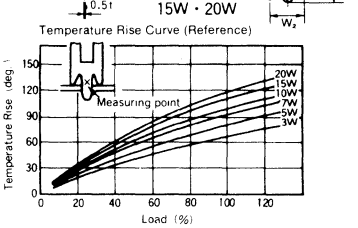
Direct mounting type on printed circuit board.





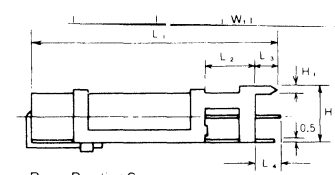
Rated Power (W)	Dimensions (m/m)									Resistance Range (Ω)		Weight (g)
	L	P	W1	W2	W3	W4	H1	H2	H3	MPS	MPR	
3	24	12.5	9	5	1.4	1.6	9	10	23.5	0.22 ~ 390	100 ~ 22 K	5.5
5	27	15	9.5	5	1.4	1.6	9.5	10	24	0.47 ~ 680	100 ~ 27 K	6.5
7	35	22.5	9.5	5	1.4	1.6	9.5	10	24	0.68 ~ 1000	200 ~ 56 K	8.3
10	48	35	9.5	5	1.4	1.6	9.5	10	24	1.0 ~ 1500	200 ~ 75 K	11.0
15	48	32.5	12.5	10	2.7	3	12.5	15	34.5	1.0 ~ 2000	———	17.8
20	63.5	50	12.5	10	2.7	3	12.5	15	34.5	1.0 ~ 3000	———	22.8

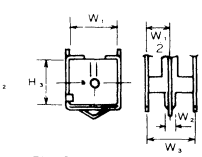




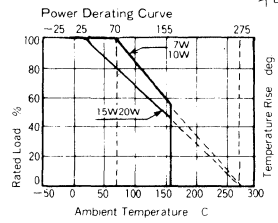
●MVS ●MVR

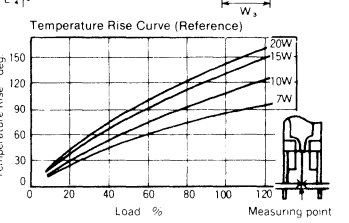
This economical type of resistor minimizes space when mounted on the printed circuit board, and allows for excellent heat conductivity.





Rated Power (W)	Dimensions (m/m)										Resistance Range (Ω)		Weight (g)
	L1	L2	L3	L4	H1	H2	H3	W1	W2	W3	MVS	MVR	
7	49	10	4	5	1.5	11	9	9.5	1.5	10	0.5 ~ 1400	200 ~ 56 K	10.0
10	62	10	4	5	1.5	11	9	9.5	1.5	10	1 ~ 2000	200 ~ 75 K	13.3
15	62.5	10	4.5	6.5	2.5	14	12.5	12.5	2.5	13	1 ~ 2000	500 ~ 110 K	22.1
20	78	10	4.5	6.5	2.5	14	12.5	12.5	2.5	13	1 ~ 3000	500 ~ 180 K	26.4





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BOURNS

General Specifications

The following specifications apply to all Bourns standard networks (Series 4100, 4200, 4300, 4400 and 4600).

Environmental Specifications

Tests per MIL-R-83401...ΔR Maximum
Short Time Overload (STOL)..±0.25%
Load Life.....±1.00%
Thermal Shock.....±0.25%*
Power Conditioning.....±0.50%*
Mechanical Shock.....±0.25%
Moisture Resistance.....±0.50%
Resistance to Solder Heat....±0.25%
Terminal Strength.....±0.25%
Vibration.....±0.25%
Low Temperature Storage....±0.25%
High Temperature Exposure...±0.50%
Low Temperature Operation...±0.25%
Operating Temperature
.....-55 to +125°C
Storage Temperature..-65 to +150°C

*Thermal Shock and Power Conditioning Combined.....±0.7% maximum

Mechanical Specifications

Flammability.....Conforms to UL94V-0
Leadframe.....Copper (Olin 194) 90/10 Electroplate
Body Material
Molded Product.....Epoxy/Novolac
Conformal Product...Epoxy/Anhydride
Lead Solderability and Solvent Resistance ...Meet requirements of MIL-R-83401

Electrical Specifications

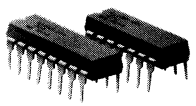
Insulation Resistance (@100V)
.....10,000 megohms minimum
Dielectric Withstanding Voltage
200VRMS.....1Ma maximum leakage current
Standard Resistance Range
.....10 ohms to 10 megohms
Resistance Tolerance
(Bussed and Isolated Circuits
±2.0%....50 ohms to 5 megohms*
±1 ohm.....10 ohms to 49 ohms
Dual Terminator
±2.0%...100 ohms to 5 megohms*
±2 ohms.....10 ohms to 99 ohms
Maximum Operating Voltage
Through-Hole Components.....100V
SMD Components.....50V
Temperature Coefficient (TCR)
±100PPM/°C 50 ohms to 2.2 megohms
±250PPM/°C Below 50 ohms and above 2.2 megohms
TCR Tracking....50PPM/°C maximum Equal value resistors
*Above 5 megohms = ±5.0%

STANDARD RESISTANCE VALUES (003, 104 Circuits)

Resistance			
Ohms		Code	
R_1	R_2	R_1	R_2
160	240	161	241
180	390	181	391
220	270	221	271
220	330	221	331
330	390	331	391
330	470	331	471
3000	6200	302	622

Molded DIP

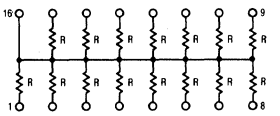
(4100 Series)



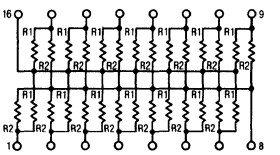
The Molded DIP product is suitable for automatic insertion and is in the standard JEDEC MS-001, .300 row spacing package.

ISOLATED RESISTORS
(001 Circuit)

BUSSED RESISTORS
(002 Circuit)



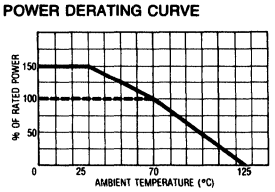
DUAL TERMINATORS
(004 Circuit)



POWER RATINGS @ 70°C
Resistor
001 Circuit.....250W
002 Circuit.....125W
003 Circuit.....125W

Package
14-Pin.....2.0W
16-Pin.....2.25W

POWER DERATING CURVE



Bourns Resistor Networks power ratings are specified at +70°C, derated to zero at +125°C.

+25°C power ratings are 1.5 X the rated power specified at @ +70°C.

STANDARD RESISTANCE VALUES (001, 002, 004, 101, 102 Circuits)

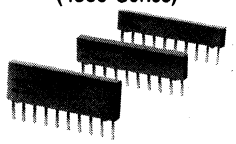
Resistance	
Ohms	Code
22	220
27	270
33	330
39	390
47	470
56	560
68	680
82	820
100	101
120	121
150	151
180	181
220	221
270	271
330	331
390	391
470	471
560	561
680	681
820	821

Resistance	
Ohms	Code
1000	102
1200	122
1500	152
1800	182
2000	202
2200	222
2700	272
3300	332
3900	392
4700	472
5600	562
6800	682
8200	822
10000	103
12000	123
15000	153
18000	183
20000	203
22000	223
27000	273

Resistance	
Ohms	Code
33000	333
39000	393
47000	473
56000	563
68000	683
82000	823
100000	104
120000	124
150000	154
180000	184
220000	224
270000	274
330000	334
390000	394
470000	474
560000	564
680000	684
820000	824
1000000	105
2200000	225

Molded SIP

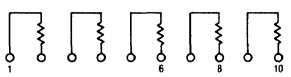
(4300 Series)



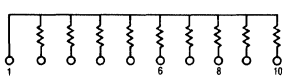
The Molded SIP product is suitable for automatic insertion and is available in low profile (.195" high), medium profile (.250" high) and high profile (.350" high) styles.

PIN COUNTS AVAILABLE
Low Profile.....6-8-9-10-11
Medium Profile.....4-6-8-10
High Profile.....4-6-8-10

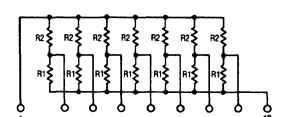
ISOLATED RESISTORS
(102 Circuit)



BUSSED RESISTORS
(101 Circuit)



DUAL TERMINATORS
(104 Circuit)



MAXIMUM PACKAGE POWER
(Watts @ 70°C)

Pins	Low Profile	Medium Profile	High Profile
4	—	.600	.800
6	.750	.900	1.200
8	1.000	1.200	1.600
9	1.125	—	—
10	1.250	1.500	2.000
11	1.375	—	—

MAXIMUM RESISTOR POWER
(Watts @ 70°C)

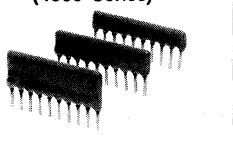
Profile	Isolated 102 Circuit	Bussed 101 Circuit	Dual Terminator 104 Circuit
Low	.300	.200	.200
Medium	.400	.250	.250
High	.500	.300	.300

Pins	A - Maximum Inches	(mm)
4	.384	(9.76)
6	.584	(14.84)
8	.784	(19.92)
9	.884	(22.46)
10	.984	(25.00)
11	1.084	(27.54)

Profile	B - Maximum Inches	(mm)
Low	.195	(4.96)
Medium	.250	(6.35)
High	.350	(8.89)

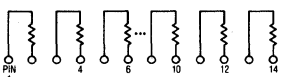
Conformal SIP

(4600 Series)

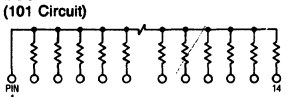


The Conformal SIP product is a lower cost alternative to the molded product and is suitable for use where manual insertion is employed. This product is available in all pin counts from 4 through 14 pins, in low profile (.200" high), medium profile (.250" high) and high profile (.350" high) packages.

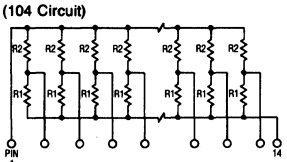
ISOLATED RESISTORS
(102 Circuit)



BUSSED RESISTORS
(101 Circuit)



DUAL TERMINATORS
(104 Circuit)



MAXIMUM PACKAGE POWER
(Watts @ 70°C)

Pins	Low Profile	Medium Profile	High Profile
4	.500	.600	.800
5	.625	.750	1.000
6	.750	.900	1.200
7	.875	1.050	1.400
8	1.000	1.200	1.600
9	1.125	1.350	1.800
10	1.250	1.500	2.000
11	1.375	1.650	2.200
12	1.500	1.800	2.400
13	1.625	1.950	2.600
14	1.750	2.100	2.800

MAXIMUM RESISTOR POWER
(Watts @ 70°C)

Profile	Isolated 102 Circuit	Bussed 101 Circuit	Dual Terminator 104 Circuit
Low	.300	.200	.200
Medium	.400	.250	.250
High	.500	.300	.300

Pin Count	A - Maximum Inches	(mm)
4	.398	(10.11)
5	.498	(12.65)
6	.598	(15.19)
7	.698	(17.73)
8	.798	(20.27)
9	.898	(22.81)
10	.998	(23.35)
11	1.098	(27.89)
12	1.198	(30.43)
13	1.298	(32.97)
14	1.398	(35.51)

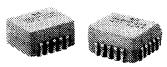
Profile	B - Maximum Inches	(mm)
Low	.200	(5.08)
Medium	.250	(6.35)
High	.350	(8.89)

Specifications are subject to change without notice.

BOURNS

Plastic Leaded Chip Carrier

(4200 Series)

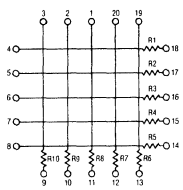


The Plastic Leaded Chip Carrier is a surface-mount device (SMD) available in 10 and 20 pin configurations. The PCC-20 is in the standard JEDEC MO-047 package and is compatible with automatic placement equipment. The PCC-10 is the same body construction as the PCC-20, but with 2 pin patterns omitted. This feature allows traces to be routed underneath the package to conserve board space.

ISOLATED RESISTORS
(102 Circuit)

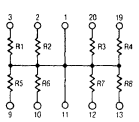
10 Pin

20 Pin

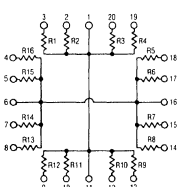


BUSSED RESISTORS
(105 Circuit)

10 Pin

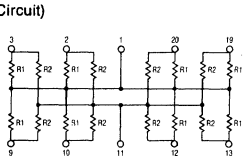


20 Pin



DUAL TERMINATORS
(104 Circuit)

10 Pin



This network terminates 8 lines; convenient for an 8-bit computer buss.

POWER RATINGS @ 70°C

Resistor

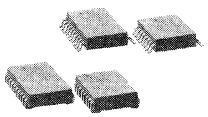
102 Circuit	.160W
104 Circuit	.160W
105 Circuit	.160W 10-Pin .115W 20-Pin

Package

4210P	1.5W
4220P	2.0W

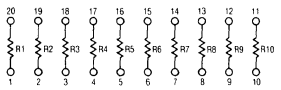
Small Outline Package

(4400 Series)

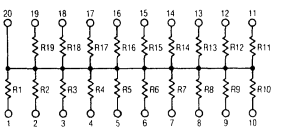


The SOL package is a surface-mount device (SMD) available in 16 and 20 pin configurations. These devices are available in the standard JEDEC MS-013 SOL (.300 wide) package with gull wing leads (Model 44XXP) and are also available with J-Hook leads (Model 44XXJ) for use where mounting area is restricted. The J-Lead version of the SOL package mounts on the same land pattern as the EIAJ SOM (.220 wide) medium wide package.

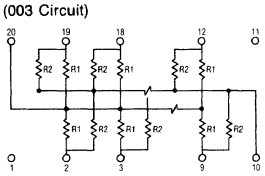
ISOLATED RESISTORS
(001 Circuit)



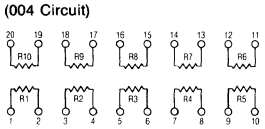
BUSSED RESISTORS
(002 Circuit)



DUAL TERMINATORS
(003 Circuit)



ISOLATED RESISTORS
(004 Circuit)



POWER RATINGS @ 70°C

Resistor

001 Circuit	.160W
002 Circuit	.160W
003 Circuit	.115W
004 Circuit	.200W

Package

4416	1.6W
4420	2.0W

Military Qualified Networks

GENERAL SPECIFICATIONS

These specifications are applicable to all Military Qualified Networks.

Electrical Specifications	Characteristic K	Characteristic M
Temperature Coefficient of Resistance (TCR)	±100ppm	±300ppm
Maximum Ambient Temperature @ Rated Power	70°C	70°C
Maximum Ambient Temperature @ Zero Power	125°C	125°C
Resistance Tolerance	G = ±2%	G = ±2% J = ±5%

Environmental Specifications	K	M
Thermal Shock ΔR Plus Power Conditioning ΔR	±0.7%	±0.7%
Low Temperature Operation ΔR	±0.25%	±0.5%
Short Time Overload ΔR	±0.25%	±0.5%
Terminal Strength ΔR	±0.25%	±0.25%
Resistance to Soldering Heat - ΔR	±0.25%	±0.25%
Moisture Resistance ΔR	±0.5%	±0.5%
Shock ΔR	±0.25%	±0.25%
Vibration - High Frequency ΔR	±0.25%	±0.25%
Life ΔR	±0.5%	±2.0%
High Temperature Exposure ΔR	±0.5%	±1.0%
Low Temperature Storage ΔR	±0.25%	±0.5%
Insulation Resistance	10,000 MegΩ	10,000 MegΩ

Mechanical Specifications

Flammability ..... Conforms to UL94V-0
Lead Frame Material ..... Copper (OLIN 194) 90/10 electro plate
Body Material ..... Epoxy resin/Novolac

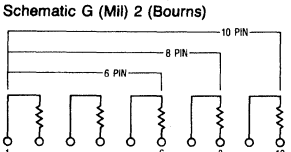
MILITARY SIP NETWORKS (M3XXX Series)

MILITARY QUALIFIED MOLDED SIPs

Low Profile (M83401-07, 08, 09)
High Profile (M83401-04, 05, 06)

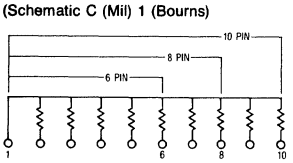
These SIP Resistor Networks are qualified in accordance with MIL-R-83401 and are available in bussed and isolated electrical configurations in pin counts of 6, 8 and 10 pins, with both low and high profile packages available.

ISOLATED RESISTORS
Schematic G (Mil) 2 (Bourns)



These models incorporate 3, 4 or 5 isolated thick-film resistors of equal value, each connected between two pins.

BUSSED RESISTORS
(Schematic C (Mil) 1 (Bourns)



These models incorporate 5, 7 or 9 thick-film resistors of equal value, each connected between a common bus (pin 1) and a separate pin.

MILITARY DIP NETWORKS (M1XXR Series)

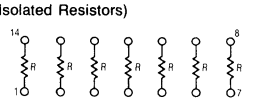
MILITARY QUALIFIED MOLDED DIPs

14-Pin (M83401-01)
16-Pin (M83401-02)

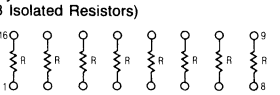
These Molded DIP Resistor Networks are qualified in accordance with MIL-R-83401 and are available in bussed and isolated electrical configurations in 14 and 16 pin packages.

ISOLATED RESISTORS
Schematic A (Mil) 2 (Bourns)

Style 01 - 14-Pin
(7 Isolated Resistors)



Style 02 - 16 Pin
(8 Isolated Resistors)



Resistor Power Rating
At 70°C ..... 0.3 watt

STANDARD RESISTANCE VALUES

Resistance (Ohms)	Resistance Code	Resistance (Ohms)	Resistance Code
51	51R0	4.7K	4701
56	56R0	5.1K	5101
68	68R0	5.6K	5601
82	82R0	6.8K	6801
100	1000	8.2K	8201
150	1500	10K	1002
220	2200	22K	2202
330	3300	33K	3302
470	4700	47K	4702
510	5100	56K	5602
560	5600	68K	6802
680	6800	82K	8202
820	8200	100K	1003
1K	1001	220K	2203
1.5K	1501	470K	4703
2.0K	2001	1Meg	1004
2.2K	2201		
3.3K	3301		

Other values available between 51 ohms and 1.0 megohm.

Bourns, Inc., 1200 Columbia Avenue, Riverside, California 92507; (714) 781-5050; TLX: 676-423; TWX: 910-332-1252; FAX: 714-781-5700. European Headquarters: Zugerstrasse 74, 6340 Baar, **Switzerland:** 042-333333; TLX: 868722; FAX: 042-319017. **Benelux:** 070-874400; TLX: 32023. **France:** 01-40033604; FAX: 01-40033614. **Germany:** 0711-22930; FAX: 0711-291568. **Ireland:** 021-357001; FAX: 021-357443. **United Kingdom:** 0276-692392; FAX: 0276-691037. Asia Pacific Headquarters: 1401 Citicorp Centre, 14th Floor, 18 Whitfield Road, **Hong Kong:** (852) 5-702171; TLX: 82953 BAPHK HX; FAX: 852-5-664341; CBL: BOURNSASPA HONGKONG. **Singapore:** (65) 339-3331; FAX: (65) 339-1116.

Specifications are subject to change without notice.

BRADFORD PRECISION METAL FILM RESISTORS

MIL-R-10509

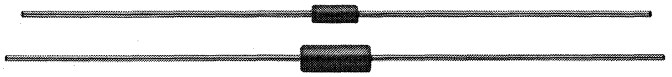
TYPES NE, NC, CT, NA

Characteristic E: RN50E, RN55E. RN60E RN65E ±25 PPM/°C
Characteristic C: RN50C, RN55C, RN60C, RN65C ±50 PPM/°C

Bradford's ±25 PPM and ±50 PPM resistors provide the tight tolerance, tight temperature coefficient and operating stability required in today's precision circuits. These resistors feature the low noise and low inductance characteristics of metal film technology. Standard resistance tolerances are 0.1%, .25%, .5% and 1%.

Characteristic D: RN55D, RN60D, RN65D ±100 PPM/°C

Precision metal film resistors for all circuit applications. Specifications meet or exceed those of MIL-R-10509. These resistors feature low noise and low inductance characteristics. MIL-R-10509 specifies +200, −500 PPM/°C as the temperature coefficient for characteristic D. Bradford guarantees ±100 PPM/°C temperature coefficient.



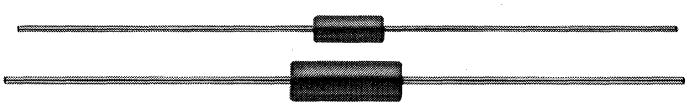
Military Type	Bradford Type	WATTAGE RATING Military 70°C	Military 125°C	Military Voltage Rating	Commercial 70°C	Commercial Voltage Rating	Resistance Range*	Standard Tolerance	Temp. Coefficient PPM/°C
RN50E	NE50		1/20	200	1/4	200	10Ω-499K	.5, 1%	25
RN55E	NE55		1/10	200	1/2	250	49.9Ω-1M	.1, .25, .5, 1%	25
RN60E	NE60		1/8	250	1	350	49.9Ω-1M	.1, .25, .5, 1%	25
RN65E	NE65		1/4	300	1	350	49.9Ω-1M	.1, .25, .5, 1%	25
RN50C	NC50		1/20	200	1/4		10Ω-499K	.5, 1%	50
RN55C	NC55		1/10	200	1/2	250	49.9Ω-1M	.1, .25, .5, 1%	50
RN60C	NC60		1/8	250	1	350	49.9Ω-1M	.1, .25, .5, 1%	50
RN65C	NC65		1/4	300	1	350	49.9Ω-1M	.1, .25, .5, 1%	50
	CT50			200	1/4	200	2Ω-499K	1%	100
RN55D	CT55	1/8		200	1/2	300	10Ω-1M	1%	100
RN60D	NA60	1/4		300	1/2	350	10Ω-1M	1%	100
RN65D	NA65	1/2	1/4	350	1	350	49.9Ω-1M 10Ω-2M	.5% 1%	100

MIL-R-55182 TYPES CJ, CH

RNC50J/H, RNC55J/H, RNC60J/H, RNC65J/H — Failure Rate Level S

RNR50J/H, RNR55J/H, RNR60J/H, RNR65J/H — Failure Rate Level S

Bradford RNC resistors are designed for the many military applications where established reliability is a must.



Military Type	Bradford Type	WATTAGE RATING Military 70°C	Military 125°C	Military Voltage Rating	Resistance Range	Standard Tolerance	Temp. Coefficient PPM/°C
RNC50J/ RNR50J	CJ50	1/10	1/20	200	49.9Ω-150K	.1, .5, 1%	25
RNC50H/ RNR50H	CH50	1/10	1/20	200	10Ω-150K 49.9Ω-150K	.5, 1% .1%	50
RNC55J/ RNR55J	CJ55	1/8	1/10	200	49.9Ω-301K	.1, .5, 1%	25
RNC55H/ RNR55H	CH55	1/8	1/10	200	10Ω-301K 49.9Ω-301K	.5, 1% .1%	50
RNC60J/ RNR60J	CJ60	1/4	1/8	250	49.9Ω-499K	.1, .5, 1%	25
RNC60H/ RNR60H	CH60	1/4	1/8	250	10Ω-499K 49.9Ω-499K	.5, 1% .1%	50
RNC65J/ RNR65J	CJ65	1/2	1/4	300	49.9Ω-1M	.1, .5, 1%	25
RNC65H/ RNR65H	CH65	1/2	1/4	300	10Ω-1M 49.9Ω-1M	.5, 1% .1%	50

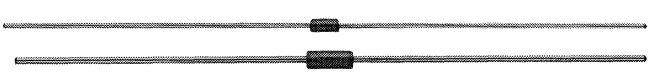
SEMI-PRECISION METAL FILM RESISTORS

MIL-R-39017 TYPE HN

RLR05C, RLR07C, RLR20C — Failure Rate Level S
RLR32C — Failure Rate Level M (Upon completion of 10,000 Hrs. test on May 31, 1988, S Level will be established for RLR32C).

MIL-R-39017 is the established reliability specification for semi-precision metal film resistors.

Extended life tests of over one-half billion unit test hours have proven the reliability inherent in Bradford's manufacturing process. This has been confirmed by field performance in high reliability programs such as: Minuteman, Safeguard, Mercury, Gemini, Apollo, Mariner, Poseidon, Space Shuttle, Trident and GPS, as well as our involvement in virtually every other military program requiring resistors.



Military Type	Bradford Type	Wattage 70°C	Voltage Rating	Resistance Range	Standard[1] Tolerance	Temp. Coefficient PPM/°C
RLR05C	HN3	1/8	200	4.7Ω-300K	1, 2, 5%	100
RLR07C	HN4	1/4	250	10Ω-1M	1, 2, 5%	100
RLR20C	HN5	1/2	350	10Ω-1M	1, 2, 5%	100
RLR32C	HN6	1	500	10Ω-1M	1, 2, 5%	100

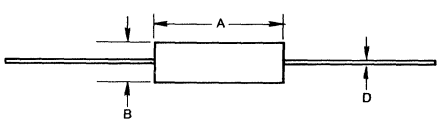
(1) 5% tolerance is inactive for new design.

For complete information, contact:
BRADFORD ELECTRONICS, INC., 550 High Street, Bradford, PA 16701 • Phone (814) 362-5700

BRADFORD SEMI-PRECISION METAL FILM

MIL-R-22684
TYPES RL07, RL32, RL42
COMMERCIAL
CT3, CT4, C6, FP32, FP42

Bradford's Semi-Precision Resistors offer: Long-Term Stability • Low Inductance • Low Noise • Low Cost • QPL to MIL-R-22684 Ideal for preamplifiers, RF and IF circuits and other general purpose usage.



*All leads are 1.5" ± .125" long [38.1 ± 3.2mm]
**.020" also available

	Military Type	Bradford Type	WATTAGE RATING Military 70°C	Military Voltage Rating	Commercial 70°C	Commercial Voltage Rating	Resistance Range	Standard Tolerance	Temp. Coefficient PPM/°C
Standard Tolerance 1%, 2%, 5%	RL07S	CT4	1/4	250	1/2	300	10Ω-1M	1, 2, 5%	100
	RL32S	C6	1	500		500	10Ω-2M	1, 2, 5%	100
Standard Tolerance 2%, 5%, 10% E-24	—	CT3			1/4	200	1Ω-499K	2, 5, 10%	100
	RL32S	FP32	1	500			10Ω-1M	2, 5, 10%	100
	RL42S(1)	FP42	2	500			10Ω-1.5M	2, 5, 10%	150

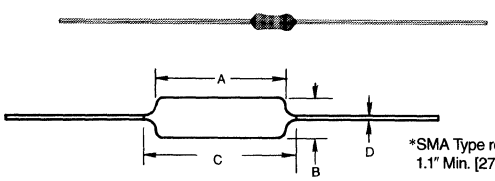
(1) Available in RL42TX

	DIMENSIONS — INCHES			DIMENSIONS — MM		
Type	A	B	D Leads*	A	B	D Leads*
CT3	.145 ± .015	.066 ± .008	.016**	3.68 ± .38	1.68 ± .20	.41**
CT4	.235 ± .020	.090 ± .008	.025	5.97 ± .51	2.29 ± .20	.63
C6	.554 ± .021	.190 + .007 − .015	.040	14.07 ± .53	4.83 + .18 − .38	1.02
FP32	.560 ± .030	.190 + .007 − .015	.040	14.27 ± .76	4.83 + .18 − .38	1.02
FP42	.687 ± .031	.300 ± .020	.045	17.45 ± .79	7.62 ± .51	1.14

COMMERCIAL
TYPES SMA3, SMA4, SMA07, SMA5, SMA20, OMA3, OMA07 — ZERO OHM JUMPERS

Temperature Coefficient: ±100 PPM/°C

Standard Tolerance: 1%, 2%, 5%



*SMA Type resistor leads are 1.1" Min. [27.9mm]

Bradford Type	Wattage Ratings Standard 70°C	Voltage Rating	Resistance Range	Standard Tolerance	Temp. Coefficient PPM/°C
SMA3	1/8	200	1Ω-1M	1, 2, 5%	100
SMA4	1/4	300	1Ω-5.1M	1%	50
SMA07	1/4	300	1Ω-5.1M	2, 5%	100
SMA5	1/2	350	1Ω-2.21M	1%	100
SMA20	1/2	350	1Ω-5.1M	2, 5%	100
OMA07	(Zero Ohm Jumper)				
OMA3	(Zero Ohm Jumper)				

	DIMENSIONS — INCHES				DIMENSIONS — MM			
Type	A	B	C	Leads* D	A	B	C	Leads* D
SMA3/OMA3	.142 ± .010	.071 Max.	.160 Max.	.020	3.6 ± .25	1.8	4.1 Max.	.5
SMA07/OMA07/SMA4	.235 ± .020	.090 ± .008	.281	.024	5.97 ± .51	2.29 ± .20	7.14	.61
SMA5/SMA20	.303 ± .020	.110 ± .008	.375	.026	7.68 ± .50	2.79 ± .20	9.53	.67

Operation of these resistors at Dual Rating Levels can produce high board temperatures in dense package configurations.

LOW RESISTANCE METAL FILM

TYPE FL4C, FL5C, FL4D, FL5D, LO4C, LO5C, LO4D, LO5D
MIL-R-10509 Equivalent (1)

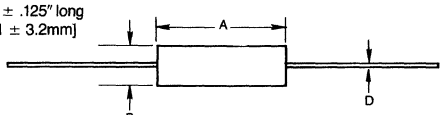
These styles provide low value resistors in both flameproof and nonflameproof construction. Temperature coefficients as tight as 50 PPM/°C are available.

	WATTAGE RATING Military Equiv. 70°C	Military Equiv. Voltage Rating	Commercial 70°C	Resistance Range	Standard Tolerance*	Temp. Coefficient PPM/°C
Bradford Type						
FL4C	1/4	250	1/2	1Ω-48.7Ω	1, 2, 5%	50
FL5C	1/2	350	1	1Ω-48.7Ω	1, 2, 5%	50
FL4D	1/4	250	1/2	1Ω-48.7Ω	1, 2, 5%	100
FL5D	1/2	350	1	1Ω-48.7Ω	1, 2, 5%	100
LO4C	1/8	200	1/2	1Ω-48.7Ω	1, 2, 5%	50
LO5C	1/4	350	1	1Ω-48.7Ω	1, 2, 5%	50
LO4D	1/8	200	1/2	1Ω-48.7Ω	1, 2, 5%	100
LO5D	1/4	350	1	1Ω-48.7Ω	1, 2, 5%	100

*Standard tolerance below 2 ohms is 2% and 5%
(1) For MIL-R-10509 equivalent product requirements below QPL resistance values.

	DIMENSIONS — INCHES			DIMENSIONS — MM		
Type	A	B	Leads* D	A	B	Leads* D
FL4C	.235 + .020 − .025	.088 ± .010	.025	5.97 + .51 − .63	2.24 ± .25	.63
FL5C	.350 ± .030	.130 + .015 − .025	.032	8.89 ± .76	3.30 + .38 − .63	.81
FL4D	.235 + .020 − .025	.088 ± .010	.025	5.97 + .51 − .63	2.24 ± .25	.63
FL5D	.350 ± .030	.130 + .015 − .025	.032	8.89 ± .76	3.30 + .38 − .63	.81
LO4C	.235 ± .020	.090 ± .008	.025	5.97 ± .51	2.29 ± .20	.63
LO5C	.355 ± .020	.148 + .000 − .023	.032	9.02 ± .51	3.76 + .000 − .58	.81
LO4D	.235 ± .020	.090 ± .008	.025	5.97 ± .51	2.29 ± .20	.63
LO5D	.355 ± .020	.148 + .000 − .023	.032	9.02 ± .51	3.76 + .000 − .58	.81

*All leads are 1.5" ± .125" long [38.1 ± 3.2mm]



For complete information, contact:
BRADFORD ELECTRONICS, INC., 550 High Street, Bradford, PA 16701 • Phone (814) 362-5700

BRADFORD FLAMEPROOF RESISTORS

PRECISION FLAMEPROOF

TYPES: FP55E, FP60E, FP55C, FP60C, FP55D

These flameproof resistors are especially suited for tight tolerance and tight temperature coefficient circuit applications.

	Bradford Type	Wattage Rating 70°C	Voltage Rating	Resistance Range	Standard Tolerance	Temperature Coefficient PPM/°C
Characteristic E ± 25 PPM/°C	FP55E	1/4	200	49.9Ω-100K	.1, .25, .5, 1%	25
	FP60E	1/2	250	49.9Ω-298K	.1, .25, .5, 1%	25
Characteristic C ± 50 PPM/°C	FP55C	1/4	200	49.9Ω-100K	.1, .25, .5, 1%	50
	FP60C	1/2	250	49.9Ω-298K	.1, .25, .5, 1%	50
Characteristic D ± 100 PPM/°C	FP55D	1/4	250	10Ω-499K	1, 2, 5%	100

POWER FLAMEPROOF

TYPES: FP1/2, FP1, FP2, FP3, FP4, FP5, FP7, FP10, FP67, FP69

Bradford FP Style Resistors are especially suited for circuitry where functions, environments and duty cycles demand small, low-power resistors with exceptional frequency characteristics, low end cost and the ability to withstand overloads up to 100 times rated power without any trace of flame.

Bradford Type	Wattage Rating 70°C	Voltage Rating	Resistance Range	Standard Tolerance*	Temperature Coefficient PPM/°C
FP1/2	1/2	350	10Ω-1M	1, 2, 5, 10%	150
FP1	1	500	10Ω-1M	1, 2, 5, 10%	150
FP2	2	500	9Ω-1.5M	1, 2, 5, 10%	150
FP3	3	500	9Ω-1M	1, 2, 5, 10%	150
FP4	4	500	6Ω-1M	1, 2, 5, 10%	150
FP5	5	600	7Ω-1M	1, 2, 5, 10%	150
FP7	7	700	8Ω-1M	1, 2, 5, 10%	150
FP10	10**	700	8Ω-1M	1, 2, 5, 10%	150
FP67	5***	500	5Ω-19K	1, 2, 5, 10%	150
FP69	2	500	2.6Ω-1.5M	1, 2, 5, 10%	150

*Available in ± .5% as special order. **At 40°C ***At 25°C

PULSE WITHSTANDING PROTECTIVE RESISTORS

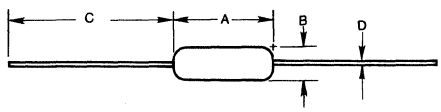
FP SERIES

1. Bradford has developed a new class of resistors which provides lightning withstand characteristics along with resistor functionality. The resistors, derived from the flameproof, tin oxide power film designs, are provided with a thicker film system, which enhances the lightning pulse and power surge absorption capabilities. Higher turns ratio and glass substrate provide a sharper fusing characteristic than the standard flameproof product line.
2. These resistors provide protection against a variety of electrical hazards which can change or destroy sensitive electronic equipment. In particular, high energy voltage surges caused by power line anomalies (direct power crosses or inductively coupled effects) or other momentary over-voltages.

RESISTANCE VALUES

Pulse withstanding capabilities are value dependent. Contact factory for surge test requirements.

Bradford Type	Resistance Range	Tolerances	Cut-off Value	Wattage Rating
FP1/2P	10 Ohm - 1 MegOhm	1, 2, 5%	1K Ohm	1/2W @ 70°C
FP1P	10 Ohm - 1 MegOhm	1, 2, 5%	900 Ohm	1W @ 70°C
FP2P	10 Ohm - 1.5 MegOhm	1, 2, 5%	300 Ohm	2W @ 70°C
FP3P	10 Ohm - 1 MegOhm	1, 2, 5%	200 Ohm	3W @ 70°C
FP69P	10 Ohm - 1 MegOhm	1, 2, 5%	400 Ohm	2W @ 70°C



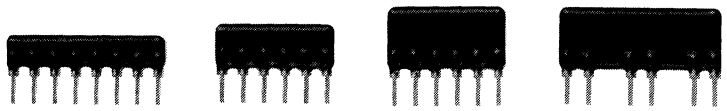
[Numbers in brackets indicate millimeters]

Type	A	B	C	D
FP1/2P	0.360 ± .020 [9.14 ± .51]	0.138 + .012 − .023 [3.51 + .30 − .58]	1.500 ± .125 [38.1 ± 3.2]	0.032 ± .002 [.81 ± .05]
FP1P	0.560 ± .031 [14.22 ± .79]	0.190 ± .015 [4.83 ± .38]	1.500 ± .125 [38.1 ± 3.2]	0.032 ± .002 [.81 ± .05]
FP69P	0.516 ± .021 [13.11 ± .53]	0.225 ± .012 [5.71 ± .30]	1.500 ± .125 [38.1 ± 3.2]	0.032 ± .002 [.81 ± .05]
FP2P	0.687 ± .031 [17.45 ± .79]	0.300 ± .020 [7.62 ± .51]	1.500 ± .125 [38.1 ± 3.2]	0.032 ± .002 [.81 ± .05]
FP3P	0.900 ± .055 [22.86 ± 1.40]	0.300 ± .020 [7.62 ± .51]	1.500 ± .125 [38.1 ± 3.2]	0.032 ± .002 [.81 ± .05]

For complete information, contact:
BRADFORD ELECTRONICS, INC., 550 High Street, Bradford, PA 16701 • Phone (814) 362-5700

BRADFORD RESISTOR NETWORKS

STANDARD SIP NETWORKS
STYLES LC, MC, HC
.200", .250", .350" PROFILES



BRADFORD Single In-line Package (SIP) Resistor Network configurations include 6 through 12 pin products with low (.200"), medium (.250"), and high (.350") profiles. These conformally coated networks are rated at 70°C and meet all the environmental requirements of MIL-R-83401. Bussed element, isolated element and terminator circuits are available.

PERFORMANCE

ELECTRICAL

Resistance Range: 22Ω to 1MΩ

Tolerance: −001 and −002 circuits ±2% or 2 ohms whichever is greater
−003 circuit standard ±5%

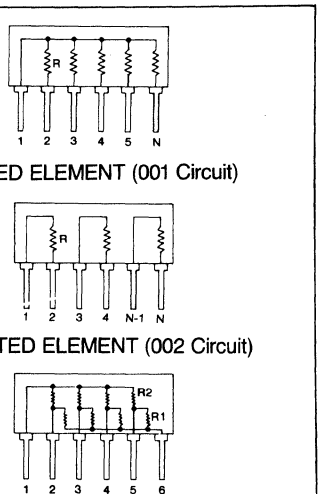
Temperature Coefficient: −001 and −002 circuits ±100 PPM/°C
−003 circuit ±200 PPM/°C

TC Tracking Voltage Rating: ±50 PPM/°C 100V

ELEMENT POWER RATING

Circuit Designation	Circuit Code	Element Power Ratings 70°C
LOW PROFILE (.200")		
Bussed Element	1	0.125
Isolated Element	2	0.200
Terminator	3	0.100
MEDIUM PROFILE (.250")		
Bussed Element	1	0.150
Isolated Element	2	0.250
Terminator	3	0.125
HIGH PROFILE (.350")		
Bussed Element	1	0.250
Isolated Element	2	0.350
Terminator	3	0.175

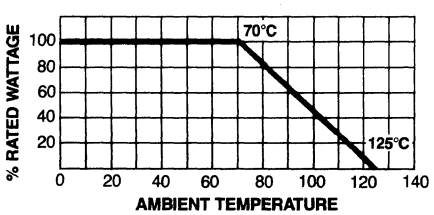
STANDARD CIRCUIT SCHEMATIC



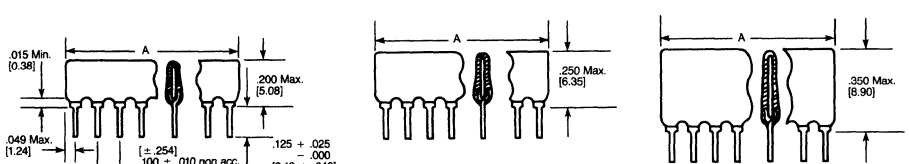
PACKAGE POWER RATING

Package Style	Package Profile	Number of Pins	Standard Circuit Codes Available	Package Power Rating 70°C
LC6	.200	6	1, 2, 3	0.625
LC7	.200	7	1, 3	0.750
LC8	.200	8	1, 2, 3	0.875
LC9	.200	9	1, 3	1.000
LC0	.200	10	1, 2, 3	1.125
LC1	.200	11	1, 3	1.250
L12	.200	12	1, 2, 3	1.375
MC6	.250	6	1, 2, 3	0.750
MC7	.250	7	1, 3	0.900
MC8	.250	8	1, 2, 3	1.050
MC9	.250	9	1, 3	1.200
MC0	.250	10	1, 2, 3	1.350
MC1	.250	11	1, 3	1.500
M12	.250	12	1, 2, 3	1.650
HC6	.350	6	1, 2, 3	1.250
HC7	.350	7	1, 3	1.500
HC8	.350	8	1, 2, 3	1.750
HC9	.350	9	1, 3	2.000
HC0	.350	10	1, 2, 3	2.250
HC1	.350	11	1, 3	2.500
H12	.350	12	1, 2, 3	2.750

POWER DERATING



DIMENSIONS
[Numbers in brackets indicate millimeters]



"A" DIMENSION

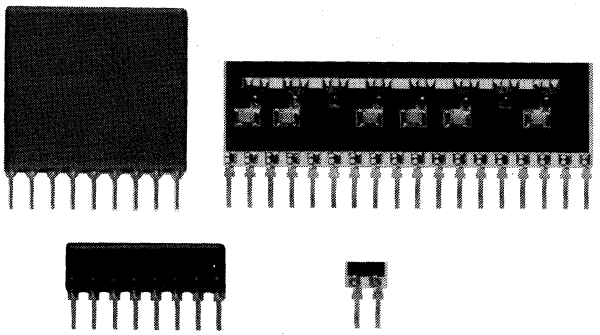
6 PIN	7 PIN	8 PIN	9 PIN	10 PIN	11 PIN	12 PIN
.595 [15.11]	.695 [17.85]	.795 [20.19]	.895 [22.73]	.995 [25.27]	1.095 [27.81]	1.195 [30.35]

MAXIMUM PACKAGE THICKNESS: .098 [2.48]
LEAD DIMENSIONS: .020 [.508] x .010 [.254]

For complete information, contact:
BRADFORD ELECTRONICS, INC., 550 High Street, Bradford, PA 16701 • Phone (814) 362-5700

BRADFORD CUSTOM NETWORKS

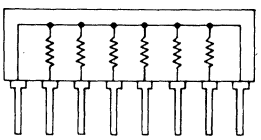
RESISTOR NETWORKS
RESISTOR CAPACITOR NETWORKS
CAPACITOR ARRAYS



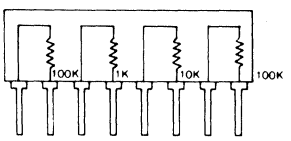
Bradford's expanded custom circuit capabilities now include custom resistor, resistor capacitor and capacitor array networks in the SIP configuration. Substrate packages up to 2" x 2" are available.

Special power and voltage requirements can also be provided. Consult Bradford Customer Engineering for further information, call (814) 362-5712.

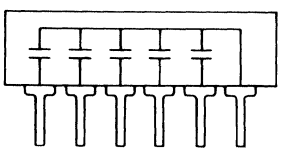
TYPICAL CUSTOM CIRCUIT SCHEMATICS



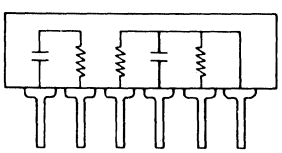
8 Pin 6 Element 2 Pin Common



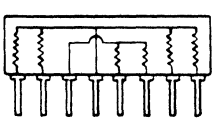
Multi-Valued Isolated Elements



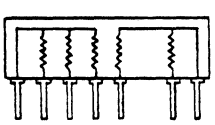
6 Pin Cap Array



6 Pin R/C



8 Pin 6 Element w/Crossover



8 Pin 5 Resistor (Pin 6 Missing)

CAPABILITIES

CHARACTERISTIC	SIP	
	RESISTORS	CAPACITORS
Values*	1Ω-15 MEG	5pF-1.5μF
Tolerances	±0.5% or 1Ω	+80 −20% (Z5U) ±20% (Z5U) ±20, 10, 5% (X7R) 5, 10% (C0G)
TCR's	±50PPM (single sided parts in limited value ranges)	+22% −58% (Z5U) ±15% (X7R) ±30PPM (C0G)
Ratio Matching	±0.5% or 1Ω	
Pin Counts	2-20 Pins (missing pins for keying can be provided)	
Lead Length Available	.085" Min./.170" Max.	
Performance Characteristics	Consult Customer Engineering	

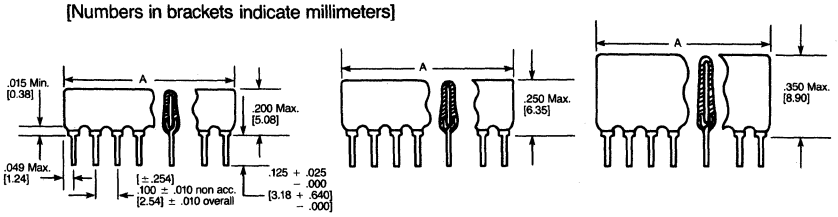
*Dependent upon physical and electrical requirements

SPECIAL FEATURES

- Substrate Thickness — Available in .025"-.100" Max. for High Power applications
- Power Networks — 10 watts @ 70°C & Greater
- Missing Pins — For Keying
- Insulation Coating — Conformally Coated Epoxy or Uncoated
- Package Height — Available from .200" Min. to 2.0" Max.

DIMENSIONS

[Numbers in brackets indicate millimeters]



"A" DIMENSION

2 PIN	6 PIN	7 PIN	8 PIN	9 PIN	10 PIN	11 PIN	12 PIN
.200 [3.08]	.595 [15.11]	.695 [17.85]	.795 [20.19]	.895 [22.73]	.995 [25.27]	1.095 [27.81]	1.195 [30.35]

MAXIMUM PACKAGE THICKNESS: .098 [2.48] LEAD DIMENSIONS: .020 [.508] x .010 [.254]

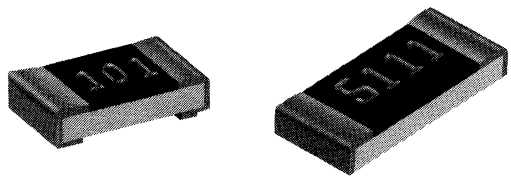
For complete information, contact:
BRADFORD ELECTRONICS, INC., 550 High Street, Bradford, PA 16701 • Phone (814) 362-5700

BRADFORD CHIP RESISTORS

CR0805, CR1206

1%, 5% tolerance

Bradford thick film chip resistors are available in 1/8 (CR1206) and 1/10 (CR0805) watt sizes in both 1% and 5% tolerances. CR1206 chips are available with 100% tin or tin-low lead (2% lead minimum) solderable finishes. They are produced on automated equipment using strict process controls and superior construction features to provide a highly reliable product with repeatable performance.



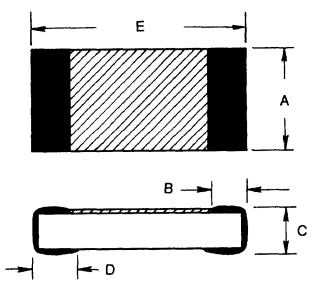
Features include:

- Glass passivation — a protective glass coating ensures electrical stability.
- Wraparound, nickel barrier terminations maintain excellent solderability, termination integrity and electrical stability.
- Small size allows dense placement on circuit boards.
- 96% alumina substrate is thermally conductive for superior heat dissipation and long-term resistance stability.
- Zero ohm jumper available in both CR0805 and CR1206 styles.
- Packaged in accordance with EIA 481A requirements and proven for use on high-speed automatic placement equipment.

PERFORMANCE CHARACTERISTICS

	CR0805	CR1206
Resistance Tolerance	F (±1%), J (±5%)	F (±1%), J (±5%)
Resistance Range	47Ω-1 Meg.	10Ω-1 Meg. (2.2Ω-10 Meg. available)
Temperature Coefficient	±100 PPM/°C (±1%) ±200 PPM/°C (±5%)	±100 PPM/°C (±1%) ±200, ±600 PPM/°C (±5%)
Power Rating	1/10 watt @ 70°C	1/8 watt @ 70°C
Voltage Rating	150 VDC	200 VDC
Thermal Shock	±0.5% ΔR	±0.5% ΔR
Short Time Overload	±0.75% ΔR	±0.75% ΔR
Low Temperature Operation	±0.5% ΔR	±0.5% ΔR
DVW	±0.5% ΔR	±0.5% ΔR
Resistance to Solder Heat	±0.25% ΔR	±0.25% ΔR
Moisture Resistance	±0.5% ΔR	±0.5% ΔR
Load Life (1000 hr. @ 70°C)	±2% ΔR	±2% ΔR
Solder Immersion (Vapor Phase Reflow Exposure)	260°C for 60 seconds	260°C for 60 seconds
Vibration	±1% ΔR	±1% ΔR

CR0805, CR1206 DIMENSIONS



TYPE	A	B	C	D*	E
CR0805	.049 + .006 − .004 [1.25 + 0.15 − 0.10]	.016 ± .008 [0.40 ± 0.20]	.018 ± .003 [0.45 ± 0.01]	.012 + .008 − .004 [0.3 + 0.2 − 0.1]	.079 ± .003 [2.0 ± 0.1]
CR1206	.061 ± .004 [1.55 ± 0.1]	.017 ± .008 [0.43 ± .020]	.022 + .004 − .002 [0.55 + 0.1 − 0.05]	.012 + .008 − .004 [0.3 + 0.2 − 0.1]	.122 ± .004 [3.1 ± 0.1]

* A .010 [.254] minimum bottom termination is available with tin-low lead solder finish.

HOW TO SPECIFY

CR0805 CR1206	102	J	G4	100% Tin
SERIES SIZE	RESISTANCE VALUE	TOLERANCE	PACKAGING	TERMINATION
	For "F" tolerance, first three digits are significant; last digit is multiplier. For "J" tolerance, first two digits are significant; last digit is multiplier.	**F** = ±1% **J** = ±5%	**G4** Tape and Reeled Punched Paper Tape **G9** Bulk **G7** Tape and Reeled Embossed Plastic tape (1206 only)	100% Tin (Standard) 2% lead available

For complete information, contact:
BRADFORD ELECTRONICS, INC., 550 High Street, Bradford, PA 16701 • Phone (814) 362-5700

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

High Performance Film Resistors

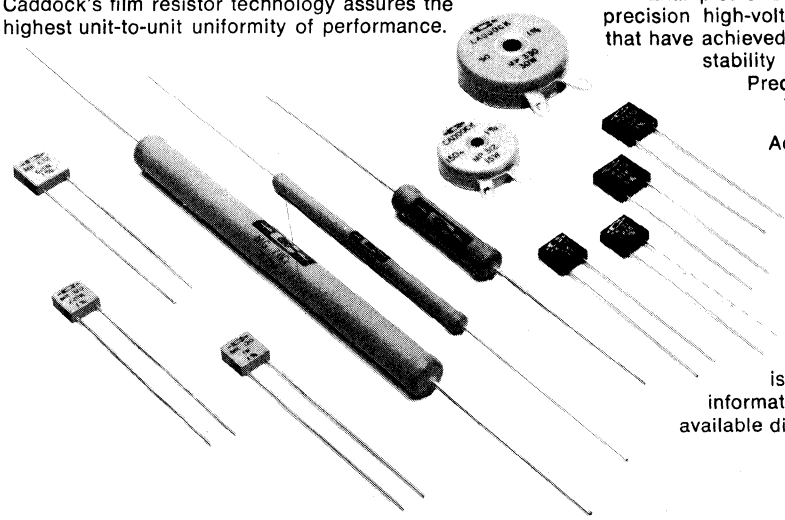
This 21st Edition of the Caddock Electronics General Catalog describes over 150 in-production models of precision discrete resistors and resistors networks that utilize Caddock's high-stability, extended-life Micronox® and Tetrinox® resistance films. With 25 years of experience and an exceptional record of in-circuit performance and reliability, Caddock Electronics continues to lead the industry in the development, production and on-time delivery of high performance film resistors.

Caddock's Advanced Resistor Technology Provides Many Exceptional Performance Advantages:

Caddock's advanced resistor technology began in 1962 with the introduction of Micronox® harsh-environment high-power and high-voltage resistors. The Caddock technology was further extended in 1975 with the development of the Tetrinox® resistance system that made possible the introduction of low TC, ultra-stable resistors and resistor networks.

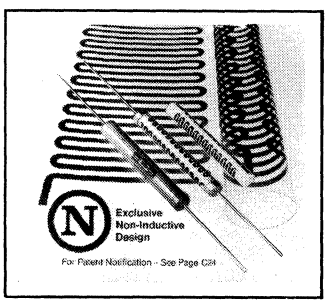
These technological advances have provided the electronics industry with a selection of precision resistor types that achieve many high-performance advantages:

- **Precision** — Tolerances as close as 0.01%.
- **Long-Term Stability** — Better than 0.005% per 1000 hours of operation under full load operating conditions.
- **Higher Power Ratings** — Up to five times higher than other resistor technologies.
- **High Operating Temperatures** — Up to +275°C.
- **Ultra-Low Temperature Coefficients** — Standard to less than 10 PPM/°C and custom values as low as 2 PPM/°C.
- **Unit-to-Unit Uniformity** — The inherent consistency of Caddock's film resistor technology assures the highest unit-to-unit uniformity of performance.



Caddock's Exclusive Non-Inductive Performance Is Available in Both High-Power and High-Voltage Micronox® Film Resistors.

For wide-band, high frequency applications, the advantages of Caddock's Exclusive Non-Inductive Design are available in most models of Micronox® resistors. This special serpentine pattern provides for neighboring lines to carry currents in opposite directions, thereby achieving maximum cancellation of flux fields over the entire length of the resistor.



The result is a truly non-inductive resistor that is about as inductive as a straight piece of wire the length of the resistor body. This efficient design means faster settling times and minimum distortion in all types of high frequency circuits.

The High-Performance Capabilities of Caddock Film Resistors Can Provide Improved Accuracy and Stability to Precision Circuitry:

Because of the special advantages of Caddock's resistance film technology, Caddock High Performance Film Resistors are often specified in the precision circuits that ultimately establish the overall accuracy and stability of the equipment.

Examples of such applications include many types of precision high-voltage supplies and voltage references that have achieved improved accuracy and extended-life stability through the use of Caddock Type MG Precision High-Voltage Resistors and Type T912 Precision Resistor Networks.

Additional examples of the application of this advanced resistor technology include the industry-wide use of Caddock Type 1776 and Type 1787 Precision Decade Divider Resistors in the signal input circuits of laboratory and bench-type digital voltage and current measuring instruments.

An introduction and index to these Caddock resistor technologies is provided on the next page. Additional information and technical assistance is also available directly from our technical staff.

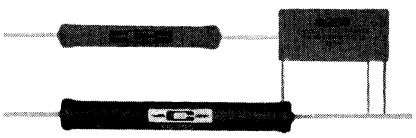
We welcome your call.

CADDOCK
ELECTRONICS, INCORPORATED.

Index to Caddock High Performance Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Precision High Voltage Resistors and High Voltage Divider Networks

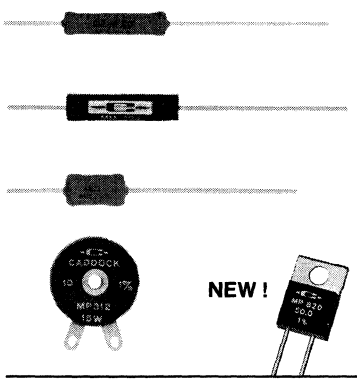


Type MG Precision High Voltage Resistors
Tolerances of 1.0% to 0.1%, TC of 80 PPM/°C — Pages C3 and C4

Type TG Low TC Precision High Voltage Resistors
TC of 25 PPM/°C from -55°C to +125°C — Page C5

Type THV Precision High Voltage Divider Networks
Ratio TC to 10 PPM/°C. Ratio Tolerances to 0.25% — Page C6

Power Film and Precision Film Resistors



NEW !

Type MS and MR Power Film Resistors
Operating Temp to +275°C, Power Ratings to 15 Watts
Non-Inductive Design — Pages C7 and C8

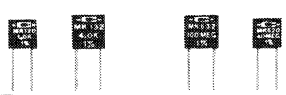
Type MM and ML Precision Film Resistors
High Temperature Resistors for Geophysical, Aerospace and Industrial Requirements — Page C9

Type MV Low Resistance Power Film Resistors
Values from 1 ohm to 50 ohms. Power to 10 Watts.
Operating Temp. to +275°C and Non-Inductive Design. — Page C10

Type MP Chassis Mounted Power Film Resistors
15 Watt and 30 Watt Rating with
Center Screw Chassis Mounting — Page C23

Type MP Kool-Tab™ Power Film Resistors
Non-Inductive 20 Watt Power Resistor
in the TO-220 Power Device Configuration — Page C24

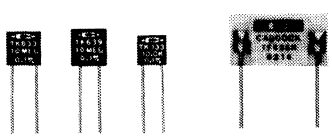
Power Radial-Lead and Extended Resistance Range Radial-Lead Resistors



Type MK 132 and MK 120 Precision Film Resistors
3/4 and 1/2 Watt Ratings at +125°C, 10 ohms to 5 Megohms — Pages C11 and C12

Type MK 632 and MK 620 Extended Resistance Range Film Resistors
Resistance Range from 2 Megohms to 100 Megohms — Pages C11 and C12

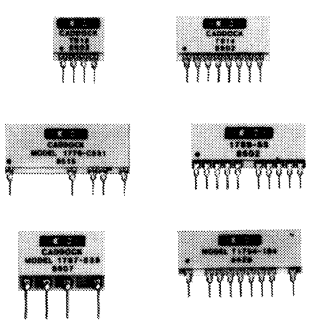
Low Temperature Coefficient Precision and Ultra-Precision Film Resistors



Type TK Low TC Precision Radial-Lead Film Resistors
Resistance Range of 1 kohm to 10 Megohms, TC of 10 PPM/°C.
Operating Temp. from -55°C to +125°C, Tolerances to 0.05% — Pages C13 and C14

Type TF Low TC Ultra-Precision Film Resistors
Resistance Range from 1 kohm to 125 Megohms,
TC to 5 PPM/°C. Tolerances to 0.01% — Page C15

Precision and Ultra-Precision Standard Resistor Networks and Custom Resistor Networks



Type T912 and T914 Precision and Ultra-Precision Networks
2 Resistor and 4 Resistor Networks with Matched Characteristics.
Ratio Tolerances to 0.01%, Ratio TC to 2 PPM/°C — Page C16

Type 1776 Precision Decade Resistor Voltage Dividers
Input Voltage Dividers for Digital Multimeters and other
Range-Switching Circuits, 36 Models — Pages C17 and C18

Type 1787 Precision Current Shunt Resistor Networks
2, 3 and 4-step Current Shunt Resistor Networks for
Current Sensing in Multi-Range Instrumentation — Pages C19 and C20

Type T1794 Custom Low TC Precision SIP Resistor Networks
Ratio TC to 5 PPM/°C. Ratio Tolerances to 0.025%.
Resistance Range from 500 ohms to 50 Megohms — Page C21

Type 1789 Custom Low Resistance Value Precision SIP Resistor Networks
Ratio TC to 15 PPM/°C. Ratio Tolerances to 0.05%
Resistance Range from 0.5 ohm to 10,000 ohms — Page C22

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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MG Precision High-Voltage Resistors

Now with Extended Resistance Range to 10,000 Megohms and Additional Models.

Temperature Coefficient as tight as 80ppm/°C. Combined with Excellent Long-Term Stability, and Precision Tolerances.

Caddock's Micronox® resistance films are the source of the Type MG Precision High Voltage Resistors' outstanding combination of performance features:

- Single-resistor values as high as 10,000 Megohms.
- Maximum continuous operating voltages as high as 48,000 volts ("-15" Ratings).
- Overvoltage capabilities of 150% of standard working voltages for all models and values.
- Resistance Tolerances from ±1.0% to ±0.1%.
- Temperature Coefficient, for standard resistance range, of 80 ppm/°C in combination with resistance tolerances as tight as ±0.1%.
- Typical extended life stability of 0.02% per 1000 hours for standard resistance range as demonstrated by reliability testing.

This exceptional performance has been proven through many years of use in equipment that demands the highest reliability and stability, including TWT amplifiers, X-ray systems, geophysical instruments and medical electronics.

Preconditioning For Power And Voltage Ratings

All power ratings and maximum operating voltage ratings are for continuous duty. These ratings are based on pre-stress voltage levels applied during the manufacturing process to provide for stable resistor performance even under momentary overload conditions.

Maximum operating voltages 60% higher than the values listed in the table may be specified by adding "-15" to the model number (Example: MG750-15), provided power ratings are not excceeded. Note that overload and overvoltage ratings do not apply to the "-15" resistors.

Non-Inductive Performance

Most models are manufactured with Caddock's patented Exclusive Non-Inductive design which uses a serpentine resistive pattern that provides for neighboring lines to carry currents in opposite directions, thereby achieving maximum cancellation of flux fields over the entire length of the resistor. This efficient non-inductive construction is accomplished without derating of any performance advantages.

Model No.	Watt-age	Max. Continuous Oper. Volt.	Dielect. Strength	Resistance			Dimensions		
				Min.	Standard Max.	Extended Max.	A	B	C
MG650	.5	600	750	200Ω	5 Meg	N/A	.313 ±.020	.094 ±.015	.025 ±.002
MG655	.5	600	750	200Ω	8 Meg	N/A	.313 ±.030	.109 ±.015	.025 ±.002
MG660	.6	1,000	750	400Ω	10 Meg	N/A	.500 ±.030	.094 ±.015	.025 ±.002
MG680	.8	2,000	750	600Ω	20 Meg	N/A	.750 ±.030	.094 ±.015	.025 ±.002
MG710	1.0	4,000	750	800Ω	50 Meg	N/A	1.000 ±.040	.094 ±.015	.025 ±.002
MG712	.6	1,000	750	800Ω	20 Meg	N/A	.400 ±.060	.140 ±.030	.025 ±.002
MG714	1.0	1,000	750	200Ω	20 Meg	N/A	.562 ±.060	.150 ±.030	.032 ±.002
MG715	1.0	2,000	750	400Ω	50 Meg	N/A	.750 ±.060	.140 ±.030	.025 ±.002
MG716	1.5	4,000	750	600Ω	75 Meg	N/A	1.000 ±.060	.140 ±.030	.025 ±.002
MG717	1.5	2,000	750	600Ω	75 Meg	225 Meg	.710 ±.050	.240 ±.030	.040 ±.002
MG720	2.0	6,000	750	1K	150 Meg	N/A	1.500 ±.080	.140 ±.030	.025 ±.002
MG721	2.0	4,000	750	200Ω	100 Meg	300 Meg	1.000 ±.050	.240 ±.030	.040 ±.002
MG725	2.5	10,000	750	1.5K	200 Meg	N/A	2.000 ±.080	.140 ±.030	.025 ±.002
MG730	3.0	6,000	1000	500Ω	250 Meg	750 Meg	1.500 ±.080	.240 ±.030	.040 ±.002
MG731	2.6	4,000	1000	200Ω	150 Meg	750 Meg	1.000 ±.060	.315 ±.030	.040 ±.002
MG735	3.6	10,000	1000	750Ω	300 Meg	1000 Meg	2.000 ±.080	.240 ±.030	.040 ±.002
MG740	3.6	6,000	1000	300Ω	300 Meg	1500 Meg	1.500 ±.060	.315 ±.030	.040 ±.002
MG745	5.0	15,000	1000	1K	500 Meg	1500 Meg	3.000 ±.100	.240 ±.030	.040 ±.002
MG750	5.0	10,000	1000	400Ω	500 Meg	2500 Meg	2.125 ±.060	.315 ±.030	.040 ±.002
MG780	7.5	15,000	1000	600Ω	750 Meg	3750 Meg	3.125 ±.060	.315 ±.030	.040 ±.002
MG785	8.0	20,000	1000	800Ω	1000 Meg	5000 Meg	4.000 ±.120	.315 ±.030	.040 ±.002
MG810	10.0	25,000	1000	1K	1250 Meg	6250 Meg	5.000 ±.120	.315 ±.030	.040 ±.002
MG815	15.0	30,000	1000	1K	2000 Meg	10000 Meg	6.000 ±.120	.350 ±.040	.040 ±.002

Models with low inductance construction are in shaded areas.
Models with Caddock's patented Exclusive Non-Inductive Design are in non-shaded areas.

Specifications

Resistance Tolerance:

Resistance Range	Tolerance
Standard	±1%, ±0.5%, ±0.25%, ±0.1%
St'd. with "-15" rating	±1%
Extended Range	±1%

Temperature Coefficient:

Resistance Range	TC Specifications
Standard and St'd. with "-15" rating	±80 ppm/°C from -15°C to +105°C, referenced to +25°C.
Extended Range	±80 ppm/°C from +25°C to +105°C. -200 ppm/°C to +50ppm/°C from -15°C to +25°C.

Insulation Resistance: 10,000 Megohms, minimum.

Overload/Overvoltage: 5 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds.

Resistance Range	Overload/Overvoltage, ΔR
Standard	0.5% max.
St'd. with "-15" rating	N/A
Extended Range	0.8% max.

Thermal Shock: MIL-STD-202, Method 107, Cond. C, ΔR, 0.25% max.

Moisture Resistance: MIL-STD-202, Method 106, ΔR, 0.4% max.

Loadlife: 1000 hours at rated power.

Resistance Range	Loadlife, ΔR
Standard	0.5% max.
St'd. with "-15" rating	0.8% max.
Extended Range	0.8% max.

Operating Temperature: 225°C max.

Lead Material: Gold Plated.

Encapsulation: Silicone Conformal.

Page C 3

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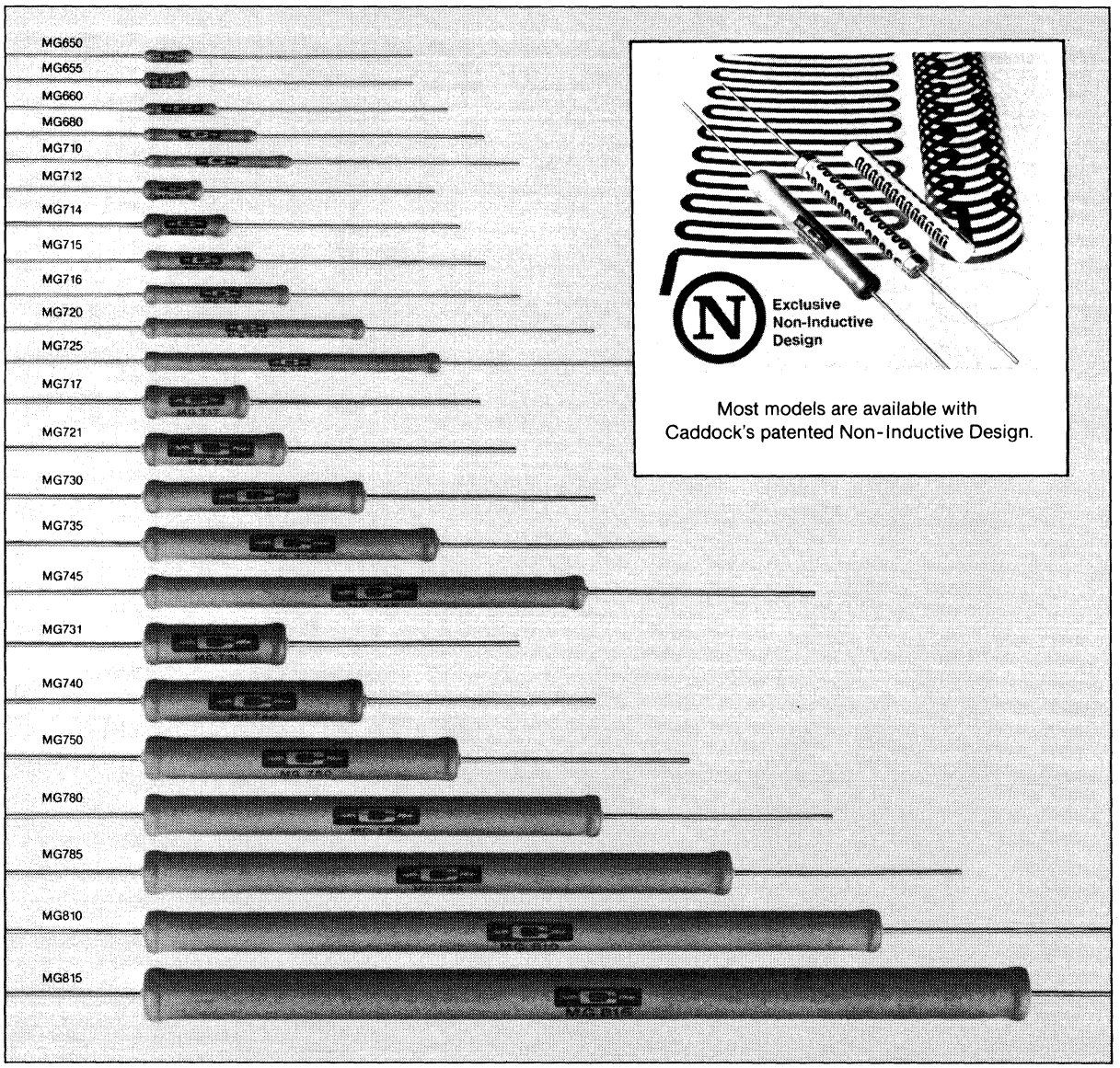
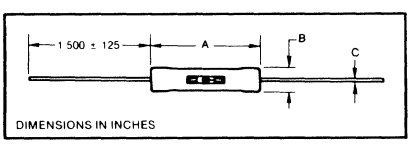
Type MG Precision High-Voltage Resistors

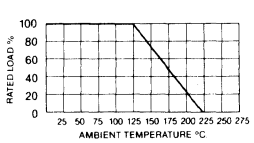
CADDOCK
HIGH PERFORMANCE FILM RESISTORS



Most models are available with Caddock's patented Non-Inductive Design.



Derating Curve:



Design Assistance in Developing High Voltage Resistor Sets with Low TC Tracking.

For immediate engineering assistance in developing Low Ratio TC matched high voltage resistor sets, call our application engineers in Riverside, California and we will be pleased to offer the best solution from our high voltage resistor product capabilities.

For your personal copy of our General Catalog, please call our Sales Office in Riverside, California.

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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type TG Low TC Precision High Voltage Resistors

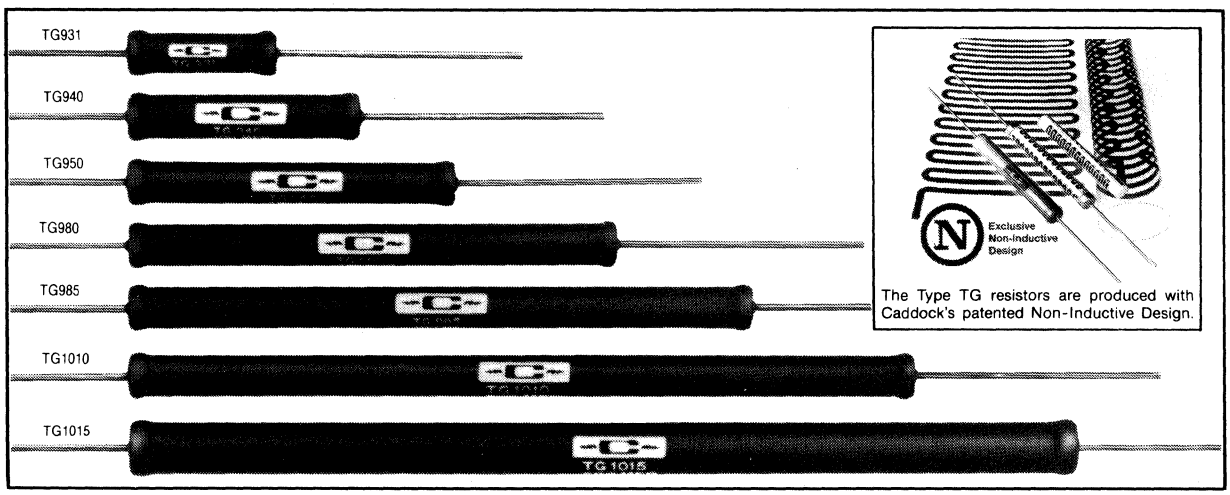
TC of 25 PPM/°C from -55°C to + 125°C, Resistance Range from 1 Megohm to 1000 Megohms.

To meet the precise temperature stability requirements of high accuracy, high voltage systems, Caddock introduces the Type TG Low TC Precision High Voltage Resistors. These resistors utilize our proven Tetrinox® resistance system to achieve the unique combination of low temperature coefficient with high stability performance at high operating voltages.

The Type TG Low TC Precision High Voltage Resistors are designed to meet the demanding stability requirements of TWT power supplies, electron microscopes, X-ray systems, high resolution CRT displays, and geophysical instruments.

The features of the Type TG Low TC Precision High Voltage Resistors are:

- Temperature Coefficient: 25PPM/°C from -55°C to +125°C.
- Loadlife Stability of 0.25% per 1000 hours.
- Resistance Tolerance from ±1.0% to ±0.1%.
- Resistance Range from 1 Megohm to 1000 Megohms.
- Maximum Continuous Operating Temperature of +225°C.
- The low temperature coefficient minimizes the self-drift due to power dissipation warm-up.



The Type TG resistors are produced with Caddock's patented Non-Inductive Design.

Model No.	Watt-age	Max. Continuous Oper. Volt	Oper. Temp. (Max.)	Dielect. Str'gth	TC ppm/°C	Resistance		Dimensions		
						Min.	Max.	A	B	C
TG931	1.0	4,000	225°C	750	25	1 Meg	50 Meg	1.000 ±.060	.315 ±.030	.040 ±.002
TG940	1.5	6,000	225°C	750	25	1.5 Meg	100 Meg	1.500 ±.060	.315 ±.030	.040 ±.002
TG950	2.0	10,000	225°C	1000	25	2 Meg	200 Meg	2.125 ±.060	.315 ±.030	.040 ±.002
TG980	3.0	15,000	225°C	1000	25	3 Meg	300 Meg	3.125 ±.060	.315 ±.030	.040 ±.002
TG985	4.0	20,000	225°C	1000	25	4 Meg	400 Meg	4.000 ±.120	.315 ±.030	.040 ±.002
TG1010	5.0	25,000	225°C	1000	25	5 Meg	500 Meg	5.000 ±.120	.315 ±.030	.040 ±.002
TG1015	6.0	30,000	225°C	1000	25	6 Meg	1000 Meg	6.000 ±.120	.350 ±.040	.040 ±.002

Extended Maximum Continuous Operating Voltage Rating

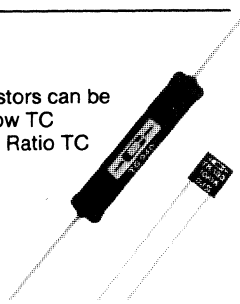
Maximum continuous operating voltages up to 60% higher than the values listed in the table can be achieved through special factory conditioning, provided the power ratings are not exceeded. To specify maximum continuous operating voltages above the values listed in the table, add a "-15" to the model number. (Example, TG950-15) Note that the standard overload and overvoltage ratings do not apply to the "-15" resistors.

Combine Type TG and Type TK Resistors for Low Ratio TC Tracking Performance.

The Type TG Low TC Precision High Voltage Resistors can be used in combination with the low TC of the Type TK Low TC Precision Radial-Lead Resistors to achieve 30 PPM/°C Ratio TC without special matching.

With special matching, a Ratio TC of 10 PPM/°C can be achieved.

The low temperature coefficient for both the Type TG and Type TK resistors will also minimize ratio drift due to power dissipation warm-up.



Specifications

Resistance Tolerance: ± 1% (tolerances to 0.1% on special order).

Temperature Coefficient: 25 PPM/°C referenced to 25°C, ΔR taken at -55°C and +125°C.

Insulation Resistance: 10,000 Megohms, min.

Overload/Overvoltage: 5 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds. ΔR, 0.20% max.

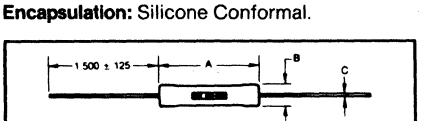
Thermal Shock: MIL-STD-202, Method 107, Cond. B, ΔR, 0.20% max.

Moisture Resistance: MIL-STD-202, Method 106, ΔR, 0.20% max.

Loadlife: 1000 hours at rated power, ΔR, 0.25%.

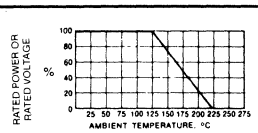
Lead Material: Gold Plated.

Encapsulation: Silicone Conformal.



ALL DIMENSIONS IN INCHES

Derating Curve



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Type THV Precision High Voltage Divider Networks

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

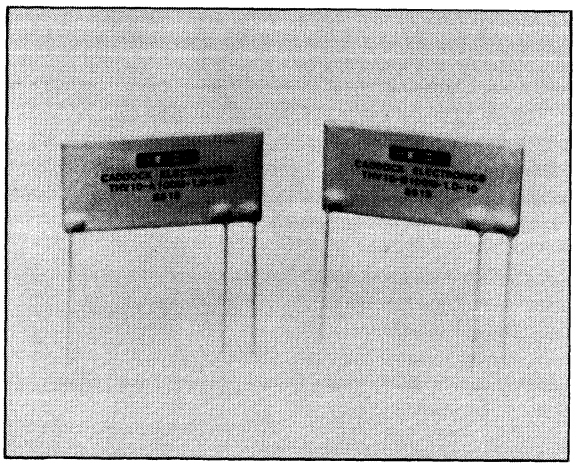
Ratio TC to 10 PPM/°C, Ratio Tolerance to ±0.25%, Operating Voltage of 10 KVDC

The Type THV Precision High Voltage Divider Networks introduce Caddock's advanced high voltage resistor technology which doubles the allowable working voltage over the length of the high voltage section. This technology combines Caddock's Tetrinox® resistance films with laser-generated V-Notch Geometry (patents pending) which optimizes the voltage gradient over the length of the resistance pattern.

The Type THV networks provide tighter ratio temperature coefficients and tighter ratio tolerances than have previously been available in standard high voltage divider products, and include these special features:

- Ratio Temperature Coefficients of 10 PPM/°C or 25 PPM/°C.
- Ratio Tolerances of ±0.25%, ±0.5%, ±1.0% or ±2.0% at 10 KVDC.
- High Continuous Operating Voltage of 10 KVDC at +125°C.
- Standard Voltage Division Ratios of 1,000:1 or 100:1, with custom ratios available.
- Standard Input Resistance of 100 Megohms with custom resistances available.

These specifications can provide important improvements in performance in many types of advanced electronic systems, including TWT power supplies, radar systems, X-ray systems, analytical equipment and high resolution CRT displays.



For complete information on price and delivery of both evaluation and production quantities, call our main offices in Riverside, California.

Standard THV 10 Precision High Voltage Divider Networks

Ordering Information

THV10 - A 100M - 1.0 - 10

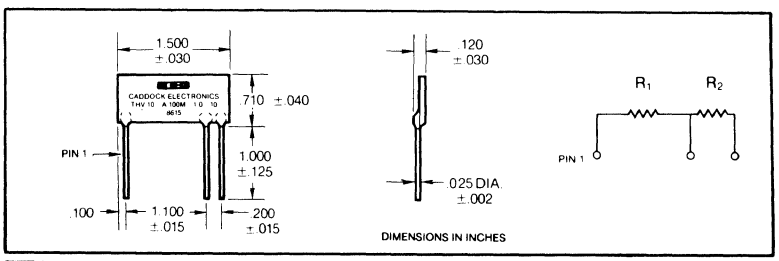
Model No.

Ratio Code Letter:
A - 1000:1 Voltage Division
R_1 = 99.9 Meg
R_2 = 100 K
B - 100:1 Voltage Division
R_1 = 99 Meg
R_2 = 1 Meg.

Total Resistance Value of the Divider:
Standard Total Resistance of Model THV 10 is 100 Meg.

Standard Ratio Tolerance at 10 KVDC:
-2.0 = 2.0% -0.5 = 0.5%
-1.0 = 1.0% -0.25 = 0.25%

Ratio Temperature Coefficient:
(-55°C to +125°C)
-25 = 25 PPM/°C -10 = 10 PPM/°C

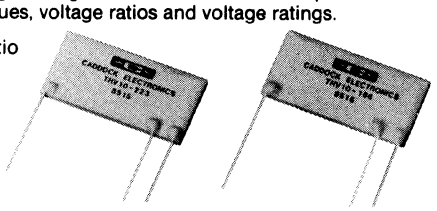


Custom Type THV Precision High Voltage Divider Networks

Custom Type THV Precision High Voltage Divider Networks can be produced with a broad range of resistance values, voltage ratios and voltage ratings.

Custom ratio tolerances and ratio temperatures coefficients can also be produced.

Contact Caddock Applications Engineering about your custom high voltage divider requirement.



Specifications

Ratio Tolerance: See ordering information.

Absolute Tolerance: 1.0% for all resistors.

Ratio Temperature Coefficient: See ordering information.

Absolute Temperature Coefficient: 30 PPM/°C. Referenced to 25°C, ΔR taken at -55°C and +125°C.

Voltage Rating: 10 KVDC applied to R_1 and R_2 in series.

Loadlife: Ratio change with 10 KVDC applied for 1000 Hrs. at +125°C, 0.4% max.

Overvoltage: 1.5 times max. continuous operating voltage for 5 seconds, ratio change 0.5% max.

Thermal Shock: MIL-STD-202, Method 107, Cond. C, ratio change 0.25% max.

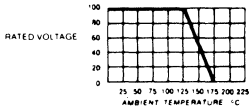
Moisture Resistance: MIL-STD-202, Method 106, ratio change 0.5% max.

Lead Material: Gold Plated.

Encapsulation: Silicone Conformal with Dielectric Withstanding Voltage of 750 volts.

Insulation Resistance: 10,000 Megohms, min.

Derating Curve



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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MR & MS Power Film Resistors

Power Film Resistor Family with Wide Resistance Range and +275° C Maximum Temperature

With power ratings to 15 watts and voltage ratings as high as 6000 volts in an axial-lead resistor with values to 30 Megohms, the Type MS Power Film Resistors deliver the performance capabilities that can simplify circuit design and reduce equipment cost and complexity.

Type MS Power Film Resistors provide all these features in a single resistor:

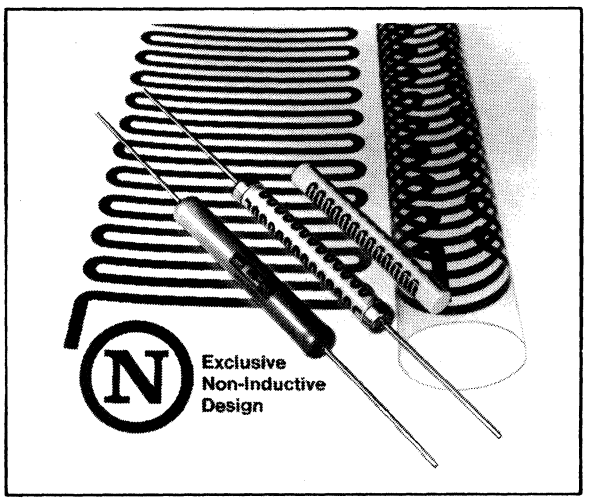
- Full power and voltage ratings, without derating —
  - for non-inductive performance.
  - for high resistance values that extend the critical resistance value up to 10 times.
- Higher voltage ratings without the limitations of minimum wire size and spacing.
- Excellent long-term stability.
  Tests demonstrate typical stability of 0.05% per 1000 hours over extended life.

Micronox® Resistance Films

Type MS performance begins with Micronox® resistance films, the basic element in every Caddock resistor. Produced exclusively by Caddock Electronics, these proven complex oxide films have been used reliably for 20 years in Caddock's precision power resistor products.

Micronox® resistance films are fired directly onto a ceramic core, in air, at 1400° F. These resistance films have demonstrated outstanding stability when exposed to a high ambient temperature, thermal shock and high power densities.

This unique approach to precision power resistors opens new design possibilities by providing wider resistance range, precise temperature characteristics, and higher temperature and power handling capability.



There's no derating of performance with Caddock's Exclusive Non-Inductive Design.

Most models are manufactured with Caddock's patented Exclusive Non-Inductive Design which uses a serpentine resistive pattern that provides for neighboring lines to carry currents in opposite directions, thereby achieving maximum cancellation of flux fields over the entire length of the resistor. This efficient non-inductive construction is accomplished without derating of any performance advantages.

The result is a truly non-inductive resistor that is about as inductive as a straight piece of wire the length of the resistor body. This efficient design means faster setting times and minimum distortion in all types of high frequency circuits.

Carefully Controlled Manufacturing and Test Procedures Assure Compliance with Strict Quality Control Requirements

Manufacturing Control

In addition to these procedures, all Type MS Resistors are produced under strict manufacturing controls with processes which include power conditioning, overvoltage conditioning and maximum temperature conditioning.

Quality Control

From the certification and testing of all materials to the supervision of manufacturing processes, all Caddock Type MS and MR Power Film Resistors are produced under procedures that have been approved for conformance to the requirements of NASA NHB5300.4(1C) and MIL-I-45208 in many recent surveys.

Reliability Verification

Type MS Resistors are included in the Caddock Reliability Testing Program. Conformance to specification parameters including Extended Life, Shock, Vibration and Humidity are verified on a periodic basis. Data from MS resistors can be compared by similarity to other Caddock resistor types, since Type ML, MM, MS, MP, MG and MK represent an identical combination of materials —aluminum oxide substrate, Micronox® resistance film and silicone insulating coating.

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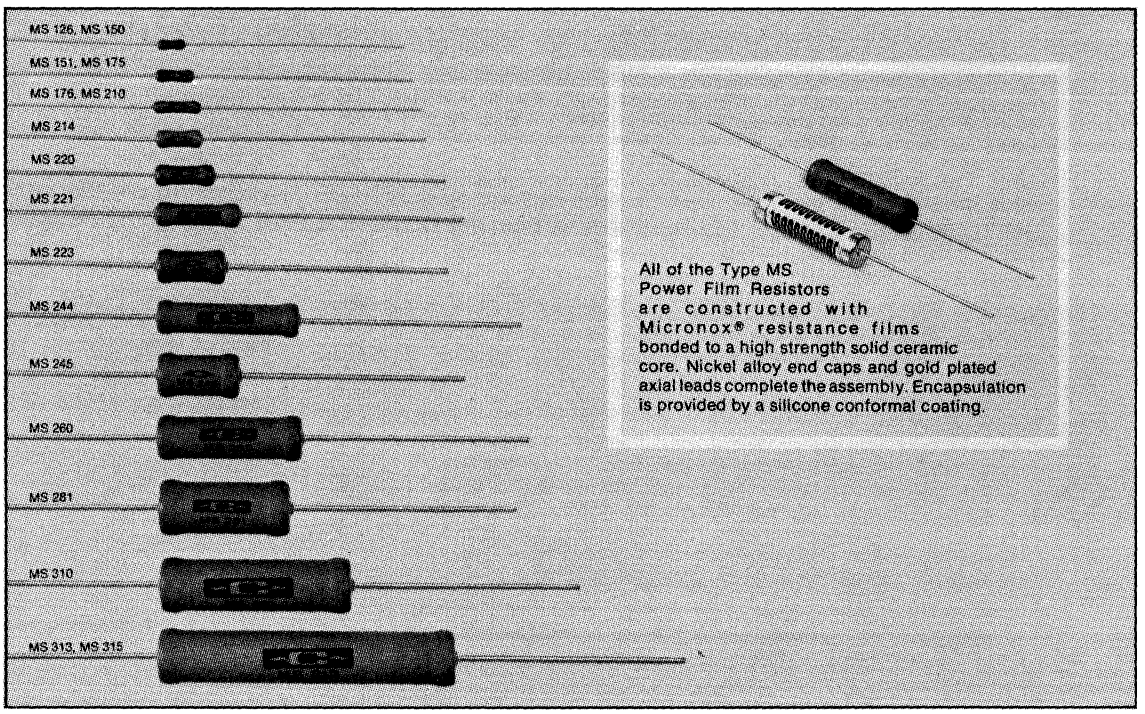
Type MR & MS Power Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS



All of the Type MS Power Film Resistors are constructed with Micronox® resistance films bonded to a high strength solid ceramic core. Nickel alloy end caps and gold plated axial leads complete the assembly. Encapsulation is provided by a silicone conformal coating.

Model No.	Wattage	Max. Voltage	Oper. Temp. (Max.)	Dielect. Str'gth	TC ppm/°C	Resistance Min.	Resistance Max.	Dimensions A	Dimensions B	Dimensions C	Encapsulation	Leadwire
MR 129	.25	200	275°C	500	150	50Ω	500 K	.188 ±.020	.070 ±.015	.020 ±.002	Silicone Conformal	Nickel
MR 154	.40	300	275°C	750	150	50Ω	1 Meg	.250 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Nickel
MR 178	.60	500	275°C	750	150	50Ω	3 Meg	.313 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Nickel
MS 126	.25	200	275°C	500	50	20Ω	1 Meg	.188 ±.020	.070 ±.015	.020 ±.002	Silicone Conformal	Gold Plated
MS 150	.5	—	275°C	500	50	20Ω	2 K	.188 ±.020	.070 ±.015	.020 ±.002	Silicone Conformal	Gold Plated
MS 151	.5	300	275°C	750	50	20Ω	2 Meg	.250 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Gold Plated
MS 175	.75	—	275°C	750	50	20Ω	2 K	.250 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Gold Plated
MS 176	.75	500	275°C	750	50	45Ω	5 Meg	.313 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Gold Plated
MS 210	1.0	—	275°C	750	50	45Ω	3 K	.313 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Gold Plated
MS 214	1.0	500	275°C	750	50	45Ω	5 Meg	.313 ±.030	.109 ±.025	.025 ±.002	Silicone Conformal	Gold Plated
MS 220	2.0	1000	275°C	800	50	20Ω	10 Meg	.400 ±.060	.140 ±.030	.025 ±.002	Silicone Conformal	Gold Plated
MS 221	3.0	1000	275°C	800	50	45Ω	10 Meg	.575 ±.050	.165 ±.030	.032 ±.002	Silicone Conformal	Gold Plated
MS 223	3.0	800	275°C	1000	50	20Ω	4 Meg	.480 ±.060	.230 ±.030	.040 ±.002	Silicone Conformal	Gold Plated
MS 244	4.0	2000	275°C	1000	50	45Ω	15 Meg	.950 ±.060	.230 ±.030	.040 ±.002	Silicone Conformal	Gold Plated
MS 245	4.0	800	275°C	1000	50	20Ω	6 Meg	.570 ±.060	.300 ±.030	.040 ±.002	Silicone Conformal	Gold Plated
MS 260	6.0	2000	275°C	1000	50	45Ω	15 Meg	.970 ±.060	.300 ±.030	.040 ±.002	Silicone Conformal	Gold Plated
MS 281	8.0	2000	275°C	1000	50	45Ω	8 Meg	.910 ±.060	.350 ±.040	.040 ±.002	Silicone Conformal	Gold Plated
MS 310	10.0	4500	275°C	1000	50	45Ω	20 Meg	1.25 ±.070	.350 ±.040	.040 ±.002	Silicone Conformal	Gold Plated
MS 313	12.5	6000	275°C	1000	50	50Ω	30 Meg	2.00 ±.080	.350 ±.040	.040 ±.002	Silicone Conformal	Gold Plated
MS 315	15.0	—	275°C	1000	50	50Ω	1 Meg	2.00 ±.080	.350 ±.040	.040 ±.002	Silicone Conformal	Gold Plated

▭ Models with low inductance construction are in shaded areas.
▭ Models with Caddock's patented Exclusive Non-Inductive Design are in non-shaded areas.

Specifications

Resistance Tolerance: ± 1% (tolerances to 0.1% on special order).

Temperature Coefficient: See Table for TC value. TC referenced to 25°C, ΔR taken at -15°C and +105°C.

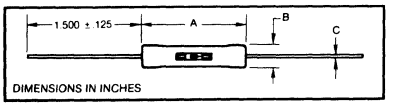
Insulation Resistance: 10,000 Megohms, min.

Overload/Overvoltage: 5 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds. ΔR, 0.5% max. or 0.5 ohms max., whichever is greater.

Thermal Shock: MIL-STD-202, Method 107, Cond. C, ΔR, 0.5% max. or 0.5 ohms max. whichever is greater.

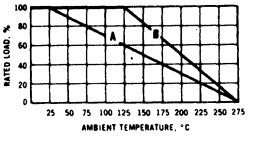
Moisture Resistance: MIL-STD-202, Method 106, ΔR, 0.5% max. or 0.5 ohms max. whichever is greater.

Loadlife: 1000 hours at rated power, ΔR, 0.5% max. or 0.5 ohms max., whichever is greater.



DIMENSIONS IN INCHES

Derating Curve:



A - all MS models except MS 126, MS 151, MS 176.

B - MS 126, MS 151, MS 176, MR 129, MR 154, MR 178.

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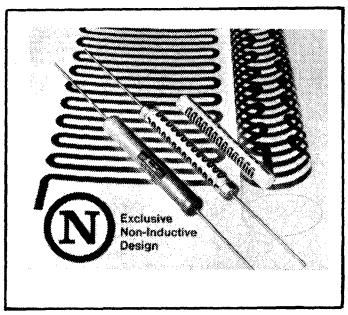
CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type ML & MM Precision Film Resistors

High-Temperature Resistors for Geophysical, Aerospace and Industrial Requirements.

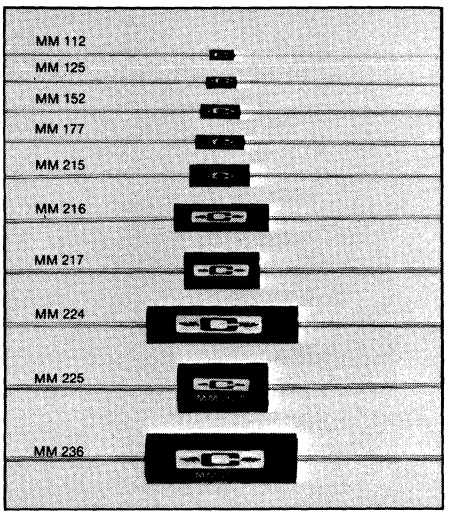
Type MM and ML resistors have a proven performance history in industrial, computer, military and space applications. With power ratings up to 3 watts and resistance values to 15 Megohms, these outstanding resistors are ideal for applications requiring tolerances as close as 0.1% and extended life stability of 0.1% per 1000 hours.

The Type MM Precision Film Resistors provide a maximum operating temperature range of +275°C and both the Type MM and Type ML have temperature coefficients of only 50 PPM/°C over the range from -15°C to +105°C.



Construction includes Micronox® resistance films fired onto a high strength solid ceramic core. End cap construction and a molded case completes the resistor assembly and provides increased resistance to abrasion and solvents.

Most models are manufactured with Caddock's patented Exclusive Non-Inductive Design that provides for neighboring lines to carry currents in opposite directions. This efficient non-inductive construction is accomplished without derating of any performance advantages.



Model No.	Wattage	Max. Voltage	Oper. Temp. (Max.)	Dielect. Str'gth	TC ppm/°C	Resistance Min.	Resistance Max.	Dimensions A	Dimensions B	Dimensions C	Encapsulation
MM 112	.12	200	275°C	400	50	45Ω	500 K	.160 ±.010	.065 ±.010	.016 ±.002	Black Molded Type
MM 125	.25	200	275°C	500	50	30Ω	1 Meg	.188 ±.020	.070 ±.015	.020 ±.002	Black Molded Type
MM 152	.4	300	275°C	750	50	30Ω	2 Meg	.250 ±.020	.094 ±.006	.025 ±.002	Black Molded Type
MM 177	.6	500	275°C	750	50	45Ω	5 Meg	.313 ±.020	.094 ±.006	.025 ±.002	Black Molded Type
MM 215	1.0	800	275°C	1000	50	45Ω	10 Meg	.400 ±.020	.150 ±.010	.025 ±.002	Black Molded Type
MM 216	1.5	1000	275°C	1000	50	45Ω	10 Meg	.625 ±.030	.190 ±.020	.032 ±.002	Black Molded Type
MM 217	1.5	800	275°C	1500	50	30Ω	4 Meg	.500 ±.030	.250 ±.020	.040 ±.002	Black Molded Type
MM 224	2.0	2000	275°C	1500	50	45Ω	15 Meg	1.00 ±.030	.250 ±.020	.040 ±.002	Black Molded Type
MM 225	2.0	800	275°C	2000	50	30Ω	6 Meg	.600 ±.030	.330 ±.020	.040 ±.002	Black Molded Type
MM 236	3.0	2000	275°C	2000	50	45Ω	15 Meg	1.00 ±.030	.330 ±.020	.040 ±.002	Black Molded Type
ML 104	.08	200	175°C	400	50	50Ω	300 K	.160 ±.010	.065 ±.010	.016 ±.002	Transfer Molded Type
ML 114	.15	200	175°C	500	50	50Ω	500 K	.188 ±.020	.070 ±.015	.020 ±.002	Transfer Molded Type
ML 124	.25	300	175°C	750	50	50Ω	600 K	.250 ±.020	.094 ±.006	.025 ±.002	Transfer Molded Type
ML 131	.4	500	175°C	750	50	50Ω	1 Meg	.313 ±.020	.094 ±.006	.025 ±.002	Transfer Molded Type
ML 181	.6	600	175°C	750	50	50Ω	5 Meg	.400 ±.020	.150 ±.010	.025 ±.002	Transfer Molded Type
ML 212	1.0	1000	175°C	1000	50	45Ω	10 Meg	.625 ±.030	.190 ±.020	.032 ±.002	Transfer Molded Type
ML 213	1.0	800	175°C	1500	50	30Ω	.4 Meg	.500 ±.030	.250 ±.020	.040 ±.002	Transfer Molded Type
ML 218	1.25	2000	175°C	1500	50	45Ω	15 Meg	1.00 ±.030	.250 ±.020	.040 ±.002	Transfer Molded Type
ML 219	1.25	800	175°C	2000	50	30Ω	6 Meg	.600 ±.030	.330 ±.020	.040 ±.002	Transfer Molded Type
ML 226	2.0	2000	175°C	2000	50	45Ω	15 Meg	1.00 ±.030	.330 ±.020	.040 ±.002	Transfer Molded Type

Models with low inductance construction are in shaded areas.

Models with Caddock's patented Exclusive Non-Inductive Design are in non-shaded areas.

Specifications

Resistance Tolerance: ± 1% (tolerances to 0.1% on special order).

Temperature Coefficient: 50 PPM/° C referenced to 25° C, ΔR taken at -15° C and +105° C.

Insulation Resistance: 10,000 Megohms, min.

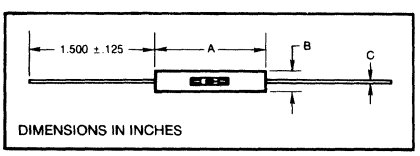
Overload/Overvoltage: 5 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds. ΔR, 0.5% max. or 0.5 ohms max., whichever is greater.

Thermal Shock: MIL-STD-202, Method 107, Cond. F, ΔR, 0.2% max. or 0.5 ohms max. whichever is greater.

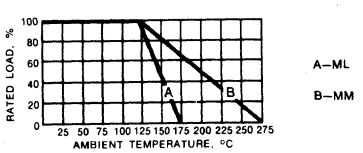
Moisture Resistance: MIL-STD-202, Method 106, ΔR, 0.5% max. or 0.5 ohms max., whichever is greater.

Loadlife: 1000 hours at rated power, ΔR, 0.5% max. or 0.5 ohms max., whichever is greater.

Lead Material: Gold Plated.



Derating Curve:



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Type MV Low Resistance Power Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

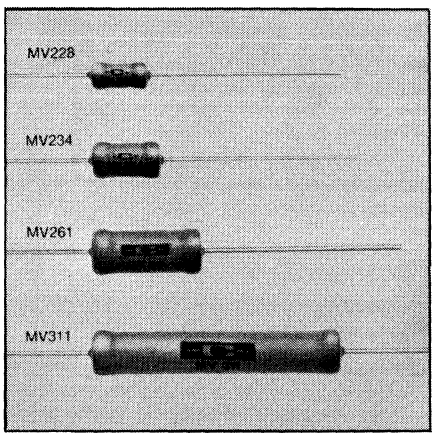
Values from 1 ohm to 50 ohms with Exclusive Non-Inductive Design

Type MV Low Resistance Power Film Resistors combine Caddock's Exclusive Non-Inductive Design with the many high performance capabilities of Micronox® resistance films to achieve these special advantages:

- Low Resistance - from 1 ohm to 50 ohms.
- Maximum Operating Temperature up to +275°C.
- Four Sizes and Power Ratings.
- Full Power Ratings without derating for Non-Inductive Performance.

The interdigitated terminations in the Type MV resistors provide a multiple-path distribution of the current into parallel resistance sections, which provides low resistance values and non-inductive performance. This Exclusive Non-Inductive Performance has provided significant improvements in performance to many types of electronic equipment, including wide-band power amplifiers, high-speed data transmission systems, current switching circuits and current sensing circuits.

For complete quantity price and delivery information on the Type MV resistors, call or write to our main offices in Riverside, California.



Model No.	Watt-age	Oper. Temp. (Max.)	Dielect. Str'gth	Resistance		Dimensions			Encap-sulation	Leadwire
				Min.	Max.	A	B	C		
MV228	2.0	275°C	1000	1Ω	50Ω	.480 ±.060	.230 ±.030	.040 ±.002	Silicone Conformal	Gold Plated
MV234	3.0	275°C	1000	1Ω	50Ω	.570 ±.060	.300 ±.030	.040 ±.002	Silicone Conformal	Gold Plated
MV261	6.0	275°C	1000	1Ω	50Ω	.910 ±.060	.350 ±.030	.040 ±.002	Silicone Conformal	Gold Plated
MV311	10.0	275°C	1000	1Ω	50Ω	2.00 ±.080	.350 ±.040	.040 ±.002	Silicone Conformal	Gold Plated

DIMENSIONS IN INCHES

Specifications:

Resistance Tolerance: ±1%.

Temperature Coefficient: 100 PPM/°C above 5 Ohms, 200 PPM/°C at 5 Ohms or below, from -15°C to +105°C, referenced to +25°C.

Insulation Resistance: 10,000 Megohms, minimum.

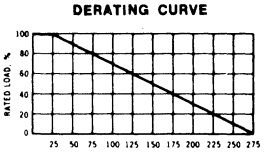
Overload: 5 times rated power for 5 seconds, ΔR 1% max.

Thermal Shock: MIL-STD-202, method 107, cond. C, ΔR 1% max.

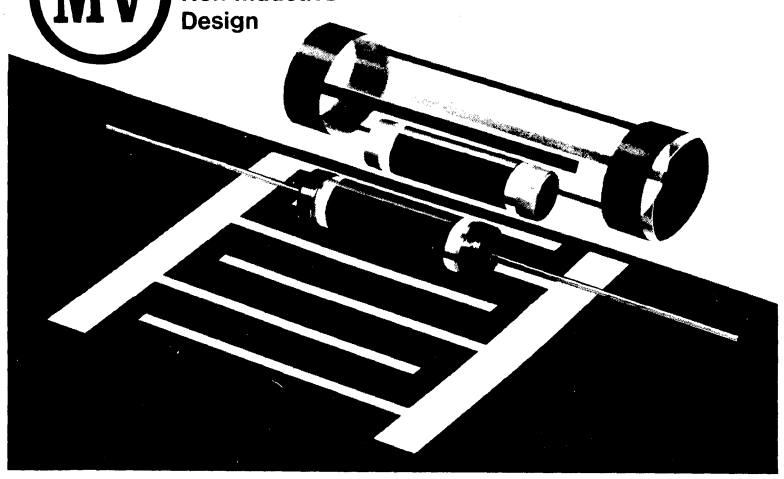
Moisture Resistance: MIL-STD-202, method 106, ΔR 1% max.

Loadlife: 1000 hours at rated power, ΔR 1% max.

DERATING CURVE



MV Exclusive Non-Inductive Design



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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MK Precision Power Radial-Lead Film Resistors

Radial-Lead Resistors with Resistance Range from 10 ohms to 100 Megohms.

Here are the low cost precision resistors that provide high density packaging in large volume printed circuit applications. Available in two miniature rectangular package configurations with standard lead spacings, Type MK Precision Film Resistors now cover the entire resistance range from 10 ohms to 100 Megohms.

Constructed with Caddock Micronox® resistance films fired onto a solid ceramic substrate, Type MK Precision Film Resistors combine all of these outstanding advantages:

- **±1% resistance tolerance is standard** - tolerances to ±0.1% are available on special order.
- **Operating temperatures** - from -55° C to +175°C.
- **Full power rating at +125° C.**
- **Temperature Coefficient is only 50 PPM/°C up to 10 Megohms and 80 PPM/°C up to 100 Megohms** - referenced to 25°C with the ΔR taken at -15°C and +105°C.
- **Extended life stability is typically better than 0.1% per 1000 hours.**
- **Caddock's Non-Inductive Performance** - provides faster settling times and minimum distortion in all types of high frequency circuits.

This combination of performance advantages in a small, standardized case can simplify many engineering and production problems:

One size of Type MK resistor can replace many sizes of axial lead resistors.

This table of "RN" style axial lead resistors shows the many sizes and power ratings that can be replaced with either of the two models of Type MK Precision Film Resistors within the maximum allowable voltage ratings.

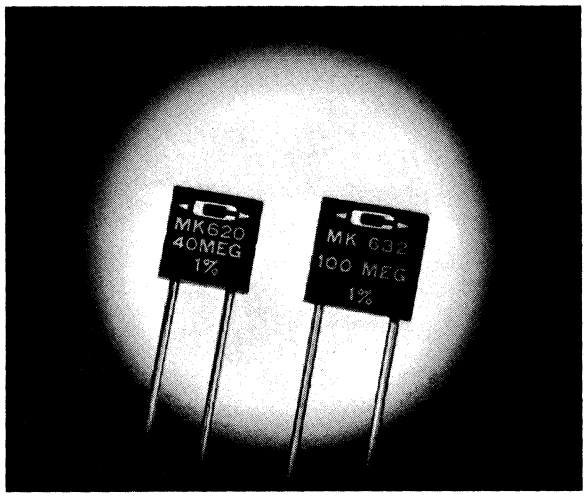
Comparison of Type MK and "RN" Ratings and Dimensions

Resistor Type	Power Rating	Maximum Resistance	Mounting Hole Spacing	
MK 120 or MK 620	**.50 WT.**	**40 Megohms**	**.150**	Even the smallest Type MK resistor can replace all of these RN type resistors.
MK 132 or MK 632	**.75 WT.**	**100 Megohms**	**.200**	
RN50	.05 WT	1 Megohm	.400	
RN 55	.10 WT	5 Megohms	.500	RN 55
RN60	.125 WT	10 Megohms	.625	RN 60
RN65	.25 WT	20 Megohms	.875	RN 65
RN70	.50 WT	40 Megohms	1.000	RN 70

All outline drawings full size — dimensions in inches.

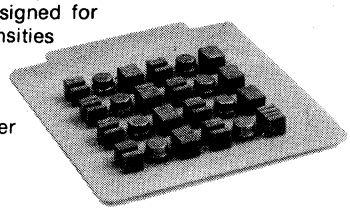
The largest Type MK — rated at .75 watt — requires less board space than even the 1/20th watt RN50.

The smallest Type MK — rated at .5 watt — provides power dissipation **equal** to the RN70 resistor. The RN70 resistor requires a mounting hole spacing of 1" and a side-to-side spacing of .250 inches, resulting in a total mounting area of .25 square inches — **10 times the area required for a .75 watt Type MK resistor!**



One standard resistor configuration can simplify board layouts.

With the exceptionally wide range of resistances that are available in each model of Type MK Precision Film Resistors, circuits can now be designed for maximum packaging densities without the need for leaving extra space where resistor value changes can require larger resistors or non-uniform lead spacings.



Standardization of resistor size can speed assembly procedures and reduce procurement costs.

The standardization of resistor size can pay additional dividends by simplifying assembly procedures. The radial leads do not require additional bending prior to insertion, and the standard lead spacing can reduce the time required for assembly.

The combination of higher power rating and smaller size can also lower procurement costs. By reducing the wide variety of sizes and types of axial lead resistors to a single, standardized resistor type, unit prices can be lowered and inventory problems simplified. For specific price and delivery information, call or write to the main offices of Caddock Electronics in Riverside, California.

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Type MK Precision Power Radial-Lead Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MK Precision Film Resistors — Standard Resistance Range

Model No.	Wattage	Max. Voltage	Oper. Temp. (Max.)	Dielect. Str'gth	TC ppm/°C†	Resistance Min.	Resistance Max.	Dimensions	Encapsulation	Leadwire
MK 120	.5	200	175°C	300	50	30 Ω	2 Meg.	Ref. Case "A" Dwg.	Transfer Molded Type	Tinned Copper
MK 132	.75	400	175 C	400	50	30 Ω	5 Meg.	Ref. Case "B" Dwg.	Transfer Molded Type	Tinned Copper

Resistance Tolerance: ±1% (tolerance to ±.1% on special order).
Operating Temperature: −55°C to 175°C.
Overload: 5 times rated power for 5 seconds, R shift .15% max., or .2 ohms max., whichever is greater.
Overvoltage: 1.5 times max. voltage for 5 seconds, R shift .15% max., or .2 ohms max., whichever is greater.
Thermal Shock: Mil-Std-202, Method 107, Cond. B, shift .2% max., or .2 ohms, max., whichever is greater.
Moisture Resistance: Mil-Std-202, Method 106, R shift .5% max., or .2 ohms, whichever is greater.
Loadlife: 1000 hours at rated power, R shift .4% max., or .2 ohms, whichever is greater.
Insulation Resistance: 10,000 Megohms, minimum.

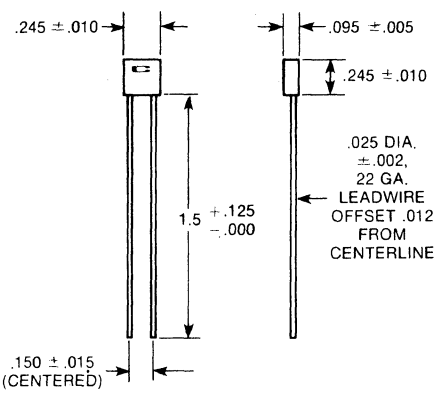
Type MK Precision Film Resistors — Extended Resistance Range

Model No.	Wattage	Max. Voltage	Oper. Temp. (Max.)	Dielect. Str'gth	TC ppm/°C†	Resistance Min.	Resistance Max.	Dimensions	Encapsulation	Leadwire
MK 620	.5	200	175°C	300	80	2 Meg.	40 Meg.	Ref. Case "A" Dwg.	Transfer Molded Type	Tinned Copper
MK 632	.75	400	175°C	400	80	5.1 Meg.	100 Meg.	Ref. Case "B" Dwg.	Transfer Molded Type	Tinned Copper

Resistance Tolerance: ±1% (consult factory for tighter tolerances).
Operating Temperature: −55°C to 175°C.
Overvoltage: 1.5 times max. voltage for 5 seconds, R shift .5% max.
Thermal Shock: Mil-Std-202, Method 107, Cond. B, R shift .5% max.
Moisture Resistance: Mil-Std-202, Method 106, R shift .5% max.
Loadlife: 1000 hours at rated power, R shift .5% max.
Insulation Resistance: 10,000 Megohms, minimum.

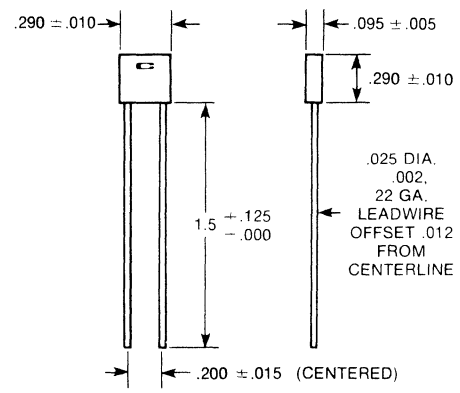
†Temperature Coefficient: Referenced to 25°C, ΔR taken at −15°C and +105°C

Case "A"
Model MK 120 and MK 620

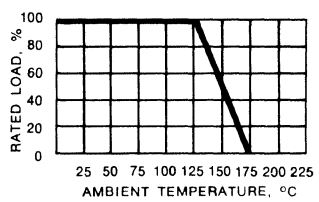


ALL DIMENSIONS IN INCHES

Case "B"
Model MK 132 and MK 632



DERATING CURVE



CADDOCK
HIGH PERFORMANCE FILM RESISTORS

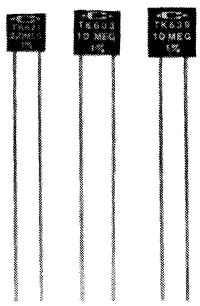
Type TK Low TC Precision Radial-Lead Film Resistors

Small Package with Low TC of 10 PPM/°C and Resistance Range from 1 kohm to 10 Megohms.

Caddock introduces a new design element for precision electronic circuitry — an advanced technology breakthrough that solves many critical circuit stability problems — the **Type TK Low TC Precision Radial-Lead Film Resistors with the Tetrinox® resistance system.**

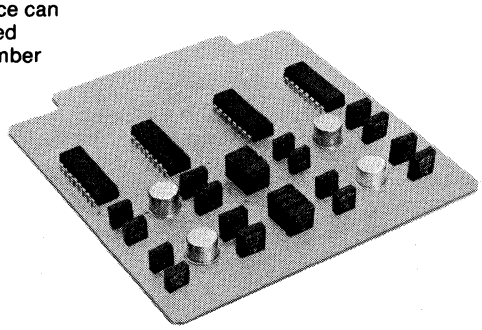
Type TK Low TC Precision Radial-Lead Film Resistors provide a combination of performance advantages never before available in a resistive component:

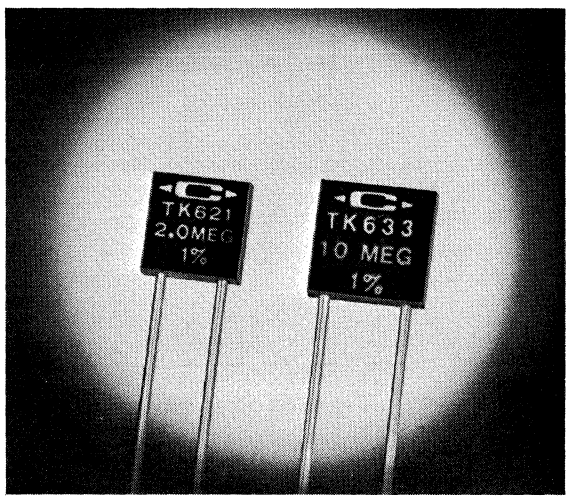
- **Temperature Stability** – better than 10 PPM/°C over the entire temperature range from −55°C to +125°C!
- **Long-Term Absolute Stability** – better than ±0.05% per 2000 hours of operation.
- **Extended Resistance Range** – from 1000 ohms to 10 Megohms.
- **Precision Tolerances** – ±1% is standard, and tolerances as close as ±0.05% are available.
- **Wide Operating Temperature Range** – from −55°C to +175°C.
- **Small Size** – with three miniature rectangular cases for maximum packaging density and minimum mounting area.
- **High Power Density** – with power ratings of .2 watt and .3 watt in molded cases, the largest of which is a standard CK 06 package.



(Photos show resistors full size)

- **Caddock's Non-Inductive Performance** - provides faster settling times and minimum distortion in all types of high frequency circuits.
- **High Density Packaging** - the radial-lead mounting and small rectangular case of the Type TK resistors permits high packaging densities in low profile circuitry. And because the three models of the Type TK resistors are available in an exceptionally wide range of resistance values, lead spacing and mounting space can be standardized in a larger number of designs.





Building on over 20 years of experience with our unique complex-oxide technology, Caddock has perfected the Tetrinox® resistance system — the first high resistance system to provide a TC that is well within 10 PPM/°C and that is also essentially linear over the entire temperature range from -55°C to +125°C.

The exceptional performance of Type TK resistors can achieve improvements in many circuit applications:

Low TC "Matched-Pair" Voltage Dividers Can be Assembled Without Pre-Selection of Resistors.

An important application for Type TK resistors is in "matched-pair" voltage dividers where the low 10 PPM/°C temperature coefficient provides ratio tracking of less than 20 PPM/°C without resistor pre-selection or special testing.

With factory selection, Type TK resistor pairs can be matched to within 1 PPM/°C.

Extended Resistance Range Reduces Power Requirements

Because the Type TK resistors provide resistance values as high as 10 Megohms — values that are up to 100 times higher than other types of ultra-low TC resistors — engineers can now design precision circuits with lower current drain and lower power requirements.

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Type TK Low TC Precision Radial-Lead Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type TK Low TC Precision Radial-Lead Film Resistors — Standard Resistance Range

Model No.	Temperature Coefficient ppm/°C †	Resistance Min.	Resistance Max.	Wattage @ +125°C	Max. Working Voltage	Dielect. Str'gth	Dimensions	Encapsulation	Leadwire
TK121	5, 10 or 20	1K	500K	.2	200	300	Ref. Case "A" Dwg.	Transfer Molded Type	Tinned Copper
TK133	5, 10 or 20	1K	1.5 Meg.	.3	300	400	Ref. Case "B" Dwg.	Transfer Molded Type	Tinned Copper
TK139	5, 10 or 20	1K	1.5 Meg.	.3	300	400	Ref. Case "C" Dwg.	Transfer Molded Type	Tinned Copper

Temperature Coefficient Identification:
5 ppm/°C Silver Dot
10 ppm/°C No Dot
20 ppm/°C Green Dot

† Specify TC when ordering. 10 PPM/°C is standard.

Resistance Tolerance: ±1% Standard. (Tolerances to ±0.05% on special order.)

Operating Temperature: −55°C to +175°C.

TC Temperature Range: −55°C to +125°C.

Overload:* 6.25 times rated power for 5 seconds at voltages not to exceed 1.5 times maximum rated working voltage, R shift less than 0.05%.

Thermal Shock: Mil-Std-202, Method 107, Condition B, R shift less than 0.05%.

Low Temperature Operation:* R shift less than 0.02%.

Dielectric Withstanding Voltage:* R shift less than 0.02%.

Moisture Resistance:* Mil-Std-202, Method 106, R shift less than 0.02%.

Load Life:* 2000 hours at +125°C, R shift less than 0.05%.

Shelf Life (Typical): 25 ppm/year.

Insulation Resistance: 10,000 Megohms.

Vibration:* R shift less than 0.01%.

Shock:* R shift less than 0.02%.

*Test methods per specifications and procedures of Mil-R-55182/9.

Type TK Low TC Precision Radial-Lead Film Resistors — Extended Resistance Range

Model No.	Temperature Coefficient ppm/°C †	Resistance Min.	Resistance Max.	Wattage @ +125°C	Max. Working Voltage	Dielect. Str'gth	Dimensions	Encapsulation	Leadwire
TK621	5, 10 or 20	501K	2 Meg	Limited by Maximum Working Voltage	200	300	Ref. Case "A" Dwg.	Transfer Molded Type	Tinned Copper
TK633	5, 10 or 20	1.51 Meg.	10 Meg.		300	400	Ref. Case "B" Dwg.	Transfer Molded Type	Tinned Copper
TK639	5, 10 or 20	1.51 Meg.	10 Meg.		300	400	Ref. Case "C" Dwg.	Transfer Molded Type	Tinned Copper

Temperature Coefficient Identification:
5 ppm/°C Silver Dot
10 ppm/°C No Dot
20 ppm/°C Green Dot

† Specify TC when ordering. 10 PPM/°C is standard.

Resistance Tolerance: ±1% Standard. (Tolerances to ±0.05% on special order.)

Operating Temperature: −55°C to +175°C.

TC Temperature Range: −55°C to +105°C.

Overload:* 1.5 times maximum rated working voltage for 5 seconds, R shift less than 0.2%.

Thermal Shock: Mil-Std-202, Method 107, Condition B, R shift less than 0.1%.

Low Temperature Operation:* R shift less than 0.05%.

Dielectric Withstanding Voltage:* R shift less than 0.05%.

Moisture Resistance:* Mil-Std-202, Method 106, R shift less than 0.05%.

Load Life:* 2000 hours at +125°C, R shift less than 0.2%.

Shelf Life (Typical): 200 ppm/year.

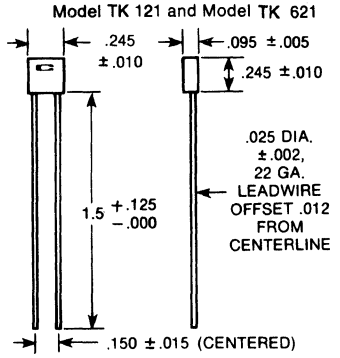
Insulation Resistance: 10,000 Megohms.

Vibration:* R shift less than 0.05%.

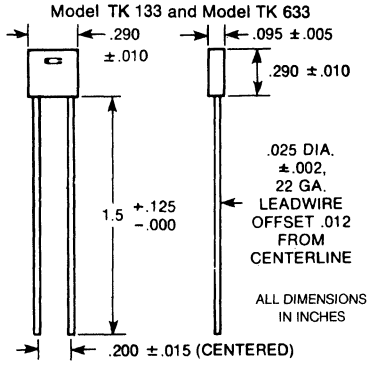
Shock:* R shift less than 0.05%.

*Test methods per specifications and procedures of Mil-R-55182/9.

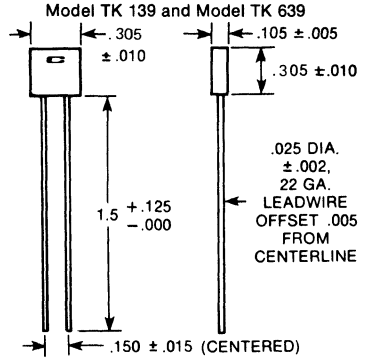
Case "A"
Model TK 121 and Model TK 621



Case "B"
Model TK 133 and Model TK 633



Case "C"
Model TK 139 and Model TK 639

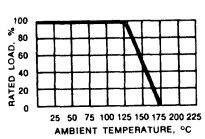


Ordering Information

TK633 - 10 Meg - 0.1% - 10 PPM/°C

- Model Number
- Resistor Value
- Tolerance
- Temperature Coefficient

Derating Curve:



APPLIES TO ALL MODELS OF TYPE TK RESISTORS

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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

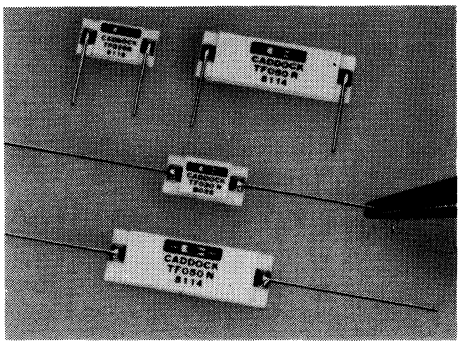
Type TF Low TC Ultra-Precision Film Resistors

Absolute TC to 5 PPM/°C — Values from 1 kohm to 125 Megohms — Absolute Tolerance to ±0.01%.

Type TF precision resistors employ the Caddock Tetrinox® resistance films — the resistance system that sets a new standard for high value, ultra-stable precision resistors that provide an exceptional combination of performance characteristics:

- **Ultra-Precision** – Seven standard resistance tolerances from ±1% to ±0.01%
- **A Wide Range of Resistance Values** – from 1 kohm to 125 Megohms.
- **Low Temperature Coefficients** – 5 PPM/°C, 10 PPM/°C and 15 PPM/°C.
- **Long-Term Stability** – to 0.01% per 1000 hours.

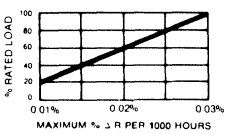
This completely new approach to quantity production of ultra-precision resistors is the result of combining our unique complex-oxide technology with an advanced high thru-put laser manufacturing capability.



Type TF - Standard Resistance Range - 1 kohm to 10 Megohms.

Model Number		Wattage @ +70°C.	Maximum Continuous Oper. Voltage	Resistance		Dimensions	
Axial Leads	Radial Leads			Min.	Max.	A	B
TF 020 N	TF 020 R	.33	300	1 K	2 Meg	.75 ±.020	.375 ±.020
TF 050 N	TF 050 R	.75	1400	10 K	10 Meg	1.5 ±.020	.50 ±.020

Load Stability:



Shelf Life: Typically 0.005% per year.

Type TF - Extended Resistance Range - 2 Megohms to 125 Megohms.

Model Number		Wattage @ +70°C.	Maximum Continuous Oper. Voltage	Resistance		Dimensions	
Axial Leads	Radial Leads			Min.	Max.	A	B
TF 626 N	TF 626 R	.33	300	2.01 Meg	35 Meg	.75 ±.020	.375 ±.020
TF 656 N	TF 656 R	.75	1400	10.01 Meg	125 Meg	1.5 ±.020	.50 ±.020

Load Stability: 1000 hours at rated voltage at +70°C, maximum ΔR 0.03%.

Shelf Life: Typically 0.010% per year.

Specifications

Apply to all Type TF resistor models

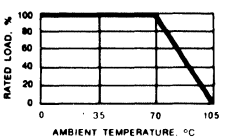
Absolute Temperature Coefficient: 5 PPM/°C, 10 PPM/°C or 15 PPM/°C. Referenced to 25°C, ΔR taken at -15°C and +105°C.

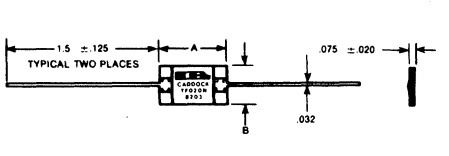
Resistance Tolerance: ±0.01%, ±0.025%, ±0.05%, ±0.10%, ±0.25%, ±0.50%, ±1.0%.

Storage Temperature: -55°C to +105°C.

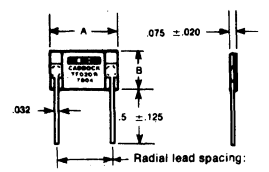
Leadwire: Tinned Copper.

Derating Curve:





ALL DIMENSIONS IN INCHES



Ordering Information

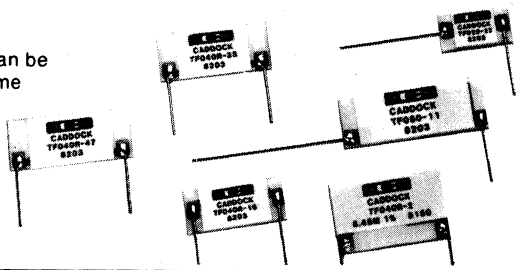
TF050R - 10 Meg - 0.01% - 10 PPM/°C

Model Number | Resistor Value | Tolerance | Temperature Coefficient

Custom Type TF Resistors

Additional cost savings can be realized when your high volume ultra-precision Type TF resistor is optimized for:

- Voltage rating.
- Power rating.
- Mechanical configuration.
- Ratio matched sets.



And for special requirements, custom Type TF resistors are available with:

- TCs of 5 ppm/°C, 10 ppm/°C 15 ppm/°C or 25 ppm/°C.
- Shelf stability of 0.0025% per year.

Type TF resistors can also be produced with custom-spaced radial leads that will plug directly into your existing circuit layouts.

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Type T912 and T914 Precision Resistor Networks

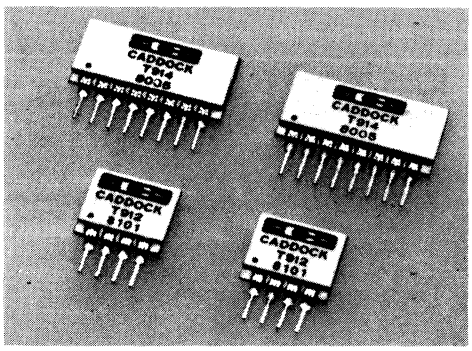
CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Resistor Pairs and Quads with Matched Characteristics for Precision Analog Circuits.

Type T912 and T914 Precision Resistor Networks are constructed with Caddock Tetrinox® resistance films to achieve the matched resistor characteristics and stability required by highly accurate amplifier circuits, voltage reference circuits and precision bridge circuits.

- **Ratio Tolerances** – from ±0.1% to ±0.01%.
- **Ratio Temperature Coefficients** – 10 PPM/°C, 5 PPM/°C or 2 PPM/°C.
- **Absolute Temperature Coefficient** – 25 PPM/°C.
- **Ratio Stability of Resistance at Full Load for 2000 hours** – Within ±0.01%.
- **Shelf Life Stability of Ratio for 6 Months** – Within ±0.005%.

Both the T912 and T914 are available in 14 standard resistance values between 1000 ohms and 1 Megohm. Caddock's high thru-put manufacturing capability assures delivery of prototype and large-volume production quantities from stock to within 6 weeks after receipt of order.



Standard Type T912 and T914 Precision Resistor Networks

In addition to the 14 standard **equal value** models of the Type T912 and T914, the Type T912 can also be ordered with —

- **10:1 resistance ratio** — for use with gain-setting amplifiers.
- **9:1 resistance ratio** — for use in voltage reference dividers.

T912 - A 10K - 010 - 02

Model Number

Ratio Code Letter: *
- **A** - T912 with R_1-R_2 where R_2 = 10R_1
  - 1K:10K 5K:50K 20K:200K 40K:400K
  - 2K:20K 10K:100K 25K:250K 50K:500K
  - 100K:1 Megohm
- **B** - T912 with R_1-R_2 where R_2 = 9R_1
  - 1K:9K 5K:45K 20K:180K 40K:360K
  - 2K:18K 10K:90K 25K:225K 50K:450K
  - 100K:900K
- **No Letter** — T912 with R_1 = R_2
- **No Letter** — T914 with R_2 = R_3 = R_4

Ratio Temperature Track: * (0°C to 70°C)
-10 = 10 PPM/°C -05 = 5 PPM/°C
-02 = 2 PPM/°C

Ratio Tolerance: * -100 = 0.1% -020 = 0.02%
-050 = 0.05% -010 = 0.01%

Standard Resistance Values: * (R_1)

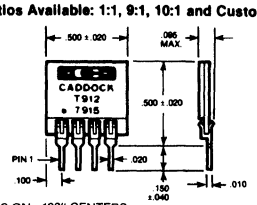
1K	10K	40K	200K	500K
2K	20K	50K	250K	1 Meg.
5K	25K	100K	400K	

Special or mixed resistance values are available as custom networks. See the custom section at the bottom of this page.

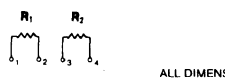
*(This information appears on the back side of the network)

Type T912

Ratios Available: 1:1, 9:1, 10:1 and Custom.

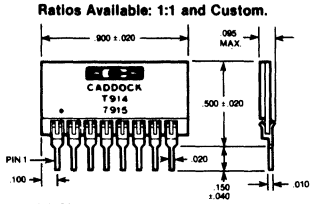


4 PINS ON .100" CENTERS

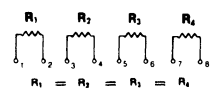


Type T914

Ratios Available: 1:1 and Custom.



8 PINS ON .100" CENTERS



$R_1 = R_2 = R_3 = R_4$

ALL DIMENSIONS IN INCHES

Specifications

Absolute Tolerance: 0.1% for all resistors.

Absolute Temperature Coefficient: ±25 PPM/°C. Referenced to 25°C, ΔR taken at 0°C and 70°C.

Voltage Rating: 30 Volts DC or RMS AC applied to R_1, R_2, R_3, or R_4.

Power Rating: 0.10 watt applied to R_1, R_2, R_3,R_4 (not to exceed rated voltage).

Package Power Rating: Type T912, 0.200 watt. Type T914, 0.400 watt.

Storage Temperature: -55°C to +105°C.

Insulation Resistance Between Isolated Pins: Pin 2 to Pin 3, Pin 4 to Pin 5, or Pin 6 to Pin 7, 1000 Megohms, minimum.

Dielectric Strength Between Isolated Pins: 50 volts RMS AC.

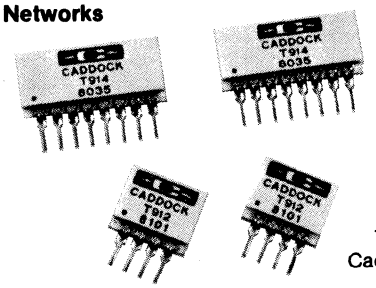
Ratio Stability Under Load: Ratio change between any two resistors in the network under full load for 2000 hours at 70°C, 0.01% maximum.

Shelf Stability of Ratio: Six months at shelf conditions, 50 PPM max.

Custom Model T912 and T914 Precision Resistor Networks

For applications requiring non-standard resistance values, the T912 and T914 custom configurations can include these special features:

- Mixed resistance values with a maximum ratio of 250-to-1. (Example: 1.0 Megohm and 4K)
- Absolute TC as low as 15 PPM/°C.
- Ratio TC as low as 2 PPM/°C.
- Custom voltage ratings.
- Matched resistors of any special value between 1K and 2 Megohms.



Identification of the electrical characteristics of each T912 and T914 resistor network is included on the back side of the network.

For performance, price and availability of custom T912 and T914 resistor networks, contact Caddock Electronics' main offices in Riverside, California.

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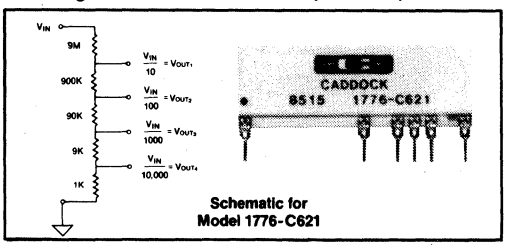
CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type 1776 Precision Decade Resistor Voltage Dividers

Input Voltage Dividers for Digital Multimeters and Range-Switching Instruments.

The exceptional performance of this extensive 'family' of Type 1776 Precision Decade Resistor Voltage Dividers has been achieved through the special combination of advantages provided by Caddock's Tetrinox® resistance films. This advanced film resistor technology provides the performance characteristics required by the precision input signal circuits of both bench-type and laboratory digital instruments.

In addition to requiring less board space, these compact precision resistor networks deliver higher performance than selected discrete resistor sets and thin-film networks.



Schematic for Model 1776-C621

There are now 36 standard models in the expanded 'family' of Type 1776 precision resistor networks that include -

- 3, 4 and 5-decade voltage dividers with ratios from 10:1 to 10,000:1.
- 1,200 volts continuous ratings and overvoltage to 2,000 volts.
- Many combinations of Ratio and Absolute Tolerances and Ratio and Absolute Temperature Coefficients.

For complete information on quantity price and delivery, call or write our main offices in Riverside, California.

Model No.	Resistance Values					Fig.	Voltage Rating ⑦	Absolute Tolerance %	Ratio Tolerance % ①	Absolute TC ppm/°C	Ratio TC ppm/°C ②	Voltage Coefficient of Ratio ppm/volt ③	Ratio Stability % Change in Ratio		
	R_1	R_2	R_3	R_4	R_5								Load Life ④	Shelf Life ⑤	Over-Voltage ⑥
1776-C61	9 Meg.	900K	90K	9K	900	6	1200	0.1	0.1	30	10	0.1	0.01	0.005	0.01
1776-C611	9 Meg	900K	90K	9K	900	6	1200	0.1	0.05	30	10	0.1	0.01	0.005	0.01
1776-C62	9 Meg	900K	90K	9K	1K	6	1200	0.1	0.1	30	10	0.1	0.01	0.005	0.01
1776-C621	9 Meg	900K	90K	9K	1K	6	1200	0.1	0.05	30	10	0.1	0.01	0.005	0.01
1776-C732	9 Meg	900K	90K	9K	900	7	1200	0.25	0.25	50	50	0.5	0.04	0.02	0.04
1776-C73	9 Meg	900K	90K	9K	900	7	1200	0.1	0.1	50	50	0.5	0.04	0.02	0.04
1776-C742	9 Meg	900K	90K	9K	1K	7	1200	0.25	0.25	50	50	0.5	0.04	0.02	0.04
1776-C74	9 Meg	900K	90K	9K	1K	7	1200	0.1	0.1	50	50	0.5	0.04	0.02	0.04
1776-232	9 Meg	900K	90K	9K	900	3	1200	0.25	0.25	50	50	0.3	0.04	0.02	0.04
1776-23	9 Meg	900K	90K	9K	900	3	1200	0.1	0.1	50	50	0.2	0.02	0.01	0.02
1776-231	9 Meg	900K	90K	9K	900	3	1200	0.1	0.05	50	50	0.2	0.02	0.01	0.02
1776-242	9 Meg	900K	90K	9K	1K	3	1200	0.25	0.25	50	50	0.3	0.04	0.02	0.04
1776-24	9 Meg	900K	90K	9K	1K	3	1200	0.25	0.1	50	50	0.2	0.02	0.01	0.02
1776-241	9 Meg	900K	90K	9K	1K	3	1200	0.25	0.05	50	50	0.2	0.02	0.01	0.02
1776-10	9 Meg	900K	90K	10K	N/A	4	1200	+0, -0.5	0.1	30	10	0.02	0.01	0.005	0.01
1776-105	9 Meg	900K	90K	10K	N/A	4	1200	+0, -0.5	0.1	30	5	0.02	0.01	0.005	0.01
1776-C10	9 Meg	900K	90K	10K	N/A	9	1200	+0, -0.5	0.1	30	10	0.02	0.01	0.005	0.01
1776-C105	9 Meg	900K	90K	10K	N/A	9	1200	+0, -0.5	0.1	30	5	0.02	0.01	0.005	0.01
1776-1	9 Meg	900K	90K	10K	N/A	2	1200	0.25	0.05	30	10	0.02	0.01	0.005	0.01
1776-14	9 Meg	900K	90K	10K	N/A	2	1200	0.25	0.1	30	10	0.02	0.01	0.005	0.01
1776-8	9.9 Meg	90K	10K	N/A	N/A	1	1200	0.25	0.1	30	25	0.2	0.02	0.01	0.02
1776-81	9.9 Meg	90K	10K	N/A	N/A	1	1200	0.25	0.05	30	25	0.2	0.02	0.01	0.02
1776-9	9.9 Meg	90K	10K	N/A	N/A	1	1200	0.25	0.1	30	10	0.02	0.01	0.005	0.01
1776-91	9.9 Meg	90K	10K	N/A	N/A	1	1200	0.25	0.05	30	10	0.02	0.01	0.005	0.01
1776-912	9.9 Meg	90K	10K	N/A	N/A	1	1200	0.25	0.02	30	5	0.02	0.01	0.005	0.01
1776-C4	10 Meg	1.1111M	101.01K	10.01K	1.0001K	8	1200	0.25	0.25	30	10	0.1	0.01	0.005	0.01
1776-C44	10 Meg	1.1111M	101.01K	10.01K	1.0001K	8	1200	0.1	0.1	30	10	0.1	0.01	0.005	0.01
1776-C441	10 Meg	1.1111M	101.01K	10.01K	1.0001K	8	1200	0.1	0.05	30	10	0.1	0.01	0.005	0.01
1776-C3	10 Meg	1.1111M	101.01K	10.01K	1.0001K	8	1200	0.5	0.5	50	50	0.5	0.04	0.02	0.04
1776-C34	10 Meg	1.1111M	101.01K	10.01K	1.0001K	8	1200	0.25	0.25	50	50	0.5	0.04	0.02	0.04
1776-C532	900K	90K	9K	900	N/A	5	750	0.25	0.25	25	25	0.4	0.02	0.01	0.02
1776-C53	900K	90K	9K	900	N/A	5	750	0.1	0.1	25	15	0.3	0.02	0.01	0.02
1776-C531	900K	90K	9K	900	N/A	5	750	0.1	0.05	25	15	0.3	0.02	0.01	0.02
1776-C542	900K	90K	9K	1K	N/A	5	750	0.25	0.25	25	25	0.4	0.02	0.01	0.02
1776-C54	900K	90K	9K	1K	N/A	5	750	0.1	0.1	25	15	0.3	0.02	0.01	0.02
1776-C541	900K	90K	9K	1K	N/A	5	750	0.1	0.05	25	15	0.3	0.02	0.01	0.02

Specifications

(Numbers inside circles reference columns in Model No. table.)

① **Ratio Tolerance:** Maximum ratio difference between two resistors in the network. (See the specific Figures for the Ratio Definition.)

② **Ratio Temperature Coefficient:** Ratio track from 0°C to +70°C.

③ **Voltage Coefficient of Ratio (ppm/volt):** R_1 in series with any combination of R_2, R_3, R_4 and R_5, 100 volts to rated voltage.

④ **Load Life:** Ratio stability of resistance under full load, rated voltage applied to R_1 in series with any combination of R_2, R_3, R_4 and R_5.

⑤ **Shelf Stability of Ratio:** Six months at shelf conditions.

⑥ **Overvoltage:** Maximum voltage of 1.67 times rated DC voltage. Volts DC or peak AC applied to R_1 and any combination of R_2, R_3, R_4 and R_5 in series with R_1 for 10 seconds.

⑦ **Voltage Rating:** DC or RMS AC voltage applied to R_1 in series with any combination of R_2, R_3, R_4 and R_5.

Storage Temperature: -55°C to +85°C.

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Type 1776 Precision Decade Resistor Voltage Dividers

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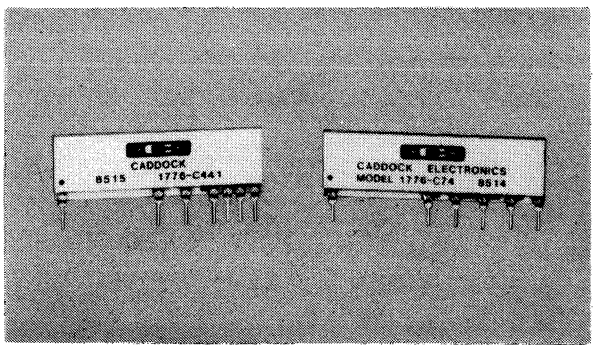


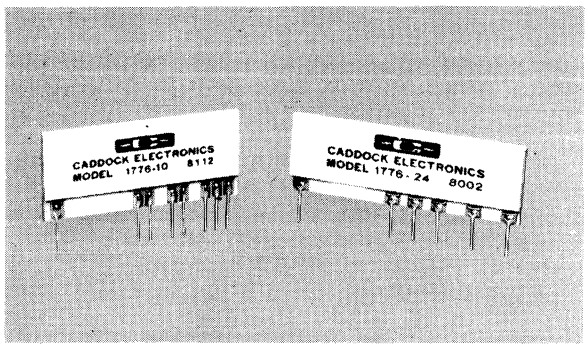
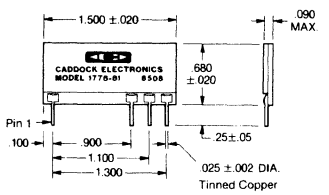


Figure 1



RATIO DEFINITION:
ALL RESISTORS RATIO ONE ANOTHER

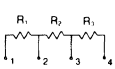
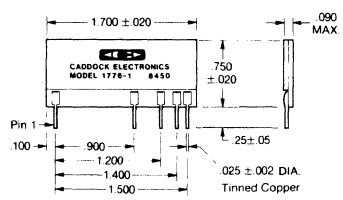


Figure 2



RATIO DEFINITION:
ALL RESISTORS RATIO ONE ANOTHER

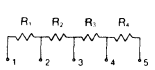
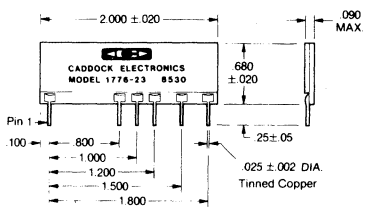
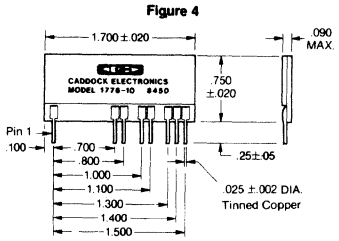


Figure 3



RATIO DEFINITION:
ALL RESISTORS RATIO ONE ANOTHER

Figure 4



RATIO DEFINITION:
ALL RESISTORS RATIO ONE ANOTHER

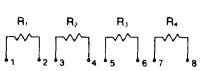
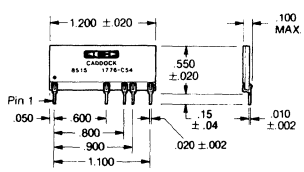


Figure 5



RATIO DEFINITION:
ALL RESISTORS RATIO ONE ANOTHER

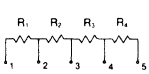
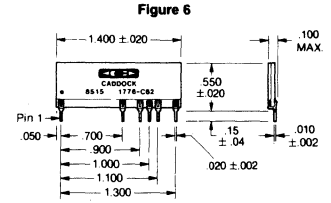
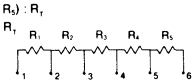


Figure 6

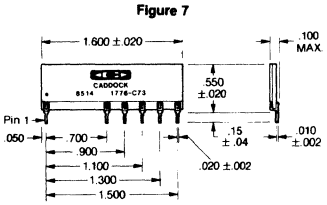


RATIO DEFINITION: Where $R_T = R_1 + R_2 + R_3 + R_4 + R_5$
RATIO 1 $(R_2 + R_3 + R_4 + R_5) : R_1$
RATIO 2 $(R_3 + R_4 + R_5) : R_1$
RATIO 3 $(R_4 + R_5) : R_1$
RATIO 4 $(R_5) : R_1$



ALL DIMENSIONS IN INCHES

Figure 7



RATIO DEFINITION:
ALL RESISTORS RATIO ONE ANOTHER

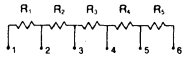
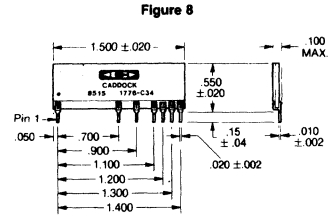
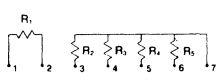


Figure 8

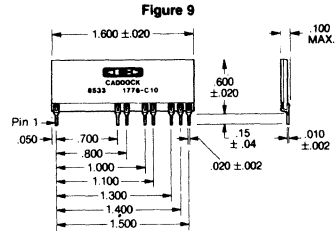


RATIO DEFINITION:

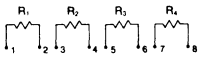


RATIO 1 $R_1 : R_2$
RATIO 2 $R_1 : R_3$
RATIO 3 $R_1 : R_4$
RATIO 4 $R_1 : R_5$

Figure 9



RATIO DEFINITION:
ALL RESISTORS RATIO ONE ANOTHER



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HIGH PERFORMANCE FILM RESISTORS

Type 1787 Current Shunt Resistor Networks

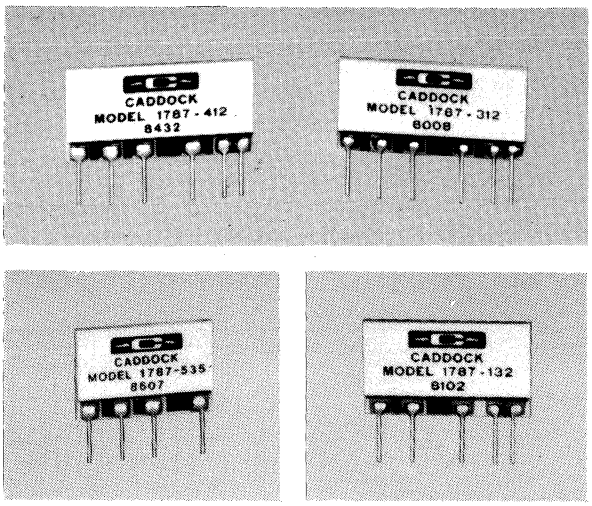
Accurate Current Sensing in Multi-Range Instrumentation

Type 1787 Current Shunt Resistor Networks utilize Caddock's Micronox® resistance films and advanced high thru-put laser manufacturing capabilities to achieve many vital advantages in precision current measurement circuits, including laboratory and bench-type digital instrumentation:

- The thin-profile single-package configuration replaces as many as four discrete current shunt resistors.
- The monolithic construction and standardized lead spacing simplifies installation.
- Caddock Micronox® resistance films provide exceptional stability for improved long-term measurement accuracy.

Twelve standard models in five network arrangements provide the specific accuracy and resistance values required for a wide range of current measuring instruments and circuits.

Prototype quantities of most models of the Type 1787 Current Shunt Resistor Networks can be delivered from stock to within 6 weeks ARO.



Model No.	Resistance Values				Power Rating Watts				Max. Power Rating Watts Total Pkg.	Fig.	Absolute Resistance Tolerance % ①	Maximum Absolute TC ppm/°C ②	Absolute Stability Max. % Change in Resistance Value	
	R_A	R_B	R_C	R_D	R_A	R_B	R_C	R_D					Load Life ③	Shelf Life ④
1787—31	999.9 Ω	99.9 Ω	9.9 Ω	0.9 Ω	0.25	0.25	0.50	1.0	1.0	1	0.25	80	0.05	0.03
1787—312	999.9 Ω	99.9 Ω	9.9 Ω	0.9 Ω	0.25	0.25	0.50	1.0	1.0	1	0.10	80	0.03	0.02
1787—41	1000 Ω	100 Ω	10 Ω	1 Ω	0.25	0.25	0.50	1.0	1.0	2	0.25	80	0.05	0.03
1787—412	1000 Ω	100 Ω	10 Ω	1 Ω	0.25	0.25	0.50	1.0	1.0	2	0.10	80	0.03	0.02
1787—5	999 Ω	99 Ω	9 Ω	N/A	0.25	0.25	0.75	N/A	0.75	3	0.25	50	0.04	0.02
1787—53	999 Ω	99 Ω	9 Ω	N/A	0.25	0.25	0.75	N/A	0.75	3	0.10	50	0.02	0.01
1787—535	999 Ω	99 Ω	9 Ω	N/A	0.25	0.25	0.75	N/A	0.75	3	0.05	50	0.02	0.01
1787—6	1000 Ω	100 Ω	10 Ω	N/A	0.25	0.25	0.75	N/A	0.75	4	0.25	50	0.04	0.02
1787—64	1000 Ω	100 Ω	10 Ω	N/A	0.25	0.25	0.75	N/A	0.75	4	0.10	50	0.02	0.01
1787—645	1000 Ω	100 Ω	10 Ω	N/A	0.25	0.25	0.75	N/A	0.75	4	0.05	50	0.02	0.01
1787—13	99.9 Ω	9.9 Ω	0.9 Ω	N/A	0.25	0.50	1.0	N/A	1.0	5	0.25	100	0.05	0.03
1787—132	99.9 Ω	9.9 Ω	0.9 Ω	N/A	0.25	0.50	1.0	N/A	1.0	5	0.10	100	0.03	0.02

① **Absolute Resistance Tolerance:** Tolerance of R_A, R_B, R_C or R_D when measured in accordance with proper Figure No.

② **Absolute Temperature Coefficient:** Temperature coefficient of R_A, R_B, R_C or R_D from 0°C to 70°C, referenced to +25°C.

③ **Load Life:** Stability of R_A, R_B, R_C or R_D with full power applied individually for 2000 hours at +70°C.

④ **Shelf Life:** Stability of R_A, R_B, R_C or R_D for six months at shelf conditions.

Storage Temperature: −55°C to +105°C.

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Type 1787 Current Shunt Resistor Networks

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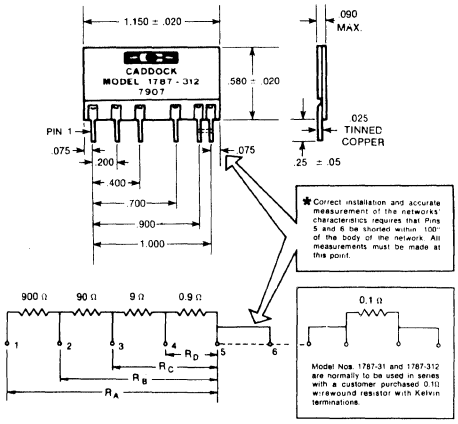
HIGH PERFORMANCE FILM RESISTORS

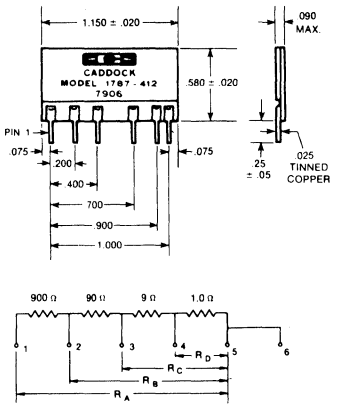
Figure 1 — Model Nos. 1787-31 and 1787-312



Model Nos. 1787-31 and 1787-312 Measurement Connections

Resistances		Kelvin Connections			
"R"	Total Value	Sense Lead P_1	Current Lead C_1	Current Lead C_2	Sense Lead P_2
R_A	999.9 Ω	Pin 1	Pin 1	Pin 5 ★	Pin 6 ★
R_B	99.9 Ω	Pin 1	Pin 2	Pin 5 ★	Pin 6 ★
R_C	9.9 Ω	Pin 1	Pin 3	Pin 5 ★	Pin 6 ★
R_D	0.9 Ω	Pin 1	Pin 4	Pin 5 ★	Pin 6 ★

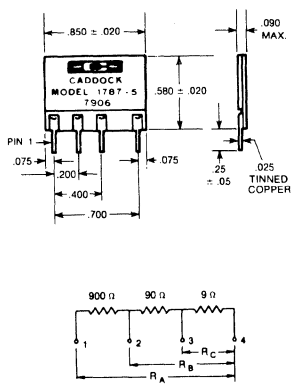
Figure 2 — Model Nos. 1787-41 and 1787-412



Model Nos. 1787-41 and 1787-412 Measurement Connections

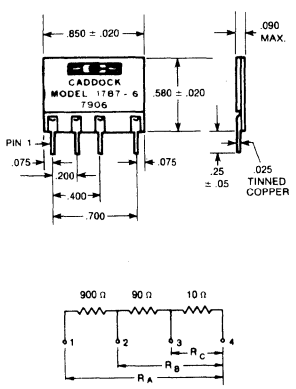
Resistances		Kelvin Connections			
"R"	Total Value	Sense Lead P_1	Current Lead C_1	Current Lead C_2	Sense Lead P_2
R_A	1000 Ω	Pin 1	Pin 1	Pin 5	Pin 6
R_B	100 Ω	Pin 1	Pin 2	Pin 5	Pin 6
R_C	10 Ω	Pin 1	Pin 3	Pin 5	Pin 6
R_D	1 Ω	Pin 1	Pin 4	Pin 5	Pin 6

Figure 3 — Model Nos. 1787-5, 1787-53 and 1787-535



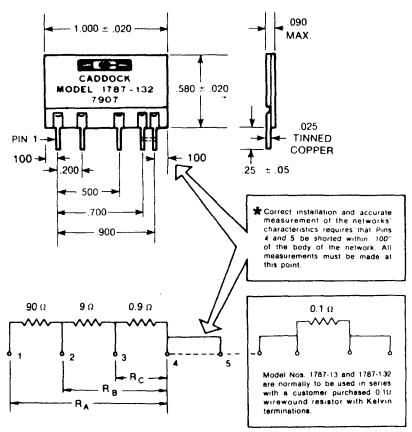
Resistances	
"R"	Total Value
R_A	999 Ω
R_B	99 Ω
R_C	9 Ω

Figure 4 — Model Nos. 1787-6, 1787-64, 1787-645 and 1787-6452



Resistances	
"R"	Total Value
R_A	1000 Ω
R_B	100 Ω
R_C	10 Ω

Figure 6 — Model Nos. 1787-13 and 1787-132



Model Nos. 1787-13 and 1787-132 Measurement Connections

Resistances		Kelvin Connections			
"R"	Total Value	Sense Lead P_1	Current Lead C_1	Current Lead C_2	Sense Lead P_2
R_A	99.9 Ω	Pin 1	Pin 1	Pin 4 ★	Pin 5 ★
R_B	9.9 Ω	Pin 1	Pin 2	Pin 4 ★	Pin 5 ★
R_C	0.9 Ω	Pin 1	Pin 3	Pin 4 ★	Pin 5 ★

ALL DIMENSIONS IN INCHES

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

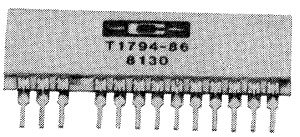
Type T1794 Custom Low Temperature Coefficient Precision SIP Resistor Networks

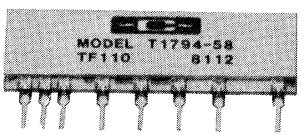
Low Absolute TC and Ratio TC in Resistor Networks with Custom Performance

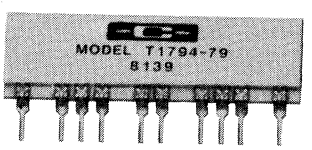
The exceptional design flexibility provided by the Type T1794 Custom Low TC Precision SIP Resistor Networks gives each circuit designer the freedom to choose the precise combination of specifications required to optimize both the performance and the price of custom precision and ultra-precision resistor networks.

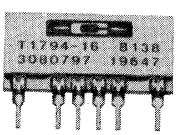
For precision analog designs with special circuit requirements, Caddock's Type T1794 Custom Low TC Precision SIP Resistor Networks are available with performance that includes -

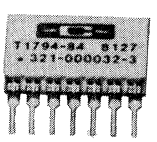
- **Resistance Values:** values from 500 ohms to as high as 50 Megohms.
- **Absolute Tolerances:** ±1.0%, ±0.50%, ±0.25%, ±0.20%, ±0.10%, ±0.05% and ±0.025%.
- **Ratio Tolerances:** ±1.0%, ±0.50%, ±0.25%, ±0.20%, ±0.10% ±0.05% and ±0.025%.
- **Absolute Temperature Coefficients:** 50 PPM/°C, 25 PPM/°C and 15 PPM/°C from 0°C to +70°C.
- **Ratio Temperature Coefficients:** 50 PPM/°C, 25 PPM/°C, 10 PPM/°C and 5 PPM/°C from 0°C to +70°C.
- **Ratio-of-Ratios:** as required, to as close as 0.025%.

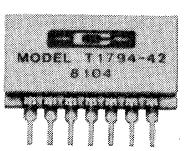


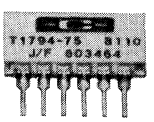












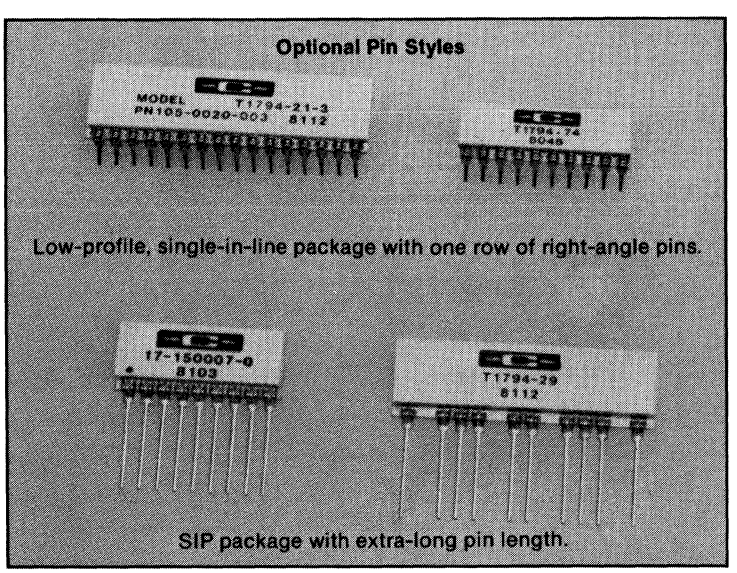
The unique thin-profile, single-in-line edge-mount package design allows the wide range of flexibility necessary to blend the performance of Tetrinox® resistance technology with particular circuit specifications to arrive at the final network package size, pin spacing and pin style.

By optimizing both performance and configuration, many designers find that these precision networks can achieve savings in both component costs and insertion costs, as compared to discrete precision resistors - even in production lot quantities as low as 1000 units.

Applications for the Type T1794 Custom Low TC Precision SIP Resistor Networks include -

- **Voltage Divider Networks**
- **Amplifier Gain-Setting Networks**
- **Differential Amplifier Input Networks**
- **Attenuator Networks**
- **Current-to-Voltage Converter Sense Networks**

Our high thru-put manufacturing capability is now committed to the production of these custom precision resistor networks. Custom network designs for requirements that range from 500 networks per year to over 400,000 networks per year are now in production.



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Type 1789 Custom Low Resistance Value Precision SIP Resistor Networks

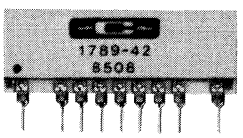
CADDOCK
HIGH PERFORMANCE FILM RESISTORS

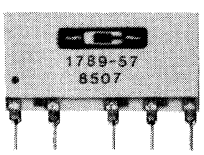
Low Resistance Custom Resistor Networks with Values as Low as 0.5 ohms

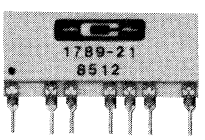
The design flexibility achieved by Caddock's advanced resistance film technologies is extended to low resistance values in precision resistor networks through the application of Caddock's Micronox® resistance films.

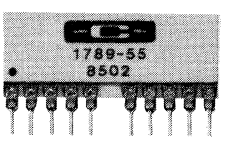
By applying this technology to the low-profile, single-in-line package configuration, the Type 1789 Custom Low Resistance Value Precision SIP Resistor Networks provide this unique combination of performance specifications:

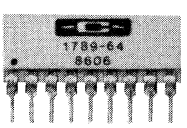
- **Resistance Values:** from 0.5 ohms to 10,000 ohms.
- **Absolute Tolerances:** ±1.0%, ±0.50%, ±0.25%, ±0.20%, ±0.10% and ±0.05%.
- **Ratio Tolerances:** ±1.0%, ±0.50%, ±0.25%, ±0.20%, ±0.10% and ±0.05%.
- **Absolute Temperature Coefficients:** 100 PPM/°C, 80 PPM/°C and 50 PPM/°C from 0°C to +70°C.
- **Ratio Temperature Coefficients:** 80 PPM/°C, 50 PPM/°C, 25 PPM/°C and 15 PPM/°C from 0°C to +70°C.
- **Power Rating:** 100 mW to 2 Watts per resistor.

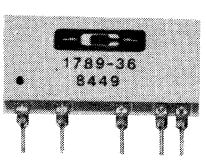












Where high accuracy and low resistance values must be combined - as in high accuracy current measurement circuitry - Kelvin terminations can be provided for low resistance values to minimize lead resistance errors.

The optimum design of Type 1789 Custom Low Resistance Value Precision SIP Resistor Networks is best achieved when the performance of Micronox® resistance film technologies is blended with particular circuit specifications and the unique thin-profile, single-in-line package design to arrive at the final network package size, pin spacing and pin style.

Applications for the Type 1789 Custom Low Resistance Value SIP Precision Resistor Networks include -

- **Current Summing Networks**
- **Precision Termination Networks**
- **Precision Current Shunts**
- **Current Sensing Networks**
- **Impedance Matching Networks**

Design Assistance in Developing Custom Resistor Networks.

For immediate engineering assistance on the custom precision resistor network configuration that can best meet your needs, call our applications engineers in Riverside, California, and we will be pleased to provide design assistance, technical performance information and pricing information.

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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MP Chassis Mounted Power Film Resistors

Type MP Chassis Mounted Power Film Resistors are made with Micronox® resistance films fired onto a ceramic substrate which is thermally bonded to an anodized aluminum base. By mounting this assembly directly to a metal surface for improved heat transfer, the high power capabilities of these unique resistors can provide increased packaging densities in many types of electronic equipment.

The special performance features of the Type MP Power Film Resistors include:

- Two case sizes that provide 15 watt and 30 watt ratings.
- Single-screw mounting to simplify attachment to the chassis or other heat conducting surface.
- A molded silicone case that encapsulates the resistor assembly to meet stringent environmental specifications.
- Extended-life stability better than 0.01% per 1000 hours has been demonstrated through a 5½ year, 50,000 hour program of continuous load-life testing.

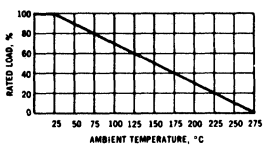
Detailed information on power ratings versus ambient temperature and chassis area has been provided on this page. A detailed report on the results of extended-life stability tests is available from the applications engineering group at Caddock Electronics, Inc.

Model No.	Power Rating†	Max. Voltage	Diel. Str.	High Temp. TC‡	Resistance Range		Dimensions				Terminals
					Min.	Max.	A	B	C	D	
MP312	15 Watts	300	600	50	10Ω	200 K	.600	.188	.185	.092	Gold Plated Solder Lugs
MP330	30 Watts	450	1000	50	10Ω	200 K	.850	.250	.250	.142	Gold Plated Solder Lugs

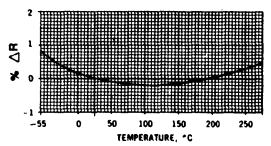
† Power rating based on chassis mounting with MP 312 on a 6" x 4" x 2" x .040" aluminum chassis and MP 330 on a 5" x 7" x 2" x .040" aluminum chassis.

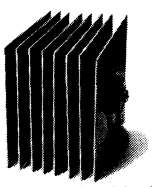
‡ TC: 50 ppm referenced to 25°C, ΔR taken at +150°C and +275°C. (Low temp. TC will be nominally −85 ppm/°C at −55°C. See typical R-T curve.)

DERATING CURVE



TYPICAL R-T CURVE

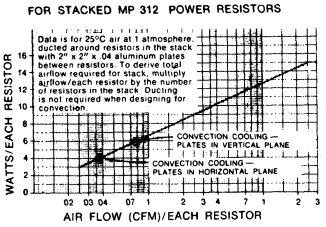




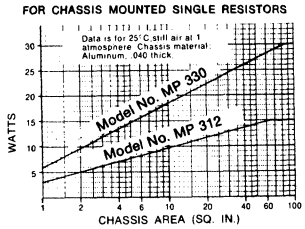
Stacked Type MP assemblies — constructed by bolting resistors between aluminum heat dissipating plates — provide a simple means of further improving packaging densities.

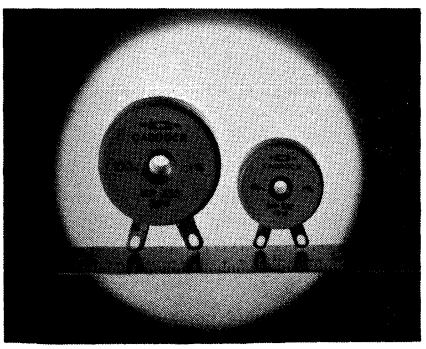
These charts of power ratings versus ambient temperature and chassis area show the high power levels that can be achieved with forced air cooling and with convection cooling in either vertical or horizontal orientation.

POWER RATING
FOR STACKED MP 312 POWER RESISTORS



POWER RATING
FOR CHASSIS MOUNTED SINGLE RESISTORS





Specifications

Resistance Tolerance: ±1% standard.(Other tolerances on special order.)

Insulation Resistance: 10,000 Megohms, min.

Terminal Strength: Per Mil-Std-202, Method 211, Cond. A (Pull Test), 5 lbs., and Cond. B (Bend Test), ΔR, 0.2% max. or 0.2 ohms max., whichever is greater.

Thermal Shock: Per Mil-R-39009, ΔR, 0.5% max. or 0.2 ohms max., whichever is greater.

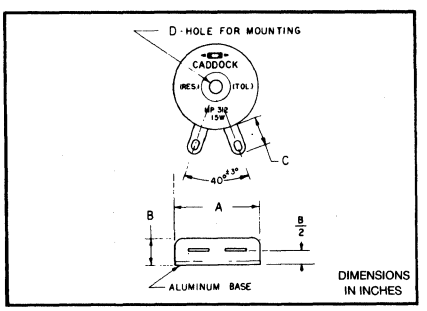
Momentary Overload: 2 times rated power or 1.5 times max. allowable working voltage, whichever gives the lower power, for 5 seconds. ΔR, 0.5% max. or 0.2 ohms max., whichever is greater.

Moisture Resistance: Mil-Std-202, Method 106, less steps 7a and 7b ΔR, 0.5% max. or 0.2 ohms max., whichever is greater.

Life: Per Mil-R-39009, 2,000 hours at rated power, ΔR, 1% max. or 0.2 ohms max., whichever is greater. Power rating dependent upon chassis area. See power rating graph.

Shock, Medium Impact: 50G, per Mil-Std-202, Method 205, Cond. C.

Vibration, High Frequency: Per Mil-Std-202, Method 204, Cond. B, ΔR, 0.2% max. or 0.2 ohms max., whichever is greater, through shock and vibration sequence.



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Type MP Kool-Tab™ Power Film Resistor

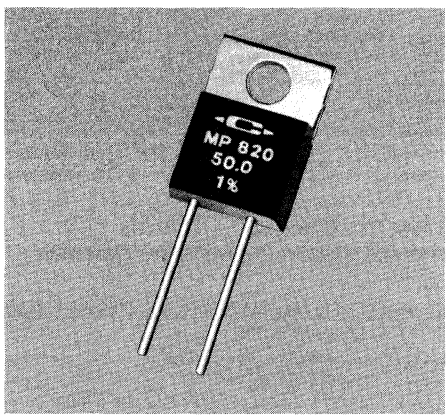
CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Non-Inductive 20 Watt Power Resistor in the TO-220 Power Device Configuration

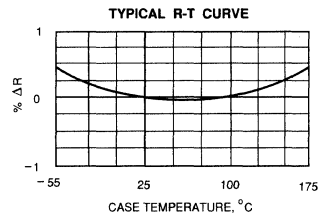
Model MP 820 Kool-Tab™ Power Film Resistor introduces our proven Micronox® resistance film system in the widely accepted TO-220 Power Package to provide the smallest 20 watt heat sink mountable resistor available. The non-inductive design makes this resistor ideal in high frequency communications and power switching circuits.

The special performance features of the Kool-Tab™ Power Film Resistor include:

- TO-220 package configuration
- 20 Watt power rating at 25°C case temperature
- Non-inductive design
- Single screw mounting simplifies attachment to heat sink
- Low profile provides an easier fit in tight places
- A molded silicone case for environmental protection



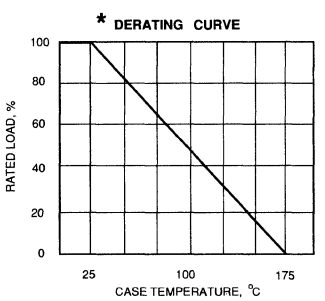
Model No.	Power Rating	Dielect. Strength V_{RMS} AC	High Temp. TC ppm/ °C	Resistance Range Min.	Resistance Range Max.	Leadwire
MP820	20 Watts*	1000	50**	10 Ω	1000 Ω	Tinned Copper



** TC: 0 to +50 ppm/°C referenced to 25°C, Δ R taken at +175°C. (Low temperature TC will be 0 ppm/°C to -100 ppm/°C. See typical R-T curve.)

Non-Inductive Design

The MP 820 Kool-Tab™ Power Film Resistor is constructed with our Micronox resistance film fired onto a flat substrate which is thermally bonded to the copper heat sink tab. The resistor body is then molded in silicone to finish the TO-220 configuration. The lead wire attachment and resistance element geometry are configured to provide outstanding non-inductive performance.



The case temperature (temperature of the metal mounting tab) is to be used for purposes of establishing the maximum applied power. See Derating Curve. Without a heat sink, when in free air at 25°C, the MP820 is rated for 2.75 watts.

Derating for case temperature above 25°C is 0.133 W/°C.

Mounting note: Maximum torque to be applied to mounting screw is 8 in-lbs.

Specifications:

Resistance Tolerance: ±1% standard (0.5%, 2%, and 5% are also available).

Insulation Resistance: 10,000 Megohms, min.

Terminal Strength: Mil-Std-202, Method 211, Cond. A (Pull Test) 5lbs., Δ R, ±(0.2 percent + 0.05ohm).

Thermal Shock: Mil-Std-202, Method 107, Cond. F, Δ R, ±(0.3 percent + 0.05 ohm).

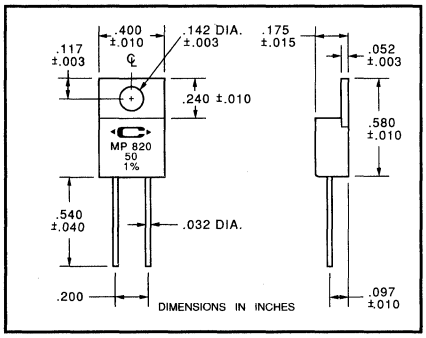
Momentary Overload: 2 times rated power for 5 seconds, Δ R, ±(0.3 percent + 0.05 ohm).

Moisture Resistance: Mil-Std-202. Method 106, less steps 7a and 7b, Δ R, ±(0.5 percent + 0.05 ohm).

Life: Per Mil-R-39009, 2,000 hours at rated power, Δ R, ±(1.0 percent + 0.05 ohm). Power rating dependent upon case temperature. See derating curve.

Shock: 100G, per Mil-Std-202, Method 213, Cond. I, Δ R, ±(0.2 percent + 0.05 ohm).

Vibration, High Frequency: Per Mil-Std-202, Method 204, Cond. D, ΔR, ±(0.2 percent + 0.05 ohm).



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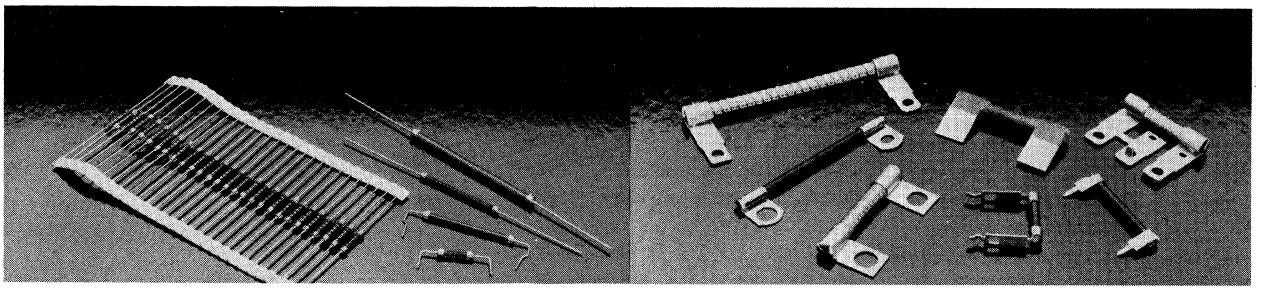


Wire Wound: Axial Lead – Type AL

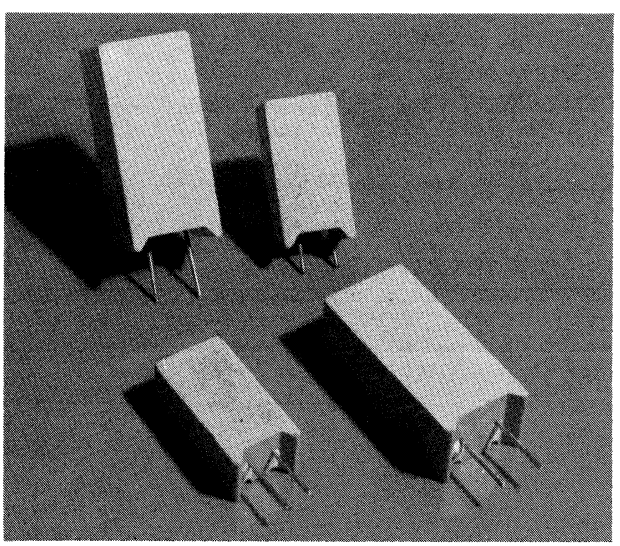
Most economical alternative for your power disipating needs

Features:

- ☐ High quality alloy resistance wire with silicone impregnated, interwoven fiberglass core
- ☐ Variety of core diameters and lengths
- ☐ Variety of temperature coefficients
- ☐ Available coated with proprietory silicone insulation
- ☐ Tape & reel packaging to customer specification
- ☐ U.S. made

Specifications:

- ☐ Resistance range: .02 ohm min. to 13k (depending on core length)
- ☐ Tolerance: ±10% standard; down to ±2% available
- ☐ Temperature coefficient: to 200 PPM (consult factory)
- ☐ Power rating: 4, 5, or 6 watts per inch available
- ☐ Terminals: oxygen-free, tinned copper leads: .032"-.040", lead lengths up to 3"; 10 lb. minimum pull strength, formed leads available to customer specification



Vertical Mounted Resistors—Surface Mounted

Designed for minimum space on PC boards at various wattage

Features:

- ☐ Economical, reliable resistors in 3, 5 and 10 watts
- ☐ High quality, fireproof ceramic case and inorganic fill
- ☐ High quality alloy resistance wire on silicone coated and impregnated, interwoven, fiberglass core
- ☐ U.S. made
- ☐ Leads trimmed to customer specifications
- ☐ Variety of termperature coefficients
- ☐ Leads: oxygen-free, tinned copper: .030"-.040"

Wire Wound Radial Terminals (Flag) – Type AW

Standard electronic and auto industry terminals

Features:

- ☐ Variety of terminal materials and styles
- ☐ High quality alloy resistance wire with silicone impregnated, interwoven fiberglass core
- ☐ Variety of temperature coefficients available
- ☐ Variety of core diameters & lengths
- ☐ Available coated or uncoated
- ☐ U.S. made

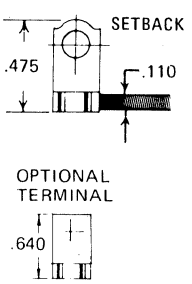
Specifications:

- ☐ Resistance range: to customer specifications
- ☐ Tolerance: ±10% standard, ±5% also available
- ☐ Temperature coefficients: to 300 PPM, consult factory
- ☐ Power rating: 4, 5, 6 watts per inch available
- ☐ Terminals: brass, tinned brass, or tinned steel, silicone base or epoxy coating available, resistance value stamped on terminal

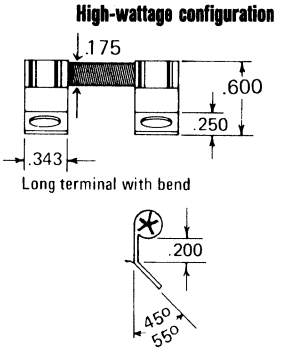
(Note: Performance same as Type AL.)

Mounting:

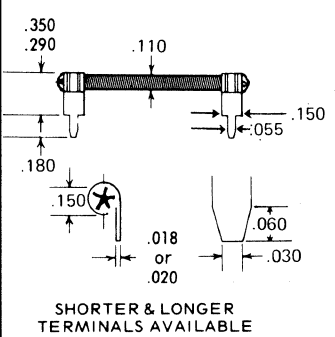
Standard configuration



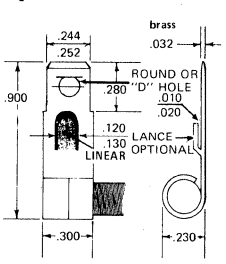
High-wattage configuration



Printed circuit terminals



Quick disconnect terminals



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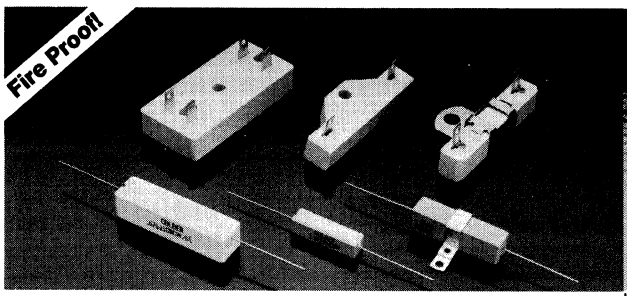
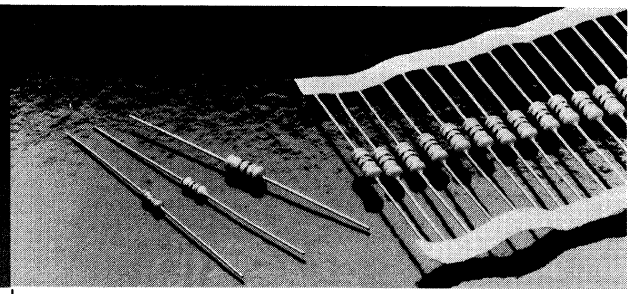




Wirewound Resistors: Commercial Power – Type CW & RU

Electronic and automotive industry standard sizes

Features:

- ☐ Economical, reliable resitors from 2 to 50 watts
- ☐ High quality, fireproof ceramic case and inorganic fill
- ☐ Custom inorganic encapsulant provides high thermal conductivity
- ☐ High quality alloy resistance wire on silicone coated and impregnated, interwoven, fiberglass core
- ☐ Brackets and standoffs available
- ☐ Fusistor styles available
- ☐ Formed leads to customer specification
- ☐ U.S. made

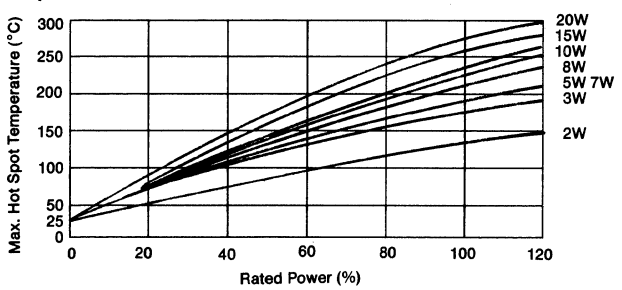
ALSO AVAILABLE: Moisture resistant, fireproof ceramic case and heat-treated, inorganic encapsulant with **silicone base.**

Specifications:

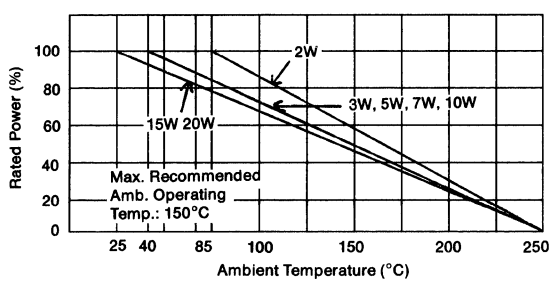
- ☐ Resistance range: .005 ohm min. to 13k (depending on core length)
- ☐ Tolerance: ±10% standard, down to ±2% also available
- ☐ Temperature coefficients: to 200 PPM, consult factory
- ☐ Power rating: 2-50 watts
- ☐ Terminals: brass, tinned brass, or tinned steel; axial lead or radial leads

Performance:

Temperature Rise vs. Load Curve



Derating Curve for High Ambient Temperature



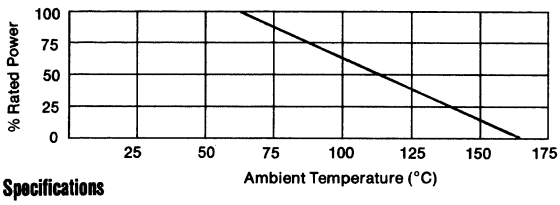
Commercial Metal Film Resistors – Type GP

±1% tolerance, (±5% tolerance available)

Features:

- ☐ 1/8, 1/4 and 1/2 watt power rating
- ☐ Meet or exceed MIL-R-1059(RN), MIL-R-22684(RL), MIL-R-39017 (RLR)
- ☐ Wide resistance range
- ☐ Temperature coefficient to 25 PPM
- ☐ Cut and formed leads to customer specification
- ☐ Tape & reel, or bulk

Derating Curve for High Ambient Temperature



Specifications

TYPE	WATTAGE 70°C	TCR (PPM/°C)	RESISTANCE RANGE
GP50	0.125	50,100,200	10 ohm to 1.0 Meg
GP55	0.25	100,200	10 ohm to 22.1 Meg
		25,50	10 ohm to 1.0 Meg
GP55S	0.50	100,200	10 ohm to 5.1 Meg
		25,50	10 ohm to 1.0 Meg
GP60	0.50	50,100,200	10 ohm to 5.1 Meg
		25	1K ohm to 1.0 Meg

Commercial Carbon Film – Type CF

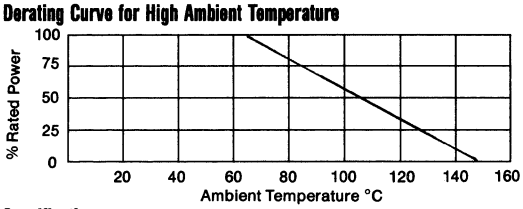
Low cost! ±5% tolerance standard, ±2% available

Features:

- ☐ 1/8 watt to 2 watt power rating
- ☐ Exceeds MIL-R-11
- ☐ Wide resistance
- ☐ Cut and formed
- ☐ Bulk & tape & reel

Performance:

Derating Curve for High Ambient Temperature



Specifications

TYPE	WATTAGE AT 70°C	RESISTANCE RANGE ±2% G	RESISTANCE RANGE ±5% J
CF12	.125W	10 ohm-220K	1 ohm-470K
CF25	.25W	10 ohm-1M	1 ohm-22M
CF50	.5W	10 ohm-1M	1 ohm-10M
CF50S	.5W	10 ohm-1M	1 ohm-10M
CF100	1.0W		1 ohm-10M
CF100S	1.0W	10 ohm-1M	1 ohm-10M
CF200S	2.0W		1 ohm-10M

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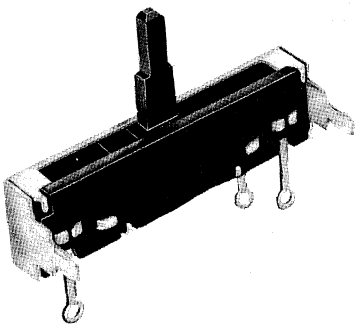
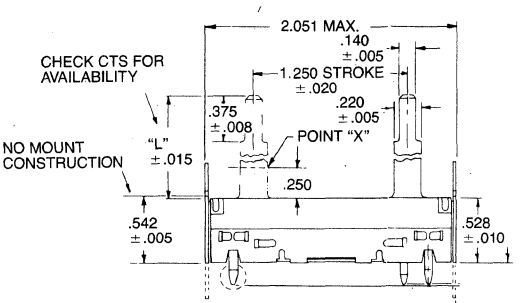
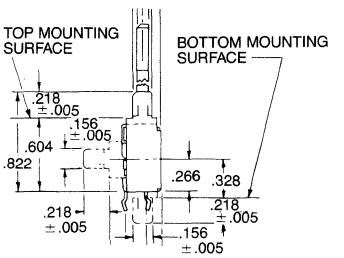
SERIES 442/LINEAR MOTION 1/4 W. COMPOSITION SLIDE CONTROL







ELECTRICAL & MECHANICAL SPECIFICATIONS

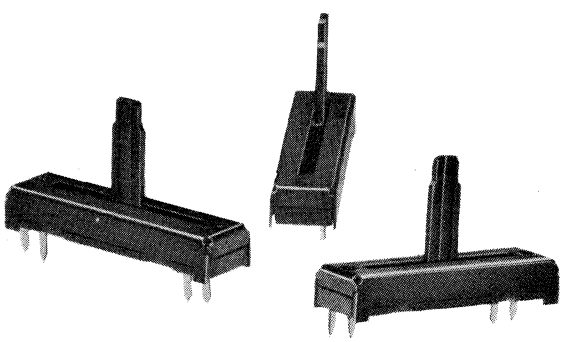
Voltage Rating
Across end terminals:
Linear curves — 500 VDC
Tapered curves — 350 VDC
(Not to exceed wattage ratings)
Between case and end terminals:
1080 VAC RMS

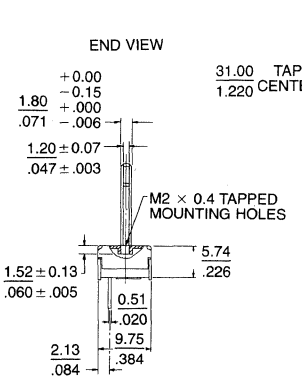
Terminal Information
Straight printed circuit, snap-in
wirewrap or solder lug styles
Mounting Information
Top, bottom, or side twist tab mounting
Resistance Range
200 ohms through 5 megohms

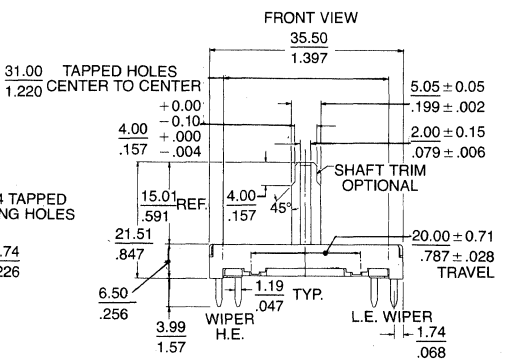
Resistance Tolerance
Standard — ±30%
Special — available

Resistance Tapers
Standard — linear
Special — available

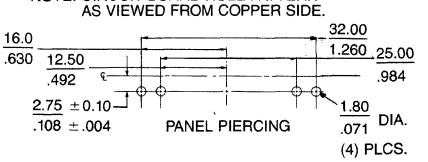
SERIES 443/LINEAR MOTION 1/6 W. COMPOSITION SLIDE CONTROL







NOTE: CIRCUIT BOARD HOLE PATTERN AS VIEWED FROM COPPER SIDE.



GENERAL TOLERANCES:
Decimal Dimensions ±.016"/±0.40 mm

ELECTRICAL & MECHANICAL SPECIFICATIONS

Voltage Rating
Across end terminals:
Linear curves — 300 VDC
(Not to exceed wattage ratings)
Slide Travel
Mechanical — .787 inches
Effective — .787 inches
Resistance Range
200 ohms through 1 megohm

Resistance Tolerance
Standard — ±30%
Special — available

Resistance Tapers
Standard — linear
Special — available

Terminal Information
Straight printed circuit

Suggested Mounting Information
Bottom mounting — PC board with cover stand off
Top mounting — M2 × 0.4 tapped extrude in cover

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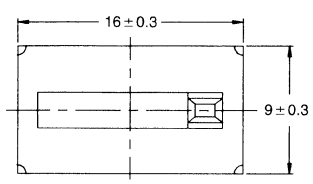
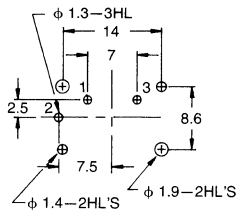
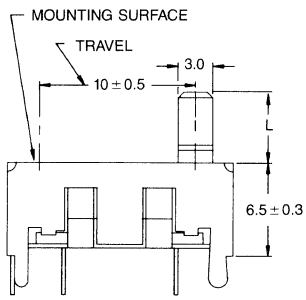
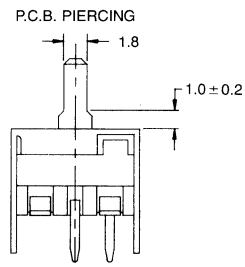
SERIES 466/10MM SLIDE VARIABLE RESISTORS

UNIT: MM









L: 5mm or 10mm

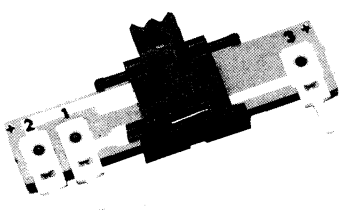
ELECTRICAL & MECHANICAL SPECIFICATIONS

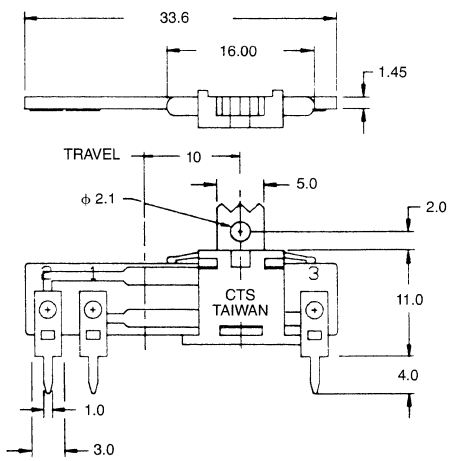
Resistance Range
Standard: 1 K ohms through 500 K ohms
Special: Available
Resistance Tolerance
Standard: ±20%
Special: Available

Power Rating
Linear Curve: 0.03 watt
Others: 0.015 watt
Insulation Resistance
Greater than 10 megohms between terminal and case with a 250 VDC applied.

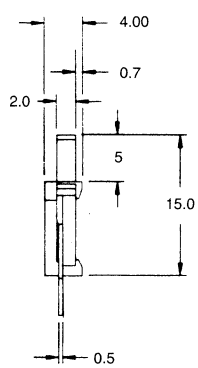
Sliding Life
3000 cycles
Tracking Error
Within 2 dB at 5mm a starting point on the single terminal side
Travel
10±0.5mm

SERIES S448/10MM SLIM SLIDE VARIABLE RESISTORS





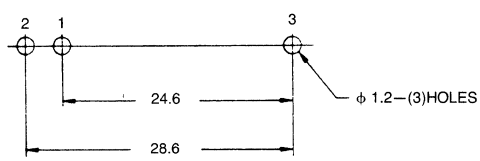
UNIT: MM



ELECTRICAL & MECHANICAL SPECIFICATIONS

Sliding Force
50—350 g
Travel
10 mm single unit
Power Rating
0.05 W nonlinear taper
0.1 W linear taper
Voltage Rating
100 V

Taper
Per requirement
Resistance Range
Standard: 1 K ohms
through
500 K ohms
Special: Available please
Consult CTS for information



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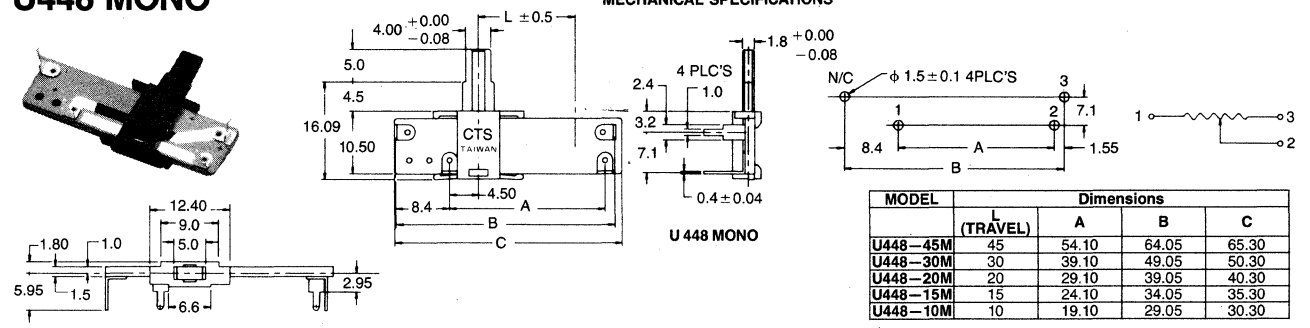
CTS® CORPORATION

SERIES X/U448 SLIM SLIDE VARIABLE RESISTORS

U448 MONO

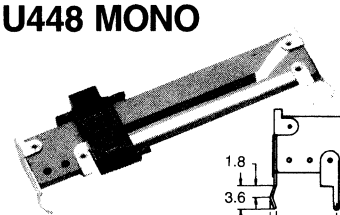
MECHANICAL SPECIFICATIONS

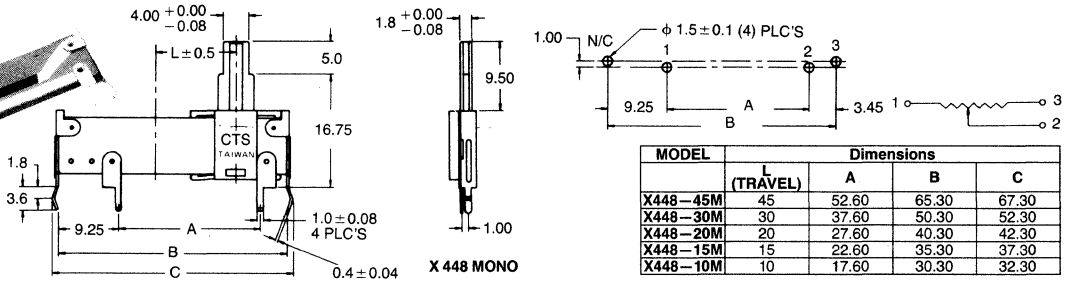


U 448 MONO

MODEL	Dimensions			
	L (TRAVEL)	A	B	C
U448—45M	45	54.10	64.05	65.30
U448—30M	30	39.10	49.05	50.30
U448—20M	20	29.10	39.05	40.30
U448—15M	15	24.10	34.05	35.30
U448—10M	10	19.10	29.05	30.30

U448 MONO

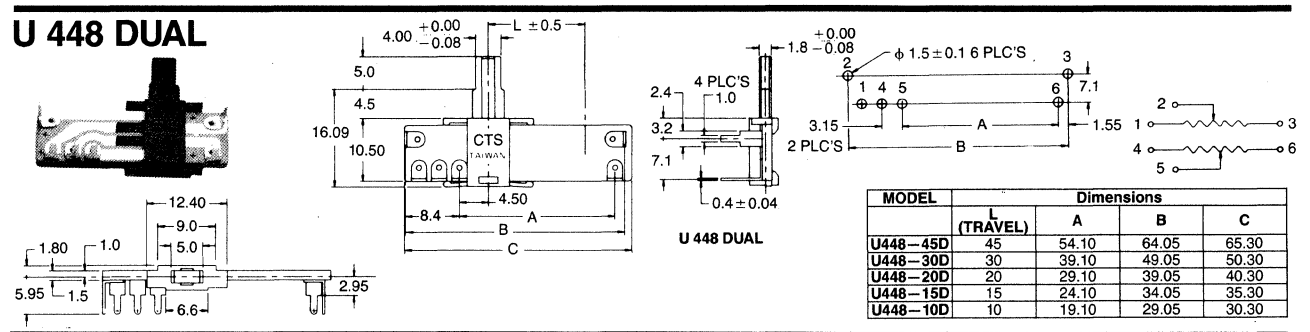




X 448 MONO

MODEL	Dimensions			
	L (TRAVEL)	A	B	C
X448—45M	45	52.60	65.30	67.30
X448—30M	30	37.60	50.30	52.30
X448—20M	20	27.60	40.30	42.30
X448—15M	15	22.60	35.30	37.30
X448—10M	10	17.60	30.30	32.30

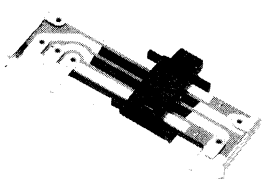
U 448 DUAL

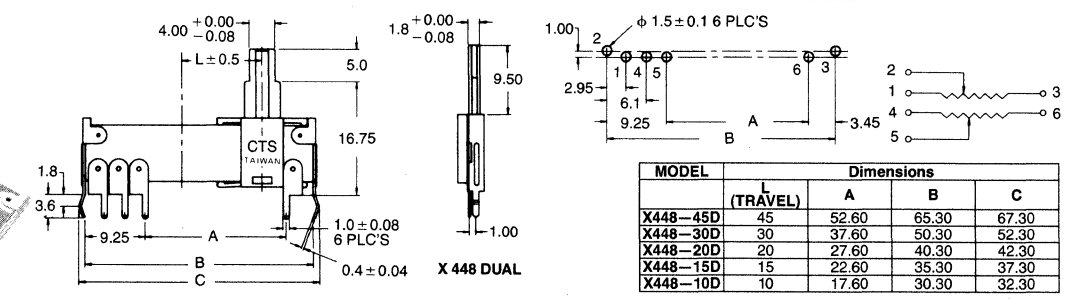


U 448 DUAL

MODEL	Dimensions			
	L (TRAVEL)	A	B	C
U448—45D	45	54.10	64.05	65.30
U448—30D	30	39.10	49.05	50.30
U448—20D	20	29.10	39.05	40.30
U448—15D	15	24.10	34.05	35.30
U448—10D	10	19.10	29.05	30.30

X 448 DUAL





X 448 DUAL

MODEL	Dimensions			
	L (TRAVEL)	A	B	C
X448—45D	45	52.60	65.30	67.30
X448—30D	30	37.60	50.30	52.30
X448—20D	20	27.60	40.30	42.30
X448—15D	15	22.60	35.30	37.30
X448—10D	10	17.60	30.30	32.30

ELECTRICAL SPECIFICATIONS

Resistance Range
500 ohms — 1 meg ohms
Resistance Tolerance
±20%
Insulation Resistance
100 meg ohms at DC 250 V
Power Rating
Linear 0.2 watt
Non linear 0.1 watt
Resistance Taper
Any type of taper available

Travel Length
10, 15, 20, 30, 45±0.5mm
Tracking Error
10 mm within 3 dB at center position
15 mm within 3 dB at center position
20 mm within 4 dB at −30—0 dB
30 mm within 3 dB at −40—0 dB
Operation Force
20—150 gF operation speed
20 mm sec.

Detent Force
Operating force + (20—200) gF
Detent Position
Center detent and multiple detents available
Operating Life
10,000 cycles
Stop Strength
3 KgF min within 10 seconds

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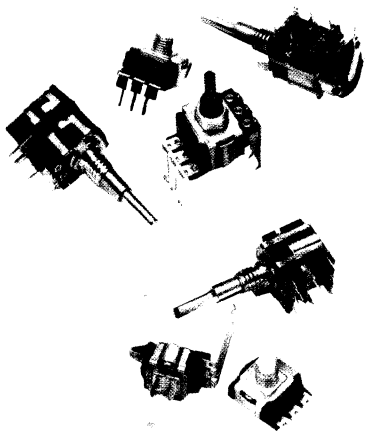
CTS CORPORATION

SERIES 280/COMMERCIAL COMPOSITION VARIABLE RESISTOR 5/8" (16MM) DIA.

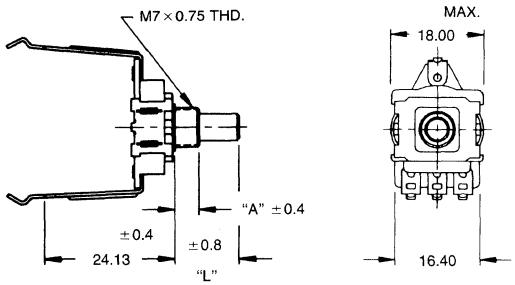
ELECTRICAL & MECHANICAL SPECIFICATIONS



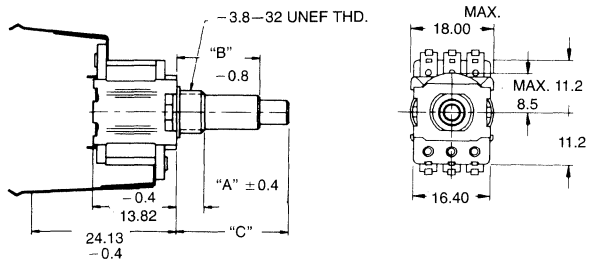
Resistance Range
500 ohms through 5 megohms (linear taper).
Resistance Tolerance
Standard: ±20%.
Special tolerances available.
Power Rating, Watts
1/4 watt per section through 10K ohms
1/8 watt per section above 10K ohms
Full rating @ 55°C derated to no load at 85°C for linear tapers (derating required on multiple section controls).

Voltage Rating
Bushing to terminals:
High pot test, one minute 750 VAC
Operating maximum 500 VDC
Across end terminals:
350 VDC, load not to exceed power rating.
Insulation Resistance
100 M ohms minimum dry
Angle of Rotation
Total Rotation:
Without switch—300° ± 5°.
With switch—315° ± 5°.
Effective Rotation:
Without switch—300° (approx.)
With switch—280° (approx.)

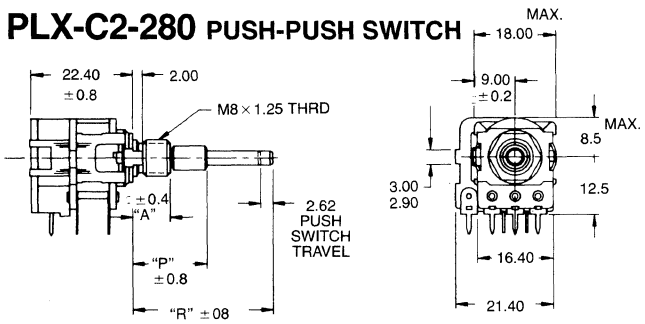
ZVDT-ZVM280



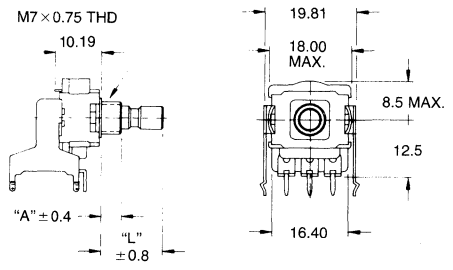
ZVM-C2-280



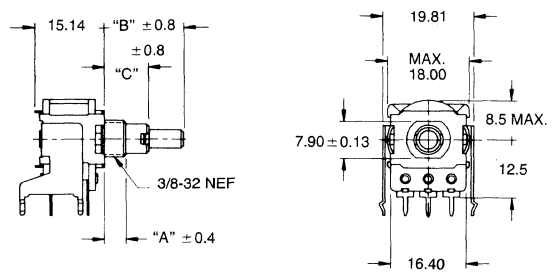
PLX-C2-280 PUSH-PUSH SWITCH



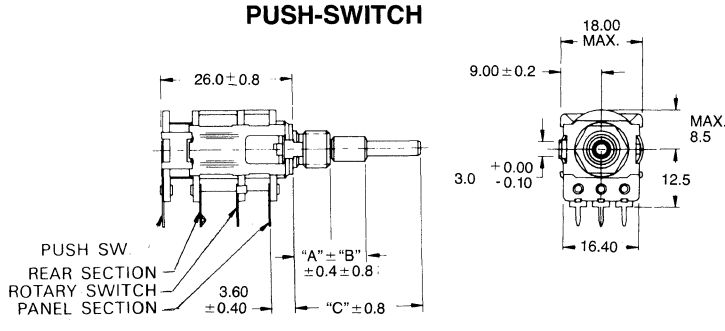
XB-280



XB-C2-280



XC2-280 ROTARY SWITCH & MOMENTARY PUSH-SWITCH



CTS OF ELKHART/DIVISION OF CTS CORPORATION 1142 W. Beardsley Avenue . Elkhart, Indiana 46514
Phone (219) 295-3675 . TWX 810-294-2258 . TELEFAX 219-295-3580

CTS® CORPORATION

SERIES 270/275 COMMERCIAL COMP. VARIABLE RESISTORS 5/8" (16MM) DIA.

ELECTRICAL & MECHANICAL SPECIFICATIONS

Resistance Range Standard: 500 ohms through 5 megohms.
Special: For non-standard resistance values contact CTS.

Resistance Tolerance Standard: ±20%.
Special: Available.

Power Rating, Watts 0.25 watts @ 40°C derated to no load @ 85°C. (For special applications requiring higher wattage ratings, please contact the factory.)

Voltage Rating Across End Terminals:
350 VDC, load not exceed listed wattage ratings.
Bushing To Terminals:
High pot test, one minute-750 VAC operating max., – 500VDC.
Load not to exceed wattage rating.

Angle of Rotation Total Rotation:
Without Switch—300°±5°.
With Switch—315°±5°.
Effective Rotation:
Without Switch—300° (approx.)
With Switch—280° (approx.)

Panel Mounting Information Standard: Die cast or brass bushing (CTS option), Twist Tab or Bracket Mounted.
Special: Bend Tab, 2 ears or 3 ears.

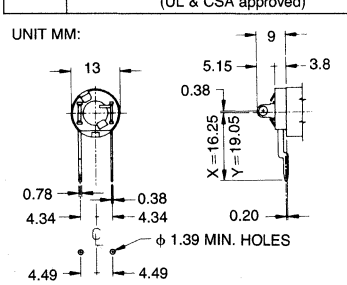
Bushing Information Diameter: 8MM × .75P, 3/8-32NEF, 1/4-32NEF
Standard Lengths: 5MM or 6.35MM
Special Lengths: As required

Terminal Information Standard: Solder lug formed 90° to the rear.
Special:
Solder lug formed down (perpendicular to shaft).
Solder lug formed 30° to the rear.
Printed Circuit:
BX-11.13MM from center of control to P.C.B. X-12.5MM from bottom of phenolic base.
U-from mounting surface—formed 90° forward.
V-from mounting surface formed 90° to the rear.

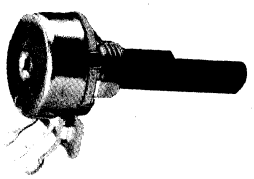
Locating Lugs (Bushing mounted style) Standard: 8MM radius from center of control.
Special: 9.5MM radius from center of control.
Standard Position: Left side terminals down supplied unless otherwise specified.
Other Positions: Available with lug right side terminals down, without lugs or with two lugs left and right side.

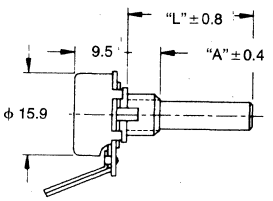
Power Switches Available (All SPST)

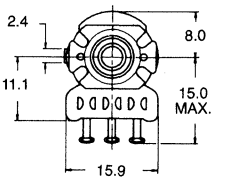
Series	T057, X057, Y057
Type	Rotary
Elect,	5A 20VDC
Rating	3A 125VAC (UL & CSA approved)



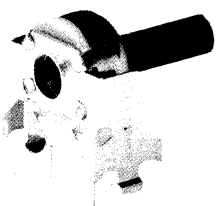
TM 270
BUSHING MOUNTED/ SOLDER LUG TERM

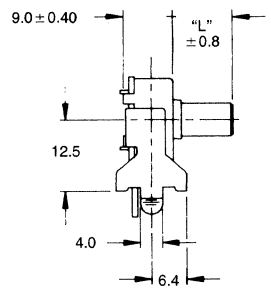


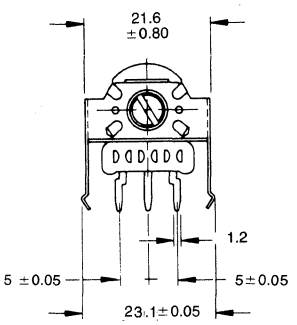




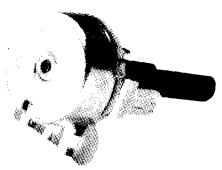
XBM 275RE

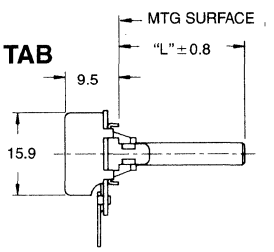


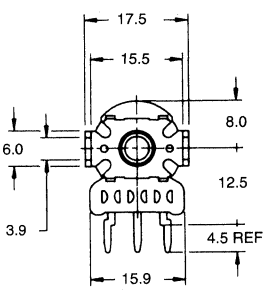




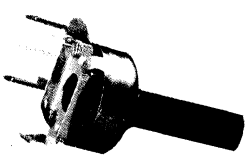
XPM 275
MOLDED SHAFT/TWIST TAB MOUNTING TYPE

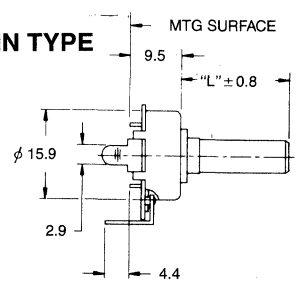


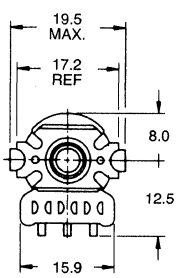




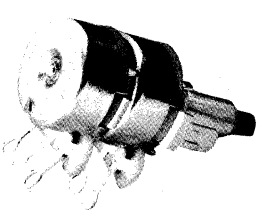
UBM 275RE
REAR EXTENDED-SNAP-IN TYPE

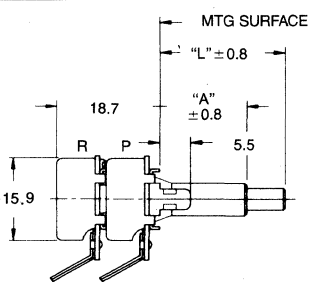


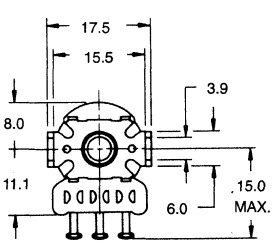




TPE C2-270
CONCENTRIC TERM







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Phone (219) 295-3675 . TWX 810-294-2258 . TELEFAX 219-295-3580

CTS® CORPORATION

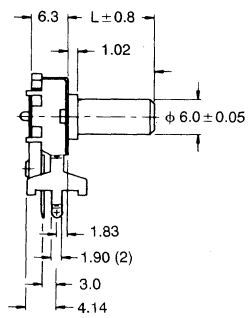
SERIES 296 COMMERCIAL COMPOSITION VARIABLE RESISTOR 15/32" (12MM) DIA.

ELECTRICAL & MECHANICAL SPECIFICATIONS

Resistance Range	Standard: 500 ohms through 1 megohms. Special: For non-standard resistance values, please contact CTS.
Resistance Tolerance	Standard: ±20%. Special: Tighter tolerances available in most resistance values.
Power Rating Watts	0.15 watts @ 40°C derated to no load @ 85°C for linear curve. 0.1 watts @ 40°C derated to no load @ 80°C for regular non-linear curve.
Voltage Rating	Across End Terminals: Standard 250 VDC; Special: 350 VDC Load not to exceed wattage ratings at given ambient temperature.
Angle of Rotation	Total Rotation: 300°±5°. Effective Rotation: 280° (approx.)
Rotational Torque	20—144 gcm
Stops	5 inch-pounds minimum stop strength.
Mounting Type	P.C. board mounting. Type "X": Control shaft parallel to P.C. board. Type "Bx": Control shaft parallel to P.C. board. Type "U": Control shaft vertical to P.C. board.
Detent	50% detent available.

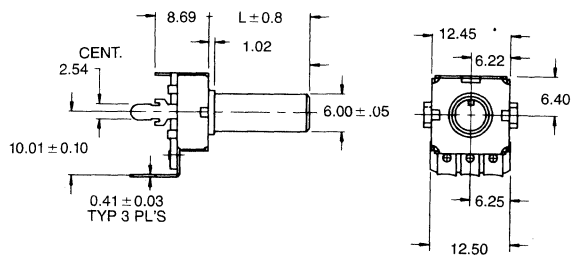
XM 296RE/BXM 296RE

MOLDED SHAFT/CONTROL SHAFT PARALLEL TO P.C. BOARD



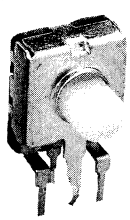
UM 296RE

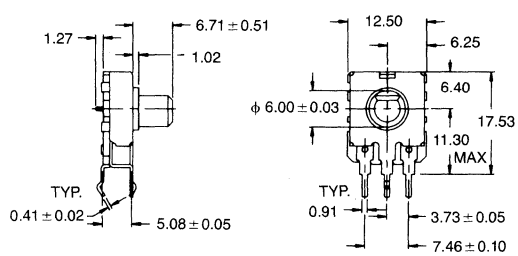
MOLDED SHAFT/CONTROL SHAFT VERTICAL TO P.C. BOARD



PM 296RE

MOLDED SHAFT/CONTROL SHAFT PARALLEL TO P.C. BOARD





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Phone (219) 295-3675 . TWX 810-294-2258 . TELEFAX 219-295-3580

CTS® CORPORATION

SERIES 262 MINIATURE COMMERCIAL 10mm COMPOSITION TRIMMER

- Miniature size
- Adjustment knob slotted for front or rear screwdriver adjustment
- P.C. mounting with knob parallel or perpendicular to printed circuit board
- Low cost
- Low height profile
- Wide resistance range
- Reliable CTS screened composition element

ELECTRICAL AND MECHANICAL SPECIFICATIONS

Resistance Range
Standard: 500 ohms through 2.5 megohms.
Special: for non-standard resistance values contact CTS.

Resistance Tolerance
Standard: ±20%
Special: Available.

Power Rating Watts
0.33 watts @70°C derated to no load @ 125°C (for special applications requiring higher wattage ratings, please contact the factory).

Voltage Rating
Across End Terminals:
350 VDC, resistance values under 2 megohms.
500 VDC, resistance values 2 megohms and over.
Load not to exceed wattage rating.

Resistance Tapers
Linear

Adjustment Knob Information
Natural color (off white) nylon knob with hex hole for front adjustment plus slot for either front or rear screwdriver adjustment.

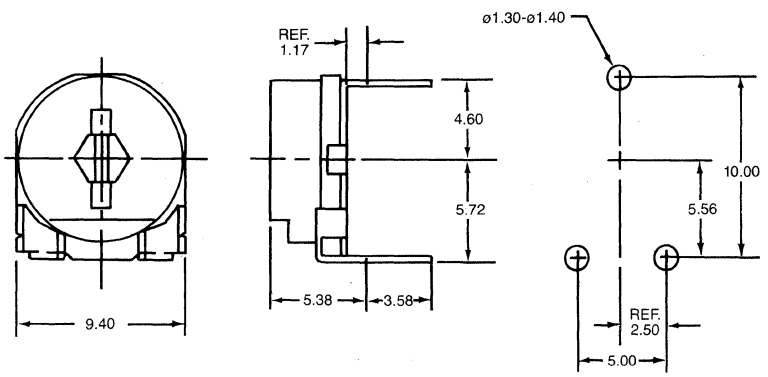
Angle of Rotation
Total Rotation: 265° ± 5°
Effective Rotation: 260° (approximately.)

Rotational Torque
.3 to 5 inch ounces.

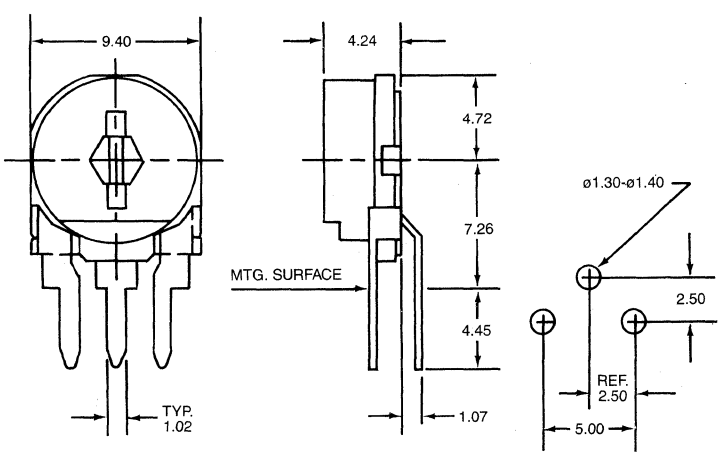
Stop Strength
16 inch ounces.

Temperature Coefficient
−450 ± 150 PPM/°C

U262 DIMENSIONS



X262 DIMENSIONS



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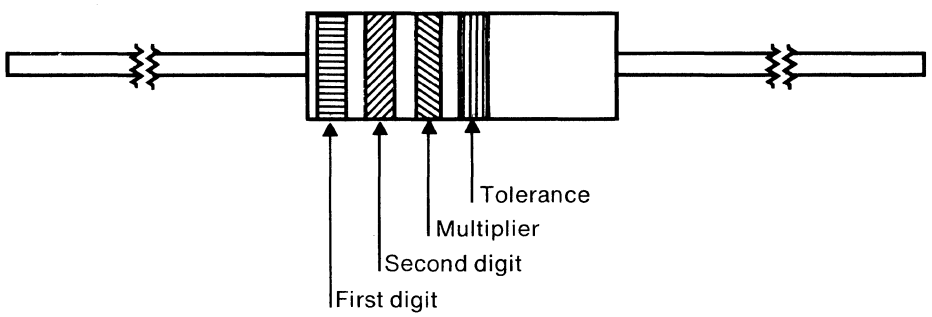
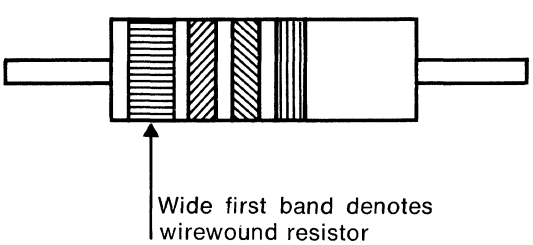
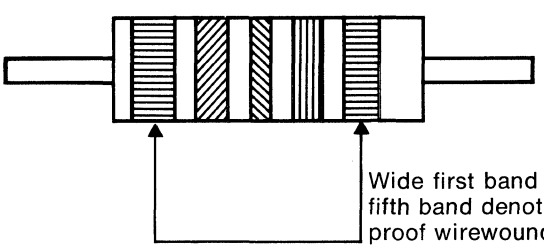
MINIGLOSSARY
RESISTOR COLOR CODES

EIA/MIL Resistor Color Codes



Color code for general-purpose industrial resistors

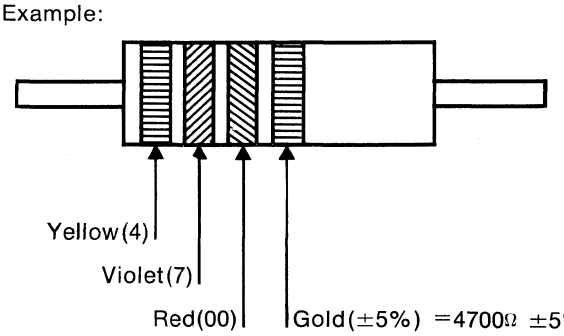




Color code for general-purpose wirewound resistors

Color	Significant digit	Multiplier	Tolerance
Black	0	1	—
Brown	1	10	± 1%
Red	2	100	± 2%
Orange	3	1000	± 3%
Yellow	4	10,000	± 4%
Green	5	100,000	—
Blue	6	1,000,000	—
Violet	7	10,000,000	—
Gray	8	—	—
White	9	—	—
Goid	—	0.1	± 5%
Silver	—	0.01	±10%
No color	—	—	±20%

Example:



CTS® CORPORATION
BERNE DIVISION

LEADED SURFACE MOUNT RESISTOR NETWORKS

SPECIFICATIONS

***Resistance Range:** Standard 22 ohm to 1.0 Megohm
***Resistance Tolerance:** Standard ±2%
Special 0.5% or 0.5 ohm (whichever greater)
***Max. Operating Coltage.** 50V not to exceed rated power
***Temp. Coefficient:** ±100 PPM typical
***Operating Temp. Range:** −55°C to +125°C
Storage Temp. Range: −55°C to +12°C
Dielectric Strength. 100V
***Power Rating.** Total network power

	Series 766		Series 767		
	8 Pin	14 Pin	16 Pin	14 Pin	16 Pin
@ 70°C	0.6w	1.0w	1.2w	1.3w	1.5w
@ 25°C	0.9w	1.6w	1.8w	2.0w	2.3w

* Custom networks can usually be designed to exceed resistance range, individual resistor power, maximum operating temperature and maximum operating voltage standard. TCR may be affected by some custom network requirements.

Environmental Performance Specifications

Test	Max. % Δ R	Mil. Std. 202 Method	Test Cond.	Test Description
Thermal Cycling Series 766 / Series 767	0.5% / 0.25%	107	B	5 cycles, −65°C to +125°C
Short Time Overload Series 766 / Series 767	0.5% / 0.25%	—	—	2½ x rated voltage, 5 sec. (100V max.)
Moisture Resistance	0.5%	106	—	240 hours, .1 rated load, −10°C to +65°C, 90% RH
High Temp. Exposure	1.0%	—	—	240 hours, no load @ 125°C
Load Life	1.0%	—	—	1000 hours @ 70°C, rated load
Resistance to Solder Heat	.25%	—	—	30 sec. @ 219°C, Flourinert*
Mechanical Shock	.25%	213	I	500g, 1 msec., 3 shocks ea. plane
Vibration	.25%	204	D	20g 10-2000 Hz, 4 hours/plane
Terminal Strength	.25%	—	—	2.0 pound pull, 30 sec., two 45° bends
Low Temp. Storage	.25%	—	—	24 hours @ −65°C, no load
Low Temp. Operation	.25%	—	—	1 hour @ −65°C, full load
Resistance to Solvents		215	—	Isopropyl alcohol, 1-1-1 Trichloroethane, Freon TMC
Solderability		208	—	RMA flux, 230°C, sec. dip, 95% coverage

* Trademark of 3M Company

STANDARD PART NUMBER

766 — 14 1 R 10K T

Series — No. Pins — Circuit Designation — Resistance Value — Packaging

Examples:

766—163 R 100K 16 pin, 8 resistors, 100K ±2%

766—141 R 10K 14 pin, 13 resistors, 10K ±2%

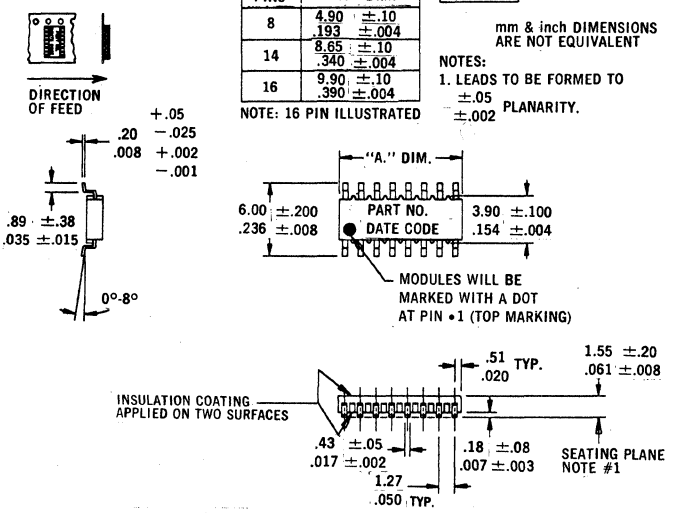
766—165R 220/330 16 pin, 28 resistors,

R_1 = 220 ohms ±2%, R_2 = 330 ohms ±2%

T — Tape & Reel
Series 766, 8 pins—12mm wide
Series 766, 14 & 16 pins—16mm wide
Series 767, 14 & 16 pins—24mm wide

S — Slide Pack All slide packs are 20" length

SERIES 766



NO. PINS	"A" DIM.
8	4.90 ±.10 / .193 ±.004
14	8.65 ±.10 / .340 ±.004
16	9.90 ±.10 / .390 ±.004

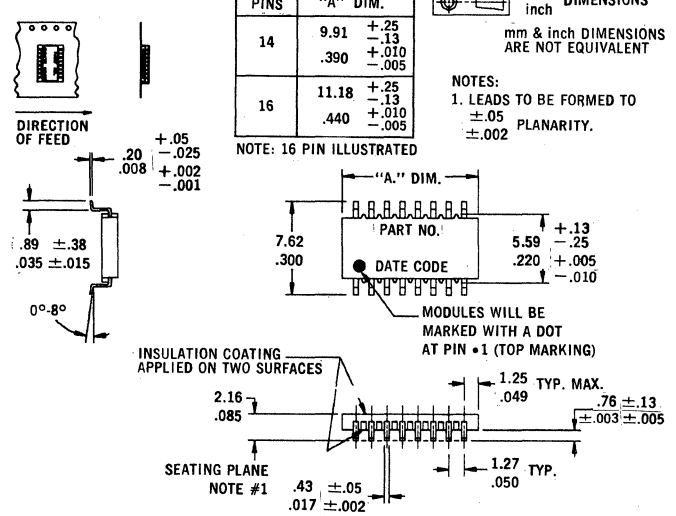
NOTE: 16 PIN ILLUSTRATED

mm / inch DIMENSIONS

mm & inch DIMENSIONS ARE NOT EQUIVALENT

NOTES:
1. LEADS TO BE FORMED TO ±.05 / ±.002 PLANARITY.

SERIES 767



NO. PINS	"A" DIM.
14	9.91 +.25 −.13 / .390 +.010 −.005
16	11.18 +.25 −.13 / .440 +.010 −.005

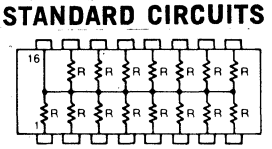
NOTE: 16 PIN ILLUSTRATED

mm / inch DIMENSIONS

mm & inch DIMENSIONS ARE NOT EQUIVALENT

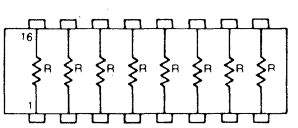
NOTES:
1. LEADS TO BE FORMED TO ±.05 / ±.002 PLANARITY.

STANDARD CIRCUITS



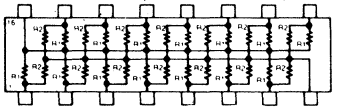
— 1 Circuit
Maximum Resistor Power*

	Series 766	Series 767
@ 25°C	.12 w	.15 w
@ 70°C	.08 w	.1 w



— 3 Circuit
Maximum Resistor Power*

	Series 766	Series 767
@ 70°C	.16 w	.2 w
@ 25°C	.24 w	.3 w



— 5 Circuit
Maximum Resistor Power*

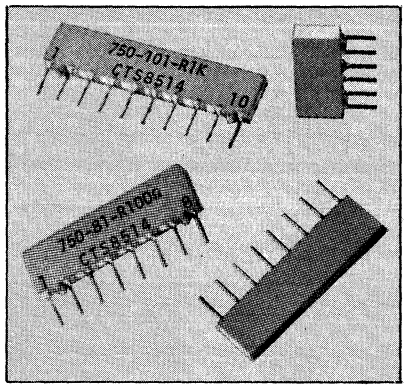
	Series 766	Series 767
@ 70°C	.08 w	.1 w
@ 25°C	.12 w	.15 w

NOTE: 16 pin illustrated. * Not to exceed maximum network power.

ORDERING INFORMATION: Place orders using following address:
BERNE DIVISION, 406 Parr Road, Berne, IN 46711 • (219) 589-8220 • TWX 810-323-1880
* In Indiana, dba CTS Electronics Corporation

CTS® CORPORATION*
BERNE DIVISION

750 SERIES SINGLE-IN-LINE SOLID CERAMIC CERMET RESISTOR NETWORKS



ELECTRICAL SPECIFICATIONS

Temperature Range:
−55°C to +125°C (operating)

Resistance Range:
Standard — 33Ω thru 1 MegΩ
Special — below 33Ω and above 1 MegΩ

Resistance Tolerance:
Standard ±2%
Special ±0.5% or 0.5Ω (whichever is greater)

Matching: (2 like resistors)
50Ω to 100 KΩ — 0.5% or 0.5Ω (whichever is greater)
100 KΩ to 500 KΩ — 1%
500 KΩ to 3 MegΩ — 2.5%

Ratio Matching:
50Ω to 100Ω — ±1%
100Ω to 100 KΩ — ±0.5%
100 KΩ to 1 MegΩ — ±2%
Note: Multiple matches available upon engineering approval

Temperature Coefficient*:
Standard ±300 PPM/°C
Special ±100 PPM/°C
Tracking available to 50 PPM/°C with same formulation on same side of substrate

Max. Operating Voltage*:
100V not to exceed rated power

Dielectric Strength:
200V

MECHANICAL SPECIFICATIONS

Substrate Material:
Alumina

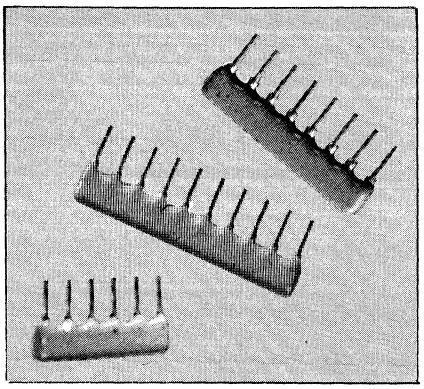
Resistor Material:
Cermet — thick film

Insulation Coating:
Organic — epoxy phenolic

Lead Material:
Solder coated copper alloy

Solder:
60/40 tin/lead

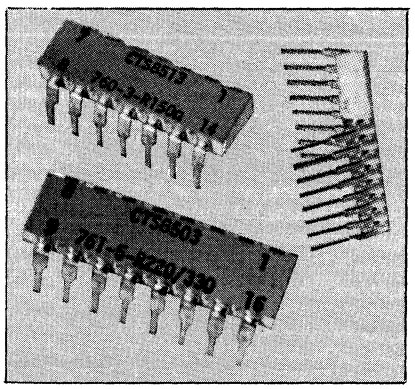
770 SERIES SINGLE-IN-LINE CONFORMAL COATED CERMET RESISTOR NETWORKS



ELECTRICAL AND MECHANICAL SPECIFICATIONS

Resistance Range:	Standard 33Ω to 1.0 MegΩ
Resistance Tolerance:	Standard: ±2% Special: ±1% or 0.5Ω (whichever is greater)
Maximum Operating Voltage:	Series 770: 50V not to exceed rated power Series 771: 100V not to exceed rated power
Temperature Coefficient:	±100 PPM 33Ω to 220 KΩ ±175 PPM above 220 KΩ to 1.0 MegΩ @ −55° to +125°C
Temp. Range:	−55° to +125°C (operating)
Storage Temp. Range:	−55° to +125°C
Dielectric Strength:	100V
Lead Material:	Solder coated copper alloy

760 SERIES DUAL-IN-LINE SOLID CERAMIC CERMET RESISTOR NETWORKS



ELECTRICAL SPECIFICATIONS

Temperature Range:
−55°C to +125°C (operating)

Resistance Range:
Standard — 22Ω through 1 MegΩ
Special — Below 22Ω and above 1 MegΩ

Resistance Tolerance:
Standard — ±2%
Special — ±0.5% or ½Ω (whichever is greater)

Resistance Matching:
(2 like resistors)
50Ω to 100 KΩ — 0.5% or 0.5Ω whichever is greater)
100 KΩ to 500 KΩ — 1%
500 KΩ to 3 MegΩ — 2.5%

Ratio Matching:
50Ω to 100Ω — ±1%
100Ω to 100K — ±0.5%
100K to 1 Meg — ±2%
Multiple ratio matching available upon engineering approval

Temperature Coefficient:
Standard — ±300 PPM/°C
Special — ±100 PPM/°C
Tracking — Available to 50 PPM/°C with same formulation and on same side of substrate

Maximum Operating Voltage*:
100V not to exceed rated power

Dielectric Strength:
200V

MECHANICAL SPECIFICATIONS

Substrate Material: Alumina

Resistor Material: Cermet — thick film

Insulation Coating: Organic — epoxy phenolic

Lead Material: Solder coated copper alloy

Solder: 60/40 tin/lead

ORDERING INFORMATION: Place orders using following address:
BERNE DIVISION, 406 Parr Road, Berne, IN 46711 • (219) 589-8220 • TWX 810-323-1880
* In Indiana, dba CTS Electronics Corporation

SINGLE-IN-LINE, Coated THICK FILM RESISTOR NETWORKS

MODEL CSC

SPECIFICATIONS

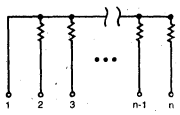
Resistance Range: 10Ω to 3.3 Meg.

Resistance Tolerance:
01 and 03 schematic: ±2% standard. ±1%, ±5%, ±10% and ±20% available.
05 schematic: ±2% standard. ±5% available

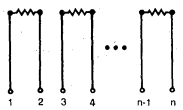
Resistance Temperature Coefficient:
±100 PPM/°C (−55°C to +125°C) typical

Terminals: Copper alloy, tin-lead plated

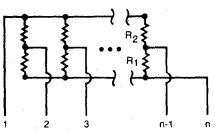
Body: High alumina. Resistors epoxy coated



01 SCHEMATIC
(Available in 4, 5, 6, 7, 8, 9, 10, 11 or 12* pin package)

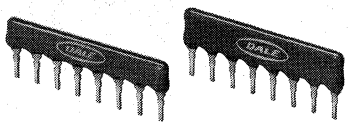


03 SCHEMATIC
(Available in 4, 6, 8, 10 or 12* pin package)



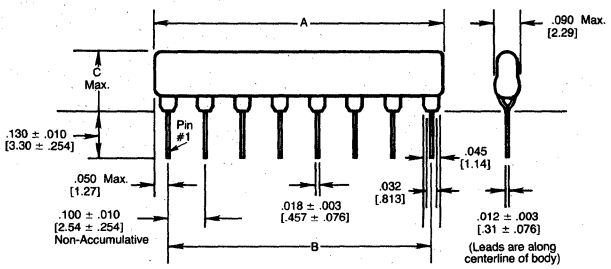
05 SCHEMATIC
(Available in 4, 5, 6, 7, 8, 9, 10, 11 or 12* pin package)

*"B" profile only



Choice of .195" [4.95] "A" and .250" [6.35] "B" maximum seated heights.

DIMENSIONAL AND TERMINAL CONFIGURATIONS [Numbers in brackets indicate millimeters]



SCHEMATICS	TYPE	A (Max.)	B	C (Max.)
01, 03, 05	CSC04	.390 [9.91]	.300 [7.62]	
01, 05	CSC05	.490 [12.45]	.400 [10.16]	
01, 03, 05	CSC06	.590 [14.99]	.500 [12.70]	
01, 05	CSC07	.690 [17.53]	.600 [15.24]	"A" Profile = .195 [4.95]
01, 03, 05	CSC08	.790 [20.07]	.700 [17.78]	"B" Profile = .250 [6.35]
01, 05	CSC09	.890 [22.61]	.800 [20.32]	
01, 03, 05	CSC10	.990 [25.15]	.900 [22.86]	
01, 05	CSC11	1.090 [27.69]	1.000 [25.40]	
01, 03, 05	CSC12	1.190 [30.23]	1.100 [27.94]	

Contact factory for stock values.

SINGLE-IN-LINE, Molded THICK FILM RESISTOR NETWORKS

MODEL MSP

SPECIFICATIONS

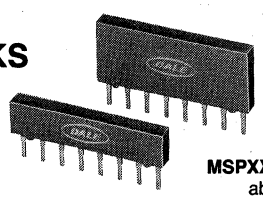
ELECTRICAL

Resistance Range: 10Ω to 3.3 Megohms

Resistance Tolerance: 01 and 03 schematic: ±2% standard. ±1%, ±5%, ±10% and ±20% available.
05 schematic: ±2% standard. ±5% available.

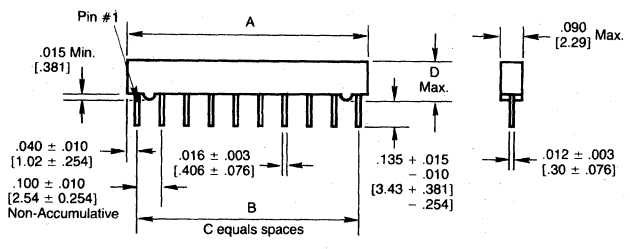
Temperature Coefficient: ±100 PPM/°C (−55°C to +125°C) typical

Terminals: Copper alloy, tin-lead plated



MSPXXC, .350" [8.89] above board

MSPXXA, .195" [4.95] above board

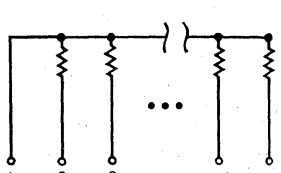


DIMENSIONAL AND TERMINAL CONFIGURATIONS [Numbers in brackets indicate millimeters]

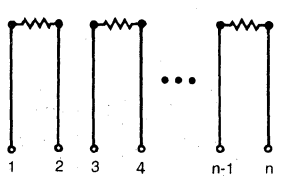
TYPE	A (Max.)	B	C	D
MSP06	.590 [14.99]	.500 [12.70]	5	.195" [4.95] for MSPXXA
MSP08	.790 [20.07]	.700 [17.78]	7	.350" [8.89] for MSPXXC
MSP10	.990 [25.15]	.900 [22.86]	9	

Contact factory for stock values.

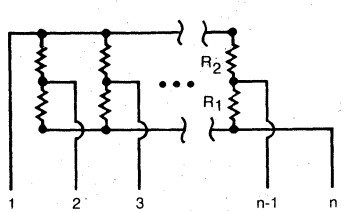
01 SCHEMATIC



03 SCHEMATIC



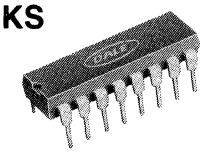
05 SCHEMATIC



For complete information, write or phone
DALE ELECTRONICS, INC., Box 26728, El Paso, TX 79926 • Phone 915-592-3253

DUAL-IN-LINE, Molded
THICK FILM RESISTOR NETWORKS

MODELS MDP14, MDP16 and MDP18
01, 03, 05 Schematic



SPECIFICATIONS

ELECTRICAL

Resistance Range: 10Ω to 3.3 Megohms

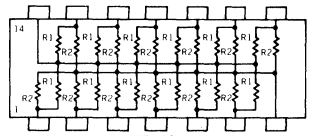
Resistance Tolerance: 01 and 03 schematic: ±2% standard. ±1%, ±5%, ±10% and ±20% available. 05 schematic: ±2% standard, ±1% and ±5% available.

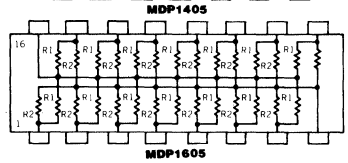
Resistance Temperature Coefficient: ±100 PPM/°C (−55°C to +125°C) standard

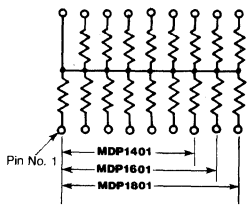
Terminals: Copper alloy, tin-lead plated

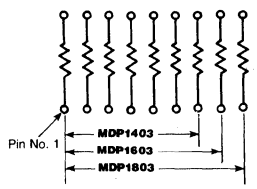
Body: Molded epoxy

STANDARD SCHEMATICS





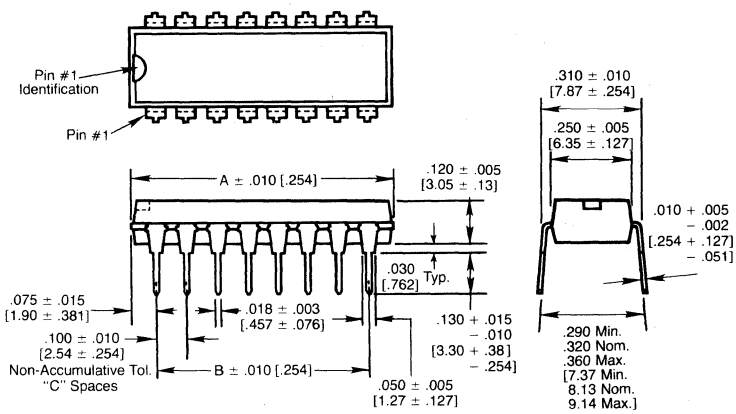




DIMENSIONS AND TERMINAL CONFIGURATIONS

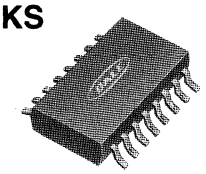
[Numbers in brackets indicate millimeters]

TYPE	A	B	C
MDP14	.750″ [19.05]	.600″ [15.24]	6
MDP16	.850″ [21.59]	.700″ [17.78]	7
MDP18	.950″ [24.13]	.800″ [20.32]	8



SURFACE MOUNTED, SMALL OUTLINE MOLDED DIP
THICK FILM RESISTOR NETWORKS

MODELS SOMC-14 and SOMC-16
01, 03, 05 Schematic



SPECIFICATIONS

ELECTRICAL

Resistance Range: 10Ω to 1 Megohms

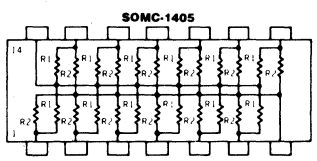
Resistance Tolerance:
01 and 03 schematic: ±2% standard. ±1%, ±5%, ±10% and ±20% available.
05 schematic: ±2% standard. ±5% available.

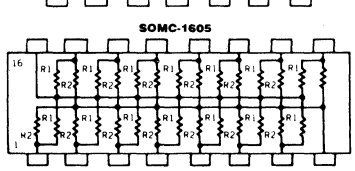
Resistance Temperature Coefficient:
±100 PPM/°C (−55°C to +125°C) typical

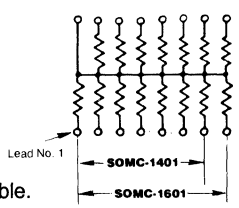
Terminals: Copper alloy, 60/40 solder dipped terminal

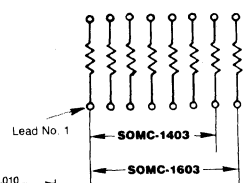
Body: Molded epoxy

SOMC-1405 / SOMC-1605





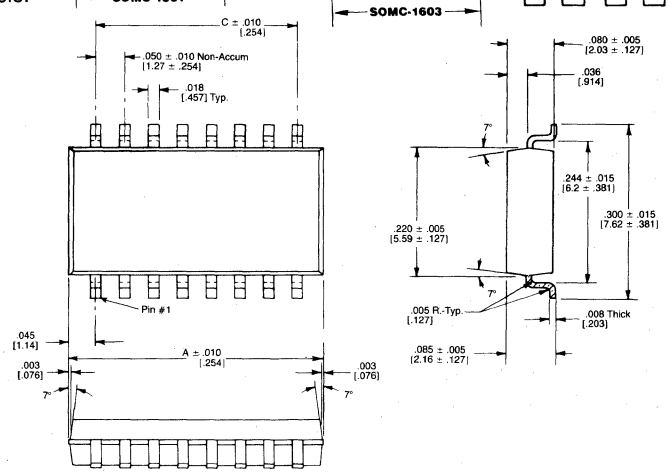




DIMENSIONAL AND TERMINAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]

TYPE	A	B	C
14	.390″ [9.906]	.350″ [8.89]	.300″ [7.62]
16	.440″ [11.176]	.400″ [10.16]	.350″ [8.89]



For complete information, write or phone
DALE ELECTRONICS, INC., Box 26728, El Paso, TX 79926 • Phone 915-592-3253

MILITARY QUALIFIED
THICK FILM RESISTOR NETWORKS

MIL-R-83401, STYLE RZ

SPECIFICATIONS (Applicable to all styles)

ELECTRICAL

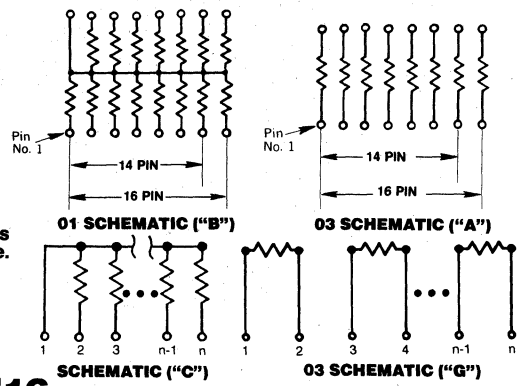
Resistance Range: 10Ω to 1 Megohm

Resistance Tolerances: ±1%, ±2%, ±5%

Temperature Coefficient: "M" = ±300 PPM/°C; "K" = ±100 PPM/°C over the temperature range of −55°C to +125°C (+25°C reference)

APPROVED SCHEMATIC ALTERNATIVES

NOTE: Mil-Qualified 05 schematics "H" and "J" also available.

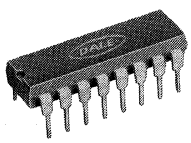


DUAL-IN-LINE, MODELS MDM14 & MDM16

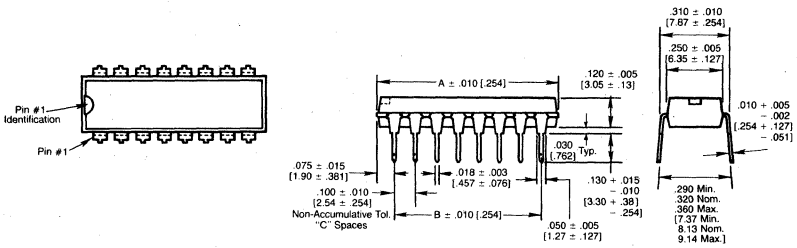
M8340101 = 14 PIN, M8340102 = 16 PIN

DIMENSIONAL AND TERMINAL CONFIGURATIONS
[Numbers in brackets indicate millimeters]

NO. OF PINS	A	B	C
14	.750 [19.05]	.600 [15.24]	6
16	.850 [21.59]	.700 [17.78]	7



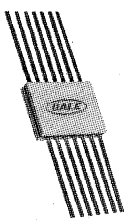
MIL P/N	MIL. STYLE	DALE TYPE	MILITARY RES. RANGE TOLERANCE ±1%, ±2%, ±5%
M8340101XXXXXXA	RZ010	MDM14-03	10Ω-1 Meg.
M8340101XXXXXXB	RZ010	MDM14-01	10Ω-1 Meg.
M8340102XXXXXXA	RZ020	MDM16-03	10Ω-1 Meg.
M8340102XXXXXXB	RZ020	MDM16-01	10Ω-1 Meg.



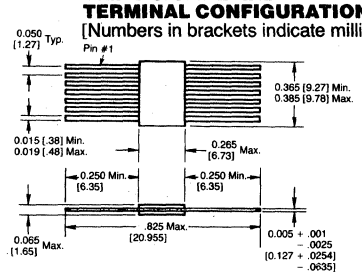
FLAT PACK, MODEL DFM M8340103 = 14 PIN

MIL P/N	MIL. STYLE	DALE TYPE	MILITARY RES. RANGE TOLERANCE ±1%, ±2%, ±5%
M8340103XXXXXXA	RZ030	DFM14-01 DFM14-11	10Ω-1 Meg. 10Ω-1 Meg.
M8340103XXXXXXB	RZ030	DFM14-02 DFM14-12	10Ω-1 Meg. 10Ω-1 Meg.

Leads: −01, −02 = gold plated, −11, −12 = hot solder dipped

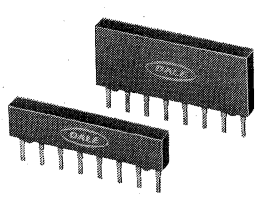


DIMENSIONAL AND TERMINAL CONFIGURATIONS
[Numbers in brackets indicate millimeters]



SINGLE-IN-LINE, MODEL MSM

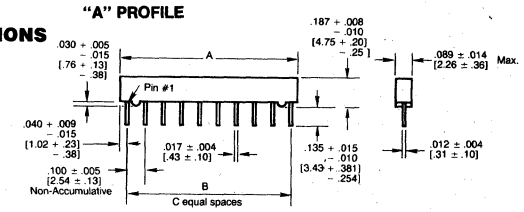
MIL P/N	MIL. STYLE	DALE TYPE	MILITARY RES. RANGE TOLERANCE ±1%, ±2%, ±5%
M8340104XXXXXXC	RZ040	MSM06C01	10Ω-1 Meg.
M8340104XXXXXXG	RZ040	MSM06C03	10Ω-1 Meg.
M8340105XXXXXXC	RZ050	MSM08C01	10Ω-1 Meg.
M8340105XXXXXXG	RZ050	MSM08C03	10Ω-1 Meg.
M8340106XXXXXXC	RZ060	MSM10C01	10Ω-1 Meg.
M8340106XXXXXXG	RZ060	MSM10C03	10Ω-1 Meg.
M8340107XXXXXXC	RZ070	MSM06A01	10Ω-1 Meg.
M8340107XXXXXXG	RZ070	MSM06A03	10Ω-1 Meg.
M8340108XXXXXXC	RZ080	MSM08A01	10Ω-1 Meg.
M8340108XXXXXXG	RZ080	MSM08A03	10Ω-1 Meg.
M8340109XXXXXXC	RZ090	MSM10A01	10Ω-1 Meg.
M8340109XXXXXXG	RZ090	MSM10A03	10Ω-1 Meg.



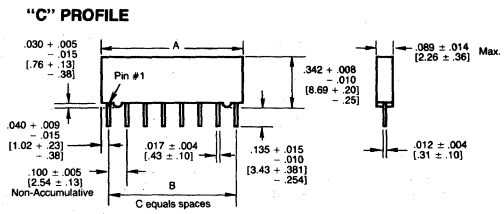
TYPE	A	B	C
MSM06	.583 ± .015 [14.81 ± .38]	.500 [12.70]	5
MSM08	.783 ± .015 [19.89 ± .38]	.700 [17.78]	7
MSM10	.983 ± .015 [24.97 ± .38]	.900 [22.86]	9

DIMENSIONAL AND TERMINAL CONFIGURATIONS
[Numbers in brackets indicate millimeters]

"A" PROFILE



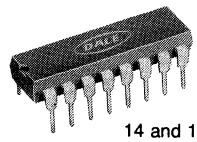
"C" PROFILE



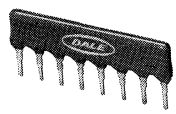
For complete information, write or phone
DALE ELECTRONICS, INC., Box 26728, El Paso, TX 79926 • Phone 915-592-3253

DUAL & SINGLE-IN-LINE PACKAGES
RESISTOR/CAPACITOR NETWORKS

R/C Networks



14 and 16 Pin
Molded DIP styles



4 thru 12 Pin
Coated SIP styles

FEATURES

- Ideal where repetitive circuits are required.
- Wide range of R/C values for special applications.
- High density packaging for reduced assembly costs, improved performance and simplified board layout.
- Utilize same thick film circuit materials as those qualified to MIL-R-83401.
- Capacitors available to EIA RS 198 or MIL-C-55681.

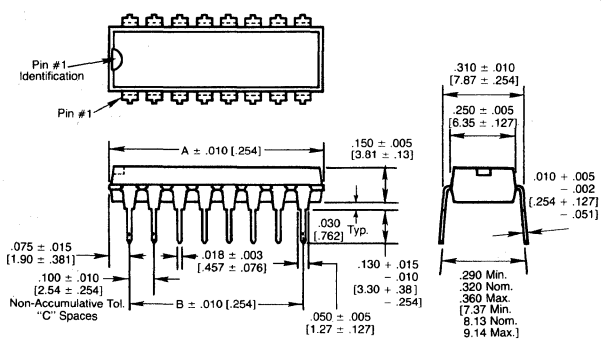
GENERAL SPECIFICATIONS

	RESISTORS	*CAPACITORS		
		NPO	BX	X7R
Value Range (SIP)	10Ω-3.3 meg	100pf-4700pf	500pf-0.1μf	500pf-0.1μf
(DIP)	10Ω-3.3 meg	100pf-2700pf	500pf-0.1μf	500pf-0.1μf
Tolerances	±2% standard, ±1%, ±5%, ±10%, ±20% available	±5% & ±10%	±10% & ±20%	±10% & ±20%
Temperature Characteristics (−55°C to +125°C)	±100ppm/°C Typical	±30ppm/°C	±15% @ OVDC & +15%, −25% @ rated VDC	±15%
Voltage Rating	100VDC	50VDC	50VDC	50VDC
Dissipation Factor (1V RMS @ 1 KHZ)	N/A	0.1% max	2.5% max	3.0% max
Operating Temperature Range	−55°C to +125°C			

*Capacitors tested at 1V RMS @ 1 KHZ @ 25°C

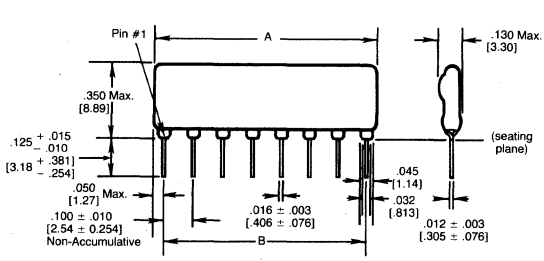
STANDARD PACKAGE CONFIGURATIONS
DIMENSIONAL AND TERMINAL CONFIGURATIONS: [Numbers in brackets indicate millimeters]

DUAL-IN-LINE



No. of Pins	A	B
14	.750 [19.05]	.600 [15.24]
16	.850 [21.59]	.700 [17.78]

SINGLE-IN-LINE



No. of Pins	A (Max.)	B
4	.390 [9.91]	.300 [7.62]
5	.490 [12.45]	.400 [10.16]
6	.590 [14.99]	.500 [12.70]
7	.690 [17.53]	.600 [15.24]
8	.790 [20.07]	.700 [17.78]
9	.890 [22.61]	.800 [20.32]
10	.990 [25.15]	.900 [22.86]
11	1.090 [27.69]	1.000 [25.40]
12	1.190 [30.23]	1.100 [27.94]

For complete information, write or phone
DALE ELECTRONICS, INC., Box 26728, El Paso, TX 79926 • Phone 915-592-3253

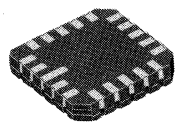
SURFACE MOUNTED RESISTORS
THIN FILM RESISTOR NETWORK

MODEL TLCC-XXA

01 Schematic: 15 to 23 resistors with highest numbered terminal common
03 and 06 Schematics: 8 to 12 isolated resistors

FEATURES

- Highly stable thin film
- Low temperature coefficient Nichrome Film
- Hermetic
- Uniform performance characteristics



SPECIFICATIONS

Resistance Range: 1K ohm to 100K ohm
Resistance Tolerance: 2%, 1%, 0.5%
Resistance Ratio Match: 1%, 0.5%, 0.1%
Resistance Temperature Coefficient: ±25 PPM/°C (−55°C to +125°C) typical
T.C. Tracking: ±10 PPM/°C (−55°C to +125°C) typical
Body: 90% minimum alumina content
Terminals: Gold, 60 microinch minimum
Lid: Gold plated Kovar
Seal: Gold-tin alloy

01 SCHEMATIC	16	20	24
Package	0.8	1.0	1.2
Element	0.05	0.05	0.05
03 and 06 SCHEMATICS	**16**	**20**	**24**
Package	0.8	1.0	1.2
Element	0.100	0.100	0.100

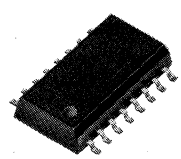
Size: TLCC-16A = .300″ x .300″ x .077″
TLCC-20A = .350″ x .350″ x .077″
TLCC-24A = .400″ x .400″ x .077″

MODELS TOMC-14 and TOMC-16

01 Schematic: 13 or 15 resistors with highest numbered lead common
03 Schematic: 7 or 8 isolated resistors

FEATURES

- .090″ [2.29] maximum seated height
- Rugged, molded case construction
- Highly stable thin film
- Low temperature coefficient, ±25 PPM/°C (−55°C to +125°C)
- Reduces total assembly costs
- Compatible with automatic surface mounting equipment
- Wide resistance range
- Uniform performance characteristics



SPECIFICATIONS

Resistance Range: 100 ohms to 100K
Resistance Tolerance: ±1%, 0.5%, .1%
Resistance Ratio Match: 0.5%, 0.1%, .25%, 0.05%
Resistance Temperature Coefficient: ±25 PPM/°C,
T.C. Tracking: ±5 PPM/°C (−55°C to +125°C) typical
Resistor Power Rating: 01 = .05 watt maximum at 25°C
03 = .100 watt maximum at 25°C

Package Power Rating: 14 pin or 14 lead = .65 watt
16 pin or 16 lead = .75 watt
(maximum at 25°C)
Solderability: Per MIL-R-83401
Leads: Copper alloy, solderable
Body: Molded epoxy
Body Size: TOMC-14 = .390″ x .220″ x .080″
TOMC-16 = .440″ x .220″ x .080″

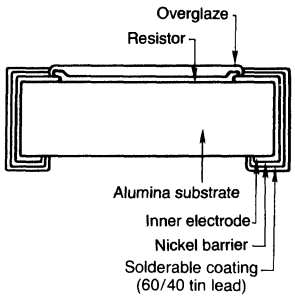
For complete information, write or phone
DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, Nebraska 68701 • Phone 402-371-0080

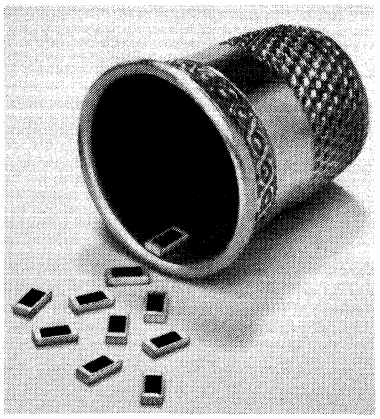
COMMERCIAL THICK FILM CHIP RESISTORS

DALE SERIES CRCW

FEATURES

- Internationally standardized size
- Automatic placement compatibility
- Flow solderable
- Thick film resistance element
- Wraparound termination
- Inner electrode protection





SPECIFICATIONS

Dale Type	RESISTANCE, TOLERANCE & TEMPERATURE COEFFICIENT RANGE						Power Rating and Maximum Operating Voltage (@ 70°C) (See derating curve)	Zero Ohm Jumpers	DIMENSIONS [Numbers in brackets indicate millimeters]				
	E-12 Std. Res. Values	E-24 Std. Res. Values		E-96 Std. Res. Values									
	±10% & ±20%	±5%	±5%	±1%	±1%	±.5%							
	±300 PPM/°C	±300 PPM/°C	±200 PPM/°C	±200 PPM/°C	±100 PPM/°C	±100 PPM/°C			A (Length)	B (Width)	C	D	E
CRCW 0805		5Ω to 5 Meg.	10Ω to 1 Meg.	10Ω to 1 Meg.	10Ω to 1 Meg.		1/16W 100V	0.05Ω Max. 1 AMP Max.	.079 ± .008 [2.00 ± .20]	.049 ± .008 [1.25 ± .20]	.020 ± .008 [.50 ± .20]	.016 ± .010 [.40 ± .25]	.016 ± .010 [.40 ± .25]
CRCW 1206	3Ω to 22 Meg.	3Ω to 22 Meg.	10Ω to 2.2 Meg.	10Ω to 2.2 Meg.	10Ω to 1 Meg.	1K to 5K	1/8W 200V	0.05Ω Max. 2 AMP Max.	.126 ± .008 [3.20 ± .20]	.063 + .006 − .008 [1.60 + .15 − .20]	.022 ± .006 [.56 ± .15]	.020 ± .010 [.50 ± .25]	.020 ± .010 [.50 ± .25]
CRCW 1210			10Ω to 1.5 Meg.	10Ω to 1.5 Meg.	20Ω to 220K		1/4W 200V	0.05Ω Max. 4 AMP Max.	.126 ± .008 [3.20 ± .20]	.098 ± .008 [2.50 ± .20]	.022 ± .006 [.56 ± .15]	.020 ± .010 [.50 ± .25]	.020 ± .010 [.50 ± .25]
CRCW 2010		3Ω to 320K	10Ω to 320K	10Ω to 320K			1/2W 200V		.200 + .009 − .006 [5.08 + .23 − .15]	.100 + .009 − .006 [2.54 + .23 − .15]	.022 ± .006 [.56 ± .15]	.020 ± .010 [.50 ± .25]	.020 ± .010 [.50 ± .25]
CRCW 2512		3Ω to 240K	10Ω to 240K	10Ω to 240K	10Ω to 240K		1W 200V		.250 + .009 − .006 [6.35 + .23 − .15]	.126 + .008 − .006 [3.20 + .20 − .15]	.022 ± .006 [.56 ± .15]	.020 ± .010 [.50 ± .25]	.020 ± .010 [.50 ± .15]

☐ = Factory Stocked Resistance Range ▒ = Contact Factory for Delivery ■ = Contact Factory for Availability

HOW TO ORDER

CRCW	XXXX	–	XXX or XXXX	X	XXX
SERIES	SIZE		RESISTANCE VALUE CODE	TOLERANCE	*PACKAGING
	0805 2010 1206 2512 1210		First two digits (3 for "F" tolerance) are significant; last digit is the multiplier	**F** = ±1% **J** = ±5%	**B02** = Bulk — 1,000 pieces per plastic bag. **RT1** = Paper Tape — 5,000 pieces per reel. **RT2** = Punched Plastic Tape — 5,000 pieces per reel. **RT3** = Punched Plastic Tape — 10,000 pieces per reel. (Contact factory)

*Contact factory for packaging on 2010 and 2512 sizes.

For complete information, write or phone
DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, Nebraska 68701 • Phone 402-371-0080

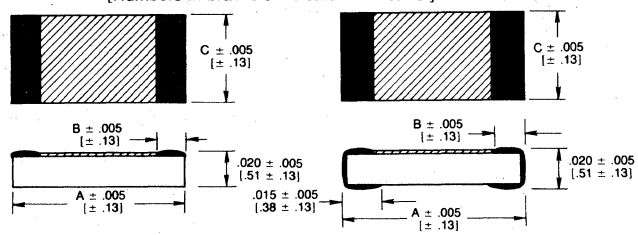
DALE® THICK FILM CHIP RESISTORS

MODELS RCM AND RCWPM/RCWM
Established Reliability
Military Qualification MIL-R-55342/2, /3, /4, /5, /6

FEATURES
- Allows wide design flexibility for use with hybrid circuitry
- One-surface and wraparound terminations
- Choice of sizes and power ratings
- Dale has complete capability to develop specific reliability programs designed to customer requirements
- Custom sizes can be designed for special applications

MODELS RC and RCWP/RCW
Commercial

DIMENSIONAL AND TERMINAL CONFIGURATIONS
[Numbers in brackets indicate millimeters.]



RC and RCM (One-surface termination) — **RCWP/RCW, RCWPM/RCWM (Wraparound termination)**

RCM and RCWPM/RCWM SPECIFICATIONS

ELECTRICAL

Resistance and Tolerance Range:
RCM/RCWPM/RCWM550: 10Ω to 470K, ±1%, 2%, 5% and 10%
RCM/RCWPM/RCWM575, 5100, 5150 and 7225:
10Ω to 1 Meg., ±1%, 2%, 5% and 10%

Resistance Temperature Coefficient:
(−55°C to +125°C) "M" = ± 300 PPM/°C
"K" = ± 100 PPM/°C

Power Rating: Maximum at 70°C
RCM/RCWPM/RCWM550 = 50 MW
RCM/RCWPM/RCWM575 = 100 MW
RCM/RCWPM/RCWM5100 = 100 MW
RCM/RCWPM/RCWM5150 = 150 MW
RCM/RCWPM/RCWM7225 = 225 MW

MILITARY STYLE	DALE TYPE	A (Length)	B	C (Width)
RM0505	RCM550	.050 [1.27]	.010 [.25]	.050 [1.27]
	RCWPM/RCWM550	.055 [1.40]		
RM0705	RCM575	.075 [1.91]	.015 [.38]	.050 [1.27]
	RCWPM/RCW7575	.080 [2.03]		
RM1005	RCM5100	.100 [2.54]	.015 [.38]	.050 [1.27]
	RCWPM/RCWM5100	.105 [2.67]		
RM1505	RCM5150	.150 [3.81]	.015 [.38]	.050 [1.27]
	RCWPM/RCWM5150	.155 [3.94]		
RM2208	RCM7225	.225 [5.72]	.015 [.38]	.075 [1.91]
	RCWPM/RCWM7225	.230 [5.84]		

RC and RCWP/RCW SPECIFICATIONS

ELECTRICAL

Resistance Range:
RC/RCWP/RCW540: 5Ω to 4.7 Meg.
RC/RCWP/RCW550: 5Ω to 4.7 Meg.
RC/RCWP/RCW575: 5Ω to 10 Meg.
RC/RCWP/RCW5100: 10Ω to 15 Meg.
RC/RCWP/RCW5150: 10Ω to 15 Meg.
RC/RCWP/RCW1100: 5Ω to 7.5 Meg.
RC/RCWP/RCW7225: 10Ω to 15 Meg.
RC/RCWP/RCW2010: 10Ω to 15 Meg.
RC/RCWP/RCW2512: 10Ω to 15 Meg.
RC/RCWP/RCW1206: 10Ω to 10 Meg.

Resistance Tolerance: ±1%, ±2%, ±5%, ±10%, ±20%

Resistance Temperature Coefficient:
(−55°C to +125°C) ±100 PPM/°C, ±200 PPM/°C, ±300 PPM/°C

Power Rating (@ 70°C) and Maximum Operating Voltage:
RC/RCWP/RCW540 = 80 MW, 40 VDC
RC/RCWP/RCW550 = 100 MW, 50 VDC
RC/RCWP/RCW575 = 150 MW, 70 VDC
RC/RCWP/RCW5100 = 200 MW, 100 VDC
RC/RCWP/RCW5150 = 350 MW, 125 VDC
RC/RCWP/RCW1100 = 400 MW, 100 VDC
RC/RCWP/RCW7225 = 600 MW, 200 VDC
RC/RCWP/RCW2010 = 800 MW, 200 VDC
RC/RCWP/RCW2512 = 1000 MW, 200 VDC
RC/RCWP/RCW1206 = 250 MW, 100 VDC

Operating Temperature Range: −55°C to +125°C

COMMERCIAL STYLE

DALE TYPE	A (Length)	B	C (Width)
RC540	.050 [1.27]	.010 [.25]	.040 [1.02]
RCWP/RCW540	.055 [1.40]	.010 [.25]	.040 [1.02]
RC550	.050 [1.27]	.010 [.25]	.050 [1.27]
RCWP/RCW550	.055 [1.40]	.010 [.25]	.050 [1.27]
RC575	.075 [1.91]	.015 [.38]	.050 [1.27]
RCWP/RCW575	.080 [2.03]	.015 [.38]	.050 [1.27]
RC5100	.100 [2.54]	.015 [.38]	.050 [1.27]
RCWP/RCW5100	.105 [2.67]	.015 [.38]	.050 [1.27]
RC5150	.150 [3.81]	.015 [.38]	.050 [1.27]
RCWP/RCW5150	.155 [3.94]	.015 [.38]	.050 [1.27]
RC1100	.100 [2.54]	.015 [.38]	.100 [2.54]
RCWP/RCW1100	.105 [2.67]	.015 [.38]	.100 [2.54]
RC7225	.225 [5.72]	.015 [.38]	.075 [1.91]
RCWP/RCW7225	.230 [5.84]	.015 [.38]	.075 [1.91]
RC2010	.200 [5.08]	.015 [.38]	.100 [2.54]
RCWP/RCW2010	.205 [5.21]	.015 [.38]	.100 [2.54]
RC2512	.250 [6.35]	.015 [.38]	.125 [3.18]
RCWP/RCW2512	.255 [6.48]	.015 [.38]	.125 [3.18]
RC1206	.120 [3.05]	.015 [.38]	.060 [1.52]
RCWP/RCW1206	.120 [3.05]	.015 [.38]	.060 [1.52]

HOW TO ORDER–MILITARY PART NUMBER

M55342/2 – M 1003 F S M

DETAIL SPEC. NO.
M55342/2 = RM0505
M55342/6 = RM0705
M55342/3 = RM1005
M55342/4 = RM1505
M55342/5 = RM2208

CHARACTERISTIC
M = ±300 PPM/°C
K = ±100 PPM/°C

RESISTANCE VALUE
The first two digits (three for "F" tolerance) are significant figures and the last digit specifies the number of zeros to follow.

TOLERANCE
F = ±1%
G = ±2%
J = ±5%
K = ±10%

TERMINATION
S = Pre-tinned Platinum-Gold one-surface (RCM).
R = Pre-tinned Platinum-Gold wraparound (RCWPM).
T = Untinned Platinum-Gold one-surface (RCM).
U = Untinned Platinum-Gold wraparound (RCWM).
B = Pre-tinned Nickel Barrier wraparound (RCWPM).
C = Untinned Palladium Silver wraparound (RCWM).

FAILURE RATE
M = 1%/1000 hours
P = 0.1%/1000 hours
R = 0.01%/1000 hours

HOW TO ORDER: RC and RCWP/RCW–Commercial Styles

RCWP 5100 103 G 40

STYLE
RC = One-surface termination.
RCW = Wraparound termination.
RCWP = Wraparound termination, pre-tinned nickel barrier.

SIZE
540 1100
550 7225
575 2010
5100 2512
5150 1206

RESISTANCE CODE
The first two digits (three for "F" tolerance) are significant figures and the last digit specifies the number of zeros to follow.

TOLERANCE
F = ±1%
G = ±2%
J = ±5%
K = ±10%
M = ±20%

TERMINATION CODE
No Code = Solder Pre-tinned (standard)
20 = Gold (RC only)
40 = Platinum Gold (RC & RCW only)
42 = Palladium Silver (RC & RCW only)

For complete information, write or phone
DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, Nebraska 68701 • Phone 402-371-0080

DALE®

COMMERCIAL PRECISION THIN FILM RESISTORS

MODEL PTF, COATED
Low T.C.—Tight Tolerance

FEATURES

- Performance exceeds MIL-R-55182 requirements
- Models available to meet MIL-R-122, contact factory
- Extremely low temperature coefficients of resistance
- Very low noise and voltage coefficient
- Wide precision resistance range in small package
- 100% laser spiralled
- Very good high frequency characteristics
- Proprietary epoxy coating provides superior moisture protection
- Acceptance testing available
- Can replace wirewound bobbins

MATERIAL

Element: Precision deposited nickel-chrome alloy with controlled annealing

Core: Fire-cleaned high purity ceramic

Encapsulant: Specially formulated epoxy compounds. Coated construction.

Termination: Standard lead material is solder-coated copper. Solderable and weldable per MIL-STD-1276, Type C.

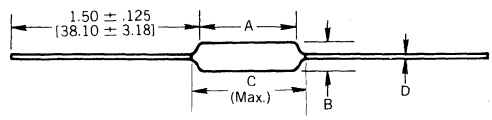
STANDARD ELECTRICAL SPECIFICATIONS

DALE TYPE	85°C RATING	MAX. WT. (Grams)	MAX. WORKING VOLTAGE	RESISTANCE RANGE
PTF 51	1/20 W	.11	200	50Ω to 100K
PTF 56	1/8 W	.35	300	50Ω to 499K
PTF 65	1/4 W	.75	500	50Ω to 1 Meg.

Standard tolerances from 1% to .01%.

PHYSICAL CONFIGURATIONS

TYPE	DIM. A	DIM. B.	DIM. C (MAX.)	DIM. D
PTF 51	.150 ± .020 [3.81 ± .51]	.070 ± .010 [1.78 ± .25]	.200 [5.08]	.016 [.406]
PTF 56	.250 + .031 − .046 [6.35 + .79 − 1.17]	.091 ± .009 [2.31 ± .23]	.300 [7.62]	.025 [.635]
PTF 65	.375 ± .062 [9.53 ± 1.57]	.145 ± .016 [3.68 ± .41]	.475 [12.07]	.025 [.635]



TEMPERATURE COEFFICIENT CODE −20° to +85°C

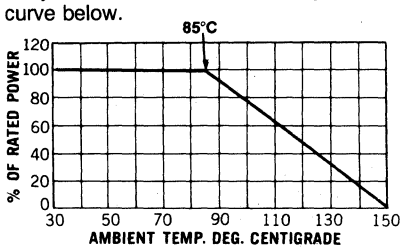
T.C. CODE	TEMPERATURE COEFFICIENT
T-10	0 ± 15 PPM/°C
T-13	0 ± 10 PPM/°C
T-16	0 ± 5 PPM/°C

PERFORMANCE DATA

TEST per MIL-R-55182 (Exceptions Noted)	MAX. ΔR (Typical Test Lots)	SPECIFICATION
Thermal Shock (−55°C to +85°C)	0.02%	MIL-STD-202, Method 107
Moisture	0.08%	MIL-STD-202, Method 106
Resistance to Solder Heat	0.02%	MIL-STD-202, Method 210
Dielectric Withstanding	0.01%	MIL-STD-202, Method 301 & 105
Short Time Overload	0.01%	MIL-R-10509, Para. 4.6.6
Damp Heat	0.08%	IEC Publication #68-2-3 (56 days)
Low Temperature Operation	0.02%	MIL-R-55182, Para. 4.7.9
Life (1000 hours rated power @ 85°C)	0.04%	MIL-R-55182, Para. 4.7.17

DERATING

Dale PTF resistors have an operating temperature range of −55°C to +150°C. They must be derated according to the curve below.



MATCHED SETS — NETWORKS

Dale's many years of experience in matching resistors for sets and networks, combined with the superb performance of the PTF product, provide the best and most economical solution to your precision resistor requirements. Why? Because most applications for precision resistors depend on two or more discretes having an initial tolerance ratio and a resistance tracking capability over temperature rather than each discrete resistor meeting the absolute requirements of the application.

Cost savings approaching 50% can be realized when relatively tight matching requirements are specified while permitting the absolute parameters of the discrete resistors to have more relaxed specifications.

Dale application engineers are available to assist you in specifying your requirements in the most economical way possible.

For complete information, write or phone
DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, NE 68701 • Phone 402-371-0080

DALE®

COMMERCIAL METAL FILM RESISTORS

MODELS CCF-07, CCF-50, CCF-55 and CCF-60, COATED

FEATURES

- 1/4 watt at 70°C power rating (CCF-07, -50, -55, -60)
  1/2 watt at 70°C power rating (CCF-55 and CCF-60)
- Superior electrical performance. CCF-50 meets or exceeds MIL-R-10509. CCF-55 and CCF-60 meet or exceed MIL-R-22684 (RL07) and MIL-R-10509 (RN55D). CCF-07 meets electrical requirements of MIL-R-22684 (RL07) and MIL-R-11.
- Flame retardant epoxy conformal coating
- Color band marking for ease of identification after mounting

SPECIFICATIONS

ELECTRICAL

Resistance Range: 10Ω to 1 Megohm, ±1%, ±2%
10Ω to 2 Megohms, ±5% (CCF-07)

Resistance Tolerance: ±1% (CCF-50, CCF-55, CCF-60) ±2%, ±5% (CCF-07)

Resistance Temperature Coefficient: ±100 PPM/°C = CCF-07 2% tolerance (−65°C to +150°C); CCF-50, CCF-55 and CCF-60 (−65°C to +165°C). ±200 PPM/°C = CCF-07, 5% tolerance (−65°C to +150°C)

Resistor Power Rating: 1/4 watt at +70°C (CCF-07, −50, −55, −60)
1/2 watt at +70°C (CCF-55 and CCF-60)

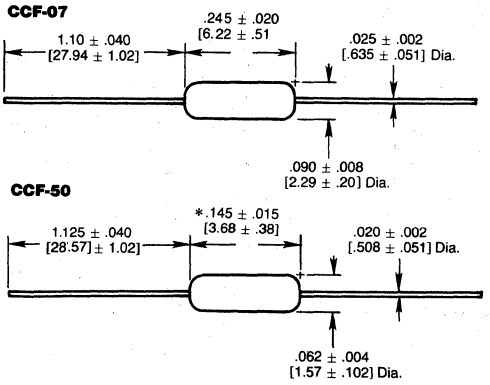
Maximum Working Voltage: 250V RMS = CCF-07 and CCF-55
200V RMS = CCF-50
350V RMS = CCF-60

Insulation Resistance: 10,000 Megohms

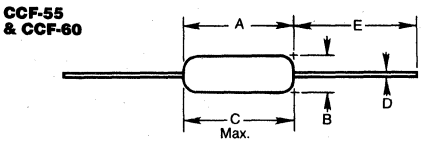
Operating Temperature Range: CCF-07 = −65°C to +150°C; CCF-50, CCF-55 and CCF-60 = −65°C to +165°C

PHYSICAL CONFIGURATION

[Numbers in brackets indicate millimeters]



*Leads solderable to within .062 [1.57] of the ends of the body.



TYPE	DIM. A	DIM. B	DIM. C (Max.)	DIM. D	DIM. E
CCF-55	.245 ± .020 [6.22 ± .51]	.090 ± .008 [2.29 ± .20]	.265 [6.73]	.025 ± .002 [.64 ± .050]	1.10 ± .040 [27.94 ± 1.02]
CCF-60	.344 ± .031 [8.74 ± .79]	.139 ± .009 [3.53 ± .23]	.400 [10.16]	.025 ± .002 [.64 ± .050]	1.00 ± .040 [25.40 ± 1.02]

RESISTANCE VALUES

CCF-07 is available in the standard 24 resistance values per decade. **CCF-50, CCF-55** and **CCF-60** are available in the standard 96 resistance values per decade. Values are obtained from the appropriate decade table by multiplying by powers of 10. Example: 24 = 24 ohms, 240 ohms, 2.4K, 24K or 240K.

CCF-07			CCF-50, CCF-55 and CCF-60										
10	22	47	10.0	12.1	14.7	17.8	21.5	26.1	31.6	38.3	46.4	56.2	68.1	82.5
11	24	51	10.2	12.4	15.0	18.2	22.1	26.7	32.4	39.2	47.5	57.6	69.8	84.5
12	27	56	10.5	12.7	15.4	18.7	22.6	27.4	33.2	40.2	48.7	59.0	71.5	86.6
13	30	62	10.7	13.0	15.8	19.1	23.2	28.0	34.0	41.2	49.9	60.4	73.2	88.7
15	33	68	11.0	13.3	16.2	19.6	23.7	28.7	34.8	42.2	51.1	61.9	75.0	90 9
16	36	75	11.3	13.7	16.5	20.0	24.3	29.4	35.7	43.2	52.3	63.4	76.8	93.1
18	39	82	11.5	14.0	16.9	20.5	24.9	30.1	36.5	44.2	53.6	64.9	78.7	95.3
20	43	91	11.8	14.3	17.4	21.0	25.5	30.9	37.4	45.3	54.9	66.5	80.6	97.6

HOW TO ORDER

MODEL NUMBER	RESISTANCE VALUE	TOLERANCE
CCF-07	241	G, J
CCF-50	3010	F
CCF-55	3010	F
CCF-60	3010	F

First two digits are significant for CCF-07; first three digits for CCF-50, CCF-55 and CCF-60. Last digit specifies the number of zeros.

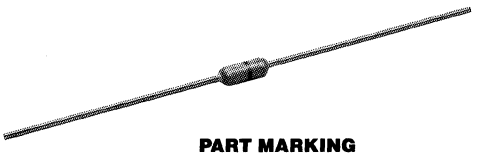
CCF-07
G = ±2%
J = ±5%

CCF-50, -55, -60
F = ±1%

EXAMPLE: CCF-07 241G = A 1/4 watt metal film resistor with ±100 PPM/°C T.C., resistance of 240 ohms and tolerance of ±2%.
CCF-50 3010F, CCF-55 3010F & CCF-60 3010F = A 1/4 watt metal film resistor with ±100 PPM/°C T.C., resistance of 301 ohms and tolerance of ±1%.

For complete information, write or phone
DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, Nebraska 68701 • Phone 402-371-0080

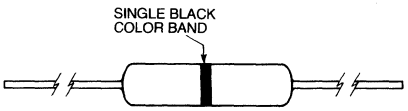
COMMERCIAL METAL FILM RESISTORS



MODELS FRJ-50 and FRJ-55 JUMPER RESISTOR

Coated TAPE AND REEL PACKAGING

PART MARKING



ELECTRICAL

Resistance: 0.01Ω Max.

Current Rating: 25 amps at 25°C, derating to 0 amps at 150°C

Insulation Resistance: Dry 10,000 Megohms; wet 100 Megohms

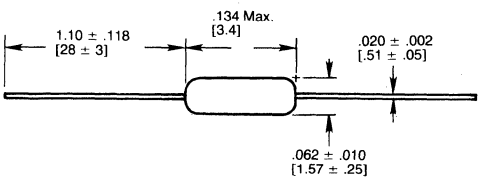
Dielectric Strength: Atmospheric — 500V RMS, reduced 325V RMS

Insulation Flammability: Self-extinguishing 10 seconds after flame is removed

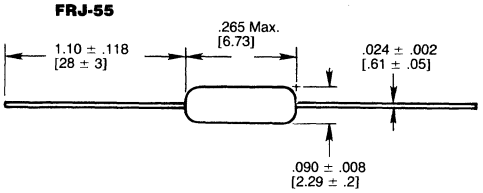
Lead Material: Tin-plated copper (Max. 98% tin)

PHYSICAL CONFIGURATION
[Numbers in brackets indicate millimeters]

FRJ-50



FRJ-55



PACKAGING

Taped Lead and Reel Package Per EIA RS296-D Class I

NOTES:

1. Quantity per reel: 5,000 pieces in 5,000-piece increments.
2. A minimum of 12″ 300mm bare tape leader shall be provided at each end of the reel.
3. Paper separator protection between layers of components.
4. Reel arbor hole is 1.25″ [31.75].

DALE TYPE CPF

Power, Flameproof

FEATURES

- High power rating, small size
- Flameproof, high temperature coating
- Special filming and coating processes
- Excellent high frequency characteristics
- Low noise
- Low voltage coefficient

SPECIFICATIONS

Resistance Tolerance: CPF-1, 2, 4 = .1%, .25%, .5%, 1%, 5%
CPF-5, 75 = .5%, 1%, 5%

Resistor Temperature Coefficient: ±100 PPM/°C; ±50 PPM/°C, ±25 PPM/°C (measured from −55°C to +125°C, referenced to +25°C)

Insulation Resistance: 10,000 Megohms

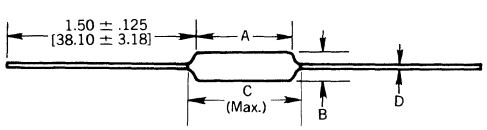
Operating Temperature Range: −65°C to +230°C

Dielectric Strength: 900 VAC for CPF-1 through CPF-5; 1000 VAC for CPF-75

DALE TYPE	WATTAGE RATING 70°C	VOLTAGE RATING	1% and above RESISTANCE RANGE
CPF-1	1	250	1 ohm-150K
CPF-2	2	350	1 ohm-150K
CPF-4	4	500	1 ohm-150K
CPF-5	5	700	9 ohm-125K
CPF-75	7.5	1000	24 ohm-125K

Contact factory for resistance range in precision tolerance.

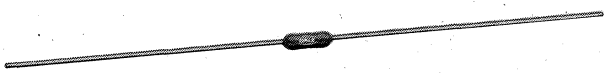
PHYSICAL CONFIGURATION
[Numbers in brackets indicate millimeters]



TYPE	DIM. A	DIM. B	DIM. C (Max.)	DIM. D
CPF-1	.240 ± .020 [6.10 ± .508]	.090 ± .008 [2.29 ± .203]	.310 [7.87]	.025 ± .002 [.635 ± .051]
CPF-2	.344 ± .031 [8.74 ± .787]	.145 ± .015 [3.68 ± .381]	.425 [10.80]	.032 ± .002 [.813 ± .051]
CPF-4	.555 ± .041 [14.10 ± 1.04]	.180 ± .015 [4.57 ± .381]	.650 [16.51]	.032 ± .002 [.813 ± .051]
CPF-5	.937 ± .062 [23.80 ± 1.58]	.296 ± .031 [7.52 ± .787]	1.187 [30.15]	.032 ± .002 [.813 ± .051]
CPF-75	2.062 ± .062 [52.38 ± 1.58]	.296 ± .031 [7.52 ± .787]	2.312 [58.72]	.032 ± .002 [.813 ± .051]

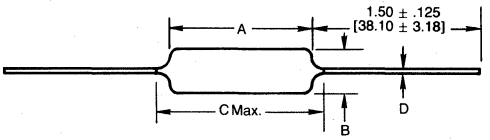
For complete information, write or phone
DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, Nebraska 68701 · Phone 402-371-0080

SPECIAL PURPOSE METAL FILM RESISTORS



MODELS CMF-55-39 and CMF-60-64
Fusible, Flameproof

PHYSICAL CONFIGURATION
[Numbers in brackets indicate millimeters]



TYPE	DIM. A	DIM. B	DIM. C	DIM. D
CMF-55-39	.240 ± .020 [6.10 ± .51]	.090 ± .008 [2.29 ± .20]	.278 [7.1]	.025 ± .002 [.635 ± .051]
CMF-60-64	.370 ± .035 [9.40 ± .89]	.145 ± .010 [3.68 ± .25]	.425 [10.80]	.032 ± .002 [.813 ± .051]

FEATURES

- Fusible – Circuit protection in case of other component failure
- Flameproof – Meets EIA RS-325, will not flame when overloaded
- Special filming and coating processes
- Meets environmental requirements of MIL-R-22684

ELECTRICAL

Resistance Range: 5Ω to 10K

Resistance Tolerance: ±1%

Resistance Temperature Coefficient: ±100 PPM/°C (−65°C to +165°C)

Resistor Power Rating: CMF-55-39 = 1/4 watt @ +70°C
CMF-60-64 = 1/2 watt @ +70°C
(Derate linearly from rated power at +70°C to zero power at +165°C)

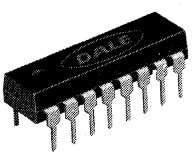
Maximum Flame Test Voltage: CMF-55-39 = 350V RMS or DC
CMF-60-64 = 500V RMS or DC

Insulation Resistance: 10,000 Megohms

Operating Temperature Range: −65°C to +165°C

DUAL-IN-LINE THIN FILM RESISTOR NETWORKS

MODELS TDP14 and TDP16



SPECIFICATIONS

Resistance Range: 100Ω to 100KΩ

Resistance Tolerance: 1%, .5%, .1%

Ratio Match: .05%, .1%, .5%

Resistance Temperature Coefficient: ±25 PPM/°C

Resistor Power Rating:
01 Circuit = .05 watt/resistor at 25°C
03 Circuit = .1 watt/resistor at 25°C

Package Power Rating: .7 watt/package at 25°C

Maximum Operating Voltage: 100 VDC

Voltage Coefficient of Resistance: < 5 PPM/V typical

T.C. Tracking: ±5 PPM/°C (−55°C to +125°C)

Operating Temperature Range: −55°C to +125°C

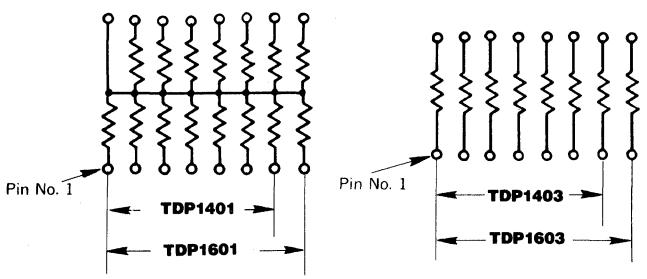
Storage Temperature Range: −55°C to +150°C

Terminals: Solder Coated Copper Alloy

Body: Molded Epoxy

Resistive Material: Nichrome film

STANDARD SCHEMATICS

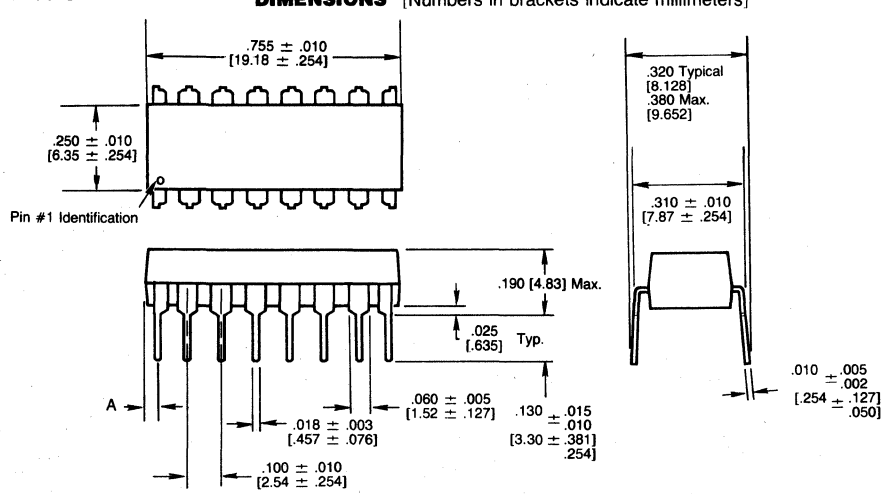


APPLICATIONS

- Precision voltage/current dividers
- Differential, instrumentation and summing amplifiers
- Converter ladder, scaling and range setting
- Oscillators and active filters

TYPE	DIM. A
TDP1401 1403	.075 ± .020 [1.91 ± .508]
TDP1601 1603	.25 ± .015 [.635 ± .381]

DIMENSIONS [Numbers in brackets indicate millimeters]

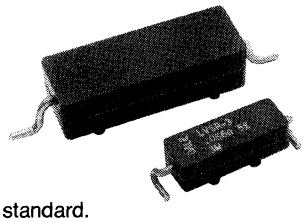


For complete information, write or phone
DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, Nebraska 68701 • Phone 402-371-0080

DALE®

SURFACE MOUNTED RESISTORS
WIREWOUND RESISTORS

MODELS LVSR-3, -5
Low Value, Precision Power



FEATURES
- Proprietary processing technique produces extremely low resistance values
- Cooler operation for high power to size ratio
- Excellent load life stability
- Low temperature coefficient
- 275°C maximum operating temperature
- Low inductance
- Ideal for all types of current sensing applications including switching and linear power supplies, test instruments and power amplifiers

SPECIFICATIONS
ELECTRICAL
Tolerance: 1%, 3%, 5%, 10% standard. Lower tolerances available as specials

Dielectric Strength: 500 VAC

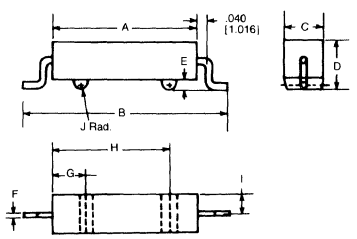
Insulation Resistance: 10,000 Megohms minimum dry

Short Time Overload: 5 seconds at 5 x rated power

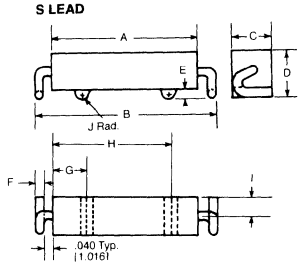
Temperature Coefficient: Measured from −55°C to +125°C. Referenced to +25°C.

DIMENSION AND TERMINAL CONFIGURATIONS [Numbers in brackets indicate millimeters]

GULL WING LEAD



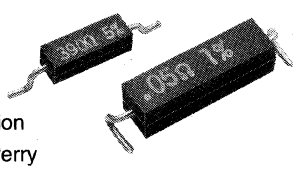
S LEAD



TYPE	B DIM. (Overall Length) LEAD STYLE GULL WING	S
3 WATT	.896 ± .063 [22.76 ± 1.60]	.704 ± .063 [17.88 ± 1.60]
5 WATT	1.325 ± .063 [33.66 ± 1.60]	1.085 ± .063 [27.56 ± 1.60]

TYPE	A	C	D	E	F	G	H	I	J Rad.
3 WATT	.560 ± .015 [14.22 ± .381]	.205 ± .015 [5.21 ± .381]	.225 ± .015 [5.72 ± .381]	.060 ± .002 [1.52 ± .051]	.032 ± .002 [.813 ± .051]	.135 ± .015 [3.43 ± .381]	.425 ± .015 [10.80 ± .381]	.103 ± .015 [2.62 ± .381]	1/32 [.794]
5 WATT	.925 ± .015 [23.49 ± .381]	.330 ± .015 [8.38 ± .381]	.295 ± .015 [7.49 ± .381]	.070 ± .002 [1.78 ± .051]	.040 ± .002 [1.016 ± .051]	.225 ± .015 [5.72 ± .381]	.700 ± .015 [17.78 ± .381]	.165 ± .015 [4.19 ± .381]	1/32 [.794]

MODELS WSM-1, -2
Precision Power



FEATURES
- Complete Welded Construction
- Molded High Temperature Silicone Encapsulation
- Available in Non-Inductive Styles with Aryton-Perry Windings for Lowest Reactive Components

STANDARD ELECTRICAL SPECIFICATIONS

DALE TYPE	POWER RATING	RESISTANCE RANGE (ohms) .05%	.1%	.25%	.5%, 1%, 3%, 5%	MAX. WORKING VOLTAGE*
WSM-1	1W	1.0-1K	.499-1K	.499-3.4K	0.1-3.4K	20V
WSM-2	2W	1.0-2.74K	.499-2.74K	.499-10.4K	0.1-10.4K	54V

*Max. working voltage determined a .0008 dia. wire res. value.

SPECIFICATIONS
STANDARD TEMPERATURE COEFFICIENTS
±90 PPM/°C Below 1.0 Ohm
±50 PPM/°C 1.0 Ohm — 9.9 Ohm
±20 PPM/°C 10 Ohm and beyond

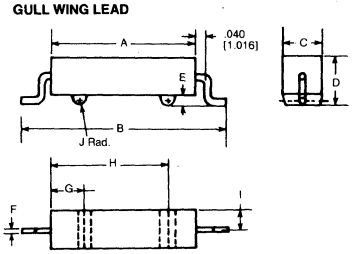
ELECTRICAL
Tolerance: Available in the following standard tolerances: 5%, 3%, 1%, .5%, .25%, .1%, .05%

Dielectric Strength: 500 VAC

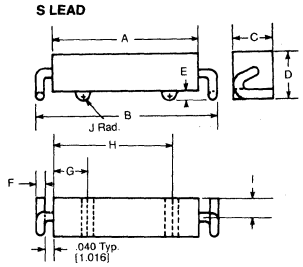
Insulation Resistance: 1000 Megohms minimum dry, 100 Megohms after moisture test

DIMENSION AND TERMINAL CONFIGURATIONS [Numbers in brackets indicate millimeters]

GULL WING LEAD



S LEAD

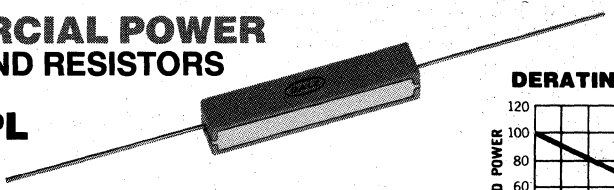


TYPE	B DIM. (Overall Length) LEAD STYLE GULL WING	S
1 WATT	.490 ± .063 [12.45 ± 1.6002]	.370 ± .063 [9.40 ± 1.6002]
2 WATT	.662 ± .063 [16.81 ± 1.6002]	.542 ± .063 [13.77 ± 1.6002]

TYPE	A	C	D	E	F	G	H	I	J Rad.
1 WATT	.250 ± .015 [6.35 ± .381]	.078 ± .015 [1.98 ± .381]	.108 ± .015 [2.74 ± .381]	.028 ± .002 [.711 ± .051]	.020 ± .002 [.508 ± .051]	.060 ± .015 [1.52 ± .381]	.190 ± .015 [4.83 ± .381]	.039 ± .015 [.991 ± .381]	.016 [.406]
2 WATT	.442 ± .015 [11.23 ± .381]	.110 ± .015 [2.79 ± .381]	.140 ± .015 [3.56 ± .381]	.030 ± .002 [.762 ± .051]	.020 ± .002 [.508 ± .051]	.094 ± .015 [2.39 ± .381]	.348 ± .015 [8.84 ± .381]	.055 ± .015 [1.40 ± .381]	.023 [.584]

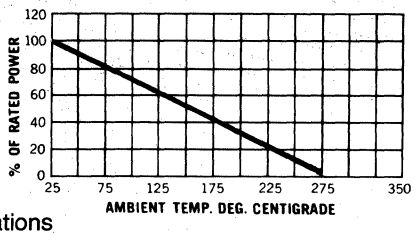
For complete information, write or phone
DALE ELECTRONICS, INC., 2064 12th Avenue, Columbus, Nebraska 68601 • Phone 402-564-3131

COMMERCIAL POWER WIREWOUND RESISTORS



MODELS CP and CPL
AXIAL LEAD

DERATING



FEATURES

- Fireproof inorganic construction
- Special inorganic potting compound provides high thermal conductivity
- Extremely low resistance values (CPL)
- Complete welded construction (CPL)
- Fuse styles (Type RF) available (CP)
- Consult factory for special pulse applications

ELECTRICAL

Max. Working Voltage = $\sqrt{PR}$

TYPE CP

Tolerance: ± 10% standard, ±5% also available

Operating Temperature: −55°C to +275°C

Temperature Coefficient:
Below 1 ohm 0 ± 800 PPM (Typ.)
1 ohm and above 0 ± 400 PPM (Typ.)

TYPE CPL

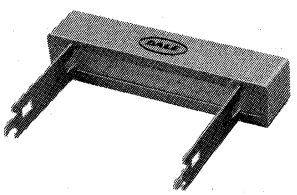
Resistance: .01Ω to .10Ω

Tolerance: ±5% standard, ±3% also available. Lower tolerances available.

Dielectric Strength: 1000 VAC

Temperature Coefficient: Varies with resistance values. Consult factory. 400 PPM Max. Resistance is measured 3/8" [9.5] from resistor body.

MODEL CPR RADIAL TERMINAL



FEATURES

- Fireproof inorganic construction
- Special inorganic potting compound provides high thermal conductivity
- Direct mounting on printed circuit board
- Circuit board lock-in mounting tabs
- Fuse styles (Type RF) available
- Pulse applications available, consult factory

SPECIFICATIONS

ELECTRICAL

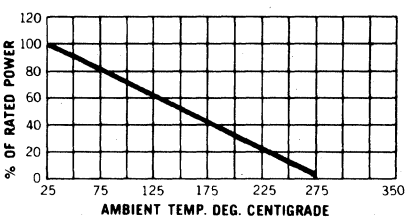
Power Rating: 5 watts to 20 watts

Tolerance: ±10%, ±5%

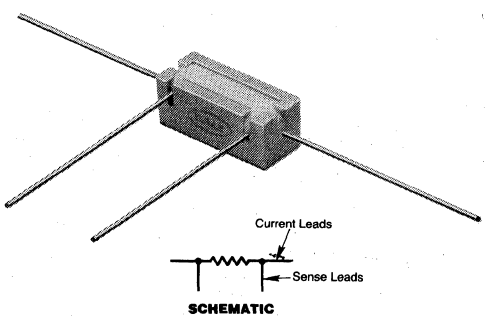
Operating Temperature:
−55°C to +275°C

Temperature Coefficient:
Below 1 ohm 0 ± 800 PPM
1 ohm and above 0 ± 400 PPM
Max. Working Voltage = $\sqrt{PR}$

DERATING



MODEL CPSL
FOUR LEAD



FEATURES

- Fireproof inorganic construction
- Special inorganic potting compound provides high thermal conductivity
- Extremely low resistance values
- Current sensing
- Low temperature coefficients
- Complete welded construction
- High power/size ratio

(For derating see CPR above)

SPECIFICATIONS

ELECTRICAL

Resistance: .01Ω to .10Ω

Tolerance: ±5% standard, ±3% also available

Dielectric Strength: 1000 VAC

Temperature Coefficient: ±100 PPM Max.

MECHANICAL

Terminal Strength: 5 lbs. minimum

Solderability: Meets requirements of MIL-STD-202, Method 208.

For complete information, write or phone
DALE ELECTRONICS, INC., 2064 12th Avenue, Columbus, Nebraska 68601 • Phone 402-564-3131

DALE®

INDUSTRIAL POWER WIREWOUND RESISTORS

DALE TYPE CW
COATED, AXIAL LEAD

FEATURES

- High performance for low cost
- High-temperature silicone coating
- Complete welded construction
- High power/size ratio
- Excellent stability in operation

SPECIFICATIONS

MATERIAL

Core: Ceramic: Steatite or alumina, depending on physical size.

Element: Copper-nickel alloy or nickel-chrome alloy, depending on resistance value.

End Caps: Stainless steel.

Coating: Special high temperature silicone.

Standard Terminals: Tinned Copperweld®

ELECTRICAL

Dielectric Strength: 1000 VAC minimum

Tolerance: Standard tolerance is ±5% 1 ohm and above. ±10% below 1 ohm. 3% available.

Temperature Coefficient: ±90 PPM/°C below 1Ω; ±50 PPM/°C 1Ω to 9.9Ω; ±30 PPM/°C 10Ω and above.

Short Time Overload: 5 seconds at 5 times rated power for 3.75 watt size and smaller; 5 seconds at 10 times rated power for 4 watt size and larger.

MECHANICAL

Terminal Strength: 10 lb. pull test.

Solderability:
MIL-R-26 Types—Meets the requirements of MIL-STD-202, Method 208.
Standard CW (Non-MIL Styles)—60/40 Electro Tin Plated terminals to facilitate soldering.

ENVIRONMENTAL SPECIFICATIONS*

TEST	DALE MAXIMUM
Load Life	±(3% + .05Ω)ΔR
Moisture Resistance	±(2% + .05Ω)ΔR
Temp. Coefficient	±90 PPM/°C below 1Ω; ±50 PPM/°C 1Ω to 9.9Ω; ±30 PPM/°C 10Ω and above
Thermal Shock	±(2% + .05Ω)ΔR
Short Time Overload	±(2% + .05Ω)ΔR
Dielectric	±(.1% + .05Ω)ΔR
Low Temp. Storage	±(2% + .05Ω)ΔR
High Temp. Exposure	±(2% + .05Ω)ΔR
Shock	±(.2% + .05Ω)ΔR
Vibration	±(.2% + .05Ω)ΔR
Terminal Strength	±(1% + .05Ω)ΔR

*All Δ figures shown are maximum, based upon testing requirements per MIL-R-26 at a maximum operating temperature of 350°C. ΔR maximum figures are considerably lower when tested at a maximum operating temperature of 275°C.

POWER RATING

Dale CW Series have two power ratings, depending on operating temperature and stability requirements.

CHARACTERISTIC U
1. 275°C maximum hot spot temperature
2. .5% maximum ΔR in 2000 hour load life

CHARACTERISTIC V
1. 350°C maximum hot spot temperature
2. 3% maximum ΔR in 2000 hour load life

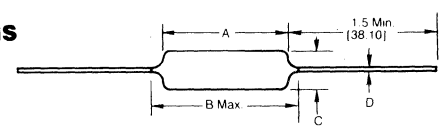
STANDARD ELECTRICAL SPECIFICATIONS

DALE TYPE	MIL. TYPE	POWER RATING (Max. Hot Spot) 275°C	350°C	MIL.	RESISTANCE RANGE (Mil. Range shown in bold face)	MAX. WT. (Grams)	MAX.* WORKING VOLTAGE 275°C	350°C
CW-2	—	4.0	5.5	—	.1Ω to 28.7K	2.1	200	235
CW-2B**	—	3.0	3.75	—	.1Ω to 15K	70	125	140
CW-2C	—	2.5	3.25	—	.1Ω to 19.9K	1.6	130	150
CW-2C-1	**RW69**	2.5	3.25	3.0	.1Ω to 19.9K **.1Ω to 2K**	1.6	130	150
CW-2C-14	—	2.5	3.25	—	.1Ω to 19.9K	1.6	130	150
CW-5**	—	5.0	6.5	—	.1Ω to 58.5K	4.2	320	365
CW-5-2	—	4.0	5.0	—	.1Ω to 40.3K	4.2	240	265
CW-5-3	—	5.0	6.5	—	.1Ω to 58.5K	4.2	320	365
CW-5-5	**RW67**	5.0	6.5	6.5	.1Ω to 58.5K **.1Ω to 8.2K**	4.2	320	365
CW-7	—	7.0	9.0	—	.1Ω to 95.2K	4.7	460	520
CW-10	—	10.0	13.0	—	.1Ω to 167K	9.0	765	875
CW-10-3	—	10.0	13.0	—	.1Ω to 167K	9.0	765	875
CW-10-4	**RW68**	10.0	13.0	11.0	.1Ω to 167K **.1Ω to 20K**	9.0	765	875

*Maximum working voltage determined at .0008" diameter wire resistance values.
**Values available down to .005Ω in 10% tolerance.

DIMENSIONAL SPECIFICATIONS

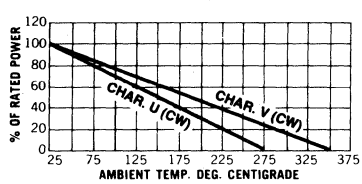
(Numbers in brackets indicate millimeters)



DALE TYPE	A ±.062 [1.57]	B (Max.)	C ±.032 [.81]	D ±.002 [.051]
CW-2	.625 [15.8]	.765 [19.43]	.250 [6.35]	.040 [1.02]
CW-2B	.562 [14.27]	.622 [15.80]	.188 [4.78]	.032 [.81]
CW-2C	.500 [12.70]	.593 [15.06]	.218 [5.54]	.040 [1.02]
CW-2C-1	.500 [12.70]	.593 [15.06]	.218 [5.54]	.032 [.81]
CW-2C-14	.500 [12.70]	.593 [15.06]	.218 [5.54]	.032 [.81]
CW-5	.875 [22.22]	1.000 [25.40]	.312 [7.92]	.040 [1.02]
CW-5-2	.875 [22.22]	1.000 [25.40]	.250 [6.35]	.032 [.81]
CW-5-3	.875 [22.22]	1.000 [25.40]	.312 [7.92]	.032 [.81]
CW-5-5	.875 [22.22]	1.000 [25.40]	.312 [7.92]	.040 [1.02]
CW-7	1.218 [30.94]	1.281 [32.54]	.312 [7.92]	.040 [1.02]
CW-10	1.781 [45.24]	1.875 [47.62]	.375 [9.52]	.040 [1.02]
CW-10-3	1.781 [45.24]	1.875 [47.62]	.375 [9.52]	.032 [.81]
CW-10-4	1.781 [45.24]	1.875 [47.62]	.375 [9.52]	.040 [1.02]

DERATING (Type CW)

Dale CW coated resistors have an operating temperature range of −55°C to +350°C. They must be derated at high ambient temperatures according to the curves below.



For complete information, write or phone
DALE ELECTRONICS, INC., 2064 12th Avenue, Columbus, NE 68601 • Phone 402-564-3131

DALE® RESISTOR SELECTION GUIDE

• Metal Film • Metal Oxide • Carbon Film • Wirewound

The industry's most complete selection of discrete resistors.
■ COMMERCIAL ■ INDUSTRIAL
■ PRECISION ■ ESTABLISHED RELIABILITY

TO USE: Resistors are listed by power rating. Locate the wattage which matches your requirement, then match with the Dale Type closest to your needs in T.C. value, tolerance, etc. In addition to these standard resistors, many nonstandard versions are available or can be engineered to match your needs. For more information and assistance, you will find factory addresses at the end of this guide.

DALE RESISTOR QUICK REFERENCE LIST

POWER (1)	TYPE	TC (PPM) (2)	ELEMENT (3)	VALUE RANGE (4)	STD. TOL. (5)	TOL. AVAIL.	MAX. WORKING VOLTAGE	PACKAGE	
								LENGTH	DIA.
1/20 W (85°C)	**PTF 51**	15/10/5	MF	50Ω-100K	1%	To .01%	200	.150	.070
1/10 W (70°C), 1/20 W (125°C)	**CMF-50** (RN50)	150/100	MF	10Ω-796K	1%	To .5%	200	.150	.065
1/10 W (70°C), 1/20 W (125°C)	**CMF-50** (RN50)	50/25	MF	10Ω-500K	1%	To .1%	200	.150	.065
1/10 W (70°C), 1/20 W (125°C)	**ERC 50** (RNC50)	100/50/25	MF	10Ω-796K	1%	To .1%	200	.150	.070
1/10 W (125°C), 1/8 W (70°C)	**CMF-55** (RN55)	150	MF	1Ω-15M	1%	To .5%	250	.250	.095
1/10 W (125°C), 1/8 W (70°C)	**CMF-55** (RN55)	100	MF	5Ω-15M	1%	To .5%	250	.250	.095
1/10 W (125°C), 1/8 W (70°C)	**CMF-55** (RN55)	50	MF	10Ω-10M	1%	To .1%	250	.250	.095
1/10 W (125°C), 1/8 W (70°C)	**CMF-55** (RN55)	25	MF	24.9Ω-2.5M	1%	To .1%	250	.250	.095
1/10 W (125°C), 1/8 W (70°C)	**ERC 55** (RNC55)	100/50/25	MF	10Ω-2M	1%	To .1%	200	.250	.091
1/8 W (85°C)	**PTF 56**	15/10/5	MF	50Ω-499K	1%	To .01%	300	.250	.091
1/8 W (125°C), 1/4 W (70°C)	**CMF-60** (RN60)	150	MF	1Ω-15M	1%	To .5%	300	.344	.145
1/8 W (125°C), 1/4 W (70°C)	**CMF-60** (RN60)	100	MF	5Ω-15M	1%	To .5%	300	.344	.145
1/8 W (125°C), 1/4 W (70°C)	**CMF-60** (RN60)	50	MF	10Ω-10M	1%	To .1%	300	.344	.145
1/8 W (125°C), 1/4 W (70°C)	**CMF-60** (RN60)	25	MF	24.9Ω-2.5M	1%	To .1%	300	.344	.145
1/8 W (125°C), 1/4 W (70°C)	**ERC 60** (RNC60)	100/50/25	MF	10Ω-3.01M	1%	To .1%	250	.375	.145
1/8 W (70°C)	**ERL-05** (RLR05)	100	MF	10Ω-300K	1%	2%&5%	200	.150	.066
1/4 W (125°C)	**RNX-1/4**	200/100/50/25	MO	100Ω-100M	1%	5% to 0.1%	750V	.358	.145
1/4 W (70°C)	**FHV-025**	200/100	MO	10K-100M	—	10% to 1%	750V	.300	.300
1/4 W (70°C)	**FHV-075**	200/100	MO	100Ω-1G	—	10% to 1%	3.75KV	.570	.210
1/4 W (70°C)	**CCF-07**	100	MF	10Ω-1M	2%	2%	250	.240	.090
1/4 W (70°C)	**CCF-07**	200	MF	10Ω-2M	5%	5%	250	.240	.090
1/4 W (70°C)	**CCF-55**	100	MF	10Ω-1M	1%	1%	250	.240	.090
1/4 W (70°C)	**CMF-07** (RL07)	200	MF	1Ω-15M	2%	5%	250	.250	.090
1/4 W (70°C)	**ERL-07** (RLR07)	100	MF	10Ω-10M	1%	2%&5%	250	.250	.090
1/4 W (85°C)	**PTF 65**	15/10/5	MF	50Ω-1M	1%	To .01%	500	.375	.145
1/4 W (125°C), 1/2 W (70°C)	**CMF-65** (RN65)	150	MF	1Ω-15M	1%	To .5%	350	.562	.185
1/4 W (125°C), 1/2 W (70°C)	**CMF-65** (RN65)	100	MF	5Ω-15M	1%	To .5%	350	.562	.185
1/4 W (125°C), 1/2 W (70°C)	**CMF-65** (RN65)	50	MF	10Ω-10M	1%	To .1%	350	.562	.185
1/4 W (125°C), 1/2 W (70°C)	**CMF-65** (RN65)	25	MF	24.9Ω-2.5M	1%	To .1%	350	.562	.185

*Hermetically Sealed. **Flat Radial Lead Package.

NOTES: (1) Military power ratings are shown for RN, RNC, RL, RLR metal film resistors. Note that CMF metal film resistors can be rated higher for commercial use...see catalog. (2) Where 20 PPM is specified on wirewound resistors, it applies to 10 ohms and up. 1-9.9 ohms = 50 PPM, .1-.99 ohms = 90 PPM. (3) MF (Metal Film), OF (Oxide Film), MO (Metal Oxide), CF (Carbon Film), WW (Wirewound). (4) Other values available, consult factory. (5) On HL and CW resistors, standard tolerance is 10% below 1 ohm.

DALE® RESISTOR SELECTION GUIDE

POWER (1)	TYPE	TC (PPM) (2)	ELE-MENT (3)	VALUE RANGE (4)	STD. TOL. (5)	TOL. AVAIL.	MAX. WORKING VOLTAGE	PACKAGE	
								LENGTH	DIA.
1/4 W (125°C), 1/2 W (70°C)	**ERC 65** (RNC65)	100	MF	30.1Ω-3.01M	1%	To .1%	300	.562	.185
1/4 W (125°C), 1/2 W (70°C)	**ERC 65** (RNC65)	50/25	MF	49.9Ω-3.01M	1%	To .1%	300	.562	.185
.4 W	**RS-1/4**	20	WW	1Ω-3.4K	1%	5% to .05%	20	.250	.078
1/2 W (125°C)	**RNX-3/8**	200/100/50/25	MO	100Ω-1G	1%	5% to 0.1%	1.5KV	.470	.145
1/2 W (70°C)	**FHV-050**	200/100	MO	10K-500M	—	5% to 1%	1.5KV	.350	.350
1/2 W (70°C)	**M-51**	−1000/−4000	CI*	60M-10T	5%	10% to 1%	500KV	1.88	.220
1/2 W (70°C)	**CCF-60**	100	MF	10Ω-1M	1%	1%	350V	.344	.139
1/2 W (70°C)	**CMF-20** (RL20)	200	MF	1Ω-15M	2%	5%	350	.375	.145
1/2 W (70°C)	**ERL-20** (RLR20)	100	MF	4.3Ω-3.01M	1%	2%&5%	350	.375	.138
1/2 W (125°C)	**CMF-70** (RN70 C&E)	50/25	MF	24.9Ω-1M (Char. C&E)	—	1% to 0.1%	500V	.562	.180
3/4 W (70°C)	**CMF-70** (RN70D)	100	MF	10Ω-2.49M (Char. D)	—	1%	500V	.562	.180
1/2 W (125°C), 3/4 W (70°C)	**ERC 70** (RNC70)	100/50/25	MF	49.9Ω-2.49M	1%	To .1%	350	.562	.185
3/4 W (70°C)	**FHV-050M**	200/100	MO	1M-100M	1%	2% to 1%	750KV	.300	.300
3/4 W	**RS-1/2**	20	WW	.1Ω-4.9K	1%	5% to .05%	29	.312	.078
1 W (70°C)	**CPF-1**	100/50/25	MF	1Ω-150K	1%	5%-0.1%	250V	.240	.090
1 W (125°C)	**RNX-3/4**	200/100/50/25	MO	100Ω-3G	1%	5% to 0.1%	3.0KV	.845	.145
1 W (125°C)	**ROX-1/2**	200/100/50	MO	1K-1G	1%	5% to 0.5%	2.0KV	.700	.295
1 W (70°C)	**FHV-100**	200/100	MO	100Ω-2G	—	10% to 1%	7.5KV	1.070	.280
1 W (70°C)	**HVX-1/2**	−400/−1500	MA	100Ω-25M	5%	10% to 5%	3.5KV	.680	.180
1 W	**EGS-1-80** (RWR81)	20	WW	.1Ω-1K	1%	1% to .1%	32	.250	.078
1 W	**G-1-80** (RW81)	20	WW	.1Ω-1.0K	1%	3% to .05%	33	.250	.078
1 W	**RS-1A** (RW70)	20	WW	.1Ω-2.74K	1%	3% to .05%	52	.422	.110
1.25 W (125°C)	**RNX-1**	200/100/50/25	MO	100Ω-5G	1%	5% to 0.1%	4.0KV	1.095	.145
1.5 W	**G-2**	20	WW	.1Ω-4.9K	1%	3% to .05%	42	.312	.078
1.5 W	**EGS-2** (RWR82)	20	WW	.1Ω-1.3K	1%	1% to .1%	44	.312	.078
1.5 W (125°C)	**RNX-1¼**	200/100	MO	100Ω-10G	1%	5% to 1%	5.0KV	1.345	.145
1.5 W (125°C)	**ROX-3/4**	200/100/50	MO	100Ω-4G	1%	5% to 0.5%	5.0KV	.900	.295
1.5 W (70°C)	**FHV-150**	200/100	MO	10K-2G	—	10% to 1%	11.25KV	1.570	.330
1.5 W (70°C)	**HVX-3/4**	−400/−1500	MA	100Ω-50M	5%	10% to 5%	7.5KV	1.062	.180
2 W (70°C)	**CPF-2**	100/50/25	MF	1Ω-150K	1%	5%-0.1%	350	.344	.145
2 W (125°C)	**RNX-1½**	200/100	MO	100Ω-10G	1%	5% to 0.5%	6.0KV	1.595	.180
2 W (125°C)	**ROX-1**	200/100/50	MO	100Ω-4G	1%	5% to 0.5%	7.5KV	1.020	.295
2 W (70°C)	**FHV-200**	200/100	MO	200Ω-8G	—	10% to 1%	15.0KV	2.020	.330
2 W (70°C)	**FHV-400**	200/100	MO	20K-2G	—	10% to 1%	7.5KV	1.020	.520
2 W	**LVR-2**	70-300***	WW	.005Ω-.332Ω	1%	3%, 5%&10%	—	.675	.250
2 W	**EGS-3-80** (RWR80)	20	WW	.1Ω-2.74K	1%	1% to .1%	79.5	.422	.110
2 W	**ESS-2A** (RWR71)	20	WW	.1Ω-12.1K	1%	1% to .1%	155.5	.812	.187
2 W	**CP-2**	400/800	WW	.1Ω-2.4K	10%	5%	$\frac{(65)}{\sqrt{PR}}$	.688	.250x.250
2 W	**G-3-80** (RW80)	20	WW	.1Ω-10.4K	1%	3% to .05%	80	.422	.110
2-1/2 W	**RS-2C**	20	WW	.1Ω-32.3K	1%	5% to .05%	138	.500	.218
2.5 W (125°C)	**RNX-2**	200/100	MO	100Ω-10G	1%	5% to 1%	8.0KV	2.100	.180
2.5 W (125°C)	**ROX-1½**	200/100/50	MO	100Ω-7.5G	1%	5% to 0.5%	11KV	1.650	.295
2.5 W (70°C)	**HVX-1**	−400/−1400	MA	100Ω-100M	5%	10% to 5%	7.5KV	1.062	.310
3 W	**ESS-2B** (RWR89)	20	WW	.1Ω-4.12K	1%	1% to .1%	112	.560	.187
3 W	**RS-2B** (RW79)	20	WW	.1Ω-6.49K	1%	5% to .1%	140	.560	.187
3 W	**LVR-3**	70-400***	WW	.005Ω-.2Ω	1%	3%, 5%, 10%	—	.560	.205
3 W	**CP-3**	400/800	WW	.1Ω-7.5K	10%	5%	$\frac{(150)}{\sqrt{PR}}$	.875	.313x.313
3 W	**CPL-3**	+400 Max.	WW	.01Ω-.1	5%	3%	—	.875	.313x.313
3 W	**CPSL-3**	±90 Max.	WW	.01Ω-.1	5%	3%	—	.875	.313x.313
3 W	**HLW-3**	30/90	WW	.1Ω-6K	5%	To 1%	180	.438	.203
3 W (125°C)	**ROX-2**	200/100/50	MO	100Ω-10G	1%	5% to 0.5%	15KV	2.150	.295
3-1/4 W	**CW-2C**	30/90	WW	.1Ω-15K	5%	3%	150	.500	.218
3-3/4 W	**CW-2B**	30/90	WW	.1Ω-15K	5%	3%	140	.560	.187
3-3/4 W	**RS-2B**	20	WW	.1Ω-24.5K	1%	5% to .05%	157	.560	.187
4 W (70°C)	**FHV-500**	200/100	MO	30K-10G	—	10% to 1%	15KV	2.070	.520

*Hermetically Sealed. **Flat Radial Lead Package. ***TC shown for values of .01Ω-.1Ω.

NOTES: (1) Military power ratings are shown for RN, RNC, RL, RLR metal film resistors. Note that CMF metal film resistors can be rated higher for commercial use...see catalog. (2) Where 20 PPM is specified on wirewound resistors, it applies to 10 ohms and up. 1-9.9 ohms = 50 PPM, .1-.99 ohms = 90 PPM. (3) MF (Metal Film), OF (Oxide Film), MO (Metal Oxide), CF (Carbon Film), WW (Wirewound). (4) Other values available, consult factory. (5) On HL and CW resistors, standard tolerance is 10% below 1 ohm.

DALE® RESISTOR SELECTION GUIDE

POWER (1)	TYPE	TC (PPM) (2)	ELE-MENT (3)	VALUE RANGE (4)	STD. TOL. (5)	TOL. AVAIL.	MAX. WORKING VOLTAGE	PACKAGE	
								LENGTH	DIA.
4 W (70°C)	**CPF-4**	100/50/25	MF	1Ω-150K	1%	5%-0.1%	500V	.555	.180
5 W	**CP-5**	400/800	WW	.1Ω-8.5K	10%	5%	$\frac{(200)}{\sqrt{PR}}$	.875	.344x.375
5 W	**CPL-5**	+400 Max.	WW	.01Ω-.1	5%	3%	—	.875	.344x.375
5 W	**CPSL-5**	±90 Max.	WW	.01Ω-.1	5%	3%	—	.875	.344x.375
5 W	**CPF-5**	100/50/25	MF	9Ω-125K	1%	5%-0.1%	700	.937	.296
5 W	**CPR-5**	400/800	WW	.1Ω-4.9K	10%	5%	$\frac{(155)}{\sqrt{PR}}$	1.060	.374x.374
5 W	**LVR-5**	70-350***	WW	.005Ω-.659Ω	1%	3%, 5%&10%	—	.925	.330
5 W	**CW-5-2**	30/90	WW	.1Ω-40.3K	5%	3%	265	.875	.250
5 W	**RS-5**	20	WW	.1Ω-95.2K	1%	5%-.05%	360	.875	.312
5 W	**RS-5-69** (RW74)	20	WW	.1Ω-24.3K	1%	5%-.1%	350	.875	.312
5 W	**ERH-5** (RER60)	50/20	WW	.1Ω-3.32K	1%	.1% to 5%	160	.600	—
5 W	**ESS-5** (RWR74)	20	WW	.1Ω-12.1K	1%	1% to .1%	250	.875	.312
5 W	**RH-5** (RE60G)	50/20	WW	.1Ω-3.32K	1%	5% to .25%	160	.600	—
5 W (125°C)	**ROX-3**	200/100/50	MO	400Ω-15G	—	5% to 0.5%	22.5KV	3.150	.295
5 W (70°C)	**HVX-2**	−400/−1400	MA	100Ω-200M	5%	10% to 5%	15KV	2.200	.310
5-1/4 W	**HLW-5**	30/90	WW	.1Ω-15K	5%	To 1%	320	.625	.250
5-1/2 W	**CW-2**	30/90	WW	.1Ω-22K	5%	3%	235	.625	.250
6-1/2 W	**CW-5**	30/90	WW	.1Ω-58.5K	5%	3%	365	.875	.312
7 W	**RS-7**	20	WW	.1Ω-154K	1%	5% to .05%	504	1.218	.312
7 W	**CP-7**	400/800	WW	.1Ω-18K	10%	5%	$\frac{(350)}{\sqrt{PR}}$	1.391	.344x.375
7 W	**CPL-7**	+400	WW	.01Ω-.1	5%	3%	—	1.391	.344x.375
7 W	**CPSL-7**	±90	WW	.01Ω-.1	5%	3%	—	1.391	.344x.375
7 W	**CPR-7**	400/800	WW	.1Ω-7.2K	10%	5%	$\frac{(225)}{\sqrt{PR}}$	1.398	.374x.374
7 W	**EGS-10-80** (RWR84)	20	WW	.1Ω-12.4K	1%	1% to .1%	295	.875	.312
7-1/2 W	**RH-5**	50/20	WW	.1Ω-24.5K	1%	5% to .25%	160	.600	—
7-1/2 W	**CPF-75**	100/50/25	MF	24Ω-125K	1%	5%-0.1%	1000	2.062	.296
8 W	**HLW-6**	30/90	WW	.1Ω-25K	5%	To 1%	250	1	.312
9 W	**CW-7**	30/90	WW	.1Ω-95.2K	5%	3%	520	1.218	.312
10 W	**ERH-10** (RER65)	50/20	WW	.1Ω-5.62K	1%	.1% to 5%	265	.750	—
10 W	**ESS-10** (RWR78)	20	WW	.1Ω-39.2K	1%	1% to .1%	650	1.780	.375
10 W	**CP-10**	400/800	WW	.1Ω-30K	10%	5%	$\frac{(540)}{\sqrt{PR}}$	1.875	.344x.375
10 W	**CPL-10**	+400	WW	.01Ω-.1	5%	3%	—	1.875	.344x.375
10 W	**CPSL-10**	±90	WW	.01Ω-.1	5%	3%	—	1.875	.344x.375
10 W	**CPR-10**	400/800	WW	.1Ω-11K	10%	5%	$\frac{(330)}{\sqrt{PR}}$	1.888	.374x.374
10 W	**LVR-10**	****	WW	.01Ω-.800Ω	1%	3%, 5%&10%	—	1.828	.392
10 W	**RS-10**	20	WW	.1Ω-273K	1%	5% to .05%	858	1.780	.375
10 W	**RS-10-38** (RW78)	20	WW	.1Ω-71.5K	1%	5% to .1%	846	1.780	.375
10 W	**RH-10** (RE65G)	50/20	WW	.1Ω-5.62K	1%	5% to .25%	265	.750	—
10 W	**HLM-10**	30/90	WW	.1Ω-15K	5%	To 1%	300	1.312	—
10 W (125°C)	**ROX-6**	200/100/50	MO	500Ω-30G	—	5% to 0.5%	45KV	6.150	.295
10 W (25°C)	**DJU**	−1000/−4000	CI	20Ω-10G	10%	15% to 3%	25KV	4.500	.750
12 W	**HL-12**	30/90	WW	.1Ω-70K	5%	To 1%	500	1.750	.313
12 W	**HLW-12**	30/90	WW	.1Ω-70K	5%	To 1%	500	1.750	.312
12-1/2 W	**RH-10**	50/20	WW	.008Ω-47.1K	1%	5% to .25%	265	.750	—
13 W	**CW-10**	30/90	WW	.1Ω-167K	5%	3%	875	1.781	.375
15 W	**CP-15**	400/800	WW	.1Ω-30K	10%	5%	$\frac{(670)}{\sqrt{PR}}$	1.875	.50x.50
15 W	**CPL-15**	+400	WW	.01Ω-.1	5%	3%	—	1.875	.50x.50
15 W	**CPSL-15**	±90	WW	.01Ω-.1	5%	3%	—	1.875	.50x.50
15 W	**CPR-15**	400/800	WW	.1Ω-10.2K	10%	5%	$\frac{(390)}{\sqrt{PR}}$	1.888	.492x.492
20 W	**ERH-25** (RER70)	50/20	WW	.1Ω-12.1K	1%	5% to .1%	550	1.062	—
20 W	**CP-20**	400/800	WW	.25Ω-30K	10%	5%	$\frac{(770)}{\sqrt{PR}}$	2.50	.50x.50
20 W	**CPR-20**	400/800	WW	.2Ω-14.7K	10%	5%	$\frac{(540)}{\sqrt{PR}}$	2.498	.492x.492
20 W	**HL-20**	30/90	WW	.1Ω-120K	5%	To 1%	880	2	.438

*Hermetically Sealed. **Flat Radial Lead Package. ***TC shown for values of .01Ω-.1Ω. ****Value Dependent. †Consult Factory.

NOTES: (1) Military power ratings are shown for RN, RNC, RL, RLR metal film resistors. Note that CMF metal film resistors can be rated higher for commercial use...see catalog. (2) Where 20 PPM is specified on wirewound resistors, it applies to 10 ohms and up. 1-9.9 ohms = 50 PPM, .1-.99 ohms = 90 PPM. (3) MF (Metal Film), OF (Oxide Film), MO (Metal Oxide), CF (Carbon Film), WW (Wirewound). (4) Other values available, consult factory. (5) On HL and CW resistors, standard tolerance is 10% below 1 ohm.

DALE® RESISTOR SELECTION GUIDE

POWER (1)	TYPE	TC (PPM) (2)	ELE-MENT (3)	VALUE RANGE (4)	STD. TOL. (5)	TOL. AVAIL.	MAX. WORKING VOLTAGE	PACKAGE	
								LENGTH	DIA.
20 W	**HLW-20**	30/90	WW	.1Ω-120K	5%	To 1%	880	2	.438
20 W	**HLM-20**	30/90	WW	.1Ω-65K	5%	To 1%	1000	2.625	—
20 W (25°C)	**DPW**	−1000/−4000	CI	30Ω-10G	10%	15% to 3%	35KV	6.500	1.125
22 W	**CP-22**	400/800	WW	.25Ω-30K	10%	5%	$\frac{(815)}{\sqrt{PR}}$	2.50	.50x.50
25 W	**HL-25**	30/90	WW	.1Ω-155K	5%	To 1%	1300	2	.563
25 W	**RH-25** (RE70)	50/20	WW	.01Ω-95.2K	1%	5% to .25%	550	1.062	—
30 W	**ERH-50** (RER75)	50/20	WW	.1Ω-39.2K	1%	5% to .1%	1250	1.968	—
30 W	**HL-24**	30/90	WW	.1Ω-55K	5%	To 1%	800	2.50	—
35 W	**HLZ-33**	90/180	WW	.05Ω-1.9Ω	10%	5%	—	2	.563
40 W (125°C)	**RJU-40**	200/100	MO	500Ω-1G	—	2% to 1%	25KV	4.500	.750
40 W	**HL-35**	30/90	WW	.1Ω-135K	5%	To 1%	1400	3.250	—
50 W	**HL-50**	30/90	WW	.1Ω-385K	5%	To 1%	1900	4	.563
50 W	**RH-50** (RE75)	50/20	WW	.01Ω-273K	1%	5% to .25%	1250	1.969	—
50 W (125°C)	**RJU-50**	200/100	MO	1K-1G	—	2% to 1%	33KV	6.000	.750
55 W	**HL-55**	30/90	WW	.1Ω-300K	5%	To 1%	1800	4.750	—
90 W	**HLZ-90**	90/180	WW	.15Ω-5.7Ω	10%	5%	—	4	.563
95 W	**HL-95**	30/90	WW	.1Ω-550K	5%	To 1%	2600	7.250	—
95 W (125°C)	**RJU-95**	200/100	MO	1K-1G	—	2% to 1%	35KV	6.500	1.125
100 W	**HL-100**	30/90	WW	.1Ω-870K	5%	To 1%	2500	6.50	.750
100 W	**RH-100** (RE77)	50/20	WW	.1Ω-50K	1%	5% to .25%	1900	3.50	—
100 W (25°C)	**DZZ**	−1000/−4000	CI	100Ω-10G	—	15% to 5%	125KV	18.500	2.000
150 W (125°C)	**RJU-150**	200/100	MO	1K-1G	—	2% to 1%	40KV	6.500	2.000
165 W	**HLZ-165**	90/180	WW	.36Ω-13Ω	10%	5%	—	6.50	.750
175 W	**HL-175**	30/90	WW	.1Ω-1.7M	5%	To 1%	5200	8.50	1.125
225 W	**HL-225**	30/90	WW	.1Ω-2.1M	5%	To 1%	6100	10.50	1.125
250 W	**RH-250** (RE80)	50/20	WW	.1Ω-75K	1%	5% to .25%	2300	4.50	—
275 W (125°C)	**RJU-275**	200/100	MO	1K-1G	—	2% to 1%	90KV	14.500	1.500
300 W	**HLZ-300**	90/180	WW	.23Ω-25Ω	10%	5%	—	8.50	1.125
400 W (125°C)	**RJU-400**	200/100	MO	1K-1G	—	2% to 1%	125KV	18.500	2.000
1000 W	Special designs to handle up to 1000 watts are available on custom order.								

*Hermetically Sealed. **Flat Radial Lead Package. †Consult Factory.

NOTES: (1) Military power ratings are shown for RN, RNC, RL, RLR metal film resistors. Note that CMF metal film resistors can be rated higher for commercial use...see catalog. (2) Where 20 PPM is specified on wirewound resistors, it applies to 10 ohms and up. 1-9.9 ohms = 50 PPM, .1-.99 ohms = 90 PPM. (3) MF (Metal Film), OF (Oxide Film), MO (Metal Oxide), CF (Carbon Film), WW (Wirewound). (4) Other values available, consult factory. (5) On HL and CW resistors, standard tolerance is 10% below 1 ohm.

DALE® GOVERNMENT SOURCE INSPECTION AND FEDERAL SUPPLIERS CODES

GOVERNMENT SOURCE INSPECTION

If Government Source Inspection is required, it should be called out on the purchase order along with the complete Government Contract Number.

Qualified Standard Part Value Selection and Deviation: If you are ordering a qualified standard part, be sure that it is a standard resistance value and a tolerance in the specification. When ordering military parts, check the Dale QPL list to assure qualification status, value range and tolerances. If any requirements exceed or do not conform to specifications for the standard qualified part, include authorization for specific deviations with purchase order. Government Source Inspection can be requested on any item manufactured by Dale. It must, however, be requested by or under authorization of the government representative at your plant. Ref. Paragraph 3.11 of MIL-I-45208 or 3.5.3 of MIL-Q-9858.

DALE FEDERAL SUPPLIERS CODES	CODE NUMBER	MANUFACTURING LOCATIONS
Dale has several Federal Suppliers Codes that can be utilized on parts supplied to the government. The list at right gives the five digits that may be marked on the part in place of the Dale logo.	**91637**	Columbus, NE; Norfolk, NE; York, NE; El Paso, TX; Juarez, Mexico; Kaufbeuren, Germany
	09969	Yankton, SD
	22929	Tempe, AZ
	69274	Robbinsville, NC

For additional information, contact your Dale Representative, Distributor or the Factory.

UNITED STATES

•FILM RESISTORS:
Dale Electronics, Inc.
2300 Riverside Blvd.
Norfolk, NE 68701
Tel: 402-371-0080

•SPECIAL FILM RESISTORS:
Dale Electronics, Inc.
P.O. Box 1179
Robbinsville, NC 28771
Tel: 704-479-6451

•WIREWOUND RESISTORS:
Dale Electronics, Inc.
2064 12th Ave.
Columbus, NE 68601
Tel: 402-564-3131

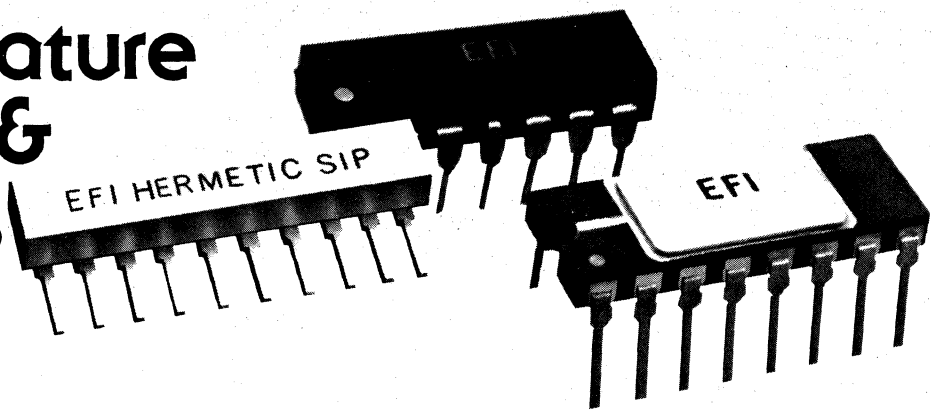
CANADA
Dale Electronics, LTD.
18 Howden Road
Scarborough, Ontario M1R 3E6
Tel: 416-759-5631
Telex: 514-331-6312

EUROPE
Dale Electronics GmbH
Benzstr. 28, Postfach 1251
8039 Puchheim
Tel: 089/80960
Telex: 05-212950

UNITED KINGDOM
Dale A.C.I. Components, LTD.
River Park Industrial Estate
Berkhamsted, Herts HP4 1HL
Tel: 04427-72391
Telex: 82402

DALE RESISTOR NETWORKS, CHIP RESISTORS AND THERMISTORS
are described elsewhere in this EEM listing.

Microminiature Resistors & Networks



RESISTOR NETWORKS

PACKAGE TYPE	PINS/LEADS/ TERMINALS	RESISTANCE RANGES	DISSIPATION	TOLERANCES	NETWORK TYPES/CONFIGURATION
SIP	2—10	20Ω—1MΩ	125mW/Res.	Absolute: ±1% to ±0.05% Ratio: ±0.1% to ±0.005%	Common connection to all resistors (S1) Series connection (S2)
Hermetically sealed SIP	10	20Ω—1MΩ	100mW/Res. 1.0W/Pkg.		Common connection (S1) Series connection (S2)
Molded DIP (P) Epoxy-coated DIP (E) Hermetic DIP (C)	8, 14, 16 4—24 even # 8, 14, 16, 18, 24	20Ω—1MΩ 20Ω—1MΩ	125mW/Res. 1.2W/Pkg.		Common connection (D1) Series connection (D2) Single resistor connection (D4)
TRIM-PAK® * Laser-Trimmable DIP	8, 14, 16, 18, 24	20Ω—1MΩ	125mW/Res. 1.2W/Pkg.	Absolute: ±1% to ±0.05% Ratio: ±0.1% to ±0.005%	Common connection (D1) Series connection (D2) Single resistor connection (D4)
Hermetically sealed Chip-carrier	16, 18, 20, 28 32, 42, 64	20Ω—1MΩ	100mW/Res. 1.0W/Pkg.	Same as TRIM-PAK	Single-layer (epoxy sealed) Multi-layer (epoxy or alloy sealed)
Flip-chip	14, 16, 24 (other on request)	20Ω—1MΩ	125mW/Res. 1.0W/Pkg.	Same as SIP & DIP, above	Common connection (D1) Series connection (D2) Single resistor connection (D4)

*Patent Pending

LADDER NETWORKS

PACKAGE TYPE	MODEL NO.	CONFIGURATION	RESOLUTION	ACCURACY	OPERATING TEMPERATURE RANGE	MAXIMUM CUMULATIVE ERROR
16-pin ceramic DIP	D355	R-2R	10-bit or 12-bit	± ½ LSB	0 to 70°C or −55°C to +125°C	12 Bits: ±0.012% 10 Bits: ±0.05%
24-pin hermetically sealed DIP	D350 D351	BCD	8, 10, or 12-bit	± ½ LSB	0 to 70°C or −55°C to +125°C	12 Bits: ±0.012% (±0.03%)** 10 Bits: ±0.05% (±0.12%)**
14-pin hermetically sealed DIP	D352 D353	BCD				
14-lead hermetically sealed flatpack	F352 F353	Binary				8 Bits: ±0.2%
16-pin hermetic chip carrier	C355	R-2R	10-bit or 12-bit	± ½ LSB	0 to 70°C or −55°C to +125°C	12 Bits: ±0.012% 10 Bits: ±.05%
24-pin hermetic chip carrier	C350	BCD	8, 10 or 12-bit	± ½ LSB	0 to 70°C or −55°C to +125°C	12 Bits: ±0.012% 10 Bits: ±0.05% 8 Bits: ±0.2%

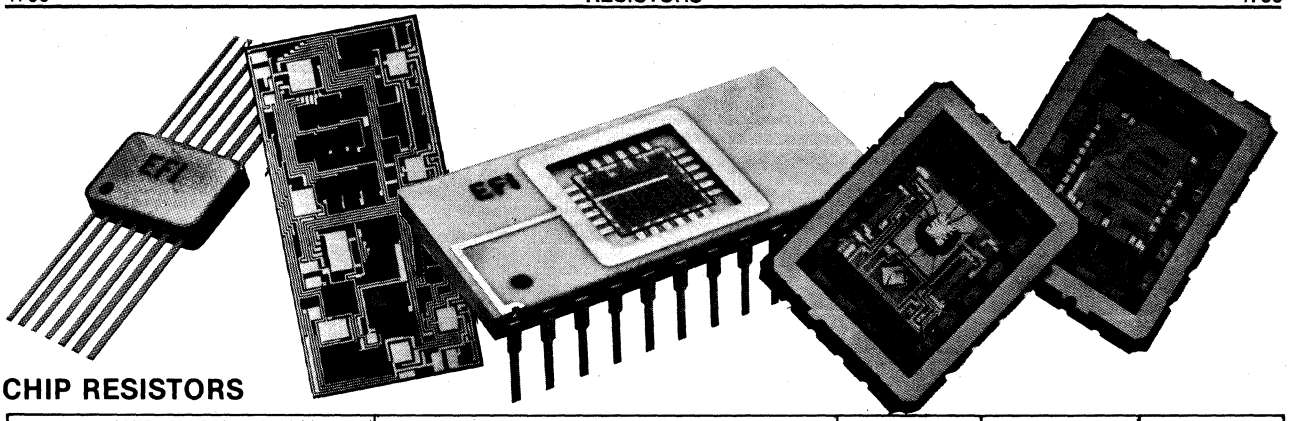
**D351 only.

MICROWAVE COMPONENTS

METALLIZED PLATES		PATTERNED AND ETCHED SUBSTRATES	HIGH FREQUENCY CHIP RESISTORS
SUBSTRATE MATERIALS	METALLIZATION		
• Alumina (as fired or polished) standard thickness of .010", .015", and .025", Dielectric constant 9.8 Typ. @ 25C-10 GHz • Quartz-BeO various thicknesses • Sizes — Up to 4.1" x 3.3"	• Sputtered in various combinations of NiCr, TaW, TiW, TaN, Cr, Ni, Au, Cu, Mo, Pd • Electroplated — Cu, Ni, Au, up to 300 micro-inches • Excellent adhesion (typically 7-10,000 lbs./in. 2 • One, Two, or Six Surfaces • Through Holes — metallized or non-metallized	• Conductor only or resistor conductor patterns • Resistive films — high stability NiCr, self passivating TaW or TaN • In house laser machining for round or odd shaped substrates • Metallized through holes • Patterned edges • Planar inductors • Lange Couplers with fine line patterns, line and space tolerances as tight as ±.000050" • Attenuator chips	• Resistance range 10 ohms to 1k ohm • Automatic laser trimming to ±.05% absolute • Edge trim for high frequency applications • Gold or solder coated terminations • TCR ±50 PPM, 25 PPM, or 10 PPM • Single side or wrap around terminations • Sizes — .020" x .040" to .100" x .100"

ELECTRO-FILMS INCORPORATED

111 GILBANE STREET, WARWICK CENTRAL INDUSTRIAL PARK, WARWICK, RI 02886
Tel. (401) 738-9150 TWX-EFI WRWK 710-382-0405 FAX 401-738-4389



CHIP RESISTORS

CHIP SIZE (±.003")**				TERMINATIONS				TOLERANCE	STABILITY	TCR
Type	Length	Width	Thickness	Width	Length	Resistance	Power*			
1.	.040"	.020"	.010"	.007"	.015"	20Ω— 24KΩ	15— 30mW	Standard: 5% and 1%	0.05%/1000 hrs. @ 125°C (Dependent on range)	Standard: ±50 PPM/°C
2.	.030"	.030"	.010"	.004"	.006"	250Ω— 40KΩ	18— 35mW			
3.	.050"	.050"	.010"	.0075"	.045"	20Ω— 125KΩ	50—100mW	Special: .5% — .1% & tighter		Special: ±25 PPM/°C ±10 PPM/°C
4.	.100"	.050"	.010"	.015"	.045"	40Ω— 400KΩ	85—175mW			
5.	.100"	.100"	.010"	.015"	.095"	20Ω—1000KΩ	200—400mW			
6.	.045"	.030"	.010"	.010"	.025"	40Ω— 59KΩ	30— 60mW			

SUBSTRATE MATERIAL	METALLIZATION
Composition — 99.5% Al_2O_3 Surface — 3—4 microinches (Standard) Thickness — .010" ±.002" (Standard) ±.001" (Special)	Resistive Material: Cr/Ni/X, 100—200Å (R.F. Sputtered) Conductor Base: Nickel — 5—8 μin. (R.F. Sputtered) Terminations: A. Gold — 100 μin. (Electroplated) B. Nickel & Solder (62/32/2) Microwave versions available.
Passivation: Optional, thermo-plastic recommended for solder applications.	

* When bonded to substrate, value dependent, @ 125°C. ** All sizes available in center tapped versions.

Surface Mounted Resistor Networks

RATIO TOLERANCES TO 0.01% ANY COMBINATION OF RESISTOR VALUES FROM 20Ω TO 250 KΩ

HERMETIC CHIP CARRIER — Standard JEDEC hermetic chip carriers to full MI STD 883C specification. Available with 16 to 64 terminals.

WRAP AROUND CHIP RESISTORS — Several sizes including the 805 and 1206 standards.

SLRIC — Single Layer Surface Mount Resistor Networks in standard and custom configurations.

VERSA CHIP — New low-cost, surface-mounted packaging design for precision resistor networks. Provides pin-for-pin equivalency with chip carrier, and versatility for many alternate configurations. Laser-trimmable by customer after mounting.

SOIC — Standard and wide variety of custom configurations.

Semi-Films Division

CHIP RESISTORS, PRECISION NETWORKS AND CHIP CAPACITORS
THIN-FILM TANTALUM NITRIDE RESISTORS AND MNOS CAPACITORS ON SILICON

CHIP RESISTORS

- CTR — Center Tap Chip Resistor, 30 x 30, 1 ohm to 1 Meg, 250wW, TCR as low as 10 PPM/C, Ratios to 0.05%, Terminations — Aluminum or Gold
- SFM — Chip Resistor, 20 x 20, 4.7 ohms to 1 Meg, 250mW, Aluminum or Gold
- BCR — Back Contact Chip Resistor, 20 x 20, 10 ohms to 1 Meg, 250mW single wirebond applications
- SFX — High R value Chip Resistors, 55 x 55 to 30 x 30 (value dependent), 1 Meg to 22 Meg ohms, Terminations — Aluminum
- MTR — Multi-Tap Resistor, 30 x 30, Terminations — Gold
- MIC/TMR — Tantalum Nitride Microwave Termination Chip Resistors on Alumina with Gold Termination

CHIP CAPACITORS

- NCA 20 x 20 4.7 pf-51 pf
- NCB 30 x 30 33 pf-100 pf
- NCC 40 x 40 56 pf-220 pf
- NCD 55 x 55 150 pf-510 pf
- NCE 60 x 60 560 pf-1000 pf
- CBX Binary MOS 3.75 pf-93 pf 4 and 5 bit (total value)

STANDARD AND CUSTOM NETWORKS

- Tantalum Nitride on Silicon, fine line (0.1 mil) capability and high power resulting in small size networks

QUALITY CONFORMANCE TESTING

- MIL-R-55342
- MIL-STD-833 Class B and S passive element evaluation

ELECTRO-FILMS INCORPORATED

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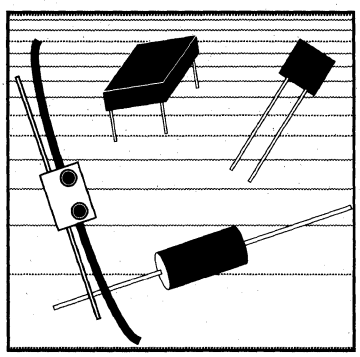
ELLIOTT JORDAN

PRECISION WIREWOUND RESISTORS

Commercial/Industrial



FEATURES

- All-welded construction
- Moisture-resistant epoxy encapsulation
- Electro-tinned oxygen-free copper leads (standard)
- Non-inductive reverse-PI wound (unless otherwise specified)
- Markings impervious to solvents
- Excellent long-term stability

GENERAL SPECIFICATIONS

- Resistance Range: 0.1Ω to 55MΩ
- Resistance Tolerance: ±0.005%, ±0.01%, ±0.02%, ±0.05%, ±0.1%, ±0.5%, ±1.0%
- Temperature Coefficient (TCR):
  < ±5 ppm/°C (–10°C to +80°C)
  < ±10 ppm/°C (–55°C to +125°C)
- TCR Tracking: Available to 2 ppm/°C
- Power Ratings: 0.030 Watts to 2 Watts @ 125°C
- Shelf-Life Stability: <50 ppm/yr.
- Insulation Resistance: >1000MΩ

Axial Leaded Styles

SUB-MINIATURE-STYLE SELECTION

E/J STYLE	OLD PART NUMBER		POWER RATING		MAX. WORKING VOLTAGE	CRITICAL RESISTANCE VALUE	RESISTANCE RANGE		DIMENSIONS		LEADS		MIL[2] EQUIV.
	ELLIOTT	JORDAN	75°C	125°C			MIN.	MAX.	DIA.[1] D±0.010	LENGTH[1] L±0.064	AWG	DIA.[1] d ±0.002	
A0931	-	J40	0.038	0.030	75	187K	0.1Ω	200K	0.097	0.312	24	0.020	
A0940	-	J40	0.050	0.040	75	140K	0.1Ω	300K	0.097	0.406	24	0.020	
A1020	E15-200	-	0.063	0.050	150	-	0.1Ω	250K	0.100	0.200	24	0.020	
A1025	E14	J60	0.063	0.050	75	113K	0.1Ω	250K	0.105	0.250	24	0.020	
A1030	E15	-	0.063	0.050	200	-	0.1Ω	250K	0.100	0.300	24	0.020	
A1221	-	J80	0.063	0.050	100	200K	0.1Ω	250K	0.125	0.215	24	0.020	
A1225	E12	J90	0.125	0.100	100	100K	0.1Ω	300K	0.125	0.250	24	0.020	
A1231	E17	-	0.125	0.100	200	-	0.1Ω	350K	0.125	0.312	22	0.025	
A1236	-	-	0.125	0.100	100	100K	0.1Ω	400K	0.125	0.375	24	0.020	
A1237	E18	J100	0.125	0.100	100	100K	0.1Ω	400K	0.125	0.375	22	0.025	
A1527	E29	J102	0.125	0.100	100	100K	0.1Ω	650K	0.155	0.270	22	0.025	
A1531	E24	-	0.156	0.125	300	720K	0.1Ω	800K	0.156	0.310	22	0.025	
A1535	E25	-	0.156	0.125	300	720K	0.1Ω	800K	0.156	0.350	22	0.025	
A1550	-	J105	0.188	0.150	150	150K	0.1Ω	1.5M	0.155	0.500	22	0.025	
A1825	E9	-	0.156	0.125	300	720K	0.1Ω	1.0M	0.187	0.250	22	0.025	
A1831	E28	-	0.156	0.125	300	720K	0.1Ω	1.0M	0.187	0.312	22	0.025	
A1838	E27	J110	0.188	0.150	150	150K	0.1Ω	1.5M	0.187	0.375	22	0.025	
A1850	-	J112	0.250	0.200	200	200K	0.1Ω	1.5M	0.187	0.500	22	0.025	RB74
A1862	E32	-	0.250	0.200	300	450K	0.1Ω	1.5M	0.187	0.625	22	0.025	

1. Dimensions listed are in inches. 2. Military type is for reference only, and does not imply QPL approval

MINIATURE-STYLE SELECTION

E/J STYLE	OLD PART NUMBER		POWER RATING		MAX. WORKING VOLTAGE	CRITICAL RESISTANCE VALUE	RESISTANCE RANGE		DIMENSIONS		LEADS		MIL[2] EQUIV.
	ELLIOTT	JORDAN	75°C	125°C			MIN.	MAX.	DIA.[1] D±0.010	LENGTH[1] L±0.064	AWG	DIA.[1] d ±0.002	
A2525	E31	J115	0.188	0.150	200	267K	0.1Ω	1.0M	0.250	0.250	22	0.025	
A2529	-	J116	0.218	0.175	300	515K	0.1Ω	2.0M	0.250	0.295	22	0.025	RB75
A2535	E40	J118	0.250	0.200	300	450K	0.1Ω	2.0M	0.250	0.350	22	0.025	
A2536	E40-20	-	0.313	0.250	300	360K	0.1Ω	2.0M	0.250	0.350	20	0.032	RB56
A2550	E48	J120	0.313	0.250	300	360K	0.1Ω	2.5M	0.250	0.500	22	0.025	
A2552	E48-20	-	0.412	0.330	300	360K	0.1Ω	2.5M	0.250	0.500	20	0.032	RB55
A2575	E56	J130	0.412	0.330	400	273K	0.1Ω	5.0M	0.250	0.750	22	0.025	
A2576	E56-20	-	0.625	0.500	600	485K	0.1Ω	4.0M	0.250	0.750	20	0.032	RB54
A25100	-	J132	0.625	0.500	400	320K	0.1Ω	5.0M	0.250	1.000	22	0.025	
A25101	E58	-	0.150	0.600	600	320K	0.1Ω	4.5M	0.250	1.000	20	0.032	
A3175	E71	-	0.562	0.450	400	356K	0.1Ω	5.0M	0.312	0.750	22	0.025	
A3181	-	J135	0.625	0.500	600	320K	0.1Ω	5.0M	0.312	0.812	22	0.025	RB76[3]
A3481	-	J138	0.750	0.600	600	267K	0.1Ω	5.0M	0.343	0.812	20	0.032	
A3750	E72	J140	0.412	0.330	400	485K	0.1Ω	7.5M	0.375	0.500	20	0.032	
A3762	E74	-	0.500	0.400	400	400K	0.1Ω	7.5M	0.375	0.625	20	0.032	
A3775	E57	J150	0.625	0.500	600	320K	0.1Ω	10.0M	0.375	0.750	20	0.032	RB53
A37100	E60	J160	1.250	1.000	600	360K	0.1Ω	13.0M	0.375	1.000	20	0.032	RB52
A5050	-	J170	0.625	0.500	400	320K	0.1Ω	12.5M	0.500	0.500	20	0.032	
A5062	E73	-	0.750	0.600	400	267K	0.1Ω	12.5M	0.500	0.625	20	0.032	
A5075	E59	J180	0.938	0.750	400	213K	0.1Ω	18.0M	0.500	0.750	20	0.032	
A50100	E61	J190	*1.250	1.000	800	640K	0.1Ω	25.0M	0.500	1.000	20	0.032	RB57
A50125	E512	-	1.562	1.250	800	512K	0.1Ω	28.0M	0.500	1.250	20	0.032	
A50150	E64	J200	1.875	1.500	900	540K	0.1Ω	40.0M	0.500	1.500	20	0.032	RB58
A50200	E63	J210	2.500	2.000	1200	720K	0.1Ω	55.0M	0.500	2.000	20	0.032	RB59

1. Dimensions listed are in inches. 2. Lead diameter per MIL-R-93 is 0.032" (20AWG). 3. Military type is for reference only, and does not imply QPL approval.

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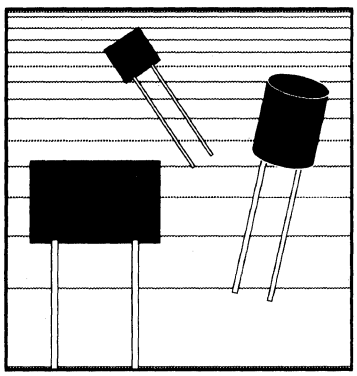
ELLIOTT. JORDAN

PRECISION WIREWOUND RESISTORS

Space Saving Printed Circuit Styles



FEATURES

- Space saving configurations
- All-welded construction
- Moisture-resistant epoxy encapsulation
- Electro-tinned oxygen-free copper leads (standard)
- Non-inductive reverse-PI wound (unless otherwise specified)
- Marking impervious to solvents
- Excellent long-term stability

GENERAL SPECIFICATIONS

- Resistance Range: 0.1 ohms to 7 meg ohms
- Resistance Tolerance: ±0.005%, ±0.01%, ±0.02%, ±0.05%, ±0.1%, ±0.5%, ±1.0%
- Temperature Coefficient of Resistance (TCR):
  < ±5 ppm/°C (–10°C to +80°C)
  < ±10 ppm/°C (–55°C to +125°C)
- TCR Tracking: Available to 2 ppm/ °C
- Power Ratings: 0.100 Watts to 0.700 Watts @ 125 °C
- Shelf-Life Stability: <50 ppm/yr.
- Insulation Resistance: >1000 MΩ

PRINTED-CIRCUIT CYLINDRICAL (P) STYLE SELECTION

E/J STYLE	OLD PART NUMBER		POWER RATING		MAX. WORKING VOLTAGE	CRITICAL RESISTANCE VALUE	RESISTANCE RANGE		DIMENSIONS		LEADS			MIL2 EQUIV.
	ELLIOTT	JORDAN	75°C	125°C			MIN.	MAX	DIA.[1] D ±0.010	LENGTH[1] L ±0.032	SPACING[1] S ±0.005	AWG	DIA.[1] d ±0.002	
P1831	-	S302P	0.125	0.100	150	225K	0.1Ω	300K	0.187	0.315	0.100	24	0.020	
P1837	-	PB20	0.163	0.130	150	173K	0.1Ω	800K	0.187	0.375	0.100	22	0.025	
P2525	-	PB27	0.188	0.150	175	204K	0.1Ω	800K	0.250	0.250	0.100	24	0.020	
P2526	111P	-	0.250	0.200	175	153K	0.1Ω	1.0M	0.250	0.250	0.150	22	0.025	
P2527	111P-200	-	0.250	0.200	175	153K	0.1Ω	1.0M	0.250	0.250	0.200	22	0.025	
P2528	-	PB32	0.188	0.150	200	267K	0.1Ω	1.0M	0.250	0.280	0.150	22	0.025	
P2531	-	PB37	0.225	0.180	225	281K	0.1Ω	1.0M	0.250	0.312	0.200	22	0.025	RB71
P2535	114P	-	0.250	0.200	250	313K	0.1Ω	1.0M	0.250	0.350	0.150	22	0.025	
P2537	-	PB42	0.250	0.200	250	313K	0.1Ω	1.0M	0.250	0.375	0.150	24	0.020	
P2550	-	PB47	0.313	0.250	400	640K	0.1Ω	1.3M	0.250	0.500	0.175	22	0.025	
P2551	112P	-	0.313	0.250	300	360K	0.1Ω	1.3M	0.250	0.500	0.150	22	0.025	
P3750	72P	-	0.413	0.330	400	485K	0.1Ω	1.3M	0.375	0.500	0.250	20	0.032	
P3751	110P	PB52	0.500	0.400	400	400K	0.1Ω	5.0M	0.375	0.500	0.200	20	0.032	RB70
P5050	116P	-	0.625	0.500	400	320K	0.1Ω	7.0M	0.500	0.500	0.300	20	0.032	
P5051	-	PB57	0.625	0.500	400	320K	0.1Ω	7.0M	0.500	0.500	0.400	20	0.032	

1. Dimensions listed are in inches. 2. Military type is for reference only, and does not imply QPL approval.

PRINTED-CIRCUIT RECTANGULAR (PR) STYLE SELECTION

E/J STYLE	OLD PART NUMBER		POWER RATING		MAX. WORKING VOLTAGE	CRITICAL RESISTANCE VALUE	RESISTANCE RANGE		DIMENSIONS			LEADS		
	ELLIOTT	JORDAN	75°C	125°C			MIIN.	MAX.	HEIGHT[1] H ±0.020	LENGTH[1] L ±0.020	WIDTH[2] W ±0.020	SPACING S ±0.005	AWG	DIA.[1] d ±0.002
PR2525	-	HD10	0.250	0.200	100	80K	0.1Ω	1.0M	0.250	0.250	0.125	0.125	20	0.032
PR2526	192P	-	0.156	0.125	100	50K	0.1Ω	1.0M	0.250	0.250	0.125	0.125	22	0.025
PR3230	191P	-	0.375	0.300	200	133K	0.1Ω	1.5M	0.320	0.300	0.100	0.150	22	0.025
PR2550	-	HD20	0.313	0.250	200	160K	0.1Ω	1.5M	0.250	0.500	0.140	0.250	20	0.032
PR3231	-	HD102	0.375	0.300	200	133K	0.1Ω	1.0M	0.328	0.306	0.110	0.150	22	0.025
PR5256	190P	-	0.625	0.500	300	180K	0.1Ω	1.5M	0.520	0.565	0.150	0.400	22	0.025
PR5387	189P	-	0.875	0.700	400	229K	0.1Ω	1.5M	0.530	0.875	0.180	0.650	22	0.025

1. Dimensions listed are in inches.

Other Available Wirewound Products

- Ultra High Stability
  - Hermetically Sealed
- Four Terminal Low ohmic value
  - Tight tolerance
- Networks
- Special TCR to +6000 ppm/°C
  - Temperature compensation
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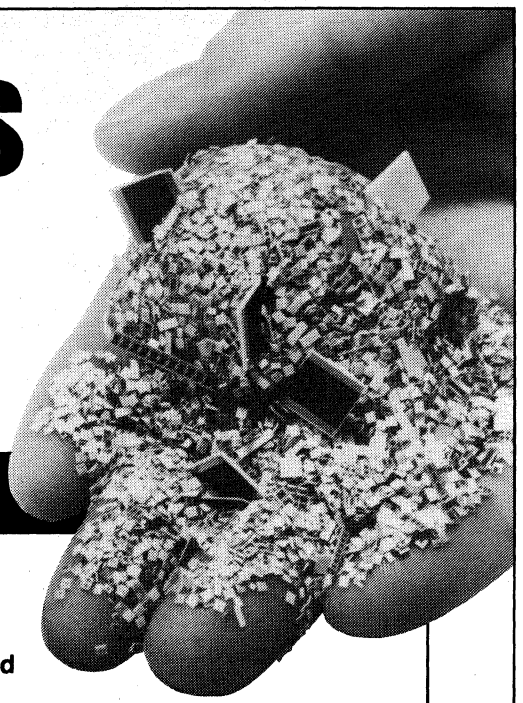
CHIP RESISTORS

Surface Mounted Devices

IMS manufactures a complete line of Chip Resistors including: Ultra Low Ohm, Low Ohm, Hi Meg, Hi Power, Micro-miniature, Miniature, RC0805, RC1206, Surface Mount Chip Resistors and Custom SIP Resistor Networks.



Standard Products

IMS No.	Length (In.)	Width (In.)	Power Rating Free Air	RCWV (Volts)
007	.025	.030	30mw	40
000	.045	.030	125mw	60
001	.050	.050	125mw	45
002	.075	.050	175mw	100
003	.100	.050	250mw	160
004	.150	.050	350mw	350
005	.100	.100	500mw	160
008	.100	.025	100mw	175
010	.125	.050	250mw	230
RC0805	.079	.049	175mw	150
RC1206	.122	.061	250mw	200
024	.240	.120	1W	350
202	.360	.140	2W	800
204	.440	.180	4W	1100
206	.520	.220	6W	1400
208	.560	.240	8W	1500
210	.620	.270	10W	1800

24 Hour Delivery Our Specialty

Standard Values
10 ohm to 25 Megohm
including any intermediate value

Special Values
0.1 ohm to 9.9 ohm and
26 Megohm to 1,000 Gigohm

Tolerances
±1%, ±2%, ±5%, ±10%, and ±20%
or ANY intermediate tolerance required

Terminations
Palladium Silver coated with 62/36/2 Solder
Palladium Silver terminals
Gold terminals
RC0805 and RC1206
with nickel barrier wrap around (Made in Japan)

Custom Capabilities
ANY of our standard products can be customized to user specifications
Custom SIP Resistor Networks can be developed to user specifications with
NO engineering or tooling charges
SIP Networks are delivered within 2 weeks
High Rel Quality Assurance Specifications with Certificate of compliance can be provided

Engineering Kits
Ideal for engineering prototypes and pilot runs
10 to 910 ohm, 1 to 910 Kohm, and
1 to 24 Megohm
Standard kits and special kits with different values and tolerances available

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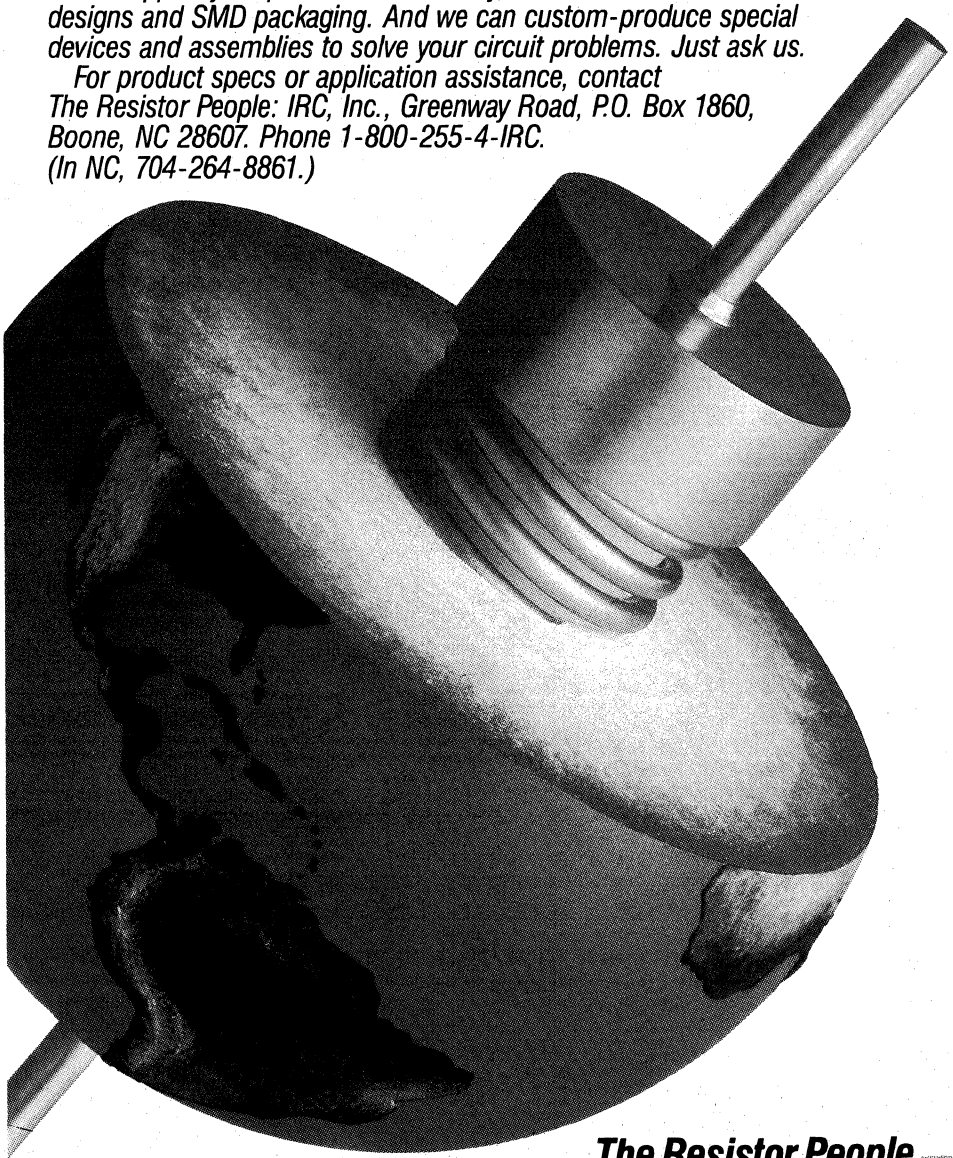
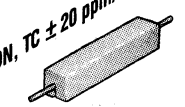


GENERAL PURPOSE
1 AND 2 W
0.1 TO 2400 Ω
TOL. ± 5% AND 10%

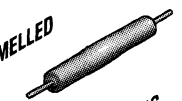
FLAMEPROOF LINE FEED RESISTOR
2 W
1 TO 1600 Ω
TOL. ± 1% TO 5%

GENERAL PURPOSE AND FAILSAFE
1 AND 2 W
0.01 TO 2400 Ω
TOL. ± 2% TO 10%

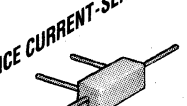
SEMI-PRECISION, TC ± 20 ppm/°C
0.5 TO 10 W
0.1 TO 17.5k Ω
TOL. ± 0.1% TO 5%



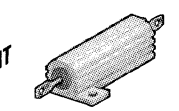
VITREOUS ENAMELLED
2.5 TO 208 W
0.1 TO 250k Ω
TOL. ± 1% TO 10%



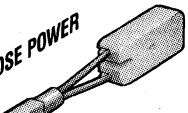
LOW-RESISTANCE CURRENT-SENSING
3 TO 15 W
.01 TO 1 Ω
TOL. ± 1% TO 10%



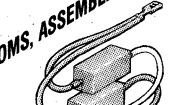
CHASSIS MOUNT
10 TO 50 W
0.05 TO 82k Ω
TOL. ± 1% TO 10%



GENERAL PURPOSE POWER
2 TO 100 W
0.1 TO 30k Ω
TOL. ± 5% AND 10%



SPECIALS, CUSTOMS, ASSEMBLIES
2 TO 100 W
0.1 TO 60k Ω
TOL. ± 5% AND 10%



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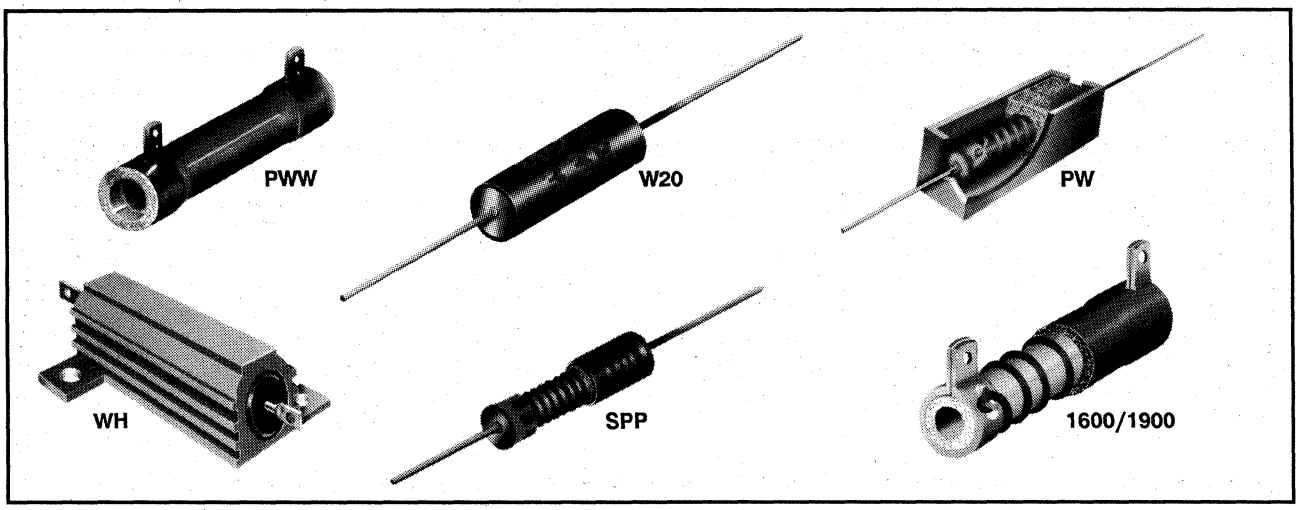
WIREWOUND RESISTORS

- Power Resistors
- Flame Retardant Resistors
- Fuse Resistors
- Vitreous Enamell Resistors
- Noninductive Resistors
- Surge Resistors
- Four Terminal Resistors
- Chassis Mount Resistors



IRC Type	Power Ratio		Resistance Range		Tolerance		TCR/°C
	Min	Max	Min	Max	Min	Max	
AS	1/2 watt	10 watt	.05 ohm	175K ohm	±.1%	±5%	±20 ppm
LPW	3 watt	15 watt	.005 ohm	1 ohm	±1%	±5%	±40 ppm to ±200 ppm
PW	2 watt	25 watt	.18 ohm	30K ohm	±5%	±10%	300 ppm to ±5500 ppm
PW	20 watt	50 watt	.1 ohm	5.1K ohm	±5%	±10%	Customs
PPW	2 watt	15 watt	1 ohm	5K ohm	±1%	±3%	±30 ppm
PWW	5 watt	225 watt	.1 ohm	1.5meg ohm	±5%	±10%	±50 ppm to ±400 ppm
WH	5 watt	50 watt	.05 ohm	82K ohm	±1%	±10%	±50 ppm
4LPW	3 watt	15 watt	.005 ohm	1 ohm	±1%	±10%	±50 ppm to ±200 ppm
SPP	1 watt	2 watt	.1 ohm	2400 ohm	±5%	±10%	±300 ppm to ±600 ppm
SP/SP20F	1 watt	1 watt	.1 ohm	1200 ohm	±2%	±10%	±150 ppm to ±800 ppm
SPH/SPF	2 watt	2 watt	.05 ohm	2400 ohm	±2%	±10%	±400 ppm to ±800 ppm
1600/1900	5 watt	208 watt	1 ohm	250K	±1%	±10%	±50 ppm to ±400 ppm
W20	2.5 watt	12 watt	.1 ohm	100K	±1%	±10%	±75 ppm to ±120 ppm
LFR-2	2 watt	----	1 ohm	1600 ohm	±1%	±10%	±50 ppm to ±300 ppm
PWR	5 watt	10 watt	.1 ohm	18K ohm	±5%	±10%	±300 ppm to ±5500 ppm
PCH	5 watt	20 watt	1 ohm	3500 ohm	±5%	±10%	±400 ppm

Custom configurations, wattages, resistance values, and assemblies available on request.

INTERNATIONAL RESISTIVE COMPANY, INC.
P.O. BOX 1860, GREENWAY ROAD ● BOONE, NC 28607.1860
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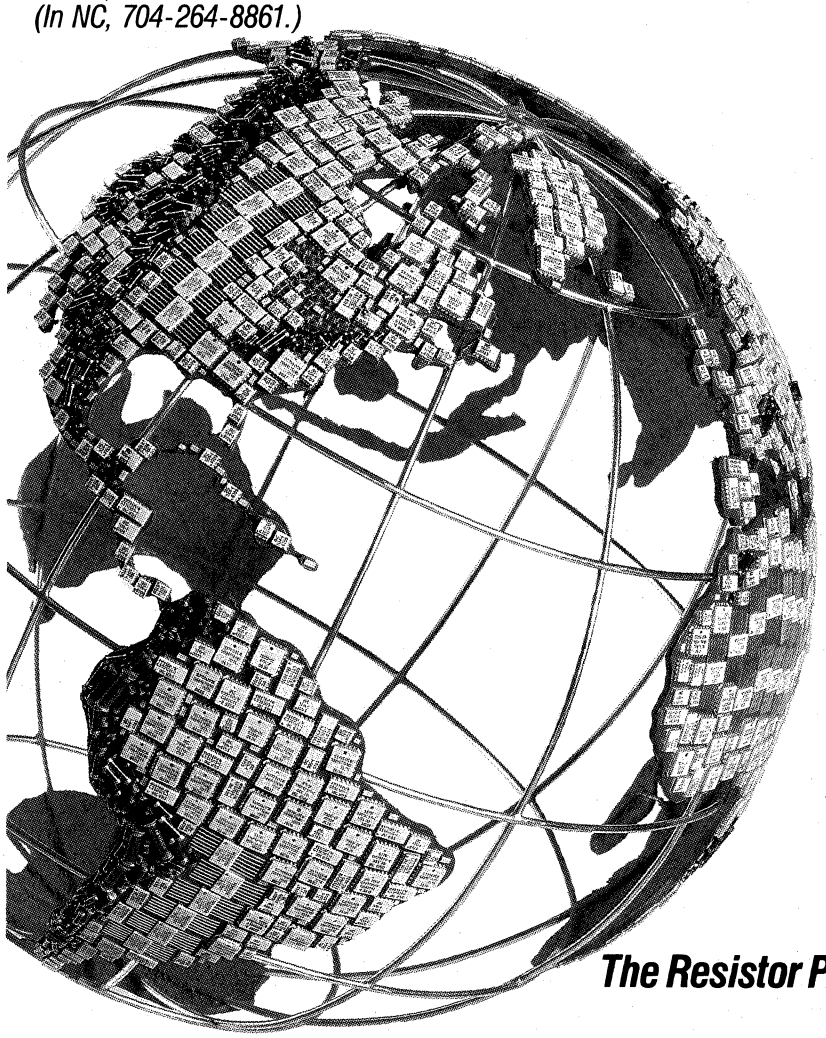
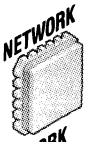


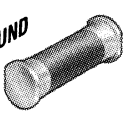
SURFACE-MOUNT RESISTOR NETWORK
50 Ω TO 100K Ω, TOL. TO ± .02%, TCR TRACKING TO 2 ppm/°C



SMALL-OUTLINE RESISTOR NETWORK
50 Ω TO 100K Ω, TOL. TO ± .02%, TC TO ± 25 ppm/°C

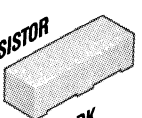
PRECISION FLAT CHIP
50 Ω TO 50K Ω, TOL. TO ± 0.1%, TC TO ± 25 ppm/°C

POWER-CHIP RESISTOR
1 Ω TO 10M Ω, TOL. TO ± 5%, 1/4 TO 2 W



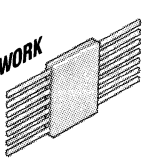
SEMI-PRECISION WIREWOUND
.1 Ω TO 1.5K Ω, TOL. TO ± 0.25%, 3 W

GENERAL PURPOSE CHIPS
10 Ω TO 2.2M Ω, TOL. ± 1% TO 5% 1/8 AND 1/10 W



LPW SURFACE-MOUNT RESISTOR
.01 Ω TO .5 Ω, TOL. ± 1, 2, & 5% 2 W

TaNTee SUBMINIATURE DUAL NETWORK
10 Ω TO 10K Ω, TOL. TO ± .1%, 1/4 W



FLAT PACK RESISTOR NETWORK
50 Ω TO 100K Ω, TOL. TO ± .02%, MIL-R-83401 CHARACTERISTIC H

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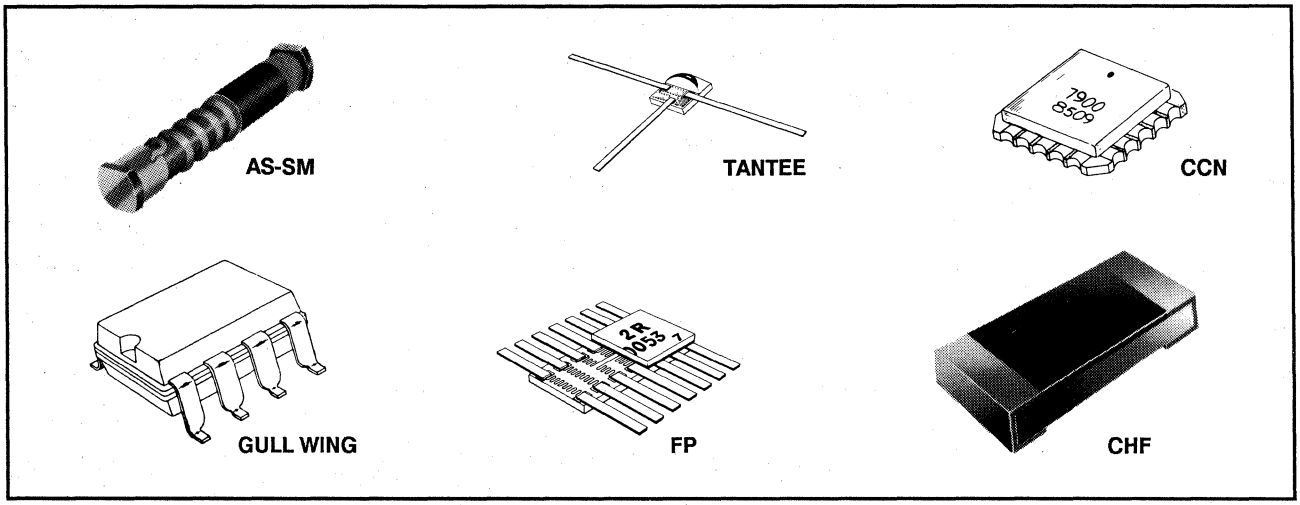
SURFACE MOUNT RESISTIVE PRODUCTS

- Power Chip
- Flat Chip
- Chip Carrier Networks
- Small Outline Networks
- Low Resistance Power Resistor
- Precision Flat Chip (For Microcircuits)
- Power Wirewound
- Flat Pack Networks (MIL-R-83401)
- TaNTee Dual Networks
- "Gull Wing" DIP Network



IRC Type	Power Ratio		Resistance Range		Tolerance		TCR/°C
	Min	Max	Min	Max	Min	Max	
CHP	1/8 watt	2 watt	3 ohm	5.1 meg ohm	±.5%	±5%	50 ppm to 300 ppm
CHF	1/10 watt	1 watt	1 ohm	10 meg ohm	±1%	±5%	100 ppm to 300 ppm
PFC	1/8 watt	----	10 ohm	50K ohm	±.1%	±1%	±25 ppm to ±100 ppm
CCN	.1 watt/R	1 watt/ntwk	50 ohm	100K ohm	±.1%	±2%	±25 ppm to -100 ±50 ppm
FP	.1 watt/R	.5w/ntwk (@70°C) .5w/ntwk (@25°C)	49.9 ohm	121K ohm	±.1%	±2%	±25 ppm to -100 ±25 ppm
AS-SM	2 watt	3 watt	.1 ohm	1.5K ohm	±.25%	±5%	±20 ppm
TANTEE	1/4 watt	50 watt	10 ohm	10K ohm	±1%	±5%	±25 ppm
LPW-SM	2 watt	----	.01 ohm	.5 ohm	±1%	±5%	±30 ppm
GUL	.1 watt/R	.5 watt/ntwk	49.9 ohm	50K ohm	±.1%	±2%	±25 ppm to -100 +25 ppm
SON	.1 watt/R	.8 watt/ntwk	50 ohm	100K ohm	±.1%	±2%	±25 ppm to -100 +50 ppm

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A PRIME TECHNOLOGY COMPANY

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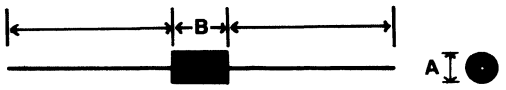
General Resistance has been engaged in the development and manufacture of precision wirewound resistors for over 30 years. The widest possible range of form factors is available, including axial and PC mounting types, in resistance values and accuracies to meet virtually any requirement.

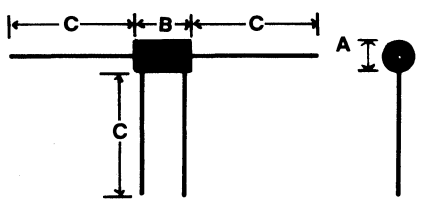
"Standard values" are normally available from stock. And *any* resistance value from 1Ω to 1,100,000Ω, as well as accuracies other than the "standard" ±0.1%, ±0.025% and ±0.01%, are available.

All General Resistance resistors are manufactured to the exacting standards typified by military specifications such as MIL-R-93/ MIL-R-39005 (RB and RBR styles).

ECONISTOR, MINI-OHM, AND MAXI-OHM

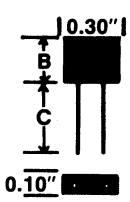


CURRISTOR

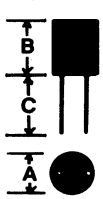


Type		Basic Resistance Range	Standard Accuracies	Stability	Tempco	Power Δ Rating ±0.1%@ +85°C	Max. Voltage	A Dia.	B Length	C Length of Wire	D† Wire Gauge
ECONISTOR (Axial-Leads)	8E16	1Ω to 1.1 Meg	±0.01% ±0.025% ±0.1% (others available)	±35ppm/ year	±5ppm/ °C max. −55°C to +125°C (others available)	8E16, 0.33W	200VDC or AC pk.	1/4" 6.4 mm	1/2" 12.7 mm	1-1/2" typ. 38 mm	22 AWG 0.6 mm
	8E24					8E24, 0.40W		1/4" 6.4 mm	3/4" 19.1 mm	1-1/2" typ. 38 mm	20 AWG 0.8 mm
SQUARISTOR (PC Mounting)	GR102	1Ω to 100K				0.30W	150VDC or AC pk.	N/A	0.32" 8.1 mm	1" typ. 25 mm	22 AWG 0.6 mm
MAXI-OHM (Axial-Leads)	12E32	1Ω to 3.5M				12E32, 0.75W	600VDC or AC pk.	3/8" 9.5 mm	1" 25.4 mm	1-1/2" typ. 38 mm	20 AWG 0.8 mm
	16E32	1Ω to 5M				16E32, 1.00W		1/2" 12.7 mm	1" 25.4 mm	1-1/2" typ. 38 mm	20 AWG 0.8 mm
PLUGISTOR (PC Mounting)	8P13	1Ω to 200K				0.30W	150VDC or AC pk.	1/4" 6.4 mm	13/32" 10.3 mm	1" typ. 25mm	22 AWG 0.6 mm
MINI-OHM (Axial Leads)	5E10	1Ω to 80K		±50ppm/ year		0.2W	175VDC or AC pk.	5/32" 4 mm	5/16" 0.5 mm	1-1/2" typ. 38 mm	24 AWG 0.4 mm
CURRISTOR	8C24	0.01Ω to 100Ω			±10ppm/ °C std. (others available)	0.50W*		1/4" 6.4 mm	3/4" 19.1 mm	1" 25 mm	22 or 20 AWG 0.6 or 0.8 mm
	12C20					0.75W*		3/8" 9.5 mm	5/8" 15.9 mm	1" 25 mm	20 AWG 0.8 mm
	16C32					1.50W*		1/2" 12.7 mm	1" 25.4 mm	1" 25 mm	20 AWG or Terminals
	16C64					2.50W*		1/2" 12.7 mm	2" 51 mm	1" 25 mm	20 AWG or Terminals
	32C64					6.00W*		1" 25.4 mm	2" 51 mm	N/A	Terminals

SQUARISTOR



PLUGISTOR



ΔFor other tolerances consult factory

*Power ratings for Curristor are at + 100°C

†All leads are tinned copper

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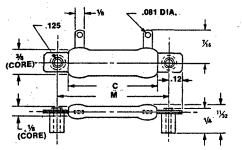
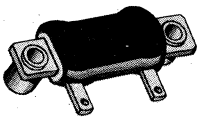
MINIATURE OVAL



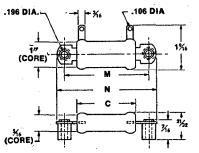


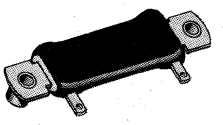
TYPE	WATT	C	M
FVOT-10	10	3/4	1
FVOT-15	15	1	1 1/4
FVOT-20	20	2	2 5/16

NOTE: FVOT = VITREOUS
FSOT = SILICONE

Miniature oval resistors, by their basic design, are ideally suited for applications where space is limited and the mounting surface can be utilized for heat dissipation purposes. Resistors can be easily stacked into compact units. Standard tolerance is ±5% for 1 ohm and greater and ±10% for less than 1 ohm. Ayrton-Perry type non-inductive winding is available.

STANDARD OVAL



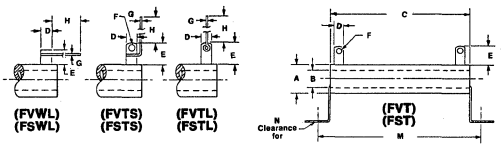


TYPE	WATT	C	M	N
FVOT-30	30	1 1/4	2	2 1/2
FVOT-40	40	2	2 3/4	3 1/4
FVOT-55	55	3 1/2	4 1/4	4 3/4
FVOT-65	70	4 3/4	5 1/2	6
FVOT-75	95	6	6 3/4	7 1/4

NOTE: FVOT = VITREOUS
FSOT = SILICONE

Standard oval resistors, like the miniature ovals are easily stacked and utilize the mounting surface as a heat-sink. When stacking two or more parts, the individual resistors should be de-rated. Standard tolerance is ±5% for 1 ohm and greater and ± 10% for less than 1 ohm. Ayrton-Perry type non-inductive winding is available.

FIXED

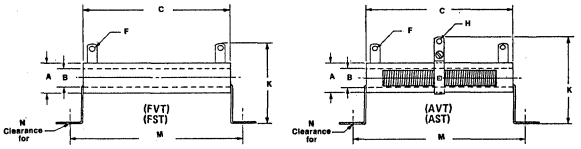


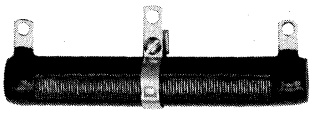
TYPE	WATT	CORE A	CORE B	CORE C	TERMINAL D	TERMINAL E	TERMINAL F	LEADS G	LEADS H	MOUNTING M	MOUNTING N
FVT-5	5	5/16	3/16	1	3/16	7/16	.104	—	—	1 7/16	6-32
FVTL-5	5	5/16	3/16	1	3/16	7/16	—	.032	2	1 7/16	6-32
FVTS-5	5	5/16	3/16	1	3/16	7/16	.104	.032	2	1 7/16	6-32
FVWL-5	8	5/16	3/16	1	1/8	1/4	—	.032	2	1 7/16	6-32
FVT-10	12	5/16	3/16	1 3/4	3/16	7/16	.104	—	—	2 3/16	6-32
FVTL-10	12	5/16	3/16	1 3/4	3/16	7/16	—	.032	2	2 3/16	6-32
FVTS-10	12	5/16	3/16	1 3/4	3/16	7/16	.104	.032	2	2 3/16	6-32
FVWL-10	12	3/16	3/16	1 3/4	1/8	1/4	—	.032	2	2 3/16	6-32
FVT-20	20	7/16	1/4	2	3/16	7/16	.104	—	—	2 1/2	6-32
FVTL-20	20	7/16	1/4	2	3/16	7/16	—	.040	2	2 1/2	6-32
FVTS-20	20	7/16	1/4	2	3/16	7/16	.104	.040	2	2 1/2	6-32
FVWL-20	20	7/16	1/4	2	1/8	1/4	—	.040	2	2 1/2	6-32

NOTE: The above chart applies to both vitreous and silicone coated resistors. The "type" nomenclature shown is for vitreous coating. When ordering coating substitute the letter "S" for the letter "V" in the type.
EXAMPLE: FVT = VITREOUS FST = SILICONE

Huntington Electric's 5-20 watt tubular resistors are offered in a variety of styles to meet your specific applications. The 5-12 watt units are also available with a 3/8" male quick-connect terminal. All units are available with Ayrton-Perry type non-inductive winding on request. Standard tolerance is ±5% for 1 ohm and greater and ±10% for less than 1 ohm. For other specific options, consult factory.

FIXED & ADJUSTABLE

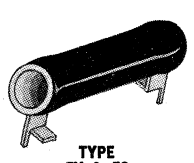




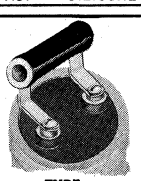
TYPE	Watt	CORE A	CORE B	CORE C	TERM F	ADJ. BAND H	MOUNTING K	MOUNTING M	MOUNTING N
FVT-10 AVT-10	12	5/16	3/16	1 3/4	.104	.104	1 3/16 7/8	2 3/16	8-32
FVT-25 AVT-25	25	5/16	5/16	2	.166	.173	1 5/16 1 11/16	2 3/4	8-32
FVT-50 AVT-50	50	5/16	5/16	4	.166	.173	1 5/16 1 11/16	4 3/4	8-32
FVT-75 AVT-75	75	5/16	5/16	6	.166	.173	1 5/16 1 11/16	6 3/4	9-32
FVT-100 AVT-100	100	3/4	1/2	6 1/2	.166	.173	2 3/32 2 5/16	7 3/8	8-32
FVT-160 AVT-160	175	1 1/8	3/4	8 1/2	.196	.166	2 11/16 2 13/16	9 3/8	8-32
FVT-200 AVT-200	225	1 1/8	3/4	10 1/2	.196	.166	2 11/16 2 13/16	11 3/8	8-32

NOTE: FVT = VITREOUS COATED FST = SILICONE COATED
AVT = VITREOUS COATED ADJUSTABLE AST = SILICONE COATED ADJUSTABLE

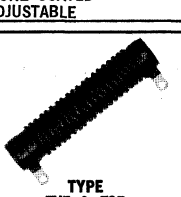
Huntington Electric's 12-225 watt wirewound resistors, like all of our other sizes and types, feature all welded construction utilizing high quality ceramic cores, resistance wire, terminal materials and vitreous enamel or silicon coatings. A variety of optional features, including quick-connect terminals, non-inductive windings and multiple taps, along with special sizes, terminal configurations and resistance tolerances, are available. Consult factory for details. Standard tolerances for fixed resistors are ±5% for 1 ohm and greater and ±10% for less than 1 ohm. ±10% is standard for adjustable units.



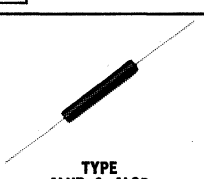
TYPE FV & FS DIRECT P.C. BOARD MOUNTING



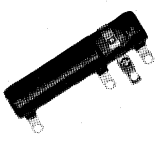
TYPE CMV & CMS CAPACITOR MOUNTING



TYPE FVE & FSE SMALL SIZE HIGH WATTAGE



TYPE ALVR & ALSR MINIATURE CIRCUITS



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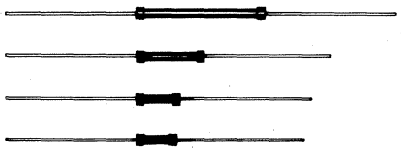
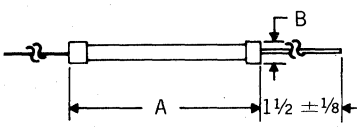


FEATURES
- Tinned copper leads .020" or .032" standard. Other lead materials available
- Conformal epoxy coated
- Glass overglaze for vacuum applications



NOTES
- Voltage coefficient is dependent on resistance value. Typically less than 5 PPM/V in mid resistance values
- Burn in and other preconditioning options available
- Tolerance to ½% on request

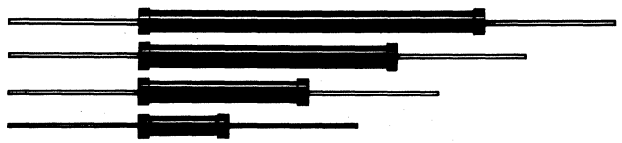
TYPES —

Type	Resistance Ohms Min	Resistance Ohms Max	Power at 70°C Watts	Maximum Operating Voltage	Tolerance at 25 VDC	Max Surface Temp.	Dimensions Max Inches A	Dimensions Max Inches B
KO1040	1 Meg	5K Meg	.75	2000V	1, 2 & 5%	220°C	.460	.145
KO1243	1 Meg	10K Meg	1.0	2500V	1, 2 & 5%	220°C	.500	.170
KO1268	1 Meg	20K Meg	1.5	5000V	1, 2 & 5%	220°C	.750	.170
KO1213	1 Meg	100K Meg	2.0	10,000V	1, 2 & 5%	220°C	1.500	.170

TEMPERATURE COEFFICIENT —

Temperature Coefficient +25°C to +125°C	KO1040 Megohms	KO1243 Megohms	KO1268 Megohms	KO1213 Megohms
±100 PPM/°C	1-100	1-100	1-200	1-400
±200 PPM/°C	100-3K	100-3K	200-6K	400-15K
±1000 PPM/°C	3K-5K	3K-10K	6K-20K	15K-100K

SERIES II RESISTORS
PRECISION HIGH OHMAGE HIGH VOLTAGE POWER RESISTORS



FEATURES
- Tinned copper leads .020" or .032" standard. Other lead materials available
- Conformal epoxy coated

NOTES
- Voltage coefficient is dependent on resistance value. Typically less than 5 PPM/V in mid resistance values
- Burn in and other preconditioning options available
- Tolerance to ½% on request

TYPES —

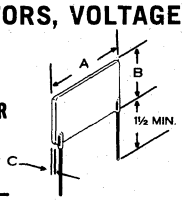
Type	Ohms Resistance Min	Ohms Resistance Max	Power at 70°C Watts	Maximum Operating Voltage	Tolerance at 25 VDC	Max Surface Temp.	Dimensions Max Inches A	Dimensions Max Inches B
KO2510	1 Meg	5K Meg	4	8,000V	1, 2 & 5%	220°C	1.125	.325
KO2520	1 Meg	10K Meg	7	16,000V	1, 2 & 5%	220°C	2.125	.325
KO2530	1 Meg	15K Meg	10	24,000V	1, 2 & 5%	220°C	3.125	.325
KO2540	1 Meg	20K Meg	12	32,000V	1, 2 & 5%	220°C	4.125	.325

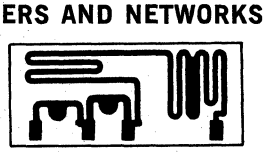
TEMPERATURE COEFFICIENT —

Temperature Coefficient +25°C to +125°C	KO2510 Megohms	KO2520 Megohms	KO2530 Megohms	KO2540 Megohms
±100 PPM/°C	1-500	1-1000	1-1500	1-2000
±200 PPM/°C	500-5K	1000-10K	1500-15K	2000-20K

SERIES III RESISTORS
PRECISION HIGH OHMAGE HIGH VOLTAGE FLAT RESISTORS, VOLTAGE DIVIDERS AND NETWORKS

SINGLE RESISTOR





TYPICAL VOLTAGE DIVIDER NETWORK

TYPES —

Type	Resistance Ohms Min	Resistance Ohms Max	Max Power @ 70°C	Max Operating Voltage	Max Surface Temp.	Dimensions Max Inches A	Dimensions Max Inches B	Dimensions Max Inches C
KF315	1 Meg	5K Meg	2	12,000V	150°C	1.550	.350	.110
KF510	1 Meg	5K Meg	2	10,000V	150°C	1.050	.550	.110
KF520	1 Meg	5K Meg	4	20,000V	150°C	2.050	.550	.110
KF1020	1 Meg	10K Meg	6	30,000V	150°C	2.050	1.050	.110

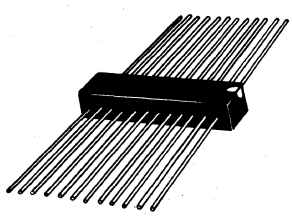
FEATURES
- Tolerances: 1%, 2%, 5%, 10%, 15%
- Conformal epoxy coated
- .032 tinned copper leads or nickel ribbon leads for welding
- Available without leads with solderable termination pads
- VCR less than 5 PPM/V
- Voltage dividers and networks designed to your specifications resistor ratios to 10,000:1 (size dependent).
- TCR tracking 25 PPM/°C
- Ratios to 1%

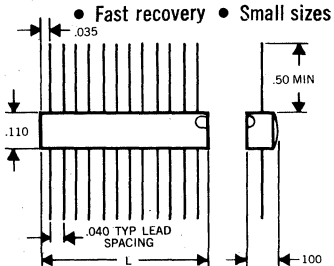
TEMPERATURE COEFFICIENT —

Temperature Coefficient +25°C to +125°C	KF315 Megohms	KF510 Megohms	KF520 Megohms	KF1020 Megohms
±100 PPM/°C	1-500	1-500	1-500	1-1000
±250 PPM/°C	500-5,000	500-5,000	500-5,000	1,000-10,000

MINIATURE HIGH VOLTAGE DIODE ARRAY

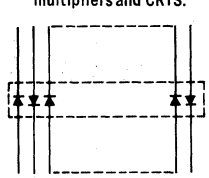
FEATURES
- Low reverse leakage current
- Fast recovery • Small sizes





MECHANICAL
- Lead Diameter .015 max
- Lead Material—Silver
- Encapsulant—Epoxy

APPLICATIONS
- Typical applications are power supplies which generate the high voltage required for image intensifiers photomultipliers and CRTS.



SPECIFICATIONS:

K & M Part No.	No. of Diodes	DIM L
107-031-12	12	.510
107-032-10	10	.430
107-033- 8	8	.350
107-034- 6	6	.270
107-035- 4	4	.190
107-036- 2	2	.110

ELECTRICAL
- PIV = 1200 VDC
- IR @ 23°C 500 VDC 10 nano amps Max
- Junction Capacitance @ 23° Max 0.35 pf Max @ 500 VDC
- Recovery Time @ 23°C 1.5 micro Sec. @ If = 10 ma
- Recovery Time @ 23°C 0.5 micro Sec. .040 Max
- Operating Temp +55°C to −54°C
- Storage Temp +85°C to −70°C

K AND M electronics • inc
MINIATURE HIGH VOLTAGE POWER SUPPLIES & COMPONENTS
123 Interstate Drive • West Springfield • Mass • 01089 • (413) 781-1350 • TWX 710-350-6463

KELVIN

Precision Wire-wound Resistors, Power Resistors & Resistor Networks

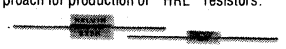
Kelvin is a pioneer in the field of very high stability, close tolerance, precision wire-wound resistors. Resistors shown represent only part of the broad Kelvin line. Complete catalog data is available on request.

HIGH RELIABILITY "HRL" SERIES

Kelvin's "HRL" Series was generated after years of experience on the Polaris, Gemini, Apollo and other important high reliability missile and space programs. Kelvin has combined the many and varied parameters of these programs into a single resistor series, designed to meet the stringent high reliability requirements of many of today's military and commercial systems.

Kelvin's reliability goal, through the design and controls of the "HRL" Series resistor and the use of acceptance inspection procedures, was to produce precision wire-wound resistors having failure rates better than .0005%/1000 hours at a 90% confidence level. Present level is .00064%/1000 hours at a 60% confidence level.

All "HRL" resistors have a documented history. This includes traceability from the spool analysis of the resistance wire, through each phase of the production operation to the finished product. Each resistor is screened to eliminate INFANT MORTALITY. This consists of a 100 hour burn in at full rated power at 125°C and a short time overload at twice the rated power. Other tests are conducted as outlined in Bulletin HR 02449, which presents the complete procedure and methods approach for production of "HRL" resistors.



KELVIN TYPE	WATTAGE*	RESISTANCE MAXIMUM**	DIA. ± .015	LENGTH ± .032	MAXIMUM VOLTS	LEAD DIA.	MIL-R-39005
HRL-20	.08	25K	.187	.375	150 V	#22	
HRL-991	.125	150K	.250	.312	150 V	#22	RBR-71
HRL-1009	.125	316K	.250	.295	150 V	#22	RBR-75
HRL-1097	.125	90K	.193†	.500	150 V	#22	RBR-74
HRL-417	.125	220K	.250	.343	150 V	#20	RBR-56
HRL-467	.150	332K	.250	.500	200 V	#20	RBR-55
HRL-334	.200	500K	.375	.500	300 V	#20	
HRL-812	.250	562K	.250	.750	300 V	#20	RBR-54
HRL-815	.333	1.1 meg	.375	.750	300 V	#20	RBR-53
HRL-1100	.500	600K	.312	.812	300 V	#20	RBR-76
HRL-254	.500	1.21 meg	.375	1.000	600 V	#20	RBR-52
HRL-27	.750	6.42 meg	.500	1.000	600 V	#20	RBR-57

† ± .010 Tolerance

SUB-MINIATURE TYPES

TOLERANCES: 1% through .005% available on most types and resistance values.

TEMPERATURE COEFFICIENT: ±20 ppm/°C standard.

T.C.s available to 1 ppm depending on size, value and temperature range.

WINDINGS: Non-inductive.

*WATTAGE RATINGS: Based on a maximum ambient temperature of 125°C, derated to zero watts at +145°C.

**RESISTANCE MAX.: Contact factory for availability of values above maximum shown.

COMBINATION AXIAL-RADIAL LEAD

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	DIA. ±1/64	LENGTH ±1/32	MAX. VOLTS	LEAD DIA.
315-PAR	.05	100K	.080	.375	100	#24
303-PAR	.05	100K	.125	.250	100	#24
162-PAR	.10	200K	.125	.375	100	#22
158-PAR	.15	700K	.187	.375	100	#22

AXIAL LEAD

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	DIA. ±1/64	LENGTH ±1/32	MAX. VOLTS	LEAD DIA.
EP-00	.05	100K	.080	.375	100	#24
1788-P	.04	50K	.100	.225	75	#24
460-P	.06	100K	.100	.281	100	#24
301-P	.05	175K	.125	.250	100	#24
EP-01	.10	200K	.125	.375	100	#22
470-P	.10	500K	.160	.500	100	#24
EP-20	.15	700K	.187	.375	200	#22
304-P	.15	500K	.250	.250	100	#22
430-P	.15	600K	.250	.312	100	#20
417-P	.20	700K	.250	.343	100	#20

PRINTED CIRCUIT TYPES

TOLERANCES: 1% through .005% available on most types and resistance values.

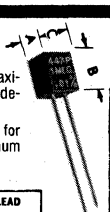
TEMPERATURE COEFFICIENT: ±20 ppm/°C standard.

T.C.s available to 1 ppm depending on size, value and temperature range.

WINDINGS: Non-inductive.

*WATTAGE RATINGS: Based on a maximum ambient temperature of 125°C, derated to zero watts at +145°C.

**RESISTANCE MAX.: Contact factory for availability of values above maximum shown.



HIGH DENSITY PACKAGING

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	SIZE ±.020 A	SIZE ±.020 B	SIZE ±.020 C	MAX. VOLTS	LEAD DIA.	LEAD SPACING
446-P	.250	2 Meg.	.140"	.270"	.500"	100	#20	.250
447-P	.125	1 Meg.	.140"	.270"	.250"	100	#20	.125

STANDARD PRINTED CIRCUIT

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	DIA. ±1/64	LENGTH ±1/32	MAX. VOLTS	LEAD DIA.	LEAD SPACING
252-P	.15	375K	.250	.250	100	#22	.150
176-P	.15	450K	.250	.312	100	#22	.150
178-P	.20	650K	.250	.400	200	#22	.150
277-P	.20	700K	.250	.437	200	#22	.150
471-P	.25	750K	.250	.500	300	#22	.150
177-P	.30	850K	.312	.500	400	#22	.200
179-P	.30	1.1M	.375	.500	400	#22	.200
155-P	.50	3.0M	.500	.625	400	#20	.250

HIGH STABILITY SERIES

LONG TERM STABILITY: .003% resistance change per year maximum under conditions involving normal equipment and room temperature variations.

TOLERANCES: 1% through .005% available on most types and resistance values.

TEMPERATURE COEFFICIENT: ±10 ppm/°C standard.

T.C.s available to 1 ppm depending on size, value and temperature range.

WINDINGS: Non-inductive.

*WATTAGE RATINGS: Based on a maximum ambient temperature of 125°C, derated to zero watts at +145°C.

**RESISTANCE MAX.: Contact factory for availability of values above maximum shown.

AXIAL LEAD

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX**	DIA. ±1/64	LENGTH ±1/32	MAX. VOLTS	LEAD DIA.
OA	.15	560K	.187	.375	300	#22
OB	.25	1.2 Meg.	.250	.500	300	#22
OC	.33	2.2 Meg.	.250	.750	400	#22
OD	.33	2.4 Meg.	.375	.500	300	#20
OE	.50	3.6 Meg.	.375	.828	400	#20
OF	.60	5.2 Meg.	.375	1.000	400	#20
OG	.50	4.0 Meg.	.500	.500	400	#20
OH	.60	6.4 Meg.	.500	.625	400	#20
OJ	1.00	8.0 Meg.	.500	1.000	800	#20
OK	1.50	10.0 Meg.	.500	1.500	900	#20
OL	1.75	10.5 Meg.	.500	1.750	900	#20
OM	2.00	13.0 Meg.	.500	2.000	1200	#20

STANDARD TYPES

TOLERANCES: 1% through .005% available on most types and resistance values.

TEMPERATURE COEFFICIENT: ±20 ppm/°C standard.

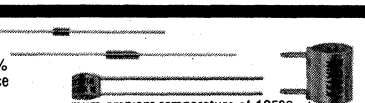
T.C.s available to 1 ppm depending on size, value and temperature range.

WINDINGS: Non-inductive.

*WATTAGE RATINGS: Based on a maximum ambient temperature of 125°C, derated to zero watts at +145°C

**RESISTANCE MAX.: Contact factory for availability of values above maximum shown.

*All Lug Types available with #20 gauge radial leads (except EP-22) by specifying letter "R" after type number.



LUG and RADIAL LEAD

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	DIA. ±1/32	LENGTH ±1/32	MAX. VOLTS	TERMINAL TYPE*	MOUNTING HOLE
EP-22	.10	350K	.312	.250	100	#24 x 2" (Wire Lead)	#2
346-P	.25	1.0M	.375	.440	150	Lug	#4
264-P	.33	1.5M	.375	.500	300	Lug	#4
EP-09	.50	4.0M	.500	.500	400	Lug	#6
263-P	.50	4.0M	.625	.500	400	Lug	#6
EP-15	.60	5.0M	.500	.625	400	Lug	#6
EP-16	1.00	6.5M	.500	1.000	800	Lug	#6
EP-30	1.50	10.0M	.500	1.500	900	Lug	#6

AXIAL-WIRE LEAD

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	DIA. ±1/64	LENGTH ±1/32	MAX. VOLTS	LEAD DIA.
EP-21	.25	1.5 Meg.	.250	.500	400	#22
467-P	.25	1.5 Meg.	.250	.500	400	#20
EP-23	.33	2.75 Meg.	.250	.750	400	#22
812-P	.33	2.75 Meg.	.250	.750	400	#20
363-P	.40	3.0 Meg.	.250	1.000	400	#22
334-P	.33	3.0 Meg.	.375	.500	300	#20
815-P	.50	4.5 Meg.	.375	.750	600	#20
EP-24	.50	4.5 Meg.	.375	.828	600	#20
EP-25	.50	5.0 Meg.	.500	.500	400	#20
254-P	.60	6.5 Meg.	.375	1.000	800	#20
EP-26	.60	8.0 Meg.	.500	.625	400	#20
EP-27	1.00	10.0 Meg.	.500	1.000	800	#20
EP-28	1.50	12.0 Meg.	.500	1.500	900	#20
366-P	1.75	13.0 Meg.	.500	1.750	900	#20
EP-29	2.00	15.0 Meg.	.500	2.000	1200	#20

CATALOG #763 COVERS ALL PRODUCTS SHOWN ON THIS PAGE

KELVIN 14724 VENTURA BOULEVARD, SHERMAN OAKS, CA 91403-3501
PHONE 818-990-1192 • FAX 818-995-6460

FAST RISE TIME APPLICATIONS

"RT" style resistors provide exceptionally high frequency performance, in addition to the other recognized advantages of wire-wound resistors. "RT" resistors can be supplied with rise times as low as 100 nanoseconds (from 10% to 90% of peak pulse amplitude at 100 KC), depending on resistance values and physical configurations. See Catalog #763

TOLERANCES: 1% through .005% available on most types and resistance values.

TEMPERATURE COEFFICIENT: ±20 ppm/°C standard.

T.C.s available to 1 ppm depending on size, value and temperature range.

WINDINGS: Non-inductive.

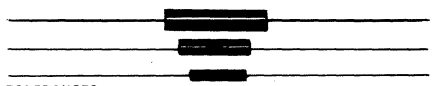
*WATTAGE RATINGS: Based on a maximum ambient temperature of 125°C, derated to zero watts at +145°C.

**RESISTANCE MAX.: Contact factory for availability of values above maximum shown.

AXIAL LEAD

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	DIA. ±1/64	LENGTH ±1/32	MAX. VOLTS	LEAD DIA.
RTA	15	560 K	.187	.375	300	#22
RTB	25	1.2 Meg	.250	.500	400	#22
RTC	33	2.2 Meg	.250	.750	400	#22
RTD	33	2.4 Meg	.375	.500	300	#20
RTE	50	3.6 Meg	.375	.828	400	#20
RTF	60	5.2 Meg	.375	1.000	400	#20
RTG	50	4.0 Meg	.500	.500	400	#20
RTH	60	6.4 Meg	.500	.625	400	#20
RTJ	1.00	8.0 Meg	.500	1.000	800	#20
RTK	1.50	10.0 Meg	.500	1.500	900	#20
RTL	1.75	10.5 Meg	.500	1.750	900	#20
RTM	2.00	13.0 Meg	.500	2.000	1200	#20

SERIES KM MOLDED, POWER RESISTORS



Series KM are general purpose, reliable power resistors designed to be used where heat sinks are not available or not desired. These resistors are extremely stable for their size as compared to film types. Series KM are considered to have the lowest dollar per watt cost of precision resistors. Send for Bulletin K-1.

TOLERANCES:

KM025, KM050, KM100—1% thru 5%
KM200 thru KM1000—.05% thru 5%

TEMPERATURE COEFFICIENT:
(Per Degree Centigrade)

±20 PPM (170 ohms and above)
±30 PPM (10 to 170 ohms)
±50 PPM (1 to 9.99 ohms)
Below one ohm—contact factory

T.C.s to 5 PPM/°C available depending on size and value.

NON-INDUCTIVE STYLES: Reduce resistance values by approximately 50%; derate maximum working voltage by 30%. Add "N" to part number. Example: KMN025.

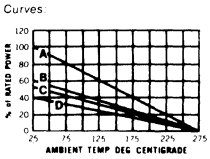
KELVIN PART NUMBER	WATTAGE @ 25° C	DC Working Voltage	Maximum Resistance	SIZE and TOLERANCES Length	Diameter	Lead Length (±0.125)	Lead Diameter (AWG)	Equivalent Military Styles MIL-R-26E
KM025	0.40	35	700Ω	0.250±.015	0.078±.015	1.5 in.	24	
KM050	0.75	50	1K	0.312±.015	0.078±.015	1.5 in.	24	
KM100	1.0	75	2K	0.422±.015	0.093±.015	1.5 in.	24	RW70
KM200	2.0	200	3.3K	0.490±.015	0.150±.015	1.5 in.	22	
KM250	2.5	200	4.8K	0.500±.031	0.218±.015	1.5 in.	20	
KM300	3.0	150	5K	0.560±.031	0.187±.015	1.5 in.	20	RW79
KM350	4.0	200	8K	0.625±.031	0.250±.015	2.0 in.	18	
KM500	5.0	400	18K	0.875±.031	0.312±.031	2.0 in.	18	RW74
KM700	7.0	600	27K	1.218±.031	0.312±.031	2.0 in.	18	
KM1000	10.0	1000	42K	1.780±.031	0.375±.031	2.0 in.	18	RW78

SERIES KC CHASSIS MOUNT POWER RESISTORS

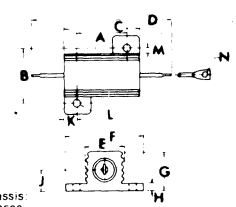
DERATING CURVES

Derating is required for reduced chassis mounting area and high ambient temperatures.

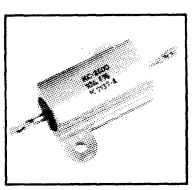
Curves:



A — When mounted on proper aluminum chassis:
48 sq. inches 0.040 aluminum for KC500 and KC1000
70 sq. inches 0.040 aluminum for KC2500
144 sq. inches 0.040 aluminum for KC5000



B — Unmounted KC500 and KC1000
C — Unmounted KC2500
D — Unmounted KC5000



Designed to provide maximum heat dissipation through heat sink and finned case configuration. Ideally suited where large amounts of power must be dissipated and small size is important. Capable of maintaining their precision tolerance in wattage ratings up to 50 watts. Send for Bulletin K-3.

TOLERANCES: 0.05% through 5.0%.

TEMPERATURE COEFFICIENT:
(Per Degree Centigrade)

TC	KC500	KC1000	KC2500	KC5000
±50PPM	1 Ω to 9.9 Ω	1 Ω to 9.9 Ω	1 Ω to 9.9 Ω	1 Ω to 9.9 Ω
±30PPM	10 Ω to 25 Ω	10 Ω to 99 Ω	10 Ω to 170 Ω	10 Ω to 500 Ω
±20PPM	26 Ω to 20K	100 Ω to 30K	171 Ω to 75K	501 Ω to 200K

Below one ohm—contact factory.

T.C.s to 5 PPM/°C available depending on size and value.

NON-INDUCTIVE STYLES: Reduce resistance values by approximately 50%; derate maximum working voltage by 30%. Add "N" to part number. Example: KCN500.

KELVIN PART NUMBER	Watts	DC Working Voltage	Max. Res.	SIZE and TOLERANCES A ±.005	B ±.005	C ±.031	D ±.062	E ±.015	F ±.015	G ±.015	H ±.010	J ±.010	K ±0.10	L ±.005	M ±.015	N ±.005	Mtg. Screw Size	MIL-R-18546
KC500	7.0	165	5K	0.344	0.490	0.600	1.125	0.334	0.646	0.320	0.065	0.133	0.078	0.093	0.078	0.050	#2	RE60
KC1000	12	275	6.4K	0.562	0.625	0.750	1.375	0.425	0.812	0.400	0.075	0.190	0.093	0.093	0.093	0.086	#2	RE65
KC2500	25	560	15K	0.719	0.781	1.062	1.938	0.525	1.080	0.550	0.088	0.280	0.171	0.125	0.115	0.086	#4	RE70
KC5000	50	1300	42K	1.563	0.844	1.969	2.781	0.615	1.150	0.615	0.085	0.307	0.203	0.125	0.115	0.086	#4	RE75

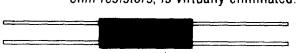
SERIES KM-4T & KC-4T POWER RESISTORS

KELVIN FOUR TERMINAL POWER RESISTORS provide low resistance and close tolerance capabilities to users who require accurate measurements in tightly designed circuits. The two voltage (sense) leads will yield a very precise measurement at the points where they join the current leads. Lead resistance, which plays a predominant role in low ohm resistors, is virtually eliminated.

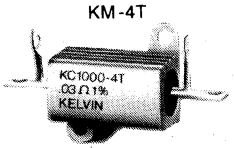
GENERAL FEATURES

TOLERANCES:	1% through 10%
RESISTANCE RANGE:	.001 ohms and up
TEMPERATURE COEFFICIENT:	.1Ω to 1Ω ±90 PPM/°C .05Ω to <.1Ω ± 150 PPM/°C Below .05 ohm—Check Factory
TEMPERATURE RANGE:	−55°C to +275°C
DIELECTRIC STRENGTH:	1000 VRMS all styles except KC5000-4T at 2500 VRMS
LEADS:	Tinned copperweld

See KM & KC Series this page for additional specifications.



KM-4T



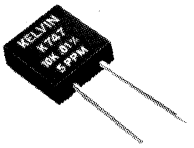
KC-4T

KELVIN PART NUMBER	WATTAGE RATING	DC WORKING VOLTAGE	MINIMUM RESISTANCE IN OHMS 10%	5%	3%	1%
KM300-4T	3W	150	.003	.005	.01	.02
KM500-4T	5W	400	.002	.003	.0075	.015
KC1000-4T	12W	275	.003	.005	.01	.02
KC2500-4T	25W	560	.002	.003	.0075	.015
KC5000-4T	50W	1300	.001	.002	.005	.01

K747 WIREWOUND RESISTOR

Lead Size:	#22 (.025) solder-coated brass
Lead Spacing ℄ to ℄:	.150" (±.010)
Wattage:	.3 watts
Voltage:	200 volts
Resistance Range:	.5Ω to 400K
Resistance Tolerance:	1% thru .005%
Temperature Coefficient:	±5 PPM standard (0–85°C) —Available to ±1PPM/°C (Value dependent)
Stability:	25PPM/year
Rise Time:	25 nanoseconds (value dependent)
Noise:	Not measureable on commercially available equipment
Environmental:	Exceeds all requirements of MIL-R-39005

Designed specifically to interchange with film resistors of same physical configuration. Performance characteristics show the K747 series to be superior in almost all instances. Send for Bulletin K747.



SIZE: 320±.020 H,
.295±.010 L,
.100±.015 W.

Kelvin pioneered the close tolerance, close temperature coefficient and excellent long term stability wire-wound resistor. State-of-the-art manufacturing techniques and superior testing capabilities yield the ultimate in quality at a competitive price. Please contact your nearest Kelvin representative or the factory direct for further details.

KELVIN 14724 VENTURA BOULEVARD, SHERMAN OAKS, CA 91403-3501
PHONE 818-990-1192 • FAX 818-995-6460

SURFACE MOUNT "MELF" RESISTORS

Parameter	CARBON FILM				METAL FILM			
	A	B	D	E	A	B	D	E
Size ℓ x d (mm)	2.00 x 1.25	3.5 x 1.45	3.20 x 1.55	5.90 x 2.20	2.00 x 1.25	3.5 x 1.45	3.20 x 1.55	5.90 x 2.20
Wattage	0.100	0.125	0.200	0.250	0.100	0.125	0.200	0.250
Resistance Range	2.2Ω~1.0M	2.2Ω~1.0M	1.0Ω~1.0M	1.0Ω~2.2M	100Ω~100K	100Ω~604K	10Ω~604K	10Ω~1.0M
Resistance Tolerance (%)	5	5	5	5	1	0.25, 0.50, 1.00	1	0.25, 0.50, 1.00
Temp. Coefficient (ppm/°C)	+350~−1300	+350~−1300	+350~−1300	+350~−1300	100	25, 50, 100	0, 100	25, 50, 100
Max. Working Voltage	150	200	250	350	150	200	250	300
Working Temp. Range	-55°C~+155°C	-55°C~+155°C	-55°C~+155°C	-55°C~+155°C	-55°C~+155°C	-55°C~+155°C	-55°C~+155°C	-55°C~+155°C
Low Temp. Operation (%)	0.30	0.30	0.30	0.30	0.20	0.20	0.20	0.20
Short Time Overload (%)	0.50	0.50	0.50	0.50	0.30	0.30	0.30	0.30
Effects of Solder (%)	1.0	1.0	1.0	1.0	0.20	0.20	0.20	0.20
Moisture Resistance (%)	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0
Load Life (%)	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0
Marking	Clr. band (3)	Clr. band (3)	Clr. band (3)	Clr. band (3)	Clr. band (4)	Clr. band (4)	Clr. band (4)	Clr. band (4)

SURFACE MOUNT RESISTOR CHIPS

Parameter	GENERAL PURPOSE TYPE				PRECISION	
	0805 (2012)	1206 (3216)	1210 (3225)	2010 (5025)	0805 (2012)	1206 (3216)
Size - ℓ x w (mm)	2.00 x 1.25	3.20 x 1.60	3.20 x 2.50	5.00 x 2.50	2.00 x 1.25	3.2 x 1.60
Wattage	0.100	0.125	0.250	0.500	0.100	0.125
Resistance Range	1.0Ω~5.6M	1.0Ω~10.0M	10Ω~160K	10Ω~80K	100Ω~510K	10Ω~1.0K
Resistance Tolerance (%)	2, 5	2, 5	5	5	0.1~1.0	0.1~1.0
Temperature Coefficient (ppm/°C)	200~500	200~500	300	300	25~100	25~100
Maximum Working Voltage	100	200	250	250	100	200
Working Temperature Range	−55°C~+125°C	−55°C~+125°C	−55°C~+125°C	−55°C~+125°C	−55°C~+125°C	−55°C~+125°C
Low Temperature Operation (%)	0.30	0.30	0.30	0.30	0.20	0.20
Short Time Overload (%)	0.50	0.50	0.50	0.50	0.30	0.30
Resistance to Bonding (%)	0.30	0.30	0.30	0.30	0.20	0.20
Moisture Resistance (%)	1.0	1.0	1.0	1.0	0.50	0.50
Load Life (%)	1.50	1.50	1.50	1.50	0.50	0.50
Marking	XXX	XXX	XXX	XXX	XXXX	XXXX

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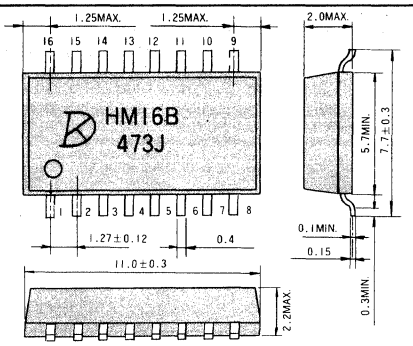
SURFACE MOUNT RESISTOR NETWORKS



Parameter	STANDARD CIRCUIT CONFIGURATION	
	Bussed	Isolated
Circuit Symbol	B	S
Power Rating (Element)	0.062 watts	0.125 watts
Resistance Range	33Ω~2.2M	100Ω~2.2M
Resistance Tolerance	2, 5%	2, 5%
Maximum Working Voltage	50vDC	50vDC
Operating Temperature Range	−55°C~+125°C	−55°C~+125°C
Temperature Coefficient	±200 ppm/°C	±200 ppm/°C
Short Time Overload	0.50%	0.50%
Temperature Cycling	0.30%	0.30%
Resistance to Solder	0.50%	0.50%
Moisture Resistance	1.0%	1.0%
Load Life	1.0%	1.0%

Custom Circuits - R/2R Ladders, Dual Terminators, Translators, User specified

SURFACE MOUNT TRIMMER RESISTORS

Parameter	TYPE									
	C4202	C4212	C4302	C4312	C4304	C4314	C4315			
Terminal Configuration	① ②		① ③ ②		② ① ③		② ① ③			
Construction	open		open		open		sealed			
Power Rating	0.20		0.20		0.20		0.10			
Maximum Working Voltage	100		100		100		50			
Maximum Working Temp.	−30°C~+100°C		−30°C~+100°C		−30°C~+100°C		−30°C~+100°C			
Resistance Taper	Linear		Linear		Linear		Linear			
Resistance Range	100Ω~1.0M		100Ω~1.0M		100Ω~1.0M		100Ω~1.0M			
Resistance Tolerance (%)	E6 30		E6 30		E6 30		E6 25			
Temperature Coefficient	250 ppm/°C		250 ppm/°C		250 ppm/°C		250 ppm/°C			
Rotation Angle	270°		270°		270°		270°			
End Stop	None		None		None		None			
Setting Torque (g/cm)	≤200		≤200		≤200		≤200			
Adjustment Access	Hex	Slot	Hex	Slot	Hex	Slot	Slot			
Effects of Solder (%)	1.5		1.5		1.5		1.5			
Rotational Life (%)	10		10		10		10			
Moisture (%)	2.0		2.0		2.0		1.5			
Load Life (%)	1.0		1.0		1.0		1.0			
Temperature Cycling (%)	0.5		0.5		0.5		0.3			
Size (mm) ℓ x w	3.80 x 4.50		3.80 x 4.50		3.80 x 4.50		4.0 x 4.50			

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You Can't Resist KOA!

FIXED RESISTORS

Parameter	METAL FILM						CARBON FILM			
	Ultra Precision	Precision	Semi Precision	MIL	Multi-Related		Gen. Purp.	Flameproof	Multi-Related	
Type Designation	H	MF	ML	RN	SN2C	MS50	CF	CFP	RDS	RDS/FP
Wattage	1/8, 1/4, 1/2, 1	1/8, 1/4, 1/2, 1	1/8, 1/4, 1/2	1/10, 1/8, 1/4, 1/2	1/8, 1/4	1/4, 1/2	1/8, 1/4, 1/2, 1	1/8, 1/4, 1/2	1/8/1/4, 1/4/1/2	1/8/1/4, 1/4/1/2
Temp. Coefficient (ppm/°C)	5, 10, 15	25, 50, 100	200	50, 100	50, 100	50, 100	250~3000	250~3000	300~1000	300~1000
Resistance Tol. (%)	0.05, 0.10, 0.25	0.1, 0.25, 0.50, 1	2, 5	0.50, 1	1	1	2, 5	2, 5	2, 5	2, 5
Oper. Temp. Range	−55°C~+175°C	−55°C~+155°C	−55°C~+155°C	−55°C~+175°C	−55°C~+155°C	−55°C~+155°C	−55°C~+150°C	−55°C~+150°C	−55°C~+150°C	−55°C~+150°C
Short Time Overload (%)	≤0.10	≤0.30	0.30	≤0.10	0.25	0.15	≤0.50	≤0.50	≤0.20	≤0.20
Temp Cycling (%)	≤0.10	0.30	0.50	0.10	0.15	0.15	0.50	0.50	0.15	0.15
Load Life (%)	≤1.0	≤1.0	1.5	≤1.0	0.25	0.50	≤2.0	≤2.0	≤1.5	≤1.5
Moisture Resistance (%)	≤1.0	≤1.0	1.5	≤1.0	0.30	0.30	≤2.0	≤2.0	<1.0	1.0
Voltage Coefficient (ppm/v)	<5	<5	<10	<5	<5	<5	≤10	≤10	<10	<10
Failure Rate (1000 hrs)	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$
Marking	Alpha-Num	Clr. Band (5)	Clr. Band (4)	Alpha-Num	Clr. Band (5)	Clr. Band (5)	Clr. Band (4)	Clr. Band (4)	Clr. Band (4)	Clr. Band (4)

FIXED POWER RESISTORS

Parameter	METAL OXIDE			
	Standard	Reduced Size	Carbon	Ceramic
Type Designation	MO	RSS	SPR	HPC
Wattage	1, 2, 3	1/2, 1, 2, 3, 5	1/2, 1, 2, 3, 5	1~30
Temperature Coefficient (ppm/°C)	200	200	150~600	NA
Resistance Tolerance (%)	2, 5	1, 2, 5	2, 5	10, 20
Operating Temperature Range	−55°C~+200°C	−55°C~+200°C	−55°C~+200°C	1000~2000
Short Time Overload (%)	0.50	0.50	1.0	2.0
Temperature Cycling (%)	0.50	0.50	1.0	2.0
Load Life (%)	2.0	2.5	3.0	5.0
Moisture Resistance (%)	2.0	2.5	3.0	5.0
Voltage Coefficient (ppm/v)	<10	<10	<10	<20
Failure Rate (1000 hrs)	$<10^{-4}$	$<10^{-3}$	$<10^{-3}$	$<10^{-5}$
Marking	Clr. Band (4)	Clr. Band (4 & 5)	Clr. Band (4)	Alpha-Num

SEE OUR AD IN CAPACITOR SECTION.

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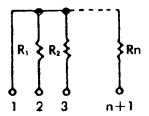
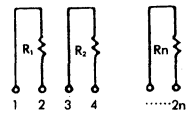
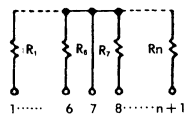
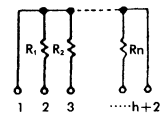
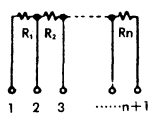
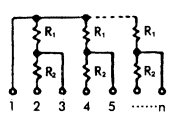
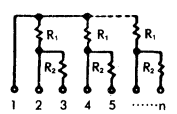
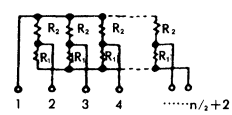
SIP RESISTOR NETWORKS

CIRCUIT SYMBOL			S	C	D
CIRCUIT CONSTRUCTION		 $R_1=R_2\cdots=Rn$ (n=3 to 13)	 $R_1=R_2\cdots+Rn$ (n=2 to 7)	 $R_1=R_2\cdots+Rn$ (n=4 to 12)	 $R_1=R_2\cdots=Rn$ (n=3 to 12)
MARKING	RKC	10KΩJ	4 S10KΩJ	10KΩJ ●	10KΩJ
	RKL	103J	S103J	C103J	D103J
	RKH	103J	4 S103J	6 C103J	6 D103J

CIRCUIT SYMBOL	A	T	E	R
CIRCUIT CONSTRUCTION	 $R_1=R_2\cdots=Rn$ (n=3 to 13)	 (n=4 to 12)	 (n=4 to 12)	 (n=6 to 18)

Parameter	TYPE		
	RKL	RKC	RKH
Seated Height (mm)	5.0	6.0	10.70
Element Power (watts)	0.125 ex "s" 0.200 "s"	0.125 ex "s" 0.250 "s"	0.250 ex "s" 0.500 "s"
Maximum Working Voltage	100	200	250
Operating Temperature Range	−55°C∼+155°C	−55°C∼+155°C	−55°C∼+155°C
Resistance Range	22Ω∼1.0M	22Ω∼10M	56Ω∼10M
Resistance Tolerance (%)	2, 5	1, 2, 5	1, 2, 5
Temperature Coefficient (ppm/°C)	200	100∼500	100∼500
Short Time Overload (%)	0.50	≤0.50	≤0.50
Resistance to Solder Heat (%)	0.50	≤0.50	≤0.50
Temperature Cycling (%)	0.50	≤0.50	≤0.50
Moisture Resistance (%)	<2.0	<1.5	<1.5
Load Life	<2.0	<1.0	<1.0

• Custom SIP Networks - R/2R Ladders, Attenuators, Op Amp Feedbacks, Matched & Tracking, User defined.

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SPECIALTY RESISTORS

JUMPER (Zero Ohm)

KSE PT#	Form	Size	Resistance	Amperage
Z12	Axial	3.7 x 1.6	0.01Ωmax	1.5A
Z16	Axial	3.4 x 1.7	0.01Ωmax	1.5A
Z25	Axial	6.3 x 2.4	0.01Ωmax	2.5A
Z33	Axial	8.5 x 3.0	0.01Ωmax	3.0A
J-1/6	Axial	3.4 x 1.7	0.01Ωmax	10.0A
J-1/4	Axial	5.0 x 2.3	0.01Ωmax	15.0A
2AZ	SM	2.0 x 1.25	50MΩmax	1.25A
2BZ	SM	3.2 x 1.6	50MΩmax	2.0A
CC10	MELF	2.0 x 1.25	10MΩmax	2.0A
CC12	MELF	3.5 x 1.45	10MΩmax	2.0A
CC20	MELF	3.2 x 1.55	10MΩmax	2.0A
CC25	MELF	5.9 x 2.2	10MΩmax	5.0A

FUSING RESISTORS

KSE PT#	Form	Size	Power	Res. Range	Res. Tolerance
RF25	Axial	6.5 x 2.3	0.250W	1.0Ω~1K	5%
RF50	Axial	8.5 x 3.0	0.500W	1.0Ω~1K	5%
RF1	Axial	9.0 x 3.5	1.000W	1.0Ω~1K	5%

LINEAR POSITIVE TEMP. COEFFICIENT RESISTORS

KSE PT#	Form	Size	Power	TC Range	Res. Range	Res. Tolerance
LT1/8	Axial	3.7 x 1.6	0.125W	150~4,500ppm	10Ω~100K	2.5%
LT1/4	Axial	6.5 x 2.3	0.250W	150~4,500ppm	10Ω~100K	2.5%
MLT2B	MELF	3.50 x 1.45	0.125W	250~4,500ppm	10Ω~100K	2.5%
MLT2E	MELF	5.9 x 2.2	0.250W	250~4,500ppm	10Ω~100K	2.5%

RESISTOR LAB KITS

Type	Wattages	# of Values	Tolerance	# pcs/value	Draws/Kit
Carbon Film	1/8, 1/4, 1/2	60	5%	100	15
Flameproof CF	1/4, 1/2	60	5%	100	15
Metal Film	1/8, 1/4, 1/2	126	1%	10	18
SM Chip	1206 (1/8)	60	5%	50	15
SM Chip	1206 (1/8)	126	1%	25	24

KOA SPEER ELECTRONICS, INC.

BOLIVAR DRIVE • P.O. BOX 547 • BRADFORD, PA. 16701 • USA • TEL: (814) 362-5536 • TWX: 510-695-5921 • TLX: 914-404 • FAX: 814-362-8883

ors ☘ Ultra Precision Resistors ☘ Ultra Precision Resi
.5% .5% 1% ☘ .005% .01% .025% .05% .1% .2% .5% 1%
ing ☘ Ratio Matching ☘ TC Tracking ☘ Ratio Matchi
Axial & Radial Leads ☘ Axial & Radial Leads ☘ A al
Sensing ☘ Temperature Compensating

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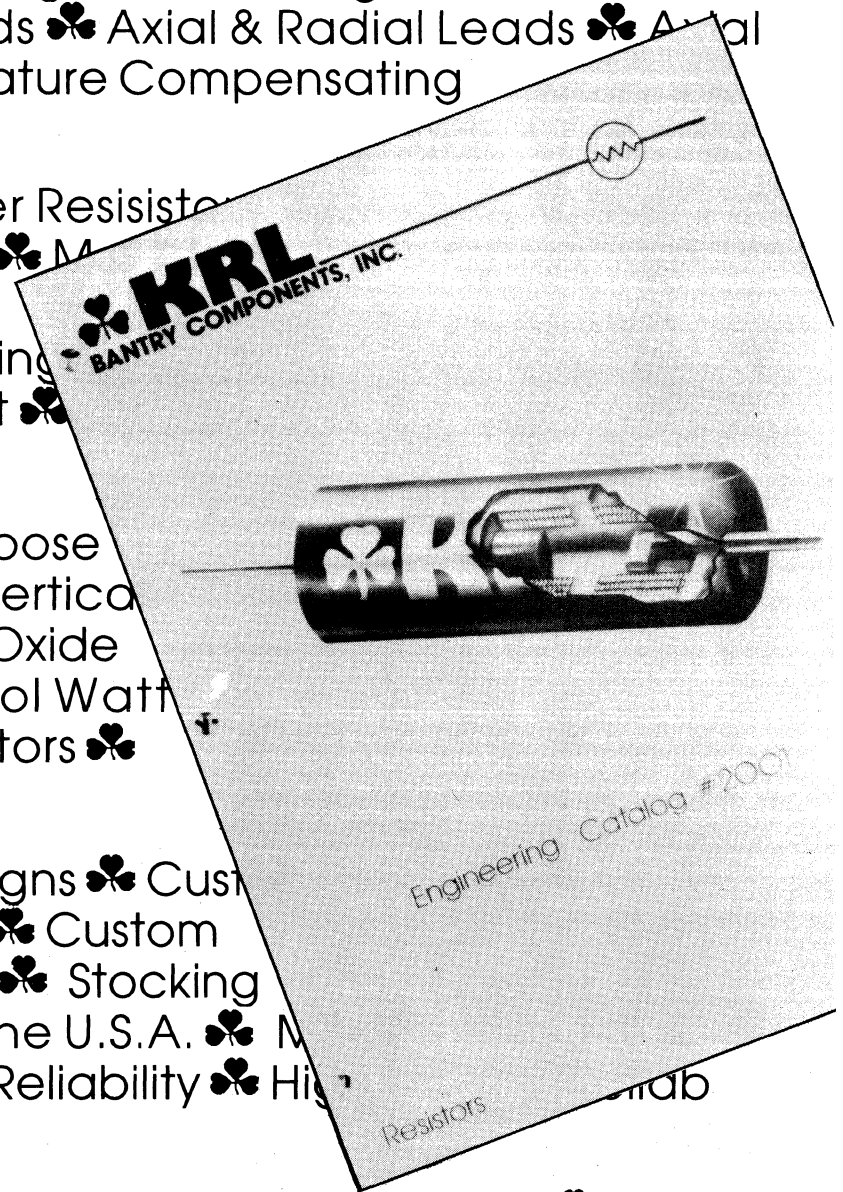
Molded & Coated ☘ M
HM ☘ Low Ohm ☘
nse ☘ Current Sensin
nt ☘ Surface Mount ☘



ose ☘ General Purpose
Vertical Mount ☘ Vertica
al Oxide ☘ Metal Oxide
ool Watt ☘ KRL 'Kool Watt
num Heatsink Resistors ☘

gns ☘ Custom Designs ☘ Cust
om Specifications ☘ Custom
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U.S.A. ☘ Made in The U.S.A. ☘ M
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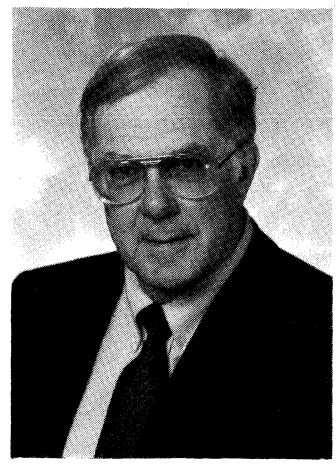
ors ☘ Nonflame Fusible Metal Film Resistors ☘ Nonfl
ircuit Protection Components ☘ Circuit Protection

Phone: 603.668.3210
Facsimile: 603.624.0634

KRL

BANTRY COMPONENTS, INC.

Forty-plus years of experience in designing and manufacturing wire-wound resistors earned KRL/Bantry Components President, B.J. Perry the sobriquet "Mister Resistor." In modernizing a mature industry to satisfy contemporary needs, Mr. Perry has gathered a dedicated group of technical experts to supply high quality, high stability parts that are commercially affordable. This same expertise is available to solve design problems and to meet special application requirements.



GENERAL SPECIFICATIONS

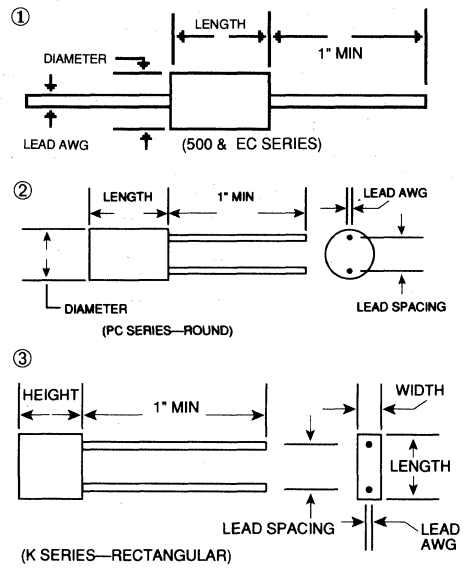
- Standard Tolerances: .005%, .01%, .02%, .05%, .1%, 0.2%, 0.5%, 1%.
- Standard Temperature Coefficient: 5-10 PPM (Available as low as 1 PPM)
- Stability: 0.0001% (1st year); 0.0025% (2nd year)
- Temperature Compensating TC's available from +80 through +6000 PPM.
- TC matching to ±0.5 PPM/°C @ 25°C
- Custom Designs Welcome

KRL STYLE	MIL-R-93	MIL-R-39005	DIMENSIONS[1] LENGTH ±.015	DIAMETER ±.015	LEAD AWG	POWER in WATTS MIL 125°C	COMM 125°C	MAXIMUM VOLTAGE	MAXIMUM RESISTANCE
532			.200	.100	24	.025	.050	100	100 K
†533			.260	.100	24	.050	.100	100	150 K
†534			.300	.100	22	.050	.100	100	150 K
†535			.250	.125	22	.065	.125	150	300 K
536			.312	.125	22	.075	.150	200	400 K
†537			.375	.125	22	.100	.200	200	500 K
†538			.375	.187	22	.125	.250	300	1 Meg
539			.250	.187	22	.115	.225	250	550 K
†540		RBR-74	.500	.187	22	.175	.350	300	1.5 Meg
550		RBR-75	.295	.250	22	.125	.250	200	1.5 Meg
†555	RB-56	RBR-56	.375	.250	20	.175	.350	300	1.5 Meg
†560	RB-55	RBR-55	.500	.250	20	.250	.500	400	2 Meg
†565	RB-54	RBR-54	.750	.250	20	.375	.750	500	3.5 Meg
570	RB-53	RBR-53	.750	.375	20	.450	.900	600	4 Meg
575	RB-52	RBR-52	1.00	.375	20	.750	1.50	750	5 Meg
578			.500	.500	20	.330	.660	400	2 Meg
580	RB-57	RBR-57	1.00	.500	20	.850	1.75	850	10 Meg
585	RB-58		1.50	.500	20	1.00	2.00	1.5KV	15 Meg

KRL STYLE	MIL-R-10509 EQUIVALENT	LENGTH ±.062	DIAMETER ±.032	LEAD AWG	POWER in WATTS	MAXIMUM VOLTAGE	MAXIMUM RESISTANCE
EC-10	RN-55	.250	.125	22	0.5	200	100 K
EC-20	RN-60	.375	.125	22	1.0	300	150 K
EC-25		.375	.187	22	1.0	325	175 K
EC-30	RN-65	.500	.187	22	1.0	350	200 K
EC-40	RN-70	.750	.250	20	1.0	400	300 K
EC-50	RN-75	1.00	.375	20	1.0	600	500 K

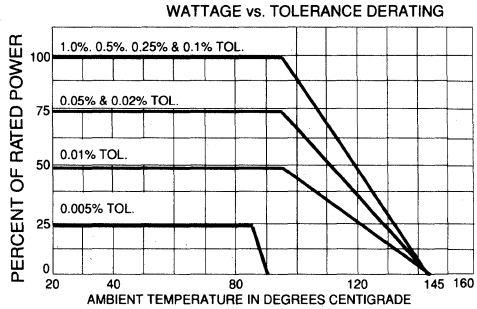
KRL STYLE	MIL-R-93	DIMENSIONS[2] LENGTH ±.032	DIAMETER ±.015	LEAD SPACING ±.010	LEAD AWG	POWER in WATTS MIL 125°C	COMM 125°C	MAXIMUM VOLTAGE	MAXIMUM RESISTANCE
†PC-50	RB-71	.312	.250	.200	22	.125	.250	300	500 K
PC-51		.375	.250	.200	22	.125	.250	300	650 K
PC-52		.500	.250	.200	22	.250	.500	300	700 K
PC-53		.375	.375	.200	20	.250	.500	300	1 Meg
PC-55	RB-70	.500	.375	.200	20	.350	.700	300	1.5 Meg

KRL STYLE	DIMENSIONS[3] HEIGHT ±.032	WIDTH ±.020	LENGTH ±.020	LEAD SPACING ±.010	LEAD AWG	POWER in WATTS MIL 125°C	COMM 125°C	MAXIMUM VOLTAGE	MAXIMUM RESISTANCE
K-300	.250	.125	.250	.125	20	.125	.250	150	500 K
K-250	.300	.125	.300	.150	20	.150	.300	150	1 Meg
K-500	.300	.150	.500	.250	20	.250	.500	150	1.5 Meg



PERCENT OF RATED POWER

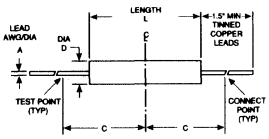
KRL PRECISION WIRE WOUND RESISTOR DERATING CHART—500, EC, PC & K series resistors must be derated for tolerances below 0.1%. Use the chart below to select tolerance vs. operating temperature to determine the percent of rated power for operations. No derating is required for operations below +20°C.



KRL/BANTRY COMPONENTS, INC. 160 Bouchard St., Manchester, NH 03103-3399
Phone: 603-668-3210 FAX: 603-624-0634 TLX: 80-4294 SPEDEX

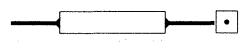
KRL LO-OHM Power Resistors

- Zero micro henries inductance • Low temperature coefficient
- Higher heat dissipation/power to size ratio
- Ideal for test instruments, power amplifiers, all types of current sensing applications, including switching and linear power supplies.



ALTERNATE CASE DESIGNS:
POTTED & MOLDED KELVIN LEADS

POTTED CERAMIC CASE



SURFACE MOUNT

STYLE	WATTS	L LENGTH	D DIA	C TEST POINT	LEAD AWG/DIA
NP-1A	1	.430±.010	.120±.010	.590	22 AWG/.025
NP-2A	3	.600±.010	.210±.010	.675	20 AWG/.032
NP-3	4	.680±.010	.265±.010	.715	20 AWG/.032
NP-5	5	.925±.010	.335±.010	.838	18 AWG/.040

KRL Wire Wound Power Resistors "HOT" MOLDED P & COATED C SERIES

KRL STYLE		MIL-R-26	MIL-R-39007	WATTAGE RATING U	WATTAGE RATING V	WORKING VOLTAGE (2) U	WORKING VOLTAGE (2) V	MAXIMUM RESISTANCE IN OHMS	DIMENSIONS LENGTH ±.062	LENGTH (±.010)	DIAMETER ±.032	DIAMETER (±.010)	LEAD AWG
	C-1/2A			.5	1.0	18	20	3.4K	.250		.094		24
(P-1/2)	C-1/2			.75	1.2	30	35	4.5K	.280	(.300)	.094	(.120)	24
(P-1A)	C-1A	RW-70		1.0	1.5	50	55	10K	.406	(.425)	.094	(.120)	22
	C-1B			1.1	1.6	62	67	12K	.530		.094		22
(P-1C)	C-1C			1.0	1.5	28	33	5K	.330	(.360)	.094	(.120)	22
	C-1D			3.25	4.5	175	200	38K	.700		.110		22
(†P-2)	†C-2			1.5	2.0	72	79	10K	.385	(.420)	.187	(.190)	20
(†P-2A)	†C-2A	RW-79		3.0	3.75	135	148	22K	.560	(.600)	.187	(.210)	20
	C-2B		RWR-71	3.25	4.75	185	220	42K	.812		.187		20
(†P-2C)	†C-2C			3.0	3.5	138	157	32K	.500	(.535)	.250	(.265)	20
(†P-2D)	†C-2D	RW-69		2.5	3.0	135	148	20K	.500	(.535)	.210	(.210)	20
(P-2E)	C-2E			3.0	3.75	135	148	22K	.560	(.600)	.158	(.173)	20
(P-2F)	C-2F			2.5	3.00	135	148	20K	.490	(.530)	.158	(.190)	20
(†P-3)	†C-3			4.0	5.5	210	250	45K	.625	(.680)	.250	(.265)	20
(†P-5)	†C-5	RW-74	RWR-74	5.0	6.0	325	375	90K	.875	(.925)	.312	(.335)	18
(P-6)	C-6	RW-67		6.0	6.5	360	400	95K	1.000	(1.080)	.312	(.335)	18
	C-7			7.0	8.0	360	400	100K	1.200	±.094	.312	±.062	18
	C-7A	RW-55		7.5	9.0	510	580	150K	1.375	±.094	.375	±.062	18
	†C-10			10.0	13.0	800	930	250K	1.815	±.094	.375	±.062	18
	C-10A	RW-78	RWR-78	10.0	12.0	800	930	240K	1.780	±.094	.375	±.062	18
	†C-10B	RW-68		10.5	14.0	800	930	275K	1.875	±.094	.375	±.062	18

†Indicates Most popular types P = Molded ( ); C = Coated

KRL Heat Sink Power Resistors

KW & AT SERIES

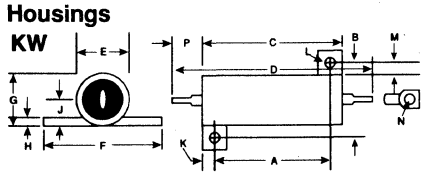
In Anodized Aluminum Housings

KW & AT SERIES

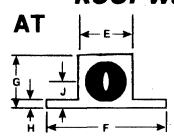
kool-watt

KRL STYLE	MIL-R-18546D	POWER RATING IN WATTS (1) KRL	POWER RATING IN WATTS (1) MIL	MAXIMUM RESISTANCE IN OHMS (2)	MAXIMUM WORKING VOLTAGE	DIELECTRIC VOLTS RMS
KW-5	RE-60	8	5	25K	160	1500
KW-10	RE-65	14	10	45K	265	1500
KW-25	RE-70	25	20	95K	550	2500
AT-50	RE-75	50	30	275K	1250	2500

KW



AT



DIMENSIONS (INCHES)

TYPE	MIL	A ±.005	B ±.005	C ±.031	D ±.062	E ±.015	F ±.015	G ±.015	H ±.010	J ±.010	K ±.010	L ±.005	M ±.015	N ±.005	P ±.062
KW-5	RE-60	.444	.490	.600	1.125	.334	.646	.320	.065	.133	.078	.093	.078	.050	.262
KW-10	RE-65	.562	.625	.750	1.375	.420	.800	.390	.075	.165	.093	.093	.102	.086	.312
KW-25	RE-70	.719	.781	1.062	1.938	.550	1.080	.546	.088	.231	.172	.125	.115	.086	.438
AT-50	RE-75	1.563	.844	1.968	2.781	.630	1.140	.610	.088	.260	.196	.125	.107	.086	.406

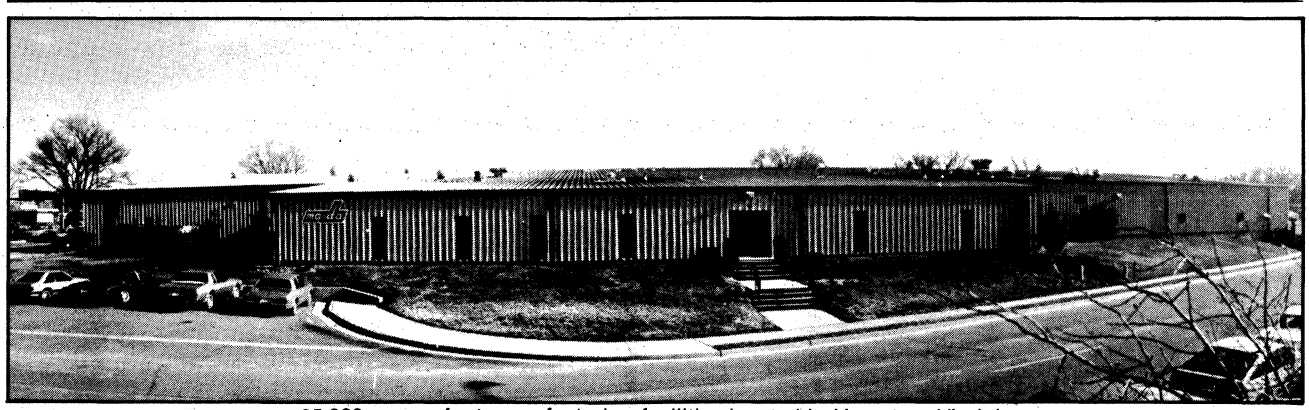
FAX US—603/624-0634—FOR MORE INFORMATION ON . . .

- **KRL Nonflame Fusible Metal Film Resistors**
- **KRL Power Oxide Resistors**
- **KRL Resistance Temperature Detectors**
- **KRL Standard Reel Packaging Specs**
- **KRL Vertical Mount Resistors**
- **KRL Failsafe Thermal Fuse Resistors**
- **KRL Temperature Compensating Resistors**

KRL/BANTRY COMPONENTS, INC. 160 Bouchard Street, Manchester, NH 03103- 3399
Phone: 603-668-3210 FAX: 603-624-0634 TLX: 80-4294 SPEDEX

ZINC OXIDE VARISTOR

MAIDA DEVELOPMENT COMPANY
"CERAMIC COMPONENT MANUFACTURER SINCE 1947"



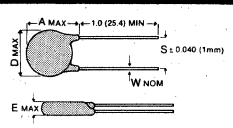
85,000 square foot manufacturing facilities located in Hampton, Virginia

Maida *Zinc Oxide Varistors*

Maida Development Company, domestically owned and operated, has served the electronics industry with a wide variety of ceramic components. We specialize in custom design and manufacturing, from ceramic powder formulation through finished devices, to meet specific requirements of our customers. Typical capacitor products include (1) high voltage capacitors for power supplies; (2) UL and CSA recognized capacitors for across-the-line, line-by-pass, and antenna coupling uses; (3) reduced titanate capacitors for low-voltage general purpose applications; (4) leadless discs; (5) slot-mounted "trapezoids" for printed circuits; and (6) multilayer capacitors. Our newest product line - zinc oxide varistors (ZOV) is designed for transient voltage suppression and surge energy absorption and many are UL recognized. Our delivery is timely and reliable-with either bulk packaging or tape and reel. We value with pride the repeat business from such customers as GE, Zenith, RCA, IBM, AT&T, Xerox, Sunbeam, GTE, NAP, Kodak, Harris, Allen-Bradley and many others.

MAXIMUM TRANSIENT POWER RATINGS (Pm)

Series	PM-watts	Series	PM-watts
D58	0.15	D61	0.4
D73	0.25	D69	0.6
D68	0.3	D65	1.0



Style Designation: (typical)
D6921ZOV511RA110

WHERE:

D- Coating identification, D means standard flame-retardent fluid bed epoxy.

69- Size code, 2 numbers. See Dimensions Table.

21- Lead Configuration code, 1 or 2 numbers used for non-standard leads. Standard leads use no code.

ZOV- Material identifier, zinc oxide varistor.

511- AC Voltage Rating code, 2 significant figures plus number of zeroes that follow, i.e. 511 is 510 VAC.

RA- Special Instructions code, RA is standard.

110- Energy Rating code, up to 3 numbers. See Ratings Tables

STANDARD DIMENSIONS: inches (mm)

Size Code	A	D	S	W	E				
				VAC	50-95	120-180	230-320	420-580	620-1000
D58	.394 (10)	.276 (7)	.197 (5)	.025 (.63)	.197 (5)	.236 (6)	NA	NA	NA
D73	.472 (12)	.354 (9)	.197 (5)	.025 0.63)	.197 (5)	.236 (6)	.276 (7)	NA	NA
D68	.512 (13)	.394 (10)	.197 (5)	.025 (.63)	NA	.236 (6)	.276 (7)	NA	NA
D61	.590 (15)	.472 (12)	.296 (7.5)	.032 (.81)	.197 (5)	.236 (6)	.276 (7)	.354 (9)	NA
D69	.770 (19.5)	.650 (16.5)	.296 (7.5)	.032 (.81)	.197 (5)	.236 (6)	.276 (7)	.354 (9)	.472 (12)
D65	1.020 (26)	.905 (23)	.296 (7.5)	.032 (.81)	NA	.236 (6)	.276 (7)	.354 (9)	.472 (12)

Standard Marking:

Minimum marking information shall consist of an abbreviated style designation and, when space is available, the manufacturer's initials "MDC".

For instance, MDC WHERE:
Z511 Z- Represents "ZOV" 110-Energy rating
110UL 511-AC voltage rating UL- UL recognition

ZINC OXIDE VARISTORS FOR SURGE VOLTAGE PROTECTION - ZOV RATINGS

STYLE NUMBER	MINIMUM MARKING	MAXIMUM RATINGS				ELECTRICAL CHARACTERISTICS				
		CONTINUOUS		TRANSIENT		VARISTOR VOLTAGE (@1.0mADC)		MAX CLAMPING VOLTAGE @ TEST CURRENT (8x20μS)		TYPICAL CAPACITANCE 1KHz @25C
		APPLICABLE VOLTAGE (AC)	APPLICABLE VOLTAGE (DC)	ENERGY (10x1000μS)	PEAK CURRENT (8x20μS)	MIN	MAX			
		VOLTS	VOLTS	JOULES	AMPERES	VOLTS	VOLTS	VOLTS	AMPERES	PICOFARADS
D58ZOV500RA01	Z500-01	50	66	2	100	71	88	165	5	300
D58ZOV600RA01	Z600-01	60	81	2	100	85	103	200	5	270
D58ZOV750RA01	Z750-01	75	102	2.5	400	108	129	245	5	220
D58ZOV950RA01	Z950-01	95	127	3	400	135	164	300	5	180
D58ZOV121RA02	Z121-02	120	160	3.5	400	170	207	350	5	160
D58ZOV131RA02	Z131-02	130	175	4	400	184	224	380	5	130
D58ZOV141RA02	Z141-02	140	180	4.5	400	198	242	410	5	120
D58ZOV151RA02	Z151-02	150	200	5	400	212	259	430	5	110
D58ZOV181RA02	Z181-02	180	230	6	400	255	311	510	5	100

20 LIBBY STREET/P.O. BOX 3529—HAMPTON, VIRGINIA 23663 / (804) 723-0785 / TELEX 82-3443 / FAX (804) 722-1194

VARISTORS

MAIDA DEVELOPMENT COMPANY

"CERAMIC COMPONENT MANUFACTURER SINCE 1947"

ZINC OXIDE VARISTORS FOR SURGE VOLTAGE PROTECTION - ZOV RATINGS

STYLE NUMBER	MINIMUM MARKING	MAXIMUM RATINGS				ELECTRICAL CHARACTERISTICS				
		CONTINUOUS		TRANSIENT		VARISTOR VOLTAGE (@1.0mADC)		MAX CLAMPING VOLTAGE @ TEST CURRENT (8x20μS)		TYPICAL CAPACITANCE 1KHz @25C ±30%
		APPLICABLE VOLTAGE (AC)	APPLICABLE VOLTAGE (DC)	ENERGY (10x1000μS)	PEAK CURRENT (8x20μS)	MIN	MAX			
		VOLTS	VOLTS	JOULES	AMPERES	VOLTS	VOLTS	VOLTS	AMPERES	PICOFARADS
D73ZOV500RA02	Z500-02	50	66	4	250	71	86	157	5	620
D73ZOV600RA02	Z600-02	60	81	5	250	85	103	190	5	500
D73ZOV750RA02	Z750-02	75	102	6	1200	108	129	230	10	420
D73ZOV950RA02	Z950-02	95	127	8	1200	135	164	255	10	340
★ D73ZOV121RA03	Z121-03UL	120	160	10	1200	170	207	320	10	300
★ D73ZOV131RA03	Z131-03UL	130	175	11	1200	184	224	340	10	250
★ D73ZOV141RA03	Z141-03UL	140	180	12	1200	198	242	360	10	230
★ D73ZOV151RA03	Z151-03UL	150	200	13	1200	212	259	395	10	220
★ D73ZOV181RA03	Z181-03UL	180	230	15	1200	255	311	470	10	180
★ D73ZOV231RA20	Z231-20UL	230	300	20	1200	326	397	595	10	140
★ D73ZOV251RA21	Z251-21UL	250	330	21	1200	354	432	650	10	130
★ D73ZOV271RA23	Z271-23UL	270	360	23	1200	382	466	710	10	120
★ D73ZOV301RA25	Z301-25UL	300	390	25	1200	425	518	790	10	110
• ★ D68ZOV121RA03	Z121-03UL	120	160	10	1200	170	207	320	10	300
• ★ D68ZOV131RA03	Z131-03UL	130	175	11	1200	184	224	340	10	250
• ★ D68ZOV141RA03	Z141-03UL	140	180	12	1200	198	242	360	10	230
• ★ D68ZOV151RA03	Z151-03UL	150	200	13	1200	212	259	395	10	220
• ★ D68ZOV181RA03	Z181-03UL	180	230	15	1200	255	311	470	10	180
• ★ D68ZOV231RA20	Z231-20UL	230	300	20	1200	326	397	595	10	140
• ★ D68ZOV251RA21	Z251-21UL	250	330	21	1200	354	432	650	10	130
• ★ D68ZOV271RA23	Z271-23UL	270	360	23	1200	382	466	710	10	120
• ★ D68ZOV301RA25	Z301-25UL	300	390	25	1200	425	518	790	10	110
D6121ZOV500RA03	Z500-03	50	66	6	400	71	86	147	10	1500
D6121ZOV600RA03	Z600-03	60	81	7	400	85	103	175	10	1200
D6121ZOV750RA03	Z750-03	75	102	8	2000	108	129	210	25	820
D6121ZOV950RA03	Z950-03	95	127	10	2000	135	164	255	25	680
• ★ D6121ZOV121RA04	Z121-04UL	120	160	13	2000	170	207	320	25	560
• ★ D6121ZOV131RA04	Z131-04UL	130	175	14	2000	184	224	340	25	500
• ★ D6121ZOV141RA04	Z141-04UL	140	180	16	2000	198	242	360	25	460
• ★ D6121ZOV151RA04	Z151-04UL	150	200	17	2000	212	259	395	25	400
• ★ D6121ZOV181RA04	Z181-04UL	180	230	20	2000	255	311	465	25	230
• ★ D61ZOV231RA35	Z231-35UL	230	300	35	2000	326	397	595	25	180
• ★ D61ZOV271RA43	Z251-40UL	250	330	40	2000	354	432	650	25	160
• ★ D61ZOV271RA43	Z271-43UL	270	360	43	2000	382	466	710	25	150
• ★ D61ZOV301RA45	Z301-45UL	300	390	45	2000	425	518	790	25	130
• ★ D61ZOV721RA45	Z321-45UL	320	420	45	2000	453	650	850	25	120
• ★ D61ZOV421RA45	Z421-45UL	420	580	45	2000	594	725	1120	25	160
• ★ D61ZOV481RA50	Z481-50UL	480	640	50	2000	679	829	1240	25	140
• ★ D61ZOV511RA55	Z511-55UL	510	675	55	2000	722	881	1350	25	130
• ★ D61ZOV551RA60	Z551-60UL	550	700	60	2000	778	950	1400	25	120
• ★ D61ZOV581RA65	Z581-65UL	580	735	65	2000	821	1002	1500	25	110
D6921ZOV500RA06	Z500-06	50	66	15	1000	71	88	147	10	3200
D6921ZOV600RA06	Z600-06	60	81	20	1000	85	103	175	10	2600
D6921ZOV750RA06	Z750-06	75	102	22	4500	106	129	210	50	2200
D6921ZOV950RA06	Z950-06	95	127	30	4500	135	164	255	50	1800
• ★ D6921ZOV121RA09	Z121-09UL	120	160	35	4500	170	207	320	50	1500
• ★ D6921ZOV131RA09	Z131-09UL	130	175	38	4500	184	224	340	50	1350
• ★ D6921ZOV141RA09	Z141-09UL	140	180	42	4500	198	242	360	50	1270
• ★ D6921ZOV151RA09	Z151-09UL	150	200	45	4500	212	259	395	50	1200
• ★ D6921ZOV181RA09	Z181-09UL	180	230	55	4500	255	311	465	50	710
• ★ D69ZOV231RA70	Z231-70UL	230	300	70	4500	326	397	595	50	550
• ★ D69ZOV251RA72	Z251-72UL	250	330	72	4500	354	432	650	50	510
• ★ D69ZOV271RA75	Z271-75UL	270	360	75	4500	382	466	710	50	470
• ★ D69ZOV301RA80	Z301-80UL	300	390	80	4500	425	518	790	50	430
• ★ D69ZOV321RA90	Z321-90UL	320	420	90	4500	453	553	850	50	400
• ★ D69ZOV421RA90	Z421-90UL	429	560	90	4500	594	725	1120	50	500
• ★ D69ZOV481RA105	Z481-105UL	480	640	105	4500	679	829	1240	50	440
• ★ D69ZOV511RA110	Z511-110UL	510	675	110	4500	722	881	1350	50	410
• ★ D69ZOV551RA115	Z551-115UL	550	700	115	4500	668	950	1400	50	380
• ★ D69ZOV581RA120	Z581-120UL	580	735	120	4500	821	1002	1500	50	370
• ★ D69ZOV621RA130	Z621-130UL	620	800	130	4500	877	1071	1620	50	350
• ★ D69ZOV681RA150	Z681-150UL	680	860	150	4500	962	1175	1800	50	310
• ★ D69ZOV102RA220	Z102-220UL	1000	1200	220	4500	1414	1728	2700	50	210
• ★ D6521ZOV121RA20	Z121-20 UL	120	160	65	6500	170	207	320	100	2500
• ★ D6521ZOV131RA20	Z131-20 UL	130	175	70	6500	184	224	340	100	2300
• ★ D6521ZOV141RA20	Z141-20 UL	140	180	75	6500	198	242	360	100	2150
• ★ D6521ZOV151RA20	Z151-20 UL	150	200	80	6500	212	259	395	100	2000
• ★ D6521ZOV181RA20	Z181-20 UL	180	230	100	6500	255	311	465	100	1300
• ★ D65ZOV231RA115	Z231-115 UL	230	300	115	6500	326	397	595	100	1000
• ★ D65ZOV251RA130	Z251-130 UL	250	330	130	6500	354	432	650	100	920
• ★ D65ZOV271RA140	Z271-140 UL	270	360	140	6500	382	466	710	100	850
• ★ D65ZOV301RA150	Z301-150 UL	300	390	150	6500	425	518	790	100	770
• ★ D65ZOV321RA160	Z321-160 UL	320	420	160	6500	453	553	850	100	720
• ★ D65ZOV421RA160	Z421-160 UL	420	560	160	6500	594	725	1120	100	910
• ★ D65ZOV481RA180	Z481-180 UL	480	640	180	6500	679	829	1240	100	800
• ★ D65ZOV511RA190	Z511-190 UL	510	675	190	6500	722	881	1350	100	740
• ★ D65ZOV551RA200	Z551-200 UL	550	700	200	6500	778	950	1400	100	690
• ★ D65ZOV581RA220	Z581-220 UL	580	735	220	6500	821	1002	1500	100	670
• ★ D65ZOV621RA230	Z621-230 UL	620	800	230	6500	877	1071	1620	100	620
• ★ D65ZOV681RA260	Z681-260 UL	680	860	260	6500	962	1175	1800	100	560
• ★ D65ZOV102RA360	Z102-360 UL	1000	1200	360	6500	1414	1728	2700	100	380

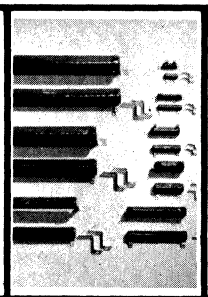
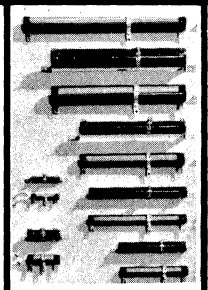
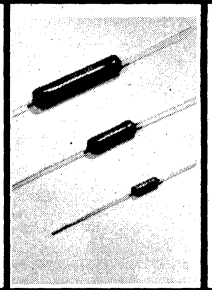
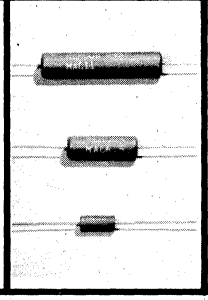
★ UL Recognized Components for Surge Suppression, File E86730

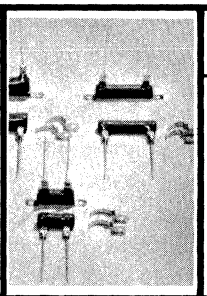
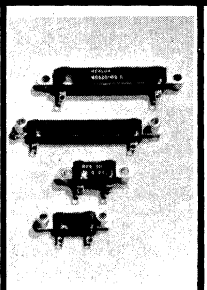
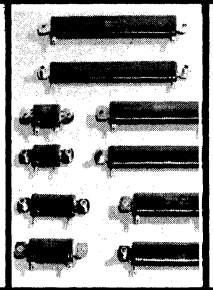
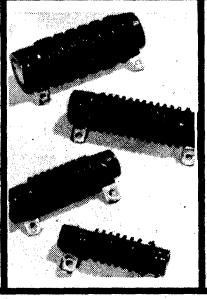
• UL Recognized Components for Across-The-Line Applications, File E38785

20 LIBBY STREET/P.O. BOX 3529—HAMPTON, VIRGINIA 23663 / (804) 723-0785 / TELEX 82-3443 / FAX (804) 722-1194

MEMCOR-TRUOHM INC.

WIRE WOUND RESISTORS

TYPE		Power Rating (Watts)	Max. Res. (Ohms)	Core Size (Inch.)
FR VITREOUS ENAMEL FIXED TUBULAR WITH TABS		5	25K	1 x 5/16
		10	50K	1¾ x 5/16
		20	100K	2 x 7/16
		25	100K	2 x 9/16
		50	250K	4 x 9/16
		100	100K	6½ x ¾
		160	100K	8½ x 1⅛
		200	100K	10½ x 1⅛
TYPE AR VITREOUS ENAMEL ADJUSTABLE TUBULAR WITH TABS		10	10K	1¾ x 5/16
		25	25K	2 x 9/16
		50	50K	4 x 9/16
		75	50K	6 x 9/16
		100	100K	6½ x ¾
		160	100K	8½ x 1⅛
		200	100K	10½ x 1⅛
TYPE VL VITREOUS ENAMEL AXIAL LEADS		3	10K	7/32 x 17/32
		5	25K	5/16 x 1 1/64
		10	50K	3/8 x 1 25/32
TYPE ML MOLDED SILICONE AXIAL LEADS		1	2500	.125 x .437
		2	3500	.205 x .590
		3	10K	.242 x .525
		6.5	80.6K	.375 x .917
		11	200K	.375 x 1.828

TYPE		Power Rating (Watts)	Max. Res. (Ohms)	Core Size (Inch.)
FR w/LEADS VITREOUS ENAMEL FIXED TUBULAR		5-8	25K	1 x 5/16
		10-12	50K	1¾ x 5/16
		20	100K	2 x 7/16
TYPE MZ VITREOUS ENAMEL MIDGET OVALS WITH TABS		10	5000	3/8 x 5/32
		20	25K	3/8 x 5/32
TYPE ZR VITREOUS ENAMEL OVALS TAB TERMINAL		30	10K	5/16 x 1
		40	15K	5/16 x 1
		55	25K	5/16 x 1
TYPE RR VITREOUS ENAMEL EDGEWOUND WITH TABS		40	1.8	2 x 9/16
		90	3	4 x 9/16
		100	2.5	3½ x ¾
		160	5.5	6 x ¾
		150	6.0	5 x 1
		300	13	8½ x 1⅛
		500	36	10½ x 1⅝
		750	40	12 x 2½
		1500	100	20 x 2½

MEMCOR-TRUOHM represent the cumulative design and production knowledge gained during 30 years experience in the industry.

Let MEMCOR-TRUOHM sales engineers aid you with your special design and application requirements.

For price, quality, and delivery look to MEMCOR-TRUOHM. Immediate delivery on stock value resistors. Typical 3-5 week delivery on other standard values and special requirements. These products are available from MEMCOR-TRUOHM's Nationwide Authorized Distributor Network.

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MEPCO/CENTRALAB

A NORTH AMERICAN PHILIPS COMPANY

FILM RESISTORS

General Purpose, Carbon Film, SFR, Precision Film, Mil-R-10509 (RN), Mil-R-22684 (RL), Mil-R-39017 (RLR), UPR, Mil-R-55182 (RCN), Mil-R-55182 (RNR)
Airport Road, P.O. Box 760 Mineral Wells, TX 76067 (817) 325-7871 FAX: 817-325-1052 Telex: GPR-881857; SPR-820545

INDUSTRIAL/CONSUMER GROUP

Mepco/ Centralab Series	Category	Body Type	Resistance Range (ohms)	Tolerance Range (±%)	Temperature Coefficient Range (PPM/°C)	Power Range @ 70°C (watts)	Max. Voltage Range (watts)
SPACE MISER®	GENERAL PURPOSE	METAL FILM Conformal-Coated	.22Ω-10 Meg 1Ω-5.1 Meg	5% 1%	±100 ±100	1/3 1/3	200 200
CR	GENERAL PURPOSE	CARBON FILM Conformal-Coated	1Ω-10 Meg	5%	−200 to +500, ±300	1/4 1/2	250-350
SFR	GENERAL PURPOSE	METAL FILM Conformal-Coated	1Ω-10 Meg	1%-2% 5%	±200 and ±100	1/4 1/2	250-350
SPR	STANDARD PRECISION	METAL FILM Conformal-Coated	1Ω-250 Meg	0.5%-5%	±50 to ±150	1/4-1	250-500
UPR & MATCHED SETS	ULTRA PRECISION	METAL FILM Conformal-Coated	51.1Ω-511 K	.01%-1%	±2 to ±25	@ 85°C 1/20 1/8-1/4, 1/3	200-300
MIL Style	**MIL Specs**	**INDUSTRIAL/STANDARD MILITARY**					
RL	MIL-R-22684	METAL FILM Conformal-Coated	4.3Ω-470K	2% 5%	±100	1/4-1/2	250-350
RN	MIL-R-10509	METAL FILM Conformal-Coated	1Ω-4 Meg	0.1%-1%	±25 to ±100	1/10-1/2	200-350
		ESTABLISHED RELIABILITY (MIL)					
RLR	MIL-R-39017 'S' Failure Rate	METAL FILM Conformal-Coated	4.3Ω-1.33M	1%-2%	±100	1/4-1/2	250-350
RNC	MIL-R-55182 'S' Failure Rate	METAL FILM Conformal-Coated	10Ω-3.01M	0.1%-1%	±25 to ±100	@ +125°C 1/20-1/2	200-300
RNR/RNN Hermetic	MIL-R-55182 'S' Failure Rate	METAL FILM Hermetic Seal	10Ω-1.21M	0.1%-1%	±25 to ±50	@ +125°C 1/10-1/2	200-300

SERIES 9B PRECISION MELF RESISTORS

Airport Road, P.O. Box 760 Mineral Wells, TX 76067 (817) 325-7871 FAX: 817-325-1052 Telex: GPR-881857; SPR-820545

Mepco/ Centralab Series	Resistance Range	Tolerance	Temperature Coefficient (ppm/°C)	Power Rating (70°C)	Maximum Voltage	Dimensions (Inches)	
						Length	Dia.
9B1406	.22-10M	.1-5%	15, 25, 50	.25W	200V	.142 Max.	055 Max.

SMD® RESISTORS

4561 Colorado Blvd., Los Angeles, CA 90039 (818) 240-4880 TWX: 910-497-2282 FAX: 818-500-9174

SERIES 9C COMMERCIAL CHIP RESISTORS

SMD (chip) resistors consist of a ceramic body (alumina) on which is deposited resistive paste. Variations in the composition of the paste result in different resistant values. A wrap around termination is deposited at each end of the resistor to allow reflow or wave soldering. The resistive layer is covered with a protective coating to assure mechanical and environmental integrity.

MEPCO/CENTRALAB
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SERIES 9C COMMERCIAL CHIP RESISTORS

Mepco/ Centralab Series	Resistance Range	Tolerance	Temperature Coefficient (ppm/°C)	Power Rating (70°C)	Maximum Voltage	Outline Drawing All Dimensions in mm (inches		
						Length (L)	Width W)	Thickness (T)
9C1206	10Ω-10MΩ	1%-.5%	100, 200	.125W	200V (R.M.S.)	3.0-3.35 (.118-.132)	1.6 ±0.15 (.063 ±.004)	0.5 ± 0.10 (.20 ± .004)

PERFORMANCE

Test	Procedure	Requirements
Effects of Soldering	Unmounted chips completely Immersed for 4 ± 1 seconds in a solder bath of 230° ± 10°C	95% coverage minimum No damage △R max. = (±1% + 0.1Ω)
Thermal Shock	½ h. −55°C/½ h. +125°C 5 cycles	△R max. = (0.5% + 0.1 Ω)
Vibration	Frequency: 10-500 Hz Displacement 1.5 mm or Acceleration 10 g., three directions: total 6 h.	No damage △R max. = (0.5% + 0.1 Ω)
Moisture	Per Mil Std., 202 Method 106 per conditions of Mil-R-55342	IR min. 1000 MΩ △R max. = (0.5% + 0.1Ω) for 100 PPM and (.2% + .2Ω) for 200 PPM
Life Test	1000 h. 70°C: nominal dissipation	△R max. = (1.0% + 0.1Ω) for 100 PPM and (5.0% + .2Ω) for 200 PPM
Short Time Overload	Room temp. dissipation 2.5 x rated voltage for 5 seconds 400 V max.	△R max. = (0.5% + 0.1Ω) for 100 PPM and (2.0% + 0.2Ω) for 200 PPM

HOW TO SPECIFY

Mepco/Centralab Chip Resistors can be completely specified using the following designation:

9C — SMD (Chip) Resistor

1206 — Chip Size 3.2mm x 1.6mm (.126″ x .063″)

3 — Power Rating (70°C) 3 = ⅛ w

A — Product Class A = Standard

1002 — Resistance Value 100 = Significant Digits 2 = Multiplier (for values less than 100 Ω use "R" as decimal designator.) i.e.: 68R1 = 68.1Ω 1002 = 10KΩ

F — Tolerance F = ±1% J = ±5%

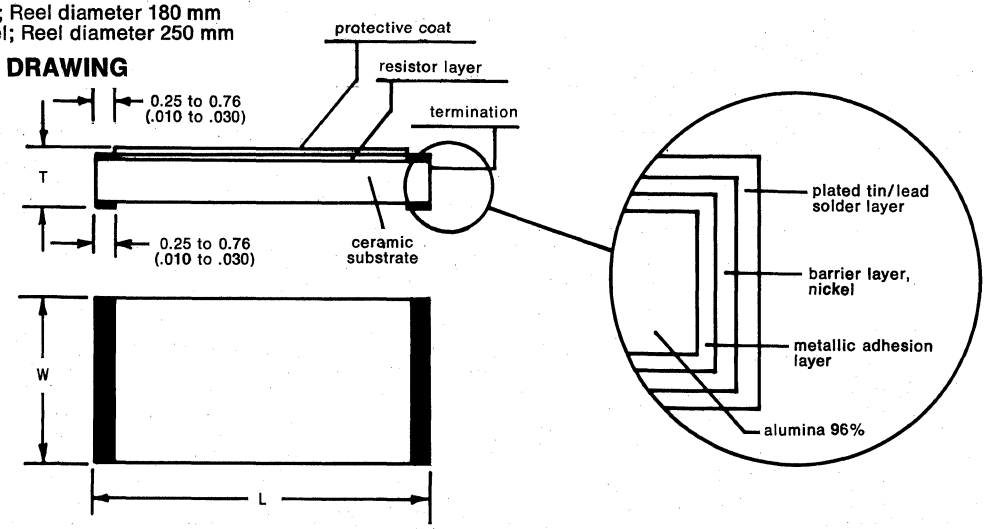
K — Temperature Coefficient (PPM/°C) K = ±100 L = ±200

R — Termination R = Wrap Around

STANDARD PACKAGING

Tape and Reel packaging, per EIA RS-481
Quantity 4000 resistors per reel; Reel diameter 180 mm
Quantity 10000 resistors per reel; Reel diameter 250 mm

TERMINATION OUTLINE DRAWING



MEPCO/CENTRALAB
A NORTH AMERICAN PHILIPS COMPANY

NETWORKS

2566 Northwestern Ave., West Lafayette, IN 47906 (317) 463-2536 TWX: 810-342-1889

STANDARD FIXED RESISTOR NETWORKS SINGLE IN LINE PACKAGE

Mepco/Centralab Series	Resistance Range	Tolerance	Temperature Coefficient (ppm/°C)	Circuits Available	Pin Styles Available
HC21, HC22	33Ω-1MΩ	±2%	±200	Terminator Pull Up/Pull Down	6, 8, and 10 Single in Line
HC23	33Ω-1MΩ	±2%	±200	Dual Terminator Circuit	6, 8, and 10 Single in Line

SERIES RZ040, RZ050, RZ060, RZ070, RZ080, RZ090, RZ030 MILITARY RESISTOR NETWORKS

Military Part Number	Resistance Range	Tolerance	Temperature Coefficient (ppm/°C)	Circuits Available	Pin Styles Available
M83401 RZ040, 050, 060	10Ω-1MΩ	±1% ±2% ±5%	±100 ±300	G-Terminator C-Pull Up	6, 8, 10 Pin High Profile
M83401 RZ070, 080, 090	10Ω-1MΩ	±1% ±2% ±5%	±100 ±300	G-Terminator C-Pull Up H-Dual Terminator	6, 8, 10 Pin Low Profile
M8340103 RZ030	18Ω-1MΩ	±1% ±2% ±5%	±100 ±300	A-Terminator B-Pull Up	14 Pin Flat Pack

10K AND 100K ECL TERMINATORS

Mepco/Centralab Series	Standard Resistance Values	Tolerance	Temperature Coefficient (ppm/°C)	Circuits Available	Capacitors	Pin Styles Available
E3408	50Ω, 68Ω, 100Ω**	±5%	±200	For 10K	.01μf X7R 25VDC	8 Pin Single in Line
E3510	50Ω, 68Ω,** 100Ω	±5%	±200	For 100K	.01μf X7R 25VDC	10 Pin Single in Line

** Others available upon request.

MEPCO/CENTRALAB

A NORTH AMERICAN PHILIPS COMPANY

NON-LINEAR RESISTORS

Airport Road, Mineral Wells, TX 76067 (817) 325-7871 FAX: 817-325-1052 Telex: GPR-881857 ; SPR820545

NEGATIVE TEMPERATURE COEFFICIENT (NTC) THERMISTORS

M/C Series	Style & Size Range	Resistance Range (Ohms) (25°C)	B-Value (°K) (25°-85°C)	Maximum Dissipation	Thermal Time Constant	Operating Temp. (Zero Power)
610	DISC 0.34″	4-1300	2800-5450	1W	60 sec.	−25° to +125°C
611	DISC 0.20″	SPECIAL				
626 & 633	BEAD & GLASS	1K-1M	2075-4100	60mW	6-10 sec.	300°C max.
640	RADIAL DISC	2.7K-330K	3660-4150	250mW	8-12 sec.	200°C max.
642	DISC 0.20″	3.3-470K	2675-4650	500mW	17-20 sec.	−25° to +125°C
644	DISC 0.40″-0.95″	2-82	2975-4650	1.5-6.5W	115-224 sec.	−25° to +155°C

STABLE LINE NTC TEMPERATURE SENSORS

645	DISC 0.1″-0.3″	1K-10K	3965	0.1-0.75W	7-43 sec.	−40° to +110°C

NTC SURGE CURRENT LIMITERS

Resistance Range (25°C)	Max. Continuous Current (0-55°C)	Power at Max. Current (25°C)	Dissipation Factor	Diameter
2-1300 ohms	1.7-15 Amps	0.35-7.4 Watts	8.5-28 mW/K	0.200″ = 0.945″

POSITIVE TEMPERATURE COEFFICIENT (PTC) THERMISTORS

M/C Series	Style & Size Range	Res. Range (Ohms) (25°C)	Useful Resistance Range (Ohms)	Switch Temp. (°C)	Operating Temp. (Zero Power)	Maximum Voltage
660	DISC 0.24″	60-250	3K-1.2K	+6 to +105	−25° to +155°C	25
661	DISC 0.34″	30-50	1K-10K	+25 to +110	−25° to +175°C	50
662	DISC 0.42″-0.50″	36-120	120-45K	+80 to +115	−25° to +175°C	265
663	DISC 0.668″	1.1	100	+140	−25° to +175°C	18
664	DISC 0.906″	0.6	80	+85	−25° to +155°C	16
670	GLASS HERMETIC	120	120	+145	−25° to +155°C	34
672	MULT FUNCTION	30-250	10K-70K	+68 to +150	−25° to +190°C	15-33

PTC HEATERS

Voltage Range	Temperature Range	Cold Start Power	Power After Regulation
12V-240V	60°C-245°C	1KW	10W to 20W

PTC OVERLOAD PROTECTION

Resistance Range (25°C)	Maximum Current	Non-Trip Current (55°C)	Trip Current (10°C)	Diameter
1.6-1900 ohms	11-18 Amps	12-680 mA	24-1360 mA	.177″-.787″

METAL OXIDE VARISTORS Recognized under UL File #E98144

Size Range	RMS Voltage	Joule Rating	Max. Non-Repetitive Transient Current
0.276″-0.886″ (5mm-20mm)	14-680	0.20-250	50A-6500A

HUMIDITY SENSORS

M/C Series	Humidity Range	Sensitivity (33%-43% R.H.)	Capacitance Range	Maximum Voltage
691	10%-90% R.H.	0.4 pF/% R.H.	112-143 pF	15

LIGHT DEPENDENT RESISTORS

M/C Series	Min. Dark Resistance	Max. Light Resistance	Max. Dissipation At 40 C	AMB Temp. Range	Min. Recovery Rate
600	1M-10M	96R-300R	0.1W & 0.2W	−30° to 60°C	200K/Sec.

JULIE RESEARCH LABORATORIES INCORPORATED

PRECISION WIREWOUND RESISTORS

PRECISION RESISTORS FOR EVERY APPLICATION

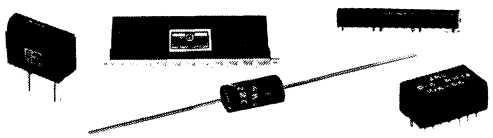
Precision Resistors for every application imaginable; high quality, low priced precision resistors are available for your every design need and at delivery schedules (1-2 weeks) even distributors can't beat!! JULIE RESEARCH resistors are guaranteed for a lifetime performance in almost every value, tolerance and stability.

Available as individual, ratio or network assemblies, these expertly manufactured and trimmed resistors assist you in eliminating countless hours of Production Test time from your design. In addition, the use of these very stable resistors contribute to reliable design and reduced component count. Specify a Julie Resistor. Better yet, call us and we will assist in helping you get the best price-performance unit your application and budget will allow.

JUST A FEW OF THE PROVEN APPLICATIONS FOR THESE LOW REACTANCE HIGH PERFORMANCE RESISTORS ARE:

- Transducer Calibrating Networks
- Current Metering
- Gyro Torquing
- AC and DC Precision Bridge Elements
- Amplifier Summing Elements
- D/A Converters
- Reference Divider
- Precision Multiplier
- Resistive Divider Networks
- Shunting
- AC or DC Ratio
- High Performance MIL Spec
- Zener Trimming Networks

RESISTOR STYLES



SPECIFICATIONS

Precision wirewound resistor accuracy and stability available in standard DIP styles.
Range: 100Ω to 100 KΩ per resistor.
Ratio Accuracy: To .001% for ratio 1:1.
Stability: Network .002% for standard ranges.
Temperature Coefficient: 1 ppm/°C to 20 ppm/°C.
Delivery: 3-4 weeks.
Custom designs available — contact factory for other package styles.

SPECIFICATIONS

Range: Individual Resistors, 1 ohm to 5 megohms. Ratio Sets, 1:1 to 10^6:1 depending on total resistance required.
Accuracy: Standard accuracy of resistors, 0.005% for values from 1000 ohms to 5 megohm. Standard accuracy of ratio sets, 0.0025% for ratios near 1:1. Accuracies from 0.002% to 0.1% are available (at corresponding prices) on special order.
Stability: Resistors, 0.002% per year for standard ranges.
Accuracy Over Military Temperature Range: ±0.02% from −45°C to +85°C.
Matching Over Military Temperature Range: ±0.005% from −45°C to +85°C.
Retrace Over Military Environmental Conditions: 0.002%.
Temperature Coefficient: Resistors, 5 ppm/°C standard. (Available as low as 1.0 ppm/°C). Ratio sets, 2.5 ppm/°C standard.
Note: Temperature Coefficient can be altered, in manufacture, over wide ranges.
Thermal Transients: All thermal-induced transient effects, e.g.: self-heating, Seebeck and Peltier effects, are less than 0.0015% at rated power dissipation. Self-heating and time constants of thermal transients are reduced to 10% of normal values in air.
Current Capability: To 2 amperes.
Voltage: Between Terminals, 300 volts maximum, Terminals to Case, 500 volts maximum.

SPECIFICATIONS

Range: Individual Resistors, 1 ohm to 10 megohms. Ratios, 1:1 to 10^6:1, depending on total resistance required.
Accuracy: Standard accuracy of resistors, 0.01%, for values from 100 ohms to 5 megohm. Standard accuracy of ratios, 0.005%, for ratios near 1:1. Intermediate accuracies of 0.05% and up and higher accuracies to .0025% are available on special order.
Stability: Resistors 0.003% per year for standard ranges.
Accuracy Over Military Temperature Range: 0.02% from −30°C to +85°C.
Retrace Over Military Environmental Conditions: 0.003%.
Temperature Coefficient: Resistors, 5 ppm/°C standard, (available as low as 1.0 ppm/°C). Ratios, 2.5 ppm/°C standard.
Note: Temperature Coefficient can be altered, in manufacture, over wide ranges.

SPECIFICATIONS

Range: Individual Resistors, 0.1 ohm to 100 ohms.
Accuracy: Standard accuracy of resistors, 0.01%, for values from 1.0 ohm to 100 ohms. (R_1 x G) .005% (CH).
Stability: Resistors 0.003% per year for standard ranges.
Accuracy Over Military Temperature Range: 0.02% fom −30°C to +85°C.
Retrace Over Military Environmental Conditions: 0.003%.
Temperature Coefficient: Resistors, 5 ppm/°C standard, (available as low as 2.5 ppm/°C).
Note: Temperature Coefficient can be altered, in manufacture, over wide ranges.
Voltage and Power Ratings: See chart.
Construction: See charts.
Group Encapsulation: Special techniquies permit group encapsulation of high-accuracy units on a high-yield basis, enabling better accuracies at competitive costs. (See JRL Bulletin B-11.)

HIGH LOAD-LIFE STABILITY, PRECISION NETWORKS

Type	Construction Dual In-Line	Resistor Configuration	Dimensions (Inches) L x W x H	Max Res Per Resistor	Max Volt Per Resistor	Max Power Per Resistor
RNX-14	14 pin	3 max.	.740 x .39 x .43	100K	125V	1/10W
RNX-16	16 pin	4 max.	.840 x .39 x .43	100K	125V	1/10W

LOWEST, LOW REACTANCE OIL FILLED AND ENCAPSULATED THA-H, CH, HCH, RESISTORS AXIAL WIRE LEAD CONSTRUCTION

Style	Size Inches	Size MM	AWG Leads	Max. Res.	Volt	Power	MIL R-93
H-32	3/8 x 1/2	9.5 x 12.7	20	250 K	250	1/2 W	—
H-33	3/8 x 3/4	9.5 x 19.1	20	350 K	450	1/2 W	RB 53
H-34	3/8 x 1	9.5 x 25.4	20	500 K	500	1/2 W	RB 52
H-42	1/2 x 1/2	12.7 x 12.7	18	750 K	250	1/2 W	—
H-44	1/2 x 1	12.7 x 25.4	18	2 Meg	500	1 W	RB 57
H-46	1/2 x 1/2	12.7 x 38.1	18	3 Meg	750	1 1/2	RB 58
H-48	1/2 x 2	12.7 x 50.8	18	5 Meg	1000	2 W	RB 59
HCH-32	3/8 x 1/2	9.5 x 12.7	20	150 K	—	3/4 W*	—
HCH-33	3/8 x 3/4	9.5 x 19.1	20	250 K	—	1 W*	—
HCH-34	3/8 x 1	9.5 x 25.4	20	350 K	—	1.5 W*	—
HCH-35	3/8 x 1 1/4	9.5 x 31.8	20	500 K	—	1.8 W*	—
HCH-42	1/2 x 1/2	12.7 x 12.7	18	375 K	—	1.5 W*	—
HCH-44	1/2 x 1	12.7 x 25.4	18	750 K	—	3 W*	—
HCH-46	1/2 x 1 1/2	12.7 x 38.1	18	1 M	—	4.5 W*	—
HCH-48	1/2 x 2	12.7 x 50.8	18	1.5 M	—	6 W*	—
CH-32	3/8 x 1/2	9.5 x 12.7	20	300 K	—	3/4*	—
CH-33	3/8 x 3/4	9.5 x 19.1	20	500 K	—	1 W*	—
CH-34	3/8 x 1	9.5 x 25.4	20	700 K	—	1.5*	—
CH-35	3/8 x 1 1/4	9.5 x 31.8	20	1 Meg	—	1.8*	—
CH-42	1/2 x 1/2	12.7 x 12.7	18	750 K	—	1.5*	—
CH-44	1/2 x 1	12.7 x 25.4	18	1.5 M	—	3.0*	—
CH-46	1/2 x 1 1/2	12.7 x 38.1	18	2 M	—	4.5*	—
CH-48	1/2 x 2	12.7 x 50.8	18	5 M	—	6 W*	—
THA-36	3/8 x 1/2	9.5 x 12.7	18	1 M	100	—	RB 53
THA-38	3/8 x 3/4	9.5 x 19.1	18	1 M	100	—	RB 53

* When mounted on heat sink.

SUPER ACCURATE, SUPER STABLE ENCAPSULATED, MINIATURE PRECISION R, XG, RS, L, GL RESISTORS

TYPE R AND C — AXIAL WIRE LEAD-CONSTRUCTION

C21X	3/4 x 3/8		24	100 K	125	1/10 W	
R-22	1/4 x 9/16	6.4 x 14.3	22	500 K	125	1/8 W	—
R-23	1/4 x 3/4	6.4 x 19.1	22	750 K	125	1/6 W	RB 54
R-24	5/16 x 1	7.9 x 25.4	22	1 Meg	350	1/4 W	—
R-32	3/8 x 1/2	9.5 x 12.7	22	750 K	125	1/4 W	—
R-33	3/8 x 3/4	9.5 x 19.1	20	1 Meg	125	1/3 W	RB 53
R-34	3/8 x 1	9.5 x 25.4	20	1.5 Meg	250	1/2 W	RB 52
R-35	3/8 x 1 1/4	9.5 x 31.8	20	2 Meg	250	5/8 W	—
R-42	1/2 x 1/2	12.7 x 12.7	18	1.5 Meg	125	1/2 W	—
R-44	1/2 x 1	12.7 x 25.4	18	4 Meg	250	1 W	RB 57
R-46	1/2 x 1 1/2	12.7 x 38.1	18	7.5 Meg	250	1 1/2 W	RB 58
R-48	1/2 x 2	12.7 x 50.8	18	10 Meg.	250	2 W	RB 59

TYPE L AND RB — RADIAL LUG CONSTRUCTION

L-10A	5/8 x 9/16	15.9 x 14.3	Solder Lug	1.5 Meg	125	1/2 W	RB 16
L-HB	5/8 x 1 1/4	15.9 x 31.8	Solder Lug	4 Meg	250	1 W	RB 18

TYPE XG — RADIAL WIRE LEAD CONSTRUCTION

R-32XG	3/8 x 9/16	9.5 x 14.3	22	500 K	125	1/4 W	—
R-42XG	1/2 x 9/16	12.7 x 14.3	20	1 Meg	125	1/2 W	—
R-44XG	1/2 x 1 5/32	12.7 x 29.3	20	3.5 Meg	250	1 W	—
R-46XG	1/2 x 1 3/8	12.7 x 34.9	20	5 Meg	250	1 1/2 W	—
R-48XG	1/2 x 2 1/16	12.7 x 52.4	20	10 Meg	250	2 W	—
R-52XG	5/8 x 1 5/32	15.9 x 15.1	20	1 Meg	125	3/4 W	—

TYPE RS — TOP HAT CONSTRUCTION

RS-36	1/13 x 1/2	10.3 x 12.7	22	750 K	125	1/4 W	—
RS-26	9/32 x 1/2	7.1 x 12.7	22	250 K	125	1/8 W	—

LOW OHM, LONG TERM STABILITY, OIL FILLED AND ENCAPSULATED 4-TERMINAL CH46-T4, R-46-T4, R46xG-T4 AXIAL AND RADIAL CONSTRUCTION

Style	Size	MM	AWG Leads	Max. Res.	Current	Power
R-46T4	1/2 x 1 1/2	12.7 x 38.1	18	100 Ohms	2 Amps	1 1/2 W
R-46XG-T4	1/2 x 1 1/2	12.7 x 38.1	20	100 Ohms	2 Amps	1 1/2 W
CH-46T4	1/2 x 1 1/2	12.7 x 38.1	18	100 Ohms	2 Amps	3 W*
CH-48T4	1/2 x 2	12.7 x 50.8	18	100 Ohms	4 Amps	6 W*

* When mounted on heat sink.

JULIE RESEARCH LABORATORIES, INC. • 211 W. 61 ST., NEW YORK, N.Y. 10023 • (212) 245-2727 • TWX: 710-581-5138

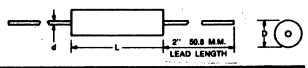
MICRO-OHM CORPORATION
1088 HAMILTON ROAD, DUARTE, CALIFORNIA 91010
(818) 357-5377/TWX 910-587-3425 FAX 818 358-6478

QUALITY PRECISION RESISTORS
WIREWOUND

AXIAL LEAD

Series 100

Tolerances: .001% to 1%
T.Cs: 1 PPM to 6000 PPM
Windings: Non-Inductive

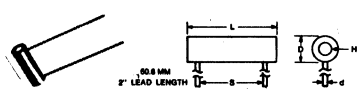


MO Style	Mil R-83 Equiv.	Length (L) Inch ±.032	Length (L) mm ±.81	Diameter (D) Inch ±.015	Diameter (D) mm ±.30	Lead (d) AWG	Lead (d) mm	Com'l Wattage	Max. Voltage DC	Max. Resistance (.0004 Wire)
133		.500	12.70	.200	5.08	22	.64	.30	300	600K
139		.700	17.78	.200	5.08	22	.64	.40	300	1.2M
144		.250	6.35	.250	6.35	22	.64	.25	150	400K
115		.312	7.92	.250	6.35	22	.64	.25	200	1M
156	RB56	.375	9.52	.250	6.35	20	.81	.25	200	700K
143	RB55	.500	12.70	.250	6.35	20	.81	.30	300	900K
137	RB54	.750	19.05	.250	6.35	20	.81	.50	300	1.2M
136		.610	15.49	.375	9.52	20	.81	.50	400	3M
132	RB53	.750	19.05	.375	9.52	20	.81	.66	500	3M
138	RB52	1.00	25.40	.375	9.52	20	.81	1.0	750	5M
134		.500	12.70	.500	12.70	20	.81	.66	300	3M
170		.625	15.88	.500	12.70	20	.81	.75	400	3M
146	RB57	1.00	25.40	.500	12.70	20	.81	1.5	750	7M
180	RB58	1.50	38.10	.500	12.70	20	.81	2.0	1000	15M
190	RB59	2.00	50.80	.500	12.70	20	.81	2.5	1200	20M
SUBMINIATURES										
140		.250	6.35	.125	3.18	24	.51	.10	100	150K
112		.375	9.52	.125	3.18	24	.51	.125	200	125K
113		.312	7.92	.160	4.06	22	.64	.15	150	300K
150		.500	12.70	.160	4.06	22	.64	.20	200	400K
114		.312	7.92	.187	4.75	22	.64	.20	200	300K
135		.375	9.52	.187	4.75	22	.64	.25	300	300K
160		.625	15.88	.187	4.75	20	.81	.30	300	600K
MICRO-MINIATURES										
XP101		.375	9.52	.050	1.27	30	.25	.02	50	10K
100		.110	2.79	.070	1.78	30	.25	.03	50	11K
105		.155	3.94	.075	1.91	30	.25	.04	50	11K
110		.200	5.08	.093	2.36	28	.32	.05	75	30K
130		.312	7.92	.093	2.36	28	.32	.06	100	60K
142		.185	4.70	.120	3.05	28	.32	.06	100	30K
141		.180	4.06	.125	3.18	28	.32	.06	100	30K

RADIAL LEAD

Series 200 & 600 (Lugs)

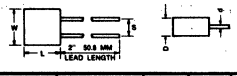
Tolerances: .001% to 1%
T.Cs: 1 PPM to 6000 PPM
Windings: Non-Inductive



MO Style	Mil R-93 Equiv.	Length (L) Inch ±.032	Length (L) mm ±.81	Dia. (D) Inch ±0.15	Dia. (D) mm ±.38	Lead (d) AWG	Lead (d) mm	Lead Spacing (S) Inch ±.032	Lead Spacing (S) mm ±.81	Mounting Hole (H) Inch ±.010	Mounting Hole (H) mm ±.35	Com'l Wattage	Max. Voltage DC	Max. Resistance (.0006 Wire)
221		.490	12.45	.365	9.27	24	.51	.390	9.91	.140	3.56	.50	300	2.5M
211		.325	8.26	.375	9.52	24	.51	.245	6.22	.120	3.05	.50	300	1.5M
226		1.000	25.40	.375	9.52	20	.81	.855	21.72	.089	2.26	1.00	600	5M
222		.668	17.48	.420	10.69	20	.81	.555	14.10	None		1.00	600	3M
236		1.125	28.59	.435	11.05	20	.81	.960	24.38	None		1.25	600	5M
220	RB17	1.000	25.40	.500	12.70	20	.81	.845	21.46	.140	3.56	1.00	600	10M
228	RB73	2.000	50.80	.500	12.70	20	.81	1.750	44.45	.140	3.56	2.00	1200	20M
227	RB08	.500	12.70	.550	13.97	20	.81	.235	5.97	.140	3.56	.50	300	1M
224	RB16	.612	15.54	.550	13.97	20	.81	.475	12.06	.140	3.56	.50	300	12M
230	RB18	1.250	31.75	.750	19.05	20	.81	1.125	28.59	.140	3.56	2.00	600	20M
SUBMINIATURES														
225		.500	12.70	.160	4.06	24	.51	.385	9.78	None		.20	200	500K
202		.250	6.35	.312	7.92	24	.51	.180	4.57	.089	2.26	.25	200	500K
243		.500	12.70	.250	6.35	22	.64	.290	7.37	None		.25	300	300K
MICRO-MINIATURES														
206		.200	5.08	.105	2.67	30	.25	.100	2.54	None		.30	100	30K
210		.250	6.35	.100	2.54	28	.32	.200	5.08	None		.05	100	30K
205		.165	4.19	.075	1.90	30	.25	.150	5.81	None		.04	50	11K

PRINTED CIRCUIT LEAD

RECTANGULAR

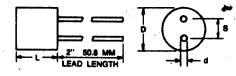


MO Style	Length (L) Inch ±.032	Length (L) mm ±.81	Width (W) Inch ±.015	Width (W) mm ±.38	Depth (D) Inch ±.015	Depth (D) mm ±.38	Lead (d) AWG	Lead (d) mm	Lead Spacing (S) Inch ±.0-0	Lead Spacing (S) mm ±.25	Com'l Wattage	Max. Voltage DC	Max. Resistance (.0006 Wire)
450	.250	6.35	.250	6.35	.125	3.18	20	.81	.125	3.18	.125	100	1M
460	.250	6.35	.500	12.70	.125	3.18	20	.81	.250	6.35	.250	100	2M

PRINTED CIRCUIT LEAD

Series 400

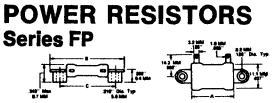
Tolerances: .001% to 1%
T.Cs: 1 PPM to 6000 PPM
Windings: Non-Inductive



MO Style	Mil R-93 Equiv.	Length (L) Inch ±.032	Length (L) mm ±.81	Diameter (D) Inch ±.032	Diameter (D) mm ±.81	Lead (d) AWG	Lead (d) mm	Lead Spacing (S) Inch ±.010	Lead Spacing (S) mm ±.25	Com'l Wattage	Max. Voltage DC	Max. Resistance (.0006 Wire)
440		.250	6.35	.125	3.18	24	.51	.050	1.27	.10	100	120K
412		.375	9.52	.125	3.18	24	.51	.050	1.27	.125	200	55K
413		.312	7.92	.160	4.06	24	.51	.080	2.03	.15	150	300K
414		.312	7.92	.187	4.75	22	.64	.100	2.54	.20	200	300K
435		.375	9.52	.187	4.75	22	.64	.100	2.54	.25	300	300K
415	RB71	.312	7.92	.250	6.35	22	.64	.200	5.08	.25	300	500K
416		.375	9.52	.250	6.35	22	.64	.200	5.08	.25	300	800K
443		.500	12.70	.250	6.35	22	.64	.125	3.18	.30	300	1M
437		.750	19.05	.250	6.35	22	.64	.125	3.18	.50	300	1M
417	RB70	.500	12.70	.375	9.52	20	.81	.200	5.08	.50	300	1.5M
436		.610	15.49	.375	9.52	20	.81	.250	6.35	.50	450	3M
438		1.00	2.54	.375	9.52	20	.81	.250	6.35	1.00	750	5M
434		.500	12.70	.500	12.70	20	.81	.300	7.62	.50	300	3M
MICRO-MINIATURES												
405		.155	3.94	.075	1.91	30	.25	.030	.76	.04	50	11K
430		.312	7.92	.093	2.36	28	.32	.040	1.02	.05	100	50K
401		.175	4.44	.105	2.67	28	.32	.040	1.02	.05	75	30K
442		.185	4.70	.120	3.05	28	.32	.050	1.27	.05	100	30K
441		.160	4.06	.125	3.18	28	.32	.050	1.27	.05	100	30K

POWER RESISTORS

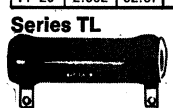
Series FP

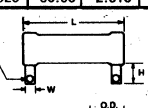


Tolerances: .05% to 10%
T.Cs: PPM/°C Resistance
20 10Ω & over
30 1Ω — 10Ω
90 under 1Ω

MO Style	Core Length (A) Inch ±.032	Core Length (A) mm ±.01	Length Inch Hdwe. (D) Inch ±.015	Length Inch Hdwe. (D) mm ±.38	Mtg. Hole Spacing (C) Inch ±.015	Mtg. Hole Spacing (C) mm ±.38	Wattage Rating	Maximum Working Voltage	Resistance Range (Ohms)
FP-10	.750	19.05	1.218	30.94	1.00	25.4	10	300	.1-15K
FP-20	2.062	52.37	2.625	66.68	2.313	58.75	20	1000	.1-15K

Series TL





Tolerances: .05% to 10%
T.Cs: 90 PPM to 20 PPM depending on value

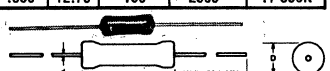
TERMINAL DIMENSIONS

M.O. Series	TL-5 Inch	TL-5 mm	TL-10 25 & 30 Inch	TL-10 25 & 30 mm	TL-60 & 100 Inch	TL-60 & 100 mm
Width (W)	.125	3.2	.187	4.8	.250	6.4
Height (H)	.250	6.4	.406	10.3	.750	19.1
Hole Dia. (h)	.062	1.57	.093	2.4	.154	3.9

No. Style	Length (L) Inch ±.062	Length (L) mm ±1.57	Diameter O.D. Inch ±.032	Diameter O.D. mm ±.81	Diameter I.D. Inch ±.032	Diameter I.D. mm ±.81	Wattage Rating	Maximum Working Voltage	Resistance Range (Ohms)
TL-6	1.00	25.40	.250	6.35	.156	3.96	5	230	.1-12K
TL-10	1.00	25.40	.438	11.12	.312	7.92	10	400	.1-22K
TL-25	2.00	50.80	.563	14.30	.312	7.92	25	1300	.1-100K
TL-50	4.00	101.60	.563	14.30	.312	7.92	50	1900	.1-250K
TL-60	4.00	101.60	.750	19.05	.500	12.70	60	2100	.1-350K
TL-100	6.50	165.10	.750	19.05	.500	12.70	100	2500	.1-550K

Series R

Tolerances: .05% to 10%
T.Cs: 90 PPM to 20 PPM depending on value



MO Style	Mil R-26 Equiv.	Length (L) Inch ±.032	Length (L) mm ±.81	Diameter (D) Inch ±.032	Diameter (D) mm ±.81	Lead (d) AWG	Lead (d) mm	Wattage U	Wattage V	Max. Working Voltage U	Max. Working Voltage V	Resistance Ranges (ohms) .05% .1% .25%	Resistance Ranges (ohms) .5% 1% 3% 5%
R-¼		.250	6.35	.078	1.98	24	.51	.40		20		10-950	.1-3.4K
R-½		.312	7.92	.078	1.98	24	.51	.75		29		10-1.3K	.1-4.9K
R-1A	RW70	.406	10.31	.093	2.36	22	.64	1.00		52		1-2.7K	.1-10.4K
R-1		.531	13.49	.093	2.36	22	.64	1.10		62		1-4.0K	.1-15K
R-2½	RW69	.500	12.70	.210	5.33	20	.81	2.50	3.25	138	157	1-8.6K	.01-32.2K
R-3A	RW79	.562	14.27	.210	5.33	20	.81	3.00	3.75	135	148	1-6.5K	.01-34.5K
R-3		.812	20.62	.210	5.33	20	1.02	3.25	4.75	185	220	1-11.4K	.01-42.1K
R-4		.625	15.88	.300	7.62	18	1.02	4.00	5.50	210	250	1-12.7K	.01-47.1K
R-5	RW67 RW74	.875	22.22	.300	7.62	18	1.02	5.00	6.50	330	376	.5-24.5K	.01-91.0K
R-7		1.218	30.94	.375	9.52	18	1.02	7.00	9.00	504	576	.5-41.4K	.01-154K
R-10	RW68 RW78	1.780	45.21	.375	9.52	18	1.02	10.00	13.00	799	911	.5-71.3K	.01-265K

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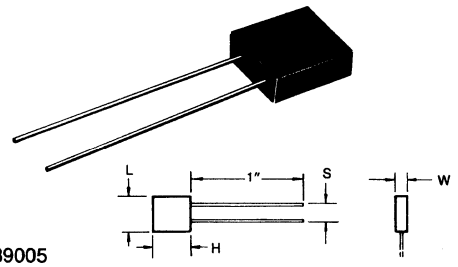
QUALITY PRECISION WIREWOUND RESISTORS

PRECISION WIREWOUND RESISTORS TYPE 451 AND 452

MINIATURE RECTANGULAR CONFIGURATION WITH PRINTED CIRCUIT LEADS



FEATURES

- Meets MIL R-39005
- Non-Inductive
- Close Tolerance
- Low Temperature Coefficient
- Ultra Stable
- Interchangeable with Bulk Metal Film Type
- Low Thermal EMF

DIMENSIONS (INCHES)

TYPE	±.020 H	±.010 L	±.010 W	±.010 S	LEAD DIAMETER	LEAD MATERIAL
451	.327	.300	.112	.150	.025 (22 ga)	TINNED COPPER
452	.250	.250	.125	.125	.025 (22 ga)	TINNED COPPER

SPECIFICATIONS

Type	Watts @ 70°C	Maximum working Voltage DC	Resistance Tolerance	Resistance Range (ohms)	Stability
451	.3	200	1% To .005%	.5–750K	25PPM/Year
452	.2	200	1% To .005%	.5–850K	25PPM/Year

TEMPERATURE COEFFICIENT TRACKING 0–85°C

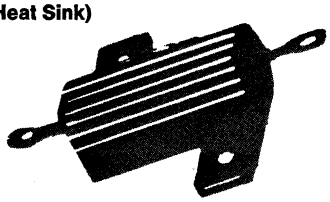
0 ± 2PPM/°C Standard
0 ± 1PPM/°C (available with certain restrictions)

TEMPERATURE COEFFICIENT (PPM/°C) 0–85°C

0 ± 2 over 100 ohms
0 ± 5 over 50 ohms
0 ± 20 over 2 ohms
0 ± 50 2 ohms and under

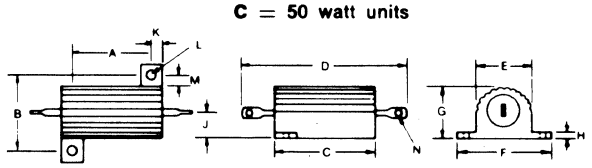
POWER WIREWOUND RESISTORS SERIES HS

(Heat Sink)



Tolerances: .05% to 10%
T.Cs: PPM/°C Resistance
20 10Ω & over
30 1Ω — 10Ω
90 under 1Ω

C = 50 watt units



POWER RATINGS

Micro-Ohm HS Resistor ratings are based on the following requirements:
1. 275°C Maximum internal hotspot temperature.
2. 1% Maximum △ R in 1000 hour load life for all models.

ELECTRICAL SPECIFICATIONS

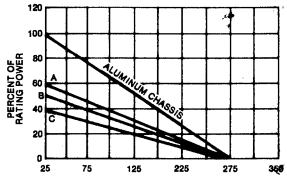
1. 4 Models, 5, 10, 25 & 50 watts.
2. Resistance Range: .05 ohms to 200K ohms.
3. Tolerances: .05% to 10%.
4. Temperature coefficient 20PPM to 90PPM.
5. 1000 VAC Minimum Dielectric Strength.
6. Non-inductive types available.

FEATURES

- Aluminum-Finned Heat Sink Case.
- Molded Construction.
- Complete Welded Construction.
- Screw Mounts on Chassis.
- High Stability at Conventional Power Ratings.
- Heavy spade lug type leads.

DERATING

Micro-Ohm HS Resistors have an operating temperature range of −55°C to +275°C. Derating is required for reduced chassis mounting area and for high ambient temp. Curves A, B & C below apply to operation of unmounted resistors.



AMBIENT TEMPERATURE DEG. CENTIGRADE
A = 5 and 10 watt units **B** = 25 watt units **C** = 50 watt units

MO Style	Mil-R 18546	Com'l Watt	Maximum Working Voltage	Max. Res.	A Inch ±.005	A mm ±.013	B Inch ±.005	B mm ±.013	C Inch ±0.32	C mm ±.81	D Inch ±.062	D mm ±1.57	E Inch ±.015	E mm ±.38	F Inch ±.015	F mm ±.38
HS5	RE60	5	160	20K	.44	11.28	.490	12.45	.600	15.24	1.125	28.58	.334	8.48	.646	16.41
HS10	RE65	10	265	30K	.562	14.27	.625	15.88	.750	19.05	1.375	34.93	.438	11.13	.812	20.62
HS25	RE70	25	550	75K	.719	18.26	.781	19.84	1.062	26.97	1.938	49.23	.500	12.70	1.094	27.29
HS50	RE75	50	1250	200K	1.563	39.70	.844	21.44	1.968	49.99	2.781	70.64	.625	15.88	1.156	29.36

MO Style	G Inch ±.015	G mm ±.38	H Inch ±.010	H mm ±.25	J Inch ±.010	J mm ±.25	K Inch ±.010	K mm ±.25	L Inch ±.005	L mm ±.013	M Inch ±.015	M mm ±.38	N Inch ±.005	N mm ±.013	Mounting Hole Size
HS5	.317	8.05	.075	1.91	.145	3.68	.078	1.98	.093	2.36	.078	1.98	.050	1.27	#2
HS10	.406	10.31	.100	2.54	.203	5.16	.093	2.36	.093	2.36	.094	2.39	.086	2.18	#2
HS25	.563	14.30	.094	2.39	.250	6.35	.171	4.34	.125	3.18	.125	3.18	.086	2.18	#2
HS50	.625	15.88	.094	2.39	.281	7.14	.196	4.98	.125	3.18	.125	3.18	.086	2.18	#4

For Non-Inductive types add letter N after style number.

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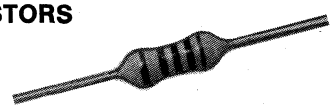
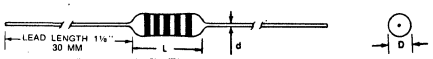
QUALITY PRECISION RESISTORS

METAL FILM RESISTORS

Type RN 55 & 50
T.C.s: 25, 50 & 100 PPM
Tolerances: 0.1% to 1%





Mil Equiv.	MO Style	Length (L) Inch ±.039	Length (L) mm ±1.0	Diameter (D) Inch ±.02	Diameter (D) mm ±0.5	Lead(d) Tin Cu. AWG	Lead(d) Tin Cu. mm	Watt. @ 70°C	Max. Working Volt.	Max. Overload Volt.	Resistance Range (Ω)
RN55	RN25	.25	6.4	.09	2.3	22	0.5	¼	250	500	1-10 Meg.
RN50	RN12	.150	3.8	.062	1.6	24	0.4	⅛	150	300	10-1 Meg.

- Exceeds Mil-R-10509 qualification
- T.C. 25, 50 & 100 PPM
- EIA Standard Color Coding
- .5% & 1% Tolerances
- Economical
- Low Noise
- Excellent high frequency characteristics
- Excellent Resistance Stability & Repeatability
- Packaging: Bulk, Strip Pack, or Tape & Reel

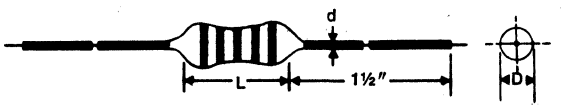
Vacuum-deposited nickel-chrome alloy is deposited on high purity ceramic cores. A multiple epoxy coating protects all resistors against adverse environmental conditions. Performance characteristics exceed all requirements of Mil-R-10509F. These stable and inexpensive resistors are recommended for use whenever miniature circuits are required for sophisticated electronic equipment.

CHARACTERISTICS

Requirements	Characteristics	Test Method JIS.C. 5202	Test Method Mil-R. 10509E
Operating Temp. Range	−55°C − +155°C	−	−
Temp. Coefficient (PPM/°C)	C, D,	5. 2. A	4. 6. 12
Short Time Overload	±(0.5% +0.05r)	5. 6 A	4. 6. 6
Insulation Resistance	Over 10^4M	5. 6 A	4. 6. 9
Dielectric Withstanding V	±(0.5% +0.05r)	5. 7 A	4. 6. 8
Effect of Soldering	±(0.5% +0.05r)	6.4. 350°C 3S	4. 6. 10
Temperature Cycling	±(0.5% +0.05r)	7. 4.	4. 6. 4
Low Temp. Operation	±(0.5% +0.05r)		4. 6. 5
Terminal Strength	±(0.5% +0.05r)	6. 1.	4. 6. 7
Moisture Resistance	±(1% +0.5r)	7.9. 1000 Hrs.	Mil-R 22684B 4. 6. 10
Load Life	±(1% +0.5r)	7.10 1000 Hrs.	4. 6. 13
Storage	±(0.2% +0.05r)	±(0.2% +0.05)	Shelved for one year in a room of Normal Temp. and Humidity.

HEAT SENSITIVE LINEAR POSITIVE TEMPERATURE RESISTOR

Type LPTC-25 Metal Film



Max. Power Rating @ 70°C	L ±.020	D ±.020	d
¼W	.250	.090	22 ga.

Type LPTC-25 Metal Film (continued)

Resistance Range: 10 ohm — 20K ohm (T1 and T2)
10 ohm — 1K ohm (T3 and T4)

Resistance Tolerance: ±2% (G) and ±5% (J)

Resistance Temperature Coefficient:
T1 (+2500 PPM) T3 (+3500 PPM)
T2 (+3000 PPM) T4 (+4000 PPM)

Features: a) Linear resistance change vs. temperature, which cannot be obtained in a semiconductor or thermister
b) Positive temperature coefficient

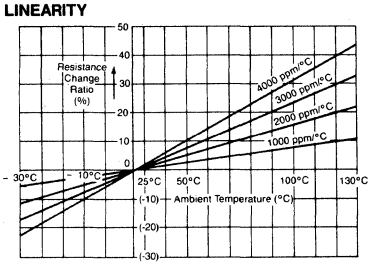
Application: Temperature compensation, temperature indication, temperature control, temperature protection and liquid level detection.

Markings: First two bands are significant digits, third band the multiplier, and the fourth and fifth bands are first two digits of T.C.R.

SPECIFICATIONS

Part No.	Rated Watt. (70°C)	Resistance Range	Temp. Coefficient PPM/°C	Res. Value	Res. Tole.	T.C.R. Tole.	Dimensions (mm) L	Dimensions (mm) D	Dimensions (mm) d
LPTC25	0.25W (¼W)	5Ω ~ +15KΩ	T1 = 2,500 T2 = 3,000 T3 = 3,500 T4 = 4,000	E−24	±2% ±5%	±10%	6.3 ±0.5	2.3 ±0.5 −0.3	0.6 ±0.05

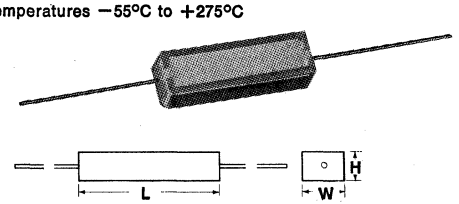
LINEARITY



BATHTUB TYPE RESISTORS

CW SERIES

√ Economical
√ 1 watt to 50 watt
√ 5 & 10% Tolerances
√ Fireproof
√ Operating temperatures −55°C to +275°C



CONSTRUCTION

Premium grade resistance wire is wound on a woven fiberglass core. Tinned copper terminals are tightly crimped or welded (depending on resistance value) to the banded core. The wound unit is potted in a high quality Steatite Ceramic case using a high temperature, high thermal conducting inorganic potting compound. This results in a completely fireproof inorganic package, highly resistant to solvents and impervious to moisture.

Stand off or feet type available in sizes 3 Watt and larger. Specify by inserting letter "F" after type number. Example: CW5F

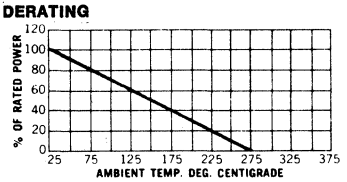
- Temperature coefficients (Typical) Below 1Ω 0 ±800 ppm; Over 1Ω 0 ±400 ppm
- Applicable specification to EIA Standard RS-344 Type
- Fuse type available
- Terminal strength: 5 lbs minimum
- Non-Inductive types available

CW SERIES - AXIAL LEAD

Type	Wattage	DIMENSIONS ±.031 (inches) Length (L)	Width (W)	Height (H)	Lead (d)	Maximum working voltage	Resistance Range (Ω)
CW1	1	.594	.219	.250	.032	60	.01-.27
CW2	2	.688	.250	.250	.032	65	.01-.35
CW3	3	.875	.312	.312	.032	150	.01-10K
CW5	5	.875	.375	.375	.032	200	.01-10K
CW7	7	1.406	.375	.343	.032	350	.01-27K
CW10	10	1.875	.375	.343	.032	540	.01-30K
CW15	15	1.875	.500	.500	.032	670	.01-30K
CW20	20	1.875	.500	.500	.032	740	.01-40K
CW25	25	2.531	.500	.500	.032	890	.01-40K
*CW50F	50	3.625	.750	.750	.032	940	.01-45K

*Available with stand off feet and radial leads only.

DERATING



HOW TO ORDER:

CW5 10 ohms 5%
5% — TOLERANCE
10 ohms — RESISTANCE VALUE
CW5 — TYPE & WATTAGE

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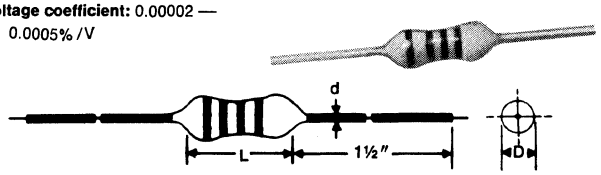
HIGH MEGOHM MG SERIES METAL GLAZE RESISTORS

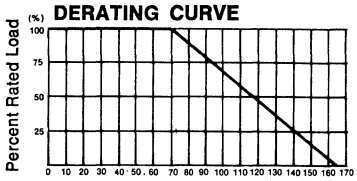
This high resistance component has been developed to be used as a precision or power resistor for X-ray equipment, measuring equipment and statistic electric equipment. It has high reliability in its shelf life, T.C.R. and other characteristics.

CHARACTERISTICS:

T.C.R.: 100 PPM
Load life: 3000 Hrs. ±1%
Anti moisture load life: ±1% after 250 Hrs. at 40°C 90-95% RH
Voltage coefficient: 0.00002 — 0.0005%/V
Shelf life: ±1% after 10,000 Hrs. at room temp.
Max. Temperature: 220°C
Temperature range: −55°C — +165°C



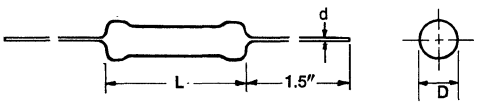
DERATING CURVE



Style	Rated Wattage (W)	Max. Working Voltage (KV)	Pulse Voltage (KV)	Resistance Range	Dimensions (Inches) D ±.04	L ±.06	d ±.004
MG-25	0.25	0.10	0.30	1 Meg- 100 Meg	.09	.256	.025
MG-50	0.50	0.25	0.70	1 Meg- 200 Meg	.126	.393	.028
MG-1	1.0	1.00	1.00	1 Meg-1000 Meg	.165	.472	.032
MG-2	2.0	5.00	7.50	1 Meg-2000 Meg	.217	.630	.032

Resistance Tolerance: F = ±1%, G = ±2%, J = ±5%. Markings: EIA color coding system or Digital marking.

FLAME-PROOF METAL OXIDE POWER RESISTORS



Style	Dimension (Inches) L ±.02	D ±.02	d (nominal)
RSF-½B	.35	.12	.028
RSF-1B	.46	.16	.028
RSF-2B	.61	.23	.032
RSF-3B	.98	.33	.032
RSF-5B	1.60	.33	.032

Style	Power Rating @ 70°C	Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	Resistance Range	Resistance Tolerance
RSF-½B	0.5W	250V	400V	500V	0.2 -100 KΩ	
RSF-1B	1W	500V	1,000V	700V	0.2 -100 KΩ	
RSF-2B	2W	500V	1,000V	700V	0.2 -120 KΩ	G*
RSF-3B	3W	750V	1,000V	1,000V	0.2 -150 KΩ	J
RSF-5B	5W	750V	1,000V	1,500V	0.47-240 KΩ	

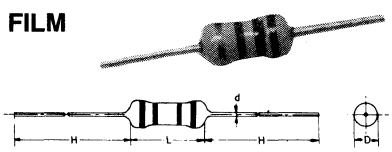
* G 5.1Ω and over

CHARACTERISTICS

Requirements		Characteristics	Test Method JIS C 5202	Test Method Mil-R-22684B
Operating Temperature Range		−55°C to +275°C		
Temperature Coefficient (ppm C)		±200	5.2	4 6 11
Max. Resistance Change	Short Time Overload	±(0.5% +0.05Ω)	5.5	4 6 5
	Effect of Soldering	±(0.5% +0.05Ω)	6.4 350°C 3 sec	4 6 9
	Temperature Cycling	±(0.5% +0.05Ω)	7.4 −55°C/85°C	4 6 3
	Moisture Resistance	±5%	7.9 1,000 hr	4 6 10
	Load Life	±5%	7.10 1,000 hr	4 6 12
Dielectric Withstanding Voltage		±(0.5% +0.05Ω)	5.7	4 6 7
Insulation Resistance		over 10^4 MΩ	5.6	4 6 8
Non-Combustibility		The resistor shall withstand Overload test in accordance with Article UL492, 213 without producing a fire hazard.		
Resistance to Solvents		The resistor shall withstand Solvents test in accordance with Article MIL-STD-202 E 215 without producing any mechanical or electrical damage.		

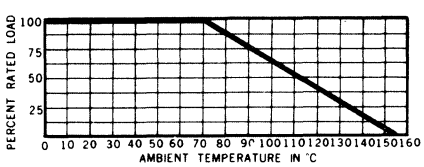
DEPOSIT CARBON FILM

Fixed Resistors
Type
M 50, 25, 12



- Size equal to carbon composition resistor.
- Greater reliability and stability.
- Greater economy.
- 2% and 5% resistance tolerances.
- Conformal multilayer epoxy coating.
- Welded cap and lead construction.
- EIA standard color coding.
- Packaging — Bulk, strip pack or tape & reeled.

DERATING CURVES



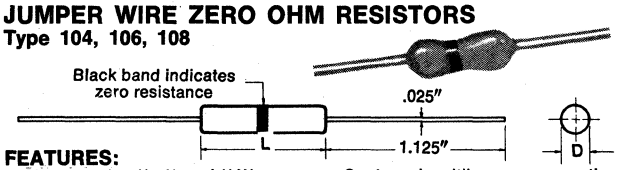
SPECIFICATIONS

Type	M-50	M-25	M-12
Wattage Rating at 70°C	0.5W	0.25W	0.125W
Max. Working Voltage	350V	250V	150V
Max. Over Load Voltage	700V	500V	300V
Resistance Tolerance	±2% (G), ±5% (J)	±2% (G) ±5% (J)	±5% (J)
Resistance Range 5% 2%	1Ω to 10 MΩ 10Ω to 910K	1Ω to 13 MΩ 10Ω to 910K	1Ω to 5 MΩ 51Ω to 220K
Temperatuge Range	−55°C to +155°C	−55°C to +155°C	−55° to +155°C

Type	Body Length (L) inch	Body Length (L) mm	Body Diameter (D) inch	Body Diameter (D) mm	Leadwire Length (H) inch	Leadwire Length (H) mm	Leadwire Diameter (d) inch	Leadwire Diameter (d) mm	Net Weight
M-50	.350 ±.020	8.9 ±0.5	.146 ±.008	3.7 ±0.2	1.125 ±.1	30 ±3	.031±.001	0.8 ±0.03	500 grms (1.1 lb.)
M-25	.245 +.020 −.010	6.7 max.	.098 max.	2.5 max.	1.125 ±.1	30 ±3	.024 ±.005	0.6 ±0.05	200 grms (.44 lb.)
M-12	.160 +.020 −.010	4.6 max.	.068 max.	1.7 max.	1.125 ±.1	30 ±3	.020 ±.005	0.5 ±0.05	135 grms (.30 lb.)

MICRO-OHM CORPORATION
1088 HAMILTON ROAD, DUARTE, CALIFORNIA 91010
(818) 357-5377/TWX 910-587-3425 FAX 818 358-6478

JUMPER WIRE ZERO OHM RESISTORS
Type 104, 106, 108



FEATURES:
- Sizes equal to ⅛, ¼ and ½W carbon film
- Economical
- Straight-through zero ohm continuity
- Conformal multilayer epoxy coating
- Welded cap and lead construction
- Packing: Tape & reeled or bulk

Type	Equiv. Wattage	Dimensions Inch Length (L) ±.030	Dimensions Inch Diameter (D) ±.020	Lead Dia. ±.005
104	1/8	.150	.080	.020
106	1/4	.245	.085	.025
108	1/2	.500	.095	.025

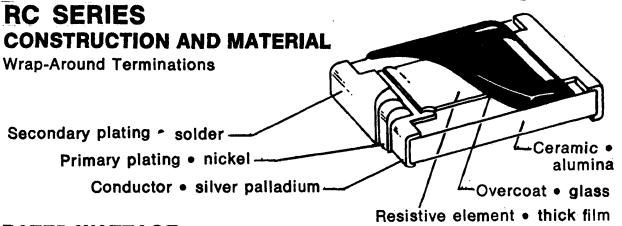
SPECIFICATIONS:
Maximum Resistance: 0.0025 ohm
Lead Material: Leads are copperclad steel with 30/70 solder coatings to allow both welding and soldering operations.
Body material: Epoxy coated metal body
Minimum Insulation Resistance: Dry, 10,000 megohm; Wet, 100 megohm
Minimum Dielectric Withstanding Voltage: Atmospheric, 500V RMS; Reduced, 325V RMS
Insulation Flammability: Resistor insulation is self extinguishing within 10 seconds after externally applied flame is removed.
Current Rating: 25 amps at 25°C, derating to 0 amps at 150°C
Reel Capacity: 5000 pcs

APPLICATIONS
Jumper wires or crossovers, as they are sometimes called, are basically interconnection devices between points on a PC board.
Generally they are used for the following reasons:
- Inability to connect two points on a PC board due to other circuit paths which must be crossed over.
- An after-the-fact design change that requires new point connections.
- Circuit tuning by changing point connections.

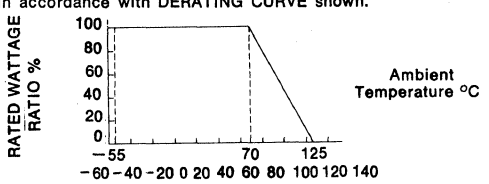
RECTANGULAR TYPE SURFACE MOUNT CHIP FIXED RESISTORS

RC SERIES

CONSTRUCTION AND MATERIAL
Wrap-Around Terminations



RATED WATTAGE
Rated wattage is specified at ambient temperature of 70°C and is to be derated in accordance with DERATING CURVE shown.



RATED VOLTAGE
Rated voltage shall be the AC or DC voltage corresponding to the rated wattage, and it shall be obtained by the following formula, however, if voltage obtained exceeds the Max. voltage shown in the table, the figure in the table shall be the Max.

$E = \sqrt{P.R}$ E: Rated Voltage (V) P: Rated Wattage (W) R: Nominal Value (Ω)

STANDARD RESISTANCE VALUE
Standard resistance value is E-12 series shown below. E-24 series and jumper chip are also available on request.

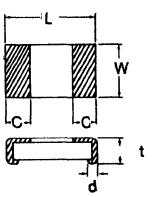
1.0	1.2	1.5	1.8	2.2	2.7	3.3	3.9	4.7	5.6	6.8	8.2

GENERAL SPECIFICATIONS TABLE

Type No.	Rated Wattage	Max. Working Voltage	Max. Overload Voltage	Resistance Range	Resistance Tolerance	Operating Temperature Range
RC110	1/32W	50V	100V	10Ω-2.2MΩ	K, M	−55 ~ +125°C
RC210	1/16W	150V	200V	10Ω-2.2MΩ	G, J, K	−55 ~ +125°C
RC310	1/10W	150V	200V	10Ω-2.2MΩ	J, K	−55 ~ +125°C
RC315	⅛W	200V	400V	10Ω-2.2MΩ	G, J, K	−55 ~ +125°C

TEMPERATURE COEFFICIENT

Nominal Value Ω	TCR ppm/°C
under 1K	−100 ~ +600
1K and over to under 100	−200 ~ +200
100K and over	−600 ~ +100

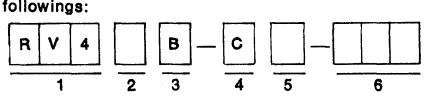


DIMENSIONS (mm)

Type	L	W	e	d	t
RC110	2.0 ±0.2	0.67 ±0.2	0.4 ±0.2	under 0.4	0.45 ±0.08
RC210	2.0 +0.2 −0.1	1.25 +0.05 −0.25	0.4 ±0.2	under 0.4	±0.45 ±0.08
RC310	2.75 ±0.2	1.0 ±0.2	0.5 ±0.2	under 0.5	0.45 ±0.08
RC315	3.10 ±0.15	1.55 ±0.15	0.5 ±0.2	under 0.5	0.55 ±0.1

SURFACE MOUNT CHIP TYPE METAL GLAZE POTENTIOMETERS

PART NUMBER CODE
Potentiometers are discriminated by size, number of terminals, characteristics, terminal configuration, way of adjustment, nominal values and part consists of followings:

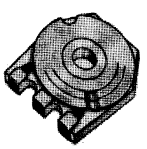


TYPE:
1 4-series metal glaze potentiometer (4.0 x 4.5)
2 Number of terminals:
2 ..... 2 terminals
3 ..... 3 terminals
3 Resistance taper:
B = B curve (linear)
4 Terminal configuration:
Chip type C
5 Adjustment driver:
Special driver no indication;
Minus driver V
6 Nominal Resistance values:
Shows resistance value —
Resistance range is shown in table 1.

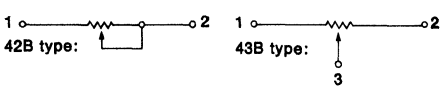
MARKING: Nominal resistance value to be stamped at bottom.

RATINGS

ITEMS	RATING
Power rating	⅛ W
Mechanical travel	270° ±20°C
Resistance range	470 ohm ~ 2.2Meg ohm
Resistance tolerance	−30 ~ +30%
Resistance taper	Linear (B curve)
Operating torque	20 ~ 200g.cm
Operating temp. range	−40 ~ 100°C



CIRCUIT CONFIGURATION



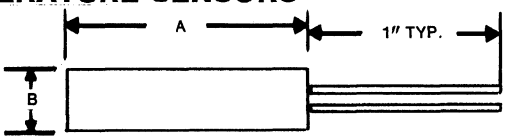
PERFORMANCE SPECIFICATIONS

ITEMS	SPECS	CONDITIONS
Temp. Characteristics	±3%	Resistance change in a chamber after 5 hours of 70° ±3°C
Operating life	±5%	25 cycles of 1 max. forward and backward rotation (10 cycles for under 10K ohm)
Load life	±5%	In a chamber of 70°C, repeat ON-OFF of rated load for 1000 hours.
Moisture load life	±5%	Repeat ON-OFF in a chamber of 40°C, 90-95% RH at rated power for 500 hours.
Temp. Cycling	±5%	5 cycles of −40°C, room temp. and 100°C.
Soldering heat	±5%	Dip terminals for 5 sec. at 260°C
Temp. coefficient	±300PPM/°C	Room Temp. and max. ambient temp.
Vibration	±1%	Total amplitude 1.5mm, 2 hours toward 3 ways of right angle each other.

MICRO-OHM CORPORATION
1088 HAMILTON ROAD, DUARTE, CALIFORNIA 91010
(818) 357-5377/TWX 910-587-3425 FAX 818 358-6478

CERAMIC ENCASED—TEMPERATURE SENSORS

Three popular sizes have been designed to fit ⅛", 3⁄16", ¼" diameter metal tubes. These high temperature elements are designed for the toughest industrial applications. Our RTD Sensors feature all welded construction for durability under stress and vibration. Stability, uniformity and repeatability are innate characteristics of these wire wound units.



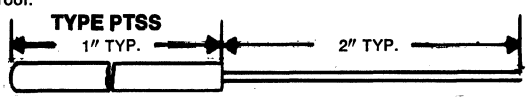
M-O Type PTC Series	Resistance Wire	Temperature Coefficient 0 to 100 degrees C	Max. Resistance (ohms)	Max. Temp.	R/T Curve Repeatability	A Lght. ±.060	B Dia. ±.01	C Lead Dia. ±.002
M10-PT	Platinum	3850 PPM	200	550 C.	Excellent			
M10-CPN	Chem. Pure Nickel	6720 PPM	120	300 C.	Good			
M10-N	Nickel 270	6000 PPM	120	300 C.	Fair	.575	.095	.015
M10-NF	Nickel Iron	5188 PPM	500	260 C.	Good			
M10-CU	Copper	4274 PPM	40	260 C.	Poor			
M20-PT	Platinum	3850 PPM	400	550 C.	Excellent			
M20-CPN	Chem. Pure Nickel	6720 PPM	200	300 C.	Good			
M20-N	Nickel 270	6000 PPM	200	300 C.	Fair	.575	.125	.015
M20-NF	Nickel Iron	5188 PPM	1000	260 C.	Good			
M20-CU	Copper	4274 PPM	60	260 C.	Poor			
M30-PT	Platinum	3850 PPM	400	550 C.	Excellent			
M30-CPN	Chem. Pure Nickel	6720 PPM	200	300 C.	Good			
M30-N	Nickel 270	6000 PPM	200	300 C.	Fair	.675	.170	.020
M30-NF	Nickel Iron	5188 PPM	1000	260 C.	Good			
M30-CU	Copper	4274 PPM	60	260 C.	Poor			

LEAD MATERIAL: Nickel for welding or Tinner copper for soldering 3-wire termination available for lead resistance cancellation

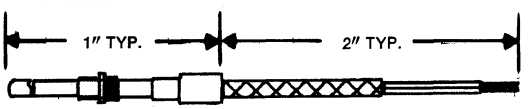
PTSS SERIES

PTC elements can be enclosed in stainless steel assemblies for severe environmental requirements. (see above) The O.D.'s available are ⅛", 5⁄32", 3⁄16", and ¼".
Lead wires are insulated with Teflon. Probes are pressure tight and moisture-proof.

TYPE PTSS



TYPE PTSSPF



(PRESSURE FITTING OPTIONAL)
FOR THREAD SIZE CONSULT FACTORY

WIREWOUND FUSE RESISTORS SERIES F-100

TWO FUNCTION—PRECISION WIREWOUND FUSE RESISTOR

GENERAL SPECIFICATIONS

Resistance Range: 0.2Ω—200Ω
Resistance Tolerance: 10%, 5% and 3%
Blow Characteristics: Per table
Continuous Operation: Per table
Operating Temperature: −55°C to +150°C
Temperature Coefficient: Under 1 ohm 50ppm/°C. Over 1 ohm 30ppm/°C.

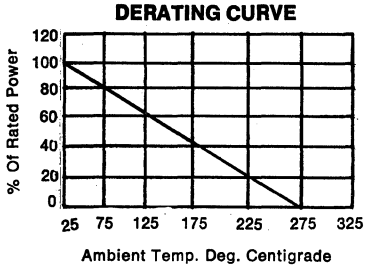
CONSTRUCTION FEATURES

1. Ceramic bobbin & shell
2. Single layer wound fusing element
3. All welded construction
4. Vacuum encapsulated
5. Flame proof

WHEN ORDERING PLEASE SPECIFY:

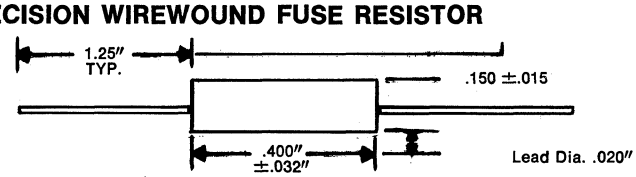
1. Normal operating current
2. Total resistance and tolerance
3. Current versus max. & min. blowtime

DERATING CURVE



ENGINEERING NOTE:

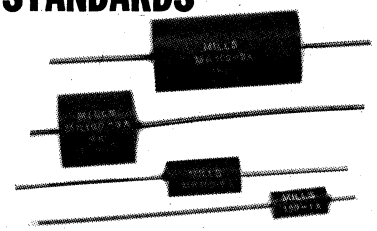
FUSE CONDITION 1 F100-F113 Approx. 4× rated current. F114-F128 Approx. 2.5× rated current.
FUSE CONDITION 2 F100-F113 Approx. 10× rated current F114-F128 Approx. 4× rated current



M-O Style	Res. (Ω)	Continuous Operation Amps	Continuous Operation Power Dis. Watts	Fuse Time 1 Amps	Fuse Time 1 Power Dis. Watts	Fuse Time 1 Max. Fuse Blow Time	Fuse Time 2 Amps	Fuse Time 2 Power Dis. Watts	Fuse Time 2 Max. Fuse Blow Time
F100	0.2	2.2A	1.0W	10A	20W	500ms	25A	125W	50ms
F102	0.2	2.2A	1.0W	10A	20W	300ms	25A	125W	30ms
F103	0.5	1.4A	1.0W	6A	18W	10sec	15A	112W	100ms
F104	0.5	1.4A	1.0W	6A	18W	500ms	15A	112W	50ms
F105	0.5	1.4A	1.0W	6A	18W	50ms	15A	112W	10ms
F106	1.0	1.0A	1.0W	4A	16W	10sec	10A	100W	100ms
F107	1.0	1.0A	1.0W	4A	16W	500ms	10A	100W	50ms
F108	1.0	1.0A	1.0W	4A	16W	50ms	10A	100W	10ms
F109	2.0	700ma	1.0W	3A	18W	10sec	7A	98W	50ms
F110	2.0	700ma	1.0W	3A	18W	200ms	7A	98W	50ms
F111	2.0	700ma	1.0W	3A	18W	50ms	7A	98W	10ms
F112	5.0	450ma	1.0W	2A	20W	200ms	4.5A	101W	50ms
F113	5.0	400ma	0.8W	1.5A	10W	50ms	4.0A	90W	10ms
F114	5.0	350ma	0.6W	1.0A	5W	100ms	1.4A	10W	20ms
F115	10	300ma	0.9W	1.2A	14W	200ms	3.0A	90W	10ms
F116	10	300ma	0.9W	1.0A	10W	100ms	1.3A	17W	50ms
F117	10	200ma	0.4W	600ma	3.6W	100ms	900ma	8W	50ms
F118	20	220ma	1.0W	600ma	7.2W	10sec	900ma	8W	100ms
F119	20	220ma	1.0W	600ma	7.2W	100ms	900ma	8W	50ms
F120	20	150ma	0.4W	350ma	2.4W	500ms	450ma	4W	50ms
F121	50	140ma	1.0W	400ma	8.0W	500ms	600ma	18W	50ms
F122	50	130ma	0.8W	350ma	6.1W	100ms	450ma	10W	50ms
F123	50	80ma	0.3W	200ma	2.0W	200ms	240ma	2.9W	50ms
F124	100	100ma	1.0W	250ma	6.2W	10sec	300ma	9.0W	100ms
F125	100	80ma	0.6W	200ma	4.0W	200ms	250ma	6.2W	250ms
F126	100	60ma	0.4W	140ma	1.4W	10sec	180ma	2.0W	200ms
F127	200	70ma	1.0W	200ma	8.0W	10sec	250ma	12.5W	100ms
F128	200	60ma	0.8W	150ma	4.0W	100ms	250ma	12.5W	10ms

PRECISION WIREWOUND RESISTORS

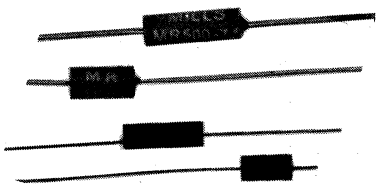
STANDARDS



Part No.	Watt	Max. R	Dia.	Length	Lead
MR100-1	.15	100K	.187	.375	#22
MR100-2	.25	1.5M	.250	.500	#22
MR100-3	.30	2.75M	.250	.750	#22
MR100-4	.35	3.0M	.375	.625	#20
MR100-5	.50	4.0M	.375	.828	#20
MR100-6	.50	5.0M	.50	.50	#20

Many other sizes available

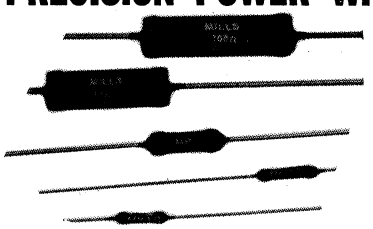
MINIATURE PARTS



Part No.	Watt	Max. R	Dia.	Length	Lead
MR500-1	.04	100K	.080	.210	#20
MR500-2	.05	125K	.080	.375	#24
MR500-3	.04	100K	.125	.125	#24
MR500-4	.05	125K	.100	.210	#24
MR500-5	.10	125K	.125	.187	#24
MR500-6	.10	125K	.125	.250	

- Lead Configuration:
  "A" after Part No. for Axial Leads
  "R" for Radial Leads
  "L" for Lugs
- For high speed applications (minimum distributed L and C) specify MR200 Series.
- For high stability applications specify MR300 Series.
- Tolerance: .005% and up; to .002% in some cases.
- Ask for our Precision Resistor Catalogue.
- Metric sizes available, ask for our Metric Flyer.

PRECISION POWER WIREWOUND RESISTORS

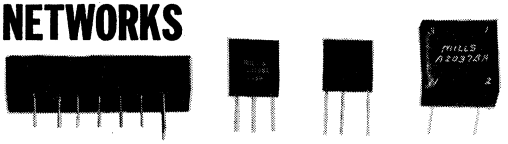


Part No.	Watt	Max. R	Dia.	Length	Lead
MRP-½	½	4.9K	.093	.343	#24
MRP-1	1	10.4K	.093	.406	#24
MRP-3	3	18K	.187	.562	#20
MRP-5	5	90K	.312	1.032	#18
MRP-10	10	370K	.344	1.719	#18

Many other sizes available

- To 10 watts.
- Silicone covered for maximum heat transfer.
- Tolerance: 5%, 1% standard, available to .05%.
- Non-Inductive winding available.
- Ask for our Power Resistor Catalogue.

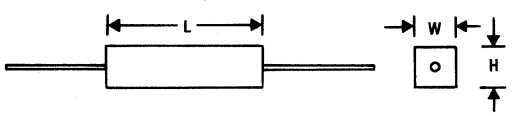
NETWORKS

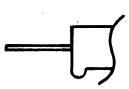


- Any configuration you desire.
- Matched 2, 3 or 4 Network configurations available in standard sizes.
- Standard R, 2R, 4R types, etc. available.
- Tolerances: To .005%, closer in some cases; Temperature Coefficient tracking to 1 PPM; Ratio matches to .001%.
- Ask for our Network Flyer.

FIBERGLASS CORE WIREWOUND RESISTORS

CERAMIC-CEMENT ENCASED RESISTORS

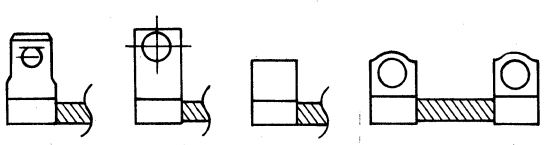




Stand Off Available

Part No.	Watt	Dimensions W	H	L	Leads
MRW-5	5	⅜	⅜	⅞	#20
MRW-7	7	⅜	⅜	1⅜	#20
MRW-10	10	⅜	⅜	1⅞	#20
MRW-15	15	½	½	1⅞	#18
MRW-22	22	½	½	2½	#18

UNCASED RESISTORS



ELECTRICAL SPECIFICATIONS

Tolerance ±10%, ±5″ available
Wattage to 20 watts
Positive temperature coefficient parts are available

MECHANICAL INFORMATION

Variety of terminals available
Tin plated steel or brass lug terminal material
Axial leads — tinned copper or copperweld
Core is silicone impregnated fiberglass
Most dimensions per your requirements

MILLS RESISTOR COMPANY, INC.

3840 CATALINA STREET
LOS ALAMITOS, CA 90720
(213) 598-2454

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SUITE #5
SACRAMENTO, CA 95823
(916) 422-5461

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CORPORATION

11731 Markon Drive, Garden Grove, California 92641

Orange County	Los Angeles	Northern California	Colorado	FAX
(714) 892-7749	(213) 598-9611	(408) 922-0500	(303) 799-0600	(714) 898-6769

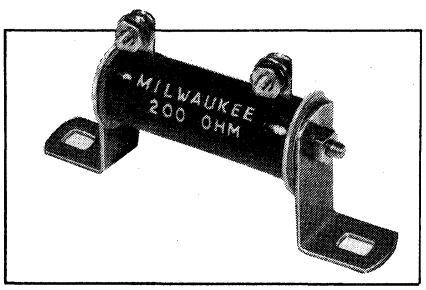
The National Resource℠ for Passive Components

CUSTOM ROUNDWIRE POWER RESISTORS

BASIC CONSTRUCTION

MRC can build a resistor to your specifications on any of the basic cores shown. If these do not fit your needs, engineering assistance is available for 32 additional cores. Ratings based on 325°C above 25°C ambient. Consider the following options to meet your requirements, special applications, and size limitations.

- **MIL-R-15109**
- **Special Tolerance**
  Resistance tolerances to ±1%
- **Special Coatings**
  Silicone-cement



- **Special Taps**
  Most any to fit your specifications
- **Special Windings**
  Aryton-Perry (non-inductive round-wire only)
  Bifilar (non-inductive)

- **Special T.C.**
  Temperature coefficient to 20 ppm/°C
- **Special Terminals**
  Single and double ¼" quick connect
  Metal sleeve ferrule
  Live-bracket
- **Hardware**
  Terminal hardware
  L-bracket mounting
  Spring clip mounting
  Vertical mounting hardware

LOAD BANKS

MRC will custom design and build load banks to your requirements.

AVAILABLE WATTAGE RATINGS by core size. Ratings based on 325°C above 25°C ambient.

	Core Size	Ohmic Range				
Watts	O.D.xI.D.xL.	Fixed †		Adjustable †		Part No.*
		Min Ω	Max Ω	Min Ω	Max Ω	
8(5)†	5/16x3/16x1	.82	13.5K	N.A.	N.A.	5-16-Ω
12(10)†	5/16x3/16x1¾	.12	49K	0.27	10.6K	5-28-Ω
11(8)	7/16x5/16x1	1.39	7.2K	N.A.	N.A.	7-16-Ω
15(10)	7/16x5/16x1½	.16	28.7K	N.A.	N.A.	7-24-Ω
20(15)†	7/16x5/16x2	.13	53.2K	N.A.	N.A.	7-32-Ω
26	7/16x5/16x3	.11	122K	N.A.	N.A.	7-48-Ω
25(20)†	9/16x5/16x2	.22	35K	0.50	19K	9-32-Ω
31(25)	9/16x5/16x2½	.11	55K	0.71	28K	9-40-Ω
50(35)†	9/16x5/16x4	.21	119K	1.34	54K	9-64-Ω
75	9/16x5/16x6	.33	207K	2.18	89K	9-96-Ω
24	¾x½x1½	.33	13K	N.A.	N.A.	12-24-Ω
30(25)	¾x½x2	.28	29K	0.66	26K	12-32-Ω
45(35)	¾x½x3	.18	63K	1.21	49K	12-48-Ω
51(40)	¾x½x3½	.22	83K	1.49	61K	12-56-Ω
61(45)	¾x½x4	.27	97K	1.77	73K	12-64-Ω
65(50)	¾x½x4½	.31	122K	2.04	84K	12-72-Ω
75(60)	¾x½x5	.35	134K	2.32	96K	12-80-Ω
90	¾x½x6	.43	172K	2.87	119K	12-96-Ω
100†	¾x½x6½	.47	186K	3.15	131K	12-104-Ω
40(33)	1⅛x¾x2	.48	7.9K	N.A.	N.A.	18-32-Ω

	Core Size	Ohmic Range				
Watts	O.D.xI.D.xL.	Fixed †		Adjustable †		Part No.*
		Min Ω	Max Ω	Min Ω	Max Ω	
80	1⅛x¾x4	.06	53K	0.40	48K	18-64-Ω
95	1⅛x¾x5	.08	79K	.56	79K	18-80-Ω
120	1⅛x¾x6	.11	100K	.71	100K	18-96-Ω
130(115)	1⅛x¾x6½	.12	111K	.78	111K	18-104-Ω
160	1⅛x¾x8	.15	144K	1.00	144K	18-128-Ω
175(160)†	1⅛x¾x8½	.16	156K	1.08	156K	18-136-Ω
225†	1⅛x¾x10½	.21	200K	1.38	200K	18-168-Ω
235	1⅛x¾x11¼	.22	216K	1.49	216K	18-180-Ω
240	1⅛x¾x11¾	.24	227K	1.56	227K	18-188-Ω
220	1⅝x1⅛x8½	.21	69K	1.38	69K	26-136-Ω
275	1⅝x1⅛x10½	.27	90K	1.81	90K	26-168-Ω
300	1⅝x1⅛x11¾	.31	104K	2.07	104K	26-188-Ω
500‡	2½x1¾x12	.49	34K	3.24	34K	40-192-Ωc
750‡	2½x1¾x15	.63	44K	4.22	44K	40-240-Ωc
1000‡	2½x1¾x20	.89	62K	5.85	62K	40-320-Ωc
1150‡	3¼x1¾x20	1.140	41K	7.58	41K	52-320-Ωc

• Wattages shown in parenthesis are Navy ratings per Mil-R-15109.
† Resistors shown are standard wattages
* Add "A" after part number for adjustable types.
† For resistance values outside the limits shown, consult MRC.
‡ Cement coating standard — Silicone available.
• Unable to find what you need above? The same cores can be wound with ribbon wire for higher wattage capability—See the ribwound A-1971.

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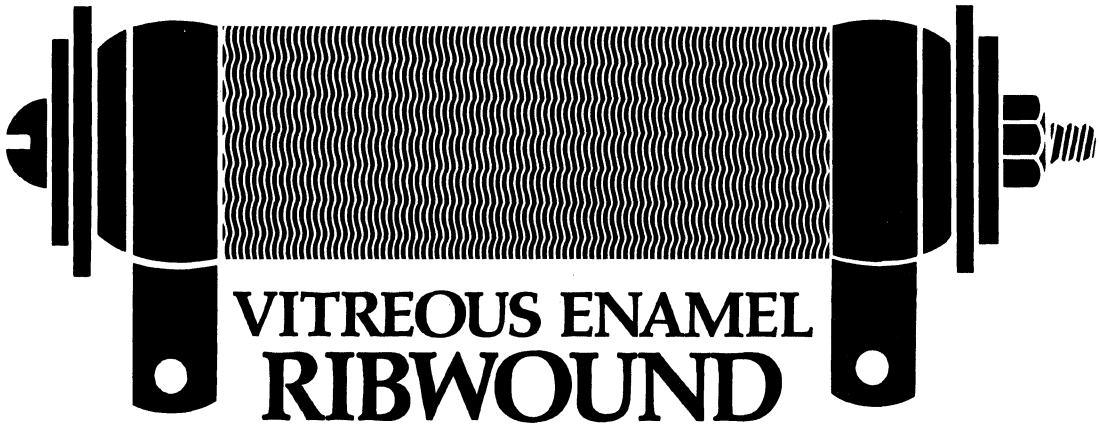

VITREOUS ENAMEL RIBWOUND RESISTORS

BASIC CONSTRUCTION

Crimped ribbon resistance wire is edgewound and then locked to the ceramic core with vitreous enamel. The resistance wire is spot welded to the terminal bands. MRC Ribwounds can be supplied in fixed, adjustable, or tapped styles. Cement or silicone coatings are optional.

HI-OHM RIBWOUNDS AN EXCLUSIVE WITH MRC

In the chart below, note that the maximum ohmic value shown for each wattage is 3 to 4 times higher than that normally available. This development is the result of precision rib winding machines designed specifically by MRC. Unique in the industry, these precision machines produce a winding with extreme uniformity. This allows much closer turns providing significantly higher resistance.

Hi-Ohm Ribwounds can replace lower ohmic value roundwire power resistors with savings in size.

OHMS	OHMS	OHMS
0.1	1.0	6.0
0.15	1.25	8.0
0.2	1.5	10.0
0.25	2.0	12.0
0.4	2.5	15.0
0.5	3.0	20.0
0.6	4.0	25.0
0.75	5.0	33.0

Many 300 watt units are stocked in both fixed and adjustable styles. Listed are the more popular 300 watt ohmic values. All other wattage ratings and styles are made to order.

APPLICATIONS

Recommended for use where high energy is to be dissipated in the lower ohmic ranges. With its ability to dissipate greater heat, the ribwound resistor is almost one half the physical size of an equally rated roundwire.

Ribwound wattage ratings are based on a temperature rise of 375°C above an ambient of 40°C.

They can be mounted with spring clips (thru 1⅛" dia.); thrubolt hardware, individual or multiple-stacked bracket assemblies or live-bracket assemblies.

WATTS	CORE SIZE	OHMIC RANGE #		PART NUMBER	
	O.D. x I.D. x L.	FIXED	ADJ.	FIXED	ADJ.
40	9/16x5/16x2	.010-10.6	N.A.	9-32-ΩR	USE SAME PART NUMBER BUT SUBSTITUTE "AR" FOR "R"
50	¾x½x2	.020-8.2	N.A.	12-32-ΩR	
60	¾x½x2½	.010-13.7	N.A.	12-40-ΩR	
75	¾x½x3	.010-19.3	N.A.	12-48-ΩR	
90	9/16x5/16x4	.015-28.3	.014-25.3	9-64-ΩR	
100	¾x½x3½	.012-24.5	.011-20.7	12-56-ΩR	
110	¾x½x4	.015-30.6	.014-26.8	12-64-ΩR	
120 (110)	¾x½x4½	.018-36.8	.017-32.9	12-72-ΩR	
135	¾x½x5	.021-42.9	.020-39.0	12-80-ΩR	
150	1⅛x¾x4	.019-44.8	.018-39.0	18-64-ΩR	
160	¾x½x6	.027-55.0	.027-51.3	12-96-ΩR	
160 (155)	1⅛x¾x4¼	.021-49.2	.020-43.6	18-68-ΩR	
175	1⅛x¾x4½	.023-53.7	.022-48.1	18-72-ΩR	
180	¾x½x6½	.030-61.3	.030-57.4	12-104-ΩR	
220	1⅛x¾x6	.035-80.6	.035-75.0	18-96-ΩR	

WATTS	CORE SIZE	OHMIC RANGE #		PART NUMBER	
	O.D. x I.D. x L.	FIXED	ADJ.	FIXED	ADJ.
225 (220)	1⅛x¾x6⅛	.036-82.8	.036-77.2	18-98-ΩR	USE SAME PART NUMBER BUT SUBSTITUTE "AR" FOR "R"
240 (240)	1⅛x¾x6½	.038-89.5	.039-83.9	18-104-ΩR	
300 (300)†	1⅛x¾x8½	.054-125	.055-120	18-136-ΩR	
375	1⅛x¾x10½	.069-161	.072-156	18-168-ΩR	
400	1⅛x¾x11¼	.075-175	.078-169	18-180-ΩR	
400 (400)	1⅝x1⅛x8½	.061-159	.062-149	26-136-ΩR	
420	1⅛x¾x11¾	.079-184	.082-178	18-138-ΩR	
500 (500)	1⅝x1⅛x10½	.081-210	.083-200	26-168-ΩR	
550 (550)	1⅝x1⅛x11¾	.093-242	.097-232	26-188-ΩR	
750‡	2½x1¾x12	.128-166	.130-158	40-192-ΩRC	
1000‡	2½x1¾x15	.168-217	.176-209	40-240-ΩRC	
1500‡	2½x1¾x20	.234-303	.248-294	40-320-ΩRC	
2000‡	3¼x1¾x20	.281-391	.300-380	52-320-ΩRC	

Standard resistance tolerance is ±10%—closer on request.
† Stock wattage—see stock list above.
‡ Cement coating is standard rather than vitreous enamel.
Wattages in parenthesis are Navy ratings per Mil-R-15109, Form EW.

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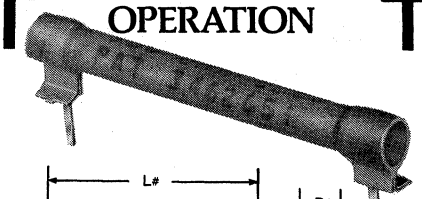
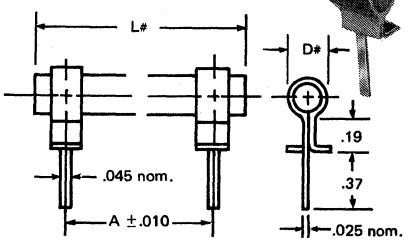
PCB RESISTORS

MOUNT AND TERMINATE IN ONE OPERATION



- **Built-in Standoffs Keep Board COOL.**
- Mounting feet prevent rocking.
- Power ratings 3 to 20 watts.
- Wide ohmic range.
- One-piece welded terminals.
- Standard pin spacing: 1/10" cc multiples, special spacing on request.
- Rectangular pins .025 x .045 in. (mount in .078" dia. PCB holes).
- Silicone-Quartz coating.
- Standard tolerances ±5% over 1 ohm, ±10% under 1 ohm & adjustable.
- 20 PPM upon request.
- Wattages based on 275° C rise above an ambient of 25° C.

* U.S. Patent 3,462,651.



FIXED

Watts	L#	A	D#	Min.Ω‡	Max.Ω‡	Part Number
3	1 1/32	0.6	5/16	.86	10K	3.5-13-Ω PCB
5	1 5/16	0.9	5/16	.181	19K	3.5-18-Ω PCB
7	1 23/32	1.3	5/16	.29	31K	3.5-24-Ω PCB
10	2 1/8	1.7	5/16	.4	43K	3.5-30-Ω PCB
15	2 1/8	1.7	13/32	.106	65K	5-32-Ω PCB
20	2 5/8	2.2	13/32	.142	88K	5-40-Ω PCB

ADJUSTABLE

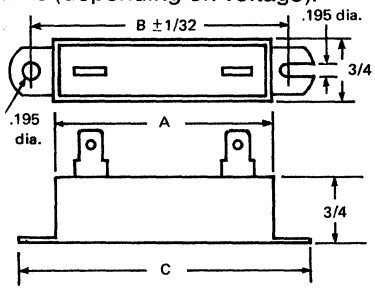
Watts†	L#	A	D#	Min.Ω‡	Max.Ω‡	Part Number
15	2 1/8	1.7	13/32	.69	14K	5-32-Ω A PCB
20	2 5/8	2.2	13/32	.93	19K	5-40-Ω A PCB

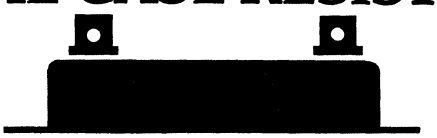
†Non-standard wattages in the range of 3-29 watts are possible—contact M.R.C.
‡For resistances above or below the limits shown, contact M.R.C.
#Maximum measurements.

METAL CASE RESISTORS

For Motor Starting, Speed Control, Solid State Ignition Systems, Shunts, Potted Circuits, and Voltage Dropping

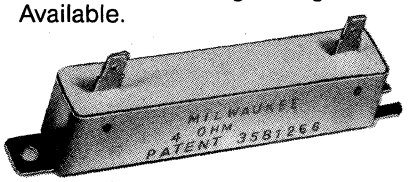
- High Heat Sink Capability—Flush Mounted Metal Case dissipates heat faster.
- Rugged—Shock Resistant.
- Wattage Rating—20 to 100 Watts (higher on specials)—based on 275° C rise above 25° C ambient.
- Resistance Range 0.2 ohm to 66,000 ohms (depending on voltage).





- Dielectric Strength—1500 Volts RMS (must be specified).
- Terminals—quick connect—screw/solder lugs.

- Additional Wattages Available.
- Additional Mounting Configurations Available.

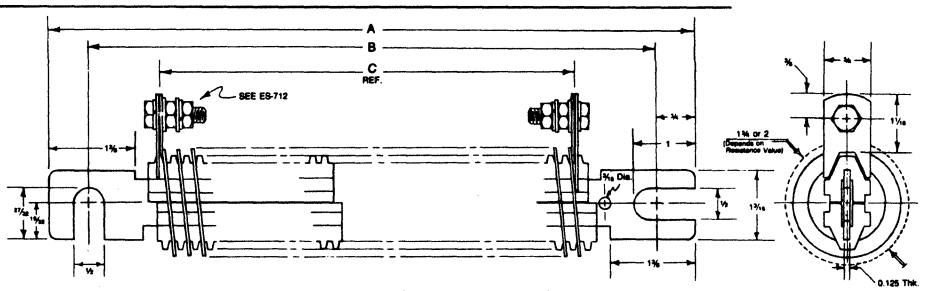


Watts Ratings at 275° C rise showing benefit of mounting flush for full heat sink.††		Dimensions			Ohmic Range		Part Number
Without Heat Sink	With Heat Sink	A	B	C	Min.Ω	Max.Ω	(Specify Terminal)
20	45	1	1 1/16	1 1/8	1.1	2750	12M16-Ω†
40	70	2 1/2	3	3 3/8	0.2	22K	12M40-Ω‡
50	100	3 11/16	4 1/8	4 9/16	0.2	66K	12M59-Ω‡

††Ratings based on mounting on steel panel 10" x 10" x .040"; (heat transfer to heat sink is improved by the use of thermal conductive grease or epoxy).
†Standard terminal is 3/16" wide with hole, Type AB. See Bulletin 8.
‡Standard terminal is single quick connect, Type H. See Bulletin 9.

PAT. 3,581,266

EDGEWOUND POWER RESISTORS



Form 3			Form 4			Form 5			Form 6			Form 7			Form 8		
600 Watt			800 Watt			1,000 Watt			1,200 Watt			1,400 Watt			1,600 Watt		
A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
12¼	11	8¼	15¼	14	11¼	18¼	17	14¼	21¼	20	17¼	24¼	23	20¼	27¼	26	23¼

Wattage rating based on 375°C rise above an ambient of 40°C

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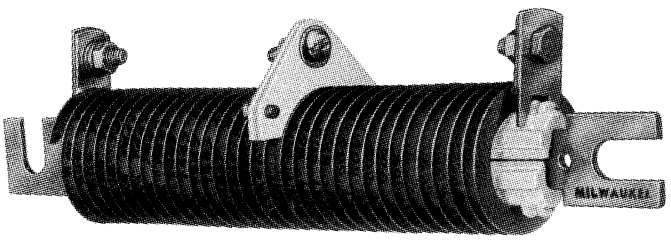
EDGEWOUND POWER RESISTORS

EDGE·POWER



HIGH CAPACITY GOOD WEIGHT/WATTAGE RATIO

New **EDGE-POWER** resistors complement Milwaukee Resistor's roundwire, ribwound and grid resistors which have been the industry's workhorse of electrical power dissipation for many years.

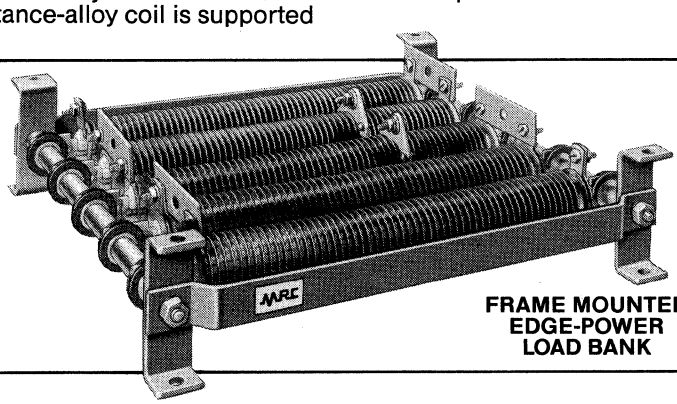
A continuous range of resistor types are now available for your high current applications. EDGE-POWER falls naturally between MRC's ribwound and grid resistors and allows full design versatility from one source.

Because of the open coil construction of EDGE-POWER resistors, heat dissipation is efficient, and reasonable surges/overloads are easily accommodated.

The heavy duty resistance-alloy coil is supported on specially designed porcelain insulators which provide insulation and proper turn-to-turn spacing. The end-slot/side-slot support bar provides versatility in mounting and adapts easily to many existing installations.

Movable tap terminals are available as an option. Terminal hardware for cable attachment is provided as a standard item on all terminals and taps.

Frame mounted load banks (as shown below) can be furnished with taps and jumpers to meet your circuit specifications (series, parallel or combination). Your load bank inquiries are invited.



FRAME MOUNTED EDGE-POWER LOAD BANK

Typical Applications of **EDGE-POWER** resistors include motor control (starting, plugging, speed control and braking), load dumping, ballast, current limiting, and voltage dropping. Edgewound resistors are commonly found in:

- Overhead Cranes
- Locomotives
- Lift Trucks
- Plating Baths
- Elevators
- Power Supplies
- Arc and Spot Welders
- Battery Lines/Chargers
- Many Industrial Controls

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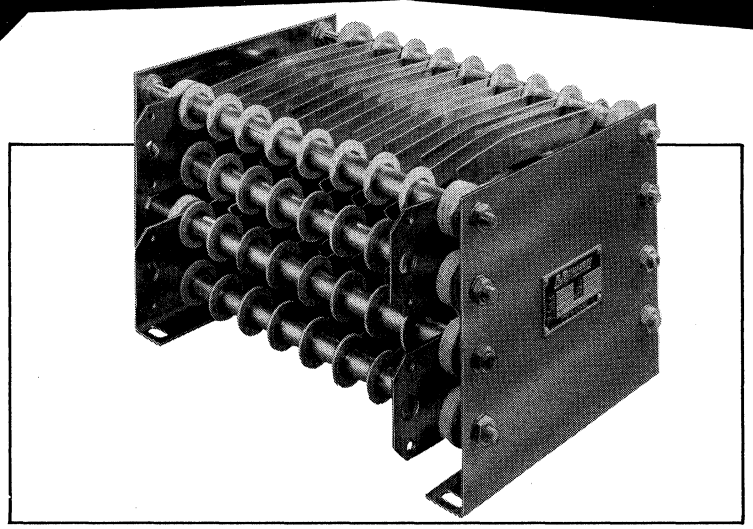
GRID RESISTORS



...For High Current and High Power Circuits

Milwaukee Grid Resistors are among the most versatile grid resistors developed. They are custom designed with the aid of a computer for specific applications.

Special features that assure longer life include: a patented* grid design that withstands overloads that would destroy conventional grids. Corrosion resistant stainless steel or special alloy elements. All-welded construction to eliminate hot spots and resistance fluctuations. Vibration-proof insulation that allows extended operation at higher voltages.

Taps and independent sections can be easily incorporated into the design to provide added flexibility. MRC grid units can be designed for use with natural convection cooling or with forced ventilation if size reduction is necessary.

They are competitively priced and incorporate more life and greater dependability than usually provided by conventional grid resistors.

*U.S. Patent 3,212,045

Typical Characteristics:

- 375° C temperature rise above an ambient of 40° C.
- Temperature coefficient of 150 ppm/° C.
- Hi potential test at 1500 VRMS—Higher on request.
- Resistances available to approximately 2 Ohms maximum.

Typical Applications:

- Motor starting
- Braking
- Power systems
- Crane controls
- Dummy loads
- Grounding resistors
- Speed controls
- Feedback resistors
- Heaters
- Industrial controls

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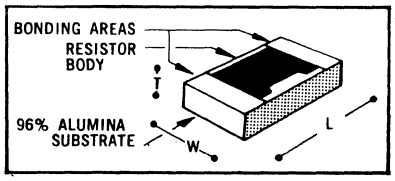
PRECISION THICK/THIN FILM CHIP RESISTORS

MINI-SYSTEMS, INC
20 David Road, P.O. Box 69, North Attleboro, MA 02761
TELEPHONE: (617) 695-0203 • TWX NO. 710-348-0564



MINI-SYSTEMS, INC., thick/thin film chip resistor components are ideally suited for the fabrication of microelectronic circuits where tight resistance tolerance, wide range of resistance values, or short production runs make the conventional screening and firing of thick/thin film resistance networks too costly. MINI-SYSTEMS, INC., chip resistors are made from a carefully engineered selection of materials. Geometries are mechanically precise and uniform. Careful testing and inspection result in the highest quality resistors.

STANDARD "MSR" SERIES

- Sizes Available: .035″ x .035″ up to .661″ x .494″.
- PDIS Rating (25°C free air): 40 mW to 15 W.
- Resistors manufactured with palladium silver or platinum gold.
- Tolerances available: ±.5%, 1%, 2%, 5%, 10%, and 20% for most resistance values.
- All types available in untinned versions for conductive epoxy attachment.
- Hi-Rel screening available on all resistor types.
- Backside metalization available upon request.
- "Flip-Chip" resistors are solder tinned (SN-62).
- Wire bond resistors have gold metalization optimized for wire bonding.
- Sandwich metalization standard on all wrap-around resistors.

***Wrap-Around Terminations**

WA-	Size (L x W)	PDIS Rating 25°C (Milliwatts)	Ohmic Range
10	.040 x .037	35	1Ω to 75MΩ
4	.057 x .052	250	1Ω to 100MΩ
13	.083 x .052	400	1Ω to 100MΩ
9	.110 x .052	500	1Ω to 100MΩ
7	.110 x .102	1000	1Ω to 100MΩ
24	.160 x .052	600	1Ω to 100MΩ

* Other standard sizes available.
Write for free literature with detailed resistor chart.

ESTABLISHED RELIABILITY QPL MIL-R-55342 CHIP RESISTORS FOR ALL CRITICAL APPLICATIONS

- Sizes 55342/1 through /6
- Terminations Available: S, R, W, T, U
- Tolerances Available: F, G, J, K
- Meet or exceed Characteristic K
- Delivery: Typically 4 weeks ARO

NEW LOW COST "JR" SERIES COMPUTER/INDUSTRIAL GRADE WRAP AROUND CHIP RESISTOR

TYPE #JR13 — .075(L) x .050(W) x .017(T)

- Resistance Range: 10Ω to 10MΩ to standard EIA/MIL/IEC resistance decade values.
- PDIS Rating (25°C free air): 200 milliwatts.
- Untinned for either epoxy or solder attachment.
- Delivery typically 2 weeks ARO.

THIN FILM

MSTF-2 SERIES

(.020″ x .020″)

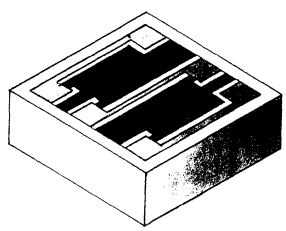
MSTF-3 SERIES

(.030″ x .030″)

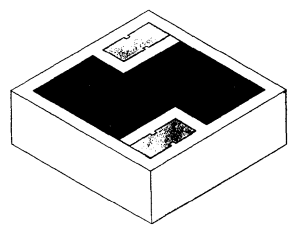
MSTF-4 SERIES

(.040″ x .040″)

CUSTOM NETWORKS



MSTF-3 FORMAT A



MSTF-3 FORMAT B

- Nichrome or Tantalum Nitride
- Choice of Substrates:
  a) Oxidized Silicon — .010″ ±.003″
  Oxide Thickness — 10,000 Å min.
  b) Ceramic, 99.6% —.010″ ±.001″
- Values range through the RETMA Series from 1Ω up to 10 megohm, depending on chip size.
- Tolerances: ±20%, 10%, 5%, 2%, 1%, 0.5% and 0.1% for most values.
- Backside gold available (3,000 Å typ.) on request.
- MSTF-3 series includes standard center tap dual resistor pattern.
- Visual requirements designed to meet MIL-STD-883 Method 2010.6 with full lot traceability of material and processing.
- Bond pad size: .005″ x .005″ minimum. Bond pad conductor material: Gold (20,000 Å typ.) standard. Bondable with normal wire bonding methods, such as thermocompression, thermosonic, or ultrasonic.
- Nichrome resistors passivated with silicon dioxide (5,000 Å typ.) for moisture protection and reliability. TCR (absolute) can be provided from 0-25 ppm. Special TCR's available on request.
- Noise: −30 to −35 dB typical for most values.
- Stability: 0.05% max. 0.02% typical. ± .003% typical Ratio. (After 1000 hours @ + 125°C.)
- Trimmable: Designed for later active trimming with Xenon or YAG Laser.
- Chip or Packaged

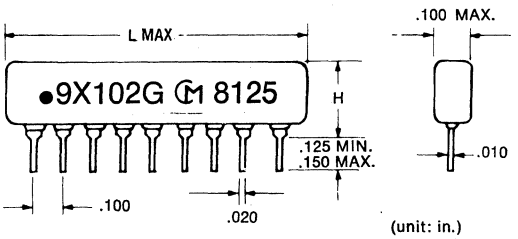
FOR ANY CUSTOM REQUIREMENTS, CONTACT FACTORY

THICK/THIN MULTILAYER SUBSTRATES/ HYBRID MICROCIRCUITS

MINI-SYSTEMS, INC. has the latest materials technology processing capabilities for thick film multilayer substrates/monolithic thick film substrates, and custom resistor networks coupled with complete facilities for hybrid assembly, packaging, and testing. Fully automatic wire bonders and fully automatic laser trim systems give substantial production quantity capabilities.

sip resistor networks

MURATA ERIE NORTH AMERICA



RSL H = .200 ⅛ W
RSC H = .250 ⅛ W
RSH H = .336 ¼ W

X-CIRCUIT

No. Pins	No. of Elements	L
4	3	0.395
5	4	0.495
6	5	0.595
7	6	0.695
8	7	0.795
9	8	0.895
10	9	1.024
11	10	1.100
12	11	1.200
13	12	1.300
14	13	1.390

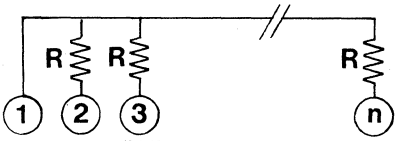
Y-CIRCUIT

No. Pins	No. of Elements	L
6	3	0.595
8	4	0.795
10	5	1.024
12	6	1.200
14	7	1.390

Z-CIRCUIT

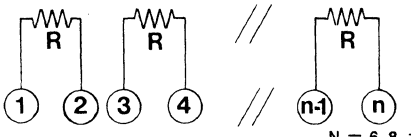
No. Pins	No. of Elements	L
6	8	0.595
8	12	0.795
9	14	0.895
10	16	1.024

X-Circuit — Parallel



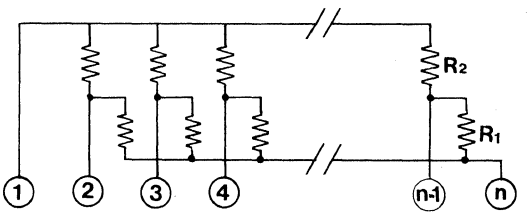
13 Elements Max. N = Pins 4 through 14

Y-Circuit — Discrete



7 Elements Max. N = 6, 8, 10, 12 and 14 Pins

Z-Circuit — Double Termination



16 Elements Max. N = 6, 8, 9 and 10 Pins

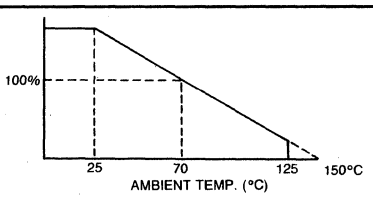
7 other circuits are std. plus custom design circuits available upon request.

SPECIFICATIONS

Electrical

Temp. Range:	−55°C to +125°C
Resistance Range:	22Ω to 1MΩ (22Ω to 1MΩ available on special request)
Resistance Tolerance:	±2% (G), ±5% (J), ±10% (K), ±20% (M)
Temp. Coefficient:	±200 ppm/°C max. (±100 ppm/°C max. on special order)
Power:	RSC-125 mW max./resistor or 1.5W max./package (whichever is smaller) RSH-250 mW max/resistor or 2.5W max./package (whichever is smaller)

Power Derating Characteristics:



Mechanical

Substrate Material:	Alumina
Resistor Material:	Cermet, thick film
Lead Pull Strength:	2 lbs.
Lead Material:	Tinned Copper Alloy

STANDARD RESISTANCES

Res. (ohms)	Code	Res. (ohms)	Code	Res. (ohms)	Code	Res. (ohms)	Code
100	101	1K	102	10K	103	100K	104
150	151	1.5K	152	15K	153	150K	154
220	221	2.2K	222	22K	223	220K	224
330	331	3.3K	332	33K	333	330K	334
470	471	4.7K	472	47K	473	470K	474
680	681	6.8K	682	68K	683	680K	684

TYPICAL RESISTANCE COMBINATIONS*

R_1/R_2	R_1/R_2	R_1/R_2
160/240	330/390	330/390
180/390	330/470	1.5K/3.3K
220/330	330/680	3K/6.2K

* **Note 1:** In addition to $R_1 = R_2$ resistance combinations, the typical resistor combinations shown in the chart are available on special order.
2: RC networks also available. Contact Murata Erie for technical details.

MARKING: Pin 1 Location, No. of Pins, Circuit Type, Res. Value, Tolerance, 4 = RSH ¼W only

PART NUMBERING SYSTEM

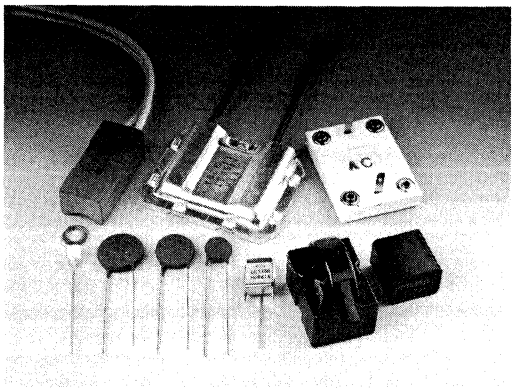
RSL 6 X 102 G

SINGLE IN-LINE RESISTOR NETWORK	NO. OF PINS	CIRCUIT TYPE	RESISTANCE CODE	RESISTANCE TOLERANCE
RSL (Low Profile) = ⅛ W RSC (Medium Profile) = ⅛ W (X,Z), ¼ W (Y), 1/32 W (L) RSH (High Profile) = ¼ W (X,Z)	4 pins thru 14 pins standard	X = Parallel Y = Discrete Z = Double Termination	First two digits are significant. Last digit specifies number of zeros to follow	J = ±5% G = ±2% F = ±1%

MURATA ERIE NORTH AMERICA 2200 Lake Park Dr., Smyrna, Georgia 30080 Tel: (404) 436-1300 Telex: 54-2329 TWX: 810-766-1531

posistor® positive temperature coefficient thermistors

MURATA ERIE NORTH AMERICA

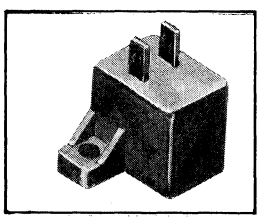


Murata Erie Posistors are basically positive temperature coefficient resistors with a very well defined resistance-temperature "knee" and the unique ability to "switch" relatively large amounts of power. They may also be used as self-regulating heating devices at useful power levels and as control devices for high power heaters. Applications include temperature sensing, over temperature and over current protection and motor starting to name a few.

Products utilizing Positors are extremely safe and reliable and offer all of the design, manufacturing, repair and sales advantages of solid state technology.

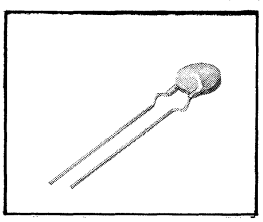
- Compact
- Reduced component count
- Extremely reliable
- "Stepless" temperature control
- Simple repair or replacement
- Long term reliability
- Shock and vibration immunity
- Nonflammable case and insulation available
- No electrical or acoustical noise
- No electrical contacts

FOR MOTOR STARTING



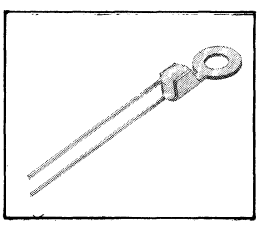
Provides a smooth, solid state electronic starting device for single phase motors utilizing a split-phase starting winding or for PSC motors as a direct replacement for starting capacitors and switches.

FOR CIRCUIT PROTECTION



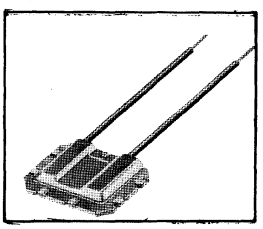
Provides overcurrent protection in a variety of applications. When connected in series with the protected device, Posistors limit the circuit current to a predetermined value — above that value they switch to a high resistance state and limit the current to a safe level.

FOR SEMICONDUCTOR OVERLOAD PROTECTION



Senses the case temperature of high power semiconductors and appropriately reduces the power dissipation when dangerous power or current levels are reached by switching to a high resistance state and reducing base bias current.

FOR HIGH POWER HEATING



Posistors for heating are self-temperature regulating with fast thermal response and power ratings to 170 watts.

NTC thermistors for surge current protection

Switching power supplies, CRT monitors, color TVs, and other power circuits need protection from extremely high surge currents. This protection can be realized with Murata Erie's power type NTC thermistors.

FEATURES

- Popular nominal resistance values available from 2.5-33 ohms
- Parts are coated with silicon resin, equivalent to UL 94V-1 grade of 250°C temperature resistance
- Resin coated parts give excellent recovery time characteristics
- Replaces many NTC's popular in the industry

Type	Resistance (25°C) +/−20% (Ohm)	Max. Steady State Current (Arms) (25°C)	Dimensions: (mm)			
			D max.	T max.	F	d
NTH22H2R5MA	2.5	9.5	23	6	7.5	1.0
NTH18H4R7MA	4.7	6.5	18.8	6	7.5	1.0
NTH18H6R8MA	6.8	5.8	18.8	6	7.5	1.0
NTH18H100MA	10	4.5	18.8	6	7.5	1.0
NTH18H150MA	15	4.1	18.8	6	7.5	1.0
NTH13H4R7MB	4.7	5.5	15.5	5.5	7.5	0.8
NTH13H6R8MB	6.8	5.0	15.5	5.5	7.5	0.8
NTH13H100MB	10	3.9	15.5	5.5	7.5	0.8
NTH13H150MB	15	3.5	15.5	5.5	7.5	0.8
NTH13H220MB	22	2.9	15.5	5.5	7.5	0.8
NTH13H330MB	33	2.2	15.5	5.5	7.5	0.8
NTH11H4R7MB	4.7	5.2	13.5	5.5	7.5	0.8
NTH11H150MB	15	3.1	13.5	5.5	7.5	0.8
NTH11H220MB	22	2.4	13.5	5.5	7.5	0.8
NTH9H100MB	10	3.3	11	5.5	7.5	0.8

glass encapsulated NTC thermistors

This NTC thermistor series features chip elements for high accuracy and stability. Encapsulated in glass, these thermistors are suitable for applications demanding high reliability and/or temperature and humidity extremes.

FEATURES

- Stable performance with negligible resistance and B-constant variation
- Glass encapsulation for reliable operation in high humidity-temperature environments
- Compact, light weight, easy to handle
- Custom orders can be produced to meet specific applications

Part Number	Resistance (25°C)	B-Constant[2]	Thermal Dissipation Constant	Thermal Time Constant	Operating Temperature Range
NTH300XH502□01	5KΩ	3350K±3%	2.0mW/°C (Typical)	20 Seconds (Typical)	−40~+300°C
NTH300XK103□01	10KΩ	3400K±3%			
NTH300XQ103□01	10KΩ	3650K±3%			
NTH300XW203□01	20KΩ	3950K±3%			
NTH300WA503□01	50KΩ	4000K±3%			
NTH300WC104□01	100KΩ	4100K±3%			
NTH300WE204□01	200KΩ	4200K±3%			

1: Letter denoting the resistance tolerance is entered into the box. (K:±10%, J:±5%, E:±3%).
2: Denotes the value obtained from the resistance at 25 and 50°C.

MURATA ERIE NORTH AMERICA
2200 Lake Park Dr., Smyrna, Georgia 30080 Tel: (404) 436-1300 Telex: 54-2329 TWX: 810-766-1531

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
ABS acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CAMAC computer automated measurement and control
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3
KSR keyboard send /receive

L
LC inductance capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIB microcomputer interface board
MIC microwave IC
MIPS million instructions per second
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

Nytronics Components Group, Inc.
700 ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

RESISTORS

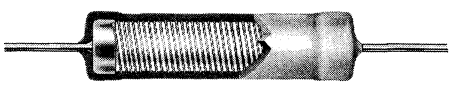
INDUSTRY'S FINEST RESISTORS

MIL-R-39007
ESTABLISHED RELIABILITY
FAILURE RATES M, P, AND R
.01%/1000 HRS.
RESISTANCE TOLERANCE ±1%
TEMPERATURE COEFFICIENT
±20 PPM/°C MAX. 10Ω AND HIGHER
±50 PPM/°C MAX. 1Ω TO 10Ω
±90 PPM/°C MAX. .1Ω TO 1Ω

SAGE SILICONE COATED fixed wire-wound units are not ordinary power resistors. They provide remarkable miniaturization vs. required wattage performance. Sage has pioneered the area of power handling capacity combined with precision and stability features ordinarily associated with Mil-R-93 resistors.

TYPE S: CONSTRUCTION

Showing ceramic core, spaced single layer winding, welded to stainless steel cap, and multiple layer coating.
Copperweld leads 60/40 Hot Solder Dip. Lead Length 2" ±1/16* is supplied on all sizes unless otherwise specified on purchase order.



* Except 250S and 500S Styles, which are 1½" minimum.

TYPE SB & NSB: HIGH WATTAGE COMMERCIAL BERYLLIA CORE RESISTORS

Standard Solderable Leads	Rated Watts G	Rated Watts V	Approx. Grams Weight
250SB	1	1.5	.18
500SB	1.5	2	.28
1000SB	2.25	2.75	.32
1200SB	3.5	4.5	1.0
1240SB	4	5	1.1
1250SB	4.5	6	1.2
1300SB	6	8	1.8
1500SB	7	9	3.6
1600SB	9	12	4.2
1700SB	14	18	7.3

TYPE S RESISTOR ITEM DESCRIPTION

Sage Part Number identification consists of a combination of numerals and letters according to the following guide. This is the nomenclature ordinarily marked on resistors and it fully serves the purpose of purchased item description except for limited cases of special testing. Note that grouping of characters is not constant, but varies to fit descriptive need of a given part.

STYLE DESIGNATION

1500 S/NS B 2740 1

- 1500 — Body type, size, lead details per catalog chart
- S/NS — S = single layer wound; NS = non-inductively wound
- B — if applicable — Core Material and Process Classification: Blank entry indicates regular steatite core, commercial processing; A = alumina core, commercial processing; B = beryllia core, commercial processing; P = alumina core, High Rel processing; M = beryllia core, High Rel processing
- 2740 — Nominal Value, Ohms (decimal symbol, as required, is used in both nominal value and tolerance)
- 1 — ±% tolerance

TYPE DESIGNATIONS

MIL STYLE	DETAIL SPEC. NO.	SAGE STYLE	MIL WATTS @ 25°C	AVAILABLE RESISTANCE RANGE
RWR80S RWR80W	/8E /8E	1009SM 1007SM	2	.10Ω to 2.67K
RWR81S RWR81W	/9C /9C	259SM 257SM	1	.10Ω to 1.0K
RWR89S RWR89W	/11C /11C	1249SM 1247SM	3	.10Ω to 4.12K
RWR71S RWR71W	/5D /5D	1259SP 1257SP	2	.10Ω to 16.2K
RWR74S RWR74W	/6C /6C	1509SP 1507SP	5	.10Ω to 12.1K
RWR78S RWR78W	/7C /7C	1709SP 1707SP	10	.10Ω to 39.2K

EXAMPLE PART DESIGNATION:

RWR-74 S 49R9 F R

- RWR-74 — Body Style
- S — Terminals: S — Solderable; W — Weldable; N — Non-inductive
- 49R9 — Nominal res., Ω. Three significant digits plus fourth indicating number of zeroes. Below 100Ω. R-decimal and following digits are significant.
- F — Tolerance ±1%
- R — Life failure rate

MIL-R-26E TYPE DESIGNATIONS

MIL STYLE	SAGE STYLE	MIL WATTS	DEFINED OHMIC RANGE: Single layer wound .00175 min. wire dia.	DEFINED OHMIC RANGE: .001 min. wire dia.
RW55V	1900S	7	.1—5100	
RW56V	1950S	14	.1—9100	
RW67V	1550S	6.5	.1—3600	.1—8200
RW68V	1700S	11	.1—8200	.1—20K
RW69V	1200S	3	.1—910	.1—2K

EXAMPLE: RW69 V 471

- RW69 — Body Style
- V — Characteristic, V only (350°C max.)
- 471 — Nominal resistance, Ω. Two significant digits plus third indicating number of zeros. Below 10ΩR = decimal and last digit is signifcant.

TOLERANCE: ±5% for values 1Ω and up; ±10% below 1Ω.
TC: ±260 ppm/°C 20Ω and up; 400 ppm/°C below 20Ω.

MIL STYLE	SAGE STYLE	MIL WATTS	VOLTAGE Max.	DEFINED OHMIC RANGE: Min.	Max. for .001" wire (Navy)	Max. for .0008" wire (all other)
RW70U	1000S	1	—	.1	1210	3160
RW74U	1500S	5	300	.1	12100	38300
RW78U	1700S	10	720	.1	40200	90900
RW79U	1240S	3	135	.1	3570	10500
RW80U	1000SB	2	—	.1	1240	3160
RW81U	250SB	1	25	.1	649	—

EXAMPLE: RW70 U 49R9 F

- RW70 — Body Style
- U — Characteristic, U only (275°C max.)
- 49R9 — Nominal resistance, Ω. Three significant digits plus four indicating number of zeros. Below 100ΩR decimal and following digits are significant.
- F — Tolerance ±% F = 1.0% B = .1% D = .5%

TC: ±30 ppm/°C 10Ω and above/±50 ppm/°C 1Ω to 10Ω/±90 ppm/°C below 1Ω.

SAGE BODY STYLE NO.	WATTAGE DATA (25°C AMBIENT) IND. STD.	SAGE CAPABILITY CHAR. G OR U 275°C	SAGE CAPABILITY CHAR. V 350°C	PHYSICAL DATA LEAD WIRE AWG NO.	BODY LENGTH INCHES	BODY DIAMETER INCHES	BODY DIELECTRIC STRENGTH VOLT rms	STD. RESISTANCE RANGE REGULAR WINDING MIN.	REGULAR WINDING MAX.	NON-INDUCTIVE MIN.	NON-INDUCTIVE MAX.
100S	1	1.2	1.7	24-.020	.400 Nom.*	.094±.031	500	0.1	8400	10	3000
200S	2	2.1	3	24-.020	.400 Nom.*	.125±.031	500	0.1	11,000	10	3900
250S	.25	.6	1	24-.020	.250±.031	.078±.016	500	0.1	3800	10	1350
300S	3	3	3.6	24-.020	.400 Nom.*	.187±.031	500	0.1	15,000	10	5300
500S	.5	.9	1.2	24-.020	.312±.031	.078±.016	500	0.1	5000	10	1750
1000S	1	1.2	1.7	24-.020	.406±.031	.094±.031	750	0.1	8400	10	3000
1100S	2	2.3	3.4	20-.032	.500±.062	.125±.031	1000	0.1	15,000	10	5500
1200S	2, 3	3	4	20-.032	.500±.062	.187±.031	1000	0.1	20,000	10	7000
1240S	3	3.2	4.2	20-.032	.562±.062	.187±.031	1000	0.1	24,000	10	8400
1250S	2, 3	3.5	5	20-.032	.812±.062	.187±.031	1000	0.1	40,000	10	14,000
1300S	3	4.2	5.5	18-.040	.625±.062	.250±.031	1000	0.1	30,000	10	10,500
1400S	3, 4	4.3	5.6	18-.040	.750±.062	.250±.031	1000	0.1	42,000	10	15,000
1500S	5	5.3	7.5	18-.040	.875±.062	.312±.031	1000	0.1	71,000	10	25,000
1550S	5	6	8	18-.040	1.000±.062	.312±.031	1000	0.1	88,000	10	31,000
1600S	7	7	9	18-.040	1.219±.062	.312±.031	1000	0.1	114,000	10	40,000
1700S	10	10	12	18-.040	1.781±.062	.375±.031	1000	0.1	230,000	10	80,000
1900S	7	10	12	18-.040	1.375±.062	.431±.031	1000	0.1	210,000	10	73,000
1950S	10	11	15	18-.040	1.437±.062	.431±.031	1000	0.1	314,000	10	110,000

* Clean lead to clean lead = .450 Max.

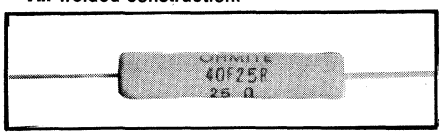
40 Series* 1% – 5% Tolerance

OHMITE®

Ohmicone® Silicone–Ceramic Conformal Axial Lead Wirewound Resistors
1% And 5% Tolerances

Features

- **Economical.**
- **Applications** include commercial, industrial and communications equipment.
- **Stability** under high temperature conditions.
- **All-welded construction.**



Ohmite's 40 Series resistors are the most economical conformal silicone-ceramic coated resistors offered. These all-welded units are characterized by their low temperature coefficients and resistance to thermal shock, making them ideal for a wide range of electrical and electronic applications.

Units with 1% and 5% tolerances are identical in construction and electrical specifications. Durable but economical 40 Series resistors exceed industry requirements for quality.

Specifications

- **Material** Coating: Conformal silicone-ceramic.
  Core: Ceramic.
  Terminals: Solder coated axial lead.

Weight:

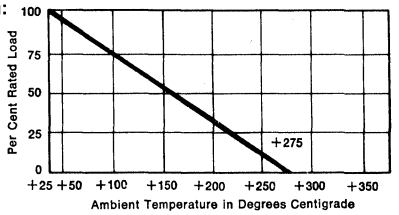
Power Rating Watts	1	2	3	5	10
Average Weight	.25 gms	.5 gms	1.0 gms	2.9 gms	7.9 gms

- **Electrical** Tolerance: ±1% and ±5%.
  Power Rating: Based on 25°C air rating.

Maximum Operating Voltage:

Power Rating Watts	1	2	3	5	10
Max. Voltage	150	100	200	460	1000

Derating:

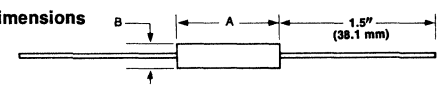


Overload:
Under 5 watts: 5 times rated wattage for 5 seconds.
5 Watts and over: 10 times rated wattage for 5 seconds.

Temperature Coefficient: Under 1 Ohm ±90 ppm/°C.
1 to 9.99 Ohms ±50 ppm/°C.
10 Ohms and Over ±20 ppm/°C.

Dielectric Withstanding Voltage: 1000 VAC for 3, 5, and 10 watt rating. 500 VAC for 1 watt rating.

- **Dimensions**



Power Rating Watts	Body Dimensions Max. Lgth.—A in.	A mm	Max. Dia.—B in.	B mm	Leads Ga.
1	.437	11.1	.125	3.2	24
2	.406	10.3	.219	5.6	20
3	.563	14.3	.250	.64	20
5	.937	23.8	.343	8.7	18
10	1.843	46.8	.406	10.3	18

[1] Popular items appear in **BOLD** print and are usually in stock at authorized Ohmite stocking distributors. Items appearing in LIGHT FACE print are available from stocking distributors but are not normally stocked in depth. **PARENTHESES** (items) indicate non-stock standard items subject to a minimum handling charge per item.

* 40 Series 1% formerly Series 44 1% (Non-Mil Specification)
40 Series 5% formerly Series 44 5% (Mil Specification)

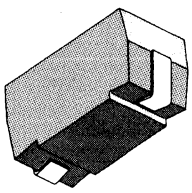
Ohmite Mfg. Co.
3601 Howard St., Skokie, IL 60076
(312) 675-2600 • TWX 910-223-0805
TELEX 72-4433 • FAX 312-675-1505

Stock Part Numbers[1] For Standard Resistance Values
(Non Standard Values Available By Special Order. Contact Nearest Ohmite Sales Office.)

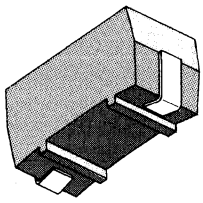
Ohms	1% Tolerance Part No. 1 Watt	3 Watt	5 Watt	10 Watt	5% Tolerance Part No. 1 Watt	2 Watt	3 Watt	5 Watt	10 Watt
.1		**43FR10**	**45FR10**	**40FR10**	**41JR10**	**42JR10**	**43JR10**	**45JR10**	**40JR10**
.15		43FR15	**45FR15**	40FR15	41JR15	42JR15	43JR15	45JR15	40JR15
.2		**43FR20**	**45FR20**	40FR20	41JR20	**42JR20**	43JR20	**45JR20**	40JR20
.3		43FR30	45FR30	40FR30	41JR30	42JR30	**43JR30**	45JR30	40JR30
.4		43FR40	45FR40	40FR40	41JR40	42JR40	43JR40	45JR40	40JR40
.5		**43FR50**	**45FR50**	40FR50	41JR50	42JR50	**43JR50**	45JR50	40JR50
.75		(43FR75)	45FR75	40FR75	**41JR75**	42JR75	43JR75	45JR75	40JR75
1	**41F1R0**	43F1R0	45F1R0	40F1R0	41J1R0	42J1R0	**43J1R0**	45J1R0	40J1R0
1.5	41F1R5	43F1R5	45F1R5	40F1R5	41J1R5	42J1R5	43J1R5	45J1R5	40J1R5
2	41F2R0	43F2R0	45F2R0	40F2R0	41J2R0	42J2R0	43J2R0	45J2R0	40J2R0
2.2	41F2R2	43F2R2	45F2R2	40F2R2	41J2R2	42J2R2	43J2R2	45J2R2	40J2R2
3	41F3R0	43F3R0	45F3R0	(40F3R0)	41J3R0	42J3R0	43J3R0	45J3R0	40J3R0
4	41F4R0	43F4R0	45F4R0	40F4R0	41J4R0	42J4R0	43J4R0	45J4R0	40J4R0
5	41F5R0	43F5R0	45F5R0	40F5R0	41J5R0	42J5R0	43J5R0	**45J5R0**	40J5R0
7.5	41F7R5	**43F7R5**	45F7R5	40F7R5	(41J7R5)	42J7R5	43J7R5	45J7R5	40J7R5
10	41F10R	43F10R	45F10R	40F10R	41J10R	42J10R	43J10R	**45J10R**	**40J10R**
12	(41F12R)	43F12R	(45F12R)	40F12R	41J12R	42J12R	43J12R	45J12R	40J12R
15	41F15R	43F15R	**45F15R**	(40F15R)	41J15R	(42J15R)	43J15R	45J15R	**40J15R**
18	(41F18R)	43F18R	(45F18R)	(40F18R)	(41J18R)	(42J18R)	43J18R	45J18R	40J18R
20	41F20R	43F20R	45F20R	40F20R	(41J20R)	42J20R	43J20R	45J20R	40J20R
22	41F22R	43F22R	45F22R	(40F22R)	41J22R	42J22R	43J22R	45J22R	40J22R
25	41F25R	43F25R	45F25R	(40F25R)	(41J25R)	42J25R	43J25R	45J25R	40J25R
27	(41F27R)	43F27R	45F27R	40F27R	(41J27R)	42J27R	43J27R	45J27R	40J27R
30	41F30R	43F30R	45F30R	40F30R	(41J30R)	42J30R	(43J30R)	45J30R	40J30R
33	41F33R	43F33R	(45F33R)	40F33R	(41J33R)	42J33R	43J33R	45J33R	40J33R
35	41F35R	(43F35R)	45F35R	40F35R	41J35R	42J35R	(43J35R)	45J35R	(40J35R)
39	41F39R	43F39R	(45F39R)	(40F39R)	(41J39R)	42J39R	43J39R	45J39R	(40J39R)
40	41F40R	43F40R	45F40R	40F40R	(41J40R)	(42J40R)	(43J40R)	45J40R	40J40R
47	41F47R	43F47R	(45F47R)	(40F47R)	41J47R	42J47R	43J47R	45J47R	40J47R
50	41F50R	43F50R	45F50R	40F50R	41J50R	42J50R	43J50R	**45J50R**	40J50R
56	41F56R	43F56R	(45F56R)	40F56R	41J56R	42J56R	43J56R	45J56R	40J56R
62	41F62R	43F62R	45F62R	40F62R	(41J62R)	42J62R	(43J62R)	45J62R	40J62R
68	41F68R	43F68R	45F68R	40F68R	41J68R	42J68R	**43J68R**	45J68R	(40J68R)
75	41F75R	43F75R	(45F75R)	40F75R	41J75R	42J75R	43J75R	45J75R	40J75R
82	(41F82R)	**43F82R**	45F82R	40F82R	41J82R	42J82R	43J82R	45J82R	(40J82R)
100	41F100	43F100	45F100	40F100	41J100	42J100	43J100	45J100	40J100
120	(41F120)	43F120	45F120	40F120	(41J120)	42J120	43J120	45J120	(40J120)
125	41F125	(43F125)	(45F125)	40F125	41J125	(42J125)	**43J125**	45J125	40J125
150	41F150	43F150	45F150	(40F150)	41J150	42J150	43J150	**45J150**	40J150
180	41F180	43F180	(45F180)	40F180	(41J180)	42J180	43J180	45J180	(40J180)
200	41F200	43F200	45F200	40F200	41J200	42J200	43J200	45J200	40J200
220	41F220	43F220	(45F220)	(40F220)	41J220	(42J220)	43J220	45J220	40J220
225	(41F225)	(43F225)	(45F225)	40F225	(41J225)	(42J225)	(43J225)	45J225	(40J225)
250	41F250	43F250	45F250	40F250	41J250	42J250	43J250	45J250	40J250
270	41F270	43F270	(45F270)	40F270	41J270	42J270	43J270	45J270	40J270
300	41F300	(43F300)	45F300	40F300	41J300	42J300	43J300	45J300	40J300
330	41F330	(43F330)	(45F330)	(40F330)	(41J330)	42J330	43J330	45J330	40J330
350	(41F350)	43F350	(45F350)	40F350	(41J350)	(42J350)	43J350	45J350	(40J350)
390	(41F390)	43F390	(45F390)	(40F390)	41J390	42J390	43J390	45J390	40J390
400	41F400	43F400	45F400	(40F400)	41J400	(42J400)	43J400	45J400	40J400
450	(41F450)	43F450	45F450	(40F450)	(41J450)	(42J450)	(43J450)	(45J450)	(40J450)
470	41F470	43F470	45F470	(40F470)	41J470	42J470	43J470	45J470	(40J470)
500	41F500	43F500	45F500	40F500	(41J500)	42J500	43J500	45J500	(40J500)
560	41F560	43F560	45F560	40F560	**41J560**	(42J560)	(43J560)	45J560	40J560
600	41F600	43F600	45F600	40F600	(41J600)	(42J600)	43J600	45J600	40J600
680	41F680	43F680	(45F680)	40F680	41J680	42J680	43J680	45J680	(40J680)
750	41F750	43F750	45F750	40F750	41J750	(42J750)	43J750	45J750	(40J750)
800	41F800	43F800	45F800	40F800	(41J800)	(42J800)	43J800	(45J800)	(40J800)
820	41F820	43F820	45F820	(40F820)	41J820	42J820	43J820	**45J820**	(40J820)
900	41F900	43F900	(45F900)	(40F900)	(41J900)	(42J900)	43J900	45J900	(40J900)
1,000	41F1K0	43F1K0	45F1K0	40F1K0	**41J1K0**	42J1K0	43J1K0	45J1K0	40J1K0
1,100	(41F1K1)	(43F1K1)	45F1K1	40F1K1	(41J1K1)	42J1K1	(43J1K1)	45J1K1	(40J1K1)
1,200	41F1K2	(43F1K2)	45F1K2	40F1K2	(41J1K2)		43J1K2	45J1K2	40J1K2
1,500	41F1K5	43F1K5	45F1K5	(40F1K5)	41J1K5	42J1K5	43J1K5	(45J1K5)	40J1K5
1,800	41F1K8	(43F1K8)	45F1K8	40F1K8	41J1K8		43J1K8	45J1K8	(40J1K8)
2,000	41F2K0	43F2K0	45F2K0	40F2K0	(41J2K0)		43J2K0	45J2K0	40J2K0
2,200	41F2K2	43F2K2	45F2K2	40F2K2	(41J2K2)		43J2K2	45J2K2	40J2K2
2,500	41F2K5	43F2K5	45F2K5	40F2K5	41J2K5		43J2K5	45J2K5	40J2K5
2,700	(41F2K7)	(43F2K7)	45F2K7	40F2K7	(41J2K7)		43J2K7	45J2K7	(40J2K7)
3,000	41F3K0	43F3K0	45K3K0	40F3K0	(41J3K0)	42J3K0	43J3K0	45J3K0	40J3K0
3,300		(43F3K3)	(45F3K3)	(40F3K3)			43J3K3	45J3K3	(40J3K3)
3,500		43F3K5	45F3K5	(40F3K5)			(43J3K5)	45J3K5	(40J3K5)
3,900		43F3K9	45F3K9	40F3K9			43J3K9	45J3K9	40J3K9
4,000		43F4K0	(45F4K0)	40F4K0			(43J4K0)	45J4K0	(40J4K0)
4,500		(43F4K5)	(45F4K5)	40F4K5			(43J4K5)	45J4K5	(40J4K5)
4,700		43F4K7	45F4K7	(40F4K7)			(43J4K7)	45J4K7	(40J4K7)
5,000		43F5K0	45F5K0	40F5K0			43J5K0	45J5K0	40J5K0
6,000		(43F6K0)	45F6K0	(40F6K0)			43J6K0	45J6K0	(40J6K0)
6,800		43F6K8	45F6K8	(40F6K8)			43J6K8	45J6K8	(40J6K8)
7,000		43F7K0	45F7K0	(40F7K0)			(43J7K0)	(45J7K0)	(40J7K0)
7,500		43F7K5	45F7K5	(40F7K5)			43J7K5	45J7K5	40J7K5
8,000		43F8K0	(45F8K0)	40F8K0			(43J8K0)	45J8K0	(40J8K0)
9,000		(43F9K0)	45F9K0	(40F9K0)			43J9K0	(45J9K0)	(40J9K0)
10,000		43F10K	45F10K	40F10K			43J10K	45J10K	40J10K
12,000			(45F12K)	40F12K					
13,000			45F13K	(40F13K)					
15,000			45F15K	40F15K					
17,000			45F17K	(40F17K)					
20,000			45F20K	**40F20K**					
22,000			45F22K	40F22K					
25,000			45F25K	40F25K					
30,000			**45F30K**	(40F30K)					
33,000				40F33K					
35,000				(40F35K)					
40,000				40F40K					
50,000				40F50K					

Ohmite Surface Mount Power Resistors

OHMITE®



Pedestal mount design is ideal for wave soldering.



Recessed foot mount design is ideal for reflow soldering.

Features

- Replaces an entire series of lower wattage chip resistors, saving real estate.
- Available in 1.5- or 2.5-watt power ratings in wirewound or film construction. (Other ratings under development.)
- Increased reliability. Ratings are determined by temperatures on the circuit board at the solder junction, not the hot spot.
- Patent-pending, flexible J-bend terminations to reduce the chance of solder joint breakage due to thermal expansion.
- Rectangular shape lends itself to applications with pick-and-place equipment.

With Ohmite Surface Mount Resistors, not only do you save room in circuit board real estate, but you save money in simplified design and easy manufacturing. Select film resistors for general purpose applications. Specify wirewound models for applications requiring lower resistance values, tighter tolerances, or lower temperature coefficients.

Performance specifications

Series	F1S5/F1R5	W1S5/W1R5	F2R5	W2R5
Power at 25°C Ambient	1.5 WATTS	1.5 WATTS	2.5 WATTS	2.5 WATTS
Max Voltage	500V	200V	750V	350V
Resistance Range	10 OHMS to 1 MEGOHM	0.1 OHM to 2000 OHMS	10 OHMS to 1 MEGOHM	0.1 OHM to 5000 OHMS
Resistance Tolerance	±5% STD	±5% STD	±5% STD	±5% STD
Temperature Coefficient 0.1 to 1 OHM		0 ±90 ppm/°C		0 ±90 ppm/°C
1 to 10 OHMS	0 ±350 ppm/°C	0 ±50 ppm/°C	0 ±350 ppm/°C	0 ±50 ppm/°C
10 OHMS and Over	0 ±250 ppm/°C	0 ±20 ppm/°C	0 ±250 ppm/°C	0 ±20 ppm/°C
Dielectric Withstanding	1000 VAC	1000 VAC	1000 VAC	1000 VAC

NOTE: Molding material rated at 180°C continuous. Ohmite reserves the right to make changes in product specifications and availability without notice or liability.

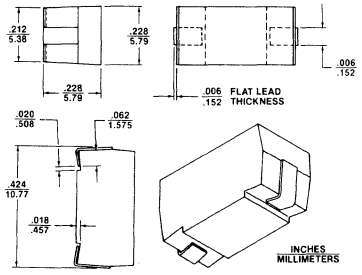
Environmental tests

Test	Mounting Board Material: Epoxy/Glass (Maximum △ R)
Temperature Cycle −55°C to 125°C 100 Cycles No mechancial damage	3.0%
Load Life 1000 hours @ max. load @ 25°C	3.0% Wire 5.0% Film
Momentary Overload 6.25 x Rated wattage, 5 sec.	2.0%
Solder Immersion 260°C Immersion, 10 sec.	0.5%
High Temperature Exposure 10 days @ 125°C	3.0%
Leaching 260°C solder Immersion, 60 sec.	No visual leaching
Thermal Shock Units @ −55°C then rated power applied	No mechanical damage
Flammability Rating	UL Material rating, UL94V0
Solderability	95% Coverage within 1/16" of contact point

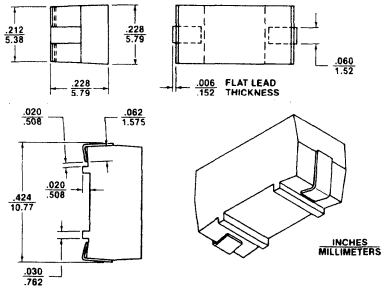
IMPORTANT: This information is based on data obtained by our own research and is considered accurate. However, no warranty is expressed or implied regarding the accuracy of those data, the results to be obtained from the use thereof, or that any such use will infringe on any patent.

Dimensions

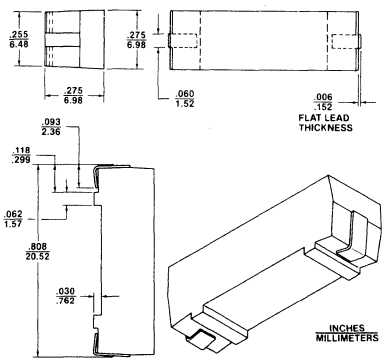
Standard pedestal mount design (F1S5/W1S5).



Recessed foot mount design (F1R5/W1R5).



Recessed foot mount design (F2R5/W2R5).



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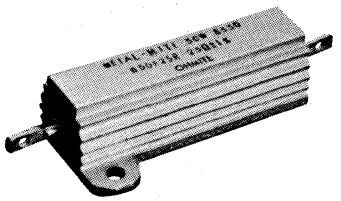
Tel. 312/675-2600 • TWX 910/223-0805 • TELEX: 72-4433 • FAX 312-675-1505

89 Type Metal-Mite®—Aluminum-housed, wirewound resistors OHMITE®



89 Type Metal-Mite resistors meet or exceed MIL-R-18546 specifications.

Features

High stability — ±0.5% ΔR

High power-to-size ratio

Molded construction

Aluminum housing — for secure chassis mounting and heat-sinking capabilities

Meet (or exceed) MIL-R-18546 specifications

Available in higher power ratings than standard axial-lead resistors

Higher stability — High power-to-size ratios

The 89 Type Metal-Mite resistors are high-performance, axial-lead type resistors. Aluminum-housed, they maintain high stability during operation and securely mount to chassis surfaces. In addition, their metal housing provides heat-sinking capabilities, for power ratings exceeding MIL specifications.

Available in power ratings which are higher than standard axial lead resistors, the 89 Metal-Mite resistors are better suited to withstand vibration, shock and harsh environments.

Material specifications

Housing:
Metal, anodized aluminum

Internal coating:
Silicone Ceramic

Core:
Ceramic

Electrical specifications

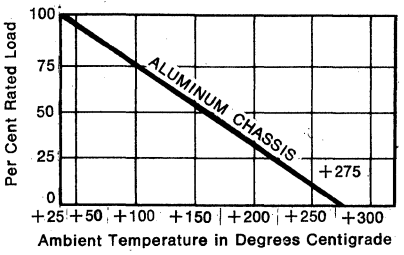
Tolerance:
±1% other tolerances available)

Overload:
5 times rated wattage for 5 seconds

Temperature Coefficient:
Under 1 Ohm: ±90 ppm/°C
1 to 9.99 Ohms: ±90 ppm/°C
10 Ohms and over: ±90 ppm/°C

Proper Heat Sink:
5 and 10 watt units: 4″ x 6″ x 2″ x .040″ (Aluminum chassis)
25 watt units: 5″ x 7″ x 2″ x .040″ (Aluminum chassis)
50 watt units: 12″ x 12″ x .059″ (Aluminum panel)

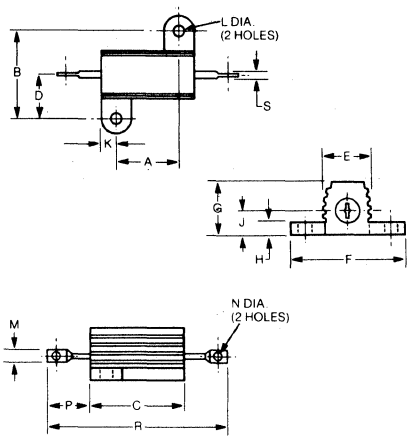
Derating:



Maximum/Dielectric Voltage/ Average Weight

Power Rating Watts	5	10	25	50
Maximum Voltage	210	320	520	1170
Dielectric Withstanding Voltage (VAC)	1000	1000	2500	2500
Average Weight	2.6 gms	5.2 gms	12.0 gms	27.5 gms

Dimensions (Millimeters)



Power Rating MIL-R-Type	Watts	A ± .127	B ± .127	C ± .787	D ± .064	E ± .381	F ± .381	G ± .381	H ± .245	J ± .381	K ± .254	L ± .127	M Min.	N ± .127	P ± .158	R ± .158	S Dia.
RE60G	5†	11.28	12.45	15.24	6.22	8.48	16.41	8.13	1.52	3.90	1.98	2.36	2.16	1.27	6.76	28.58	1.29
RE65G	10†	14.27	15.88	19.05	7.93	10.67	20.32	9.91	1.90	4.65	2.36	2.36	3.56	2.18	7.92	34.93	2.05
RE70G	20††	18.26	19.84	26.97	9.93	13.97	27.43	13.87	2.24	2.54	4.37	3.18	3.56	2.18	11.13	49.23	2.05
RE75G	30††	39.70	21.44	49.99	10.72	16.00	28.96	15.49	2.24	2.54	4.98	3.18	3.56	2.18	11.13	70.64	2.05

† Can be rated 7.5 and 12.5 watts respectively. †† Rated 25 and 50 watts, respectively, by Ohmite.

Part numbers[1] for standard resistance values (Non-standard values available by special order)

Ohms	Part No. 5 Watt RE60G	10 Watt RE65G	25 Watt RE70G	50 Watt RE75G	Ohms	Part No. 5 Watt RE60G	10 Watt RE65G	25 Watt RE70G	50 Watt RE75G	Ohms	Part No. 5 Watt RE60G	10 Watt RE65G	25 Watt RE70G	50 Watt RE75G
.1			**825FR10**	**850FR10**	40	(805F40R)	810F40R	—	—	3.000	(805F3K0)	**810F3K0**	825F3K0	(850F3K0)
.3			825FR30	(850FR30)	50	805F50R	810F50R	825F50R	**850F50R**	3.500	(805F3K5)	(810F3K5)	—	—
.5			825FR50	(850FR50)	75	(805F75R)	(810F75R)	825F75R	**850F75R**	4.000	805F4K0	810F4K0	—	—
.7			(825FR70)	(850FR70)	100	805F100	810F100	825F100	**850F100**	4.500	(805F4K5)	(810F4K5)	—	—
1	**805F1R0**	**810F1R0**	**825F1R0**	**850F1R0**	150	805F150	810F150	**825F150**	**850F150**	5.000	805F5K0	810F5K0	825F5K0	850F5K0
1.5	(805F1R5)	810F1R5	—	—	200	(805F200)	(810F200)	825F200	850F200	6.000	(805F6K0)	(810F6K0)	—	—
2	(805F2R0)	810F2R0	**825F2R0**	**850F2R0**	250	805F250	810F250	**825F250**	850F250	10.000	805F10K	(810F10K)	**825F10K**	850F10K
3	805F3R0	810F3R0	**825F3R0**	**850F3R0**	300	**805F300**	(810F300)	—	—	15.000	**805F15K**	810F15K	(825F15K)	(850F15K)
4	(805F4R0)	810F4R0	—	—	400	(805F400)	(810F400)	—	—	20.000	(805F20K)	(810F20K)	—	—
5	805F5R0	**810F5R0**	**825F5R0**	850F5R0	500	805F500	(810F500)	825F500	**850F500**	25.000	**805F25K**	(810F25K)	(825F25K)	(850F25K)
10	805F10R	**810F10R**	**825F10R**	**850F10R**	750	(805F750)	(810F750)	**825F750**	850F750	50.000		(810F50K)	—	—
15	**805F15R**	810F15R	**825F15R**	**850F15R**	1000	(805F1K0)	810F1K0	**825F1K0**	850F1K0	75.000			(825F75K)	—
20	805F20R	**810F20R**	—	—	1500	805F1K5	(810F1K5)	(825F1K5)	**850F1K5**	100.000				(850F100K)
25	805F25R	810F25R	825F25R	**850F25R**	2000	805F2K0	810F2K0	(825F2K0)	(850F2K0)					
30	(805F30R)	(810F30R)	—	—	2500	805F2K5	810F2K5	—	—					

[1] Popular items appear in **BOLD** print and are usually in stock at authorized Ohmite stocking distributors. Items appearing in **LIGHT FACE** print are available from stocking distributors but are not normally stocked in depth. PARENTHESES (items) indicate non-stock standard items subject to a minimum handling charge per item.

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80 Series 1% Tolerance

OHMITE®

Acrasil® Silicone-Ceramic Conformal Axial Lead Wirewound Resistors MIL-R-26 Specifications

Features

- **High Stability** ±1%Δ R.
- **Designed** for precision power applications.
- **Resistors** marked with "Mil" designation and Ohmite stock part number.
- **In accordance** with MIL-R-26 specifications.
- **All**-welded construction.

Choose Ohmite's highest quality conformal axial lead silicone-ceramic coated resistors for applications requiring high precision and stability.

The wirewound 80 Series 1% tolerance resistors have a low temperature coefficient and maintain a high degree of stability under demanding conditions.

They feature all-welded construction and have the ability to maintain accurate resistance values due to their being stabilized. High quality 80 Series resistors meet or exceed rigid MIL-R-26 specifications.

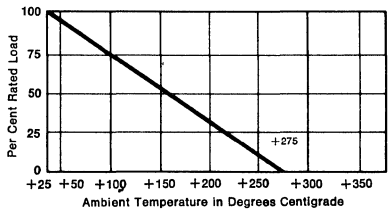
Specifications

- **Material** Coating: Silicone-ceramic.
  Core: Ceramic
  Terminals: Solder coated axial lead.
- **Electrical** Tolerance: ±1% (other tolerances available).
  Power Rating: Based on 25°C free air rating.

Maximum Operating Voltage:

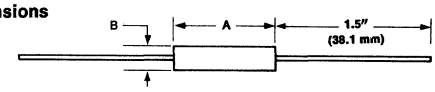
Power Rating Watts	1	3	5	10
Maximum Voltage	50	135	300	720

Derating:



Overload: Under 5 watts; 5 times rated wattage for 5 seconds.
5 watts and over; 10 times rated wattage for 5 seconds.
Temperature Coefficient: Under 1 Ohm; ±90 ppm/°C.
1 to 9.99 Ohms; ±50 ppm/°C. 10 Ohms and Over; ±20 ppm/°C.
Dielectric Withstanding Voltage: 500 VAC for 1 watt rating.
1000 VAC for 3, 5 and 10 watt rating.

- **Dimensions**



Power Rating Watts	MIL-R-26 Designation	Body Dimensions Max. Lgth.—A in.	A mm	Max. Dia.—B in.	B mm	Leads Ga.
1	RW70U—F	.437	11.1	.125	3.2	24
3	RW79U—F	.597	15.2	.218	5.5	20
5	RW74U—F	.937	23.8	.343	8.7	18
10	RW78U—F	1.842	46.8	.406	10.3	18

Stock Part Numbers[1] For Standard Resistance Values
(Non Standard Values Available By Special Order. Contact Nearest Ohmite Sales Office.)

Ohms	Part No. 1 Watt RW70U-F	3 Watt RW79U-F	5 Watt RW74U-F	10 Watt RW78U-F	Ohms	Part No. 1 Watt RW70U-F	3 Watt RW79U-F	5 Watt RW74U-F	10 Watt RW78U-F	Ohms	Part No. 1 Watt RW70U-F	3 Watt RW79U-F	5 Watt RW74U-F	10 Watt RW78U-F
.1	81FR10	**83FR10**	**85FR10**	**80FR10**	11		83F11R	85F11R	80F11R	1,330		(83F1K33)	85F1K33	(80F1K33)
.11		83FR11	85FR11	80FR11	12.1	81F12R1	83F12R1	85F12R1	80F12R1	1,500	81F1K5	83F1K5	85F1K5	(80F1K5)
.121	81FR121	83FR121	85FR121	80FR121	13.3		(83F13R3)	(85F13R3)	(80F13R3)	1,620		83F1K62	(85F1K62)	(80F1K62)
.133		83FR133	(85FR133)	80FR133	15	81F15R	83F15R	**85F15R**	(80F15R)	1,820	81F1K82	83F1K82	85F1K82	80F1K82
.15	81FR15	83FR15	**85FR15**	80FR15	16.2		(83F16R2)	(85F16R2)	(80F16R2)	2,000	81F2K0	83F2K0	85F2K0	80F2K0
.162		(83FR162)	(85FR162)	80FR162	18.2	81F18R2	83F18R2	85F18R2	80F18R2	2,210		83F2K21	85F2K21	80F2K21
.182	81FR182	83FR182	85FR182	80FR182	20	81F20R	83F20R	85F20R	80F20R	2,490	81F2K49	83F2K49	85F2K49	80F2K49
.2	81FR20	83FR20	**85FR20**	80FR20	22.1		83F22R1	85F22R1	80F22R1	2,740		83F2K74	85F2K74	80K2K74
.221		83FR221	85FR221	80FR221	24.9	81F24R9	83F24R9	85F24R9	80F24R9	3,010	81F3K01	83F3K01	85F3K01	80F3K01
.249	81FR249	83FR249	85FR249	80FR249	27.4		83F27R4	85F27R4	80F27R4	3,320		83F3K32	85F3K32	80F3K32
.274		83FR274	85FR274	80FR274	30.1	81F30R1	83F30R1	85F30R1	80F30R1	3,740		83F3K74	85F3K74	80F3K74
.301	81FR301	83FR301	85FR301	80FR301	33.2		83F33R2	85F33R2	80F33R2	4,020		83F4K02	85F4K02	80F4K02
.332		83FR332	(85FR332)	80FR332	37.4		83F37R4	(85F37R4)	80F37R4	4,530		83F4K53	(85F4K53)	80F4K53
.374		83FR374	(85FR374)	80FR374	40.2	81F40R2	83F40R2	85F40R2	80F40R2	4,990		83F4K99	85F4K99	80F4K99
.392		83FR392	85FR392	80FR392	45.3		83F45R3	85F45R3	80F45R3	5,110		83F5K11	85F5K11	80F5K11
.402	81FR402	83FR402	85FR402	80FR402	49.9	81F49R9	83F49R9	85F49R9	80F49R9	5,620		83F5K62	85F5K62	80F5K62
.453		83FR453	85FR453	80FR453	51.1		83F51R1	85F51R1	80F51R1	6,190		83F6K19	85F6K19	80F6K19
.499	81FR499	**83FR499**	85FR499	80FR499	56.2	81F56R2	83F56R2	85F56R2	80F56R2	6,810		83F6K81	85F6K81	80F6K81
.511		83FR511	(85FR511)	(80FR511)	61.9		83F61R9	85F61R9	80F61R9	7,500		83F7K5	85F7K5	(80F7K5)
.562	81FR562	83FR562	85FR562	80FR562	68.1	81F68R1	83F68R1	85F68R1	80F68R1	8,250		83F8K25	85F8K25	80F8K25
.619		83FR619	85FR619	80FR619	75		83F75R	(85F75R)	80F75R	9,090		(83F9K09)	85F9K09	(80F9K09)
.681	81FR681	83FR681	85FR681	80FR681	82.5	81F82R5	83F82R5	85F82R5	80F82R5	10,000		83F10K	85F10K	80F10K
.75		(83FR75)	85FR75	80FR75	90.9		83F90R9	85F90R9	80F90R9	10,500		83F10K5	(85F10K5)	(80F10K5)
.825	81FR825	83FR825	85FR825	80FR825	100	81F100	83F100	85F100	80F100	11,000		83F11K	(85F11K)	(80F11K)
.909		83FR909	(85FR909)	80FR909	110		83F110	85F110	80F110	12,100		(83F12K1)	(85F12K1)	(80F12K1)
1	81F1R0	83F1R0	85F1R0	80F1R0	121	81F121	83F121	85F121	80F121	13,300		(83F13K3)	85F13K3	(80F13K3)
1.1		83F1R1	85F1R1	80F1R1	133		(83F133)	85F133	(80F133)	15,000		83F15K	85F15K	80F15K
1.21	81F1R21	83F1R21	85F1R21	80F1R21	150	81F150	83F150	85F150	(80F150)	16,200		(83F16K2)	85F16K2	80F16K2)
1.330		(83FR133)	85F1R33	80F1R33	162		83F162	85F162	80F162	18,200		(83F18K2)	85F18K2	(80F18K2)
1.5	81F1R5	83F1R5	85F1R5	80F1R5	182	81F182	83F182	85F182	80F182	20,000		83F20K	85F20K	80F20K
1.62		(83F1R62)	85F1R62	80F1R62	200	81F200	83F200	85F200	80F200	22,100			85F22K1	80F22K1
1.82	81F1R82	83F1R82	85F1R82	80F1R82	221		83F221	85F221	80F221	24,900			85F24K9	80F24K9
2	81F2R0	83F2R0	85F2R0	80F2R0	249	81F249	83F249	85F249	80F249	27,400			85F27K4	80F27K4
2.21		83F2R21	85F2R21	80F2R21	274		83F274	(85F274)	80F274	30,100			85F30K1	80F30K1
2.49	81F2R49	83F2R49	85F2R49	80F2R49	301	81F301	83F301	85F301	80F301	33,200			85F33K2	80F33K2
2.74		83F2R74	85F2R74	80F2R74	332		83F332	85F332	80F332	37,400			(85F37K4)	(80F37K4)
3.01	81F3R01	83F3R01	85F3R01	80F3R01	374		83F374	85F374	80F374	38,300			85F38K3	(80F38K3)
3.32		83F3R32	85F3R32	80F3R32	402	81F402	83F402	85F402	80F402	40,200			80F40K2	80F40K2
3.74		83F3R74	85F3R74	80F3R74	453		83F453	85F453	80F453	45,300			85F45K3	80F45K3
4.02	81F4R02	83F4R02	85F4R02	80F4R02	499	81F499	83F499	85F499	80F499	49,900			85F49K9	80F49K9
4.53		83F4R53	85F4R53	80F4R53	511		83F511	85F511	80F511	51,100			85F51K1	80F51K1
4.99	81F4R99	83F4R99	85F4R99	80F4R99	562	81F562	83F562	85F562	80F562	56,200			85F56K2	80F56K2
5.11		83F5R11	85F5R11	80F5R11	619		83F619	85F619	80F619	61,900			85F61K9	80F61K9)
5.62	81F5R62	83F5R62	85F5R62	80F5R62	681	81F681	83F681	85F681	80F681	68,100			85F68K1	80F68K1
6.19		83F6R19	85F6R19	80F6R19	750		83F750	85F750	80F750	75,000			85F75K	80F75K
6.81	81F6R81	83F6R81	85F6R81	80F6R81	825	81F825	83F825	85F825	80F825	82,500				80F82K5
7.5		83F7R5	85F7R5	80F7R5	909		83F909	85F909	80F909	90,900				80F90K9
8.25	81F8R25	83F8R25	(85F8R25)	80F8R25	1000	81F1K0	83F1K0	85F1K0	80F1K0	100,000				80F100K
9.09		83F9R09	85F9R09	80F9R09	1100		(831K1)	85F1K1	80F1K1	150,000				80F150K
10	81F10R	83F10R	85F10R	80F10R	1210	81F1K21	83F1K21	85F1K21	80F1K21	200,000				80F200K

[1] Popular items appear in **BOLD** print and are usually in stock at authorized Ohmite stocking distributors. Items appearing in LIGHT FACE print are available from stocking distributors but are not normally stocked in depth. PARENTHESES (items) indicate non-stock standard items subject to a minimum handling charge per item.

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80 Series 5% Tolerance*

OHMITE®

Acrasil® Silicone-Ceramic Conformal Axial Lead Wirewound Resistors MIL-R-26 Specifications

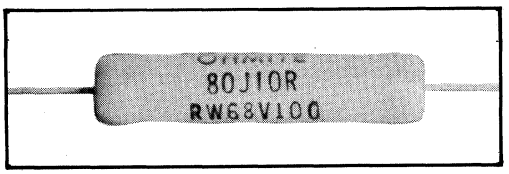
Features

- **In accordance** with MIL-R-26 specifications.
- **Resistors marked** with "Mil" designation and Ohmite stock part number.
- **All**-welded construction.
- **High** stability.

Select Ohmite's highest quality 5% conformal axial lead silicone-ceramic coated resistors for applications requiring high stability with less precision.

The wirewound 80 Series 5% tolerance resistors feature a low temperature coefficient and high stability during demanding usage.

These top quality resistors have an all-welded construction, are stabilized and meet or exceed strict MIL-R-26 specifications.



Specifications

- **Material**

Coating: Silicone-ceramic.
Core: Ceramic.
Terminals: Solder coated axial lead.
Weight:

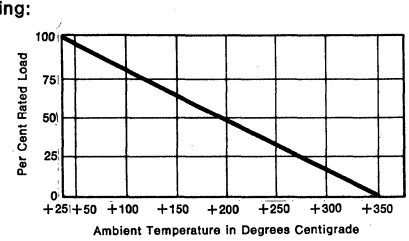
Power Rating Watts	3	6.5	11
Average Weight	1.0 gms	2.9 gms	7.9 gms

- **Electrical**

Tolerance: ±5% (other tolerances available).
Power Rating: Based on 25°C free air rating.
Maximum Operating Voltage:

Power Rating Watts	3	6.5	11
Maximum Voltage	200	460	1000

Derating:

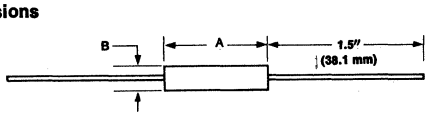


Overload:
Under 5 watts: 5 times rated wattage for 5 seconds.
5 watts and over: 10 times rated wattage for 5 seconds.

Temperature Coefficient:
Under 1 Ohm: ±90 ppm/ °C.
1 to 9.99 Ohms: ±50 ppm/°C.
10 Ohms and Over: ±20 ppm/°C.

Dielectric Withstanding Voltage: 1000 VAC.

- **Dimensions**



Power Rating Watts	MIL-R-26 Designation	Body Dimensions				Leads Ga.
		Max. Lgth.—A		Max. Dia.—B		
		in.	mm	in.	mm	
3	RW69V—	.563	14.3	.250	6.4	20
6.5	RW67V—	.937	23.8	.343	8.7	18
11	RW68V—	1.842	46.8	.406	10.3	18

* 80 Series 5% Tolerance formerly Series 44 5% Mil Specification.

Stock Part Numbers[1] For Standard Resistance Values
(Non Standard Values Available By Special Order. Contact Nearest Ohmite Sales Office.)

Ohms	Part No.		
	3 Watt RW69V	6.5 Watt RW67V	11 Watt RW68V
1	**83J1R0**	85J1R0	80J1R0
1.2	**83J1R2**	85J1R2	80J1R2
1.5	83J1R5	85J1R5	80J1R5
1.8	83J1R8	85J1R8	80J1R8
2	83J290	85J2R0	80J2R0
2.4	83J2R4	85J2R4	80J2R4
3	83J3R0	85J3R0	80J3R0
3.3	83J3R3	85J3R3	80J3R3
3.9	83J3R9	85J3R9	80J3R9
4.7	83J4R7	**85JR47**	80J4R7
5.1	83J5R1	**85J5R1**	80J5R1
5.6	83J5R6	**85J5R6**	80J5R6
6.8	83J6R8	85J688	80J6R8
8.2	83J8R2	85J8R2	80J8R2
10	83J10R	**85J10R**	**80J10R**
12	83J12R	85J12R	80J12R
15	83J15R	85J15R	**80J15R**
18	83J18R	85J18R	80J18R
20	83J20R	85J20R	80J20R
24	83J24R	85J24R	80J24R
30	(83J30R)	85J30R	80J30R
33	83J33R	85J33R	80J33R
39	83J39R	(85J39R)	(80J39R)
47	83J47R	85J47R	80J47R
51	83J51R	**85J51R**	80J51R
56	83J56R	85J56R	80J56R
68	**83J68R**	85J68R	(80J68R)
82	83J82R	85J82R	(80J82R)
100	83J100	85J100	80J100
120	83J120	85J120	(80J120)
150	83J150	**85J150**	80J150
180	83J180	85J180	80J180
200	83J200	85J200	80J200
240	(83J240)	85J240	80J240
300	83J300	85J300	80J300
330	83J330	85J330	80J330
390	83J390	85J390	80J390
470	83J470	85J470	(80J470)
510	83J510	85J510	80J510
560	(83J560)	85J560	80J560
680	83J680	85J680	(80J680)
820	83J820	**85J820**	(80J820)
1,000	83J1K0	85J1K0	80J1K0
1,200	83J1K2	85J1K2	80J1K2
1,500	83J1K5	85J1K5	80J1K5
1,800	83J1K8	85J1K8	(80J1K8)
2,000	83J2K0	85J2K0	80J2K0
2,400		85J2K4	80J2K4
3,000		85J3K0	80J3K0
3,300		85J3K3	(80J3K3)
3,900		85J3K9	80J3K9
4,700		(85J4K7)	(80J4K7)
5,100		85J5K1	80J5K1
5,600		85J5K6	(80J5K6)
6,800		85J6K8	(80J6K8)
8,200		85J8K2	(80J8K2)
10,000			80J10K
12,000			80J12K
15,000			80J15K
18,000			80J18K
20,000			80J20K

[1] Popular items appear in **BOLD** print and are usually in stock at authorized Ohmite stocking distributors. Items appearing in LIGHT FACE print are available from stocking distributors but are not normally stocked in depth. PARENTHESES items) indicate non-stock standard items subject to a minimum handling charge per item.

Ohmite Manufacturing Company • 3601 Howard Street • Skokie, Illinois 60076
Tel. 312/675-2600 • TWX 910/223-0805 • TELEX: 72-4433 • FAX 312-675-1505

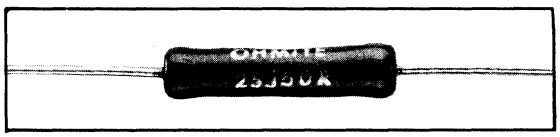
20 Series*

OHMITE®

Vitreous Enamel Conformal Axial Lead Wirewound Resistors 5% Tolerance

Features

- **Rugged** vitreous enamel coating withstands high humidity and temperature cycling.
- **Durable** construction, recommended for industrial applications where reliability is paramount.
- **All**-welded construction.
- **Flame** resistant vitreous enamel coating.



The 20 Series axial lead resistors are both durable and economical. They have all the electrical attributes of the more expensive 90 Series resistors, including an all-welded construction.

They offer the durability of a silicone-free conformal vitreous enamel coating and are ideal for computer, communications and industrial applications in which cost, quality and reliability are key considerations.

Specifications

- **Material** Coating: Conformal vitreous enamel.
  Core: Ceramic
  Terminals: Solder coated axial lead.

Weight:

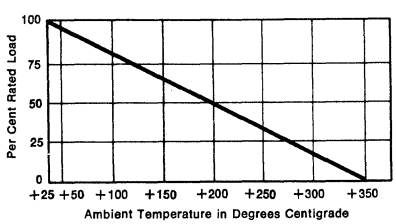
Power Rating Watts	1	2	3	5	7	10
Average Weight	.5 gms	.75 gms	1.0 gms	1.75 gms	4.1 gms	5.6 gms

- **Electrical** Tolerance: ±5% (other tolerances available).
  Power Rating: Based on 25°C free air rating.

Maximum Operating Voltage:

Power Rating Watts	1	2	3	5	7	10
Maximum Voltage	75	65	135	330	450	720

Derating:

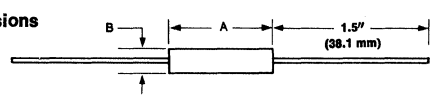


Overload:
Under 5 watts: 5 times rated wattage for 5 seconds.
5 watts and over: 10 times rated wattage for 5 seconds.

Temperature Coefficient:
1 to 9.99 Ohms: ±50 ppm/°C
10 Ohms and Over: ±30 ppm/°C

Dielectric Withstanding Voltage:
1000 VAC: 2, 3, 5, 7 and 10 watt rating.
500 VAC: 1 watt rating.

- **Dimensions**



Power Rating Watts	Body Dimensions				Leads Ga.
	Max. Lgth.—A		Max. Dia.—B		
	in.	mm	in.	mm	
1	.406	10.3	.156	4.0	24
2	.406	10.3	.219	5.6	20
3	.562	14.3	.250	6.4	20
5	1.000	25.4	.250	6.4	20
7	1.250	31.8	.343	8.7	20
10	1.797	45.6	.343	8.7	20

* 20 Series formerly Series 22

Stock Part Numbers[1] For Standard Resistance Values
(Non Standard Values Available By Special Order. Contact Nearest Ohmite Sales Office.)

Ohms	Part No. 1 Watt	2 Watt	3 Watt	5 Watt	7 Watt	10 Watt
1	**21J1R0**	**22J1R0**	**23J1R0**	**25J1R0**	27J1R0	20J1R0
1.5	21J1R5	22J1R5	23J1R5	25J1R5	27J1R5	20J1R5
2	**21J2R0**	22J2R0	23J2R0	**25J2R0**	(27J2R0)	20J2R0
2.2	21J2R2	22J2R2	23J2R2	25J2R2	(27J2R2)	20J2R2
3	21J3R0	22J3R0	23J3R0	25J3R0	27J3R0	20J3R0
4	21J4R0	(22J4R0)	23J4R0	25J4R0	(27J4R0)	20J4R0
5	21J5R0	22J5R0	23J5R0	**25J5R0**	(27J5R0)	**20J5R0**
7.5	**21J7R5**	22J7R5	23J7R5	25J7R5	(27J7R5)	20J7R5
10	21J10R	22J10R	23J10R	25J10R	(27J10R)	20J10R
12	(21J12R)	(22J12R)	23J12R	25J12R	(27J12R)	**20J12R**
15	21J15R	(22J15R)	23J15R	(25J15R)	27J15R	**20J15R**
18	21J18R	(22J18R)	23J18R	25J18R	(27J18R)	27J18R
20	21J20R	22J20R	23J20R	25J20R	(27J20R)	20J20R
22	21J22R	22J22R	23J22R	25J22R	(27J22R)	20J22R
25	(21J25R)	22J25R	23J25R	25J25R	(27J25R)	20J25R
27	21J27R	22J27R	23J27R	25J27R	(27J27R)	(20J27R)
30	**21J30R**	22J30R	23J30R	25J30R	(27J30R)	20J30R
33	21J33R	22J33R	23J33R	25J33R	27J33R	20J33R
35	(21J35R)	(22J35R)	(23J35R)	25J35R	(27J35R)	(20J35R)
39	21J39R	22J39R	23J39R	(25J39R)	(27J39R)	20J39R
40	21J40R	(22J40R)	23J40R	25J40R	(27J40R)	20J40R
47	**21J47R**	22J47R	23J47R	25J47R	(27J47R)	20J47R
50	21J50R	22J50R	23J50R	**25J50R**	27J50R	20J50R
56	(21J56R)	22J56R	23J56R	25J56R	(27J56R)	(20J56R)
62	(21J62R)	(22J62R)	23J62R	25J62R	(27J62R)	**20J62R**
68	21J68R	22J68R	23J68R	25J68R	(27J68R)	20J68R
75	21J75R	22J75R	23J75R	25J75R	(27J75R)	20J75R
82	21J82R	22J82R	23J82R	25J82R	(27J82R)	20J82R
100	**21J100**	(22J100)	**23J100**	**25J100**	27J100	20J100
120	21J120	22J120	**23J120**	25J120	(27J120	20J120
125	(21J125)	(22J125)	23J125	25J125	27J125	20J125
150	21J150	22J150	**23J150**	**25J150**	(27J150)	20J150
180	21J180	22J180	23J180	25J180	(27J180)	**20J180**
200	**21J200**	22J200	23J200	25J200	27J200	20J200
220	**21J220**	22J220	23J220	25J220	(27J220)	20J220
225	(21J225)	(22J225)	(23J225)	(25J225)	(27J225)	(20J225)
250	21J250	22J250	23J250	25J250	(27J250)	20J250
270	**21J270**	22J270	23J270	25J270	(27J270)	(20J270)
300	21J300	22J300	23J300	25J300	(27J300)	20J300
330	**21J330**	22J330	23J330	25J330	(27J330)	20J330
350	(21J350)	22J350	(23J350)	25J350	(27J350)	20J350
390	21J390	(22J390)	23J390	(25J390)	(27J390)	(20J390)
400	(21J400)	(22J400)	23J400	25J400	(27J400)	20J400
450	(21J450)	(22J450)	(23J450)	25J450	(27J450)	20J450
470	**21J470**	22J470	23J470	25J470	(27J470)	20J470
500	21J500	22J500	**23J500**	25J500	27J500	20J500
560	21J560	22J560	23J560	25J560	(27J560)	(20J560)
600	21J600	22J600	**23J600**	25J600	(27J600)	20J600
680	21J680	(22J680)	23J680	25J680	(27J680)	20J680
750	21J750	22J750	23J750	25J750	(27J750)	20J750
800	21J800	(22J800)	23J800	25J800	(27J800)	(20J800)
820	21J820	22J820	23J820	25J820	(27J820)	20J820
900	(21J900)	22J900	23J900	25J900	(27J900)	(20J900)
1,000	**21J1K0**	**22J1K0**	**23J1K0**	**25J1K0**	27J1K0	**20J1K0**
1,100	(21J1K1)	(22J1K1)	23J1K1	25J1K1	(27J1K1)	20J1K1
1,200	21J1K2	22J1K2	**23J1K2**	25J1K2	(27J1K2)	20J1K2
1,500	**21J1K5**	22J1K5	**23J1K5**	25J1K5	(27J1K5)	20J1K5
1,800	21J1K8	22J1K8	23J1K8	(25J1K8)	(27J1K8)	(20J1K8)
2,000	(21J2K0)	22J2K0	**23J2K0**	25J2K0	(27J2K0)	20J2K0
2,200	21J2K2	22J2K2	23J2K2	25J2K2	(27J2K2)	20J2K2
2,500	**21J2K5**	22J2K5	23J2K5	**25J2K5**	(27J2K5)	**20J2K5**
2,700	21J2K7	22J2K7	23J2K7	(25J2K7)	(27J2K7)	20J2K7
3,000	21J3K0	22J3K0	**23J3K0**	25J3K0	(27J3K0)	20J3K0
3,300			23J3K3	25J3K3	(27J3K3)	(20J3K3)
3,500			(23J3K5)	25J3K5	(27J3K5)	(20J3K5)
3,900			23J3K9	25J3K9	(27J3K9)	20J3K9
4,000			**23J4K0**	25J4K0	(27J4K0)	20J4K0
4,500			(23J4K5)	25J4K5	(27J4K5)	(20J4K5)
4,700			23J4K7	25J4K7	(27J4K7)	20J4K7
5,000			23J5K0	**25J5K0**	27J5K0	20J5K0
6,000			23J6K0	25J6K0	27J6K0	20J6K0
6,800			23J6K8	25J6K8	(27J6K8)	(20J6K8)
7,000			23J7K0	25J7K0	(27J7K0)	(20J7K0)
7,500			23J7K5	25J7K5	(27J7K5)	20J7K5
8,000			23J8K0	25J8K0	(27J8K0)	20J8K0
9,000			23J9K0	(25J9K0)	(27J9K0)	(20J9K0)
10,000			**23J10K**	**25J10K**	(27J10K)	20J10K
12,000				25J12K	(27J12K)	20J12K
13,000					(27J13K)	20J13K
15,000				**25J15K**	(27J15K)	**20J15K**
17,000					(27J17K)	(20J17K)
20,000				**25J20K**	27J20K	20J20K
22,000				**25J22K**	(27J22K)	(20J22K)
25,000				25J25K	(27J25K)	20J25K
30,000						**20J30K.**
33,000						(20J33K)
35,000						(20J35K)
40,000						20J40K
50,000						**20J50K**

[1] Popular items appear in **BOLD** print and are usually in stock at authorized Ohmite stocking distributors. Items appearing in LIGHT FACE print are available from stocking distributors but are not normally stocked in depth. PARENTHESES (items) indicate non-stock standard items subject to a minimum handling charge per item.

90 Series*

OHMITE®

Vitreous Enamel Molded Axial Lead Wirewound Resistors 5% Tolerance

Features

- **Molded** construction provides consistent shape and size (Permits mounting in clips which extended power rating).
- **Meets** Mil-R-26 requirements for insulated resistors.
- **All**-welded construction.
- **Flame resistant** vitreous enamel coating

Specifications

- **Material** Coating: Molded vitreous enamel.
  Core: Ceramic.
  Terminals: Solder coated axial lead.

Weight:

Power Rating Watts	1½	2¼	3¼	5	11
Average Weight	0.5 gms	0.8 gms	1.2 gms	18 gms	6.4 gms

- **Electrical** Tolerance: ±5% (other tolerances available).
  Power Rating: Based on 25°C free air rating.

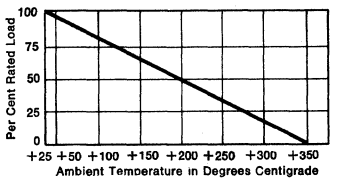
Maximum Operating Voltage:

Power Rating Watts	1½	2¼	3¼	5	11
Max. Voltage	150	85	200	495	1080

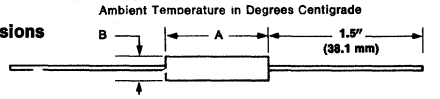
Overload: Under 5 watts; 5 times rated wattage for 5 seconds.
5 watts and over; 10 times rated wattage for 5 seconds.

Temperature Coefficient: 1 to 9.99 Ohms; ±100 ppm/°C.
10 Ohms and over; ±30 ppm/°C.
Dielectric Withstanding Voltage: 1000 VAC for 2, 3, 5, 7 and 10 watt rating. 500 VAC for 1 watt rating.

Derating:



- **Dimensions**



Power Rating Watts	Body Dimensions Max. Lgth.—A in.	Max. Lgth.—A mm	Max. Dia.—B in.	Max. Dia.—B mm	Leads Ga.
1½	.437	11.1	.140	3.6	24
2¼	.390	9.9	.219	5.6	20
3¼	.562	14.3	.234	5.9	20
5	.953	24.2	.234	5.9	20
11	1.796	45.6	.343	8.7	20

Stock Part Numbers[1] For Standard Resistance Values
(Non Standard Values Available By Special Order.
Contact Nearest Ohmite Sales Office.)

* 90 Series formerly Series 99 and Type 995

Ohms	Part No. 1½ Watt	2¼ Watt	3¼ Watt	5 Watt	11 Watt	Ohms	Part No. 1½ Watt	2¼ Watt	3¼ Watt	5 Watt	11 Watt	Ohms	Part No. 3¼ Watt	5 Watt	11 Watt
1	**91J1R0**	**92J1R0**	**93J1R0**	**95J1R0**	90J1R0	180	91J180	92J180	93J180	95J180	90J180	9,100	93J9K1	(95J9K1)	(90J9K1)
1.1	91J1R1	(92J1R1)	(93J1R1)	95J1R1	(90J1R1)	200	91J200	92J200	93J200	95J200	90J200	10,000	**93J10K**	**95J10K**	**90J10K**
1.2	91J1R2	92J1R2	93J1R2	95J1R2	(90J1R2)	220	91J220	92J220	**93J220**	95J220	90J220	11,000		95J11K	(90J11K)
1.3	(91J1R3)	92J1R3	91J1R3	(95J1R3)	90J1R3	240	(91J240)	(92J240)	93J240	95J240	90J240	12,000		**95J12K**	90J12K
1.5	91J1R5	92J1R5	93J1R5	95J1R5	90J1R5	250	91J250	92J250	93J250	95J250	90J250	13,000		95J13K	(90J13K)
1.6	(91J1R6)	(92J1R6)	(93J1R6)	(95J1R6)	(90J1R6)	270	91J270	92J270	93J270	95J270	90J270	14,000		95J14K	(90J14K)
1.8	91J1R8	(92J1R8)	(93J1R8)	95J1R8	90J1R8	300	91J300	92J300	93J300	95J300	90J300	15,000		95J15K	**90J15K**
2	91J2R0	92J2R0	**93J2R0**	95J2R0	90J2R0	330	91J330	92J330	93J330	95J330	**90J330**	16,000		**95J16K**	(90J16K)
2.2	91J2R2	92J2R2	93J2R2	95J242	90J2R2	350	91J350	92J350	93J350	95J350	(90J350)	17,000		(95J17K)	(90J17K)
2.4	**91J2R4**	(92J2R4)	93J2R4	95J2R4	90J2R4	360	91J360	92J360	93J360	95J360	(90J360)	18,000		95J18K	90J18K
2.7	91J2R7	92J2R7	93J2R7	95J2R7	90J2R7	390	91J390	92J390	93J390	95J390	90J390	20,000		95J20K	90J20K
3	91J3R0	92J3R0	93J3R0	95J3R0	90J3R0	400	91J400	92J400	93J400	95J400	90J400	22,000		95J22K	90J22K
3.3	91J3R3	92J3R3	93J3R3	95J3R3	90J3R3	430	91J430	92J430	93J430	95J430	(90J430)	24,000		(95J24K)	(90J24K)
3.6	(91J3R6)	(92J3R6)	(93J3R6)	95J3R6	(90J3R6)	450	(91J450)	92J450	93J450	(95J450)	(90J450)	25,000		95J25K	90J25K
3.9	91J3R9	92J3R9	93J3R9	95J3R9	90J3R9	470	91J470	**92J470**	93J470	95J470	90J470	27,000			**90J27K**
4	91J4R0	92J4R0	93J4R0	95J4R0	90J4R0	500	91J500	92J500	93J500	95J500	90J500	30,000			90J30K
4.3	(91J4R3)	92J4R3	(93J4R3)	95J4R3	90J4R3	510	(91J510)	92J510	93J510	93J510	95J510	33,000			90J33K
4.7	91J4R7	92J4R7	**93J4R7**	95J4R7	90J4R7	560	91J560	92J560	93J560	95J560	90J560	35,000			(90J35K)
5	91J5R0	92J5R0	93J5R0	**95J5R0**	**90J5R0**	600	91J600	(92J600)	93J600	95J600	90J600	36,000			90J36K
5.1	(91J5R1)	92J5R1	93J5R1	(95J5R1)	(90J5R1)	620	91J620	(92J620)	93J620	(95J620)	(90J620)	39,000			90J39K
5.6	91J5R6	92J5R6	93J5R6	95J5R6	90J5R6	680	91J680	92J680	93J680	95J680	90J680	40,000			90J40K
6.2	(91J6R2)	92J6R2	93J6R2	95J6R2	90J6R2	700	(91J700)	92J700	93J700	95J700	(90J700)	43,000			90J43K
6.8	91J6R8	(92J6R8)	93J6R8	**95J6R8**	90J6R8	750	91J750	92J750	93J750	95J750	90J750	45,000			(90J45K)
7.5	(91J7R5)	92J7R5	93J7R5	95J7R5	90J7R5	800	91J800	(92J800)	93J800	95J800	90J800	47,000			90J47K
8.2	(91J8R2)	92J8R2	93J8R2	95J8R2	90J8R2	820	91J820	92J820	93J820	95J820	90J820	50,000			**90J50K**
9.1	(91J9R1)	(92J9R1)	93J9R1	95J9R1	(90J9R1)	900	(91J900)	(92J900)	93J900	95J900	(90J900)	51,000			(90J51K)
10	91J10R	92J10R	93J10R	**95J10R**	90J10R	910	(91J910)	(92J910)	93J910	(95J910)	(90J910)				
11	(91J11R)	(92J11R)	(93J11R)	95J11R	90J11R	1,000	**91J1K0**	92J1K0	**93J1K0**	**95J1K0**	90J1K0				
12	91J12R	92J12R	93J12R	95J12R	90J12R	1,100	(91J1K1)	92J1K1	93J1K1	(95J1K1)	(90J1K1)				
13	(91J13R)	(92J13R)	93J13R	95J13R	(90J13R)	1,200	91J1K2	**92J1K2**	93J1K2	95J1K2	90J1K2				
15	91J15R	**92J15R**	93J15R	95J15R	90J15R	1,300	91J1K3	92J1K3	93J1K3	95J1K3	90J1K3				
16	91J16R	(92J16R)	93J16R	95J16R	90J16R	1,400	(91J1K4)	92J1K4	(90J1K4)	(95J1K4)	90J1K4				
18	91J18R	92J18R	93J18R	95J18R	90J18R	1,500	91J1K5	92J1K5	93J1K5	95J1K5	90J1K5				
20	91J20R	92J20R	93J20R	95J20R	90J20R	1,600	(91J1K6)	(92J1K6)	93J1K6	95J1K6	90J1K6				
22	91J22R	92J22R	93J22R	95J22R	90J22R	1,800	91J1K8	**92J1K8**	93J1K8	95J1K8	90J1K8				
24	(91J24R)	(92J24R)	93J24R	95J24R	90J24R	2,000	91J2K0	92J2K0	93J2K0	95J2K0	90J2K0				
25	(91J25R)	92J25R	93J25R	95J25R	90J25R	2,200	91J2K2	92J2K2	93J2K2	95J2K2	90J2K2				
27	91J27R	92J27R	93J27R	95J27R	90J27R	2,400	91J2K4	92J2K4	**93J2K4**	95J2K4	(90J2K4)				
30	91J30R	92J30R	93J30R	95J30R	90J30R	2,500	91J2K5	92J2K5	93J2K5	**95J2K5**	**90J2K5**				
33	91J33R	(92J33R)	93J33R	**95J33R**	**90J33R**	2,700	(91J2K7)	92J2K7	93J2K7	95J2K7	90J2K7				
35	91J35R	(92J35R)	93J35R	95J35R	90J35R	3,000	91J3K0	92J3K0	93J3K0	95J3K0	90J3K0				
36	91J36R	(92J36R)	(93J36R)	95J36R	(90J36R)	3,300			93J3K3	95J3K3	90J3K3				
39	91J39R	92J39R	93J39R	95J39R	90J39R	3,500			93J3K5	95J3K5	90J3K5				
40	(91J40R)	92J40R	93J40R	95J40R	90J40R	3,600			93J3K6	95J3K6	90J3K6				
43	(91J43R)	92J43R	93J43R	95J43R	90J43R	3,900			93J3K9	95J3K9	90J3K9				
47	91J47R	92J47R	93J47R	95J47R	90J47R	4,000			93J4K0	95J4K0	90J4K0				
50	91J50R	92J50R	**93J50R**	**95J50R**	90J50R	4,300			(93J4K3)	95J4K3	90J4K3				
51	(91J51R)	(92J51R)	93J51R	95J51R	(90J51R)	4,500			93J4K5	95J4K5	90J4K5				
56	91J56R	92J56R	93J56R	95J56R	90J56R	4,700			93J4K7	95J4K7	90J4K7				
62	91J62R	92J62R	93J62R	95J62R	**90J62R**	5,000			93J5K0	**95J5K0**	90J5K0				
68	91J68R	92J68R	93J68R	95J68R	90J68R	5,100			(93J5K1)	95J5K1	90J5K1				
75	91J75R	92J75R	93J75R	95J75R	90J75R	5,600			**93J5K6**	**95J5K6**	90J5K6				
82	91J82R	92J82R	93J82R	95J82R	90J82R	6,000			93J6K0	95J6K0	90J6K0				
91	91J91R	(92J91R)	93J91R	95J91R	90J91R	6,200			93J6K2	95J6K2	90J6K2				
100	**91J100**	92J100	**93J100**	**95J100**	**90J100**	6,800			**93J6K8**	95J6K8	90J6K8				
110	91J110	92J110	93J110	95J110	90J110	7,000			93J7K0	95J7K0	90J7K0				
120	91J120	92J120	93J120	95J120	90J120	7,500			93J7K5	95J7K5	90J7K5				
130	(91J130)	92J130	93J130	95J130	90J130	8,000			93J8K0	95J8K0	90J8K0				
150	91J150	92J150	93J150	95J150	90J150	8,200			93J8K2	95J8K2	90J8K2				
160	91J160	(92J160)	93J160	85J160	90J160	9,000			93J9K0	95J9K0	(90J9K0)				

[1] Popular items appear in **BOLD** print and are usually in stock at authorized Ohmite stocking distributors. Items appearing in LIGHT FACE print are available from stocking distributors but are not normally stocked in depth. PARENTHESES (items) indicate non-stock standard items subject to a minimum handling charge per item.

Ohmite Manufacturing Company • 3601 Howard Street • Skokie, Illinois 60076
Tel. 312/675-2600 • TWX 910/223-0805 • TELEX: 72-4433 • FAX 312-675-1505

200 Type Brown Devil® Fixed Resistors

OHMITE®

***Brown Devil*®** (Type 200) resistors, are vitreous enameled, wirewound units long famous for ruggedness and durability in small power resistors. With the emphasis toward miniaturization and the current industry trend toward high operating temperatures, Ohmite has been able to increase the ratings on two Brown Devil sizes. The 5 watt size is now rated 8 watts and the 10 watt size is now rated 12 watts. The 20 watt unit retains the same rating.

Available on special order in 3 watt size and in values other than those listed as standard. Also available on special order with radial leads for P-C board mounting.

Standard resistance tolerance is ±5% for values 1 ohm or higher; ±10% for values below 1 ohm. Tinned leads 1½" long: 3 and 5¼ watt, 20 AWG; 8, 12 and 20 watt, 18 AWG.

DIMENSIONS & WEIGHTS

Rating	5¼W	8W	12W	20W
Core Dimen.	⅝x¼D	1x5/16D	1¾x5/16D	2x5/16D
Weight (lbs.)	.005	.01	.015	.03

Ohms	5¼ WATT Old Cat. No.	5¼ WATT New Cat. No.	8 WATT Old Cat. No.	8 WATT New Cat. No.	12 WATT Old Cat. No.	12 WATT New Cat. No.	20 WATT Old Cat. No.	20 WATT New Cat. No.
0.5					1700A	B12KR50	1800A	B20KR50
1.0	2822	B5J1R0	1500	B8J1R0	1701	B12J1R0	1802A	B20J1R0
1.1	(2823)	B5J1R1						
1.2	(2824)	B5J1R2						
1.3	(2825)	B5J1R3						
1.5	2826	B5J1R5	1500B	B8J1R5	1704	B12J1R5		
1.6	(2827)	B5J1R6						
1.8	2828	B5J1R8						
2.0	2829	B5J2R0	1501	B8J2R0	1705	B12J2R0	1802B	B20J2R0
2.2	2830	B5J2R2						
2.4	2831	B5J2R4						
2.7	(2832)	B5J2R7						
3.0	2833	B5J3R0	1502	B8J3R0	1706	B12J3R0	1802C	B20J3R0
3.3	2834	B5J3R3						
3.6	(2835)	B5J3R6						
3.9	2836	B5J3R9						
4.0			1503	B8J4R0	1707	B12J4R0	1802D	B20J4R0
4.3	2837	B5J4R3						
4.7	2838	B5J4R7						
5.0			1504	B8J5R0	1708	B12J5R0	1803	B20J5R0
5.1	2839	B5J5R1						
5.6	(2840)	B5J5R6						
6.2	2841	B5J6R2						
6.8	(2842)	B5J6R8						
7.5	2843	B5J7R5	1505	B8J7R5	1709	B12J7R5		
8.2	2844	B5J8R2						
9.1	(2845)	B5J9R1						
10	2846	B5J10R	1506	B8J10R	1710	B12J10R	1804	B20J10R
11	(2847)	B5J11R						
12	2848	B5J12R	1507	B8J12R	1711	B12J12R		
13	(2849)	B5J13R						
15	2850	B5J15R	1508	B8J15R	1712	B12J15R		
16	(2851)	B5J16R						
18	2852	B5J18R						
20	2853	B5J20R	1509	B8J20R	1713	B12J20R		
22	2854	B5J22R						
24	2855	B5J24R						
25			1510	B8J25R	1714	B12J25R	1805	B20J25R
27	2856	B5J27R						
30	2857	B5J30R	1511	B8J30R	1715	B12J30R		
33	2858	B5J33R						
35			1512	B8J35R	1716	B12J35R		
36	2859	B5J36R						
39	2860	B5J39R						
40			1513	B8J40R	1717	B12J40R		B20J40R
43	2861	B5J43R						
47	2862	B5J47R						
50			1514	B8J50R	1718	B12J50R	1806	B20J50R
51	2863	B5J51R						
56	2864	B5J56R						
62	2865	B5J62R						
68	2866	B5J68R						
75	2867	B5J75R	1515	B8J75R	1719	B12J75R	1807	B20J75R
82	2868	B5J82R						
91	2869	B5J91R						
100	2870	B5J100	1516	B8J100	1720	B12J100	1808	B20J100
110	(2871)	B5J110						
120	2872	B5J120						
125			1517	B8J125	1721	B12J125		B20J125
130	2873	B5J130						
150	2874	B5J150	1518	B8J150	1722	B12F150	1809	B20J150
160	2875	B5J160						
180	2876	B5J180						
200	2877	B5J200	1519	B8J200	1723	B12J200	1810	B20J200
220	2878	B5J220						
225			1520	B8J225	1724	B12J225		
240	2879	B5J240						
250			1521	B8J250	1725	B12J250	1811	B20J250
270	2880	B5J270						
300	2881	B5J300	1522	B8J300	1726	B12J300	1812	B20J300
330	2882	B5J330						
350			1523	B8J350	1727	B12J350	1813	B20J350
360	2883	B5J360						
390	2884	B5J390						
400			1524	B8J400	1728	B12J400	1814	B20J400
430	2885	B5J430						
450			1525	B8J450	1729	B12J450		
470	2886	B5J470						

Ohms	5¼ WATT Old Cat. No.	5¼ WATT New Cat. No.	8 WATT Old Cat. No.	8 WATT New Cat. No.	12 WATT Old Cat. No.	12 WATT New Cat. No.	20 WATT Old Cat. No.	20 WATT New Cat. No.
500			1526	B8J500	1730	B12J500	1815	B20J500
510	2887	B5J510						
560	2888	B5J560						
600			1527	B8J600	1731	B12J600		
620	2889	B5J620						
650							1816	B20J650
680	2890	B5J680						
700			1528	B8J700	1732	B12J700	1817	B20J700
750	2891	B5J750	(1529)	B8J750	1733	B12J750	1818	B20J750
800			1530	B8J800	1734	B12J800	1819	B20J800
820	2892	B5J820						
900			1531	B8J900	1735	B12J900	(1820A)	B20J900
910	2893	B5J910						
1000	2894	B5J1K0	1532	B8J1K0	1736	B12J1K0	1821	B20J1K0
1100	(2895)	B5J1K1	(1533)	B8J1K1	(1737)	B12J1K1		
1200	2896	B5J1K2	1534	B8J1K2	1738	B12J1K2	1822	B20J1K2
1250			1535	B8J1K25	1739	B12J1K25	1823	B20J1K25
1300	2897	B5J1K3						
1500	2898	B5J1K5	1536	B8J1K5	1740	B12J1K5	1824	B20J1K5
1600	(2899)	B5J1K6						
1750			1537	B8J1K75	1741	B12J1K75	1825	B20J1K75
1800	2900	B5J1K8						
2000	2901	B5J2K0	1538	B8J2K0	1742	B12J1K0	1827	B20J1K0
2200	2902	B5J2K2						
2250			1539	B8J2K25	1743	B12J2K25	(1828)	B20J2K25
2400	2903	B5J2K4						
2500			1540	B8J2K5	1744	B12J2K5	1830	B20J2K5
2700	2904	B5J2K7						
2750							1831	B20J2K75
3000	2905	B5J3K0	1541	B8J3K0	1745	B12J3K0	1832	B20J3K0
3300	2906	B5J3K3						
3500			1542	B8J3K5	1746	B12J3K5	1833	B20J3K5
3600	2907	B5J3K6						
3900	2908	B5J3K9						
4000			1543	B8J4K0	1747	B12J4K0	1834	B20J4K0
4300	(2909)	B5J4K3						
4500			1544	B8J4K5	1748	B12J4K5	1835	B20J4K5
4700	2910	B5J4K7						
5000			1545	B8J5K0	1749	B12J5K0	1836	B20J5K0
5100	2911	B5J5K1						
5600	2912	B5J5K6						
6000			1546	B8J6K0	1750	B12J6K0	1837	B20J6K0
6200	2913	B5J6K2						
6800	2914	B5J6K8						
7000			1547	B8J7K0	1751	B12J7K0	1838	B20J7K0
7500	2915	B5J7K5	1548	B8J7K5	1752	B12J7K5	1839	B20J7K5
8000			1549	B8J8K0	1753	B12J8K0	1840	B20J8K0
8200	2916	B5J8K2						
8500					(1754)	B12J8K5		
9000			1550	B8J9K0	(1754A)	B12J9K0	(1840A)	B20J9K0
9100	(2917)	B5J9K1						
10K	2918	B5J10K	1551	B8J10K	1755	B12J10K	1841	B20J10K
11K	(2919)	B5J11K			(1756)	B12J11K		
12K	2920	B5J12K			1757	B12J12K		
12.5K			1552	B8J12K5	1758	B12J12K5	1842	B20J12K5
13K	2921	B5J13K						
13.5K					(1759)	B12J13K5		
15K	2922	B5J15K	1553	B8J15K	1761	B12J15K	1843	B20J15K
16K	2923	B5J16K			(1762)	B12J16K		
17.5K			(1554)	B8J17K5	(1763)	B12J17K5		
18K	2924	B5J18K			1764	B12J18K		
20K	2925	B5J20K	1555	B8J20K	1765	B12J20K	1844	B20J20K
22.5K			(1556)	B8J22K5	1766	B12J22K5		
25K			1557	B8J25K	1767	B12J25K	1845	B20J25K
30K					1768	B12J30K	1846	B20J30K
35K					1769	B12J35K	(1847)	B20J35K
40K					1770	B12J40K	1848	B20J40K
45K					1771	B12J45K	(1849)	B20J45K
50K					1772	B12J50K	1850	B20J50K
55K							(1851)	B20J55K
60K							(1852)	B20J60K
65K							(1853)	B20J65K
70K							(1854)	B20J70K
75K							(1855)	B20J75K
80K							1856	B20J80K
85K							(1857)	B20J85K
90K							(1858)	B20J90K
95K							(1859)	B20J95K
100K							1860	B20J100K

Ohmite Manufacturing Company • 3601 Howard Street • Skokie, Illinois 60076
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270 Type Vitreous Enameled Fixed Resistors

OHMITE®

These lug type resistors are wire-wound on high quality ceramic cores, protected and insulated by Ohmite vitreous enamel — the time-proved standard covering that is the best conductor of heat for a material which must also be a good electrical insulator.

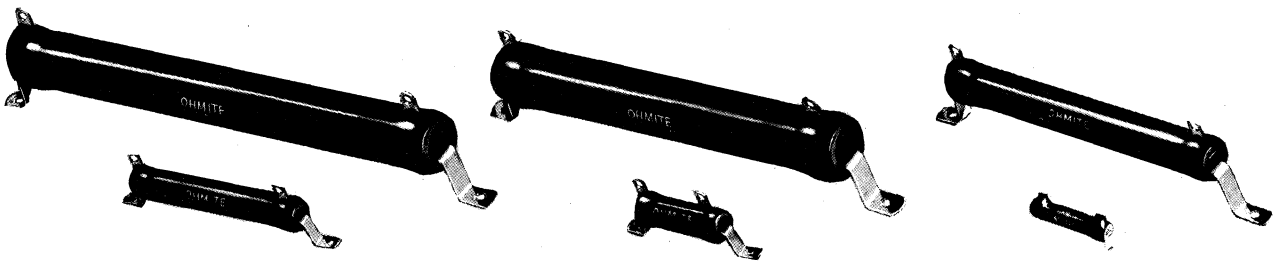
Resistance tolerance is ±5% for values 1 ohm or higher; ±10% below 1 ohm.

Wattage ratings are for use in free air. When resistors are mounted in closed spaces or where the circulation of air is restricted, they should not be used at more than one-half rating. Currents and voltages for reduced ratings can be obtained by multiplying full rating by the following factors: 75% load = .86, 66% = .81, 50% = .71, 33% = .57, 25% = .50.

Higher wattage resistors are available on a custom manufactured basis. Call for information.

These items are also available on special order, with non-inductive windings, (Aryton Perry).

The resistors listed below are standard stock items only. The 270 resistors are also available, on special order, in wattages from 3 through 1,000 with many intermediate values. Resistance values can also be supplied to meet your specific requirements. Contact our field representatives or our application engineers for assistance.



12 WATT Free air rating to 5600 Ohms Core: 1-3/4" x 9/16" Mtg. Ctr: 2 9/16" — Av. Wt. .02 lb. Std. Mtg. Brkt.: Cat. No. 5			Ohms Res.	25 WATT Free air rating to 12,000 Ohms. Core: 2" x 9/16" Mtg. Ctr: 2¾" — Av. Wt. .05 lb. Std. Mtg. Brkt.: No. 9		50 WATT Free air rating to 25,000 Ohms. Core: 4" x 9/16" Mtg. Ctr: 4¾" — Av. Wt. .09 lb. Std. Mtg. Brkt.: No. 9		100 WATT Free air rating to 60,000 Ohms. Core: 6½" x ¾" Mtg. Ctr: 7⅛" — Av. Wt. .20 lb. Std. Mtg. Brkt.: No. 12		175 WATT Free air rating for All Values Core: 8½" x 1⅛" Mtg. Ctr: 9⅜" — Av. Wt. .50 lb. Std. Mtg. Brkt.: No. 18		225 WATT Free air rating for All Values Core: 10½" x 1⅛" Mtg. Ctr: 11⅜" — Av. Wt. .62 lb. Std. Mtg. Brkt.: No. 18	
Resist. Ohms	Catalog Numbers Old	New		Catalog Numbers Old	New	Old	New	Old	New	Old	New	Old	New
.51	3723	L12KR51	1	0200J	L25J1R0	0400J	L50J1R0	0600C	L100J1R0	0700C	L175J1R0	0900C	L225J1R0
1.0	3730	L12J1R0	2	0200K	L25J2R0	0400K	L50J2R0	0600D	L100J2R0	0700D	L175J2R0	0900D	L225J2R0
1.5	3734	L12J1R5	3	0200	L25J3R0	0400L	L50J3R0	0600E	L100J3R0	0700E	L175J3R0	0900E	L225J3R0
2.2	3738	L12J2R2	4	0200N	L25J4R0	0400N	L50J4R0	0600F	L100J4R0	0700F	L175J4R0	0900F	L225J4R0
3.3	3742	L12J3R3	5	0200A	L25J5R0	0400A	L50J5R0	0600A	L100J5R0	0700A	L175J5R0	0900A	L225J5R0
4.7	3746	L12J4R7	10	0200B	L25J10R	0400B	L50J10R	0600B	L100J10R	0700B	L175J10R	0900B	L225J10R
6.8	3750	L12J6R8	15	0200R	L25J15R								
10	3754	L12J10R	25	0200C	L25J25R	0400C	L50J25R	0601	L100J25R	0701	L175J25R	0901	L225J25R
12	3756	L12J12R	50	0200D	L25J50R	0400D	L50J50R	0602	L100J50R	0702	L175J50R	0902	L225J50R
15	3758	L12J15R	75	0200E	L25J75R	0400E	L50J75R	0603	L100J75R	0703	L175J75R	0903	L225J75R
18	3760	L12J18R	100	0200F	L25J100	0400F	L50J100	0604	L100J100	0704	L175J100	0904	L225J100
22	3762	L12J22R	125					0604B	L100J125	0704B	L175J125		
27	3764	L12J27R	150	0200G	L25J150	0400G	L50J150	0605	L100J150	0705	L175J150	0905	L225J150
33	3766	L12J33R	200	0200H	L25J200	0400H	L50J200						
39	3768	L12J39R	250	0201	L25J250	0401	L50J250	0606	L100J250	0706	L175J250	0906	L225J250
47	3770	L12J47R	500	0202	L25J500	0402	L50J500	0607	L100J500	0707	L175J500	0907	L225J500
56	3772	L12J56R	750	0203	L25J750	0403	L50J750	0608	L100J750	(0708)	L175J750	0908	L225J750
68	3774	L12J68R	800	0204	L25J800	0404	L50J800						
82	3776	L12J82R	1,000	0205	L25J1K0	0405	L50J1K0	0609	L100J1K0	0709	L175J1K0	0909	L225J1K0
100	3778	L12J100	1,500	0206	L25J1K5	0406	L50J1K5	0610	L100J1K5	0710	L175J1K5	0910	L225J1K5
120	3780	L12J120	2,000	0207	L25J2K0	0407	L50J2K0	0611	L100J2K0	0711	L175J2K0	0911	L225J2K0
150	3782	L12J150	2,500	0208	L25J2K5	0408	L50J2K5	0612	L100J2K5	0712	L175J2K5	0912	L225J2K5
180	3784	L12J180	3,000	0209	L25J3K0	0409	L50J3K0	0613	L100J3K0	0713	L175J3K0	0913	L225J3K0
220	3786	L12J220	3,500	0210	L25J3K5								
270	3788	L12J270	4,000	0211	L25J4K0	0410	L50J4K0						
330	3790	L12J330	5,000	0212	L25J5K0	0411	L50J5K0	0614	L100J5K0	0714	L175J5K0	0914	L225J5K0
390	3792	L12J390	6,000	0213	L25J6K0								
470	3794	L12J470	7,500	0214	L25J7K5	0412	L50J7K5	0615	L100J7K5	0715	L175J7K5	0915	L225J7K5
560	3796	L12J560	8,000			0413	L50J8K0						
680	3798	L12J680	10,000	0215	L25J10K	0414	L50J10K	0616	L100J10K	0716	L175J10K	0916	L225J10K
820	3800	L12J820	12,000	0216	L25J12K	0415	L50J12K						
1,000	3802	L12J1K0	15,000	0217	L25J15K	0416	L50J15K	0617	L100J15K	0717	L175J15K	0917	L225J15K
1,200	3804	L12J1K2	20,000	0218	L25J20K	0417	L50J20K	0618	L100J20K	0718	L175J20K	0918	L225J20K
1,500	3806	L12J1K5	25,000	0219	L25J25K	0418	L50J25K	0619	L100J25K	0719	L175J25K	0919	L225J25K
1,800	3808	L12J1K8	30,000	0220	L25J30K			0620	L100J30K	0720	L175J30K	0920	L225J30K
2,200	3810	L12J2K2	35,000	0221	L25J35K	0419	L50J35K						
2,700	3812	L12J2K7	40,000	0222	L25J40K			(0621)	L100J40K	0721	L175J40K	0921	L225J40K
3,300	3814	L12J3K3	50,000	0224	L25J50K	0420	L50J50K	0622	L100J50K	0722	L175J50K	0922	L225J50K
3,900	3816	L12J3K9	60,000	0225	L25J60K			0623	L100J60K	0723	L175J60K	0923	L225J60K
4,700	3818	L12J4K7	70,000	0226	L25J70K								
5,600	3820	L12J5K6	75,000			0421	L50J75K	0624	L100J75K	0724	L175J75K	0924	L225J75K
6,800	3822	L12J6K8	80,000	0227	L25J80K								
8,200	3824	L12J8K2	100,000	0229	L25J100K	0422	L50J100K	0625	L100J100K	0725	L175J100K	0925	L225J100K
10,000	3826	L12J10K	125,000			0423	L50J125K						
12,000	3828	L12J12K	150,000			0424	L50J150K						
15,000	3830	L12J15K	175,000			0425	L50J175K						
18,000	3832	L12J18K	200,000			0426	L50J200K						
22,000	3834	L12J22K	250,000			0428	L50J250K						
27,000	3836	L12J27K											
33,000	3838	L12J33K											
39,000	3840	L12J39K											
47,000	3842	L12J47K											
51,000	3843	L12J51K											

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210 Type Dividohm® Adjustable Vitreous Enameled Resistors

OHMITE®

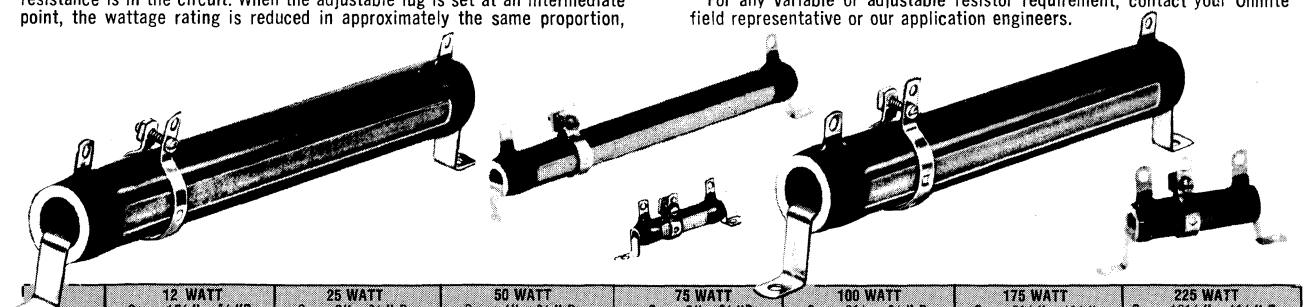
Dividohm resistors make ideal voltage dividers for original equipment and replacement in transmitters, rectifiers and other apparatus. Such tapped "bleeders" are made by using one or more adjustable lugs, as required. ***Dividohm*** are also handy for obtaining odd resistance values, for adjusting circuits, and for use on equipment which must be set to meet various line voltages.

Dividohm resistors are vitreous enameled resistors on which a narrow strip has been left uncovered to expose a portion of each turn. Contact to any wire in this strip is made by an embossed contact on the adjustable lug (supplied).

WATT RATING: The stated wattage rating applies only when the entire resistance is in the circuit. When the adjustable lug is set at an intermediate point, the wattage rating is reduced in approximately the same proportion, i.e., if the lug is set at half the resistance, the wattage is reduced by one-half. A safe rule to follow is to make sure that the maximum rated current is not exceeded. This should be carefully checked particularly if the resistor will be used as a voltage divider with several adjustable lugs. Resistance tolerance is ±10% for the total resistance value.

The items listed in the chart below, are those items that have proven to be the most popular based on usage. "Dividohm" style resistors are available on special order in resistance values other than those shown and in a wattage range of 12 Watts through 1000 Watts. In addition to the vitreous enamel standard coating, these items are also available with an Ohmicone silicone ceramic coating.

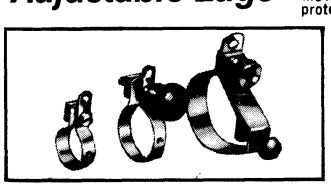
For any variable or adjustable resistor requirement, contact your Ohmite field representative or our application engineers.



	12 WATT Core: 1¾" x ¾"D. Mtg. Ctr: 2⁹⁄₁₆" — Av. Wt. .02 lb. Std. Mtg. Brkt.* No. 5		25 WATT Core: 2" x ¾" D. Mtg. Ctr: 2¾" — Av. Wt. .05 lb. Std. Mtg. Brkt.* No. 9		50 WATT Core: 4" x ¾" D. Mtg. Ctr: 4¾" — Av. Wt. .09 lb. Std. Mtg. Brkt.* No. 9		75 WATT Core: 6" x ¾"D. Mtg. Ctr: 6¾" — Av. Wt. .15 lb. Std. Mtg. Brkt.* No. 9		100 WATT Core: 6½ x ¾" D. Mtg. Ctr: 7⅜" — Av. Wt. .20 lb. Std. Mtg. Brkt.* No. 12		175 WATT Core: 8½" x 1⅛" Mtg. Ctr: 9⅜" — Av. Wt. .50 lb. Std. Mtg. Brkt.* No. 18		225 WATT Core: 10½" x 1⅛" D. Mtg. Ctr: 11⅜" — Av. Wt. .62 lb. Std. Mtg. Brkt.* No. 18	
Resist. Ohms	Old Cat. No.	New Cat. No.	Old Cat. No.	New Cat. No.	Old Cat. No.	New Cat. No.	Old Cat. No.	New Cat. No.	Old Cat. No.	New Cat. No.	Old Cat. No.	New Cat. No.	Old Cat. No.	New Cat. No.
1	1001	D12K1R0	0360	D25K1R0	0560A	D50K1R0	0769A	D75K1R0	0956A	D100K1R0	1156A	D175K1R0	1356A	D225K1R0
2	1002	D12K2R0	0360B	D25K2R0	0560B	D50K2R0	0769B	D75K2R0	0956B	D100K2R0	1156B	D175K2R0	1356B	D225K2R0
3	1003	D12K3R0	0361	D25K3R0	0560C	D50K3R0	0769C	D75K3R0	0956C	D100K3R0	1156C	D175K3R0	1356C	D225K3R0
4					0560D	D50K4R0	(0769D)	D75K4R0	0956D	D100K4R0	1156D	D175K4R0	1356D	D225K4R0
5	1004	D12K5R0	0362	D25K5R0	0560	D50K5R0	0769	D75K5R0	0956	D100K5R0	1156	D175K5R0	1356	D225K5R0
7.5	1005	D12K7R5	0362B	D25K7R5										
10	1006	D12K10R	0363	D25K10R	0561	D50K10R	0770	D75K10R	0957	D100K10R	1157	D175K10R	1357	D225K10R
15	1007	D12K15R	0364	D25K15R			0771	D75K15R						
20	1008	D12K20R	0364B	D25K20R										
25	1009	D12K25R	0365	D25K25R	0562	D50K25R	0772	D75K25R	0958	D100K25R	1158	D175K25R	1358	D225K25R
50	1010	D12K50R	0366	D25K50R	0563	D50K50R	0773	D75K50R	0959	D100K50R	1159	D175K50R	1359	D225K50R
75	1011	D12K75R	0367	D25K75R	0564	D50K75R								
100	1012	D12K100	0368	D25K100	0565	D50K100	0774	D75K100	0960	D100K100	1160	D175K100	1360	D225K100
150	1013	D12K150	0369	D25K150	0566	D50K150								
200	1014	D12K200	0370	D25K200	0567	D50K200	0774B	D75K200						
250	1015	D12K250	0371	D25K250	0568	D50K250	0775	D75K250	0960B	D100K250	1160B	D175K250	1360B	D225K250
300	1016	D12K300	0371B	D25K300	0568B	D50K300	0775B	D75K300						
350	(1017)	D12K350												
400	1018	D12K400	0371C	D25K400	0568C	D50K400	0775C	D75K400						
500	1019	D12K500	0372	D25K500	0569	D50K500	0776	D75K500	0961	D100K500	1161	D175K500	1361	D225K500
600	(1020)	D12K600												
750	1021	D12K750	0373	D25K750	0570	D50K750	0777	D75K750						
800	(1022)	D12K800	0374	D25K800	0571	D50K800	(0777B)	D75K800						
1000	1023	D12K1K0	0375	D25K1K0	0572	D50K1K0	0778	D75K1K0	0962	D100K1K0	1162	D175K1K0	1362	D225K1K0
1250	1024	D12K1K25	0375B	D25K1K25	0572B	D50K1K25	0778B)	D75K1K25						
1500	1025	D12K1K5	0376	D25K1K5	0573	D50K1K5	(0779)	D75K1K5	0962B	D100K1K5	1162B	D175K1K5	1362B	D225K1K5
2000	1026	D12K2K0	0377	D25K2K0	0574	D50K2K0	(0780)	D75K2K0						
2250	(1027)	D12K2K25	0377B	D25K2K25	(0574B)	D50K2K25	(0780B)	D75K2K25						
2500	1028	D12K2K5	0378	D25K2K5	0575	D50K2K5	(0781)	D75K2K5	0963	D100K2K5	1163	D175K2K5	1363	D225K2K5
3000	1029	D12K3K0	0379	D25K3K0	0576	D50K3K0	(0781B)	D75K3K0						
3500	(1030)	D12K3K5	0380	D25K3K5	0576B	D50K3K5	(0782)	D75K3K5						
4000	1031	D12K4K0	(0381)	D25K4K0	0577	D50K4K0	(0782B)	D75K4K0						
4500	(1032)	D12K4K5	0381B	D25K4K5	(0577B)	D50K4K5	(0782C)	D75K4K5						
5000	1033	D12K5K0	0382	D25K5K0	0578	D50K5K0	(0783)	D75K5K0	0964	D100K5K0	1164	D175K5K0	1364	D225K5K0
6000	1034	D12K6K0	0383	D25K6K0	(0578B)	D50K6K0	(0783B)	D75K6K0						
7000	1035	D12K7K0	0383B	D25K7K0	0578C	D50K7K0	(0783C)	D75K7K0						
7500	1036	D12K7K5	0384	D25K7K5	0579	D50K7K5	(0784)	D75K7K5						
8000	(1037)	D12K8K0	(0384B)	D25K8K0	(0580)	D50K8K0	(0784B)	D75K8K0						
8500	(1038)	D12K8K5												
9000	(1039)	D12K9K0	(0384C)	D25K9K0	0580B	D50K9K0	(0784C)	D75K9K0						
10000	1040	D12K10K	0385	D25K10K	0581	D50K10K	(0785)	D75K10K	0965	D100K10K	1165	D175K10K	1365	D225K10K
12000			(0386)	D25K12K	(0582)	D50K12K	0785B	D75K12K						
15000			0387	D25K15K	0583	D50K15K	(0786)	D75K15K	(0966)	D100K15K	(1166)	D175K15K	1366	D225K15K
20000			0388	D25K20K	0584	D50K20K	0787	D75K20K	(0967)	D100K20K	(1167)	D175K20K	1367	D225K20K
25000			0389	D25K25K	0585	D50K25K	(0788)	D75K25K	(0968)	D100K25K	(1168)	D175K25K	1368	D225K25K
30000					0586	D50K30K	(0789)	D75K30K	(0969)	D100K30K	(1169)	D175K30K	(1369)	D225K30K
35000							0790	D75K35K						
40000					0587	D50K40K	(0791)	D75K40K	(0970)	D100K40K	(1170)	D175K40K	(1370)	D225K40K
45000							(0792)	D75K45K						
50000					0588	D50K50K	(0793)	D75K50K	0971	D100K50K	(1171)	D175K50K	1371	D225K50K
60000					(0589)	D50K60K	(0794)	D75K60K						
75000									(0972)	D100K75K	(1172)	D175K75K	1372	D225K75K
80000					(0590)	D50K80K	(0795)	D75K80K						
100000					0591	D50K100K	(0796)	D75K100K	0973	D100K100K	(1173)	D175K100K	1373	D225K100K

Adjustable Lugs

One "Screw Driver Type Adjustable Lug" is supplied with each unit. Lugs with a silver contact button can be ordered from the table below. MOVING THE LUGS: Lugs always should be loosened completely before moving and not moved except while the current is off, in order to protect the exposed wire from mechanical or electrical injury and to protect the operator from dangerous voltages.



DOUBLE THUMB SCREW ADJUSTABLE LUG

This adjustable lug, which is illustrated at left, features two advantages — ease of adjustment and less chance of damaging the resistance wire while moving lugs. Available for 1⅛" cores.
Catalog No. **2160**

STANDARD

Core Diam. Inches	Screw Driver Type New Cat. No.	Screw Driver Type Old Cat. No.	Bakelite Knob Type New Cat. No.	Bakelite Knob Type Old Cat. No.
⅝	2115	1058	—	—
⅞	2121	0358	2122	0359
¾	2125	1958	2126	1959
1⅛	2133	2158	2134	2159

With SILVER CONTACT BUTTONS

Core Diam. Inches	Screw Driver Type New Cat. No.	Screw Driver Type Old Cat. No.	Bakelite Knob Type New Cat. No.	Bakelite Knob Type Old Cat. No.
⅝	2116	2161	—	—
⅞	2123	2164	2124	2165
¾	2127	2166	2128	2167
1⅛	2135	2170	2136	2171

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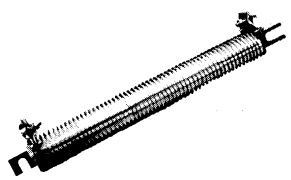
Powr-Rib® Edgewound/Round Wire Power Resistors

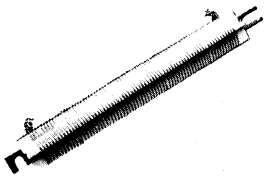
OHMITE®

Features

- **Rugged** construction withstands shock and vibration.
- **Thick** metal and porcelain construction.
- **Extremely** high power capacity, from 700 to 1000 watts as stock models.
- **Edgewound** designed for very low resistance and high power capacity.
- **Round wire** designed for higher resistance with lower power capacity requirements.



Edgewound



Round Wire

Ohmite's largest and most rugged stock resistors, Powr-Ribs, are designed to handle 700 to 1000 watts of power (up to 1600 watts on special order). Their construction consists of heavy resistance alloy wound around ceramic insulators supported by a metal mounting bar. The bar is slotted on each end to facilitate installation

Clamp-type terminals on the Edgewound units permit a reliable connection which can be moved along the resistive element to obtain intermediate values.

Edgewound Powr-Ribs provide low resistance at high current ratings, while Round Wire Powr-Ribs produce higher resistance at lower current ratings.

Specifications

- **Material**

Heavy resistance alloy mounted on ceramic insulators supported by a metal bar mounting bracket, which is slotted for rapid installation.

Core: Ceramic with metal support.

Terminals:

Clamps, movable along resistor wire for setting intermediate resistance values on Edgewound units.

Weight:

Model	Edgewound		Round Wire
	Under .18Ω	.18 Ω & Over	
Average Weight	3-5 obs.	1.5-3 lbs.	3½ lbs.

- **Electrical**

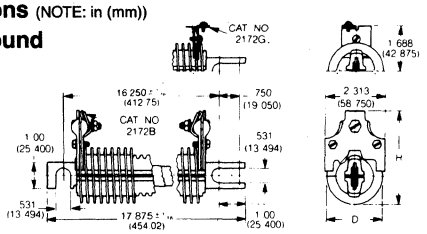
Tolerance: ± 10%

Overload: 10 times rated watts for 5 seconds.

Temperature Coefficient:
Under 47 Amps: 300 ppm/°C.
Over 50 Amps: 500 ppm/°C.

- **Dimensions** (NOTE: in (mm))

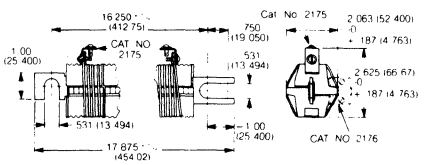
Edgewound



OHMS	H ±.125 (3.175)		D ±.125 (3.175)	
	in.	mm	in.	mm
.10–.22	3.313	84.150	2.125	53.975
.25–1.00	3.125	79.375	1,875	47.625
1.30–1.60	2.563	65.100	1.875	47.625
2.20, 2.80, 4.50, 5.40	2.500	63.500	1.750	44.450
3.50, 6.80, 8.50	2.438	61.925	1.625	41.275

1. Terminal 2172B standard on models with .10 to 1.00 ohms.
2. Terminal 2172G standard on models with 1.30 to 8.50 ohms.

Round Wire



1. Terminal 2175 standard on models with 8.30 amperes rating or less.
2. Terminal 2176 optional for 90° terminal mounting.

Powr-Rib Stock Part Numbers[1] For Standard Resistance Values

(Non Standard Values Available By Special Order. Contact Nearest Ohmite Sales Office.)

Edgewound

Ohms	Part No.	Max. Amps	Ohms	Part No.	Max. Amps
.1	PFE5KR100	100	.67	PFE5KR670	41
.12	(PFE5KR120)	91	.75	PFE5KR750	39
.14	PFE5KR140	89	1	PFE5K1R00	33
.16	(PFE5KR160)	78	1.3	PFE5K1R30	29
.18	(PFE5KR180)	75	1.6	PFE5K1R50	26
.22	PFE5KR220	68	2.2	PFE5K2R20	18.4
.25	PFE5KR250	63	2.8	PFE5K2R80	16.3
.3	(PFE5KR300)	57	3.5	PFE5K3R50	14.6
.33	PFE5KR330	54	4.5	PFE5K4R50	12.7
.37	PFE5KR370	50	5.4	PFE5K5R40	11.8
.5	PFE5KR500	47	6.8	PFE5K6R80	10.3
.6	PFE5KR600	43	8.5	PFE5K8R50	9.4

Round Wire

Ohms	Part No.	Max. Amps
11	PFR5K11R0	8.3
13	PFR5K13R0	7.6
17	PFR5K17R0	6.6
20	PFR5K20R0	5.9
25	PFR5K25R0	5.1

Extra Terminals

Available for Edgewound and Round Wire models. Extra terminals may be used as taps.

For Edgewound Powr-Rib		For Round Wire Powr-Rib	
Description	Part No.	Description	Part No.
30 Amps & more	2172B	In-Line Mfg.	2175
20 Amps & less	2172G	90° Mfg.	2176

[1]Popular items appear in **BOLD** print and are usually in stock at authorized Ohmite stocking distributors. Items appearing in LIGHT FACE print are available from stocking distributors but are not normally stocked in depth. PARENTHESES (items) indicate non-stock standard items subject to a minimum handling charge per item.

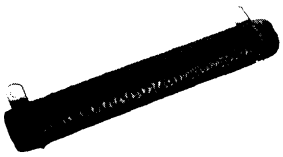
Ohmite Manufacturing Company • 3601 Howard Street • Skokie, Illinois 60076
Tel. 312/675-2600 • TWX 910/223-0805 • TELEX: 72-4433 • FAX 312-675-1505

Corrib® Fixed Adjustable Vitreous Enamel Power Resistors.

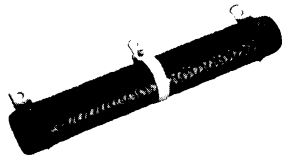
OHMITE®

Features

- **Ribbed** construction aids in rapid cooling.
- **Designed** for equipment requiring low resistance loads at low ohmic values and high current capacity.
- **Especially** constructed for motor starting, dynamic braking, etc.



Fixed



Adjustable

Corrib resistors are ideal for applications involving high currents at very low resistance values—as low as 0.1 ohm for the 300 Watt units. These large, heavy-duty resistors are designed to withstand frequent start-stop cycles characteristic of motor starting, dynamic braking and other similar applications. Special order units are available to accommodate up to 1500 watts.

Corribs are manufactured with corrugated resistive wire. To accelerate cooling, the wire is securely fused to the ceramic core by a protective vitreous enamel coating to improve durability. Corrib resistors are hollow-core units which can be securely fastened to chassis surfaces with thru bolts and brackets.

Specifications

- **Material**

Coating:
Vitreous enamel (except for extreme low resistance 35 watt models, which are Ohmicone® silicone-ceramic.

Core: Tubular ceramic.

Terminals: Heavy lug with hole.

Adjustable Lug: Supplied with adjustable Dividohm 300 watt models. Part No. 1974-A or 1974-B.

Weight:

Power Rating Watts	300				35
	Fixed		Adjustable		Fixed
Average Weight	lbs.	gr.	lbs.	gr.	gr.
	.61	277	.64	290	25

- **Electrical**

Tolerance: ±10%.

Power Rating: Based on 25°C free air rating.

Derating:
Derate linearly from 100% @ +25°C to 0% @ +400°C.

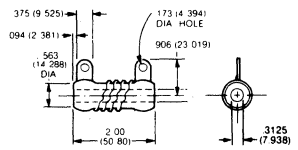
Overload: 10 times rated wattage for 5 seconds.

Temperature Coefficient: 400ppm/°C.

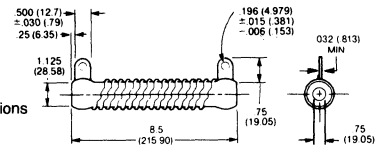
Dielectric Withstanding Voltage: 1000 VAC, measured from terminal to mounting bracket.

- **Dimensions** (NOTE: in (mm))

Fixed 35 Watt



Fixed Adjustable 300 Watt*



*For resistance values over .16 ohms, terminal dimensions same as 35 Watt Corrib shown above.

Corrib Stock Part Numbers[1] For Standard Resistance Values

(Non Standard Values Available By Special Order. Contact Nearest Ohmite Sales Office.)

35 Watt

Ohms	Part No.	Max. Amps
.02	C35KR02*	41.8
.04	(C35KR04)*	29.6
.06	(C35KR06)*	24.2
.08	(C35KR08)	20.9
.1	(C35KR10)	18.7
.15	(C35KR15)	15.3
.2	(C35KR20)	13.2
.25	(C35KR25)	11.8
.3	C35KR30	10.8
.4	(C35KR40)	9.4
.5	C35KR50	8.4
.6	(C35KR60)	7.6
.8	(C35KR80)	6.6
1	C35K1R0	5.9
1.25	(C35K1R25)	5.3

*Silicone-Ceramic Coated

300 Watt

Ohms	Part No.		Max. AMps
	Fixed	Adjustable	
.1	C300KR10	E300KR10	54.7
.12	C300KR12	E300KR12	50.0
.16	C300KR16	E300KR16	43.3
.2	C300KR20	E300KR20	38.7
.25	C300KR25	E300KR25	34.6
.31	C300KR31	E300KR31	31.1
.4	C300KR40	E300KR40	27.4
.5	C300KR50	E300KR50	24.5
.63	C300KR63	E300KR63	21.8
.8	(C300KR80)	E300KR80	19.3
1	C300K1R0	E300K1R0	17.3
1.2	C300K1R2	(E300K1R)	15.8
1.6	C300K1R6	E300K1R6	13.7
2	C300K2R0	E300K2R0	12.2
2.5	C300K2R5	E300K2R5	10.9
3.1	C300K3R1	E300K3R1	9.8
4	C300K4R0	E300K4R0	8.6
5	C300K5R0	E300K5R0	7.7
6.3	C300K6R3	E300K6R3	6.9
8	C300K8R0	E300K8R0	6.1
10	C300K10R	E300K10R	5.5
12	C300K12R	E300K12R	5.0
16	C300K16R	E300K16R	4.3
20	C300K20R	E300K20R	3.8

Resistor Hardware

Thru Bolts Mounting Brackets for 300 Watt Corrib includes 2 each bracket, bolt, washers (centering, mica, lock) and nut

Note: Single unit mounting contains 1 each bolt and nut, 2 each all Washers

Part No.		No. of Resistors	Mounting Derating %
Slotted	Elongated		
6110-8½	6126-P-8½	1	100%
—	6127-P-8½	2	83%
—	6128-P-8½	3	80%
—	6129-P-8½	4	80%

Extra Adjustable Lugs for 300 Watt Adjustable Corrib

Part No.	For 300 Watt Adjustable Corrib
1974-A	E300KR40—E300KR63 E300K1R0—E300K5R0 E300K8R0—E300K20R
1974-B	E300KR10—E300KR31 E300KR80 & E300K6R3

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PowrFilm®

OHMITE®

Metal Alloy Film Resistors 5% Tolerance

Features

- **High** power to size ratio.
- **Economical.**
- **Endures** continuous full loading with very little change in value over time.
- **Excellent** applications where compact, space saving resistors are required.

PowrFilm resistors offer a major advantage over comparable metal film, carbon composition and fiberglass core wire types; a high power to size ratio. These resistors can dissipate 1.6 watts in a size smaller than a comparable ½ watt resistor and 2.5 watts in a package smaller than a comparable 1 watt unit.

PowrFilm is a high quality resistor constructed with a metal film alloy deposited on a high grade ceramic body. A non-flammable coating provides for environmental and electrical protection.

PowrFilm resistors are an excellent choice for large volume, cost sensitive applications requiring a high quality resistor that approaches the initial accuracy and long term stability of wirewound resistors.

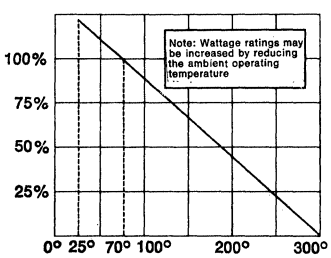
Specifications

- **Material** Coating: Non-flammable silicone.
  Core: High grade ceramic.
  Terminals: Solder coated axial lead.
  Weight: PFI .40 grms; PF2 .91 gms.
- **Electrical** Tolerance: ±5%.
  Power Rating:

Series Number	PF1		PF2	
	Watts	Ohms	Watts	Ohms
Power At 25°C Ambient	2.0	≤27K	3	≤51K
	1.5	≤27K	2.4	>51K
Power At 70°C Ambient	1.6	>27K	2.5	≤51K
	1.2	>27K	2.0	>51K

Maximum Operating Voltage: PF1: 500V. PF2: 750V.

Derating:



Overload: 6.25 times rated wattage for 5 seconds.

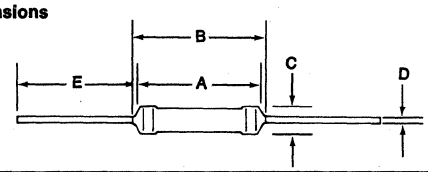
Temperature Coefficient:

Under 10 Ohms: ±350 ppm/°C.

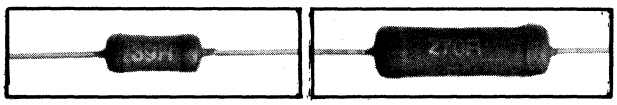
Over 10 Ohms: ±250 ppm/°C.

Dielectric Withstanding Voltage: 500 VAC.

- **Dimensions**



Type	A Max. Length	B Clean Lead To Clean Lead	C Max. Diameter	D Lead Diameter	E Lead Length
PF1	.394″ (10 mm)	.433″ (11 mm)	.154″ (3.9 mm)	.024″ (.6 mm)	1.5″ (38 mm)
PF2	.657″ (17 mm)	.704″ (18 mm)	.205″ (5.2 mm)	.024″ (.6 mm)	1.5″ (38 mm)



Stock Part Numbers[1] For Standard Resistance Values
(Non Standard Values Available By Special Order.
Contact Nearest Ohmite Sales Office.)

Ohms	Part No. 1.6 Watts	Part No. 2.5 Watts	Ohms	Part No. 1.6 Watts	Part No. 2.5 Watts
1	PF1J1R0	PF2J1R0	2,200	PF1J2K2	PF2J2K2
1.1	PF1J1R1	PF2J1R1	2,400	PF1J2K4	PF2J2K4
1.2	PF1J1R2	PF2J1R2	2,700	PF1J2K7	PF2J2K7
1.3	PF1J1R3	PF2J1R3	3,000	PF1J3K0	PF2J3K0
1.5	PF1J1R5	PF2J1R5	3,300	PF1J3K3	PF2J3K3
1.6	PF1J1R6	PF2J1R6	3,600	PF1J3K6	PF2J3K6
1.8	PF1J1R8	PF2J1R8	3,900	PF1J3K9	PF2J3K9
2	PF1J2R0	PF2J2R0	4,300	PF1J4K3	PF2J4K3
2.2	PF1J2R2	PF2J2R2	4,700	PF1J4K7	PF2J4K7
2.4	PF1J2R4	PF2J2R4	5,100	PF1J5K1	PF2J5K1
2.7	PF1J2R7	PF2J2R7	5,600	PF1J5K6	PF2J5K6
3	PF1J3R0	PF2J3R0	6,200	PF1J6K2	PF2J6K2
3.3	PF1J3R3	PF2J3R3	6,800	PF1J6K8	PF2J68K
3.6	PF1J3R6	PF2J3R6	7,500	PF1J7K5	PF2J7K5
3.9	PF1J3R9	PF2J3R9	8,200	PF1J8K2	PF2J8K2
4.3	PF1J4R3	PF2J4R3	9,100	PF1J9K1	PF2J9K1
4.7	PF1J4R7	PF2J4R7	10,000	PF1J10K	PF2J10K
5.1	PF1J5R1	PF2J5R1	11,000	PF1J11K	PF2J11K
5.6	PF1J5R6	PF2J5R6	12,000	PF1J12K	PF2J12K
6.2	PF1J6R2	PF2J6R2	13,000	PF1J13K	PF2J13K
6.8	PF1J6R8	PF2J6R8	15,000	PF1J15K	PF2J15K
7.5	PF1J7R5	PF2J7R5	16,000	PF1J16K	PF2J16K
8.2	PF1J8R2	PF2J8R2	18,000	PF1J18K	PF2J18K
9	PF1J9R1	PF2J9R1	20,000	PF1J20K	PF2J20K
10	PF1J10R	PF2J10R	22,000	PF1J22K	PF2J22K
11	PF1J11R	PF2J11R	24,000	PF1J24K	PF2J24K
12	PF1J12R	PF2J12R	27,000	PF1J27K	PF2J27K
13	PF1J13R	PF2J13R	30,000	PF1J30K	PF2J30K
15	PF1J15R	PF2J15R	33,000	PF1J33K	PF2J33K
16	PF1J16R	PF2J16R	36,000	PF1J36K	PF2J36K
18	PF1J18R	PF2J18R	39,000	PF1J39K	PF2J39K
20	PF1J20R	PF2J20R	43,000	PF1J43K	PF2J43K
22	PF1J22R	PF2J22R	47,000	PF1J47K	PF2J47K
24	PF1J24R	PF2J24R	51,000	PF1J51K	PF2J51K
27	PF1J27R	PF2J27R	56,000	PF1J56K	PF2J56K
30	PF1J30R	PF2J30R	62,000	PF1J62K	PF2J62K
33	PF1J33R	PF2J33R	68,000	PF1J68K	PF2J68K
36	PF1J36R	PF2J36R	75,000	PF1J75K	PF2J75K
39	PF1J39R	PF2J39R	82,000	PF1J82K	PF2J82K
41	PF1J43R	PF2J43R	91,000	PF1J91K	PF2J91K
47	PF1J47R	PF2J47R	100,000	PF1J100K	PF2J100K
51	PF1J51R	PF2J51R	110,000	PF1J110K	PF2J110K
56	PF1J56R	PF2J56R	120,000	PF1J120K	PF2J120K
62	PF1J62R	PF2J62R	130,000	PF1J130K	PF2J130K
68	PF1J68R	PF2J68R	150,000	PF1J150K	PF2J150K
75	PF1J75R	PF2J75R	160,000	PF1J160K	PF2J160K
82	PF1J82R	PF2J82R	180,000	PF1J180K	PF2J180K
91	PF1J91R	PF2J91R	200,000	PF1J200K	PF2J200K
100	PF1J100	PF2J100	220,000	PF1J220K	PF2J220K
110	PF1J110	PF2J110	240,000	PF1J240K	PF2J240K
120	PF1J120	PF2J120	270,000	PF1J270K	PF2J270K
130	PF1J130	PF2J130	300,000	PF1J300K	PF2J300K
150	PF1J150	PF2J150	330,000	PF1J330K	PF2J330K
160	PF1J160	PF2J160	360,000	PF1J360K	PF2J360K
180	PF1J180	PF2J180	390,000	PF1J390K	PF2J390K
200	PF1J200	PF2J200	430,000	PF1J430K	PF2J430K
220	PF1J220	PF2J220	470,000	PF1J470K	PF2J470K
240	PF1J240	PF2J240	510,000	PF1J510K	PF2J510K
270	PF1J270	PF2J270	560,000	PF1J560K	PF2J560K
300	PF1J300	PF2J300	620,000	PF1J620K	PF2J620K
330	PF1J330	PF2J330	680,000	PF1J680K	PF2J680K
360	PF1J360	PF2J360	750,000	PF1J750K	PF2J750K
390	PF1J390	PF2J390	820,000	PF1J820K	PF2J820K
430	PF1J430	PF2J430	910,000	PF1J910K	PF2J910K
470	PF1J470	PF2J470	1 MEG	PF1J1M0	PF2J1M0
510	PF1J510	PF2J510			
560	PF1J560	PF2J560			
620	PF1J620	PF2J620			
680	PF1J680	PF2J680			
750	PF1J750	PF2J750			
820	PF1J820	PF2J820			
910	PF1J910	PF2J910			
1,000	PF1J1K0	PF2J1K0			
1,100	PF1J1K1	PF2J1K1			
1,200	PF1J1K2	PF2J1K2			
1,300	PF1J1K3	PF2J1K3			
1,500	PF1J1K5	PF2J1K5			
1,600	PF1J1K6	PF2J1K6			
1,800	PF1J1K8	PF2J1K8			
2,000	PF1J2K0	PF2J2K0			

[1] Popular items appear in **BOLD** print and are usually in stock at authorized Ohmite stockdistributors. Items appearing in LIGHT FACE print are available from stocking distributors but are not normally stocked in depth. PARENTHESES (items) indicate non-stock standard items subject to a minimum handling charge per item.

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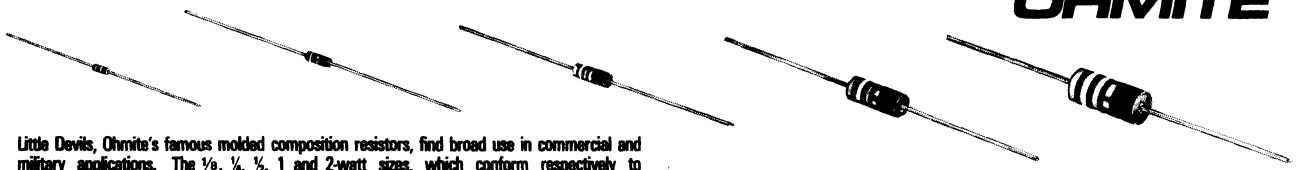
Little Devil® Molded Composition Resistors 5% Tolerance

OHMITE®



Little Devils, Ohmite's famous molded composition resistors, find broad use in commercial and military applications. The ⅛, ¼, ½, 1 and 2-watt sizes, which conform respectively to Styles RC05, RC07, RC20, RC32 and RC42 of MIL-R-11, meet all the stringent requirements of this military specification. All sizes available satisfy a wide range of design and service needs.

Little Devils have molded insulation for high dielectric strength. Noted advantages of these units are great stability, low noise level, low voltage coefficient, high insulation breakdown voltage and rapid heat dissipation. They may be used at full rated wattage at 70°C (158°F) ambient temperature.

Little Devils are available from stock in standard EIA resistance values in the tolerances and resistance ranges shown in the price table. Ratings for maximum continuous RMS voltage drop are high: 150 volts for ¼ watt units, 250 volts for ¼ watt, 350 volts for ½ watt, 500 volts for 1 watt, and 500 volts for 2 watt units.

SPECIFICATIONS

Watts	Length	Diameter	Leads	Mil-R-11
⅛	.160	.066	.018 x 1	RC05
¼	.265	.098	.027 x 1½	RC07
½	.406	.148	.035 x 1½	RC20
1	.593	.233	.043 x 1½	RC32
2	.719	.320	.048 x 1½	RC42

Catalog Number						Catalog Number						Catalog Number					
Resist. (Ohms)	⅛ Watt	¼ Watt	½ Watt	1 Watt	2 Watt	Resist. (Ohms)	⅛ Watt	¼ Watt	½ Watt	1 Watt	2 Watt	Resist. (Ohms)	⅛ Watt	¼ Watt	½ Watt	1 Watt	2 Watt
1			0E10G5			300	0B3015	0C3015	0E3015	0G3015	0H3015	82000	0B8235	0C8235	0E8235	0G8235	0H8235
1.1			0E11G5			330	0B3315	0C3315	0E3315	0G3315	0H3315	91000	0B9135	0C9135	0E9135	0G9135	0H9135
1.2			0E12G5			360	0B3615	0C3615	0E3615	0G3615	0H3615	0.1 MEG	0B1045	0C1045	0E1045	0G1045	0H1045
1.3			0E13G5			390	0B3915	0C3915	0E3915	0G3915	0H3915	0.11 MEG	0B1145	0C1145	0E1145	0G1145	0H1145
1.5			0E15G5			430	0B4315	0C4315	0E4315	0G4315	0H4315	0.12 MEG	0B1245	0C1245	0E1245	0G1245	0H1245
1.6			0E16G5			470	0B4715	0C4715	0E4715	0G4715	0H4715	0.13 MEG	0B1345	0C1345	0E1345	0G1345	0H1345
1.8			0E18G5			510	0B5115	0C5115	0E5115	0G5115	0H5115	0.15 MEG	0B1545	0C1545	0E1545	0G1545	0H1545
2.0			0E20G5			560	0B5615	0C5615	0E5615	0G5615	0H5615	0.16 MEG	0B1645	0C1645	0E1645	0G1645	0H1645
2.2			0E22G5			620	0B6215	0C6215	0E6215	0G6215	0H6215	0.18 MEG	0B1845	0C1845	0E1845	0G1845	0H1845
2.4			0E24G5			680	0B6815	0C6815	0E6815	0G6815	0H6815	0.20 MEG	0B2045	0C2045	0E2045	0G2045	0H2045
2.7	0B27G5	0C27G5	0E27G5	0G27G5		750	0B7515	0C7515	0E7515	0G7515	0H7515	0.22 MEG	0B2245	0C2245	0E2245	0G2245	0H2245
3.0	0B30G5	0C30G5	0E30G5	0G30G5		820	0B8215	0C8215	0E8215	0G8215	0H8215	0.24 MEG	0B2445	0C2445	0E2445	0G2445	0H2445
3.3	0B33G5	0C33G5	0E33G5	0G33G5		910	0B9115	0C9115	0E9115	0G9115	0H9115	0.27 MEG	0B2745	0C2745	0E2745	0G2745	0H2745
3.6	0B36G5	0C36G5	0E36G5	0G36G5		1000	0B1025	0C1025	0E1025	0G1025	0H1025	0.30 MEG	0B3045	0C3045	0E3045	0G3045	0H3045
3.9	0B39G5	0C39G5	0E39G5	0G39G5		1100	0B1125	0C1125	0E1125	0G1125	0H1125	0.33 MEG	0B3345	0C3345	0E3345	0G3345	0H3345
4.3	0B43G5	0C43G5	0E43G5	0G43G5		1200	0B1225	0C1225	0E1225	0G1225	0H1225	0.36 MEG	0B3645	0C3645	0E3645	0G3645	0H3645
4.7	0B47G5	0C47G5	0E47G5	0G47G5		1300	0B1325	0C1325	0E1325	0G1325	0H1325	0.39 MEG	0B3945	0C3945	0E3945	0G3945	0H3945
5.1	0B51G5	0C51G5	0E51G5	0G51G5		1500	0B1525	0C1525	0E1525	0G1525	0H1525	0.43 MEG	0B4345	0C4345	0E4345	0G4345	0H4345
5.6	0B56G5	0C56G5	0E56G5	0G56G5		1600	0B1625	0C1625	0E1625	0G1625	0H1625	0.47 MEG	0B4745	0C4745	0E4745	0G4745	0H4745
6.2	0B62G5	0C62G5	0E62G5	0G62G5		1800	0B1825	0C1825	0E1825	0G1825	0H1825	0.51 MEG	0B5145	0C5145	0E5145	0G5145	0H5145
6.8	0B68G5	0C68G5	0E68G5	0G68G5		2000	0B2025	0C2025	0E2025	0G2025	0H2025	0.56 MEG	0B5645	0C5645	0E5645	0G5645	0H5645
7.5	0B75G5	0C75G5	0E75G5	0G75G5		2200	0B2225	0C2225	0E2225	0G2225	0H2225	0.62 MEG	0B6245	0C6245	0E6245	0G6245	0H6245
8.2	0B82G5	0C82G5	0E82G5	0G82G5		2400	0B2425	0C2425	0E2425	0G2425	0H2425	0.68 MEG	0B6845	0C6845	0E6845	0G6845	0H6845
9.1	0B91G5	0C91G5	0E91G5	0G91G5		2700	0B2725	0C2725	0E2725	0G2725	0H2725	0.75 MEG	0B7545	0C7545	0E7545	0G7545	0H7545
10	0B1005	0C1005	0E1005	0G1005	0H1005	3000	0B3025	0C3025	0E3025	0G3025	0H3025	0.82 MEG	0B8245	0C8245	0E8245	0G8245	0H8245
11	0B1105	0C1105	0E1105	0G1105	0H1105	3300	0B3325	0C3325	0E3325	0G3325	0H3325	0.91 MEG	0B9145	0C9145	0E9145	0G9145	0H9145
12	0B1205	0C1205	0E1205	0G1205	0H1205	3600	0B3625	0C3625	0E3625	0G3625	0H3625	1.0 MEG	0B1055	0C1055	0E1055	0G1055	0H1055
13	0B1305	0C1305	0E1305	0G1305	0H1305	3900	0B3925	0C3925	0E3925	0G3925	0H3925	1.1 MEG	0B1155	0C1155	0E1155	0G1155	0H1155
15	0B1505	0C1505	0E1505	0G1505	0H1505	4300	0B4325	0C4325	0E4325	0G4325	0H4325	1.2 MEG	0B1255	0C1255	0E1255	0G1255	0H1255
16	0B1605	0C1605	0E1605	0G1605	0H1605	4700	0B4725	0C4725	0E4725	0G4725	0H4725	1.3 MEG	0B1355	0C1355	0E1355	0G1355	0H1355
18	0B1805	0C1805	0E1805	0G1805	0H1805	5100	0B5125	0C5125	0E5125	0G5125	0H5125	1.5 MEG	0B1555	0C1555	0E1555	0G1555	0H1555
20	0B2005	0C2005	0E2005	0G2005	0H2005	5600	0B5625	0C5625	0E5625	0G5625	0H5625	1.6 MEG	0B1655	0C1655	0E1655	0G1655	0H1655
22	0B2205	0C2205	0E2205	0G2205	0H2205	6200	0B6225	0C6225	0E6225	0G6225	0H6225	1.8 MEG	0B1855	0C1855	0E1855	0G1855	0H1855
24	0B2405	0C2405	0E2405	0G2405	0H2405	6800	0B6825	0C6825	0E6825	0G6825	0H6825	2.0 MEG	0B2055	0C2055	0E2055	0G2055	0H2055
27	0B2705	0C2705	0E2705	0G2705	0H2705	7500	0B7525	0C7525	0E7525	0G7525	0H7525	2.2 MEG	0B2255	0C2255	0E2255	0G2255	0H2255
30	0B3005	0C3005	0E3005	0G3005	0H3005	8200	0B8225	0C8225	0E8225	0G8225	0H8225	2.4 MEG	0B2455	0C2455	0E2455	0G2455	0H2455
33	0B3305	0C3305	0E3305	0G3305	0H3305	9100	0B9125	0C9125	0E9125	0G9125	0H9125	2.7 MEG	0B2755	0C2755	0E2755	0G2755	0H2755
36	0B3605	0C3605	0E3605	0G3605	0H3605	10000	0B1035	0C1035	0E1035	0G1035	0H1035	3.0 MEG	0B3055	0C3055	0E3055	0G3055	0H3055
39	0B3905	0C3905	0E3905	0G3905	0H3905	11000	0B1135	0C1135	0E1135	0G1135	0H1135	3.3 MEG	0B3355	0C3355	0E3355	0G3355	0H3355
43	0B4305	0C4305	0E4305	0G4305	0H4305	12000	0B1235	0C1235	0E1235	0G1235	0H1235	3.6 MEG	0B3655	0C3655	0E3655	0G3655	0H3655
47	0B4705	0C4705	0E4705	0G4705	0H4705	13000	0B1335	0C1335	0E1335	0G1335	0H1335	3.9 MEG	0B3955	0C3955	0E3955	0G3955	0H3955
51	0B5105	0C5105	0E5105	0G5105	0H5105	15000	0B1535	0C1535	0E1535	0G1535	0H1535	4.3 MEG	0B4355	0C4355	0E4355	0G4355	0H4355
56	0B5605	0C5605	0E5605	0G5605	0H5605	16000	0B1635	0C1635	0E1635	0G1635	0H1635	4.7 MEG	0B4755	0C4755	0E4755	0G4755	0H4755
62	0B6205	0C6205	0E6205	0G6205	0H6205	18000	0B1835	0C1835	0E1835	0G1835	0H1835	5.1 MEG	0B5155	0C5155	0E5155	0G5155	0H5155
68	0B6805	0C6805	0E6805	0G6805	0H6805	20000	0B2035	0C2035	0E2035	0G2035	0H2035	5.6 MEG	0B5655	0C5655	0E5655	0G5655	0H5655
75	0B7505	0C7505	0E7505	0G7505	0H7505	22000	0B2235	0C2235	0E2235	0G2235	0H2235	6.2 MEG	0B6255	0C6255	0E6255	0G6255	0H6255
82	0B8205	0C8205	0E8205	0G8205	0H8205	24000	0B2435	0C2435	0E2435	0G2435	0H2435	6.8 MEG	0B6855	0C6855	0E6855	0G6855	0H6855
91	0B9105	0C9105	0E9105	0G9105	0H9105	27000	0B2735	0C2735	0E2735	0G2735	0H2735	7.5 MEG	0B7555	0C7555	0E7555	0G7555	0H7555
100	0B1015	0C1015	0E1015	0G1015	0H1015	30000	0B3035	0C3035	0E3035	0G3035	0H3035	8.2 MEG	0B8255	0C8255	0E8255	0G8255	0H8255
110	0B1115	0C1115	0E1115	0G1115	0H1115	33000	0B3335	0C3335	0E3335	0G3335	0H3335	9.1 MEG	0B9155	0C9155	0E9155	0G9155	0H9155
120	0B1215	0C1215	0E1215	0G1215	0H1215	36000	0B3635	0C3635	0E3635	0G3635	0H3635	10.0 MEG	0B1065	0C1065	0E1065	0G1065	0H1065
130	0B1315	0C1315	0E1315	0G1315	0H1315	39000	0B3935	0C3935	0E3935	0G3935	0H3935	11.0 MEG	0B1165	0C1165	0E1165	0G1165	0H1165
150	0B1515	0C1515	0E1515	0G1515	0H1515	43000	0B4335	0C4335	0E4335	0G4335	0H4335	12.0 MEG	0B1265	0C1265	0E1265	0G1265	0H1265
160	0B1615	0C1615	0E1615	0G1615	0H1615	47000	0B4735	0C4735	0E4735	0G4735	0H4735	13.0 MEG	0B1365	0C1365	0E1365	0G1365	0H1365
180	0B1815	0C1815	0E1815	0G1815	0H1815	51000	0B5135	0C5135	0E5135	0G5135	0H5135	15.0 MEG	0B1565	0C1565	0E1565	0G1565	0H1565
200	0B2015	0C2015	0E2015	0G2015	0H2015	56000	0B5635	0C5635	0E5635	0G5635	0H5635	16.0 MEG	0B1665	0C1665	0E1665	0G1665	0H1665
220	0B2215	0C2215	0E2215	0G2215	0H2215	62000	0B6235	0C6235	0E6235	0G6235	0H6235	18.0 MEG	0B1865	0C1865	0E1865	0G1865	0H1865
240	0B2415	0C2415	0E2415	0G2415	0H2415	68000	0B6835	0C6835	0E6835	0G6835	0H6835	20.0 MEG	0B2065	0C2065	0E2065	0G2065	0H2065
270	0B2715	0C2715	0E2715	0G2715	0H2715	75000	0B7535	0C7535	0E7535	0G7535	0H7535	22.0 MEG	0B2265	0C2265	0E2265	0G2265	0H2265

Ohmite Manufacturing Company • 3601 Howard Street • Skokie, Illinois 60076
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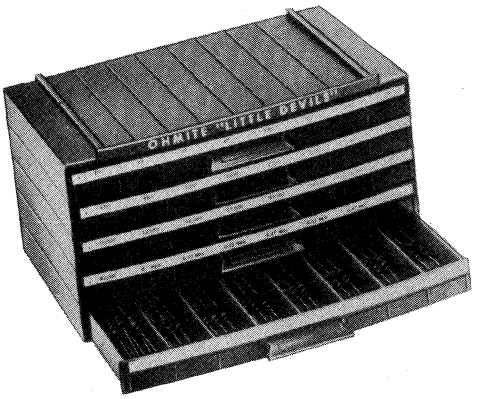
Cabinet Resistor Assortments

OHMITE®



Perfect for R & D and prototype labs.
All popular values included.
8 wattage sizes to choose from.
Contents clearly marked on front of each drawer segment.

Always have the right style, wattage, and resistance value on hand. Thwart Murphey's Law which states; "The resistance value needed will not be available."

Ohmite cabinet assortments come in four different resistor styles and 8 different wattages. The resistors used to make up these assortments are the most popular resistance values as determined by national usage.

The handy compact plastic cabinets are packed in accordance with the tables below, which state the quantities, number of values, and the resistance range of each assortment. Each drawer segment is individually labeled. Dovetail tops and bottoms of each cabinet facilitate stacking. Individual cabinet dimensions are: 9″ long by 4¾″ high by 5¼″ deep.

For specific information regarding any of the cabinet assortments, ask your Ohmite Distributor for the latest cabinet brochure.

Style of Resistor	Watts	Cat. No.	Tolerance	Quantity	No. of Values	No. of Cab. in Assortment	Resistance Range
WIREWOUND							
Conformal Vitreous Enamel	1	CAB-221	5%	167	40	1	1Ω - 3KΩ
Conformal Vitreous Enamel	3	CAB-223	5%	325	71	2	1Ω - 10KΩ
Conformal Vitreous Enamel	5	CAB-225	5%	357	77	2	1Ω - 25KΩ
Conformal Vitreous Enamel	10	CAB-220	5%	185	40	1	1Ω - 50KΩ
Conformal Ohmicone®	1	CAB-441	5%	120	40	1	.1Ω - 3KΩ
Conformal Ohmicone®	3	CAB-443	5%	120	40	1	.1Ω - 5KΩ
Conformal Ohmicone®	5	CAB-445	5%	120	40	1	.1Ω - 10KΩ
Conformal Ohmicone®	10	CAB-440	5%	120	40	1	.1Ω - 15KΩ
LITTLE DEVIL®							
Carbon Composition	⅛	CAB-21	5%	500	80	2	2.7Ω - 22 MEGΩ
Carbon Composition	⅛	CAB-45	5%	1000	160	4	2.7Ω - 22 MEGΩ
Carbon Composition	¼	CAB-54	5%	124	37	1	47Ω - 10MΩ
Carbon Composition	¼	CAB-525	5%	800	80	2	2.7Ω - 22MΩ
Carbon Composition	¼	CAB-46	5%	1500	160	4	2.7Ω - 22MΩ
Carbon Composition	½	CAB-510	5%	120	40	1	10Ω - 10MΩ
Carbon Composition	½	CAB-526	5%	800	80	2	2.7Ω - 22MΩ
Carbon Composition	½	CAB-47	5%	1500	160	4	2.7Ω - 22MΩ
Carbon Composition	1	CAB-52	5%	100	40	1	10Ω - 10MΩ
Carbon Composition	1	CAB-527	5%	480	80	2	2.7Ω - 22MΩ
Carbon Composition	1	CAB-48	5%	900	160	4	2.7Ω - 22MΩ
Carbon Composition	2	CAB-53	5%	100	40	1	10Ω - 10MΩ
LITTLE REBEL®							
Carbon Film	⅛	CAB-5F	5%	150	31	1	10Ω to 22MΩ
Carbon Film	⅛	CAB-22F	5%	500	52	2	10Ω to 22MΩ
Carbon Film	⅛	CAB-34F	5%	1000	104	3	10Ω to 22MΩ
Carbon Film	¼	CAB-6F	5%	150	36	1	1Ω to 1MΩ
Carbon Film	¼	CAB-23F	5%	500	75	2	1Ω to 1MΩ
Carbon Film	¼	CAB-43F	5%	1500	137	4	1Ω to 1MΩ
Carbon Film	½	CAB-7F	5%	150	36	1	1Ω to 1MΩ
Carbon Film	½	CAB-24F	5%	500	75	2	1Ω to 1MΩ
Carbon Film	½	CAB-44F	5%	1500	137	4	1Ω to 1MΩ
METAL DEVIL®							
Metal Film	¼	CAB-8M	1%	250	40	1	10Ω to 301KΩ
Metal Film	¼	CAB-28M	1%	500	80	2	10Ω to 301KΩ
Metal Film	¼	CAB-31M	1%	1000	120	3	10Ω to 301KΩ
Metal Film	½	CAB-9M	1%	250	40	1	10Ω to 1MΩ
Metal Film	½	CAB-29M	1%	500	80	2	10Ω to 1MΩ
Metal Film	½	CAB-32M	1%	1000	120	3	10Ω to 1MΩ

DECADE-RANGER

0.1% ACCURACY PRECISION DECADE RESISTANCE BOX NO. 3416

SPECIFICATIONS:

ACCURACY: ±0.1% (PLUS 0.03Ω MAXIMUM CONTACT AND CIRCUIT RESISTANCE)

NUMBER OF DECADES: 6

SELECTION: ROTARY TAP SWITCHES, CONTINUOUS ROTATION IN EITHER DIRECTION

READ OUT: DIGITAL, IN LINE, THROUGH "WINDOWS" IN PANEL

SWITCH LIFE: IN EXCESS OF 50,000 OPERATIONS

DIMENSIONS: 10½″ LONG x 3¾″ HIGH x 4⅝″ DEEP

RANGE: 1Ω — 1,111,110Ω IN 1Ω STEPS

CAP-RANGER®

ECONOMICAL, PORTABLE CAPACITANCE SELECTOR

100 picofarads to 11.111 microfarads in 100 picofarad steps with ±2% accuracy. Three binding posts, one to ground the metal case. Compact size. Big performance. Simple operation. Solves your troubleshooting, breadboarding and circuit design problems using simple sliding switches. Dimensions 4″ x 6″ x 1″.

Catalog No. 3430A

OHM-RANGER®

ECONOMICAL, PORTABLE RESISTANCE SELECTOR

- **Over 11 million ohms in one-ohm increments**
- **1% accuracy***
- **Easy slide switch operation**
- **Handy slimline size**
- **Rugged metal construction**

1 to 11,111,110 ohms, in one-ohm steps — with accuracy assured by half-watt 1% tolerance resistors! Has three binding posts, one to ground case. Small enough to take anywhere in your pocket, the handy easy-to-use OHM-RANGER is ideal for lab use, schools and service technicians. Dimensions 4″ x 6″ x 1″.

* 10 ohms and above

Catalog No. 3420

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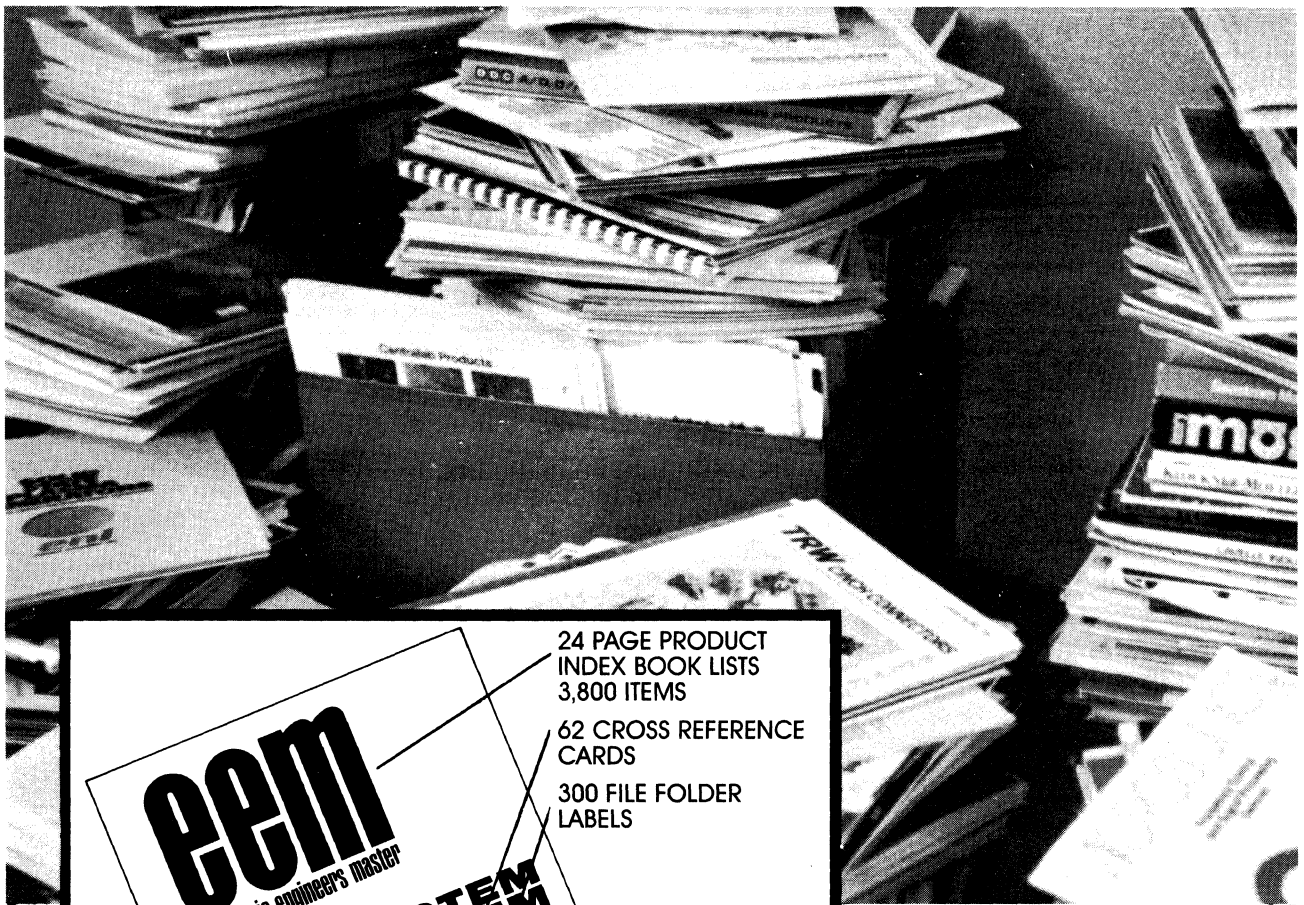

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OAC
ovenaire · audio · carpenter

Carbon Film Resistors

HIGH VOLTAGE RESISTORS

Type	Volts Max.	Watts Max.	Dimensions—Inches L	D	ID	FD	Ohms Min.	Ohms Max.	Available in Fig. No.'s
CFA	2,500	.5	¾	¼			10K	1G	2
CFB	5,000	1	1½	¼			20K	2G	2
CFC	3,500	1	1	5/16			10K	10G	1,2,4
CFD	10,000	2	1¾	5/16			10K	25G	1,2,4
CFE	15,000	3	3	5/16	NA	NA	20K	25G	1,2,4
CFF	30,000	5	5½	5/16			40K	25G	1,2,4
CFG	15,000	4	2½	9/16			20K	25G	1,2
CFH	25,000	6	4	9/16			40K	25G	1,2
CFJ	40,000	10	6½	9/16			70K	25G	1,2
NFA	2,500	.5	¾	¼			10K	1G	3
NFB	5,000	1	1½	¼			20K	2G	3
NFC	3,500	1	1	5/16	NA	NA	10K	10G	3
NFD	10,000	2	1¾	5/16			10K	25G	3
NFE	15,000	3	3	5/16			20K	25G	3
*CJA	25 KV	10	4½	¾	½	—	50K	100G	5
*CJB	35 KV	20	6½	1 1/8	¾	13/16	100K	100G	5,6
*CJC	65 KV	30	10½	1 1/8	¾	13/16	200K	100G	5,6
*CJD	90 KV	60	14½	1½	1 1/8	1 9/64	400K	100G	5,6
*CJE	40 KV	35	6½	2	1 9/16	1 9/64	300K	100G	5,6
*CJF	125 KV	100	18½	2	1 9/16	1 9/64	700K	100G	5,6

*Sleeving available on request. Standard Tolerances are 15%, 10% 5% and 3%.

PRECISION TOLERANCE RESISTORS

Type	Volts Max.	Watts Max.	Dimensions—Inches L	D	Resistance Value (Max.) ±2%	±1%	Available in Fig. No.'s
MP-1	5KV	1	1½	¼	2G	1G	2
MP-2	10KV	2	2	5/16	20G	5G	1,2,4
MP-4	20KV	4	3½	5/16	50G	10G	1,2,4
MP-6	30KV	6	6	5/16	50G	10G	1,2,4
MP-8	30KV	8	5	9/16	50G	10G	1,2
MP-10	60KV	10	11	5/16	50G	10G	1,2,4
MP-12	50KV	12	8	9/16	50G	10G	1,2
MP-20	80KV	20	13	9/16	50G	10G	1,2
SP-1	5KV	1	1½	¼	100G	25G	2
SP-2	10KV	2	2	5/16	100G	25G	1,2,4
SP-4	20KV	4	3½	5/16	100G	25G	1,2,4
SP-6	30KV	6	6	5/16	100G	25G	1,2,4
SP-8	30KV	8	5	9/16	100G	25G	1,2
SP-10	60KV	10	11	5/16	100G	25G	1,2,4
SP-12	50KV	12	8	9/16	100G	25G	1,2
SP-20	80KV	20	13	9/16	100G	25G	1,2

NOTE: Megohm equal 10^6, Gigohm equals 10^9, Teraohm equals 10^{12}.

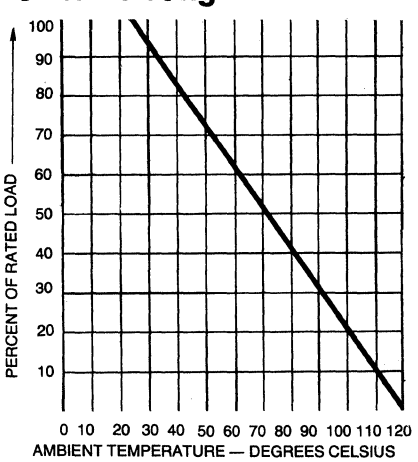
TEST DATA

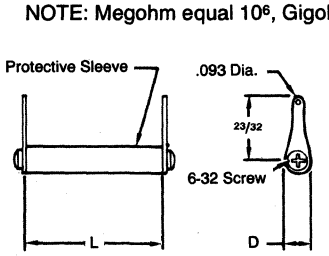
Voltage and Temperature Characteristics

Type	Voltage Coeficient Neg. PPM/V Avg.	Temperature Coefficient Neg. PPM/°C Avg.
CFA	20-50	1100-4000
CFB	10-25	1100-4000
CFC	15-40	1100-5000
CFD	7-20	1000-4800
CFE	4-10	950-4400
CFF	2-6	900-4200
CFG	3-7.5	900-4200
CFH	1.5-4.5	875-4100
CFJ	1-2.5	850-4000
All SF Types	Less than 15% of Value at Max. Voltage	2000-5000
CJA	1.25-3.5	850-4900
CJB	.6-1.7	775-4500
CJC	.35-.9	725-4300
CJD	.2-.5	700-4000
CJE	.35-1	730-4200
CJF	.1-.25	675-3800
All SJ Types	Less than 15% of Value at Max. Voltage	2000-5000

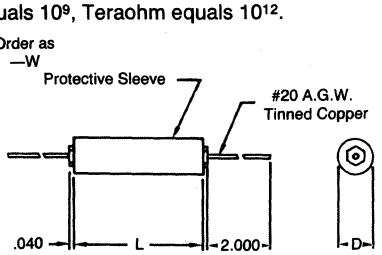
NF Types have same characteristics as CF Types. HF Types are approximately 30% lower in V.C. and 10% lower in T.C. as compared to the CF Types.

Power Derating

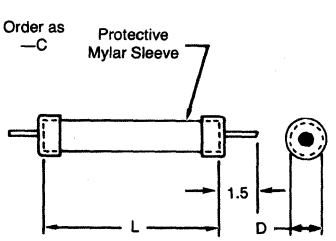




RADIAL LUG
FIG. 1



THREADED AXIAL WIRE LEAD
FIG. 2



CAPPED AXIAL WIRE LEAD
FIG. 3

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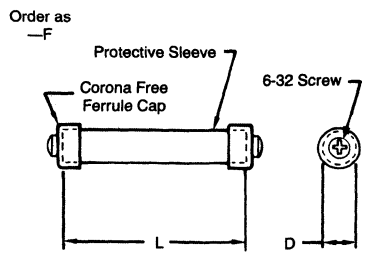
HIGH FREQUENCY RESISTORS

Type	Volts Max.	Watts Max.	Dimensions—Inches L	D	ID	FD	Ohms Min.	Ohms Max.	Available in Fig. No.'s
SFA	400	.5	¾	¼			20	20M	2
SFB	800	1	1½	¼			25	40M	2
SFC	500	1	1	5/16			20	25M	1,2,4
SFD	1,000	2	1¾	5/16			25	50M	1,2,4
SFE	2,000	3	3	5/16	NA	NA	35	100M	1,2,4
SFF	3,700	5	5½	5/16			60	100M	1,2,4
SFG	1,500	4	2½	9/16			20	50M	1,2
SFH	2,800	6	4	9/16			25	75M	1,2
SFJ	4,500	10	6½	9/16			40	100M	1,2
*SJA	3,000	10	4½	¾	½	—	20	50M	5
*SJB	4,000	20	6½	1 1/8	¾	13/16	20	50M	5,6
*SJC	7,000	30	10½	1 1/8	¾	13/16	30	100M	5,6
*SJD	10,000	60	14½	1½	1 1/8	19/64	35	100M	5,6
*SJE	4,500	35	6½	2	19/16	19/64	20	35M	5,6
*SJF	12,500	100	18½	2	19/16	19/64	30	100M	5,6

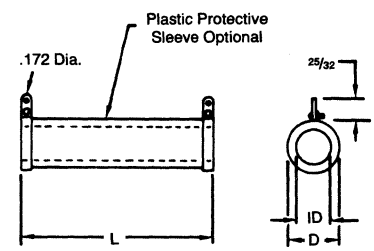
*Sleeving available on request.



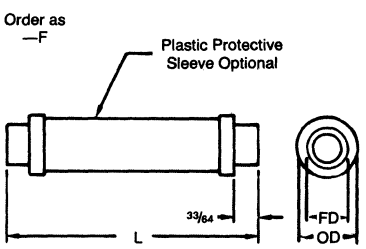
FERRULE CAP
FIG. 4

HIGH MEGOHM RESISTORS

Type	Volts Max.	Watts Max.	Dimensions—Inches L	D	Ohms Min.	Ohms Max.	Available in Fig. No.'s
HFA	2,500	.5	¾	¼	1M	1T	2
HFB	5,000	1	1½	¼	1M	5T	2
HFC	3,500	1	1	5/16	1M	25T	1,2,4
HFD	10,000	2	1¾	5/16	1M	50T	1,2,4
HFE	15,000	3	3	5/16	1M	100T	1,2,4
HFF	30,000	5	5½	5/16	1M	100T	1,2,4
HFG	15,000	4	2½	9/16	1M	100T	1,2
HFH	25,000	6	4	9/16	1M	100T	1,2
HFJ	40,000	10	6½	9/16	1M	100T	1,2



RADIAL BAND
FIG. 5



FERRULED ENDS
FIG. 6

- Standard Tolerances are 20%, 15%, 10% and 5% for the SF and SJ Series and 10%, 5% and 3% for the HF Series.
- Resistors of greater than 10G, are provided with special coating to minimize effects of handling and humidity, no change in diameter.
- All Dimensional Tolerances ± 1/64 or 1% whichever is greater.
- If units are to be operated near maximum limits, at elevated ambient, or in a coolant, order resistors without sleeving.
- Special values or configurations are available upon request.
- Special coatings available upon request.

OAC

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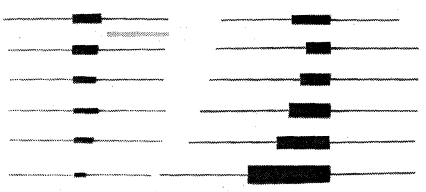
PRECISION POWER RESISTORS
Sub-Miniature Wire Wound
V-Coated for 350° C

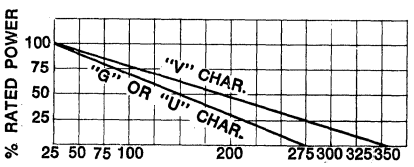


TYPE A MOLDED
.4 to 14 watts

TYPE B MOLDED
1 watt to 10 watts
Beryllium or Alumina Oxide Core

ELECTRICAL SPECIFICATIONS

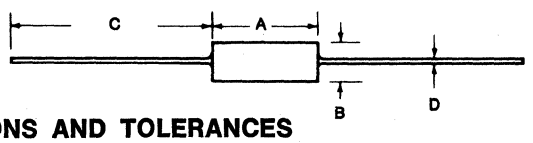
1. **Tolerances** — 5%, 3%, 1%, .5%, .25%, .1%, .05%, .02%.
2. **Dielectric Strength** — 500 VAC for 04A, 05A, 15A; B1, B3. Bal. 1000 VAC, circular foil wrap method or V-block.
3. Life — Maximum 0.5% resistance change after 1000 hour load life cycling 1½ hours on, ½ hour off, full load at 25°C).
4. Temperature Coefficient — Below 1 ohm = 90 PPM, Below 10 ohms = 50 PPM, Below 50 ohms = 30 PPM, All above = 20 PPM.



AMBIENT TEMP. DEG. CENTIGRADE

GENERAL SPECIFICATIONS

1. **Molded Type A** axial-lead resistors, molded for uniformity and minimum size for today's space age requirements.
2. Completely welded construction.
3. Meet or exceed requirements of Mil-R26, characteristic U.
4. Leads are tinned copperweld. Other materials available on request.
5. High temperature silicone molded coating.
6. **Molded Type B** beryllium oxide or alumina with power ratings 1.4 to 4 times higher than conventional ceramic resistors of the same size.

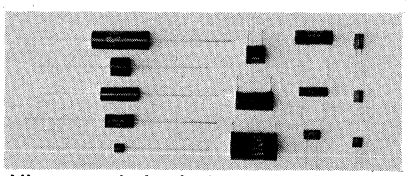


DIMENSIONS AND TOLERANCES

PRC Type	DIMENSIONS AND TOLERANCES A	B	C	D	Wattages G 275°	V 350°	Max. Res. Value	Working Voltage	MIL-R26 E Equiv.
04A	.250 ±.010	.090 ±.010	1.5	#24	.4	.75	3.4K	30	
05A	.330 ±.010	.110 ±.010	1.5	#24	.5	1.0	6K	50	
*15A	.412 ±.010	.115 ±.010	1.5	#24	1.25	2.0	7.5K	75	
20A	.550 ±.010	.115 ±.010	1.5	#24	1.25	2.0	10K	100	
S1A	.490 ±.010	.162 ±.010	1.5	#22	1.75	2.5	15K	150	
1A	.610 ±.010	.210 ±.010	1.5	#20	3.0	3.75	20K	200	
**N1A	.535 ±.010	.220 ±.010	1.5	#20	3.0	3.75	20K	200	
25A	.890 ±.010	.210 ±.010	1.5	#20	3.0	4.5	28K	200	
2A	.535 ±.010	.270 ±.010	2.0	#18	3.0	4.25	20K	200	
3A	.656 ±.010	.270 ±.010	2.0	#18	3.25	5.2	30K	200	
***5A	.900 ±.010	.312 ±.010	2.0	#18	5.5	7.5	75K	400	
7A	1.187 ±.010	.312 ±.010	2.0	#18	7.0	9.0	100K	600	
****10A	1.825 ±.010	.405 ±.010	2.0	#18	10.0	14.0	200K	1000	
B1	.250 ±.010	.090 ±.010	1.5	.020	1.0w	1.5w	3.4K	35	RW 81
B2	.325 ±.010	.090 ±.010	1.5	.020	1.5	2.0	4.9K	48	
B3	.412 ±.010	.115 ±.010	1.5	.020	2.25	3.0	10.4K	85	RW 80
B5	.610 ±.010	.210 ±.010	1.5	.032	4.0	5.0	24.5K	172	
B5C	.540 ±.010	.240 ±.010	2.0	.040	5.0	7.0	32.3K	260	
B6	.656 ±.010	.270 ±.010	2.0	.040	6.0	8.0	47.1K	300	
B10	.900 ±.010	.312 ±.010	2.0	.040	7.0	10.0	96 K	470	

* RW 70 ** RW 59/69/79 *** RW 57/67/74 **** RW 58/68/78
For Non-Inductive Winding add Suffix "N" to Callout.

MOLDED PRECISION WIRE WOUND RESISTORS



TYPE AP: AXIAL PRECISION
TYPE LP: LUG PRECISION
TYPE RP: RADIAL PRECISION
TYPE RPC: RECTANGULAR PRINTED CIRCUIT
TYPE PC: PRINTED CIRCUIT

All are non-inductively, reverse Pi wound at minimum wire tension for maximum long life stability. All production is aged before calibration for insurance of minimum long-term load-life drift. Due to advance winding techniques and design they have extremely low rise time characteristics approaching film type resistors. Through matching of materials, resistance changes from temperature expansion rates is eliminated. Zero voltage coefficient and low noise characteristics. Leads are solderable or weldable. TC of 15 PPM/°C standard. TC of 2 PPM/°C to 6000 PPM/°C available. All bridges and other instrumentation used in calibration are periodically checked against National Bureau Primary Standards. Designs exceed Mil-R-93 and Mil-R-9444. Distinct capabilities for: Special Networks; Matched Sets; Voltage Dividers; Molded and encapsulated Modules.

DIMENSIONS TABLE

New Type		Comm. Watts	Max. Res.	Max. Dia.	Max. Length	Max. Volt.	Lead Spacing	Lead Gauge	Hole Size
118AP		.08	250K	.128	.263	100		#24	
122AP		.10	500K	.128	.380	100		#24	
130AP		.13	1.2M	.190	.300	100		#22	
134AP		.15	1.3M	.190	.380	100		#22	
142AP		.15	750K	.260	.260	150		#20	
152AP	RB56	.20	2.0M	.260	.385	100		#20	
156AP		.25	2.5M	.260	.510	150		#22	
160AP	RB55	.25	2.5M	.260	.510	150		#20	
164AP	RB54	.35	4.5M	.260	.760	300		#20	
168AP	RB53	.50	8.0M	.385	.760	400		#20	
172AP		.50	4.0M	.385	.510	300		#20	
176AP		.50	8.0M	.510	.510	400		#20	
180AP		.60	9.0M	.510	.635	400		#20	
184AP	RB52	.60	9.0M	.385	1.010	400		#20	
188AP	RB57	1.00	18.0M	.510	1.010	800		#20	
192AP	RB58	1.50	30.0M	.510	1.510	900		#20	
202RP		.25	500K	.260	.285	100	.200	#22	N.H.
214RP		.25	1.0M	.260	.447	150	.277	#22	#2
324LP	RB08	.50	4.0M	.510	.510	400	.325	Lug	#6
372LP	RB18	2.00	10.0M	.760	1.260	1000	1.000	Lug	#6
400RPC		.125	500K	.145 x .260	x .260	150	.125	#20	
500PC		.25	500K	.260	.320	150	.200	#22	
512PC		.20	700K	.260	.410	150	.150	#20	

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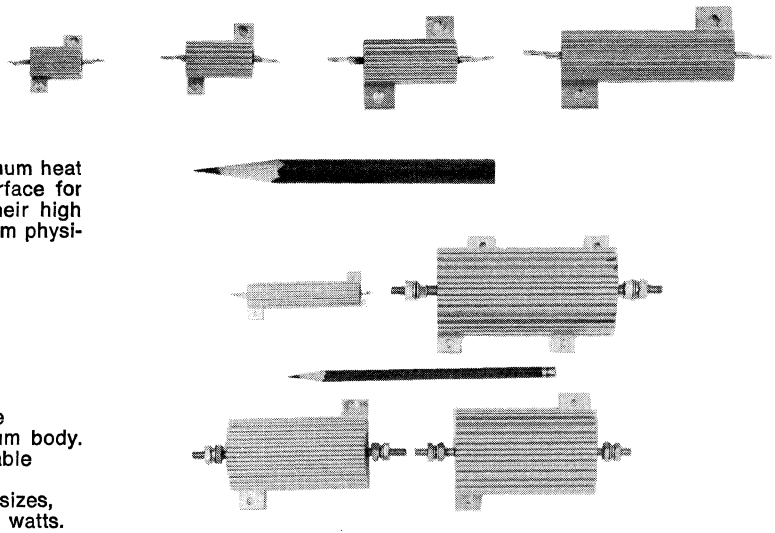
PRECISION POWER RESISTORS
Aluminum-Finned Heat Sink

TYPE CH CHASSIS MOUNT
5 through 250 watts

TYPE BCH CHASSIS MOUNT
15 through 35 watts
Beryllium Oxide or Alumina Core



Chassis Mount, Type CH units are designed for maximum heat dissipation by mounting solidly to metal chassis surface for maximum heat transfer. They are outstanding for their high power dissipation with precision tolerances in minimum physical sizes.

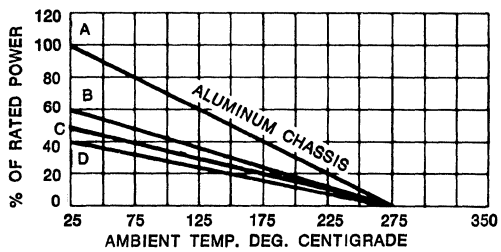
ELECTRICAL SPECIFICATIONS

1. Resistance Range — .05 ohms to 275K ohms.
2. Tolerance — 5%, 3%, 1%, .5%, .25%, .1%, .05%.
3. Temperature Coefficient — ±20 PPM to 90 PPM

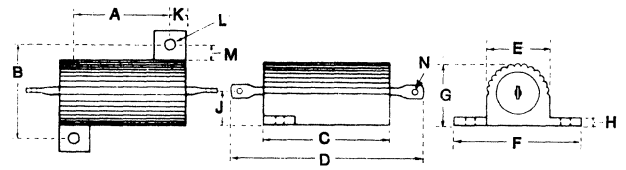
GENERAL SPECIFICATIONS

1. Lower hot spot ratings due to exclusive complete encapsulation of element within anodized aluminum body.
2. Welded construction throughout assures long stable load life.
3. Heavy spade lug type leads on 5 through 70 watt sizes, threaded heavy stud terminals on 100 through 250 watts.
4. 1000 VAC minimum dielectric strength on 5CH, 10CH, B5CH and B10CH; 2500 VAC on 25CH, 50CH, 100CH, and B25CH; 5500 VAC on all others.
5. Temperature Range — −55°C to +275°C.
6. Eight standard sizes.

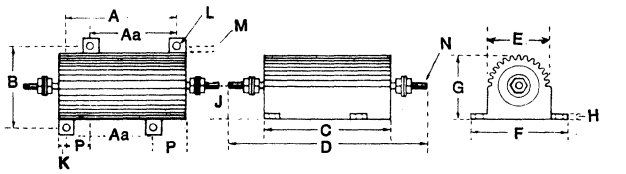
DERATING CURVES



Temp. of −55°C to +275°C. Derating is required for reduced chassis mounting area and high ambient temp.
Curves:
A — When mounted on proper alum.
Chassis:
4x6x2x.040 alum. chassis = 5CH & 10CH.
5x7x2x.040 alum. chassis = 25CH, B25CH, & B50CH.
12x12x.059 alum. panel = 50CH & 100CH.
12x12x.125 alum. panel = 110CH, 180CH, and 250CH.
B — Unmounted 5CH, 10CH, B5CH, B10CH.
C — Unmounted 25CH, 100CH, B25CH, and 110CH.
D — Unmounted 50CH, 180CH, and 250CH.



5CH, 10CH, 25CH, 50CH, 100CH, B5CH, B10CH, B25CH



110CH, 180CH, 250CH

Core Conductivity at 275°C — BTU-Ft / Ft²-Hr-°F

- BERYLLIUM OXIDE (BeO)-64
- ALUMINUM OXIDE — 8
- STEATITE — 1.5

DIMENSIONS TABLE

PRC Type	Mil-R 18546	Com. Watts	Max. Res.	A	Aa	B	C	D	E	F	G	H	J	K	L	M	N	P	No. Mtg. Screw Size
5CH	RE60	5	20K	.444	—	.490	.500	1.125	.334	.646	.317	.075	.145	.078	.093	.078	.050		2-#2
10CH	RE65	10	30K	.562	—	.625	.750	1.375	.438	.812	.406	.100	.203	.093	.093	.094	.086		2-#2
25CH	RE70	25	75K	.719	—	.781	1.062	1.938	.500	1.094	.563	.094	.250	.171	.125	.125	.086		2-#2
50CH	RE75	50	200K	1.563	—	.844	1.968	2.781	.625	1.156	.625	.094	.281	.196	.125	.125	.086		2-#4
100CH	—	70	275K	2.625	—	.844	2.968	3.781	.625	1.156	.625	.094	.281	.196	.125	.125	.086		2-#4
B5CH	RE60	15	20K	.444	—	.490	.600	1.125	.334	.646	.317	.075	.145	.078	.093	.078	.050		2-#2
B10CH	RE65	20	30K	.562	—	.625	.750	1.375	.438	.812	.406	.100	.203	.093	.093	.094	.086		2-#2
B25CH	RE70	35	75K	.719	—	.781	1.062	1.938	.500	1.094	.563	.094	.250	.171	.125	.125	.086		2-#2
TOL.	—	—	—	±.010	—	±.010	±.062	±.062	±.062	±.031	±.031	±.031	±.031	±.031	±.005	±.016	±.005 thd	—	—
110CH	RE77	100	50K	2.750	—	2.250	3.500	5.478	1.80	2.813	1.750	.188	.800	.375	.188	.250	12/24 thd		2-#8
180CH	—	180	50K	2.750	—	2.500	3.500	5.478	2.125	3.000	2.188	.250	.950	.375	.188	.200	12/24 thd		2-#8
250CH	RE80	250	45K	3.875	3.00	2.500	4.500	7.000	2.125	3.000	2.188	.250	1.00	.312	.188	.200	¼/20	.875	4-#8
TOL.	—	—	—	±.01	‡.01	±.01	±.094	±.094	REF.	±.031	±.031	±.031	REF.	±.031	±.010	REF.	—	±.01	—

‡ For Non-Inductive Winding add Suffix "N" to Callout.

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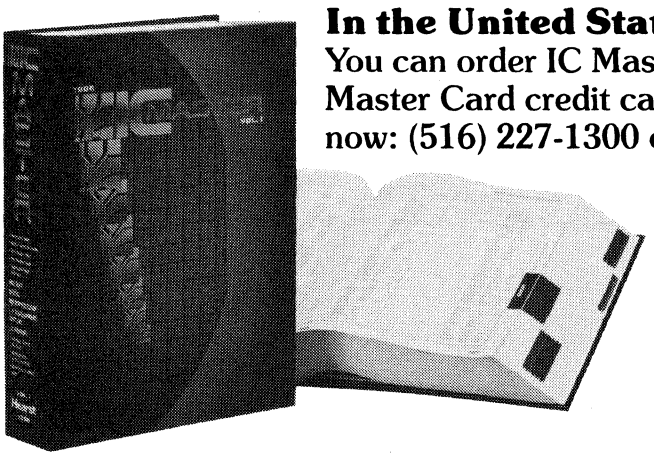

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CR-	XXX	-XXXX	-XX	-X	-X	-X	-X
SR							
CR- Thin Film SR- Thick Film	Value in [1] Ohms	Size Code [2]	Thickness Code	Tolerance Code	Termination Code	Substrate Code	Resistor Material
Sizes: 0302**		0805	Standard	M = ±20%	**Thin Film:**	**Substrate**	TaN (CR only)
0303*		1005**	10 = .010	K = ±10%	W-Gold One Side		
0402		1008	25 = .025	J = ± 5%	2W-Gold Two Sides	A-Aluminum	NiCr
0404**		1010**		G = ± 2%	S-Solder (SN 62)	B-Beryllia	
0502**		1206	Others Available	F = ± 1%	R-Wraparound	S-Silicon	
0504		1612		Others Available		G-Glass	
0505*		2010**			**Thick Film:**		
0604		2512**			D-Palladium Silver		
0703**		3725**			T-Platinum Gold		
0705		Custom			W-Gold		
0202					2-Metal Two Sides		
0503					R-Wraparound		
					S-Solder (SN62)		

*Other Sizes Available.

Available

1. Nichrome or Tantalum Nitride Thin Film
2. Passivation or Glassivation
3. Aluminum conductor
4. Tolerances below ± 1%
5. Specific TCR's
6. High Temp Operating Capabilities
7. Custom Testing
8. Nickel Barrier (CR)

CUSTOM THIN FILM COATINGS

Piconics is equipped to provide custom THIN FILM coatings as either a product or service. Our In-Line Automatic Sputtering system and Fast Cycle Automatic E-Beam Unit together with peripheral controls gives Piconics a broad range of Film Capabilities. We provide coated substrates of Alumina, Beryllia or Glass with materials such as Gold, Aluminum, Nichrome, Tantalum, Nickel, Chrome, Titanium/Tungsten, Indium Tin, Silicon Nitride, Silicon Dioxide, and others upon request.

NOTE: Tantalum and Nichrome coating to your Specified Sheet Resistivity.

General Performance Specifications

Property	Conditions	Thin Film	Thick Film
Temp Coefficient	−55° to +125°C	Nichrome 0 - 50 PPM Tantalum 0 to −250 ppm	0 ± 200 ppm
Temp Track (Networks)	−55°C to +125°C	1 - 2 ppm typ.	5 - 10 ppm typ.
Noise*	MIL-STD-202 M 308	−20 dB to −35 dB	+10 dB to −30 dB
Voltage Coefficient	—	<.1 microvolt/volt	0.1% / volt typ. (depending on value)
Value Range	—	2 ohms - 2 meg. (Higher as Custom)	2 ohms - 100 meg.
Operating Voltage	Typical 100 V.	Layout/Value dependent	Layout Value dependent
Stability	1000 hours +125°C w/Power	±0.5% Max.	±1.0% Max.
Short Term Overload	2.5x Max Rated Current	±.25% Max.	±.5% Max.
Moisture Resistance	MIL-STD-202 M106	±0.5% Max.	±0.5% Max.
Thermal Shock	MIL-STD-202 M107	±.15% Max.	±.25% Max.
Solder Exposure	300°C −30 sec.	±0.4% Max.	±0.5% Max.
High Frequency	Layout/Film dependent	to 18 GHz	To 2 GHz
Power Rating: Alumina Beryllia Silicon	Size Dependent	50mw to 5w 200mw − 10w 200mw − 5w	50mw to 15w 200mw to 15w N.A.
High Temp Exposure	150°C, 100 hours	±.25% Max.	±0.5% Max.
Resistance to Bonding	—	±.15% Max.	±.25% Max.

Notes: 1. TCR may be "tailored" at times to meet needs to ± 5ppm.
2. High Temperature Resistors available to operate at up to +300°C.
3. Operating Voltage may be custom designed to 1200V.
4. Parts inspected to MIL-STD-883 Method 2010/2017 Level B.
5. Testing meets MIL-R-55342 Requirements.
6. Custom Requirements Welcomed.
7. Wraparounds available on most sizes for Surface Mounting.
8. Silicon Dioxide Passivation available on Thin Film and Thick Film and Glassivation on Thick Film.

*The Johnson Noise level is dependent on Resistor value and film sheet resistivity with lower noise levels found on lower resistivity Films.

**Derate Power from Max at 70°C to zero at 150°C

CUSTOM LASER SERVICES

Our In-House Tooling/Probe Card assembly and YAG Laser Systems provide customers with resistor trimming of THICK AND THIN FILM circuits on a rapid turn-around basis. We can process prototype quantities or large production runs rapidly to provide our customers with a "panic" turnaround or backup to their own shop. Piconics is equipped for passive or active trimming of thin or thick film materials automatically, semi-automatically or manually.

PICONICS, INC. 26 CUMMINGS ROAD, TYNGSBORO, MA 01879 • TEL: (508) 649-7501 • TELEX: 754759 • FAX: 508-649-9643

PRECISION RESISTIVE PRODUCTS, INC.
HIGHWAY 61 SOUTH, MEDIAPOLIS, IOWA 52637
(319) 394-9131 • TWX: 510-100-8039 • FAX: (319) 394-9280

METAL FILM RESISTORS

PR-SERIES

ULTRA PRECISION METAL FILM RESISTORS

- **Low Temperature Coefficients**
- **Tight Tolerance • High Stability • Low Noise**

DIMENSIONS

Style	Max. L.	Max. Dia.	CL to CL	Dim. A
PR-/20	0.170	0.072	0.200	AWG #26
PR1/10	0.280	0.102	0.300	AWG #22
PR1/8	0.400	0.150	0.450	AWG #22
PR1/4	0.600	0.200	0.685	AWG #22

SPECIFICATIONS

Style	Resistance Range (Ohms)	Wattage Rating @ 85°C	Voltage Rating
PR1/20	10-300K	1/20	200
PR1/10	10-500K	1/10	300
PR1/8	10-1M	1/8	400
PR1/4	10-1M	1/4	500

TYPICAL PERFORMANCE	% ΔR
1000 Hr. Load Life 85°C	0.02
Humidity	0.04
Temperature Cycling	<0.01
Short Time Overload	<0.01
Dielectric Withstanding	<0.01
Noise	<−30dB
Insulation Resistance	>10000 M. Ohm
Shelf Life	<50 PPM/YR.

TEMPERATURE COEFFICIENTS
TC25 = 0 ±25 PPM/°C −20 to +85°C
TC20 = 0 ±20 PPM/°C −20 to +85°C
TC15 = 0 ±15 PPM/°C −20 to +85°C
TC10 = 0 ±10 PPM/°C −20 to +85°C
TC5 = 0 ± 5 PPM/°C −20 to +85°C

RESISTANCE TOLERANCES
±1.0%, ±0.5%, ±.25%, & ±0.1%, ±0.5%, ±.02%, ±.01%

LEAD MATERIAL
OFHC with 60/40 Tin/Lead Coating.

RL-SERIES

ULTRA PRECISION METAL FILM RESISTORS

- **Radial Leads • Small Size**
- **Low TC • High Stability**

DIMENSIONS (INCHES)

H	Height	0.365
L	Length	0.260
W	Width	0.140
LS	Lead Spacing Lead Gage #22	0.150

SPECIFICATIONS

Style	Temperature Coefficient	Resistance Range (Ohms)	Standard Tolerance	Wattage @ 85°C
RL 1	20 PPM/°C 15 10 5	20 thru 100K	1%, 5%, .25%, .10%, .05%, & .02% .01%	0.1
RL 3	20 PPM/°C 15 10 5 2	20 thru 100K	1%, 5%, .25%, .1% .05%, & .02% .01%	0.3

TYPICAL ENVIRONMENTAL PERFORMANCE	
	% ΔR
†000 Hr. Load Life	±0.02%
Humidity	±0.04%
Temperature Cycling	±0.01%
Short Time Overload	±0.01%
Insulation Resistance	>100 Megohms
Noise Index	<−30dB
Voltage Coefficient	<0.05 PPM/Volt
1 Year Shelf Life	±50 PPM

TEMPERATURE COEFFICIENTS
TC20 = 0 ±20 PPM/°C −20 to +85°C
TC15 = 0 ±15 PPM/°C −20 to +85°C
TC10 = 0 ±10 PPM/°C −20 to +85°C
TC 5 = 0 ± 5 PPM/°C −20 to +85°C

CUSTOMIZED RESISTORS

SETS AND NETWORKS

- **Custom Designed • Cost Effective**
- **Low TCR • High Stability**

CUSTOMIZED RESISTOR SETS AND NETWORKS

Because of the high consistency and uniformity of the film deposition process and the high, repeatable accuracy of automated trimming equipment, descrete film resistors are available in matched pairs, multivalue sets and discrete networks with high precision and very dependable performance at reasonable cost. Resistance values, tolerances, temperature coefficients, as well as the matching and/or tracking of these parameters, can be specified and meet to exceptionally high degrees. The optimum range for the tightest requirements is 100 ohms thru 100,000 ohms, but 10 ohms thru 1 megohms is a practical range for less stringent requirements.

NOTE:
Cost savings can be realized when relatively tight matching requirements are specified while permitting the absolute parameters of the discrete resistor to have more relaxed specifications.
Application engineers are available to assist you in specifying your requirements in the most economical way possible.
Please contact the factory for complete information.

GENERAL SPECIFICATIONS	
Nominal Resistance	10 ohms thru 1 megohm
Resistance Tolerance	±1% thru ±0.01%
Wattage	1/20 watt thru 1 watt
Temperature Coefficient	±100 PPM thru ±5 PPM
Resistance Matching	±1% to ±.005%
Temperature Coef. Tracking	±50 PPM/°C to ±1 PPM/°C

PACKAGING

Matched sets are individually packaged in coin envelopes and identified by customer part number.

Discrete resistor networks are available in S.I.P. and D.I.P. configurations and can be customized in an infinite variety of shapes and sizes to meet customer requirements.

PRECISION RESISTIVE PRODUCTS, INC.
HIGHWAY 61 SOUTH, MEDIAPOLIS, IOWA 52637
(319) 394-9131 • TWX: 510-100-8039 • FAX: (319) 394-9280

METAL FILM RESISTORS

SGP¼-SERIES

GENERAL PURPOSE MINIATURE ¼ WATT RESISTORS

- **Small Size** • **¼ Watt Rating**
- **Conformal Coating** • **Metal Film Performance**

DIMENSIONS

Style	Max. L.	Max. Dia.	Dim. A	Lead L.
SGP¼	0.170	0.072	0.020	1.0 ±0.062

SPECIFICATIONS

Style	Resistance Tolerance	Resistance Range (Ohms)	Wattage Rating @ 70°C	Voltage Rating
SGP¼	1%, 5%	10R-500K	¼	200

NOTE:
The SPG¼ is suitable for high density applications and is capable of being auto inserted. Standard metal film performance has been enhanced by using a ceramic core, .020 leads, in line testing and a state of the art coating system for environmental protection. Marking is alpha-numeric.

TYPICAL PERFORMANCE	% ΔR
1000 Hr. Load Life @ 70°C	±0.25
Temperature Cycling	0.25
Noise	<−30dB
Shelf Life	<100 PPM
Humidity	0.40
Short Time Overload	0.25
Insulation Resistance	>1000 M

TEMPERATURE COEFFICIENTS
50 PPM/°C & 100 PPM/°C

RESISTANCE TOLERANCES
±5.0%, ±2.0% ±1.0%

LEAD MATERIAL
The core material is OFHC and is electroplated with a 200 micro inch coating of 60/40 tin/lead.

GP-SERIES

GENERAL PURPOSE PRECISION METAL FILM RESISTORS

- **Economical** • **High Performance**
- **Very Stable** • **Low Noise**

DIMENSIONS

Style	Max. L.	Max. Dia.	CL to CL	Dim. A
GP⅛	0.170	0.072	0.200	AWG #26
GP¼	0.280	0.102	0.325	AWG #22
GP½	0.400	0.150	0.450	AWG #22
GP¾	0.600	0.200	0.685	AWG #22
GP1	0.600	0.200	0.685	AWG #20

SPECIFICATIONS

PRP Style	Mil. Style	Resist. Range (Ohms)	Wattage Rating @ 70°C	Wattage Rating @ 125°C	Voltage Rating
GP⅛	RN50	10—500K	⅛	1/20	200
GP¼	RN55	2.5—500K	¼	1/10	300
GP½	RN60	2.5—1 M	½	⅛	500
GP¾	RN65	10—1.5M	¾	¼	500
GP1	RN70	10—1.5M	1	½	500

NOTE:
The GP-Series of resistors is conformally coated and fully protected against moisture by a multi-paint coat system and a hard epoxy outer coating.
Marking is alpha-numeric and meets the most demanding marking requirements. Special marking is available upon request.
Consult the factory concerning failsafe, flameproof, and fusing requirements.

TYPICAL PERFORMANCE	% ΔR
Temperature Cycling	0.05
Low Temperature Operation	0.03
Terminal Strength, 5 Lb. Load	0.02
Resistance To Soldering Heat	0.02
Dielectric Withstanding Voltage	0.02
Short Time Overload	0.05
Moisture Resistance	0.20
1000 Hour Load Life @ 125°C	0.15

TEMPERATURE COEFFICIENTS
TC25 = 0 ± 25 PPM/°C −20 to +85°C
TC50 = 0 ± 50 PPM/°C −20 to +85°C
TC100 = 0 ±100 PPM/°C −20 to +85°C
TC250 = 0 ±250 PPM/°C −20 to +85°C
1010

RESISTANCE TOLERANCES
±5.0%, ±2.0%, ±1.0%, ±0.5%, ±.25%, & ±0.1%

LEAD MATERIAL
OFHC with 60/40 Tin/Lead Coating

LCR¼-SERIES

GENERAL PURPOSE PRECISION METAL FILM RESISTORS

- **Low Cost** • **Taped and Reel Package**
- **Color Band Marking** • **Exceeds Mil-R-22684B & Mil-R-10509F Performance Requirements**

DIMENSIONS

Max. L.	Max. Dia.	Lead L.	Lead Dia.
0.270″	0.098″	1¼″	0.025

GENERAL SPECIFICATIONS

Resist. Tolerance	Resist. Range	Temp. Coef. of Resist.	Power Rating	Max. Volt.
1% 2% 5%	10Ω through 1M	50 & 100 PPM/°C	¼W (70°C)	250 VRMS

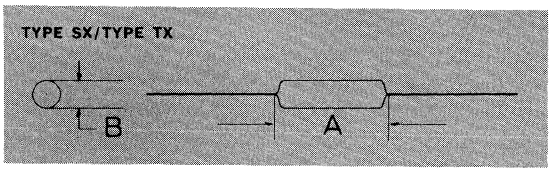
Performance Characteristics		PRP	Mil-R-22684B	Mil-10509F
Type No. (Style)		LCR¼	RL07	RN55D
Size: Inch	Body Length	.270	.243 ±.038	.250 ±.031
	Body Dia.	.098 Max.	.090 ±.008	.109 ±.031
	Lead Dia.	.024 ±.002	0.23 ±.004	.025 ±.002
Power Rating		0.25W at 70°C 0.125W at 125°C	0.25W at 70°C 0.078W at 125°C	0.125W at 70°C 0.0625W at 25°C

Performance Characteristics	PRP	Mil-R-22684B	Mil-10509F
Max. Rated Continuous Working Voltage	250V	250V	200V
Max. Ambient Temperature	165°C	150°C	165°C
TCR	±50 & ±100 PPM/°C	±200 PPM/°C	+200 −500 PPM/°C
Nominal Resistance Range	10Ω to 1MΩ	47Ω to 150kΩ	10Ω to 301kΩ
Standard Tolerances	1%, 2% & 5%	5% & 2%	1%
Dielectric Withstanding Voltage ΔR	0.25%	0.5%	0.5%
Insulation Resistance	10,000 MΩ	1,000 MΩ	10,000 MΩ
Temperature Cycling ΔR	0.25%	1.0%	0.5%
Short-Time Overload ΔR	0.25%	0.5%	0.5%
Moisture Resistance ΔR	0.5%	1.5%	1.5%
Load Life ΔR	1.0%	2.0%	1.0%
Terminal Strength ΔR	0.2%	0.5%	0.2%
Resistance to Soldering Heat ΔR	0.5%	0.5%	0.5%
Shock ΔR	0.2%	0.5%	0.5%
Vibration ΔR	0.2%	0.5%	0.5%
Low Temperature Operation ΔR	0.25%	0.5%	0.5%
Shelf Life ΔR	0.2%	0.2%	N.A.

PRECISION

TYPE SX (SILICONE PROTECTION)
TYPE TX (ECONOMY LINE)

- Internationally popular and our best selling high performance wire wound resistors.
- Widest selections available.
- 100% testing to assure uniform quality.
- Economically priced with no minimums.
- For custom special-purpose applications.



ELECTRICAL AND PHYSICAL SPECIFICATIONS

PRC Types				$P=\frac{E^2}{R}$	$E=\sqrt{PR}$	Body Dimensions ±.787mm (.031")				1.5"L. (Leads)†	Resistance (Ohms)		
TYPE SX		TYPE TX				(A) Length		(B) Diameter					
Inductive	Non-inductive	Inductive	Non-inductive	Max. Watts	Max. Volts	mm	(ins.)	mm	(ins.)	Max. Diam.	Min.	Max. Standard	Max. Special*
SX030	—	TX030	—	.03W	25V	5.59	(.220")	1.27	(.050")	.020"	1.0	3K	5K
SX062	SX062N	TX062	TX062N	.04W	35V	6.86	(.270")	2.03	(.080")	.020"	1.0	17K	30K
SX063	SX063N	TX063	TX063N	.05W	50V	8.43	(.332")	2.03	(.080")	.020"	0.1	20K	50K
SX072	SX072N	TX072	TX072N	.06W	45V	6.86	(.270")	2.29	(.090")	.020"	0.1	25K	35K
SX073	SX073N	TX073	TX073N	.07W	65V	8.43	(.332")	2.29	(.090")	.020"	0.1	30K	65K
SX093	SX093N	TX093	TX093N	.1W	85V	8.43	(.332")	2.92	(.115")	.025"	0.1	35K	75K
SX094	SX094N	TX094	TX094N	.1W	100V	10.03	(.395")	2.92	(.115")	.025"	0.1	50K	100K
SX095	SX095N	TX095	TX095N	.125W	125V	11.61	(.457")	2.92	(.115")	.025"	0.1	60K	180K
SX105	SX105N	TX105	TX105N	.166W	165V	11.61	(.457")	3.3	(.130")	.025"	0.1	75K	210K
SX123	SX123N	TX123	TX123N	.166W	165V	8.43	(.332")	3.68	(.145")	.025"	0.1	40K	120K
SX106	SX106N	TX106	TX106N	.2W	200V	13.21	(.520")	3.3	(.130")	.025"	0.1	100K	280K
SX124	SX124N	TX124	TX124N	.2W	200V	10.03	(.395")	3.68	(.145")	.025"	0.1	50K	160K
SX143	SX143N	TX143	TX143N	.2W	200V	8.43	(.332")	4.06	(.160")	.028"	0.1	50K	130K
SX154	SX154N	TX154	TX154N	.25W	250V	10.03	(.395")	4.47	(.176")	.028"	0.1	100K	200K
SX155	SX155N	TX155	TX155N	.25W	250V	11.61	(.457")	4.47	(.176")	.028"	0.1	100K	300K
SX156	SX156N	TX156	TX156N	.33W	330V	13.21	(.520")	4.47	(.176")	.028"	0.1	140K	400K
SX174	SX174N	TX174	TX174N	.33W	330V	10.03	(.395")	4.83	(.190")	.028"	0.1	130K	220K
SX175	SX175N	TX175	TX175N	.33W	330V	11.61	(.457")	4.83	(.190")	.028"	0.1	135K	350K
SX158	SX158N	TX158	TX158N	.5W	500V	16.38	(.645")	4.47	(.176")	.028"	0.1	450K	600K
SX177	SX177N	TX177	TX177N	.5W	500V	14.78	(.582")	4.83	(.190")	.028"	0.1	400K	540K
SX185	SX185N	TX185	TX185N	.5W	500V	11.61	(.457")	5.26	(.207")	.028"	0.01*	135K	360K
SX186	SX186N	TX186	TX186N	.5W	500V	13.21	(.520")	5.26	(.207")	.028"	0.01*	150K	480K
SX188	SX188N	TX188	TX188N	.6W	600V	16.38	(.645")	5.26	(.207")	.028"	0.01*	450K	720K
SX2210	SX2210N	TX2210	TX2210N	.8W	800V	19.56	(.770")	6.10	(.240")	.032"	0.1	511K	1.1 MEG
SX3110	SX3110N	TX3110	TX3110N	1W	1000V	19.56	(.770")	8.43	(.332")	.032"	0.1	750K	1.6 MEG
SX2812	SX2812N	TX2812	TX2812N	1.25W	1000V	22.73	(.895")	7.62	(.300")	.032"	0.1	1 MEG	1.8 MEG
SX3114	SX3114N	TX3114	TX3114N	1.33W	1000V	25.91	(1.020")	8.43	(.332")	.032"	0.1	1.25 MEG	2 MEG
SX3712	SX3712N	TX3712	TX3712N	1.5W	1000V	22.73	(.895")	11.1	(.437")	.032"	0.25	1.5 MEG	2.5 MEG
SX3716	SX3716N	TX3716	TX3716N	2W	1250V	29.08	(1.145")	11.1	(.437")	.032"	0.5	2 MEG	3.5 MEG
SX3724	SX3724N	TX3724	TX3724N	3W	1250V	41.78	(1.645")	11.1	(.437")	.032"	0.5	3 MEG	5 MEG
SX3730	SX3730N	TX3730	TX3730N	5W	1500V	51.31	(2.020")	11.1	(.437")	.032"	0.5	4 MEG	6 MEG

* 0.01 ohm to 0.1 ohm and maximum special resistance values available in non-standard physical sizes — 0 + .062"
† Commercially pure copper (Electrolytic Tough Pitch/Oxygen-Free High Conductivity).

ENGINEERING DATA:

1 RESISTANCE RANGE AND TOLERANCE "Repeatable (part-to-part)"
Any ohmic value or decimal part of an ohm desired with tolerances to ±0.05%. Refer to type HR for closer resistance tolerances.

2 TEMPERATURE COEFFICIENT OF RESISTANCE (TCR)
Zero ±10ppm/°C. (Standard)
For specific TCR characteristics to ±1 ppm/°C refer to type HR. See type PT for Precision Positive (+) TCR characteristics to +6000 ppm/°C.

3 STABILITY VS. TIME CHARACTERISTICS "Low ΔR"
To ±0.005%/year at 25°C (no load).

4 POWER RATINGS VS. AMBIENT TEMPERATURE AND RESISTANCE TOLERANCE
(Full power ratings are based upon standard ±1% resistance tolerance. Derating is required for higher temperatures and closer resistance tolerances.)
Type SX: To +125°C.
Type TX: To + 85°C.

5 INDUCTANCE
The standard Type SX/TX resistors are inductively wound. Non-inductive resistors are available — add suffix letter "N" in part number.

6 TERMINALS
Solderable hot-tinned (63% Sn — 37% Pb) copper wire leads. Low thermal EMF, noise free construction.

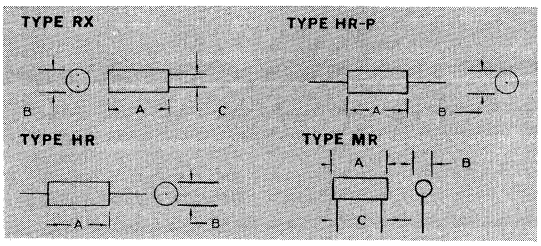
7 PROTECTIVE COATINGS
Type SX: New **solvent resistant** silicone-epoxy-seal.
Type TX: Commercial plastic conformal coating.

8 PURCHASING INFORMATION
Please specify: Quantity, type, resistance value, resistance tolerance and special features which may apply.

PRC PRECISION RESISTOR CO., INC.
10601 75th STREET NO. • LARGO, FL 34647 U.S.A. • TEL: (813) 541-5771 • TELEX: 821788 • FAX: (813) 546-9515

AXIAL LEAD TYPE HR
HIGH VOLTAGE TYPE HR-P
PC AND RADIAL LEAD TYPES RX/MR

ULTRA



- Ultra-precision wire wound resistors.
- Greater stability of calibration for all resistance tolerances.
- TCR zero ±5 ppm/°C (std.) matched to exact temperature span of operation.
- Ideal for precise DC measurements, transfer standards and state-of-the-art voltage dividers.
- N.B.S. traceability and certification available.

ELECTRICAL AND PHYSICAL SPECIFICATIONS

PRC Types	Meets or Exceeds Environmental Conditions of: MIL-R-39005	MIL-R-93	Max. Watts 1% Res. Tol.	Max. Volts	Body Dimensions ±.787mm (.031″) (A) Length mm	(ins.)	(B) Diameter mm	(ins.)	Standard Space C	(ETP/OFHC)* Tinned Copper Leads Diam. Max.	Length† (±.125″)	Resistance (Ohms) Min.	Max. Standard	Max. Special
PRINTED CIRCUIT														
RX378N	—	RB70	.5W	200V	12.7	(.500″)	9.53	(.375″)	.200″	.032″	1″	0.1	301K	500K
RX255N	RBR71	RB71	.25W	100V	7.92	(.312″)	6.35	(.250″)	.200″	.025″	1″	0.1	100K	150K
RX258N	—	—	.33W	300V	12.7	(.500″)	6.35	(.250″)	.200″	.025″	1″	0.1	250K	350K
RADIAL LEAD														
MR165N	RBR80	—	.2W	100V	8.26	(.325″)	4.06	(.160″)	.225″	.020″	1″	0.1	80K	120K
MR168N	RBR81	—	.2W	100V	12.7	(.500″)	4.06	(.160″)	.400″	.020″	1″	0.1	150K	250K
AXIAL LEAD														
HR103	—	—	.1W	50V	5.08	(.200″)	2.54	(.100″)	—	.020″	1.5″	1.0	10K	20K
HR175N	—	—	.2W	100V	7.92	(.312″)	3.96	(.156″)	—	.020″	1.5″	0.1	80K	100K
HR186N	—	—	.2W	150V	9.53	(.375″)	4.75	(.187″)	—	.025″	1.5″	0.1	100K	150K
HR188N	RBR74	—	.25W	150V	12.7	(.500″)	4.9	(.193″)	—	.025″	1.5″	0.1	125K	200K
HR255N	RBR75	—	.25W	150V	7.49	(.295″)	6.35	(.250″)	—	.025″	1.5″	0.1	110K	316K
HR256N	RBR56	RB56	.25W	200V	9.53	(.375″)	6.35	(.250″)	—	.032″	1.5″	0.1	127K	200K
HR258N	RBR55	RB55	.33W	300V	12.7	(.500″)	6.35	(.250″)	—	.032″	1.5″	0.1	226K	500K
HR2512N	RBR54	RB54	.5W	300V	19.05	(.750″)	6.35	(.250″)	—	.032″	1.5″	0.1	511K	1 MEG
HR3114N	RBR76	—	.5W	300V	20.62	(.812″)	7.92	(.312″)	—	.032″	1.5″	0.1	600K	1.5 MEG
HR3712N	RBR53	RB53	.66W	300V	19.05	(.750″)	9.53	(.375″)	—	.032″	1.5″	0.1	750K	2 MEG
HR3716N	RBR52	RB52	1W	600V	25.4	(1.000″)	9.53	(.375″)	—	.032″	1.5″	0.1	1.5 MEG	3 MEG
HR5016N	RBR57	RB57	1.5W	600V	25.4	(1.000″)	12.7	(.500″)	—	.032″	1.5″	0.1	2 MEG	5 MEG
HR5024N	—	RB58	2W	900V	38.1	(1.500″)	12.7	(.500″)	—	.032″	1.5″	0.1	3.01 MEG	7.5 MEG
HR5032N	—	RB59	2.5W	1200V	50.8	(2.000″)	12.7	(.500″)	—	.032″	1.5″	0.1	5.11 MEG	10 MEG

PRC Types	Meets or Exceeds Environmental Conditions of: MIL-R-39005	MIL-R-93	Max. Watts 1% Res. Tol.	Max. Volts	Body Dimensions ±.787mm (.031″) (A) Length mm	(ins.)	(B) Diameter mm	(ins.)	(ETP/OFHC)* Tinned Copper Leads Diam. Max.	Length† (±.125″)	Resistance vs. Wattage Max. Res. @ Max. Watts	Max. Res. @ Derated Watts	Std. Res. vs. Power
HIGH VOLTAGE/HIGH VALUE AXIAL LEAD													
HR5024NP	—	RB58	2W	1350V	38.1	(1.500″)	12.7	(.500″)	.032″	1.5″	911K @ 2W	1.8 MEGS @ 1W	1 MEG @1.5W
HR5032NP	—	RB59	2.5W	1800V	50.8	(2.000″)	12.7	(.500″)	.032″	1.5″	1.3 MEGS @ 2.5W	3.2 MEGS @ 1W	2 MEGS @ 1.5W

* Commercially pure copper (Electrolytic Tough Pitch/Oxygen-Free High Conductivity). † 2″ leads on MIL-Styles

ENGINEERING DATA:

1 RESISTANCE RANGE AND TOLERANCE "MIL Guidelines"

Standard: Any ohmic value or decimal part of an ohm desired with tolerances to ±0.01%. 10Ω min. res. (.01%).

Special: Higher or lower values beyond the standard limits with tolerances to ±0.005% at calibrated temp. (25°C).

2 TEMPERATURE COEFFICIENT OF RESISTANCE (TCR)

Standard: Zero ±5 ppm/°C (100 ohms and above). **Zero ±15 ppm/°C** (values below 100 ohms).

Special: To ±1 ppm/°C. TCR matching to within 0.5 ppm/°C. Please specify temp. span of operation.

3 INDUCTANCE

Standard: Non-inductivity wound with balanced reverse pi winding.

4 STABILITY OF CALIBRATION

To ±0.001% (10 ppm) per year at 25°C — no load — regardless of resistance tolerance.

5 POWER RATINGS VS. AMBIENT TEMPERATURE

These resistors are designed for full load operation providing the ambient temperature plus the temperature rise due to power dissipation does not exceed +125°C. (Derated to zero power at +145°C.)

6 HIGH VOLTAGE RATINGS

Type HR-P high operating voltage winding patterns also eliminate dangerous cross-overs and potential problems of standard bobbin style resistors. To calculate the safe operating voltage for any resistance value below the maximum listed, apply the formula $E = \sqrt{PR}$.

7 STABILITY VS. THERMAL EMF (With respect to copper terminals)

Standard: < +2 microvolts per °C (100 ohms and above). < −3 microvolts per °C. (values below 100 ohms).

8 PROTECTIVE ENCAPSULATION

Expansion — stress free base coat and epoxy seal. Solder — heat and solvent resistant.

9 MARKING (Identification)

Standard: PRC symbol, type, resistance value and tolerance.

Special: Military or custom marking.

10 TRACEABILITY TO N.B.S.

Certification (Absolute values in ohms) to N.B.S. is available.

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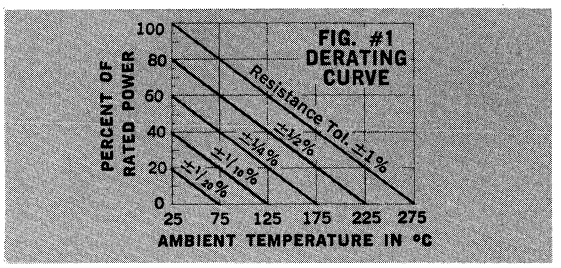
POWER

TYPE SM AXIAL LEAD

- Subminiature 2-terminal precision power wire wound resistors.
- Widest range of resistance in the industry.
- Highest operating voltage ratings.
- Extremely high or low-value non-inductive designs available.
- Instrument grade low EMF vs. copper.
- Excellent thermal stability.



ELECTRICAL AND PHYSICAL SPECIFICATIONS

TWO (2) TERMINAL
ALL DRAWINGS
ILLUSTRATE ACTUAL SIZE

For higher resistance values (at max. rated voltage) decrease max. power rating ($P = E^2/R$)
For lower resistance values (at max. rated power) decrease max. voltage rating ($E = \sqrt{PR}$)
* Resist. values based upon max. power and max. voltage.

PRC Type	RW Styles MIL R-26	Max. Power Rating (Watts)	*Min. Allowable Resist. (Ohms)	*Resist. ($R=E^2/P$)	*Max. Allowable Resist. (Ohms)	Max. Voltage Rating	Body Dimensions ±.787mm (.031") Length mm	Length (ins.)	Diameter mm	Diameter (ins.)	1.5"L. Lead Diam. Tinned Copper
SM041	—	⅛W	1.0	5K	10K	25V	6.35	(.250")	1.52	(.060")	.020"
SM062	—	¼W	1.0	17K	30K	65V	6.35	(.250")	2.03	(.080")	.020"
SM063	—	½W	0.1	24K	50K	110V	7.92	(.312")	2.03	(.080")	.020"
SM094	RW70	1W	0.1	40K	80K	200V	10.31	(.406")	2.92	(.115")	.025"
SM076	—	1⅛W	0.1	53K	180K	245V	12.7	(.500")	2.29	(.090")	.020"
SM156	—	1½W	0.1	90K	400K	375V	13.49	(.531")	4.47	(.176")	.028"
SM1711	—	2W	0.1	225K	900K	670V	20.62	(.812")	4.83	(.190")	.028"
SM186	RW69	3W	*0.025	80K	480K	500V	12.7	(.500")	5.26	(.207")	.028"
SM177	RW79	3W	0.1	80K	540K	500V	14.27	(.562")	4.83	(.190")	.028"
SM228	—	3W	*0.02	120K	720K	600V	15.88	(.625")	6.10	(.240")	.032"
SM2812	RW74	5W	*0.02	200K	1 MEG	1000V	22.23	(.875")	7.92	(.312")	.032"
SM3114	RW67	6½W	0.1	154K	1.5 MEG	1000V	25.4	(1.000")	7.92	(.312")	.032"
SM3726	RW78	10W	*0.07	156K	4 MEG	1250V	45.21	(1.780")	10.03	(.395")	.032"

* 0.02 ohm to 0.1 ohm and maximum resistance values available in non-standard physical sizes −0 +.062".
All low value 2-terminal designs are calibrated and tested at mid-point on lead unless otherwise specified.

CONSIDER THESE INNOVATIVE FEATURES:

1 WIDE RESISTANCE RANGE
"Widest in the industry" any ohmic value or decimal part of an ohm from 0.02 ohm to 4 megohms.

2 DEPENDABLE TOLERANCES
Small quantity lots, as well as, competitive high volume production quantities are accurately checked 100% to assure specified limits... ±1% (Std.), ±0.5%, ±0.25%, ±0.1% and ±0.05% resistance tolerances.

Call us about your design requirements and questions. Engineering samples are available for testing and evaluation.

3 STABILITY VS. TEMPERATURE CHARACTERISTICS
Carefully selected materials/processes & quality control procedures insure low temperature (TCR) and power coefficients. **Standard:** Zero ±10 ppm/°C 100Ω and above. Zero ± 15 ppm/°C below 100 ohms. **Special** to ±2 ppm.

4 HIGH VOLTAGE RATINGS
(D.C. Voltage or Peak Voltage)
Precision's high operating voltage winding patterns also eliminate dangerous crossovers and potential problems of standard mandrel style resistors. To calculate the safe operating voltage for any resistance value below the maximum listed, apply the formula $E = \sqrt{PR}$.

5 PRECISION POWER RATINGS
All (Std.) Type SM 1% tolerance resistors are designed for continuous full load operation at 25°C (% Δ under load ≈ .06%/W.). Derate to zero power at +275°C. (Fig. #1)

6 SOLVENT RESISTANT COATING
All Type SM resistors are sealed in a tough solvent resistant—high temperature silicone coating . . . with indelible marking.

7 PURCHASING INFORMATION
Please Specify: Quantity, type, resistance value, resistance tolerance and special features which may apply. TCR characteristic together with temperature span of operation should be specified in behavior spec.

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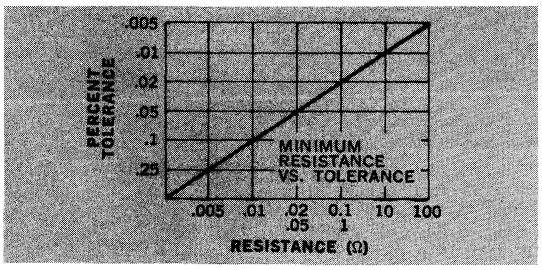
FOUR TERMINAL TYPE SM-(4)

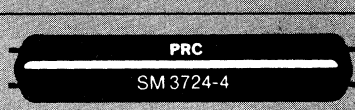
POWER



- Precision power 4-terminal shunts provide extremely precise low-value resistance measurements.
- Reliable current sensing by voltage drop method.
- Part-to-part interchangeability.
- Resistance values to 0.005 ohm.
- Exact engineering samples available.

ELECTRICAL AND PHYSICAL SPECIFICATIONS

Precise low-value repeatability. Eliminates lead-out and contact resistance. "Single Joint" design makes lead identification academic.

PRC Type	Max. Power Rating	Body Dimensions ±.787mm (.031") Length mm	Length (ins.)	Diameter mm	Diameter (ins.)	Std. Space	1.4"L* Std. Lead Diam. (±.001")	Standard Min. Res. @ Max. Watts Ω	W	Special* Min. Res.* @ Derated Power Ω	W	FOUR (4) TERMINAL ALL DRAWINGS ILLUSTRATE ACTUAL SIZE
SM155-4	1¼W	13.21	(.520")	5.08	(.200")	.110"	.0285"	.015 @ 1¼W		.005 @ .5W		
SM186-4	2½W	16.5	(.650")	6.35	(.250")	.110"	.0285"	.025 @ 2½W		.005 @ .5W		
SM228-4	3W	19.69	(.775")	7.11	(.280")	.110"	.0285"	.03 @ 3W		.005 @ .5W		
SM2212-4	4W	26.04	(1.025")	7.11	(.280")	.110"	.0285"	.028 @ 4W		.005 @ .75W		
SM2812-4	5W	26.04	(1.025")	8.71	(.343")	.118"	.032"	.02 @ 5W		.005 @ 1.125W		
SM3724-4	7½W	45.72	(1.800")	11.10	(.437")	.243"	.032"	.03 @ 7½W		.005 @ 1.125W		

* Heavier current carrying capacity leads are available for low resistance — full power applications. Refer to Type PLV for custom millivolt drop requirements.

ENGINEERING DATA:

1 RESISTANCE RANGE AND TOLERANCE

Standard: Any ohmic value or decimal part of an ohm desired from 0.015 ohm to 100 ohm with tolerances to ±0.005%.

Special: 0.005 ohm through 0.01 ohm with microhm tolerances to ±0.1%. (See resistance vs. tolerances graph above)

2 TEMPERATURE COEFFICIENT OF RESISTANCE

Zero ±15 ppm/°C — please specify temperature span of operation.

3 STABILITY VS. TIME CHARACTERISTICS (No Load)

To ±0.001%/year @ 25°C.

4 SOLVENT RESISTANT COATING

. . . with indelible marking.

5 PRECISION POWER RATINGS

Minimum resistance values @ full power ratings are based upon ±1% resistance tolerances at 25°C. Derating is required for higher temperatures, closer tolerances and lower resistance values.

6 TERMINALS

Solderable "hot-tinned" copper wire leads act as an excellent wetting agent and provide long shelf life. Low EMF construction reduces thermal effects. Select any two terminals as current leads (directly or diagonally opposite) and the other two potential leads for voltage drop.

7 TWO TERMINALS VS. FOUR TERMINALS

Two-wire devices are for relatively high values where the effects of lead-out resistance and contact resistance are minimal. Allow approx. +.001 ohm per inch for lead-out resistance on 2-wire designs. Adder may be eliminated by using a 4-terminal resistor for very accurate, repeatable low resistance measurements.

Four-wire circuits will only indicate the voltage drop across the resistor eliminating lead-out and lead-heating errors.

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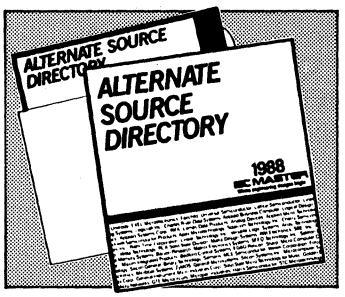

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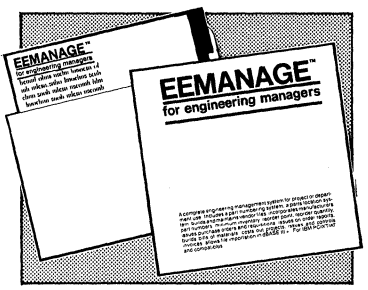

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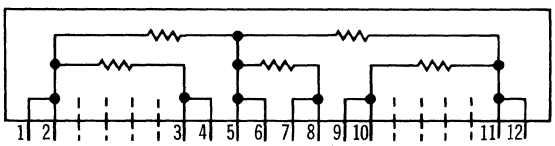
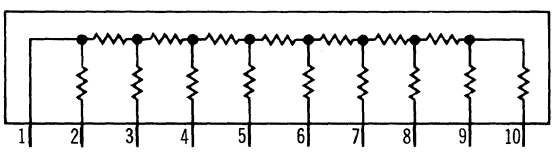
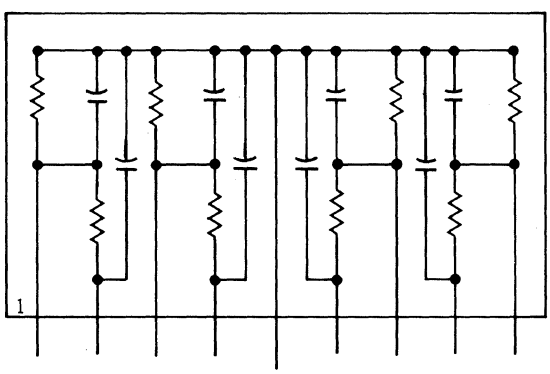
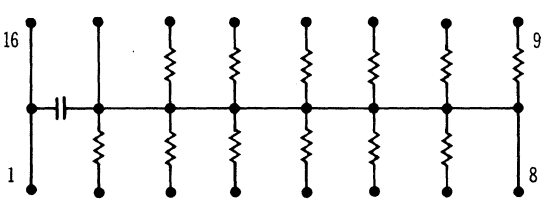
EXAMPLES OF CIRCUITS:









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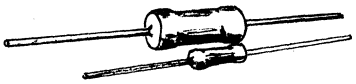
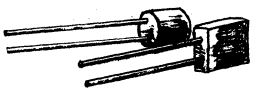


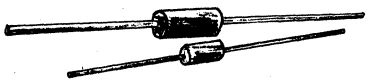
Series 100-Silicone Coated*

Designed to meet Mil-R-26 (RW) and Mil-R-39007 (RWR). 16 sizes, ½W to 16W, tolerances to ±0.01%, 5PPM. Flameproof and non-inductive available. **Delivery from stock 0.01Ω to 100K.**



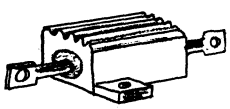
Series PC-Ultra Precision*

Direct low-cost substitute for ultra precision films. Designed per RNC90Y and Mil-R-39005 (RBR). Radial leads for highest density. 10 sizes. Tolerances to ±0.005%, 2PPM.



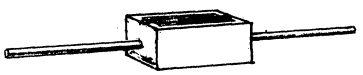
Series FR-Fusible*

Custom designed for accurate resistance and fusing under overload for precise circuit protection. Fusing time to 5mS. Flameproof. Fusing current 0.1A and up. Std sizes ⅛W to 10W. Pulse withstanding option available.



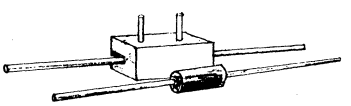
Series 600-Chassis Mount*

High wattage in small package sizes. Designed to meet Mil-R-18546 (RE) and Mil-R-39009 (RER) 7 sizes, 5W to 300W, .005Ω to 200K, tolerances to ±0.01% 5PPM. Available with non-inductive design.



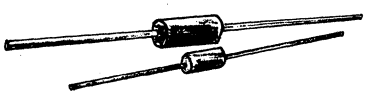
Series PW-Industrial Power*

Low-cost general purpose power resistors. Ceramic encased, flameproof. 8 sizes, 2W to 25W, 0.05Ωto 100K. Non-inductive, fusible, PTC, & vertical mount versions available. **5W and 10W sizes from stock.**



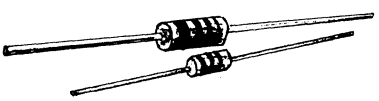
Series ULV-Ultra Low Values*

Resistance value of .0002Ω to .1Ω, 2W to 10W. Tolerances to 0.1%. Optional four-terminal construction available on LVF series. Vertical mount versions available.



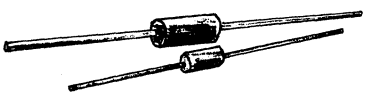
Series SA, MA-Precision*

Precision accuracy across wide resistance range. Non-inductive design per Mil-R-93 (RB) and Mil-R-39005 (RBR). 20 sizes, .05W to 2W, 0.1Ω to 25M, tolerances to ±0.005%, 2PPM.



Series RW-Economy Wirewound*

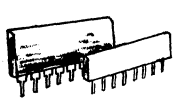
Low cost wirewounds offer space savings, RW-1 (1 watt) is size of ½W carbon comp. RW-2(2W) and RW-3(3W) are both the size of a 1W comp. Non-inductive, flameproof available.



Series Q-Film Replacements*

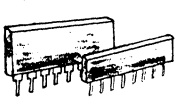
Wirewound substitutes for precision metal films RN55, RN60, RN65, RN70, RN75. Features improved stability, lower price in same package sizes. Tolerance to 0.01%, ±2PPM.

Resistor Networks



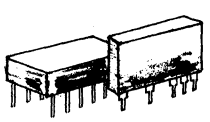
SIP Networks-Thick Film

Variety of configurations, 4 thru 12 pin, 10Ω to 10M, tolerances to 1%. Custom configurations available. Series "C" is conformal coated for commercial applications. **6, 8, 10 pin sizes (low profile) from stock.**



SIP Networks-Thin Film*

Available in separate, bussed, or custom configurations. 3 pin thru 15 pin, tolerances to 0.05%, 5 PPM. Unparalleled stability.



Custom Networks, Hybrids*

SIP and DIP networks utilize thick film, thin film, and wirewound technology depending on requirement. Infinite variety of configurations including res/cap/diode hybrids. Tol to ±0.005%, TCR to 2PPM, .01Ω to 1000 Gigohm.

Surface Mount Products

Series MC-Chip Resistors

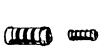
Wrap-around termination with nickel barrier—1Ω to 2000Meg, 1/10W to 3.0W. Standard tolerances—1%, 2%, 5%. 3 or 4 digit marking. **⅛W "1206" chips from stock (bulk or 8mm Tape/Reel, 1% & 5%)**

Series "Blu-Chip" Thin Film

Precision thin film chips designed for professional-grade applications. Tolerances to 0.1%, 10PPM; Wraparound termination with nickel barrier. Available on 8mm Tape.

Specialty Chips

Series HR—high megohm chips to $10^{12}\Omega$
Series MBW—flame proof fusible MELF's
Series MLP—temp. sensitive MELF's

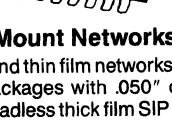


MELF's—Wirewound & Film*

Melf resistors are available in carbon, metal film and wirewound construction, tolerances to 0.01% 5PPM. Miniature ¼W size is same as conventional ⅛W size. Other sizes up to 2 watt.

Series ZC-Chip Jumpers

Zero-ohm chip jumpers (0.05Ω max) are available in 7 sizes. Also available in MELF packages. **"1206" size is available from stock on 8mm Tape/Reel.**



Surface Mount Networks

Thick film and thin film networks are available in SOIC packages with .050" or .025" lead spacing. Leadless thick film SIP networks and LCC packages up to 24 pin.

Available on RCD's exclusive "SWIFT" program (1 week delivery) when you require super fast delivery of a non-stock item!

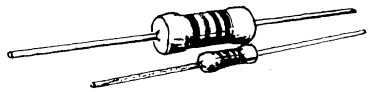
RCD COMPONENTS INC., *520 E. Industrial Pk. Dr., Manchester, N.H. 03103 USA TEL (603) 669-0054 FAX (603) 669-5455 TLX 943512*

the low cost of high quality.

Film Resistor Styles

Series MF & PMF-Precision Film*

Designed to meet Mil-R-10509 (RN50, RN55, 60, 65, 70, 75), and MIL-R-55182 (RNR, RNC). Wide resistance range—2.5Ω to 22.1M. Tolerance to ±0.01%, T.C. to ±5ppm. Matched sets available.

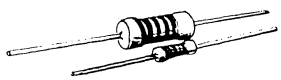


Series RSF & RMF-Metal Oxide

Flameproof, complex oxide film. New mini RMF series results in significant space savings. ¼W to 9W, 0.1Ω to 240K. Tolerances to ±1%. **Delivery of 1W, 2W, 3W, 5W, 5% from stock.**

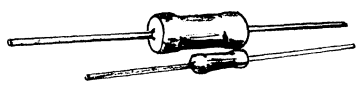
Series SR-High Power

Wattage ratings up to 250W.
Voltage ratings up to 300KV.
Resistance values up to 5000Meg.
Ferrule terminals for clip mounting.



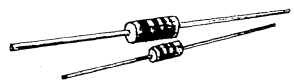
Series GP-Economy Film

Designed to meet Mil-R-10509(RN) and Mil-R-22684(RL). Values to 22.1MΩ. New mini ¼W is same size as ⅛W. 5 sizes ⅛w to 2w. **Delivery of ¼w 1%, 2% from stock (bulk or tape/reel)**



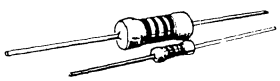
Series RG & RH-High Voltage

Cermet thick film for high voltage and/or high resistance applications. Voltage capability to 60KV. Resistance to 10,000 GIG.⅛W to 16W. Tolerances to 0.1%, 10PPM.



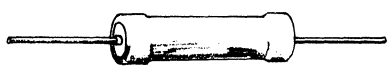
Series MG, MR-Miniature

MG-1 is 1.0W in ¼W size, MG-½ is .5W in a ⅛W size. High density due to molded thick film construction. Series MR are micro-miniature radial-lead resistors, 4.7Ω to 8.2M, tolerances to ±1.0%, 50PPM.



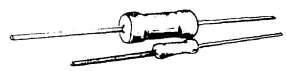
Series CF-Carbon Film

RCD's carbon film's feature improved stability and noise levels. 7 sizes ⅛W to 2W, 1Ω to 22M. New mini ¼W is same size as ⅛W. Flameproof coating available. **Delivery of ⅛, ¼, ½, 1, 2W 5% from stock (bulk or tape/reel).**



Series UHV-High Megohm

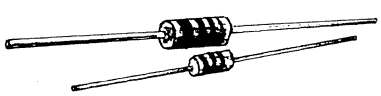
Extremely wide resistance range utilizing RCD's exclusive oxide film. Resistance range 10M to 100T (10^{14}). Glass encased version is avail. Voltage to 25KV. Tol. to 1.0%, 25PPM. VCR to 1PPM. Chips available to 1000 Gig ohms.



Series BW Failsafe Fusible

Low cost general purpose fusible series. Fuses at 15X rated power or less. Standard sizes ¼W to 3.0W. 0.1 ohm to 100K. Custom fusing curves available. Pulse withstanding option available.

Inductive Components

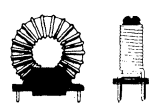


Series AL-Inductor Chokes

Low cost inductors per MIL-C-15305. Special core results in high Q and SRF, low DCR. Available in .250" and .350" lengths. 0.1μH to 56,000μH. Tolerances to ±5%. Shielded versions available. **Delivery of 0.1μH to 1000μH from stock.**

Series CI-Inductor Chips

Leadless miniature inductors for hybrid microcircuits. .01μH to 1000μH. Sizes as small as .080 square. Typical Q is 20 to 70. Standard tol ±10%. Available on 8mm tape.



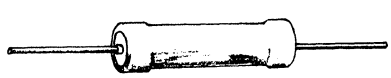
Custom Coils, Transformers

RCD's Caribbean plant is equipped for toroid and transformer windings resulting in extremely low costs for custom components. Specialize in power line chokes up to 4A, mini transformers, and variable inductors.

Specialty Products

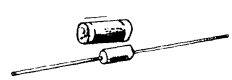
ZERO-OHM Jumpers

¼watt size insulated jumpers are suited for automatic insertion. Single black band denotes resistance of .02Ω or less. **Delivery from stock.**



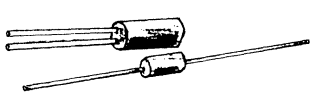
Surge Resistors*

Series PCN withstand high energy dissipation and absorb surges due to solid ceramic composition. Non-inductive. Series PPW wirewound surge resistors feature a completely welded design.



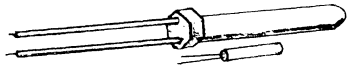
Microwave Resistors*

Non-helixed film resistors for use at higher frequency levels to 10GHZ, depending on how resistors are mounted. Microwave resistors are available from 10Ω to 10k.



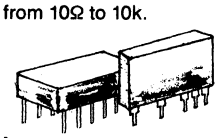
PTC Temperature Sensors*

Temperature sensitive resistors offer any TCR from 0 to +7000PPM. Series LP is thin-film for low-cost volume applications. Series ATS and ATB are wirewound for high temp and precision applications.



RTD Elements and Probes

Ceramic encased RTD Elements are designed for superior linearity to ±550°C. Wound with Platinum, Nickel, Nickel-Iron, or Copper wire. RTD probes feature stainless steel case and teflon extension leads.



Delay Lines

RCD delay lines are available in lumped constant (passive) or digital DTL and TTL (active) designs in both Sip and Dip packages. Molded Dips are machine insertable. Delay times available from 1nS to 1000nS.

Available on RCD's exclusive "SWIFT" program (1 week delivery) when you require super fast delivery of a non-stock item!

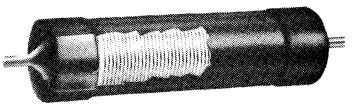
RCD COMPONENTS INC., *520 E. Industrial Pk. Dr., Manchester, N.H. 03103 USA TEL (603) 669-0054 FAX (603) 669-5455 TLX 943512*

RCL·Shallcross
WIREWOUND RESISTORS
DIVISION OF IRC, INC.

POWER

MIL-R-26, Type RW

T Series, Silicone Coated



GENERAL SPECIFICATIONS

Wattage Range: 25 styles to choose from ranging from .4 to 14 watts.

Resistance Values: From 0.1 ohm to maximum values as stated in table. For values below 0.1 ohm, use RCL-Shallcross Low Ω Metal Element Resistors.

Power Rating: Two power ratings, depending on operating temperature and stability requirements:

- Characteristic U: 275°C maximum hotspot temperature.
- Characteristic V: 350°C maximum hotspot temperature.

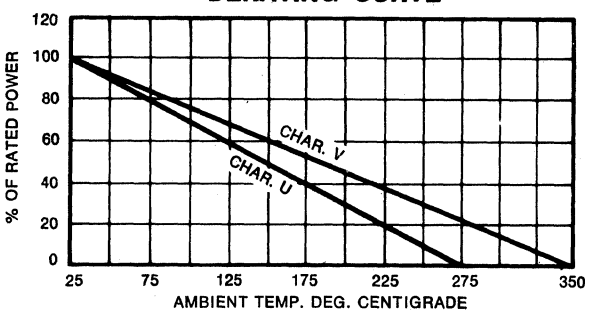
Derating: Wattage Ratings based on operation at 25°C. For higher ambient temperatures, derate per derating curve.

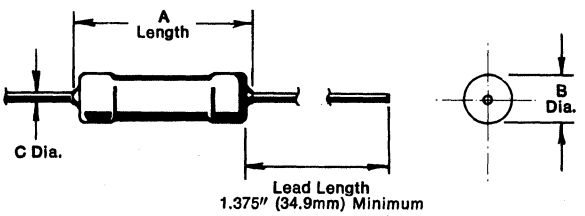
Tolerance: ±1.0% is standard. Closer tolerances are available.

Temperature Range: From −65°C to +275°C (Characteristic U) or +350°C (Characteristic V).

Temperature Coefficient of Resistance: Standard T.C.: ±20 PPM/°C = 500Ω and up, ±30 PPM/°C = 10Ω to 499Ω, ±50 PPM/°C = 1Ω to 9.99Ω, ±90 PPM/°C = 0.1Ω to 0.99Ω, ±400 PPM/°C = 0.025Ω to 0.099Ω, ±650 PPM/°C = 0.01Ω to 0.024Ω.

DERATING CURVE





ELECTRICAL AND DIMENSIONAL SPECIFICATIONS

Metric Dimensions

RCL[1] Style	MIL-R-26[1] Style	Wattage Rating U	Wattage Rating V	Dimensions Clean lead to clean lead Length A	Dimensions Clean lead to clean lead Diameter B	Resistance[2] RCL Style	Resistance[2] MIL-R-26 Style	Lead[2] Diam. C AWG	Dimensions Clean lead to clean lead Length A mm	Dimensions Clean lead to clean lead Diameter B mm	Lead Diam. mm
T-½-A	—	0.4		.220 ±.062	.078 ±.031	2K	—	#24	5.6 ±1.6	2.0 ±0.8	0.5
T½	—	0.75	—	.330 ±.062	.078 ±.031	4K		#24	8.4 ±1.6	2.0 ±0.8	0.5
T-½-A81	RW81	1.0	—	.250 ±.032	.085 ±.020	2K	1K	#24	6.4 ±0.8	2.2 ±0.8	0.5
T-1-80	RW80	2.0		.406 ±.032	.094 ±.032	10K	3.16K	#24	10.3 ±0.8	2.4 ±0.5	0.5
T-1A	—	1.0	1.25	.406 ±.062	.093 ±.032	6.5K	—	#24	10.3 ±1.6	2.4 ±0.8	0.5
T-1A-70	RW70	1.0		.406 ±.031	.094 ±.031	6.5K	3.16K	#24	10.3 ±0.8	2.4 ±0.8	0.5
T-1B	—	1.1	1.30	.530 ±.062	.093 ±.031	8.2K	—	#24	13.5 ±1.6	2.4 ±0.8	0.5
T-1C	—	1.0	—	.280 ±.062	.093 ±.031	3.4K	—	#24	7.1 ±1.6	2.4 ±0.8	0.5
T-2	—	1.5	—	.343 ±.062	.156 ±.031	8K	—	#20	8.7 ±1.6	4.0 ±0.8	0.8
T-2A	—	3.0	3.75	.500 ±.062	.187 ±.031	12K	—	#20	12.7 ±1.6	4.8 ±0.8	0.8
T-2A-69	RW69	—	3.00	.500 ±.063	.188 ±.063	18K	2K	#20	12.7 ±1.6	4.8 ±1.6	0.8
T-2B	—	3.0	3.75	.812 ±.062	.188 ±.031	34K	—	#20	20.0 ±1.6	4.8 ±0.8	0.8
T-2B-79	RW79	3.0		.560 ±.062	.187 ±.031	22K	10.5K	#20	14.2 ±1.6	4.8 ±0.8	0.8
T-2C	—	3.0	3.25	.500 ±.062	.250 ±.031	18K	—	#18	12.7 ±1.6	6.3 ±0.8	1.0
T-3	—	4.0	5.5	.625 ±.062	.250 ±.031	25K	—	#18	15.8 ±1.6	6.3 ±0.8	1.0
T-5	—	5.0	6.5	.875 ±.062	.312 ±.031	45K	—	#18	22.2 ±1.6	8.0 ±0.8	1.0
T-5-74	RW74	5.0	—	.875 ±.062	.312 ±.031	45K	38.3K	#18	22.2 ±1.6	8.0 ±0.8	1.0
T-6	—	6.0	7.5	1.00 ±.062	.312 ±.031	65K	—	#18	25.4 ±1.6	8.0 ±0.8	1.0
T-6-67	RW67	—	6.5	1.00 ±.094	.313 ±.063	65K	8.2K	#20	25.4 ±2.4	8.0 ±1.6	0.8
T-7	—	7.0	9.0	1.185 ±.062	.312 ±.031	75K	—	#18	30.0 ±1.6	8.0 ±0.8	1.0
T-7A-55	RW55	—	7.0	1.375 ±.094	.469 ±.094	120K	5.1K	#20	35.0 ±2.4	12.0 ±2.4	0.8
T-10	—	10.0	13.0	1.812 ±.062	.375 ±.031	150K	—	#18	46.0 ±1.6	9.5 ±0.8	1.0
T-10-78	RW78	10.0	—	1.780 ±.062	.375 ±.031	150K	90.9K	#18	45.2 ±1.6	9.5 ±0.8	1.0
T-10-68	RW68	—	11.0	1.875 +.063 −.125	.344 ±.094	150K	20K	#20	22.2 +1.6 −3.2	8.7 ±2.4	0.8
T-10-A-56	RW56	—	14.0	2.00 ±.094	.469 ±.094	200K	9.1K	#20	50.8 ±2.4	12.0 ±2.4	0.8

[1] Aryton Perry Winding available for non-inductive requirements. (Divide Max. Resistance Value by 2).
[2] Contact factory for lead diameter, ohmic values or temperature coefficients not listed as standard.

NON-INDUCTIVE WINDINGS, RADIAL LEADS, EXTENDED HEAT DISSIPATION and other SPECIAL FEATURES are available.

Call or write factory for complete information:

RCL·Shallcross
WIREWOUND RESISTORS
DIVISION OF IRC, INC.

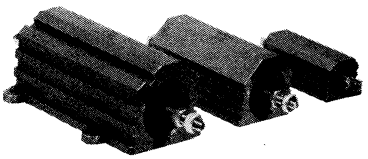
195 McGregor St., Manchester, NH 03102 • (603) 627-3831
U.S. Hwy. 70 East, Smithfield, NC 27577 • (919) 934-5181

RCL·Shallcross
WIREWOUND RESISTORS
DIVISION OF IRC, INC.

CHASSIS MOUNT POWER

MIL-R-18546, Type RE

AL Series, Aluminum Housed Chassis Mount



GENERAL SPECIFICATIONS

Wattage Range: 7 styles to choose from ranging from 5 to 250 watts.

Resistance Values: From 0.1 ohm to maximum values as stated in table.

Power Rating: 275°C maximum hotspot at 25°C ambient. 1% maximum ΔR in 1000 hour load life.

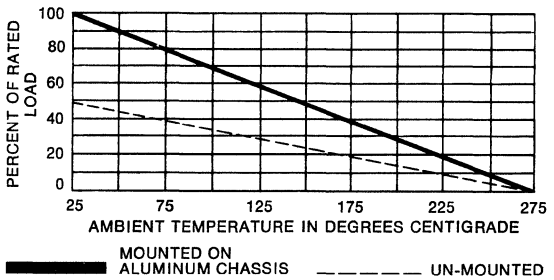
Derating: Wattage ratings based on operation at 25°C. For higher ambient temperatures, derate per derating curve.

Tolerance: ±1.0% is standard.

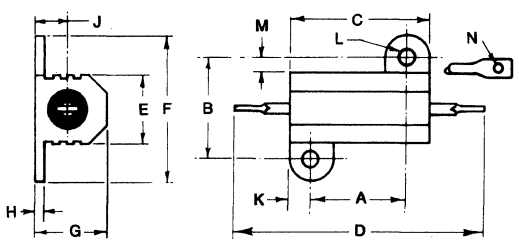
Temperature Range: From −55°C to +275°C.

Temperature Coefficient of Resistance: Standard T.C.: ±20 PPM/°C = 10Ω and up, ±50 PPM/°C = 1Ω to 9.99Ω, ±90 PPM/°C = below 1Ω.

WATTAGE VS. AMBIENT TEMP. DERATING

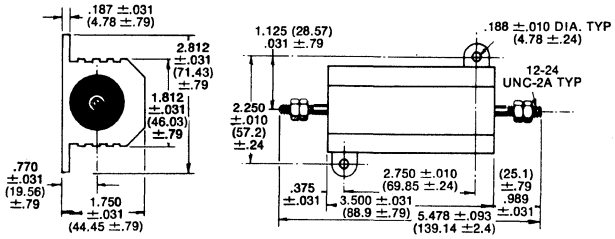


DIMENSIONS — 5 THRU 75 WATTS

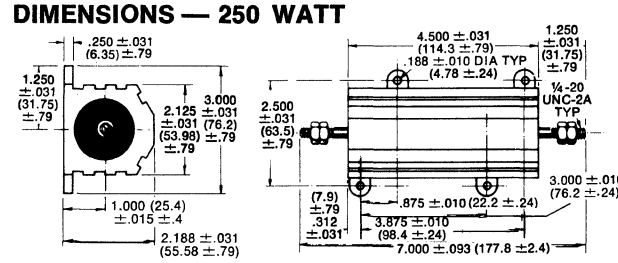


(METRIC DIMENSIONS ARE IN PARENTHESIS)

DIMENSIONS — 100 WATT



DIMENSIONS — 250 WATT



ELECTRICAL SPECIFICATIONS

RCL** Style	MIL Style	Power Rating (Watts)*		Resistance Range			Max. Weight
		RCL	MIL	Min.	Max.	Max. MIL	Grams
AL-5	RE-60G	5	5	.1	16K	3.32K	3
AL-10	RE-65G	10	10	.1	25K	5.62K	7
AL-25	RE-70G	25	20	.1	55K	12.1K	14
AL-50	RE-75G	50	30	.1	180K	39.2K	29
AL-75		75		.1	75K		120
AL-100	RE-77G †	100	75	.1	50K		400
AL-250	RE-80G †	250	120	.1	75K		800

* AL resistors have an operating temperature range of −55°C to +275°C. Derating is required for reduced chassis mounting area and or for high ambient temperatures.

** To order non-inductive styles add suffix N. (e.g.: ALN-5, RE-60N) (Divide Max. Res. Values by 2).

† For reference only

DIMENSIONAL SPECIFICATIONS

Style	A	B	C	D	E	F	G	H	J	K	L	M	N
Tol.	±.005	±.005	±.031	±.062	±.015	±.015	±.015	±.010	±.010	±.010	±.005	±.015	±.005
Tol. (metric)	±0.1	±0.1	±0.8	±1.6	±0.4	±0.4	±0.4	±0.25	±0.25	±0.25	±0.1	±0.1	±0.1
AL-5	.444 (11.28)	.490 (12.45)	.600 (15.24)	1.125 (28.58)	.334 (8.48)	.646 (16.41)	.320 (8.13)	.065 (1.65)	.140 (3.56)	.078 (1.98)	.093 (2.36)	.078 (1.98)	.050 (1.27)
AL-10	.562 (14.27)	.625 (15.88)	.750 (19.1)	1.375 (34.93)	.430 (10.92)	.800 (20.3)	.400 (10.2)	.075 (1.91)	.190 (4.83)	.093 (2.4)	.093 (2.4)	.102 (2.59)	.086 (2.18)
AL-25	.719 (18.26)	.781 (19.84)	1.062 (26.97)	1.938 (49.23)	.530 (13.46)	1.080 (27.43)	.560 (14.22)	.085 (2.16)	.260 (6.6)	.172 (4.37)	.125 (3.18)	.115 (2.92)	.086 (2.18)
AL-50	1.563 (39.7)	.844 (21.44)	1.968 (49.99)	2.781 (70.64)	.615 (15.62)	1.140 (28.96)	.615 (15.62)	.085 (2.16)	.300 (7.62)	.196 (4.97)	.125 (3.18)	.107 (2.71)	.086 (2.18)
Tol.	±.010	±.010	±.031	±.093	±.031	±.031	±.031	±.015	±.015	±.015	±.005	±.015	±.005
Tol. (metric)	±0.25	±0.25	±0.8	±2.4	±0.8	±0.8	±0.8	±0.4	±0.4	±0.4	±0.1	±0.4	±0.1
AL-75	2.125 (53.98)	1.500 (38.1)	2.500 (63.5)	3.750 (95.25)	1.125 (28.58)	1.875 (47.62)	1.125 (28.58)	.125 (3.18)	.625 (15.89)	.187 (4.75)	.172 (4.37)	.187 (4.75)	.095 (2.4)

NON-INDUCTIVE WINDINGS, SPECIAL LEADS and EXTENDED HEAT DISSIPATION versions are available.

Call or write factory for complete information:

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DIVISION OF IRC, INC.

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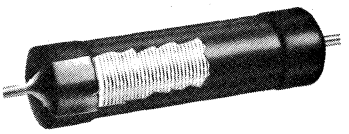
ESTABLISHED RELIABILITY POWER

RCL Shallcross
WIREWOUND RESISTORS
DIVISION OF IRC, INC.

MIL-R-39007, Type RWR, S Level PR Series, Silicone Coated



GENERAL SPECIFICATIONS

Wattage Range: 15 styles to choose from ranging from 1 to 15 watts.

Resistance Values: From 0.1 ohm to maximum values as stated in table.

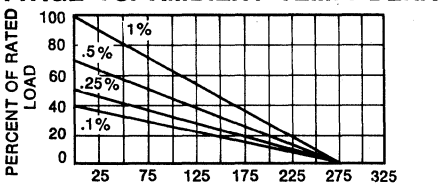
Power Rating: 275°C maximum hotspot at 25°C ambient.

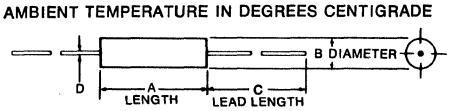
Tolerance: ±1.0% is standard. ±0.1%, ±0.25%, ±0.5%, ±3%, ±5% and ±10% are available.

Temperature Range: −55°C to +275°C.

Temperature Coefficient of Resistance: Standard T.C.: ±20 PPM/°C = 10Ω and up, ±50 PPM/°C = 1Ω to 10Ω, ±400 PPM/°C = 0.499Ω to 1Ω, ±650 PPM/°C = 0.1Ω to 0.499Ω.

WATTAGE VS. AMBIENT TEMP. DERATING





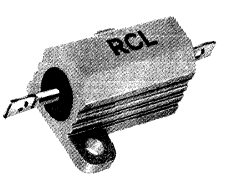
ELECTRICAL AND DIMENSIONAL SPECIFICATIONS

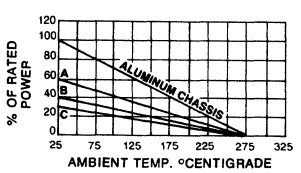
Shallcross Style	MIL-R-39007[1,2,3] Style	Power Rating (Watts) 275°	Resistance Value Min. Tol. 0.1%	Min. Tol. 1.0%	Max. All Tol.	Maximum Weight (Grams)	Dimensions A	B	C	D
PR13		6	10	0.1	10K	2.25	.625 ±.062	.250 ±.032	1.500	.040
PR17		5	10	0.1	7K	1.5	.500 ±.062	.218 ±.032	1.500	.040
PR33		15	10	0.1	80K	8.5	1.780 ±.062	.375 ±.032	1.500	.040
PR433	RWR78	10	0.499	0.1	80K	8.5	1.780 ±.062	.375 ±.032	1.500	.040
PR246	RWR84	7	0.499	0.1	25K	4.0	.875 ±.062	.312 ±.032	1.500	.040
PR446	RWR74	5	0.499	0.1	25K	4.0	.875 ±.062	.312 ±.032	1.500	.040
PR49	RWR80	2	0.499	0.1	3.16K	.35	.406 ±.032	.094 ±.032	1.500	.020
PR449		1	10	0.1	3.16K	.35	.406 ±.032	.094 ±.032	1.500	.020
PR60		10	10	0.1	45K	4.7	1.218 ±.062	.312 ±.032	1.500	.040
PR61	RWR89	4	0.499	0.1	4.12K	1.0	.560 ±.062	.187 ±.032	1.500	.032
PR261	RWR89	3	0.499	0.1	4.12K	1.0	.560 ±.062	.187 ±.032	1.500	.032
PR461		3	10	0.1	4.12K	1.0	.560 ±.062	.187 ±.032	1.500	.032
PR62		4.5	10	0.1	14K	1.25	.812 ±.062	.187 ±.032	1.500	.032
PR462	RWR71	3.25	0.499	0.1	16.2K	1.25	.812 ±.062	.187 ±.032	1.500	.032
PR66	RWR82	1.5	0.499	0.1	1.3K	.30	.312 ±.032	.085 ±.015	1.500	.020
PR68	RWR81	1	0.499	0.1	1K	.25	.250 ±.032	.085 ±.015	1.500	.020
PR268	RWR81	1	0.499	0.1	1K	.25	.250 ±.032	.085 ±.015	1.500	.020

[1] MIL-R-39007 Approved. To Life Failure Rate M, P, R, & S.
[2] Tolerances F (1%), D (.5%) and B (.1%) available at Life Failure Rate M, P, R, & S.
[3] Ayrton Perry Winding available for Non-Inductive requirements.

MIL-R-39009, Type RER, R Level

AL-ER Series, Aluminum Housed Chassis Mount





GENERAL SPECIFICATIONS

Wattage Range: 4 styles to choose from ranging from 5 to 50 watts.

Power Rating: 275°C maximum hotspot at 25°C ambient. 1% maximum ΔR in 2000 hour load life.

Derating: AL-ER chassis mount resistors have an operating temperature range of −55°C to +275°C. For higher ambient temperatures, use derating curve which applies to operation of unmounted resistors (A = AL5ER and AL10ER, B = AL25ER and C = AL50ER).

Tolerance: ±1% is standard.

Temperature Coefficient of Resistance: Standard T.C.: ±20 PPM/°C = 20Ω and up, ±50 PPM/°C = 1Ω to 19.6Ω, ±100 PPM/°C = below 1Ω.

Dimensional Specifications: Identical to AL Series on previous page.

ELECTRICAL SPECIFICATIONS

RCL Style Refer to Note #1	MIL-R-39009 Style	Power Rating* (Watts) RCL	MIL	Minimum Resistance	Maximum Resistance	Maximum Working Voltage	Maximum Weight (Grams)
ALN5 ER	RER-40	7.5	5	1.0Ω	1.65K	90.8	3.3
AL5 ER	RER-60	7.5	5	0.1Ω	3.32K	128.9	3.0
ALN10 ER	RER-45	12.5	10	1.0Ω	2.80K	167.3	8.8
AL10 ER	RER-65	12.5	10	0.1Ω	5.62K	237.1	8.0
ALN25 ER	RER-50	25.0	20	1.0Ω	6.04K	347.6	16.5
AL25 ER	RER-70	25.0	20	0.1Ω	12.1K	550.0	15.0
ALN50 ER	RER-55	50.0	30	1.0Ω	19.6K	766.8	35.0
AL50 ER	RER-75	50.0	30	0.1Ω	39.2K	1085.0	32.0

* Rating based on chassis mounting at +25°C ambient.

Call or write factory for complete information:

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RCL·Shallcross
WIREWOUND RESISTORS
DIVISION OF IRC, INC.

PRECISION

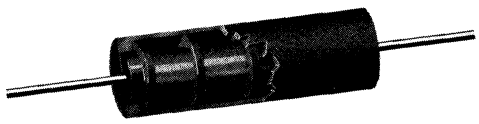
MIL-R-93, RB Type

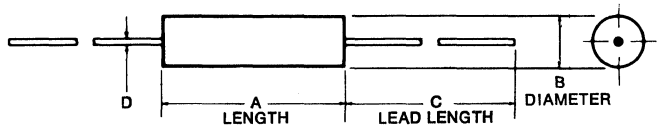
VA, SP and 7000 Series, Axial Lead

ELECTRICAL AND DIMENSIONAL SPECIFICATIONS

Shallcross VA Style	MIL-R-93[2]	Dimensions A ±.032	B ±.015	C	D Awg.	Watts MIL 125°C	Watts Commercial[1] 85°C	Max. Volt. DC	Approx. Weight Grams	Max. Resistance
• 10	RB56	.343	.250	2.0	20	.125	.250	200	1.0	350K
• 11		.295	.250	1.5	22	.125	.250	150	.3	250K
• 12	RB55	.500	.250	2.0	20	.150	.300	300	1.0	525K
13		.625	.250	1.5	20	.200	.400	500	1.5	800K
• 14	RB54	.750	.250	2.0	20	.250	.500	300	2.0	850K
16		1.0	.250	1.5	20	.500	1.0	750	3.0	1.25Meg
19		.812	.312	1.5	20	.500	1.0	300	3.5	5.0Meg
30		.343	.375	1.5	20	.125	.250	300	2.0	1.0Meg
• 32		.500	.375	1.5	20	.250	.500	300	3.5	1.5Meg
• 34	RB53	.750	.375	2.0	20	.330	.660	500	4.5	2.0Meg
• 36	RB52	1.0	.375	2.0	20	.500	1.0	750	6.0	2.5Meg
38		1.5	.375	1.5	20	.750	1.500	1000	7.5	3.5Meg
39		2.0	.375	1.5	20	1.250	2.500	1200	10.0	4.0Meg
52		.500	.500	1.5	20	.330	.660	300	5.5	2.0Meg
• 54		.750	.500	1.5	20	.500	1.0	500	7.0	3.0Meg
• 56		1.0	.500	1.5	20	.750	1.5	750	8.5	4.0Meg
• 58		1.5	.500	1.5	20	1.0	2.0	1000	11.5	5.0Meg
• 59		2.0	.500	1.5	20	1.250	2.5	1200	12.5	10.0Meg
SP Style	SUBMINIATURES									
• 20		.250	.187	1.5	22	.100	.200	150	.3	125K
• 21		.375	.187	1.5	22	.125	.250	300	.3	200K
• 22		.500	.187	1.5	22	.150	.300	300	.3	300K
23		.625	.187	1.5	22	.175	.350	600	1.0	400K
26		1.0	.187	1.5	22	.250	.500	1000	1.5	500K
40		.500	.160	1.5	22	.100	.200	300	.3	500K
• 41		.250	.125	1.5	22	.050	.100	100	.2	125K
• 42		.375	.125	1.5	22	.065	.125	200	.2	200K
• 43		.500	.125	1.5	22	.075	.150	200	.3	300K
47		.187	.100	1.5	24	.025	.050	75	.1	50K
• 48		.312	.100	1.5	24	.030	.060	100	.1	100K
49		.437	.100	1.5	24	.040	.075	100	.2	150K
• 68		.250	.085	1.5	24	.020	.040	100	.1	50K
69		.375	.085	1.5	24	.025	.050	100	.1	100K

• Standard Style [1] Commercial ratings may be applied at 125°C provided 175°C max. operating temperature is permissible. [2] MIL-R-93 Approved.





RCL Style	MIL-R-93 Style	Dia. ±.015	Lgth. ±.032	RCL Max. Watts	MIL Max. Watts	MIL Style Max. Res. 0.001 (.0254)	RCL Style 0.0005 (.0127)	Non-Inductive Winding	Lead Dia. AWG D	Metric Dimensions Dia. ±.4 mm	Lgth. ±.8 mm	Lead Dia. D mm
7002		.110	.220	.1			100K	NO	#24	2.8	5.6	0.5
7003		.100	.260	.05			150K	NO	#24	2.5	6.6	0.5
7004		.100	.300	.05			250K	YES	#24	2.5	7.6	0.5
7005		.125	.250	.1			300K	YES	#22	3.2	6.3	0.6
7006		.125	.3125	.1			350K	YES	#22	3.2	7.9	0.6
7007		.1875	.375	.125			700K	YES	#22	4.8	9.5	0.6
7008		.250	.250	.150			1Meg	YES	#22	6.3	6.3	0.6
7009	RB-56	.250	.343	.25	.125	127K	1.4Meg	YES	#20	6.3	8.7	0.8
7010	RB-55	.250	.500	.33	.15	226K	3Meg	YES	#20	6.3	12.7	0.8
7020	RB-54	.250	.750	.50	.25	511K	4.4Meg	YES	#20	6.3	19.0	0.8
7030	RB-53	.375	.750	.60	.33	750K	8Meg	YES	#20	9.5	19.0	0.8
7040	RB-52	.375	1.000	1.00	.50	1.5Meg	12Meg	YES	#20	9.5	25.4	0.8
7044		.500	.500	.50			7Meg	YES	#20	12.7	12.7	0.8
7045		.500	.625	.60			8Meg	YES	#20	12.7	15.9	0.8
7045A		.437	.625	.60			9Meg	YES	#20	11.1	15.9	0.8
7050	†RB-57	.500	1.00	1.25	.75	2Meg	14Meg	YES	#20	12.7	25.4	0.8
7050A		.437	1.00	1.25			13Meg	YES	#20	11.1	25.4	0.8
7060	†RB-58	.500	1.50	1.50	1.0	3Meg	20Meg	YES	#20	12.7	38.1	0.8
7070	†RB-59	.500	2.00	2.00	1.25	5Meg	30Meg	YES	#20	12.7	50.8	0.8

† For reference only

PC and 4000 Series Printed Circuit Board Style

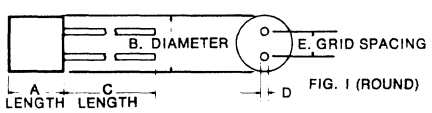


FIG. I (ROUND)

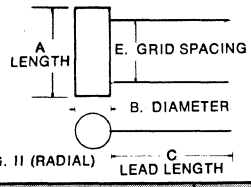
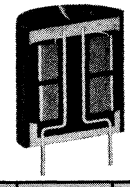


FIG. II (RADIAL)



ELECTRICAL AND DIMENSIONAL SPECIFICATIONS

Shallcross PC Style	PC Style MIL-R-93	Fig.	Dimensions A ±.032	B ±.015	C 1" Min.	D Awg.	E ±.010	Watts MIL 125°C	Watts Commercial[1] 85°C	Maximum Voltage DC	Approx. Weight Grams	Maximum Resistance
1		I	.250	.250	1.0	22	.200	.100	.200	150	.3	150K
3		I	.359	.265	1.0	22	.200	.125	.250	150	1.0	250K
4		I	.375	.375	1.0	20	.200	.250	.500	300	2.5	500K
8	RB71	I	.312	.250	1.0	22	.200	.125	.250	300	.3	150K
340		II	.500	.160	1.0	22	.406	.100	.200	300	.3	500K

[1] Commercial ratings may be applied at 125°C provided 175°C max. operating temperature is permissible.

RCL Style	MIL-R-93 Style	Fig. I Length (A)	Fig. I Diameter (B)	MIL..Style Max. R Using .001 (25.4 μ)	RCL Style* Max. R Using .0006 (15.2 μ)	RCL Style** Max. Wattage	Standard Lead Spacing (±0.010)	Lead Diameter (AWG)	Metric Dimensions Length (mm)	Diameter (mm)	Standard Lead Spacing (mm ±0.25)	Lead Diameter (mm)
4060	RB-71	.312 ±.032	.250 ±.025	100K	500K	.250**	.200	#22	7.9 ±0.8	6.3 ±0.6	5.08	0.6
4061		.375 ±.032	.250 ±.025	160K	800K	.250	.200	#22	9.5 ±0.8	6.3 ±0.6	5.08	0.6
4062		.437 ±.032	.250 ±.025	160K	800K	.250	.200	#22	11.1 ±0.8	6.3 ±0.6	5.08	0.6
4063		.375 ±.032	.375 ±.015	185K	1Meg	.333	.200	#20	9.5 ±0.8	9.5 ±0.4	5.08	0.8
4064		.437 ±.032	.375 ±.015	250K	1.3Meg	.333	.200	#20	11.1 ±0.8	9.5 ±0.4	5.08	0.8
4065	RB-70	.500 ±.032	.375 ±.015	301K	1.5Meg	.333**	.200	#20	12.7 ±0.8	9.5 ±0.4	5.08	0.8
4066		.375 ±.032	.437 ±.015	450K	2Meg	.400	.300	#20	9.5 ±0.8	11.1 ±0.4	7.62	0.8
4067		.437 ±.032	.437 ±.015	600K	3Meg	.400	.300	#20	11.1 ±0.8	11.1 ±0.4	7.62	0.8
4068		.500 ±.032	.437 ±.015	700K	3.5Meg	.400	.300	#20	12.7 ±0.8	11.1 ±0.4	7.62	0.8

* Not applicable for MIL Styles (RB). ** Max. Wattage for MIL-R-93 Styles is 0.125 for RB-71 and 0.250 for RB-70.
Lead length 1½" (38.1 mm) Minimum. Tinned, weldable leads. RB-70 and RB-71, Lead length 1" ±⅛" (25.4 ±3.18 mm).

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ESTABLISHED RELIABILITY PRECISION

RCL Shallcross
WIREWOUND RESISTORS
DIVISION OF IRC, INC.

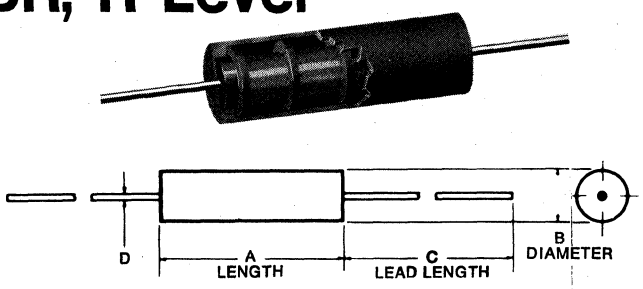
MIL-R-39005, Type RBR, R Level

HR Series

Mil Tolerance Range For HR & ER Series:

RBR	Value	Tol. Minimum
52, 53, 55, 56, & 71	≥ 10Ω ≥ 0.1Ω	±.01% ±1%
54	≥ 4.99Ω ≥ 0.1Ω	±.01% ±1%
80 & 81	≥ 1000Ω ≥ 100Ω ≥ 10Ω	±0.01% ±0.02% ±0.10%

±1.0% (F); ±0.1% (B); ±0.5% (D); ±0.05% (A); ±0.02% (Q); ±0.01% (T).



ELECTRICAL AND DIMENSIONAL SPECIFICATIONS

Shallcross HR Style	HR Style MIL-R-39005	Dimensions A ±.032	B ±.015	C Min.	D Awg.	Watts MIL 125°C	Watts Commercial [1] 85°C	Maximum DC Voltage	Approx. Weight Grams	Maximum Resistance
1		.250	.250	1.0	22	.100	.200	150	.3	150K
3		.359	.265	1.0	22	.125	.200	150	1.0	250K
4		.375	.375	1.0	20	.250	.500	300	2.5	500K
• 5 [2]		.500	.250	1.0	22	.250	.500	300	1.0	500K
6		.375	.250	1.0	22	.125	.250	300	1.0	300K
7		.500	.375	1.0	20	.330	.660	300	3.0	600K
• 8	RBR71 [3,4]	.312	.250	1.0	22	.125	.250	300	.3	150K
9		.750	.375	1.0	20	.500	1.0	600	4.5	1.0Meg
• 10	RBR56 [3,4]	.343	.250	1.5	20	.125	.250	200	1.0	350K
11	RBR75	.295	.250	1.5	22	.125	.250	150	.3	250K
• 12	RBR55 [3,4]	.500	.250	1.5	20	.150	.300	300	1.0	525K
13		.625	.250	1.5	20	.200	.400	500	1.5	800K
• 14	RBR54 [3,4]	.750	.250	1.5	20	.250	.500	500	2.0	850K
16		1.0	.250	1.5	20	.500	1.0	750	3.0	1.25Meg
19	RBR76	.812	.312	1.5	20	.500	1.0	500	3.5	5.0Meg
• 20		.250	.187	1.5	22	.100	.200	150	.3	125K
• 21		.375	.187	1.5	22	.125	.250	300	.3	200K
• 22	RBR74	.500	.187	1.5	22	.125	.300	300	.3	300K
23		.625	.187	1.5	22	.175	.350	600	1.0	400K
26		1.0	.187	1.5	22	.250	.500	1000	1.5	500K
30		.343	.375	1.5	20	.125	.250	300	2.0	1.0Meg
• 32		.500	.375	1.5	20	.250	.500	300	3.5	1.5Meg
• 34	RBR53 [3,4]	.750	.375	1.5	20	.330	.660	500	4.5	2.0Meg
• 36	RBR52 [3,4]	1.0	.375	1.5	20	.500	1.0	750	6.0	2.5Meg
38		1.50	.375	1.5	20	.750	1.5	1000	7.5	3.5Meg
39		2.00	.375	1.5	20	1.250	2.5	1200	10.0	4.0Meg
40		.500	.160	1.5	22	.100	.200	300	.3	500K
• 41		.250	.125	1.5	22	.050	.100	100	.2	125K
• 42		.375	.125	1.5	22	.065	.125	200	.2	200K
43		.500	.125	1.5	22	.075	.150	200	.3	300K
47		.187	.100	1.5	24	.025	.050	75	.1	50K
• 48		.312	.100	1.5	24	.030	.060	100	.1	100K
49		.437	.100	1.5	24	.040	.075	100	.2	150K
52		.500	.500	1.5	20	.330	.660	300	5.5	2.0Meg
54		.750	.500	1.5	20	.500	1.0	500	7.0	3.0Meg
• 56	RBR57	1.0	.500	1.5	20	.750	1.5	750	8.5	4.0Meg
• 68		.250	.085	1.5	24	.020	.040	100	.1	50K
69		.375	.085	1.5	24	.025	.050	100	.1	100K
340 [5]	RBR81	.500 Max.	.160 Max.	1.0	24	.100	.200	300	.55	175K
341 [5]	RBR80	.325 Max.	.160 Max.	1.0	24	.100	.200	150	.40	50K

• **Standard Style**....[1] Commercial ratings may be applied at 125°C max. provided 175°C max. operating temperature is permissible. [2] Printed Circuit Style — See previous page for dimension diagram. Standard grid spacing 200″. [3] Available in failure rate levels M, P and R. [4] MIL-R-39005 Approved. [5] Printed Circuit Style — See pevious page, Figure II for dimension diagram. Standard grid spacing for HR 340 is .400″ ±.005″ and for HR 341 is .225″ ±.005″.

2000 ER, 4000 ER & 7000 ER Series

FIG. "A" — AXIAL LEAD

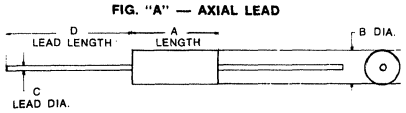


FIG "B" — PLUG-IN

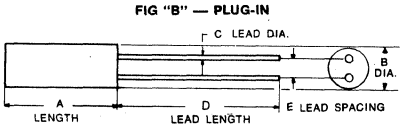
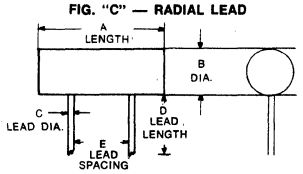


FIG. "C" — RADIAL LEAD



RCL Style	Military Style	MIL Resistance Range (Ohms)	Power Rating (Watts)	Fig.	Maximum Dimensions Length A	Diam. B	Lead Diam. C	Min. Lead Length D	Lead Spacing E ±0.005	Approx. Weight (Grams)	Style
7040-ER	RBR 52	0.1-1,200,000	0.5	A	1.020 (25.91)	0.39 (9.9)	0.034 (0.86)	1.5 (38.1)	N.A.	6.0	Axial
7030-ER	RBR 53	0.1-1,100,000	0.33	A	0.770 (19.6)	0.39 (9.9)	0.034 (0.86)	1.5 (38.1)	N.A.	4.5	Axial
7020-ER	RBR 54	0.1-562,000	0.25	A	0.770 (19.6)	0.265 (6.7)	0.034 (0.86)	1.5 (38.1)	N.A.	2.0	Axial
7010-ER	RBR 55	0.1-332,000	0.15	A	0.520 (13.21)	0.265 (6.7)	0.034 (0.86)	1.5 (38.1)	N.A.	1.0	Axial
7009-ER	RBR 56	0.1-220,000	0.125	A	0.364 (9.2)	0.265 (6.7)	0.034 (0.86)	1.5 (38.1)	N.A.	1.0	Axial
4060-ER	RBR 71	0.1-150,000	0.125	B	0.343 (8.7)	0.281 (7.1)	0.027 (0.69)	0.875 (22.2)	0.200 (5.1)*	0.3	Plug-In
R2407-ER	RBR 80	10.0-120,000	0.1	C	0.325 (8.3)	0.160 (4.06)	0.022 (0.56)	1.0 (25.4)	0.225 (5.7)	6.0	Radial
R2408-ER	RBR 81	10.0-250,000	0.1	C	0.50 (12.7)	0.160 (4.06)	0.022 (0.56)	1.0 (25.4)	0.400 (10.2)	6.0	Radial

(Metric dimensions in mm are in parenthesis) *±0.010 (±0.254)

Call or write factory for complete information:

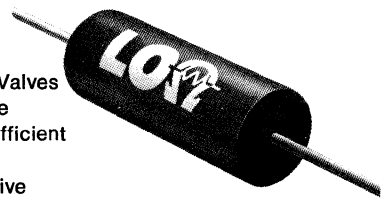
RCL Shallcross
WIREWOUND RESISTORS
DIVISION OF IRC, INC.

195 McGregor St., Manchester, NH 03102 • (603) 627-3831
U.S. Hwy. 70 East, Smithfield, NC 27577 • (919) 934-5181

RCL·Shallcross
WIREWOUND RESISTORS
DIVISION OF IRC, INC.

SPECIAL PRODUCTS

LO Ω® Metal Element Resistors



GENERAL SPECIFICATIONS

Wattage Range: 3 and 5 watts.

Resistance Values: 0.005, 0.01, 0.015, 0.02, 0.025, 0.03, 0.04, 0.05, 0.07, 0.08, 0.1, 0.2 ohms.

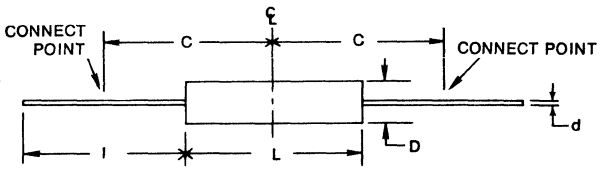
Derating: Lo Ω Metal Element Resistors are derated linearly from room temperature at full power to 0 power at 275°C.

Tolerance: 5% — All styles and values, 3% — All styles and values, 0.5% available above 0.005 ohms.

Construction: Tinned copper leads are welded directly to a low temperature coefficient of resistance element by a highly mechanized proprietary process. Resistors are encapsulated in a special formulated compound.

FEATURES

- Ultra Low Resistance Valves
- High Stability Over Life
- Low Temperature Coefficient of Resistance
- Inherently Non-Inductive

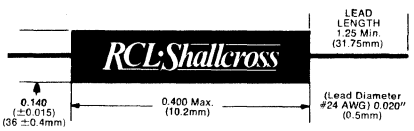


DIMENSION SPECIFICATIONS — Inches (Millimeters)

Style	L	D	C	l	d
LO-3	0.560 ±0.010 (14.224 ±0.254)	0.210 ±0.010 (5.334 ±0.254)	0.655 (16.64)	1.375 ±0.125 (34.925 ±3.175)	0.032 ±0.002 (0.813 ±0.051)
LO-5	0.920 ±0.010 (23.368 ±0.254)	0.330 ±0.010 (8.382 ±0.254)	0.835 (21.209)	1.250 ±0.125 (31.750 ±3.175)	0.040 ±0.002 (1.016 ±0.051)

Dual Function Fuse Resistors

A Dual Purpose Device That Acts As Both A Wirewound Resistor and Fuse



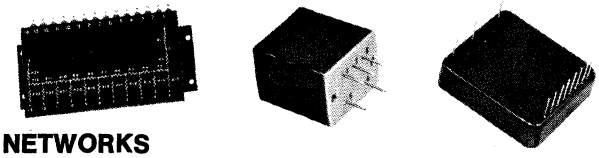
GENERAL SPECIFICATIONS

Resistance Range: 0.2Ω to 200Ω.
Resistance Tolerance: 10% is standard, 5% and 2% definition.
Operating Temperature: −55°C to +150°C
Temperature Coefficient: ±50 PPM/°C Max.

FEATURES

- Affords protection for semiconductor devices
- Eliminates fire hazard and circuit board damage to overheated components
- Eliminates unnecessary blowing due to transient conditions
- Reduces the number of discrete components required.

Discrete Resistor Networks and Matched Sets



NETWORKS

Network quality is determined by the qualities of its individual resistors and the packaging and mounting expertise of its assembler. RCL/Shallcross offers a unique background of experience, data, manufacturing and testing skills for its wirewound resistor networks. PARAMETERS: (1) Resistance ratios to .001%, (2) Resistor tolerances to ±.005% (at ambient), (3) Ratio tolerances as close as .01% (over a range of temperatures), (4) Stability to ±.001% per year.

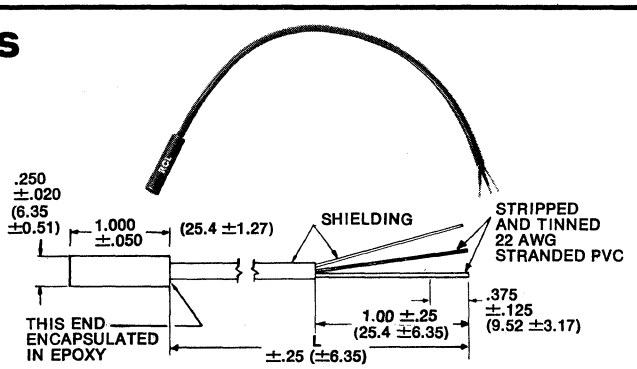
MATCHED SETS

Two or more resistors can be matched with relative tolerance much higher than each one's individual tolerance. Characteristics most often matched are: (1) DC Resistance at one or more temperatures, (2) AC and DC Voltage ratios, (3) Temperate Coefficients and (4) Phase Shifts. Principle advantages of matched sets are: (a) Very tight relative tolerances, (b) Lower cost than networks of comparable accuracy and (c) Flexibility in locating components during design and packaging. An engineering staff at RCL/Shallcross is ready to assist you in specifying your matched set requirements.

Molded Temperature Sensors

RCL offers a standard line of epoxy encapsulated sensing resistors for temperature compensating applications. The standard resistance tolerance ±5% with tighter tolerances available on special order. Cable lengths from 2.0" to 48.0" (50.80 to 1219.2 mm) are available with 6.0" (152.40 mm) standard. Operating temperature range is −55°C to +105°C. Repeatability of tempco within a given lot is ±100 PPM.

RCL Style	Resistance Range	PPM/°C Average Tempco 0°C — 100°C
TC35	10Ω — 50KΩ	3500 ±350
TC45	10Ω — 10KΩ	4500 ±450
TC55	10Ω — 5KΩ	5500 ±550



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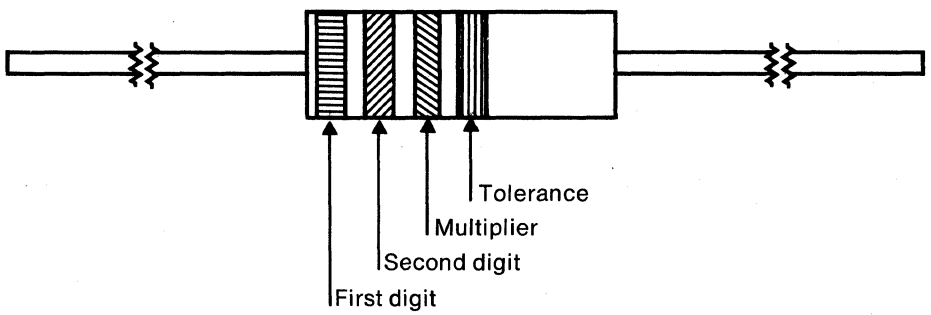
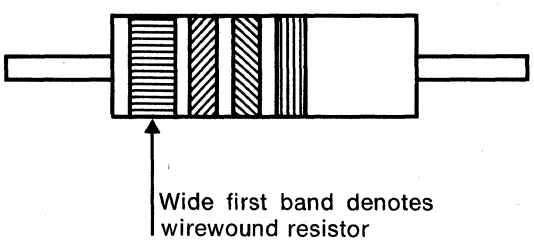
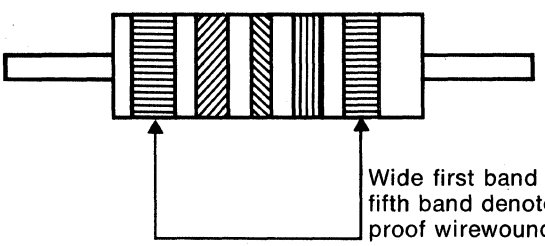
MINIGLOSSARY
RESISTOR COLOR CODES

EIA/MIL Resistor Color Codes



Color code for general-purpose industrial resistors

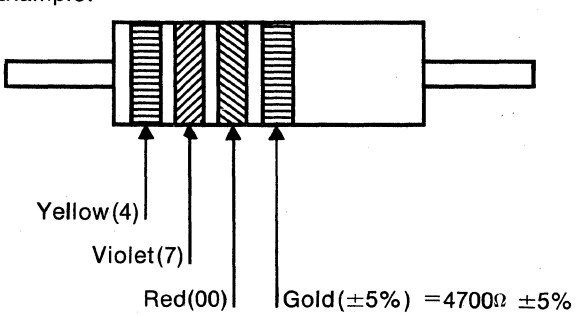




Color code for general-purpose wirewound resistors

Color	Significant digit	Multiplier	Tolerance
Black	0	1	—
Brown	1	10	± 1%
Red	2	100	± 2%
Orange	3	1000	± 3%
Yellow	4	10,000	± 4%
Green	5	100,000	—
Blue	6	1,000,000	—
Violet	7	10,000,000	—
Gray	8	—	—
White	9	—	—
Gold	—	0.1	± 5%
Silver	—	0.01	±10%
No color	—	—	±20%

Example:



We've Put up a LOT of Resistance...

Reliable Performance *Wherever* Needed!

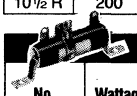
Also Military Versions:
RW29, 30, 31. RS 32, 33, 35.
RW67, 68, 69. RX29, 32, 33, 35.

For More Than 40 Years Our Famous, *Versatile* Ohmic Capabilities have met the rigid demands of smart buyers with unerring consistency—saving time, tempers and money.

Against this enviable background our engineers envision even greater challenges in solving future OEM and industrial resistor application problems. For prompt, practical answers to your requirements, send us your prints or specs.

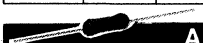
FIXED LUG

No.	Wattage	Resistance Min.-Max.	Max. Dimensions O.D. x Lgth.
1 M	5	0.1-11,000	5/16 x 1
1 3/4 M	10	0.1-50,000	5/16 x 1 3/4
2 E	20	0.25-100,000	7/16 x 2
2 B	25	0.25-100,000	9/16 x 2
4 B	50	0.5-175,000	9/16 x 4
6 1/2 C	100	1.0-300,000	3/4 x 6 1/2
8 1/2 R	160	1.0-300,000	1 1/8 x 8 1/2
10 1/2 R	200	1.0-400,000	1 1/8 x 10 1/2



ADJUSTABLE

No.	Wattage	Resistance Min.-Max.	Max. Dimensions O.D. x Lgth.
1 3/4 MA	10	1.0-10,000	5/16 x 1 3/4
2 BA	25	1.0-25,000	9/16 x 2
4 BA	50	1.0-100,000	9/16 x 4
6 BA	75	1.0-100,000	9/16 x 6
6 1/2 CA	100	1.0-100,000	3/4 x 6 1/2
8 1/2 RA	160	1.0-100,000	1 1/8 x 8 1/2
10 1/2 RA	200	1.0-100,000	1 1/8 x 10 1/2

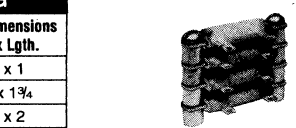


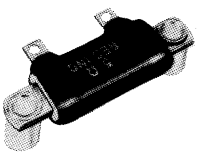
AXIAL LEAD

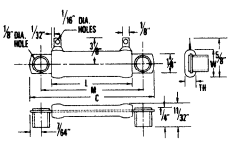
No.	Watts	Resistance Min. Max.	Dimensions O.D. x Lgth.
3 AX	3	0.1-10,000	1/4 max. x 9/16
5 AX	5	0.1-30,000	11/32 max. x 1 1/16
10 AX	10	0.1-50,000	13/32 max. x 1 5/16

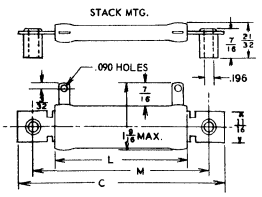
NON-INDUCTIVE RESISTORS: for high frequency power circuits. Available in all types except adjustable, 10 watts and larger. Standard tolerances: ± 10%.

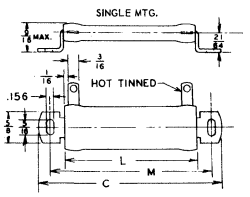
RESISTANCE TOLERANCES: Standard: ± 5%, 1.0 ohm and over. Special: down to ± 1%.











FLAT OVAL

Watts* Free Air	Core—L	Min. Ohms	Maximum Ohms Vitreous	Maximum Ohms Silicone	Mounting	C	M
10	3/4"	.23	15K	6.9K	Stack	1 7/32	1"
15	1"	.389	25K	12.7K	Stack	1 15/32	1 1/4
20	2"	.66	50K	27.6K	Stack	2 17/32	2 5/16"
25	2"	1.01	—	51.7K	Stack	2 5/16	2 3/8
30	1 1/4	0.1	10K	7.7K	Single Stack	2 1/8 2 1/2	1 3/4 2
40	2	0.2	30K	25K	Single Stack	2 7/8 3 1/4	2 1/2 2 3/4
55	3 1/2	0.3	60K	76K	Single Stack	4 3/8 4 3/4	4 4 1/4
65	4 3/4	0.4	85K	132K	Single Stack	5 5/8 6	5 1/4 5 1/2
75	6	0.5	100K	193K	Single Stack	6 7/8 7 1/4	6 1/2 6 3/4

* Ratings of flat oval resistors based on mounting on steel panel 10" x 10" x .040". When mounted on non-metallic surface, reduce wattage approximately 15%.

NEW

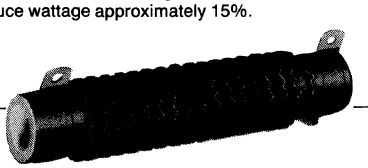
FLEXIBLE WIREWOUND

Conforms to available shape. Fiberglass sleeve.
Wattage Rating: 2 watts per inch.
Resistance Range: 1200 Ohms per inch, max. .35 Ohms per inch, min.
Tolerance: 10% standard. Others on request.
Size: 1 inch long per 2 watts.
Leads: Hot tinned, 1-3/8" long.

UPRIGHT PC Mount

NEW

Fiberglass core, Ceramic Case.
Wattage Ratings: 10, 15, 20, 25, 30, 35, 40 & 45
Resistance Range: Min: .14 Ohms (10 Watt) Max: 11K Ohms (45 Watt)
Tolerance: 10% standard. Others on request.
Size: 1" to 5" long x 19/32" Dia.
Leads: Tinned, for .070" PC holes.



RIBBON WOUND For Heavy Current

RIBBON WOUND RESISTORS

Watts	Core Size D	Core Size L	Ohms Min. Res.	Ohms Max. Res.	Watts	Core Size D	Core Size L	Ohms Min. Res.	Ohms Max. Res.
400	1 1/8	11 1/4	0.24	18.00	135	3/4	5	0.06	4.25
375	1 1/8	10 1/2	0.22	16.50	105	3/4	4	0.04	3.00
300	1 1/8	8 1/2	0.17	13.00	100	3/4	3 1/2	0.03	2.40
240	1 1/8	6 1/2	0.11	8.20	135	9/16	6	0.06	5.50
185	1 1/8	5	0.09	6.40	105	9/16	5	0.05	3.65
180	3/4	6 1/2	0.08	6.00	90	9/16	4	0.04	2.75

Available with adjustable tap bands or with tapped windings.

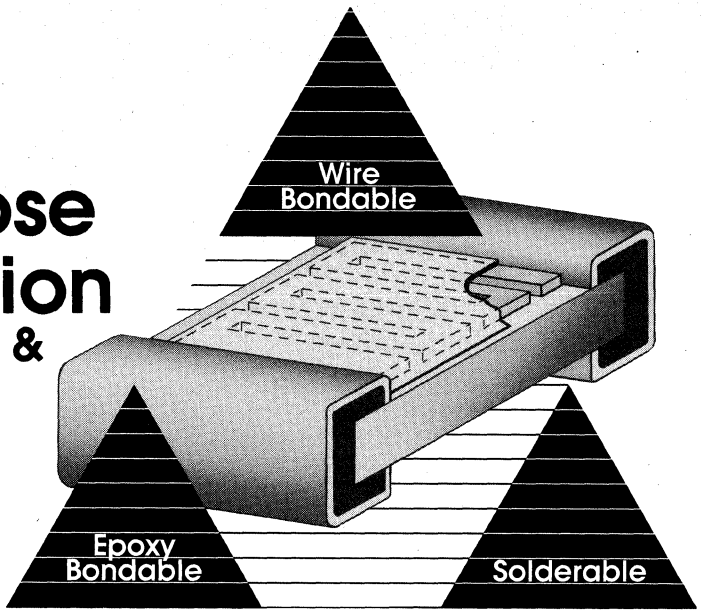
Write For Complete Catalog

resistors, inc.
CUSTOM DESIGNING, ENGINEERING, MANUFACTURING
5226 West 26th Street, Chicago, Illinois 60650
Phones: 312/652-7555 • 312/242-1539
• FAX: 312/863-4272

OHMTEK
2160 Liberty Drive
Niagara Falls, NY 14304
716-283-4025 TWX: 710-524-1653
FAX: 716-283-5932

All Purpose Termination

Precision Thick & Thin Film Chip Resistors



Meets or Exceeds MIL-R-55342 Characteristic "E"

The all-purpose terminations on Ohmtek precision wraparound resistor chips accept all three types of mounting — solder mount, conductive epoxy or gold wire bonding. Low noise, superior stability, low TCR and low voltage coefficient guarantee that Ohmtek chips meet the exacting standards of your applications. **Construction consists of gold plating over an electroplated nickel barrier.**

Precision Thin Film Style

See page 6 of the Ohmtek Surface Mount Resistor Catalog for Performance Characteristics.

ORDERING INFORMATION

STYLE	SIZE (L x W)	TCR CHARACTERISTIC	OHMIC VALUE	ABSOLUTE TOLERANCE	TERMINATION
P = Precision Thin Film Wraparound	1206 = .120" x .060" 0705 = .075" x .050" 1505 = .150" x .050"	E = ±25 ppm/°C (available) H = ±50 ppm/°C (std.)	The first three digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point.	B = ±0.1% D = ±0.5% F = ±1.0% G = ±2.0% J = ±5.0% L = (Values less than 100 ohms use ±1 ohm) S = Trimmable	B = Solderable (solder coated with nickel barrier) G = Solderable/ Weldable (Au over Ni)

EXAMPLE: P0705H6801FG is a thin film wraparound chip resistor 50 x 75 mil, with a TCR of ±50 ppm/°C, a value of 6800 ohms, ±1% tolerance with all-purpose gold plated nickel terminations.

Precision Thick Film Style

See page 4 of the Ohmtek Surface Mount Resistor Catalog for Performance Characteristics.

ORDERING INFORMATION

STYLE	CASE SIZE (L x W)	TCR CHARACTERISTIC	OHMIC VALUE	TOLERANCE	TERMINATION
M = High Rel Cermet Thick Film Wraparound	0303 = 35 x 35 0502 = 50 x 25 0504 = 50 x 40 0505 = 50 x 50 0705 = 75 x 50 1002 = 100 x 25 1005 = 100 x 50 1010 = 100 x 100 1206 = 120 x 60 1505 = 150 x 50 2010 = 200 x 100 2208 = 225 x 75 2512 = 250 x 125	K = ±100 ppm/°C L = ±200 ppm/°C M = ±300 ppm/°C	The first three digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point.	F = ± 1% G = ± 2% J = ± 5% K = ±10% S = Special	B = Solderable (solder coated with nickel barrier) G = Solderable/ Weldable (Au over Ni)

EXAMPLE: M0505K1003JG is a thick film cermet wraparound chip resistor 50 mil square, with a TCR of ±100 ppm/°C, a value of 100K ohms, ±5% tolerance and all-purpose gold plated nickel terminations.

SFERNICE, INC.

OHMTEK
2160 Liberty Drive
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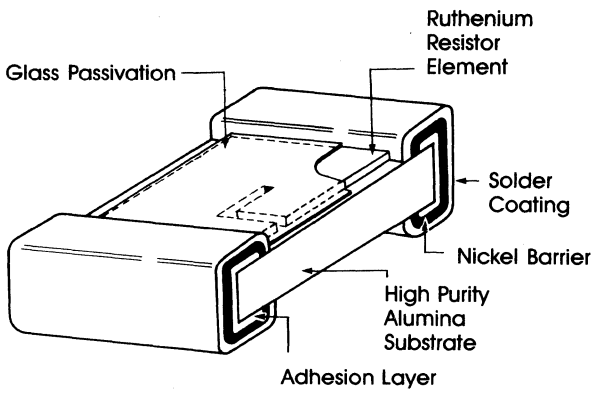
MIL-R-55342 THICK FILM CHIP RESISTORS
R LEVEL APPROVED

OHMTEK's long history in supplying wraparound thick film chip resistors for demanding applications enables them to supply a wide range of resistance values and sizes, to the most exacting requirements, especially for situations demanding documented, tightly controlled reliability.

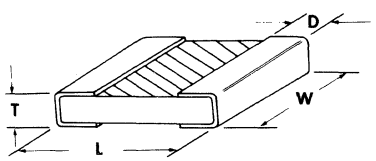
FEATURES

- High purity alumina substrate for high power dissipation
- Wraparound terminations featuring a high temperature adhesion layer covered with a leach resistant nickel barrier layer for 150°C operating conditions
- High speed laser trimming provides clean kerf and economical production
- Ruthenium based cermet thick film for dependable performance
- Fired-on glass passivation
- Complete MIL-testing available in-house
- Antistatic waffle pack or tape and reel packaging available



SPECIFICATIONS:

- Resistance Range: 20 ohms to 1 megohm
- Tolerance: ±1, 2, 5, 10%
- TCR: ±100ppm/°C, 300ppm/°C
- Operating Temperature Range: −55°C to +150°C



CASE SIZE	SIZE								POWER RATING (MW)	RESISTANCE RANGE (ohms)
	L		W		T		D			
	inches +0.010 −0.005	mm ±0.40	inches +0.005	mm +0.25 −0.15	inches (max.)	mm (max.)	inches +0.010 −0.005	mm ±.25		
M55342/2	.050	1.50	.050	1.25	.020	1.00	.010	.400	100	20-470K
M55342/6	.075	2.15	.050	1.25	.020	1.00	.015	.500	150	20-1 Meg
M55342/3	.100	2.80	.050	1.25	.030	1.00	.015	.500	200	20-1 Meg
M55342/4	.150	4.00	.050	1.25	.030	1.00	.015	.500	325	20-1 Meg

ORDERING INFORMATION*

STYLE	TCR	OHMIC VALUE	TOLERANCE	TERMINATION	FAILURE RATE
M55342/2 M55342/6 M55342/3 M55342/4	K = ±100 ppm/°C M = ±300 ppm/°C	The first three digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point Example: 20 ohms = 20R0 100 ohms = 1000 1000 ohms = 1001	F = ± 1% G = ± 2% J = ± 5% K = ± 10%	B = solderable wraparound (nickel barrier) R = wraparound S = one surface	M = 1.0% per 1000 hours P = 0.1% R = .01%

EXAMPLE: M55342/2 K1003FBM calls out a QPL thick film cermet wraparound chip resistor 50 mil square with a resistance of 100,000 ohms, a ±1% tolerance, solderable terminations, and a failure rate of 1.0%/1000 hrs.

*Also available using Rev D QPL part numbers.

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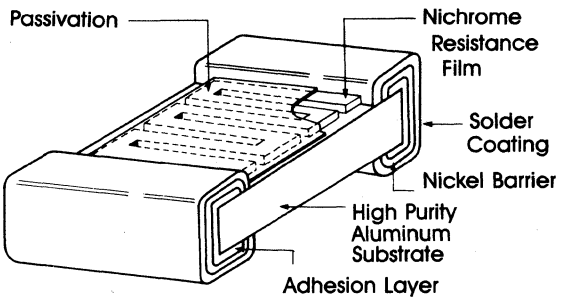
PRECISION THIN FILM WRAPAROUND CHIP RESISTORS

MEETS OR EXCEEDS MIL-R-55342 CHARACTERISTIC "E" METAL FILM PERFORMANCE

For demanding applications of low noise, superior stability, low temperature coefficient of resistance and low voltage coefficient, OHMTEK's proven precision thin film wraparound resistors meet your exact requirements.

Thin Film Chip Resistor Construction



FEATURES

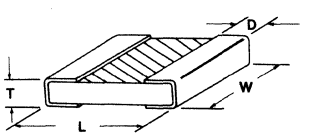
- Standard 1206 and 0705 sizes (other sizes available)
- High purity alumina substrate
- High stability nichrome resistive film
- Available for functional trim after mounting
- 100% visual inspected per MIL-R-55342
- Gold plated or pre-tinned terminations over nickel barrier
- Very low noise and voltage coefficient
- Non-inductive
- TCR ±50 ppm/°C Standard
- Laser-trimmed tolerances to ±0.1%
- Wraparound resistance less than 10 milliohms
- In-lot tracking less than 5ppm/°C

PERFORMANCE CHARACTERISTICS

ENVIRONMENTAL TEST	LIMITS MIL-R-55342 CHARACTERISTIC "H" Δ R ± (%)	TYPICAL OHMTEK PERFORMANCE 10K ohm Δ R ± (%)	TYPICAL OHMTEK PERFORMANCE 100K ohm Δ R ± (%)
THERMAL SHOCK	.25	.04	.02
SHORT TERM OVERLOAD	.10	.01	.01
LOW TEMPERATURE OPERATION	.25	.01	.01
RESISTANCE TO SOLDER HEAT	.25	.04	.03
MOISTURE RESISTANCE	.40	.02	.01
HIGH TEMPERATURE EXPOSURE	.20	.03	.06
LOAD LIFE - 2000 hours (70°C)	.50	.12	.18
TCR - (ppm/°C)	50 ppm	30 ppm	30 ppm

SPECIFICATIONS:

Resistance Range:
0705 = 10 ohms to 100K ohms
1206 = 10 ohms to 500K ohms
1505 = 10 ohms to 500K ohms
Tolerance:
±0.1% at 10 ohms — 500K ohms standard
Operating Temperature Range: –55 to +150°C
Power Rating:
0705 = 150 MW at 70°C
1206 = 300 MW at 70°C
1505 = 300 MW at 70°C
Noise: –35 DB



CASE SIZE	SIZE L inches (+0.010) (–0.005)	L mm ±0.40	W inches ±0.005	W mm +0.25 –0.15	T inches (max.)	T mm (max.)	D inches +0.010 –0.005	D mm ±25	MAX. POWER (MW)	RESISTANCE RANGE (ohms)
0705	.075	2.15	.050	1.25	.020	.080	.015	.500	200	10-100K
1206	.120	3.25	.060	1.50	.030	1.00	.015	.500	330	10-500K
1505	.150	3.81	.050	1.25	.030	.760	.015	.380	330	10-500K

OTHER SIZES (Consult Factory)

ORDERING INFORMATION

STYLE	SIZE L x W	TCR CHARACTERISTIC	OHMIC VALUE	ABSOLUTE TOLERANCE	TERMINATION
P = Precision Thin Film Wraparound	0705 = .075"x .050" 1206 = .120" x .060" 1505 = .150" x .050"	E = ±25 ppm/°C (available) H = ±50 ppm/°C (std)	The first three digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point.	B = ±0.1% D = ±0.5% F = ±1.0% G = ±2.0% J = ±5.0% L = (Values less than 100 ohms use ±1 ohm) S = Trimmable	B = Solderable (solder coated with nickel barrier) G = Solderable/ Weldable (Au over Ni)

EXAMPLE: P0705H6801FB is a thin film wraparound chip resistor 50 x 75 mil, with a TCR of ±50 ppm/°C, a value of 6800 ohms, ±1% tolerance with solder coated nickel barrier terminations.

SFERNICE, INC.

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TANTALUM NITRIDE THIN FILM CHIP RESISTORS

ELECTRICAL SPECIFICATIONS

Resistance Range (.030 x .030 size):
4.7 OHMS 3 MEGOHMS

Resistance Range (.020 x .020 size):
20 OHMS 1 MEGOHM

Resistance Ratio Accuracy:
±2% standard or ±.1 OHM whichever is greater (.025% avail.)

Power Rating at 70°C (.030 x .030 size):
250 MW

Power Rating at 70°C (.020 x .020 size):
125 MW

TCR Tracking:
2PPM/°C Typical (on C.T. style)

Noise:
−35 DB

Temperature Range:
−55 to +125°C

FULL LOT TRACEABILITY TO WAFER LEVEL

Visual Criteria:
MIL-STD-883 Level B Method 2010

Thermal Shock (MIL-STD-202, Method 107, Test Condition C):
.05% Max $\frac{\Delta R}{R}$ (.02% typical)

High Temperature Exposure (125°C 1000 Hours in Air):
.1% Max $\frac{\Delta R}{R}$ (.07% typical)

Low Temperature Operation (MIL-R-55342 Paragraph 4.7.4):
.05% Max $\frac{\Delta R}{R}$ (.025% typical)

Moisture Resistance (MIL-STD-202 Method 106):
.25% Max $\frac{\Delta R}{R}$ (.05% typical)

Short Time Overload (5x Rated Power 25°C, 5 sec):
.25% Max $\frac{\Delta R}{R}$ (.05% typical)

Load Life 1000 Hours at 70°C at 250 MW:
Less than .1% Max $\frac{\Delta R}{R}$ (.05% typical)

MECHANICAL SPECIFICATIONS

Substrate	Silicon	10 ±2 mils	15 ±2 mils Thick
Isolation layer	SiO_2	10,000A	Thick Min.
Metalization	Aluminum Gold	10,000A 15,000A	Thick Min. Thick Min.
Die size	30 ±3 mils 20 mils ±3 mil	Square Square	

ORDERING INFORMATION

SUBSTRATE	CHIP SIZE	RATIO TOLERANCES	TCR CHARACTERISTIC	OHMIC VALUE	ABSOLUTE TOLERANCE
S = SILICON (SiO_2) A = ALUMINA (99.6% PURITY) B = SAPPHIRE	(.020" X .020") = 20 (.030" X .030") = 30 Single value resistor chip (.030" x .030"), (ratio) = 3OR Center tapped resistor with both sides matched to the ratio tolerance indicated by the letter following "R." Standard absolute tolerance is ±2% IN VALUES > 100 OHMS (.030" X .030") = 30R Center tapped resistor with each side equal to R/2 and trimmed to the absolute tolerance.	S = ±2.0% (STANDARD) A = ±1.0% D = ±0.5% B = ±0.1% N = Not Applicable (Not applicable on 20 Mil Sq. Size or Single Value Resistors. Special Order X = ±0.05% Y = ±0.025%	F = ± 10ppm/°C E = ± 25ppm/°C C = ± 50ppm/°C K = ±100ppm/°C M = ±250ppm/°C S = Special	The first three digits are significant figures and the last digit specifies the number of zeros to follow Example: 1 Ohm = 1R00 10 Ohms = 10R0 12.5 Ohms = 12R5 100 Ohms = 1000 1000 Ohms = 1001	B = ± 0.1% D = ± 0.5% F = ± 1.0% G = ± 2.0% J = ± 5.0% K = ±10.0% S = ±20.0% M = (Values less than 10 Ohms use ±1 Ohm) X = Special

EXAMPLE: S30RDC6801F IS A 30 MIL SQUARE CENTER TAP CHIP RESISTOR ON SILICON WITH A RATIO TOLERANCE OF ±0.5%, A TCR OF ±50 PPM/°C, RESISTANCE VALUE OF 6.8K OHMS, AND ABSOLUTE TOLERANCE OF ±1%

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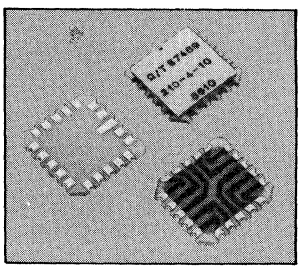
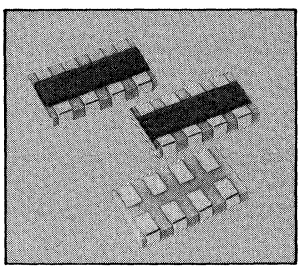
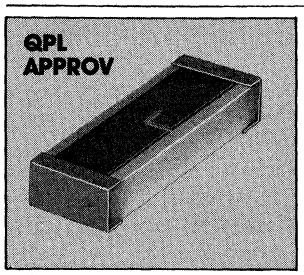
OHMTEK Surface Mount Resistors Chips/Networks



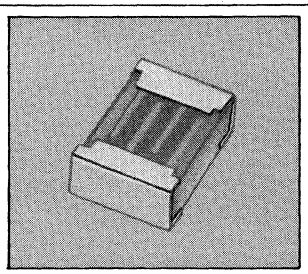
LEADLESS CHIP CARRIERS
Designed to meet Mil-R-83401 Characteristic "K"
- Saves board space and reduces assembly costs
- Wide resistance range: 10 ohms to 10 megohms
- Tolerances to 1%
- Low TCR to ± 100ppm/°C
- 14 through 28 terminals (20 standard)
- JEDEC standard "A" & "B" schematics or custom circuits
- Glazed overcoat or ceramic cover
- Auto placement compatibility



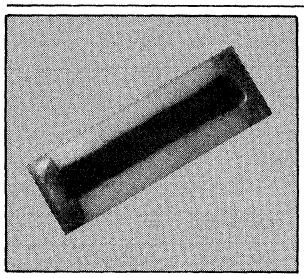
WRAPAROUND QUAD CHIP RESISTOR NETWORKS
- Saves board space
- Reduces assembly costs
- Greater design flexibility
- Two or four isolated resistors
- 50 Mil pad spacing
- Resistance range: 100 ohms to 10 megohms
- Tolerance to 1%
- TCR: ± 100ppm/°C



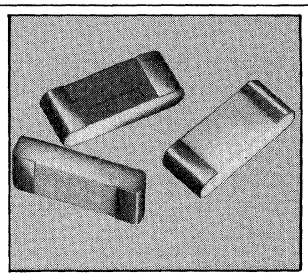
CERMET WRAPAROUND CHIP RESISTORS
Designed to meet Mil-R-55342, Characteristic "K"
- Greater design flexibility
- Resistance range: 10 ohms to 10 megohms
- Tolerances to 1%
- Low TCR to ± 100ppm/°C
- Several standard sizes (including 1206)
- Customs available
- Wave or reflow mounting
- Auto placement compatibility
- Tape and reel or bulk packaging



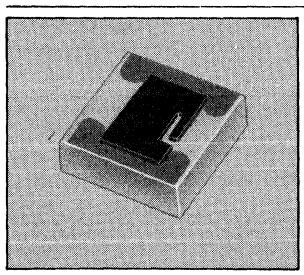
PRECISION THIN FILM WRAPAROUND CHIP RESISTORS
Designed to meet Mil-R-55342 Characteristic "H"
- Resistance range: 10 ohms to 600K ohms
- Tolerances to 0.1%
- Low TCR to ± 25ppm/°C
- Standard sizes (including 1206)
- Ideal for high frequency, low noise, and tight TCR applications requiring good stability



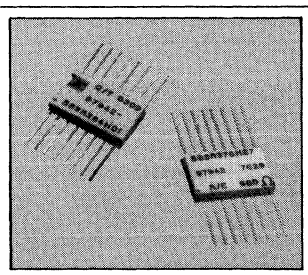
ULTRA-HIGH VALUE CERMET WRAPAROUND CHIP RESISTORS
- High ohm resistance range: 10 megohms to 500 megohms
- Tolerances: 5, 10, 20%
- Standard sizes available
- Bulk or tape and reel packaging
- Economically priced industrial grade features



ULTRA-LOW VALUE WRAPAROUND CHIPS
- Low ohm resistance range: .05 ohm to 10 ohms
- Precision tolerances for current sensing applications
- Good stability - TCR better than ± 100ppm/°C
- High power: up to 0.5 watt/75°C
- 1206 Case size
- Wave or reflow mounting
- Solder coating with nickel barrier



WIRE BONDABLE CHIP RESISTORS
- Design flexibility
- Saves board space
- Cermet chip with gold-wire-bondable terminations
- Resistance range: 10 ohms to 10 megohms
- Tolerances to 1%
- 50 x 50 and 35 x 35 mils standard
- Customs available
- Backside metalization available for eutectic bonding



THICK FILM FLATPACKS
Qualified for Mil-R-83401/03 Characteristics "K" & "M"
- High density packaging resistor networks
- Resistance range: 100 ohms to 100K ohms
- Tolerances to 1%
- TCR to ± 100ppm/°C
- 14 through 28 lead packages available
- Standard "A" & "B" schematics
- Custom R or R-C networks
- Fully tested under Group "A" & "B"

Features:
- All wraparound connections feature a thick or thin film adhesion layer covered with a leach-resistant nickel barrier layer and solder coated for 150°C applications.
- Ruthenium-based cermet thick film yields dependable performance and low cost.
- Abrasive and laser trimming available.
- Hi-Rel screening available on all resistor types with all Mil-Spec Qual testing in house.
- Special metalization and custom sizes available upon request.
- No inductance.
- Tape and Reel or static free waffle pack packaging is standard.
- Glass fired passivation as standard adds reliability and stability to the resistor elements.

Performance/Design Characteristics:
- Tolerances: ± 0.1% - 20%
- Resistance values: .1 ohm to 500 megohms
- TCR: Thin Film
  ± 50 ppm/°C (standard)
  Thick Film
  ± 100 ppm/°C (standard)
- Operating temperature range: -55°C to +150°C

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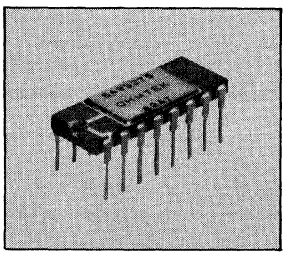
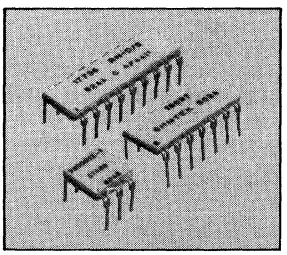
OHMTEK Precision Resistor Networks

CLOSE TRACKING - TIGHT RATIO TOLERANCE

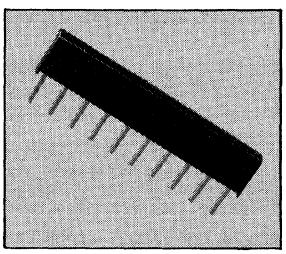
RUGGED CONSTRUCTION PROVIDES DEPENDABLE PERFORMANCE AT MINIMUM COST



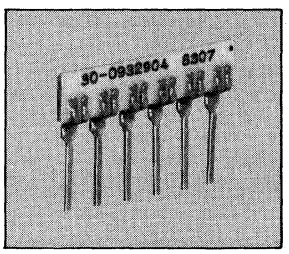
DUAL-IN-LINE HERMETIC
Meets Mil-R-83401 Characteristic "C" for military and other environmental extremes. Available 8, 14, 16 and 18 leads.



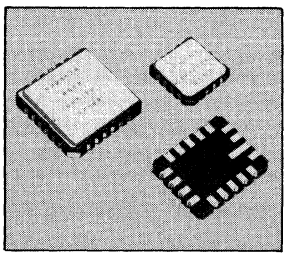
DUAL-IN-LINE CERAMIC SANDWICH
Meets Mil-R-83401 Characteristic "V". Packages of 4-22 leads in rugged monolithic inexpensive construction with highest precision in the industry.



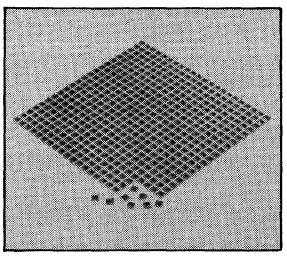
SINGLE-IN-LINE MIL-GRADE
Meets Mil-R-83401
Characteristic "V" and "H" 6-10 lead molded construction in high and low profile versions.



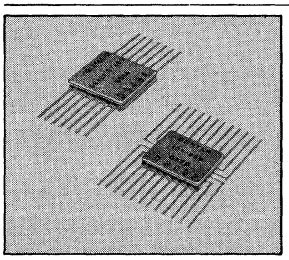
SINGLE-IN-LINE CONFORMAL
3-13 lead packages available. Designed for a wide range of tolerances and values at minimum cost.



LEADLESS CHIP CARRIERS
Hermetic or ceramic sandwich JEDEC packages. 16-28 terminals available. Standard and custom schematics available.



CHIP RESISTORS AND ARRAYS
Exceptional stability and reliability. Available in general purpose, 30-Mil square Mil-R-55342 characteristics and custom circuit arrays on ceramic or silicon.



FLATPACKS
Hermetic; meet Mil-R-83401 Characteristic "C", "V" or "K". Available in 14 through 28 lead packages.

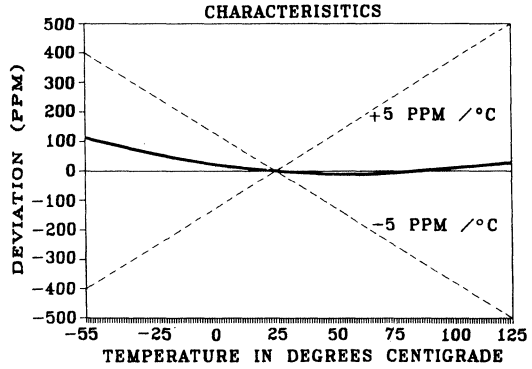
Features:

- Standard and custom circuits as required for demanding military and commercial applications.
- Tracking less than 1 ppm.
- Operating temperature range: -55°C to +125°C
- Low noise: -35 db.
- Full mil-spec screening available in-house.
- Tolerances: .005% - 1%
- Resistance values: 10 ohms to 10 megohm.
- Low TCR: 25ppm/°C Typical
- Nichrome or Tantalum based films optional.

NEW ULTRA LOW TCR ±5ppm/°C -55°C to +125°C

TAMELOX® II

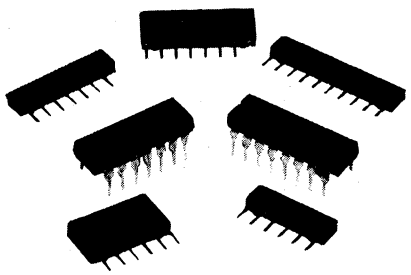
RESISTANCE TEMPERATURE CHARACTERISITICS



SFERNICE, INC.

TECHNO
7803 Lemona Avenue
Van Nuys, CA 91405
(818) 781-1642 FAX: 818-781-8647

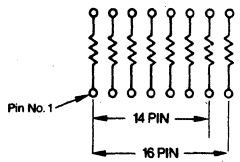
M83401 resistor networks



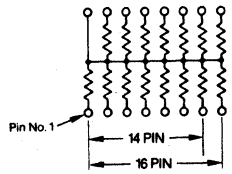
- Designed to withstand thermal stress from – 65° to + 125°C.
- Qualified to military specification M83401.
- Designed for automatic insertions.
- Conforms to IC package configurations.
- Higher temperature solder joints.
- Solderable leads.
- SIPs available as molded or conformal coated.

01 = 14 Pin DIP **02** = 16 Pin DIP

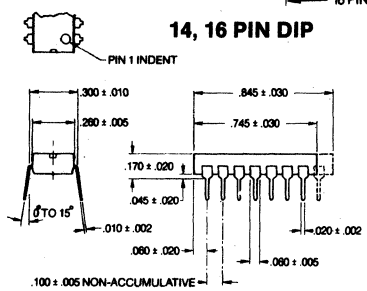
SCHEMATIC "A"



SCHEMATIC "B"

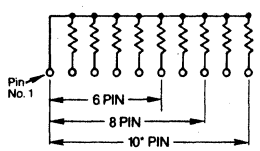


14, 16 PIN DIP



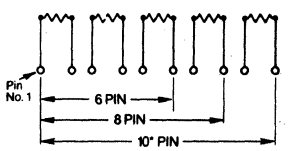
04 = 6 Pin Standard Profile SIP **07** = 6 Pin Low Profile SIP
05 = 8 Pin Standard Profile SIP **08** = 8 Pin Low Profile SIP
06 = 10 Pin Standard Profile SIP **09** = 10 Pin Low Profile SIP

SCHEMATIC "C"



* Low profile only

SCHEMATIC "G"

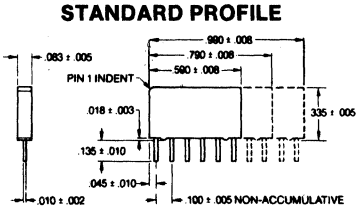


* Low profile only

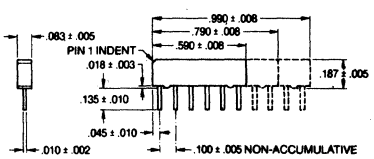
SPECIFICATIONS

Resistance Range:	10Ω to 1 megohm, standard
Resistance Tolerances:	**F** = ±1%, **G** = ±2%, **J** = ±5% (Tighter tolerances available)
Operating Temperature Range:	−65°C to +125°C
100% Burned In:	Military type
Temperature Coefficient:	**M** = ±300 PPM/°C **K** = ±100 PPM/°C Over the temperature range −65°C to +125°C
Leads:	Solderable
Insulation Resistance:	10,000 megohms minimum

6, 8, 10 PIN STANDARD PROFILE



6, 8, 10 PIN LOW PROFILE



HOW TO ORDER
MIL-R-83401

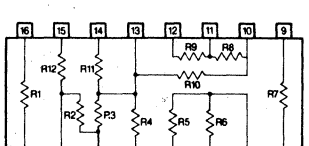
M83401 02 M 1003 F B
① ② ③ ④ ⑤ ⑥

① Basic MIL #
② 01 = 14 pin DIP 04 = 6 pin std. profile SIP
02 = 16 pin DIP 05 = 8 pin std. profile SIP
06 = 10 pin std. profile SIP 07 = 6 pin low profile SIP
08 = 8 pin low profile SIP
09 = 10 pin low profile SIP
③ TC, M = ± 300ppm/°C
K = ± 100ppm/°C
④ R Value: First 3 digits significant.
Last digit = number of zeros.
Letter "R" represents decimal point for values less than 100 Ohms
1003 = 100,000 Ohms
37RO = 37 Ohms
⑤ Resistance Tolerance: F = ± 1%, G = ± 2%, J = ± 5%
⑥ Schematic — A, B, C or G

HOW TO ORDER
Techno Part No.

16 D M 1003 F B
① ② ③ ④ ⑤ ⑥

① 16 = # pins
② D = DIP
S = Std. Profile SIP
L = Low Profile SIP
③⑤ Same as MIL



TYPICAL SPECIAL

CUSTOM CAPABILITIES

TECHNO has the capability of producing a nearly unlimited variety of custom schematics utilizing either single- or double-sided printing. We package in all of the standard sized molded DIP and SIP configurations, conformal coated SIP's, or will produce custom substrate configurations with or without leads.

GENERAL SPECIFICATIONS AVAILABLE

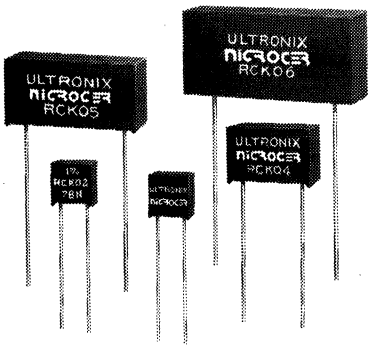
Resistance Range: 3 ohms to 5 Megohms
Tolerance: ±1% standard with tighter available
TC: ±50 PPM/°C standard with tighter available
TCR Tracking: ±50 PPM/°C or tighter
Terminations Available: Gold, Palladium, Silver, Platinum Silver, or Platinum/Palladium Silver
Complete Military Screening and Power Conditioning Capabilities
TECHNO will design from customer schematics and welcomes the opportunity to work with customer engineers during the initial design phase.

SFERNICE, INC.

ULTRONIX
P.O. Box 1090
Grand Junction, CO 81502
(303) 242-0810 FAX: 303-242-5917

metal foil & precision resistive networks

Metal Foil Resistor nicrocer® Process
Very High Precision and Stability
MIL qualification to MIL-R-55182/9 (RNC90Y)



FEATURES:

- Very Tight Tolerances: ± 1% - Matching to 0.002%.
- Very Low Temperature Coefficient: typical < ± 3 ppm/°C (- 55° to + 155°C) ± 1 ppm (0° to + 60°C) tracking to 0.5 ppm/°C.
- Very High Stability: < 25 ppm/year or < 50 ppm/3 years (shelf life).
- Negligible Rise Time: approx. 1 x 10^{-9} sec.

*The T.C. of RCK resistors is always better than ± 5 ppm/°C in the temperature range - 55°C to + 155°C.

NEW low temperature coefficient of ± 1 ppm/°C now available over entire mil temperature range. Ask for the RNK Series in place of the RCK Series.

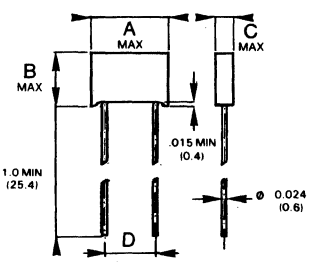
For a group of resistors, T.C. matching can be made to better than ± 0.5 ppm/°C. Consult ULTRONIX.

STANDARD ELECTRICAL SPECIFICATIONS

Ultronix Type	Mil Type	70°C Rating	125°C Rating	Max. Working Voltage	Resistance Range (Ohms)			
					± 0.005%	± 0.02% ± 0.01%	± 0.05%	± 0.1%,± 0.2% ± 0.5% ± 1%
RCK02A	RNC90Y**	0.6W	0.33W	300V	50 Ω - 200K	25 Ω - 200K	10 Ω - 200K	1 Ω - 200K
RCK04	—	1.0W	0.6W	350V	50 Ω - 400K	25 Ω - 400K	10 Ω - 400K	2 Ω - 400K
RCK05/05A	—	1.2W	0.9W	500V	150 Ω - 600K	75 Ω - 600K	30 Ω - 600K	3 Ω - 600K
RCK06	—	1.5W	1.2W	650V	200 Ω - 1M	100 Ω - 1M	40 Ω -1M	4 Ω - 1M

**Consult Ultronix for QPL Max. and Min. Values

New Size Available:
RCK01
Dim. A: 0.210
Dim. B: 0.210
Dim. C: 0.110
Dim. D: 0.100

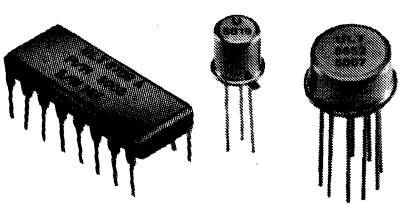


PHYSICAL CONFIGURATIONS

Type	Dim. A	Dim. B	Dim. C	Dim. D
RNC90Y	.320	.375	.120	.150
RCK02A	.312	.330	.115	.150*
RCK04	.575	.413	.138	.400
RCK05	.890	.413	.138	.700
RCK05A	.890	.413	.138	.650
RCK06	1.200	.531	.256	.900

*RCK02 Lead Spacing: .20

Precision Resistive Networks
— nicrocer® Process —
MIL qualification to MIL-R-83401



FEATURES:

- Absolute Resistance Value to ± .001%.
- Resistor Ratio Match At Room Temperature to .001%.
- TCR Tracking with Temperature (- 55°C to + 125°C) to 0.5 ppm/°C.
- Resistance Ratio Tracking Under Variable Power 0 to 50mW: Less Than 5 ppm.
- Resistance Ratio Tracking Under Power, Temperature and Time (10mW; 60°C, for 2,000 hours): < 10 ppm.

ALL COMMERCIAL TYPES OF PACKAGING ARE AVAILABLE.

For more details contact ULTRONIX Application Engineering Department.

PERFORMANCES

TEST OR CONDITION		PERFORMANCE OF ULTRONIX MINIATURE HERMETICALLY SEALED NETWORKS
Resistance temperature characteristic Tracking to the reference element (- 55 to + 125°C)		± 2ppm/°C Typ. ± 5ppm/°C Max. 0.5ppm/°C Typ. ± 5ppm/°C Max.
Maximum ambient temperature at rated wattage		70°C
Maximum ambient temperature at zero power		125°C
Thermal shock	Δ R Δ Ratio	± .002% Typ. ± 0.01% Max. ± .002% Typ. ± 0.01% Max.
Power conditioning	Δ R Δ Ratio	± .001% Typ. ± 0.01% Max. ± .001% Typ. ± 0.01% Max.
Low temperature operation	Δ R Δ Ratio	± .005% Typ. ± 0.01% Max. ± .005% Typ. ± 0.01% Max.
Short time overload	Δ R Δ Ratio	± .002% Typ. ± 0.01% Max. ± .002% Typ. ± 0.01% Max.
Resistance to soldering heat	Δ R Δ Ratio	± .002% Typ. ± 0.01% Max. ± .001% Typ. ± 0.01% Max.
Moisture resistance	Δ R Δ Ratio	± .003% Typ. ± 0.01% Max. ± .003% Typ. ± 0.01% Max.
Shock (specified pulse)	Δ R Δ Ratio	± .001% Typ. ± 0.01% Max. ± .001% Typ. ± 0.01% Max.
Vibration, high frequency	Δ R Δ Ratio	± .001% Typ. ± 0.01% Max. ± .001% Typ. ± 0.01% Max.
Load life (70°C, full power, 1,000 hours)	Δ R Δ Ratio	± 0.025% Typ. ± 0.05 Max. ± 0.01% Typ. ± 0.02% Max.

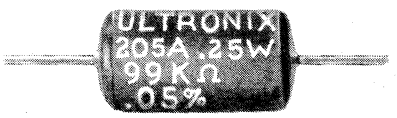
SFERNICE, INC.

ULTRONIX
P.O. Box 1090
Grand Junction, CO 81502
(303) 242-0810 FAX: 303-242-5917

precision wirewound resistors

Very High Precision Wirewound Resistors

MIL qualifications to MIL-R-39005 and MIL-R-93



MINIMUM VALUES:

- Generally 0.1 Ω for 1% and 0.5% and 10 Ω for 0.1% and tighter.

TOLERANCES (±)

- Standards are 0.005%, 0.01%, 0.02%, 0.05%, 0.1%, 0.5% and 1% depending on style and value.

TEMPERATURE COEFFICIENTS:

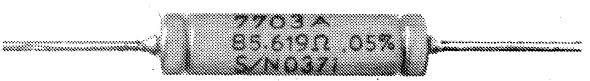
- ± 5 ppm/°C standard for 10 Ω and above. Higher T.C.'s on low ohmic values.
  ± 1 ppm/°C available T.C. match to ± 0.5 ppm/°C.
  High T.C.'s up to + 6000 ppm/°C are available.

SPECIFICATIONS

MIL Style			Maximum Value Ω			Power Rating at 125°C (Watts)			Dimensions ± .020		Ø Leads	
MIL-R 93	MIL-R 39005	Ultronix Type	MIL-R 93	MIL-R 39005	Comm.	MIL	Comm.	Max Volts	Diameter inch	Length inch	AWG	inch
—	—	123A	—	—	111K	—	0.05	150	.100	.230	24	.020
—	—	118A	—	—	192K	—	0.05	150	.130	.180	26	.016
—	—	122A	—	—	199K	—	0.05	150	.123	.218	24	.020
—	—	102A	—	—	334K	—	0.10	150	.110	.250	24	.020
—	—	101A	—	—	410K	—	0.10	300	.130	.375	22	.026
—	—	101P	—	—	453K	—	0.125	150	contact factory		22	.026
—	—	103A	—	—	633K	—	0.10	150	.150	.300	22	.026
—	—	105A	—	—	468K	—	0.125	300	.160	.500	22	.026
—	—	102P	—	—	821K	—	0.125	150	contact factory		22	.026
—	—	184A	—	—	817K	—	0.125	300	.187	.375	22	.026
—	RBR74	185A	—	6.52K	961K	0.125	0.125	300	.188	.500	22	.026
RB56	RBR75	202A	42K	150K	968K	0.125	0.25	200	.250	.310	22	.026
RB56	RBR56	203A	42K	220K	1.7M	0.125	0.25	200	.250	.343	20	.032
RB71	RBR71	203PA	100K	150K	1.48M	0.125	0.25	150	contact factory		22	.026
RB55	RBR55	205A	80K	332K	1.93M	0.15	0.33	400	.250	.500	20	.032
RB54	RBR54	207A	170K	562K	3.0M	0.25	0.50	800	.250	.750	20	.032
—	RBR76	308A	—	3.344K	3.0M	0.50	0.60	800	.312	.810	20	.032
—	—	210A	—	—	4.10M	—	0.50	800	.250	1.00	20	.032
RB53	RBR53	307A	320K	1.1M	5.63M	0.33	0.60	800	.375	.750	20	.032
RB52	RBR52	310A	610K	1.21M	7.68M	0.50	1.00	800	.375	1.00	20	.032
RB57	RBR57	510A	830K	1.37M	24M	0.75	1.25	800	.500	1.00	20	.032
—	—	515A	—	—	35M	—	1.50	1200	.500	1.50	20	.032
—	—	517A	—	—	43M	—	1.75	1200	.500	1.75	20	.032
—	—	520A	—	—	43M	—	2.00	1200	.500	2.00	20	.032

Hermetically Sealed — Ultra High Stability Wirewound Resistors

0.125W to 1.8W at 125°C



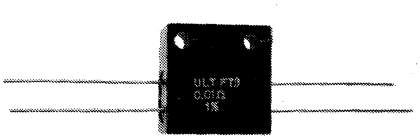
FEATURES:

- Accuracy to 25 ppm absolute.
- Shelf life to 10 ppm/year.
- Temperature coefficient to ± 1 ppm/°C.
- Zero voltage coefficient.
- Noise free.
- Low thermal EMF.

SPECIFICATIONS

Style	Max Value (Ω)	Power rating at 25°C (W)	Max Volts	Dimensions		Ø Leads	
				Dia. ± .01 inch	Length ± .02 inch	AWG	inch
HS185A	817 K Ω	0.125	300	.187	.500	22	.026
HS205A	1.93 M Ω	0.25	300	.250	.500	20	.032
HS207A	2.3 M Ω	0.4	600	.250	.750	20	.032
HS210A	4.10 M Ω	0.5	600	.250	1.000	20	.032
HS307A	4.10 M Ω	0.6	600	.375	.750	20	.032
HS310A	5.63 M Ω	0.8	600	.375	1.000	20	.032
HS510A	24 M Ω	1.	600	.500	1.000	20	.032
HS520A	43 M Ω	1.8	900	.500	2.000	20	.032

Very Low Ohm, Ultra Precision Four Terminal Resistors



Ultronix manufactures a large variety of four-terminal resistors and networks for specilized applications. These are used in requirements of low value where high precision and low temperature coefficient is required. Tolerances available 1.0% or greater. Temperature Coefficient for the FT1, FT2 and FT3 is 100 ppm/°C from + 25°C to + 125°C. FT5 and FT7 T.C. is 10 ppm/°C from + 25°C to + 125°C.

Contact Ultronix Applications Engineering Department for assistance.

STANDARD OHMIC VALUES & WATTAGES AVAILABLE

Ohmic Value	Product Type				
	FT1	FT2	FT3	FT5	FT7
.00167			3 watts		
.003		2 watts	3 watts		
.00455		2 watts	3 watts		
.005		2 watts	3 watts		
.010	1 watt	2 watts	3 watts		
.0139		2 watts	3 watts		
.025	1 watt	2 watts	3 watts		
.050	1 watt	2 watts			
1. - 35.				5 watts	7 watts

SFERNICE, INC.

ULTRONIX
P.O. Box 1090
Grand Junction, CO 81502
(303) 242-0810 FAX: 303-242-5917

power wirewound resistors

Axial Leaded Power Wirewound Resistors

MIL qualifications to MIL-R-39007 and MIL-R-26

ELECTRICAL:

- Tolerance Standard: 0.1%, 0.5%, 1.0%.
- Temperature Coefficient:
  + 650 ppm/°C 0.1 Ω ≤ R < .499 Ω.
  + 400 ppm/°C .499 Ω ≤ R < 1 Ω.
  ± 50 ppm/°C 1 Ω ≤ R < 10 Ω.
  ± 20 ppm/°C R ≥ 10 Ω.
- Dielectric Strength:
  RWR 74, 78, 84, 89 = 1000 VRMS.
  RWR 80,81, 82 = 500 VRMS voltage applied for one minute.
- Insulation Resistance: not less than 1000 M Ω.
- Voltage Rating:
  $\sqrt{PR}$ Where: R = nominal resistance.
  P = power rating
  voltage rating "E" = $\sqrt{PR}$.

MECHANICAL:

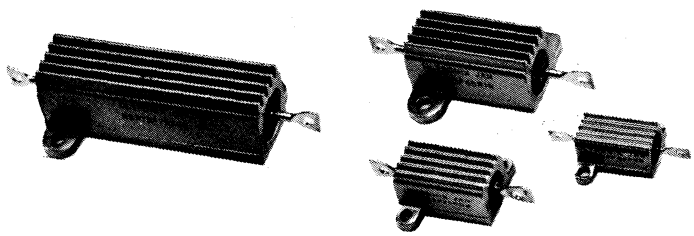
- Resistance Element: nickel chromium alloy.
- Core: ceramic.
- End Caps: stainless steel.
- Encapsulation: RWR 80, 81, 82, 89: molded silicone resin.
  RWR 74, 78, 84: conformal coated silicone resin.
- Terminals:
  solderable - tinned copper weld (S and N).
  weldable - nickel (W and Z).

SPECIFICATIONS

Product Selection			Power Rating At 25°C/Maximum Value			Dimensions		Ø Lead	
Ultronix	Mil-R 26	Mil-R 39007	Commercial	Mil-R-26	Mil-R-39007	Ø Diameter A inch	Length B inch	AWG	Inch
MS1	RW81	RWR81	1W/1.25K	1W/1K	1W/1.00K	.085 ± .020	.250 ± .031	24	.020
MS101	—	RWR82	1.5W/1.5K	—	1.5W/1.3K	.093 max	.343 max	24	.020
MS2	RW70	—	2W/3316K	1W/3.16K	—	.094 ± .031	.406 ± .031	24	.020
MS2	RW80	RWR80	2W/3.16K	2W/2.67K	2W/3.16K	.094 ± .031	.406 ± .031	24	.020
MS25/CS3	RW69	—	3W/10K	3W/2K	—	.200 ± .031	.500 ± .062	20	.032
MS3/CS4	RW79	RWR89	3W/11K	3W/10.5K	3W/4.12K	.187 ± .031	.560 ± .062	20	.032
CS5	—	—	4W/20K	—	—	.200 ± .031	.812 ± .062	20	.032
CS6	RW74	RWR74	5W/38K	5W/12.1K	5W/12.1K	.312 ± .031	.875 ± .062	18	.040
CS7	RW87	—	6.5W/45K	6.5W/8.2K	—	.312 ± .031	1.000 ± .062	20	.032
CS6	—	RWR84	7W/38K	—	7W/12.4K	.312 ± .031	.875 ± .062	18	.040
CS8	—	—	8W/84K	—	—	.375 ± .031	1.375 ± .062	18	.040
CS10	RW78	RWR78	10W/115K	10W/39.2K	10W/39.2K	.375 ± .031	1.780 ± .062	18	.040
CS11	RW68	—	11W/115K	11W/20K	—	.375 ± .031	1.780 ± .062	18	.040

Chassis Mount

MIL qualifications to MIL-R-39009 and MIL-R-18546
10 to 50 watts



ELECTRICAL:

- Tolerance: 5.0% to 0.1%, 1% standard for offshelf delivery.
- Temperature Coefficient: 20 ppm/°C standard.
- Dielectric Strength: greater than 1000 VAC on MC-100 and MC-250, and greater than 2000 VAC on MC-500.

MECHANICAL:

- Resistance Element: copper nickel alloy or nickel chromium alloy.
- Core: ceramic steatite.
- End Caps: stainless steel.
- Sealant: molded constructed.
- Housing: aluminium with hard anodized coating.
- Terminals: tinned copper weld.

DIMENSIONS

Style	Length ± .016	Height ± .031	Body Width ± .031
MC - 80	.600	.320	.334
MC - 100	.750	.406	.438
MC - 250	1.063	.562	.500
MC - 500	1.969	.625	.563

Dimensions in inches.

STANDARD RESISTANCE RANGES

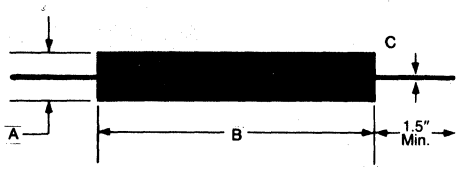
Type	Mil Equiv.		Ultronix Rating Mounted (Watts)	Mil Rating Mounted (Watts)	Maximum Resistance Values
	Mil-R-18546	Mil-R-39009			
MC - 80 X	RE60 (N)	RER40, RER60	8	5	3.32 K Ω
MC - 100 X	RE65 (N)	RER45, RER65	10	10	5.6 K Ω
MC - 250 X	RE70 (N)	RER50, RER70	25	20	12.1 K Ω
MC - 500 X	RE75 (N)	RER55, RER75	50	30	39.2 K Ω

SFERNICE, INC.

TEL-LABS
P.O. Box 375
Londonderry, NH 03053
(603) 625-8994 FAX: 603-623-2395

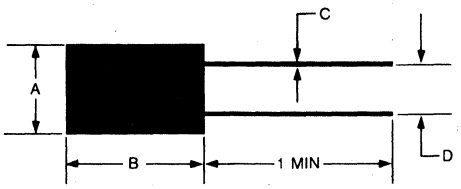
power & precision wirewound resistors

Type VR Vitreous Power



Tel-Labs Style	Watts 325 Degree C Temp. Rise	Dimensions in inches		Resistance		Lead (C) Size Inches
		Diameter (A)	Length (B)	Min.	Max.	
VR1	1.0	.093 ± .031	.406 ± .031	1.5 Ω	3 K	.020
VR2	2.0	.187 ± .031	.375 ± .062	1.5 Ω	3 K	.032
VR3	3.0	.187 ± .031	.500 ± .062	2.5 Ω	6.8 K	.032
VR5	5.0	.187 ± .031	.937 ± .062	7 Ω	16 K	.032
VR7	7.0	.312 ± .062	1.000 ± .062	14 Ω	27 K	.040
VR10	10.0	.312 ± .069	1.750 ± .062	25 Ω	50 K	.040
VR12	12.5	.375 ± .062	1.750 ± .062	32 Ω	72 K	.040

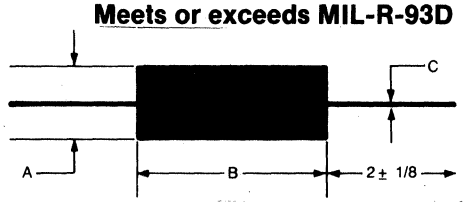
Type PW Series



Tel-Labs Style	Mil R93D Desig.	A ± .015	B ± .032	C	D ± .015	Max. Value Mil.	Max. Value Comm.	Wattage Mil.	Wattage Comm.	Max. Voltage Mil. Comm.
PW1	RB71	.250	.312	.025	.200	100 K	125 K	.125W	.15W	300
PW2		.250	.406	.025	.200		175 K		.2W	600
PW20	RB70	.375	.500	.032	.200,.250	301 K	375 K	.250W	.33W	150 600
PW40		.468	.625	.032	.250,.300		500 K		.3W	600
PW31		.500	.625	.032	.250,.300		1.75 Meg		.6W	600
PW10		.406	1.250	.032	.250,.300		1.0 Meg		1.0W	1200
PW50		.531	1.000	.032	.250,.300		3.0 Meg		1.0W	1200

Type SA Epoxy

Meets or exceeds MIL-R-93D



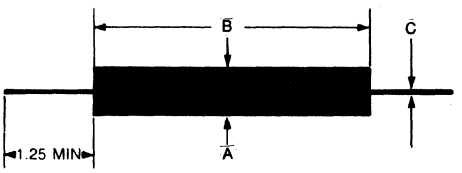
Tel-Labs Style	Mil R93D Desig.	Dia. A ± .015	Length B ± .031	Lead Dia. C	Max. Value Mil.	Max. Value Comm.	Wattage Mil.	Wattage Comm.	Max. Voltage Mil.	Max. Voltage Comm.
SA1	RB55	.250	.500	.032	226 K	1.1 Meg	.15W	.3W	400	400
SA2	RB54	.250	.750	.032	448 K	2 Meg	.25W	.4W	300	400
SA3	RB53	.375	.750	.032	750 K	8 Meg	.333W	.5W	300	400
SA4	RB52	.375	1.000	.032	1.5 Meg	10 Meg	.5W	.75W	600	800
SA5	RB57	.500	1.000	.032	2 Meg	16 Meg	.75W	1.0W	800	1000
SA6	RB58	.500	1.531	.032	3 Meg	24 Meg	1.0W	1.5W	900	1200
SA7	RB59	.500	2.031	.032	5.11 Meg	24 Meg	1.25W	2.0W	1200	1800
SA11		.250	.625	.032		400 K		.33W		800
SA13		.312	.937	.032		1.2 Meg		.5W		800
SA16	RB56	.250	.375	.032	127 K	205 K	.125W	.25W	200	200
SA19		.250	.250	.032		500 K		.2W		200
SA18		.500	.500	.032		3 Meg		.5W		500

Subminiatures

Tel-Labs Style	Diameter A ± .015	Length B ± .031	Lead Dia. C	Maximum Value	Maximum Wattage	Maximum Voltage
SA9	.135	.312	.025	400 K	.08W	100
SA10	.185	.500	.025	500 K	.2W	100
SA20	.165	.500	.025	400 K	.150W	100,.200
SA21	.187	.375	.025	500 K	.125W	100,.200
SA22	.150	.400	.025	190 K	.07W	100
SA24	.125	.250	.020	75 K	.05W	100
SA25	.110	.300	.020	85 K	.05W	100
SA26	.125	.375	.025	140 K	.05W	100
SA29	.100	.300	.025	80 K	.05W	100
SA30	.200	.405	.025	550 K	.13W	100
SA31	.100	.220	.020	70 K	.04W	100

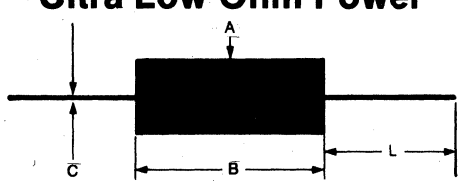
Type EL Silicone Power

Meets or exceeds MIL-R-26



Tel Labs Style	Mil Desig. RW	Wattage U 275°	Wattage V 350°	Dimensions in inches Dia. (A)	Dimensions in inches Length (B)	Max. Res. .05% to .05%	Max. Res. 1% to 5%	Lead Dia. (C) Inches
EL¼		.5W	1.0W	.090 ± .031	.215 ± .031	500 Ω	500 Ω	.020
EL½		.75W	1.0W	.094 ± .031	.280 ± .031	1 K	1.5 K	.020
EL1A	RW70	1.0W	1.25W	.094 ± .031	.406 ± .031	2 K	6 K	.020
EL1B		1.0W	1.50W	.094 ± .031	.530 ± .031	4 K	9 K	.020
EL1C		1.0W	2.0W	.135 ± .031	.335 ± .031	2 K	4.4 K	.025
EL2F		2.5W	3.0W	.188 ± .031	.500 ± .062	4 K	12 K	.032
EL2H		2.5W	3.0W	.188 ± .031	.385 ± .062	2 K	5.7 K	.032
EL2G		2.5W	3.0W	.188 ± .031	.430 ± .062	2 K	8 K	.032
EL2B		3.0W	3.5W	.188 ± .031	.625 ± .062	8 K	16 K	.032
EL2A		3.25W	4.5W	.188 ± .031	.825 ± .062	10 K	28 K	.032
EL2E	RW59	2.5W	3.5W	.195 ± .031	.500 ± .062	8 K	15.4 K	.032
EL2E	RW69	2.5W	3.5W	.195 ± .031	.500 ± .062	8 K	15.4 K	.032
EL2I	RW79	3.0W	3.5W	.195 ± .031	.560 ± .062	8 K	19 K	.032
EL2D		3.0W	4.0W	.250 ± .031	.500 ± .062	7.5 K	19 K	.032,.040
EL2C		3.0W	4.0W	.250 ± .031	.562 ± .062	8 K	22 K	.032,.040
EL2		3.5W	4.5W	.250 ± .031	.625 ± .062	12 K	31 K	.032,.040
EL3		3.5W	5.0W	.295 ± .031	.500 ± .062	8.3 K	23 K	.032,.040
EL5	RW74	5.0W	7.0W	.290 ± .062	.925 ± .093	22 K	56 K	.032,.040
EL7		6.0W	8.0W	.290 ± .062	1.200 ± .093	35 K	90 K	.032,.040
EL5A	RW57	5.0W	6.5W	.350 ± .062	1.000 ± .093	35 K	90 K	.040
EL5A	RW67	5.0W	6.5W	.350 ± .062	1.000 ± .093	35 K	90 K	.040
EL7A		7.0W	9.0W	.350 ± .062	1.360 ± .093	45 K	100 K	.040
EL10A	RW58	10W	11W	.350 ± .062	1.815 ± .093	75 K	175 K	.040
EL10A	RW68	10W	11W	.350 ± .062	1.815 ± .093	75 K	175 K	.040
EL12	RW56	12W	14W	.469 ± .062	2.000 ± .093	90 K	235 K	.040

Ultra Low Ohm Power



Tel-Labs Style	Length B	Diameter A	Lead L	Lead C	Resistance Measurement Points from body
TL01	.406 ± .015	.094 ± .015	1.5 Min.	.025 ± .002	.375 each side
TL03	.560 ± .015	.210 ± .015	1.5 Min.	.032 ± .002	.375 each side
TL05	.920 ± .015	.330 ± .015	1.5 Min.	.040 ± .002	.375 each side

Additional items include:

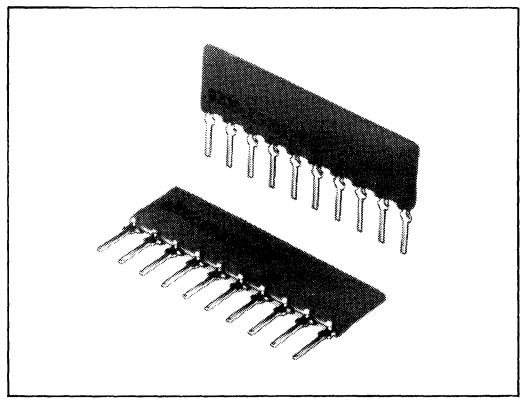
- TYPE EH — Aluminum Housed
- TYPE BL — Beryllium Oxide
- TYPE PR — Subminiature Printed Circuit
- TYPE Q81 — Special Temperature Compensation
- TYPE Q239 — Special 4-Terminal Device

Send for our new catalog covering our complete line of fixed wirewound resistors.

SFERNICE, INC.

SPRAGUE R-C NETWORKS

Type 206C Line Terminator Conformal-Coated SIP R-C Networks



Features

- 8, 9 and 10-Pin SIPs Standard
- X7R and C0G Capacitors
- Low Cross Talk
- Virtually Unlimited Custom Capability

Electrical Specifications Resistors

Resistance Range: 10 Ohms to 1 Megohm.
Resistance Tolerance:
±2% or ±2 Ohms, whichever is greater.
Temperature Coefficient: ±200 ppm/°C.
TCR Tracking: ±100 ppm/°C.
Operating Voltage: 50 V Max.
Operating Temperature: −55°C to +125°C.

Power Ratings: at +70°C.
Power per Resistor: 125 mW.
Pins: 6—Package Power: 0.6 W.
Pins: 8—Package Power: 0.8 W.
Pins: 10—Package Power: 1.0 W.

Electrical Specifications Capacitors

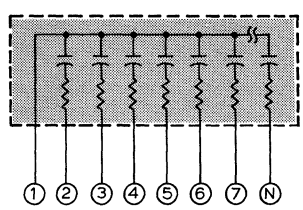
Capacitance: 56 pF to 0.01 μF.
Capacitance Tolerance: ±10%.
EIA Characteristics: X7R and C0G.
Dissipation Factor: Max. 2.5%.
Temperature Coefficient: +15%.
Dielectric Test: 2.5 X Rated Voltage.
Moisture Resistance: Meet requirement of MIL-Std-202, Method 106.
Operating Voltage: 50 V at +125°C.
100 V at +85°C.

Catalog Numbering System

206C H 500 R2 T U

- **SPRAGUE TYPE NUMBER.**
- **NUMBER OF PINS.** H = 8-PINS; J = 9-PINS; K = 10-PINS (4 TO 22 PINS—SPECIAL ORDER)
- **RESISTANCE CODE.** IN OHMS. THE FIRST 2 DIGITS ARE SIGNIFICANT FIGURES. THE 3RD IS THE NUMBER OF ZEROS FOLLOWING.
- **RESISTOR TOLERANCE.** X2 = ±2% (≥100 OHMS). R2 = ±2 OHMS (<100 OHMS).
- **CIRCUIT.** T = LINE TERMINATOR.
- **CAPACITOR VALUE.** U = 0.01 μF

LINE TERMINATORS



Number of Pins	L MAX. in.
D (4-Pin)	0.390
E (5-Pin)	0.490
F (6-Pin)	0.590
G (7-Pin)	0.690
H (8-Pin)	0.790
J (9-Pin)	0.890
K (10-Pin)	0.990
L (11-Pin)	1.090
M (12-Pin)	1.190

Popular Cap.	Codes
56 pF	F
100 pF	G
220 pF	J
470 pF	L
1000 pF	N
0.01 μF	U

Popular Resistance	Codes
50 Ω	500
56 Ω	560
68 Ω	680
75 Ω	750
100 Ω	101

For applications engineering assistance, write or call Thick-Film Products, Sprague Electric Company, 89 Factory St. Extension, Nashua, New Hampshire 03060-3351 · Tel. 603/883-9774. For complete technical data, write for Data Sheet RN-126A-3 to Technical Literature Service, Sprague Electric Company, P.O. Box 9102, Mansfield, MA 02048-9102.

SPRAGUE®
THE MARK OF RELIABILITY

CARBORUNDUM® NON-INDUCTIVE POWER RESISTORS

Choose Type SP for great A-C power handling capability, whether it be at power frequency or many megahertz.

Choose Type A when high resistance is required in a high power non-inductive resistor.

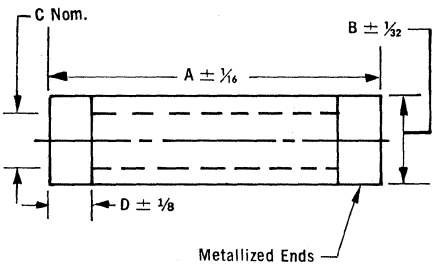
Choose Type AS for its ability to absorb huge amounts of energy and for its non-inductive property at high voltage.

CHARACTERISTICS	Type SP	Type AS	Type A
Maximum Operating Temperature: °C	350	230 150*	230
Temperature Coefficient: Percent per degree C, −55°C to maximum rated temperature	±0.075	−0.075	−0.20
Voltage Coefficient: Maximum percent per kilovolt per inch active length (overall length less termination)	1.0	1.0	–
Short Time Overload: Maximum percent change after 5 cycles 10 times rated power, 5 seconds on, 90 seconds off	2.0	2.0	–
Moisture Resistance: Maximum percent change when tested per MIL-STD-202 method 103	2.5	2.5	2.5

*with epoxy insulation for use in oil

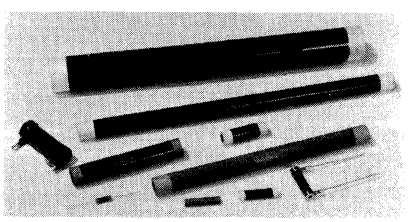
STANDARD SIZES
(Special sizes are also available: consult factory.)

Type	A	B	C (SP & AS)	C (A)	D
884 SP	2.0	0.50	0.22	—	0.25
885 SP, AS, & A	2.5	0.75	0.50	0	0.50
886 SP, AS, & A	5.0	0.75	0.50	0	0.62
887 SP, AS, & A	6.0	1.00	0.75	0.5	0.50
888 SP, AS, & A	8.0	1.00	0.75	0.5	0.88
889 SP, AS, & A	12.0	1.00	0.75	0.5	0.88
890 SP, AS, & A	18.0	1.00	0.75	0.5	0.88
891 SP	18.0	2.00	1.50	—	1.00
892 SP	24.0	2.00	1.50	—	1.00



SERIES 800 AND 1000

This general line is available in a wide variety of sizes and terminations. They retain the non-inductive and heavy load characteristics of all Carborundum ceramic resistors. These resistors can handle up to 1000 watts, 165 KJ and 165 KV in resistance values from 1 ohm to 1 megohm.



Parts are specified by the four or five character type number (for example 885SP, 888AS, 890A), the first two digits of the resistance, a single digit to indicate the power of ten multiplier, and a "J" for ±5%, a "K" for ±10%, or an "L" for ±20%. Where the resistance is less than ten ohms, the power of ten multiplier is not used, and an "R" replaces the decimal point. Thus R50 = 0.50 ohm, 7R5 = 7.5 ohm, 220 = 22.0 ohm, 152 = 1500 ohm, etc. *Type AS with a suffix letter to part number denotes optional construction: "D" for dielectric coating; "O" for oil application; "N" for No Arc terminal. Consult Customer Service for additional options and part number detail. A typical part number would be 886AS501KD. This represents a type AS resistor, 5" long x ¾" diameter, 500 ±10% ohms, with dielectric coating.

ELECTRICAL SPECIFICATIONS

Length and Diameter	Type	Resistance Available (ohms) Min.	to Max.	Average Power @ 40°C (watts)	Peak Energy (joules)	Peak Voltage (volts)
2" x ½"	884SP	1.0	200	22.5	250	1,000
2½" x ¾"	885SP	1.0	130	45	250	1,000
	885AS	6.0	1200	15	2,800	4,000
	885AS..D*	6.0	1200	15	2,800	8,000*
	885A	1500	220K	15	750	3,750
5" x ¾"	886SP	1.0	330	90	500	4,000
	886AS	15.0	3300	30	7,000	10,000
	886AS..D*	15.0	3300	30	7,000	20,000*
	886A	3900	390K	30	1,500	10,000
6" x 1"	887SP	1.0	330	150	1,600	4,000
	887AS	12.0	3300	50	13,000	15,000
	887AS..D*	12.0	3300	50	13,000	30,000*
	887A	3900	390K	50	6,000	12,000
6" x 1½"	1026AS	5.0	1200	70	37,000	15,000
	1026AS..D*	5.0	1200	70	37,000	30,000*
8" x 1"	888SP	1.0	390	190	2,100	6,000
	888AS	15.0	3900	75	16,500	22,500
	888AS..D*	15.0	3900	75	16,500	45,000*
	888A	4700	470K	60	7,500	15,000
8" x 1½"	1028AS	6.5	1875	100	46,000	22,500
	1028AS..D*	6.5	1875	100	46,000	45,000*
12" x 1"	889SP	1.0	680	275	3,200	10,000
	889AS	25.00	6800	100	27,000	37,500
	889AS..D*	25.00	6800	100	27,000	75,000*
	889A	8200	680K	90	12,500	25,000
12" x 1½"	1032AS	9.0	2500	150	75,000	37,500
	1032AS..D*	9.0	2500	150	75,000	75,000*
18" x 1"	890SP	1.0	1000	375	4,200	16,000
	890AS	40.0	10K	150	43,000	60,000
	890AS..D*	40.0	10K	150	43,000	120,000*
	890A	12K	1M	125	20,000	40,000
18" x 1½"	1038AS	15.0	3800	225	119,000	60,000
	1038AS..D*	15.0	3800	225	119,000	120,000*
18" x 2"	891SP	1.0	450	750	15,000	16,000
24" x 2"	892SP	1.0	600	1000	17,500	22,000
24" x 1½"	1044AS	20.0	4800	300	164,000	82,500
	1044AS..D*	20.0	4800	300	164,000	165,000*

Standard Oil Engineered Materials Company
Electronic Ceramics Division
Post Office Box 339, Niagara Falls, NY 14302
Tel: (716) 278-2553 • Telex: 67-11401 (CARBO VW)

STANDARD OIL
ENGINEERED MATERIALS

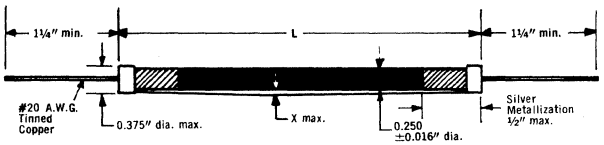
CARBORUNDUM® NON-INDUCTIVE POWER RESISTORS FOR SPECIAL PROBLEM SOLUTIONS

Series 102/104/106/109AS & SP Pencil-type Resistors

These ¼" diameter resistors are available in a variety of lengths. Pencil shaped resistors offer unique non-inductive and high-voltage properties in a compact, easily-wired configuration.

Type AS for high voltage and energy applications.

Type SP for high AC power handling capabilities.



Length	Type No.	Resistance Available (ohms) Min.	Max.	Average Power @ 40°C (watts)	Peak Energy (joules)	Peak Voltage (volts)
2"	102AS	30	9,000	5	600	3,000
	102SP	1	700	15	50	1,000
4"	104AS	55	18,000	9	1,200	9,000
	104SP	2	1,500	25	95	3,600
6"	106AS	90	30,000	13	1,900	15,000
	106SP	3	2,400	36	155	5,000
9"	109AS	150	48,000	20	3,000	25,000
	109SP	4	3,800	55	250	8,800

TYPE 234 AND 231 RESISTORS

Carborundum type 234 and 231 resistors are a small size non-inductive bulk type resistor (there are no spirals or windings), capable of dissipating a full 10 watts of power (Type SP) or absorbing **275** Joules of energy (Type AS).

234 — ¼" x 1"
231 — 5/32" x ¾"

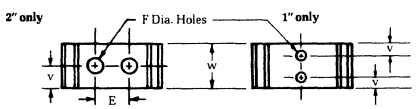
Specifications	234SP	234AS	231SP	231AS
Resistance, ohms ±5%, ±10%, ±20%	1-330	12-5000	1-1000	25-6250
Peak Voltage	500 Volts	2.5kv	375 Volts	1.5kv
Power at 40°C	10 Watts	3 Watts	2.5 Watts	1.5 Watts
Derate Linearly to 0 Watts at	350°C	230°C	350°C	230°C
Max operating temperature	350°C	230°C	350°C	230°C
Peak Energy	30 Joules	**275** Joules	15 Joules	75 Joules

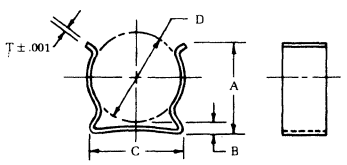
Characteristics	234SP	234AS	231SP	231AS
Short Time Overload	5% max.	1% max.	3.5% max.	1% max.
• 10 Cycles of 1000% rated power				
• 5 sec. on, 90 sec. off				
Life test 1000hr rated power	5% max.	5% max.	5% max.	5% max.
Temperature Coefficient	±0.075% /°C	−0.075% /°C	±0.075% /°C	−0.075% /°C

Termination and Mounting

Electrical connection to the resistive bodies of resistors is made by flame-sprayed metal end bands. The standard metal is aluminum for type SP, nickel or silver for types AS and A. Special terminations of brass or copper overspray or tinned ends are readily available specials. Add "B," "C," or "T" respectively to the part number to designate these special terminations.

In most cases, connections to the resistors may be made by stock clips such as these:





CLIPS DIMENSIONS

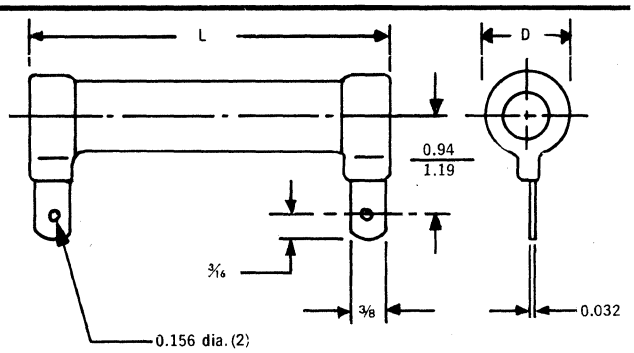
Stock No.	Size	Holes	A	B	C	D	E	F	T	V	W
35370	½"	1	0.620	0.090	0.560	0.500		0.093	0.020	0.188	0.375
35267	¾"	1	0.940	0.155	0.830	0.750		0.144	0.020	0.312	0.625
35268	1"	2	1.230	0.170	1.070	1.000		0.128	0.024	0.156	0.625
35371	1½"	2	1.650	0.100	1.650	1.500	0.925	0.103	0.032	0.250	0.500
35269	2"	2	2.375	0.544	1.080	2.000	0.375	0.125	0.043	0.375	0.750

Material: Beryllium Copper
Finish: Electro Tin Plate

TYPE AS EPOXY COATED STYLE

Carborundum Type AS High-Energy Ceramic Resistors are available with an epoxy coating which protects the resistors body from contaminants. It is especially useful where the resistor is employed in an application where it is not protected from a dirty ambient atmosphere or where it is immersed in a cooling or dielectric fluid. Energy level in oil should not exceed 300 joules/cc.

The overall length, L, of the coated resistor is approximately 0.25" longer than the uncoated part; the diameter, D, is approximately 0.30" greater. Coated resistors are also available with an axial mounted tab.



Standard Oil Engineered Materials Company
Electronic Ceramics Division
Post Office Box 339, Niagara Falls, NY 14302
Tel: (716) 278-2553 • Telex: 67-11401 (CARBO VW)

STANDARD OIL
ENGINEERED MATERIALS

Thick-Film Chip Resistors

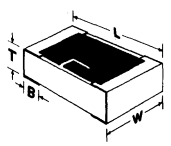
Chip resistors were State of the Art's first manufactured product, and in the years since we started production our resistor chip line has grown into the broadest range of thick film chip resistors offered anywhere. We offer lower values, higher values, closer tolerances, flatter temperature coefficients, smaller sizes, etc., etc.

RESISTOR PERFORMANCE

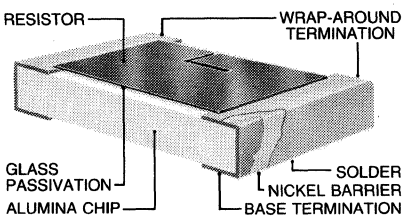
PERFORMANCE CHARACTERISTICS STANDARD PRODUCTION	MAX CHANGE IN RESISTANCE
RESISTANCE TO SOLDERING	0.5%
THERMAL SHOCK	0.5%
SHORT TIME OVERLOAD	0.5%
HIGH TEMPERATURE STORAGE	1.0%
LOAD LIFE (1000 hrs)	1.0%

SIZES AVAILABLE

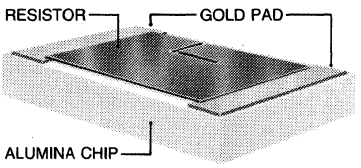
State of the Art offers fourteen standard resistor chip sizes, ranging from the extremely compact .030 x .020 inch chip to a 2-watt chip measuring .250 x .125 inch.



OTHER SIZES AVAILABLE
0703
1002
1507
CHECK WITH FACTORY FOR FULL DETAILS



STYLE C CONSTRUCTION



STYLE A CONSTRUCTION

TABLE I | MEASUREMENT IN INCHES / MEASUREMENT IN mm — 1mm = .03937 inch.

SIZE CODE	LENGTH (L)	WIDTH (W)	MAXIMUM THICKNESS (T)	END-BAND (B)	MAXIMUM POWER (mW)	MAXIMUM VOLTAGE
0302	.030±.005 .76 ±.13	.020±.005 .51 ±.13	.015 .38	.004- .015 .10 - .38	35	15
0402	.040±.005 1.02 ±.13	.020±.005 .51 ±.13	.020 .51	.007- .015 .18 - .38	50	30
0404	.035±.005 .89 ±.13	.035±.005 .89 ±.13	.020 .51	.006- .015 .15 - .38	35	25
0504	.050±.005 1.27 ±.13	.040±.005 1.02 ±.13	.020 .51	.007- .017 .18 - .43	125	40
0705	.075±.007 1.91 ±.18	.050±.005 1.27 ±.13	.020 .51	.007- .020 .18 - .51	200	50
1005	.100±.008 2.54 ±.21	.050±.005 1.27 ±.13	.020 .51	.010- .025 .25 - .64	250	75
1206	.120±.010 3.05 ±.25	.060±.005 1.50 ±.13	.025 .64	.010- .030 .25 - .76	250	200
1505	.150±.010 3.81 ±.25	.050±.005 1.27 ±.13	.020 .51	.010- .030 .25 - .76	330	100
1010	.100±.010 2.54 ±.25	.100±.010 2.54 ±.25	.020 .51	.010- .025 .25 - .64	500	75
2010	.200±.010 5.08 ±.25	.100±.010 2.54 ±.25	.030 .76	.020- .040 .51 -1.02	1000	125
2512	.250±.010 6.35 ±.25	.125±.010 3.18 ±.25	.030 .76	.030- .050 .76 -1.27	2000	150

PART NUMBERING SYSTEM

Our part numbering system is explained on the right. As an example, we show the part number of our standard production; passivated; 50 x 40-mil chip; with pretinned nickel barrier wrap-around terminations, 15 ohm ±5%. The part number is S0504CPX150J:

PACKAGING

Standard production resistors are bulk packed in anti-static bags. High reliability units are packed in anti-static "waffle pack" chip trays. Tape and reel packaging is available for sizes 0504, 0705, 1005, 1206, and 1505 when requested.

If in doubt about the proper codes, or if there is more information to be transmitted than the part number can carry, use plain language.

S 0504 C PX 150 J

SPECIAL TERMINATION
G - Gold **PS** - Platinum/silver **PG** - Platinum/gold

TCR CERTIFICATION
05: 50 ppm/°C **10:** 100 ppm/°C **20:** 200 ppm/°C **30:** 300 ppm/°C

RESISTANCE TOLERANCE
M: 20% **K:** 10% **J:** 5% **G:** 2% **F:** 1% **D:** ½%

RESISTANCE VALUE
Use a three or four digit code. Four digits are used for 1% tolerance or lower, otherwise three digits are used. The first two or three digits represent significant figures and the last digit specifies the number of zeros to follow. The letter "R" shall be used to represent the decimal point when fractional values of an ohm are required: i.e., 1 ohm = 1R0; 4.7 ohms = 4R7; 16.9 ohms = 16R9, etc.

P: Passivated (glass)
X: Tinned NICKEL BARRIER
U: Untrimmed resistor

TERMINATION STYLE
A — Single surface for gold wire bonding
C — Wrap-around style
D — Metallized bottom side
E — Metallized bottom with one side wrap-around

SIZE CODE
See Table I for size code

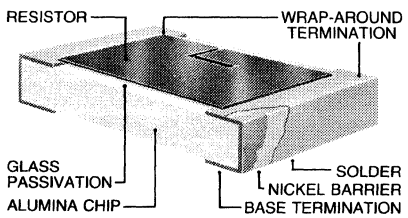
PREFIX
C — Commercial/industrial (please consult factory)
S — Standard production
H — High reliability testing

CALL TOLL FREE
800-458-3401

State of the Art, Inc.
2470 FOX HILL ROAD, STATE COLLEGE, PA 16803-1797
PHONE 814-355-8004, TELEX 866633, SOURCE CODE 56235

MIL-R-55342 Thick-Film Chip Resistors

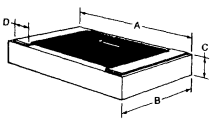
CHARACTERISTICS



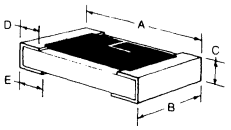
TECHNICAL SPECIFICATIONS	TEMPERATURE CHARACTERISTICS K	M
RESISTANCE TEMPERATURE CHARACTERISTICS	0 ± 100	0 ± 300
MAXIMUM AMBIENT TEMP. FULL POWER	70°C	70°C
MAXIMUM TEMPERATURE ZERO WATTAGE	125°C	125°C
THERMAL SHOCK (max. % change)	± 0.50	± 0.50
LOW TEMP. OPERATION (max. % change)	± 0.25	± 0.50
SHORT TIME OVERLOAD (max. % change)	± 0.25	± 0.50
HIGH TEMPERATURE EXPOSURE (max. % change)	± 0.50	± 1.00
RESISTANCE TO BONDING EXPOSURE (max. % change)	± 0.25	± 0.25
MOISTURE RESISTANCE (max. % change)	± 0.50	± 0.50
LIFE, 2000 HOURS (max. % change)	± 2.00	± 2.00

DIMENSIONS

GOLD TERMINATIONS



'W' TERMINATION
GOLD WIRE BONDABLE



'B' TERMINATION
PRETINNED NICKEL BARRIER

SIZE	RM0505	RM0705	RM1005	RM1505	RM2208
LENGTH A	.050 +.010 −.005	.075 +.010 −.005	.100 +.010 −.005	.150 +.010 −.005	.225 +.010 −.005
WIDTH B	.050 +.005 −.005	.050 +.005 −.005	.050 +.005 −.005	.050 +.005 −.005	.075 +.005 −.005
THICKNESS C	.015 +.007 −.000	.015 +.007 −.000	.015 +.007 −.000	.015 +.007 −.000	.025 +.007 −.000
TOP END BAND D	.010 ±.005	.015 ±.005	.015 ±.005	.015 ±.005	.015 ±.005
BOTTOM END BAND E	.015 ±.005	.015 ±.005	.015 ±.005	.015 ±.005	.015 ±.005

OUR MIL-R-55342 TERMINATIONS FEATURE NICKEL BARRIER

PRODUCTION TESTING

Inspection of Product for Delivery

Production testing of product for delivery consists of group A and group B inspections. Each production lot or batch of chip resistors must pass this screening before shipment can be authorized.

Each production batch must be subjected to and pass the group A screening listed below. Sub-group 2 sampling is in accordance with MIL-STD-105, general inspection level II.

Each production batch must also pass the group B tests below. Sampling is in accordance with MIL-STD-105, special inspection level S-4.

GROUP A — INSPECTION

SUBGROUP 1
THERMAL SHOCK
DC RESISTANCE
SUBGROUP 2
VISUAL and MECHANICAL INSPECTION

GROUP B — INSPECTION

SUBGROUP 1
RESISTANCE to BONDING EXPOSURE
RESISTANCE-TEMPERATURE CHARACTERISTICS
LOW-TEMPERATURE OPERATION
SHORT TIME OVERLOAD
SUBGROUP 2
ADHESION
SUBGROUP 3
SOLDERABILITY

PACKAGING

Resistors are packaged in anti-static waffle packs. Tape and reel is available on request. Individual chips are not marked. Each package contains a noncorrosive label indicating source code, lot number, military part number, quantity, date code, resistance value and tolerance. Unit packages are heat sealed in water-vapor proof conductive bags in conformance with MIL-B-81705 (type I) and are labeled per MIL-STD-129.

PART NUMBERING SYSTEM

To order MIL-R-55342 thick film chip resistors, use part numbers as in the following example. A .075" x .050", 100 ohm, ± 1% tolerance, ± 100 PPM, tinned, wrap-around resistor is properly indicated with part number: M55342K06B100DS, which has the code elements shown below.

M55342 K 06 B 100D S

LIFE FAILURE RATE:
M: 1% per 1000 hours **R:** .01% per 1000 hours
P: .1% per 1000 hours **S:** .001% per 1000 hours

RESISTANCE AND TOLERANCE CODE:
Three significant digits, with a letter indicating the decimal location, the tolerance, and the value range (Ω, KΩ, MΩ).
TOLERANCE and VALUE CODES
D: 1%Ω **G:** 2%Ω **J:** 5%Ω **M:** 10%Ω
E: 1%KΩ **H:** 2%KΩ **K:** 5%KΩ **N:** 10%KΩ
F: 1%MΩ **T:** 2%MΩ **L:** 5%MΩ **P:** 10%MΩ

TERMINATION TYPE:
R: Pre-tinned, wrap around style.
B: Pre-tinned, wrap around barrier (Ni) Style.
W: Wire bondable single surface (Au)

SIZE CODE:
02: RM0505 **04:** RM1505 **06:** RM0705 **08:** RM2010
03: RM1005 **05:** RM2208 **07:** RM1206 **09:** RM2512

TEMPERATURE CHARACTERISTIC:
K: ± 100 ppm per °C. **M:** ± 300 ppm per °C

MILITARY SPECIFICATION INDICATING MIL-R-55342

'S' Failure Rate level on all sizes > 50 ohms.

CALL TOLL FREE
800-458-3401

State of the Art, Inc.
2470 FOX HILL ROAD, STATE COLLEGE, PA 16803-1797
PHONE 814-355-8004, TELEX 866633, SOURCE CODE 56235

Thin-Film Resistor Products

State of the Art, Inc. is proud to announce the availability of a broad range of thin film resistor products. We have refined the process of RF sputtering to achieve extremely stable and precise resistive and conductive films for microwave and a wide variety of other hybrid microelectronic applications.

CHIP RESISTORS

- 7 sizes (Military, Aerospace, and Microwave Applications)
- TCR to 25 ppm, (−55 to +125°C), Tolerance to 0.1%
- Meets MIL-R-55342 characteristics 'E' and 'H'
- Wire bondable and wrap-around pretinned NICKEL BARRIER terminations

METALIZED SUBSTRATES

- Nichrome/Nickel/Gold (NiCr/Ni/Au)
- Tantalum Nitride/Titanium-Tungsten/Gold (Ta_2N/TiW/Au)
- Single/Double sided metalization up to 4" x 4" Alumina
- 20 ohms/sq to 200 ohms/sq resistivity

CUSTOM NETWORKS

- TCR to 25 ppm (−55 to +125°C), Tolerance to 0.1%
- Geometries to 0.25 mil on SILICON and to 0.5 mil on ALUMINA
- High stability resistive films (0.1%/1000 hours, 125°C)

Custom Networks

State of the Art produces a variety of custom conductor networks, resistor networks, and resistor/capacitor networks in low and high volume. We can quote and manufacture from a complete network layout or from a schematic with size, component, and output pad location requirements. Our design department will be glad to assist you in designing your network to achieve your lowest cost.

NETWORK CONSTRUCTION

SUBSTRATE: 96% Alumina std — 99% Alumina optional
THICKNESS: .025 inch std — .012 .015. 020 .040 inch optional
LINEAR TOOLING: Laser scribed, green scored, diamond saw cut
HOLE TOOLING: Laser drilled, green punched
CONDUCTORS: Silver, palladium silver, platinum silver, gold, platinum gold, etc. NICKEL BARRIER is available on some types of networks.
RESISTORS: Screened on substrate or thick film chip
PASSIVATION: Glass or silicone based
TINNING: Solder dip or solder paste
CAPACITORS: Screened on thick film or multilayer ceramic chip
COMPONENT MOUNTING: Conductive epoxy or solder reflow; Other components: consult factory

Surface-Mount Resistor Networks

State of the Art produces a variety of surface mount resistor and resistor/capacitor networks. These devices feature thick film materials on alumina substrates, providing good thermal management and electrical stability. The standard "lead" configuration is a pretinned wrap-around with NICKEL BARRIER, offering excellent resistance to leaching in rigorous soldering applications such as reflow and vapor phase. For high volume applications where maximum economy is needed, top surface only terminations are available.

RESISTANCE VALUES

10 ohm to 1 Mohm, STANDARD
1 ohm to 100 Mohm, SPECIAL ORDER

TOLERANCE

10%, 5%, 2%, 1%

TEMPERATURE COEFFICIENT

300 ppm, 200 ppm, 100 ppm

PERFORMANCE CHARACTERISTICS

	MAXIMUM CHANGE IN RESISTANCE 100 PPM UNITS	OTHER UNITS
LOW TEMPERATURE OPERATION	±0.25	±0.5
SHORT TIME OVERLOAD	±0.25	±0.5
MOISTURE RESISTANCE	±0.5	±0.5
THERMAL SHOCK	±0.5	±0.5
RESISTANCE TO SOLDERING HEAT	±0.25	±0.5
HIGH TEMPERATURE EXPOSURE	±0.5	±1.0
LIFE	±2.0	±2.0

CUSTOM DESIGNS

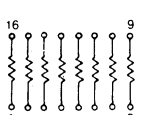
State of the Art can produce a variety of custom network designs for surface mount applications. Using the SLAMDIP, JEDEC, or non-JEDEC style substrates, the individual resistors can be altered to suit the need; other resistance patterns can be applied — limited only by what can be put into the available space.

We can also produce other substrate designs. Custom length, width, and "lead" configuration can be provided. Please contact State of the Art's engineering department for information and quotations. Tooling for special networks is not expensive.

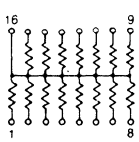
SLAMDIP RESISTOR NETWORK

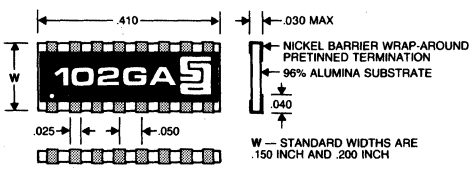
When State of the Art's "SLAM DIP" resistor network replaces individual chip resistors, you will save space and reduce your placement labor. Other benefits also surface, such as better tracking and lower board cost.

CONFIGURATION A
SLAMDIP 8
POWER RATING
Package 500 mW
Resistor 62 mW
Maximum Voltage: 100V



CONFIGURATION B
SLAMDIP 15
POWER RATING
Package 500 mW
Resistor 31 mW
Maximum Voltage: 50V

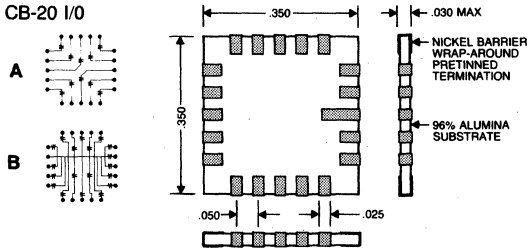




JEDEC LCCC RESISTOR AND RESISTOR/CAPACITOR NETWORKS

Having a maximum profile height of just .030 inch (resistor circuits only), these packages are ideal in circuits where small size and low head space is needed. Almost any conductor, resistor or resistor/capacitor circuit can be placed on these substrates — limited only by the available space. Our 20 I/O configuration is shown below, but a wide variety of sizes is available.

CB-20 I/0



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MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

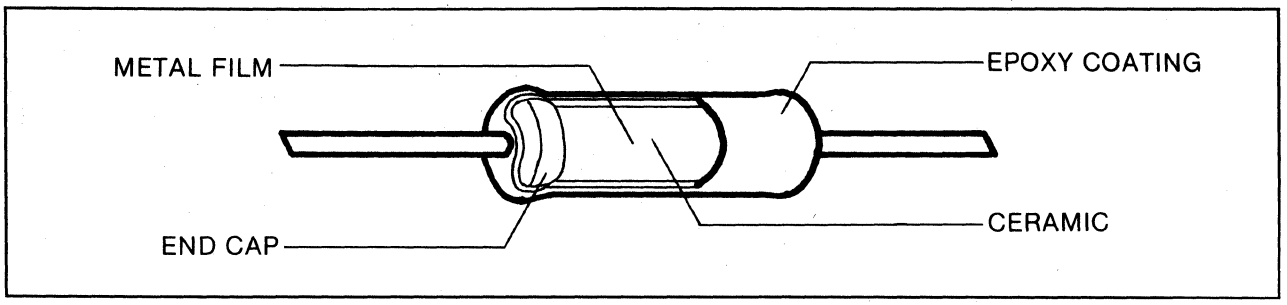
WHERE TO FIND THEM IN THE 88/89 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1134, **B**•1098, **C**•1082, **D**•1038
ASCII Code ..... **D**•1073
Batteries, Product Selection Guide ..... **D**•1428
Batteries & Fuel Cells, Characteristics ..... **D**•1454
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1030
Capacitors, Miniglossary ..... **A**•1027
Capacitors, Product Selection Guide ..... **A**•1003
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1193
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1760
Connectors, Miniglossary ..... **C**•1374
Connectors, Terminals & Sockets, Product Selection Guide ..... **C**•1127
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide ..... **A**•1331
Delay Lines, Product Selection Guide ..... **A**•1495
Discrete Semiconductors, Product Selection Guide ..... **A**•2113
Displays, Readouts, & CRTs, Product Selection Guide ..... **B**•1033
EBCDIC Code ..... **D**•1162
Encapsulation, Miniglossary ..... **C**•1110
Fans, Blowers, Cooling Equipment & Heat Exchangers, Product Selection Guide ..... **C**•1643
Filters, Product Selection Guide ..... **A**•1633
IC Master ..... **A**•1718
Instruments, Panel Meters, Product Selection Guide ..... **D**•1350
Instruments, Test & Measuring, Product Selection Guide ..... **D**•1190
Interconnection Systems, Product Selection Guide ..... **C**•1719
Keyboards & Keypads, Product Selection Guide ..... **B**•1808
Lamps, Lights, & Inductors, Product Selection Guide ..... **B**•1104
Logofinder & Trademark Directories ..... **C**•901
Microwave Components, Product Selection Guide ..... **A**•1761
Military Qualified Products List ..... **B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1181
Opto Semiconductors, Miniglossary ..... **B**•1262
Oscilloscopes, Product Selection Guide ..... **D**•1408
Panel Hardware, Product Selection Guide ..... **C**•1603
Potentiometers, Trimmers, Controls & Rheostats, Product Selection Guide ..... **A**•2057
Power Supplies, Miniglossary ..... **D**•1504
Power Supplies, AC, Product Selection Guide ..... **D**•2060
Power Supplies, DC, Product Selection Guide ..... **D**•1497
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide ..... **B**•1297
Relay Contact Forms ..... **B**•1371
Relays, Electromechanical, Miniglossary ..... **B**•1364
Relays, Product Selection Guide ..... **B**•1355
Resistor Color Codes ..... **A**•1911
Resistors, Product Selection Guide ..... **A**•1849
Servo Components, Miniglossary ..... **B**•1238, **D**•2176
SI Units, Basic Guide To, ... **A**•1090, **B**•1050, **C**•1092, **D**•1048
Solenoids, Product Selection Guide ..... **B**•1612
Switches, Product Selection Guide ..... **B**•1636
Thermal Components, Product Selection Guide ..... **B**•1834
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1842
Thyristors/High Power Diodes, Miniglossary ..... **A**•2145
Trademark & Logofinder Directories ..... **C**•901
Transducers & Encoders, Product Selection Guide ..... **B**•1874
Transformers, Product Selection Guide ..... **A**•2153
Voltage Drop Nomograph ..... **C**•1912, **D**•2042
Wire & Cable, Product Selection Guide ..... **C**•1763
Wire Guages—Diameter, Area, Copper Weight ..... **C**•1864

VPR

A Division of
CODECO CORPORATION OF VERMONT

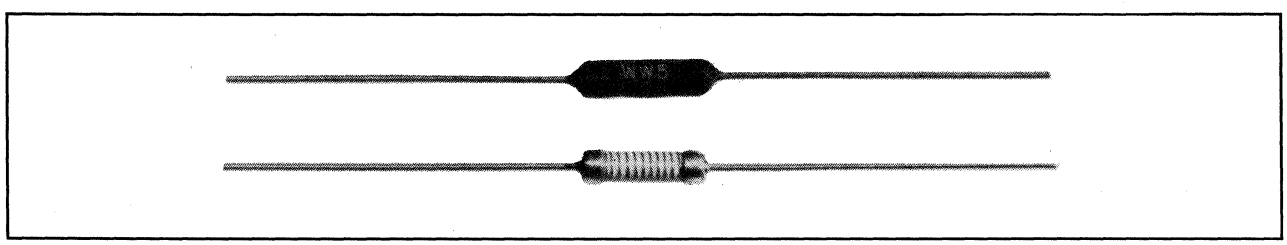
METAL FILM RESISTORS TYPE-LM EPOXY COATED



VPR type-LM Epoxy Coated Metal Film Resistors have been designed not only to meet but also surpass the specifications of MIL-R-10509 characteristics C, E, and F. The resistors feature a high evaporation of metal alloy on ceramic substrate with gold end bands. These resistors are then finished with coatings of exclusive silicon epoxy coating and paint. Special techniques and methods are used in every step of the process to ensure the lasting reliability of the type-LM Metal Film Resistors with built-in low noise and low failure rate characteristics.

VPR Type-LM Metal Film Resistors are available in 1/8, 1/4, 1/2, watt size; with 0.1%, 1/4%, 1/2% or 1% tolerance; and temperature coefficient ±5, ±10, ±25, ±50, or ±100 parts per million per degree centigrade.

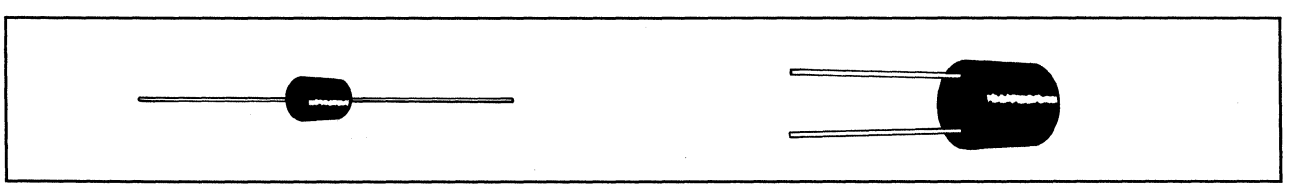
WIREWOUND RESISTORS TYPE WW SILICONE COATED



The VPR WW Series are axial lead, silicone coated precision resistors. These parts are controlled stress wound on centerless ground cores of high quality alumina. The caps are welded to the resistive element, then copper-weld leads are welded to the caps. The body of the resistor is conformally covered with an exceptionally high temperature silicone coating. Modern production equipment allows competitive pricing and superior quality.

Tolerances of the WW Series range through all the standard groupings from 5% down to .05%. Our standard temperature coefficients are ±90 PM on Values up to 1 ohm and ±20 PM on values above 1 ohm. These parts meet & exceed MIL R-26E.

ULTRA-PRECISION WIRE-WOUND RESISTORS



VPR's ultra-precision resistors should be used wherever there is a requirement for extremely tight tolerances, temperature coefficients or a combination of both. These resistors are wound on bobbins of molded epoxy with a single strand of nickel-chromium wire. This wire has no soldered or welded splices that will cause problems after the circuit is in the field. All parts are wound on reversed pi segmented bobbins to eliminate any inductance.
Tension is controlled and kept to a minimum while the winding process takes place to keep out any possible fatigue problems. The windings are then relieved of stresses by extensive aging before calibration and termination operations.
The resistors are given a silicon buffer coat before the final epoxy molding occurs, resulting in a case size that is extremely consistent from part to part. Available in axial or radial leads.

Resistance Tolerances (Most Sizes): 1%; 0.5%; 0.25%; 0.1%; 0.05%; 0.025%; 0.01%.
Temperature Coefficient: 100 ohms and up: 10 PPM/°C; 10 to 100 ohms: 20 PPM/°C; below 10 ohms: 30 PPM/°C.

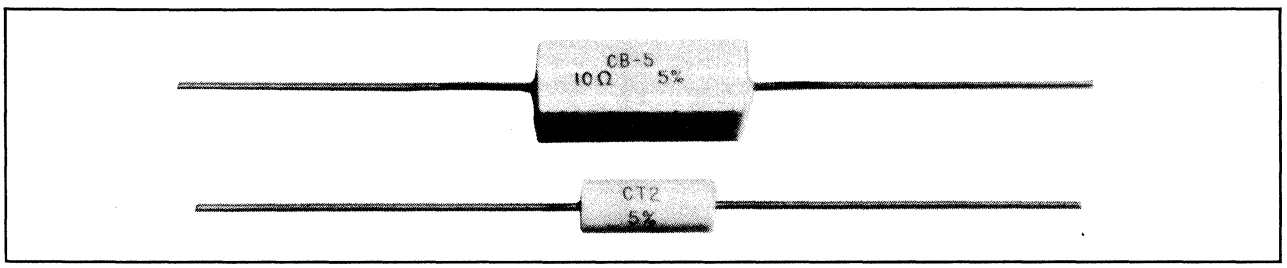
Sales: WEST HILL ROAD, P.O. BOX 1207 • STOWE, VT 05672-1170 • 802-253-8567 • 802-253-7649 • Factory: BISBEE, AZ

VPR

A Division of

CODECO CORPORATION OF VERMONT

SEMI PRECISION POWER WIREWOUND RESISTORS FLAMEPROOF / FUSABLE



VPR CT & CB Series resistors are manufactured to exacting specifications. A resistive element is wound around a fiberglass core by precision winders insuring uniform windings. Wire leads and caps are secured to the resisting element. The assembly is then installed in a fireproof ceramic tube or boat sealed with an especially formulated silicone compound. This provides excellent heat dissipation as well as single unit construction. A rigid QC program assures our customer that each part manufactured is to our specifications which eliminates costly customer rejects.

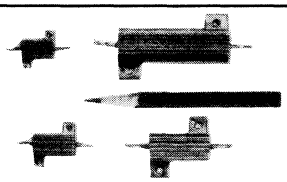
FIREPROOF INORGANIC CONSTRUCTION

VPR makes available Type CB & CT wirewound resistors in ten ratings: 1, 2, 3, 5, 7, 10, 15, 18, 22 and 25 watts.

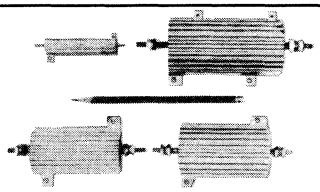
APPLICATIONS:

Type CB or CT wire resistors are recommended:
• In circuits where a wirewound resistor is required with a wattage dissipation equal to or less than the wattage rating of the CB or CT resistor selected. • For operation at a high ambient temperature. • For radio, TV or industrial circuits requiring the wattage dissipations, and where a fireproof resistor is essential. • In medium to high power bridge circuits requiring balanced pairs. • In power attenuator networks. • Wherever a low-cost, easily installed resistor is required. • In special applications requiring positive temperature coefficient, such as transistor stages. • Applications where a CB or CT fusible resistor will replace both fuse and resistor, consult factory.

PRECISION POWER RESISTORS 5 through 250 Watts



5W Through 50W Compared To A Normal Pencil



70W Through 250W Compared To A Normal Pencil

The KAL series resistors are designed for high power dissipation with precision tolerances in a minimum of physical size. They provide extremely efficient heat dissipation by mounting solidly to a metal chassis surface for maximum heat transfer.

GENERAL SPECIFICATIONS:

• Low hot spot ratings due to exclusive complete encapsulation of the resistive element within the anodized aluminum body. • Welded construction throughout assures long stable load life. • Copperweld leads are hot tin dipped for solderability. Heavy spade lug type leads are used on the 5 through 70 watt sizes, threaded heavy stud terminals are used on the 100 through 250 watt sizes. • Extruded aluminum housings are used for maximum heat dissipation. • Cores are centerless ground for uniformity.

ELECTRICAL SPECIFICATIONS:

• Resistance Range—.05Ω to 275KΩ • Tolerances—from 5% to .05%. • Temperature Coefficient—20PPM, slightly higher on low value resistors. Different TCs are available on special order. • Minimum dielectric strength—1,000 VAC through 10 watts, 2,500 VAC through 70 watts, 5,500VAC through 250 watts. • Operating temperature range— −55°C to +275°C • Stability—as low as .001% per annum.

VPR'S SPECTRUM OF PARTS

SERIES	POWER	MIN. TOL.	TEMP. CO.*	NON-INDUC.
SWP	.06W to .25W	.005%	10 PPM	YES
WP	.15W to 2W	.01%	10 PPM	YES
LM	.125W to 1W	.01%	5 PPM	OPTIONAL
WW	.5W to 10W	.01%	10 PPM	OPTIONAL
CB	2W to 25W	2%	400 PPM	NO
KAL	5W to 250W	.05%	20 PPM	OPTIONAL

*Temperature Coefficients: The TCs shown are for mid and high value resistors. Low value parts will run slightly higher. TCs of ±2PPM are available on some parts. Some positive TCs are also available on special order. Example: +6000 PPM.

Sales: WEST HILL ROAD, P.O. BOX 1207 • STOWE, VT 05672-1170 • 802-253-8567 • 802-253-7649 • Factory: BISBEE, AZ

VICTOREEN RX-1 HI-MEG Resistors

- **Available resistances to 10,000,000 megohms**
- **Glass sealed hermetic resistors**

VICTOREEN HI-MEG RESISTORS were originally designed for use in electrometer circuits where a high order of performance is required. **HI-MEG** resistors achieve a high degree of accuracy and stability, and operate at this high level for a long period of time. The **HI-MEGS** are manufactured in accordance with **MIL-R-14293A,** characteristic T, and are measured at 5 volts. Reference to the typical voltage coefficient table below will indicate what deviations from the marked resistance value may be encountered when used at high voltages. By special order, Victoreen can supply resistors with resistance measurements at specified voltages.

GLASS SEAL: HI-MEGS are vacuum sealed in a glass envelope which is treated with a special silicone varnish to keep the resistor relatively free from the effects of moisture. Care should be exercised, however to avoid contamination in handling, such as fingerprints, which might result in reduced effective resistance.

NOISE: The noise level is negligible for most uses.

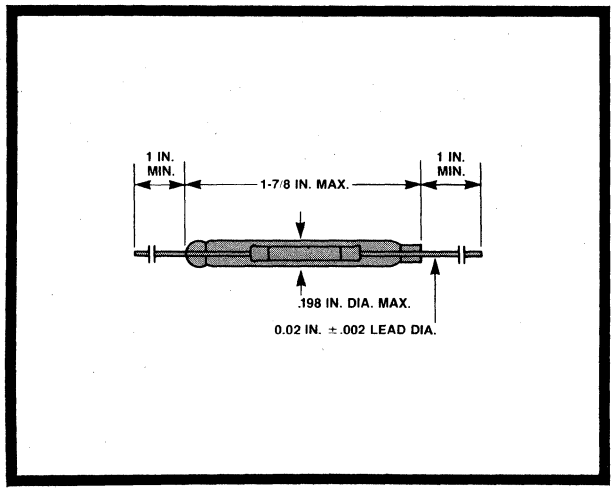
POWER RATING: 1/2 watt @ 25°C.

RESISTANCE: HI-MEG resistors are available in values from 10^7 to 10^{13} ohms.

TOLERANCE: HI-MEG resistors can be supplied in the following tolerances: 1% below 2.5 x 10^{11} ohms, 2% and 5% below 10^{12} ohms, 10% below 10^{13} ohms and 20% at 10^{13}.

MAXIMUM WORKING VOLTAGE: 1000 volts.

MAXIMUM OPERATING AMBIENT TEMPERATURE: 100°C.



TYPICAL TEMPERATURE AND VOLTAGE COEFFICIENT (IN PPM)						
Resistance Decade (ohms)	**10^8**	**10^9**	**10^{10}**	**10^{11}**	**10^{12}**	**10^{13}**
Temperature Coefficient	600	700	800	1,000	1,500	2,000
Voltage Coefficient	200	200	200	300	600	1,200

VICTOREEN RX-1 HI MEG resistors are commonly used for high resistance standards. By special order, Victoreen can calibrate these resistors at any voltage from 1 to 1000 volts. (Preference to decade multiples of 1, 2.5, and 5.)

RX-1M Resistor

Precision, Glass Encapsulated Resistor

- **Tolerances to 0.1%**
- **Resistance Values to 100,000 Megohm**
- **Metal oxide resistive element**

Victoreen is pleased to introduce a hermetically sealed, precision, metal oxide resistor which is based upon the reliable RX-1.

The RX-1M is available with resistance tolerances of 0.1% through 10,000 megohm, and 1, 0.5, and 0.25% through 100,000 megohm. The use of the metal oxide resistive elements allows for vastly improved temperature and voltage coefficient performance characteristics.

SPECIFICATIONS:

Resistance Range: 1 Megohm to 100,000 megohm

Voltage Rating: 1000 volts

Power Rating: 1/2 Watt at 25°C

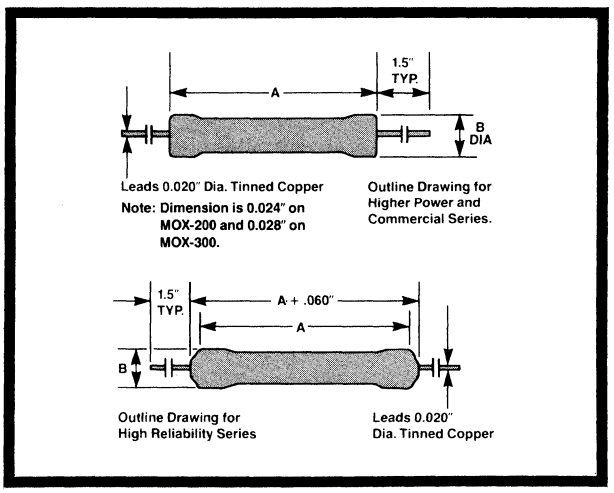
TYPICAL TEMPERATURE AND VOLTAGE COEFFICIENT (IN PPM)						
Resistance Decade (megohms)	**10^8**	**10^9**	**10^{10}**	**10^{11}**	**10^{12}**	**10^{13}**
Temperature Coefficient	100	100	500	500		
Voltage Coefficient	5	5	5	5		

Please call or write:

VICTOREEN, INC.
6000 Cochran Road
Cleveland, Ohio 44139-3395 U.S.A.
(216) 248-9300
FAX: (216) 248-9301
TWX: (810) 421-8287

VICTOREEN MINI-MOX Resistors

- **Metal Oxide Resistive Element**
- **Wide resistance range 10 Kohms to 100,000 Megohms**
- **Voltage rating to 5KV**
- **Power rating to 1.4 watt**
- **Available with silicone or epoxy coatings**



VICTOREEN MINI-MOX TYPE NUMBER

MOX – 400 – 2 4

TYPE — SIZE — LEAD — COATING

LEAD:
2 = 0.020″ Tinned copper
3 = 0.020″ Tinned dumet
7 = 0.032″ Tinned copper
9 = Other

COATING:
2 = High temperature
3 = High reliability
4 = Commercial
9 = Other

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HIGHER POWER SERIES *(silicone coated)*

Type	Resistance Range (ohms)	Power @70°C	Maximum Voltage Rating	Avail Tol (%)	Dimensions (inches) A (max)	Dimensions (inches) B (max)
MOX-400-22	1 K to 10,000 Meg	0.35W	1000V	1,2,5	0.470″	0.140″
MOX-750-22	1K to 10,000 Meg	0.70W	2000V	1,2,5	0.540″	0.140″
MOX1125-22	1K to 10,000 Meg	1.40W	5000V	1,2,5	1.235″	0.140″

HIGH RELIABILITY SERIES *(epoxy coated)*

Type	Resistance Range (ohms)	Power @70°C	Maximum Voltage Rating	Avail* Tol (%)	Dimensions (inches) A (max)	Dimensions (inches) B (max)
MOX-400-23	1 K to 30,000 Meg	0.25W	1000V	0.5,1,2,5	0.540″	0.165″
MOX-750-23	1K to 70,000 Meg	0.50W	2000V	0.5,1,2,5	0.860″	0.165″
MOX1125-23	1K to 100,000 Meg	1.00W	5000V	0.5,1,2,5	1.250″	0.165″

*Values beyond 10,000 Meg are available in 5% and 10% tolerance.

COMMERCIAL SERIES *(epoxy coated)*

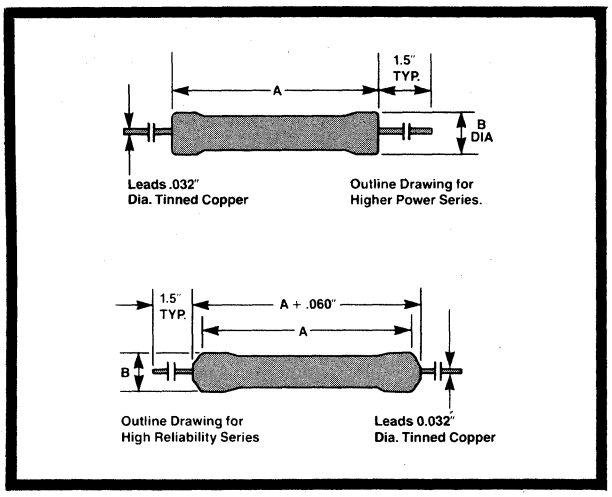
Type	Resistance Range (ohms)	Power @25°C	Maximum Voltage Rating	Avail Tol (%)	Dimensions (inches) A (max)	Dimensions (inches) B (max)
MOX-200	1 K to 1,000 Meg	0.25W	500V	0.5,1,2,5	0.275″	0.105″
MOX-300	1 K to 1,000 Meg	0.50W	1000V	0.5,1,2,5	0.435″	0.145″

STANDARD TEMPERATURE COEFFICIENT

Type	100 PPM/°C	250 PPM/°C	500 PPM/°C
MOX-200	1 Meg - 100 Meg	101 Meg - 1,000 Meg	—
MOX-300	1 Meg - 400 Meg	401 Meg - 1,000 Meg	—
MOX-400	10 K - 500 Meg	501 Meg - 1,000 Meg	1,001 Meg - 30,000 Meg
MOX-750	20 K - 1,000 Meg	1,001 Meg - 2,000 Meg	2,001 Meg - 70,000 Meg
MOX1125	50 K - 1,500 Meg	1,501 Meg - 3,000 Meg	3,001 Meg - 100,000 Meg

VICTOREEN MAXI-MOX Resistors

- **Metal Oxide Resistive Element**
- **Wide resistance range 1 Kohms to 10,000 Megohms**
- **Voltage rating to 37.5KV**
- **Power rating to 12.5 watts**
- **Available with silicone or epoxy coatings**



VICTOREEN MAXI-MOX TYPE NUMBER

MOX – 2 – 1 3
SIZE — COATING — LEAD
TYPE

LEAD:
1 = 0.032" Tinned copper
5 = 0.032" Tinned dumet
6 = 6-32 Threaded Formula*
9 = Other

COATING:
2 = High temperature
3 = High reliability
9 = Other

*Available with the High Temperature coating only.

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HIGH RELIABILITY SERIES *(epoxy coated)*

Type	Resistance Range (ohms)	Power @70°C	Maximum Voltage Rating	Avail Tol (%)	Dimensions (inches) A (max)	Dimensions (inches) B (max)
MOX-1-13	1 K to 10,000 Meg	1.5W	7.5KV	0.5,1,2,5	0.140"	0.345"
MOX-2-13	1 K to 10,000 Meg	3.0W	15.0V	0.5,1,2,5	2.140"	0.345"
MOX-3-13	1 K to 10,000 Meg	4.5W	22.5V	0.5,1,2,5	3.140"	0.345"
MOX-4-13	1 K to 10,000 Meg	6.0W	30.0V	0.5,1,2,5	4.140"	0.345"
MOX-5-13	1 K to 10,000 Meg	7.5W	37.5V	0.5,1,2,5	5.140"	0.345"

HIGHER POWER SERIES *(silicone coated)*

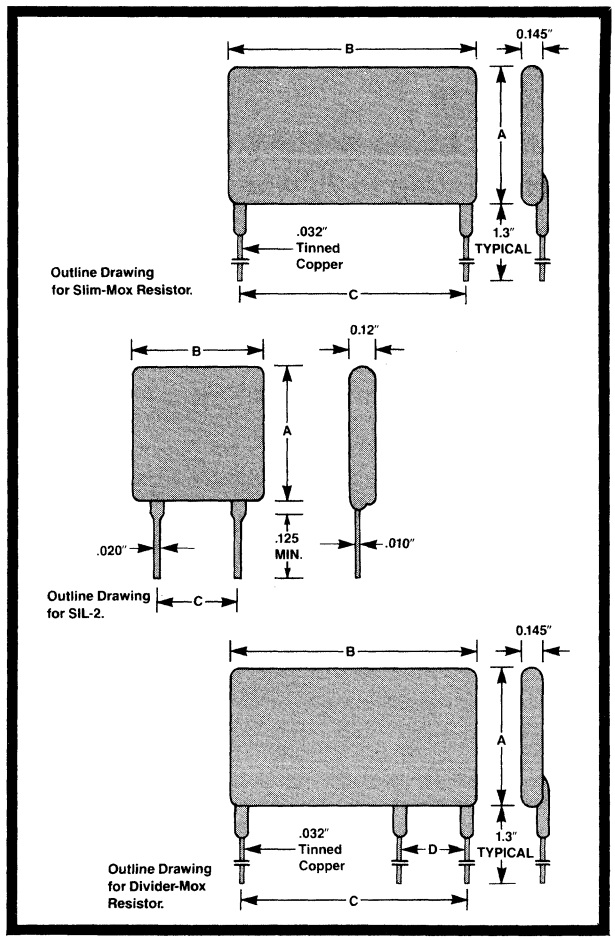
Type	Resistance Range (ohms)	Power @70°C	Maximum Voltage Rating	Avail Tol (%)	Dimensions (inches) A (max)	Dimensions (inches) B (max)
MOX-1-12	1 K to 10,000 Meg	2.5W	7.5KV	1,2,5	1.120"	0.310"
MOX-2-12	1 K to 10,000 Meg	5.0W	15.0V	1,2,5	2.120"	0.310"
MOX-3-12	1 K to 10,000 Meg	7.5W	22.5V	1,2,5	3.120"	0.310"
MOX-4-12	1 K to 10,000 Meg	10.0W	30.0V	1,2,5	4.120"	0.310"
MOX-5-12	1 K to 10,000 Meg	12.5W	37.5V	1,2,5	5.120"	0.310"

STANDARD TEMPERATURE COEFFICIENT

Type	100 PPM/°C	250 PPM/°C	500 PPM/°C
MOX-1	1 K - 300 Meg	301 Meg - 1,000 Meg	1,001 Meg - 10,000 Meg
MOX-2	1 K - 600 Meg	601 Meg - 2,000 Meg	2,001 Meg - 10,000 Meg
MOX-3	1 K - 900 Meg	901 Meg - 3,000 Meg	3,001 Meg - 10,000 Meg
MOX-4	1 K - 1,200 Meg	1,201 Meg - 4,000 Meg	4,001 Meg - 10,000 Meg
MOX-5	1 K - 1,500 Meg	1,501 Meg - 5,000 Meg	5,001 Meg - 10,000 Meg

VICTOREEN SLIM-MOX Resistors

- **Metal Oxide Resistive Element**
- **Noninductive resistor design**
- **Wide resistance range to 5,000 Megohms**
- **Voltage rating to 20KV**
- **Power rating to 15 watts**
- **High dielectric and low outgassing epoxy coating**
- **Resistance tolerances range from 0.5, 1, 5, 10, and 20%**



SLIM-MOX RESISTOR DIVIDER SERIES

Type	Resistance Range (ohms)	Power @25°C	Maximum Voltage Rating	Max Ratio	Dimension D(Inches) ±.032″
SLIM-MOX104RD	1 Meg - 1,000 Meg	1.0W	3,750V	1,000:1	.2
SLIM-MOX108RD	1 Meg - 3,000 Meg	2.0W	7,500V	1,000:1	.6
SLIM-MOX204RD	1 Meg - 3,000 Meg	2.0W	7,500V	1,000:1	.2
SLIM-MOX208RD	1 Meg - 5,000 Meg	4.0W	12,000V	4,000:1	.4
SLIM-MOX308RD	2 Meg - 5,000 Meg	5.0W	15,000V	4,000:1	.3
SLIM-MOX408RD	5 Meg - 5,000 Meg	6.0W	20,000V	5,000:1	.3

Ratio tolerances available 0.5, 1, 3%

STANDARD TEMPERATURE COEFFICIENT

Type	100 PPM/°C	250 PPM/°C	500 PPM/°C
SLIM-MOX101	1 K - 20 Meg	21 Meg - 100 Meg	101 Meg - 250 Meg
SLIM-MOX102	1 K - 50 Meg	51 Meg - 250 Meg	251 Meg - 1,000 Meg
SLIM-MOX104	1 K - 100 Meg	101 Meg - 500 Meg	501 Meg - 1,200 Meg
SLIM-MOX202			
SLIM-MOX108	1 K - 200 Meg	201 Meg - 1,000 Meg	1,001 Meg - 5,000 Meg
SLIM-MOX204			
SLIM-MOX208	1 K - 400 Meg	401 Meg - 2,000 Meg	2,001 Meg - 5,000 Meg
SLIM-MOX308	1 K - 600 Meg	601 Meg - 3,000 Meg	3,001 Meg - 5,000 Meg
SLIM-MOX408			

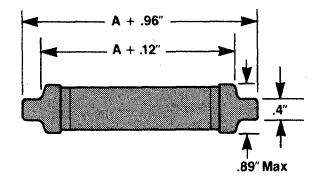
SLIM-MOX SERIES

Type	Resistance Range (ohms)	Power @25°C	Maximum Voltage Rating	Dimensions (inches) A (max)	B (max)	C ±.032″
SIL-2	1 K to 100 Meg	0.25W	1.5KV	0.30″	0.30″	0.10″
SLIM-MOX101	1 K to 250 Meg	0.5W	2.0KV	0.34″	0.33″	0.2″
SLIM-MOX102	1 K to 1,000 Meg	1.0W	5.0KV	0.34″	0.58″	0.4″
SLIM-MOX104	1 K to 1,200 Meg	2.0W	10.0KV	0.34″	1.08″	0.9″
SLIM-MOX108	1 K to 5,000 Meg	4.0W	20.0KV	0.34″	2.08″	1.9″
SLIM-MOX202	1 K to 1,200 Meg	2.0W	5.0KV	0.59″	0.58″	0.4″
SLIM-MOX204	1 K to 5,000 Meg	4.0W	10.0KV	0.59″	1.08″	0.9″
SLIM-MOX208	1 K to 5,000 Meg	8.0W	20.0KV	0.59″	2.08″	1.9″
SLIM-MOX308	1 K to 5,000 Meg	10.0W	20.0KV	0.84″	2.08″	1.9″
SLIM-MOX408	1 K to 5,000 Meg	15.0W	20.0KV	1.09″	2.08″	1.9″

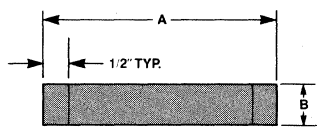
VICTOREEN POWER-MOX Resistors

- **Metal Oxide Resistive Element**
- **Wide resistance range to 7,000 Megohms**
- **Voltage rating to 60KV**
- **Power rating to 75 watts**
- **0.4″ diameter ferrule, 1/4-20 threaded end cap, or radial bands**
- **Available resistance tolerances 0.5, 1, 2, 5%**
- **Typical voltage coefficient 1 PPM/Volt**

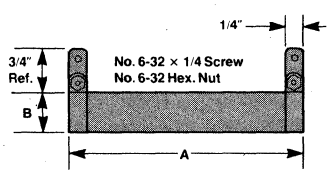
VICTOREEN POWER-MOX Resistors are very high power or very high voltage applications, POWER-MOX Resistors are also available as voltage dividers.



Power Mox with .4″ Ferrule End Caps



Power Mox with Silver Terminations



Power Mox with Radial Band Option

TEMPERATURE COEFFICIENT TABLE

Type	Standard Temperature Coefficient	
	100 PPM/°C	250 PPM/°C
MOX-F	20 K - 300 Meg	301 Meg - 3,000 Meg
MOX-G	20 K - 500 Meg	501 Meg - 5,000 Meg
MOX-H	20 K - 700 Meg	701 Meg - 7,000 Meg
MOX-J	20 K - 1,000 Meg	1,001 Meg - 7,000 Meg

POWER MOX SERIES

Type	Resistance Range (ohms)	Power @25°C	Maximum Voltage Rating	Avail Tol (%)	Dimensions (inches)	
					A Typical	B Max
MOX-F	20 K to 3,000 Meg	25W	20KV	0.5,1,2,5	3.0″	.770″
MOX-G	20 K to 5,000 Meg	40W	30V	0.5,1,2,5	4.5″	.770″
MOX-H	20 K to 7,000 Meg	50W	45V	0.5,1,2,5	6.0″	.770″
MOX-J	20 K to 7,000 Meg	75W	60V	0.5,1,2,5	8.0″	.770″

POWER-MOX RESISTOR DIVIDER SERIES

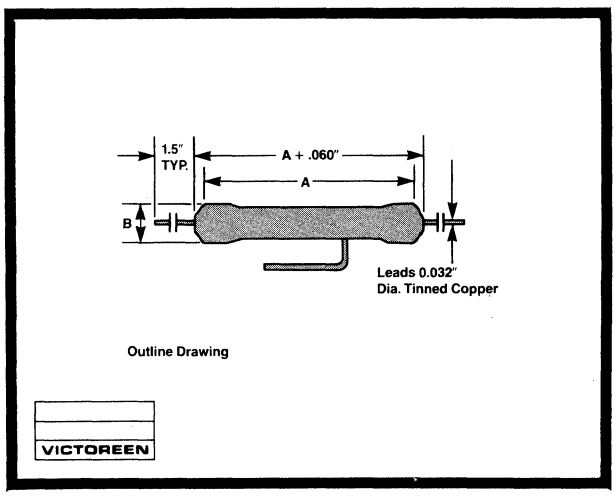
Type	Resistance Range (ohms)	Power @25°C	Maximum Voltage Rating	Max Ratio	Ratio Tolerances
MOX-FRD	20 K - 2,500 Meg	15.0W	15KV	5,000:1	1,2,5%
MOX-GRD	20 K - 4,000 Meg	30.0W	25KV	5,000:1	1,2,5%
MOX-HRD	20 K - 6,000 Meg	40.0W	35KV	5,000:1	1,2,5%
MOX-JRD	20 K - 6,000 Meg	60.0W	50KV	5,000:1	1,2,5%

Please call or write:

VICTOREEN, INC.
6000 Cochran Road
Cleveland, Ohio 44139-3395 U.S.A.
(216) 248-9300
FAX: (216) 248-9301
TWX: (810) 421-8287

Cylindrical DIVIDER-MOX Resistors

- **Metal Oxide Resistive Element**
- **Input voltage to 30 KV**
- **Wide resistance range to 4,000 Megohms**
- **Divider ratio available to 10,000:1**
- **Temperature coefficient tracking to 25PPM/°C**
- **Conformal epoxy coated**



Outline Drawing

VICTOREEN DIVIDER-MOX Resistors provide the design engineer with a voltage divider network and more. Effects of temperature coefficient matching, self generated heat and other parameters are minimized.

When specifying Victoreen resistor dividers, the following information is required.

R_1 value and tolerance
R_2 value and tolerance

$$\text{Ratio} = \frac{R_1 + R_2}{R_2} \text{ and ratio tolerance}$$

DIVIDER-MOX SERIES

Type	Resistance Range (ohms)	Power @70°C	Maximum Voltage Rating	Maximum Ratio	Dimensions (inches) A (max)	Dimensions (inches) B (max)
MOX-2RD	1 Meg to 1,000 Meg	1.5W	7.5KV	5,000:1	2.140"	0.345"
MOX-3RD	1 Meg to 2,000 Meg	3.0W	15.0KV	10,000:1	3.140"	0.345"
MOX-4RD	1 Meg to 3,000 Meg	4.5W	22.5KV	10,000:1	4.140"	0.345"
MOX-5RD	1 Meg to 4,000 Meg	6.0W	30.0KV	10,000:1	5.140"	0.345"

Ratio tolerances available 1, 2, or 5%.

Please call or write:

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VISHAY

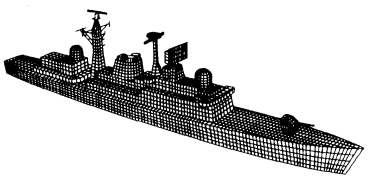
BULK METAL FOIL®MILITARY RESISTORS

Established Reliability

At the cutting edge of today's advanced technology, military programs like the Space Shuttle, Sky Lab, satellites, and S.D.I., Aegis, MK48, etc., Missiles and Military aviation like the F18, etc., often require established-reliability precision resistors beyond the level of existing military specifications. VISHAY can take the basic generic military resistor and with specific testing offer the following improved performance specifications.

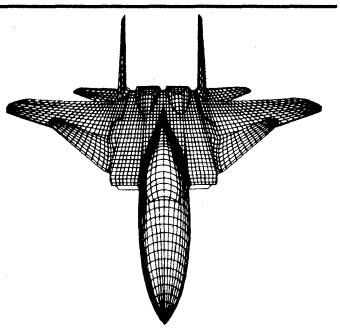
- TCR: ±1 ppm/° (-55°C to +125°C)
- Load Life Stability: 0.015% (150 ppm) ΔR for 10,000 hrs.
- Shelf Life: 0.0025% (25 ppm) for 3 yrs.
- Voltage Coefficient: <0.1%μV/V
- Current Noise: -32dB
- Thermal EMF: 0.05%μV/°C

RNC90Y
MIL-R-55182/9
(See Catalog VMF-2000)



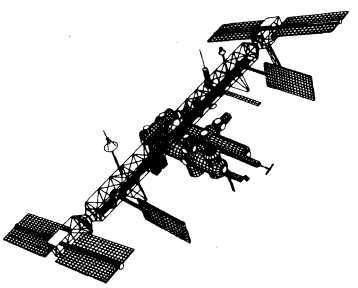
The VISHAY RNC90Y (S555) resistor is qualified to the "R" reliability level for resistance values from 4.99Ω through 121KΩ and for tolerances from ±0.005% to ±1.0%. VISHAY has accumulated over 160 million unit hours of testing on the RNC90Y resistor. The VISHAY RNC90Y high-performance resistors are designed for both the critical military systems market and for demanding industrial applications.
The same resistors are also available as a non-qualified product (S555) for customers desiring extended resistance range. Both the qualified and the non-qualified version are manufactured on the same product line facilities and are subjected to the same process, lot control, conditioning, and basic QPL testing requirements.
The VISHAY RNC90Y resistor is approved to MIL-STD-975D (NASA). It is also manufactured and packaged to comply with ESD requirements.

M122/1
MIL-R-122
(See Data Sheet VMF-600)



The VISHAY S22-1 (M122/1) resistor is qualified to the "R" reliability level for resistance values from 4.99Ω through 50KΩ and for tolerances from ±0.005% to ±1.0%. VISHAY M122/1 high-performance resistors are designed for both the critical military systems market and for demanding industrial applications.
The same resistors are also available as a non-qualified product (S22-1) for customers desiring extended resistance range. Both the qualified and the non-qualified version are manufactured on the same product line facilities and are subjected to the same process, lot control, conditioning, and basic QPL testing requirements.
The VISHAY M122/1 resistor is manufactured and packaged to comply with ESD requirements.

VISHAY
Improved Performance Testing (IPT)
(Contact Application Engineering Dept.)



VISHAY also provides the basic MIL resistors with specific conditioning to ensure improved TCR and long term stability. This specific conditioning could include:

- Thermal Shock
- Specific Burn In Cycles
- Short Time Overload

The guaranteed level of the Improved Performance Testing (IPT) Specifications are shown below.

Comparison of Specifications

SPECIFICATION	MIL-R-55182/9 Characteristics Y Limits	MIL-R-122 Characteristic A Limits	VISHAY Improved Performance Testing (IPT) Limits
Temperature Coefficient of Resistance - Maximum TCR	±5 ppm/°C (-55°C to 125°C) ±10 ppm/°C (+125°C to 175°C)	±2.5 ppm/°C (-55°C to +125°C) ±3.5 ppm/°C (+125°C to +150°C) ±4.5 ppm/°C (+150°C to +175°C)	-1 ppm/°C (-55°C to +25°C) +1 ppm/°C (+25°C to +125°C) -0.3 ppm/°C (0°C to +25°C) +0.3 ppm/°C (+25°C to +60°C)
Selected TCR Tracking	Not Specified	Not Specified	3.0 ppm/°C, Standard Spread
Load-Life Stability (0.3W @ 125°C) at 2000 hours at 10,000 hours	 0.5% Maximum ΔR (5000 ppm) 0.5% Maximum ΔR (5000 ppm)	 0.2% Maximum ΔR (2000 ppm) 0.2% Maximum ΔR (2000 ppm)	 0.02% Maximum ΔR (200 ppm) 0.05% Maximum ΔR (500 ppm)
Current Noise (Not Specified)	-32dB	-32dB	-32dB
High Frequency Operation Rise-Decay Time Inductance (L) Capacitance (C) Reactance	 Not Specified Not Specified Not Specified Not Specified	 Not Specified Not Specified Not Specified ≤ 10%	 1.0 ns for 1KΩ 0.1μH Maximum, 0.08μH Typical 1.0pF Maximum, 0.05pF Typical <1%
Voltage Coefficient	0.0005%/V (5 ppm/V)	0.0001% /V (1 ppm/V)	<0.00001% /V (<0.1 ppm/V)
Working Voltage	300 Volts Maximum	300 Volts Maximum	300 Volts Maximum
Thermal EMF	Not Specified	1μV/°C	0.1μV/°C Maximum

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VISHAY

CHIPS

Microchip (V5X5) and Minichips (V15X5, V15X10) Resistors for Hybrid Microcircuits

Model Number	Resistance[1] (Ohms)	Trim Range	Tolerance To	Power at 70°C	Max. Working Voltage	Nominal Chip Dimensions Inch (mm) L x W x T	Shelf-Life Stability (Max. ΔR)	Load-Life Stability (Max. ΔR)	Nominal TCR
V5X5	5-10K	0 to 1.2x the nominal prevalue	±0.01%	0.05W	40V	0.050 x 0.050 x 0.020 (1.27) x (1.27) x (0.508)	0.005% /Yr. 0.0005% /Yr. Hermetically Packaged	0.05% 2000 Hrs. @ 70°C	0°C to +25°C +0.6 ppm/°C ±1.5 ppm/°C +25°C to +60°C -0.6 ppm/°C ±1.5 ppm/°C -55°C to +25°C +2.2 ppm/°C ±2.0 ppm/°C +25°C to +125°C -1.8 ppm/°C ±2.0 ppm/°C
V15X5	5-33K	0 to 1.3x the nominal prevalue		0.1W	60V	0.150 x 0.050 x 0.020 (3.81) x (1.27) x (0.508)			
V15X10	33-80K			0.15W	100V	0.150 x 0.100 x 0.020 (3.81) x (2.54) x (0.508)			

1. Higher resistance ranges and larger size chips available.

Bulk Metal®Foil
PRECISION SURFACE MOUNT CHIP RESISTORS

±0.6 ppm/° C TCR ■ 0.01% Tolerance ■ Very High Stability
Designed to Exceed Requirements of MIL-R-55342

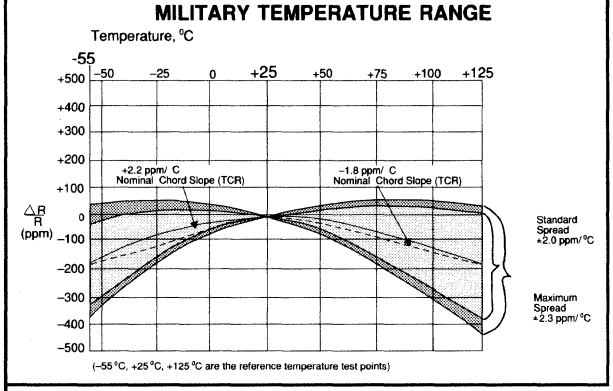
VISHAY VSM resistors offer an-order-of magnitude improvement in performance over other surface mounted chip resistors. Until now, the best chips available had a ±50 ppm/°C (–55°C to +125°C) Temperature Coefficient of Resistance (TCR); the VISHAY chips, however, exhibit a nominal TCR of only +2.2 ppm/°C over the temperature range of -55°C to +25°C and -1.8 ppm/°C from +25°C to +125°C. The VISHAY standard TCR spread from nominal is ±2.0 ppm/°C over the full temperature range. This TCR characteristic is accomplished automatically without selection and regardless of the date of manufacture - even if years apart! Selected TCR tracking is available to 0.5 ppm/°C. Where other chip resistors are, at best, supplied only as close as ±0.1% resistance tolerance, VISHAY surface mounted have standard resistance tolerances to ±0.01%.

VISHAY surface mounted precision chip resistors exhibit performance which dramatically exceeds the requirements of MIL-R-55342. In Trident passivation tests, VISHAY chips repeatedly showed no deterioration when exposed to destructive ceric annomium nitrate solutions (three 15 second etches), indicating a high order of protection and absence of "nichrome migration."

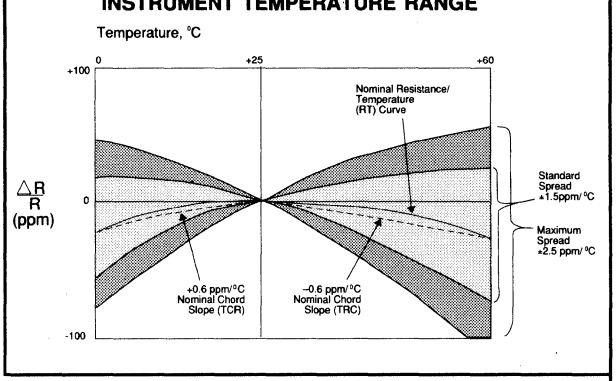
Model Number	Resistance (Ohms)	Power at 70°C	Max. Working Voltage	Nominal Chip Dimensions Inch (mm) L x W x T	Shelf-Life Stability (Max. ΔR)	Load-Life Stability (Max. ΔR)	Nominal TCR
VSM16X6	5-33K	0.10W	60V	0.160 x 0.065 x 0.035 (4.064) x (1.651) x (0.889)	0.003% /Yr. 0.0005% /Yr. Hermetically Packaged	0.05% 2000 Hrs. @ 70°C	0°C to +25°C +0.6 ppm/°C ±1.5 ppm/°C +25°C to +60°C -0.6 ppm/°C ±1.5 ppm/°C -55°C to +25°C +2.2 ppm/°C ±2.0 ppm/°C +25°C to +125°C -1.8 ppm/°C ±2.0 ppm/°C
VSM16X11	33K-80K	0.15W	100V	0.160 x 0.110 x 0.035 (4.064) x (2.794) x (0.889)			
VSM21X11	5-100K	0.20W	140V	0.210 x 0.110 x 0.035 (5.334) x (2.794) x (0.889)			
VSM21X20	5-150K	0.30W	200V	0.210 x 0.205 x 0.035 (5.334) x (5.207) x (0.889)			

Resistance Value Vs. Tolerance		
Value (Ohms)	Tolerance	
	Tightest	Loosest
5Ω-<10Ω	0.10%	1.0%
10Ω-<50Ω	0.05%	1.0%
50Ω-<100Ω	0.02%	1.0%
100Ω-<150K	0.01%	1.0%

MILITARY TEMPERATURE RANGE



INSTRUMENT TEMPERATURE RANGE



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VISHAY

FIXED RESISTORS

*Precision Resistors - High Performance Industrial & Aerospace Group**

Model Number	Resistance (Ohms)	Tolerance[1] Available To	Power at 70°C	Power at 125°C	Max. Working Voltage	Nominal Dimensions Inch (mm) W x L x H	Shelf-Life Stability (Max. ΔR)[3]	Load-Life Stability (Max. ΔR)	Temperature Coefficient of Resistance
S102C™[4] (1 chip)	1-100K >100K-250K	±0.005%	0.6W 0.4W	0.3W 0.2W	300	0.105 x 0.302 x 0.326 (2.67) x (7.67) x (8.28) Dim. Tol. ±0.010 (0.25) Lead Spacing 0.150 (3.81) Nom.	25 ppm after 1 year and 50 ppm after 3 years	0.005% 2000 hrs. 0.1W per chip @ 70°C	Nominal[2] / Standard Spread 0°C to +25°C: +.06 ppm/°C / ±1.5 ppm/°C +25°C to +60°C: -0.6 ppm/°C / ±1.5 ppm/°C -55°C to +25°C: +2.2 ppm/°C / ±2.0 ppm/°C +25°C to +125°C: -1.8 ppm/°C / ±2.0 ppm/°C
S104D (2 chips)	1-200K >200K-500K	±0.005%	1.0W 0.6W	0.5W 0.3W	350	0.160 x 0.575 x 0.413 (4.06) x (14.61) x (10.49) Lead Spacing 0.400 (10.16) Nom.		0.015% 2000 hrs. 0.3W per chip @ 125°C	
S105D (3 chips)	1-300K >300K-750K	±0.005%	1.5W 0.8W	0.75W 0.4W	350	0.160 x 0.820 x 0.413 (4.06) x (20.83) x (10.49) Lead Spacing 0.650 (16.51) Nom.			
S106D (4 chips)	0.5-400K >400K-1M	±0.005%	2.0W 1.0W	1.0W 0.5W	500	0.260 x 1.190 x 0.413 (6.60) x (30.23) x (10.49) Lead Spacing 0.900 (22.86) Nom.		0.05% 10,000 hrs. 0.3W per chip @ 125°C	

1, 2, 3, 4 For numerical footnote information, refer to VISHAY's Short Form Catalog or contact VISHAY at the number listed below.

*** VISHAY "S" series resistors** are also available with the new improved "K" chip (specify S102K Series). The TCR specification is much improved but pricing remains the same.

Improved TCR: ±0.3 ppm/°C (nom), ±1.3 ppm/°C (max), (0°C to +60°C)
± 1.0 ppm/°C (nom), ±2.5 ppm/°C (max), (-55°C to +125°C)

FIXED AXIAL LEADED RESISTORS

Value Engineered and Standard Stock Axial Leaded Precision Resistors

Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 70°C	Power at 125°C	Max. Working Voltage	Nominal Dimensions Inch (mm) D x L	Shelf-Life Stability (Max. ΔR)[3]	Load-Life Stability (Max. ΔR)[3]	Temperature Coefficient of Resistance (Limits)
VTA52 (RBR52)	5-750K 25-750K	±0.1 ±0.01	1.0W	0.5W	300	0.375 x 1.00 (9.53) x (25.4)	25 ppm after 1 year	0.05% 2000 hrs. @ 125°C	0°C to +60°C ±4 ppm/°C -55°C to +25° ±8 ppm/°
VTA53 (RBR53)	5-500K 25-500K	±0.1 ±0.01	0.66W	0.33W	300	0.375 x 0.750 (9.53) x (19.05)			
VTA54 (RBR54)	5-500K 25-500K	±0.1 ±0.01	0.5W	0.25W	300	0.260 x 0.750 (6.60) x (19.05)			
VTA55 (RBR55)	5-250K 25-250K	±0.1 ±0.01	0.3W	0.15W	300	0.260 x 0.500 (6.60) x (12.70)			
VTA56 (RBR56)	5-250K 25-250K	±0.1 ±0.01	0.25W	0.125W	300	0.260 x 0.356 (6.60) x (9.04)			
VMTA55 (RNC55)	5-30K 50-30K	±0.1 ±0.01	0.2W	0.1W	200	0.120 x 0.270 (3.05) x (6.86)			
VMTA60 (RNC60)	5-30K 50-30K	±0.1 ±0.01	0.25W	0.125W	250	0.125 x 0.375 (3.18) x (9.53)			
VMTB60 (RNC60)	5-60K 50-60K	±0.1 ±0.01	0.25W	0.125W	250	0.160 x 0.375 (4.06) x (9.53)			
VSA100	5-150K 50-150K	±0.1 ±0.01	0.6W	0.3W	300	L: 0.305 (7.75)max. T: 0.102 (2.59)max. H: 0.260 (6.60)max.			

1, 3 For footnote information, refer to VISHAY's Short Form Catalog or contact VISHAY at the number listed below.

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VISHAY

Hermetically Sealed "O" TCR Resistor

VHP-100, the New Improved VISHAY Thermotropic Resistor with Self-Correcting Resistance versus Temperature Performance

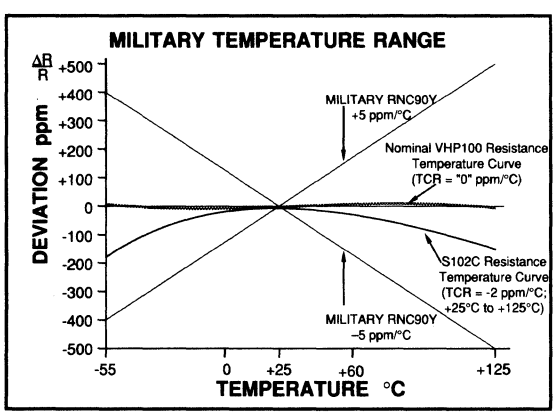
■ Essentially Zero TCR ■ No Humidity Effect ■ Lowest Thermal EMF in the Industry
■ Excellent Stability ■ Essentially Non-Inductive Performance

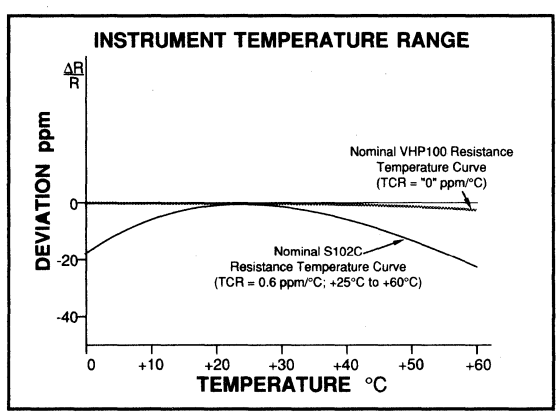
Self-correcting thermal stability is achieved by programming the resistance to change or turn in the desired direction in response to a specified stimulus (tropic); the stimulus in this case is the temperature (thermo). As temperature changes cause the resistance to move away from the desired ohmic value, the corrective factors reverse the direction of resistance change to restore the resistance to its initial desired ohmic value, a thermotropic phenomenon. The changing temperature, which normally increases the error, is used to reverse the temperature induced error and activate the self-compensating mechanisms which provide the thermal stability.

VHP-100 SPECIFICATIONS

TCR	<0.6 ppm/°C (MIL range) <0.3 ppm/°C (+15°C to +45°C)
Resistance Range	100Ω to 150KΩ
Tolerance at +25°C[1]	±0.005% to ±1.0%
Power at +70°C at +125°C	 0.3 watts 0.15 watts
Load-Life Stability[2] (For 2000 hours)	0.3W @ +70°C; 0.015% (150 ppm) Max. ΔR 0.15W @ +125°C; 0.015% (150 ppm) Max. ΔR
Shelf-Life Stability[3]	0.0005% (5 ppm) Max. ΔR after 1 yr.; 0.0010% (10 ppm) Max. ΔR after 3 yrs.
Thermal EMF Due to temperature difference between leads Due to self-heating under 0.1 watts	 0.05μV/°C 0 to 2μV
High-Frequency Operation Rise/Decay Time Inductance (L) Capacitance (C)	 1.0 ns for 1KΩ 0.1μH Max.; 0.08μH Typical 1.0pF Max.; 0.5pF Typical
Maximum Working Voltage	300V
Voltage Coefficient	<0.1 ppm/V (non-measurable)
Current Noise	<0.025μV (RMS)/volt (-32dB)
Hermeticity	10^{-7} atmospheric cc/sec.
Nominal Dimensions — Inch (mm) Width Length Height Lead Spacing	 0.185 ±0.020 (4.70 ±0.51) 0.435 ±0.020 (11.05 ±0.51) 0.430 ±0.020 (10.92 ±0.51) 0.150 (3.81) nominal[4]

1, 3 Refer to VISHAY's Short Form catalog or contact VISHAY at the number listed below.
2 Load-life stability is considerably improved by reducing the temperature, power, or by "burn-in."
4 0.375H (9.53) available on special order.





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VISHAY

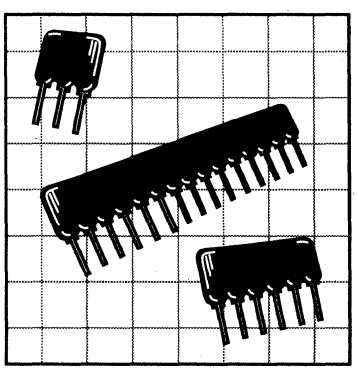
NETWORKS

Hermetically Sealed Miniature Precision Resistor Networks in DIP, TO and Other Packages

Model Number	Type Package	Max. No. of V5 x 5 (V15 x 5) Resistors	Max. R Value V5 x 5 (V15 x 5) Resistors	Tolerance Ratio Between Resistors @ 25°C To	Max. Dimensions (Excluding leads) Inch (mm) H x D – pin circle	TCR Ratio Between Resistors (Ref. @25°C)
1401	3 pin TO-18	1 (1)	10K (30K)	N/A	0.210 x 0.230 - 0.100 (5.33) x (5.84) - (2.54)	0° to +60°C -55°C to +125°C Standard Spread ±1.5ppm/°C +2.0ppm/°C Maximum Spread ±2.5ppm/°C ±2.3ppm/°C Available To 0.5ppm/°C 0.5ppm/°C
1403	4 pin TO-18	5 (1)	10K (30K)	0.0025%	0.200 x 0.212 - 0.100 (5.08) x (5.38) - (2.54)	
1413	8 pin TO-5	9 (3)	10K (30K)	0.0025%	0.200 x 0.370 - 0.200 (5.08) x (9.40) - (5.08)	
1417	8 pin TO-5	12 (3)	10K (30K)	0.0025%	0.200 x 0.362 - 0.230 (5.08) x (9.16) - (5.84)	
1419	10 pin TO-5	12 (3)	10K (30K)	0.0025%	0.200 x 0.362 - 0.230 (5.08) x (9.19) - (5.84)	
1421	12 pin TO-8	49 (16)	10K (30K)	0.0025%	0.200 x 0.602 - 0.400* (5.08) x (15.29) - (10.16)*	
1422	16 pin TO-8	49 (16)	10K (30K)	0.0025%	0.200 x 0.602 - 0.400* (5.08) x (15.29) - (10.16)*	
1442	8 pin DIP	12 (4)	10K (30K)	0.0025%	**H x L x W - Lead Spacing** 0.100 x 0.528 x 0.320 - 0.300 (2.54) x (13.41) x (8.13) - (7.62)	
1445	14 pin DIP	30 (10)	10K (30K)	0.0025%	0.100 x 0.778 x 0.296 - 0.300 (2.54) x (19.76) x (7.52) - (7.62)	
1446	16 pin DIP	36 (12)	10K (30K)	0.0025%	0.100 x 0.810 x 0.298 - 0.300 (2.54) x (20.57) x (7.57) - (7.62)	
1457	18 pin DIP	80 (25)	10K (30K)	0.0025%	0.150 x 1.007 x 0.502 - 0.300 (3.81) x (25.58) x (12.7) - (7.62)	
1460	20 pin 1" x 1" Plug-in	221 (73)	10K (30K)	0.0025%	0.220 x 1.010 x 0.900 - 0.900 (5.59) x (25.65) x (22.86) - (22.86)	
1476	30 pin 1" x 1" Flat Pack	225 (105)	10K (30K)	0.0025%	0.125 x 1.148 x 0.950 - 0.05** (3.18) x (29.16) x (24.13) - (1.27)**	
1485	16 pin Leadless Chip Carrier	12 (4)	10K (30K)	0.0025%	0.055 x 0.360 x 0.295 (1.40) x (9.14) x (7.49)	

* pin square **axial lead pin spacing

THIN FILM ACCUTRACK™



For high ratios (10,000:1) and high resistance values (up to 10MΩ) use Thin Film Networks. Networks are available in chip form or SIPs, DIPs and TO packages.

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- TCR tracking to 1.0ppm/°C. Absolute TCR of 5ppm/°C.
- Resistance ratios to 0.01% (100ppm).
- SIPs up to 16 pins. Other packages available.
- Minimum thermal EMF <0.08μV/°C against PCB copper.
- End of life to 0.01% (100ppm).
- Noise -32dB.

VISHAY can also supply Bulk Metal®Foil and Thin Film custom-designed chips, with bondable gold pads for hybrid and SMD applications.

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VISHAY

POWER RESISTORS AND PLATES

Precision Power Plate Resistors for Current Sensing and Power Surge Applications

Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 25°C	Maximum Working Voltage	Maximum Dimensions Inch (mm) W x L x H	Shelf-Life Stability/Yr. (Max. ΔR)[3]	Standard TCR Spread from Nominal
VPR-5	1-100K	0.01%	5W	300	0.450 x 0.630 x 0.315 (11.43) x (16.00) x (8.00)	25ppm	Above 10 ohms ±5ppm/°C
VPR-7			7W		0.450 x 1.035 x 0.312 (11.43) x (26.29) x (8.00)		Below 10 ohms ±10ppm/°C

1, 3 For numerical footnote information, refer to VISHAY's Short Form Catalog or contact VISHAY at the number listed below.

Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 25°C	Nominal Plate Dimensions Inch (mm) W x L x H	Shelf-Life Stability/Yr. (Max. ΔR)[3]	Load-Life Stability/Yr. (Max. ΔR)[3]	Resistance Element Area Sq. In. (mm)	Nominal TCR[2]
V3PR-300589	10-5K	±0.005%	3W in air; 10W on heat sink	1.000 x 1.000 x 0.025 (25.4) x (25.4) x (0.635)	25ppm after 1 year	0.03% 2000 hrs. @ 125°C	1.00 (25.40)	±2ppm/°C
V3PR-300586 (2 R's)	0.25	±0.25%	25W*	1.600 x 1.700 x 0.025 (40.64) x (43.18) x (0.635)			0.98 (24.89)	
V3PR-300338	0.5							
V3PR-300571	1.0	±0.25%	20W*	1.750 x 1.120 x 0.025 (44.45) x (28.45) x (0.635)			0.658 (16.71)	±10ppm/°C
V3PR-300572	2.0	±0.25%	20W*	1.750 x 1.120 x 0.025 (44.45) x (28.45) x (0.635)			0.658 (16.71)	
V3PR-300610 (4 R's)[7]	2.0	±0.25%	>100W*	4.000 x 5.000 x 0.025 (101.6) x (127.0) x (0.635)			11.20 (284.48)	

*Power is 10W/sq. in. when a heat sink, which keeps the foil temperature below 100°C, is used.
1, 2, 3, 7 For numerical footnote information, refer to VISHAY's Short Form Catalog or contact VISHAY at the number listed below.

Molded Precision Power and Current Sensing Resistors

Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 25°C	Maximum Working Voltage	Nominal Plate Dimensions Inch (mm) W x L x H	Shelf-Life Stability/Yr. (Max. ΔR)[3]	Load-Life Stability/Yr. (Max. ΔR)[3]	Nominal TCR[2]	Standard Spread
VFP-3 and VFP-4	0.05 - 500K	±0.01% tightest to ±5.0% loosest	3W in air; 10W on heat sink	350V	0.276 x 1.575 x 0.394 (7.0) x (40.0) x (10.0)	0.0025% ΔR/year	0.05% Maximum ΔR under full rated power of 3 watts @ 25°C	0°C to 25°C +0.6ppm/°C +25°C to +60°C -0.6ppm/°C -55°C to +25°C +2.2ppm/°C +25°C to +125°C -1.8ppm/°C	±1.5ppm/°C ±1.5ppm/°C ±2.0ppm/°C ±2.0ppm/°C

1, 2, 3 For numerical footnote information, refer to VISHAY's Short Form Catalog or contact VISHAY at the number listed below.

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SI UNITS

RELATIVE QUANTITY SYMBOLS

$\neq$	not equal to
$\approx$	approximately equal to
$\propto$	proportional to
$<$	smaller than
$\leq$	smaller than or equal to
$\ll$	much smaller than
$>$	larger than
$\geq$	larger than or equal to
$\gg$	much larger than
$\equiv$	identical to or equivalent
$\uparrow$	increases
$\downarrow$	decreases

PREFIXES FOR SI UNITS

Multiple	Prefix	Symbol
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p

Quantity	Symbol	SI Unit	Symbol	Derivation
acceleration	a	m s^{-2}	—	velocity/time
acceleration due to gravity	g	m s^{-2}	—	velocity/time
amount of substance	n	mole	mol	mole fraction (n) used
amplification factor	μ	*a ratio*	—	—
angle	$\theta_1, \varphi_1, \alpha_1$	—	—	—
angle of incidence	i	degree or radian	°	—
angle of refraction	r	degree or radian	°	—
angle, Bragg	θ	number	—	—
angle, critical	c	degree or radian	°	—
anode slope resistance	R_A	ohm	Ω	$\Delta V_a / \Delta I_a$
area	A	metres squared	m^2	$l \times b$
atomic number	Z	a number	—	number of protons
Avogadro constant	L, N_A	number	—	—
breadth	b	metre	m	fundamental unit
capacitance	C	farad	F	charge/p.d.
charge, electric	Q	coulomb	C	current × time
charge on electron	e	coulomb	C	$1{\cdot}6 \times 10^{-19}$ C
conductance	G	ohm^{-1}	Ω^{-1}	reciprocal of resistance
current, electric	I	ampere	A	fundamental unit
decay constant	λ	*a ratio*	—	—
density	ρ	kg m^{-3}	—	m/V
distance along path	s	metre	m	fundamental unit
efficiency	η	*a ratio*	—	work output/work input
electrochemical equiv.	z	g C^{-1}	—	mass/charge
electromotive force	E	volt	V	energy/charge
electron	e	—	—	—
energy	E	joule	J	N m
energy, kinetic	E_k	joule	J	N m. $E_k = 1/2mv^2$
energy, potential	E_p	joule	J	N m. $E_p = mgh$
Faraday constant	F	coulomb mol^{-1}	C mol^{-1}	96,500 C mol^{-1}
field strength, electric	E	V m^{-1}	—	potential gradient: p.d./dist.
field-strength magnetic	H	ampere-turns	—	current × no. of turns
flux, magnetic	Φ	weber	Wb	e.m.f/rate of change of flux
flux density	B	tesla	T	flux/area
focal length	f	metre	m	—
force	F	newton	N	kg m s^{-2}
free energy	ΔG	joule	J	—
frequency	f	hertz	Hz	oscillations/time
gas constant	r	joule	J	energy
half-life,radioactivity	$t_{1/2}$	second	s	fundamental unit
heat capacity	C	J K^{-1}	—	quantity of heat/temp. rise
heat of reaction	ΔH	joule	J	heat energy
heat capacity, specific	c	J K^{-1} kg^{-1}	—	heat capacity/mass
heat, quantity of	q	joule	J	energy

SI UNITS

Quantity	Symbol	SI Unit	Symbol	Derivation
height	h	metre	m	fundamental unit
image distance	υ	metre	m	fundamental unit
inductance, mutual	M	henry	H	induced e.m.f./rate of change of current
inductance, self	L	henry	H	—
intensity of radiation	I	*a number*	—	—
latent heat	L	joule	J	quantity of heat
latent heat, specific	l	J kg^{-1}	—	quantity of heat
latent heat, molar	L_m	joule mol^{-1}	J	quantity of heat
length	l	metre	m	fundamental unit
magnetizing force	H	ampere-turns	—	—
magnetic moment	m	Wb m	—	torque in unit magnetic field
magnification, linear	m	*a ratio*	—	—
mass	m	kilogramme	kg	fundamental unit
mass number	A	*a number*	—	number of neutrons + protons
molar volume	V_m	(dm^3)	—	volume of 1 mole
molar solution	M	*a ratio*	—	moles/dm^3
moment of force	—	N m	—	force × perp. distance
neutron number	N	*a number*	—	number of neutrons
number	n	—	—	—
number of molecules	N	—	—	—
number turns on coil	n	*a number*	—	—
number order spectrum	p	*a number*	—	—
object distance	u	metre	m	fundamental unit
peak current	I_O	ampere	A	see current
peak e.m.f.	E_O	volt	V	see e.m.f.
period	T	second	s	fundamental unit
permeability	μ	H m^{-1}	—	henry/metre
permeability, vacuum	μ_o	H m^{-1}	—	—
permeability, relative	μ_r	*a ratio*	—	$\mu = \frac{\mu}{\mu_O}$
permittivity	ε	F m^{-1}	—	farad/metre
permittivity, vacuum	ε_o	F m^{-1}	—	farad/metre
permittivity, relative	ε_r	*a ratio*	—	$\varepsilon_r = \frac{\varepsilon}{\varepsilon_0}$
potential, electric	V	volt	V	energy/charge
potential difference	V	volt	V	energy/charge
power	P	watt	W	J s^{-1}
pressure	p	pascal	Pa	N m^{-2}: force/area
radius	r	metre	m	fundamental unit
reactance	X	ohm	Ω	E_0/I_0
refractive index	n	*a ratio*	—	—
resistance	R	ohm	Ω	p.d./current
resistivity, electrical	ρ	ohm-metre	—	resistance × length
relative density	d	*a ratio*	—	ρ_{sub}/ρ_{water}
r.m.s. current	$I_{r.m.s}$	ampere	A	see current
r.m.s. voltage	$V_{r.m.s}$	volt	V	see e.m.f.
slit separation	s	metre	m	fundamental unit
tension	T	newton	N	see force
temperature, Celsius	θ	degree C	°C	from kelvin
temp. interval	θ	degree	° or K	—
temp. absolute	T	kelvin	K	fundamental unit
thickness	d	metre	m	fundamental unit
time	t	second	s	fundamental unit
torque	T	Nm	—	see moment
turns ratio	T	*a ratio*	—	n_{sec}/n_{prim}
(unit of electricity)	—	kW h	—	kilowatt × hour
velocity	u,υ	ms^{-1}	—	distance/time
velocity, angular	ω	$second^{-1}$	s^{-1}	angle/time
velocity, e.m.waves	c	m s^{-1}	—	—
velocity of sound	υ	m s^{-1}	—	—
volume	V	metre cubed	m^3	l × b × h
wavelength	λ	metre	m	fundamental unit
work	w	joule	J	force x distance (Nm)
weight	W	newton	N	kg m s^{-2}or mg

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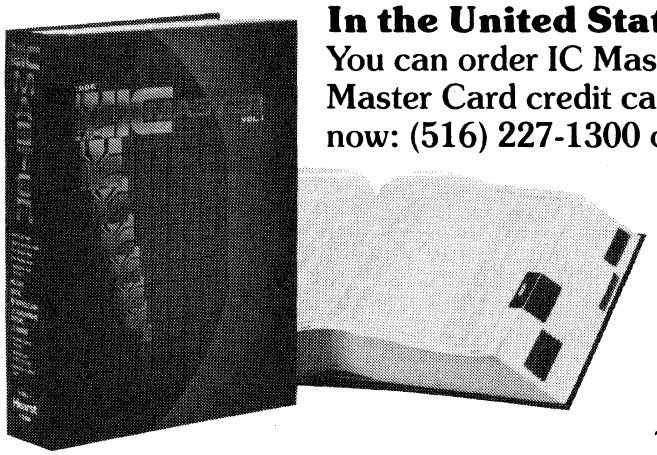

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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
ABS acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CAMAC computer automated measurement and control
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3
KSR keyboard send /receive

L
LC inductance capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIB microcomputer interface board
MIC microwave IC
MIPS million instructions per second
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

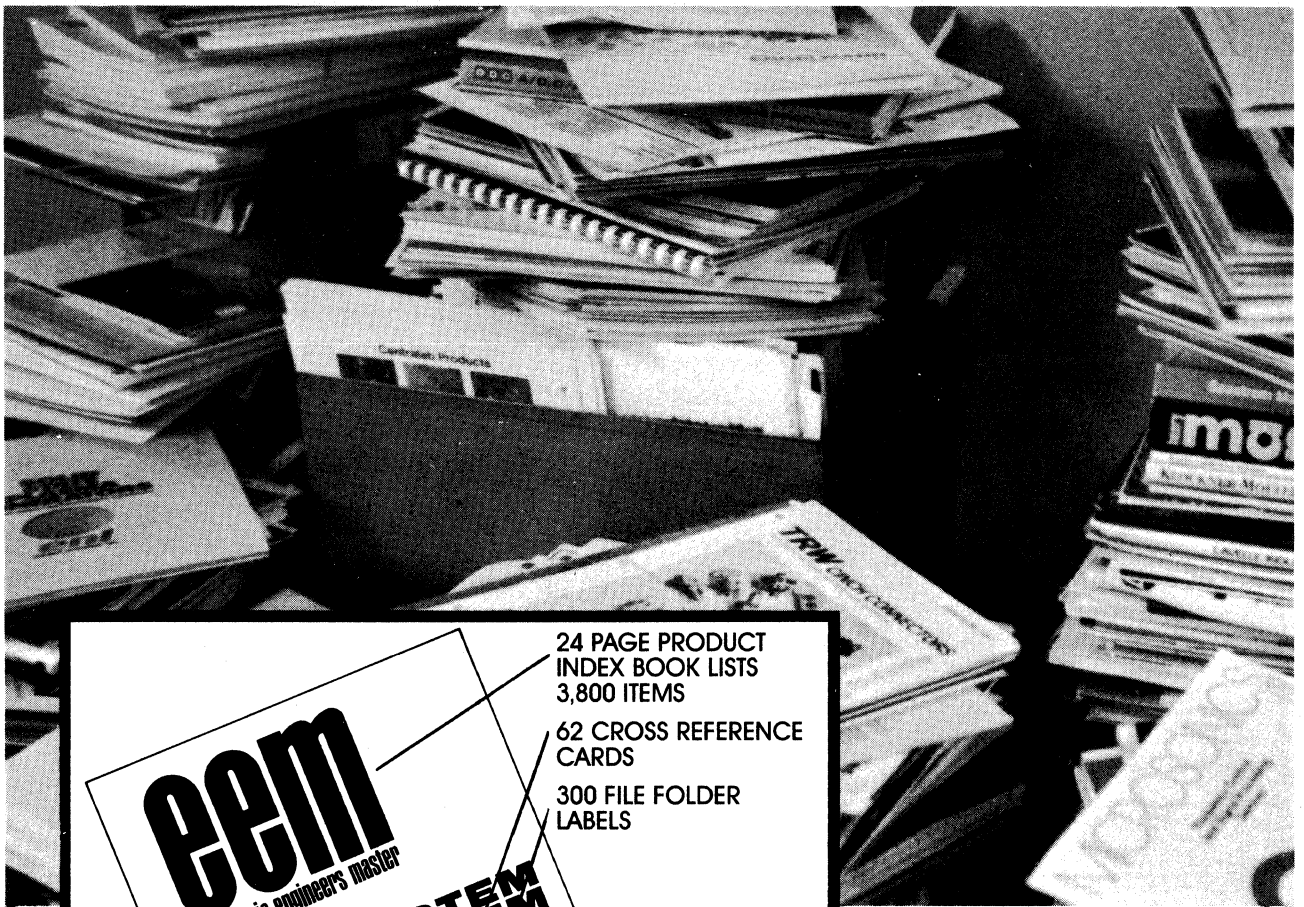
U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force



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POTENTIOMETERS/RHEOSTATS†

Manufacturer	EEM Page No. A•	Resistive Element Material						Features											Other Features
								Mechanical Adjustment					Mounting						
		Carbon Film	Carbon Comp.	Cermet	Conductive Plastic	Hybrid	Wirewound	Single Turn	Multiturn	Slider Motion	Nonlinear Tapers	High Power >5W	Precision	Linear Thru Panel	PCB	Servo Adj.	Switch	Multisect.	
Allen Bradley	2059		¤	¤	¤			¤	¤		¤			¤	¤		¤	¤	
Angstrom/Vishay	2062								¤			¤		¤					
Beckman	2063					¤	¤	¤	¤		¤		¤	¤	¤				Turns Counting Dials
Bourns*	2064			¤	¤	¤	¤	¤	¤	¤	¤		¤	¤	¤	¤	¤		Push-button; Dials; Encoders Motorized
Cord Electronics	2068	¤		¤				¤	¤	¤	¤		¤	¤	¤		¤	¤	
Dale Electronics	2069					¤		¤					¤		¤				Surface Mount
ETI Systems	2070				¤	¤	¤	¤	¤	¤		¤	¤	¤	¤	¤	¤	¤	Rheostats†; Turns Counting Dials; Pot/Dial Combinations; Stepper Actuated Pots
JDK Controls *	2075				¤			¤			¤		¤	¤		¤	¤		Gear Heads
Kilo Int'l	2076							¤	¤										Turns Counting Dials
Mallory Timers *	2077						¤	¤	¤		¤	¤		¤		¤	¤	¤	
Maurey * Instrument	2078	¤			¤		¤	¤	¤	¤	¤		¤	¤		¤	¤	¤	
Memcor-Truohm	2086						¤												Rheostats†
Mepco/ Centralab	2087	¤	¤	¤	¤		¤				¤			¤	¤		¤		
Ohmite Mfg.	2094		¤				¤	¤				¤		¤				¤	Rheostats†
Piher International	2096	¤					¤			¤	¤			¤	¤		¤		
Precision Control Manufacturing *	2097						¤	¤	¤				¤	¤					Vernier Decades, Elements
Preh Electronic	2098	¤		¤	¤		¤	¤	¤	¤									
Sfernice *	2099			¤	¤		¤	¤	¤		¤			¤		¤			
Tocos America	2100	¤	¤	¤			¤	¤	¤	¤	¤	¤		¤	¤				
Vernitech	2103	¤			¤	¤		¤	¤	¤	¤		¤	¤		¤	¤	¤	Elements
VRN International*	2107						¤	¤	¤		¤	¤	¤	¤	¤	¤		¤	
Waters Mfg./ Talley Industries *	2110				¤														Elements

† A rheostat is a two-terminal variable resistor. When both ends of the resistance element and the slider contact (three terminals) are used, it's called a potentiometer . By tradition, nevertheless, power variable resistors are often referred to as rheostats, no matter how used.

* Mil. Spec.

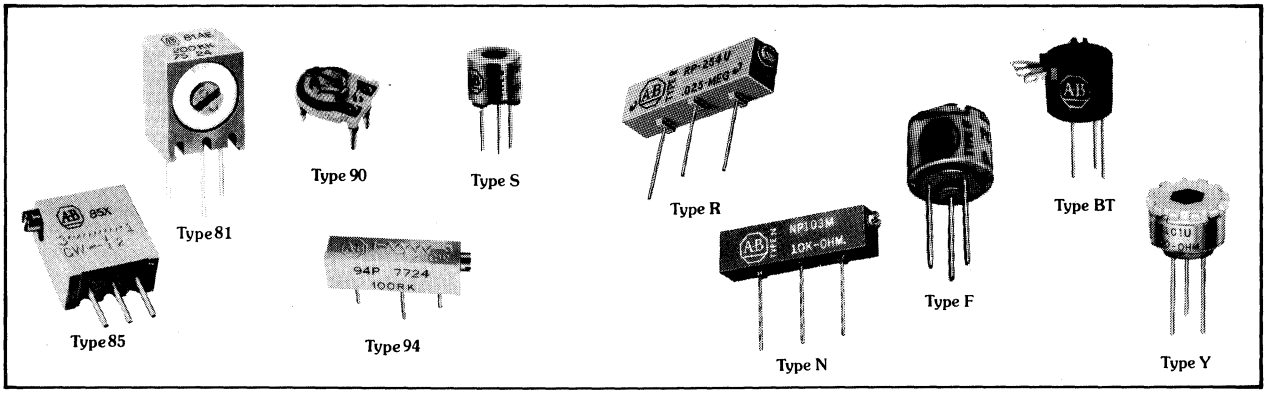
TRIMMERS

Manufacturer	EEM Starting Page No	Resistance Element Material						Features								Other Features
								Mechanical Adjustment		Motion			Mounting			
		Carbon Film	Carbon Comp	Cermet	Conductive Plastic	Metal Film	Wirewound	Single Turn	Multi-turn	Linear	Non-linear	Precision	Thru Panel	PCB	Multi-section	
Allen Bradley	A•2059		¤	¤				¤	¤	¤	¤		¤	¤		
Beckman	A•2063						¤	¤	¤	¤	¤	¤	¤			Surface Mount
Bourns *	A•2064			¤	¤		¤	¤	¤	¤	¤	¤	¤	¤		Industrial grade Surface Mount
Cord Electronics	A•2068	¤		¤				¤		¤			¤	¤		
Dale Electronics	A•2069			¤				¤		¤				¤		Surface Mount
Mepcopal *	A•2088			¤			¤	¤	¤							Surface Mount
Murata Erie *	A•2090	¤	¤	¤	¤			¤	¤	¤		¤		¤		Surface Mount
Piher International	A•2096	¤		¤				¤		¤	¤		¤	¤		
Preh Electronic	A•2098	¤		¤	¤			¤	¤	¤		¤				
Sfernice	A•2099			¤	¤	¤	¤	¤	¤	¤	¤					
Tocos America	A•2100	¤	¤	¤		¤	¤	¤	¤	¤	¤		¤	¤		
Vishay *	A•2105								¤			¤				Bulk Metal Foil
VRN International *	A•2107			¤			¤	¤	¤	¤	¤		¤	¤		

* Mil. Spec.

TYPES 81, 85, 90, 94, S, N, R, F, BT, Y

Trimming Potentiometers



SPECIFICATIONS

Type	Resistance Element and Adjustment Turns	Resistance Range and Tolerance	Power	Voltage Rating (RMS or DC)	Operating Temperature Range	Terminal Types	Case Dimensions in Inches (millimeters)	Enclosure
81	Cermet Single Turn	10 Ohms to 1 Megohm ±10%, ±20%	0.5 Watt at 70°C	300V	−55°C to +125°C	Pin	0.25 (6.35) Diameter by 0.25 (6.35)	Immersion Sealed
85	Cermet Multi-Turn	10 Ohms to 2 Megohms ±10%, ±20%	0.5 Watt at 70°C	300V	−55°C to +125°C		L 0.4 (10) H 0.42 (10.7) W 0.21 (5.3)	
90	Cermet Single Turn	100 Ohms to 2 Megohms ±20%	0.5 Watt at 70°C 1.0 Watt at 40°C	200V	−55°C +125°C		L 0.466 (11.9) W 0.393 (10.0) D 0.228 (5.8)	Open Frame
94	Cermet Multi-Turn	10 Ohms to 2 Megohms ±10%, ±20%	0.5 Watt at 70°C 0.75 Watt at 25°C	300V	−55°C +125°C		L 0.76 (19.3) H 0.45 (11.55) W 0.2 (5.08)	Immersion Sealed
S	Cermet Single Turn	50 Ohms to 1 Megohm ±5%, ±10%	0.5 Watt at 85°C		−65°C +150°C		0.375 (9.52) Diameter by 0.375 (9.52)	
N	Composition Multi-Turn	100 Ohms to 2.5 Megohms ±10%, ±20%	0.25 Watt at 70°C		−55°C to +100°C		L 1.250 (31.75) H 0.359 (9.13) W 0.250 (6.35)	
R					−55°C to +125°C	Pin or Solder Lug		
F	Composition Single Turn	100 Ohms to 5 Megohms ±10%, ±20%	0.25 Watt at 70°C		−55°C to +120°C	Pin or Solder Lug	0.500 (12.70) Diameter by 0.531 (13.49)	
BT			Consult Factory		−40°C to +120°C	Front: 3 Lugs Rear: 3 Pins or Front: 2 Pins Rear: 2 Pins	0.500 (12.70) Diameter by 0.535 (13.59)	Dust and Splash Resistant
Y			0.25 Watt at 50°C	350V	−55°C to +100°C	Pin or Solder Lug	0.500 (12.70) Diameter by 0.359 (9.13)	Dust and Splash Resistant

Conductive Plastic, Cermet and Hot-Molded Carbon Composition Panel Potentiometers

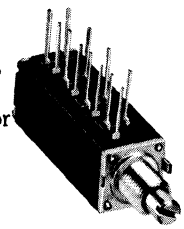
SPECIFICATIONS

Type	Resistance Element	Resistance Range and Tolerance	Power Rating (Linear Taper)	Voltage Rating (RMS or DC)	Operating Temperature Range	Number of Sections Available	Case Dimensions in Inches (millimeters)	Enclosure
Series 70	Cermet	100 Ohms to 5 Megohms ±10%	2.0 Watts @ 70° C	350V	−55° C to +150° C	1, 2, 3 or 4	0.625 (15,88) Square Lug terminals: 0.594 (15,08) Deep Pin terminals: 0.625 (15,88) Deep (Single Section)	Dust and Splash Resistant
	Hot-Molded Composition	50 Ohms to 10 Megohms ±10%, ±20%	1.0 Watt @ 70° C		−55° C to +120° C			
	Conductive Plastic	100 Ohms to 1 Megohm ±10%, ±20%	0.5 Watt @ 70° C					
Series 72	Cermet	100 Ohms to 5 Megohms ±10%	1.0 Watt @ 70° C		−55° C to +100° C	1 or 2		
	Hot-Molded Composition	50 Ohms to 10 Megohms ±10%, ±20%	0.5 Watt @ 70° C					
	Conductive Plastic	100 Ohms to 1 Megohm ±10%, ±20%	0.25 Watt @ 70° C					
Series 73	Cermet	100 Ohms to 5 Megohms ±10%	2.0 Watts @ 70° C		−55° C to +120° C	1, 2, 3 or 4		
	Hot-Molded Composition	50 Ohms to 10 Megohms ±10%, ±20%	1.0 Watt @ 70° C					
	Conductive Plastic	100 Ohms to 1 Megohm ±10%, ±20%	0.5 Watt @ 70° C					
J(RV4 and 2RV7)	Hot-Molded Composition	50 Ohms to 5 Megohms ±10%, ±20%	2.25 Watts @ 70° C	500V	−55° C to +120° C	1, 2 or 3	0.625 (15,88) Deep by 1.156 (29,36) Diameter (Single Section) [1]	
EJ			2.25 Watts @ 70° C			1 or 2		
G(RV6)		100 Ohms to 5 Megohms ±10%, ±20%	0.5 Watt @ 70° C	350V	−55° C to +120° C	1	For G and W 0.469 (11,91) Deep For WR: 0.422 (10,72) Deep by 0.500 (12,70) Diameter Above dimensions for types G and WR do not include the available switch option. [1]	Immersion Sealed
W(RV6)			0.5 Watt @ 70° C		−55° C to +120° C	1		
WR			0.5 Watt @ 70° C					Dust and Splash Resistant
SP	Cermet	50 Ohms to 1 Megohm ±10% (5% available)	1.0 Watt @ 70° C	300V	−65° C to +150° C		0.438 (11,11) Deep by 0.375 (9,52) Diameter	Immersion Sealed
2000	Conductive Plastic	250 Ohms to 1 Megohm ±20%	0.5 Watt @ 70° C	350V	−55° C to +125° C	1	0.625 (15,88) Square	Sealed for Board Washing

[1] All depth dimensions are maximum.

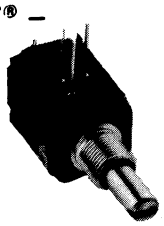
ALLEN-BRADLEY
A ROCKWELL INTERNATIONAL COMPANY

Series 70 MOD POT® – Modular design innovated by Allen-Bradley offers almost unlimited combinations: single, dual, triple or quadruple sections. Options include PC or solder lug terminals, variety of switches, vernier drives, concentric shafts, hot-molded composition, cermet or conductive plastic resistance elements.

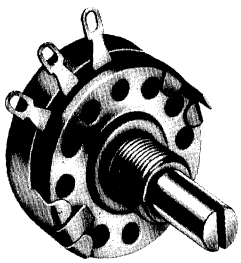


Series 72 MOD POT® – Similar to Series 70, except the bushing and shaft are non-metallic. Available in single or dual combination only.

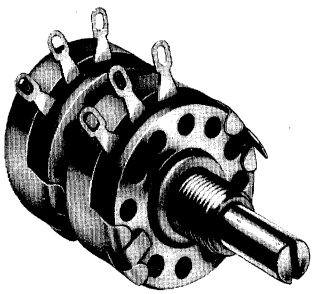
Series 73 MOD POT® – Similar to Series 70, except the bushing is of a more economical design. Available in single, dual, triple or quadruple sections.



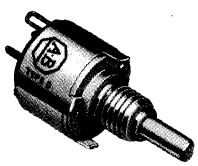
Type J (RV4 and 2RV7) – Standard of the industry for quality. Hot-molded composition, 50 ohms to 5 megs, ±10% and ±20% (special values to 1000 megs available), 2.25W at 70°C, single, dual, triple sections available. Switch for single or dual sections.



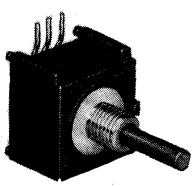
Type EJ – Extra long life version of the Type J with rotational life exceeding one million rotations, single or dual configurations. Slip clutch available.



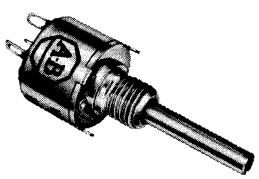
Type G (RV6) – Hot-molded composition, 100 ohms to 5 megs, ±10% and ±20%, 0.5W at 70° C, single section available with or without SPST switch.



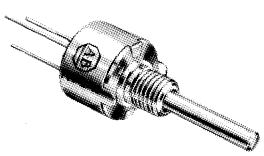
Type 2000 – Designed cost-effective in conductive plastic. 250 ohms to 1 meg, ±20%, 0.5W at 70° C single section. Three terminal options. Sealed for board washing. Non-metallic case and shaft. Choice of bushing.



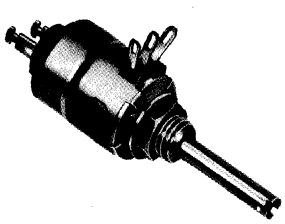
Type W (RV6) – Hot-molded composition, 100 ohms to 5 megs, ±10% and ±20%, 0.5W at 70° C, single section.



Type WP – Pin-terminal version of Type W. Suited for printed circuit board mounting.



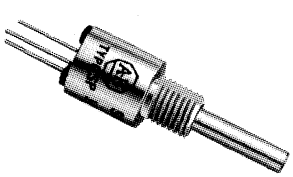
Type WR – Radial-lead version of Type W. Available with or without switch. Switch versions offer contacts that close at start of clockwise rotation (TYPE WRS) or with switch with contacts that close at start of counter-clockwise rotation (TYPE WRH).



Standard options for most types include linear and non-linear tapers, a variety of shafts, bushings, shaft endings, shaft lengths, and hardware.

Types J and the multi-section MOD POT® with composition tracks are well suited for attenuator applications.

Type SP – Cermet, 50 ohms to 1 meg, ±10%, 1.0W at 70° C, single section. Only 3/8 inch diameter.



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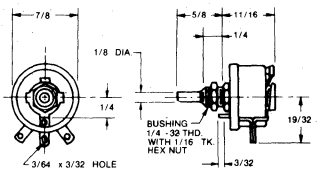
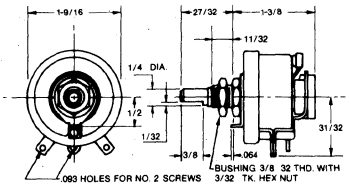
ANGSTROHM

POWER RHEOSTATS



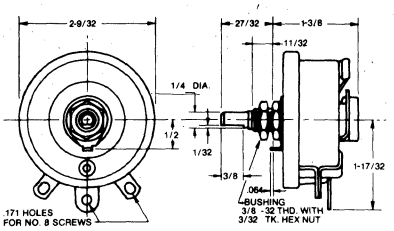
Diameter 7/8" ... Depth behind panel 11/16" ... Shaft 1/8" diameter ... Rotation 300°, ±5°. Mounts on panels up to 1/8" by means of 1/4"-32 bushing and hex nut ... Non-turn lugs require 1/8" hole 1/4" below center of shaft (Type "A" shaft). Weight: 0.037 lb., 17 Gms.

Total Ohms	Max. Amps	Approx. Steps
1.0	3.53	29
2.0	2.50	42
2.5	2.24	38
3.0	2.04	44
5.0	1.58	40
6.0	1.44	48
8.0	1.25	51
10.0	1.12	51
15.0	0.91	51
25.0	0.71	73
35.0	0.60	75
50.0	0.50	86
75.0	0.41	103
100.0	0.35	108
125.0	0.32	128
150.0	0.29	128
175.0	0.27	148
200.0	0.25	130
250.0	0.22	166
350.0	0.19	185
500.0	0.16	215
750.0	0.13	255
1000.0	0.11	260
1500.0	0.091	310
2500.0	0.071	321
3500.0	0.060	378
5000.0	0.050	430



Diameter 1 9/16" ... Depth behind panel 1 3/8" ... Shaft 1/4" diameter ... Rotation 300°, ±5°. Mounts on panels up to 1/4" by means of 3/8"-32 bushing and hex nut ... Non-turn lugs require 3/16" hole 1/2" below center of shaft (Type "A" shaft). Weight: 0.180 lb., 82 Gms.

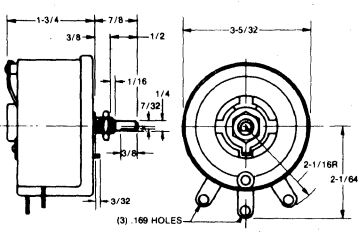
Total Ohms*	Max. Amps	Approx. Steps
1.0	5.00	28
2.0	3.54	31
3.0	2.89	48
6.0	2.04	51
8.0	1.77	54
10.0	1.58	54
15.0	1.29	64
25.0	1.00	86
35.0	0.85	105
50.0	0.71	115
75.0	0.58	135
100.0	0.50	152
125.0	0.45	143
175.0	0.38	160
250.0	0.32	185
350.0	0.27	205
500.0	0.22	230
750.0	0.18	270
1000.0	0.16	292
1500.0	0.13	353
2500.0	0.10	358
3500.0	0.08	392
5000.0	0.07	440



Diameter 2 9/32" ... Depth behind panel 1 3/8" ... Shaft 1/4" diameter ... Rotation 300°, ±5°. Mounts on panels up to 1/4" by means of 3/8"-32 bushing andhex nut ... Non-turn lugs require 3/16" hole 1/2" below center of shaft (Type "A" shaft). Weight: 0.321 lb., 145 Gms.

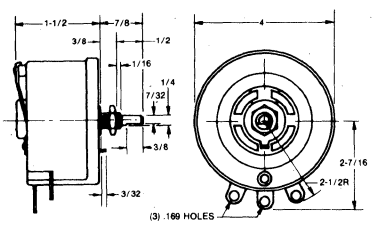
Total Ohms	Max. Amps	Approx. Steps
0.5	10.00	24
1.0	7.07	46
2.0	5.00	50
4.0	3.54	44
6.0	2.89	74
8.0	2.50	85
12.0	2.04	108
16.0	1.76	108
22.0	1.50	123
35.0	1.19	148
50.0	1.00	113
80.0	0.79	147
125.0	0.63	178
150.0	0.58	173
225.0	0.47	203
300.0	0.41	214
500.0	0.32	290
800.0	0.25	365
1000.0	0.22	358
1600.0	0.18	367
2500.0	0.14	460
3500.0	0.12	505
5000.0	0.10	565
8000.0	0.08	695
10000.0	0.07	693

RESISTANCE VALUES



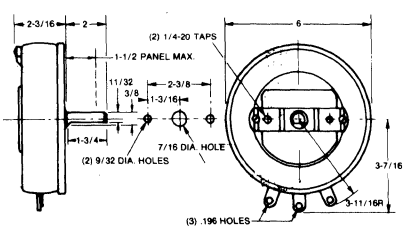
Diameter 3 5/32" ... Depth behind panel 1 1/2" ... Shaft 1/4" diameter ... Rotation 300°, ±5° ... Mounts on panels up to 1/4" by means of 3/8"-32 bushing and hex nut ... Non-turn lugs require a 3/16" hole 1/2" below center of shaft (Type "A" shaft). Weight: 0.594 lbs., 268 Gms.

Total Ohms	Max. Amps	Approx. Steps
0.5	14.140	30
1.0	10.000	30
2.0	7.071	56
3.0	5.774	66
5.0	4.472	56
7.5	3.652	66
10.0	3.162	104
15.0	2.582	113
25.0	2.000	144
50.0	1.414	180
75.0	1.155	180
100.0	1.000	216
200.0	0.707	252
300.0	0.577	252
400.0	0.500	252
500.0	0.447	324
750.0	0.365	396
1000.0	0.316	410
2000.0	0.224	410
2500.0	0.200	410
5000.0	0.141	685
7500.0	0.115	820
10000.0	0.100	820



Diameter 4" ... Depth behind panel 1 3/4" ... Shaft 1/4" diameter ... Rotation 300°, ±5° ... Mounts on panels up to 1/4" by means of 3/8"-32 bushing and hex nut ... Non-turn lugs require a 3/16" hole 1/2" below center of shaft (Type "A" shaft). Weight: 1.014 lbs., 460 Gms.

Total Ohms*	Max. Amps	Approx. Steps
0.5	17.350	35
1.0	12.247	39
2.0	8.660	39
3.0	7.071	70
5.0	5.477	73
7.5	4.472	70
10.0	3.873	70
15.0	3.162	120
25.0	2.449	152
50.0	1.732	190
75.0	1.414	228
100.0	1.225	228
200.0	0.866	265
300.0	0.707	303
400.0	0.612	342
500.0	0.548	342
750.0	0.447	418
1000.0	0.387	432
2000.0	0.274	575
2500.0	0.244	456
5000.0	0.173	865
7500.0	0.141	1000
10000.0	0.122	1000



Diameter 6" ... Depth behind panel 2 3/16" ... Shaft 3/8" diameter ... Rotation 315°, ±5° ... Mounts on panels up to 1 1/4" by means of mounting bracket with two 1/4"-20 flat head screws (Type "A" shaft). Weight: 2.625 lbs., 1.191 Kg.

Total Ohms*	Max. Amps	Approx. Steps
1.0	17.320	40
1.5	14.142	58
2.0	12.247	78
2.5	10.954	78
3.0	10.000	73
4.0	8.660	78
5.0	7.745	78
7.5	6.324	148
10.0	5.477	154
15.0	4.472	147
25.0	3.464	155
35.0	2.927	231
50.0	2.449	267
75.0	2.000	308
100.0	1.732	326
150.0	1.414	270
200.0	1.224	308
300.0	1.000	340
400.0	0.866	370
500.0	0.774	455
750.0	0.632	514
1000.0	0.547	578
1500.0	0.447	675
2500.0	0.346	720

* Higher ranges available to 25,000 Ohms

All other intermediate resistance values are available and can be manufactured on normal delivery cycle.

VISHAY

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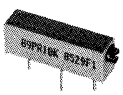
Beckman Industrial Quick Reference Guide

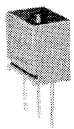
HELITRIM® CERMET TRIMMING POTENTIOMETERS

RECTANGULAR MULTI-TURN

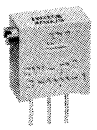


Model Series 89 Low Profile
Length:
0.75 In.
Resistance, Range:
10 to 2 Meg. Ohms
Resistance, Tolerance:
±10%
(<100 Ohms=±20%)
Resistance, Temperature Coefficient:
±100 ppm/°C
Power Rating:
0.75 Watts at 70°C
0 Watts at 125°C
Seal:
85°C Fluorinert®
Pin Styles:
Side Adjust

SQUARE MULTI-TURNS



Model Series 64
Dimension:
0.25 In. Sq.
Resistance, Range:
10 to 1 Meg. Ohms
Resistance, Tolerance:
±10%
(<100 Ohms=±20%)
Resistance, Temperature Coefficient:
±100 ppm/°C
Power Rating:
0.25 Watts at 85°C
0 Watts at 125°C
Seal:
85°C Fluorinert®
Pin Styles:
Side Adjust
Top Adjust

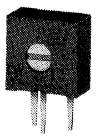


Model Series 67
Dimension:
0.375 In. Sq.
Resistance, Range:
10 to 2 Meg. Ohms
Resistance, Tolerance:
±10%
(<100 Ohms=±20%)
Resistance, Temperature Coefficient:
±100 ppm/°C
Power Rating:
0.5 Watts at 70°C
0 Watts at 125°C
Seal:
85°C Fluorinert®
Pin Styles:
Side Adjust
Top Adjust

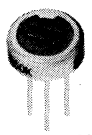
SURFACE MOUNT

Model Series 83
Length:
0.185 In.
Resistance, Range:
10 to 1 Meg. Ohms
Resistance, Tolerance:
±10%
(<100 Ohms=±20%)
Resistance, Temperature Coefficient:
±100 ppm/°C
Power Rating:
0.5 Watts at 70°C
0 Watts at 125°C
Seal:
85°C Fluorinert®
Pin Styles:
Side Adjust
Top Adjust

SINGLE TURNS



Model Series 72
Dimension:
0.375 In. Sq.
Resistance, Range:
10 to 2 Meg. Ohms
Resistance, Tolerance:
±10%
(<100 Ohms=±20%)
Resistance, Temperature Coefficient:
±100 ppm/°C
Power Rating:
0.5 Watts at 70°C
0 Watts at 125°C
Seal:
85°C Fluorinert®
Pin Styles:
Side Adjust
Top Adjust

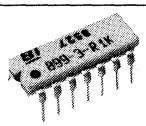


Model Series 82
Diameter:
0.25 In.
Resistance, Range:
10 to 1 Meg. Ohms
Resistance, Tolerance:
±10%
(<100 Ohms=±20%)
Resistance, Temperature Coefficient:
±100 ppm/°C
Power Rating:
0.5 Watts at 70°C
0 Watts at 125°C
Seal:
85°C Fluorinert®
Pin Styles:
Side Adjust
Top Adjust

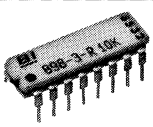
Model Series 91
Diameter:
0.375 In.
Resistance, Range:
10 to 2 Meg. Ohms
Resistance, Tolerance:
±20%
Resistance, Temperature Coefficient:
±100 ppm/°C
Power Rating:
0.5 Watts at 70°C
0 Watts at 125°C
Seal:
Dust Cover
Pin Styles:
Side Adjust
Top Adjust

RESNET® RESISTOR NETWORKS

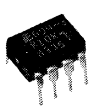
DUAL IN-LINE



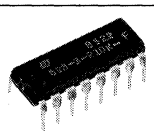
Model Series 899
Resistor Film Type: Thick
Lead:
Number–14
Type–Flat
Centers–0.10 In.
Length:
0.780 In.
Resistance, Range:
22-1 Meg. Ohms
Resistance, Tolerance:
±2% and ±5%
(≤33 Ohms=±1 Ohm)
Resistance, Temperature Coefficient, ppm/°C:
±100 (<100 Ohms=±250)
Resistance, Temperature Coefficient Tracking:
±50 ppm/°C
Power Rating
–Bussed Resistors:
0.125 Watts at 70°C
–Isolated Resistors:
0.250 Watts at 70°C



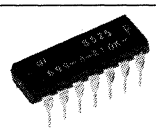
Model Series 898
Resistor Film Type: Thick
Lead:
Number–16
Type–Flat
Centers–0.10 In.
Length:
0.800 In.
Resistance, Range:
22-1 Meg. Ohms
Resistance, Tolerance:
±2% and ±5%
(≤33 Ohms=±1 Ohm)
Resistance, Temperature Coefficient, ppm/°C:
±100 (<100 Ohms=±250)
Resistance, Temperature Coefficient Tracking:
±50 ppm/°C
Power Rating
–Bussed Resistors:
0.125 Watts at 70°C
–Isolated Resistors:
0.250 Watts at 70°C



Model Series 694
Resistor Film Type: Thin
Lead:
Number–8
Type–Flat
Centers–0.10 In.
Length:
0.390 In.
Resistance, Range:
100 to 100K Ohms
Resistance, Tolerance:
±1.0% to ±0.10%
Resistance, Temperature Coefficient ppm/°C:
±50
Resistance, Temperature Coefficient Tracking:
±5 ppm/°C
Power Rating
–Bussed Resistors:
N/A
–Isolated Resistors:
0.150 Watts at 25°C



Model Series 699
Resistor Film Type: Thin
Lead:
Number–14
Type–Flat
Centers–0.10 In.
Length:
0.780 In.
Resistance, Range:
100 to 100K Ohms
Resistance, Tolerance:
±1.0% to ±0.10%
Resistance, Temperature Coefficient ppm/°C:
±50
Resistance, Temperature Coefficient Tracking:
±5 ppm/°C
Power Rating
–Bussed Resistors:
0.050 Watts at 25°C
–Isolated Resistors:
0.100 Watts at 25°C



Model Series 698
Resistor Film Type: Thin
Lead:
Number–16
Type–Flat
Centers–0.10 In.
Length:
0.780 In.
Resistance, Range:
100 to 100K Ohms
Resistance, Tolerance:
±1.0% to ±0.10%
Resistance, Temperature Coefficient ppm/°C:
±50
Resistance, Temperature Coefficient Tracking:
±5 ppm/°C
Power Rating
–Bussed Resistors:
0.050 Watts at 25°C
–Isolated Resistors:
0.100 Watts at 25°C

SINGLE IN-LINE

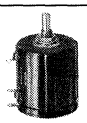
Model Series L
Resistor Film Type: Thick
Lead:
Number–4 to 14
Type: Flat
Centers–0.10 In.
Length:
0.105 In. x No. of Leads
Resistance, Range:
22 to 1 Meg. Ohms
Resistance, Tolerance:
±2% and ±5%
(≤33 Ohms=1 Ohm)
Resistance, Temperature Coefficient ppm/°C:
±100 (<100 Ohms= ±250)
Resistance, Temperature Coefficient Tracking:
±50 ppm/°C
Power Rating
–Bussed Resistors:
0.125 Watts at 70°C
–Isolated Resistors:
0.200 Watts at 70°C

HELIPOT® PRECISION POTENTIOMETERS

SINGLE-TURN

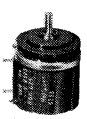
Model Series 6187
Body Diameter:
⅞ In.
Body Length:
0.455 In.
Mounting:
Bushing–⅜"-32
Shaft Diameter:
¼ In.
Shaft Length:
0.875 In.
Resistance, Range:
1K to 100K Ohms
Resistance, Tolerance:
±10%
Resistance, Temperature Coefficient:
–400 ppm/°C
Power Rating:
1 Watt at 70°C
0 Watts at 125°C

10-TURNS



Model Series A
Body Diameter:
1 13/16 In.
Body Length:
2.0 In.
Mounting:
Bushing–⅜"-32
Shaft Diameter:
¼ In.
Shaft Length:
0.812 In.
Resistance, Range:
10 to 648K Ohms
Resistance, Tolerance:
±3% (≤100= ±5%)
Resistance, Temperature Coefficient:
±20 ppm/°C
Power Rating:
5.0 Watts at 40°/C
0 Watts at 85°/C

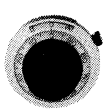
Model Series 7296
Body Diameter:
⅞ In.
Body Length:
0.75 In.
Mounting:
Bushing–⅜"-32
Shaft Diameter:
¼ In.
Shaft Length:
0.812 In.
Resistance, Range:
10 to 100K Ohms
Resistance, Tolerance:
±5%
Resistance, Temperature Coefficient:
±20 ppm/°C
Power Rating:
2.0 Watts at 70°/C
0 Watts at 125°/C



Model Series 8103
Body Diameter:
⅞ In.
Body Length:
0.875
Mounting:
Servo
Shaft Diameter:
⅛ In.
Shaft Length:
0.375 In.
Resistance, Temperature Coefficient:
±0.20 ppm/°C
Power Rating:
2.0 Watts at 70°/C
0 Watts at 125°/C

TURNS-COUNTING DIALS

DUODIAL® ANALOG DIALS



Model Series RB
Counting Capacity:
15 Turns, Max.
For Shaft Diameter:
¼ In.
For Bushing Diameter:
⅜ In.
Dial Diameter, Nominal:
1.812 In.
Depth, From Face of Panel:
1.02 In. Max.

Model Series 2606
Counting Capacity:
15 Turns, Max.
For Shaft Diameter:
¼ In.
For Bushing Diameter:
⅜ In.
Dial Diameter, Nominal:
0.875 In.
Depth, From Face of Panel:
1.02 In. Max.

DIGIDIAL® DIGITAL READING DIALS

Model Series 2157
Counting Capacity:
10 Turns, Max.
For Shaft Diameter:
¼ In.
For Bushing Diameter:
0.470 In. Max.
Height, Nominal:
1.95 In.
Width, Nominal:
1.00 In.
Depth, From Face of Panel:
1.050 In.

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FAX: (714) 447-2500

BOURNS

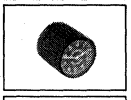
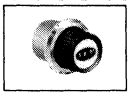
Bourns® Dials; Pushbutton and Knobpot® Potentiometers

PUSH-BUTTON POTENTIOMETERS

3680 Series
Cermet

Decades	Model	Resistance	Resolution
1	3681	10 to 10k ohms	10%
2	3682	100 ohms to 1 megohm	1.0%
3	3683	1k ohms to 1 megohm	0.1%
4	3684	10k ohms to 1 megohm	0.01%
5	3685	100k ohms to 1 megohm	0.001%

KNOBPOT® POTENTIOMETERS

		Resistance	Power Rating	Dia
3600 Wirewound		100 to 100k ohms	1.5 watts @ 25°C	3/4"
3610 Wirewound		100 to 100k ohms	1.5 watts @ 25°C	7/8"
3640 Wirewound		100 to 100k ohms	2.5 watts @ 25°C	1-1/4"
3650 Wirewound		100 to 100k ohms	2.5 watts @ 25°C	1-1/4"

DIALS

H-507-6
7/8" dia

CT23
1-5/64" dia

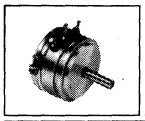
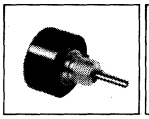
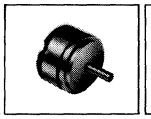
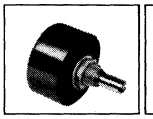
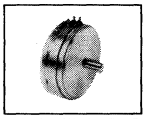
H-490
1" dia

CT26
1-7/32" dia

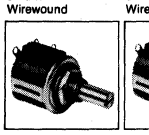
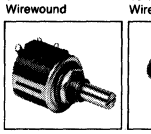
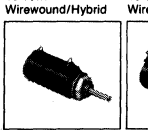
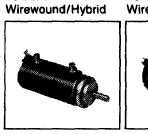
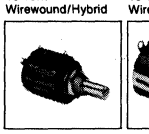
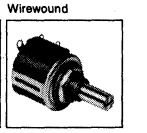
Bourns, Inc., 1200 Columbia Avenue, Riverside, California 92507; (714) 781-5050; TLX: 676-423; TWX: 910-332-1252; FAX: 714-781-5700. European Headquarters: Zugerstrasse 74, 6340 Baar, **Switzerland:** 042-333333; TLX: 868722; FAX: 042-319017. **Benelux:** 070-874400; TLX: 32023. **France:** 01-40033604; FAX: 01-40033614. **Germany:** 0711-22930; FAX: 0711-291568. **Ireland:** 021-357001; FAX: 021-357443. **United Kingdom:** 0276-692392; FAX: 0276-691037. Asia Pacific Headquarters: 1401 Citicorp Centre, 14th Floor, 18 Whitfield Road, **Hong Kong:** (852) 5-702171; TLX: 82953 BAPHK HX; FAX: 852-5-664341; CBL: BOURNSASPA HONGKONG. **Singapore:** (65) 339-3331; FAX: (65) 339-1116.

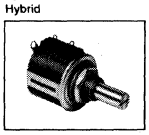
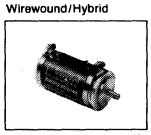
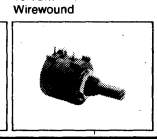
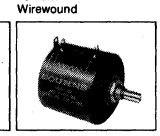
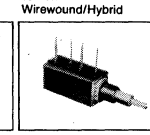
Specifications are subject to change without notice.

Bourns® Single-Turn Precision Potentiometers

	6534 Conductive Plastic Servo Mount	**6637/6638** Conductive Plastic Bushing Mount	**6538** Conductive Plastic Servo Mount	**6657** Conductive Plastic Bushing Mount	**6574** Conductive Plastic Servo Mount
					
Resistance	1k to 100k ohms	1k to 100k ohms	1k to 100k ohms	1k to 100k ohms	1k to 100k ohms
Power Rating @ 70°C	1.0 watt	1.0 watt	1.0 watt	1.5 watts	2.0 watts
Independent Linearity	±0.5%	±1.0%	±1.0%	±1.0%	±.25%
Rotational Life	25x10⁶ revolutions	**6637** 10x10⁶ revolutions **6638** 20x10⁶ revolutions	20x10⁶ revolutions	10x10⁶ revolutions	25x10⁶ revolutions
Size	7/8" diameter x 15/32"	7/8" diameter x 7/16"	7/8" diameter x 15/32"	1-5/16" diameter x 5/8"	2" diameter x 19/32"

Bourns® Multiturn Precision Potentiometers

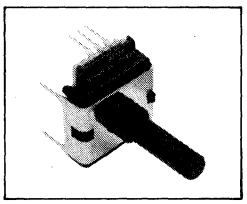
	3543 3-Turn Wirewound	**3545** 5-Turn Wirewound	**3700/3701** 10-Turn Wirewound/Hybrid	**3750/3751** 10-Turn Wirewound/Hybrid	**3500/3501** 10-Turn Wirewound/Hybrid	**3540** 10-Turn Wirewound
						
Resistance	20 to 50k ohms	50 to 50k ohms	**3700** 100 to 100k ohms **3701** 1k to 50k ohms	**3750** 100 to 100k ohms **3751** 1k to 50k ohms	**3500** 50 to 200k ohms **3501** 1k to 100k ohms	100 to 100k ohms
Power Rating @ 70°C	1.0 watt	1.5 watts	1.0 watt	1.0 watt	2.0 watts	2.0 watts
Independent Linearity	±0.25%	±0.25%	±0.25%	±0.25%	**3500** ±0.2% **3501** ±0.25%	±0.25%
Rotational Life	0.3x10⁶ revolutions	0.5x10⁶ revolutions	**3700** 1x10⁶ revolutions **3701** 4x10⁶ revolutions	**3750** 1x10⁶ revolutions **3751** 10X10⁶ revolutions	**3500** 2x10⁶ revolutions **3501** 4x10⁶ revolutions	1x10⁶ revolutions
Size	7/8" diameter x 3/4"	7/8" diameter x 3/4"	1/2" diameter x 1"	1/2" diameter x 1"	7/8" diameter x 1"	7/8" diameter x 3/4"

	3541 10-Turn Hybrid	**3550/3551** 10-Turn Wirewound/Hybrid	**3590** 10-Turn Wirewound	**3400** 10-Turn Wirewound	**83/84** 10-Turn Wirewound/Hybrid
					
Resistance	1k to 100k ohms	**3550** 100 to 200k ohms **3551** 1k to 100k ohms	200 to 100k ohms	100 to 500k ohms	**Wirewound** 200 to 100k ohms **Hybrid** 1k to 100k ohms
Power Rating @ 70°C	2.0 watts	**3550** 2.5 watts **3551** 2.0 watts	2.0 watts @ 40°C 0 watts @ 125°C	5.0 watts @ 40°C	1.0 watt
Independent Linearity	±0.25%	±0.2%	±0.25%	±0.15%	±0.25%
Rotational Life	5x10⁶ revolutions	**3550** 2x10⁶ revolutions **3551** 10x10⁶ revolutions	1x10⁶ revolutions	2x10⁶ revolutions	**Wirewound** 1x10⁶ revolutions **Hybrid** 4x10⁶ revolutions
Size	7/8" diameter x 3/4"	7/8" diameter x 1-9/16"	7/8" diameter x 3/4"	1-13/16" diameter x 1-3/4"	5/8" square x 3/4"

BOURNS

Digital Contacting Encoders

Bourns® Contacting Encoders



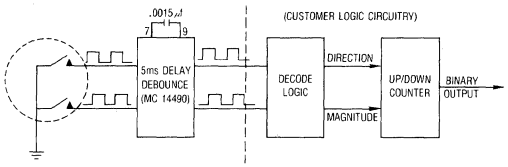
This new series of digital contacting encoders provides superior performance, at a fraction of the cost you're used to paying.

Each model features long operating temperature capabilities.

A wide selection of options are available, including 24-cycle quadrature output with 24 detent positions and 9-cycle quadrature output with 36 detent positions.

Digital contacting encoders are another example of what's new from Bourns Precisions/Controls.

RECOMMENDED INCREMENTAL CONTROL DIAGRAM



Electrical Characteristics

Output	2 bit Gray Code, Channel A leads Channel B by 90° electrically turning clockwise (CW)
Closed Circuit Resistance	5 ohms maximum
Open Circuit Resistance	100K ohms minimum
Contact Rating	10 milliamp @ 10 VDC or 0.1 watt maximum
Insulation Resistance (500 VDC)	1,000 megohms minimum
Dielectric Withstanding Voltage	MIL-STD-202 Method 301
Sea Level	1,000 VAC minimum
Electrical Travel	Continuous
Contact Bounce (15 RPM)	5 milliseconds maximum
RPM (Operating)	120 maximum

Environmental Characteristics

Storage Temperature Range	−40°C to +140°C
Operating Temperature Range	−15°C to +125°C
Humidity	MIL-STD-202, Method 103B, Condition B
Vibration	15 G
Contact Bounce	0.1 millisecond maximum
Shock	50 G
Contact Bounce	0.1 millisecond maximum
Rotational Life	200,000 shaft revolutions

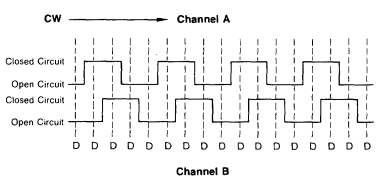
Mechanical Characteristics

Mechanical Angle	Continuous
Weight	Approximately 0.75 oz.
Torque	0.75 to 2.5 oz-in.
Shaft Side Load (Static)	10 lbs minimum

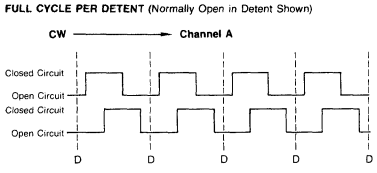
QUADRATURE OUTPUT TABLE

This table is intended to show available outputs as currently defined.

1/4 CYCLE PER DETENT

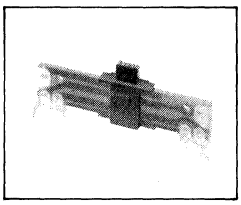


FULL CYCLE PER DETENT (Normally Open in Detent Shown)



Open-Frame Slide Potentiometers

Bourns® Slide Potentiometers

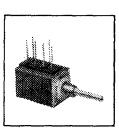
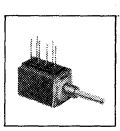
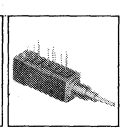
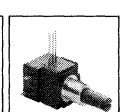
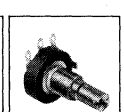
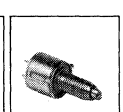


10, 15, 20, AND 30MM LOW PROFILE

- Minimal installation space for maximum design flexibility
- Linear or audio taper versions
- Wide assortment of options

SPECIFICATIONS \ MODEL	OPEN FRAME SLIDE POTENTIOMETERS			
	10MM	15MM	20MM	30MM
ELECTRICAL				
Standard Resistance Range (ohms) Linear	1K 2K 5K 10K 20K 50K 100K 200K		2K 5K 10K 20K 50K 100K 200K 500K	
Standard Resistance Range (ohms) Audio	2K 5K 10K 20K 50K 100K 200K		5K 10K 20K 50K 100K 200K 500K	
Resistance Tolerance	±20%, All Resistances/Tapers			
Resistance Taper Linear	B and Y Tapers (see taper curves)			
Resistance Taper Audio	D and G Tapers (see taper curves)			
Independent Linearity	±5% for B Tapers (see curves for Y, D and G tapers)			
Absolute Minimum Resistance	1% or 100 ohms, whichever is less, for B taper			
Continuity	Maintained for full stroke			
Effective Electrical Travel	80% of Mechanical Travel	85% of Mechanical Travel	90% of Mechanical Travel	90% of Mechanical Travel
Peak Noise (CRV) Linear/Audio	3% / 6%	2% / 5%	2% / 5%	2% / 5%
Theoretical Resolution	Essentially Infinite			
Dielectric Strength (Sea Level)	500 VAC, 1 Minute, between Lever and Terminals			
Insulation Resistance (500 VDC)	1,000 Megohms Minimum between Lever and Terminals			
Power Rating at 70°C Linear	0.05 Watt	0.05 Watt	0.1 Watt	0.1 Watt
Power Rating at 70°C Audio (0 Watt at 90°C)	0.025 Watt	0.025 Watt	0.05 Watt	0.05 Watt
Maximum Working Voltage	Power Dissipation or 350 VAC, Whichever is Less			
Tracking Error (Dual Only)	4 dB Maximum; 0 to −40 dB			
MECHANICAL				
Operating Force	15 to 150 Gr			
Stop Strength	1.5 Kg Minimum			
Stroke	10mm	15mm	20mm	30mm
Terminals	PC Pins (Vertical or Horizontal)			
Marking	Trademark, Date Code, Taper and Resistance (ex. B10K) and Japan			
ENVIRONMENTAL				
Storage Temperature	−20°C to +90°C			
Temperature Coefficient of Resistance	±1,000ppm/°C			
Vibration (10 to 55Hz, 1.5mm)	Voltage Ratio Change: ±5% Maximum. Total Resistance Shift: ±2% Maximum			
Load Life (Rated Power at 25°C for 1,000 Hours)	(Pre-conditioning: 55°C, 20% RH, 24±4 Hours) Total Resistance Shift: ±10%			
Sliding Life (No Load - 15,000 Cycles)	Total Resistance Shift: ±5% = Linear; 2K, 5K, 10K, 20K, 50K ±10% = Linear; 100K, 200K, 500K & Audio; 2K to 500K			
Moisture Resistance (96 Hours @ 40°C 90-95% RH, Rated Power)	Total Resistance Shift: Linear ±12% Maximum, Audio ±20% Maximum Insulation Resistance: 100 Megohms Minimum			
Soldering Heat (3 Seconds @ 350°C)	Total Resistance Shift: ±5% Maximum			

Bourns® Panel Controls

81/82	87/88	85/86*	91/92/93/ 94/95/96	97/98/99*	3851/3852	3862
						
•5/8" square •Modular construction •Single or multiple sections •Linear or audio tapers •Concentric or single shafts, metal •Cermet •Conductive plastic	•5/8" square •Modular construction •Single or multiple sections •Semi-precision linear tapers •Concentric or single shafts, metal •Cermet •Conductive plastic	•5/8" square •Modular construction •Multiple sections •DPST and DPDT rotary switches* •Concentric or single shafts, metal •Cermet •Conductive plastic	•5/8" square •Modular construction •Single or dual sections •Linear or audio tapers •Single shaft, plastic •Sealed (96 only) •Cermet •Conductive plastic	•5/8" square •Modular construction •Dual section •DPST and DPDT rotary switches •Single shaft, plastic •Cermet •Conductive plastic	•3/4" diameter •1/4" depth •Single section •Linear or audio tapers •Single shaft, metal •Cermet •Conductive plastic	•1/2" diameter •Rear terminals •Single section •Linear taper •1/8" diameter single shaft, metal •Cermet

Specifications are subject to change without notice.

BOURNS

Industrial Grade Trimpot® Potentiometers

SQUARE, MULTITURN, SEALED

Board Space	Product	Model Number	Element Type	Turns	Pin Styles
.500 (12.70)		3250	Wirewound	25	L,P,W W-66 (X)
		3252	Cermet	25	L,P,W,X
.375 (9.53)		3290	Wirewound	25	H,P,W
		3292	Cermet	25	L,P,W,X
		3299	Cermet	25	P,W,X,Z,Y
		3296	Cermet	25	P,W,X,Y,Z W,X (T&R)
.35 (8.89)		3272 (SMD)	Cermet	12	A,C
.250 (6.35)		3260	Wirewound	11	H,W
		3262	Cermet	12	P,W,X
		3266	Cermet	12	W,X Y,Z (T&R)
		3269 (SMD)	Cermet	12	P,W,X

SQUARE, SINGLE-TURN, SEALED

Board Space	Product	Model Number	Element Type	Terminal Styles
.375 (9.53)		3386	Cermet	H,X,S,B,W,C F,Y,P,R,M,T W (T&R)
		3386 HV1	Cermet	N,U
.250 (6.35)		3323	Cermet	P,W,X,S,U
		3362	Cermet	H M,U (T&R)
.200 (5.08)		3335 (SMD)	Cermet	W,X

ROUND, SINGLE-TURN, SEALED

.450 (11.43)		3345	Wirewound	W,P
.300 (7.62)		3339 (4 Turns)	Cermet	H,P,S,W
.250 (6.35)		3325 (SMD)	Cermet	P,W,X
		3329	Cermet	H,P,W,X,S M,U T&R)

RECTANGULAR, MULTITURN, SEALED

Board Space	Product	Model Number	Element Type	Turns	Pin Styles
1.250 (31.75)		3057	Wirewound	22	L,P,J,Y
		3059	Cermet	22	L,P,J,Y
.785 (20.00)		20	Cermet	15	P
.750 (19.05)		3005	Wirewound	20	P
		3006	Cermet	15	P,W,Y
		3009	Cermet	15	P,Y
		3099 (DIP)	Cermet	20	P
.500 (12.70)		3082	Cermet	10	P

SQUARE, SINGLE-TURN, OPEN STYLE

Board Space	Product	Model Number	Element Type	Terminal Styles
.150 (3.8)		3304 (SMD)	Cermet	W,X

ROUND, SINGLE-TURN, OPEN STYLE

.375 (9.53)		3352	Cermet	K,H,V,W,E,P,T
		3359	Cermet	P,W
.354 (9.00)		3309	Cermet	P,W
.268 (6.8)		3306	Cermet	P,W

Bourns, Inc., 1200 Columbia Avenue, Riverside, California 92507; (714) 781-5050; TLX: 676-423; TWX: 910-332-1252; FAX: 714-781-5700. European Headquarters: Zugerstrasse 74, 6340 Baar, **Switzerland:** 042-333333; TLX: 868722; FAX: 042-319017. **Benelux:** 070-874400; TLX: 32023. **France:** 01-40033604; FAX: 01-40033614. **Germany:** 0711-22930; FAX: 0711-291568. **Ireland:** 021-357001; FAX: 021-357443. **United Kingdom:** 0276-692392; FAX: 0276-691037. Asia Pacific Headquarters: 1401 Citicorp Centre, 14th Floor, 18 Whitfield Road, **Hong Kong:** (852) 5-702171; TLX: 82953 BAPHK HX; FAX: 852-5-664341; CBL: BOURNSASPA HONGKONG. **Singapore:** (65) 339-3331; FAX: (65) 339-1116.

Specifications are subject to change without notice.

BOURNS

Tape and Reel Packaged Trimpot® Potentiometers

Model 3266
1/4" square multiturn
Vertical and horizontal adjust
Available in two pin configurations

Model 3296
3/8" square multiturn
Vertical and horizontal adjust
Available in two pin configurations
Optional packaging available:
new ammo pack

Model 3304
4mm square single-turn
Horizontal adjust
Available in two pin configurations

Model 3329
1/4" diameter single-turn
Vertical and horizontal adjust
Available in two pin configurations

Model 3335
5mm square single-turn
Horizontal adjust
Available in five configurations

Model 3362
1/4" square single-turn
Vertical and horizontal adjust
Available in two pin configurations

Model 3386
3/8" square single-turn
Horizontal adjust
Optional packaging available:
new ammo pack

Military Grade Trimpot® Potentiometers

RECTANGULAR, MULTITURN, SEALED

Board Space	Product	Model Number	Element Type	Turns	Grade	Pin Styles
1.250 (31.75)		RTR12	Wirewound	22	Hi-Rel Military	L,P,Y
		RT12	Wirewound	22	Military	L,P,Y
		RJR12	Cermet	22	Hi-Rel Military	L,Y
		RJ12	Cermet	22	Military	L,P,Y
.500 (12.70)		RJR28	Cermet	10	Hi-Rel Military	P

SQUARE, MULTITURN, SEALED

Board Space	Product	Model Number	Element Type	Turns	Grade	Pin Styles
.500 (12.70)		RTR22	Wirewound	25	Hi-Rel Military	L,P,W,X
		RT22	Wirewound	25	Military	L,P,W,X
		RJ22	Cermet	25	Military	L,P,W,X
.375 (9.53)		RTR24	Wirewound	25	Hi-Rel Military	P,W,X
		RT24	Wirewound	25	Military	P,W,X
		RJR24	Cermet	22	Hi-Rel Military	P,W,X
		RJ24	Cermet	22	Military	L,P,W,X
.250 (6.35)		RT26	Wirewound	11	Military	W,X
		RJR26	Cermet	12	Hi-Rel Military	P,W,X
		RJ26	Cermet	12	Military	P,W,X

ROUND, SINGLE-TURN, SEALED

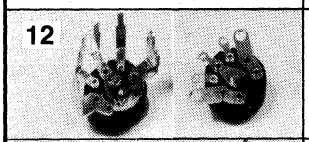
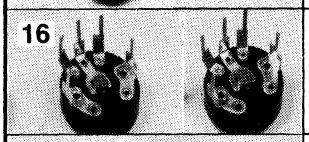
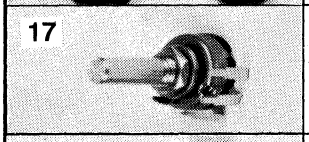
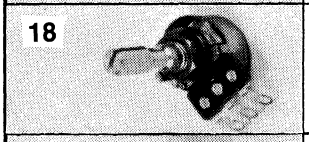
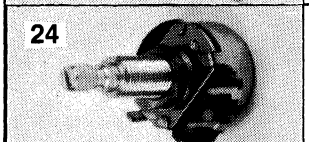
.250 (6.35)		RJR50	Cermet	1	Hi-Rel Military	P
		RJ50	Cermet	1	Military	P

Surface Mounted Trimpot® Potentiometers

		TYPE		CONFIGURATION				ADJUSTMENT				PKG
		SEALED	OPEN	LEADLESS CHIP	"J" LEAD	GULL WING	LEADED	TOP ADJUST	SIDE ADJUST	MULTITURN	SINGLE-TURN	EMBOSSED TAPE
Model 3269 1/4" square	• Recommended for reflow solder processing only • Plastic tube and tray packaging	•				•	•	•	•	•		
Model 3272 .350" square	• JEDEC package • Exceptional setting stability • Packaged in plastic trays	•				•			•	•		•
Model 3304 4mm square	• Unique cross-slot rotor • Two packaging styles • Supplied in 12mm embossed tape		•	•				•			•	•
Model 3325 1/4" diameter	• Stable, infinite resolution cermet element • Plastic tube and tray packaging	•				•	•	•	•		•	
Model 3335 5mm square	• 12mm embossed tape packaging • Auto adjust rotor • Recommended for reflow solder processing only	•			•	•	•	•			•	•

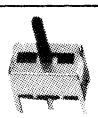
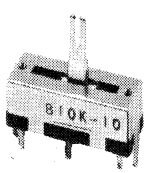
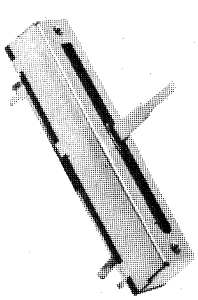
CORD ELECTRONICS INCORPORATED
177 Cantiague Rock Road, Westbury, N.Y. 11590 U.S.A.
Phone: (516) 935-3640 • Tlx: 4758020 • Fax: (516) 935-0780

ROTARY SLIDE TRIMMING CARBON COMPOSITION

SERIES	DIAMETER IN/MM	RESISTANCE RANGE (KΩ)(+/−20%)	POWER RATING (WATTS)	SHAFT TYPE	SWITCH TYPE	SWITCH RATING	TERMINAL TYPE P-PCB, S-SOLDER	ANGLE OF ROTATION (+/−10%)
12 	1/2/12	.5-500	0.1	SQ	ROTARY SPST	12VDC/1A	P/S	230°
16 	5/8/16	.5-1000	0.1	N/A	ROTARY SPST	12VDC/1A	P/S	260°
17 	43/64/17	.5-1000	0.1	S,R,F	ROTARY SPST	12VDC/1A	P/S	260°
18 	21/32/16.8	.5-1000 AVAILABLE WITH DUAL ELEMENT	0.2	S,F,R	ROTARY SPST	125 VAC/1A	P/S	300°
24 	15/16/24	1-3000 AVAILABLE WITH DUAL ELEMENT AND DUAL ELEMENT WITH SWITCH.	0.5	S,F,R	ROTARY SPST SPST SPST DPST DPST DPDT PUSH-PUSH	125VAC/1A 125VAC/3A 250VAC/1A 125VAC/3A 125VAC/1A 125VAC/1A 125VAC/3A	P/S	300°

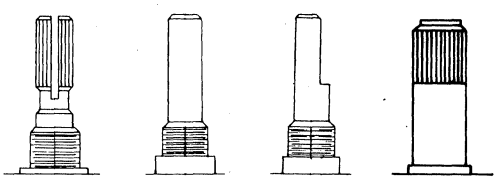
ROTARY POTS:
DETENTS–SERIES 18 AND 24
CENTER,11, 41

SLIDE POTS:
CENTER DETENTS-20, 30, 45, 60
11 DETENTS-30 21 DETENTS-45

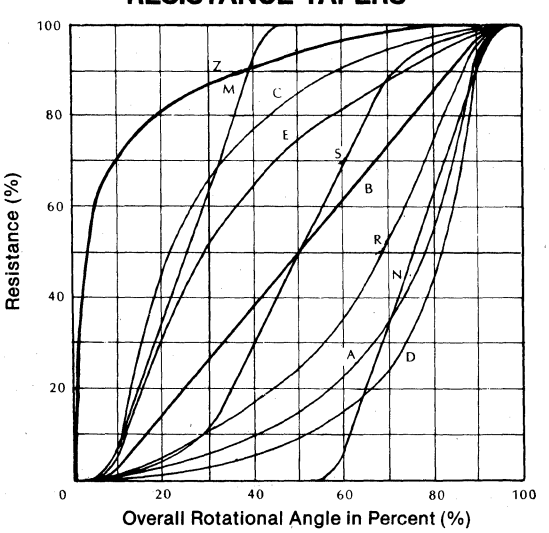
SLIDE POTS	TRAVEL (MM)	TERMINAL TYPE P-PCB, S-SOLDER	DUAL AVAIL.
SV10 	10	P	YES
SV20 	20	P	YES
		S	YES
SV30 	30	P	YES
		S	YES
SV45	45	P	YES
		S	YES
SV60	60	P	YES
		S	YES
SV100	100	P	YES
		S	YES

RESISTANCE RANGE: 500Ω-2MΩ

SHAFT TYPES

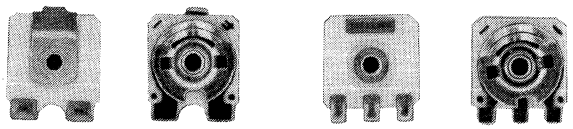


RESISTANCE TAPERS



DALE®

SURFACE MOUNTED CHIP POTENTIOMETERS



MODELS ST-22, ST-23

FEATURES

- Designed for efficient, accurate miniaturization
- Can be wave or dip soldered without rotor problems
- Coded marking for easy identification of resistance value
- Models for standard, automatic or reverse adjustment
- 12mm tape and reel packaging

STANDARD RESISTANCE VALUES

Ohms	Ohms	Ohms
100	2K	50K
200	5K	100K
500	10K	200K
1K	20K	500K
		1 Meg.

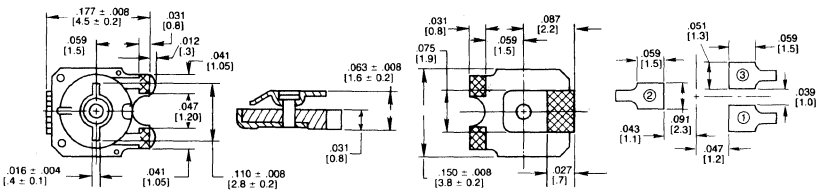
SPECIFICATIONS

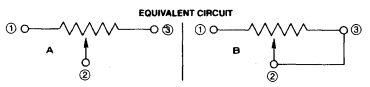
Resistance Values	100Ω-1MΩ
Resistance Tolerance	±30%
Rated Power	0.2W (70°C)
Rated Voltage	100 VDC
Rotation Life	20 Rotations
Torque	20 to 200 g/cm
Rotation Angle	270 ± 20° Total
Operating Temp. Range	−40°C to +100°C
TCR	±250 PPM
CRV	5% Max.

DIMENSIONAL & TERMINAL CONFIGURATIONS [Numbers in brackets indicate millimeters]

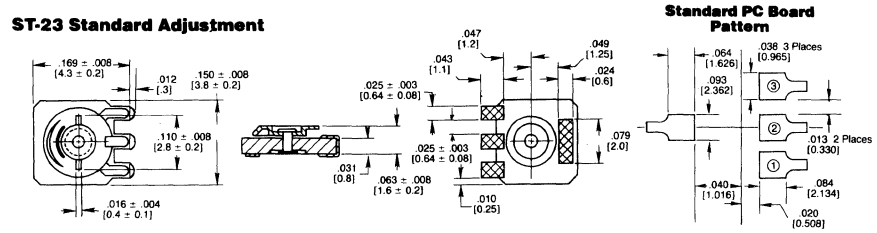
NOTE: Numbers without specified tolerance are for reference only.

ST-22 Standard Adjustment

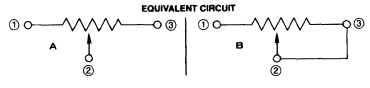




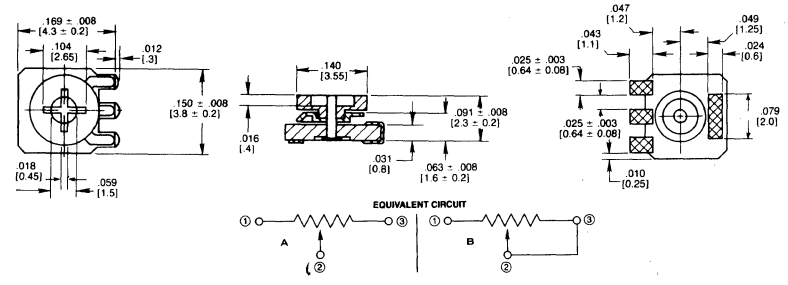
ST-23 Standard Adjustment



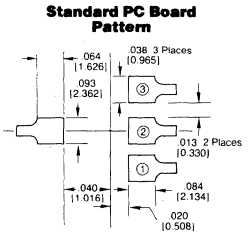
Standard PC Board Pattern



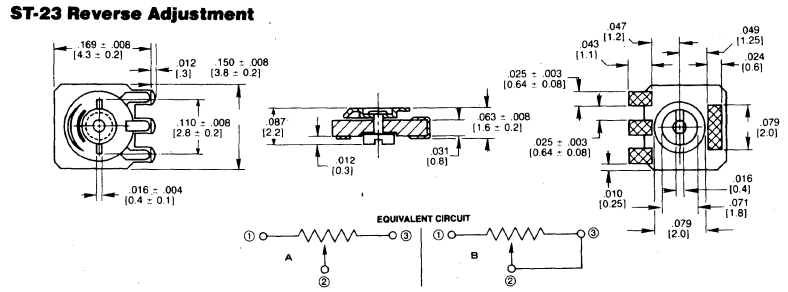
ST-23 Automatic Adjustment



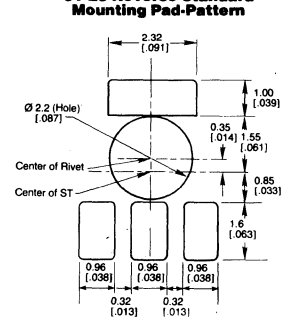
Standard PC Board Pattern



ST-23 Reverse Adjustment



ST-23 Reverse Standard Mounting Pad-Pattern



For complete information, write or phone

DALE ELECTRONICS, INC., 1155 West 23rd Street, Tempe, AZ 85282 • Phone 602-967-7874

ETI SYSTEMS

LINEAR MOTION POTENTIOMETERS

Series LCP8-10 "Mini-Lini" **SMALLEST!**

Element: Conductive Plastic
Resistance Range: 1K to 50K
Stroke: 7/16"
Wattage: 0.1 Watt
Size: 0.287" x 1.26"
Spring return available

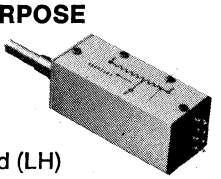
LCP12 SPRING RETURN AVAILABLE

Element: Conductive Plastic
Resistance Range: 500-20K
Stroke: ½", 1", 2", 4"
Wattage: 0.3 to 1.2 Watts
Body Size: 7/16" x ½" Dia. x 1.5"-5" long
Threaded shafts & spring returns available

LO10 LO20 **OIL FILLED PROTECTION FROM HARSH ENVIRONMENTS**

Element: Wirewound
Resistance Range: 15 to 50K
Stroke: 0.6 to 8"
Wattage: 1 to 2 Watts
Size: ½" & ⅞" Dia. x 3⅜"—11¼" Long

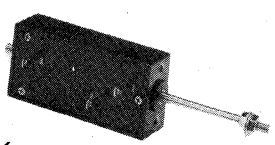
LW20 LH20 LCP20 **GENERAL PURPOSE**



Element: Wirewound (LW) Hybrid (LH)
Conductive Plastic (LCP)
Resistance Range: 500 to 20K
Stroke: 0.6 to 3.9"
Wattage: 0.3 to 1.25 Watts
Size: 0.790 Sq. x 2"—5 5/16" Long

LCP15 **TERMINALS ACCEPT "AMP" 110 CONNECTORS**

NEW!



Element: Conductive Plastic
Resistance Range: 500 to 10 K
Stroke: 0.3937" to 1.1819"
Wattage: 0.2 to 0.5 watts
Body Size: 0.95" wide x 0.5906" high

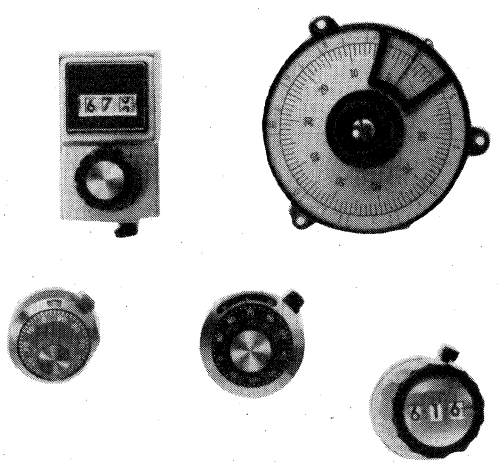
LWR10 LWR20 **SAME AS OIL FILLED EXCEPT NO OIL!**

Element: Wirewound
Resistance Range: 15 to 50K
Stroke: 0.6" to 8"
Wattage: 1 to 2 Watts
Size: ½" & ⅞" Dia. x 3⅜"-11¼" long

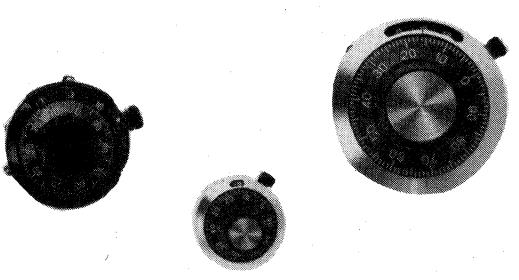
MANY OPTIONS AVAILABLE WITH OUR FULL LINE OF LINEAR MOTION POTENTIOMETERS
PLEASE CONTACT FACTORY FOR APPLICATION ASSISTANCE!

TURNS COUNTING DIALS

When your turns need counting — dial ETI Systems



Dials are available from ⅞" to 4" in diameter, and count up to 100 turns. Many incorporate the "over the center lock" which is superior to the older "brake" design. All dials accept ¼" shaft (others available). Gray, Black, or Satin finish.



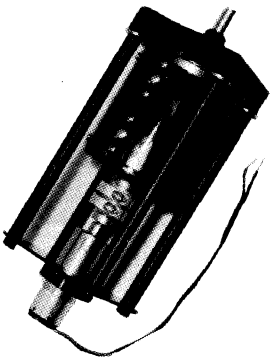
ETI SYSTEMS
ETI SYSTEMS
DEPT. EM, 215 VIA DEL NORTE • OCEANSIDE, CA 92054
TEL: (619) 757-7770 • TWX: 910-322-1396 • FAX: 619-757-2305
DIV: POLARIS ENTERPRISES, INC.

MOTORIZED POTENTIOMETERS
DIRECT CURRENT

MC20-1 MC20-2 (Dual gang)

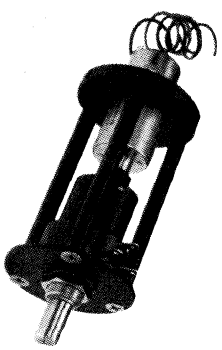
GENERAL PURPOSE

MC20-1/MC20-2
- 10 Turn Single Gang Potentiometer (MC20-1)
- 10 Turn Multigang (2) Potentiometer (MC20-2)
- 3 or 5 Turn Pots Available
- Wirewound Element
- 0.16, to 222 RPM Speed Range
- 6 or 12 VDC



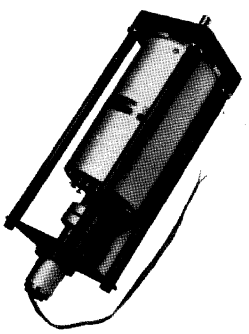
INCREASED POWER HIGH RESOLUTION

MC46-1
- Multi-Turn Potentiometer (3, 5 or 10 Turns)
- Wirewound Element
- 0.16 to 65 RPM Speed Range (24 VDC unit available)
- 6 or 12 VDC



HIGH REL, SMOOTH RUNNING LONG LIFE

MC2P/MC2C
- Single Turn
- Wirewound Element (MC2C)
- Conductive Plastic (MC2P)
- 0.16 to 222 RPM Speed Range
- 6 or 12 VDC



LIMIT SWITCHES AT END OF TRAVEL

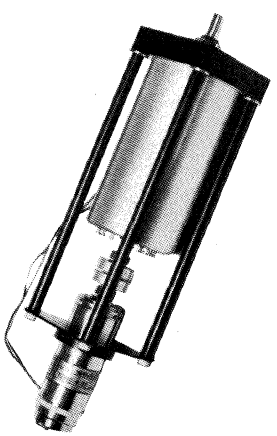
MC46-2
- 5 Amp On-Off Switches at each end of Pot
- Multi-Turn Potentiometer (3, 5, 10 or 20 Turns)
- 0.16 to 65 RPM Speed Range (24 VDC unit available)
- 6 or 12 VDC

DIGITAL READOUT

MC20-3
- Same as MC20-1; Except with Turns Counting Dial Assembled
- 10 Turn
- Dial DA10
- 0.16 to 50 RPM Speed Range
- 6 or 12 VDC

DB10

Recommended Turns Counting Dial. Also available with large knob and no lock for motorpots. (see other dials on Pg. A-2070



HEAVY DUTY

MC46-4/MC46-5 (shown)
- Heavy Duty Motor
- Single Gang (MC46-4)
- Multi-Gang (MC46-5)
- Multi-Turn Potentiometer (3, 5, 10, or 12 turns)
- Wirewound Element
- 0.4 to 86 RPM
- 6, 12 or 24 VDC

MOTORPOT FEATURES

Due to versatile design, many variations and specials can be supplied with low engineering costs. A friction clutch in each unit allows manual adjustment. All D.C. motorpots serve as an "Analog Memory" (preferable to some stepper motor systems) moving only when commanded and maintaining set position if power fails. D.C. motorpots may be pulsed.

For Automatic Control Applications Such As: Speed Controls, Remote Controls, Valve Positioning, Tensioning Motors etc.

ETI SYSTEMS
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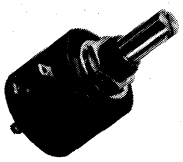
ETI SYSTEMS

POTENTIOMETERS

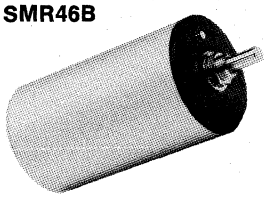
MULTI TURN

MW22



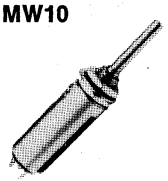
⅞" Dia.—General Purpose—
3, 5, 10 Turns
Resis. Range: 100 to 100,000 Ohms
2 Watts, Wirewound

SMR46B



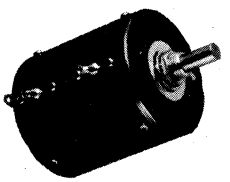
1¾₆" Dia.—Limit Switches—
3, 5, 10, 15, 20, 25, 30 Turns
5 Amp Independent Switches at each end
Resis. Range: 100 to 100,000 Ohms
5 Watts, Wirewound

MW10



Smallest Ten Turn—Only .400" Dia.—
⅛" Shaft
Resis. Range: 100 to 50,000 Ohms
1.5 Watts, Wirewound

MW46B



1¾₆" High Rel—High Resolution—
3, 5, 10, 20 Turns
High Temperature Housing
Resis. Range: 100 to 500,000 Ohms
5 Watts, Wirewound

WE HAVE MANY MORE STYLES AND DESIGNS THAN SHOWN ON THESE PAGES
• Servo Mounts • Hybrids • Multi-Section • Slidewire • PC Mounts • Sine/Cosine • Multi-Tapped • High Torque • Low Torque • Spring Returns • Threaded Shafts • Rear Shafts, etc.

SINGLE TURN

SP22E

⅞" Dia.—General Purpose—
Conductive Plastic Element
10,000,000 Turn Life
Resistance Range: 10 to 20,000 Ohms
1 Watt
Wirewound Available

SP30

1¾₆" Dia.—Highest Performance Model—
50,000,000 Turn Life
All Metal Construction
Conductive Plastic
0.75 Watts
Resis. Range: 1 to 10,000 Ohms

OIL FILLED—For Hostile Environments

SO30

Single Turn—1¼" Dia.
.75 Watt
Wirewound
50 to 10K Ohm
Conductive Plastic
Available

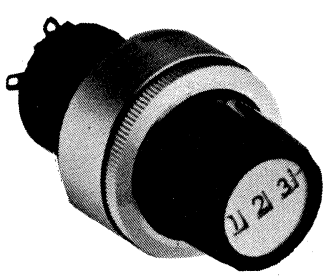
MO20

Ten Turn—1¼" Dia.
1.5 Watt
Wirewound
2K–100K Ohm
Hybrid Element Available

MO46

Ten Turn—2½" Dia.
5 Watt
Wirewound
5–50K Ohm
Servo Mount Available

Combo 3



±/–5% absolute readout accuracy.
Mounts in a 1.187" dia. panel opening.
Available for all ⅜" threaded multi-turn potentiometers.

Many Non-Standards are Stocked at ETI Systems

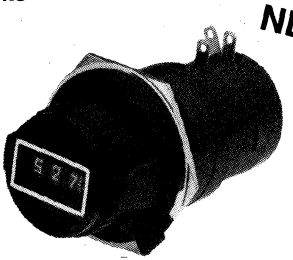
POT/DIAL COMBINATIONS

Pre-assembled and Factory Calibrated

APPLICATIONS
Measuring Equipment
Temperature Controllers
Machine Tool Controllers
Test Equipment
Remote Stations

Combo 4

NEW!



±5% absolute readout accuracy.
Mounts in a 1.125" dia. panel opening.
Available for MW22 potentiometer (Model DC22) and MW20 potentiometer (Model DC20).
Over the center lock device.

FOR ASSISTANCE IN CHOOSING THE RIGHT UNIT, CONTACT FACTORY

ETI SYSTEMS
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DEPT. EM, 215 VIA DEL NORTE • OCEANSIDE, CA 92054
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DIV: POLARIS ENTERPRISES, INC.

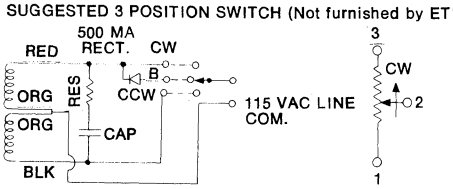
ETI SYSTEMS

A.C. MOTORIZED POTENTIOMETER

115 VAC Reversible

MOTOR SCHEMATIC **POT SCHEMATIC**

SUGGESTED 3 POSITION SWITCH (Not furnished by ETI)



FEATURES

- Reversible AC hysteresis, synchronous motor with 24 VAC or 115 VAC inputs.
- RPMs: ½, 1, 2, 3, 5, 8, 10 and 15. (Standard). RPM avail. to 1 rev./day on special order. Slow speed is excellent for compensating system drift.
- Circuit board (when specified) neatly packages the starting capacitor, balancing resistor and braking diode.
- Braking diode prevents motor coasting when A.C. power is switched to terminal "B".
- All units have slip clutch between motor and potentiometer, allowing manual adjustment when power is off.
- UL approved motor.

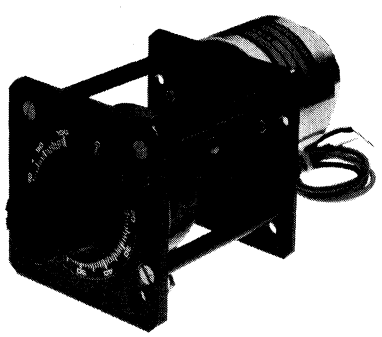
OPTIONS AVAILABLE

Single or multi-turn potentiometers. Film or wirewound elements. Multi section potentiometers.
Snap action limit switches. Special shaft lengths and modifications.
Special circuit modifications.

FOR OUR COMPLETE LINE OF TURNS COUNTING DIALS AND COMPATIBLE POTENTIOMETERS SEE PAGE A. 2070

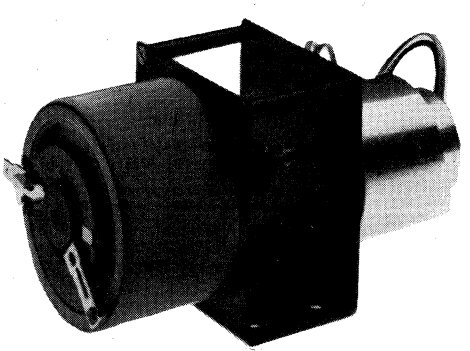
CONTROL YOUR POWER NEEDS

Motorized Rheostats and Variable Transformers



MOTORIZED RHEOSTAT

- Automatically or Remotely Control Power Needs with a Motorized Rheostat or Variable Transformer from ETI Systems
- Single or Multi Gangs Available
- 6, 12 or 24 VDC
- 24, 115 VAC
- Many RPM Selections



MOTORIZED VARIABLE TRANSFORMER

WE HAVE POSITIONING CIRCUITRY AVAILABLE

FOR APPLICATION ASSISTANCE, PLEASE CONTACT OUR FACTORY

Call our order desk & specify desired wattage, motor voltage, RPM & resistance

ETI SYSTEMS

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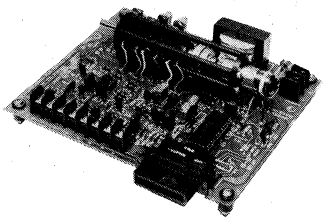
DIV: POLARIS ENTERPRISES, INC.

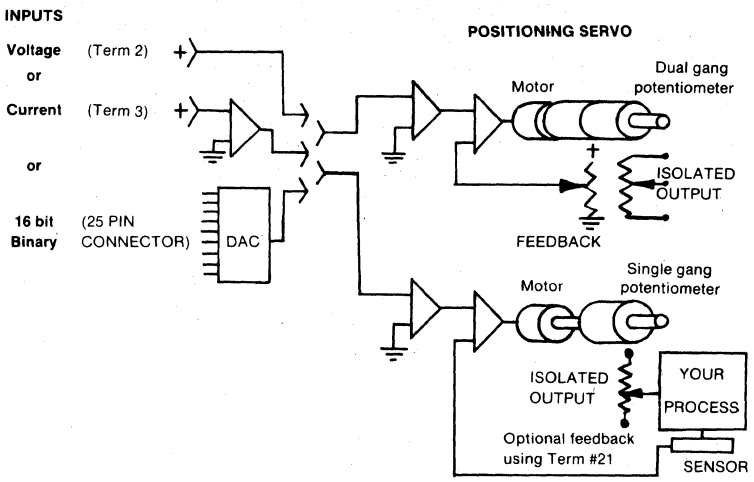
POSITION CONTROLS AND ROTARY ACTUATORS



SIZE: 7" x 6"

SERIES 6500

OPERATIONAL DIAGRAMS—6500/6570



FEATURES—6500 (Shown)

Internal Power Supply (regulated) (115VAC INPUT)
Light emitting diodes for *visual* inspection
Closed loop confirmation option

FEATURES—6570

Series 6570 operation is the same as Series 6500 except output is a 2¼ AMP variable transformer type 10c. May be attached by cable.

FEATURES—5500

Voltage or Current input only, the 5500 is smaller, more compact board at lower cost than the 6500 Series. The 5500 utilizes the same power supply and positioning accuracy of the larger boards. The servo inhibit feature is included. It does not have a run output indicator.

INPUTS—6500/6570

(a) 0 to 5 or 0 to 10 VDC
(b) 4 to 20 milliamps
(c) 16 bit compatible (14 bit DAC)

INPUT—5500

(a) 0 to 5 or 0 to 10 VDC
(b) 4 to 20 milliamps

OUTPUT—6500/6570

Potentiometer (Single Turn or Multi-Turn)
Isolated Circuit

OUTPUT—5500

Potentiometer (Single Turn or Multi-Turn)

APPLICATIONS

- Process Controls
- Speed Controls
- Air Conditioning
- Tension Controller
- Valve Positioner
- Remote Controls
- Governor Controls
- Drift Compensator

ROTARY ACTUATORS/VALVE POSITIONERS

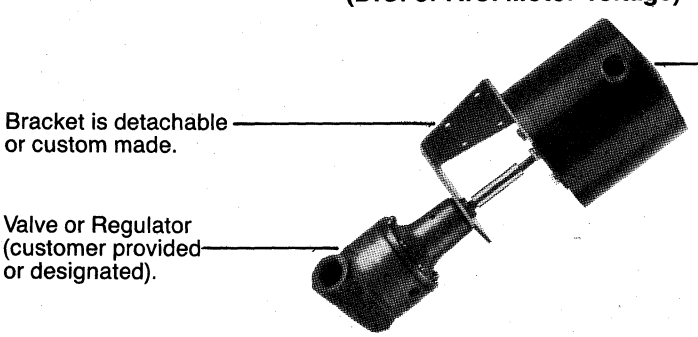
CALL OUR FACTORY FOR NEW ROTARY ACTUATORS AND VALVE POSITIONERS

Up to 200 inch lbs. of torque

CUSTOM MADE TO YOUR APPLICATION

VM 100

(D.C. or A.C. Motor Voltage)



Housing is 5" in Dia. and contains:

- End travel limit switches.
- Feedback Position Potentiometer.
- Multiple motors (patent pending) provides higher torque, better load distribution, and prevents catastrophic motor failure.
- energy absorbers (patent pending) reduces sticking.

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DIV: POLARIS ENTERPRISES, INC.

PRECISION CO-MOLDED CONDUCTIVE PLASTIC POTENTIOMETERS & ASSEMBLIES

JDKontrols, Inc.

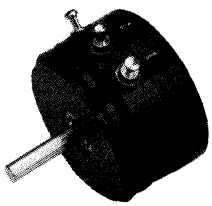
WHEN POTENTIOMETER PERFORMANCE IS *CRITICAL*

2630 Lavery Court
Newbury Park, California 91320-1593
(805) 499-7779

The JDK Co-Molded Conductive Plastic Process

JDK manufactures one type of potentiometer element — co-molded conductive plastic — because, to the designer and builder of systems in critical applications, there is no justification to use less than the best. In the JDK process, the termination and resistance materials are simultaneously molded with the plastic substrate. The result is a flush circuit with a very hard, smooth surface which, when combined with JDK's multifinger precious metal contacts, promotes ultra-long life, as well as excellent electrical performance in all environments. The superiority of the JDK flush circuit over the raised circuit elements (i.e., conductive plastic film, screened conductive plastic, cermet, hybrid, and wirewound) is most evident in its long-term consistent performance and reliability.

SERVO MOUNT MODELS



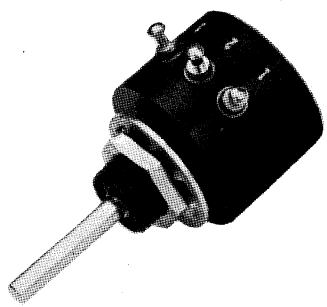
MODEL #	OUTSIDE DIAMETER INCHES	SHAFT DIAMETER INCHES	SHAFT LENGTH	BODY LENGTH MAXIMUM	RESISTANCE RANGE	ELECTRICAL ANGLE	INDEPENDENT LINEARITY	OUTPUT SMOOTHNESS
6005	.500	.1249	.500	.550	1K-50K	325°	1.0%	<0.1%
6008	.750	.1249	.500	.625	1K-50K	340°	.5%	<0.1%
6009	.875	.1249	.500	.625	1K-50K	340°	.5%	<0.1%
6011	1.062	.1249	.500	.625	1K-50K	340°	.5%	<0.1%
6015	1.437	.2498	.625	.750	1K-50K	340°	.5%	<0.1%
6018	1.750	.2498	.625	.750	1K-50K	350°	.5%	<0.1%
6020	2.000	.2498	.625	.750	1K-50K	350°	.5%	<0.1%

Specials available

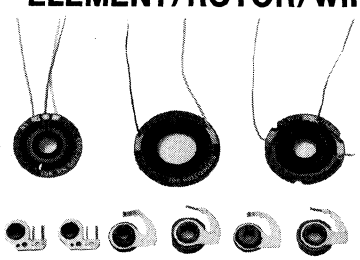
BUSHING MOUNT MODELS

MODEL #	OUTSIDE DIAMETER INCHES	SHAFT DIAMETER INCHES	SHAFT LENGTH	BODY LENGTH MAXIMUM	RESISTANCE RANGE	ELECTRICAL ANGLE	INDEPENDENT LINEARITY	OUTPUT SMOOTHNESS
6205	.500	.1249	.687	.550	1K-50K	325°	1.0%	<0.1%
6208	.750	.1249	.687	.625	1K-50K	340°	.5%	<0.1%
6209	.875	.1249	.687	.625	1K-50K	340°	.5%	<0.1%
6211	1.062	.1249	.687	.625	1K-50K	340°	.5%	<0.1%
6215	1.437	.2498	.875	.750	1K-50K	340°	.5%	<0.1%
6218	1.750	.2498	.875	.750	1K-50K	350°	.5%	<0.1%
6220	2.000	.2498	.875	.750	1K-50K	350°	.5%	<0.1%

Specials available



ELEMENT/ROTOR/WIPER ASSEMBLIES



MODEL	NOMINAL OUTSIDE DIAMETER	NOMINAL INSIDE DIAMETER	NOMINAL THICKNESS	WIRE TERMINATIONS
6909	.702	.186	.072	30 Awg Tefzel Coated single conductor 6" long
6911	.888	.186	.072	30 Awg Tefzel Coated single conductor 6" long
6915	1.252	.435	.072	30 Awg Tefzel Coated single conductor 6" long
6918	1.557	.435	.072	30 Awg Tefzel Coated single conductor 6" long
6920	1.805	.435	.072	30 Awg Tefzel Coated single conductor 6" long

Electrical performance similar to servo and bushing models
Many custom sizes available

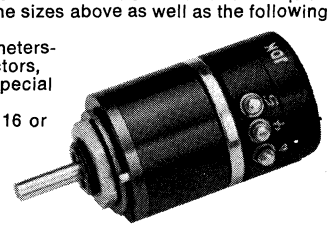
THE JDK DIFFERENCE

Since the JDK process and systems are foremost in the industry, we are able to offer the following features:

- ULTRA-LONG ROTATIONAL LIFE — 50 million cycles minimum for most applications of 6000 & 6200 models
- STATE-OF-THE-ART OUTPUT SMOOTHNESS — always under 0.1%
- NO INTERNAL SOLDER CONNECTIONS — conductive epoxy and welded connections used for greater reliability
- LOW TORQUE — less than 0.1 in oz. available in most single cup 6000 & 6200 models
- 18 MONTH WARRANTY — standard for most applications of 6000 & 6200 models
- OUTSTANDING VALUE = best "price/performance" ratio in the industry
- ALL UNITS DESIGNED, MANUFACTURED, AND TESTED IN ACCORDANCE WITH MIL-R-39023

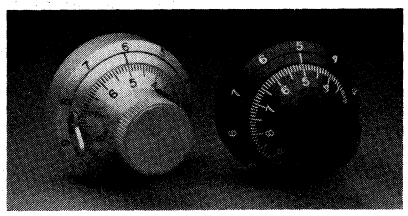
CUSTOM REQUIREMENTS AND ASSEMBLIES

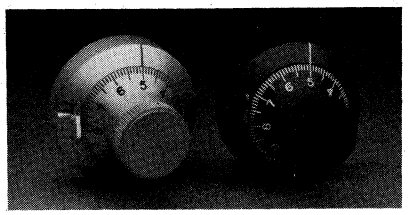
JDK specializes in custom electrical and/or mechanical requirements for potentiometer in the sizes above as well as the following:
Next Assemblies:
JDK will add to its potentiometers-
Flanges, extra cups, connectors, multiple taps, flying leads, special shafts
Motor and/or Gearheads in 16 or 22mm diameters

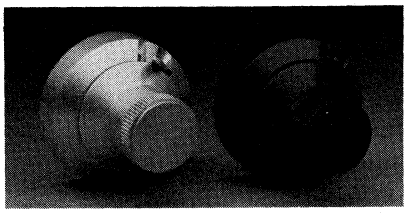


KILO INTERNATIONAL

Series 400, 500, 600: The world's finest machined 1 inch turns-counting dials.







SERIES 400 (462-411)

Standard 1″ 10 Turn

Mechanical Specifications:

KILO's facilities for machine engraving provides fast response and low cost for special calibrations.

Requires only one square inch of panel space.

Mounts on true 1 inch centers.

SERIES 500 (562-512)

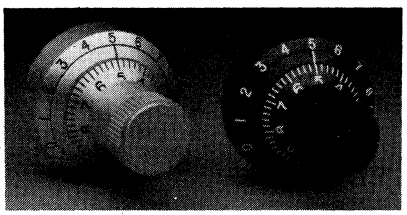
Standard 1″ 1 Turn

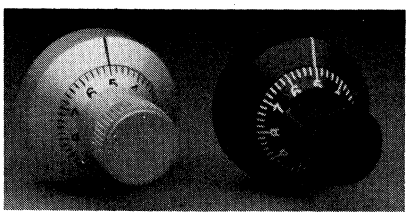
SERIES 600 (662-612)

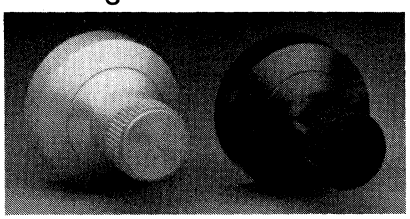
Standard 1″ Uncalibrated

MODELS FOR	POT. SHAFT SIZE AND BUSHING	
¼″ Shaft	.2500 +.0000 −.0006	⅜-32 NEF2
⅛″ Shaft	.1250 +.0000 −.0006	¼-32 NEF2
3/32″ Shaft	.0935 +.0000 −.0006	¼-32 NEF2
SHAFT EXTENSION BEYOND FACE OF PANEL .600 Min.,	.800 Max.,	.725 Optimum
BUSHING EXTENSION BEYOND FACE OF PANEL .125 Min. thread (full thread)	.297 Max.	

Series 700, 800, 900: The world's finest machined ¾ inch turns-counting dials.







SERIES 700 (771-721)

¾″ 10 Turn

Mechanical Specifications:

Series 700 through 900: These machined dials provide a 25% reduction in size of the world's finest one inch dial with improvements in performance.

Mounts on true ¾ inch centers, both horizontally and vertically.

SERIES 800 (871-821)

¾″ 1 Turn

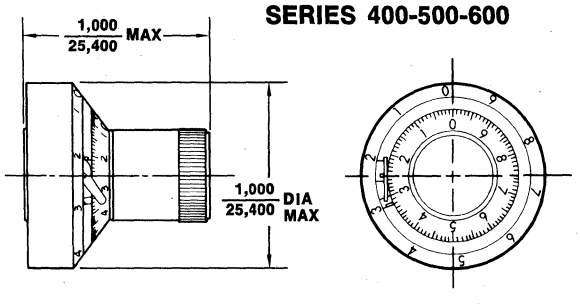
SERIES 900 (971-921)

¾″ Uncalibrated

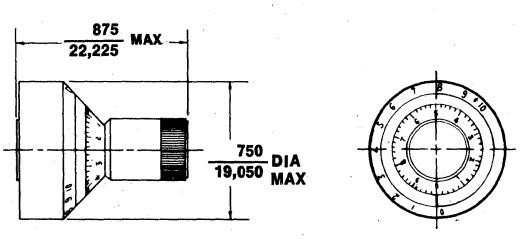
MODELS FOR	POT. SHAFT SIZE AND BUSHING	
⅛″ Shaft	.1250 +.0000 −.0006	¼-32 NEF2
3/32″ Shaft	.0937 +.0000 −.0006	¼-32 NEF2
SHAFT EXTENSION BEYOND FACE OF PANEL .655 Max.	.450 Min.	
BUSHING EXTENSION BEYOND FACE OF PANEL .225 Max.		

DIMENSIONS

SERIES 400-500-600



SERIES 700-800-900



A MODEL NUMBER IS CREATED BY SELECTING 3 DIGITS

EXAMPLE | 4 | 6 | 2 |

4 = STANDARD 10 TURN
6 = CLEAR ANODIZED AND ¼ IN. SHAFT
2 = STANDARD SHORT BRAKE LEVER

First Digit	Second Digit	Third Digit
100 Military 10 Turn	**10** Black ¼″ Shaft	**1** No Brake
200 Military 1 Turn	**20** Black ⅛″ Shaft	**2** Short Brake Lever (Original Design)
300 Military Uncalibrated	**30** Black 3/32″ Shaft	**3** Long Brake Lever
400 Standard 1″ 10 Turn	**40**	**4**
500 Standard 1″ 1 Turn	**50**	**5**
600 Standard 1″ Uncalibrated	**60** Clear ¼″ Shaft	**6**
700 ¾″ 10 Turn	**70** Clear ⅛″ Shaft	**7**
800 ¾″ 1 Turn	**80** Clear 3/32″ Shaft	**8**
900 ¾″ Uncalibrated	**90**	**9**
1400 1″ Plastic 10 Turn		
2500 ⅞″ 1 Turn		
2600 ⅞″ Uncalibrated		
Not available on ¾″ Series (700, 800, 900)		

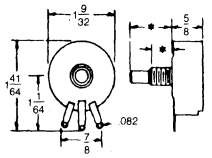
KILO INTERNATIONAL

KILO INTERNATIONAL
2118 D Street, La Verne
California 91750
Telephone 714 593-4626

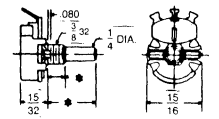
MALLORY

WIREWOUND POTENTIOMETERS

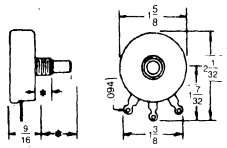
STYLE R AND QR



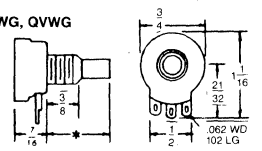
STYLE LW



STYLE M, QM, MG, QMG



STYLE VW, QVW, VWG, QVWG



STYLE SC, QSC, SCG, QSCG
As Above But Smaller Shaft & Bushing Diameter

OTHER WIREWOUND POTENTIOMETER FEATURES AVAILABLE ON SELECTED PRODUCT TYPES:
- nonlinear resistance tapers,
- ±5% resistance tolerance,
- multisection units,
- twist-tab mounting.

MALLORY MANUFACTURES A COMPLETE LINE OF "T", "L", AND "LL" PAD ATTENUATORS.

In addition to the many types of wire-wound controls carried as stock items, Mallory can supply custom made units tailored to your exact requirements. Specifying Mallory for your custom made control will assure exacting quality for either your prototype or production use.

POTENTIOMETER LINE SWITCHES AVAILABLE

Grade Name	Action	Type	Size	Rating	Available On Control	Approval
OAC-1	Rotary	SPST	15/16"	6 A 125VAC 3 A 125VDC	M, R	UL & CSA
OAC-2	Rotary	DPST	15/16"	6 A 125VAC 6 A 125VDC (3 amps/circuit)	M, R	UL & CSA
OAC-3	Rotary	2XSPST	15/16"	3 amps 125VAC	M, R	UL & CSA
OAC-SPC	Rotary	SPST	15/16"	15A 10VDC	M, R	N.R.
OAC-4	Rotary	SPST	15/16"	5 amps 125VAC	M, R	UL & CSA
OAC-8 Auto-SPL	Rotary	SPST	15/16"	20 amps 15VDC	M, R	Automotive
OAC-5	Rotary	SPST	15/16"	5 amps 125VAC	M, R	UL & CSA
OAC-8	Rotary	SPST	15/16"	5 amps 125VAC	M, R	CSA
OAC-8 AUTO	Rotary	SPST	15/16"	15 amps 10V	M, R	UL & CSA
OAC-6	Rotary	SPST	15/16"	5 amps 125VAC		UL & CSA
OAC-8 AUTO	Rotary	SPST	15/16"	15 amps 20VDC 7.5 amps 10VDC	M, R	
OAC-9	Rotary	SPDT	15/16"	5 amps 125VAC	M, R	CSA
OPP-3	Push-Pull	SPST	15/16"	5 amps 125VAC 1 amp 125VDC	LW	UL & CSA
OPP-5	Push-Return	Momentary SPST	15/16"	1 amp 125VAC	LW	UL
PPSI	Push-Pull Side Mount	DPST (OAC-2) SPDT (OAC-3)				
PPS2	Push-Push Side Mount	DPST (OAC-2) SPDT (OAC-3)				
Dual Switches any pr. of OAC		Side Mounted Rotary switches may be used.				
MOAC-1 MOAC-3	Rotary Rotary	SPST SPDT	1/2" 1/2"	3 amps 125VAC 2 amps 125VAC	NO NO	UL UL

Most of the above switches are available separately for mounting on the customer's control, either by welding or tab mounting.

SPECIFICATION TABLE

						Degrees Of Rotation			Resistance ±10%		Locating Lug Radius (3 and/or 9 o'clock)
Watts	Style	Diameter	Depth	Standard Bushing	Standard Shaft Diameter	Mechanical	Electrical W/Switch	Electrical W/O Switch	Min. OHMS	Max. OHMS	Radius
3	R	1 9/32	5/8	3/8-32	1/4	297	260	290	1	50K	17/32
4	M	1 5/8	9/16	3/8-32	1/4	294	245	275	1/2	100K	17/32
5	SC	3/4	7/16	1/4-32	1/8	305	—	275	1	25K	15/64
5	VW	3/4	7/16	3/8-32	1/4	305	—	275	1	25K	17/32
5	LW	15/16	15/32	3/8-32	1/4	300	—	280	3	25K	7/16
10	SCT	3/4	7/16	1/4-32	1/8	305	—	275	1	25K	15/64
10	VWG	3/4	7/16	3/8-32	1/4	305	—	275	1	24K	17/32
12 1/2	MG	1 5/8	9/16	3/8-32	1/4	294	245	275	1/2	100K	17/32

Style M, MG, R, SC, SCG, VW and VWG also available with "Q" prefix in Military Construction.

Standard Breakdown Voltage test 900 V RMS

The above data is only a guide. This listing of controls does not cover all possible configurations tooled. Please consult Mallory Components Engineering for further details and availability of deviations.

EMHART CANADA LIMITED, MALLORY COMPONENTS DIVISION,
Emhart Electrical/Electronic Group
P.O. Box 210, 1079 Parkinson Road, Woodstock, Ontario N4S 7W8, Canada
Phone: (519) 539-4891, Telex: 064-74132, Fax: (519) 539-6684

EMHART MALLORY

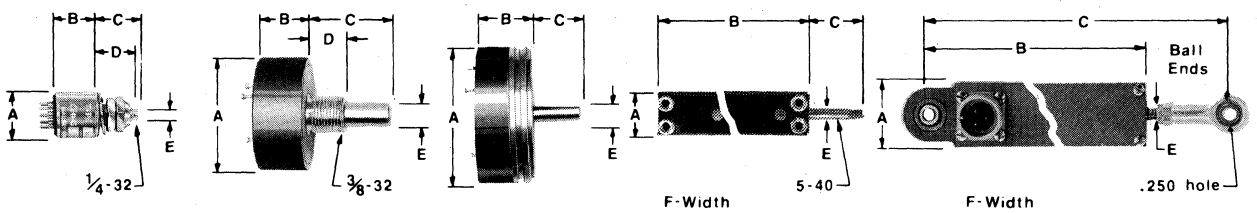
MAUREY INSTRUMENT CORP.

Potentiometers

Rotary and Linear Motion Transducers

WIREWOUND These precision potentiometers were developed for military use over a period of 27 years. They are widely used in instrumentation and automation where precise electrical and mechanical requirements are specified. Low resistance tolerance and TCR; close electrical angle tolerance. Custom designs are available.

CONDUCTIVE PLASTIC Our raised molded track will withstand 200,000,000 cycles of high dynamic velocities (10″ per second). The infinite resolution and low noise make these units particularly suitable for servo feedback applications. 100 g shock, 100—20,000 Hz at 50 g. Impervious to most gases and oils.



		TRIMMER	BUSHING			SERVO**			LINEAR MOTION (LMA)				LINEAR MOTION (LMB)		
	Part No.	Type	A	B	C	D	E	F	OHMS Range	OHMS ± %	Lin. ± %	Elect. Travel	Mech. Travel	Watts @ 40°C	Torque OZ-IN
Wirewound	50-M123	TRIMMER	.50	.50	.50	.44	.125	—	50Ω-50K	5	3.0	325°	325°	2	1-8
	50-M125	BUSH'G	.50	.50	.62	.25	.125	—	50Ω-25K	5	1.0-0.5	325°	325°	2	0.5
	87-M44	SERVO**	.87	.68	.50	—	.125	—	100Ω-25K	5	1.0-0.2	353°	360°	2	0.1
	131-M3	BUSH'G	1.31	.50	.87	.38	.250	—	100Ω-50K	5	1.0-0.3	320°	330°	3	0.1
	200-M167	SERVO**	2.00	.80	.75	—	.250	—	100Ω-50K	5	1.0-0.1	356°	360°	5	0.5
	200-M493	BUSH'G	2.00	1.00	.87	.38	.250	—	100Ω-100K	5	1.0-0.4	320°	360°	4	0.6
	300-M74	SERVO**	3.00	.80	.75	—	.250	—	500Ω-100K	5	0.2-0.05	358°	360°	7	0.6
	M1326-1	LMA ‡	.50	2.00	.75	—	.125	.38	50Ω-20K	5	3.0-0.3	1.00″ ‡	1.10″	1	4*
	M1326-4	LMA ‡	.50	**5.00**	.75	—	.125	.38	250Ω-50K	5	0.3-0.1	4.00″ ‡	4.10″	4	4*
	M1326-12	LMA ‡	.50	13.00	.75	—	.125	.38	5K-100K	5	0.1-0.05	12.0″ ‡	12.10″	12	4*
	M2028-5	LMB ‡	1.25	10.50	**13.20**	—	.250	.76	1K-100K	5	0.2-0.03	5.0″ ‡	5.25″	5	4*
	M2028-10	LMB ‡	1.25	15.80	**18.50**	—	.250	.76	2K-200K	5	0.1-0.02	10.0″ ‡	10.25″	10	4*
	M2028-15	LMB ‡	1.25	21.00	**23.70**	—	.250	.76	5K-200K	5	0.1-0.01	15.0″ ‡	15.25″	15	4*
Conductive Plastic	87-P82	BUSH'G	.87	.53	.87	.38	.250	—	500Ω-50K	20	2.0	340°	360°	1	1
	87-P83	SERVO**	.87	.59	.50	—	.125	—	500Ω-50K	10	0.5	340°	360°	1	0.5
	106-P249	SERVO**	1.06	.65	.50	—	.125	—	500Ω-100K	10	0.5	340°	360°	1.5	0.5
	112-P16	BUSH'G	1.12	.53	.87	.38	.250	—	500Ω-100K	20	2.0	340°	360°	1.5	1
	112-P19	SERVO**	1.12	.65	.50	—	.125	—	500Ω-100K	10	0.5	340°	360°	1.5	0.5
	200-P445	BUSH'G	2.00	.53	.87	.38	.250	—	1K-100K	20	1.0	340°	360°	3	1
	200-P446	SERVO**	2.00	.80	.75	—	.250	—	1K-100K	10	0.5	340°	360°	3	0.5
	P1613-1	LMA ‡	.50	2.00	.75	—	.125	.38	1K-5K	20	2.0	1.0″ ‡	1.1″	0.5	4*
	P1613-4	LMA ‡	.50	5.00	.75	—	.125	.38	4K-10K	20	0.5	4.0″ ‡	4.1″	2	4*
	P1991-5	LMB ‡	1.25	10.50	**13.20**	—	.250	.76	5K-20K	20	0.5	5.0″ ‡	5.25″	2.5	4*
	P1991-10	LMB ‡	1.25	15.80	**18.50**	—	.250	.76	10K-25K	20	0.5	10.0″ ‡	10.25″	5	4*
	P1991-15	LMB ‡	1.25	21.00	**23.70**	—	.250	.76	15K-50K	20	0.5	15.0″ ‡	15.25″	7	4*

* Frictional force in ounces shown for linear motion units.
** Servo dimensions to MIL-R12934C and MIL-R39023A. Custom deviations to the above units are available.
‡ Available travel in one inch increments.

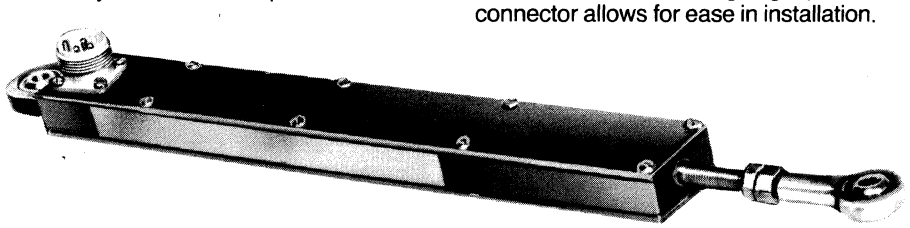
MAUREY
INSTRUMENT CORPORATION
4555 West 60th Street, Chicago, IL 60629 • PHONE (312) 581-4555 • FAX (312) 581-2576

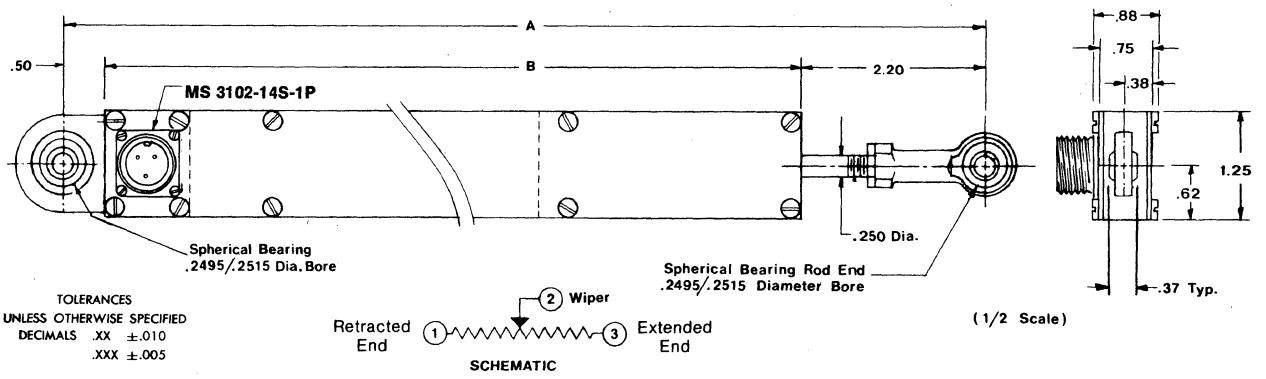
MAUREY INSTRUMENT CORP.

HEAVY DUTY LINEAR MOTION POTENTIOMETERS WIREWOUND AND CONDUCTIVE PLASTIC HDL

WIREWOUND M2028 This transducer combines the inherent accuracy and reliability of a wirewound potentiometer with the physical ruggedness required in industrial applications. They are used with hydraulic and mechanical actuators to measure and control linear motion. The self-aligning spherical ball ends and MS connector simplifies installation. High duty bearings give the ¼ inch shaft stability in the extended position.

CONDUCTIVE PLASTIC P1991 Where severe environmental conditions exist as in mills, factories and power generating plants, this linear motion transducer is practically indestructible. The unit is impervious to dust, oil and moisture. The molded, raised conductive track and graphite composition contacts provide for years of maintenance free service. As with the M2028, the self-aligning spherical ball ends and MS connector allows for ease in installation.





ELECTRICAL AND MECHANICAL CHARACTERISTICS

	M2028 WIREWOUND	P1991 CONDUCTIVE PLASTIC
Total Resistance (Ohms)	See Charts II & III	See Note 5
Total Resistance Tolerance	±5%	±20%
Theoretical Resolution	See Chart III	.001 inch
Independent Linearity	See Note 6	±0.5%
Theoretical Elect. Travel (inches)	See Chart I	See Chart I
Theoretical Elect. Travel Tolerance (inches)	±.010	±.025
Total Mechanical Travel (inches)	See Chart I	See Chart I
Temperature Coefficient	50 PPM/°C	500 PPM/°C
Operating Temperature Range	−55 to 125°C	−55° to 105°C
Power Rating (Watts at 40°C)	1 watt/inch	0.5 watt/inch
Dielectric Strength (Volts, RMS for 60 Sec)	750 volts, RMS	750 volts, RMS
Terminals	3	3
Taps	1/2 inch spacing	1/2 inch spacing
Tap Tolerance (inches)	±.010	±.030
Life Expectancy (Cycles at 60 in./min.)	500,000	50,000,000
Shaft Frictional Force	4 ounces	4 ounces
Weight (ounces)	See Chart I	See Chart I
Bearings	Nylon	Nylon

Notes:
1. Mating connector supplied.
2. Stainless steel shaft.
3. Anodized aluminum housing.
4. Terminals available on special request.
5. Ohms per inch for P1991: 500, 1K, 2K, 5K, 10K.
7. Independent linearity for M2028: (100% ÷ Total Turns x 2)
6. With modification, this type is available in strokes greater than 15 inches.

CHART I

Dash No.	Elect. Travel	Mech. Travel	A	B	Wt. Ozs.
−1	1.00	1.25	13.20	10.50	10
−2	2.00	2.25	13.20	10.50	10
−3	3.00	3.25	13.20	10.50	10
−4	4.00	4.25	13.20	10.50	10
−5	5.00	5.25	13.20	10.50	10
−6	6.00	6.25	18.50	15.80	15
−7	7.00	7.25	18.50	15.80	15
−8	8.00	8.25	18.50	15.80	15
−9	9.00	9.25	18.50	15.80	15
−10	10.00	10.25	18.50	15.80	15
−11	11.00	11.25	23.70	21.00	20
−12	12.00	12.25	23.70	21.00	20
−13	13.00	13.25	23.70	21.00	20
−14	14.00	14.25	23.70	21.00	20
−15	15.00	15.25	23.70	21.00	20

CHART II

DASH NO.	TOTAL RESISTANCE
102	1,000
202	2,000
502	5,000
103	10,000
203	20,000
503	50,000
104	100,000

CHART III

OHMS PER INCH	NUMBER OF TURNS PER INCH
500	270
1,000	370
2,000	415
2,500	450
5,000	550
10,000	660
20,000	1000

PART NUMBER DESIGNATION (EXAMPLE)
M2028-5-502
- BASIC TYPE
- ELECTRICAL TRAVEL (5.00 INCHES)
- TOTAL RESISTANCE (5000 Ω)

MAUREY INSTRUMENT CORPORATION
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PHONE (312) 581-4555
FAX (312) 581-2576

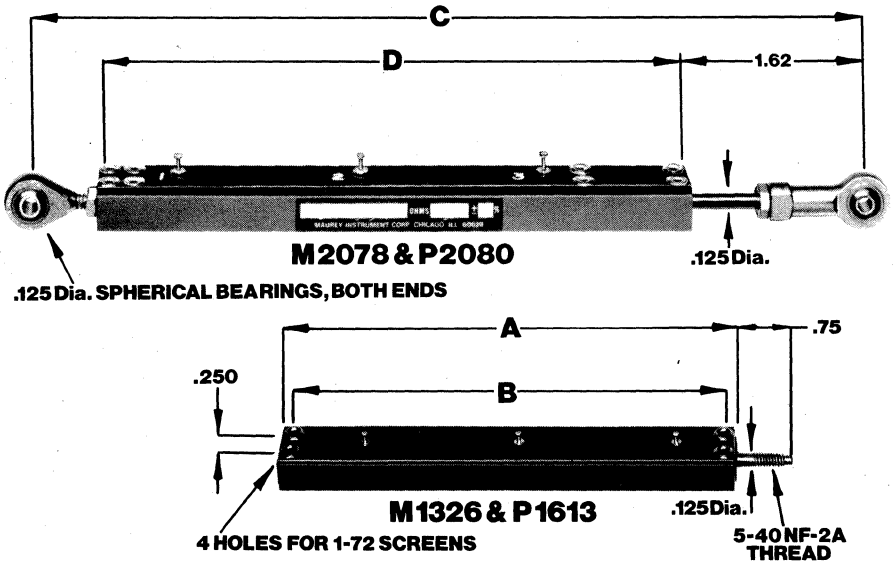
MAUREY INSTRUMENT CORP.

LIGHT DUTY LINEAR MOTION POTENTIOMETERS WIREWOUND AND CONDUCTIVE PLASTIC

LDL

WIREWOUND (M-Series) These miniature transducers combine the best electrical characteristics in the smallest size at the lowest cost. The units were designed for use in laboratory test equipment, light industrial applications and automation where great accuracy of electrical output is essential. The spherical ball ends add flexibility to mounting. These wirewound, linear motion potentiometers will meet the requirement in the majority of applications.

CONDUCTIVE PLASTIC (P-Series) Where long life in a hostile environment is required, these linear motion transducers with molded, raised tracks and graphite composition contacts have no equal. They are practically impervious to dust, water and oil. The high contact pressure resists the effects of severe vibration and shock. The units are being used in factories and mills where maintenance-free operation is essential.



Stroke (Inches)	M1326 / P1613		M2078 / P2080	
	A	B	C	D
1	2.00	1.800	5.12	3.00
2	3.00	2.800	6.12	4.00
3	4.00	3.800	7.12	5.00
4	5.00	4.800	8.12	6.00
5	6.00	5.800	9.12	7.00
6	7.00	6.800	10.12	8.00
7	8.00	7.800		
8	9.00	8.800		
9	10.00	9.800		
10	11.00	10.800		
11	12.00	11.800		
12	13.00	12.800		

Shaft shown in fully retracted position
Shaft is free to rotate. .
Body: ½ wide on terminal side x ⅜ deep.

ELECTRICAL AND MECHANICAL CHARACTERISTICS

	M1326 WIREWOUND	P1613 CONDUCTIVE PLASTIC	M2078 WIREWOUND	P2080 CONDUCTIVE PLASTIC
Total Resistance (Ohms)	25 Ω to 20K/inch	250 Ω to 10K/inch	25 Ω to 20K/inch	250 Ω to 10K/inch
Total Resistance Tolerance	±5%	±20%	±5%	±20%
Theoretical Resolution (inch)	.006 to .001	.001	.006 to .001	.001
Independent Linearity	±1.2% to ±0.1%	±2% to ±0.5%	±1.2% to ±0.1%	±2% to ±0.5%
Theoretical Electrical Travel (inches)	1.000 to 12.000	1.00 to 5.00	1.000 to 6.000	1.00 to 5.00
Theoretical Elect. Travel Tolerance (inches)	±.010	±.050	±.010	±.050
Total Mechanical Travel (inches)	1.10 to 12.10	1.10 to 5.10	1.10 to 6.11	1.10 to 5.10
Temperature Coefficient (PPM/°C)	50	500	50	500
Operating Temperature Range	−55°to125°C	−55°to105°C	−55°to125°C	−55°to105°C
Power Rating (Watts at 40°C)	1 watt/inch	0.5 watt/inch	1 watt/inch	0.5 watt/inch
Dielectric Strength (Volts, RMS for 60 Sec)	750	750	750	750
Terminals	3	3	3	3
Taps	4 taps/inch	4 taps/inch	4 taps/inch	4 taps/inch
Tap Tolerance (inches)	±.010	±.050	±.010	±.050
Life Expectancy (cycles at 60 in./min.)	500,000	50,000,000	500,000	50,000,000
Shaft Frictional Force (ounces, max.)	4 oz.	4 oz.	4 oz.	4 oz.
Bearings	Nylon	Nylon	Nylon	Nylon

Standard Resistance Values, Ohms / inch: 250Ω, 500Ω, 1K, 2K, 2.5K, 10K, 20K

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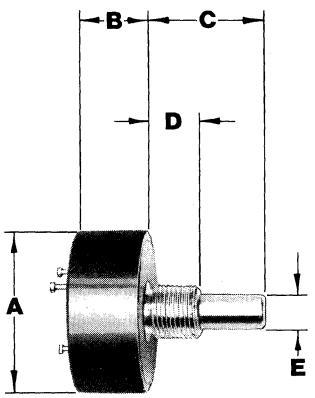
MAUREY INSTRUMENT CORP.

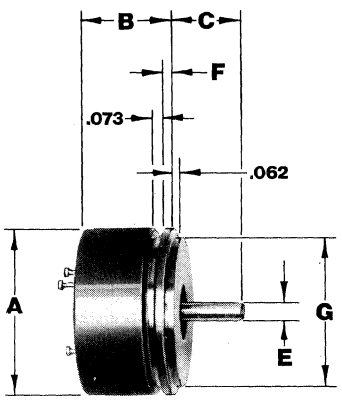
PRECISION CONDUCTIVE-PLASTIC SINGLE TURN POTENTIOMETERS

PST

These conductive plastic potentiometers have been specially designed for severe environmental conditions in mill-factory operations as well as in critical military applications. The molded, raised track maintains itself free from contamination of foreign particles, oil or water. The high gram pressure of the graphite composition contact on the raised track gives excellent resistance to contact bounce under punishing vibration or shock, as well as an exceptional rotational life. Such units are particularly suited for applications where trouble-free maintenance is required.



BUSHING



SERVO

	TYPE	A	B	C	D	E	F	G
87-P82	BUSHING	.87	.53	.87	.38	.250	—	—
87-P83	SERVO	.87	.59	.50	—	.125	.062	.750
106-P249	SERVO	1.06	.57	.50	—	.125	.062	.968
112-P16	BUSHING	1.12	.50	.87	.38	.250	—	—
112-P19	SERVO	1.12	.57	.50	—	.125	.062	1.000
143-P93	SERVO	1.43	.63	.50	—	.250	.093	1.312
200-P445	BUSHING	2.00	.50	.87	.38	.250	—	—
200-P446	SERVO	2.00	.75	.75	—	.250	.093	1.875

ELECTRICAL AND MECHANICAL CHARACTERISTICS

	87-P82 BUSHING	87-P83 SERVO	106-P249 SERVO	112-P16 BUSHING	112-P19 SERVO	143-P SERVO	200-P445 BUSHING	200-P446 SERVO
Total Resistance (Ohms)	500 Ω - 50K	500 Ω - 50K	500 Ω - 100K	500 Ω - 100K	500 Ω - 100K	1K - 100K	1K - 100K	1K - 100K
Total Resistance Tolerance	±20%	±10%	±10%	±20%	±10%	±10%	±20%	±10%
Theoretical Resolution	.001%	.001%	.001%	.001%	.001%	.001%	.001%	.001%
Independent Linearity	±2%	±0.5%	±0.5%	±2%	±0.5%	±0.5%	±2%	±0.5%
Theoretical Electrical Travel (Degrees)	340°	340°	340°	340°	340°	340°	340°	340°
Theoretical Elect. Travel Tolerance (Degrees)	±5°	±3°	±2°	±5°	±2°	±2°	±5°	±2°
Total Mechanical Travel (Degrees)	360°	360°	360°	360°	360°	360°	360°	360°
Temperature Coefficient (PPM/°C)	400	400	400	400	400	400	400	400
Operating Temperature Range (°C)	−55°to105°C	−55°to105°C	−55°to105°C	−55°to105°C	−55°to105°C	−55°to105°C	−55°to105°C	−55°to105°C
Power Rating (Watts at 40°C)	1	1	1.5	1.5	1.5	2	3	3
Dielectric Strength (Volts, RMS for 60 Sec)	1000	1000	1000	1000	1000	1000	1000	1000
Terminals, Standard	3	3	3	3	3	3	3	3
Taps, Maximum Available	4	4	6	6	6	9	9	9
Tap Tolerance	±5°	±3°	±2°	±5°	±2°	±2°	±5°	±2°
Life Expectancy (Revolutions at 500RPM)	20,000,000	100,000,000	100,000,000	20,000,000	100,000,000	100,000,000	20,000,000	100,000,000
Moment of Inertia (gm-cm^2)	0.2	0.2	0.2	0.2	0.2	1.5	1.5	1.5
Starting Torque (ounce-inches)	*0.6	0.5	0.5	*0.6	0.5	0.3	*0.6	0.3
Running Torque (ounce-inches)	*0.5	0.4	0.4	*0.5	0.4	0.2	*0.5	0.2
Weight (ounces)	0.5 oz.	0.6 oz.	0.6 oz.	0.6 oz.	0.6 oz.	1.7 oz.	2 oz.	4 oz.
*Stop Strength (pound-inches)	**2 lb.-in.	—	—	*2 lb.-in.	—	—	*3 lb.-in.	—
Bearings	Bronze	SS Ball B.	SS Ball B.	Bronze	SS Ball B.	SS Ball B.	Bronze	SS Ball B.

* Add one ounce-inch for O-ring seal

** For units with mechanical stops.

Conforms to MIL - R - 39023 A

Standard Resistance Values Within Range Indicated.

500 Ω , 1K, 2K, 5K, 10K, 20K, 50K, 100K

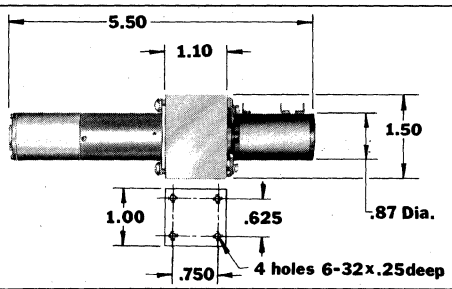
MAUREY INSTRUMENT CORPORATION
4555 West 60th Street, Chicago, IL 60629 • PHONE (312) 581-4555 • FAX (312) 581-2576

MAUREY INSTRUMENT CORP. MOTORIZED POTENTIOMETERS AND SWITCHES

MPS

General Description & Applications

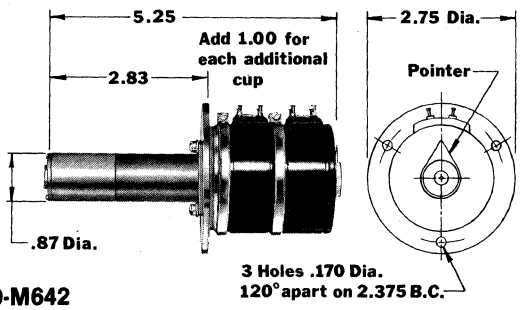
A family of single turn and multiturn, motor driven potentiometers and switches has been developed for industrial servo applications. They are used for such applications as variable speed controls on power generating sets, electrical-mechanical remote control, and readouts. They provide excellent accuracy at an economical price. These integrated motor-potentiometers are the result of years of Maurey experience in the manufacture of precision potentiometers and motor assemblies. The potentiometers, gear head, clutch, and motor are precisely matched to perform to exacting specifications. Motor-clutch-pot units are available in a wide range of specifications. A motor of selected speed and voltage may be matched with single, 3, 5, or 10 turn potentiometers, either wirewound or conductive plastic. When multiple voltages are required, single cups may be conveniently ganged with or without clutches. In addition, Maurey engineers can provide multi-tap potentiometers, special shafts and mountings, and a wide range of AC or DC motors to your specification.



87-H477

87-H477 DC Motorized Multiturn Potentiometer

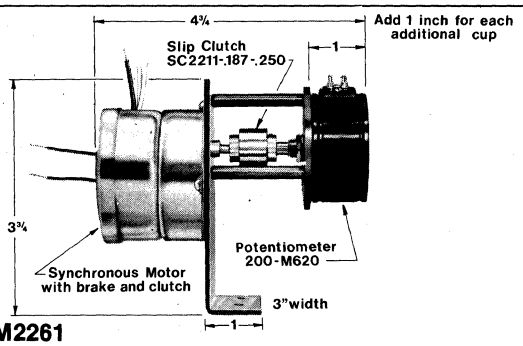
A compact, motor driven, 10 turn ⅞" diameter precision potentiometer. A slip clutch between the motor and the potentiometer protects the stops at the end of mechanical travel. The precision machined, square aluminum housing provides mounting holes for the device.
Sealed from dust and normal industrial environment.
Potentiometer independent linearity: ±0.25% or better
Power rating: 2.5 watts at 60°C
Resistances available: 500Ω, 1K, 2K, 5K, 10K, 20K, 50K, 100K.



200-M642

200-M642 DC Motorized Single Turn Potentiometer

A versatile motor, switch, potentiometer assembly. This model may use multi-pole, single throw switch cups, and with up to six precision potentiometers of various resistance values. All components are easily assembled or changed. Proven design for factory or mill environments. A pointer indicates position of wiper or percentage of voltage. A mounting flange simplifies installation on a panel or bracket.
Potentiometers have 320°electrical angle, linearity: ±0.5%
Power: 5 watts at 85°C.
Resistances available: 100Ω, 250Ω, 500Ω, 1K, 2K, 2.5K, 5K, 10K, 20K, 25K, 50K, 100K.



M2261

M2261 AC Motorized Single Turn Potentiometers

A compact AC motor driven wirewound potentiometer with mechanical stops. A slip clutch provides positive protection to the mechanical stops in the potentiometer. The slip clutch can be eliminated for continuous rotation potentiometers. Also available with single throw switches.
Potentiometer: ±0.5% independent linearity; 4 watts, standard resistances of 250, 500, 1K, 2K, 2.5K, 5K, 10K, 20K, 50K, 100K.
Motor: 115 Volts, A.C. 60 Hz; synchronous continuous duty with positive clutch and instantaneous brake; standard RPM: 1, 2, 4, 6, 10, 12, 30, 60.

Standard DC Motor Data:

Speed: (See chart)
Voltage: (See chart)
Current: (See chart)
Torque at 24 volts: 50 oz-in.
Break away voltage: 10 volts DC
Other requirements on request

Voltage VDC	ma	Speed RPM
12	49	6.0
24	50	16.0
28	51	21.2
35	53	24.5

Special Requirements

The types shown here are representative of a wide range of motor driven mechanisms manufactured by Maurey. AC or DC motors may be used. Single and multicup carbon, wirewound, or conductive plastic potentiometers may be specified, with or without slip clutches or switches. Write or phone for a solution to your requirement.

MAUREY
INSTRUMENT CORPORATION
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MAUREY
INSTRUMENT CORP.

TYPE DP

DANCER WITH CONDUCTIVE PLASTIC POTENTIOMETER

The Type DP Dancer Potentiometer sensor is used to monitor the slack or tension on a moving sheet of material such as plastic, steel, rubber, etc. The construction is trouble free with almost unlimited life.

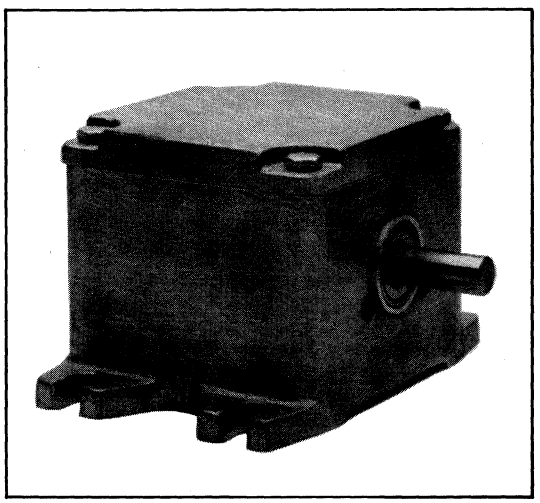
The precision potentiometer actuated by the shaft is designed with the unique Maurey raised molded track. In addition to the life of 200,000,000 ditters or oscillations of the wiper on the resistance track, the unit is impervious to moisture, oil, dust and corrosive gases.

The ground and polished stainless steel shaft is supported by stainless steel ball bearings in a one piece cast aluminum, explosion proof type housing. The electrical travel is adjustable by the two internal snap action switches.

To facilitate wiring, the housing has a 1/2 inch tapped hole and internal barrier type terminal block.

GENERAL SPECIFICATIONS

One piece aluminum housing.
Stainless steel ball bearings.
Stainless steel shaft.
Oil, water and dust sealed.
Shaft torque (not at detents): 6 ounce-inches
Life: 200,000,000 ditters at 60 cycles per minute
Operating temperature range: – 55° to 105° C.
Equipped with internal terminal board.
Tapped for 1/2 conduit.

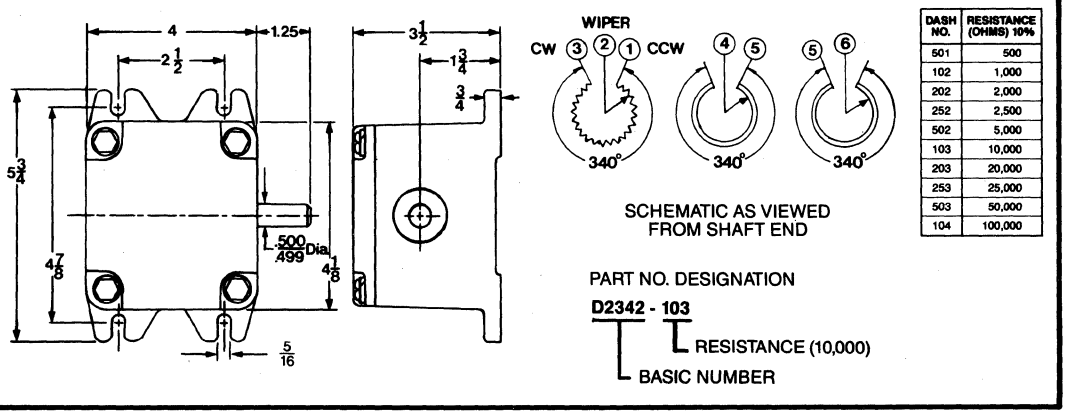


CONDUCTIVE PLASTIC POTENTIOMETER

Resistance: See Chart
Resistance Tolerance: ± 10%
Resolution: Infinite
Independent Linearity: ± 1.0%
Repeatability: ± 0.2%
Output Smoothness: 1%
Electrical Function Angle: 340° ± 3°
Mechanical Angle: 360° Continuous
Temperature Coefficient of Resistance: 500 PPM/° C
Power: 1.0 Watt at 85° derated to zero at 105° C
Dielectric Strength: 750 Volts AC for 60 SEC.
Precious metal contacts.

SWITCH SPECIFICATIONS

Single pole, double throw
Current: 15 amp/125 VAC,
7.5 amp/250 VAC
Voltage: 125/250 Volts, AC
Power: 1/4 H.P.



DASH NO.	RESISTANCE (OHMS) 10%
501	500
102	1,000
202	2,000
252	2,500
502	5,000
103	10,000
203	20,000
253	25,000
503	50,000
104	100,000

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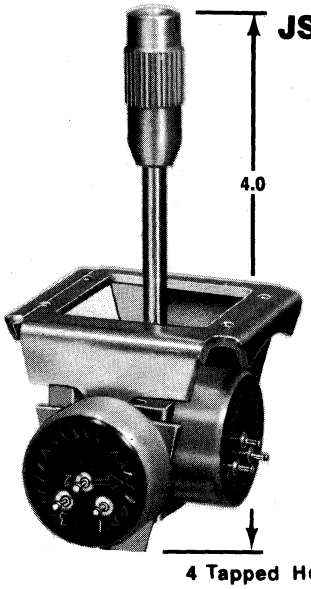
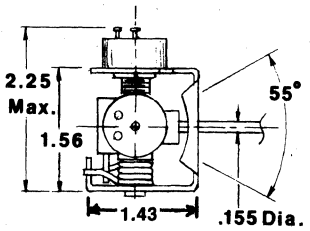
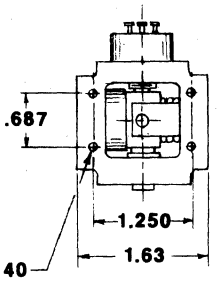
MAUREY INSTRUMENT CORP.

JOYSTICKS JSP/JSE

JSP JOYSTICK CONTROLS WITH POTENTIOMETERS







The Maurey JSP 2302 series precision joystick controls have been proven in a wide variety of applications.

Designed with long life precision potentiometers, the JSP series is available with either single, dual or triple axis control. The compact all metal construction provides a strong, reliable unit.

To better suit your application, the JSP series is available with either internal or external boot, a push button switch in the handle and a variety of knob styles.

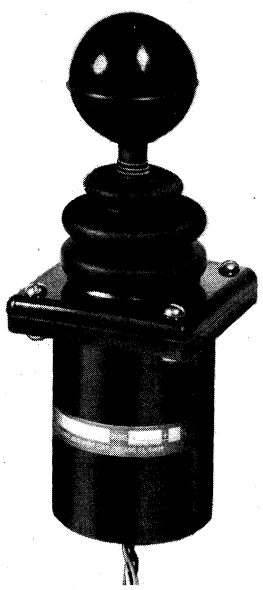
MECHANICAL SPECIFICATIONS

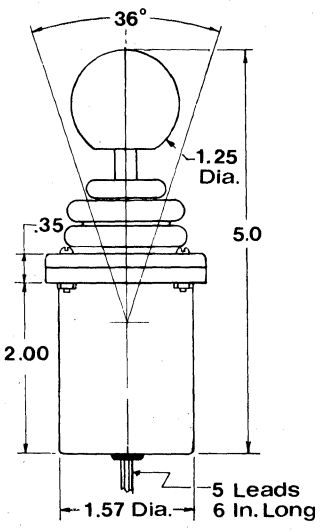
Spring return to center
Knob torque: 12 ounce-inches
Life: 2,000,000 cycles
Limiter Plates available to limit direction of knob.

CONDUCTIVE PLASTIC POTENTIOMETER SPECIFICATIONS

Voltage Repeatability: ±0.2%
Resistance available: (±20%): 1K, 5K, 10K, 20K
Power: 1 Watt at 25°C
Wipers phased at center of resistance.
Temperature Range: —30° to 105°C

JSE INDUCTION TYPE JOYSTICK CONTROL

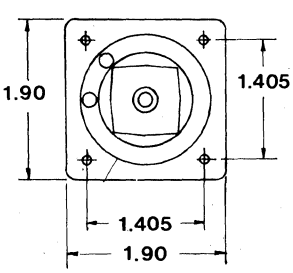


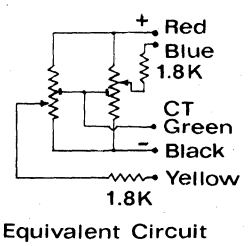


The Maurey JSE 2304 Joystick Control is a non-contacting, inductive device which provides extremely long life, infinite resolution and zero noise. Inherent in the design is a constant output throughout the life of the unit.

A shaft seal boot is supplied on all units to protect the mechanism from moisture and dust.

The electronic circuitry is encapsulated in an anodized aluminum case resulting in an assembly which is compatible to most hostile environments.





Equivalent Circuit

ELECTRICAL SPECIFICATIONS

Operating Voltage:	4.5 to 15.0 Volts, D.C.	Center Tap Voltage:	50% of Input Voltage
Current:	15 ma at 10 Volts, D.C.	Resolution:	Infinite
Output Impedance:	1800 ohms (Signals)	Life:	20,000,000 cycles
Center Tap Impedance:	340 ohms	Leads:	6 inch standard length, color coded
Equivalent Noise Resistance:	None		
Temperature Range:	—30° to 105° C	Knob has spring return to center.	

MAUREY
INSTRUMENT CORPORATION
4557 West 60th Street, Chicago, IL 60629 • PHONE (312) 581-4555 • FAX (312) 581-2576

MAUREY
INSTRUMENT CORP.

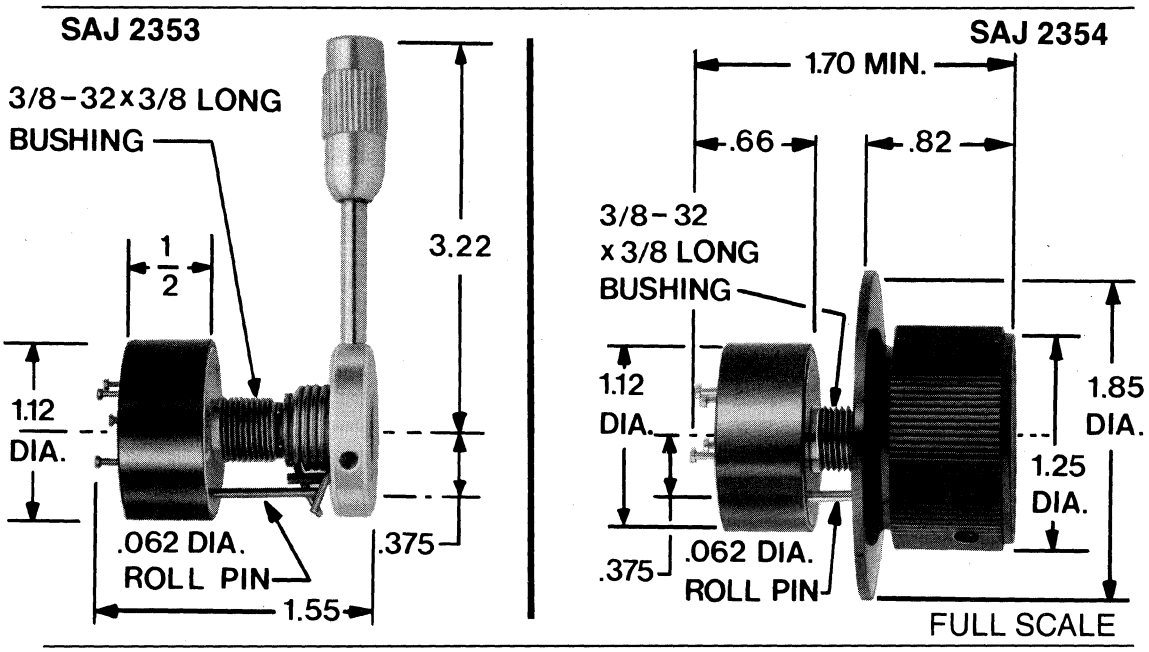
TYPE SAJ

SINGLE AXIS JOYSTICK CONTROLS WITH POTENTIOMETER

The Type SAJ single axis joystick control is the ideal choice for those industrial applications where a single plane of travel is to be controlled. Such devices are used to control the speed of a single motor, or to determine the back and forth motion of a hydraulic or pneumatic cylinder.

Both units are spring return to center for zero reference. They are available with either lever type or rotary actuator and will adapt to almost any mounting configuration. The bushing type potentiometer facilitates installation.

The precision conductive plastic potentiometer uses the unique Maurey raised molded track, resulting in almost unlimited life. In addition, this design insures that the potentiometer is impervious to moisture, oil, dust and industrial gases.



MECHANICAL SPECIFICATIONS

Major axis operating angle: ±30° (60° total)
Spring return to center tap.
Knob Torque: 12 ounce-inches
Life: 10,000,000 cycles
Temperature range: –30° to 105° C

CONDUCTIVE PLASTIC POTENTIOMETER SPECIFICATIONS

Standard resistances: 1K, 5K, 10K
Resistance tolerance: ±20%
Electrical travel: ±30° (60° total)
Center tap at center of electrical travel.
Knob phased at center tap.
Linearity: ±2%
Repeatability: ±0.2%
Power: 1 watt at 40° C.

DASH NO.	RESISTANCE OHMS
501	500
102	1,000
202	2,000
252	2,500
502	5,000
103	10,000
203	20,000
253	25,000
503	50,000

JOYSTICK
PART NUMBER
DESIGNATION

SAJ2353 - 103

MODEL

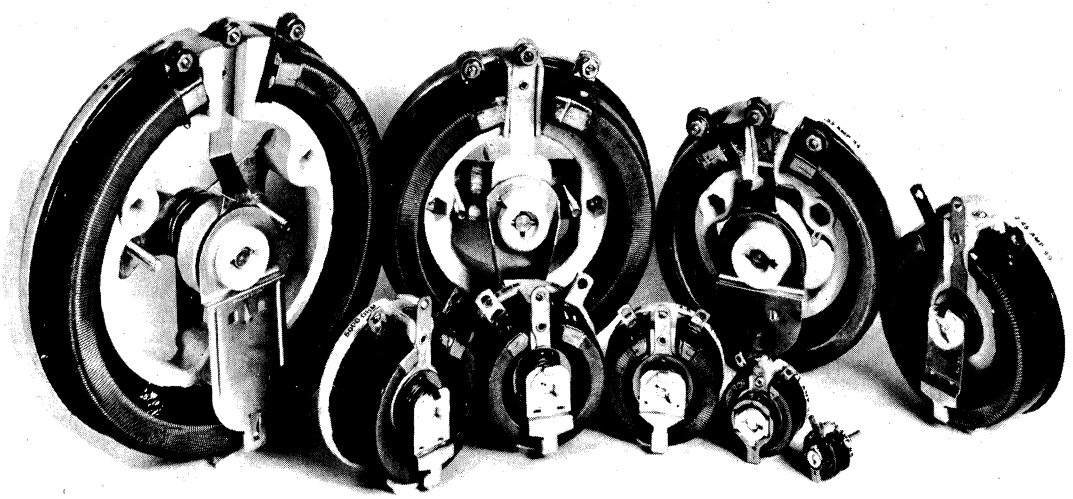
RESISTANCE (10K)

MAUREY
INSTRUMENT CORPORATION
4555 W. 60th Street, Chicago, IL 60629 • PHONE (312) 581-4555 / FAX No. (312) 581-2576

MEMCOR-TRUOHM INC.

POWER RHEOSTATS

MEET THE MEMCOR FAMILY OF HIGH QUALITY WIRE-WOUND POWER RHEOSTATS



All MEMCOR Power Rheostats are vitreous enamel coated. The core and base are bonded together with vitreous enamel, thereby contributing markedly to the heat dissipation.

Standard tolerance: ±10%, ±5% available as a special.

TYPE	POWER (Watts)	RESISTANCE RANGE	DIAMETER	WEIGHT
R12½	12½ Watt	1 - 5000 Ohms	⅞″	.035 Lbs.
R25	25 Watt	1 - 5000 Ohms	1 1/16″	0.23 Lbs.
R50	50 Watt	0.5 - 10,000 Ohms	2 15/16″	0.45 Lbs.
R75	75 Watt	0.5 - 10,000 Ohms	2¾″	0.60 Lbs.
R100	100 Watt	0.5 - 10,000 Ohms	3⅛″	0.72 Lbs.
R150	150 Watt	0.5 - 10,000 Ohms	4″	1.50 Lbs.
R225	225 Watt	1 - 2500 Ohms	5″	2.18 Lbs.
R300	300 Watt	1 - 2500 Ohms	6″	3.0 Lbs.
R500	500 Watt	1 - 2500 Ohms	8″	3.75 Lbs.
R1000	1000 Watt	1 - 2000 Ohms	12″	10.0 Lbs.

Special Rheostats with Tapered Sections, Locking Devices, Off Positions, Tandem Mountings, Special Shafts on Bushing, and many other variations can be supplied.

Write for FREE Catalog.

MEMCOR-TRUOHM INC.

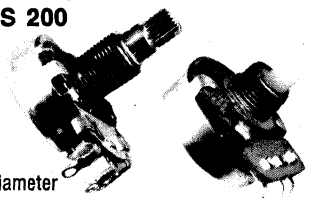
DEPT. EM
1320 FLAXMILL ROAD
HUNTINGTON, INDIANA 46750
Fax No. 356-7376
Telephone: (219) 356-4300
ESY LINK 629-38315

MEPCO/CENTRALAB

A NORTH AMERICAN PHILIPS COMPANY

POTENTIOMETERS

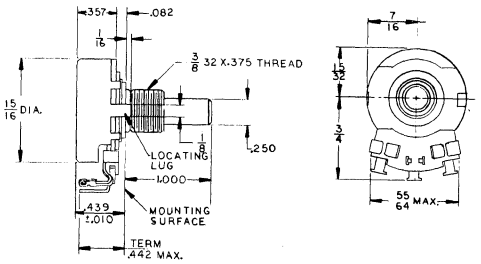
SERIES 200



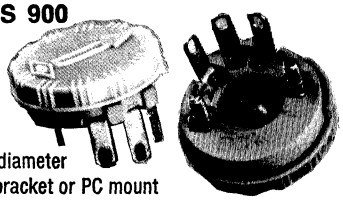
- 13/16" diameter
- PC, wirewrap or solder lub terminals
- Bushing, twist tab, or PC Terminal Mount
- Numerous metal or plastic shaft options

SPECIFICATIONS

Resistor: Carbon, Linear ±20%
Carbon, Non-Linear ±20"
Power Rating: .5 Watt Linear
.2 Watt Non-Linear
Max. Oper. Voltage: 350VDC
Rotational Life: 25,000 cycles
Rotation: 300° ±5°
CRV: <5%
Insulation Resistance: >100 megohm



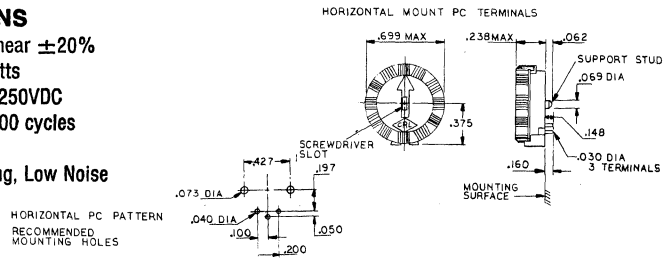
SERIES 900



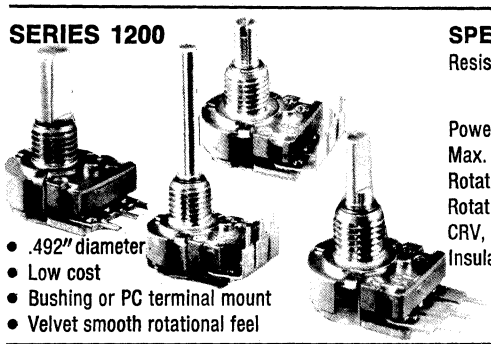
- .699" diameter
- Stud, bracket or PC mount
- Numerous knob styles and colors available
- Vertical or horizontal mounting styles

SPECIFICATIONS

Resistor: Carbon, Linear ±20%
Power Rating: .2 Watts
Max. Oper. Voltage: 250VDC
Rotational Life: 25,000 cycles
Rotation: 260° ±3°
Contacts: Dual Wiping, Low Noise



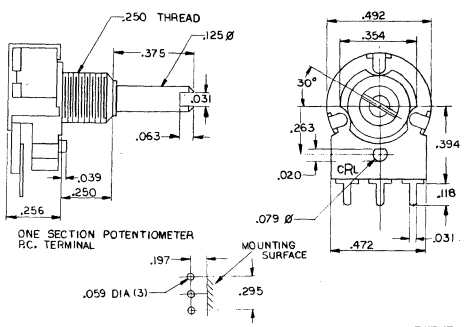
SERIES 1200



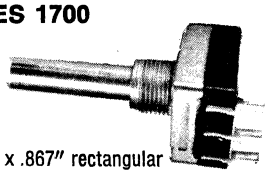
- .492" diameter
- Low cost
- Bushing or PC terminal mount
- Velvet smooth rotational feel

SPECIFICATIONS

Resistor: Carbon, Linear
<500K ohm ±20%
>500K ohm ±30%
Power Rating: .16 Watt
Max. Oper. Voltage: 200 Volts (RMS or VDC)
Rotational Life: 25,000 cycles
Rotation: 300° ±10°
CRV, Initial: 2% Nominal
Insulation Resistance: 100 Megohm Min.



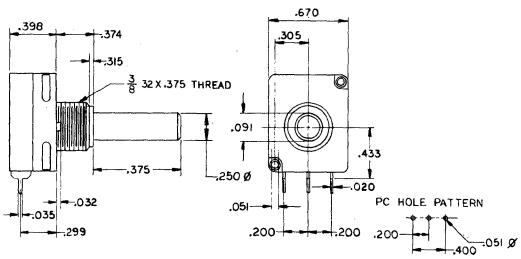
SERIES 1700



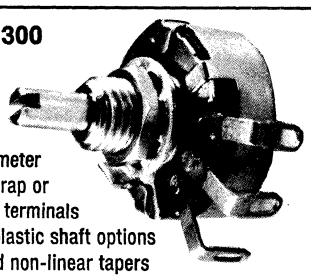
- .670" x .867" rectangular
- High-torque viscous feel
- Broad variety of modular configurations
- Bushing, bracket, or PC mounting options

SPECIFICATIONS

Resistor: Carbon, Linear ±20"
Cermet, Linear ±10%
Power Rating: .2 Watts, Carbon
1.25 Watts, Cermet
Max. Oper. Voltage: 500VDC Max.
Rotational Life: 100,000 cycles
Rotation: 300° ±2%
CRV, Initial: <2%, Carbon
<1%, Cermet
Insulation Resistance: >100 Megohm



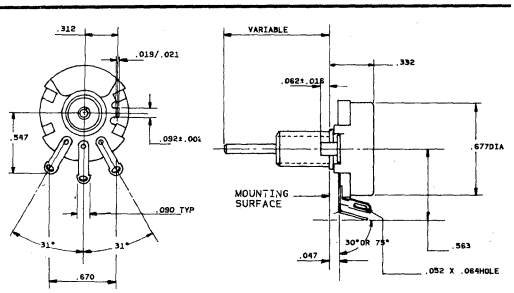
SERIES 300



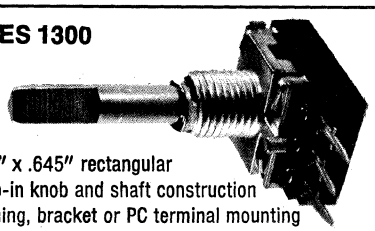
- 677" diameter
- PC, wirewrap or solder lug terminals
- Metal or plastic shaft options
- Linear and non-linear tapers
- Numerous line switches available

SPECIFICATIONS

Resistor: Carbon, Linear ±20%
Cermet, Linear ±10%
Power Rating: .25 Watt, Carbon
2 Watt, Cermet
Max. Oper. Voltage:
250 VRMS or DC Max., Carbon
450 VRMS or DC Max., Cermet
Rotational Life: 25,000 cycles, Carbon
50,000 cycles, Cermet
Rotation: 260° ±3°
CRV, Initial: <3%, Standard, Carbon
<2%, Standard, Cermet
Insulation Resistance: >100 Megohm



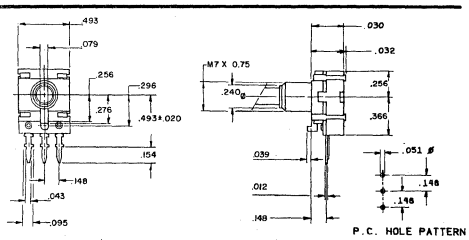
SERIES 1300



- .492" x .645" rectangular
- Snap-in knob and shaft construction
- Bushing, bracket or PC terminal mounting options

SPECIFICATIONS

Resistance: Carbon, Linear ±30%
Power Rating: .2 Watt @ 40°C, Linear
.1 Watt @ 40°C, Non-Linear
Max. Oper. Voltage: 350VAC or 500VDC Max.
Rotational Life: 25,000 cycles
Rotation: 300° ±2°
CRV, Initial: ≤2%
Insulation Resistance: >100 Megohm



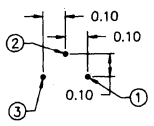
MEPCOPAL
Trimmers and Switches.

TRIMMER PIN STYLES

TOP ADJUST
1106B*
1106T
1113B*
1113T
1113TR†
8024Y
8026W

SIDE ADJUST
CT-6X
RJ-6X
TM-7X
8014X
8038U

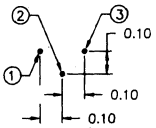
TO-5



TOP ADJUST
CT-6P
RJ-6P
RJ-13B*
RJ-13P
RJ-13PR†
TM-7P
8014P

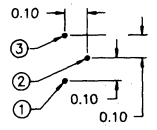
SIDE ADJUST
CT-6S
RJ-6S
RJ-13S
RJ-13SR†
TM-7S
1106S
1113S
1113SR†

TO-5



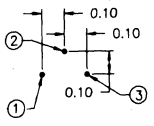
SIDE ADJUST
8026X

TO-5



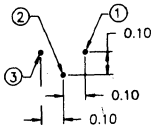
SIDE ADJUST
CT-6N
CT-9P
1309P
8024P
8026P
8038X

TO-5



TOP ADJUST
CT-6R
8038P

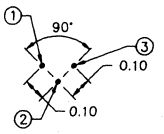
TO-5



TOP ADJUST
CT-6W
RJ-4W
RJ-6W
TM-7W
8014W

SIDE ADJUST
RJ-4WS

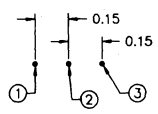
TO-18



TOP ADJUST
8038R

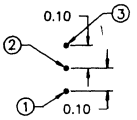
SIDE ADJUST
8038Z

IN-LINE



SIDE ADJUST
CT-9X
1309X
8024X

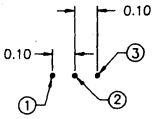
IN-LINE



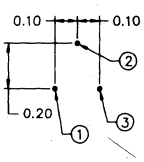
TOP ADJUST
CT-6V
CT-9W
1309W
8024W

SIDE ADJUST
CT-6H
8038W
8038V‡

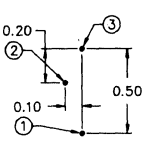
IN-LINE



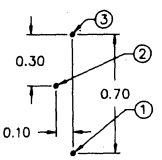
TOP ADJUST
8038H



SIDE ADJUST
CT-20P
1208P
8035P

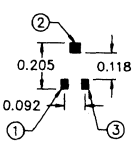


SIDE ADJUST
CT-20X
1211P
1211PB*



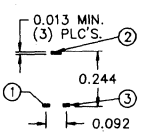
SURFACE MOUNT

TOP ADJUST
ST-4A

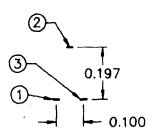


SURFACE MOUNT

TOP ADJUST
ST-4B



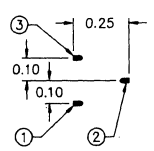
TOP ADJUST
ST-4C



SURFACE MOUNT

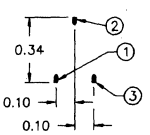
TOP ADJUST
ST-5W

SIDE ADJUST
ST-5X



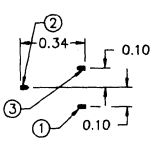
SURFACE MOUNT

SIDE ADJUST
ST-5P



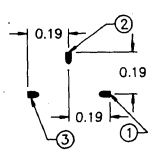
SURFACE MOUNT

SIDE ADJUST
ST-5R



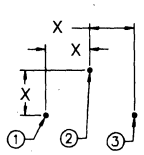
SURFACE MOUNT

TOP ADJUST
ST-6P



BOTTOM ADJUST

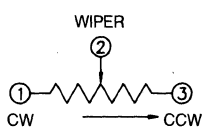
	x dimension
CT-6F	.17
RJ-6F	.17
1106F	.14
1113F	.30
1113FR†	.30



SIDE ADJUST
1211L
1211LB*

Flexible Color Coded Leads, 6" Long

*Bushing
†Knob
‡Pins 1 and 3 reversed



- Pin patterns shown are as seen from bottom view of the part.
- For all side adjust pin styles, the shaft points towards the top of the page.
- All dimensions are in inches.

STANDARD RESISTANCE VALUES
(in ohms)

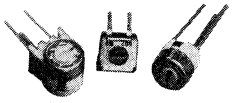
10	1K	100K
20	2K	200K
50	5K	500K
100	10K	1M
200	20K	2M
500	50K	5M

MEPCOPAL Mepcopal Company, 11468 Sorrento Valley Road, San Diego, California 92121
619/453-0332, FAX: 619/481-1123

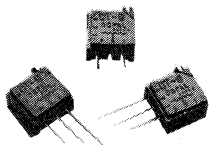
MEPCOPAL

Trimmers & Switches.

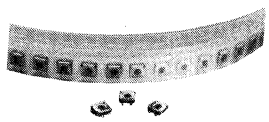
TRIMMER SPECIFICATIONS



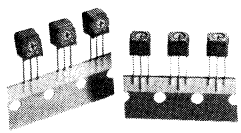
RJ-4/ST-4C TRIMMERS



CT-9 TRIMMERS



ST-4 TRIMMERS



CT-6 TRIMMERS

Element	Style	Shape	Number of Turns (Nominal)	Model	Basic Outline Dimen. Inch	Basic Outline Dimen. MM	Resistance Range (Ω)	Power Rating (°C)	Operating Temperature Range (°C)	Adjustment Pin Configuration: Pin Style: Adj. Mode	To-18	To-5	In-Line	Other	Pkg.: Bulk	Magazine	Tape & Reel
CERMET	SINGLE TURN	ROUND	1	RJ-4	.19	4.9	10-2 Meg	.50W@70°	−55 to +125	TOP	W				•		
										SIDE	WS						
			1	8014	.25	6.4	10-5 Meg	.50W@25°	−25 to +125	TOP	W	P			•		
										SIDE		X					
			1	RJ-6	.25	7.0	10-5 Meg	.50W@70°	−55 to +125	TOP	W	P		F	•		
										SIDE		S,X					
			1	RJ-13	.50	12.6	10-5 Meg	.75W@70°	−55 to +125	TOP		P,B,PR			•		
										SIDE		S,SR					
		SQUARE	1	CT-6	.25	7.0	10-2 Meg	.50W@70°	−55 to +125	TOP	W	P,R	V	F	•	•	•
										SIDE		S,X	H				
			1	8038	.38	9.5	10-5 Meg	.50W@85°	−25 to +125	TOP		P	R	H	•		
										SIDE		U,X	V,W,Z,				
	MULTI-TURN	ROUND	3	TM-7	.28	7.2	50-2 Meg	.50W@70°	−55 to +125	TOP	W	P			•		
										SIDE		S,X					
		SQUARE	12	8026*	.25	6.4	10-5 Meg	.25W@85°	−65 to +150	TOP		W			•		
										SIDE		P,X					
			25	8024*	.38	9.5	10-5 Meg	1.0W@70°	−65 to +150	TOP		Y	W		•		
										SIDE		P	X				
			18	CT-9	.38	9.5	10-5 Meg	.50W@70°	−55 to +125	TOP			W		•		•
										SIDE		P	X				
		REC-TANGLE	15	8035	.75	19.0	10-5 Meg	.75W@70°	−55 to +125					P	•	•	•
										SIDE							
			15	CT-20	.75	19.0	10-5 Meg	.50W@70°	−55 to +125					P,X	•		
										SIDE							
(CERMET) SURFACE MOUNT	SINGLE TURN	SQUARE	1	ST-4	.18	4.5	10-2 Meg	.25W@70°	−55 to +125	TOP				A,B,C,F	•	•	•
			1	ST-6	.25	7.0	10-2 Meg	.50W@70°	−55 to +125	TOP				P	•		
	MULTI-TURN		14	ST-5	.25	6.4	10-2 Meg	.25W@85°	−55 to +125	TOP				P,R,X,W	•	•	•
										SIDE							
WIRE-WOUND	SINGLE TURN	ROUND	1	1106	.25	6.6	10-30K	.37W@70°	−55 to +120	TOP		T,B		F	•		
										SIDE		S					
			1	1113	.50	13.5	10-100K	.75W@70°	−55 to +120	TOP		T,B,T,R		F,FR	•		
										SIDE		S,SR					
	MULTI-TURN	SQUARE	19	1309	.38	9.5	10-50K	.50W@70°	−55 to +120	TOP			W		•		
										SIDE		P	X				
		REC-TANGLE	16	1208	.75	19.0	10-50K	.50W@70°	−55 to +120					P	•		
										SIDE							
			22	1211	1.25	31.8	10-100K	.75W@85°	−55 to +120					P,L,PB, LB	•		
										SIDE							

Notes:

1. Temperature Coefficient of resistance is 100 ppm/°C maximum. This may vary at high and low resistance values. See catalog for details.
2. All models pass immersion at 85°C. Available in military RJ & RJR versions.

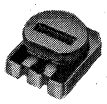
MEPCOPAL Mepcopal Company, 11468 Sorrento Valley Road, San Diego, California 92121
619/453-0332, FAX: 619/481-1123

chip trimming potentiometers, cermet

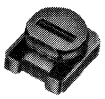
MURATA ERIE NORTH AMERICA

RVG4H01A

RVG4E01A



RVG4F03A



RVG4F05A

The RVG4 Series has presoldered electrodes to facilitate surface mounted auto-placement and reflow soldering. They are also available with conventional lead type terminals. The wide 200° rotational angle improves performance and resistance range.

FEATURES

- Miniature size—3.8 x 4.5 x 2.25 (mm) for close component spacing (for RVG4F types)
- Easily adjusts with regular screwdriver
- Large, solid axle not affected by vacuum chuck during autoplacement (F/H/E types)
- Nickel barrier layer terminals eliminate solder leaching in reflow soldering operation
- RVG4 Series available on 12mm Tape and Reel for auto-placement

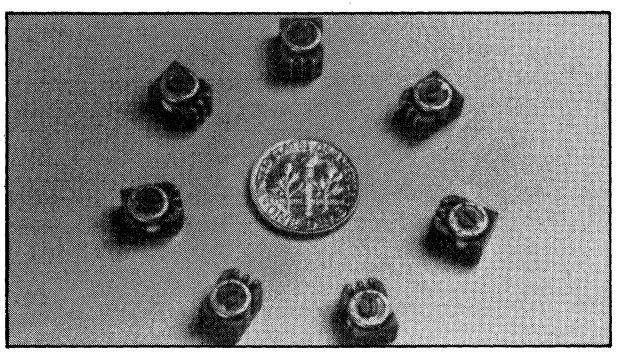
APPLICATIONS

The RVG4 Series is widely applicable to fine circuit adjustments in consumer electronic equipment such as small VTR cameras, TV tuners, portable TV and stereo sets, as well as transceiver communication circuits and industrial motor controllers, photoelectric switches and medical electronic equipment.

SPECIFICATIONS

Item	RVG4H	RVG4E	RVG4F
Resistance Range	100 Ω to 2 MΩ		
Tolerance	±25%		
Taper	B (Linear)		
Power Rating	0.1W at 70°C		
Max. Working Voltage	50V DC		
Torque	2.0 to 24.5 mNm		
Electrical Rotation	240 ±10°	270 ±10°	240 ±10°

chip trimming potentiometers, cermet, sealed



The POT3321A Series is a sealed, flame retardant unit which meets UL94V-0 requirements and may be wave soldered.

FEATURES

- Miniature size—7.0 x 9.1 x 6.4 (mm) for close component spacing
- Easily adjusts with regular screwdriver
- Large, solid axle not affected by vacuum chuck during auto-placement
- Solder coated terminals eliminate solder leaching in reflow soldering operation
- POT3321A Series available in magazine packaging only

APPLICATIONS

The POT3321A Series is widely applicable to fine circuit adjustments in consumer electronic equipment such as small VTR and stereo sets, as well as transceiver communication circuits and industrial and motor controllers, photoelectric switches and medical electronic equipment.

SPECIFICATIONS

	POT3321A
Resistance Range	10 Ω to 5 MΩ
Tolerance	±20%
Temperature Coefficient	±100ppm/°C
Residual Resistance	1% or 2 Ω max., whichever is greater
Power Rating	0.5W at 70°C. Derated to 0W at +150°C
Working Voltage	300 VDC max.
Operating Temp. Range	−55°C to +150°C
Contact Resistance Variation	3% or 3 Ω max., whichever is greater
Dielectric Strength	600 VAC, room conditions
Insulation Resistance	1,000 MΩ min. at 500 VDC
Torque	2.8 in.-oz. max.
Effective Electrical Rotation	230° nominal

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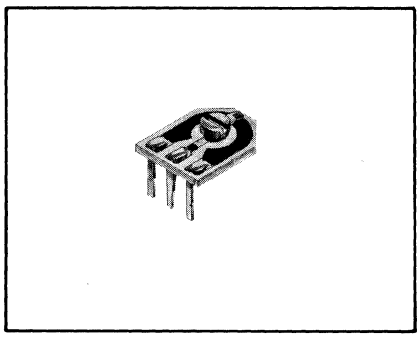
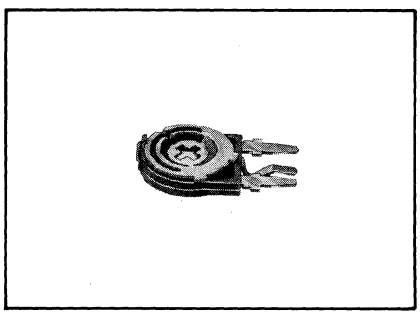
single turn, low cost trimming potentiometers

MURATA ERIE NORTH AMERICA



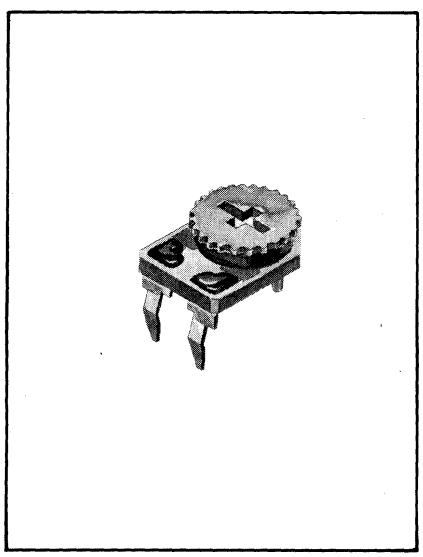
1/10 Watt, Carbon—RVA0607

Resistance Range:	200 ohms to 2 Megohms
Tolerance:	±30%
Residual Resistance:	200 to 500 ohms — 5 ohms max. Over 500 ohms — 1% max.
Taper:	Linear
Power Rating:	0.1W (at 70°C) Derated to 0 watts at 100°C
Max. Working Voltage:	50 VDC
Torque:	.27 to 2.8 in.-oz. (20 to 200 g cm)
Terminal Strength:	35.27 oz. (1.0 kg) when the force is applied in the direction of the axes of the terminal
Effective Rotation:	Approx. 220°



.15 Watt, Carbon—RVF8

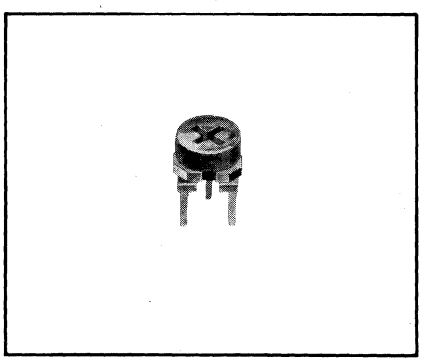
Resistance Range:	100 ohms to 1 Megohm
Tolerance:	±25%
Residual Resistance:	Less than 5% of nominal rated resistance
Taper:	Linear
Power Rating:	0.15W (at 70°C) Derated to 0 watts at 85°C
Max. Working Voltage:	150 VDC
Torque:	.4 to 4.17 in.-oz.
Terminal Strength:	17.64 oz. when the force is applied in the direction of the axes of the terminal
Effective Rotation:	270° ±10°



1/5 to 3/4 Watt, Carbon, Conductive Plastic & Cermet—0911/1214

Characteristic	RVA (Carbon) RVX (Cond. Plastic)		RVG (Cermet)	
	0911	1214	0911	1214
Resistance Range:	200 — 5 Megohms*		200 — 1 Megohm	
Tolerance:	±20%			
Residual Resistance:	Less than 500Ω, 5Ω maximum 500Ω and up, less than 1% of nominal rated resistance			
Taper:	Linear			
Power Rating**:	1/5W (70°C)	1/3W (70°C)	1/2W (70°C)	3/4W (70°C)
Max. Working Voltage***:	250 VDC	350 VDC	350 VDC	500 VDC
Torque:	0.56-4.86 in.-oz.	0.83-6.0 in.-oz.	0.56-4.86 in.-oz.	0.83-6.0 in.-oz.
Terminal Strength:	35.27 oz.			
Effective Rotation: Elec.	240°	250°	240°	250°
Mech.	260° ±10°	280° ±10°	260° ±10°	280° ±10°
Stop Strength:	13.9 in.-oz.			

*100 Ohms available in RVA **Derated to 0 watts at 100°C (for Carbon and Cond. Plastic), at 125°C (for Cermet)
*** Max working V varies with resistance value. Vmax = √Resistance x Power



1/3 Watt, Cermet—RVS0707

Resistance Range:	100 ohms to 1 Megohm
Tolerance:	±20%
Temperature Coefficient:	±100ppm/°C
Residual Resistance:	100 to 500 ohms — 5 ohms max. Over 500 ohms — 1% max.
Taper:	Linear
Power Rating:	1/3W (at 70°C) Derated to 0 Watts at 125°C
Max. Working Voltage:	100 VDC
Torque:	.27 to 2.8 in.-oz. (20 to 200 g cm)
Terminal Strength:	12.35 oz. (350 gr) when the force is applied in the direction of the axes of the terminal
Effective Rotation:	200° ±10°

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sealed precision cermet trimming potentiometers—±100 ppm/°C

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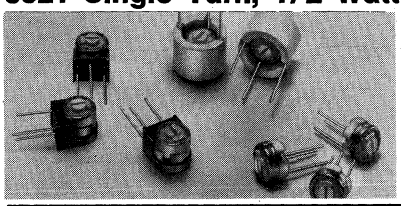
3321 Single Turn, 1/2 Watt



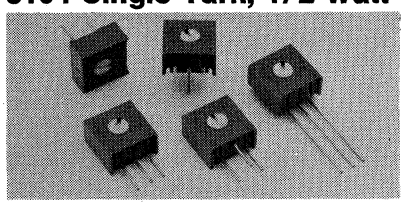
FEATURES

- Flame retardant rotor meets UL94V-0 requirements
- Extremely small size — .260″D. x .181″
- Sealed to withstand wave soldering and immersion cleaning processes

SPECIFICATIONS

Resistance Range	10 ohms to 5 Megohms
Tolerance	±20%
Residual Resistance	1% or 2 ohms max. whichever is greater
Power Rating	0.5W at 70°C. Derated to 0W at +150°C
Working Voltage	300 VDC max.
Operating Temperature Range	−55°C to +150°C
Contact Resistance Variation	3% or 3 ohms max. whichever is greater

3104 Single Turn, 1/2 Watt



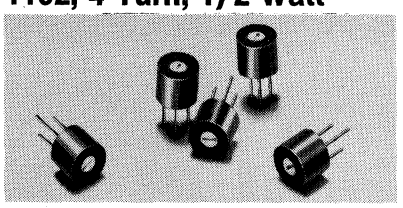
FEATURES

- Low cost
- ⅜″ square

SPECIFICATIONS

Resistance Range	10 ohms to 2 Megohms
Tolerance	±10%
Residual Resistance	2 ohms max.
Power Rating	0.5W at 70°C. Derated to 0W at +125°C
Working Voltage	300 VDC max.
Operating Temperature Range	−55°C to +125°C
Contact Resistance Variation	1% or 1 ohm max. whichever is greater

1102, 4-Turn, 1/2 Watt



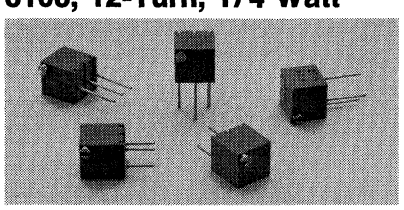
FEATURES

- Unique planetary drive provides the precise setting capability of a multi-turn unit in a small single-turn package
- Just .299″D x .260″
- Sealed to withstand wave soldering and immersion cleaning process

SPECIFICATIONS

Resistance Range	10 ohms to 2 Megohms
Tolerance	±10%
Residual Resistance	1% or 2 ohms max. whichever is greater
Power Rating	0.5W at 70°C. Derated to 0W at +125°C
Working Voltage	300 VDC max.
Operating Temperature Range	−55°C to +125°C
Contact Resistance Variation	3% or 3 ohms max. whichever is greater

3103, 12-Turn, 1/4 Watt



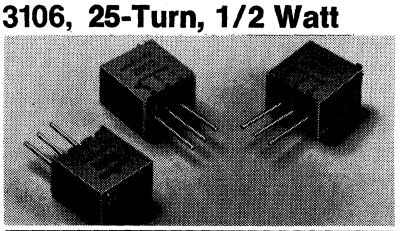
FEATURES

- ¼″ square
- Sealed to MIL-R-22097 standards

SPECIFICATIONS

Resistance Range	10 ohms to 1 Megohm
Tolerance	±10%
Residual Resistance	1% or 2 ohms max. whichever is greater
Power Rating	0.25W at 70°C. Derated to 0W at +125°C
Working Voltage	200 VDC max.
Operating Temperature Range	−55°C to +125°C
Contact Resistance Variation	3% or 3 ohms max. whichever is greater

3106, 25-Turn, 1/2 Watt



FEATURES

- Small size — .374″ x .394″ x .200″
- Sealed to MIL-R-22097 standards. Will withstand industrial cleaning processes

SPECIFICATIONS

Resistance Range	10 ohms to 2 Megohms
Tolerance	±10%
Residual Resistance	1% or 2 ohms max. whichever is greater
Power Rating	0.5W at 70°C. Derated to 0W at +125°C
Working Voltage	300 VDC max.
Operating Temperature Range	−55°C to +125°C
Contact Resistance Variation	3% or 3 ohms max. whichever is greater

2103, 15-Turn, 3/4 Watt

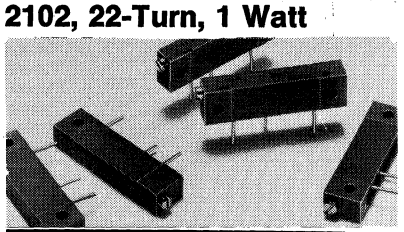
FEATURES

- Small size — .181″ x .252″ x .752″ for close board spacing
- Sealed to MIL-R-22097 standards. Will withstand industrial cleaning processes

SPECIFICATIONS

Resistance Range	10 ohms to 2 Megohms
Tolerance	±10%
Residual Resistance	3% or 1 ohm max. whichever is greater
Power Rating	0.75W at 70°C. Derated to 0W at +125°C
Working Voltage	300 VDC max.
Operating Temperature Range	−55°C to +125°C
Contact Resistance Variation	3% or 3 ohms max. whichever is greater

2102, 22-Turn, 1 Watt



FEATURES

- 22-turn mechanism provides extremely fine adjustment capability
- High power dissipation: 1.0W at 70°C
- Sealed to withstand wave soldering and immersion cleaning processes

SPECIFICATIONS

Resistance Range	10 ohms to 2 Megohms
Tolerance	±10%
Residual Resistance	1% or 2 ohms max. whichever is greater
Power Rating	1W at 70°C. Derated to 0W at +150°C
Max. Working Voltage	300 VDC max.
Operating Temperature Range	−55°C to +150°C
Contact Resistance Variation	3% or 3 ohms max. whichever is greater

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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
ABS acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CAMAC computer automated measurement and control
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3
KSR keyboard send /receive

L
LC inductance capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIB microcomputer interface board
MIC microwave IC
MIPS million instructions per second
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

Vitreous Enameled Rheostats (Potentiometers)

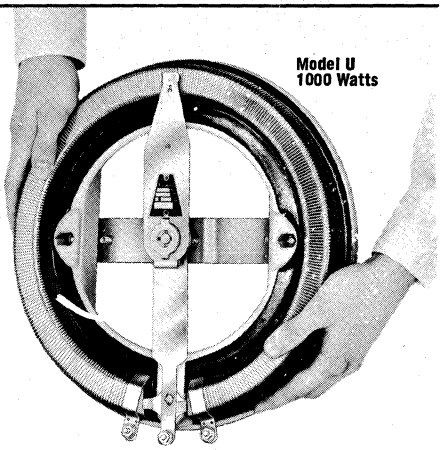
OHMITE®

Now, Ohmite offers TWELVE sizes in its line of famous rheostats.

In all Ohmite rheostats, the resistance wire is wound on a solid ceramic core. The turns are locked in place with tough, protective vitreous enamel or Ohmicone® silicone ceramic. Pivoted, universal action mounting of the brush, assures perfect contact. Metal-graphite contact brushes, varied to fit current and resistance, insure good contact with negligible wear of the wire. Terminals at each end of the winding permit connection of the unit as a potentiometer.

NOW, FOR IT'S RATING, INDUSTRY'S SMALLEST RHEOSTAT!

Model C
7½ Watts



Model U
1000 Watts

Dimensions and Other Parameters	Mod. C Encl.	Model E Unencl.	Model E Encl.	Model H	Model J	Model G	Model K	Model L	Model P	Model N	Model R	Model T	Model U
Rated Watts	7½	12½		25	50	75	100	150	225	300	500	750	1000
Resistance Range - Ohms	10 to 5,000	1 to 15,000		1 to 25,000	0.5 to 50,000	0.5 to 50,000	0.5 to 50,000	0.5 to 50,000	1 to 30,000	1 to 50,000	1 to 20,000	1 to 15,000	1 to 20,000
Overall Diameter	.515	⅞	1 3/64	1 5/16	2 5/16	2¾	3⅛	4	5	6	8	10	12
Overall Depth Behind Panel	⅞	1 1/16	1 1/32	1⅜	1⅜	1¾	1¾	2	2⅛	2⅜	2⅛	3	3
Weight - Lbs.	.017	.037	.053	0.19	0.32	0.52	0.64	1.1	2	2.6	4	7.6	10
Mtg. Centers (Dimension "M")	(Single-Hole Mounting)								⅞	1 3/16	1½	1⅞	3

MODEL C — 7½ WATT* — STANDARD & LOCKING SHAFT

Ohms	Amps	Standard Shaft Catalog No. Old	Standard Shaft Catalog No. New	Locking Shaft Catalog No. Old	Locking Shaft Catalog No. New	Ohms	Amps	Standard Shaft Catalog No. Old	Standard Shaft Catalog No. New	Locking Shaft Catalog No. Old	Locking Shaft Catalog No. New	Ohms	Amps	Standard Shaft Catalog No. Old	Standard Shaft Catalog No. New	Locking Shaft Catalog No. Old	Locking Shaft Catalog No. New
10	.86	4908	RCS10R	4948	RCL10R	100	.27	4914	RCS100	4954	RCL100	750	.10	4920	RCS750	4960	RCL750
15	.71	4909	RCS15R	4949	RCL15R	150	.22	4915	RCS150	4955	RCL150	1000	.086	4921	RCS1K0	4961	RCL1K0
25	.55	4910	RCS25R	4950	RCL25R	200	.19	4916	RCS200	4956	RCL200	1500	.071	4922	RCS1K5	4962	RCL1K5
35	.46	4911	RCS35R	4951	RCL35R	250	.17	4917	RCS250	4957	RCL250	2500	.055	4923	RCS2K5	4963	RCL2K5
50	.39	4912	RCS50R	4952	RCL50R	350	.15	4918	RCS350	4958	RCL350	3500	.046	4924	RCS3K5	4964	RCL3K5
75	.32	4913	RCS75R	4953	RCL75R	500	.12	4919	RCS500	4959	RCL500	5000	.039	4925	RCS5K0	4965	RCL5K0

* Rating on metal panel — unit is silicone-ceramic coated.

MODEL "E" — 12½ WATT* — UNENCLOSED & ENCLOSED

Total Ohms	Max. Amps	Appr. Steps	Unenclosed Standard Shaft Catalog No. Old	Unenclosed Standard Shaft Catalog No. New	Unenclosed Locking Shaft Catalog No. Old	Unenclosed Locking Shaft Catalog No. New	Enclosed Standard Shaft Catalog No. Old	Enclosed Standard Shaft Catalog No. New	Total Ohms	Max. Amps	Appr. Steps	Unenclosed Standard Shaft Catalog No. Old	Unenclosed Standard Shaft Catalog No. New	Unenclosed Locking Shaft Catalog No. Old	Unenclosed Locking Shaft Catalog No. New	Enclosed Standard Shaft Catalog No. Old	Enclosed Standard Shaft Catalog No. New
1	3.53	32	0101	RES1R0	L0101	REL1R0	W0101	REE1R0	175	.27	145	0114	RES175	L0114	REL175	W0114	REE175
2	2.50	28	0102	RES2R0	L0102	REL2R0	W0102	REE2R0	200	.25	132	0114A	RES200	L0114A	REL200	W0114A	REE200
2.5	2.24	31	0102A	RES2R5	L0102A	REL2R5	W0102A	REE2R5	250	.22	128	0115	RES250	L0115	REL250	W0115	REE250
3	2.04	33	0103	RES3R0	L0103	REL3R0	W0103	REE3R0	350	.19	149	0116	RES350	L0116	REL350	W0116	REE350
5	1.58	61	0103A	RES5R0	L0103A	REL5R0	W0103A	REE5R0	500	.16	213	0117	RES500	L0117	REL500	W0117	REE500
6	1.44	58	0104	RES6R0	L0104	REL6R0	W0104	REE6R0	750	.13	193	0118	RES750	L0118	REL750	W0118	REE750
8	1.25	61	0105	RES8R0	L0105	REL8R0	W0105	REE8R0	1000	.10	257	0119	RES1K0	L0119	REL1K0	W0119	REE1K0
10	1.12	76	0106	RES10R	L0106	REL10R	W0106	REE10R	1500	.090	255	0120	RES1K5	L0120	REL1K5	W0120	REE1K5
15	.91	64	0107	RES15R	L0107	REL15R	W0107	REE15R	2500	.070	277	0121	RES2K5	L0121	REL2K5	W0121	REE2K5
25	.71	67	0108	RES25R	L0108	REL25R	W0108	REE25R	3500	.060	313	0122	RES3K5	L0122	REL3K5	W0122	REE3K5
35	.60	73	0109	RES35R	L0109	REL35R	W0109	REE35R	5000	.050	255	0123	RES5K0	L0123	REL5K0	W0123	REE5K0
50	.50	83	0110	RES50R	L0110	REL50R	W0110	REE50R	7500	.041	299	4190	RES7K5	L4190	REL7K5	W4190	REE7K5
75	.40	101	0111	RES75R	L0111	REL75R	W0111	REE75R	10,000	.035	398	4191	RES10K	L4191	REL10K	W4191	REE10K
100	.35	106	0112	RES100	L0112	REL100	W0112	REE100	12,500	.031	434	4192	RES12K5	L4192	REL12K5	W4192	REE12K5
125	.32	132	0113	RES125	L0113	REL125	W0113	REE125	15,000	.029	521	4193	RES15K	L4193	REL15K	W4193	REE15K
150	.29	125	0113A	RES150	L0113A	REL150	W0113A	REE150									

* Rating on metal panel — unit is silicone-ceramic coated.

25 WATT MODEL "H" — UL Listed

Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	Standard Shaft Catalog No. New	Locking Shaft Catalog No. Old	Locking Shaft Catalog No. New	Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	Standard Shaft Catalog No. New	Locking Shaft Catalog No. Old	Locking Shaft Catalog No. New	Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	Standard Shaft Catalog No. New	Locking Shaft Catalog No. Old	Locking Shaft Catalog No. New
1	5.0	30	0140	RHS1R0	L0140	RHL1R0	75	.575	107	0150	RHS75R	L0150	RHL75R	2500	.10	341	0160	RHS2K5	L0160	RHL2K5
2	3.54	30	0141	RHS2R0	L0141	RHL2R0	100	.50	142	0151	RHS100	L0151	RHL100	3500	.084	315	0161	RHS3K5	L0161	RHL3K5
3	2.88	31	0142	RHS3R0	L0142	RHL3R0	125	.445	139	0152	RHS125	L0152	RHL125	5000	.070	355	0162	RHS5K0	L0162	RHL5K0
6	2.04	50	0143	RHS6R0	L0143	RHL6R0	175	.375	154	0153	RHS175	L0153	RHL175	7500	.058	439	4200	RHS7K5	L4200	RHL7K5
8	1.77	53	0144	RHS8R0	L0144	RHL8R0	250	.316	177	0154	RHS250	L0154	RHL250	10,000	.050	476	4201	RHS10K	L4201	RHL10K
10	1.58	52	0145	RHS10R	L0145	RHL10R	350	.267	197	0155	RHS350	L0155	RHL350	15,000	.041	431	4202	RHS15K	L4202	RHL15K
15	1.29	67	0146	RHS15R	L0146	RHL15R	500	.222	220	0156	RHS500	L0156	RHL500	20,000	.035	422	4203	RHS20K	L4203	RHL20K
25	1.0	89	0147	RHS25R	L0147	RHL25R	750	.182	261	0157	RHS750	L0157	RHL750	25,000	.032	527	4204	RHS25K	L4204	RHL25K
35	.845	98	0148	RHS35R	L0148	RHL35R	1000	.155	278	0158	RHS1K0	L0158	RHL1K0							
50	.707	80	0149	RHS50R	L0149	RHL50R	1500	.129	267	0159	RHS1K5	L0159	RHL1K5							

50 WATT MODEL "J" — UL Listed

Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	Standard Shaft Catalog No. New
0.5	10.0	24	0308	RJSR50
1	7.07	44	0309	RJS1R0
2	5.00	43	0310	RJS2R0
4	3.53	42	0311	RJS4R0
6	2.88	45	0312	RJS6R0
8	2.50	43	0313	RJS8R0
12	2.04	86	0314	RJS12R
16	1.76	91	0315	RJS16R
22	1.50	100	0316	RJS22R
35	1.19	125	0317	RJS35R
50	1.00	112	0318	RJS50R
80	.79	143	0319	RJS80R
125	.63	176	0320	RJS125
150	.575	170	0321	RJS150
225	.470	199	0322	RJS225
300	.408	211	0323	RJS300
500	.316	284	0324	RJS500
800	.250	282	0325	RJS800
1000	.224	352	0326	RJS1K0
1600	.176	355	0327	RJS1K6
2500	.141	449	0328	RJS2K5
3500	.119	496	0329	RJS3K5
5000	.100	459	0330	RJS5K0
8000	.079	576	0331	RJS8K0
10,000	.070	565	0332	RJS10K
15,000	.058	568	4210	RJS15K
20,000	.050	599	4211	RJS20K
25,000	.045	573	4212	RJS25K
30,000	.041	688	4213	RJS30K
40,000	.035	673	4214	RJS40K
50,000	.032	842	4215	RJS50K

75 WATT MODEL "G" — UL Listed

Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	Standard Shaft Catalog No. New
0.5	12.3	27	1100	RGSR50
1	8.66	27	1101	RGS1R0
2	6.12	30	1102	RGS2R0
3	5.0	28	1103	RGS3R0
5	3.88	53	1104	RGS5R0
7.5	3.16	50	1105	RGS7R5
10	2.74	53	1106	RGS10R
16	2.17	91	1107	RGS16R
25	1.73	113	1108	RGS25R
50	1.23	142	1109	RGS50R
75	1.0	134	1110	RGS75R
100	.866	178	1111	RGS100
200	.612	180	1112	RGS200
300	.50	211	1113	RGS300
400	.433	223	1114	RGS400
500	.388	279	1115	RGS500
750	.316	338	1116	RGS750
1000	.274	356	1117	RGS1K0
1500	.224	420	1118	RGS1K5
2000	.194	443	1119	RGS2K0
2500	.173	441	1120	RGS2K5
5000	.123	564	1121	RGS5K0
7500	.100	547	1122	RGS7K5
10,000	.087	572	1123	RGS10K

100 WATT MODEL "K" — UL Listed

Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	Standard Shaft Catalog No. New
0.5	14.1	33	0440	RKSR50
1	10	33	0441	RKS1R0
2	7.07	32	0442	RKS2R0
3	5.75	39	0443	RKS3R0
5	4.47	57	0444	RKS5R0
7.5	3.65	60	0445	RKS7R5
10	3.16	57	0446	RKS10R
16	2.50	88	0447	RKS16R
25	2.0	109	0448	RKS25R
50	1.41	137	0449	RKS50R
75	1.15	163	0450	RKS75R
100	1.00	172	0451	RKS100
200	.707	216	0452	RKS200
300	.575	261	0453	RKS300
400	.500	272	0454	RKS400
500	.447	269	0455	RKS500
750	.365	325	0456	RKS750
1000	.316	343	0457	RKS1K0
1500	.258	404	0458	RKS1K5
2000	.224	426	0459	RKS2K0
2500	.200	426	0460	RKS2K5
5000	.141	543	0461	RKS5K0
7500	.115	528	0462	RKS7K5
10,000	.100	704	0463	RKS10K

150 WATT MODEL "L" — UL Listed

Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	Standard Shaft Catalog No. New
0.5	17.3	29	0524	RLSR50
1	12.3	41	0525	RLS1R0
2	8.65	40	0526	RLS2R0
3	7.07	42	0527	RLS3R0
5	5.48	44	0528	RLS5R0
7.5	4.47	75	0529	RLS7R5
10	3.88	79	0530	RLS10R
15	3.16	75	0531	RLS15R
25	2.45	120	0532	RLS25R
35	2.07	133	0533	RLS35R
50	1.74	151	0534	RLS50R
75	1.42	179	0535	RLS75R
100	1.23	190	0536	RLS100
150	1.00	225	0537	RLS150
200	.865	239	0538	RLS200
250	.775	236	0539	RLS250
350	.655	265	0540	RLS350
500	.548	296	0541	RLS500
750	.447	362	0542	RLS750
1250	.346	473	0543	RLS1K25
1800	.288	537	0544	RLS1K8
2250	.259	529	0545	RLS2K25
3000	.224	558	0546	RLS3K0
4000	.182	667	0547	RLS4K0
7500	.141	714	0548	RLS7K5
10,000	.122	952	0549	RLS10K

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Tel. 312/675-2600 • TWX 910/223-0805 • TELEX: 72-4433 • FAX 312-675-1505

Vitreous Enameled Rheostats (Potentiometers)

OHMITE®

225 WATT MODEL "P" — UL Listed

Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	New
1	15	42	1250	RPS1R0
2	10.6	41	1251	RPS2R0
3	8.66	61	1252	RPS3R0
4	7.50	58	1253	RPS4R0
5	6.71	57	1254	RPS5R0
7.5	5.49	60	1255	RPS7R5
10	4.74	115	1256	RPS10R
15	3.87	108	1257	RPS15R
25	3.00	114	1258	RPS25R
50	2.12	218	1259	RPS50R
75	1.73	206	1260	RPS75R
100	1.50	275	1261	RPS100
150	1.22	259	1262	RPS150
200	1.06	345	1263	RPS200
300	.866	326	1264	RPS300
400	.750	342	1265	RPS400
700	.567	483	1266	RPS700
900	.500	484	1267	RPS900
1200	.433	513	1268	RPS1K2
1500	.387	641	1269	RPS1K5
1750	.358	603	1270	RPS1K75
2000	.336	690	1270A	RPS2K0
2500	.300	679	1271	RPS2K5

300 WATT MODEL "N" — UL Listed

Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	New
1	17.32	56	0650	RNS1R0
2	12.24	51	0651	RNS2R0
3	10.00	51	0652	RNS3R0
4	8.66	77	0653	RNS4R0
5	7.75	76	0654	RNS5R0
7.5	6.32	72	0655	RNS7R5
10	5.48	76	0656	RNS10R
15	4.47	144	0657	RNS15R
25	3.46	134	0658	RNS25R
50	2.45	230	0659	RNS50R
75	2.00	275	0660	RNS75R
100	1.73	288	0661	RNS100
150	1.41	345	0662	RNS150
200	1.22	364	0663	RNS200
300	1.00	433	0664	RNS300
400	.866	456	0665	RNS400
700	.655	500	0666	RNS700
900	.578	517	0667	RNS900
1200	.500	541	0668	RNS1K2
1500	.447	676	0669	RNS1K5
1750	.414	625	0670	RNS1K75
2000	.387	714	0670A	RNS2K0
2500	.346	720	0671	RNS2K5

500 WATT MODEL "R"

Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	New
1	22.3	56	0849	RRS1R0
1.5	18.2	71	0850	RRS1R5
2	15.8	75	0851	RRS2R0
2.5	14.1	78	0852	RRS2R5
3	12.9	79	0853	RRS3R0
4	11.2	74	0854	RRS4R0
5	10.0	104	0855	RRS5R0
8	7.9	104	0856	RRS8R0
12.5	6.3	115	0857	RRS12R5
16	5.6	186	0858	RRS16R
25	4.47	205	0859	RRS25R
40	3.54	206	0860	RRS40R
50	3.16	205	0872	RRS50R
80	2.52	316	0861	RRS80R
125	2.0	388	0862	RRS125
175	1.69	434	0863	RRS175
250	1.41	490	0864	RRS250
325	1.24	505	0865	RRS325
500	1.00	614	0866	RRS500
750	.817	735	0867	RRS750
1000	.707	769	0868	RRS1K0
1500	.577	932	0869	RRS1K5
2000	.50	971	0870	RRS2K0
2500	.447	962	0871	RRS2K5

750 WATT MODEL "T"

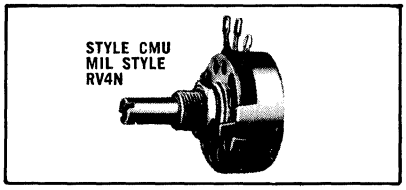
Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	New
1	27.4	72	1300	RTS1R0
1.5	22.3	72	1301	RTS1R5
2	19.4	96	1302	RTS2R0
2.5	17.3	101	1303	RTS2R5
3	15.8	96	1304	RTS3R0
4	13.6	94	1305	RTS4R0
5	12.2	104	1306	RTS5R0
8	9.65	100	1307	RTS8R0
10	8.65	139	1308	RTS10R
12.5	7.75	138	1309	RTS12R5
16	6.82	139	1310	RTS16R
25	5.47	137	1311	RTS25R
50	3.87	246	1312	RTS50R
80	3.06	381	1313	RTS80R
100	2.74	376	1314	RTS100
160	2.17	476	1315	RTS160
200	1.94	469	1316	RTS200
300	1.58	562	1317	RTS300
400	1.37	593	1318	RTS400
600	1.18	705	1319	RTS600
750	1.00	694	1320	RTS750
1200	.791	889	1321	RTS1K2
1800	.646	1050	1322	RTS1K8
2000	.610	935	1322A	RTS2K0
2500	.547	1170	1323	RTS2K5

1000 WATT MODEL "U"

Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	New	Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	New	Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	New
1	31.6	91	1450	RUS1R0	10	10.0	117	1458	RUS10R	225	2.11	630	1466	RUS225
1.5	25.8	90	1451	RUS1R5	12.5	8.95	163	1459	RUS12R5	300	1.83	661	1467	RUS300
2	22.4	90	1452	RUS2R0	16	7.90	166	1460	RUS16R	400	1.58	704	1468	RUS400
2.5	20.0	127	1453	RUS2R5	25	6.33	162	1461	RUS25R	500	1.41	695	1469	RUS500
3	18.3	114	1454	RUS3R0	50	4.47	327	1462	RUS50R	750	1.15	828	1470	RUS750
4	15.8	120	1455	RUS4R0	75	3.65	307	1463	RUS75R	1000	1.00	870	1471	RUS1K0
5	14.1	124	1456	RUS5R0	100	3.16	446	1464	RUS100	1500	.816	1040	1472	RUS1K5
8	11.2	118	1457	RUS8R0	175	2.39	490	1465	RUS175	2500	.633	1100	1473	RUS2K5

Molded Composition Potentiometers

OHMITE®



Ohmite molded composition potentiometers (Type AB) provide high quality and dependable performance.

Because the resistance element is a thick, solid-molded ring, longer life and smoother operation are obtained. This is due also to the molded composition contact. Units are dust and splash proof, fungus and corrosion resistant and meet the requirements of military specification MIL-R-94.

Type AB is rated 2 watts at 70°C ambient.

TYPE AB IS AVAILABLE WITH:

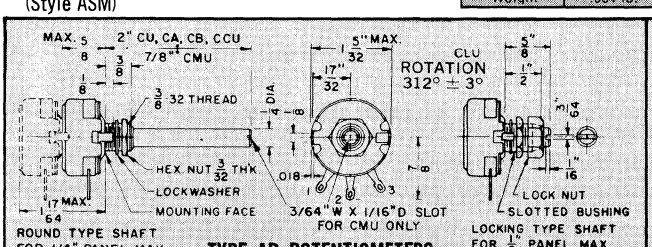
7/8" slotted shaft (CMU)

2" unslotted shaft (CU, CA, CB, CCU) and in a slotted shaft with locking type bushing (CLU)

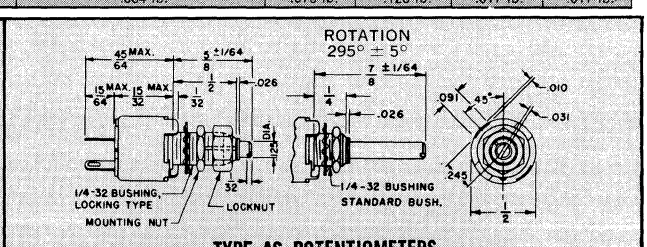
TYPE AS AVAILABLE WITH:

- Locking type bushing and slotted shaft (Style AS)
- Standard bushing with longer, slotted shaft (Style ASM)

Resistance Ohms Except As Noted Tol. ±10% except * ±20%	Type AB (1½" Dia.) Rated 2 Watts: Single Unit ⅞" Shaft Style CMU Linear	Single Unit 2" Shaft Style CU Linear	Single Unit 2" Shaft Style CA CW log	Single Unit 2" Shaft Style CB CCW log	Locking Style CLU Linear	Dual Style CCU Linear	Type AS (½" Dia.) Rated ½ Watt: Miniature Locking Style AS Linear	Miniature ⅞" Shaft Style ASM Linear
50	CMU5001	CU5001			CLU5001			
100	CMU1011	CU1011			CLU1011		AS3601	ASM6661
150	CMU1511	CU1511			CLU1511			
250	CMU2511	CU2511			CLU2511		AS3602	ASM6662
350	CMU3511	CU3511			CLU3511			
500	CMU5011	CU5011			CLU5011		AS3603	ASM6663
750	CMU7511	CU7511			CLU7511			
1000	CMU1021	CU1021			CLU1021	Resistance Shown is for Each Unit	AS3604	ASM6664
1500	CMU1521	CU1521			CLU1521			
2500	CMU2521	CU2521			CLU2521		AS3605	ASM6665
3500	CMU3521	CU3521			CLU3521			
5000	CMU5021	CU5021			CLU5021		AS3606	ASM6666
7500	CMU7521	CU7521			CLU7521			
10,000	CMU1031	CU1031		CB1031	CLU1031	CCU1031	AS3607	ASM6667
15,000	CMU1531	CU1531			CLU1531			
25,000	CMU2531	CU2531		CB2531	CLU2531	CCU2531	AS3608	ASM6668
35,000	CMU3531	CU3531			CLU3531			
50,000	CMU5031	CU5031		CB5031	CLU5031	CCU5031	AS3609	ASM6669
75,000	CMU7531	CU7531			CLU7531			
.1 meg.	CMU1041	CU1041	CA1041		CLU1041	CCU1041	AS3610	ASM6670
.15 meg.	CMU1541	CU1541			CLU1541			
.25 meg.	CMU2541	CU2541	CA2541		CLU2541	CCU2541	AS3611	ASM6671
.35 meg.	CMU3541	CU3541			CLU3541			
.5 meg.	CMU5041	CU5041	CA5041		CLU5041	CCU5041	AS3612	ASM6672
.75 meg.*	CMU7542	CU7542			CLU7542			
1.0 meg.*	CMU1052	CU1052	CA1052		CLU1052	CCU1052	AS3613	ASM6673
1.5 meg.*	CMU1552	CU1552			CLU1552			
2.0 meg.*	CMU2052	CU2052			CLU2052		AS3684	ASM6674
2.5 meg.*	CMU2552	CU2552	CA2552		CLU2552		AS3614	ASM6675
3.5 meg.*	CMU3552	CU3552			CLU3552			
5.0 meg.*	CMU5052	CU5052			CLU5052		AS3615	ASM6676
Weight	.084 lb.	.084 lb.			.070 lb.	.123 lb.	.017 lb.	.017 lb.



TYPE AB POTENTIOMETERS



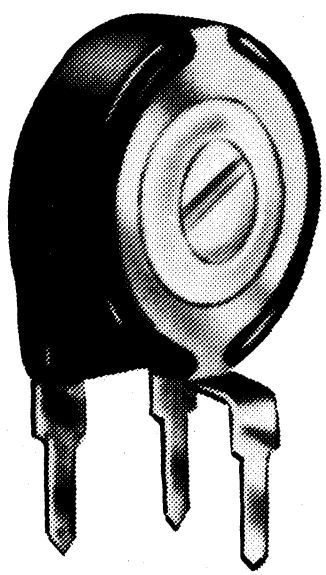
TYPE AS POTENTIOMETERS

Ohmite Manufacturing Company • A North American PHILIPS Company • 3601 Howard Street • Skokie, Illinois 60076
Tel. 312/675-2600 • TWX 910/223-0805 • TELEX: 72-4433 • FAX 312-675-1505

Real Estate

can be a problem...

PT6 Miniature Trimmer Potentiometers are the answer!



FEATURING

PT6 SERIES—DIA. 6mm - ¼"
RESISTANCE ELEMENT: Carbon
RESISTANCE RANGE: 100 ohm to 2.2 meg
POWER RATING: 0.1W
MOUNTING: Vertical 5mm x 2.5mm & Horizontal 5mm x 5mm
ADJUSTMENT: Cross-slot or Adjustment Knob
FULLY ENCLOSED
DUAL CONTACT WIPERS
RESISTANCE TO CLEANING SOLVENTS
SELF-EXTINGUISHABLE MATERIAL (UL-94 (VO) upon request)
PLASTIC DISPENSERS FOR AUTOMATIC INSERTION

and don't forget our 10mm and 15mm series Potentiometer available in both carbon and cermet elements...cross reference charts available...call for literature, samples and information.

Piher International Corp.

PIHER

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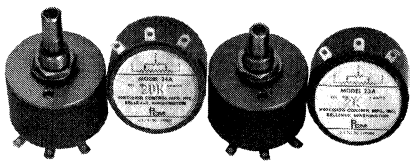
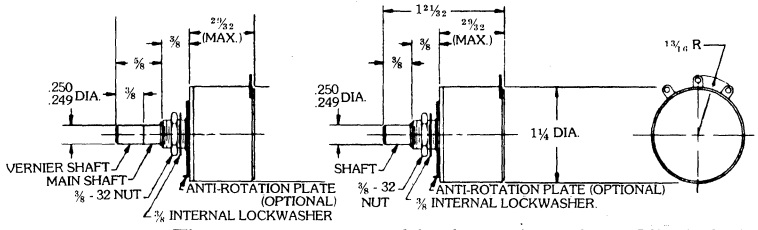
Mt. Prospect, IL 60056
Telephone: 1(312) 390-6680
Toll-Free: 1(800) 323-6693
Telex: 4949176
Facsimile: 1(312) 390-9866

PRECISION CONTROL MFG. INC.
1509 B QUEEN ANNE AVENUE N., SEATTLE WASHINGTON 98109 (206) 281-9380
We Specialize in Precision Controls

HIGH RESOLUTION VERNIER POTENTIOMETERS





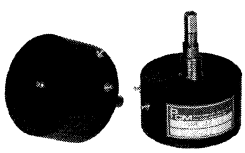
The model 23A and 24A high resolution vernier wirewound potentiometers incorporate both coarse and fine elements coupled mechanically and electrically in a single case. Any 5% portion of the coarse element is expanded over the 270° of shaft rotation on the vernier element giving a total rotation of 555° and a resolution roughly the same as the 3600° of rotation on a 10 turn potentiometer. The model 23A is controlled via a single knob rotated past the desired point on the course winding and backed up on the vernier to interpolate the desired setting. The model 24A can be controlled either with a single knob as with the 23A or with individually mounted knobs on the coarse and vernier shafts.

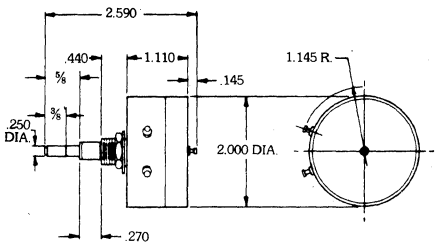
The main case is of high quality glass filled diallylphthalate thermo plastic which coupled with integral bushing/front mounting plate greatly adds to the mechanical and thermal stability. Premium resistance alloys are used throughout and precious metals selected for wear and compatibility are used for all contacts.

Three watt ±3% tolerance is standard; however, special tolerances to ±0.5% are available. Standard and special values from 100 ohms to 100K ohms are available.

Consult factory for your requirements.

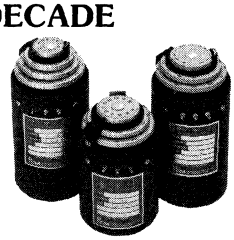
DOUBLE VERNIER POTENTIOMETERS

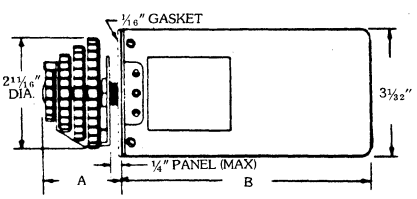




For applications requiring extremely high resolution, the Model 30A Vernier Potentiometer provides 0.002% or better resolution in less than 2½ turns of the shaft. The 30A does not rely on gear ratios to achieve mechanical resolution, but through a unique patented design, provides true electrical resolution which is roughly equivalent to 40 turn potentiometers. The vernier contacts span any 5% of the main winding and expand it over the 280° rotation of the first vernier. Any 5% segment of the first vernier is in turn expanded over the 270° rotation of the second vernier. Thus extreme resolution is possible in only 830° of total shaft rotation.

HIGH ACCURACY DECADE POTENTIOMETERS AND RHEOSTATS





Precision Control Mfg., Inc. (PCM) produces high quality, coaxial dial decade potentiometers and rheostats for high accuracy applications. The basic design features a positive in-line readout and easy, rapid adjustment made possible by a combination of distinct dials and a parallax free indicator. The unique electrical and mechanical design of PCM decades makes a small and accurate package which is very rugged.

Decade potentiometers provide linearities ranging from ±0.005% in the model 50A to ±0.0025% in the model 60A. All PCM rheostats have an accuracy base of ±0.025%.

All PCM decades are available in militarized versions which meet or exceed the environmental portions of MIL-E-5272C, Sections 4.2.2, 4.3.1, 4.4, 4.6 through 4.11.2, 4.12, 4.15 and MIL-T-945A, Sections 4.4.1 through 4.6. Resistors used in PCM decades are wound with only premium resistance alloys for low temperature coefficients and are single layer wound, with low inductance making possible precision attenuation over a wide range of frequencies. Switch decks utilize low leakage materials and feature gold plated silver contacts. The case is heavy gauge aluminum to provide shielding and dust protection, shafts are of stainless steel.

Preh Electronic Industries, Inc.
470 East Main Street, Lake Zurich, IL 60047-2578 U.S.A.
Phone (312) 438-4000 • Telex 297-112 PEI UR • FAX 312-438-5522

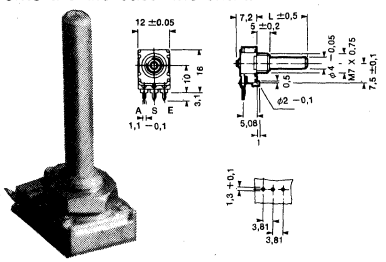
PREH POTENTIOMETERS

PREOSTAT 12 63100-000
PREOSTAT 12 MONO "P"

Both, the "Mono" and the "Duplo" versions of the Preostat 12 potentiometer provide an adjustability which is independent of manufacturing or fixture tolerances, that is virtually free of back lash.

This is accomplished by using Preh's proprietory process when combining the die cast shaft with the plastic rotor part.

In case of "Tandem" potentiometers, tracking of great accuracy is assured by using a "Janus" fashioned rotor, which is slipped onto the die cast zinc shaft.



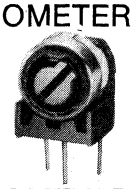
OPTIONS
1. Battery rotary switch s.p. "ON"
2. Tap middle position
3. Diameter of shaft 6 mm (thread M9 x 0,75)
4. Ends of shaft: flattened, star-shaped with slit
5. Solder terminal

PREH TRIMMING RESISTOR 86
60100-000
Trimming potentiometer
8.6 "S"
Cross recess, snap-in upon request.

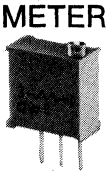
TECHNICAL DATA

Part No.	Power rating (Watt) lin (lg)	Operating voltage (Volt)	Range of Rotation ON
60100-000*	0,1 (0,05)	100 (70)	270° ±10°

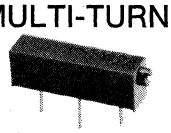
TRIMMPOTENTIOMETER 1/4"
76592-005*
CERMET SEALED



TRIMMPOTENTIOMETER 3/8" MULTI-TURN
76592-027
CERMET SEALED



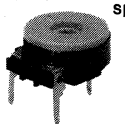
TRIMMPOTENTIOMETER 19 mm (3/4") MULTI-TURN
76592-001
CERMET SEALED



FILM ROTARY RESISTOR15

60224-501
Film rotary resistor 15, version S or SD for insulated plug-in spindle

60226-501
Film rotary resistor 15, version P, for insulated plug-in spindle



TECHNICAL DATA
Power: 0.15 W linear law; 0.08 W log. and other laws
Nominal resistance: 47 Ohms to 16 MOhms linear law; 220 Ohms to 10. MOhms log and other laws
Max. operational voltage: 250V; 180 V
Rotation N: 270° ±10°
Turning torque: 0.5 −2 Ncm
End stop torque: ≥15 Ncm
End stop torque: ≥30 Ncm version with casted-on insulated spindle
Application class: JSG

NOTE:
Version "S"—Potentiometer shaft is perpendicular to the mounting surface
Version "P"—Potentiometer shaft is parallel to the mounting surface

FILM ROTARY RESISTORS, INCAPSULATED VERSION FOR PRINTED CIRCUITS
Film rotary resistor 10

Film rotary resistor 10, insulated version is optional for printed circuit version S, SD, or with center detent.
An insulated plug-in spindle can be inserted into the center hexagon shaped hole. (The spindle has to be ordered separately).

63000-000
Rotary potentiometer 10 "S"

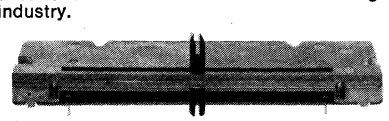
63001-000
Rotary potentiometer 10 "P"

Insulated plug-in shaft, grey for rotary potentiometer 10 only.
11054-322

TECHNICAL DATA
Power: 0.1 W linear law; 0.05 W log. and other laws
Nominal resistance: 47 Ohms to 10 MOhms linear law; 220 Ohms to 1 MOhm log and other laws
Max. operational voltage: 200 V linear law; 140 V log and other laws
Rotation N: 250° ±10°
Turning torque: 0.4 −2.5 Ncm
End stop torque: ≥5 Ncm
Application class: HSF

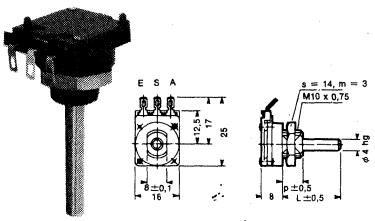
FILM SLIDER RESISTORS, INCAPSULATED VERSION FOR PRINTED CIRCUITS
66908-004
SLIDE POTENTIOMETER 100 (SEMI PROFESSIONAL)

Tandem (100mm travel) slide potentiometer encased in a metal molded housing. For applications in the audio and video mixing industry.



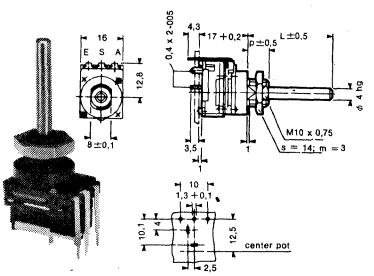
63604-000
Preostat 16, with insulated housing

This film rotary potentiometer can withstand a testing voltage of 2500 V RMS. Due to its special build and the use of an insulated housing, located between all terminals of the rotary resistor and the metal spindle (part which can be touched). Leakage path was considered (according to VDE recommendation). These film rotary resistors can be inserted into SCR-controls or others where main voltage is directly applied on the rotary resistor.



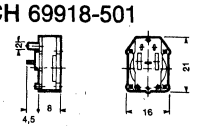
TECHNICAL DATA
Power: 0.15 W linear law
Nominal resistance: 47 Ohms to 16 MOhms
Max. operational voltage: 250 V
Insulation voltage: >2500 V RMS on metal spindle
Insulation restance: >5 GOhms on metal spindle
Rotation N 270° ±10° = max. 50°
Turning torque: 0.3 −1 Ncm
Turning torque for tandem: 0.3 −1.5 Ncm
End stop torque: ≥40 Ncm
Application class: JSG
Insulated spindle: —

PREOSTAT 16
WITH ROTARY SWITCH 63616-007



Preostat 16 with rotary switch, s.p. 69918-501 with insulated housing, version S.
TECHNICAL DATA
Power: 0.15 W linear law
Nominal resistance: 47 Ohms to 16 MOhms
Max. operational voltage: 250 V
Insulation voltage: >2500 V RMS; >5 GOhms on metal spindle
Rotation without rotary switch N: 270° ±10°
Rotation in rotary switch M: 270° ±10°, S = max. 50°
Turning torque: 0.3 −1 Ncm
Turning torque for tandem: 0.3 −1.5 Ncm
End stop torque: ≥40 Ncm
Application class: JSG
Insulated spindle: —

ROTARY SWITCH 69918-501
s. p. "on" Isolated diagram without soldering hole.



TECHNICAL DATA
Switch rating: 10 A/250 V AC cos. ϕ ≥0.6 this version can be used for light bulb load up to 6 A CC
Switch torque: 3-7 Ncm (in addition to the turning torque of the film rotary resistor)
Life: 10,000 switching cycles

***DETAILED CATALOG AVAILABLE UPON REQUEST**

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Van Nuys, CA 91405
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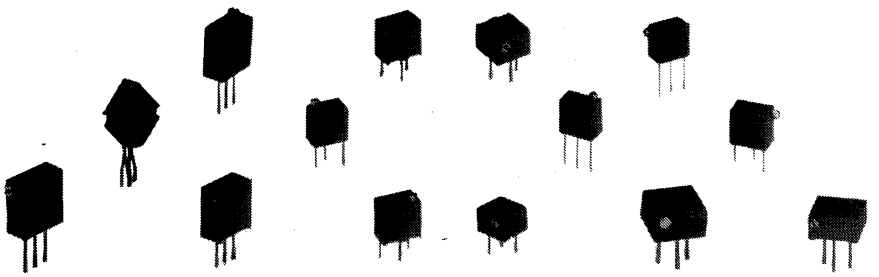
wirewound and cermet trimmers - MIL Approved

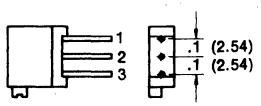
QUALIFIED TO
MIL-R-22097(RJ)
MIL-R-27208(RT)
MIL-R-39015(RTR)
MIL-R-39035(RJR)



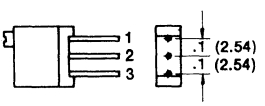
STYLE	DESCRIPTION	RESISTANCE RANGE*	T.C. (PPM/°C)*	FAILURE RATE*	POWER	PIN STYLE/DIMENSIONS H x L x W (IN.)
WIREWOUND ELEMENTS						
RT24 **RTR24**	⅜" Square 22 Turn	10Ω- 10K	50	RTR24 @M, P, & R	1W @ 85°C	L (Wire)/.150 x .380 x .380 P (Edge)/.217 x .375 x .375 W (Top)/.410 x .375 x .190 X (Side)/.410 x .375 x .190
RT26 **RT27**	¼" Square 22 Turn	10Ω- 5K	50	N/A	½W @ 85°C	P (Edge)/.190 x .260 x .260 W (Top)/.260 x .260 x .160 X (Side)/.260 x .260 x .160
CERMET ELEMENTS						
RJ24 **RJR24**	⅜" Square 25 Turn	10Ω- 1 Mec	50 100 250	RJR24 @M, P, & R	½W @ 85°C	P (Edge)/.190 x .380 x .380 W (Top)/.410 x .380 x .190 X (Side)/.410 x .380 x .190
RJ26 **RJR26**	¼" Square 22 Turn	10Ω- 1 Meg	50 100	RJR26 @M, P, & R	¼W @ 85°C	P (Edge)/.190 x .265 x .265 W (Top)/.265 x .265 x .180 X (Side)/.265 x .265 x .180

*CONTACT FACTORY FOR LATEST QUALIFICATION REGARDING AVAILABLE COMBINATIONS OF OHMIC VALUE, T.C., AND FAILURE RATE. 20K - 50K Ω AVAILABLE IN WIREWOUNDS AS A NON-MILITARY PART #.

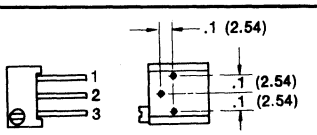
PINOUTS FOR MULTITURN PRODUCTS



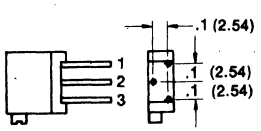
RJ24-X	RJR24-X
RT24-X	RTR24-X
RT27-X	14S-X
C24-X	W24-X
T63XA	T93XA



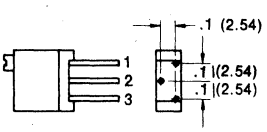
RJ24-W	RJR24-W
RT24-W	RTR24-W
RT27-W	12S-W
C24-W	W24-W
T63YA	T93YA



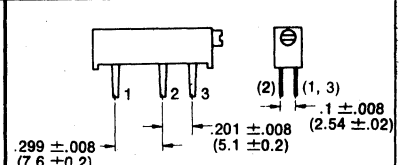
RJ24-P	RJR24-P
RT24-P	RTR24-P
RJ26-P	RJR26-P
C24-P	W24-P
C26-P	T93Z



RJ26-X	RJR26-X
RT26-X	TM6X
C26-X	W26-X
T63XB	T93XB

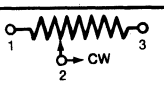


RJ26-W	RJR26-W
RT26-W	TM6Y
C26-W	W26-W
T63YB	T93YB



T18

CIRCUIT DIAGRAM



SFERNICE, INC.

TOCOS AMERICA

565 West Golf Road
Arlington Heights, IL 60005
312-364-7277
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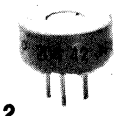
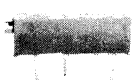
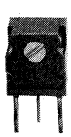
TLX: 910-221-0140

Affiliated with COSMOS TOKYO

TRIMMING POTENTIOMETERS

SERIES	DESCRIPTION	ADJ. TURNS	RES. RANGE (Ω)	RES. TOL. (%)	POWER RATING (W)	FEATURES & AVAILABLE
GF04* Cermet	Round 0.19″ 4.8mm	1	100~2M	±20 ±10 Available	0.5 @ 70°C 0 @ 125°C	• Sealed • Space Saver Size • Radial Taping
RJC06 Cermet	Round 0.250″ 6.2mm	1	10~1M	±20	0.5 @ 70°C 0 @ 125°C	• Low Profile • Excellent Adjustability
GF06* Cermet	Square 0.250″ 6.8mm	1	10~2M	±10	0.5 @ 70°C 0 @ 125°C	• Sealed & Smaller Size • Radial Taping • Surface Mount • Low Cost
 **G12** Cermet	Round 0.500″ 12.6mm	1	10~1M	±20 ±10 Available	0.75 @ 70°C 0 @ 125°C	• Sealed • Excellent Stability
RA12 Wire-Wound	Round 0.500″ 12.5mm	1	10~20K	±10	0.5 @ 70°C 0 @ 125°C	• Low Noise • Sealed • With Thumbwheel Knob
 **RJC097** Cermet	Rectilinear 0.750″ 19.0mm	15	10~2M	±10	0.75 @ 70°C 0 @ 125°C	• With Knob • Sealed • Low Cost • Excellent Stability
 **GV6*** Cermet	Rectilinear 0.250″ 6.8mm	2	100~2M	±10	0.5 @ 70°C 0 @ 125°C	• Metal Shaft • Excellent Stability • Radial Taping
NEW **G4*** Cermet	0.156×0.187″ Square 4.5mm×5mm	FOR SMD APPLICATIONS 1 SIDE ADJUST MODELS AVAILABLE	100~1M	±20	0.25 @ 70°C 0 @ 125°C	• Sealed & Surface Mount • Space Saver Size • P.C. Pins
FF08 Carbon	0.312″ 8mm	1	500~1M	±25	0.2 @ 50°C 0 @ 70°C	• Low TCR • Low Cost • Dust Proof

* AVAILABLE WITH TAPE AND REEL PACKAGING

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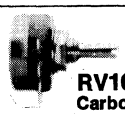
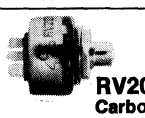
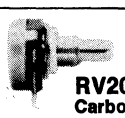
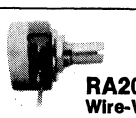
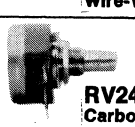
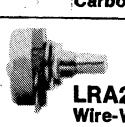
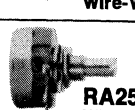
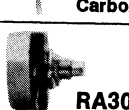
PANEL CONTROLS

SERIES	DESCRIPTION	MECH. TRAVEL	RES. RANGE (Ω)	RES. TOL. (%)	POWER RATING (W)	FEATURES & AVAILABLE
RV102Y Carbon	10mm Dia. Bushing 6mm Dia. Shaft 3mm Dia.	300°	200~2M	±20	0.25 @ 40°C 0 @ 85°C	• Smaller Size • Plastic Housing
RV12Y Carbon	12.8mm Dia. Bushing ¼" Dia. Shaft 3.2mm Dia.	300°	100~2M	±20	0.5 @ 70°C 0 @ 125°C	• Low Cost • With Non-Turn Device (Adapter Plate)
 **RV16Y** Carbon	16mm Dia. Bushing 6mm Dia. Shaft 3.2mm Dia.	260°	100~2M	±10	0.125 @ 40°C 0 @ 85°C	• With Switch (SP-DT) • Shaft Lock • Dual • Tandem • for P.C.B. (Side Adj.)
RA16Y Wire-Wound	16.5mm Dia. Bushing 5mm Dia. Shaft 3mm Dia.	290°	10~10K	±10	0.5 @ 40°C 0 @ 100°C	• Shaft Lock • for P.C.B. (Side Adj.) • −30°C~(Low Temp.)
GF16 Cermet	16.5mm Dia. Bushing 6mm Dia. Shaft 3.2mm Dia.	260°	100~1M	±20	0.5 @ 70°C 0 @ 120°C	• Low Cost • for P.C.B. (Side Adj.)
 **RV20Y** Carbon	20mm Dia. Bushing 9mm Dia. Shaft 6mm Dia.	260°	100~2M	±10	0.25 @ 40°C 0 @ 85°C	• Shaft Lock • for P.C.B. (Top Adj.)
 **RV202Y** Carbon	20mm Dia. Bushing 9mm Dia. Shaft 6mm Dia.	290°	500~2M	±10	0.25 @ 40°C 0 @ 85°C	• Low Cost • for P.C.B. (Side Adj.)
 **RA20Y** Wire-Wound	20mm Dia. Bushing 8mm Dia. Shaft 6mm Dia.	290°	10~10K	±10	1.0 @ 40°C 0 @ 100°C	• Shaft Lock • for P.C.B. (Side Adj.) • Tandem • −30°C~(Low Temp.)
RA202YC Wire-Wound	20.3mm Dia.	290°	10~10K	±10	2.0 @ 40°C 0 @ 100°C	• Sealed • Ear Mount
 **RV24Y** Carbon	24mm Dia. Bushing 9mm Dia. Shaft 6mm Dia.	300°	100~2M	±10	0.25 @ 40°C 0 @ 85°C	• Shaft Lock • Tandem & Dual • With Switch (SP-ST, SP-DT) • With Center Tap
 **LRA25** Wire-Wound	25mm Dia. Bushing 9mm Dia. Shaft 6mm Dia.	300°	500~20K	±5	1.5 @ 40°C 0 @ 100°C	• High Linearity • High Torque
 **RA25Y** Wire-Wound	25mm Dia. Bushing 9mm Dia. Shaft 6mm Dia.	300°	5~20K	±10	1.2 @ 40°C 0 @ 100°C	• Shaft Lock • Tandem & Dual • −30°C~(Low Temp.)
RV30Y Carbon	30mm Dia. Bushing 9mm Dia. Shaft 6mm Dia.	300°	100~2M	±10	1.0 @ 40°C 0 @ 85°C	• With Switch (SP-ST, SP-DT) • Shaft Lock • Tandem & Dual
 **RA30Y** Wire-Wound	31mm Dia. Bushing 9mm Dia. Shaft 6mm Dia.	300°	5~20K	±10	0.25 @ 40°C 0 @ 100°C	• With Center Tap • With Switch (SP-ST, SP-DT) • Shaft Lock • Tandem & Dual • −30°C~(Low Temp.)

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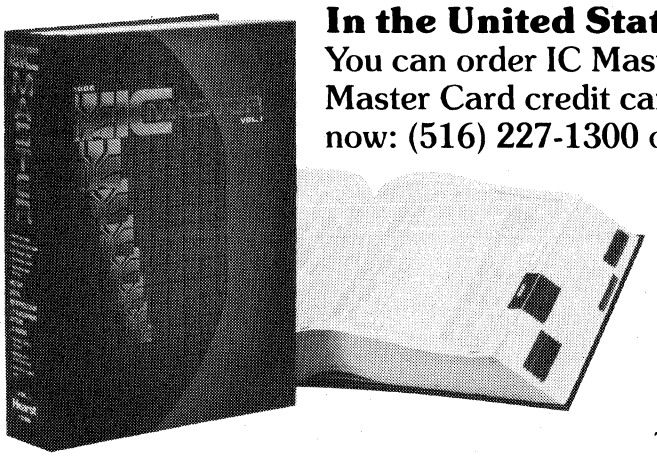

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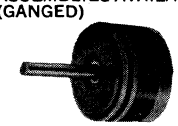
ROTARY SINGLE-TURN POTENTIOMETERS LINEAR-FUNCTIONAL/SINE-COSINE

MULTI-ELEMENT ASSEMBLIES AVAILABLE (GANGED)



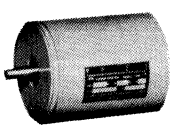
AVAILABLE FROM ½" TO 5" DIAMETERS

SPECIFICATIONS

	LINEAR	SINE-COSINE
Mechanical Rotation	360° Continuous	
Electrical Function Angle	350° Nominal	360°
Resistance Range	0.5KΩ - 2 MegΩ	500Ω - 50KΩ/Quad
Best Linearity or Conformity	.1% ÷ Inch of Dia.	.3% P-P ÷ Inch of Dia.
Virtual Resolution	1/250,000	
Wattage	Diameter x 2 Watt(s)	
Temperature Range	−55°C to +125°C	
Taps, Maximum No.	Diameter x 6	
Starting Torque (In.-Oz.)	Diameter x .15	Diameter x .2
Guaranteed Life (at 100 RPM)	To 30 Million Cycles Depending on Circuitry	

ROTARY MULTI-TURN POTENTIOMETERS LINEAR-FUNCTIONAL

#7810



#20010

AVAILABLE FROM ½" TO 2" DIAMETERS

SPECIFICATIONS

MODEL	7810†**	7820	7813/7814	20010
Mechanical Rotation	3700° Min.	7200° +100° −0°	3600° +100° −0°	3600° +100° −0°
Electrical Function Angle	3600° ±10°	7200° ±10°	3600 ±5°	3600 ±5°
Resistance Range	250Ω-125KΩ		5KΩ-1.5 MegΩ	5KΩ-3MegΩ
Best Linearity or Conformity	.075%	.05%	0.05%	0.01%
Virtual Resolution (Typ.)	1/200,000		1/400,000	
Wattage at 25°C	1		2	4
Temperature Range	−55°C to +125°C			
Taps Maximum No.*	1	2	1	
Starting Torque (In.-Oz.)	1.5		0.5	1.0
Guaranteed Life (at 100 RPM)	100 x 10^6 Revolutions Depending on Circuitry			
Stop Strength	10 In.-Oz. Max.		50 In.-Oz.	160 In.-Oz.

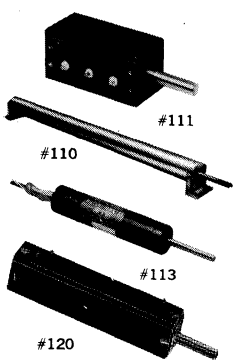
DIMENSIONS

MODEL	7810/ 7820	7813/ 7814	20010
A	.875	.875	2.000
B*	.750	.750	1.875
C	.1875	.125	.250
D*	.750	.800	.750
E	.062	.062	.035
F/G	.062	.062	.060
H	.600	.531	†
J	2.00	1.875	2.625
K	.375	.375	.375

* +.0000 −.0005 † Axial Rear Terminations

* For voltage reference, specify 0° width taps. For current carrying, specify zero resistance taps.
† Available in Dual Units, same case dimensions.
** Available to 36,000°

LINEAR MOTION POTENTIOMETERS/ TRANSDUCERS



#111

#110

#113

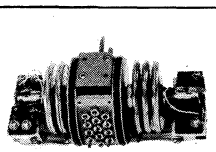
#120

SPECIFICATIONS

MODEL	110*	111*	112	113*	116†	119*	120	121	111V*
Electrical Stroke	To 60"	To 28"	To 12"	To 4"	To 12"	To 10"	To 1"	To 12"	To 28"
Cross Section Configuration ¶	RD ○	SQ □	REC ▭	RD ○	REC ▭	RD ○	REC ▭	RD ○	SQ □
Resistance Range	250Ω/In. to 200K Ω/In.	150Ω/In. to 200K Ω/In.	150Ω/In. to 200K Ω/In.	500Ω/In. to 250K Ω/In.	150Ω/In. to 125K Ω/In.	350Ω/In. to 250K Ω/In.	500Ω/In. to 125K Ω/In.	500Ω/In. to 250K Ω/In.	150Ω/In. to 200K Ω/In.
Best Linearity	0.2% ÷ Length of Electrical Stroke								
Virtual Resolution	1/400,000								
Wattage	1 Watt per Inch of Stroke								
Temperature Range	−55°C to +125°C								
Taps Maximum No.‡	4	To Suit	To Suit	1	1	1	1	1	To Suit
Starting Force Oz. at 25°C	16	8	4	8	4	8	4	8	8
Life	30 Million Strokes, Depending on Circuitry								
Shaft Misalignment Feature	Available	Available	Available	Not Available	Not Available	Available	Available	Not Available	Available

* Available in Dual Units, same case dimensions.
† Available in Dual Unit providing the resistance and function of both elements is the same.
‡ For Voltage reference, specify zero width taps. For current carrying, specify zero resistance taps.
§ Threaded, ball, spring-return and other shaft endings available.
¶ RD — Round SQ — Square REC — Rectangular

PRESSURE TRANSDUCERS



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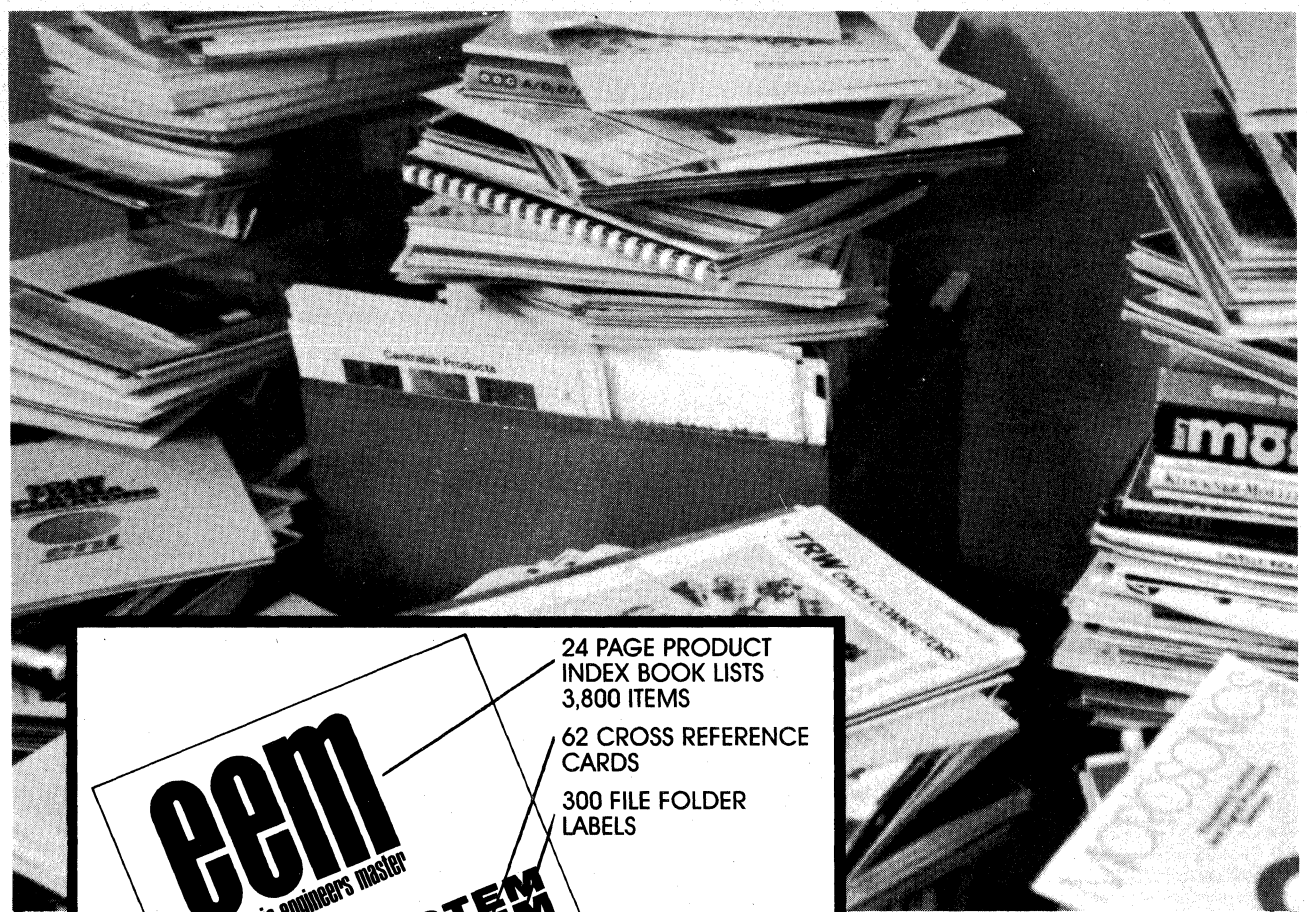

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Model Number	Resistance (Ohms)	Tolerance[1] Available To	Power	No. of Adjustment Turns	Nominal Dimensions (Excluding Leads) H x L x W Inch (mm) and Termination Styles	Load-Life Stability (Max. Δ R)[2]	TCR (End to End)[8]
1202* (RJ12 Style)	2, 5, 10 20, 50, 100, 200, 500, 1K 2K, 5K, 10K, 20K	±10%, ±20%, ±5%, ±10%	0.5W @ 85°C	25 ±2	0.325 x 1.250 x 0.195 (8.255) x (31.750) x (4.953) Type P: In-line pins Type Y: Staggered pins Type L: Flexible leads Type LB: Panel-mount with flexible leads	0.5% 2,000 hrs. @ 85°C	-55°C to +25°C +10 ppm/°C +25°C to +150°C -10 ppm/°C
1208 (RJ12 Style)	20, 50, 100 200. 250, 500 1K, 2K, 5K, 10K	±20% ±10%				1.0% 2,000 hrs. @ 85°C	-55°C to +25°C +20 ppm/°C +25°C to +150°C -20 ppm/°C
1240* (RJ26 Style)	5, 10 20, 50, 100, 200, 500, 1K 2K, 5K, 10K	±10% ±5%	0.25W @ 85°C	21 ±2	0.250 x 0.250 x 0.175 (6.350) x (6.350) x (4.445) Type X: Edge-mount, side-adjust Type W: Edge-mount, top-adjust 0.175 x 0.250 x 0.250 (4.445) x (6.350) x (6.350) Type P: Flat-mount, side adjust	1.0% 10,000 hrs. @ 85°C	-55°C to +25°C +10 ppm/°C +25°C to +150°C -10 ppm/°C
1242† (RJ26)	50, 100, 200, 500, 1K, 2K, 5K	±10%				1.0% 1,000 hrs. @ 85°C	-55°C to +25°C +10 ppm/°C +25°C to +150°C -10 ppm/°C
1248 (RJ26 Style)	20, 50, 100, 200, 500, 1K, 2K, 5K,	±10%				1.0% 1,000 hrs. @ 85°C	-55°C to +25°C +20 ppm/°C +25°C to +150°C -20 ppm/°C
1260* (RJ24 Style)	5, 10, 20, 50, 100, 200, 500 1K, 2K, 5K, 10K	±10% ±5%	0.25W @ 85°C	21 ±2	0.420 x 0.375 x 0.170 (10.67) x (9.53) x (4.32) Type W: Edge-mount, top-adjust Type X: Edge-mount side-adjust	1.0% 10,000 hrs. @ 85°C	-55°C to +25°C +10 ppm/°C +25°C to +150°C -10 ppm/°C
1268 (RJ24 Style)	20, 50, 100 200, 500, 1K 2K, 5K	±10%				1.0% 1,000 hrs. @ 85°C	-55°C to +25°C +20 ppm/°C +25°C to +150°C -20 ppm/°C
1280G* (1280)*	10, 20, 50, 100, 200, 500, 1K, 2K, 5K, 10K, 20K	±10%	0.75W @ 25°C	26 ±2	0.270 x 0.750 x 0.190 (6.86) x (19.05) x (4.83) Panel mount available	0.5% 2,000 hrs. @ 25°C	-55°C to +25°C -15 ppm/°C +25°C to +125°C -15 ppm/°C
1285G* (1285)*	10 20, 50, 100, 200, 500, 1K, 2K, 5K, 10K, 20K	±10% ±5%	0.75W @ 25°C	26 ±2	0.270 x 0.750 x 0.190 (6.86) x (19.05) x (4.83) Panel mount available	0.5% 2,000 hrs. @ 25°C	-55°C to +25°C +5 ppm/°C +25°C to 125°C -5 ppm/°C

* Screening for low noise (CRV) is available.
† Qualified to MIL-R-22097
1, 2, 8 For numerical footnote information, refer to VISHAY's Short Form Catalog or contact VISHAY at the number listed below.

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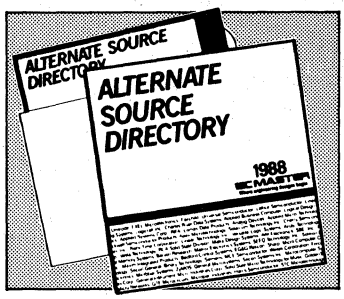

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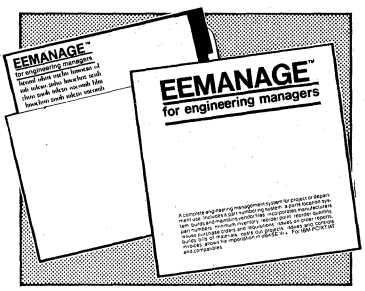

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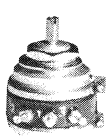
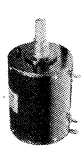
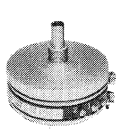
VRN PRECISION POTENTIOMETERS

VRN manufactures a series of wirewound precision potentiometers with many custom adaptations available. Most single-turn models can be supplied with cermet or conductive plastic elements. Servo-mount is an available option on many models. Call VRN to take the mystery out of problem solving!

MODEL	DESCRIPTION
5000	**½" Diameter Multi-Turn Wirewound** **Power rating:** @ 40°C 1W (5000) 1.5W (5005) **Standard resistance range:** 100Ω to 100KΩ (5000) 50Ω to 50KΩ (5005) **Resistance tolerance:** ±5% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.5% std. (closer upon request) **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 125°C **Mechanical rotation:** 3600° +6° −0 (5000) 1800° +6° −0 (5005) **Electrical rotation:** Same as mechanical
5001	**½" Diameter Single-Turn Wirewound** **Power rating:** 2W @ 40°C **Standard resistance range:** 10Ω to 50KΩ **Resistance tolerance:** ±5% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±5% **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 150°C **Mechanical rotation:** Continuous **Electrical rotation:** 320° ±5°
7501	**¾" Diameter Single-Turn Wirewound** **Power rating:** 2.25W @ 40°C **Standard resistance range:** 50Ω to 50KΩ **Resistance tolerance:** ±5% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±1% **Noise (ENR):** 100Ω max. **Operating temperature range:** −55 to 125°C **Mechanical rotation:** Continuous **Electrical rotation:** 320° ±5°
 **0871**	**⅞" Diameter Single-Turn Wirewound** **Power rating:** 1.25W @ 70°C **Standard resistance range:** 100Ω to 10KΩ **Resistance tolerance:** ±3% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.5% **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 150°C **Mechanical rotation:** Continuous **Electrical rotation:** 350° ±2°
7400/ 7600	**¾" Diameter Multi-Turn Wirewound** **Power rating:** @ 40°C 3W (7400) 2W (7405) **Standard resistance range:** 100Ω to 100KΩ (7400) 100Ω to 50KΩ (7405) **Resistance tolerance:** ±5% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** .25% (7400) .5% (7405) **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 125°C **Mechanical rotation:** 3600° +6° −0 (7400) 1800° +6° −0 (7405) **Electrical rotation:** Same as mechanical
8400/ 8500	**⅞" Diameter Multi-Turn Wirewound** **Power rating:** @ 40°C 3W (8400/8500) 2W (8403-05/8503-05) **Standard resistance range:** 100Ω to 100KΩ (8400/8500) 50Ω to 50KΩ (8403-05/8503-05) **Resistance tolerance:** ±5% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.25% (8400/8500) ±.5% (8403-05/8503-05) **Noise (ENR):** 100Ω max. **Operating temperature range:** −55 to 125°C **Mechanical rotation:** 3600° +10° −0 (8400/8500) 1800° +10° −0 (8405-8505); 1080° +10° −0 (8403/8503) **Electrical rotation:** Same as mechanical

MODEL	DESCRIPTION
1000/ 1220	**1" Diameter Multi-Turn Wirewound** **Power rating:** @ 40°C 3W (1000) 2W (1005) 4W (1215) 5W (1220) **Standard resistance range:** 500Ω to 250KΩ (1000) 250Ω to 100KΩ (1005) 500Ω to 450KΩ (1215) 1KΩ to 600KΩ (1220) **Resistance tolerance:** ±5% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.5% (1000/1005) ±.1% (1215/1220) **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 125°C **Mechanical rotation:** 3600° +4° −0 (1000) 1800° +4° −0 (1005) 5400° +4° −0 (1215) 7200° +4° −0 (1220) **Electrical rotation:** Same as mechanical
1061	**1 1/16" Diameter Single-Turn Wirewound** **Power rating:** 1.5W @ 40°C **Standard resistance range:** 50Ω to 50KΩ **Resistance tolerance:** ±3% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.5% **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 150°C **Mechanical rotation:** Continuous **Electrical rotation:** 350° ±2°
1441	**1 7/16" Diameter Single-Turn Wirewound** **Power rating:** 2W @ 40°C **Standard resistance range:** 100Ω to 40KΩ **Resistance tolerance:** ±3% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.5% **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 150°C **Mechanical rotation:** Continuous **Electrical rotation:** 350° ±2°
151	**1½" Diameter Single-Turn Wirewound** **Power rating:** 3.5W @ 40°C **Standard resistance range:** 100Ω to 100KΩ **Resistance tolerance:** ±5% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.5% **Operating temperature range:** −65 to 150°C **Mechanical rotation:** Continuous **Electrical rotation:** 350° ±5°
 **HD150**	**1½" Diameter Multi-Turn Wirewound** **Power rating:** @ 40°C 5W (HD150) 3W (HD153) 4W (HD155) **Standard resistance range:** 500Ω to 500KΩ (HD150) 200Ω to 250KΩ (HD153) 200Ω to 500KΩ (HD155) **Resistance tolerance:** ±3% (HD150) ±5% (HD153/155) **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.25% (HD150) ±.5% (HD153/155) **Noise (ENR):** 100Ω max. **Operating temperature range:** −55 to 100°C **Mechanical rotation:** 3600° +4° −0 (HD150) 1080° +4° −0 (HD153) 1800° +4° −0 (HD155) **Electrical rotation:** Same as mechanical
 **2000/ 3000**	**2" and 3" Diameter Single-Turn Wirewound** **Power rating:** @ 40°C 4W (2000) 6W (3000) **Standard resistance range:** 100Ω to 60KΩ (2000) 200Ω to 100KΩ (3000) **Resistance tolerance:** ±3% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.25% **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 150°C **Mechanical rotation:** Continuous **Electrical rotation:** 350° ±2°

Quality trimmer and precision potentiometers, attenuators and custom resistive devices.

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INTERNATIONAL DIVISION

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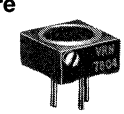
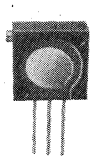
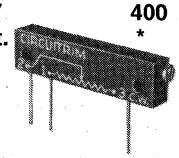
VRN CIRCUITRIM® TRIMMER POTENTIOMETERS

VRN has a broad line of fully enclosed cermet and wirewound trimmer potentiometers with more military approvals than any other manufacturer (see our listing in vol. B, section 2440). Our application engineers are just a phone call away to help you with custom applications. Call VRN to take the mystery out of problem solving!

THE VRN ADVANTAGE

- Square, round and rectangular sizes
- Cermet and wirewound elements
- Low CRV/noise
- Single and multi-turn versions
- Most models sealed to withstand immersion cleaning
- Standard and special temperature coefficients
- Solder-coated leads standard on cermet versions
- Selected types available in surface mount version

VRN CIRCUITRIM® WIREWOUND TRIMMERS

Size	Series	No. Turns	Std. Res. (Ω)	Tol.	Pwr. Rating	Temp. Coeff.	Termination
3/8" Square 	700 *	23	10-20K	±5%	1.0W	±50	3 PC pin styles, flexible leads (top & side adjust)
1/2" Round	100	1	20-20K	±5%	1.0W	±50	PC pins, J-Hooks, flexible leads (top & side adjust)
1/2" Square 	205 *	24	10-20K	±5%	1.0W	±50	3 PC pin styles, flexible leads (top & side adjust)
1 1/4" Rect. 	400 *	22	10-20K	±5%	1.0W	±50	2 PC pin styles, flexible leads (side adjust)

*Includes military approved versions

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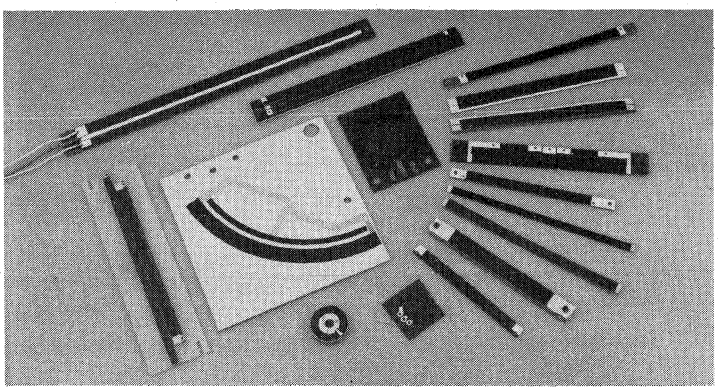
VRN CIRCUITRIM® CERMET TRIMMERS

Size	Series	No. Turns	Std. Res. (Ω)	Tol.	Pwr. Rating	Temp. Coeff.	Termination
1/4" Round	170 **	1	10-2M	±10%	.5W	±100 ***	2 PC pin styles (top adjust)
1/4" Square	180 * **	1	10-2M	±10%	.5W	±100 ***	3 PC pin styles (top & side adjust)
1/4" Square	260 * **	16	20-2M	±10%	.5W	±100 ***	3 PC pin styles (top & side adjust)
3/8" Square	780	1	10-2M	±10%	.5W	±100 ***	15 PC pin styles (top & side adjust)
3/8" Square	753 *	24	20-2M	±10%	.5W	±100	3 PC pin styles (top & side adjust)
5/16" Square	850	13	10-2M	±10%	.3W	±100	1 PC pin style (top & side adjust)
1/2" Round	150	1	50-2M	±10%	.75W	±100 ***	PC pins, J-Hooks, flexible leads (top & side adjust)
1/2" Square	255 *	24	20-2M	±10%	1.0W	±100 ***	3 PC pin styles, flexible leads (top & side adjust)
3/4" Rect.	960	20	10-2M	±10%	.75W	±100 ***	3 PC pin styles (side adjust)
1 1/4" Rect.	450 *	22	10-2M	±10%	1.0W	±100 ***	2 PC pin styles, flexible leads (side adjust)

*Includes military approved versions **Surface mount version available ***Tighter specifications available—consult factory

POSITION FEEDBACK

Repeatable to .0005″
Design it in—your way!

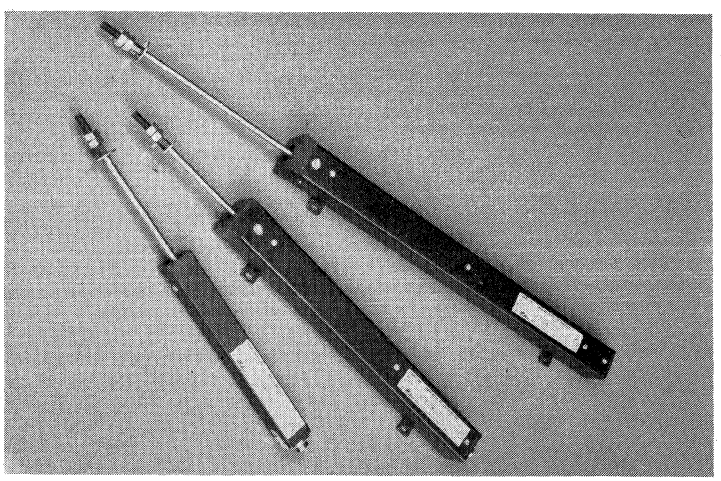


Waters built in servo-feedback elements simplify design and cut costs.

Why box yourself in with "packaged pots"—and linear-to-rotary conversions, and linkages, and costly housings, shafts and bearings you don't really need? Design position or motion feedback *your* way—with our long-lasting, low-noise, custom-made feedback elements.

We can supply squares, circles, strips—any geometric shape you need in linear and non-linear plastic elements. You'll save time. Cut costs. And chances are you'll improve performance. Send today for full information. Or call (508) 358-2777.

LONGFELLOW® POSITION TRANSDUCERS



If you make or use automated machinery, machine tools, molding presses or other equipment that requires reliable, long-lasting and highly accurate linear position signaling, Waters' Longfellow series of Linear Motion Transducers is the only answer.

Controller-compatible, the Longfellow series provides accurate position sensing, position feedback or programmable setpoint control with repeatability to .0005″. With built-in features like MystR® conductive plastic elements and collectors, precious metal wipers, aluminum housing and stainless steel shafts, these transducers can provide up to 100 million operations.

For the long (70″) and the short (1″) of it: Longfellow Transducers are the buy of the times.

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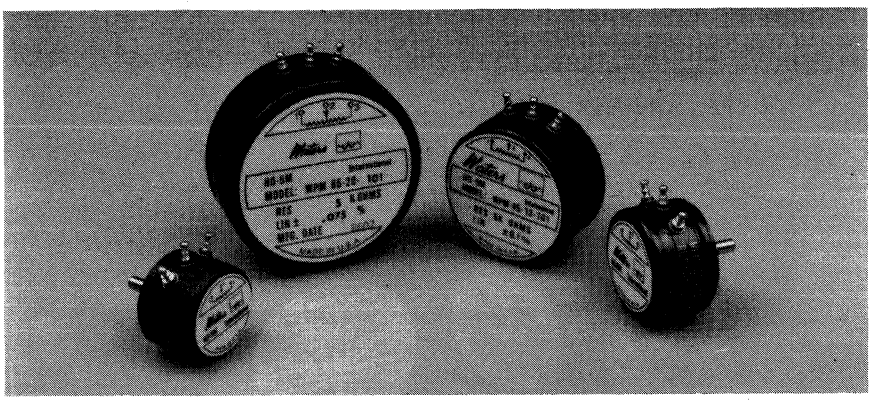
SERVO POTS

True Positional Output

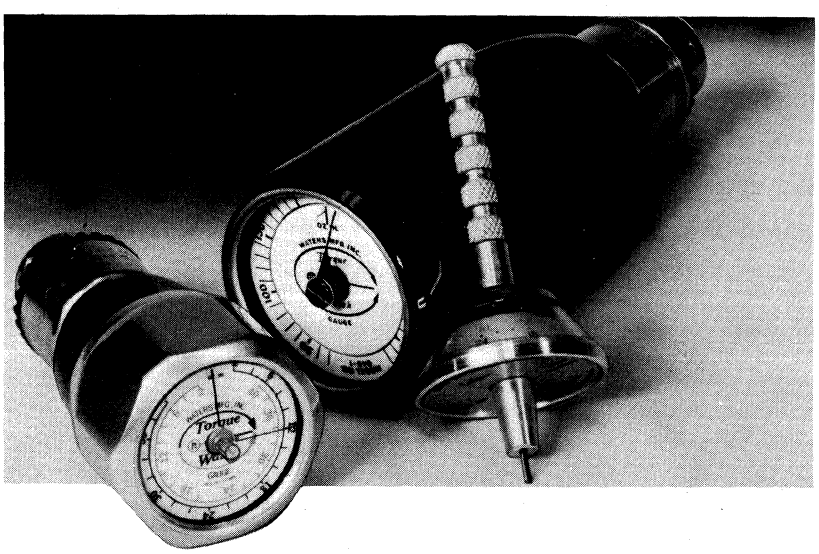


Finally, a line of servo-mount potentiometers with true transducer performance that tells your machine where it really is. Waters' new HQ-5M International Standard Series uses our newly designed "ZB"® zero backlash wipers (patent pending) that provide *true* positional output in high speed, dynamic feedback or measuring systems.

- Long life with Waters' MystR® conductive plastic resistance elements—250x10^6 cycles, minimum
- Dither life 10^9 cycles, minimum
- Hysteresis less than 0.01 degrees
- Accuracy < 0.1% APA (Absolute Positional Accuracy)
- Meets all applicable MIL-R-39023 specifications

HQ-5M series are available from stock in 4 standard servo sizes 9, 11, 13 & 20 (7/8", 1 1/16", 1 7/16" and 2").

TORQUE WATCH® GAUGE



Waters' Torque Watch Gauge, the world's standard for measurement of low torque values from 0.003 oz. in. to 200 oz. in. Now also available in Metric (gram-cm) and S.I. units. Waters also provides the Torque Watch Gauge Calibrator for on-site calibration and standardization.

Send now for detailed brochure.

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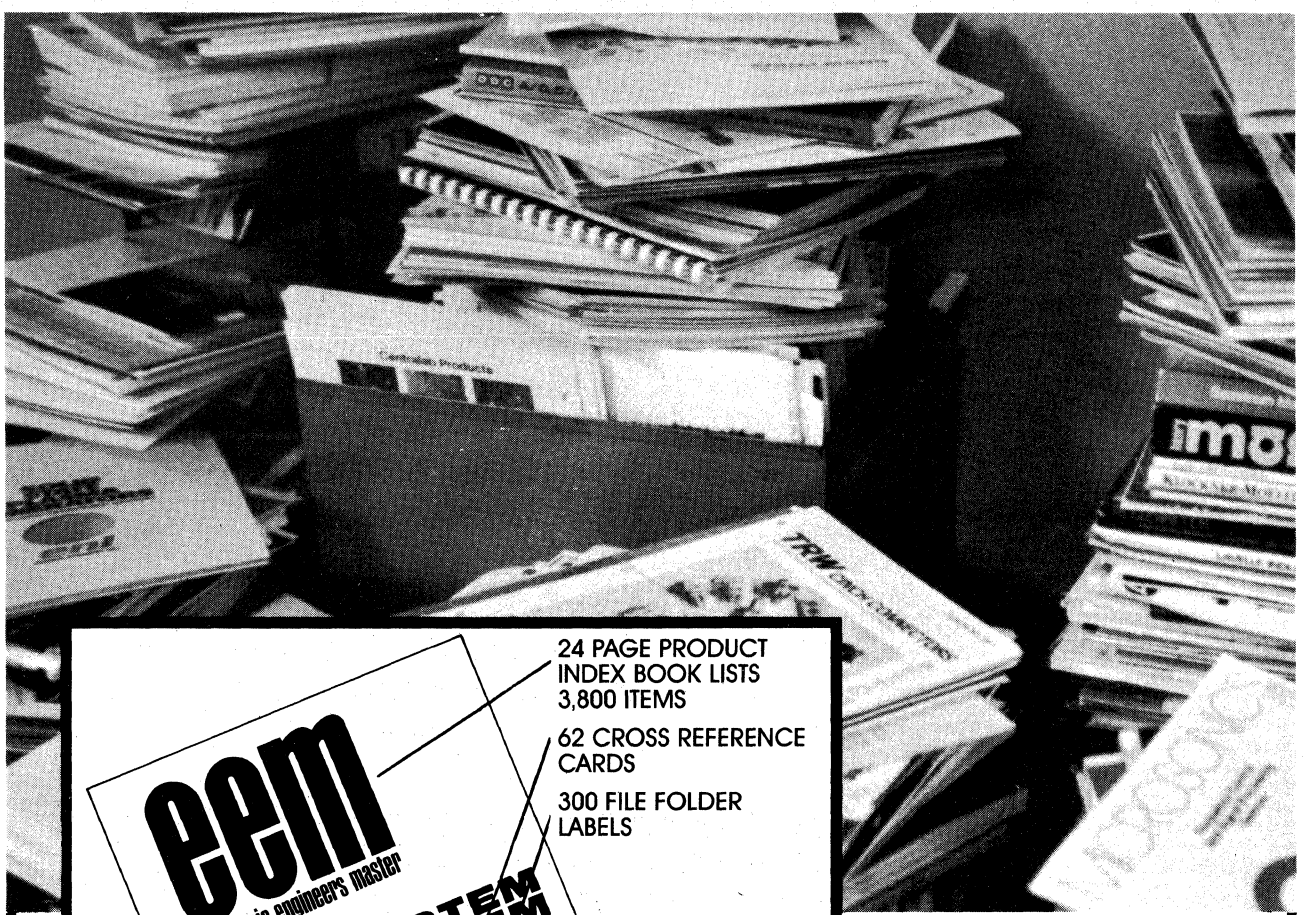

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		SCRs	Triacs	Diacs	Silicon	Germanium	Bridges & Assemblies	Zener	Varactor	
American Microsemiconductor	A•2115	¤§	¤	¤	¤§	¤§	¤§	¤	¤	Diodes, Avalanche-Tunnel
Amperex	A•2116	¤	¤		¤		¤	¤§	¤§	
Collmer	A•2127				¤					
Delbert Blinn	A•2130									Heat Sinks; Mica Insulators; Pads; Mounting Kits
Electronic Devices	A•2131				¤		¤§			High Voltage Diodes, Assemblies
Fagor Electronic Comps.	A•2132				¤§		¤§	¤		Silicon & Suppressor Diodes
Philips ECG	A•2134	¤	¤	¤	¤	¤	¤	¤	¤	
Powerex	A•2136	¤	¤		¤		¤			
Raytheon Co.	A•2139	¤	¤							Chips-SCR, TRIAC
Sharp Electronics	A•2142									Infrared LED's; Laser Diodes; GaAs Hall Devices
Teccor	A•2146	¤	¤§	¤	¤					
Voltage Multipliers	A•2151				¤§		¤§			

§ Surface Mount

TRANSISTORS

Manufacurer	EEM Page No.	RF(Incl. Microwave)	Power		Switching	UJT	Darlington	Chip	Germanium	Small Signal
			Bipolar	FET						
American Microsemiconductor	A•2115	¤	¤	¤	¤	¤	¤	¤	¤	
Amperex	A•2116	¤	¤	¤	¤		¤			¤
Collmer	A•2127		¤				¤			
Philips ECG	A•2134	¤	¤	¤	¤	¤	¤		¤	¤
Powerex	A•2136		¤	¤	¤		¤			
Power Tech	A•2137		¤		¤		¤			

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 88/89 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1134, **B**•1098, **C**•1082, **D**•1038
ASCII Code ..... **D**•1073
Batteries, Product Selection Guide ..... **D**•1428
Batteries & Fuel Cells, Characteristics ..... **D**•1454
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1030
Capacitors, Miniglossary ..... **A**•1027
Capacitors, Product Selection Guide ..... **A**•1003
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1193
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1760
Connectors, Miniglossary ..... **C**•1374
Connectors, Terminals & Sockets, Product Selection Guide ..... **C**•1127
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide ..... **A**•1331
Delay Lines, Product Selection Guide ..... **A**•1495
Discrete Semiconductors, Product Selection Guide ..... **A**•2113
Displays, Readouts, & CRTs, Product Selection Guide ..... **B**•1033
EBCDIC Code ..... **D**•1162
Encapsulation, Miniglossary ..... **C**•1110
Fans, Blowers, Cooling Equipment & Heat Exchangers, Product Selection Guide ..... **C**•1643
Filters, Product Selection Guide ..... **A**•1633
IC Master ..... **A**•1718
Instruments, Panel Meters, Product Selection Guide ..... **D**•1350
Instruments, Test & Measuring, Product Selection Guide ..... **D**•1190
Interconnection Systems, Product Selection Guide ..... **C**•1719
Keyboards & Keypads, Product Selection Guide ..... **B**•1808
Lamps, Lights, & Inductors, Product Selection Guide ..... **B**•1104
Logofinder & Trademark Directories ..... **C**•901
Microwave Components, Product Selection Guide ..... **A**•1761
Military Qualified Products List ..... **B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1181
Opto Semiconductors, Miniglossary ..... **B**•1262
Oscilloscopes, Product Selection Guide ..... **D**•1408
Panel Hardware, Product Selection Guide ..... **C**•1603
Potentiometers, Trimmers, Controls & Rheostats, Product Selection Guide ..... **A**•2057
Power Supplies, Miniglossary ..... **D**•1504
Power Supplies, AC, Product Selection Guide ..... **D**•2060
Power Supplies, DC, Product Selection Guide ..... **D**•1497
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide ..... **B**•1297
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Relays, Product Selection Guide ..... **B**•1355
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Resistors, Product Selection Guide ..... **A**•1849
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Solenoids, Product Selection Guide ..... **B**•1612
Switches, Product Selection Guide ..... **B**•1636
Thermal Components, Product Selection Guide ..... **B**•1834
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1842
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Trademark & Logofinder Directories ..... **C**•901
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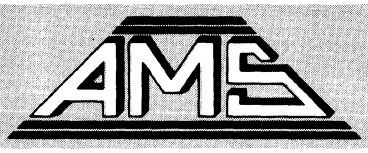
Transformers, Product Selection Guide ..... **A**•2153
Voltage Drop Nomograph ..... **C**•1912, **D**•2042
Wire & Cable, Product Selection Guide ..... **C**•1763
Wire Guages—Diameter, Area, Copper Weight ..... **C**•1864



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- **OBSOLETE DEVICES**

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DIACs
Diode Arrays (Incl. Photo)
Diodes, Avalanche
Diodes, Backward
Diodes, Chip, Unpackaged
Diodes, Germanium
Diodes, High Voltage (1,000 Volts & Over)
Diodes, Matched Pairs
Diodes, Power, Surface Mount
Diodes, Schottky
Diodes, Silicon
Diodes, Switching
Diodes, Switching, Surface Mount
Diodes, Temperature Compensating
Diodes, Tunnel
Diodes, Varactor
Diodes, Varactor, Surface Mount
Diodes, Zener & Stabistors (Forward Reference Diodes)
Diodes, Zener, Surface Mount

INTEGRATED CIRCUITS

Integrated Circuits, Digital
Integrated Circuits, Interface
Integrated Circuits, Linear
Integrated Circuits, Memory
Integrated Circuits, Microprocessor

RECTIFIERS

Rectifier Assemblies
Rectifiers, Bridges & Assemblies
Rectifiers, General Purpose, Surface Mount
Rectifiers, Germanium
Rectifiers, Schottky, Surface Mount
Rectifiers, Selenium
Rectifiers, Silicon
Rectifiers, Surface Mount

THYRISTOR/TRANSISTORS/TRIACS

Thyristors and SCRs, Surface Mount
Thyristors (Incl. Silicon Controlled Rectifiers)
Transistors, Bipolar
Transistors, Bipolar, Surface Mount
Transistors, Chip, Unpackaged
Transistors, Darlington
Transistors, Dual
Transistors, Field Effect
Transistors, Germanium
Transistors, Power
Transistors, Power, Bipolar
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SLATERSVILLE DIVISION

PHILIPS POWER SEMICONDUCTORS

RECTIFIERS

SEE PAGE A-2124 FOR PACKAGE OUTLINES

General Purpose Silicon Rectifiers

Type	Pkg	$I_{F(AV)}$ Max A	V_{RRM} Max V	V_F @ I_F Max V @ A
BYD13D	SOD-81	1.4	200	1.05 @ 1
BYD13G			400	
BYD13J			600	
BYD13K			800	
BYD13M			1000	
BYD14D	SOD-84	2	200	1.5 @ 3
BYD14G			400	
BYD14J			600	
BYD14K			800	
BYD14M			1000	
BY527	SOD-57	2	1250	1.65 @ 10
BY627	SOD-84	2	1250	1.65 @ 10
BYW54	SOD-57	2	600	1.15 @ 2.5
BYW55			800	
BYW56			1000	
IN5059	SOD-57	2	200	1.15 @ 2.5
IN5060			400	
IN5061			600	
IN5062			800	
BYM56A	SOD-64	3.5	200	0.95 @ 3
BYM56B			400	
BYM56C			600	
BYM56D			800	
BYM56E			1000	
BYX38-300	DO-4 (1)	6	300	1.7 @ 20
-600			600	
-1200			1200	
BY249-300	TO-220AC	7	300	1.6 @ 20
-600			600	
-800			800	
BYX98-300	DO-4 (1)	10	300	1.7 @ 20
-600			600	
-1200			1200	
BYX42-300	DO-4 (1)	12	300	1.4 @ 15
-600			600	
-1200			1200	
BYX99-300	DO-4 (1)	15	300	1.55 @ 50
-600			600	
-1200			1200	
BYX96-300U	DO-4 (1)	30	300	1.7 @ 100
-600U			600	
-1200U			1200	
BYX56-600	DO-5	50	600	1.8 @ 150
-800			800	
-1000			1000	
-1200			1200	
-1400			1400	

Schottky Rectifiers

Type	Pkg	$I_{F(AV)}$ Max A	V_{RRM} Max V	V_F @ I_F Max V @ A
BYV10-20	DO-41	1	20	0.4 @ 1
-30			30	
-40			40	
BYV18-30	TO-220AB	10	30	0.6 @ 5
-35			35	
-40			40	
-45			45	
BYV19-30	TO-220AC	10	30	0.6 @ 7
-35			35	
-40			40	
-45			45	
BYV20-30	DO-4 (1)	15	30	0.6 @ 15
-35			35	
-40			40	
-45			45	
PHBR1635	TO-220AC	16	35	0.6 @ 15
PHBR1640			40	
PHBR1645			45	
BYV33-30	TO-220AB	20	30	0.6 @ 7
-35			35	
-40			40	
-45			45	
BYV21-30	DO-4 (2)	28	30	0.55 @ 30
-35			35	
-40			40	
-45			45	
BYV43-30	TO-220AB	30	30	0.6 @ 15
-35			35	
-40			40	
-45			45	
BYV73-30	SOT-93	30	30	0.6 @ 15
-35			35	
-40			40	
-45			45	
PHSD241	TO-3	30	45	0.6 @ 20
IN5832	DO-5	40	20	0.52 @ 40
IN5833			30	0.55 @ 40
IN5834			40	0.59 @ 40
IN6097	DO-5	50	30	0.86 @ 160
IN6098			40	
PHSD51	DO-5	60	45	0.8 @ 157

Schottky Rectifiers (Cont.)

Type	Pkg	$I_{F(AV)}$ Max A	V_{RRM} Max V	V_F @ I_F Max V @ A
BYV22-30	DO-5	60	30	0.55 @ 50
-35			35	
-40			40	
-45			45	
BYV23-30	DO-5	80	30	0.55 @ 70
-35			35	
-40			40	
-45			45	

Ultra-Fast Recovery Epitaxial Rectifiers

Type	Pkg	$I_{F(AV)}$ Max A	V_{RRM} Max V	V_F @ I_F Max V @ A
PHS1001	SOD-57	1	50	0.89 @ 1
PHS1002			100	
PHS1003			150	
BYV26A	SOD-57	1	200	1.3 @ 1
B			400	
C			600	
D			800	
E			1000	
BYV36A			200	
B		1.6	400	1.0 @ 1
C	SOD-57		600	
D		1.5	800	1.05 @ 1
E			1000	
BYD73A	SOD-81		50	
B			100	
C		1.75	150	0.74 @ 1
D			200	
F		1.7	300	0.83 @ 1
G		1.7	400	0.83 @ 1
PHS1101	SOD-57	2	50	0.88 @ 3
PHS1102			100	
PHS1103			150	
BYV27-50	SOD-57	2	50	0.88 @ 3
-100			100	
-150			150	
-200			200	
BYD74A	SOD-84		50	
B			100	0.72 @ 2
C		2.4	150	
D			200	
F		2.15	300	0.82 @ 2
G			400	
BYV28-50	SOD-64	3.5	50	0.75 @ 3
-100			100	
-150			150	
-200			200	
PHR605CT	TO-220AB	6	50	0.75 @ 3
PHR610CT			100	
PHR615CT			150	
PHR620CT			200	
BYQ28-50			50	
-100	TO-220AB	10	100	0.85 @ 5
-150			150	
-200			200	
PHS1401	TO-220AC	8	50	0.89 @ 8
PHS1402			100	
PHS1403			150	
BYW29-50	TO-220AC	8	50	0.85 @ 5
-100			100	
-150			150	
-200			200	
BYR29-600	TO-220AC	8	600	1.85 @ 20
-800			800	
BYV29-300	TO-220AC	9	300	1.05 @ 5
-400			400	
-500			500	
BVR30-300	DO-4 (1)	12	300	1.05 @ 12
-400			400	
-500			500	
BYV32F-50	SOT-186	12	50	0.85 @ 5
-100			100	
-150			150	
-200			200	
BYW30-50U	DO-4 (1)	14	50	0.85 @ 10
-100U			100	
-150U			150	
-200U			200	
BYT79-300	TO-220AC	14	300	1.05 @ 10
-400			400	
-500			500	
BYV79-50	TO-220AC	14	50	0.85 @ 10
-100			100	
-150			150	
-200			200	
PHS2401	TO-220AB	16	50	0.8 @ 4
PHS2402			100	
PHS2403			150	
PHS2404			200	
BYV32-50	TO-220AB	20	50	0.85 @ 5
-100			100	

Ultra-Fast Recovery Epitaxial Rectifiers (Cont.)

Type	Pkg	$I_{F(AV)}$ Max A	V_{RRM} Max V	V_F @ I_F Max V @ A
BYV32-150	TO-220AB	20	150	0.85 @ 5
-200			200	
BYV34-300	TO-220AB	20	300	1.1 @ 10
-400			400	
-500			500	
BYW31-50U	DO-4 (2)	28	50	0.85 @ 20
-100U			100	
-150U			150	
-200U			200	
BYV42-50	TO-220AB	30	50	0.85 @ 10
-100			100	
-150			150	
-200			200	
BYV44-300	TO-220AB	30	300	1.1 @ 15
-400			400	
-500			500	
BYV72-50	SOT-93	30	50	0.85 @ 10
-100			100	
-150			150	
-200			200	
BYV74-300	SOT-93	30	300	1.1 @ 15
-400			400	
-500			500	
PHS2601	TO-3	30	50	0.825 @ 15
PHS2602			100	
PHS2603			150	
PHS2604			200	
BYV92-200	DO-5	40	200	1.05 @ 40
-300			300	
-400			400	
-500			500	
BYW92-50U	DO-5	40	50	0.95 @ 35
-100U			100	
-150U			150	
-200U			200	
BYW93-50U	DO-5	60	50	0.85 @ 50
-100U			100	
-150U			150	
-200U			200	
PHS801	DO-5	70	50	0.84 @ 70
PHS802			100	
PHS803			150	
PHS804			200	
BYW94-50U	DO-5	80	50	0.85 @ 70
-100U			100	
-150U			150	
-200U			200	

Fast Recovery Rectifiers—Double Diffused Very Fast Types

Type	Pkg	$I_{F(AV)}$ Max A	V_{RRM} Max V	V_F @ I_F Max V @ A
BYD33D	SOD-81	1.3	200	1.3 @ 1
G			400	
J			600	
K			800	
M			1000	
BYV95A	SOD-57	1.5	200	1.6 @ 3
B			400	
C			600	
BYV96D	SOD-57	1.5	800	1.6 @ 3
E			1000	
BYW95A	SOD-64	3	200	1.5 @ 3
B			400	
C			600	
BYW96D	SOD-64	3	800	1.5 @ 3
E			1000	
IN3879	DO-4 (1)	6	50	1.4 @ 6
IN3880			100	
IN3881			200	
IN3882			300	
IN3883			400	
IN3889	DO-4 (1)	12	50	1.4 @ 12
IN3890			100	
IN3891			200	
IN3892			300	
IN3893			400	
BYX30-200	DO-4 (2)	14	200	2.1 @ 14
-300			300	
-400			400	
-500			500	
-600			600	
IN3899	DO-5	20	50	1.4 @ 20
IN3900			100	
IN3901			200	
IN3902			300	
IN3903			400	
BYX46-200	DO-4 (2)	22	200	2 @ 50
-300			300	
-400			400	
-500			500	
-600			600	

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RECTIFIERS, DIODES, ZENERS, THYRISTORS, TRIACS, MOS TRANSISTORS

SEE PAGE A-2124 FOR PACKAGE OUTLINES

Type	Pkg	$I_{F(AV)}$ Max A	V_{RRM} Max V	V_F @ I_F Max V @ A
Fast Recovery Rectifiers—Double Diffused Very Fast Types (Cont.)				
IN3909	DO-5	30	50	1.4 @ 30
IN3910			100	
IN3911			200	
IN3912			300	
IN3913			400	
Fast Types				
BY458	SOD-57	4	1200	1.6 @ 3
BY448			1500	
BY438	SOD-64	5	1200	1.5 @ 5
BY228			1500	
BY359-1300	TO-220AC	5	1300	2.3 @ 20
-1500			1500	
BY229-200	TO-220AC	7	200	1.85 @ 20
-400			400	
-600			600	
-800			800	
-1000			1000	
BY329-1000	TO-220AC	8	1000	1.85 @ 20
-1200			1200	
BYV24-800U	DO-4 (1)	14	800	1.7 @ 20
-1000U			1000	
BYW25-800	DO-5	40	800	2.25 @ 150
-1000			1000	
High Voltage Rectifier Diodes				
BY584	SOD-61	85mA	1800	
BY614	SOD-61H	50mA	2200	
BY505	SOD-61	85mA	2200	
BYX90G	SOD-83	550mA	7500	
BY707	SOD-61	3mA	9000	
BY708	SOD-61	3mA	12000	
BY709	SOD-61	3mA	14000	
BY509	SOD-61	4mA	15000	
BY609	SOD-61	4mA	15000	
BY619	SOD-61	4mA	15000	
BY610	SOD-61	4mA	17000	
BY620	SOD-61	4mA	17000	
BY710	SOD-61	3mA	17000	
BY711	SOD-61	3mA	19000	
BY712	SOD-61	3mA	22000	
BY713	SOD-61	3mA	24000	
BY714	SOD-61	3mA	30000	

Type	Pkg	$I_{O(AV)}$ Max A.	$V_{I(RMS)}$ Max V	V_{IRM} Max V	I_{ISM} Max A
Bridge Rectifiers					
BY224-400	SOT-112	4.8	220	400	100
-600			280	600	
BY225-100	SOT-112	4.8	50	100	100
-200			80	200	

Type	Pkg	Polarity	P_{TOT} Max W	Reg V V_Z
Power Zeners (Voltage Regulator)				
BZX79	DO-35	Norm	400mW	2.4 to 75
BZD23	SOD-81	Norm	2.5W	3.9 to 270
BZT03	SOD-57	Norm	3.25W	7.5 to 270
BZW03	SOD-64	Norm	6W	7.5 to 270
BZY93	DO-4 (1)	Both	20W	7.5 to 75
BZY91	DO-5	Both	100W	7.5 to 75

Type	Pkg	Polarity	P_{RSM} Max W	Stand-off VR
Power Zeners (Transient Suppressor)				
BZD23	SOD-81	Norm	300W	3.0 to 220
BZT03	SOD-57	Norm	600W	5.6 to 220
BZW03	SOD-64	Norm	1000W	6.2 to 220
BZY93	DO-4 (1)	Both	700W	5.6 to 56
BZY91	DO-5	Both	9.5kW	5.6 to 56

Type	Pkg	$I_{T(AV)}$ Max A	V_{RRM} Max V	V_{GT} Min V	I_{GT} Min A
General Purpose Thyristors					
BT149F	TO-92	0.5	50	0.8	200µA
A			100		
B			200		
D			400		
E			500		
M			600		
C122F	TO-220AB	5	50	1.5	25mA
A			100		
B			200		
D			400		
E			500		
M			600		
OT168	TO-220AB	5	500	1.5	200µA

Type	Pkg	$I_{T(AV)}$ Max A	V_{RRM} Max V	V_{GT} Min V	I_{GT} Min A
General Purpose Thyristors (Cont.)					
BT151-500	SOT-186	5.7	500	1.5	15mA
-650			650		
-800			800		
BT151-500R	TO-220AB	7.5	500	1.5	15mA
-650			650		
-800			800		
BTW38-600RU	TO-64	10	600	1.5	50mA
-800RU			800		
-1000RU			1000		
BTW42-600RU	TO-64	10	600	1.5	50mA
-800RU			800		
-1000RU			1000		
C127F	TO-220AB	10	50	1.5	30mA
A			100		
B			200		
D			400		
E			500		
M			600		
BT152-400R	TO-220AB	13	400	1.5	32mA
-600R			600		
-800R			800		
BT145-500	TO-220AB	16	500	1.5	35mA
-600			600		
-800			800		
BTW45-400RU	TO-48	16	400	1.5	75mA
-600RU			600		
-800RU			800		
-1000RU			1000		
BTW40-400RU	TO-48	20	400	1.5	75mA
-600RU			600		
-800RU			800		

Type	Pkg	$I_{T(AV)}$ Max A	V_{DRM} Max V	V_{GT} Min V	I_{GT} Min A
Fast Turn-Off Thyristors/ASCRs					
BT153	TO-220AB	4	500	2.5	40mA
BT155-600RK	TO-220AB	9.5	600	2.0	100mA
-800RK			800		
-600RN			600		
-800RN			800		
-600RP			600		
-800RP			800		
BTW62-800RK	TO-238AA	18	800	2.0	250mA
BTW62D-800RK	TO-238AA	18	800	2.0	250mA
BTW63-600RK	TO-48	25	600	2.0	250mA
-800RK			800		
-600RN			600		
-800RN			800		
-1000RN			1000		
-600RP			600		
-800RP			800		

Type	Pkg	$I_{T(AV)}$ Max A	V_{RRM} Max V	V_{GT} Min V	I_{GT} Min A
Gate Turn-Off Thyristors					
BT157-1300R	TO-220AB	3.2	1300	1.5	
-1500R			1500		
BTW58-1000R	TO-220AB	6.5	1000	1.5	
-1300R			1300		
-1500R			1500		
BTV58-600R	TO-220AB	10	600	1.5	
-850R			850		
-1000R			1000		
BTS59-850R	SOT-93	15	850	1.5	
-1000R			1000		
-1200R			1200		
BTV59-600R	TO-238AA	15	600	1.5	
-850R			850		
-1000R			1000		
BTV60-850R	TO-238AA	25	850	1.5	
-1000R			1000		
-1200R			1200		

Type	Pkg	$I_{T(RMS)}$ Max A	V_{DRM} Max V	V_{GT} Min V
TRIACs				
BT136-500	TO-220AB	4	500	1.5
-600			600	
-800			800	
BT136-500D	TO-220AB	4	500	1.5
BT136-500E	TO-220AB	4	500	1.5
-600E			600	
-800E			800	
BT136-500F	TO-220AB	4	500	1.5
-600F			600	
-800F			800	
BT136-500G	TO-220AB	4	500	1.5
-600G			600	
-800G			800	
BT137-500	TO-220AB	8	500	1.5

Type	Pkg	$I_{T(RMS)}$ Max A	V_{DRM} Max V	V_{GT} Min V
TRIACs (Cont.)				
BT137-600	TO-220AB	8	600	
-800			800	
BT137-500D	TO-220AB	8	500	1.5
BT137-500E	TO-220AB	8	500	1.5
-600E			600	
-800E			800	
BT137-500F	TO-220AB	8	500	1.5
-600F			600	
-800F			800	
BT137-500G	TO-220AB	8	500	1.5
-600G			600	
-800G			800	
BT138-500	TO-220AB	12	500	1.5
-600			600	
-800			800	
BT138-500E	TO-220AB	12	500	1.5
-600E			600	
-800E			800	
BT138-500F	TO-220AB	12	500	1.5
-600F			600	
-800F			800	
BT138-500G	TO-220AB	12	500	1.5
-600G			600	
-800G			800	
BTW43-600GU	TO-64	12	600	2.5
-800GU			800	(5V with
-1000GU			1000	T-, G+)
-1200GU			1200	
BTW43-600HU	TO-64	12	600	2.5
-800HU			800	(5V with
-1000HU			1000	T-, G+)
-1200HU			1200	
BT139-500	TO-220AB	16	500	1.5
-600			600	
-800			800	
BT139-500E	TO-220AB	16	500	1.5
-600E			600	
-800E			800	
BT139-500F	TO-220AB	16	500	1.5
-600F			600	
-800F			800	
BT139-500G	TO-220AB	16	500	1.5
-600G			600	
-800G			800	
BTA140-500	TO-220AB	25	500	1.5
-600			600	
-800			800	

Type	Pkg	V_{DS} Max V	I_D Max A	P_{TOT} Max W	R_{DS} On <Ω	gfs typ A/V	Crs typ pF
Power MOS Transistors							
BUZ10	TO-220AB	50	12	75	0.1	4.8	120
BUZ10A			12	75	0.12	4.8	120
BUZ11			30	75	0.04	8.0	360
BUZ11A			25	75	0.06	8.0	360
BUZ71			12	40	0.1	4.8	160
BUZ71A			12	40	0.12	4.8	160
BUZ14	TO-3	50	39	125	0.04	12.0	500
BUZ15			45	125	0.03	12.0	500
BUZ20	TO-220AB	100	12	75	0.2	4.0	80
BUZ21			18	75	0.1	3.5	200
BUZ72			10	40	0.2	3.8	80
BUZ72A			9	40	0.25	3.8	80
BUZ23	TO-3	100	10	78	0.2	4.0	80
BUZ24			32	125	0.06	10.0	500
BUZ25			19	78	0.1	8.0	360
BUZ30	TO-220AB	200	7	75	0.75	3.5	100
BUZ31			12.5	75	0.2	5.0	140
BUZ32			9.5	75	0.4	3.5	100
BUZ73			7.0	40	0.4	3.5	60
BUZ73A			5.8	40	0.6	3.5	60
BUZ33	TO-3	200	7.2	78	0.75	3.5	100
BUZ34			17	125	0.2	7.5	500
BUZ35			9.9	78	0.4	3.5	100
BUZ36			22	125	0.12	7.5	500
BUZ60	TO-220AB	400	5.5	75	1.0	2.5	30
BUZ60B			4.5	75	1.5	2.5	30
BUZ76			3.0	40	1.8	2.5	25
BUZ76A			2.6	40	2.5	2.5	25
BUZ63	TO-3	400	5.9	78	1.0	2.5	30
BUZ63B			4.5	78	1.5	2.5	30
BUZ64			10.5	125	0.4	4.5	100
BUZ40	TO-220AB	500	2.5	75	4.5	2.5	30
BUZ41A			4.5	75	1.5	2.5	30
BUZ42			4.0	75	2.0	2.5	30
BUZ74			2.4	40	3.0	2.5	20
BUZ74A			2.0	40	4.0	2.5	20
BUZ43	TO-3	500	2.8	78	4.5	2.5	30
BUZ44A			4.8	78	1.5	2.5	30

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MOS TRANSISTORS (CONT.), DARLINGTONS, TRANSISTORS

SEE PAGE A-2124 FOR PACKAGE OUTLINES

Type	Pkg	V_{DS} Max V	I_D Max A	P_{TOT} Max W	R_{DS} On $<\Omega$	gfs typ A/V	Crs typ pF
Power MOS Transistors (Cont.)							
BUZ45	TO-3	500	9.6	125	0.6	4.0	100
BUZ45A			8.3	125	0.8	4.0	100
BUZ45B			10	125	0.5	4.0	100
BUZ46			4.2	78	2.0	2.5	30
BUZ80	TO-220AB	800	2.6	75	4.0	1.8	30
BUZ80A			3.0	75	3.0	1.8	30
BUZ83	TO-3	800	2.9	78	4.0	1.8	30
BUZ83A			3.4	78	3.0	1.8	30
BUZ84			5.3	125	2.0	3.0	100
BUZ84A			6.0	125	1.5	3.0	100
BUZ50A	TO-220AB	1000	2.5	75	5.0	1.5	30
BUZ50B			2.0	75	8.0	1.5	30
BUZ50C			2.25	75	6.0	1.5	30
BUZ53A	TO-3	1000	1.6	78	5.0	1.5	30
BUZ54			5.3	125	2.0	2.0	100
BUZ54A			4.6	125	2.6	2.0	100
Low Power Types						gfs typ	
N-CHANNEL						mA/V	
2N6659	TO-39	35	1.4	6.25	1.8	170	
BS170	TO-92	60	0.5	0.83	5	200	
2N6660	TO-39	60	1.1	6.25	3	170	
BST72A	TO-92	80	0.3	0.83	10	150	
BST90	TO-39	80	0.5	2.5	4	300	
BST70	TO-92	80	0.5	1	4	300	
2N6661	TO-39	90	0.9	6.25	4	170	
BST97	TO-18	180	0.3	1.5	10	250	
BST76A	TO-92	180	0.3	1	10	250	
BS107	TO-92	200	0.12	0.5	28	200	
BST74A	TO-92	200	0.25	1	12	250	
BST78	TO-126	450	0.75	15	14	400	
P-CHANNEL							
BST110	TO-92	50	0.3	0.83	10	125	
BST100	TO-92	60	0.3	1	6	200	

Type NPN	PNP	Pkg	I_C (DC) Max A	V_{CEO}	$h_{FE}@I_C$ Min
General Purpose Darlingtons, Low Voltage					
TIP110	TIP115	TO-220AB	2	60	1000 @ 1A
TIP111	TIP116			80	and
TIP112	TIP117			100	500 @ 2A
BD675	BD676	TO-126	4	45	750 @ 1.5A
BD677	BD678			60	
BD679	BD680			80	
BD681	BD682			100	
BD683	BD684			120	
6037Y	6034Y	SOT-194	4	40	750 @ 2A
6038Y	6035Y			60	
6039Y	6036Y			80	
BDT61	BDT60	TO-220AB	4	60	750 @ 1.5A
BDT61A	BDT60A			80	
BDT61B	BDT60B			100	
BDT61C	BDT60C			120	
TIP120	TIP125	TO-220AB	5	60	1000 @ 3A
TIP121	TIP126			80	
TIP122	TIP127			100	
BD645	BD646	TO-220AB	8	60	750 @ 3A
BD647	BD648			80	
BD649	BD650			100	
BD651	BD652			120	
BD645F	BD646F	SOT-186	8	60	750 @ 3A
BD647F	BD648F			80	
BD649F	BD650F			100	
BD651F	BD652F			120	
BU806		TO-220AB	8	200	—
BU807				150	
BU806F		SOT-186	8	200	—
BU807F				150	
TIP130	TIP135	TO-220AB	8	60	500 @ 1A
TIP131	TIP136			80	and
TIP132	TIP137			100	1000 @ 4A
BDT63	BDT62	TO-220AB	10	60	1000 @ 3A
BDT63A	BDT62A			80	
BDT63B	BDT62B			100	
BDT63C	BDT62C			120	
TIP140	TIP145	SOT-93	10	60	1000 @ 5A
TIP141	TIP146			80	and
TIP142	TIP147			100	500 @ 10A
BDV65	BDV64	SOT-93	12	60	1000 @ 5A
BDV65A	BDV64A			80	
BDV65B	BDV64B			100	
BDV65C	BDV64C			120	
BDT65	BDT64	TO-220AB	12	60	1000 @ 5A
BDT65A	BDT64A			80	
BDT65B	BDT64B			100	
BDT65C	BDT64C			120	

Type NPN	PNP	Pkg	I_C (DC) Max A	V_{CEO} V	$h_{FE}@I_C$ Min
General Purpose Darlingtons, Low Voltage (Cont.)					
BDX67	BDX66	TO-3	16	60	1000 @ 10A
BDX67A	BDX66A			80	
BDX67B	BDX66B			100	
BDX67C	BDX66C			120	
BDV67A	BDV66A	SOT-93	16	80	1000 @ 10A
BDV67B	BDV66B			100	
BDV67C	BDV66C			120	
BDV67D	BDV66D			150	
General Purpose Transistors, Low Voltage					
TIP29	TIP30	TO-220AB	1	40	40 @ 200mA
TIP29A	TIP30A			60	and
TIP29B	TIP30B			80	15 @ 1A
TIP29C	TIP30C			100	
BDT31F	BDT32F	SOT-186	3	40	25 @ 1A
BDT31AF	BDT32AF			60	
BDT31BF	BDT32BF			80	
BDT31CF	BDT32CF			100	
TIP31	TIP32	TO-220AB	3	40	25 @ 1A
TIP31A	TIP32A			60	and
TIP31B	TIP32B			80	10 @ 3A
TIP31C	TIP32C			100	
BD933F	BD934F	SOT-186	3	45	25 @ 1A
BD935F	BD936F			60	
BD937F	BD938F			80	
BD939F	BD940F			100	
BD941F	BD942F			120	
TIP41	TIP42	TO-220AB	6	40	30 @ 300mA
TIP41A	TIP42A			60	and
TIP41B	TIP42B			80	15 @ 3A
TIP41C	TIP42C			100	
BD201	BD202	TO-220AB	8	45	30 @ 3A
BD203	BD204			60	30 @ 2A
BDX77	BDX78			80	30 @ 2A
BD201F	BD202F	SOT-186	8	45	30 @ 3A
BD203F	BD204F			60	30 @ 2A
BDX77F	BDX78F			80	30 @ 2A
BDV91	BDV92	SOT-93	10	60	20 @ 4A
BDV93	BDV94			80	
BDV95	BDV96			100	
TIP33	TIP34	SOT-93	10	40	20 @ 3A
TIP33A	TIP34A			60	
TIP33B	TIP34B			80	
TIP33C	TIP34C			100	
BDT91	BDT92	TO-220AB	10	60	20 @ 4A
BDT93	BDT94			80	
BDT95	BDT96			100	
BDT81	BDT82	TO-220AB	15	60	50 @ 5A
BDT83	BDT84			80	
BDT85	BDT86			100	
BDT87	BDT88			120	
TIP3055	TIP2955	SOT-93	15	60	20 @ 4A
High Speed, Low Voltage Darlingtons					
BDX42	BDX45	TO-126	1	45	2000 @ 0.5A
BDX43	BDX46			60	
BDX44	BDX47			80	
High Speed, Low Voltage Transistors					
BD135	BD136	TO-126	1	45	25 @ 0.5A
BD137	BD138			60	
BD139	BD140			80	
BD226	BD227	TO-126	1.5	45	25 @ 1A
BD228	BD229			60	
BD230	BD231			80	
BDX35		TO-126	5	60	45 @ 0.5A
BDX36				60	
BDX37				80	

Type	Pkg	I_C (DC) Max A	V_{CEO}	V_{CE} (Sat) Max I_C/I_B R/R
High Speed, High Voltage Transistors				
BUX86	TO-126	0.5	400	1.5 @ 0.1
BUX87			450	
TIP47			250	
TIP48			300	
TIP49	TO-220AB	1.0	350	1.0 @ 2
TIP50			400	
BUX99	TO-126	1.5	300	1 @ 0.2
BUX84	TO-220A	2	400	1 @ 1/0.2
BUX85			450	
BUX84F	SOT-186	2	400	1 @ 1/0.2
BUX85F			450	
MJE13004	TO-220AB	4	300	0.6 @ 2/0.5
MJE13005			400	
BUT11	TO-220AB	5	400	1.5 @ 3/0.6
BUT11A			450	1.5 @ 2.5/0.5
BUT11F	SOT-186	5	400	1.5 @ 3/0.6

Type	Pkg	I_C (DC) Max A	V_{CEO} V	V_{CE} (Sat) Max I_C/I_B A/A
High Speed, High Voltage Transistors (Cont.)				
BUT11AF			450	1.5 @ 2.5/0.5
BUW11	SOT-93	5	400	1.5 @ 3/0.6
BUW11A			450	1.5 @ 2.5/0.5
BUS11	TO-3	5	400	1.5 @ 3/0.6
BUS11A			450	1.5 @ 2.5/0.5
BUT21A	TO-220AB	5	350	1.5 @ 3/0.34
BUT21B			400	1.5 @ 3/0.4
BUT21C			450	1.5 @ 3/05
BUS21A	TO-3	5	350	1.5 @ 3/0.34
BUS21B			400	1.5 @ 3/0.4
BUS21C			450	1.5 @ 3/05
BUT18	TO-220AB	6	400	1.5 @ 4/0.8
BUT18A			450	
BUT18F	SOT-186	6	400	1.5 @ 4/0.8
BUT18AF			450	
BUT12	TO-220AB	8	400	1.5 @ 6/1.2
BUT12A			450	1.5 @ 5/1
BUW12	SOT-93	8	400	1.5 @ 6/1.2
BUW12A			450	1.5 @ 5/1
BUS12	TO-3	8	400	1.5 @ 6/1.2
BUS12A			450	1.5 @ 5/1
BUT22A	TO-220AB	8	350	1.5 @ 6/0.67
BUT22B			400	1.5 @ 6/0.8
BUT22C			450	1.5 @ 6/1
MJE13006	TO-220AB	8	300	2 @ 5/1
MJE13007			400	
MJE13007A			400	
BUP22A	SOT-93	8	350	1.5 @ 6/0.67
BUP22B			400	1.5 @ 6/0.8
BUP22C			450	1.5 @ 6/1
BUS22A	TO-3	8	350	1.5 @ 6/0.67
BUS22B			400	1.5 @ 6/0.8
BUS22C			450	1.5 @ 6/1
MJE13008	TO-220AB	12	300	1.5 @ 8/1.6
MJE13009			400	
BUW13	SOT-93	15	400	1.5 @ 10/2
BUW13A			450	1.5 @ 8/1.5
BUS13	TO-3	15	400	1.5 @ 10/2
BUS13A			450	1.5 @ 8/1.6
BUP23A	SOT-93	15	350	1.5 @ 10/1.11
BUP23B			400	1.5 @ 10/1.33
BUP23C			450	1.5 @ 10/1.67
BUS23A	TO-3	15	350	1.5 @ 10/1.11
BUS23B			400	1.5 @ 10/1.33
BUS23C			450	1.5 @ 10/1.67
PH6676P	SOT-93	15	300	1.5 @ 15/3
PH6677P			350	
PH6676	TO-3	15	300	1.5 @ 15/3
PH6677			350	
BUS14	TO-3	30	400	1.5 @ 20/4
BUS14A			450	1.5 @ 16/3.2
BUS24A	TO-3	30	350	1.5 @ 20/2.22
BUS24B			400	1.5 @ 20/2.66
BUS24C			450	1.5 @ 20/3.34
High Speed, High Voltage Darlingtons				
BU824	TO-202	0.5	375	5 @ 0.2
BU826	SOT-93	6	375	2 @ 2.5
BU826A			400	
BUV90	SOT-93	12	400	1.5 @ 5
High Speed, Medium Voltage Transistors				
BU406	TO-220AB	7	200	1 @ 5
BU407			100	
BDY90	TO-3	10	100	1 @ 10
BDY91			80	
BDY92			60	
BDY90A	TO-3	12	100	1 @ 12
BUV28	TO-220AB	12	200	1.5 @ 6
BUV28A			225	1.5 @ 4
BUV27	TO-220AB	13	120	1.5 @ 8
BUV27A			150	1 @ 7
BUV26	TO-220AB	14	90	1.5 @ 12
BUV26A			100	1 @ 10
Very High Voltage Transistors				
BU505	TO-220AB	2.5	700	5 @ 2
BU506	TO-220AB	3.0	700	5 @ 3
BU506D	TO-220AB	3.0	700	5 @ 3
BU706	SOT-93A	3.0	700	5 @ 3
BU706D	SOT-93A	3.0	700	5 @ 3
BU509	TO-220AB	4.0	750	2 @ 2.5
BUY89	TO-3	6	800	1 @ 4.5
BUV89	SOT-93A	8.0	800	1 @ 4.5
BU508A	SOT-93	8	700	1 @ 4.5
BU508D	SOT-93A	8.0	700	1 @ 4.5
BUX88	TO-3	12	800	1 @ 9

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Amperex®

A NORTH AMERICAN **PHILIPS** COMPANY
SLATERSVILLE DIVISION

PHILIPS SMALL SIGNAL SEMICONDUCTORS

TRANSISTORS, DIODES, DARLINGTONS

SEE PAGE A-2124 FOR PACKAGE OUTLINES

Type NPN	PNP	Pkg	I_C (DC) Max A	V_{CEO} V	h_{FE} @ I_C Min mA	V_{CE} (Sat) Max I_C/I_B A/mA	f_T MHz
High Frequency, Video, Transistors							
BF469	BF470	TO-126	0.1	250	50 @ 25	—	60
BF471	BF472			300			
BF869	BF870	TO-202	0.1	250	50 @ 25	—	60
BF871	BF872			300			
BF419	—	TO-126	0.3	250	45 @ 20	11 @ 0.2/ 20mA	90
BF457	—	TO-126	0.3	160	26 @ 30	1 @ 0.03/ 6mA	90
BF458				250			
BF459				300			
BF819	—	TO-202	0.3	250	45 @ 20	11 @ 0.2/ 20mA	90
BF857	—	TO-202	0.3	160	26 @ 30	1 @ 0.03/ 6mA	90
BF858				250			
BF859				300			

Type	Pkg	V_R V	I_F mA	V_F @ I_F V	mA	t_{RR}
Switching Diodes						
1N914	DO-35	75	75	1.00	10	4
1N914A	DO-35	75	75	1.00	20	4
1N914B	DO-35	75	75	0.72	5	4
1N916	DO-35	75	75	1.00	10	4
1N916A	DO-35	75	75	1.00	20	4
1N916B	DO-35	75	75	0.73	5	4
1N4148	DO-35	75	200	1.00	10	4
1N4149	DO-35	75	200	1.00	10	4
1N4150	DO-35	50	200	0.74	10	4
1N4151	DO-35	75	200	1.00	50	2
1N4153	DO-35	75	200	0.88	20	2
1N4446	DO-35	75	200	1.00	20	4
1N4448	DO-35	75	200	0.72	5	4
1N4449	DO-35	75	200	0.73	5	4
1N4531	DO-34	75	200	1.00	10	4
1N4532	DO-34	75	200	1.00	10	2
BAS11	DO-35	300	350	1.10	300	1000
BAV10	DO-35	60	300	1.00	200	6
BAV18	DO-35	50	250	1.00	100	50
BAV19	DO-35	100	250	1.00	100	50
BAV20	DO-35	150	250	1.00	100	50
BAV21	DO-35	200	250	1.00	100	50

Type	Pkg	V_R V	I_F mA	C_D @ V_R pF	V
Bandswitch Diodes					
BA223	DO-34	20	50	3.5	6
BA423	DO-34	20	50	2.5	3
BA482	DO-34	35	100	1.2	3
BA483	DO-34	35	100	1.0	3
BA484	DO-34	35	100	1.6	3

Type	Pkg	V_R V	I_F mA	V_F @ I_F V	mA
Schottky Barrier Diodes					
BAT81	DO-34	40	30	410	1
BAT82	DO-34	50	30	410	1
BAT83	DO-34	60	30	410	1
BAT85	DO-34	30	200	320	1
BAT86	DO-34	50	200	380	1
BYV10-20	DO-41	20	1000	550	1000
BYV10-30	DO-41	30	1000	550	1000
BYV10-40	DO-41	40	1000	550	1000

Type	Pkg	V_R V	I_F mA	C_D @ V_R @ f pF	V	MHz
Variable Capacitance Diodes						
BB119	DO-35	15	200	20-25	4.0	1.0
BB417	DO-34	20	20	8-11	4.0	0.5
BB112	SOD-69	12	50	440-540	1.0	1.0
BB130	SOD-69	30	50	450-550	1.0	1.0
BB212	TO-92	12	100	500-620	0.5	1.0
BB204B	TO-92	30	100	37-42	3.0	1.0
BB204G	TO-92	30	100	34-39	3.0	1.0
BB405B	DO-34	30	20	18 MAX	1.0	0.5
BB809	DO-34	28	20	39-46	1.0	0.5
BB909A	DO-34	30	20	31 MIN	1.0	0.5
BB909B	DO-34	30	20	33.5 MIN	1.0	0.5

Type	V_Z @ I_{ZT} V	Z_{ZT} @ I_{ZT} Ω	I_{ZT} mA
Zener Diodes—400mW, 5%, DO-35			
1N746A	3.3	28	20
1N747A	3.6	24	20
1N748A	3.9	23	20
1N749A	4.3	22	20
1N750A	4.7	19	20
1N751A	5.1	17	20
1N752A	5.6	11	20
1N753A	6.2	7	20
1N754A	6.8	5	20
1N755A	7.5	6	20
1N756A	8.2	8	20
1N757A	9.1	10	20
1N758A	10.0	17	20
1N759A	12.0	30	20
1N957B	6.8	4.5	18.5
1N958B	7.5	5.5	16.5
1N959B	8.2	6.5	15.0
1N960B	9.1	7.5	14.0
1N961B	10	8.5	12.5
1N962B	11	9.5	11.5
1N963B	12	11.5	10.5
1N964B	13	13	9.5
1N965B	15	16	8.5
1N966B	16	17	7.8
1N967B	18	21	7.0
1N968B	20	25	6.2

Type	V_Z @ I_{ZT} V	Z_{ZT} @ I_{ZT} Ω	I_{ZT} mA
Zener Diodes—400mW, 5%, DO-35 (Cont.)			
1N969B	22	29	5.6
1N970B	24	33	5.2
1N971B	27	41	4.6
1N972B	30	49	4.2
1N973B	33	58	3.8

Type	V_Z @ I_{ZT} V	Z_{ZT} @ I_{ZT} Ω	I_{ZT} mA
Zener Diodes—500m W, 5%, DO-35			
1N5225B	3.0	29	20
1N5226B	3.3	28	20
1N5227B	3.6	24	20
1N5228B	3.9	23	20
1N5229B	4.3	22	20
1N5230B	4.7	19	20
1N5231B	5.1	17	20
1N5232B	5.6	11	20
1N5233B	6.0	7	20
1N5234B	6.2	7	20
1N5235B	6.8	5	20
1N5236B	7.5	6	20
1N5237B	8.2	8	20
1N5238B	8.7	8	20
1N5239B	9.1	10	20
1N5240B	10	17	20
1N5241B	11	22	20
1N5242B	12	30	20
1N5243B	13	13	9.5
1N5244B	14	15	9.0
1N5245B	15	16	8.5
1N5246B	16	17	7.8
1N5247B	17	19	7.4
1N5248B	18	21	7.0
1N5249B	19	23	6.6
1N5250B	20	25	6.2
1N5251B	22	29	5.6
1N5252B	24	33	5.2
1N5253B	25	35	5.0
1N5254B	27	41	4.6
1N5255B	28	44	4.5
1N5256B	30	49	4.2
1N5257B	33	58	3.8
1N5258B	36	70	3.4
1N5259B	39	80	3.2
1N5260B	43	93	3.0
1N5261B	47	105	2.7
1N5262B	51	125	2.5
1N5263B	56	150	2.2
1N5264B	60	170	2.1
1N5265B	62	185	2.0
1N5266B	68	230	1.8
1N5267B	75	270	1.7

Type	Pkg	V_R V	I_F mA	I_R @ V_R A	V	V_R @ I_F V	mA
Low Leakage Diodes							
BAV45	TO-18	20	50	5pA	5	1.00	10
BAS45	DO-34	125	225	1nA	125	0.80	5

Type	Pkg	Ref. V	$\triangle V_{ref}$ mV	T_C %/°C	r_{DIFF} Ω
Temp. Compensated Ref. Diodes					
1N821	DO-34	6.2	96	0.01	15
1N823	DO-34	6.2	48	0.005	15
1N825	DO-34	6.2	19	0.002	15
1N827	DO-34	6.2	9	0.001	15
1N829	DO-34	6.2	5	0.0005	15
1N821A	DO-34	6.2	96	0.01	10
1N823A	DO-34	6.2	48	0.005	10
1N825A	DO-34	6.2	19	0.002	10
1N827A	DO-34	6.2	9	0.001	10
1N829A	DO-34	6.2	5	0.0005	10

Type	Pkg	BV_{CES} V	I_C mA	h_{FE} @ I_C	mA	V_{CE} (Sat) @ I_C @ I_B V	mA	mA	f_T @ I_C MHz	mA
Darlington Transistors—NPN										
MPSA12	TO-92	20	300	20,000	10	1.0	10	0.01	—	—
MPSA13	TO-92	30	500	10,000	100	1.5	100	0.10	125	10
MPSA14	TO-92	30	500	20,000	100	1.5	100	0.10	125	10
MPSA25	TO-92	40	500	10,000	100	1.5	100	0.10	125	10
MPSA26	TO-92	50	500	10,000	100	1.5	100	0.10	125	10
MPSA27	TO-92	60	500	10,000	100	1.5	100	0.10	—	—
—PNP										
MPSA62	TO-92	20	500	20,000	10	1.0	10	0.01	—	—
MPSA63	TO-92	30	500	10,000	100	1.5	100	0.10	125	10

Type	Pkg	BV_{CES} V	I_C mA	h_{FE} @ I_C	mA	V_{CE} (Sat) @ I_C @ I_B V	mA	mA	f_T @ I_C MHz	mA
Darlington Transistors—PNP (Cont.)										
MPSA64	TO-92	30	500	20,000	100	1.5	100	0.10	125	10
MPSA75	TO-92	40	500	10,000	100	1.5	100	0.10	125	10
MPSA76	TO-92	50	500	10,000	100	1.5	100	0.10	125	10
MPSA77	TO-92	60	500	10,000	100	1.5	100	0.10	—	—

Type	Pkg	BV_{CBO} V	I_C mA	h_{FE} @ I_C min	max	mA	f_T @ I_C MHz	mA
General Purpose & Switching Transistors—NPN								
2N1613	TO-39	50	500	40	120	150	60	50
2N1711	TO-39	50	1000	100	300	150	70	50
2N1893	TO-39	80	500	40	120	150	—	—
2N2219	TO-39	60	800	100	300	150	250	20
2N2219A	TO-39	75	800	100	300	150	300	20
2N2222	TO-18	30	800	100	300	150	250	20
2N2222A	TO-18	40	800	100	300	150	300	20
2N2297	TO-39	35	1000	40	120	150	60	50
2N2368	TO-18	15	200	20	60	10	400	10
2N2369	TO-18	15	200	40	120	10	500	10
2N2369A	TO-18	15	200	40	120	10	500	10
2N2483	TO-18	60	50	40	120	.01	60	.5
2N2484	TO-18	60	50	100	500	.01	60	.5
2N3019	TO-39	80	1000	100	300	150	100	50
2N3020	TO-39	80	1000	40	120	150	80	50
2N3053	TO-39	40	700	50	250	150	100	50
2N3903	TO-92	40	200	50	150	10	300	10
2N3904	TO-92	40	200	100	300	10	250	10
2N4123	TO-92	30	200	50	150	2	250	10
2N4124	TO-92	25	200	120	360	2	300	10
2N4400	TO-92	40	600	50	150	150	200	20
2N4401	TO-92	40	600	100	300	150	250	20
2N5088	TO-92	30	50	300	900	0.1	50	.5

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Type	Pkg	BV_{CBO} V	I_C mA	h_{FE} @ I_C min	h_{FE} @ I_C max	mA	f_T @ I_C MHz	mA
General Purpose & Switching Transistors—NPN (Cont.)								
2N5089	TO-92	25	50	400	1200	0.1	50	.5
MPS6512	TO-92	30	100	50	100	2	—	—
MPS6513	TO-92	30	100	90	180	2	(330)	10
MPS6514	TO-92	25	100	150	300	2	(480)	10
MPS6515	TO-92	25	100	250	500	2	(480)	10
MPS6520	TO-92	25	100	200	600	2	(390)	2
MPS6521	TO-92	25	100	300	—	2	(390)	2
MPS6530	TO-92	40	600	40	120	100	—	—
MPS6531	TO-92	40	600	90	270	200	(390)	50
MPS6532	TO-92	30	600	30	—	100	—	—
MPSA05	TO-92	60	500	50	—	100	100	10
MPSA06	TO-92	80	500	50	—	100	100	10
PN222	TO-92	30	800	100	300	150	250	20
PN222A	TO-92	40	800	100	300	150	300	20
PN2369	TO-92	15	500	40	120	10	500	10

Type	Pkg	BV_{CBO} V	I_C mA	h_{FE} @ I_C min	h_{FE} @ I_C max	mA	f_T @ I_C mHz	mA
General Purpose & Switching Transistors—PNP								
2N2905	TO-39	40	600	100	300	150	200	50
2N2905A	TO-39	60	600	100	300	150	200	50
2N2907	TO-18	40	600	100	300	150	200	50
2N2907A	TO-18	60	600	100	300	150	200	50
2N3905	TO-92	40	200	50	150	10	300	10
2N3906	TO-92	40	200	100	300	10	300	10
2N4030	TO-39	60	1000	40	120	100	100	50
2N4031	TO-39	80	1000	40	120	100	100	50
2N4032	TO-39	60	1000	100	300	100	150	50
2N4033	TO-39	80	1000	100	300	100	150	50
2N4125	TO-92	30	200	50	150	2	200	10
2N4126	TO-92	25	200	120	360	2	250	10
2N4402	TO-92	40	600	50	150	150	150	20
2N4403	TO-92	40	600	100	300	150	200	20
2N5086	TO-92	50	50	150	500	0.1	40	.5
2N5087	TO-92	50	50	250	800	0.1	40	.5
MPS6516	TO-92	40	100	50	100	2	—	—
MPS6517	TO-92	40	100	90	180	2	(330)	10
MPS6518	TO-92	40	100	150	300	2	(480)	10
MPS6519	TO-92	25	100	250	500	2	(480)	10
MPS6522	TO-92	25	100	200	600	2	(340)	2
MPS6523	TO-92	25	100	300	—	2	(340)	2
MPS6533	TO-92	40	600	40	120	100	—	—
MPS6534	TO-92	40	600	90	270	100	(390)	50
MPS6535	TO-92	30	600	30	—	100	—	—
MPSA55	TO-92	60	500	50	—	100	50	100
MPSA56	TO-92	80	500	50	—	150	50	100
PN2907	TO-92	40	600	100	300	150	200	50
PN2907A	TO-92	60	600	100	300	100	200	50

Type	Pkg	BV_{CEO} V	I_C mA	h_{FE} @ I_C min	mA	V_{CE} (Sat) @ I_C V	mA	f_T @ I_C MHz	mA
High Voltage Transistors—NPN									
2N3439	TO-39	350	1000	40	20	0.50	50	4	10
2N3440	TO-39	250	1000	40	20	0.50	50	4	10
2N5550	TO-92	140	600	80	10	0.25	50	100	10
2N5551	TO-92	160	600	80	10	0.20	50	10	10
MPSA42	TO-92	300	500	40	10	0.50	20	50	10
MPSA43	TO-92	200	500	40	10	0.50	20	50	10
PN3439	TO-92	350	1000	40	20	0.50	50	4	10
PN3440	TO-92	250	1000	40	20	0.50	50	4	10
—PNP									
2N5400	TO-92	120	600	40	10	0.50	50	100	10
2N5401	TO-92	150	600	60	10	0.50	50	100	10
2N5415	TO-39	200	1000	30	50	2.50	50	15	10
2N5416	TO-39	350	1000	30	50	2.00	50	15	10
MPSA92	TO-92	300	500	40	10	0.50	20	50	10
MPSA93	TO-92	200	500	40	10	0.50	20	50	10
PN5415	TO-92	200	1000	30	50	2.50	50	15	10
PN5416	TO-92	350	1000	30	50	2.00	50	15	10

Type	Pkg	Mode	V_{DS} V	I_D mA	r_{DSon} Ω	yfs mA/V	$V_{GS(th)}$ V
Field Effect Transistors, D-MOS, FET, N-Channel							
2N6659	TO-39	ENH	35	1400	0.9	>170	0.8-2.0
2N6660	TO-39	ENH	60	1100	1.4	>170	0.8-2.0
2N6661	TO-39	ENH	90	900	1.9	>170	0.8-2.0
BS107	TO-92	ENH	200	120	15	—	—
BS170	TO-92	ENH	60	500	3.5	200	0.8-3.0
BSD10	TO-72	DPL	10	50	15	15	<2.0
BSD12	TO-72	DPL	20	50	15	15	<2.0
BSD212	TO-72	ENH	10	50	25	15	0.1-2.0
BSD213	TO-72	ENH	10	50	25	15	0.1-2.0
BSD214	TO-72	ENH	20	50	25	15	0.1-2.0
BSD215	TO-72	ENH	20	50	25	15	0.1-2.0
BST70A	TO-92	ENH	80	500	2	300	1.5-3.5
BST72A	TO-92	ENH	80	300	7	150	1.5-3.5
BST74A	TO-92	ENH	200	250	6	250	0.8-2.8

Type	Pkg	Mode	V_{DS} V	I_D mA	r_{DSon} Ω	yfs mA/V	$V_{GS(th)}$ V
Field Effect Transistors, D-MOS, FET, N-Channel (Cont.)							
BST76A	TO-92	ENH	180	300	6	250	0.7-2.7
BST78	TO-126	ENH	450	750	10	400	2.0-4.0
BST90	TO-39	ENH	80	500	2.0	300	1.5-3.5
BST97	TO-18	ENH	180	300	6	250	0.7-2.7
P-Channel							
BST100	TO-92	ENH	60	300	4.5	200	1.5-3.5
BST110	TO-92	ENH	50	250	7.5	125	1.5-3.5

Type	Pkg	$\pm V_{DS}$ V	I_{DSS} mA	$-V_{(P)GS}$ V	r_{DSon} Ω	C_{RS} @ V_{GS} pF	V
J-FET							
2N3822	TO-72	50	2-10	<6	—	3.0	0
2N3823	TO-72	30	4-20	<8	—	2.0	0
2N3966	TO-72	30	>2	4-6	220	1.5	7
2N4091	TO-18	40	>30	5-10	30	5.0	20
2N4092	TO-18	40	>15	2-7	50	5.0	20
2N4093	TO-18	40	>8	1-5	80	5.0	20
2N4391	TO-18	40	50-150	4-10	30	3.5	12
2N4392	TO-18	40	25-75	2-5	60	3.5	7
2N4393	TO-18	40	5-30	0.5-3	100	3.5	5
2N4856	TO-18	40	>50	4-10	25	8.0	10
2N4857	TO-18	40	25-100	2-6	40	8.0	10
2N4858	TO-18	40	8-80	0.8-4	60	8.0	10
2N4859	TO-18	30	>50	4-10	25	8.0	10
2N4860	TO-18	30	25-100	2-6	40	8.0	10
2N4861	TO-18	30	8-80	0.8-4	60	8.0	10

Type	Pkg	$\pm V_{DS}$ V	I_{DSS} mA	$-V_{(P)G1-S}$ V	yfs mA/V	N_F & G_P @ f dB	dB	MHz	C_{RS} f_F
Dual Gate MOSFET									
BF960	SOT-103	20	2-20	3.5	12	2.8	16.5	800	25
BF964	SOT-103	20	2-20	2.5	17	1.5	25	200	25
BF964S	SOT-103	20	4-20	2.5	18	1.0	25	200	25
BF966	SOT-103	20	2-20	2.5	17	2.8	18	800	25
BF966S	SOT-103	20	4-20	2.5	18	1.8	18	800	25
BF980	SOT-103	18	—	1.3	19	2.8	—	800	25
BF981	SOT-103	20	4-25	2.5	14	1.0	26	200	25
BF982	SOT-103	20	—	1.3	25	1.2	—	200	30

Type	Pkg	BV_{CEO} V	I_C mA	f_T @ I_C GHz	mA	N_F @ f @ I_C dB	MHz	mA
RF Transistors—NPN								
2N2857	TO-72	15	40	>1	2	<4.5	450	1.5
2N5053	TO-72	15	25	1.2	2	<3.5	200	2
2N5054	TO-72	15	25	1.5	2	<3.5	200	2
2N6595	TO-72	15	25	>3.5	14	<3.2	200	2
2N6596	TO-72	15	25	>4	14	<2	200	2
2N6597	TO-72	12	35	>3.5	30	<3.2	200	2
2N6598	TO-72	12	35	>4	30	<2	200	2
2N6599	TO-72	15	75	>3.5	50	<4	200	5
2N6600	TO-72	15	75	>3.5	50	4	200	50
2N6601	TO-72	10	50	1.8	30	<4	200	2
A210	TO-39	25	150	1.2	150	<6	200	30
A234	TO-39	18	150	3.5	75	8	500	120
				4	150	—	—	—
A268	TO-39	18	300	4	240	—	—	—
A400	TO-72	15	25	5	14	2.3	200	2
A401	TO-72	12	35	5	30	1.9	500	2
A402	TO-72	15	25	5	14	1.8	500	4
A403	TO-72	12	35	5	30	1.5	500	4
A406	TO-72	15	75	5	50	4	200	50
A424	TO-72	5	2.5	2.3	1	3.8	500	1
A425	TO-72	10	50	7.5	15	2.5	2000	5
A430	TO-72	10	50	1.6	50	<5	500	2
A485	TO-72	15	25	>1	2	<3.5	200	2
A486	SOT-37	15	25	1	2	4	500	2
A490	TO-72	15	25	>1	15	<5.5	200	15
BFG34	SOT-103	18	150	3.7	100	2.3	800	20
BFG90A	SOT-103	15	25	5	14	—	—	—
BFG91A	SOT-103	12	35	6	30	—	—	—
BFG96	SOT-103	15	150	5	50	—	—	—
BFQ34T	SOT-37	18	150	3.7	100	—	—	—
BFQ65	SOT-37	10	50	7.5	15	2.5	2000	5
BFR90	SOT-37	15	25	5	14	2.4	500	2
BFR90A	SOT-37	15	25	5	14	1.8	800	4
						3.8	800	4
BFR91	SOT-37	12	35	5	30	1.9	500	2
BFR91A	SOT-37	12	35	6	30	1.6	800	4
						2.3	800	30
BFR95	TO-39	25	150	3.5	80	9	200	80
BFR96	SOT-37	15	75	5.5	75	3.3	500	50
BFR96S	SOT-37	15	100	5	70	4	800	70
BFT24	SOT-37	5	2.5	2.3	1	3.8	500	1
BFW92A	SOT-37	15	25	2.8	25	2.5	800	2
BFW93	SOT-37	10	50	1.7	50	<5	500	2
BFX89	TO-72	15	25	1	2	<4	200	2
				1.2	25	<6.5	500	2

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Type	Pkg	BV_{CEO} V	I_C mA	f_T @ I_C GHz	mA	N_F @ f @ I_C dB	MHz	mA
RF Transistors—PNP								
A440	TO-72	15	25	5	14	2.3	200	2
A441	TO-72	12	35	5	30	2.4	200	2
A446	TO-72	15	75	4	50	4	500	50
BFG23	SOT-103	12	35	5	30	2.3	800	4
BFG32	SOT-103	15	75	4.5	50	4.3	800	50
BFG51	SOT-103	15	25	5	14	2.4	800	4
BFQ23	SOT-37	12	35	5	30	2.4	500	2
BFQ32	SOT-37	15	75	4.2	50	3.75	500	50
BFQ51	SOT-37	15	25	5	14	2.7	500	2

Type	Y_{CEO} V	I_C mA	P_T W	Gain BW f_T GHz	I_C mA	Noise N_F dB	f MHz	I_C mA	Power Gain dB @ f MHz 500	800	1000	2000
RF Transistors, Ceramic Stripline, PAC 70, NPN												
A500	15	25	0.25	5	14	2.5	1000	2	21		16	10
A510	12	35	0.25	5	30	2.0	1000	2	18		13	7.5
A550	8	20	0.18	12	14	2.5	2000	5	24		19	13
A560	15	75	0.5	5.5	75	3.3	500	50	17		11.5	
A574	10	50	0.35	7.5	15	2.5	2000	5				12.5
A590	15	25	0.25	1.3	25	3.5	500	2	16		10	
PAC-70, PNP												
A520	12	35	0.25	5	30	2.0	500	2	17		12	7
A522	15	75	0.5	4.6	75	3.5	500	50	15		10	
A524	15	25	0.25	5	14	2.4	500	2	20		15	9
PAC-85, NPN												
BFP90A	15	30	0.25	5	14	1.7	800	4	24	19		
BFP91A	12	50	0.35	6	30	1.6	800	4	22	18		
BFP96	15	100	0.5	4.5	50	2.5	800	10	19	15		
BFQ66	10	50	0.35	7.5	15	2.5	2000	5				12.5
PAC-85, PNP												
BFQ23C	12	50	0.35	5	30	2.3	800	4	19	15		
BFQ51C	15	30	0.25	5	14	2.5	800	4	21	17		
PAC-100, NPN												
A501	15	25	0.3	5	14	2.5	1000	2	21		16	10
A511	12	35	0.3	5	30	2.0	1000	2	18		13	7.5
A516	20	150	0.7	1.3	100	4	200	30	12			
A534	18	150	0.7	3.5	75	5	500	90	16			
A541	25	150	0.7	3.5	90	5	500	90	14			
A551	8	20	0.18	12	14	2.5	2000	5	24		19	13
A561	15	100	0.5	4.5	50	2.5	800	10	19		15	
A568	18	300	0.7	3.8	150				16.5		10.5	
A573	10	50	0.35	7.5	15	2.5	2000	5				12.5
A591	15	25	0.3	1.3	25	3.5	500	2	16		10	
2N6602	15	25	0.37	3.5	14	3	1000	5			16	10
2N6603	15	30	0.4	5.5	10	2.9	2000	5				11
2N6604	15	30	0.5	5.5	20	4.3	2000	5				10
PAC-100, PNP												
A523	15	75	0.5	4.6	75	3.5	500	50	15		10	
METAL, TO-39, NPN									200	500	800	2000
A210	25	150	1.5	1.2	150	<6	200	30	16		6.5	
A234	18	150	1.5	3.5	75	8	500	120		16		
				4.0	150							
A268	18	300	3.0	4	240				23	16	12	
BFR95	25	150	1.5	3.5	80	9	200	80	9 (40-300 MHz)			
METAL, TO-72, NPN												
A400	15	25	0.2	5	14	2.3	200	2		18.5		
A401	12	35	0.15	5	30	1.9	500	2		16.5		
A402	15	25	0.2	5	14	1.8	500	4		19		
A403	12	35	0.2	5	30	1.5	500	4		16		
A406	15	75	0.5	5	50	4	200	50		13.5		
A424	5	2.5	0.05	2.3	1	3.8	500	1	24	17	11	
A425	10	50	0.25	7.5	15	2.5	2000	5				12.5
A430	10	50	0.25	1.6	50	<5	500	2	21		7.5	
A485	15	25	0.2	>1.0	2	<3.5	200	2	30	22	10	
				>1.3	25	<5	500					
A490	15	25	0.2	>1	15	<5.5	200	15	30	22	10	
BFX89	15	25	0.2	1.0	2	<4	200	2	28		10	
				1.2	25	<6.5	500					
2N2857	15	40	0.2	>1	2	<4.5	450	1.5		15		
2N5053	15	25	0.2	1.2	2	<3.5	200	2	36	22		
				1.4	25	<5	450					
2N5054	15	25	0.2	1.5	2	<3.5	200	2	36	22		
				1.7	25	<4	450					
2N6595	15	25	0.2	>3.5	14	<3.2	200	2		16.5		
2N6596	15	25	0.2	>4	14	<2	200	2		18		
2N6597	12	35	0.2	>3.5	30	<3.2	200	2		14.5		
2N6598	12	35	0.2	>4	30	<2	200	2		15.5		
2N6599	15	75	0.5	>3	50	<4	200	5		12		
2N6600	15	75	0.5	>3.5	50	4	200	50		13.5		
2N6601	10	50	0.25	1.8	30	<4	200	2	21		7.5	
						<5	500					

Type	Y_{CEO} V	I_C mA	P_T W	Gain BW f_T GHz	I_C mA	Noise N_F dB	f MHz	I_C mA	Power Gain dB @ f MHz 300	500	800	1000	2000
METAL, TO-72, PNP													
A440	15	25	0.2	5	14	2.3	200	2			18		
A441	12	35	0.15	5	30	2.4	200	2			14		
A446	15	75	0.5	4	50	4	500	50			12		
PLASTIC, T-PACK, SOT-37, NPN													
A486	15	25	0.19	1.0	2	4	500	2		15	11		
				1.6	25								
BFQ34T	18	150	1.0	3.7	100				20				
BFQ65	10	50	0.3	7.5	15	2.5	2000	5					8
						3	2000	15					
BFR90	15	25	0.18	5	14	2.4	500	2		19.5		13.5	
BFR90A	15	25	0.18	5	14	1.8	800	4		19.5		13.5	
						3.6	2000	4					
BFR91	12	35	0.18	5	30	1.9	500	2		18		12	
BFR91A	12	35	0.3	6	30	1.6	800	4			14		
						2.3	800	30					
BFR96	15	75	0.5	5.5	75	3.3	500	50		15.2		9.5	
BFR96S	15	100	0.7	5	70	4	800	70			11.5		
BFT24	5	2.5	0.03	2.3		3.8	500	1		17	11		
BFW92A	15	25	0.2	2.8	25	2.5	800	2			13		
BFW93	10	50	0.19	1.7	50	<5	500	2	16.5		10.5		
PLASTIC, T-PACK, SOT-37, PNP													
BFQ23	12	35	0.18	5	30	2.4	500	2		16.5			
BFQ32	15	75	0.5	4.2	50	3.75	500	50		14			
				4.6	75								
BFQ51	15	25	0.18	5	14	2.7	500	2		19			
PLASTIC, X-PACK, SOT-103, NPN													
BFG34	18	150	1	3.7	100	2.3	800	20		14			7
BFG90A	15	25	0.18	5	14						18		
BFG91A	12	35	0.3	6	30						17		
BFG96	15	150	0.5	5	50						14		
PLASTIC, X-PACK, SOT-103, PNP													
BFG23	12	35	0.18	5	30	2.3	800	4			14.5		
BFG32	15	75	0.7	4.5	50	4.3	800	50			13		
BFG51	15	25	0.18	5	14	2.4	800	4			15.9		
STUD, TO-117, NPN													
BFR94	25	150	2.5	3.5	90	5	500	90		13.5			
					150								
STUD, SOT-122, NPN													
BFQ34	18	150	2.25	3.5	75	8	500	120		16.3			
BFQ68	18	300	4.5	4	240						13		

SURFACE MOUNT SEMICONDUCTORS

Type	Pkg	V_{CEO} V	I_C mA	h_{FE} @ I_C/V_{CE} min/max	mA/V	$t_{(MAX)}$ on/off @ I_C/I_B ns	mA
Switching Transistors—NPN							
BSR13	SOT-23	30	800	100/300	150/10	35/285	150/—
BSR14	SOT-23	40					
BSR17	SOT-23	40	200	50/150	10/1	70/225	10/1
BSR17A	SOT-23	40	200	100/300	10/1	70/250	10/1
BSR40	SOT-89	60	1000	40/120	100/5	250/1000	100/5
BSR41	SOT-89			100/300			
BSR42	SOT-89	80	1000	40/120	100/5	250/1000	100/5
BSR43	SOT-89			100/300			
BSS64	SOT-23	80	100	20/80	10/1	/1000	15/1
BSV52	SOT-23	12	100	40/120	10/1	12/18	10/3
PMBT2222	SOT-23	30	600	100/300	150/10	35/285	150/15
PMBT2222A	SOT-23	40	600	100/300	150/10	35/285	150/15
PXT2222	SOT-89	30	600	100/300	150/10	35/285	150/15
PXT2222A	SOT-89	40	600	100/300	150/10	35/285	150/15
—PNP							
BSR12	SOT-23	15	100	30/120	50/1	20/30	30/3
BSR15	SOT-23	40	600	100/300	150/10	45/100	150/15
BSR16	SOT-23	60	600	100/300	150/10	45/100	150/15
BSR18	SOT-23	40	200	50/150	10/1	70/250	10/1
BSR18A	SOT-23	40	200	100/300	10/1	70/300	10/1
BSR30	SOT-89	60	1000	40/120	100/5	500/650	100/5
BSR31	SOT-89	60		100/300			
BSR32	SOT-89	80		40/120			
BSR33	SOT-89	80		100/300			
BSS63	SOT-23	100	100	30/—	25/1	—	—
PMBT2907	SOT-23	40	600	100/300	150/10	45/100	150/15
PMBT2907A	SOT-23	60	600	100/300	150/10	45/100	150/15
PXT2907	SOT-89	40	600	100/300	150/10	45/100	150/15
PXT2907A	SOT-89	60	600	100/300	150/10	45/100	150/15

						f_T MHz	
General Purpose Transistors—NPN							
BC817	SOT-23	45	500	100/600	100/1	100	
BC818	SOT-23	25	500	100/600	100/1	100	

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Type	Pkg	V_{CEO} V	I_C mA	h_{FE} @ I_C/V_{CE} min/max	mA/V	f_T MHz
General Purpose Transistors, PNP (Cont.)						
BC846	SOT-23	65	200	110/450	2/5	300
BC847	SOT-23	45	200	110/800	2/5	300
BC848	SOT-23	30	200	110/800	2/5	300
BC868	SOT-89	20	1000	85/375	500/1	60
BCV61	SOT-143	30	100	100/800	2/5	300
BCV71	SOT-23	60	100	110/220	2/5	300
BCV72	SOT-23	60	100	200/450	2/5	300
BCW31	SOT-23	32	100	110/220	2/5	300
BCW32	SOT-23	32	100	220/450	2/5	300
BCW33	SOT-23	32	100	420/800	2/5	300
BCW60A	SOT-23	32	200	120/220	2/5	250
BCW60B	SOT-23	32	200	180/310	2/5	250
BCW60C	SOT-23	32	200	250/460	2/5	250
BCW60D	SOT-23	32	200	380-630	2/5	250
BCW71	SOT-23	45	100	110/220	2/5	300
BCW72	SOT-23	45	100	200/450	2/5	300
BCW81	SOT-23	45	100	420/800	2/5	300
BCX19	SOT-23	45	500	100/600	100/1	200
BCX20	SOT-23	25	500	100/600	100/1	200
BCX54	SOT-89	45	1000	40/250	150/2	130
BCX55	SOT-89	60	1000	40/250	150/2	130
BCX56	SOT-89	80	1000	40/250	150/2	130
BCX68	SOT-89	20	1000	85/375	500/1	60
BCX70G	SOT-23	45	200	120/220	2/5	250
BCX70H	SOT-23	45	200	180/310	2/5	250
BCX70J	SOT-23	45	200	250/460	2/5	250
BCX70K	SOT-23	45	200	380/630	2/5	250
PMBTA05	SOT-23	60	500	50/	100/1	>100
PMBTA06	SOT-23	80	500	50/	100/1	>100
PMBT3903	SOT-23	40	200	50/150	10/1	>250
PMBT3904	SOT-23	40	200	100/300	10/1	>300
PMBT4401	SOT-23	40	600	100/300	150/1	>250
PXT3904	SOT-89	40	200	100/300	10/1	>300
—PNP						
BC807	SOT-23	45	500	100/600	100/1	100
BC808	SOT-23	25	500	100/600	100/1	100
BC856	SOT-23	65	100	75/475	2/5	150
BC857	SOT-23	45	100	75/475	2/5	150
BC858	SOT-23	30	100	75/800	2/5	150
BC869	SOT-89	20	1000	85/375	500/1	60
BCV62	SOT-143	30	100	100/800	2/5	150
BCW29	SOT-23	32	100	120/260	2/5	150
BCW30	SOT-23	32	100	215/500	2/5	150
BCW61A	SOT-23	32	200	120/220	2/5	180
BCW61B	SOT-23	32	200	180/310	2/5	180
BCW61C	SOT-23	32	200	250/460	2/5	180
BCW61D	SOT-23	32	200	380/630	2/5	180
BCW69	SOT-23	45	100	120/260	2/5	150
BCW70	SOT-23	45	100	215/500	2/5	150
BCW89	SOT-23	60	100	120/260	2/5	150
BCX17	SOT-23	45	500	100/600	100/1	100
BCX18	SOT-23	25	500	100/600	100/1	100
BCX51	SOT-89	45	1000	40/250	150/2	50
BCX52	SOT-89	60	1000	40/250	150/2	50
BCX53	SOT-89	80	1000	40/250	150/2	50
BCX69	SOT-89	20	1000	85/375	500/1	60
BCX71G	SOT-23	45	200	120/220	2/5	180
BCX71H	SOT-23	45	200	180/310	2/5	180
BCX71J	SOT-23	45	200	250/460	2/5	180
BCX71K	SOT-23	45	200	380/630	2/5	180
PMBTA55	SOT-23	60	500	50/	100/1	>50
PMBTA56	SOT-23	80	500	50/	100/1	>50
PMBT3906	SOT-23	40	200	100/300	10/1	>250
PMBT4403	SOT-23	40	600	100/300	150/2	>200
PXT3906	SOT-89	40	200	100/300	10/1	>250

Type	Pkg	V_{CEO} V	I_C mA	h_{FE} @ I_C/V_{CE} min/max	mA/V	N_F @ I_C dB	mA	f_T MHz
High Freq. Transistors—NPN								
BFS18	SOT-23	20	30	35/125	1/10	4	1	200
BFS19	SOT-23	20	30	65/225	1/10	4	1	260
BFS20	SOT-23	20	25	40/—	7/10	—	—	450
—PNP								
BF536	SOT-23	30	25	25/—	1/10	5	1	350
BF550	SOT-23	40	25	50/—	1/10	2	1	325
BF569	SOT-23	35	30	25/—	3/10	4.5	3	900
BF579	SOT-23	20	25	20/—	10/10	4.5	10	1350
BF660	SOT-23	30	25	30/—	3/10	—	—	650
BF767	SOT-23	30	20	15/—	3/10	4	3	900
Broadband Transistors—NPN								GHz
BFQ17	SOT-89	25	150	25/—	150/5	—	—	1.2
BFQ18A	SOT-89	15	150	25/—	100/10	—	—	3.6
BFQ19	SOT-89	15	75	25/—	75/10	3.3	50	5.0
BFR53	SOT-23	10	50	25/—	50/5	5.0	2	2.0
BFR92	SOT-23	15	25	25/—	14/10	2.4	2	5.0
BFR92A	SOT-23	15	25	40/—	14/10	1.8	4	5.0

Type	Pkg	V_{CEO} V	I_C mA	h_{FE} @ I_C/V_{CE} min/max	mA	N_F @ I_C dB	mA	f_T GHz
Broadband Transistors—NPN (Cont.)								
BFR93	SOT-23	12	35	25/—	30/5	1.9	2	5.0
BFR93A	SOT-23	12	35	40/—	30/5	1.6	4	5.0
BFS17	SOT-23	15	25	20/150	2/1	4.5	2	1.3
BFT25	SOT-23	5	6.5	20/—	1/1	3.8	1	2.3
—PNP								
BFT92	SOT-23	15	25	20/—	14/10	2.7	2	5
BFT93	SOT-23	12	35	20/—	30/5	2.4	2	5
Low Noise Transistors—NPN							μA	MHz
BC849	SOT-23	30	200	200/900	2/5	1.2	200	300
BC850	SOT-23	45	200	200/900	2/5	1.0	200	300
BCF32	SOT-23	32	100	200/450	2/5	1.2	200	300
BCF33	SOT-23	32	100	420/800	2/5	1.2	200	300
BCF81	SOT-23	45	100	420/800	2/5	1.2	200	300
—PNP								
BC859	SOT-23	30	100	125/800	2/5	1.2	200	150
BC860	SOT-23	45	100	125/800	2/5	1.0	200	150
BCF29	SOT-23	32	100	120/260	2/5	1.0	200	150
BCF30	SOT-23	32	100	215/500	2/5	1.0	200	150
BCF70	SOT-23	45	100	215/500	2/5	1.0	200	150
High Voltage Transistors—NPN								
BF620	SOT-89	—	20	50/—	25/20			60
BF622	SOT-89	250	20	50/—	25/20			60
BF820	SOT-23	—	50	50/—	25/20			60
BF822	SOT-23	250	50	50/—	25/20			60
BSR19	SOT-23	140	600	60/250	10/5			100
BSR19A	SOT-23	160	600	80/250	10/5			100
BST39	SOT-89	350	1000	40/160	20/10	15		
BST40	SOT-89	250	1000	40/160	20/10	15		
PMBTA42	SOT-23	300	500	40/—	30/10	50		
PMBTA43	SOT-23	200	500	40/—	30/10	50		
PMBT5550	SOT-23	140	600	60/250	10/5	200		
—PNP								
BF621	SOT-89	—	20	50/—	25/20	60		
BF623	SOT-89	250	20	50/—	25/20	60		
BF821	SOT-23	—	50	50/—	25/20	60		
BF823	SOT-23	250	50	50/—	25/20	60		
BSR20	SOT-23	120	600	40/180	10/5	100		
BSR20A	SOT-23	150	600	60/240	10/5	100		
BST15	SOT-89	200	1000	30/150	50/10	15		
BST16	SOT-89	300	1000	30/120	50/10	15		
PMBTA92	SOT-23	300	500	25/—	30/10	50		
PMBTA93	SOT-23	200	500	25/—	30/10	50		
PMBT5401	SOT-23	150	600	60/240	10/5	200		

Type	Pkg	$\pm V_{DS}$ V	$-V_{GSO}$ V	I_D mA	I_{DSS} mA	I_{DSS} mA min/max	$-V_{(P)GS}$ V	Y_{fs} mA/V	C_{VS} pF	V_N μV
Field Effect Transistors										
BF510	SOT-23	20	—	30	10	0.7/3.0	0.8	2.5	0.4	—
BF511	SOT-23	20	—	30	10	2.5/7.0	1.5	4	0.4	—
BF512	SOT-23	20	—	30	10	6/12	2.2	6	0.4	—
BF513	SOT-23	20	—	30	10	10/18	3	7	0.4	—
BF989	SOT-143	20	—	20	50	2/20	2.7	9.5	0.025	—
BF990	SOT-143	18	—	30	25	—	1.3	17	0.025	—
BF991	SOT-143	20	—	20	50	4/25	2.5	10	0.020	—
BF992	SOT-143	20	—	40	25	—	1.3	20	0.04	—
BF994	SOT-143	20	—	30	50	2/20	2.5	15	0.025	—
BF996	SOT-143	20	—	30	50	2/20	2.5	15	0.025	—
BFR30	SOT-23	25	25	10	0.2	4/10	5	1	1.5	0.5
BFR31	SOT-23	25	25	10	0.2	1/5	2.5	1.5	1.5	0.5
BFR101A	SOT-143	30	30	10	5	0.2/1.5	1.0	1.2	—	—
BFR101B	SOT-143	30	30	10	5	1/5	2.5	2.5	—	—
BFT46	SOT-23	25	25	10	0.2	0.2/1.5	1.0	1.0	1.5	0.5
BSR56	SOT-23	40	40	—	1	50/—	10	—	5	—
BSR57	SOT-23	40	40	—	1	20/100	6	—	5	—
BSR58	SOT-23	40	40	—	1	8/80	4	—	5	—
PMBF4391	SOT-23	40	40	—	1	50/150	4-10	—	3.5	—
PMBF4392	SOT-23	40	40	—	1	25/75	2-5	—	3.5	—
PMBF4393	SOT-23	40	40	—	1	5/30	0.53	—	3.5	—

Type	Pkg	Polarity	V_{DS} V	V_{GS} V	I_D mA	Y_{FS} mA/V	$V_{GS(th)}$ V	R_{DSon} Ω	R_{DSon} mA/V
Vertical D-MOS FETs									
BST80	SOT-89	N	80	20	500	300	1.5-3.5	4	500/10
BST82	SOT-23	N	80	20	175	150	1.6-3.5	10	150/5
BST84	SOT-89	N	200	20	250	250	0.8-2.8	12	250/10
BST86	SOT-89	N	180	20	300	250	0.7-2.7	10	15/3
BST120	SOT-89	P	60	—	300	200	1.5-3.5	6	200/10

Type	Pkg	Mode	V_{DS} V	I_D mA	g_{FS} mA/V	$V_{(P)GS}$ V	R_{DSon} Ω	R_{DSon} mA
N-Channel MOSFET Switching Transistors								
BSD20	SOT-143	Dpl	10	50	15	−2.0	30	1/10
BSD22	SOT-143	Dpl	20	50	15	−2.0	30	1/10
BSS83	SOT-143	Enh	10	50	15	2.0	45	0.1/10

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Type	Pkg	V_{CBO} V	V_{CER} V	I_C mA	h_{FE} @ I_C/V_{CE} min	mA/V	V_{CE} (Sat) @ I_C/I_B V	mA	f_T MHz
Darlington Transistors—NPN									
BST50	SOT-89	60	45	500	2000	500/10	1.3	500/0.5	—
BST51	SOT-89	80	60	500	2000	500/10	1.3	500/0.5	—
BST52	SOT-89	90	80	500	2000	500/10	1.3	500/0.5	—
PMBTA13	SOT-23	30	30	500	10,000	100/5	1.5	100/0.1	125
PMBTA14	SOT-23	30	30	500	20,000	100/5	1.5	100/0.1	125
—PNP									
BST60	SOT-89	60	45	500	2000	500/10	1.3	500/0.5	—
BST61	SOT-89	80	60	500	2000	500/10	1.3	500/0.5	—
BST62	SOT-89	90	80	500	2000	500/10	1.3	500/0.5	—
PMBTA63	SOT-23	30	30	500	10,000	100/ 5	1.5	100/0.1	125
PMBTA64	SOT-23	30	30	500	20,000	100/ 5	1.5	100/0.1	125

Type	Pkg	V_{GA} V	I_A mA	I_P µA	I_V µA
Triggers, PNPN					
BRY61	SOT-23	70	175	5/1	30/50
BRY62	SOT-143	70	175	—	—

Type	Pkg	V_R V	I_F mA	t_{RR} nS	V_F-mV @ I_F 10/100/150/200 mA
General Purpose Diodes					
BA682	SOD-80	35	100	—	—
BA683	SOD-80	35	100	—	—
BAS16	SOT-23	75	250	6	855/—/1250/—
BAS17	SOT-23	—	—		830/960/—/—
BAS19	SOT-23	100	200	50	—/1000/—/—
BAS20	SOT-23	150	200	50	—/1000/—/—
BAS21	SOT-23	200	200	50	—1000/—/—
BAS28	SOT-143	75	250	6	855/—/1250/—
BAS29	SOT-23	90	250	50	—/900/—/1000
BAS31	SOT-23	90	250	50	—/900/—/1000
BAS32	SOD-80	75	200	4	—
BAS35	SOT-23	90	250	50	—/900/—/1000
BAS56	SOT-143	60	200	6	—/—/—/1000
BAT17	SOT-23	4	30	—	600/—/—/—
BAT18	SOT-23	35	100	—	—/1200/—/—
BAT54	SOT-23	30	200	5	400/1000/—/—
BAT74	SOT-143	30	300	5	400/1000/—/—
BAV23	SOT-143	200	200	50	—/1000/—/1250
BAV70	SOT-23	70	250	6	855/—/1250/—
BAV74	SOT-23	50	200	4	—/1000/—/—
BAV99	SOT-23	70	250	6	855/—/1250/—
BAV100	SOD-80	50	250	50	—
BAV101	SOD-80	100	250	50	—
BAV102	SOD-80	150	250	50	—
BAV103	SOD-80	200	250	50	—
BAW56	SOT-23	70	250	6	855/—/1250/—

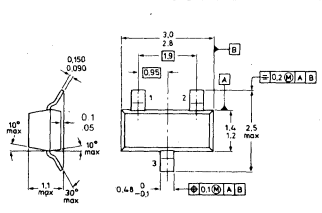
Type	Pkg	V_R V	I_F mA	Cd @ V_R pF	V
Variable Capacitance Diodes					
BB215	SOD-80	30	20	18 min.	1
BB219	SOD-80	30	20	31 min.	1
BBY31	SOT-23	28	20	1.8-2.8	25
BBY40	SOT-23	28	20	4.3-6	25

Type SOT-23	Type SOT-89	Type SOD-80	Suffix	V_Z @ I_Z ±5%	mA	R_{DIFF} @ I_Z Ω	S_Z @ I_Z mV/°C	I_R @ V_R µA	V
Zener Diodes									
BZX84	BZV49	BZV55	C2V4	2.4	5	100	0	50	1
BZX84	BZV49	BZV55	C2V7	2.7	5	100	0	20	1
BZX84	BZV49	BZV55	C3V0	3.0	5	95	0	10	1
BZX84	BZV49	BZV55	C2V3	3.3	5	95	0	5	1
BZX84	BZV49	BZV55	C3V6	3.6	5	90	0	5	1
BZX84	BZV49	BZV55	C3V9	3.9	5	90	0	3	1
BZX84	BZV49	BZV55	C4V3	4.3	5	90	0	3	1
BZX84	BZV49	BZV55	C4V7	4.7	5	80	.2	3	2
BZX84	BZV49	BZV55	C5V1	5.1	5	60	1.2	2	2
BZX84	BZV49	BZV55	C5V6	5.6	5	40	2.5	1	2
BZX84	BZV49	BZV55	C6V2	6.2	5	10	3.7	3	4
BZX84	BZV49	BZV55	C6V8	6.8	5	15	4.5	2	4

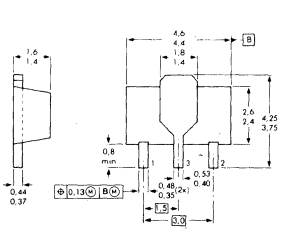
Type SOT-23	Type SOT-89	Type SOD-80	Suffix	V_Z @ I_Z ±5%	mA	R_{DIFF} @ I_Z Ω	S_Z @ I_Z mV/°C	I_R @ V_R µA	V
Zener Diodes (Cont.)									
BZX84	BZV49	BZV55	C7V5	7.5	5	15	5.3	1	5
BZX84	BZV49	BZV55	C8V2	8.2	5	15	6.2	.7	5
BZX84	BZV49	BZV55	C9V1	9.1	5	15	7.0	.5	6
BZX84	BZV49	BZV55	C10	10.0	5	20	8.0	.2	7
BZX84	BZV49	BZV55	C11	11	5	20	9.0	.1	8
BZX84	BZV49	BZV55	C12	12	5	25	10.0	.1	8
BZX84	BZV49	BZV55	C13	13	5	30	11.0	.1	8
BZX84	BZV49	BZV55	C15	15	5	30	13.0	.05	
BZX84	BZV49	BZV55	C16	16	5	40	14.0	.05	
BZX84	BZV49	BZV55	C18	18	5	45	16.0	.05	
BZX84	BZV49	BZV55	C20	20	5	55	18.0	.05	
BZX84	BZV49	BZV55	C22	22	5	55	20.0	.05	
BZX84	BZV49	BZV55	C24	24	5	70	22.0	.05	
BZX84	BZV49	BZV55	C27	27	2	80	25.3	.05	
BZX84	BZV49	BZV55	C30	30	2	80	29.4	.05	
BZX84	BZV49	BZV55	C33	33	2	80	33.4	.05	
BZX84	BZV49	BZV55	C36	36	2	90	37.4	.05	
BZX84	BZV49	BZV55	C39	39	2	130	41.2	.05	
BZX84	BZV49	BZV55	C43	43	2	150	46.6	.05	
BZX84	BZV49	BZV55	C47	47	2	170	51.8	.05	
BZX84	BZV49	BZV55	C51	51	2	180	57.2	.05	
BZX84	BZV49	BZV55	C56	56	2	200	63.8	.05	
BZX84	BZV49	BZV55	C62	62	2	215	71.6	.05	
BZX84	BZV49	BZV55	C68	68	2	240	79.8	.05	
BZX84	BZV49	BZV55	C75	75	2	255	88.6	.05	

*NOM VZ ± 0.7

Type	V_Z at I_{ZT} ±5%	mA	Z_{ZK} @ I_{ZK} = 0.25mA Ω	Ω	Θ_{VZ} %/°C	I_R at V_R µA	V
Zener Diodes, SOD-80 (MELF)							
PMLL5225B	3.0	20	29	1600	−0.75	50	1.0
PMLL5226B	3.3	20	28	1600	−0.70	25	1.0
PMLL5227B	3.6	20	24	1700	−0.65	15	1.0
PMLL5228B	3.9	20	23	1900	−0.60	10	1.0
PMLL5229B	4.3	20	22	2000	±.055	5.0	1.0
PMLL5230B	4.7	20	19	1900	±.030	5.0	2.0
PMLL5231B	5.1	20	17	1600	±.030	5.0	2.0
PMLL5232B	5.6	20	11	1600	+.038	5.0	3.0
PMLL5233B	6.0	20	7.0	1600	+.038	5.0	3.5
PMLL5234B	6.2	20	7.0	1000	+.045	5.0	4.0
PMLL5235B	6.8	20	5.0	750	+.050	3.0	5.0
PMLL5236B	7.5	20	6.0	500	+.058	3.0	6.0
PMLL5237B	8.2	20	8.0	500	+.062	3.0	6.5
PMLL5238B	8.7	20	8.0	600	+.065	3.0	6.5
PMLL5239B	9.1	20	10	600	+.068	3.0	7.0
PMLL5240B	10	20	17	600	+.075	3.0	8.0
PMLL5241B	11	20	22	600	+.076	2.0	8.4
PMLL5242B	12	20	30	600	+.077	1.0	9.1
PMLL5243B	13	9.5	13	600	+.079	0.5	9.9
PMLL5244B	14	9.0	15	600	+.082	0.1	10
PMLL5245B	15	8.5	16	600	+.082	0.1	11
PMLL5246B	16	7.8	17	600	+.083	0.1	12
PMLL5247B	17	7.4	19	600	+.084	0.1	13
PMLL5248B	18	7.0	21	600	+.085	0.1	14
PMLL5249B	19	6.6	23	600	+.086	0.1	14
PMLL5250B	20	6.2	25	600	+.086	0.1	15
PMLL5251B	22	5.6	29	600	+.087	0.1	17
PMLL5252B	24	5.2	33	600	+.088	0.1	18
PMLL5253B	25	5.0	35	600	+.089	0.1	19
PMLL5254B	27	4.6	41	600	+.090	0.1	21
PMLL5255B	28	4.5	44	600	+.091	0.1	21
PMLL5256B	30	4.2	49	600	+.091	0.1	23
PMLL5257B	33	3.8	58	700	+.092	0.1	25
PMLL5258B	36	3.4	70	700	+.093	0.1	27
PMLL5259B	39	3.2	80	800	+.094	0.1	30
PMLL5260B	43	3.0	93	900	+.095	0.1	33
PMLL5261B	47	2.7	105	1000	+.095	0.1	36
PMLL5262B	51	2.5	125	1100	+.096	0.1	39
PMLL5263B	56	2.2	150	1300	+.096	0.1	43
PMLL5264B	60	2.1	170	1400	+.097	0.1	46
PMLL5265B	62	2.0	185	1400	+.097	0.1	47
PMLL5266B	68	1.8	230	1600	+.097	0.1	52
PMLL5267B	75	1.7	270	1700	+.098	0.1	56



SOT-23



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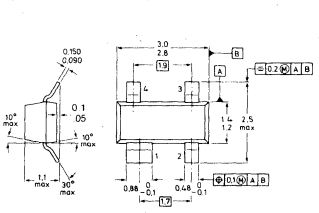

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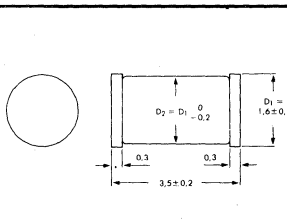

SOD-80

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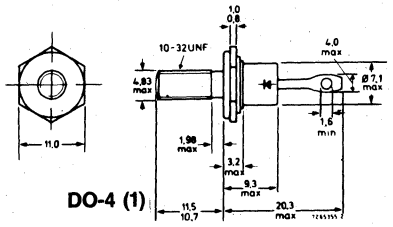

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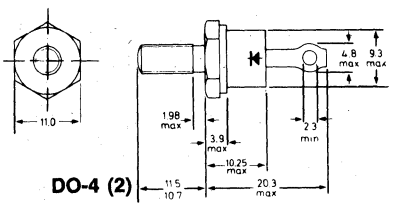

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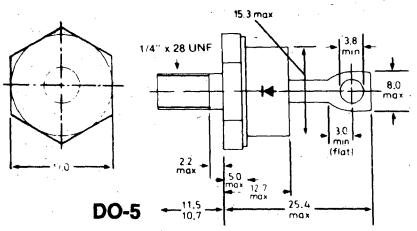

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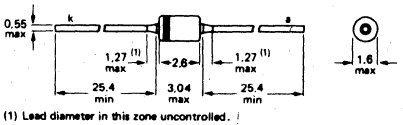
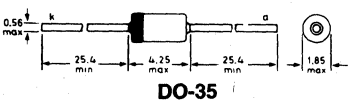


(1) Lead diameter in this zone uncontrolled.

DO-34



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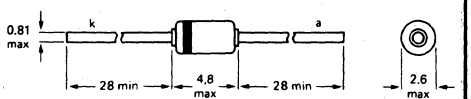

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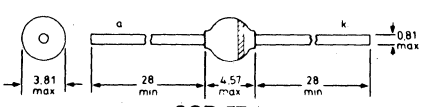

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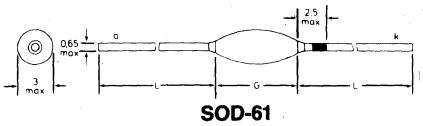

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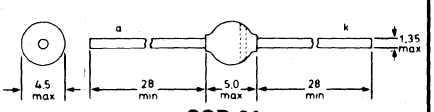
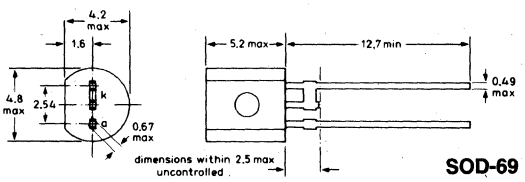


SOD-64



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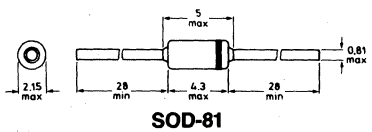

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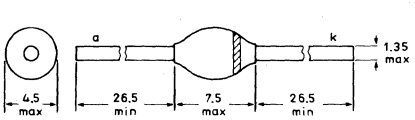

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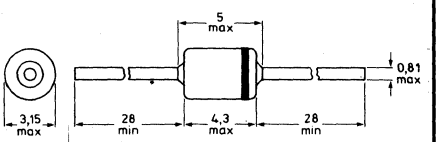

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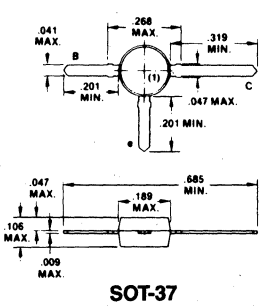

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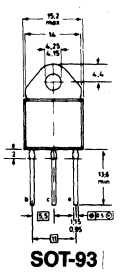

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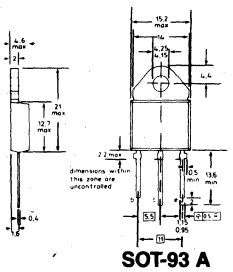

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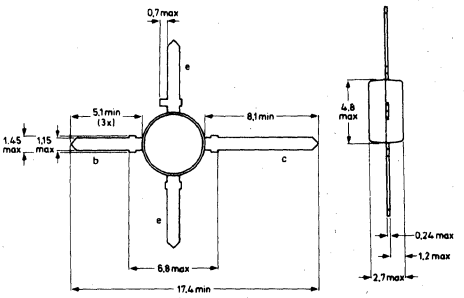

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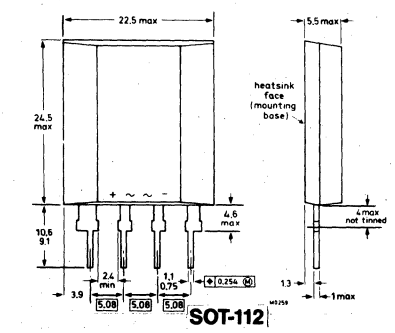

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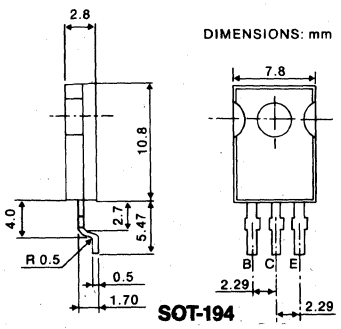

SOT-194

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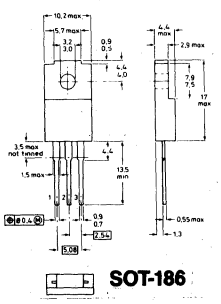

SOT-186

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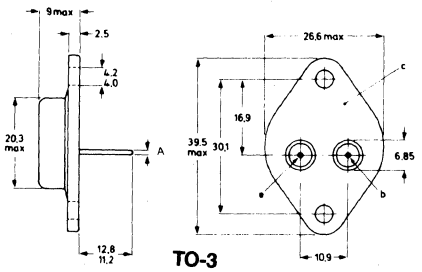
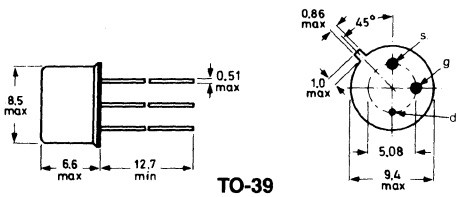


TO-3



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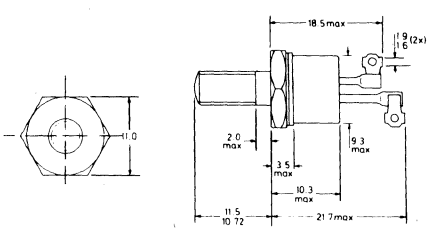
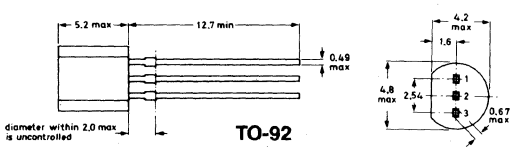


TO-64



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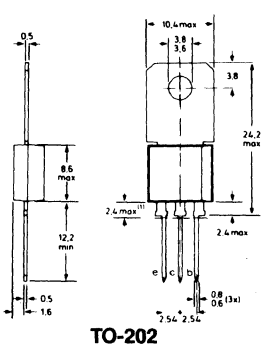

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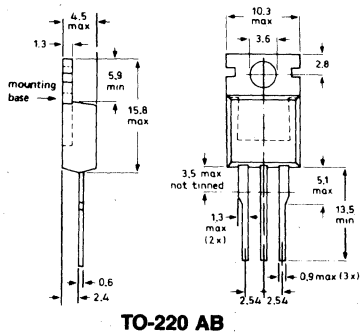

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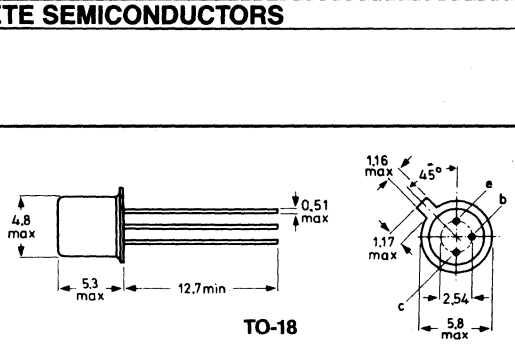

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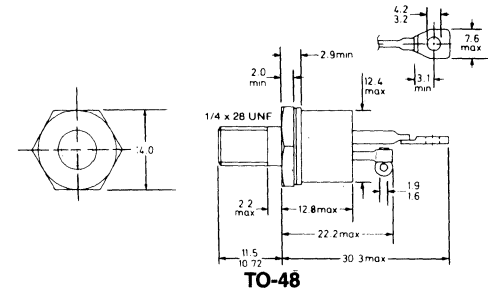

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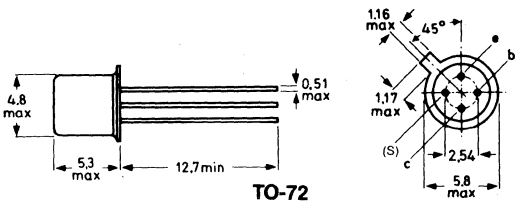

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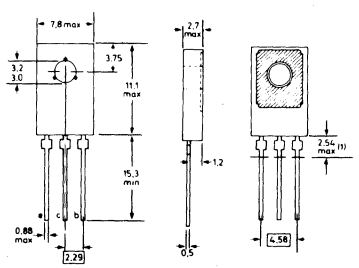

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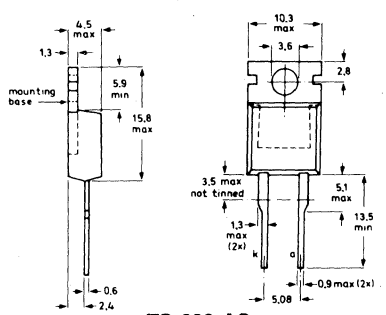
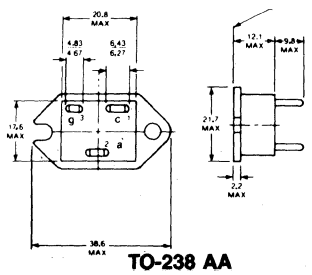


TO-220 AC



TO-238 AA

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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
ABS acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CAMAC computer automated measurement and control
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3
KSR keyboard send /receive

L
LC inductance capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIB microcomputer interface board
MIC microwave IC
MIPS million instructions per second
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

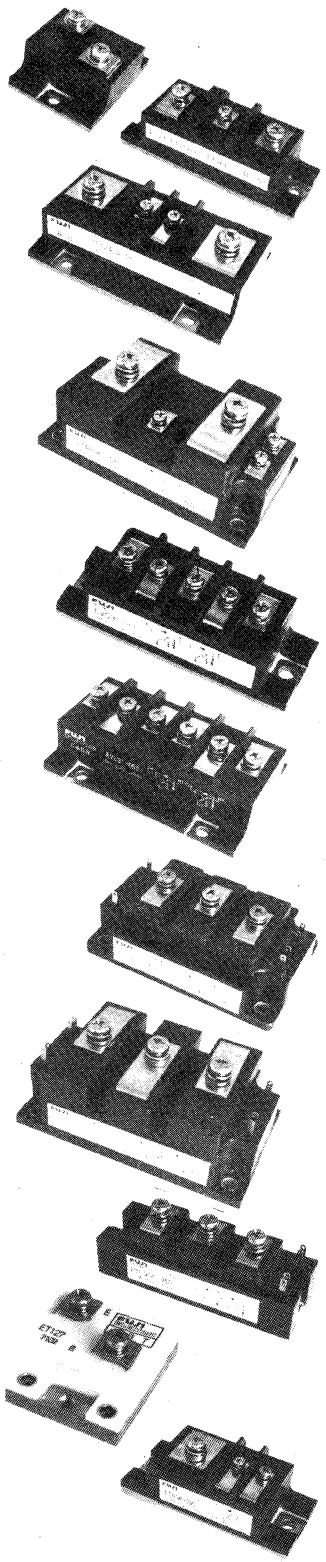
Power Darlington Modules

500 VOLTS

Device Type	VCBO volts	VCEO volts	VCEO (sus) volts	IC cont. amps	PC watts (per xstr)	hFE min.	IC amps	VCE volts	Switching Time (max.) ton µsec	ts µsec	tf µsec	Package
SINGLE DARLINGTON MODULES (ISOLATED)												
ETG81-050	600	600	450	30	200	100	30	5	3	12	3	M102
ETK81-050	600	600	450	50	300	100	50	5	3	12	4	M102
ETK85-050	600	600	450	75	350	70	75	5	2	10	2.5	M102
ETL81-050	600	600	500	100	600	100	100	5	3	10	3	M103
ETN81-055	600	600	550	200	1000	70	200	5	2	12	3	M104
1DI240A-055	600	600	550	240	1000	70	240	5	2	12	3	M104
ETN85-050	600	600	450	300	1200	70	300	5	2	12	2.5	M104
1DI480-A-055	600	600	550	480	2000	70	480	5	2	12	3	M105
DUAL DARLINGTON MODULES (ISOLATED)												
EVG31-050	600	600	450	30	200	100	30	5	3	12	4	M201
2DI30D-050	600	600	450	30	250	100	30	5	3	12	4	M208
EVK31-050	600	600	450	50	300	100	50	5	3	12	4	M201
2DI50D-050	600	600	450	50	310	100	50	5	3	12	4	M208
2DI50D-055A	600	600	550	50	300	70	50	5	2	12	4	M208
EVK71-050	600	600	450	75	350	70	75	5	2	12	2.5	M202
2DI75S-050A	600	600	450	75	350	100	75	5	2	10	2.5	M202
EVK75-050	600	600	450	75	350	70	75	5	2	10	2.5	M201
2DI75D-050	600	600	450	75	350	100	75	5	3	12	4	M208
2DI75D-055A	600	600	550	75	350	70	75	5	3	12	4	M208
EVK71-055	600	600	550	75	350	70	75	5	2	12	3	M202
EVL31-050	600	600	450	100	500	100	100	5	3	12	4	M203
2DI100D-050	600	600	450	100	620	100	100	5	3	12	4	M205
2DI100L-050	600	600	450	100	400	80	100	5	3	12	4	M201
EVL31-055	600	600	550	100	500	70	100	5	2	12	3	M203
EVL32-055	600	600	550	120	500	70	120	5	2	12	3	M203
EVM31-050A	600	600	500	150	600	70	150	5	2	10	2.5	M203
2DI50D-050	600	600	450	150	690	100	150	5	3	12	4	M205
2DI240A-055	600	600	550	240	1000	70	240	5	2	12	3	M207
SINGLE DARLINGTONS AND TRANSISTORS (NON-ISOLATED)												
ET188	400	400	300	100	600	200	100	5	2	12	3	BBT II
ET127-450V	600	600	450	100	960	100	100	5	4	10	3	BBT
ET127-520V	600	600	520	100	960	100	100	5	4	10	3	BBT
2SC2770	600	600	450	100	960	8	60	5	4	8	3	BBT
ETN01-055	600	600	550	200	1500	8	120	5	2	8	2	BBT III
ETN31-055	600	600	550	200	1500	70	200	5	2	12	3	BBT III
ETM36-030	400	400	320	200	1000	150	200	5	2	10	1.2	BBT III
ETN36-030	400	400	320	300	1500	150	300	5	2	10	1.2	BBT III

1000 VOLTS

Device Type	VCBO volts	VCEO volts	VCEX* VCEO (sus) volts	IC cont. amps	PC watts (per xstr)	hFE min.	IC amps	VCE volts	Switching Time (max.) ton µsec	ts µsec	tf µsec	Package
SINGLE DARLINGTON MODULES (ISOLATED)												
1DI300D-100	1000	1000	*1000	300	2000	100	300	5	2.5	15	3	M105
1DI400D-100	1000	1000	*1000	400	2400	70	400	5	2.5	15	3	M105
DUAL DARLINGTON MODULES (ISOLATED)												
EV1277	1000	1000	*1000	30	300	100	30	5	3	12	2	M202
2DI30D-100	1000	1000	*1000	30	300	100	30	5	2.5	15	3	M204
2DI50D-100	1000	1000	*1000	50	400	100	50	5	2.5	15	3	M204
2DI75D-100	1000	1000	*1000	75	500	100	75	5	2.5	15	3	M206
2DI100D-100	1000	1000	*1000	100	800	100	100	5	2.5	15	3	M207
2DI150D-100	1000	1000	*1000	150	1000	100	150	5	2.5	15	3	M207
2DI200D-100	1000	1000	*1000	200	1200	100	200	5	2.5	15	3	M207
NEW 1000 VOLT "Z" MODULES, HIGH SPEED, EXTRA RUGGED												
2DI30Z-100	1000	1000	*1000	30	300	100	30	5	2.5	10	2	M204
2DI50Z-100	1000	1000	*1000	50	400	100	50	5	2.5	10	2	M204
2DI75Z-100	1000	1000	*1000	75	500	100	75	5	2.5	10	2	M209
2DI100Z-100	1000	1000	*1000	100	800	100	100	5	2.5	10	2	M210
2DI150Z-100	1000	1000	*1000	150	1000	100	150	5	2.5	10	2	M210
1DI200Z-100	1000	1000	*1000	200	1400	100	200	5	2.5	10	2	M106
1DI300Z-100	1000	1000	*1000	300	2000	100	300	5	2.5	10	2	M106



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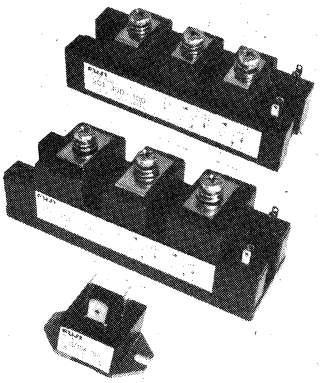
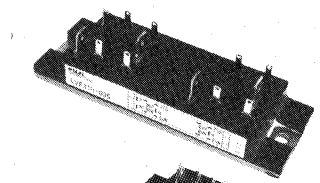
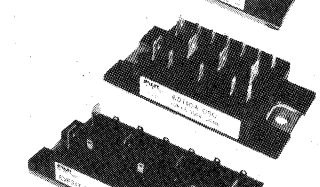
Power Darlington Modules / High Voltage Silicon Rectifiers & High Power Rectifier Assemblies

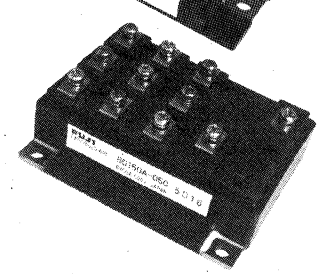
1200/1400 VOLTS/6-PACK

Device Type	VCBO volts	VCEO volts	VCEO *VCEX (sus) volts	IC cont. amps	PC watts (per xstr)	hFE min.	IC amps	VCE volts	Switching Time (max.) ton µsec	ts µsec	tf µsec	Package
NEW 1200 VOLT "Z" MODULES, HIGH GAIN, EXTRA RUGGED												
2DI30Z-120	1200	1200	*1200	30	300	100	30	5	3	15	2	M204
2DI50Z-120	1200	1200	*1200	50	400	100	50	5	3	15	2	M204
2DI75Z-120	1200	1200	*1200	75	500	100	75	5	3	15	2	M209
2DI100Z-120	1200	1200	*1200	100	800	100	100	5	3	15	2	M210
2DI150Z-120	1200	1200	*1200	150	1000	100	150	5	3	15	2	M210
1DI200Z-120	1200	1200	*1200	200	1400	100	200	5	3	15	2	M106
1DI300-Z-120	1200	1200	*1200	300	2000	100	300	5	3	15	2	M106
SINGLE DARLINGTON MODULES (ISOLATED)												
1DI200A-120	1200	1200	1200	200	1600	70	300	5	3	15	3	M105
1DI300-A-120	1200	1200	1200	300	2000	70	300	5	3	15	3	M105
1DI800A-120	1200	1200	1200	800	6000	100	800	5	3	15	3	
1DI200A-140	1400	1400	1200	200	1400	70	200	5	3	15	3	M105
1DI300A-140	1400	1400	1200	300	2000	70	300	5	3	15	3	M105
DUAL DARLINGTON MODULES (ISOLATED)												
2DI30A-120	1200	1200	1200	30	300	70	30	5	3	15	3	M204
2DI50A-120	1200	1200	1200	50	400	70	50	5	3	15	3	M206
2DI75A-120	1200	1200	1200	75	500	70	75	5	3	15	3	M206
2DI100A-120	1200	1200	1200	100	800	70	100	5	3	15	3	M207
2DI150A-120	1200	1200	1200	150	1000	70	150	5	3	15	3	M207
2DI30A-140	1400	1400	1200	30	300	70	30	5	3	15	3	M204
2DI50A-140	1400	1400	1200	50	400	70	50	5	3	15	3	M206
2DI75A-140	1400	1400	1200	75	500	70	75	5	3	15	3	M206
2DI100A-140	1400	1400	1200	100	800	70	100	5	3	15	3	M207
2DI150A-140	1400	1400	1200	150	1000	70	150	5	3	15	3	M207
6-PACK DARLINGTON MODULES												
6DI10A-050	600	600	*450	10	80	100	10	5	1	12	2	M601
6DI10A-120	1200	1200	*1200	10	100	70	10	5	3	15	3	M604
6DI15A-050	600	600	*450	15	80	100	15	5	1	12	2	M604
6DI15A-120	1200	1200	1200	15	150	70	15	5	3	15	3	M605
6DI20C-050	600	600	*450	20	100	100	20	5	1	12	1	M604
6DI30A-050	600	600	*450	30	150	100	30	5	3	12	4	M603
6DI30A-120	1200	1200	1200	30	230	70	30	5	3	15	3	M606
6DI50A-050	600	600	*450	50	230	100	50	5	3	12	4	M603
6DI75A-050	600	600	*450	75	350	100	75	5	3	12	4	M603



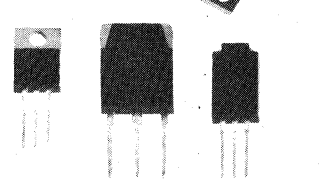


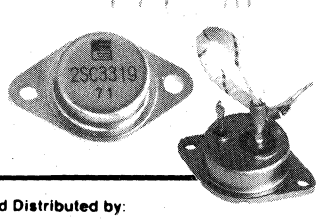




HIGH VOLTAGE RECTIFIERS/ASSEMBLIES

Part Number	VRRM (KV)	Io (mA)	VF (V)	Trr (µsec)	Pkg. L. (in)	Pkg. Dia. (in)	Wire Dia. (in)
RESIN PACKAGE, 80 NANOSECOND RECOVERY 3mm DIAMETER							
ESJA88-06	6	5	22.4	.08	.256	.098	.020
ESJA88-08	8	5	28.0	.08	.256	.098	.020
ESJA82-10	10	5	33.6	.08	.394	.118	.024
ESJA82-12	12	5	42.0	.08	.394	.118	.024
ESJA82-14	14	5	47.6	.08	.394	.118	.024
ESJA83-16	16	5	56.0	.08	.472	.118	.024
ESJA83-18	18	5	61.6	.08	.472	.118	.024
ESJA83-20	20	5	70.0	.08	.472	.118	.024
ESJA86-24	24	5	84.0	.08	.591	.118	.024
RESIN PACKAGE, 100 NANOSECOND RECOVERY 3mm DIAMETER							
ESJA57-04	4	5	12.5	.10	.197	.098	.020
ESJA54-06	6	5	20.0	.10	.315	.118	.024
ESJA54-08	8	5	25.0	.10	.315	.118	.024
ESJA52-10	10	5	30.0	.10	.394	.118	.024
ESJA52-12	12	5	37.5	.10	.394	.118	.024
ESJA52-14	14	5	42.5	.10	.394	.118	.024
ESJA53-16	16	5	50.0	.10	.472	.118	.024
ESJA53-18	18	5	55.0	.10	.472	.118	.024
ESJA53-20	20	5	62.5	.10	.472	.118	.024
ESJA56-20	20	5	62.5	.10	.591	.118	.024
ESJA56-24	24	5	75.0	.10	.591	.118	.024
X-RAY DIODES							
ESJC04-05	5	420	8.4	1.0	.394	.236	.047
ESJC01-09	9	350	12.0	—	.866	.295	.047
ESJC03-09	9	280	18.0	1.0	.591	.177	.031
ESJC01-12	12	350	12.0	—	.866	.295	.047





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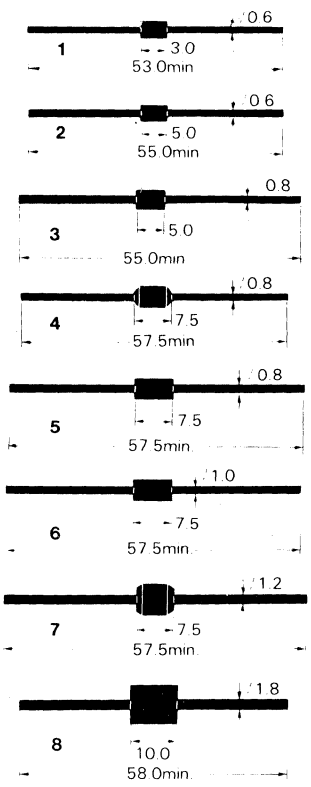
High Power/Voltage Rectifier Assemblies
Schottky and Fast Recovery Diodes

HIGH VOLTAGE ASSEMBLIES

Part Number	VRRM (KV)	Io (amps)	VF (V)	Trr (μsec)	Pkg. L. (in.)	Pkg. Dimension (in.) width x height	Wire Dia. (in.)
HIGH VOLTAGE, HIGH POWER RECTIFIER ASSEMBLIES							
CS4107A12	12	1.5	17	—	7	1 x 1.25	Term.
CS4107A15	15	1.5	20	—	7	1 x 1.25	Term.
CS4107A20	20	1.5	25	—	7	1 x 1.25	Term.
CS4107A25	25	1.5	30	—	7	1 x 1.25	Term.
CS4107A30	30	1.5	35	—	7	1 x 1.25	Term.
CS4107X12	12	1.5	22	.15	7	1 x 1.25	Term.
CS4107X15	15	1.5	25	.15	7	1 x 1.25	Term.
CS4107X20	20	1.5	30	.15	7	1 x 1.25	Term.
CS4107X25	25	1.5	35	.15	7	1 x 1.25	Term.
CS4107X30	30	1.5	40	.15	7	1 x 1.25	Term.

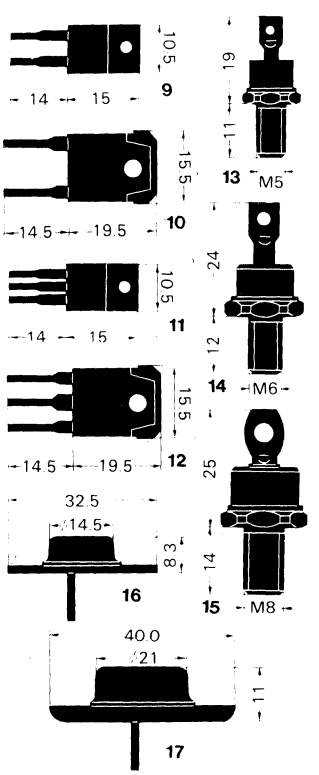


SCHOTTKY "QUICK REFERENCE" SELECTION GUIDE

	PACKAGE	45 VOLT			90 VOLT		
		Part Number	Io(A)	Pkg.	Part Number	Io(A)	Pkg.
SINGLE	AXIAL LEAD	ERA 82-004 (Mini Molded)	.6	1	ERA 84-009	1.0	2
		ERA 81-004	1.0	2	ERB 84-009	2.0	4
		ERB81-004	2.0	4	ERC 84-009	3.0	7
		ERC81-004	3.0	7			
		ERC 81S-004	5.0	7			
	TO-220	ERC 80-004	5.0	9	ERC 88-009	5.0	9
		ERC 62-004	10.0	9			
	TO-3P	ERD 80-004	15.0	10			
		ERG 80-004	50.0	10			
	STUD	ERD 81B-004	15.0	13			
		ERE 81B-004	30.0	14			
		ERG 81B-004	60.0	15			
	MODULE	ESAG 84-004 (40V)	200.0	—			
DUAL	TO-220	ESAB 82-004	5.0	11	ESAB 85-009	5.0	11
		ESAC 82-004	10.0	11	ESAC 85-009	10.0	11
	TO-3P	ESAC 83-004	20.0	12	ESAC 87-009	16.0	12
		ESAD 83-004	30.0	12	ESAD 85-009	25.0	12
		ESAE 83-004	50.0	12			
	TO-3	ESAC 81-004	8.0	16			
		ESAD 81-004D	30.0	17			

FAST RECOVERY "QUICK REFERENCE" SELECTION GUIDE

	PACKAGE	200V				400V				600V			
		Part Number	Io(A)	trr n s	Pkg.	Part Number	Io(A)	trr n s	Pkg.	Part Number	Io(A)	trr n s	Pkg.
SINGLE	AXIAL	ERA 91-02	.5	35	1	ERA 38-04	.5	50	1	ERA 38-06	.5	50	1
		ERB 91-02	1.0	35	3	ERA 21-04	.5	400	2	ERA 21-06	.5	400	2
		ERC 91-02	3.0	35	7	ERA 22-04	.5	400	1	ERA 22-06	.5	400	1
		ERC 35-02	2.5	100	7	ERB 43-04	.5	400	3	ERB 43-06	.5	400	3
		ERA 21-02	.5	400	2	ERB 28-04	.5	400	5	ERB 28-06	.5	400	5
		ERA 22-02	.5	400	1	ERA 48-04	.8	400	1	ERC 24-06	1.0	400	5
		ERB 43-02	.5	400	3	ERB 44-04	1.0	400	3	ERC 25-06	1.2	400	6
		ERA 48-02	.8	400	1	ERC 24-04	1.0	400	5	ERD 28-06	1.5	400	7
		ERB 44-02	1.0	400	3	ERC 47-04	1.2	400	6	ERD 29-06	2.5	400	8
		ERC 47-02	1.2	400	6	ERC 25-04	1.2	400	6	ERB 24-06C	1.0	700	5
		ERD 29-02	2.5	400	8	ERD 28-04	1.5	400	7	ERB 24-06D	.7	1000	5
						ERD 29-04	2.5	400	8				
						ERB 24-04C	1.0	700	5				
						ERB 24-04D	.7	1000	5				
		500V				800V				1000V			
	AXIAL	ERA 38-05	.5	50	1	ERA 22-08	.5	400	1	ERA 34-10	.1	150	1
						ERB 43-08	.5	400	3	ERA 22-10	.5	400	1
		200V				400V				600V			
	TO-220	ERC 90-02	5	35	9	ERC 20-04	5	400	9				
		ERC 20-02	5	400	9								
DUAL	TO-220	ESAB 92-02	5	35	11	ESAC 25-04 (C, N, D)	10	400	11				
		ESAC 92-02	10	35	11								
		ESAB 33-02CS	5	100	11								
		ESAC 33-02CS	10	100	11								
		ESAC 33-02 (C, N, D)	8	100	11								
		ESAC 31-02 (C, N, D)	10	300	11								
		ESAC 25-02 (C, N, D)	10	400	11								
	TO-3P	ESAC 93-02	12	35	12	ESAD 25-04 (C, N, D)	15	400	12				
		ESAD 92-02	20	40	12								
		ESAD 33-02 (C, N, D)	15	100	12								
		ESAC 33-02CS	20	100	12								
		ESAD 25-02 (C, N, D)	15	400	12								
	TO-66	ESAC 75-02	8	800	16								
	TO-3	ESAD 75-02	16	300	17								



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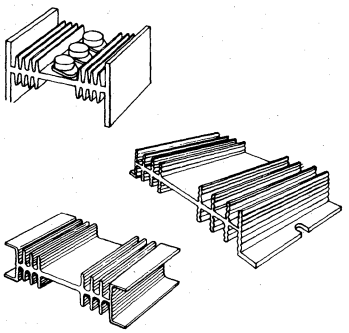
The DELBERT BLINN COMPANY has for many years designed, fabricated and supplied specialty hardware items for the rapidly changing and expanding electronics industry. Our vast experience in plastic and metal fabrication guarantees you the best possible service for your particular needs regardless of quantity.



HEAT SINK DISSIPATORS

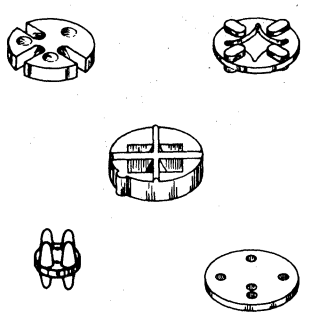
Efficiency, light weight and economy are incorporated in a complete line of professionally engineered heat sinks available in a variety of sizes and shapes. Material: Aluminum 6063-T5 alloy, mill finish. Lengths to 5 ft. available. (Serrations--U.S. Pat. No. 3163207). Can be cut, drilled, anodized or painted to your specifications.

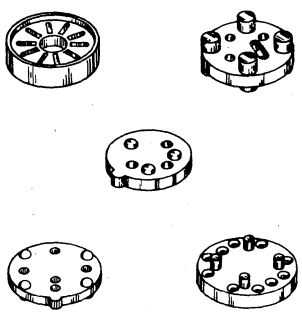
CATALOG SERIES — AHS

NYLON TRANSISTOR PADS

Precision molded from Zytel 101 (MIL-P-20693), these pads provide an economical insulator and thermal barrier with high dielectric strength. Resist continuous exposure to 135° C.

CATALOG SERIES — TPN





DIALLYL PHTHALATE TRANSISTOR PADS

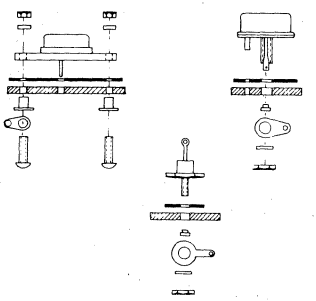
Available with and without stand-offs in configurations for all applications, these pads are molded of glass-filled Diallyl Phthalate (Mil-M-14F SDG) and provide an excellent mounting base. They resist continuous exposure to 400°F. and offer very high dielectric strength.

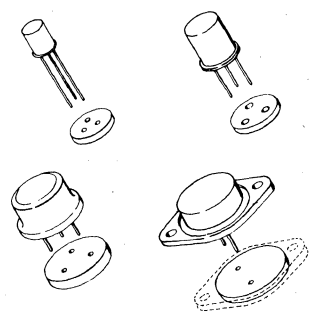
CATALOG SERIES — TPD

MOUNTING KITS

These and other standard kits incorporating mica, beryllium oxide or anodized aluminum insulators provide the parts necessary to mount all semi-conductors. Special materials and configurations can also be furnished to your specifications.

CATALOG SERIES — MK





BERYLLIUM OXIDE TRANSISTOR HEAT SINKS

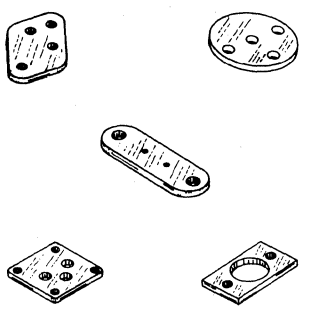
Made of high purity (99+%) sintered BeO, these sinks provide a satisfactory solution to the design engineer where electronic applications require both dielectric insulation and high heat transfer.

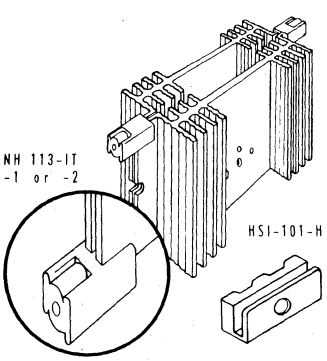
CATALOG SERIES — BOS

MICA INSULATORS

Delbert Blinn mica insulators are precision stamped from quality controlled stock and will withstand temperatures to 1000°F. with negligible dehydration. Standard thickness is .002 ± .001. Other designs, shapes, thicknesses or tolerances are available on special order.

CATALOG SERIES — MI





HEAT SINK MOUNTING INSULATOR

Delbert Blinn mounting insulators are precision molded of Microlon "202" and provide a practical, compact and economical method for mounting and insulating all standard heat sinks.
These insulators are capable of continuous operation to 175° C. and have a dielectric strength of 340 V/MIL.

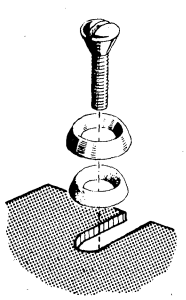
CATALOG SERIES — HSM

NYLON CUP WASHER FILLERS

Employed as insurance against damage, these quality fillers are molded from high strength Polyamide (nylon) and guarantee chip and crack free panel installation.

Available in Nos. 6, 8, 10 and 12 screw sizes.

CATALOG SERIES — NWF



Many other heat sink, transistor pad and specialty items not shown above are available.

Write for additional information.

When custom designs or modifications of standard electronic hardware parts are needed, our years of experience in the molding, extruding, stamping and fabrication of metal and plastic parts enables us to supply you with parts unsurpassable in quality.

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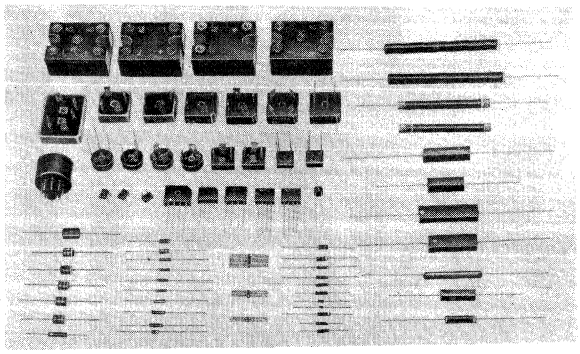

BRIDGE RECTIFIERS

Hundreds of stock designs. Surface mount, printed circuit board types, miniature and standard cases, round and square cases, metal and epoxy cases, wire and quick connect terminals. Single-phase, 3-phase, center taps, doublers, UL Recognition.

VOLTAGES: 50 to 1,400 PRV
CURRENTS: 1 to 100 Amperes
SURGES: To 1,000 Amperes
RECOVERY TIMES: To 50 ns

HV DIODES

Hundreds of designs are available from stock

VOLTAGES: 50 to 15,000 PRV
CURRENTS: To 6 Amperes
SURGES: To 1,000 Amperes
RECOVERY TIMES: To 50 ns
OPERATING TEMP: To 200° C

FREE SAMPLES

Write or call outlining your OEM requirements for samples (some restrictions may apply)

FREE CATALOGS

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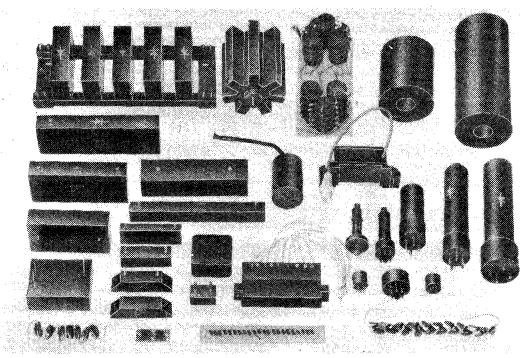

HV ASSEMBLIES

CUSTOM AND STANDARD

Blocks, High Voltage Packs, Cylinders, CRT Rectifiers, Cartridges, Night Vision Arrays, High Temperature, Solid-State Rectifier Tubes. SPECIALS: Electronic Devices, Inc. also specializes in the design and manufacture of custom high voltage assemblies. For solutions to your unique problems, just give us a call.

VOLTAGES: To 250,000 PRV
CURRENTS: To 25 Amperes
SURGES: To 1,000 Amperes
RECOVERY TIMES: To 50 ns

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Electronic Devices, Inc. has specialized since 1951 in the design and manufacture of rectifiers. Our engineering abilities have enabled us to develop a number of patented, unique, products. Our ability to perform every manufacturing process gives us complete quality control over every step from silicon diffusion to final inspection for high quality and reliability products.

A FEW EXAMPLES OF OUR EXPERIENCE
CONSUMER: electrostatic air cleaners, ion generation, battery chargers. **INDUSTRIAL:** Computers and peripherals, motor drives, induction welding and heating, X-ray and medical equipment. **MILITARY:** night vision, radar, jet engine ignition, communications.

AN AMERICAN ELECTRONIC COMPONENTS COMPANY

FAGOR Electronic Components Inc.

Quality Discrete Silicon Semiconductors

ZENER DIODES

Nominal Zener Voltage	0.4W		0.5W	1W	5W
	T_{Max} = +175°C				T_{Max} = +150°C
	Cathode = Polarity Mark				
	DO-35	DO-35	DO-35	DO-41	DO-27A
2.4	....	....	1N5221B	....	....
2.5	....	....	1N5222B	....	....
2.7	....	....	1N5223B	....	....
2.8	....	....	1N5224B	....	....
3.0	....	....	1N5225B	....	....
3.3	....	....	1N5226B	1N4728A	....
3.6	....	....	1N5227B	1N4729A	....
3.9	....	....	1N5228B	1N4730A	....
4.3	....	....	1N5229B	1N4731A	....
4.7	....	....	1N5230B	1N4732A	....
5.1	1N751A	....	1N5231B	1N4733A	....
5.6	1N752A	....	1N5232B	1N4734A	....
6.0	....	....	1N5233B	....	....
6.2	1N753A	....	1N5234B	1N4735A	....
6.8	1N754A	1N957B	1N5235B	1N4736A	....
7.5	1N755A	1N958B	1N5236B	1N4737A	....
8.2	1N756A	1N959B	1N5237B	1N4738A	....
8.7	....	....	1N5238B	....	1N5345B
9.1	1N757A	1N960B	1N5239B	1N4739A	1N5346B
10	1N758A	1N961B	1N5240B	1N4740A	1N5346B
11	....	1N962B	1N5241B	1N4741A	1N5348B
12	1N759A	1N963B	1N5242B	1N4742A	1N5349B
13	....	1N964B	1N5243B	1N4743A	1N5350B
14	....	....	1N5244B	....	1N5351B
15	....	1N965B	1N5245B	1N4744A	1N5352B
16	....	1N966B	1N5246B	1N4745A	1N5353B
17	....	....	1N5247B	....	1N5354B
18	....	1N967B	1N5248B	1N4746A	1N5355B
19	....	....	1N5249B	....	1N5356B
20	....	1N968B	1N5250B	1N4747A	1N5357B
22	....	1N969B	1N5251B	1N4748A	1N5358B
24	....	1N970B	1N5252B	1N4749A	1N5359B
25	....	....	1N5253B	....	1N5360B
27	....	1N971B	1N5254B	1N4750A	1N5361B
28	....	....	1N5255B	....	1N5362B
30	....	1N972B	1N5256B	1N4751A	1N5363B
33	....	1N973B	1N5257B	1N4752A	1N5364B
36	....	....	....	....	1N5365B
39	....	....	....	....	1N5366B
43	....	....	....	....	1N5367B
47	....	....	....	....	1N5368B
51	....	....	....	....	1N5369B
56	....	....	....	....	1N5370B
60	....	....	....	....	1N5371B
62	....	....	....	....	1N5372B
68	....	....	....	....	1N5373B
75	....	....	....	....	1N5374B
82	....	....	....	....	1N5375B
87	....	....	....	....	1N5376B
91	....	....	....	....	1N5377B
100	....	....	....	....	1N5378B
110	....	....	....	....	1N5379B
120	....	....	....	....	1N5380B
130	....	....	....	....	1N5381B
140	....	....	....	....	1N5382B
150	....	....	....	....	1N5383B
160	....	....	....	....	1N5384B
170	....	....	....	....	1N5385B
180	....	....	....	....	1N5386B
190	....	....	....	....	1N5387B
200	....	....	....	....	1N5388B

TRANSIENT SUPPRESSOR DIODES 1N62 AND 1.5KE SERIES

Breakdown V_{BR} Volts Nom	Breakdown @1T mA	Type		Max. Clamping Voltage V_{CL} at I_{pp} max. 1ms Expo. Volts	Amps
8.2	10	1N6269	1.5KE8.2	12.5	120.0
8.2	10	1N6269A	1.5KE8.2A	12.1	124.0
9.1	1	1N6270	1.5KE9.1	13.8	109.0
9.1	1	1N6270A	1.5KE9.1A	13.4	112.0
10.0	1	1N6271	1.5KE10	15.0	100.0
10.0	1	1N6271A	1.5KE10A	14.5	103.0
11.0	1	1N6272	1.5KE11	16.2	93.0
11.0	1	1N6272A	1.5KE11A	15.6	96.0
12.0	1	1N6273	1.5KE12	17.3	87.0
12.0	1	1N6273A	1.5KE12A	16.7	90.0
13.0	1	1N6274	1.5KE13	19.0	79.0
13.0	1	1N6274A	1.5KE13A	18.2	82.0
15.0	1	1N6275	1.5KE15	22.0	68.0
15.0	1	1N6275A	1.5KE15A	21.2	71.0
16.0	1	1N6276	1.5KE16	23.5	64.0
16.0	1	1N6276A	1.5KE16A	22.5	67.0
18.0	1	1N6277	1.5KE18	26.5	56.5
18.0	1	1N6277A	1.5KE18A	25.2	59.5
20.0	1	1N6278	1.5KE20	29.1	51.5
20.0	1	1N6278A	1.5KE20A	27.7	54.0
22.0	1	1N6279	1.5KE22	31.9	47.0
22.0	1	1N6279A	1.5KE22A	30.6	49.0
24.0	1	1N6280	1.5KE24	34.7	43.0
24.0	1	1N6280A	1.5KE24A	33.2	45.0
27.0	1	1N6281	1.5KE27	39.1	38.5
27.0	1	1N6281A	1.5KE27A	37.5	40.0
30.0	1	1N6282	1.5KE30	43.5	34.5
30.0	1	1N6282A	1.5KE30A	41.4	36.0
33.0	1	1N6283	1.5KE33	47.7	31.5
33.0	1	1N6283A	1.5KE33A	45.7	33.0
36.0	1	1N6284	1.5KE36	52.0	29.0
36.0	1	1N6284A	1.5KE36A	49.9	30.0
39.0	1	1N6285	1.5KE39	56.4	26.5
39.0	1	1N6285A	1.5KE39A	53.9	28.0
43.0	1	1N6286	1.5KE43	61.9	24.0
43.0	1	1N6286A	1.5KE43A	59.3	25.3
47.0	1	1N6287	1.5KE47	67.8	22.2
47.0	1	1N6287A	1.5KE47A	64.8	23.2
51.0	1	1N6288	1.5KE51	73.5	20.4
51.0	1	1N6288A	1.5KE51A	70.1	21.4
56.0	1	1N6289	1.5KE56	80.5	18.6
56.0	1	1N6289A	1.5KE56A	77.0	19.5
62.0	1	1N6290	1.5KE62	89.0	16.9
62.0	1	1N6290A	1.5KE62A	85.0	17.7
68.0	1	1N6291	1.5KE68	98.0	15.3
68.0	1	1N6291A	1.5KE68A	92.0	16.3
75.0	1	1N6292	1.5KE75	108.0	13.9
75.0	1	1N6292A	1.5KE75A	103.0	14.6
82.0	1	1N6293	1.5KE82	118.0	12.7
82.0	1	1N6293A	1.5KE82A	113.0	13.3
91.0	1	1N6294	1.5KE91	131.8	11.4
91.0	1	1N6294A	1.5KE91A	125.0	12.0
100.0	1	1N6295	1.5KE100	144.0	10.4
100.0	1	1N6295A	1.5KE100A	137.0	11.0
110.0	1	1N6296	1.5KE110	158.0	9.5
110.0	1	1N6296A	1.5KE110A	152.0	9.9
120.0	1	1N6297	1.5KE120	173.0	8.7
120.0	1	1N6297A	1.5KE120A	165.0	9.1
130.0	1	1N6298	1.5KE130	187.0	8.0
130.0	1	1N6298A	1.5KE130A	179.0	8.4
150.0	1	1N6299	1.5KE150	215.0	7.0
150.0	1	1N6299A	1.5KE150A	207.0	7.2
160.0	1	1N6300	1.5KE160	230.0	6.5
160.0	1	1N6300A	1.5KE160A	219.0	6.8
170.0	1	1N6301	1.5KE170	244.0	6.2
170.0	1	1N6301A	1.5KE170A	234.0	6.4
180.0	1	1N6302	1.5KE180	258.0	5.8
180.0	1	1N6302A	1.5KE180A	246.0	6.1
200.0	1	1N6303	1.5KE200	287.0	5.2
200.0	1	1N6303A	1.5KE200A	274.0	5.5

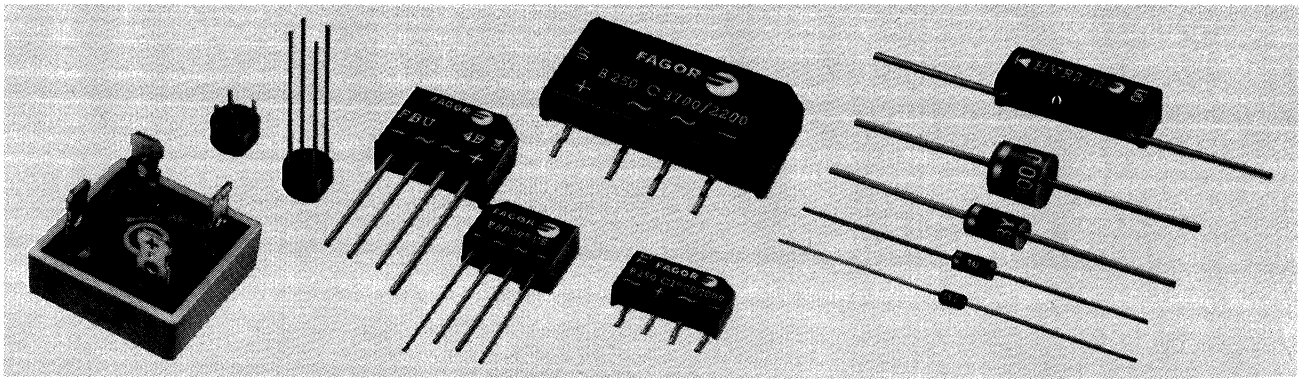
* Available in both unidirectional & bi-directional

TRANSIENT SUPPRESSOR DIODES P6KE SERIES

Breakdown V_{BR} Volts Nom	Breakdown @1T mA	Type	Max. Clamping Voltage V_{CL} at I_{pp} max. 1ms Expo. Volts	Amps	Breakdown V_{BR} Volts Nom	Breakdown @1T mA	Type	Max. Clamping Voltage V_{CL} at I_{pp} max. 1ms Expo. Volts	Amps	Breakdown V_{BR} Volts Nom	Breakdown @1T mA	Type	Max. Clamping Voltage V_{CL} at I_{pp} max. 1ms Expo. Volts	Amps
7.5	10	P6KE7.5A	11.3	53	24	1	P6KE24A	33.2	18	75	1	P6KE75A	103.0	5.8
8.2	10	P6KE8.2A	12.1	50	27	1	P6KE27A	37.5	16	82	1	P6KE82A	113.0	5.3
9.1	1	P6KE9.1A	13.4	45	30	1	P6KE30A	41.4	14.4	91	1	P6KE91A	125.0	4.8
10	1	P6KE10A	14.5	41	33	1	P6KE33A	45.7	13.2	100	1	P6KE100A	137.0	4.4
11	1	P6KE11A	15.6	38	36	1	P6KE36A	49.9	12	110	1	P6KE110A	152.0	4.0
12	1	P6KE12A	16.7	36	39	1	P6KE39A	53.9	12.2	120	1	P6KE120A	165.0	3.6
13	1	P6KE13A	18.2	33	43	1	P6KE43A	59.3	10.1	130	1	P6KE130A	179.0	3.3
15	1	P6KE15A	21.0	28	47	1	P6KE47A	64.8	9.3	150	1	P6KE150A	207.0	2.9
16	1	P6KE16A	22.5	27	51	1	P6KE51A	70.1	8.6	160	1	P6KE160A	219.0	2.7
18	1	P6KE18A	26.5	23	62	1	P6KE62A	77.0	7.8	170	1	P6KE170A	234.0	2.6
20	1	P6KE20A	27.7	22	56	1	P6KE56A	85.0	7.1	180	1	P6KE180A	246.0	2.4
22	1	P6KE22A	30.6	20	68	1	P6KE68A	92.0	6.5	200	1	P6KE200A	274.0	2.2

Part numbers shown are for unipolar devices. Add C or CA suffix to specify bipolar suppressors. Also available in other tolerances.

FAGOR Electronic Components Inc. — Quality Discrete Silicon Semiconductors



GENERAL PURPOSE RECTIFIERS

FAST RECOVERY RECTIFIERS

	I_O, AVERAGE RECTIFIED FORWARD CURRENT (Amperes)						
	1.0	1.5	3.0	6.0	1.0	3.0	5.0
	DO-41 Plastic	DO-15 Plastic	DO-27A Plastic	P-6 Plastic	DO-15 Plastic	DO-27A Plastic	P6 Plastic
V_{RRM} VOLTS							
50	1N4001	1N5391	1N5400	P600A	1N4933	MR850	MR820
100	1N4002	1N5392	1N5401	P600B	1N4934	MR851	MR821
200	1N4003	1N5393	1N5402	P600D	1N4935	MR852	MR822
300	....	1N5394	....	....	....	....	....
400	1N4004	1N5395	1N5404	P600G	1N4936	MR854	MR824
500	....	1N5396	....	....	....	....	....
600	1N4005	1N5397	1N5406	P600J	1N4937	MR856	MR826
800	1N4006	1N5398	1N5407	P600K	....	....	....
1000	1N4007	1N5399	1N5408	....	....	....	....
1300	BY133*	....	....	....	....	....	....

BRIDGE RECTIFIERS

	I_O, AVERAGE RECTIFIED FORWARD CURRENT (Amperes)							
	1.0	1.5		4.0	10.0	25.0	35.0	50.0
	Plastic Case	Plastic Case	Plastic Case	Plastic Case	Metal Case	Metal Case	Metal Case	Metal Case
V_{RRM}								
50	WL005F	W005F	FBP005	FBU4A	....	FB2500	FB3500	FB5000
100	....	....	....	FBU4B	FB1001	FB2501	FB3501	FB5001
200	WL02F	W02F	FBP02	FBU4D	FB1002	FB2502	FB3502	FB5002
400	WL04F	W04F	FBP04	FBU4G	FB1004	FB2504	FB3504	FB5004
600	WL06F	W06F	FBP06	FBU4J	FB1006	FB2506	FB3506	FB5006
800	WL08F	W08F	FBP08	FBU4K	....	....	....	....
1000	WF10F	W10F	FBP10	FBU4M	....	....	....	....

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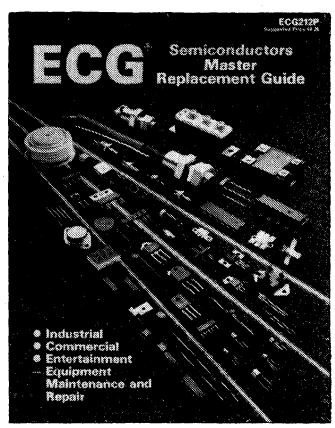
Silicon Controlled Switch (SCS) .....
Bilateral Trigger Diodes (DIACs) .....



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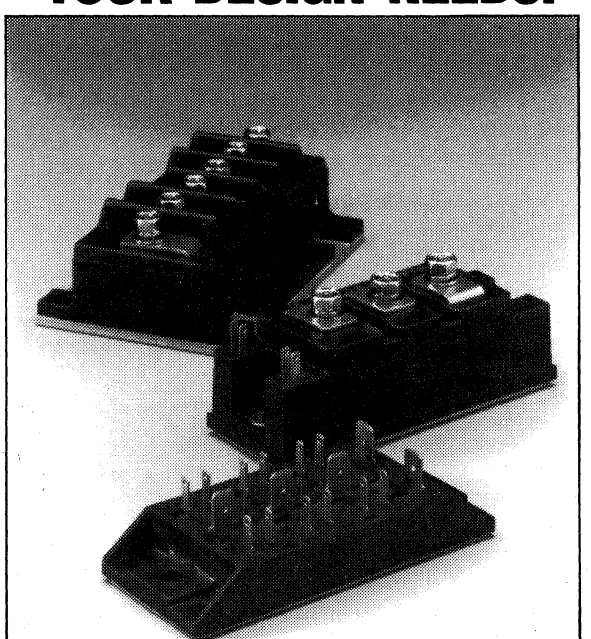

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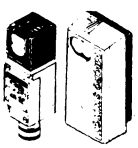
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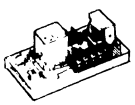
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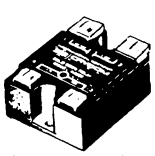
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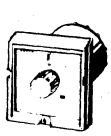
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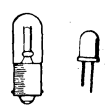
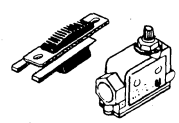

LAMPS & LEDS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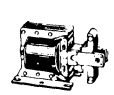
RELAYS

INDICATOR LIGHTS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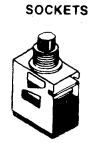
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TIMERS

PADDLE SWITCHES

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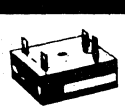
TIMERS

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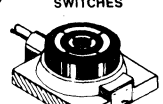
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Part Number Definition

Technology	Current Range	I_{GT}-Current Range Sensitive Gate SCR's ($<200\mu A$)			Non-Sensitive SCR's ($>200\mu A$)			Voltage	Package
SCR		Code	Min	Max(μA)	Code	Min	Max(mA)		
E = Epitaxial (Fast) F = Fast (gold doped, glass passivated) L = Light activated P = Planar S = Glass passivated X = Top Glass	01 = up to 1A 02 = up to 2A 03 = 3A 04 = 4A 05 = 5A 06 = 6A 08 = 8A **10 = 10A** 12 = 12A 15 = 15A 16 = 16A 25 = 25A 40 = 40A	00 = 01 = 02 = 03 = 04 = 05 = 06 = 07 = 08 = 09 = 10 =	— 1 — 20 — 20 50 — 1 — 5	20 20 200 200 50 50 200 5 5 1 20	05 = 07 = 08 = 10 = 12 = 13 = 14 = 15 =	— 5 — 10 25 — 30 1	5 10 10 25 50 50 75 5	Y = 30 F = 60 A = 100 B = 200 C = 300 D = 400 **M = 600** S = 700 N = 800 P = 1000 V = 1200	A = TO-92 B = RD-26 C = SOT-89 D = TO-18 E = TO-202-1 F = TO-202-2 G = TO-39 **H = TO-220** J = TO-220 Isolated K = RD-101 Isolated L = SOT-23 M = Micro Mini Q = RD-101 Isolated Gate Faston 0.8 mm R = DO-35 S = Sub Mini T = TO-92 Taped and Reeled U = TO-218 V = Vial W = Waffle Pack X = Expanded Water Y = Unscribed Wafer Z = Specials

Triacs

Code	mA I	max II	in III	Quad IV
02 =	3	3	3	3
05 =	5	5	5	5
09 =	10	10	10	10
10 =	**25**	**25**	**25**	**25**
12 =	50	50	50	50
13 =	50	50	50	75

Diacs VBO (Volts)

Code	Min	Typ	Max
01	29	32	35
02	30	32	34
03	28	32	36

Special Selections on all Products

Codes 20 to 99

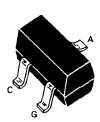
Triac

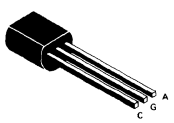
T = Glass passivated
Z = Top Glass

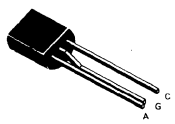
Diac

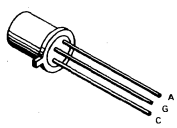
D = Glass passivated

Example T1010MH: T = Glass passivated Triac / 10 = 10A / 10 = I_{GT} 25/25/25/25 ma / M = 600 V / H = TO-220


SOT 23


TO 92


RD 26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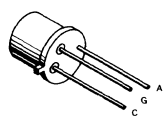
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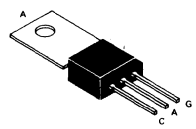
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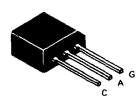
TO 202-2

SCR'S

Package	$I_{T\ (RMS)}$ (Amps)	V_{DRM} V_{RRM}	I_{GT}(μA) Min–Max – 1	Min–Max – 5	Min–Max 1 5	Min–Max – 20	Min–Max 1 20	Min–Max 5 20	Min–Max 20 50	Min–Max – 50	Min–Max 20 200	Min–Max 50 200	Min–Max – 200
SOT 23	0.2	100											P0102AL
		200											P0102BL
		300											P0102CL
		400											P0102DL
TO 92	0.8	100	P0109AA	P0107AA	P0108AA	P0100AA	P0101AA	P0110AA	P0105AA	P0104AA	P0103AA		P0102AA
		200	P0109BA	P0107BA	P0108BA	P0100BA	P0101BA	P0110BA	P0105BA	P0104BA	P0103BA		P0102BA
		300	P0109CA	P0107CA	P0108CA	P0100CA	P0101CA	P0110CA	P0105CA	P0104CA	P0103CA		P0102CA
		400	P0109DA	P0107DA	P0108DA	P0100DA	P0101DA	P0110DA	P0105DA	P0104DA	P0103DA		P0102DA
		600					P0101MA	P0110MA			P0103MA		
		800					P0101NA	P0110NA			P0103NA		
	0.8	200							X0105BA	X0104BA	X0103BA	X0106BA	X0102BA
		400							X0105DA	X0104DA	X0103DA	X0106DA	X0102DA
		600							X0105MA	X0104MA	X0103MA	X0106MA	X0102MA
		800							X0105NA	X0104NA	X0103NA	X0106NA	X0102NA
	1.25	200							X0205BA	X0204BA	X0203BA	X0206BA	X0202BA
		400							X0205DA	X0204DA	X0203DA	X0206DA	X0202DA
		600							X0205MA	X0204MA	X0203MA	X0206MA	X0202MA
		800							X0205NA	X0204NA	X0203NA	X0206NA	X0202NA
RD 26	0.8	100	P0109AB	P0107AB	P0108AB	P0100AB	P0101AB	P0110AB	P0105AB	P0104AB	P0103AB		P0102AB
		200	P0109BB	P0107BB	P0108BB	P0100BB	P0101BB	P0110BB	P0105BB	P0104BB	P0103BB		P0102BB
		300	P0109CB	P0107CB	P0108CB	P0100CB	P0101CB	P0110CB	P0105CB	P0104CB	P0103CB		P0102CB
		400	P0109DB	P0107DB	P0108DB	P0100DB	P0101DB	P0110DB	P0105DB	P0104DB	P0103DB		P0102DB
TO 18	1.0	100											P0102AD
		200											P0102BD
		300											P0102CD
		400											P0102DD
TO 39	3.3	200							X0305BG		X0303BG		X0302BG
		400							X0305DG		X0303DG		X0302DG
		600							X0305MG		X0303MG		X0302MG
		800							X0305NG		X0303NG		X0302NG
TO 202-1	4	200							X0405BE		X0403BE		X0402BE
		400							X0405DE		X0403DE		X0402DE
		600							X0405ME		X0403ME		X0402ME
		800							X0405NE		X0403NE		X0402NE
TO 202-2	4	200							X0405BF		X0403BF		X0402BF
		400							X0405DF		X0403DF		X0402DF
		600							X0405MF		X0403MF		X0402MF
		800							X0405NF		X0403NF		X0402NF

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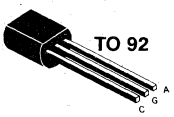

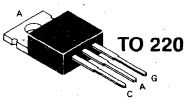

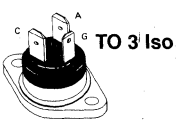

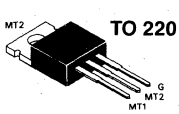

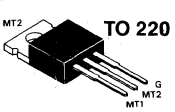

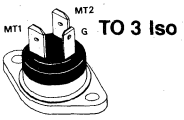

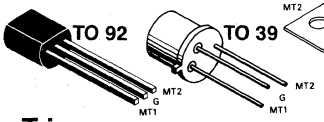

SCR's

Package	$I_{T\ (RMS)}$ (Amps)	V_{DRM} V_{RRM}	I_{GT}(mA) Min–Max 0.2	Min–Max 5.0	Min–Max 1 5	Min–Max 5.0 10	Min–Max 10 25
To 92 (Preliminary)	1.25	200 400 600 800			X0215BA X0215DA X0215MA X0215NA		
TO 220	4	200 400 600 800	S0402BH S0402DH S0402MH S0402NH	S0405BH S0405DH S0405MH S0405NH		S0407BH S0407DH S0407MH S0407NH	S0410BH S0410DH S0410MH S0410NH
	6	200 400 600 800	S0602BH S0602DH S0602MH S0602NH	S0605BH S0605DH S0605MH S0605NH		S0607BH S0607DH S0607MH S0607NH	S0610BH S0610DH S0610MH S0610NH
	8	200 400 600 800	S0802BH S0802DH S0802MH S0802NH	S0805BH S0805DH S0805MH S0805NH		S0807BH S0807DH S0807MH S0807NH	S0810BH S0810DH S0810MH S0810NH
	10	200 400 600 800		S1005BH S1005DH S1005MH S1005NH		S1007BH S1007DH S1007MH S1007NH	S1010BH S1010DH S1010MH S1010NH
	12	200 400 600 800		S1205BH S1205DH S1205MH S1205NH		S1207BH S1207DH S1207MH S1207NH	S1210BH S1210DH S1210MH S1210NH

SCR's

Package	$I_{T\ (RMS)}$ (Amps)	V_{DRM} V_{RRM}	I_{GT}(mA) Min–Max 10 25	Min–Max 25 50	Min–Max 30 75
TO 220	16	200 400 600 800	S1610BH S1610DH S1610MH S1610NH	S1612BH S1612DH S1612MH S1612NH	
	25	200 400 600 800		S2512BH S2512DH S2512MH S2512NH	S2514BH S2514DH S2514MH S2514NH
	40	200 400 600 800		S4012BH S4012DH S4012MH S4012NH	S4014BH S4014DH S4014MH S4014NH
TO 3 Iso	25*	200 400 600 800		S2512BK S2512DK S2512MK S2512NK	S2514BK S2514DK S2514MK S2514NK
	25**	200 400 600 800		S2512BQ S2512DQ S2512MQ S2512NQ	S2514BQ S2514DQ S2514MQ S2514NQ
	40*	200 400 600 800		S4012BK S4012DK S4012MK S4012NK	S4014BK S4014DK S4014MK S4014NK
	40**	200 400 600 800		S4012BQ S4012DQ S4012MQ S4012NQ	S4014BQ S4014DQ S4014MQ S4014NQ

* Gate Faston Thickness 0.5 mm **Gate Faston Thickness 0.8 mm

Triacs

Package	$I_{T\ (RMS)}$ (Amps)	V_{DRM} V_{RRM}	I_{GT}(mA) Maximum Q1–Q4 3	Q1–Q4 5	Q1–Q4 10	Q1–Q4 25
TO 92	0.8	200 400 600 800	Z0102BA Z0102DA Z0102MA Z0102NA	Z0105BA Z0105DA Z0105MA Z0105NA	Z0109BA Z0109DA Z0109MA Z0109NA	Z0110BA Z0110DA Z0110MA Z0110NA
TO 39	3	200 400 600 800	Z0302BG Z0302DG Z0302MG Z0302NG	Z0305BG Z0305DG Z0305MG Z0305NG	Z0309BG Z0309DG Z0309MG Z0309NG	Z0310BG Z0310DG Z0310MG Z0310NG
TO 202-1	4	200 400 600 800	Z0402BE Z0402DE Z0402ME Z0402NE	Z0405BE Z0405DE Z0405ME Z0405NE	Z0409BE Z0409DE Z0409ME Z0409NE	Z0410BE Z0410DE Z0410ME Z0410NE
TO 202-2	4	200 400 600 800	Z0402BF Z0402DF Z0402MF Z0402NF	Z0405BF Z0405DF Z0405MF Z0405NF	Z0409BF Z0409DF Z0409MF Z0409NF	Z0410BF Z0410DF Z0410MF Z0410NF

Triacs

Package	$I_{T\ (RMS)}$ (Amps)	V_{DRM} V_{RRM}	I_{GT}(mA) Maximum Q1–Q4 5	Q1–Q4 10	Q1–Q4 25	Q1–Q4 50	Q1–Q3, Q4 50 75
TO 220	5	200 400 600 800	T0505BH T0505DH T0505MH T0505NH	T0509BH T0509DH T0509MH T0509NH	T0510BH T0510DH T0510MH T0510NH	T0512BH T0512DH T0512MH T0512NH	
	6	200 400 600 800	T0605BH T0605DH T0605MH T0605NH	T0609BH T0609DH T0609MH T0609NH	T0610BH T0610DH T0610MH T0610NH	T0612BH T0612DH T0612MH T0612NH	
	8	200 400 600 800	T0805BH T0805DH T0805MH T0805NH	T0809BH T0809DH T0809MH T0809NH	T0810BH T0810DH T0810MH T0810NH	T0812BH T0812DH T0812MH T0812NH	
	10	200 400 600 800			T1010BH T1010DH T1010MH T1010NH	T1012BH T1012DH T1012MH T1012NH	T1013BH T1013DH T1013MH T1013NH
	12	200 400 600 800			T1210BH T1210DH T1210MH T1210NH	T1212BH T1212DH T1212MH T1212NH	T1213BH T1213DH T1213MH T1213NH
	16	200 400 600 800				T1612BH T1612DH T1612MH T1612NH	T1613BH T1613DH T1613MH T1613NH
	25	200 400 600 800				T2512BH T2512DH T2512MH T2512NH	T2513BH T2513DH T2513MH T2513NH

Iso-Triacs

U.L. Recognized, File Nr. E72763(M)

Package	$I_{T\ (RMS)}$ (Amps)	V_{DRM} V_{RRM}	I_{GT}(mA) Q1–Q4 10	Q1–Q4 25	Q1–Q4 50	Q1–Q3, Q4 50 75
TO 220 Iso	4	200 400 600 800	T0409BJ T0409DJ T0409MJ T0409NJ	T0410BJ T0410DJ T0410MJ T0410NJ		
	6	200 400 600 800	T0609BJ T0609DJ T0609MJ T0609NJ	T0610BJ T0610DJ T0610MJ T0610NJ	T0612BJ T0612DJ T0612MJ T0612NJ	
	8	200 400 600 800		T0810BJ T0810DJ T0810MJ T0810NJ	T0812BJ T0812DJ T0812MJ T0812NJ	T0813BJ T0813DJ T0813MJ T0813NJ
	10	200 400 600 800		T1010BJ T1010DJ T1010MJ T1010NJ	T1012BJ T1012DJ T1012MJ T1012NJ	T1013BJ T1013DJ T1013MJ T1013NJ
	12	200 400 600 800			T1212BJ T1212DJ T1212MJ T1212NJ	T1213BJ T1213DJ T1213MJ T1213NJ
	15	200 400 600 800			T1512BJ T1512DJ T1512MJ T1512NJ	T1513BJ T1513DJ T1513MJ T1513NJ
TO 3 Iso	25*	200 400 600 800			T2512BK T2512DK T2512MK T2512NK	T2513BK T2513DK T2513MK T2513NK
	25**	200 400 600 800			T2512BQ T2512DQ T2512MQ T2512NQ	T2513BQ T2513DQ T2513MQ T2513NQ
	40*	200 400 600 800			T4012BK T4012DK T4012MK T4012NK	T4013BK T4013DK T4013MK T4013NK
	40**	200 400 600 800			T4012BQ T4012DQ T4012MQ T4012NQ	T4013BQ T4013DQ T4013MQ T4013NQ

* Gate Faston Thickness 0.5 mm
**Gate Faston Thickness 0.8 mm

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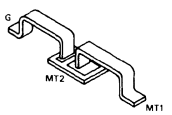

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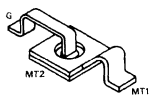

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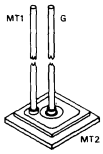

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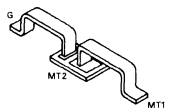

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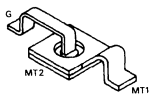

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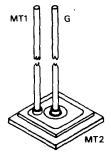


Sub Mini

Preassembled SCR's

Package	$I_{T\ (RMS)}$ (Amps)	V_{DRM} V_{RRM}	I_{GT}(mA) Min–Max – 5	Min–Max – 10	Min–Max 10 25	Min–Max 25 50
Micro Mini	8	200	S0805BM	S0808BM	S0810BM	
		400	S0805DM	S0808DM	S0810DM	
		600	S0805MM	S0808MM	S0810MM	
Micro Mini	12	200	S1205BM	S1208BM	S1210BM	
		400	S1205DM	S1208DM	S1210DM	
		600	S1205MM	S1208MM	S1210MM	
	16	200		S1608BM	S1610BM	S1612BM
		400		S1608DM	S1610DM	S1612DM
		600		S1608MM	S1610MM	S1612MM
	25	200			S2510BM	S2512BM
		400			S2510DM	S2512DM
		600			S2510MM	S2512MM
Sub Mini	12	200	S1205BS	S1208BS	S1210BS	
		400	S1205DS	S1208DS	S1210DS	
		600	S1205MS	S1208MS	S1210MS	
	16	200		S1608BS	S1610BS	S1612BS
		400		S1608DS	S1610DS	S1612DS
		600		S1608MS	S1210MS	S1612MS

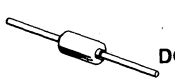
Preassembled Triacs

Package	$I_{T\ (RMS)}$ (Amps)	V_{DRM} V_{RRM}	I_{GT}(mA) Q1–Q4 5	Q1–Q4 10	Q1–Q4 25	Q1–Q4 50	Q1–Q3,Q4 50 75
Micro Mini	5	200	T0505BM	T0509BM	T0510BM	T0512BM	
		400	T0505DM	T0509DM	T0510DM	T0512DM	
		600	T0505MM	T0509MM	T0510MM	T0512MM	
Micro Mini	8	200	T0805BM	T0809BM	T0810BM	T0812BM	
		400	T0805DM	T0809DM	T0810DM	T0812DM	
		600	T0805MM	T0809MM	T0810MM	T0812MM	
	12	200			T1210BM	T1212BM	T1213BM
		400			T1210DM	T1212DM	T1213DM
		600			T1210MM	T1212MM	T1213MM
	16	200				T1612BM	T1613BM
		400				T1612DM	T1613DM
		600				T1612MM	T1613MM
Sub Mini	8	200	T0805BS	T0809BS	T0810BS	T0812BS	
		400	T0805DS	T0809DS	T0810DS	T0812DS	
		600	T080MSM	T0809MS	T0810MS	T0812MS	
	12	200			T1210BS	T1212BS	T1213BS
		400			T1210DS	T1212DS	T1213DS
		600			T1210MS	T1212MS	T1213MS

Chips

Chip	$I_{T(RMS)}$ (Amps)	Plating Ni 50/50	Ni 10/90	Al top, Au back	Al top, Cr Ni Ag back	Packaging Wafer	Expanded Wafer	Vial	Waffle	SCR I_{GT} 200 µA	1–5 mA	5–10 mA	10–25 mA	25–50 mA	Triac I_{GT} 5 mA Q1-4	10 mA Q1-4	25 mA Q1-4	50 mA Q1-4	50 mA Q1-3, 75mAQ4	V_{DRM}/V_{RRM} 200V	400V	600V	Full Charact Refer to Part Nr.
SP 01	0.8			●		●	●	●	●	●										●	●		P0102DA
STE 0	0.8				●	●	●	●	●	●										●	●	●	X0102MA
STE 1	4				●	●	●	●	●	●										●	●	●	X0402ME
S 1.6	8	●	●					●	●	●	●	●	●							●	●	●	S0805MH
S 3	12	●	●					●	●		●	●	●							●	●	●	S1207MH
S 5.7	16	●	●					●	●		●	●	●							●	●	●	S1610MH
S 8	25	●	●					●	●			●	●	●						●	●	●	S2512MH
S 16	40	●	●					●	●			●	●	●						●	●	●	S4012MK
TTE 1	4				●	●	●	●	●						●	●	●			●	●	●	Z0409ME
T 1.6	5	●	●					●	●						●	●	●	●		●	●	●	T0509MH
T 3	8	●	●					●	●						●	●	●	●		●	●	●	T0810MH
T 5.7	12	●	●					●	●								●	●	●	●	●	●	T1210MH
T 8	16	●	●					●	●								●	●	●	●	●	●	T1612MH
T 16	40	●	●					●	●									●	●	●	●	●	T4012MH
SP 02	1.0			●				●	●	OPTO-SCR										●	●		L0100DV

● Available Options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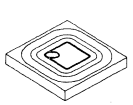
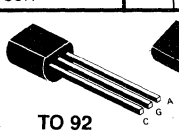
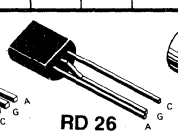

Light activated SCR's



TO 92



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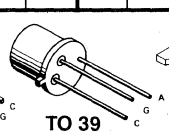

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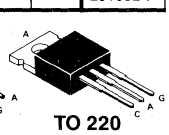

TO 220

Miscellaneous

Diacs	V_{BO} Min.	Typ	Max.	$\triangle V_{BO}$ Max.	Part Number
DO 35	29	32	35	2	D0201YR
	30	32	34	2	D0202YR
	28	32	36	3	D0203YR

Light activated SCR's	$I_{T(RMS)}$	V_{DRM} V_{RRM}	Part Number	Effective Trigger Irradiance H_{ET}
	1.0	200	L0100BV	70 mW/cm² GaAs Source at 945 nm or
		400	L0100DV	210 mW/cm² Tungsten Source at 2870 K
	3.0	200	L0300BV	70 mW/cm²GaAs Source at 945 nm or
		400	L0300DV	210 mW/cm² Tungsten Source at 2870 K

Fast SCR's

Package	$I_{T(RMS)}$ (Amps)	V_{DRM} V_{RRM}	tq µs at Tj 125°C	tgd µs at Tj 125°C	I_{GT}(µA) Min–Max – 200	I_{GT}(mA) Min–Max 10 25
TO 92	0.8	30	10	0.05	E0102YA	
		60	10	0.05	E0102FA	
		100	10	0.05	E0102AA	
RD 26	0.8	30	10	0.05	E0102YB	
		60	10	0.05	E0102FB	
		100	10	0.05	E0102AB	
TO 39	1.0	30	10	0.05	E0102YG	
		60	10	0.05	E0102FG	
		100	10	0.05	E0102AG	
TO 220	8	200	15	500		F0810BH
		400	15	500		F0810DH
		600	15	500		F0810MH
		800	15	500		F0810NH

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GL351

GL352

GL360

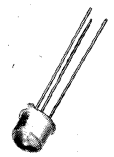
GL420

GL430

GL450

GL452

GL532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GL504

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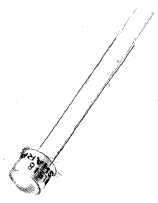
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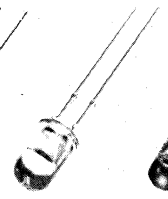
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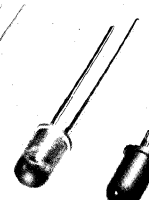
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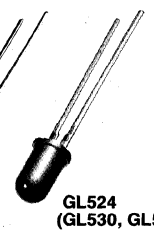
GL524
(GL530, GL531)

Infrared Light Emitting Diodes

(TA = 25°C)

Model No.	Package	Absolute maximum ratings				Φe(mW)			VF(V)			Δθ (deg.)	λp (nm)
		IF (mA)	VR (V)	P (mW)	Topr (°C)	MIN.	TYP.	IF (mA)	TYP.	MAX.	IF (mA)	TYP.	TYP.
GL351	φ3 ceramic	60	3	90	−25 ~ +100	1.7	3.3	40	1.2	1.4	40	±78	950
GL371	φ3 resin stem	50	6	75	−25 ~ + 85	1.7	3.3	40	1.3	1.6	40	±90	950
GL352	φ3 ceramic	60	3	90	−25 ~ +100	1.7	3.3	40	1.2	1.4	40	±52	950
GL372	φ3 resin stem	50	6	75	−25 ~ + 85	1.7	—	40	1.3	1.6	40	±70	950
GL360	φ3 resin	60	3	90	−25 ~ + 85	1.5	2.4	40	1.3	1.5	40	±20	950
GL420	Resin with lens	50	6	75	−25 ~ + 85	0.75	—	20	1.2	1.4	20	±30	950
GL430	Resin with lens	50	6	75	−25 ~ + 85	0.5	1.1	20	1.2	1.4	20	±13	950
GL450*	Resin with bidirectional lens	50	6	75	−25 ~ + 85	0.7	1.0	20	1.2	1.4	20	±18	950
GL452	Resin with bidirectional lens	50	6	75	−25 ~ + 85	0.7	1.0	20	1.2	1.4	20	±18	950
GL480	Epoxy resin	50	6	75	−25 ~ + 85	0.7	—	20	1.2	1.4	20	±13	950
GL504	TO-18	100	6	150	−40 ~ +125	0.72	2.16	50	1.3	1.4	50	± 7	950
GL514	TO-18	150	6	250	−40 ~ +125	3.31	5.35	100	1.35	1.6	100	± 7	950
GL513F	TO-18	150	6	250	−40 ~ +125	1.44	2.88	100	1.35	1.6	100	±50	950
GL518	TO-18	80	6	120	−25 ~ +125	2.0	3.0	50	1.3	1.6	50	±10	950
GL520	φ5 resin	80	6	120	−25 ~ + 85	1.0	—	20	1.2	1.4	20	±18	950
GL521	φ5 resin	100	6	150	−25 ~ + 85	1.6	—	20	1.2	1.4	20	±13	950
GL522	φ5 resin	100	6	150	−25 ~ + 80	5*	10*	50	1.25	1.45	50	±25	950
GL524	φ5 resin	100	6	150	−25 ~ + 80	8*	16*	50	1.25	1.45	50	±15	950
GL526	TO-18 Infrared	100	6	150	−25 ~ +100	2.5	5.0	100	1.35	1.85	100	±38	950
	TO-18 Red color	50	4	100		1.0	2.0	50	1.85	2.5	50	±38	660
GL530	φ5 resin	100	6	150	−25 ~ + 80	7.5*	10.0	50	1.25	1.45	50	±25	950
GL531	φ5 resin	100	6	150	−25 ~ + 80	12*	10.0	50	1.25	1.45	50	±15	950
GL532	φ5 resin	50	3	70	−20 ~ + 50	—	30*	50	1.25	1.4	50	± 2	940

* GL451, long lead version of GL450, is also available.
* Radiation intensity mw/sr

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SHARP Optoelectronics

GaAs Hall Devices

LT110-LT120-LT130 series

LT140-LT150 series

LT130S series

LT140S

Taping type

GaAs Hall Devices

Package size (mm)	Forming type		Straight type	
		Taping		Taping
1.5 × 2.9 × 1.1	LT110	LT110A		
	LT120	LT120A		
	LT130	LT130A	LT130S	LT130SA
1.45 × 1.45 × 0.6	LT140	LT140A	LT140S	LT140SA
	LT150	LT150A		

Absolute Maximum Rating*

Parameter	Symbol	Rating	Unit
Control voltage	V_C	12	V
Power dissipation	P_D	150	mW
Operating temperature	Topr	−55 ~ +125	°C
Storage temperature	Tstg	−55 ~ +150	°C

Electrical characteristics*

Parameter	Symbol	Condition	LT110 series			LT120 series			LT130 series			Unit
			MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
No-load Hall voltage	V_H	V_C = 6V, B = 1kG	100	110	120	145	160	175	230	270	310	mV
Unbalance ratio	V_{HO}/V_H	V_C = 6V, B = 0/B = 1kG	−12		12	−12		12	−17mV*		17mV*	%
Input resistance	Rin	I_C = 1mA, B = 0	600	700	800	650	800	950	600	800	1000	Ω
Output resistance	Rout	I_C = 1mA, B = 0	600	700	800	1300	1600	1900			5000	Ω
Temperature coefficient of Hall voltage	V_{HT}	I_C = 6mA, B = 1kG			−0.06			−0.06		−0.03		%/°C
Temperature coefficient of input resistance	R_T	I_C = 1mA, B = 0			0.3			0.3			0.3	%/°C
Linearity of Hall voltage	ΔK	I_C = 6mA, B = 1kG ~ 5kG			2			2			2	%

Parameter	Symbol	Condition	LT140 series			LT150 series			Unit
			MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
No-load Hall voltage	V_H	V_C = 6V, B = 1kG	145	160	175	170	190	210	mV
Unbalance ratio	V_{HO}/V_H	V_C = 6V, B = 0/B = 1kG	−12		12	−17mV*		17mV*	%
Input resistance	Rin	I_C = 1mA, B = 0	650	800	950	600	800	1000	Ω
Output resistance	Rout	I_C = 1mA, B = 0	1300	1600	1900			5000	Ω
Temperature coefficient of Hall voltage	V_{HT}	I_C = 6mA, B = 1kG			−0.06			−0.06	%/°C
Temperature coefficient of input resistance	R_T	I_C = 1mA, B = 0			0.3			0.3	%/°C
Linearity of Hall voltage	ΔK	I_C = 6mA, B = 1kG ~ 5kG			2			2	%

* Absolute value

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SHARP Optoelectronics

Power Devices

Multi-functional Regulator

(Ta = 25°C)

Model No.	Features		Absolute maximum ratings: DC input voltage V_{IN} (V)	Absolute maximum ratings: Power dissipation (W) Pd1 *1	Absolute maximum ratings: Power dissipation (W) Pd2 *2	Absolute maximum ratings: Operating temp. Topr (°C)	Electrical characteristics: Load variation ratio Reg_L (op) MAX.	Electrical characteristics: Load variation ratio I_O (A)	Output Voltage V_O (V) MAX.
PQ05R01	• Built-in output voltage ON/OFF control circuit • Built-in overcurrent protection circuit • Built-in overheat compensation circuit	Center-tap rectifier	31.0	2.0	20.0	−20 ~ +80	1.0	0.25 ~ 0.75	5.35
PQ05R02		Bridge rectifier							
PQ05R03		DC input							
PQ09R01		Center-tap rectifier							9.55
PQ09R02		Bridge rectifier							
PQ09R03		DC input							
PQ012R01		Center-tap rectifier							12.70
PQ012R02		Bridge rectifier							
PQ012R03		DC input							
PQ05R04	Low-priced DC input. Built-in output voltage ON/OFF control circuit. Built-in overcurrent protection circuit and overheat compensation circuit			1.5	30.3				5.35
PQ09R04									9.55
PQ12R04									12.70
PQ05R041	High precision output voltage type (±2.5%) of PQ✻✻R04 series (✻✻ shows 05, 09 or 12)								5.12
PQ09R041									9.22
PQ12R041									12.30
PQ05R05	Type with output voltage minuite adjustment terminal of PQ✻✻R04 series (Without output voltage ON/OFF control function)								5.35
PQ09R05									9.55
PQ12R05									12.70

*1 Ta = 25°C *2 Tc = 25°C

Triacs

Model No.	Package	Absolute maximum ratings: I_T (Arms)	Absolute maximum ratings: V_{DRM} (V)	Absolute maximum ratings: Tj (°C)	Electrical characteristics: I_{DRM}(μA) MAX.	Electrical characteristics: V_{TH}(V) MAX.	Electrical characteristics: dv/dt(V/μs) MIN.	Electrical characteristics: (dv/dt)c(V/μs) MIN.
PQ105A1	TO-220	5	400	−40 ~ +125	100	1.5	30	5
PQ108A1		8	400	−40 ~ +125	100	1.5	30	5
PQ205A1		5	600	−40 ~ +125	100	1.5	30	5
PQ208A1		8	600	−40 ~ +125	100	1.5	30	5

Power Transistor Module

(Ta = 25°C)

Model No.	Absolute maximum ratings: V_{CEO} (V)	Absolute maximum ratings: *5 V_{CEO} (Vrms)	Absolute maximum ratings: Tstg (°C)	Electrical characteristics: h_{FE} MIN.	V_{CE} (V)	I_C (A)	V_{CE} (sat) (V) MAX.	I_C (A)	I_B (A)	ton (μs) MAX.	tf (μs) MAX.	*6 I_C (A)	R_L (Ω)	Vcc (V)
PQ10TM11	600	2,000	−40 ~ +125	100	5	10	2.0	10	0.25	1.5	2.5	10	30	300
PQ15TM11	600	2,000	−40 ~ +125	100	5	15	2.0	15	0.4	1.5	2.5	15	20	300
PQ20TM11	600	2,000	−40 ~ +125	100	5	20	2.0	20	0.5	1.5	2.5	20	15	300

*5 AC voltage is applied between electrode and metallic case for one minute. *6 $+I_B = -I_B = 0.4A$

Power Transistor Module with Incorporating Photocoupler

(Ta = 25°C)

Model No.	Absolute maximum ratings: V_{PT} (V)	Absolute maximum ratings: *7 V_{ISO} (Vrms)	Absolute maximum ratings: Tstg (°C)	Electrical characteristics: I_{FTH} (mA) MAX.	I_O (A)	V_{CE} (sat) (V) MAX.	I_C (A)	I_{CD} (A) TYP.	I_C (A)	ton (μs) MAX.	tf (μs) MAX.	*8 I_C (A)	R_L (Ω)	Vcc (V)
PQ15M01	450	2,000	−40 ~ +100	4.0	15	2.5	15	20	30	10	3	15	20	300

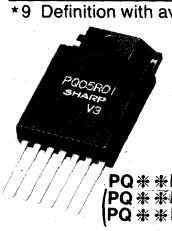
*7 Vpd1: between U(+) and U(−), V(+) and V(−), W(+) and W(−) Vpd2: between X(+) and X(−)
*8 AC 60Hz sine wave for 1 minute between case and terminal

Diode Module

(Ta = 25°C)

Model No.	Absolute maximum ratings: V_{RRM} (V)	Absolute maximum ratings: *9 Io(A) Ta = 40°C	Absolute maximum ratings: *9 Io(A) Tc = 60°C	Absolute maximum ratings: I_{FSM} (A)	Absolute maximum ratings: Tj (°C)	Absolute maximum ratings: Tstg (°C)	Electrical characteristics: Peak forward voltage (V) MAX.	Electrical characteristics: Peak forward current I_{FM} (A)	Electrical characteristics: Repetitive peak current (μA) MAX.	Electrical characteristics: Repetitive peak current V_{RRM} (V)
PQ12DM1	400	3	12.5	*10 400(50Hz)	−40 ~ +150	−40 ~ +150	1.1	50	10	400

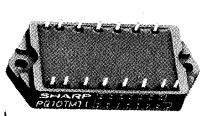
*9 Definition with average output current in half-wave rectification *10 Single trapezoid wave



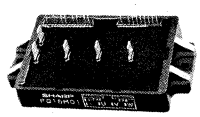
PQ✻✻R01
PQ✻✻R02
PQ✻✻R03

PQ✻✻R04
PQ✻✻R041
PQ✻✻R05

PQ105A1
PQ108A1
PQ205A1
PQ208A1

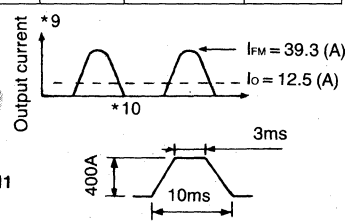


PQ10TM11



PQ15M01

PQ12DM1



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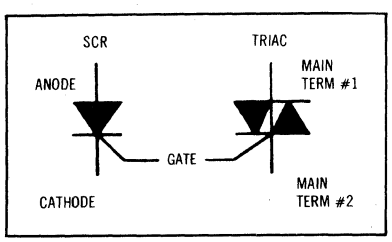
MINIGLOSSARY THYRISTORS/ HIGH POWER DIODES

THYRISTORS

A thyristor is a four-layer semiconductor (pnpn) that can be switched from an OFF to an ON state. This is usually done by a voltage or current pulse to the gate terminal. The device will then continue to conduct so long as the principal current of the device flows through the thyristor's two main terminals.

In many respects a thyristor is analogous to an electromechanical latching relay. In fact, thyristors have largely replaced these relays in newer equipment designs. But, misapplications and/or failure to fully understand the parameters of these and other solid state devices often leads to catastrophic field failures.

The terminology shown on this page has been condensed from common industry data books and is intended to be a guide for the engineer.



di/dt: *Critical rate of rise of ON state current* is the user's maximum design limit (Fig. 1).

di_R/dt: *Rate of decay of ON state current* (Fig. 1 & 2).

dv/dt (critical): *Rate of rise of OFF state voltage*. Lowest voltage rate of rise to cause a thyristor to turn ON.

dv/dt (reapplied) : *Rate of rise of reapplied OFF state voltage.*

I_{FSM}: *Nonrepetitive ON state surge current in diodes.* Maximum peak value of ½ cycles (60 Hz) a diode can withstand up to 100 times in its lifetime.

I_{TSM}: *Nonrepetitive ON state surge current in thyristors*. Maximum peak value of 60 Hz cycles a thyristor can withstand up to 100 times in its lifetime.

I_{DRM}/I_{RRM}: *Maximum peak forward/ reverse leakage current* at specified temperature and repetitive conditions.

I_{GDM}: *Continuous gate current not to trigger*. Highest dc gate current that will *not* cause thyristor to switch from OFF to ON at a specific temperature.

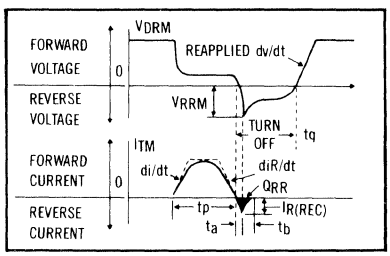


Fig. 1. Concurrent voltage and current waveforms

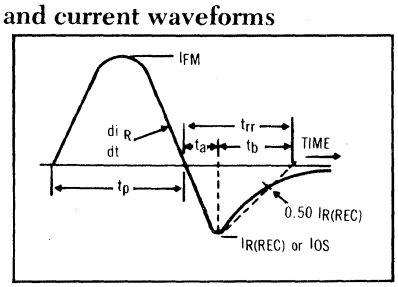


Fig. 2. Recovery current waveform

I_{GT}: *Continuous gate trigger current.* Absolute minimum gate current required to switch thyristor from OFF to ON.

I_H: *Holding Current*. Minimum current required to hold thyristor ON.

I_L: *Latching current*. Minimum current required to hold thyristor ON after removal of gate drive.

$I_{(REC)}$; *Recovery current*. Peak value of reverse current during recovery or turn OFF (Fig. 1 & 2).

I_{OS}: *Overshoot current*. See $I_{R(REC)}$.

I^2t: Maximum ON state, short time thermal capacity of the silicon element for operations less than ½ cycle of 180° conduction angle.

$I_{T(AV)}$: *Average ON state current* (max.)

Q_{RR}: *Reverse recovered charge* (Fig. 1).

$R_{\theta JC}$: *Junction-to-case thermal resistance* in degrees C per watt.

$T_{C(MAX)}$: *Max. allowable case temperature.*

$T_{J(MAX)}$: *Maximum allowable junction temp.*

t_d: *Delay time*. Interval between a specified point at beginning of gate pulse and the instant at which the principal voltage drops to a specified value. (OFF-ON) (Fig. 3)

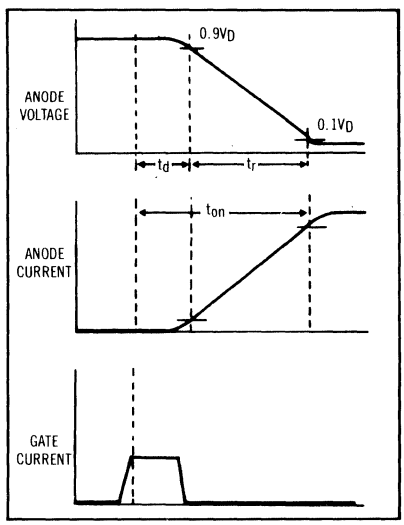


Fig. 3. Turn-on time waveforms

t_{on}: *Turn-on time*. The sum of delay time and rise time. (OFF-ON) (Fig. 3)

t_q: *Turn-off time.* Time between principal current reaching zero and the instant thyristor can block forward voltage without turning ON. (Fig. 1)

t_r: *Rise time*. Time between principal voltage dropping from one value to a second lower value when thyristor turns from OFF to ON. (Fig. 3)

t_{rr}: *Reverse recovery time*. (Fig. 2)

V_{DRM}/V_{RRM}: *Maximum repetitive peak OFF state/reverse voltage* excluding non-repetitive transients.

V_{DSM}/V_{RSM}: *Maximum nonrepetitive peak OFF state/reverse voltage*.

V_{FM}/V_{TM}: *Maximum forward voltage drop* at a specific forward current and case temp.

V_{GDM}: *Gate nontrigger voltage*. Highest dc voltage that will *not* cause thyristor to switch from OFF to ON.

V_{LATCH}: *Latching voltage*. Voltage required for thyristor to latch ON at a given gate current and junction temp.

$V_{TM(DYN)}$: *Dynamic ON state voltage*. Transient ON state voltage of thyristor when triggered into conduction for a given load and time.

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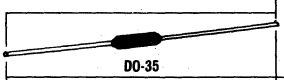
- TRIACS
- SCRs
- DIACS
- SIDACS
- DIODES
- SIDACTORS



DO-35	TO-92	TO-202 AB	TO-220 AB ISOLATED	TO-220 AB NON-ISOLATED	TO-3 BASE	NON-ISOLATED TO-218X	ISOLATED TO-218X	SURFACE MOUNT SOT-89 (TO-243)
HT	E	F	L	R	P	W	J	U

LOGIC TRIACS

IT(RMS)	PART NUMBER	VDRM	*IGT(mA)	PKG. TYPE
0.8 AMP	L200U3	200	3	U
	L400U3	400	3	
	L200U5	200	5	
	L400U5	400	5	
	L200U7	200	10	
	L400U7	400	10	
	L200U9	200	25	
	L400U9	400	25	
1.0 AMP	L201E3	200	3	E
	L401E3	400	3	
	L201E5	200	5	
	L401E5	400	5	
	L201E7	200	10	
	L401E7	400	10	
	L201E9	200	25	
	L401E9	400	25	
1.6 AMPS	L2001L3	200	3	L
	L4001L3	400	3	
	L2001L5	200	5	
	L4001L5	400	5	
	L2001L7	200	10	
	L4001L7	400	10	
	L2001L9	200	25	
	L4001L9	400	25	
4.0 AMPS	L2004L3	200	3	L
	L4004L3	400	3	
	L2004L5	200	5	
	L4004L5	400	5	
	L2004L7	200	10	
	L4004L7	400	10	
	L2004L9	200	25	
	L4004L9	400	25	
	L2004F31	200	3	F
	L4004F31	400	3	
	L2004F51	200	5	
	L4004F51	400	5	
	L2004F71	200	10	
	L4004F71	400	10	
	L2004F91	200	25	
	L4004F91	400	25	
6.0 AMPS	L2006L6	200	5	L
	L4006L6	400	5	
	L2006L7	200	10	
	L4006L7	400	10	
	L2006L9	200	25	
	L4006L9	400	25	
8.0 AMPS	L2008L6	200	5	L
	L4008L6	400	5	
	L2008L7	200	10	
	L4008L7	400	10	
	L2008L9	200	25	
	L4008L9	400	25	

*IGT *in Quadrants I, II, III & IV*

TRIACS

IT(RMS)	PART NUMBER	VDRM	IGTmA	PKG. TYPE
1.0 AMP	Q201U3	200	10	U
	Q401U3	400	10	
	Q201U4	200	25	
	Q401U4	400	25	
	Q201E3	200	10	E
	Q401E3	400	10	
	Q201E4	200	25	
	Q401E4	400	25	
1.6 AMPS	Q2001L3	200	10	L
	Q4001L3	400	10	
	Q2001L4	200	25	
	Q4001L4	400	25	
3.0 AMPS	Q2003L3	200	10	L
	Q4003L3	400	10	
	Q2003L4	200	25	
	Q4003L4	400	25	
4.0 AMPS	Q2004L3	200	10	L
	Q4004L3	400	10	
	Q2004L4	200	25	
	Q4004L4	400	25	
	Q5004L4	500	25	
	Q6004L4	600	25	
	Q8004L5	800	50	
	Q2004F31	200	10	F
	Q4004F31	400	10	
	Q2004F41	200	25	
	Q4004F41	400	25	
	Q5004F41	500	25	
	Q6004F41	600	25	
	Q2004R4	200	25	R
	Q4004R4	400	25	
	Q5004R4	500	25	
	Q6004R4	600	25	
6.0 AMPS	Q2006L4	200	25	L
	Q4006L4	400	25	
	Q5006L4	500	25	
	Q6006L5	600	50	
	Q2006F41	200	25	F
	Q4006F41	400	25	
	Q5006F41	500	25	
	Q6006F51	600	50	
	Q2006R4	200	25	R
	Q4006R4	400	25	
	Q5006R4	500	25	
	Q6006R5	600	50	
	SC141B	200	50	R
	SC141D	400	50	
	SC141E	500	50	
	SC141M	600	50	

TRIACS (cont'd.)

IT(RMS)	PART NUMBER	VDRM	IGT(mA)	PKG. TYPE
6.0 AMPS	T2500B	200	25	R
	T2500D	400	25	
	T2801B	200	80	
	T2801C	300	80	
	T2801D	400	80	
	T2801E	500	80	
	T2801M	600	80	
8.0 AMPS	Q2008L4	200	25	L
	Q4008L4	400	25	
	Q5008L4	500	25	
	Q6008L5	600	50	
	Q2008F41	200	25	F
	Q4008F41	400	25	
	Q5008F41	500	25	
	Q6008F51	600	50	
	Q2008R4	200	25	R
	Q4008R4	400	25	
	Q5008R4	500	25	
	Q6008R5	600	50	
	2N6342	200	50	
	2N6343	400	50	
	2N6344	600	50	
	2N6346	200	50	
	2N6347	400	50	
	2N6348	600	50	
	SC143B	200	50	
	SC143D	400	50	
	SC143E	500	50	
	SC143M	600	50	
	T2800B	200	25	
	T2800C	300	25	
	T2800D	400	25	
	T2800E	500	25	
	T2800M	600	25	
	T2802B	200	50	
	T2802C	300	50	
	T2802D	400	50	
	T2802E	500	50	
	T2802M	600	50	
10.0 AMPS	Q2010L5	200	50	L
	Q4010L5	400	50	
	Q5010L5	500	50	
	Q6010L5	600	50	
	Q8010L5	800	50	
	Q2010F51	200	50	F
	Q4010F51	400	50	
	Q5010F51	500	50	
	Q6010F51	600	50	
	Q2010R5	200	50	R
	Q4010R5	400	50	
	Q5010R5	500	50	
	Q6010R5	600	50	
	SC146B	200	50	
	SC146D	400	50	
	SC146E	500	50	
	SC146M	600	50	

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TRIACS, SCRs, DIACS, SIDACS, DIODES, SIDACTORS

THYRISTOR SPECIALIST

TRIACS (cont'd.)

IT(RMS)	PART NUMBER	VDRM	IGT(mA)	PKG. TYPE
12.0 AMPS	Q2012L5	200	50	L
	Q4012L5	400	50	
	Q5012L5	500	50	
	Q6012L5	600	50	
	Q2012R5	200	50	R
	Q4012R5	400	50	
	Q5012R5	500	50	
	Q6012R5	600	50	
	2N6342A	200	50	
	2N6343A	400	50	
	2N6344A	600	50	
	2N6346A	200	50	
	2N6347A	400	50	
	2N6348A	600	50	
	SC149B	200	50	
	SC149D	400	50	
	SC149E	500	50	
	SC149M	600	50	
15.0 AMPS	Q2015L5	200	50	L
	Q4015L5	400	50	
	Q5015L5	500	50	
	Q6015L5	600	50	
	Q8015L9	800	100	
	Q2015R5	200	50	R
	Q4015R5	400	50	
	Q5015R5	500	50	
	Q6015R5	600	50	
	Q8015R9	800	100	
	SC151B	200	50	
	SC151D	400	50	
	SC151E	500	50	
	SC151M	600	50	
25.0 AMPS	Q2025L6	200	80	L
	Q4025L6	400	80	
	Q5025L6	500	80	
	Q6025L6	600	80	
	Q8025L9	800	100	
	Q2025P	200	80	P
	Q4025P	400	80	
	Q5025P	500	80	
	Q6025P	600	80	
	Q2025R6	200	80	R
	Q4025R6	400	80	
	Q5025R6	500	80	
	Q6025R6	600	80	
	Q8025R9	800	100	
	SC129B	200	50	
	SC129D	400	50	
	SC129E	500	50	
	SC129M	600	50	
	Q2025J6	200	80	J
	Q4025J6	400	80	
	Q5025J6	500	80	
	Q6025J6	600	80	
	Q8025J6	800	80	
	Q2025W6	200	80	W
	Q4025W6	400	80	
	Q5025W6	500	80	
	Q6025W6	600	80	
	Q8025W6	800	80	

TRIACS (cont'd.)

IT(RMS)	PART NUMBER	VDRM	IGT(mA)	PKG. TYPE
40.0 AMPS	Q2040P	200	100	P
	Q4040P	400	100	
	Q5040P	500	100	
	Q6040P	600	100	
	Q2040J9	200	100	J
	Q4040J9	400	100	
	Q5040J9	500	100	
	Q6040J9	600	100	
	Q8040J9	800	100	
	Q2040W9	200	100	W
	Q4040W9	400	100	
	Q5040W9	500	100	
	Q6040W9	600	100	
	Q8040W9	800	100	

*IGT in Quadrants I, II & III

QUADRAC's

IT(RMS)	PART NUMBER	VDRM	VOLTS	PKG. TYPE
1.6 AMPS	Q2001LT	200	30-45	L
	Q4001LT	400	30-45	
3.0 AMPS	Q2003LT	200	30-45	L
	Q4003LT	400	30-45	
4.0 AMPS	Q2004LT	200	30-45	L
	Q4004LT	400	30-45	
	Q5004LT	500	30-45	
	Q6004LT	600	30-45	
	Q2004FT1	200	30-45	F
	Q4004FT1	400	30-45	
	Q5004FT1	500	30-45	
	Q6004FT1	600	30-45	
6.0 AMPS	Q2006LT	200	30-45	L
	Q4006LT	400	30-45	
	Q5006LT	500	30-45	
	Q6006LT	600	30-45	
	Q2006FT1	200	30-45	F
	Q4006FT1	400	30-45	
	Q5006FT1	500	30-45	
	Q6006FT1	600	30-45	
8.0 AMPS	Q2008LT	200	30-45	L
	Q4008LT	400	30-45	
	Q5008LT	500	30-45	
	Q6008LT	600	30-45	
	Q2008FT1	200	30-45	F
	Q4008FT1	400	30-45	
	Q5008FT1	500	30-45	
	Q6008FT1	600	30-45	
10.0 AMPS	Q2010LT	200	30-45	L
	Q4010LT	400	30-45	
	Q5010LT	500	30-45	
	Q6010LT	600	30-45	
	Q2010FT1	200	30-45	F
	Q4010FT1	400	30-45	
	Q5010FT1	500	30-45	
	Q6010FT1	600	30-45	
15.0 AMPS	Q2015LT	200	30-45	L
	Q4015LT	400	30-45	
	Q5015LT	500	30-45	
	Q6015LT	600	30-45	

SENSITIVE SCR's

TYPE	PART NUMBER	VDRM & VRRM	IGT(μA)	PKG. TYPE
0.8 AMP	EC103Y	30	200	E
	EC103A	100	200	
	EC103B	200	200	
	EC103C	300	200	
	EC103D	400	200	
	EC103E	500	200	
	EC103M	600	200	
	EC103Y1	30	12	
	EC103A1	100	12	
	EC103B1	200	12	
	EC013C1	300	12	
	EC103D1	400	12	
	EC103E1	500	12	
	EC103M1	600	12	
	EC103Y2	30	50	
	EC103A2	100	50	
	EC103B2	200	50	
	EC103C2	300	50	
	EC103D2	400	50	
	EC103E2	500	50	
	EC103M2	600	50	
	EC103Y3	30	500	
	EC103A3	100	500	
	EC103B3	200	500	
	EC103C3	300	500	
	EC103D3	400	500	
	EC103E3	500	500	
	EC103M3	600	500	
	2N5060	30	200	
	2N5061	60	200	
	2N5062	100	200	
	2N5063	150	200	
	2N5064	200	200	
	2N6564	300	200	
	2N6565	400	200	
1.2 AMPS	S030US1	30	50	U
	S100US1	100	50	
	S200US1	200	50	
	S300US1	300	50	
	S400US1	400	50	
	S500US1	500	50	
	S600US1	600	50	
	S030US2	30	200	
	S100US2	100	200	
	S200US2	200	200	
	S300US2	300	200	
	S400US2	400	200	
	S500US2	500	200	
	S600US2	600	200	
1.6 AMPS	S0301LS1	30	50	L
	S0301LS2	30	200	
	S0301LS3	30	500	
	S0501LS1	50	50	
	S0501LS2	50	200	
	S0501LS3	50	500	
	S1001LS1	100	50	
	S1001LS2	100	200	
	S1001LS3	100	500	
	S2001LS1	200	50	
	S2001LS2	200	200	
	S2001LS3	200	500	
	S4001LS1	400	50	
	S4001LS2	400	200	
	S4001LS3	400	500	

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TRIACS, SCRs, DIACS, SIDACS, DIODES, SIDACTORS

THYRISTOR SPECIALIST

SEN. SCRs (cont'd.)

TYPE	PART NUMBER	V_{DRM} & V_{RRM}	I_{GT}(μA)	PKG. TYPE
3.0 AMPS	S0303LS1	30	50	L
	S0303LS2	30	200	
	S0303LS3	30	500	
	S0503LS1	50	50	
	S0503LS2	50	200	
	S0503LS3	50	500	
	S1003LS1	100	50	
	S1003LS2	100	200	
	S1003SL3	100	500	
	S2003LS1	200	50	
	S2003LS2	200	200	
	S2003LS3	200	500	
	S4003LS1	400	50	
	S4003LS2	400	200	
	S4003LS3	400	500	
4.0 AMPS	T106Q1	15	200	F
	T106Y1	30	200	
	T106F1	50	200	
	T106A1	100	200	
	T106B1	200	200	
	T106C1	300	200	
	T106D1	400	200	
	T106E1	500	200	
	T106M1	600	200	
	T107Q1	15	500	
	T107Y1	30	500	
	T107F1	50	500	
	T107A1	100	500	
	T107B1	200	500	
	T107C1	300	500	
	T107D1	400	500	
	T107E1	500	500	
	T107M1	600	500	
6.0 AMPS	S0306LS2	30	200	L
	S0306LS3	30	500	
	S0506LS2	50	200	
	S0506LS3	50	500	
	S1006LS2	100	200	
	S1006LS3	100	500	
	S2006LS2	200	200	
	S2006LS3	200	500	
	S4006LS2	400	200	
	S4006LS3	400	500	
	S0306FS21	30	200	F
	S0306FS31	30	500	
	S0506FS21	50	200	
	S0506FS31	50	500	
	S1006FS21	100	200	
	S1006FS31	100	500	
	S2006FS21	200	200	
	S2006FS31	200	500	
	S4006FS21	400	200	
	S4006FS31	400	500	
8.0 AMPS	S0308LS2	30	200	L
	S0308LS3	30	500	
	S0508LS2	50	200	
	S0508LS3	50	500	
	S1008LS2	100	200	
	S1008LS3	100	500	
	S2008LS2	200	200	
	S2008LS3	200	500	
	S4008LS2	400	200	
	S4008LS3	400	500	

SEN. SCRs (cont'd.)

TYPE	PART NUMBER	V_{DRM} & V_{RRM}	I_{GT}(μA)	PKG. TYPE
8.0 AMPS	S0308FS21	30	200	F
	S0308FS31	30	500	
	S0508FS21	50	200	
	S0508FS31	50	500	
	S1008FS21	100	200	
	S1008FS31	100	500	
	S2008FS21	200	200	
	S2008FS31	200	500	
	S4008FS21	400	200	
	S4008FS31	400	500	
10.0 AMPS	S0310LS2	30	200	L
	S0310LS3	30	500	
	S0510LS2	50	200	
	S0510LS3	50	500	
	S1010LS2	100	200	
	S1010LS3	100	500	
	S2010LS2	200	200	
	S2010LS3	200	500	
	S4010LS2	400	200	
	S4010LS3	400	500	
	S0310FS21	30	200	F
	S0310FS31	30	500	
	S0510FS21	50	200	
	S0510LS31	50	500	
	S1010FS21	100	200	
	S1010FS31	100	500	
	S2010FS21	200	200	
	S2010FS31	200	500	
	S4010FS21	400	200	
	S4010FS31	400	500	

SCR's

TYPE	PART NUMBER	V_{DRM} & V_{RRM}	I_{GT}(mA)	PKG. TYPE
1 AMP	S031E	30	10	E
	S051E	50	10	
	S101E	100	10	
	S201E	200	10	
	S401E	400	10	
	S601E	600	10	
1.6 AMPS	S0301L	30	10	L
	S0501L	50	10	
	S1001L	100	10	
	S2001L	200	10	
	S4001L	400	10	
	S6001L	600	10	
3 AMPS	S0303L	30	10	L
	S0503L	50	10	
	S1003L	100	10	
	S2003L	200	10	
	S4003L	400	10	
	S6003L	600	10	
4 AMPS	S0304F1	30	10	F
	S0504F1	50	10	
	S1004F1	100	10	
	S2004F1	200	10	
	S4004F1	400	10	
	S6004F1	600	10	
6 AMPS	S0306L	30	15	L
	S0506L	50	15	
	S1006L	100	15	
	S2006L	200	15	
	S4006L	400	15	
	S6006L	600	15	

SCR's (cont'd.)

TYPE	PART NUMER	V_{DRM} & V_{RRM}	I_{GT}(mA)	PKG. TYPE
6 AMPS	S0306F1	30	15	F
	S0506F1	50	15	
	S1006F1	100	15	
	S2006F1	200	15	
	S4006F1	400	15	
	S6006F1	600	15	
8 AMPS	S0308L	30	15	L
	S0508L	50	15	
	S1008L	100	15	
	S2008L	200	15	
	S4008L	400	15	
	S6008L	600	15	
	S0308F1	30	15	F
	S0508F1	50	15	
	S1008F1	100	15	
	S2008F1	200	15	
	S4008F1	400	15	
	S6008F1	600	15	
	S0308R	30	15	R
	S0508R	50	15	
	S1008R	100	15	
	S2008R	200	15	
	S4008R	400	15	
	S6008R	600	15	
	C122F	50	25	
	C122A	100	25	
	C122B	200	25	
	C122C	300	25	
	C122D	400	25	
	C122E	500	25	
	C122M	600	25	
10 AMPS	S0310L	30	15	L
	S0510L	50	15	
	S1010L	100	15	
	S2010L	200	15	
	S4010L	400	15	
	S6010L	600	15	
	S8010L	800	15	
	S0310F1	30	15	F
	S0510F1	50	15	
	S1010F1	100	15	
	S2010F1	200	15	
	S4010F1	400	15	
	S6010F1	600	15	
	S2800F	50	15	R
	S2800A	100	15	
	S2800B	200	15	
	S2800C	300	15	
	S2800D	400	15	
	S2800E	500	15	
	S2800M	600	15	
	S8010R	800	15	
12 AMPS	S0312L	30	20	L
	S0512L	50	20	
	S1012L	100	20	
	S2012L	200	20	
	S4012L	400	20	
	S6012L	600	20	
	S0312R	30	20	R
	S0512R	50	20	
	S1012R	100	20	
	S2012R	200	20	

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THYRISTOR SPECIALIST

SCR's (cont'd.)

TYPE	PART NUMBER	V_{DRM} & V_{RRM}	I_{GT}(mA)	PKG. TYPE
12 AMPS	S4012R	400	20	R
	S6012R	600	20	
	2N6394	50	30	
	2N6395	100	30	
	2N6395	200	30	
	2N6397	400	30	
	2N6398	600	30	
15 AMPS	S0315L	30	30	L
	S0515L	50	30	
	S1015L	100	30	
	S2015L	200	30	
	S4015L	400	30	
	S6015L	600	30	
	S8015L	800	30	
16 AMPS	S0316R	30	30	R
	S0516R	50	30	
	S1016R	100	30	
	S2016R	200	30	
	S4016R	400	30	
	S6016R	600	30	
	S8016R	800	30	
	2N6400	50	30	
	2N6401	100	30	
	2N6402	200	30	
	2N6403	400	30	
	2N6404	600	30	
20 AMPS	S0320L	30	30	L
	S0520L	50	30	
	S1020L	100	30	
	S2020L	200	30	
	S4020L	400	30	
	S6020L	600	30	
	S8020L	800	30	
25 AMPS	S0325L	30	30	L
	S0525L	50	30	
	S1025L	100	30	
	S2025L	200	30	
	S4025L	400	30	
	S6025L	600	30	
	S8025L	800	30	
	S0325R	30	30	R
	S0525R	50	30	
	S1025R	100	30	
	S2025R	200	30	
	S4025R	400	30	
	S6025R	600	30	
	S8025R	800	30	
	2N6504	50	40	
	2N6505	100	40	
	2N6506	200	40	
	2N6507	400	40	
	2N6508	600	40	
35 AMPS	S0335J	30	40	J
	S0535J	50	40	
	S1035J	100	40	
	S2035J	200	40	
	S4035J	400	40	
	S6035J	600	40	
	S8035J	800	40	
	S0335W	30	40	W
	S0535W	50	40	
	S1035W	100	40	
	S2035W	200	40	
	S4035W	400	40	
	S6035W	600	40	
	S8035W	800	40	

SCR's (cont'd.)

TYPE	PART NUMBER	V_{DRM} & V_{RRM}	I_{GT}(mA)	PKG. TYPE
50 AMPS	S0550J	50	40	J
	S1050J	100	40	
	S2050J	200	40	
	S4050J	400	40	
	S6050J	600	40	
	S8050J	800	40	
55 AMPS	S0555W	50	40	W
	S1055W	100	40	
	S2055W	200	40	
	S4055W	400	40	
	S6055W	600	40	
	S8055W	800	40	
65 AMPS	S0565P	50	50	P
	S1065P	100	50	
	S2065P	200	50	
	S4065P	400	50	
	S6065P	600	50	
	S0565J	50	50	J
	S1065J	100	50	
	S2065J	200	50	
	S4065J	400	50	
	S6065J	600	50	
	S8065J	800	50	
70 AMPS	S0570W	50	50	W
	S1070W	100	50	
	S2070W	200	50	
	S4070W	400	50	
	S6070W	600	50	
	S8070W	800	50	

DIACS

PART NUMBER	V_{BO}	PKG. TYPE
HT-32	32	HT
HT-35	35	
HT-40	40	
HT-60	63	
HT5760	28	
HT-5761	32	
HT-5761A	32	
HT-5762	36	

SIDAC's

PART NUMBER	V_{BO}	PKG. TYPE
K1050U	95-113	U
K1100U	104-118	
K1200U	110-125	
K1300U	120-138	
K1400U	130-146	
K1500U	140-170	
K1050E	95-113	E
K1100E	104-118	
K1200E	110-125	
K1300E	120-138	
K1400E	130-146	
K1500E	140-170	
K2000F1	190-215	F
K2200F1	205-230	
K2400F1	220-250	
K2500F1	240-280	
K3000F1	270-330	

DIODES

TYPE	PART NUMBER	V_{RRM}	I_{RM} (mAmps)	I_T (RMS)	PKG. TYPE
15 AMPS	D2015L	200	.05	15	L
	D4015L	400	.05	15	
	D6015L	600	.05	15	
20 AMPS	D2020L	200	.05	20	L
	D4020L	400	.05	20	
	D6020L	600	.05	20	
35 AMPS	D0535J	50	.1	35	J
	D2035J	200	.1	35	
	D4035J	400	.1	35	
	D6035J	600	.1	35	
	D8035J	800	.1	35	
	D0535W	50	.1	35	W
	D2035W	200	.1	35	
	D4035W	400	.1	35	
	D6035W	600	.1	35	
	D8035W	800	.1	35	
50 AMPS	D0550J	50	.1	50	J
	D2050J	200	.1	50	
	D4050J	400	.1	50	
	D6050J	600	.1	50	
	D8050J	800	.1	50	
55 AMPS	D0555W	50	.1	55	W
	D2055W	200	.1	55	
	D4055W	400	.1	55	
	D6055W	600	.1	55	
	D8055W	800	.1	55	
65 AMPS	D0565J	50	.1	65	J
	D2065J	200	.1	65	
	D4065J	400	.1	65	
	D6065J	600	.1	65	
	D8065J	800	.1	65	
70 AMPS	D0570W	50	.1	70	W
	D2070W	200	.1	70	
	D4070W	400	.1	70	
	D6070W	600	.1	70	
	D8070W	800	.1	70	

SIDACTOR's

TRANSIENT SURGE PROTECTOR

PART NUMBER	V_{BO} (Clamping Voltage)	I_H(μAmps)	I_{PP} (Peak Pulse Current)	PKG. TYPE
P1050E	95-113	150	75	E
P1100E	104-118	150	75	
P1200E	110-125	150	75	
P1300E	120-138	150	75	
P1400E	130-146	150	75	
P1500E	140-170	150	75	
P2000F1	190-215	150	75	F
P2200F1	205-230	150	75	
P2400F1	220-250	150	75	
P2500F1	240-280	150	75	
P3000F1	270-330	150	75	
P1050M	95-113	150	130	W
P1100M	104-118	150	130	
P1200M	110-125	150	130	
P1300M	120-138	150	130	
P1400M	130-146	150	130	
P1500M	140-170	150	130	
P2000M	190-215	150	130	
P2200M	205-230	150	130	
P2400M	220-250	150	130	
P2500M	240-280	150	130	
P3000M	270-330	150	130	

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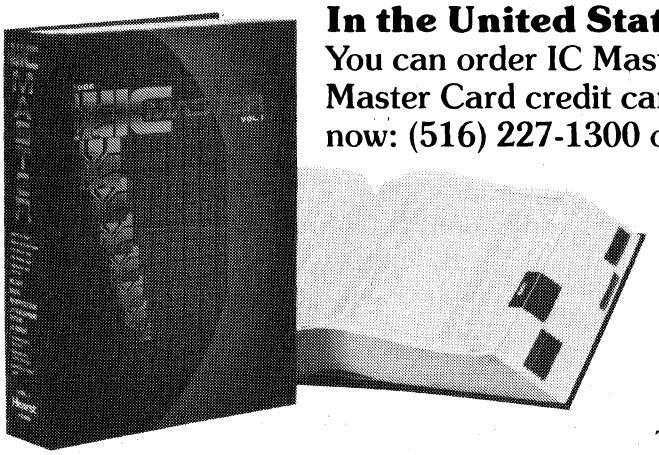

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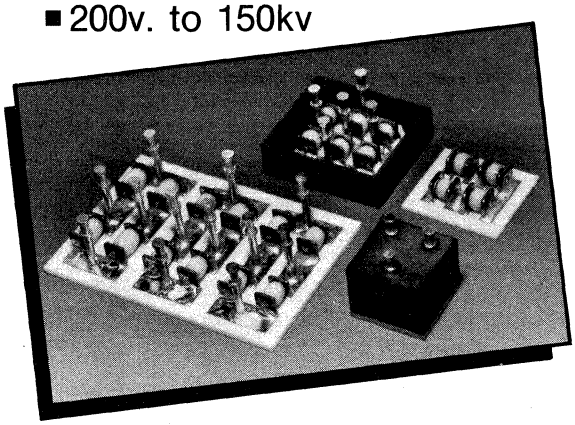

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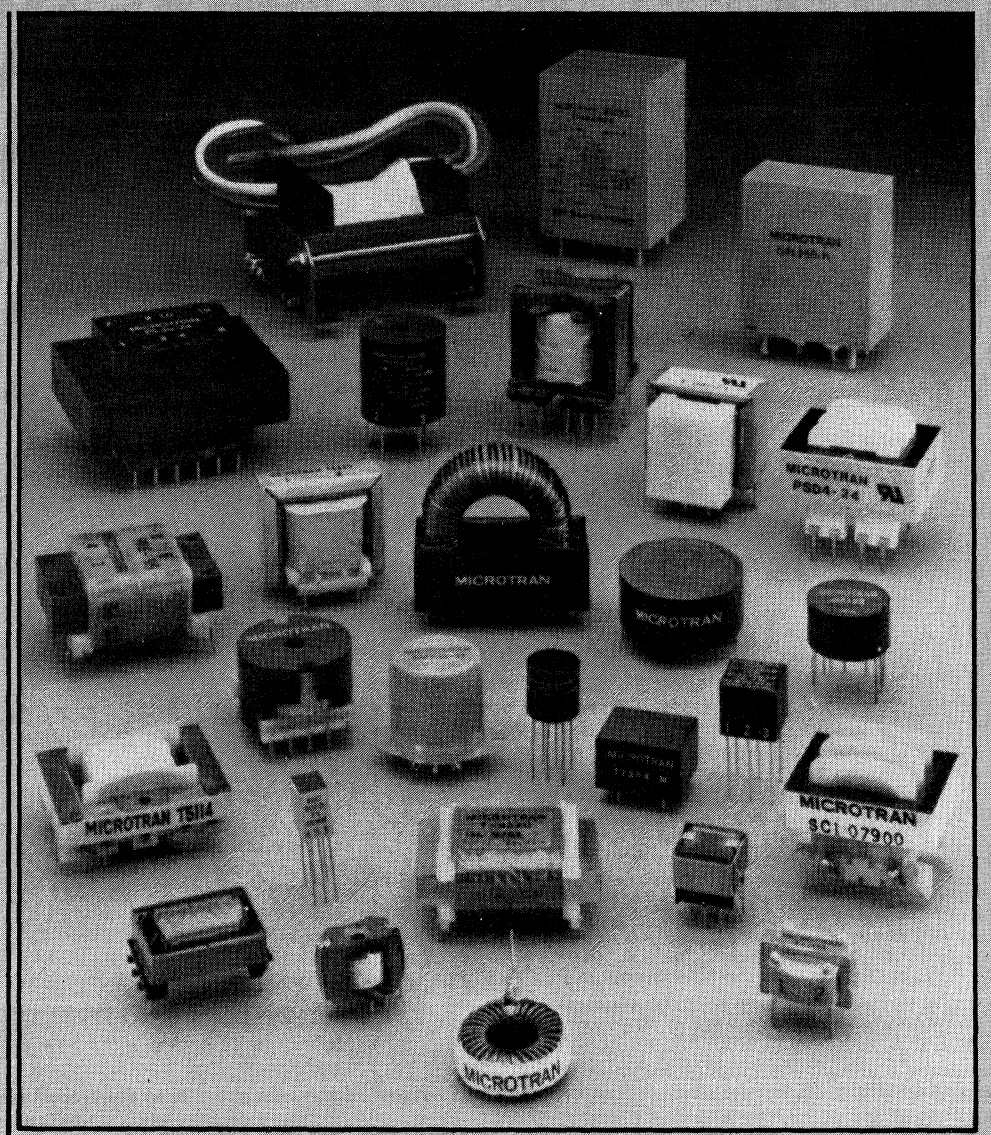

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See EEM Pages A. 2280 thru A. 2296 and Coil Section 1800 Page 1246

TRANSFORMERS, POWER

Manufacturer	Starting EEM Page No.	Power: 115-230V Input 50-60 Hz	Power: 115-230V Input 400 Hz	Power: Filament	Power: Rectifier	Power: Split Bobbin	Power: Toroidal	Power: Isolation	Power: Voltage Regulating	Power: DC-to-DC Converter	Power: Variable Incl. Auto Transformer	Power: High Voltage	Scott T	PC Mount	Control: Synchro/Resolver Synchro	Control: Servo	Current Instrument	Switch Mode
Abbott	A•2157	¤	¤	¤	¤	¤	¤	¤		¤				¤			¤	¤
Amecon	A•2167	¤	¤				¤					¤		¤	¤	¤	¤	¤
Arstan Products	A•2180	¤				¤								¤				¤
AT & T Techn.	A•2184	¤																
Avel-Lindberg	A•2192	¤	¤				¤	¤						¤				
Bey	A•2197	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤					
BH Electronics	A•2198						¤							¤				¤
Bicron	A•2202	¤	¤		¤		¤	¤										
C & C Jetronics	A•2204	¤	¤		¤	¤		¤	¤	¤	¤	¤		¤			¤	¤
Dale Electronics	A•2205	¤	¤			¤	¤	¤		¤				¤				¤
Del Electronics	A•2210	¤		¤				¤				¤						
Delta	A•2211	¤			¤									¤				¤
Dynage	A•2212	¤	¤	¤	¤	¤		¤	¤	¤		¤		¤				¤
Electromech	A•2214	¤	¤	¤	¤	¤				¤		¤		¤			¤	¤
EWC	A•2216	¤	¤	¤	¤	¤	¤	¤			¤	¤		¤			¤	
Flex-Core/Morlan	A•2229																¤	
Foxboro	A•2231	¤								¤				¤			¤	¤
Hipotronics	A•2236			¤	¤			¤	¤		¤	¤	¤					
Hi-Sonic	A•2239	¤	¤				¤			¤		¤			¤			
Hitran	A•2240	¤		¤	¤			¤	¤			¤						
ISL Products	A•2241	¤	¤	¤	¤	¤		¤						¤				
Jerome Industries	A•2242	¤			¤						¤			¤				
JM Transformer	A•2243			¤	¤	¤		¤			¤			¤				
Lenco Electronics	A•2248	¤			¤	¤	¤		¤						¤	¤		¤
Magnetek	A•2250	¤	¤		¤	¤	¤	¤		¤		¤		¤			¤	¤
Magnetek Triad	A•2252	¤	¤	¤	¤	¤	¤	¤	¤		¤	¤		¤	¤	¤	¤	
Magnetico	A•2262	¤	¤		¤		¤	¤		¤		¤	¤	¤	¤	¤	¤	¤
MCI Transformer	A•2264	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤			¤	
Microtran	A•2280	¤	¤	¤	¤	¤	¤	¤		¤			¤	¤				¤
Multi Products	A•2298	¤			¤						¤			¤				¤
North Hills	A•2300	¤	¤					¤										
NWL Transformers	A•2303	¤	¤	¤	¤			¤				¤					¤	

TRANSFORMERS, POWER (cont'd)

Manufacturer	Starting EEM Page No.	Power											Scott T	PC Mount	Control		Current Instrument	Switch Mode
		115-230V Input 50-60 Hz	400 Hz	Filament	Rectifier	Split Bobbin	Toroidal	Isolation	Voltage Regulating	DC-to-DC Converter	Variable Incl. Auto Transformer	High Voltage			Synchro/ Resolver Synchro	Servo		
Paraline	A•2318	¤	¤											¤	¤	¤		
PCA Electronics	A•2305		¤				¤	¤		¤				¤				
PC Transformer	A•2308	¤		¤	¤	¤		¤			¤			¤				
Pearson Electronics	A•2316																¤	
Perkin-Elmer	A•2317		¤				¤	¤		¤			¤	¤	¤	¤	¤	¤
Pico Electronics	A•2319		¤							¤				¤				¤
Polyphase Instrument	A•2350	¤		¤	¤		¤	¤		¤		¤		¤			¤	¤
Power Magnetech	A•2352	¤	¤	¤	¤	¤	¤	¤	¤	¤		¤	¤	¤	¤	¤	¤	¤
Prem Magnetics	A•2355	¤	¤			¤	¤	¤						¤				
Renco	A•2367	¤	¤			¤	¤	¤						¤				¤
Shogyo	A•2366	¤	¤			¤			¤	¤				¤				
Signal Transformer	A•2372	¤	¤	¤	¤	¤	¤	¤			¤			¤				
Stancor	A•2393					¤		¤						¤				
Superior Electric	A•2370	¤									¤							
Talema Electronic	A•2390				¤		¤				¤							
Tamura	A•2395				¤			¤						¤				
Technipower	A•2405	¤	¤						¤		¤							
Technitrol	A•2407	¤	¤	¤	¤		¤	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤
Todd Systems	A•2408	¤		¤	¤			¤			¤							
Toroid Corp.	A•2412	¤	¤		¤		¤	¤										
Torotel Products	A•2418	¤	¤											¤				
Torwico Electronics	A•2424		¤															
Trans American	A•2426	¤	¤		¤		¤	¤				¤	¤	¤	¤	¤	¤	¤
Transformer Technology	A•2427	¤					¤											
Ulveco	A•2430	¤	¤		¤			¤	¤		¤						¤	
United Transformer/Opt	A•2428	¤	¤	¤	¤	¤	¤	¤	¤	¤		¤	¤	¤	¤	¤	¤	¤
Vitec Electronic	A•2435	¤	¤		¤		¤	¤		¤				¤			¤	¤
Wayne Transformer	A•2440	¤	¤	¤				¤	¤			¤						

AUDIO, RF, SPECIAL

Manufacturer	Starting EEM Page No.	Driver	Input	Inter-stage	Matching	Micro-phone	Output	Telephone Coupling	Isolation	RF-IF	Pulse including Trigger
Abbott Technologies	A•2157										¤§
Arstan Products	A•2180				¤			¤			
AT & T	A•2184				¤						¤§
Bel Fuse	A•2194								¤	¤	¤
Bey	A•2197	¤	¤	¤	¤				¤		
BH Electronics	A•2198	¤§			¤§				¤§	¤§	¤§
C & C Jetronics	A•2204	¤§	¤§		¤§	¤§	¤§	¤§	¤§	¤§	¤§
Dale Electronics	A•2205							¤			¤
DeltaProducts	A•2211	¤						¤		¤	¤
Dynage	A•2212							¤			
Electromech	A•2214									¤	
ESC	A•2215			¤				¤		¤	¤
EWC	A•2216	¤	¤	¤	¤		¤	¤			¤
Foxboro	A•2231	¤§			¤§	¤§	¤§	¤§	¤	¤§	¤§
Hi Sonic	A•2239				¤		¤			¤	¤
ISL Products	A•2241	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤
Lenco Electronics	A•2248	¤	¤		¤			¤			
Magnetek	A•2250	¤	¤	¤	¤				¤		¤
Magnetek Triad	A•2252	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤
MCI Transformer	A•2264	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤
Microtran	A•2281	¤	¤	¤	¤	¤	¤	¤	¤		¤
Multi Products	A•2298		¤		¤				¤	¤	¤
North Hills	A•2300				¤			¤	¤	¤	
NWL Transformers	A•2303						¤				
Paraline	A•2318	¤						¤			
PCA Electronics	A•2305								¤	¤	¤
PC Transformer	A•2308		¤	¤			¤	¤	¤	¤	
Perkin-Elmer	A•2317	¤	¤								
Pico Electronic	A•2319		¤	¤		¤§	¤§	¤		¤§	¤§
PolyPhase Instrument	A•2350	¤	¤	¤	¤	¤		¤	¤	¤	¤
Power Magnetech	A•2352	¤§	¤§	¤§	¤§	¤§	¤§	¤§	¤§	¤§	¤§
Prem Magnetics	A•2355	¤		¤	¤			¤	¤	¤	
Renco Electronics	A•2367	¤		¤	¤				¤	¤	¤
Shogyo	A•2366				¤			¤			
Tamura	A•2395				¤	¤	¤	¤	¤	¤	¤
Technitrol	A•2407	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤§
TTE, Inc.	A•2433		¤	¤	¤	¤	¤	¤	¤	¤	
Ulveco, Inc.	A•2430		¤				¤		¤		
United Transformer /OPT	A•2428	¤§	¤§	¤§	¤§	¤	¤§	¤§	¤		¤
Vitec Electronics	A•2435					¤		¤			¤
Wayne Transformers	A•2440	¤		¤			¤		¤		

§ Surface Mount

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 88/89 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1134, **B**•1098, **C**•1082, **D**•1038
ASCII Code ..... **D**•1073
Batteries, Product Selection Guide ..... **D**•1428
Batteries & Fuel Cells, Characteristics ..... **D**•1454
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1030
Capacitors, Miniglossary ..... **A**•1027
Capacitors, Product Selection Guide ..... **A**•1003
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1193
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1760
Connectors, Miniglossary ..... **C**•1374
Connectors, Terminals & Sockets, Product Selection Guide ..... **C**•1127
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide ..... **A**•1331
Delay Lines, Product Selection Guide ..... **A**•1495
Discrete Semiconductors, Product Selection Guide ..... **A**•2113
Displays, Readouts, & CRTs, Product Selection Guide ..... **B**•1033
EBCDIC Code ..... **D**•1162
Encapsulation, Miniglossary ..... **C**•1110
Fans, Blowers, Cooling Equipment & Heat Exchangers, Product Selection Guide ..... **C**•1643
Filters, Product Selection Guide ..... **A**•1633
IC Master ..... **A**•1718
Instruments, Panel Meters, Product Selection Guide ..... **D**•1350
Instruments, Test & Measuring, Product Selection Guide ..... **D**•1190
Interconnection Systems, Product Selection Guide ..... **C**•1719
Keyboards & Keypads, Product Selection Guide ..... **B**•1808
Lamps, Lights, & Inductors, Product Selection Guide ..... **B**•1104
Logofinder & Trademark Directories ..... **C**•901
Microwave Components, Product Selection Guide ..... **A**•1761
Military Qualified Products List ..... **B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1181
Opto Semiconductors, Miniglossary ..... **B**•1262
Oscilloscopes, Product Selection Guide ..... **D**•1408
Panel Hardware, Product Selection Guide ..... **C**•1603
Potentiometers, Trimmers, Controls & Rheostats, Product Selection Guide ..... **A**•2057
Power Supplies, Miniglossary ..... **D**•1504
Power Supplies, AC, Product Selection Guide ..... **D**•2060
Power Supplies, DC, Product Selection Guide ..... **D**•1497
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide ..... **B**•1297
Relay Contact Forms ..... **B**•1371
Relays, Electromechanical, Miniglossary ..... **B**•1364
Relays, Product Selection Guide ..... **B**•1355
Resistor Color Codes ..... **A**•1911
Resistors, Product Selection Guide ..... **A**•1849
Servo Components, Miniglossary ..... **B**•1238, **D**•2176
SI Units, Basic Guide To, ... **A**•1090, **B**•1050, **C**•1092, **D**•1048
Solenoids, Product Selection Guide ..... **B**•1612
Switches, Product Selection Guide ..... **B**•1636
Thermal Components, Product Selection Guide ..... **B**•1834
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1842
Thyristors/High Power Diodes, Miniglossary ..... **A**•2145
Trademark & Logofinder Directories ..... **C**•901
Transducers & Encoders, Product Selection Guide ..... **B**•1874
Transformers, Product Selection Guide ..... **A**•2153
Voltage Drop Nomograph ..... **C**•1912, **D**•2042
Wire & Cable, Product Selection Guide ..... **C**•1763
Wire Guages—Diameter, Area, Copper Weight ..... **C**•1864

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READY REFERENCE GUIDE

Model Family		Input		Construction		Power Levels (VA)	Output Voltages	EEM Page
Cat.	QPL*	Freq. (Hz)	Phase	Mil-Spec	Ind'l			
P	M27/312-322	50-60	1φ	Grade 4		5-300	5-486	A•2159
6C	M27/326-331	50-60	1φ	Grade 4		5-170	5-120	A•2160
6DM	—	50-60	3φ	Grade 5		200-3000	5-200	A•2161
6DF	—	50-60	3φ		Ind'l	200-3000	5-200	A•2161
6B	—	50-60	1φ		Ind'l	10-1300	5-120	A•2162
E	M27/388-343	380-420	1φ	Grade 5		2-175	5-486	A•2163
4A	M27/332-337	380-420	1φ	Grade 5		7-150	5-120	A•2164
4D	M27/344-349	380-420	3φ	Grade 5		90-1000	5-200	A•2165
TM	M27/350-354	380-420	1φ	Grade 5		15-100	5-115	A•2166
TF	—	380-420	1φ		Ind'l	15-100	5-115	A•2166

* For specific QPL Model Numbers contact the sales office nearest you.

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- Shock
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- Immersion
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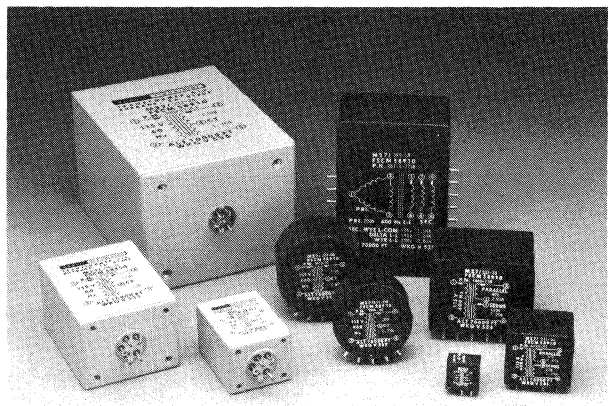

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Only Abbott offers a selection this wide.

60 Hz	400 Hz (1ϕ and 3ϕ)
5-220 Volts	5-220 Volts
5-300 VA	2-375 VA
Grade 4, Class S	Grade 5, Class S

(See "Ready Reference Guide" on adjacent page for more model information.)

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Our reputation for reliability has been earned by a conservative design philosophy in which special attention is given to thermal margins and the use of quality materials. Our Quality Assurance program is in accordance with MIL-I-45208A and MIL-STD-45662. Each transformer is 100% tested to the following requirements: visual and mechanical, turns ratio, excitation current, dielectric withstanding voltage and continuity.

We have our own fully equipped test laboratory which has been accepted by the Defense Logistics Agency to perform qualification testing and Group A and B Inspection to military specification MIL-T-27. This is a reflection of our commitment to serving the defense electronics and aerospace industries, by providing military transformers that perform "when reliability is imperative®."

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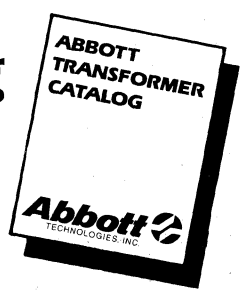
To help you take advantage of Abbott's QPL status, we have included all QPL Cross-reference numbers in our new catalog. Call or write today for your free copy.



ABBOTT TECHNOLOGIES, INC.
Burbank Div., General Offices: 639 S. Glenwood Pl., Burbank, CA 91506 (818) 841-3630. FAX: (818) 954-9305

Abbott TECHNOLOGIES, INC.

60 Hz MIL-T-27 Transformers

MODEL **P**

SPECIFICATIONS

INPUT PRIMARY: 115 VAC, 60 Hz ± 5 Hz, 1 phase.†

REGULATION: 10% no load to full load.

SECONDARY VOLTAGE TOLERANCE: Within 3% of listed output voltage when measured at full load and 115 VAC input.

CONSTRUCTION: To MIL-T-27, Grade 4, Class S, Case: steel.

ENVIRONMENT: To operate in 95°C maximum ambient temperature. Encapsulated to meet MIL-STD-810 for vibration, shock, acceleration, sand, dust, humidity, saltspray, fungus, sunshine, rain, explosion, and altitude (to a vacuum). NOTE: For high altitude operation, encapsulate terminals.

INSULATION TEST: 1750 VAC.

SECONDARY: See output voltage and current of specific models listed.

† For 50 Hz operation, reduce secondary current by 10% of ratings listed. These units are capable of 400 Hz operation; however, see Abbott's distinct line of miniature 400 Hz transformers.

Now QPL!

TF4S03YY

Output Volts (F.L.)	Output Current (Amp)	Size	Secondary DCR ohms (typical)	Model Number
5.0	1.00	A1	0.335	5P5CT
	2.00	A2	0.12	10P5CT
	3.00	A3	0.07	15P5CT
	4.00	A4	0.066	20P5CT
	6.00	A5	0.04	30P5CT
	8.00	A6	0.03	40P5CT
	16.00	A7	0.014	80P5CT
6.3	0.79	A1	0.53	5P6.3CT
	1.58	A2	0.18	10.6:3CT
	2.38	A3	0.094	15P6.3CT
	3.16	A4	0.1	20P6.3CT
	4.76	A5	0.06	30P6.3CT
	6.35	A6	0.059	40P6.3CT
	12.70	A7	0.02	80P6.3CT
	19.00	A8	0.0014	120P6.3CT
8.0	0.67	A1	0.87	5P8CT
	1.25	A2	0.27	10P8CT
	1.88	A3	0.16	15P8CT
	2.50	A4	0.15	20P8CT
	3.76	A5	0.08	30P8CT
	5.00	A6	0.079	40P8CT
	10.00	A7	0.04	80P8CT
	15.00	A8	0.022	120P8CT
	20.00	A9	0.0072	160P8CT
10	0.50	A1	1.34	5P10CT
	1.00	A2	0.42	10P10CT
	1.50	A3	0.23	15P10CT
	2.00	A4	0.23	20P10CT
	3.00	A5	0.14	30P10CT
	4.00	A6	0.11	40P10CT
	8.00	A7	0.05	80P10CT
	12.00	A8	0.031	120P10CT
	16.00	A9	0.008	160P10CT
	20.00	A10	0.02	200P10CT
12.6	0.39	A1	2.06	5P12.6CT
	0.79	A2	0.65	10P12.6CT
	1.19	A3	0.4	15P12.6CT
	1.59	A4	0.34	20P12.6CT
12.6	2.38	A5	0.2	30P12.6CT
	3.18	A6	0.18	40P12.6CT
	6.35	A7	0.07	80P12.6CT
	9.53	A8	0.041	120P12.6CT
	12.70	A9	0.035	160P12.6CT
	15.90	A10	0.027	200P12.6CT
14	0.36	A1	2.95	5P14CT
	0.72	A2	0.74	10P14CT
	1.07	A3	0.6	15P14CT
	1.43	A4	0.4	20P14CT
	2.15	A5	0.23	30P14CT
	2.86	A6	0.19	40P14CT
	5.72	A7	0.1	80P14CT
	8.59	A8	0.055	120P14CT
	11.40	A9	0.042	160P14CT
	14.30	A10	0.029	200P14CT
16	0.34	A1	3.35	5P16CT
	0.68	A2	1.08	10P16CT
	0.94	A3	0.67	15P16CT
	1.25	A4	0.52	20P16CT
	1.87	A5	0.28	30P16CT
	2.50	A6	0.28	40P16CT
	5.00	A7	0.12	80P16CT
	7.50	A8	0.072	120P16CT
	10.00	A9	0.046	160P16CT
	12.50	A10	0.034	200P16CT
	18.70	A11	0.02	300P16CT
18	0.28	A1	4.65	5P18CT
	0.55	A2	1.42	10P18CT
	0.83	A3	0.78	15P18CT
	1.11	A4	0.62	20P18CT
	1.67	A5	0.38	30P18CT
	2.21	A6	0.36	40P18CT
	4.44	A7	0.16	80P18CT
	6.68	A8	0.08	120P18CT
	8.89	A9	0.060	160P18CT
	11.10	A10	0.04	200P18CT
	16.70	A11	0.022	300P18CT
20	0.25	A1	5.25	5P20CT
	0.50	A2	1.54	10P20CT
	0.75	A3	0.9	15P20CT
	1.00	A4	0.85	20P20CT
	1.50	A5	0.4	30P20CT
	2.00	A6	0.43	40P20CT
	4.00	A7	0.19	80P20CT
	6.00	A8	0.120	120P20CT
	8.00	A9	0.070	160P20CT
	10.00	A10	0.066	200P20CT
	15.00	A11	0.026	300P20CT
22	0.22	A1	7.3	5P22CT
	0.45	A2	1.9	10P22CT
	0.68	A3	1.2	15P22CT
	0.91	A4	0.95	20P22CT
	1.36	A5	0.55	30P22CT
	1.82	A6	0.57	40P22CT
	3.64	A7	0.25	80P22CT
	5.45	A8	0.125	120P22CT
	7.27	A9	0.092	160P22CT
	9.10	A10	0.073	200P22CT
	13.60	A11	0.031	300P22CT
25	0.20	A1	8.23	5P25CT
	0.40	A2	2.55	10P25CT
	0.60	A3	1.4	15P25CT
	0.80	A4	1.37	20P25CT
	1.20	A5	0.7	30P25CT
	1.60	A6	0.67	40P25CT
	3.20	A7	0.3	80P25CT
	4.80	A8	0.182	120P25CT
	6.40	A9	0.11	160P25CT
	8.00	A10	0.079	200P25CT
	12.00	A11	0.042	300P25CT
28	0.18	A1	11.4	5P28CT
	0.36	A2	3.0	10P28CT
	0.54	A3	1.9	15P28CT
	0.71	A4	1.6	20P28CT
	1.07	A5	0.94	30P28CT
	1.43	A6	0.90	40P28CT
28	2.86	A7	0.4	80P28CT
	4.29	A8	0.205	120P28CT
	5.72	A9	0.150	160P28CT
	7.10	A10	0.11	200P28CT
	10.70	A11	0.046	300P28CT
31	0.16	A1	13.8	5P31CT
	0.32	A2	3.8	10P31CT
	0.48	A3	2.2	15P31CT
	0.64	A4	2.2	20P31CT
	0.97	A5	0.96	30P31CT
	1.29	A6	0.95	40P31CT
	2.58	A7	0.45	80P31CT
	3.87	A8	0.31	120P31CT
	5.17	A9	0.166	160P31CT
	6.40	A10	0.12	200P31CT
	9.67	A11	0.054	300P31CT
35	0.14	A1	17.6	5P35CT
	0.29	A2	4.5	10P35CT
	0.43	A3	3.0	15P35CT
	0.57	A4	2.4	20P35CT
	0.86	A5	1.4	30P35CT
	1.14	A6	1.32	40P35CT
	2.28	A7	0.5	80P35CT
	3.43	A8	0.35	120P35CT
	4.57	A9	0.240	160P35CT
	5.71	A10	0.17	200P35CT
	8.59	A11	0.072	300P35CT
39	0.13	A1	19.7	5P39CT
	0.26	A2	6.3	10P39CT
	0.38	A3	3.5	15P39CT
	0.51	A4	3.6	20P39CT
	0.77	A5	1.62	30P39CT
	1.03	A6	1.5	40P39CT
	2.05	A7	0.7	80P39CT
	3.07	A8	0.342	120P39CT
	4.10	A9	0.270	160P39CT
	5.12	A10	0.18	200P39CT
	7.69	A11	0.08	300P39CT

Other standard models to 486V are available. Contact our nearest office for complete information.

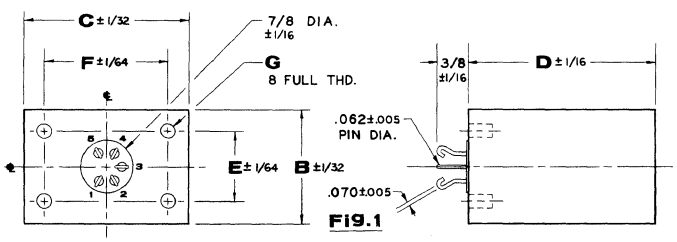


Fig. 1

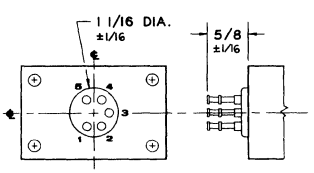


Fig. 2

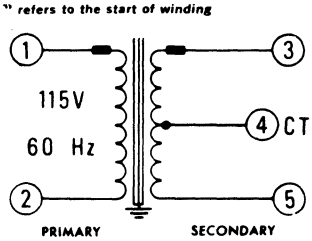
Size	B	C	D	E	F	G
A1	1½	1¾	2⅜	1 1/16	1¼	6-32
A2	1¾	2 1/16	2¾	1¼	1½	6-32
A3	1⅞	2⅜	3⅛	1¼	1¾	8-32
A4	2	2⅜	3⅛	1½	1¾	8-32
A5	2⅛	2 1/16	3½	1½	2	8-32
A6	2¼	2 1/16	3½	1⅝	2	8-32
A7*	2⅝	3⅛	4⅛	2	2¼	8-32
A8*	2⅞	3 1/16	4½	2¼	2½	10-32
A9*	3⅛	3¾	4⅞	2 1/16	2¾	10-32
A10*	3⅜	4 1/16	5¼	2⅝	3	¼-20
A11*	3⅞	4 1/16	6	2¾	3½	¼-20

* See Fig. 2 for header configuration used on any unit with output current greater than 10 amps.

Model Type	Weight Lbs. (Max.)	Primary DCR (ohms typical)
5P	1.0	86
10P	1.5	36
15P	2.0	24
20P	2.5	15
30P	3.0	8.5
40P	3.3	6.7
80P	5.0	3.7
120P	6.5	1.9
160P	8.2	1.6
200P	10.5	1.1
300P	17.0	0.5

TYPICAL CIRCUIT DIAGRAM

"■" refers to the start of winding



ABBOTT TECHNOLOGIES, INC.
Burbank Div., General Offices: 639 S. Glenwood Pl., Burbank, CA 91506 (818) 841-3630. FAX: (818) 954-9305

Abbott TECHNOLOGIES, INC.

60 Hz MIL-T-27 Transformers

MODEL 6C

SPECIFICATIONS

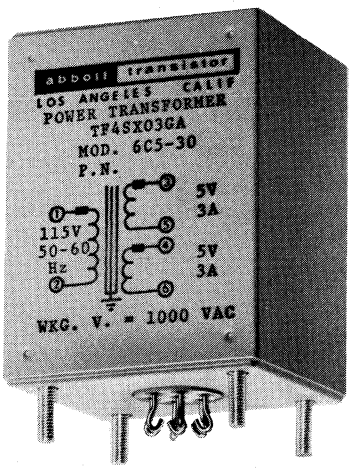
INPUT PRIMARY: 115 VAC, 50 to 65 Hz, 1 Phase.
REGULATION: 10% no load to full load.
SECONDARY VOLTAGE TOLERANCE: Within 3% when measured at full load and 115 VAC input.
INSULATION TEST: 1500 VAC.
OPERATING TEMP.: 90°C maximum ambient temperature.
CONSTRUCTION: To MIL-T-27, Grade 4, Class S, life "X" (10,000 hrs.)

EFFICIENCY: From 80% to 90% typical.

ENVIRONMENT: Encapsulated to meet MIL-STD-810 for vibration, shock, sand, dust, humidity, salt spray, fungus, sunshine, rain, explosion, and altitude (to a vacuum). NOTE: for high altitude operation, encapsulate terminals.

OPTIONS AVAILABLE: Other output voltages and 230 VAC input are available. Please consult our nearest office for complete information.

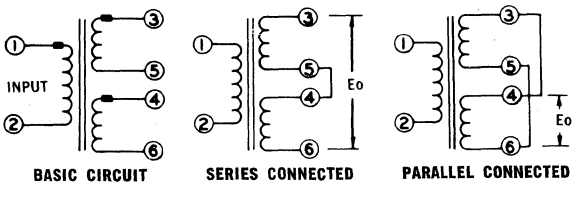
Now QPL!



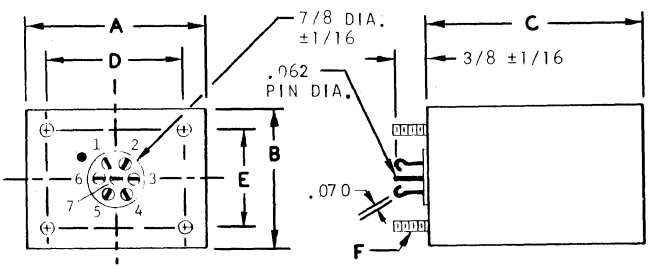
TF4S03 __

NOTE: These units are also capable of 400 Hz operation.

Output Volts (F.L.)	Output Current (Amps) Parallel Connection	Output Current (Amps) Series Connection	Size	Weight Lbs. Typ.	Model Number
5V Parallel	1.00	0.50	EB	1.2	6C5-5
10V C.T.	3.00	1.50	FA	2.2	6C5-15
Series	6.00	3.00	GA	3.3	6C5-30
	12.00	6.00	HA	4.7	6C5-60
	20.00	10.00	JA	7.4	6C5-100
6.3V Parallel	0.80	0.40	EB	1.2	6C6-5
12.6V C.T.	2.38	1.19	FA	2.2	6C6-15
Series	4.76	2.38	GA	3.3	6C6-30
	9.52	4.76	HA	4.7	6C6-60
	20.00	10.00	JA	7.4	6C6-126
8V Parallel	0.62	0.31	EB	1.2	6C8-5
16V C.T.	1.86	0.93	FA	2.2	6C8-15
Series	3.72	1.86	GA	3.3	6C8-30
	7.44	3.72	HA	4.7	6C8-60
	17.50	8.75	JA	7.4	6C8-140
	20.00	10.00	KA	9.8	6C8-160
10V Parallel	0.50	0.25	EB	1.2	6C10-5
20V C.T.	1.50	0.75	FA	2.2	6C10-15
Series	3.00	1.50	GA	3.3	6C10-30
	6.00	3.00	HA	4.7	6C10-60
	14.00	7.00	JA	7.4	6C10-140
	17.00	8.50	KA	9.8	6C10-170
12V Parallel	0.40	0.20	EB	1.2	6C12-5
24V C.T.	1.20	0.60	FA	2.2	6C12-15
Series	2.40	1.20	GA	3.3	6C12-30
	4.80	2.40	HA	4.7	6C12-60
	11.60	5.80	JA	7.4	6C12-140
	14.16	7.08	KA	9.8	6C12-170
17V Parallel	0.30	0.15	EB	1.2	6C17-5
34V C.T.	0.88	0.44	FA	2.2	6C17-15
Series	1.76	0.88	GA	3.3	6C17-30
	3.52	1.76	HA	4.7	6C17-60
	8.20	4.10	JA	7.4	6C17-140
	10.00	5.00	KA	9.8	6C17-170
20 V Parallel	0.24	0.12	EB	1.2	6C20-5
40V C.T.	0.72	0.36	FA	2.2	6C20-15
Series	1.44	0.72	GA	3.3	6C20-30
	2.88	1.44	HA	4.7	6C20-60
	7.00	3.50	JA	7.4	6C20-140
	8.50	4.25	KA	9.8	6C20-170
28V Parallel	0.18	0.09	EB	1.2	6C28-5
56V C.T.	0.54	0.27	FA	2.2	6C28-15
Series	1.08	0.54	GA	3.3	6C28-30
	2.16	1.08	HA	4.7	6C28-60
	5.00	2.50	JA	7.4	6C28-140
	6.06	3.03	KA	9.8	6C28-170
44V Parallel	0.10	0.05	EB	1.2	6C44-5
88V C.T.	0.30	0.15	FA	2.2	6C44-15
Series	0.60	0.30	GA	3.3	6C44-30
	1.20	0.60	HA	4.7	6C44-60
	3.16	1.58	JA	7.4	6C44-140
	3.86	1.93	KA	9.8	6C44-170
60V Parallel	0.08	0.04	EB	1.2	6C60-5
120V C.T.	0.24	0.12	FA	2.2	6C60-15
Series	0.48	0.24	GA	3.3	6C60-30
	0.96	0.48	HA	4.7	6C60-60
	2.32	1.16	JA	7.4	6C60-140
	2.82	1.41	KA	9.8	6C60-170



BASIC CIRCUIT SERIES CONNECTED PARALLEL CONNECTED



NOTE: Black dot at Pin #1.

Size	A	B	C	D	E	F
EB	1.938	1.812	2.438	1.375	1.250	6-32 x 3/8
FA	2.312	2.062	3.125	1.688	1.438	6-32 x 3/8
GA	2.750	2.375	3.812	2.125	1.750	6-32 x 3/8
HA	3.062	2.625	4.250	2.297	1.859	8-32 x 3/8
JA	3.562	3.062	4.875	2.625	2.125	8-32 x 3/8
KA	3.938	3.375	5.250	3.000	2.438	10-32 x 1/2

Dimension A, B = +0.000 −0.125
Dimension C = +0.000 −0.188
Dimension D, E = ±0.016 except size KA = 0.031
Dimension F = ±0.062

ABBOTT TECHNOLOGIES, INC.
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Abbott TECHNOLOGIES, INC.

60 Hz, 3 Ø MIL-T-27 and Industrial Transformers

MODEL 6D

SPECIFICATIONS

INPUT PRIMARY:

WYE:	120V L-Com.	Suffix A
WYE:	208V L-L	Suffix B
DELTA:	120V L-L	Suffix C
DELTA:	230V L-L	Suffix E
DELTA:	440V L-L	Suffix F

NOTE: To order a specific input voltage add suffix to model number. (EXAMPLE: 6D ( ) 15-200E has input 230V L-L (3 wire DELTA)).

INPUT FREQUENCY: 50 Hz to 65 Hz.

OUTPUT: See specific models listed.

OUTPUT VOLTAGE TOLERANCE: Within 5% when measured at full load and nominal VAC input.

REGULATION: 10% max. no load to full load. (6% on size 3 thru 6).

INSULATION TEST: 1500 VRMS

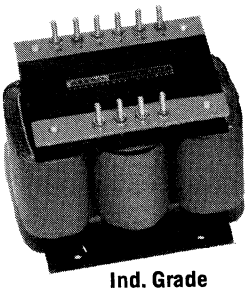
EFFICIENCY: Ranges from 90% to 95% typical.

OPERATING AMBIENT TEMP.: 80°C maximum on sizes 1-6; 60°C maximum on sizes 7-9.

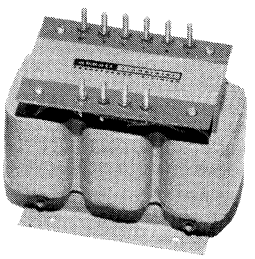
MIL-T-27 CONSTRUCTION: (Grade 5 Class S). Specify the letter "M" in the model number. (Example: 6DM15-200 ( )).

NOTE: MIL-T-27 add .20 to Dim. A, B, C. Other inputs and/or outputs available.

INDUSTRIAL CONSTRUCTION: Industrial Grade (open frame): Specify the letter "F" in the model number. (Example: 6DF 15-200 ( )).



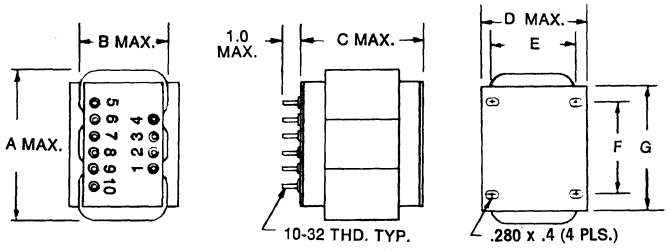
Ind. Grade

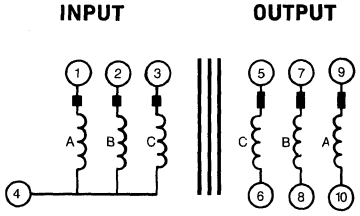


MIL-T-27
TF 5S03ZZ

Model No.	Delta: L to L (3 wire) WYE: L to Com. (4 wire) Volts R.M.S.	Load Current (Amps)	WYE: L to L (3 wire) Volts R.M.S.	Load Current (Amps)	Size	Wt. Lbs. (Typ.)
6D( )5-200( )	5	13.30	8.66	7.70	1	14
6D( )5-450( )	5	30.00	8.66	17.30	2	20
6D( )5-650( )	5	43.30	8.66	25.00	3	28
6D( )12-200( )	12	5.56	20.8	3.21	1	14
6D( )12-450( )	12	12.50	20.8	7.21	2	20
6D( )12-650( )	12	18.10	20.8	10.40	3	28
6D( )12-850( )	12	23.60	20.8	13.60	4	39
6D( )12-1100( )	12	30.60	20.8	17.60	5	48
6D( )12-1500( )	12	41.70	20.8	24.00	6	58
6D( )12-2000( )	12	55.55	20.8	32.05	7	60
6D( )12-2500( )	12	69.44	20.8	40.09	8	68
6D( )12-3000( )	12	83.30	20.8	48.08	9	78
6D( )15-200( )	15	4.44	26.0	2.56	1	14
6D( )15-450( )	15	10.00	26.0	5.77	2	20
6D( )15-650( )	15	14.40	26.0	8.33	3	28
6D( )15-850( )	15	18.90	26.0	10.90	4	39
6D( )15-1100( )	15	24.40	26.0	14.10	5	48
6D( )15-1500( )	15	33.30	26.0	19.20	6	58
6D( )15-2000( )	15	44.44	26.0	25.65	7	60
6D( )15-2500( )	15	55.55	26.0	32.05	8	68
6D( )15-3000( )	15	66.66	26.0	38.46	9	78
6D( )20-200( )	20	3.33	34.6	1.93	1	14
6D( )20-450( )	20	7.50	34.6	4.33	2	20
6D( )20-650( )	20	10.80	34.6	6.26	3	28
6D( )20-850( )	20	14.20	34.6	8.19	4	39
6D( )20-1100( )	20	18.30	34.6	10.60	5	48
6D( )20-1500( )	20	25.00	34.6	14.40	6	58
6D( )20-2000( )	20	33.33	34.6	19.27	7	60
6D( )20-2500( )	20	41.66	34.6	24.08	8	68
6D( )20-3000( )	20	50.00	34.6	28.88	9	78

Model No.	Delta: L to L (3 wire) WYE: L to Com. (4 wire) Volts R.M.S.	Load Current (Amps)	WYE: L to L (3 wire) Volts R.M.S.	Load Current (Amps)	Size	Wt. Lbs. (Typ.)
6D( )28-200( )	28	2.38	48.5	1.37	1	14
6D( )28-450( )	28	5.36	48.5	3.09	2	20
6D( )28-650( )	28	7.74	48.5	4.47	3	28
6D( )28-850( )	28	10.10	48.5	5.83	4	39
6D( )28-1100( )	28	13.10	48.5	7.56	5	48
6D( )28-1500( )	28	17.90	48.5	10.30	6	58
6D( )28-2000( )	28	23.81	48.5	13.75	7	60
6D( )28-2500( )	28	29.76	48.5	17.18	8	68
6D( )28-3000( )	28	35.71	48.5	20.62	9	78
6D( )48-200( )	48	1.39	83.1	.80	1	14
6D( )48-450( )	48	3.13	83.1	1.81	2	20
6D( )48-650( )	48	4.51	83.1	2.61	3	28
6D( )48-850( )	48	5.90	83.1	3.41	4	39
6D( )48-1100( )	48	7.64	83.1	4.41	5	48
6D( )48-1500( )	48	10.40	83.1	6.02	6	58
6D( )48-2000( )	48	13.88	83.1	8.02	7	60
6D( )48-2500( )	48	17.36	83.1	10.02	8	68
6D( )48-3000( )	48	20.83	83.1	12.03	9	78
6D( )115-200( )	115	.58	200.0	.34	1	14
6D( )115-450( )	115	1.30	200.0	.75	2	20
6D( )115-650( )	115	1.88	200.0	1.09	3	28
6D( )115-850( )	115	2.46	200.0	1.42	4	39
6D( )115-1100( )	115	3.19	200.0	1.84	5	48
6D( )115-1500( )	115	4.35	200.0	2.51	6	58
6D( )115-2000( )	115	5.80	200.0	3.33	7	60
6D( )115-2500( )	115	7.25	200.0	4.18	8	68
6D( )115-3000( )	115	8.67	200.0	5.00	9	78





INPUT CONNECTION

WYE: L-Com. 1, 2, 3 Line. 4 com.
WYE: L-L 1, 2, 3 (Pin 4 not used)
DELTA: L-L 1, 2, 3 (Pin 4 not used)

OUTPUT CONNECTION

WYE: L-Com. connect 6-8-10 Load 5-6, 7-6, 9-6
DELTA: L-L Connect 6-7, 8-9, 5-10 Load 5, 7, 9
WYE: L-L connect 6-10, 8-10 Load 5, 7, 9

SIZE	A	B	C	D	E	F	G
1	6.10	4.10	4.62	4.10	3.10	3.75	4.81
2	7.70	4.10	5.43	4.10	3.10	4.00	6.00
3	7.70	5.10	5.43	5.10	4.10	4.00	6.00
4	9.20	4.60	6.78	5.10	3.86	5.24	7.50
5	9.20	5.10	6.78	5.60	4.36	5.24	7.50
6	9.20	5.85	6.78	6.35	5.11	5.24	7.50
7	11.00	4.85	8.13	5.10	3.86	6.40	9.00
8	11.00	5.35	8.13	5.60	4.36	6.40	9.00
9	11.00	5.85	8.13	6.10	5.11	6.40	9.00

DIM. TOL.: E, F, G, ±.06

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Abbott TECHNOLOGIES, INC.

60 Hz Industrial Transformers

MODEL 6B

SPECIFICATIONS

INPUT PRIMARY: 115 VAC standard. 230 VAC at 10% additional cost. Specify by suffixing "A" to model number. 115/230 VAC dual input at 10% additional cost. Specify by suffixing "B" to model number.

INPUT FREQUENCY: 50 to 400 Hz, 1 phase.

REGULATION: 15% Max. from no load to full load (6% on units size 8 and larger).

SECONDARY VOLTAGE TOLERANCE: Within 5% of listed output voltage when measured at full load and 115 VAC input.

INSULATION TEST: 1500 VAC.

OPERATING TEMPERATURE: 80°C maximum ambient (70°C on units size 8 and larger).

APPROXIMATE EFFICIENCY: Ranges from 80% to 90% typical.

CONSTRUCTION: Commercial grade using Silicon Iron for core and heavy insulated synthetic film magnet wire with class "B" rating impregnated with a high quality insulating varnish having a class "H" rating. Other outputs and/or inputs available on request.

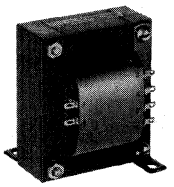


FIG. 1, 2, 3

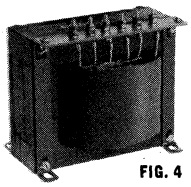
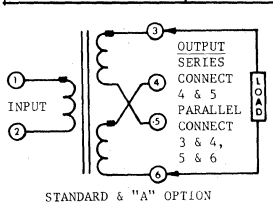


FIG. 4

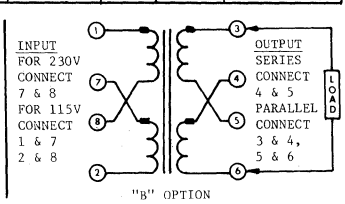
Output Volts (F.L.)	Output Current (Amps) Parallel Connection	Output Current (Amps) Series Connection	Size	Weight Lbs. Typ.	Model Number
5V Parallel	2.0	1.0	1	1.2	6B5-10
10V C.T. Series	3.0	1.5	2	1.5	6B5-15
	6.0	3.0	3	2.2	6B5-30
	12.0	6.0	4	3.0	6B5-60
	18.0	9.0	5	4.3	6B5-90
	26.0	13.0	6	5.5	6B5-130
	32.0	16.0	7	7.0	6B5-160†
	60.0	30.0	8	13.0	6B5-300†
	100.0	50.0	9	23.0	6B5-500†
6.3V Parallel	1.60	0.80	1	1.2	6B6-10
12.6V C.T. Series	2.40	1.20	2	1.5	6B6-15
	4.80	2.40	3	2.2	6B6-30
	9.40	4.70	4	3.0	6B6-60
	14.4	7.20	5	4.3	6B6-90
	20.6	10.3	6	5.5	6B6-130
	25.4	12.7	7	7.0	6B6-160†
	48.0	24.0	8	13.0	6B6-300†
	95.0	47.5	9	23.0	6B6-600†
8V Parallel	1.20	0.60	1	1.2	6B8-10
16V C.T. Series	1.80	0.90	2	1.5	6B8-15
	3.60	1.80	3	2.2	6B8-30
	7.60	3.80	4	3.0	6B8-60
	11.2	5.60	5	4.3	6B8-90
	16.2	8.10	6	5.5	6B8-130
	20.0	10.0	7	7.0	6B8-160*
	37.5	18.75	8	13.0	6B8-300†
	75.0	37.50	9	23.0	6B8-600†
	100.0	50.0	10	26.0	6B8-800†
10V Parallel	1.0	0.5	1	1.2	6B10-10
20V C.T. Series	1.5	0.75	2	1.5	6B10-15
	3.0	1.5	3	2.2	6B10-30
	6.0	3.0	4	3.0	6B10-60
	9.0	4.5	5	4.3	6B10-90
	13.0	6.5	6	5.5	6B10-130
	16.0	8.0	7	7.0	6B10-160*
	30.0	15.0	8	13.0	6B10-300†
	60.0	30.0	9	23.0	6B10-600†
	85.0	42.5	10	26.0	6B10-850†
	100.0	50.0	11	36.0	6B10-1000†
12V Parallel	0.82	0.41	1	1.2	6B12-10
24V C.T. Series	1.24	0.62	2	1.5	6B12-15
	2.50	1.25	3	2.2	6B12-30
	5.0	2.50	4	3.0	6B12-60
	7.5	3.75	5	4.3	6B12-90
	10.82	5.41	6	5.5	6B12-130
	13.32	6.66	7	7.0	6B12-160*
	25.00	12.50	8	13.0	6B12-300†
	50.00	25.00	9	23.0	6B12-600†
	71.00	35.50	10	26.0	6B12-850†
	100.00	50.00	11	36.0	6B12-1200†

* Use Fig. 3 for layout †Use Fig. 4 for layout

Output Volts (F.L.)	Output Current (Amps) Parallel Connection	Output Current (Amps) Series Connection	Size	Weight Lbs. Typ.	Model Number
17V Parallel	0.58	0.29	1	1.2	6B17-10
34V C.T. Series	0.88	0.44	2	1.5	6B17-15
	1.76	0.88	3	2.2	6B17-30
	3.52	1.76	4	3.0	6B17-60
	5.28	2.64	5	4.3	6B17-90
	7.64	3.82	6	5.5	6B17-130
	9.40	4.70	7	7.0	6B17-160*
	17.65	8.8	8	13.0	6B17-300†
	35.00	17.5	9	23.0	6B17-600†
	50.00	25.00	10	26.0	6B17-850†
	76.5	38.25	11	36.0	6B17-1300†
20V Parallel	0.5	0.25	1	1.2	6B20-10
40V C.T. Series	0.74	0.37	2	1.5	6B20-15
	1.5	0.75	3	2.2	6B20-30
	3.0	1.5	4	3.0	6B20-60
	4.5	2.25	5	4.3	6B20-90
	6.5	3.25	6	5.5	6B20-130
	8.0	4.0	7	7.0	6B20-160*
	15.0	7.50	8	13.0	6B20-300*
	30.0	15.0	9	23.0	6B20-600†
	42.5	21.25	10	26.0	6B20-850†
	65.0	32.50	11	36.0	6B20-1300†
28V Parallel	0.36	0.18	1	1.2	6B28-10
56V C.T. Series	0.52	0.26	2	1.5	6B28-15
	1.06	0.53	3	2.2	6B28-30
	2.14	1.07	4	3.0	6B28-60
	3.20	1.60	5	4.3	6B28-90
	4.64	2.32	6	5.5	6B28-130
	5.70	2.85	7	7.0	6B28-160 *
	10.70	5.35	8	13.0	6B28-300*
	21.43	10.71	9	23.0	6B28-600†
	30.36	15.18	10	26.0	6B28-850†
	46.42	23.21	11	36.0	6B28-1300†
44V Parallel	0.22	0.11	1	1.2	6B44-10
88V C.T. Series	0.34	0.17	2	1.5	6B44-15
	0.68	0.34	3	2.2	6B44-30
	1.36	0.68	4	3.0	6B44-60
	2.04	1.02	5	4.3	6B44-90
	2.94	1.47	6	5.5	6B44-130
	3.62	1.81	7	7.0	6B44-160*
	6.82	3.41	8	13.0	6B44-300*
	13.64	6.82	9	23.0	6B44-600*
	19.32	9.66	10	26.0	6B44-850*
	29.54	14.77	11	36.0	6B44-1300†
60V Parallel	0.16	0.08	1	1.2	6B60-10
120V C.T. Series	0.250	0.125	2	1.5	6B60-15
	0.50	0.25	3	2.2	6B60-30
	1.0	0.50	4	3.0	6B60-60
	1.5	0.75	5	4.3	6B60-90
	2.16	1.08	6	5.5	6B60-130
	2.66	1.33	7	7.0	6B60-160*
	5.00	2.50	8	13.0	6B60-300*
	10.00	5.00	9	23.0	6B60-600*
	14.16	7.08	10	26.0	6B60-850*
	21.67	10.83	11	36.0	6B60-1300†



STANDARD & "A" OPTION



"B" OPTION

SIZE	A	B	C	D	E	F	HOLE	FIG.
1	1.95	1.68	2.31	2.37	—	2.87	0.18	1
2	2.26	1.93	2.68	2.81	—	3.12	0.18	1
3	2.57	2.18	3.06	3.12	—	3.56	0.18	1
4	2.81	2.43	3.37	2.25	2.12	2.70	0.2 x 0.3	2
5	3.12	2.68	3.75	2.50	2.25	2.86	0.2 x 0.3	2
6	3.44	2.93	4.12	2.75	2.37	2.98	0.2 x 0.3	3
7	3.75	3.18	4.50	3.00	2.50	3.11	0.2 x 0.3	3
8	5.25	3.87	4.37	4.37	2.85	3.75	0.26 x 0.4	3 or 4
9	6.37	4.62	5.31	5.31	3.22	4.20	0.26 x 0.4	3 or 4
10	6.37	4.99	5.31	5.31	3.60	4.58	0.26 x 0.4	3 or 4
11	7.50	5.37	6.25	6.75	3.60	4.85	0.26 x 0.4	3 or 4

DIMENSIONAL TOLERANCE: ±0.06 except B is max.

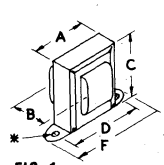


FIG. 1

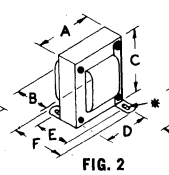
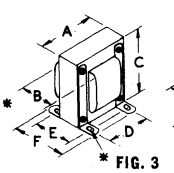


FIG. 2



* FIG. 3

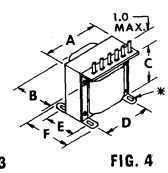


FIG. 4

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Abbott TECHNOLOGIES, INC.

400 Hz MIL-T-27 Transformers

MODEL **E**

SPECIFICATIONS

Input Primary
115V, 400 Hz ±20 Hz, 1 phase

Regulation
10% no load to full load
(12% for 2E models)

Secondary Voltage Tolerance
Within 5% when measured at full load and 115 VAC input

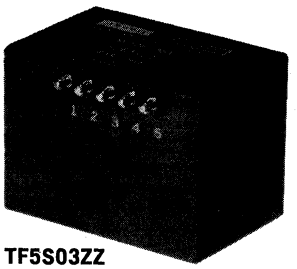
Construction
To MIL-T-27, Grade 5, Class S Molded Dially Phthalate

Environment
Encapsulated to meet MIL-STD-810, including vibration, ambient temperature to 85°C, shock, sand, dust, humidity, saltspray, fungus, sunshine, rain, explosion, and altitude (to a vacuum).

Output Secondary
See voltage and current of specific models listed.

Other models are available. Contact our nearest office for complete information.

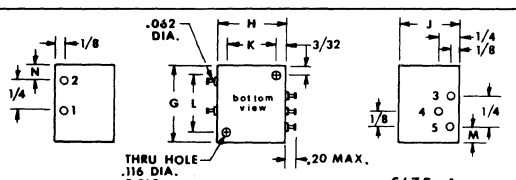
Now QPL!



TF5S03ZZ

Output Volts	Output Current (Amps)	Size	Sec. DCR (ohms)	Model Number
5.0	0.400	A	**0.60**	2E5CT
	1.200	B	**0.173**	6E5CT
	3.000	C	**0.046**	15E5CT
	4.800	D	**0.040**	24E5CT
	16.000	E2	**0.009**	80E5CT
	35.000	F2	**0.012**	175E5CT
6.3	0.317	A	1.06	2E6.3CT
	0.950	B	0.24	6E6.3CT
	2.380	C	0.088	15E6.3CT
	3.800	D	0.107	24E6.3CT
	12.800	E2	0.016	80E6.3CT
	27.800	F2	0.019	175E6.3CT
8.0	0.250	A	1.63	2E8CT
	0.750	B	0.396	6E8CT
	1.880	C	0.135	15E8CT
	3.000	D	0.140	24E8CT
	10.000	E2	0.017	80E8CT
	22.000	F2	0.010	175E8CT
10.0	0.200	A	2.50	2E10CT
	0.600	B	0.587	6E10CT
	1.500	C	0.27	15E10CT
	2.400	D	0.180	24E10CT
	8.000	E	7.2	80E10CT
	17.500	F2	0.020	175E10CT
12.6	0.158	A	4.10	2E12.6CT
	0.475	B	0.99	6E12.6CT
	1.180	C	0.32	15E12.6CT
	1.900	D	0.225	24E12.6CT
	6.350	E	0.030	80E12.6CT
	13.900	F2	0.021	175E12.6CT
14.0	0.142	A	5.59	2E14CT
	0.428	B	1.11	6E14CT
	1.070	C	0.35	15E14CT
	1.720	D	0.32	24E14CT
	5.600	E	0.04	80E14CT
	12.500	F2	0.022	175E14CT
16	0.125	A	6.63	2E16CT
	0.375	B	1.58	6E16CT
	0.940	C	0.54	15E16CT
	1.500	D	0.35	24E16CT
	5.000	E	0.05	80E16CT
	10.900	F2	0.025	175E16CT
18	0.111	A	9.00	2E18CT
	0.333	B	2.21	6E18CT
	0.832	C	0.74	15E18CT
	1.330	D	0.40	24E18CT
	4.450	E	0.08	80E18CT
	9.700	F	0.027	175E18CT
20	0.100	A	10.9	2E20CT
	0.300	B	2.78	6E20CT
	0.750	C	1.4	15E20CT
	1.200	D	0.48	24E20CT
	4.000	E	0.09	80E20CT
	8.750	F	0.020	175E20CT
22	0.091	A	14.6	2E22CT
	0.273	B	2.80	6E22CT
	0.680	C	0.92	15E22CT
	1.090	D	0.63	24E22CT
	3.630	E	0.12	80E22CT
	7.900	F	0.020	175E22CT
25	**0.080**	A	20.4	2E25CT
	0.240	B	3.60	6E25CT
	0.600	C	1.3	15E25CT
	0.960	D	0.68	24E25CT
	3.200	E	0.13	80E25CT
	7.000	F	0.042	175E25CT
28	0.071	A	30.0	2E28CT
	0.214	B	4.20	6E28CT
	0.535	C	1.83	15E28CT
	0.855	D	0.98	24E28CT
	2.850	E	0.14	80E28CT
	6.250	F	.043	175E28CT
31	**0.064**	A	25.6	2E31CT
	0.192	B	5.71	6E31CT
	0.485	C	1.62	15E31CT
	0.772	D	1.27	24E31CT
	2.470	E	0.18	80E31CT
	5.650	F	0.061	175E31CT
35	0.057	A	29.5	2E35CT
	0.171	B	6.89	6E35CT
	0.428	C	2.28	15E35CT
	0.685	D	1.70	24E35CT
	2.280	E	0.28	80E35CT
	5.000	F	0.098	175E35CT
39	0.051	A	38.6	2E39CT
	0.154	B	9.39	6E39CT
	0.384	C	2.54	15E39CT
	0.615	D	2.20	24E39CT
	2.050	E	0.32	80E39CT
	4.480	F	0.110	175E39CT
43	0.046	A	44.3	2E43CT
	0.139	B	10.25	6E43CT
	0.348	C	2.85	15E43CT
	0.556	D	2.42	24E43CT
	1.860	E	0.35	80E43CT
	4.060	F	0.114	175E43CT
48	0.041	A	57.0	2E48CT
	0.125	B	15.30	6E48CT
	0.312	C	4.05	15E48CT
	0.500	D	3.27	24E48CT
	1.660	E	0.40	80E48CT
	3.650	F	0.160	175E48CT
55	0.036	A	89.0	2E55CT
	0.109	B	17.30	6E55CT
	0.262	C	7.2	15E55CT
	0.435	D	3.83	24E55CT
	1.450	E	0.67	80E55CT
	3.170	F	0.196	175E55CT
63	0.031	A	100.0	2E63CT
	0.095	B	24.9	6E63CT
	0.238	C	6.51	15E63CT
	0.380	D	5.35	24E63CT
	1.270	E	0.71	80E63CT
	2.770	F	0.20	175E63CT
70	0.028	A	139.0	2E70CT
	0.085	B	27.1	6E70CT
	0.214	C	9.4	15E70CT
	0.342	D	8.10	24E70CT
	1.140	E	0.80	80E70CT
	2.500	F	0.25	175E70CT
80	0.025	A	163.0	2E80CT
	0.075	B	39.0	6E80CT
	0.198	C	13.4	15E80CT
	0.300	D	9.0	24E80CT
	1.000	E	0.92	80E80CT
	2.180	F	0.34	175E80CT
90	0.022	A	218.0	2E90CT
	0.067	B	41.0	6E90CT
	0.166	C	15.9	15E90CT
	0.267	D	12.5	24E90CT
	0.890	E	1.08	80E90CT
	1.940	F	0.38	175E90CT
100	0.020	A	283.0	2E100CT
	0.060	B	59.5	6E100CT
	0.150	C	16.8	15E100CT
	0.240	D	14.4	24E100CT
	0.800	E	1.64	80E100CT
	1.750	F	0.52	175E100CT
110	0.018	A	392.0	2E110CT
	0.054	B	62.3	6E110CT
	0.136	C	22.1	15E110CT
	0.218	D	19.5	24E110CT
	0.728	E	2.03	80E110CT
	1.590	F	0.72	175E110CT

NEW 26V, 115 V and other standard models to 486V are available. Contact our nearest office for complete information.

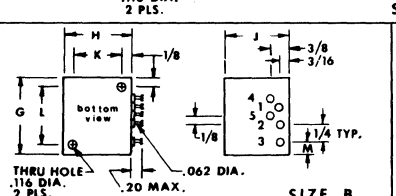


SIZE A

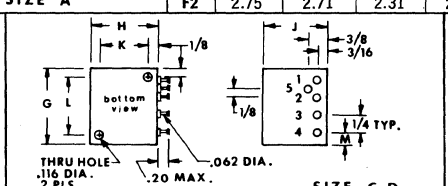
SIZE	G	H	J	K	L	M	N
A	.87	.74	.78	.55	.68	3/16	3/16
B	1.25	1.19	.88	.94	1.00	1/4	—
C	1.43	1.24	1.27	.99	1.18	1/4	—
D	1.47	1.28	1.40	1.03	1.22	1/4	—
E	2.31	1.52	1.75	1.02	1.81	1/2	—
E2	2.31	1.52	1.75	1.02	1.81	1/2	3/4
F	2.75	2.71	2.31	2.21	2.25	3/4	—
F2	2.75	2.71	2.31	2.21	2.25	3/4	1

Dim. Tol. =
Fraction ±1/32,
xx = ±0.015,
xxx = ±0.005

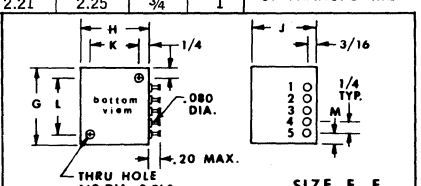
NOTE:
DIMENSIONS G & H MEASURED AT TOP OF TRANSFORMER



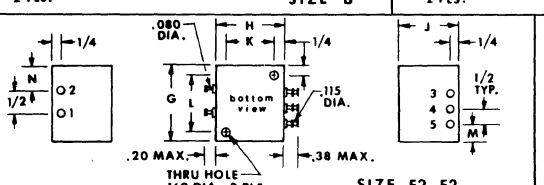
SIZE B



SIZE C,D

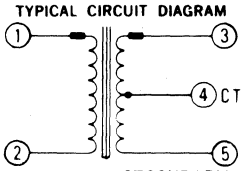


SIZE E, F



SIZE E2, F2

TYPICAL CIRCUIT DIAGRAM



MODEL TYPE	WEIGHT lbs. (max)	PRIMARY DCR ohms (typical)
2E	0.06	201
6E	0.15	61
15E	0.28	14
24E	0.32	12
80E	0.80	2.0
175E	2.2	0.7

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Abbott TECHNOLOGIES, INC.

400 Hz MIL-T-27 Transformers

MODEL 4A

SPECIFICATIONS

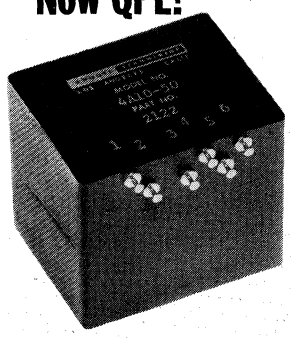
INPUT PRIMARY: 115 V, 400 Hz ±20 Hz, 1 Phase.
REGULATION: 10% no load to full load.
SECONDARY VOLTAGE TOLERANCE: Within 5% when measured at full load and 115 VAC input.
INSULATION TEST: 1500 VAC.
OPERATING TEMP.: 95°C maximum ambient temperature.
CONSTRUCTION: To MIL-T-27, Grade 5, Class S, life "X", (10,000 hrs.)

EFFICIENCY: From 90% to 93% typical.

ENVIRONMENT: Encapsulated to meet MIL-STD-810 for vibration, shock, sand, dust, humidity, salt spray, fungus, sunshine, rain, explosion, and altitude (to a vacuum). NOTE: for high altitude operation, encapsulate terminals.

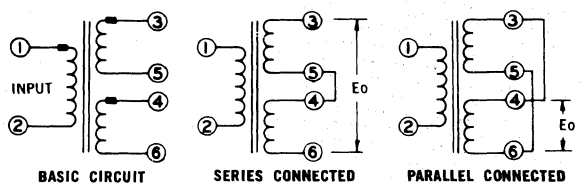
OPTIONS AVAILABLE: Other output voltages and 230 VAC input are available. Please consult our nearest office for complete information.

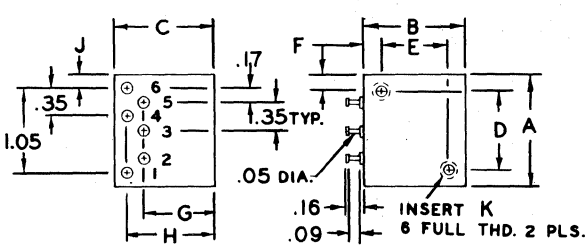
Now QPL!



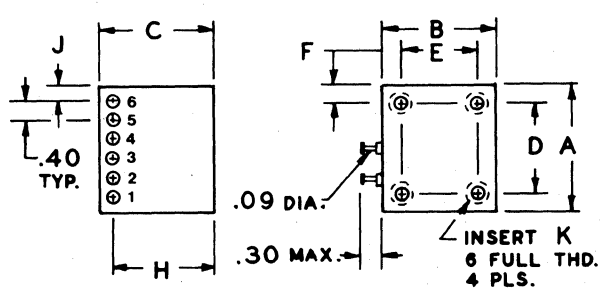
TF5S03ZZ

Output Volts (F.L.)	Output Current (Amps) Parallel Connection	Output Current (Amps) Series Connection	Size	Weight Lbs. Typ.	Model Number
5V Parallel	1.40	0.70	1	0.26	4A5-7
10V C.T.	2.00	1.00	2	0.30	4A5-10
Series	5.00	2.50	3	0.47	4A5-25
	8.00	4.00	4	0.77	4A5-40
	24.0	12.0	5	1.6	4A5-120
	30.0	15.0	6	2.0	4A5-150
6.3V Parallel	1.11	0.55	1	0.26	4A6-7
12.6V C.T.	1.58	0.79	2	0.30	4A6-10
Series	4.00	2.00	3	0.47	4A6-25
	8.00	4.00	4	0.77	4A6-50
	19.0	9.50	5	1.6	4A6-120
	23.8	11.9	6	2.0	4A6-150
8V Parallel	0.87	0.43	1	0.26	4A8-7
16V C.T.	1.25	0.62	2	0.30	4A8-10
Series	3.12	1.56	3	0.47	4A8-25
	6.24	3.12	4	0.77	4A8-50
	15.0	7.50	5	1.6	4A8-120
	18.7	9.35	6	2.0	4A8-150
10V Parallel	0.70	0.35	1	0.26	4A10-7
20V C.T.	1.00	0.50	2	0.30	4A10-10
Series	2.50	1.25	3	0.47	4A10-25
	5.00	2.50	4	0.77	4A10-50
	12.0	6.00	5	1.6	4A10-120
	15.0	7.50	6	2.0	4A10-150
12V Parallel	0.58	0.29	1	0.26	4A12-7
24V C.T.	0.84	0.42	2	0.30	4A12-10
Series	2.08	1.04	3	0.47	4A12-25
	4.16	2.08	4	0.77	4A12-50
	10.0	5.00	5	1.6	4A12-120
	12.5	6.25	6	2.0	4A12-150
17V Parallel	0.41	0.20	1	0.26	4A17-7
34V C.T.	0.58	0.29	2	0.30	4A17-10
Series	1.47	0.73	3	0.47	4A17-25
	2.94	1.47	4	0.77	4A17-50
	7.06	3.53	5	1.6	4A17-120
	8.82	4.41	6	2.0	4A17-150
20V Parallel	0.35	0.17	1	0.26	4A20-7
40V C.T.	0.50	0.25	2	0.30	4A20-10
Series	1.25	0.62	3	0.47	4A20-25
	2.50	1.25	4	0.77	4A20-50
	6.00	3.00	5	1.6	4A20-120
	7.50	3.75	6	2.0	4A20-150
28V Parallel	0.25	0.12	1	0.26	4A28-7
56V C.T.	0.35	0.17	2	0.30	4A28-10
Series	0.89	0.44	3	0.47	4A28-25
	1.78	0.89	4	0.77	4A28-50
	4.28	2.14	5	1.6	4A28-120
	5.36	2.68	6	2.0	4A28-150
44V Parallel	0.15	0.07	1	0.26	4A44-7
88V C.T.	0.22	0.11	2	0.36	4A44-10
Series	0.56	0.28	3	0.47	4A44-25
	1.12	0.56	4	0.77	4A44-50
	2.72	1.36	5	1.6	4A44-120
	3.40	1.70	6	2.0	4A44-150
60V Parallel	0.11	0.05	1	0.26	4A60-7
120V C.T.	0.16	0.08	2	0.30	4A60-10
Series	0.41	0.20	3	0.47	4A60-25
	0.82	0.41	4	0.77	4A60-50
	2.00	1.00	5	1.6	4A60-120
	2.50	1.25	6	2.0	4A60-150





SIZES 1, 2, 3, 4



SIZES 5, 6

Size	A	B	C	D	E	F	G	H	J	K
1	1.37	1.25	1.31	1.00	.87	.19	1.00	1.19	.16	4-40
2	1.50	1.37	1.37	1.12	1.00	.19	1.06	1.25	.22	4-40
3	1.75	1.50	1.56	1.25	1.00	.25	1.25	1.44	.35	6-32
4	2.00	1.62	1.81	1.50	1.12	.25	1.50	1.69	.47	6-32
5	2.43	2.00	2.10	1.93	1.50	.25	—	1.90	.21	6-32
6	2.81	2.12	2.43	2.21	1.52	.30	—	2.23	.40	8-32

Tolerance: ±.02 except F, G, H, J: ±.04.
Note: NEW models available to 200 VA. Contact our nearest office for complete information.

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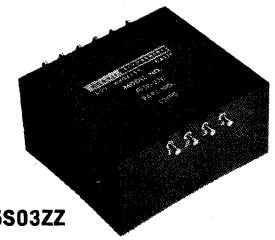
Abbott TECHNOLOGIES, INC.

400 Hz, 3 Ø MIL-T-27 Transformers

MODEL 4D

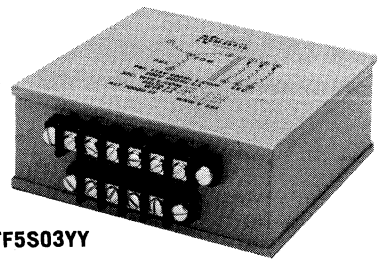
Now QPL!



TF5S03ZZ

Sizes 1 through 6

- Designed to meet the light weight and high temperature requirements of airborne, shipboard, and military electronics.
- Power levels range from 90 to 1,000 watts.



TF5S03YY

Sizes 7 through 10

MODEL NUMBER	OUTPUT PER PHASE: DELTA: L to L (3 wire) WYE: L to COM. (4 wire) VOLTS R.M.S.	LOAD CURRENT AMPS	OUTPUT PER PHASE: WYE: L to L (3 wire) VOLTS R.M.S.	LOAD CURRENT AMPS	SIZE	WEIGHT LBS. (TYP.)
4D5-90	5	6.00	8.66	3.47	1	1.3
4D5-120	5	8.00	8.66	4.62	2	1.6
4D5-150	5	10.00	8.66	5.78	3	2.3
4D5-200	5	13.34	8.66	7.70	4	2.4
4D5-500	5	20.00	8.66	19.24	7	6.1
4D5-650	5	30.00	8.66	25.02	8	6.8
4D12-90	12	2.50	20.8	1.45	1	1.3
4D12-120	12	3.34	20.8	1.93	2	1.6
4D12-150	12	4.17	20.8	2.41	3	2.3
4D12-200	12	5.56	20.8	3.21	4	2.4
4D12-270	12	7.50	20.8	4.33	5	2.8
4D12-375	12	10.42	20.8	6.02	6	3.8
4D12-500	12	13.88	20.8	8.01	7	6.1
4D12-650	12	18.05	20.8	10.42	8	6.8
4D12-800	12	22.22	20.8	12.82	9	7.6
4D12-1000	12	27.78	20.8	16.02	10	8.1
4D15-90	15	2.00	26.0	1.16	1	1.3
4D15-120	15	2.67	26.0	1.54	2	1.6
4D15-150	15	3.34	26.0	1.93	3	2.3
4D15-200	15	4.45	26.0	2.57	4	2.4
4D15-270	15	6.00	26.0	3.47	5	2.8
4D15-375	15	8.34	26.0	4.82	6	3.8
4D15-500	15	11.11	26.0	6.41	7	6.1
4D15-650	15	14.44	26.0	8.33	8	6.8
4D15-800	15	17.78	26.0	10.25	9	7.6
4D15-1000	15	22.23	26.0	12.82	10	8.1
4D20-90	20	1.50	34.6	.87	1	1.3
4D20-120	20	2.00	34.6	1.16	2	1.6
4D20-150	20	2.50	34.6	1.45	3	2.3
4D20-200	20	3.34	34.6	1.93	4	2.4
4D20-270	20	4.50	34.6	2.60	5	2.8
4D20-375	20	6.25	34.6	3.61	6	3.8
4D20-500	20	8.33	34.6	4.81	7	6.1
4D20-650	20	10.83	34.6	6.26	8	6.8
4D20-800	20	13.33	34.6	7.70	9	7.6
4D20-1000	20	16.67	34.6	9.63	10	8.1
4D28-90	28	1.08	48.5	.62	1	1.3
4D28-120	28	1.43	48.5	.83	2	1.6
4D28-150	28	1.79	48.5	1.03	3	2.3
4D28-200	28	2.38	48.5	1.38	4	2.4
4D28-270	28	3.22	48.5	1.86	5	2.8
4D28-375	28	4.47	48.5	2.58	6	3.8
4D28-500	28	5.95	48.5	3.43	7	6.1
4D28-650	28	7.74	48.5	4.46	8	6.8
4D28-800	28	9.52	48.5	5.50	9	7.6
4D28-1000	28	11.91	48.5	6.87	10	8.1
4D48-90	48	.63	83.1	.36	1	1.3
4D48-120	48	.84	83.1	.49	2	1.6
4D48-150	48	1.05	83.1	.61	3	2.3
4D48-200	48	1.39	83.1	.81	4	2.4
4D48-270	48	1.88	83.1	1.09	5	2.8
4D48-375	48	2.61	83.1	1.51	6	3.8
4D48-500	48	3.47	83.1	2.00	7	6.1
4D48-650	48	4.51	83.1	2.60	8	6.8
4D48-800	48	5.56	83.1	3.20	9	7.6
4D48-1000	48	6.95	83.1	4.01	10	8.1
4D115-90	115	.26	200.0	.15	1	1.3
4D115-120	115	.35	200.0	.20	2	1.6
4D115-150	115	.44	200.0	.25	3	2.3
4D115-200	115	.58	200.0	.34	4	2.4
4D115-270	115	.79	200.0	.45	5	2.8
4D115-375	115	1.09	200.0	.63	6	3.8
4D115-500	115	1.45	200.0	.83	7	6.1
4D115-650	115	1.88	200.0	1.08	8	6.8
4D115-800	115	2.32	200.0	1.33	9	7.6
4D115-1000	115	2.90	200.0	1.66	10	8.1

SPECIFICATIONS

INPUT PRIMARY: WYE: (4 wire) Line to Common 115 VAC
WYE: (3 wire) Line to Line 200 VAC
DELTA: (3 wire) Line to Line 115 VAC (see option "A")
DELTA: (3 wire) Line to Line 200 VAC (see option "B")

INPUT FREQUENCY: 400 Hz ±20 Hz.

OUTPUT: See specific models listed.

OUTPUT VOLTAGE TOLERANCE: Within 5% when measured at full load and nominal VAC input.

REGULATION: 10% no load to full load.

INSULATION TEST: 1500 VRMS

EFFICIENCY: Ranges from 90% to 95% typical.

OPERATING TEMPERATURE: 80°C maximum ambient temperature.

TEMPERATURE RISE: Less than 50°C.

Construction: To MIL-T-27 Grade 5, Class S.

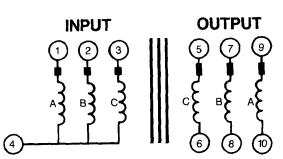
ENVIRONMENT: Encapsulated to meet MIL-STD-810, including vibration temperature to 80°C, shock, sand, dust, humidity, salt spray, fungus, sunshine, rain, explosion. Note: For high altitude operation, encapsulate terminals.

Option "A"—To order DELTA input 115 VAC L-L; Add suffix "A" to Model No., e.g., 4D5-90A.

Option "B"—To order DELTA input 200 VAC L-L; Add suffix "B" to Model No., e.g., 4D5-90B.

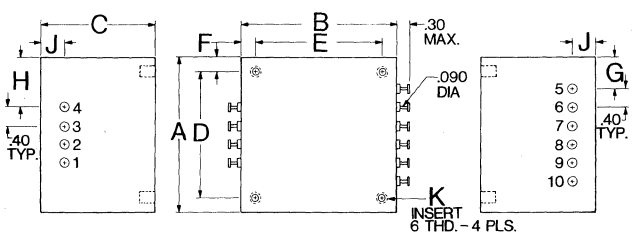
Size	A	B	C	D	E	F	G	H	J	K
1	2.90	2.40	1.45	2.50	2.00	.20	.45	.85	.20	6-32
2	2.90	2.70	1.55	2.50	2.30	.20	.45	.85	.20	6-32
3	3.65	2.80	1.70	3.15	2.30	.25	.82	1.22	.20	8-32
4	3.65	3.00	1.70	3.15	2.50	.25	.82	1.22	.20	8-32
5	3.65	3.00	1.95	3.15	2.50	.25	.82	1.22	.20	8-32
6	4.95	3.20	1.90	4.45	2.70	.25	1.47	1.87	.20	8-32
7	5.31	4.50	2.00	4.31	3.50	.50	.62	1.37	—	10-32
8	5.62	4.20	2.31	4.62	3.20	.50	.78	1.53	—	10.32
9	5.31	4.75	2.31	4.31	3.75	.50	.78	1.53	—	10.32
10	6.12	4.75	2.31	5.12	3.75	.50	.78	1.53	—	10.32

Load current more then 20 amps. Dim. H is 1.56
Dim. Tol.: D. E. ±.02 all others ±.04

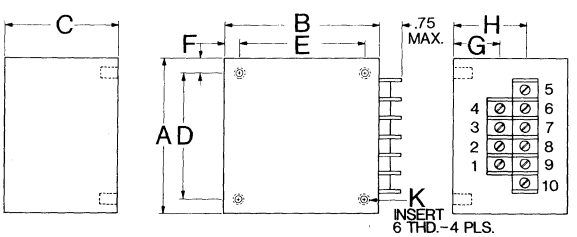


INPUT CONNECTION:
WYE, 115V to Com. 1, 2, 3, Line 4 Com
WYE, 200V L-L 1, 2, 3 (Pin 4 not used)
DELTA 115V or 200V L-L 1, 2, 3 (Pin 4 not used)

OUTPUT CONNECTION:
WYE, L-Com Connect 6-8 10 Load 5-6, 7-6, 9-6
DELTA L-L Connect 6-7, 8-9, 5-10 Load 5, 7, 9
WYE L-L Connect 6-10, 8-10 Load 5, 7, 9



SIZE 1 THROUGH 6



SIZE 7 THROUGH 10

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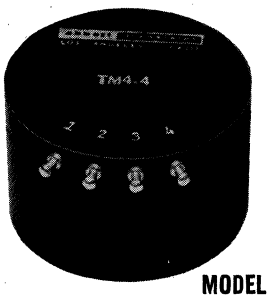
Abbott TECHNOLOGIES, INC.

400 Hz MIL-T-27 and Industrial Toroid Transformers

MODELS TM TF

Now QPL!



MODEL TM
TF5S03ZZ

SPECIFICATIONS

INPUT PRIMARY: 115V, 400 Hz ±20 Hz, 1 phase; for 230V operation add the suffix "A"

REGULATION: 5% or less, no load to full load

SECONDARY VOLTAGE TOLERANCE: Within 5% when measured at full load and 115 VAC input

INSULATION TEST: 1000 VAC

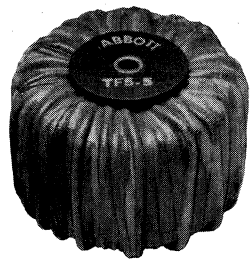
OPERATING TEMPERATURE: MODEL TM 90°C maximum ambient/MODEL TF 80°C maximum ambient.

APPROXIMATE EFFICIENCY: 90% to 95% typical.

OUTPUT SECONDARY: See voltage and current of specific models listed

CONSTRUCTION: MODEL TF — Open frame, Industrial Grade with Teflon leads 6" long. MODEL TM — to meet MIL-T-27, Grade 5, Class S, MIL-type Designation TF5S03ZZ

OPTIONS: "A" option is for 230V input primary. Add suffix "A" to model number (i.e. TF10-1A). "C" option is for center tapped output. Add suffix "C" to mode number (i.e. TF10-1C)

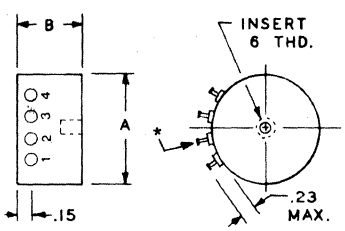


MODEL TF
Industrial Grade

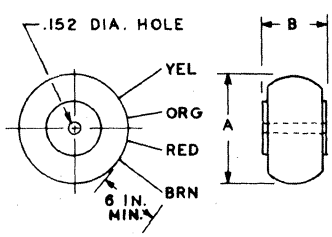
Output Volts (F.L.)	Model No. TM	Model No. TF	Output Current (Amps)	Size	VA
5V	TM1-1	TF1-1	3.00	1	15
	TM1-2	TF1-2	5.00	2	25
	TM1-3	TF1-3	10.00	3	50
7V	TM2-1	TF2-1	2.14	1	15
	TM2-2	TF2-2	3.57	2	25
	TM2-3	TF2-3	7.14	3	50
	TM2-4	TF2-4	10.00	4	70
10V	TM3-1	TF3-1	1.50	1	15
	TM3-2	TF3-2	2.50	2	25
	TM3-3	TF3-3	5.00	3	50
	TM3-4	TF3-4	7.50	4	75
	TM3-5	TF3-5	10.00	5	100
12V	TM4-1	TF4-1	1.25	1	15
	TM4-2	TF4-2	2.08	2	25
	TM4-3	TF4-3	4.17	3	50
	TM4-4	TF4-4	6.25	4	75
	TM4-5	TF4-5	8.33	5	100
14V	TM5-1	TF5-1	1.07	1	15
	TM5-2	TF5-2	1.79	2	25
	TM5-3	TF5-3	3.57	3	50
	TM5-4	TF5-4	5.36	4	75
	TM5-5	TF5-5	7.14	5	100

NEW 26V models available. Contact our nearest office for complete information.

Output Volts (F.L.)	Model No. TF	Model No. TM	Output Current (Amps)	Size	VA
17V	TM6-1	TF6-1	0.88	1	15
	TM6-2	TF6-2	1.47	2	25
	TM6-3	TF6-3	2.94	3	50
	TM6-4	TF6-4	4.41	4	75
	TM6-5	TF6-5	5.88	5	100
24V	TM7-1	TF7-1	0.63	1	15
	TM7-2	TF7-2	1.04	2	25
	TM7-3	TF7-3	2.08	3	50
	TM7-4	TF7-4	3.13	4	75
	TM7-5	TF7-5	4.17	5	100
28V	TM8-1	TF8-1	0.54	1	15
	TM8-2	TF8-2	0.89	2	25
	TM8-3	TF8-3	1.79	3	50
	TM8-4	TF8-4	2.68	4	75
	TM8-5	TF8-5	3.57	5	100
34V	TM9-1	TF9-1	0.44	1	15
	TM9-2	TF9-2	0.75	2	25
	TM9-3	TF9-3	1.47	3	50
	TM9-4	TF9-4	2.21	4	75
	TM9-5	TF9-5	2.94	5	100
115V	TM10-1	TF10-1	0.13	1	15
	TM10-2	TF10-2	0.21	2	25
	TM10-3	TF10-3	0.43	3	50
	TM10-4	TF10-4	0.65	4	75
	TM10-5	TF10-5	0.87	5	100

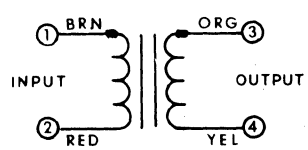


MODEL TM

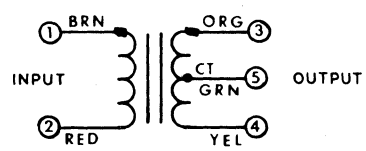


MODEL TF

STANDARD & OPTION A



OPTION C



SIZE	1		2		3		4		5	
MODEL	TM	TF	TM	TF	TM	TF	TM	TF	TM	TF
DIM A	1.62	1.50	1.75	1.63	2.13	2.00	2.13	2.00	2.38	2.25
DIM B	0.95	0.95	1.00	1.00	1.10	1.10	1.30	1.30	1.60	1.60
WT. (LB. MAX.)	0.26	0.17	0.33	0.25	0.52	0.38	0.66	0.52	1.1	0.79
INSERT	6-32	—	8-32	—	8-32	—	10-32	—	10-32	—

DIMENSIONAL TOLERANCE: Model TM ±.03; Model TF Dim A, B Max.
*Terminal Spacing is 0.35.

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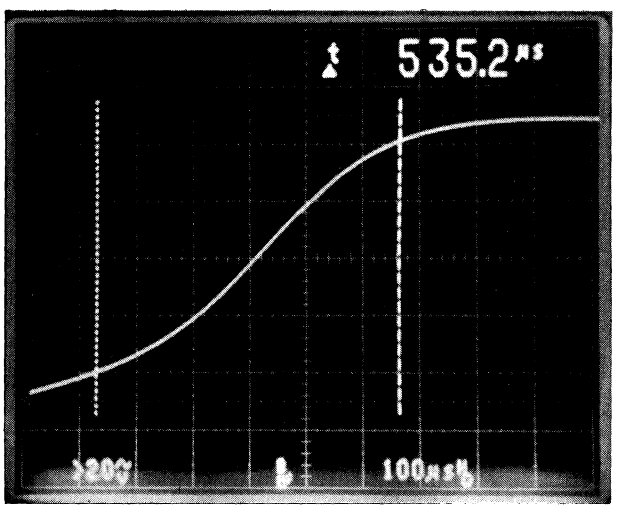
AMECON
QUALITY MAGNETIC COMPONENTS • DESIGNED WITH 30 YRS. OF EXPERTISE
1900 CHRIS LANE / ANAHEIM, CA 92805 / 714-634-2220 / FAX 714-634-0905 / TLX 510-100-0364

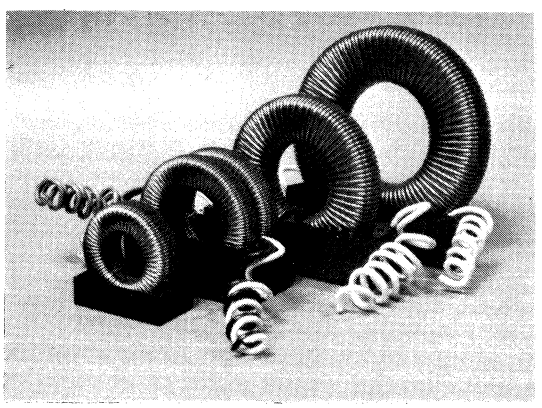
PRECISION WOUND HEAVY DUTY TOROIDAL INDUCTORS

FOR PROFESSIONAL LIGHT DIMMERS, MOTOR CONTROLS, SCR CONTROLS & LINE FILTERS

- **AVAILABLE IN SEMI OR FULL EPOXY MOLDED**
- **HORIZONTAL & VERTICAL MOUNTING**
- **ALL "UL" RECOGNIZABLE MATERIALS**
- **ABSOLUTELY LATEST "STATE OF THE ART" MATERIALS, PRODUCTION & TESTING TECHNOLOGIES ARE EMPLOYED THROUGHOUT ALL PHASES OF THIS PRODUCT LINE**
- **SPECIFICALLY DESIGNED FOR 120 VOLTS 60 Hz**



TYPICAL TURN ON RISE TIME 90° FIRING



VERTICAL MTG. SHOWN LEFT TO RIGHT.
10A, DUAL 20A., 50A & 100.A.

Part No.	Rating Amps Rms	dI/dt 10% 90% µs.	△t°C Above Ambient	DCR Ohms 100°C	Dimensions* Open Style O.D. x Ht.
1618-119128	5	150	85	0.241	1.70 x 0.75
2017-118150	5	200	70	0.237	2.10 x 0.75
2017-119180	5	250	92	0.355	2.10 x 0.75
1618-118090	6.66	100	83	0.134	1.70 x 0.75
2017-117112	6.66	150	71	0.140	2.20 x 0.75
2023-117115	6.66	200	74	0.165	2.20 x 0.88
2017-115110	8.33	150	70	0.092	2.20 x 0.75
2617-115136	8.33	250	72	0.126	2.80 x 0.75
2622-115130	8.33	300	72	0.133	2.80 x 0.90
2626-115128	8.33	350	73	0.141	2.80 x 1.00
2626-116145	8.33	400	90	0.200	2.80 x 1.00

Part No.	Rating Amps Rms	dI/dt 10% 90% µs.	△t°C Above Ambient	DCR Ohms 100°C	Dimensions* Open Style O.D. x Ht.
3024-115164	8.33	450	77	0.180	3.20 x 1.00
2617-115134	10	250	90	0.123	2.80 x 0.75
2622-115125	10	300	88	0.128	2.80 x 0.90
2626-114125	10	350	79	0.113	2.80 x 1.10
2626-115140	10	400	97	0.158	2.80 x 1.00
3024-114145	10	400	77	0.128	3.20 x 1.00
2634-114122	10	450	80	0.127	2.80 x 1.30
3024-115176	10	450	100	0.194	3.20 x 1.00
2634-115134	10	500	96	0.173	2.80 x 1.30
3032-114135	10	500	76	0.137	3.20 x 1.30

* Semi Epoxy Molded, Add 0.20" O.D. & 0.09" Ht. Full Epoxy Molded, Add 0.20" O.D. & Ht.
NOTES: Dimensions stated are based on perfect windings not always achieveable. Electrical data accurate to within ±6%.

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PRECISION WOUND HEAVY DUTY TOROIDAL INDUCTORS

SPECIFICALLY DESIGNED FOR 120 VOLTS 60 Hz

Part No.	Rating Amps Rms	di/dt 10% 90% μs.	△t°C Above Ambient	DCR Ohms 100°C	Dimensions* Open Style O.D. x Ht.
2626-113106	12.5	300	80	0.076	2.80 x 1.10
2634-112095	12.5	350	69	0.065	2.80 x 1.40
2634-113108	12.5	400	84	0.090	2.80 x 1.30
3521-114148	12.5	450	95	0.133	3.70 x 0.90
3032-113134	12.5	500	86	0.110	3.20 x 1.30
3024-112108	15	300	78	0.062	3.30 x 1.10
2634-112095	15	350	84	0.065	2.80 x 1.40
3032-111106	15	400	72	0.057	3.30 x 1.30
3032-112118	15	450	86	0.079	3.30 x 1.30
2634-113106	15	400	102	0.089	2.80 x 1.30
3526-112133	15	500	87	0.086	3.70 x 1.10
3032-113130	15	500	104	0.107	3.20 x 1.30
3532-111118	15	550	75	0.068	3.70 x 1.30
3024-112104	20	300	107	0.060	3.30 x 1.10
3521-111100	20	300	86	0.049	3.80 x 1.00
3032-110092	20	350	79	0.040	3.30 x 1.40
3526-112095	20	350	97	0.059	3.70 x 1.10
4021-110104	20	400	77	0.045	4.30 x 1.00
3526-110106	20	400	81	0.045	3.80 x 1.20
4021-110115	20	450	82	0.050	4.30 x 1.00
3526-111118	20	450	99	0.062	3.80 x 1.20
3532-110106	20	500	84	0.050	3.80 x 1.40
4021-111128	20	500	99	0.069	4.30 x 1.00
3532-111115	20	550	100	0.067	3.80 x 1.40
4026-110113	20	550	84	0.053	4.30 x 1.20
3521-110096	25	300	95	0.037	3.80 x 1.00
3526-110092	25	350	95	0.038	3.80 x 1.20
3532-110085	25	400	93	0.039	3.80 x 1.40
4021-109100	25	400	85	0.036	4.30 x 1.10
4026-109092	25	450	84	0.035	4.30 x 1.20
3532-110094	25	450	99	0.044	3.80 x 1.40
4026-109101	25	500	80	0.039	4.30 x 1.20
3532-110104	25	500	107	0.049	3.80 x 1.40
4032-109092	25	550	87	0.038	4.30 x 1.40

Part No.	Rating Amps Rms	di/dt 10% 90% μs.	△t°C Above Ambient	DCR Ohms 100°C	Dimensions* Open Style O.D. x Ht.
4026-110111	25	550	107	0.052	4.30 x 1.20
4026-108065	30	300	73	0.020	4.30 x 1.30
4021-109090	30	350	97	0.032	4.30 x 1.10
4032-109068	30	400	87	0.027	4.30 x 1.40
3532-109084	30	400	100	0.032	3.80 x 1.40
4042-108060	30	450	77	0.022	4.30 x 1.80
3542-109073	30	450	95	0.031	3.80 x 1.70
4042-108065	30	500	82	0.025	4.30 x 1.80
3542-109082	30	500	103	0.035	3.80 x 1.70
4042-109072	30	550	97	0.034	4.30 x 1.70
3542-109088	30	550	108	0.038	3.70 x 1.70
3542-211057	35	350	90	0.019	3.80 x 1.60
4042-211053	35	400	88	0.019	4.20 x 1.60
4042-211058	35	450	92	0.021	4.30 x 1.70
4047-211058	35	500	94	0.022	4.30 x 1.80
4047-211063	35	550	98	0.024	4.30 x 1.80
3547-210051	40	350	88	0.015	3.80 x 1.80
4042-210052	40	400	89	0.015	4.30 x 1.70
4047-210052	40	450	91	0.016	4.30 x 1.80
4042-211058	40	450	105	0.021	4.30 x 1.70
4047-211057	40	500	106	0.022	4.30 x 1.80
4047-211062	40	550	111	0.024	4.30 x 1.80
4042-209049	50	400	95	0.011	4.30 x 1.70
4042-210056	50	450	115	0.016	4.30 x 1.70
4047-210051	50	450	111	0.016	4.30 x 1.80
4052-210051	50	500	113	0.017	4.30 x 2.00
4052-210055	50	550	118	0.018	4.30 x 2.00
4047-209045	60	400	111	0.011	4.30 x 1.90
4052-209046	60	450	114	0.012	4.30 x 2.00
4063-209042	60	500	112	0.012	4.30 x 2.40
4063-209046	60	550	117	0.013	4.30 x 2.40
5252-308036	75	400	88	0.005	5.50 x 2.10
5252-208036	75	400	101	0.008	5.50 x 2.10
5252-408032	100	375	95	0.004	5.50 x 2.10
5252-308034	100	400	108	0.005	5.50 x 2.10

* Semi Epoxy Molded, Add 0.20″ O.D. & 0.09″ Ht. Full Epoxy Molded, Add 0.20″ O.D. & Ht.
NOTES: Dimensions stated are based on perfect windings not always achieveable. Electrical data accurate to within ±6%.

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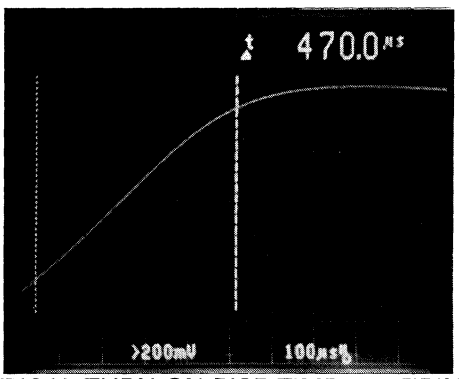
PRECISION WOUND HEAVY DUTY TOROIDAL INDUCTORS

FOR PROFESSIONAL LIGHT DIMMERS, MOTOR CONTROLS, SCR CONTROLS & LINE FILTERS

- **AVAILABLE IN SEMI OR FULL EPOXY MOLDED**
- **HORIZONTAL & VERTICAL MOUNTING**
- **ALL "UL" RECOGNIZABLE MATERIALS**
- **ABSOLUTELY LATEST "STATE OF THE ART" MATERIALS, PRODUCTION & TESTING TECHNOLOGIES ARE EMPLOYED THROUGHOUT ALL PHASES OF THIS PRODUCT LINE**
- **SPECIFICALLY DESIGNED FOR 240 VOLTS 50 Hz**



TYPICAL TURN ON RISE TIME 90° FIRING

NEW

VERTICAL MTG. SHOWN LEFT TO RIGHT. 10A, DUAL 20A., 50A & 100.A.

Part No.	Rating Amps Rms	di/dt 10% 90% µs.	△t°C Above Ambient	DCR Ohms 100°C	Dimensions* Open Style O.D. x Ht.
2634-116159	8.3	300	99	0.2584	2.80 x 1.30
3521-115198	10	300	101	0.2210	3.70 x 0.90
3032-114159	10	300	85	0.1640	3.20 x 1.30
2634-116159	10	300	123	0.2570	2.80 x 1.30
3532-114172	10	400	87	0.1895	3.70 x 1.30
3526-115188	10	350	101	0.2310	3.70 x 1.10
3532-115192	10	450	105	0.2630	3.70 x 1.20
3040-112125	15	300	91	0.0947	3.30 x 1.60
4021-113155	15	300	105	0.1257	4.20 x 0.90
3056-112120	15	400	93	0.1115	3.30 x 2.10
3048-113138	15	400	112	0.1450	3.30 x 1.80
3552-112134	15	500	97	0.1237	3.70 x 1.90
3542-113157	15	500	117	0.1600	3.70 x 1.60
3542-110098	20	300	84	0.0519	3.80 x 1.70
4026-111122	20	300	100	0.0703	4.20 x 1.20
4032-111131	20	400	108	0.0828	4.20 x 1.30
3542-112128	20	400	126	0.1044	3.70 x 1.60
4042-111128	20	500	110	0.0913	4.20 x 1.60
4032-110115	20	350	89	0.0587	4.30 x 1.40
3542-111113	20	350	103	0.0744	3.70 x 1.60
4042-110114	20	450	93	0.0656	4.30 x 1.70
3542-112139	20	440	133	0.1140	3.70 x 1.60

Part No.	Rating Amps Rms	di/dt 10% 90% µs.	△t°C Above Ambient	DCR Ohms 100°C	Dimensions* Open Style O.D. x Ht.
4032-109100	25	300	92	0.0413	4.30 x 1.40
3542-109096	25	300	93	0.0416	3.80 x 1.70
3552-109092	25	350	94	0.0445	3.80 x 2.00
4042-109101	25	400	97	0.0470	4.30 x 1.70
4047-109101	25	450	99	0.0498	4.30 x 1.90
4042-110113	25	450	115	0.0650	4.30 x 1.70
4052-109101	25	500	100	0.0523	4.30 x 2.00
4058-109101	25	550	102	0.0558	4.30 x 2.20
4052-110112	25	550	118	0.0717	4.30 x 2.00
4032-109098	30	300	110	0.0404	4.30 x 1.40
4042-109100	300	400	116	0.0465	4.30 x 1.70
4052-109100	30	500	119	0.0521	4.30 x 2.00
4063-210052	40	300	95	0.0187	4.30 x 2.30
4052-211061	40	300	111	0.0246	4.20 x 2.00
4067-211062	40	400	116	0.0292	4.20 x 2.50
5252-210077	40	450	103	0.0263	5.50 x 2.00
4063-210051	50	300	116	0.0184	4.30 x 2.30
5252-209068	50	400	107	0.0187	5.50 x 2.00
5252-209084	50	500	119	0.0231	5.50 x 2.00
5252-208052	60	300	100	0.0116	5.50 x 2.10
5252-209067	60	400	125	0.0185	5.50 x 2.00
5278-208057	60	500	112	0.0158	5.50 x 2.90

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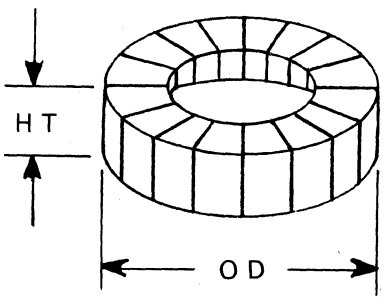
LARGEST SELECTION OF HEAVY DUTY 50/60Hz TOROIDAL POWER TRANSFORMERS

SOME ADVANTAGES OF TOROIDAL POWER TRANSFORMERS COMPARED TO LAMINATED TRANSFORMERS

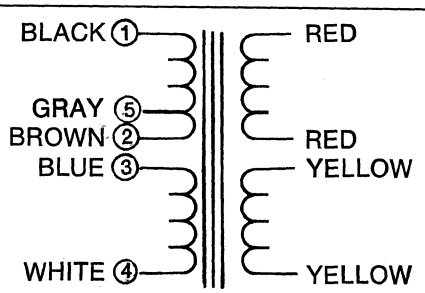
- Lower mechancial hum
- Lower electrical noise
- Lower magnetic leakage
- Easier to electrostatically shield
- Lower weight
- Smaller dimensions
- Higher efficiency
- And most important price competitive vs. old fashioned laminated transformers

MECHANICAL DRAWING



INTERNATIONAL PRIMARY CONFIGURATIONS

Voltage	100 V	120 V	220 V	240 V
Input	1 & 5	1 & 2	1 & 4	1 & 4
Connection	1 & 3 5 & 4	1 & 3 2 & 4	5 & 3	2 & 3



TYPICAL INTERNATIONAL PRIMARIES WITH TWO SECONDARIES

Secondary Power VA	Part No. 5800	Secondary No Load Voltage V	Secondary Load Voltage V	Secondary Load Current A	Dimensions Nom. OD	Dimensions (Inch) HT
6	5807	7.0	6	1.0	2.0	1.0
	5811	13.9	12	0.5		
	5812	17.4	15	0.4		
8	5820	10.4	9	0.89	2.2	1.0
	5821	13.9	12	0.67		
	5822	17.4	15	0.53		
	5826	34.8	30	0.27		
12	5830	11.6	10	1.2	2.3	1.1
	5832	17.4	15	0.8		
	5835	34.8	30	0.4		
	5829	2 x 7.0	2 x 6	1.0		
	5836	2 x 10.5	2 x 9	0.67		
	5837	2 x 13.9	2 x 12	0.50		
	5838	2 x 17.4	2 x 15	0.40		
	5839	2 x 20.9	2 x 18	0.33		
	5840	2 x 27.8	2 x 24	0.25		
	5841	2 x 32.5	2 x 28	0.21		

Secondary Power VA	Part No.	Secondary No Load Voltage V	Secondary Load Voltage V	Secondary Load Current A	Dimensions Nom. OD	Dimensions (Inch) HT
20	5845	11.6	10	2.0	2.6	1.2
	5846	13.9	12	1.7		
	5849	27.7	24	0.83		
	5850	34.7	30	0.67		
	5844	2 x 7	2 x 6	1.7		
	5851	2 x 11.6	2 x 10	1.0		
	5853	2 x 17.3	2 x 15	0.67		
	5854	2 x 20.7	2 x 18	0.56		
	5855	2 x 27.7	2 x 24	0.38		
	5856	2 x 32.4	2 x 28	0.35		
25	5862	17.3	15	1.7	2.6	1.3
	5864	27.7	24	1.0		
	5865	34.7	30	0.83		
	5859	2 x 7	2 x 6	2.0		
	5866	2 x 11.6	2 x 10	1.25		
	5868	2 x 17.3	2 x 15	0.83		
	5869	2 x 20.7	2 x 18	0.69		
	5870	2 x 27.7	2 x 24	0.52		

AMECON
QUALITY MAGNETIC COMPONENTS • DESIGNED WITH 30 YRS. OF EXPERTISE
1900 CHRIS LANE / ANAHEIM, CA 92805 / 714-634-2220 / FAX 714-634-0905 / TLX 510-100-0364

LARGEST SELECTION OF HEAVY DUTY 50/60Hz TOROIDAL POWER TRANSFORMERS

Secondary Power VA	Part No.	Secondary			Dimensions*	
		No Load Voltage V	Load Voltage V	Load Current A	Nom. OD	(Inch) HT
40	5873	27.2	24	1.66	3.0	1.3
	5874	34.2	30	1.33		
	5876	2 x 13.6	2 x 12	1.67		
	5877	2 x 17.1	2 x 15	1.33		
	5878	2 x 20.5	2 x 18	1.11		
	5879	2 x 22.8	2 x 20	1.00		
	5880	2 x 27.2	2 x 24	0.833		
60	5885	17.0	15	4.0	3.1	1.4
	5886	27.0	24	2.5		
	5887	33.4	30	2.0		
	5882	40.5	36	1.67		
	5883	47.4	42	1.43		
	5884	2 x 6.8	2 x 6	5.0		
	5891	2 x 20.4	2 x 18	1.67		
	5892	2 x 27.0	2 x 24	1.25		
	5893	2 x 33.4	2 x 30	1.00		
80	5901	16.8	15	5.33	3.6	1.5
	5902	20.2	18	4.44		
	5903	26.8	24	3.33		
	5904	33.6	30	2.67		
	5905	2 x 9	2 x 8	5.00		
	5906	2 x 16.8	2 x 15	2.67		
	5907	2 x 20.2	2 x 18	2.22		
	5908	2 x 26.8	2 x 24	1.67		
	5909	2 x 33.6	2 x 30	1.33		
100	5911	26.8	24	4.16	3.6	1.5
	5912	33.6	30	3.33		
	5913	47.0	42	2.38		
	5919	2 x 20	2 x 18	2.78		
	5920	2 x 24.5	2 x 22	2.27		
	5923	2 x 31.2	2 x 28	1.79		
	5921	2 x 33.5	2 x 30	1.67		
	5922	133.5	120	0.833		
120	5925	26.5	24	5.0	4.0	1.5
	5926	33.2	30	4.0		
	5927	66.5	60	2.0		
	5933	2 x 20	2 x 18	3.33		
	5934	2 x 26.5	2 x 24	2.50		
	5937	2 x 39.8	2 x 36	1.67		
160	5939	13.2	12	13.3	4.2	1.9
	5940	26.5	24	6.67		
	5941	39.8	36	4.44		
	5942	66.5	60	2.67		
	5943	2 x 66.4	2 x 60	1.33		
	5944	2 x 33	2 x 30	2.67		

Secondary Power VA	Part No.	Secondary			Dimensions*	
		No Load Voltage V	Load Voltage V	Load Current A	Nom. OD	(Inch) HT
250	5950	13.0	12	20.8	4.6	2.0
	5951	26.5	24	10.4		
	5952	2 x 26.5	2 x 24	5.21		
	5953	2 x 33	2 x 30	4.17		
	5954	2 x 66	2 x 60	2.08		
	5955	2 x 53	2 x 48	2.60		
320	5960	13.0	12	26.7	4.9	2.2
	5961	26.0	24	13.3		
	5962	32.5	30	10.7		
	5963	52.0	2 x 48	3.33		
	5964	2 x 65	2 x 60	2.67		
400	5966	12.9	12	33.4	5.2	2.3
	5967	25.8	24	16.7		
	5968	64.8	60	6.7		
	5969	38.6	2 x 36	5.56		
	5970	40.7	2 x 38	5.10		
	5971	51.6	2 x 48	4.04		
600	5973	2 x 25.7	2 x 24	12.5	5.6	2.7
	5974	2 x 29.7	2 x 28	10.7		
	5975	2 x 35	2 x 33	9.09		
	5976	2 x 40.3	2 x 38	7.8		
	5977	2 x 51	2 x 48	6.2		
	5978	2 x 64	2 x 60	5.0		
800	5982	2 x 31.6	2 x 30	13.3	6.4	2.7
	5981	2 x 50.5	2 x 48	8.3		
	5983	2 x 63.4	2 x 60	6.7		
	5984	2 x 126.5	2 x 120	3.3		
1200	5980	2 x 31.4	2 x 30	20	6.6	3.3
	5985	2 x 63	2 x 60	10		
	5986	2 x 125	2 x 120	5		
2000	5987	2 x 49.8	2 x 48	20.8	7.3	4.4
	5988	2 x 62.4	2 x 60	16.7		
	5989	2 x 124.5	2 x 120	8.3		
5K	5280	2 x 62.2	2 x 60	41.6	10.87	4.25
	5281	2 x 124	2 x 120	20.8		
7.5K	5290	2 x 61.5	2 x 60	62.5	12.62	4.25
	5291	2 x 122.5	2 x 120	31.2		
10K	5295	2 x 61.5	2 x 60	83.3	14.75	5.25
	5296	2 x 122.5	2 x 120	41.6		

* Semi Epoxy Molded, Add 0.20" O.D. & 0.09" Ht. Full Epoxy Molded, Add 0.20" O.D. & Ht.
NOTES: Dimensions stated are based on perfect windings not always achieveable. Electrical data accurate to within ±6%.

IMPORTANT NOTES:

1. All transformers have been designed for 50/60HZ.
2. 60HZ to 400HZ. Designs available upon request.
3. Custom designs tailored to your specs. are made & evaluated on a 2 wk. cycle.
4. 100% electrostatic shielding available on all transformers with a small power derating.
5. Magnetic shielding & lower magnetic leakage designs for sensitive areas such as encountered in computers & audio equipment, are available on all transformers.
6. Low profile designs are available upon request.
7. Amecon has the world's most complete toroidal mfg. facilities. We can machine wind toroids in excess of 50" dia. & 2000 lbs.

AMECON
QUALITY MAGNETIC COMPONENTS • DESIGNED WITH 30 YRS. OF EXPERTISE
1900 CHRIS LANE / ANAHEIM, CA 92805 / 714-634-2220 / FAX 714-634-0905 / TLX 510-100-0364

LARGEST SELECTION OF HEAVY DUTY 60 Hz TOROIDAL POWER TRANSFORMERS

Output Power VA	Part Number	No Load Voltage Volts	Load Voltage Volts	Load Current Amp	DCR @ 20°C	Core Loss W	Copper Loss W	Maximum Dimensions* OD x HT in Inches	Total Weight lbs	Voltage Regulation %
7.5	6810	10.9	9	.833	1.06	.101	1.33	2.0 x 1.0	0.38	21.1
	6811	14.5	12	.625	1.76	.101	1.28			20.3
	6812	18.1	15	.500	2.8	.101	1.29			20.5
	6813	21.8	18	.417	4.23	.101	1.33			21.2
	6814	29.0	24	.313	7.12	.101	1.29			20.4
	6815	34.0	28	.268	10.4	.101	1.34			21.4
10	6820	10.8	9	1.11	.747	.123	1.67	2.2 x 1.0	0.45	19.8
	6821	14.3	12	.833	1.25	.123	1.61			19.1
	6822	17.9	15	.667	1.96	.123	1.61			19.2
	6823	21.7	18	.555	3.02	.123	1.68			20.0
	6824	28.6	24	.417	5.00	.123	1.60			19.1
	6825	32.9	28	.357	5.75	.123	1.44			17.2
15	6830	10.75	9	1.66	.434	.160	2.41	2.3 x 1.1	0.61	19.2
	6831	14.8	12	1.25	.95	.160	2.78			21.9
	6832	18.4	15	1.00	1.50	.160	2.78			21.9
	6833	21.6	18	.833	1.75	.160	2.43			20.0
	6834	28.5	24	.625	2.92	.160	2.34			18.6
	6835	33.6	28	.536	4.37	.160	2.48			19.0
	6836	2 x 10.8	2 x 9	.833	2 x .878	.160	2.45			19.4
	6837	2 x 14.2	2 x 12	.625	2 x 1.45	.160	2.33			18.6
	6838	2 x 17.9	2 x 15	.500	2 x 2.33	.160	2.38			18.8
	6839	2 x 21.6	2 x 18	.417	2 x 3.51	.160	2.44			19.3
	6840	2 x 28.6	2 x 24	.313	2 x 5.91	.160	2.36			18.7
	6841	2 x 33.47	2 x 28	.268	2 x 8.59	.160	2.44			19.5
25	6845	10.6	9	2.78	.252	.205	3.58	2.6 x 1.2	0.82	17.8
	6846	14.5	12	2.08	.547	.205	4.07			20.0
	6847	18.1	15	1.66	.865	.205	4.10			20.3
	6848	21.2	18	1.39	1.01	.205	3.60			17.9
	6849	28.2	24	1.04	1.68	.205	3.46			17.2
	6850	33.0	28	.89	2.49	.205	3.62			18.0
	6851	2 x 10.7	2 x 9	1.39	2 x .51	.205	3.62			18.0
	6852	2 x 14.1	2 x 12	1.04	2 x .84	.205	3.46			17.2
	6853	2 x 17.6	2 x 15	.833	2 x 1.33	.205	3.48			17.3
	6854	2 x 21.2	2 x 18	.69	2 x 2.03	.205	3.60			17.9
	6855	2 x 28.2	2 x 24	.52	2 x 3.4	.205	3.47			17.3
	6856	2 x 33.2	2 x 28	.45	2 x 5.01	.205	3.64			18.1
30	6860	10.5	9	3.33	.183	.240	4.03	2.6 x 1.3	0.90	16
	6861	13.9	12	2.5	.306	.240	3.89			15.4
	6862	17.3	15	2.00	.479	.240	3.89			15.5
	6863	21.0	18	1.66	.731	.240	4.03			16.0
	6864	27.8	24	1.25	1.23	.240	3.91			15.5
	6865	32.6	28	1.07	1.80	.240	4.07			16.2
	6866	2 x 10.5	2 x 9	1.66	2 x .366	.240	4.03			16.0
	6867	2 x 13.9	2 x 12	1.25	2 x .615	.240	3.91			15.5
	6868	2 x 17.4	2 x 15	1.00	2 x .961	.240	3.89			15.5
	6869	2 x 17.4	2 x 18	.833	2 x 1.47	.240	4.04			16.0
	6870	2 x 27.8	2 x 24	.625	2 x 2.45	.240	3.88			15.4
	6871	2 x 32.6	2 x 28	.536	2 x 3.65	.240	4.09			16.3
50	6875	2 x 10.4	2 x 9	2.78	2 x .218	.318	6.64	3.0 x 1.3	1.3	15.9
	6876	2 x 13.9	2 x 12	2.08	2 x .367	.318	6.48			15.4
	6877	2 x 17.3	2 x 15	1.66	2 x .575	.318	6.46			15.4
	6878	2 x 20.9	2 x 18	1.39	2 x .879	.318	6.66			15.9
	6879	2 x 27.8	2 x 24	1.04	2 x 1.46	.318	6.45			15.3
	6880	2 x 32.7	2 x 28	.893	2 x 2.18	.318	6.79			16.1
75	6885	17.2	15	5.00	.196	.415	8.88	3.1 x 1.4	1.6	14.1
	6886	27.7	24	3.125	.504	.415	8.96			14.1
	6887	34.6	30	2.5	.793	.415	8.99			14.2
	6888	2 x 10.4	2 x 9	4.16	2 x .150	.415	9.25			14.7
	6889	2 x 13.8	2 x 12	3.125	2 x .252	.415	8.96			14.1
	6890	2 x 17.3	2 x 15	2.50	2 x .397	.415	8.99			14.2
	6891	2 x 20.7	2 x 18	2.08	2 x .6	.415	9.25			14.6
	6892	2 x 27.5	2 x 24	1.56	2 x 1.01	.415	8.93			14.2
	6893	2 x 34.4	2 x 30	1.25	2 x 1.58	.415	8.95			14.2

* Semi Epoxy Molded, Add 0.20″ O.D. & 0.09″ Ht. Full Epoxy Molded, Add 0.20″ O.D. & Ht.
NOTES: Dimensions stated are based on perfect windings not always achieveable. Electrical data accurate to within ±6%.

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LARGEST SELECTION OF HEAVY DUTY 60 Hz TOROIDAL POWER TRANSFORMERS

Output Power VA	Part Number	No Load Voltage Volts	Load Voltage Volts	Load Current Amp	DCR @ 20°C	Core Loss W	Copper Loss W	Maximum Dimensions* OD x HT In Inches	Total Weight lbs	Voltage Regulation %
100	6900	13.6	12	8.33	.075	.524	10.4	3.6 x 1.5	2.2	12.3
	6901	16.9	15	6.66	.118	.524	10.4			12.4
	6902	20.4	18	5.55	.179	.524	10.8			12.8
	6903	27.1	24	4.17	.299	.524	10.4			12.3
	6904	33.7	30	3.33	.470	.524	10.4			12.4
	6905	2 x 9.5	2 x 8.5	5.88	2 x .660	.524	9.67			11.5
	6906	2 x 16.9	2 x 15	3.33	2 x .236	.524	10.5			12.4
	6907	2 x 20.4	2 x 18	2.78	2 x .358	.524	10.8			12.8
	6908	2 x 26.9	2 x 24	2.08	2 x .595	.524	10.3			12.3
	6909	2 x 33.8	2 x 30	1.67	2 x .95	.524	10.4			12.4
120	6915	20.5	18	6.66	.152	.67	11.4	3.6 x 1.5	2.4	13.0
	6916	25.0	22	5.45	.23	.67	11.6			13.3
	6917	2 x 13.7	2 x 12	5.00	2 x .128	.67	11.0			12.6
	6918	2 x 17.0	2 x 15	4.00	2 x .20	.67	11.11			12.6
	6919	2 x 20.4	2 x 18	3.33	2 x .30	.67	11.4			13.0
	6920	2 x 25.0	2 x 22	2.73	2 x .47	.67	11.6			13.0
	6921	2 x 34.1	2 x 30	2.00	2 x .80	.67	11.2			12.6
	6922	2 x 135	2 x 110, 120	.500	2 x 12.9	.67	11.1			12.7
150	6930	2 x 9.6	2 x 8.5	8.82	2 x .039	.806	20	4.0 x 1.5	2.8	13.0
	6931	2 x 13.6	2 x 12	6.25	2 x .07	.806	20			13.0
	6932	2 x 17.0	2 x 15	5.00	2 x .11	.806	20			13.0
	6933	2 x 20.5	2 x 18	4.17	2 x .16	.806	20			13.0
	6934	2 x 27.1	2 x 24	3.13	2 x .28	.806	20			13.0
	6935	2 x 34	2 x 30	2.50	2 x .45	.806	20			13.0
	6936	2 x 135	2 x 110, 120	.625	2 x 7.1	.806	20			13.0
200	6940	2 x 9.3	2 x 8.5	11.76	2 x .0253	1.03	13.1	4.2 x 1.9	4.4	7.7
	6941	2 x 12.9	2 x 12	8.33	2 x .0443	1.03	12.0			7.2
	6942	2 x 19.3	2 x 18	5.56	2 x .106	1.03	1.24			7.4
	6943	2 x 23.7	2 x 22	4.55	2 x .164	1.03	12.7			7.6
	6944	2 x 32.2	2 x 30	3.33	2 x .280	1.03	12.1			7.2
	6945	2 x 128.9	2 x 110, 120	.833	2 x 4.5	1.03	12.1			7.2
300	6950	28.6	26.5	11.3	0.074	1.69	22.5	4.6 x 2.0	5.7	7.5
	6951	2 x 9.15	2 x 8.5	17.6	0.030	1.69	20.5			6.9
	6952	2 x 28.3	2 x 26.5	5.67	0.294	1.69	20.8			7.0
	6953	2 x 35.3	2 x 33	4.55	0.366	1.69	18.5			6.2
	6954	2 x 56.6	2 x 53	2.83	0.935	1.69	18.9			6.2
	6955	2 x 70.5	2 x 66	2.27	1.47	1.69	18.5			6.2
400	6960	2 x 38.2	2 x 36	5.55	2 x .170	1.72	20.0	4.9 x 2.2	6.9	5.9
	6961	2 x 40.5	2 x 38	5.26	2 x .180	1.72	19.5			5.8
	6962	2 x 51.0	2 x 48	4.17	2 x .287	1.72	19.4			5.8
	6963	2 x 127.5	2 x 110, 120	1.67	2 x 1.81	1.72	19.5			5.8
500	6967	2 x 25.5	2 x 24	10.42	2 x .058	1.84	24.3	5.2 x 2.3	8.0	5.8
	6968	2 x 31.9	2 x 30	8.33	2 x .091	1.84	24.4			5.8
	6969	2 x 34.8	2 x 33	7.58	2 x .099	1.84	23.1			5.5
	6970	2 x 40.5	2 x 38	6.58	2 x .146	1.84	24.5			5.8
	6971	2 x 51.0	2 x 48	5.20	2 x .231	1.84	24.3			5.8
	6972	2 x 63.7	2 x 60	4.17	2 x .365	1.84	24.5			5.8
	6973	2 x 127.5	2 x 110, 120	2.08	2 x 1.46	1.84	24.5			5.8
750	6976	2 x 31.8	2 x 30	12.5	2 x .0505	2.62	30.6	5.6 x 2.7	11.2	4.8
	6977	2 x 50.5	2 x 48	7.81	2 x .127	2.62	30.0			4.8
	6978	2 x 63.3	2 x 60	6.25	2 x .200	2.62	30.3			4.8
	6979	2 x 126	2 x 110, 120	3.13	2 x .800	2.62	30.1			4.8
1K	6982	2 x 31.1	2 x 30	16.66	2 x .0283	3.52	30.1	6.4 x 2.7	15.5	3.6
	6983	2 x 62.3	2 x 60	8.33	2 x .113	3.52	30.1			3.6
	6984	2 x 124.6	2 x 110, 120	4.17	2 x .454	3.52	30.1			3.6
2.5K	6987	2 x 49.3	2 x 48	26.0	2 x .0214	7.71	56.3	7.3 x 4.4	32.0	2.7
	6988	2 x 62.2	2 x 60	20.8	2 x .0335	7.71	56.1			2.7
	6989	2 x 123.3	2 x 110, 120	10.4	2 x .133	7.71	55.5			2.7

* Semi Epoxy Molded, Add 0.20″ O.D. & 0.09″ Ht. Full Epoxy Molded, Add 0.20″ O.D. & Ht.
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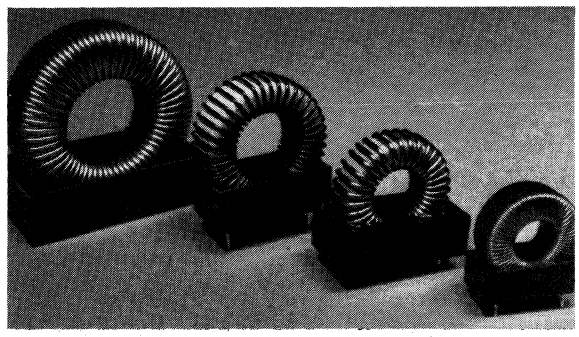
AMECON
QUALITY MAGNETIC COMPONENTS FOR S.M.P.S. SINCE 1972
1900 CHRIS LANE / ANAHEIM, CA 92805 / 714-634-2220 / FAX 714-634-0905 / TLX 510-100-0364

SWITCH MODE POWER SUPPLY FILTER INDUCTORS

- Minimum possible size • Low profile
- Performance verified in 25KHZ switching power supply
- Large selection of sizes available
- Available with open winding type or encapsulated and semi-encapsulated constructions.
- Custom designs are available up to 200AMPS.
- Advanced materials • Best production technologies, with 27 yrs. of SMPS expertise



I_{dc} (AMPS)	Part Number	L_{MIN} (μh) @ Rated I_{dc}	L_{MIN} (μh) @ Zero I_{dc}	DCR_{NOM} (OHMS)	Min Energy Storage (μ-Joule)	Mechanical Specifications (inch)	
						$OD_{NOM.}$	$HT_{NOM.}$
5 VOLTS POWER INDUCTORS							
1	5500	480	430	0.360	240	1.12	0.49
2	5501	275	330	0.150	550	1.14	0.52
3	5502	160	210	0.080	720	1.17	0.54
5	5503	104	160	0.055	1250	1.20	0.58
8	5504	60	84	0.015	1920	1.25	0.76
10	5505	50	62	0.012	2500	1.30	0.81
12	5506	40	48	0.009	3456	1.32	0.84
15	5507	30	50	0.009	3712	1.52	0.57
20	5508	25	40	0.006	5000	1.56	0.72
25	5509	20	26	.004	6250	1.62	0.76
30	5510	16	28	.004	7200	1.65	1.25
40	5511	12	20	.003	9600	1.72	1.28
50	5512	10	14	.002	12500	2.12	1.00
60	5513	8	12	.0015	14400	2.20	1.10
100	5514	5	7	.001	25000	2.12	1.00
10 VOLTS POWER INDUCTORS							
1	5520	1000	850	0.53	500	1.12	0.63
2	5521	500	510	0.27	1000	1.14	0.66
3	5522	310	320	0.13	1395	1.17	0.68
5	5523	180	210	0.17	2250	1.42	0.55
8	5524	120	150	0.04	3840	1.72	0.73
10	5525	100	140	0.03	5000	1.75	0.76
12	5526	75	110	0.02	7920	1.78	0.80
15	5527	68	100	0.016	8437	1.81	0.82
20	5528	51	65	0.010	10200	2.10	1.00
30	5529	32	42	0.010	14400	1.90	1.87
15 VOLTS POWER INDUCTORS							
1	5530	1250	1250	0.650	625	1.60	0.52
2.5	5531	500	520	0.170	1000	1.62	0.54
5.0	5532	250	315	0.080	3937	1.70	0.70
7.5	5533	170	225	0.050	4780	1.75	0.75
10	5534	125	170	0.030	6250	1.78	0.78
15	5535	85	130	0.017	9560	2.06	0.94
25	5536	50	90	0.009	15625	2.12	1.00
30	5537	43	75	0.008	19350	2.31	1.42
24 VOLTS POWER INDUCTORS							
2	5540	1100	1050	0.22	2200	1.95	0.82
5	5541	550	510	0.10	6875	2.00	0.87
7.5	5542	300	380	0.06	8437	2.12	1.00
10	5543	225	300	0.04	11250	2.25	1.12
15	5544	150	220	0.026	16875	2.35	1.31
25	5545	90	150	0.013	28125	2.30	1.88
35	5546	65	95	0.008	39812	2.4	2.06
48 VOLTS POWER INDUCTORS							
5	5550	750	820	0.14	9375	2.0	1.6
10	5551	375	520	2.06	18750	2.25	1.87
15	5552	250	450	0.05	28125	2.37	1.93
25	5553	150	280	0.03	46875	2.5	2.5

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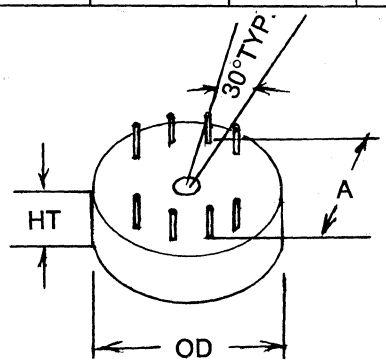
PRECISION TOROIDAL POWER TRANSFORMERS 400 Hz

- PRIMARY VOLTAGE: 115 ±15 VOLTS
  230 ±30 VOLTS
- OPERATING FREQUENCY: 400 Hz ±20 Hz
- INSULATION VOLTAGE: 1500 VAC
- MOLDED FOR P.C. MOUNTING
- 400 Hz POWER TRANSFORMERS FEATURE LOW PROFILES AND ARE DESIGNED FOR STANDARD REGULATOR CHIPS USING FULL WAVE BRIDGE CENTER TAP OR FULL WAVE BRIDGE.
- ANY SIZE 5VA TO 15,000VA. THESE TRANSFORMERS ARE ALL MACHINE MADE TO ACHIEVE HIGH CONSISTENCY AND RELIABILITY.

Part Number	Volt. Amps	Volts Load Rms	Current Amp Rms	Volts N/L Rms	A	Size OD	Size HT
6490		2 x 5	10	2 x 5.9	2.80	3	1.0
6491		2 x 10	5	2 x 11.8	2.80	3	1.0
6492	100	2 x 12	4.2	2 x 14.0	2.80	3	1.0
6493		2 x 18	2.8	2 x 21.2	2.80	3	1.0
6494		2 x 24	2.1	2 x 28.4	2.80	3	1.0
6495		2 x 28	1.78	2 x 33.0	2.80	3	1.0
6470		2 x 5	5	2 x 5.5	2.55	2¾	1.0
6471		2 x 10	2.5	2 x 11.0	2.55	2¾	1.0
6472	50	2 x 12	2.1	2 x 12.8	2.55	2¾	1.0
6473		2 x 18	1.4	2 x 19.0	2.55	2¾	1.0
6474		2 x 24	1.05	2 x 25.5	2.55	2¾	1.0
6475		2 x 28	.89	2 x 30	2.55	2¾	1.0
6450		2 x 5	2.5	2 x 5.5	2.18	2⅜	¾
6451		2 x 10	1.125	2 x 11.2	2.18	2⅜	¾
6452	25	2 x 12	1.05	2 x 13.0	2.18	2⅜	¾
6453		2 x 18	.70	2 x 19.6	2.18	2⅜	¾
6454		2 x 24	.50	2 x 26.0	2.18	2⅜	¾
6455		2 x 28	.45	2 x 30.4	2.18	2⅜	¾
6430		2 x 5	1.00	2 x 5.3	1.80	2	¾
6431		2 x 10	.5	2 x 10.8	1.80	2	¾
6432	10	2 x 12	.42	2 x 12.8	1.80	2	¾
6433		2 x 18	.28	2 x 19	1.80	2	¾
6434		2 x 24	.208	2 x 25.5	1.80	2	¾
6435		2 x 28	.18	2 x 31	1.80	2	¾
6410		2 x 5	.50	2 x 5.3	1.67	1⅞	¾
6411		2 x 10	.25	2 x 10.8	1.67	1⅞	¾
6412	5	2 x 12	.21	2 x 12.8	1.67	1⅞	¾
6413		2 x 18	.14	2 x 19	1.67	1⅞	¾
6414		2 x 24	.104	2 x 25.5	1.67	1⅞	¾
6415		2 x 28	.09	2 x 30.0	1.67	1⅞	¾



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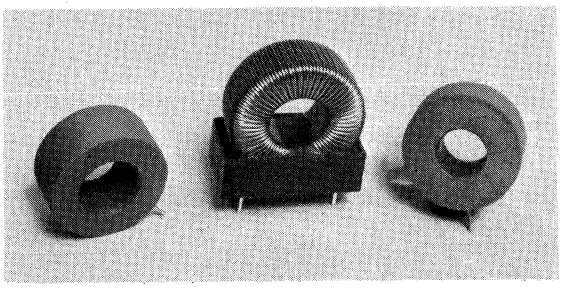
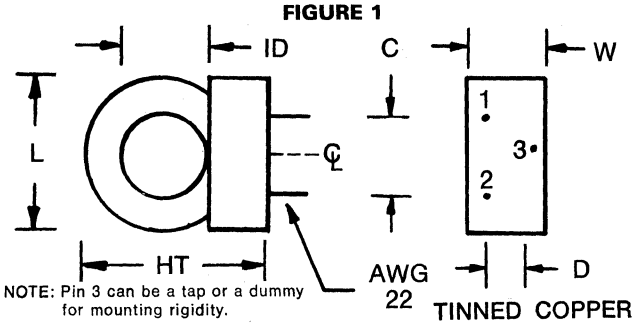
TOROIDAL CURRENT SENSE TRANSFORMERS

- Designed for switched mode power supply applications.
- Cost effective design.
- Operating frequency 20 kHz above.
- Pri Peak current up to 20 amps
- Available with open winding type, pvc sealed, and totally epoxy encapsulated.
- All our SMPS components backed by 19 yrs. of experience.
- With or without wound Pri turns.



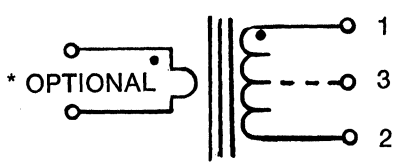
Part Number	Turns Ratio	L_{MIN} (MH) @ 20 kHz 1 Volt	DCR_{MAX} (Ohms)	R_L (Ohms)	Dimensions (inch)				
					L_{MAX}	ID_{MIN}	HT_{MAX}	W_{MAX}	CXD
5600	30:1	2.0	0.30	30	0.67	0.18	0.75	0.4	0.50 x 0.25
5601	50:1	5.0	0.50	50					
5602	100:1	20.0	1.20	100					
5603	200:1	90.0	2.00	200					
5604	400:1	210.0	5.0	400	1.18	0.31	1.18	0.50	0.75 x 0.37
5605	600:1	480.0	9.0	600					
5606	800:1	850.0	15.0	800					
5607	20CT:1	1.0	0.20	20	0.67	0.18	0.75	0.4	0.50 x 0.25
5608	40CT:1	3.5	0.40	40					
5609	100CT:1	22.0	1.20	100					
5610	200CT:1	90.0	2.00	200					
5611	500CT:1	350.0	7.5	500	1.18	0.31	1.18	0.50	0.75 x 0.37
5612	800CT:1	850.0	15.0	800					
5613	1000CT:1	1400.0	24.5	1000					

FIGURE 1



NOTE: Pin 3 can be a tap or a dummy for mounting rigidity.

FIGURE 2



* USUALLY CUSTOMER SUPPLIED

HIGH FREQUENCY INVERTER TRANSFORMERS FOR SWITCHING POWER SUPPLIES UTILIZING NORMAL POWER TRANSISTORS AND MOSFETS

Output switching transformers for power levels from 10 watts to 1000 watts with low power losses. Switching frequencies from 5 KHz to 100 kHz. Many custom designs are available at the same prices as STD. components, when 250 parts or more are ordered.

Power	P/C Mount	L	W	HT	Pin Centers	Pin Dia.
20 W	8 Pins	.75	.70	.70	.514	.025 Sq.
50 W	10 Pins	1.03	.75	.80	.615	.025 Sq.
100 W	12 Pins	1.5	1.125	1.0	.862	.025 Sq.
200 W	12 Pins	1.62	1.40	1.25	.95	.025 Sq.
350 W	12 Pins	1.815	1.55	1.25	1.10	.025 Sq.

PIN SPACING 0.20 TYP. OUTPUT VOLTAGE ON REQUEST

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CT SERIES—STANDARD ACCURACY AND SIZE

P/N	I_P A	Volt per Amp	R_L Ω	R.C.F. at 100% I_P	R.C.F. at 10% I_P	Approximate Open Style Dims. OD	ID	W	Wt. Lb.	Potted Dimensions L	ID	HT	W	C	D
*5301	5	.1	100	100.0	106.1	.83	.40	.35	.025	0.938	.375	0.938	.438	0.6	.3
*5302	10	.1	100	100.0	103.4	.83	.40	.35	.025	0.938	.375	0.938	.438	0.6	.3
*5303	15	.1	100	100.0	103.0	.83	.40	.35	.025	0.938	.375	0.938	.438	0.6	.3
*5304	20	.1	100	100.0	102.8	.83	.40	.35	.025	0.938	.375	0.938	.438	0.6	.3
*5305	25	.1	100	100.0	102.0	1.08	.53	.47	.06	1.188	.5	1.188	.563	.08	.4
*5306	30	.1	100	100.0	101.9	1.08	.53	.47	.06	1.188	.5	1.188	.563	.08	.4
*5307	40	.1	100	100.0	102.0	1.20	.66	.46	.07	1.375	.625	1.375	.563	1.0	.4
*5308	50	.1	100	100.0	101.9	1.20	.66	.46	.07	1.375	.625	1.375	.563	1.0	.4
5309	60	.1	100	100.0	101.8	1.35	.76	.49	.09	1.5	.688	1.5	.563	1.2	.4
5310	75	.1	100	100.0	101.6	1.35	.76	.49	.09	1.5	.688	1.5	.563	1.2	.4
5311	100	.1	100	100.0	101.4	1.60	.88	.49	.13	1.75	.75	1.75	.563	1.4	.4
5312	150	.1	100	100.0	101.0	2.04	1.05	.70	.30	2.188	.938	2.188	.813	1.8	.5
5313	200	.1	100	100.0	100.9	2.04	1.05	.70	.30	2.188	.938	2.188	.813	1.8	.5

* Stock Items

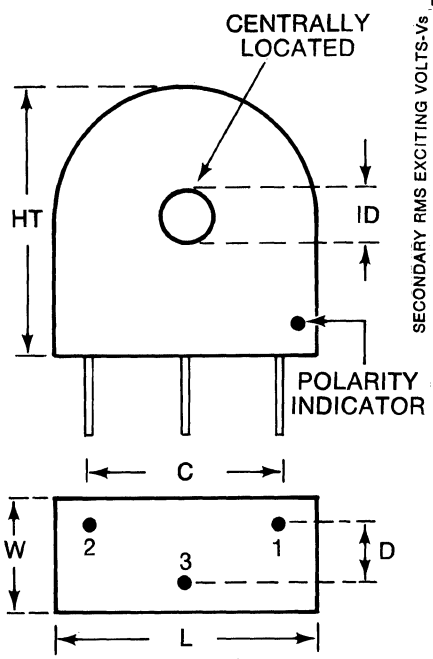


Fig. 1

All dimensions in inches

* This output voltage only occurs when transformer is used with the RL recommended and in its most linear range as shown in Fig. 4.

Fig. 2 Typical Excitation Curve for Models 5301 and 5302 Current Transformers.

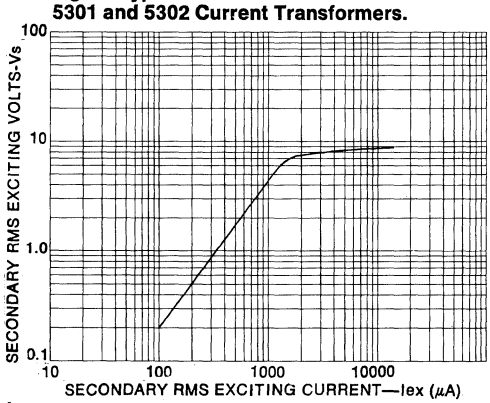


Fig. 3 Ratio Error RE vs. Load RL Across Secondary at the Rated Current Input of 5 Amps for the Current Transformer Model 5301

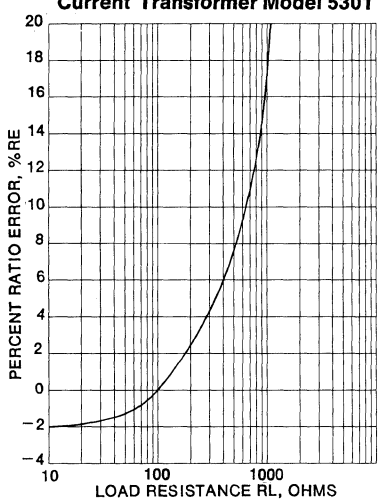
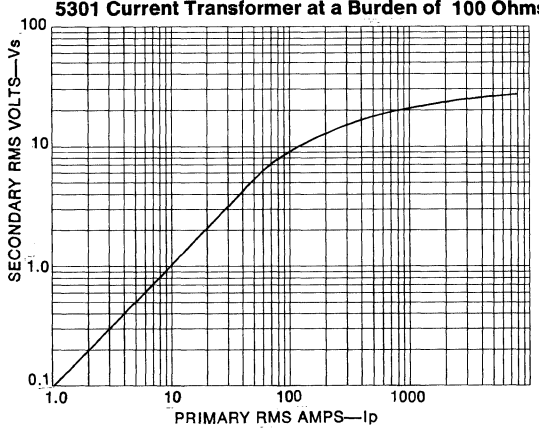


Fig. 4 Output Voltage vs. Input Current for Model 5301 Current Transformer at a Burden of 100 Ohms.



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CT SERIES—HIGH ACCURACY MINIATURE

P/N	I_P Amp	Volt per Amp	Burden Ohms	R.C.F. at 100% I_P	R.C.F. at 10% I_P	Approximate Open Style Dims. OD	ID	W	WT Lb.	Potted Dimensions L	ID	HT	W	C	D
5326	3.5	.2	200	100.0	102.8	.6	.23	.50	.012	.625	.188	.625	.625	.5	.4
*5327	5.0	.1	100	100.0	101.1	.6	.23	.25	.007	.625	.188	.625	.375	.5	.25
*5328	5.0	.2	200	100.0	101.37	.6	.23	.5	.012	.625	.188	.625	.625	.5	.4
*5329	10.0	.05	100	100.0	100.70	.6	.23	.25	.008	.625	.188	.625	.375	.5	.25
*5330	10.0	.10	200	100.0	100.87	.6	.23	.5	.013	.625	.188	.625	.625	.5	.4
5331	15.0	.05	100	100.0	100.40	.6	.23	.5	.013	.625	.188	.625	.625	.5	.4
5332	20.0	.025	50	100.0	100.30	.6	.23	.5	.014	.625	.188	.625	.625	.5	.4

* Stock Items

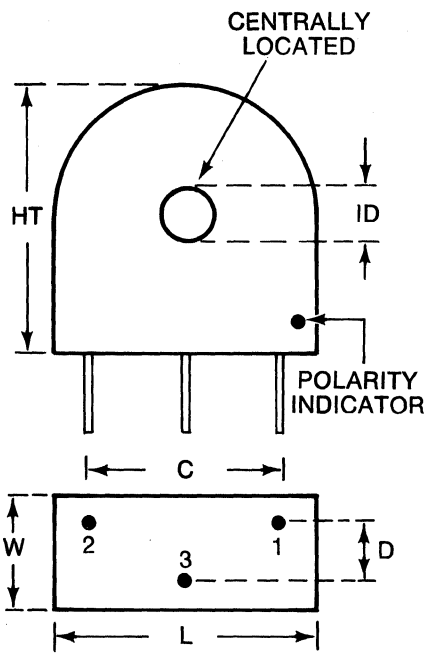


Fig. 1

All dimensions in inches

Fig. 2 Ratio Error RE vs. Load RL Across Secondary at the Rated Current Input of 3.5 Amps for the Current Transformer Model 5326

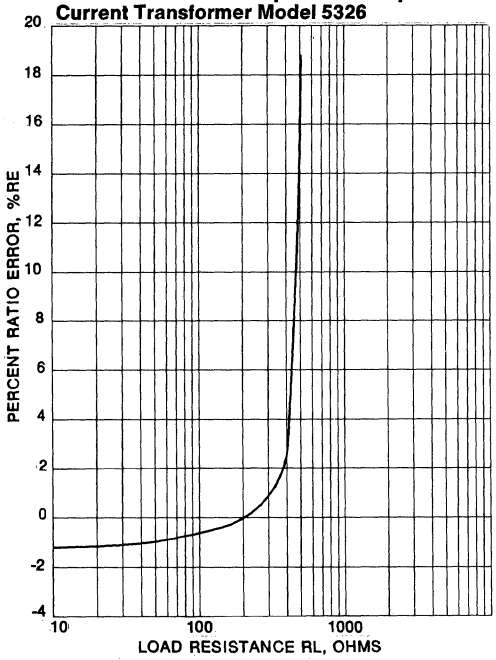
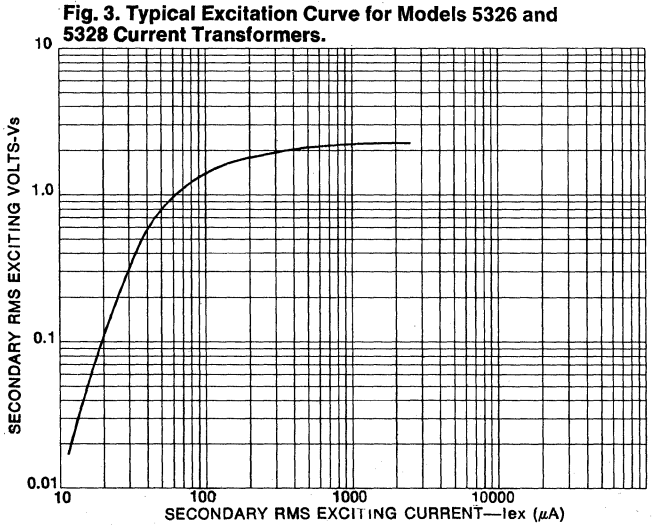


Fig. 3. Typical Excitation Curve for Models 5326 and 5328 Current Transformers.



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CT SERIES—HIGH ACCURACY COMPACT SIZE

P/N	I_P Amp	Volt per Amp	Burden R_L Ohms	R.C.F. at 100% I_P	R.C.F. at 10% I_P	Approximate Open Style Dims. OD	ID	W	WT Lb.	Potted Dimensions L	ID	HT	W	C	D
*5351	5	.1	100	100.0	103.3	0.9	.33	.42	.025	1.06	.188	1.06	.563	0.8	.4
*5352	10	.1	100	100.0	101.9	0.9	.33	.42	.025	1.06	.188	1.06	.563	0.8	.4
*5353	15	.1	100	100.0	101.6	1.14	.48	.40	.042	1.25	.375	1.25	.563	1.0	.4
*5354	20	.1	100	100.0	101.1	1.14	.48	.40	.042	1.25	.375	1.25	.563	1.0	.4
5355	25	.1	100	100.0	100.9	1.26	.61	.53	.067	1.375	.5	1.375	.625	1.0	.5
5356	30	.1	100	100.0	100.8	1.26	.61	.53	.067	1.375	.5	1.375	.625	1.0	.5
5357	40	.1	100	100.0	100.7	1.53	.71	.55	.11	1.75	.625	1.75	.625	1.5	.5
5358	50	.1	100	100.0	100.6	1.53	.71	.55	.11	1.75	.625	1.75	.625	1.5	.5
5359	60	.1	100	100.0	100.5	1.67	.82	.71	.17	1.875	.625	1.875	.875	1.5	.7
5360	75	.1	100	100.0	100.4	1.67	.82	.71	.17	1.875	.625	1.875	.875	1.5	.7

* Stock Items

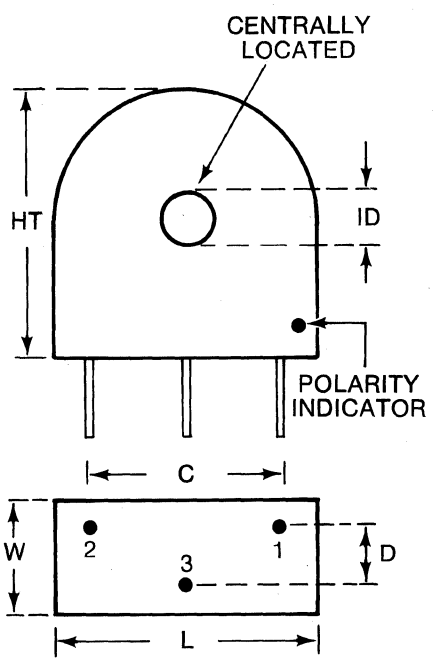


Fig. 1

All dimensions in inches

Fig. 2 Ratio Error RE vs. Load RL Across Secondary at the Ratel Current Input of 5 Amps for the Current Transformer Model 5351.

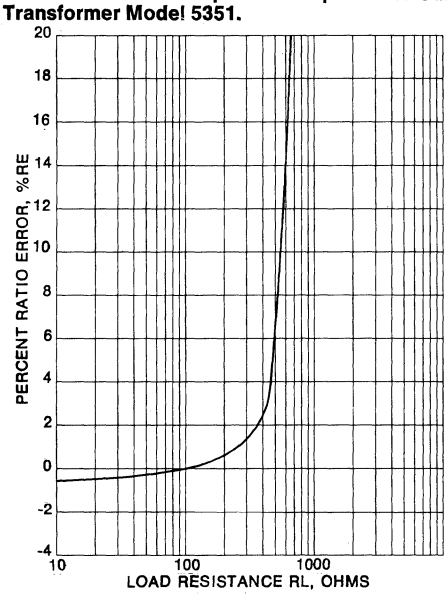
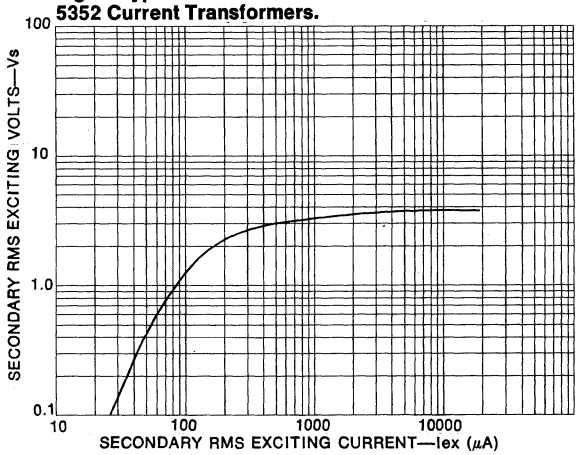


Fig. 3. Typical Excitation Curve for Models 5351 and 5352 Current Transformers.



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- ☐ Vertical or horizontal mounting
- ☐ Leads or terminals
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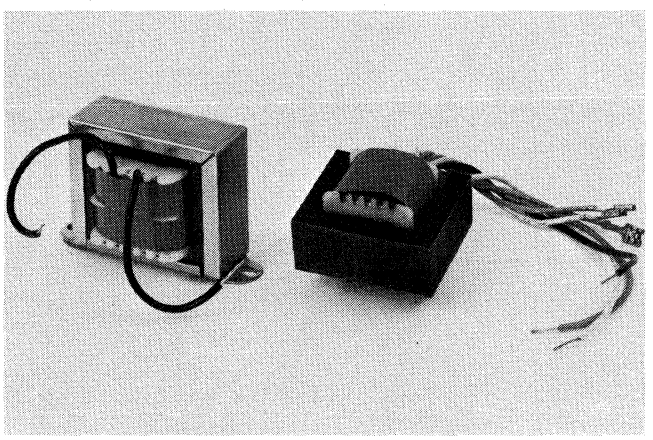
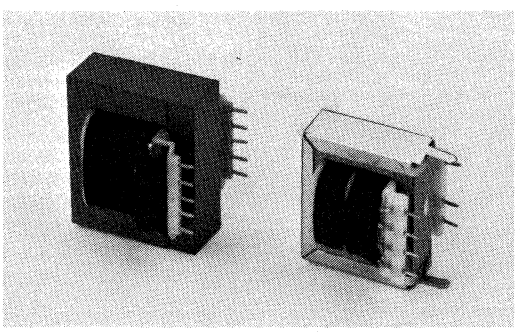
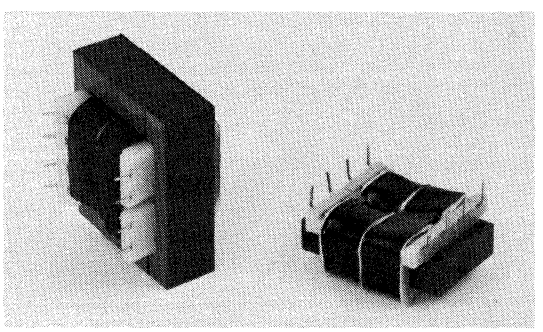
- ☐ High efficiency, specified power dissipation
- ☐ Designed to meet UL/CSA/VDE as required



STYLE HMV **STYLE HMH**



STYLE PCV1 **STYLE PCV2**



STYLE PCH **STYLE PCL**

STYLE AND SIZE SELECTION GUIDE (SIZE IN INCHES — LxWxH)

POWER VA	HMV/HMH	PCV	PCH	PCL
1 - 1.5	✲	1.375 x 1.125 x 1.187	1.375 x 1.125 x .937	✲
1.5 - 5	1.625 x 1.062 x 1.183	1.625 x 1.25 x 1.375	1.375 x 1.125 x 1.187	1.875 x 1.562 x .65
5 - 8	1.687 x 1.25 x 1.375	✲	1.625 x 1.312 x 1.312	1.875 x 1.562 x .85
8 - 15	1.937 x 1.375 x 1.625	1.875 x 1.437 x 1.625	1.875 x 1.562 x 1.437	2.50 x 2.00 x 1.065
15 - 25	✲	1.625 x 2.25 x 1.375	2.25 x 1.875 x 1.437	✲
25 - 35	2.312 x 1.687 x 1.937	✲	2.625 x 2.187 x 1.562	✲
35 - 60	2.687 x 1.812 x 2.25	———	———	———
60 - 100	3.062 x 2.25 x 1.562	———	———	———

✲Available in non-standard sizes.

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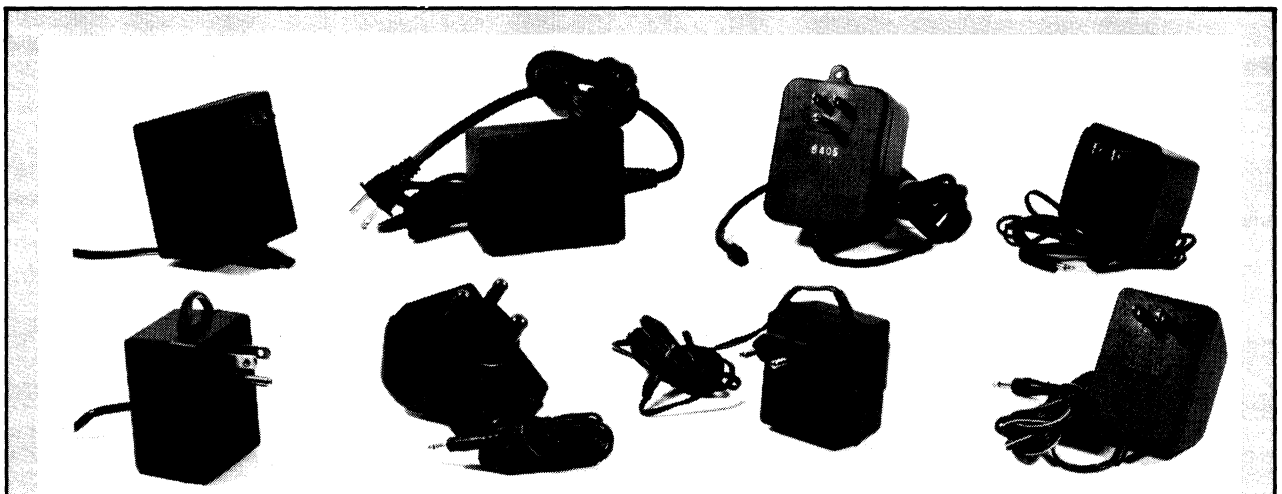
ARSTAN WALL PLUG-IN/DESK TOP ADAPTERS WITH AC OR DC OUTPUT

Our products are engineered domestically in the **U.S.** and manufactured in the **FAR EAST**. Selection available from a variety of designs which are **UL/CSA** recognized or have our engineers help you select a custom design for your application.



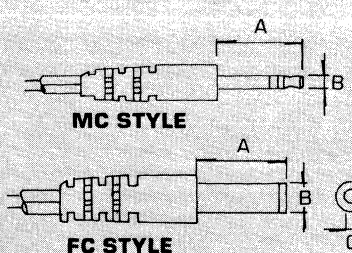
AVAILABLE FEATURES

- ☐ Any combination of voltage and load current
- ☐ Selection of input voltages for domestic or overseas use
- ☐ Center tap for AC adapters
- ☐ Specified regulation
- ☐ Selection of cords and connectors
- ☐ Table top option for large adapters
- ☐ UL/CSA recognized or designed as required

SELECTION GUIDE FOR TYPICAL CASE SIZES (IN INCHES)

POWER (watts)	For additional details and engineering application notes please see pages D1590–1591 in Section 4000, Power Supplies.			
D-6	WP4 2 x 1.625 x 1.375	WP6.3 2.25 x 1.875 x 1.5	WP6 2 x 2 x 1.5	WP7 2.625 x 1.875 x 1.5
6-12	WP6 2 x 2 x 1.5	WP8 2.5 x 1.875 x 1.625	WP9 2.25 x 2.25 x 1.875	DT12 3.187 x 2.125 x 1.875
12-24	WP10 2.5 x 2.25 x 1.875	WP17 3.25 x 2.5 x 2.125	DT12 3.187 x 2.125 x 1.875	DT18 3.25 x 2.5 x 2.125
24-72	DT25 3.375 x 2.75 x 2.75	DT31 4.625 x 3 x 2.25	---	---

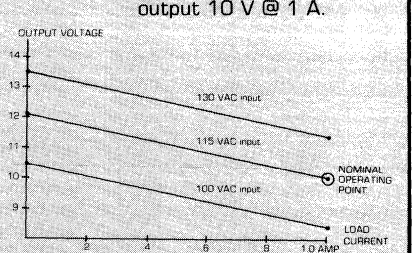
TYPICAL CONNECTORS



CONNECTOR SELECTION GUIDE

STYLE	Dimensions (mm) A	B	C
MC 1	14.5	3.5	---
MC 2	11.5	2.5	---
FC 1	12	5.0	2.0
FC 2	12	5.0	2.5
FC 3	12	5.5	2.1
FC 4	12	5.5	2.5

TYPICAL OUTPUT LOAD CURVES for adapter with nominal output 10 V @ 1 A.



Please see pages D 1594, D 1595 DC Power Supplies Section 4000 for detailed notes

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TELEPHONE LINE INTERFACE FOR VOICE/DATA PER FCC PART 68

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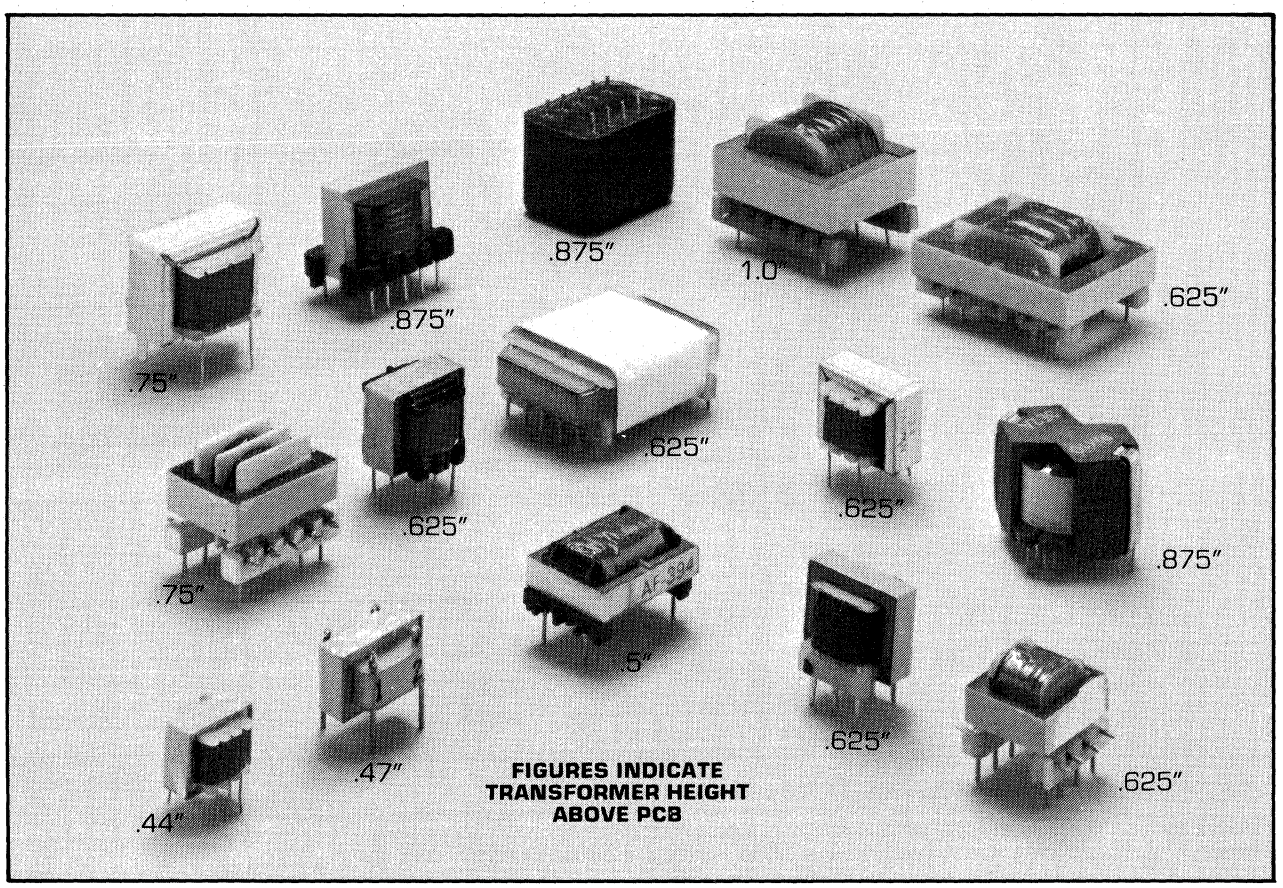


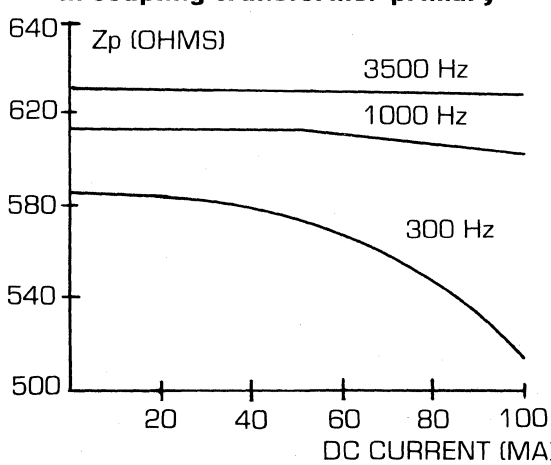
RANGE OF PARAMETERS-SELECTION GUIDE:

Impedances 50/100/150/300/600/900/1200/ 1500 Ohms
Impedance Matching 5-25% inside range of 200-5000 Hz

Return Loss	10-36 DB
DC Current	0-120 MA
DCR	10-300 Ohms
Frequency Response	.3-3 DB
Insertion Loss	.3-6DB
Max. Power Level	0 to +12 DBM
Logitudinal Balance	40-80 DB
Cross Talk	60-90 DB
Breakdown Voltage	250-4000 VRMS

✲We will help you select the optimum design in the smallest package based on your exact parameters.

Typical reflected impedance Vs DC Current in coupling transformer primary



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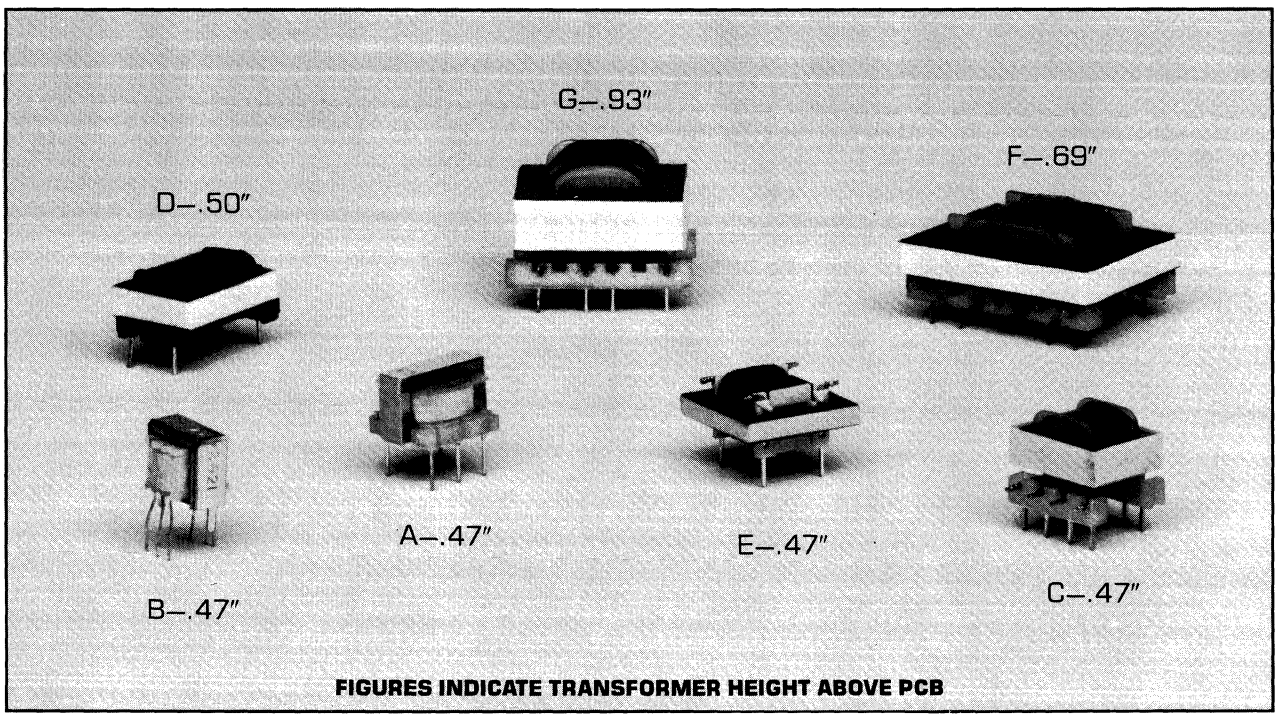

FIGURES INDICATE TRANSFORMER HEIGHT ABOVE PCB

Description:

Dry Coupling Transformers

A. For Voice/Data applications • (Equivalent of Microtran **T-1104**)

B. EI-14 coupling transformer, Lead type • (Equivalent of Prem **SPT-130**)

C. EI-19 Voice/Data, Pin type • (Can also be made to operate with low DC current up to 20 MA.)

Wet Coupling Transformers-Modem Applications

C. EI-19 for Modem applications, Pin type.

D. Compatible with Rockwell Modem chip set and other Modems. .5 inch high. (Equivalent of Microtran **T-9312** and Pan Magnetic **TTC-143**)

E. For Modems .47 inch high • (Equivalent of MidCom **8001**)

Wet Coupling Transformers-Voice Range

F. Split primary, 80 MA DC Current • (Equivalent of Prem **SPT-124**)

G. Split secondary, 80 MA DC Current • (Equivalent of Microtran **T-5114**)

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TRANSFORMERS

Audio/Voice Frequency Transformers — 2659E

Description

The 2659E Transformer operates over the audio/voice frequency range. This laminated-core transformer is used for impedance matching and transference of audio frequency signals from one circuit to another. It has an optimum return loss at 1 kHz. The device is just one of the many transformers available in the 2659 Audio/Voice Frequency Transformer series.

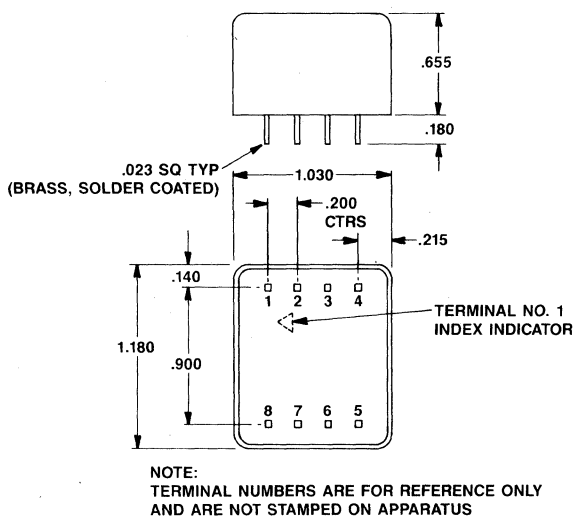
Electrical Characteristics

Parameter	2659E
Impedance	
Primary	600 Ω
Secondary*	418 Ω
Maximum Unbalanced dc (Primary)	0.1 mA
Min. Primary Inductance at 200 Hz, 3 Vac	4.8 H
dc Resistance	
Primary	44 Ω
Secondary	52 Ω
Frequency Response (Relative to 1 kHz)	
200 Hz	0.1 dB
5000 Hz	0.1 dB
Insertion Loss at 1 kHz	1 dB
Return Loss (Primary)	
200 Hz	>30 dB
1000 Hz	>40 dB
3500 Hz	>30 dB

* Shunted with a .02 μF capacitor.

Outline Drawing

(Dimensions in Inches)



NOTE:
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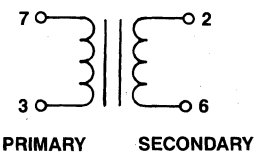
Benefits

- Potted for environmental protection
- Printed wiring board mountable
- Custom design service available

2659E Transformer



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TRANSFORMERS

Miniature Pulse Transformers — 2661F, J, & K

Description

The 2661F, J, and K Miniature Pulse Transformers are ferrite-core transformers used to transmit rectangular waves or trains of pulses. They provide this transmission while closely retaining the original signal shape. The 2661F, J, and K transformers are just three of the many transformers available in the 2661 Miniature Pulse Transformers series.

Electrical Characteristics*

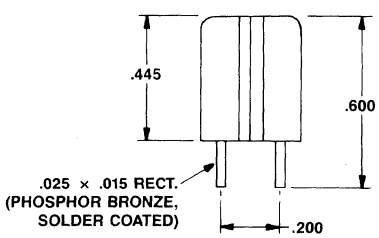
Parameter	2661F	2661J	2661K
Turns Ratio	2.65CT:1.03CT:1	3:45CT:1CT:1	2:76CT:1CT:1
Min. Primary Sine Wave Open Circuit Inductance (OCL)	3220 μH	9000 μH	9000 μH
Max. Primary ET Constant	48 V-μs	75 V-μs	75 V-μs
Max. Primary Leakage Inductance	4.0 μH	7.0 μH	12.0 μH
Effective Distributed Capacitance**	15 pF	45 pF	45 pF
Max. dc Resistance			
Primary	4.2 Ω	7.0 Ω	7.5 Ω
Secondary	1.7 Ω	2.4 Ω	2.8 Ω
Tertiary	2.9 Ω	2.4 Ω	3.1 Ω

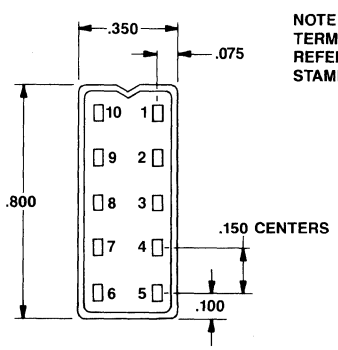
* 2661F, J, and K are designed to withstand an 850 V surge between primary and secondary and between primary and tertiary.

** Measured at primary windings with one end grounded; other windings are not grounded.

Outline Drawing

(Dimensions in Inches)



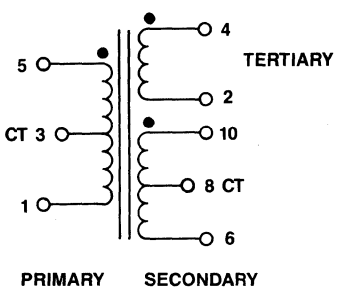


NOTE:
TERMINAL NUMBERS ARE FOR REFERENCE ONLY AND ARE NOT STAMPED ON APPARATUS

Benefits

- Couple balanced circuits to unbalanced circuits
- Potted in a plastic case for environmental protection
- Occupy a small area
- Printed wiring board mountable
- Custom design service available

2661F, J, and K Transformers



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TRANSFORMERS

Miniature Pulse Transformers — 2664A, C, & N

Description

The 2664A, C, and N Miniature Pulse Transformers are ferrite-core transformers used to transmit rectangular waves or trains of pulses. They provide this transmission while closely retaining the original signal shape. The 2664A, C, and N devices are just three of the many transformers available in the 2664 Miniature Pulse Transformer series.

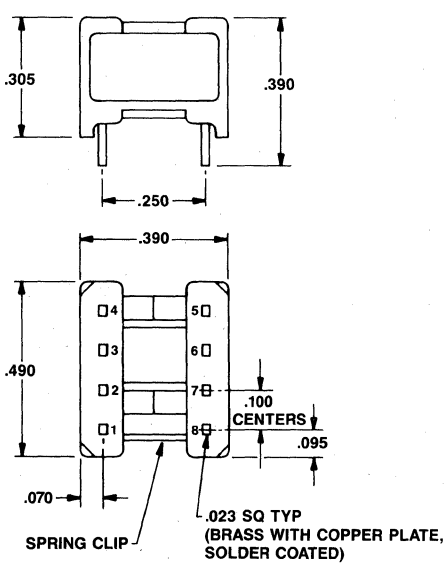
Electrical Characteristics

Parameter	2664A	2664C	2664N
Turns Ratio	2:1	1:1:1	1:1:1:1
Min. Primary Sine Wave Open Circuit Inductance (OCL)	1580 μH	45.5 μH	117 μH
Max. Primary ET Constant	33 V-μs	5.4 V-μs	9 V-μs
Max. Primary Leakage Inductance	10.0 μH	0.15 μH	.38 μH
Effective Distributed Capacitance*	20 pF	5 pF	5 pF
Max. dc Resistance			
Primary	3.3 Ω	0.16 Ω	0.3 Ω
Secondary	2.1 Ω	0.22 Ω	0.3 Ω
Tertiary	—	0.24 Ω	0.3 Ω
Quaternary	—	—	0.3 Ω

* Measured at primary winding with one end and shield (where applicable) grounded; other windings are not grounded.

Outline Drawing

(Dimensions in Inches)



NOTE:
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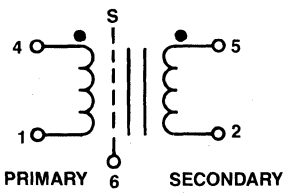
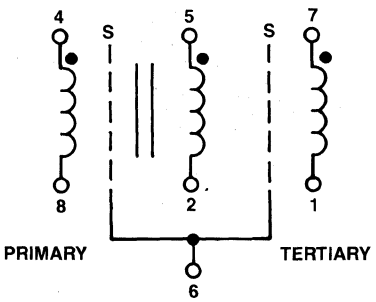
Benefits

- Physically low profile
- Printed wiring board mountable
- Custom design service available
- Couple balanced circuits to unbalanced circuits

2664A Transformer

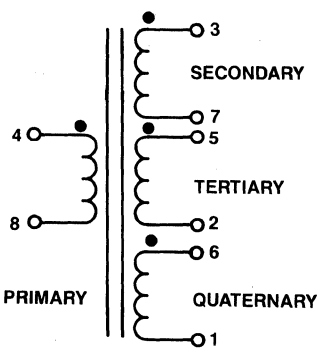


2664C Transformer



S DENOTES ELECTROSTATIC SHIELD

2664N Transformer



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TRANSFORMERS

Wide Band Transformers — 2717E, H, & AL

Description

The 2717E, H, and AL Wide Band Transformers are ferrite-core transformers. The 2717AL device operates over the voice frequency range of 200 Hz to 3500 Hz; the 2717E and H devices operate over the carrier frequency range of 60 kHz to 20 MHz. They are just three of the many transformers in the 2717 Wide Band Transformer series. Other codes in the 2717 series provide coupling of balanced to unbalanced circuits and power splitting.

Electrical Characteristics

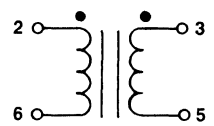
Parameter	2717E	2717H	2717AL
Impedance			
Primary	75 Ω	75 Ω	600 Ω
Secondary	300 Ω	75 Ω	600 Ω
Min. Primary Inductance	2.2 mH*	1.8 mH*	1.0 H**
dc Resistance			
Primary	0.59 Ω	0.57 Ω	24 Ω
Secondary	1.13 Ω	0.57 Ω	24 Ω
Frequency Shaping (0.5 dB loss points)			
Lower	10 kHz	8 kHz	.2 kHz
Upper	20 MHz	35 MHz	20 kHz
Insertion Loss			
1.5 kHz	—	—	0.4 dB
500 kHz	0.3 dB	0.3 dB	—

* At 10 kHz, 2 mA ac
** At 200 Hz, 0.5 Vac

Benefits

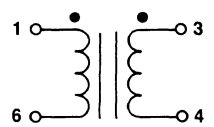
- Occupy a small board area
- Printed wiring board mountable
- Custom design service available

2717E Transformer



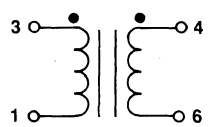
PRIMARY SECONDARY

2717H Transformer



PRIMARY SECONDARY

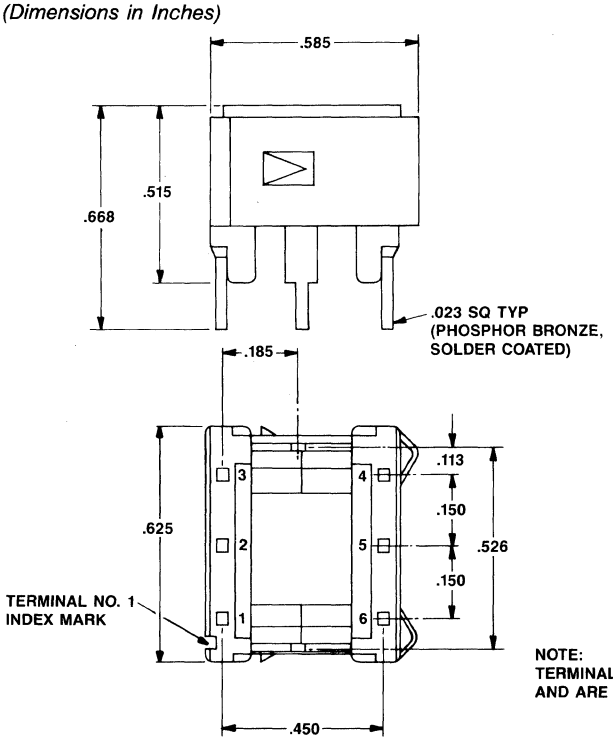
2717AL Transformer



PRIMARY SECONDARY

Outline Drawing

(Dimensions in Inches)



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TRANSFORMERS

Miniature Pulse Transformers — 2745B & 2745C

Description

The 2745B & 2745C Miniature Pulse Transformers are ferrite-core devices. They have a compact design for use on densely populated boards. They are compatible with water-soluble fluxes and can be cleaned with aqueous or solvent systems. The devices are packed in tubes for easy machine insertion and are available in through-hole or surface-mount technology. These devices are just two of the many quality transformers offered by AT&T.

Application

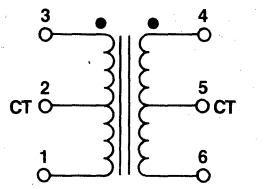
The 2745B & 2745C Transformers are designed for use as line interface transformers and are compatible with the AT&T LC1046 Digital Signaling Interface (DSI) device. These transformers contain well-balanced windings to help cancel common-mode noise on the line and improve longitudinal suppression. The 2745B device is designed with a 1CT:2CT turns ratio for use on the receive line. The 2745C device is designed with a 1:1.37CT turns ratio for use on the transmit line.

Electrical Characteristics

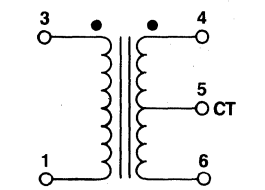
Parameter	2745B	2745C
Turns Ratio	1CT:2CT	1:1.37CT
Max. dc Resistance		
Primary	4.9 Ω	1.0 Ω
Secondary	10.2 Ω	1.4 Ω
Max. Primary ET Constant	48 V-μs	21 V-μs
Max. Primary Leakage Inductance	7.0 μH	1.2 μH
Effective Distributed Capacitance*	50 pF	15 pF
Interwinding Capacitance		
Primary to Secondary	110 pF	85 pF
Min. Primary Sine Wave Open Circuit Inductance (OCL)	3500 μH	680 μH

* Measured at primary winding with one end grounded; other winding not grounded.

2745B Transformer

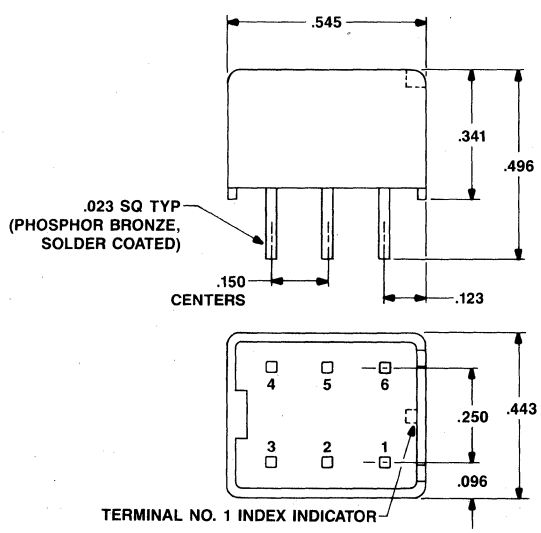


2745C Transformer



Outline Drawing

(Dimensions in Inches)



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TRANSFORMERS

Audio/Voice Frequency Transformers — 2746A & 2746B

Description

The 2746A & 2746B Transformers operate over the audio/voice frequency range. They are used for intercircuit signal transfer and impedance matching. These devices are just two of the many transformers available from AT&T.

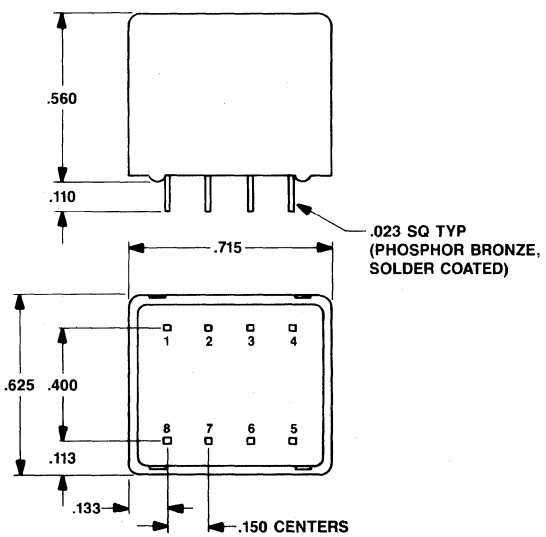
Electrical Characteristics

Parameter	2746A	2746B
Impedance		
Primary	600 Ω	600 Ω
Secondary	600 Ω	600 Ω
Maximum Unbalanced dc (Primary)	0.1 mA	0.1 mA
Min. Primary Inductance*	1.5 H	1.5 H
dc Resistance		
Primary	60 Ω	60 Ω
Secondary	60 Ω	60 Ω
Frequency Shaping (Relative to 1 kHz)		
200 Hz	0.5 dB	0.5 dB
100 kHz	0.5 dB	0.5 dB
Insertion Loss (1 kHz)	1.0 dB	1.0 dB
Voltage Breakdown (between Primary & Secondary)	100 Vac	1500 Vac

* At 200 Hz: 1 Vac

Outline Drawing

(Dimensions in Inches)



NOTE:
TERMINAL NUMBERS ARE FOR REFERENCE ONLY AND ARE NOT STAMPED ON APPARATUS

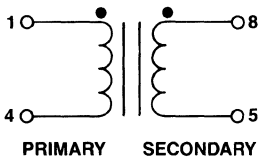
Benefits

- Printed wiring board mountable
- Compatible with aqueous and solvent cleaning
- Custom design service available

Features

- Low height
- Occupy a small board area

2746A & 2746B Transformers



For additional information, contact your AT&T Account Manager, or call:
☐ AT&T Microelectronics, Dept. 51AL230230, 555 Union Boulevard, Allentown, PA 18103 **1-800-372-2447** (In Canada, **1-800-553-2448)**

TRANSFORMERS

Forward Converter Transformers — 3271C

Description

The 3271C is an off-line, forward conversion transformer. It is designed to operate over a wide range of input voltages, and has very high current capability outputs. It utilizes a printed wiring board-mountable, horizontal ferrite structure.

Benefits

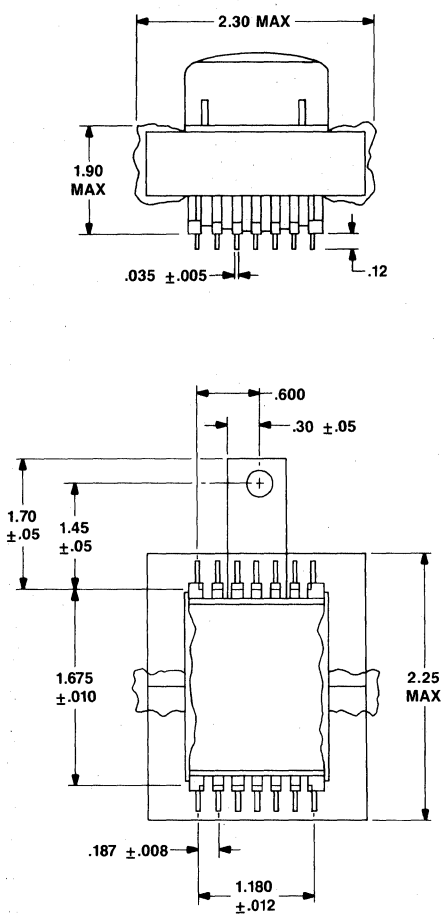
- High power capability
- Custom design service available
- UL,CSA,VDE safety certification

Electrical Characteristics

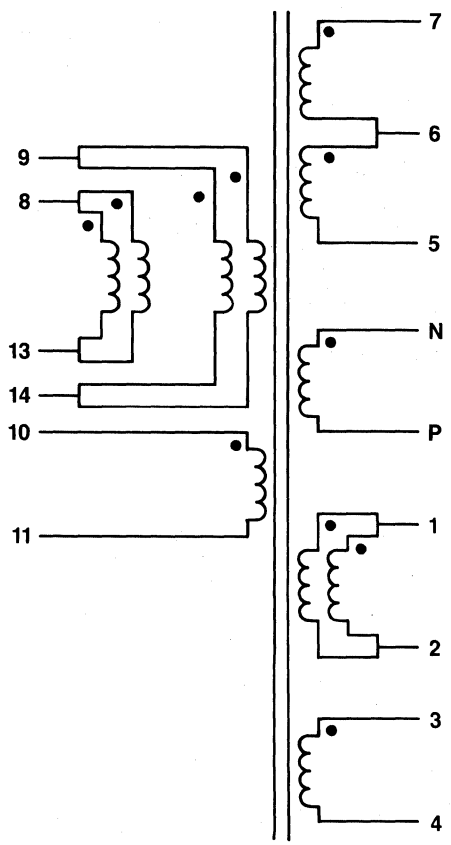
		Primary		Secondary		
Output Power (W)	Freq (kHz)	Voltage Range (V)	EΔt (μV-s)	Voltage (V)	Current (A)	Safety Cert.
450.0	62.0	107.0—395.0	1000.0	5.00	90.0	UL,CSA,VDE
				−48.00	9.0	
				−5.00	2.0	

Outline Drawing

(Dimensions in Inches)



3271C Transformers



TRANSFORMERS
Power Line Transformers — 3311D

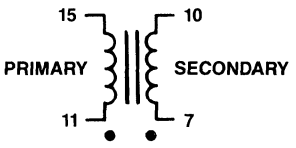
Description

The 3311D is a 20 VA PC board-mountable power line transformer designed on an EI-87 size lamination with a stack height of 1".

Input: 115 VAC at 60 Hz.
Output: 16 Vrms at 1.25 Arms (maximum 2.25 A)

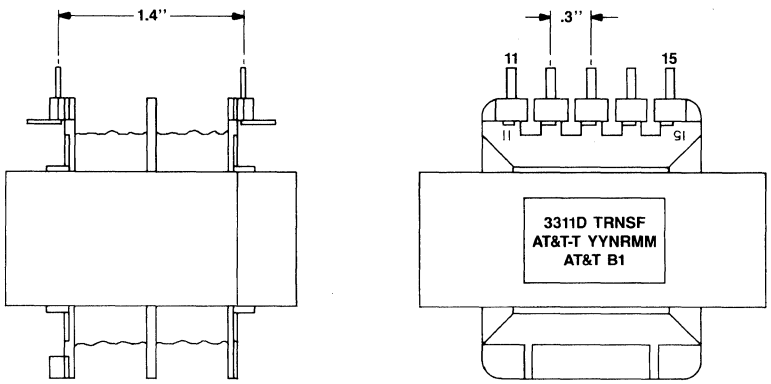
The 3311D is one of the many semi-custom power line transformers available at AT&T.

3311D Transformer



Outline Drawing

(Dimensions in Inches)



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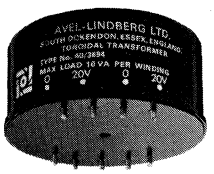
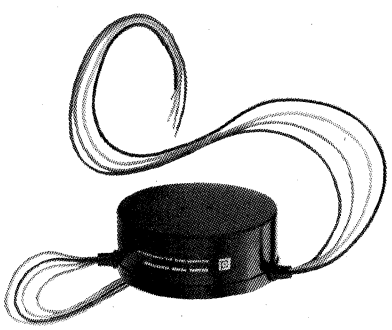
ENCAPSULATED RANGE PRINTED CIRCUIT STYLE

TYPE	Nom. load VA	Secondary RMS Volts	Secondary RMS Current	Dia. in.	Ht. in.	Weight lbs.
60/3030	15	6+6	1.250	2.60	1.30	0.77
60/3031	15	9+9	0.830	2.60	1.30	0.77
60/3032	15	12+12	0.625	2.60	1.30	0.77
60/3033	15	15+15	0.500	2.60	1.30	0.77
60/3034	15	20+20	0.375	2.60	1.30	0.77
60/3035	30	6+6	2.500	3.25	1.40	1.30
60/3036	30	9+9	1.666	3.25	1.40	1.30
60/3037	30	12+12	1.250	3.25	1.40	1.30
60/3038	30	15+15	1.000	3.25	1.40	1.30
60/3039	30	20+20	0.750	3.25	1.40	1.30
60/3040	50	9+9	2.800	3.75	1.55	2.00
60/3041	50	12+12	2.100	3.75	1.55	2.00
60/3042	50	15+15	1.670	3.75	1.55	2.00
60/3043	50	20+20	1.250	3.75	1.55	2.00
60/3044	50	25+25	1.000	3.75	1.55	2.00



ENCAPSULATED RANGE FLEXIBLE LEAD STYLE

TYPE	Nom. load VA	Secondary RMS Volts	Secondary RMS Current	Dia. in.	Ht. in.	Weight lbs.
60/3000	15	6+6	1.250	2.70	1.25	0.77
60/3001	15	9+9	0.830	2.70	1.25	0.77
60/3002	15	12+12	0.625	2.70	1.25	0.77
60/3003	15	15+15	0.500	2.70	1.25	0.77
60/3004	15	20+20	0.375	2.70	1.25	0.77
60/3005	30	6+6	2.500	3.30	1.35	1.30
60/3006	30	9+9	1.666	3.30	1.35	1.30
60/3007	30	12+12	1.250	3.30	1.35	1.30
60/3008	30	15+15	1.000	3.30	1.35	1.30
60/3009	30	20+20	0.750	3.30	1.35	1.30
60/3010	50	9+9	2.800	3.90	1.55	2.00
60/3011	50	12+12	2.100	3.90	1.55	2.00
60/3012	50	15+15	1.670	3.90	1.55	2.00
60/3013	50	20+20	1.250	3.90	1.55	2.00
60/3014	50	25+25	1.000	3.90	1.55	2.00
60/3015	90	12+12	3.750	4.20	1.80	3.00
60/3016	90	15+15	3.000	4.20	1.80	3.00
60/3017	90	20+20	2.250	4.20	1.80	3.00
60/3018	90	25+25	1.800	4.20	1.80	3.00
60/3019	90	30+30	1.500	4.20	1.80	3.00
60/3020	130	18+18	3.610	4.90	1.90	4.30
60/3021	130	22+22	3.000	4.90	1.90	4.30
60/3022	130	30+30	2.160	4.90	1.90	4.30
60/3023	130	35+35	1.850	4.90	1.90	4.30
60/3024	130	40+40	1.620	4.90	1.90	4.30

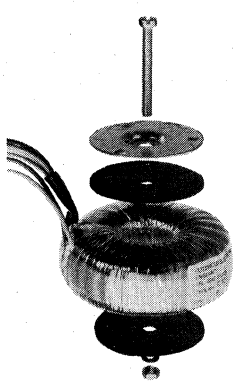


Nominal Load VA	Regulation	Temperature Rise °C	Iron Loss W	Copper Loss W
15	15%	14	0.26	2.25
30	13%	30	0.40	4.00
50	10%	35	0.60	5.00
90	7%	40	1.00	6.50
130	6.5%	40	2.00	10.00

ENCAPSULATED RANGE SPECIFICATIONS

Dual Primary 115V + 115V
Frequency 50/60 Hz Operating range 47 to 400 Hz
Primary to Secondary insulation: 4000V R.M.S.
Resin filled thermoplastic cases with threaded inserts
UL Recognized.

BUDGET RANGE



BUDGET RANGE SPECIFICATIONS

Dual Primary 120V + 120V
Frequency 50/60 Hz Operating range 47 to 400 Hz
Primary to Secondary insulation: 4000V R.M.S.
Mylar Finish — Clamp fixing UL Recognized

COTSWOLD "BUDGET RANGE"

TYPE	Load VA	Secondary RMS Volts	Secondary RMS Current	Dia. in.	Ht. in.	Weight lbs.
D3000	30	6+6	2.50	2.76	1.18	1.00
D3001	30	9+9	1.67	2.76	1.18	1.00
D3002	30	12+12	1.25	2.76	1.18	1.00
D3003	30	15+15	1.00	2.76	1.18	1.00
D3004	30	18+18	0.83	2.76	1.18	1.00
D3005	30	22+22	0.68	2.76	1.18	1.00
D3006	30	25+25	0.60	2.76	1.18	1.00
D3007	30	30+30	0.50	2.76	1.18	1.00
D3010	60	9+9	3.33	3.43	1.30	1.65
D3011	60	12+12	2.50	3.43	1.30	1.65
D3012	60	15+15	2.00	3.43	1.30	1.65
D3013	60	18+18	1.67	3.43	1.30	1.65
D3014	60	22+22	1.36	3.43	1.30	1.65
D3015	60	25+25	1.20	3.43	1.30	1.65
D3016	60	30+30	1.00	3.43	1.30	1.65
D3017	60	110	0.55	3.43	1.30	1.65
D3018	60	220	0.27	3.43	1.30	1.65
D3019	60	240	0.25	3.43	1.30	1.65
D3020	100	12+12	4.17	3.47	1.57	2.20
D3021	100	15+15	3.33	3.47	1.57	2.20
D3022	100	18+18	2.78	3.47	1.57	2.20
D3023	100	22+22	2.27	3.47	1.57	2.20
D3024	100	25+25	2.00	3.47	1.57	2.20
D3025	100	30+30	1.67	3.47	1.57	2.20
D3026	100	110	0.91	3.47	1.57	2.20
D3027	100	220	0.45	3.47	1.57	2.20
D3028	100	240	0.42	3.47	1.57	2.20
D3030	160	18+18	4.44	4.25	1.66	3.31
D3031	160	22+22	3.64	4.25	1.66	3.31
D3032	160	25+25	3.20	4.25	1.66	3.31
D3033	160	30+30	2.67	4.25	1.66	3.31
D3034	160	35+35	2.29	4.25	1.66	3.31
D3035	160	110	1.46	4.25	1.66	3.31
D3036	160	220	0.73	4.25	1.66	3.31
D3037	160	240	0.67	4.25	1.66	3.31
D3040	230	25+25	4.60	4.53	1.97	4.85
D3041	230	30+30	3.83	4.53	1.97	4.85
D3042	230	35+35	3.29	4.53	1.97	4.85
D3043	230	40+40	2.88	4.53	1.97	4.85
D3044	230	110	2.09	4.53	1.97	4.85
D3045	230	220	1.05	4.53	1.97	4.85
D3046	230	240	0.96	4.53	1.97	4.85
D3050	330	25+25	6.60	5.12	2.05	6.17
D3051	330	30+30	5.50	5.12	2.05	6.17
D3052	330	35+35	4.71	5.12	2.05	6.17
D3053	330	40+40	4.13	5.12	2.05	6.17
D3054	330	45+45	3.67	5.12	2.05	6.17
D3055	330	110	3.00	5.12	2.05	6.17
D3056	330	220	1.50	5.12	2.05	6.17
D3057	330	240	1.38	5.12	2.05	6.17
D3060	530	30+30	8.83	5.71	2.37	8.38
D3061	530	35+35	7.57	5.71	2.37	8.38
D3062	530	40+40	6.63	5.71	2.37	8.38
D3063	530	45+45	5.89	5.71	2.37	8.38
D3064	530	50+50	5.30	5.71	2.37	8.38
D3065	530	110	4.82	5.71	2.37	8.38
D3066	530	220	2.41	5.71	2.37	8.38
D3067	530	240	2.21	5.71	2.37	8.38

Load VA	Regulation	Temperature Rise °C	Iron Loss W	Copper Loss W
30	16%	55	0.35	4.5
60	13%	55	0.6	8
100	10%	62	1.5	10
160	10%	60	2.0	17
230	8%	65	2.5	20
330	7%	66	3.0	24
530	6%	65	3.5	30

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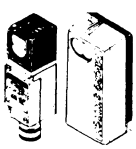
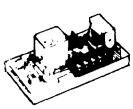
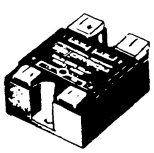
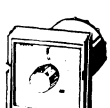

PHOTOELECTRICS

RELAYS


LIQUID LEVEL CONTROLS


SOLID STATE RELAYS

TERMINAL BLOCKS


TEMPERATURE CONTROLS

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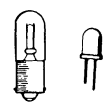
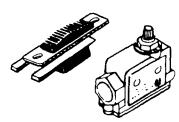
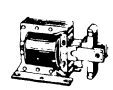

LAMPS & LEDS


SWITCHES

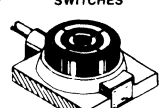
RELAYS

INDICATOR LIGHTS

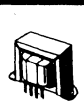

SOLENOIDS

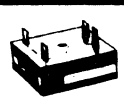
SOCKETS

PUSHBUTTON SWITCHES


PROXIMITY CONTROLS

PADDLE SWITCHES


TRANSFORMERS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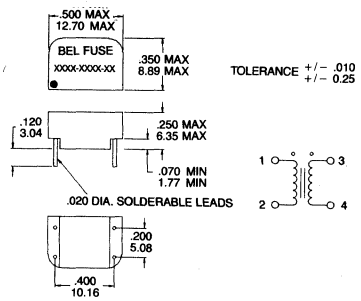
- Designed for hub-node use
- All parts comply with international safety requirements for lans; including 2000V RMS isolation
- Custom designs available
- Four wire filter available

TABLE OF ELECTRICAL SPECIFICATIONS @ 25° C.

Part Number 0553-	Turns Ratio (±5%)	Pulse Inductance (μh±20%)	ET Constant (V-μs min.)	Rise Time (ns max.)	Pri/Sec CW/W (pf max.)	Pri-Sec LL (μh max.)	Primary DCR (ohms max.)	HYPOT (Vrms)	Package Style**
0033-AC	1:1	2.5	25	50	25	6.0	1.0	2000	C
3005-AC	1:1	2.5	25	20	40	0.80	1.0	2000	C
0033-AJ	1:1	2.5	25	50	25	6.0	1.0	2000	J
3005-AJ	1:1	2.5	25	20	40	0.80	1.0	2000	J
0506-JK	1:1:1:1	N/A*	N/A	N/A	30	0.30	0.065	2000	K

* Sine wave inductance: 40μh min at 100kHz 20 mv.

PACKAGE C



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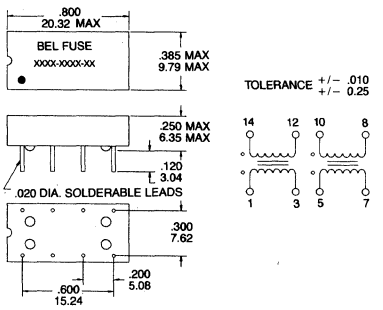

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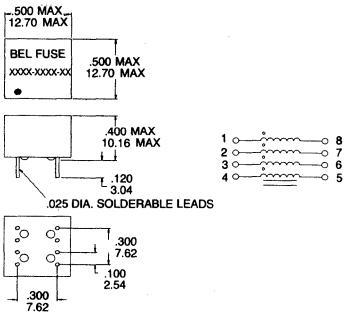


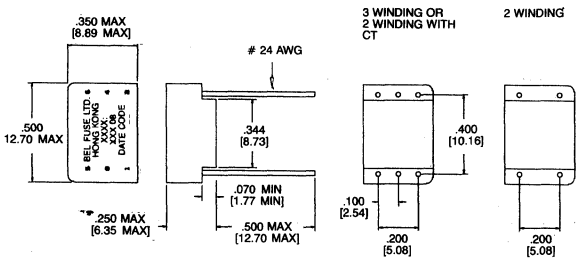
HIGH QUALITY NETWORKING TRANSFORMERS

- Wide selection of standard types (see sample table). Consult factory for complete standards list.
- Special lead lengths available at no additional cost
- Custom designs available (consult factory)
- Wide operating temperature range (0 to 70°C)
- Competitive pricing on both small and high volume orders
- Ship from stock availability on most items
- 200V RMS isolation standard on all units
- Versatile "T" case outline

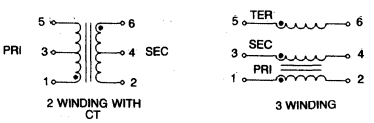
SAMPLE TABLE

Part Number* 0553-	Turns Ratio (±5%)	Primary Sine Wave OCL (μh min.)	Primary Winding ET-Constant (V-μs min.)	Rise Time ((ns max.)	Pri/Sec CW/W (pf max.)	Pri/Sec Leakage Inductance (μh max.)	Primary DCR. (ohms max.)	Secondary DCR. (ohms max.)	Tertiary DCR. (ohms max.)
0053-IC	1:1:1	5,000	25.0	10.5	60	1.3	3.9	3.9	3.9
5006-IC	1:1:1	500	8.5	5.3	32	0.4	1.3	1.3	1.3
0106-IC	1:1:1	10	3.7	5.1	22	0.5	0.9	0.9	0.9
0053-PC	2:1:1	5,000	25.0	16.0	33	3.6	3.9	2.0	2.0
0206-PC	3:1:1	20	3.2	2.7	6	1.3	0.9	0.4	0.4
0023-DC	1ct:1ct	2,000	16.0	8.2	37	0.8	2.5	2.5	—
0106-DC	1ct:1ct	10	3.7	5.1	22	0.5	0.9	0.9	—
0023-OC	2ct:1ct	2,000	16.0	11.0	19	1.8	2.5	1.4	—
0106-OC	2ct:1ct	10	3.7	4.5	9	1.5	0.9	0.5	—

INCHES
MM



PINOUTS



CUSTOM DESIGNS

Involving other ratios, variations betweeen the individual transformers, or changes in electrical parameters are welcomed by our design staff. Consult the factory for a prompt quotation based upon your requirements.

Bel Fuse manufactures a comprehensive line of pulse transformers, coils, SMD & custom magnetics. In addition to our extensive line of magnetic components we offer a complete line of standard and custom delay lines and fuses.

Specifications Subject To Change Without Notice

bel/ defining a degree of excellence

HIGH ISOLATION TRANSFORMERS FOR TOKEN RING APPLICATIONS

- IEEE 802.5 token ring compatible
- Single and dual transformer packages: low profile
- High isolation voltage to comply with international safety requirements for lan's: 1000 volts minimum!
- Designed for token ring applications

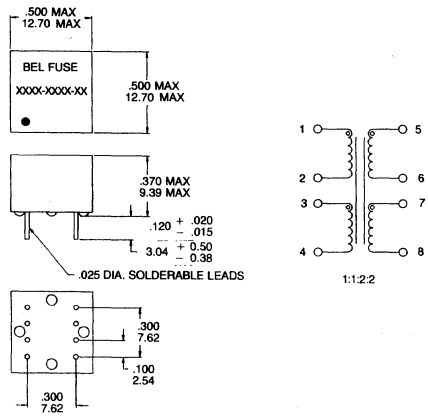
RATINGS: ALL TRANSFORMERS

Turns Ratio	Insertion Loss	CMRR	Return Loss	Rise Time	HYPOT
1:1:2:2	0.50 dB Max.	−60 dB Min.	20 dB Min.	15 ns Max.	1000V-RMS

TABLE OF ELECTRICAL SPECIFICATIONS @ 25°C.

Part Number 0553-	Primary OCL (μh typ)	Primary LL (μh max.)	Pri-Sec CW/W (pf max.)	DCR (ohms max.) Pri	DCR (ohms max.) Sec
5006-KK	500	0.25	10	0.40	0.80
5006-KL	500	0.25	10	0.40	0.80

PACKAGE K



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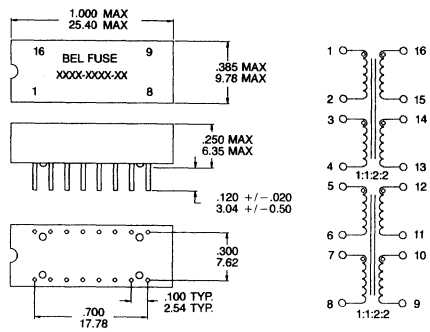


HIGH FREQUENCY ISOLATION TRANSFORMERS

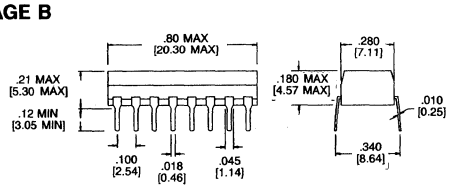
ETHERNET/LAN NETWORKING APPLICATIONS

- IEEE 802.3 compatible (10BASE2 & 10BASE5)
- High temperature suitable (0° to 70°C. operable)
- Custom designs available
- Low profile 14 and 16 pin styles available for autoinsertion
- Cost effective triad packaging
- Fast rise times — efficient operation
- All packages comply with international safety requirements for Lans; including 2,000V RMS isolation
- Suitable for high frequency applications

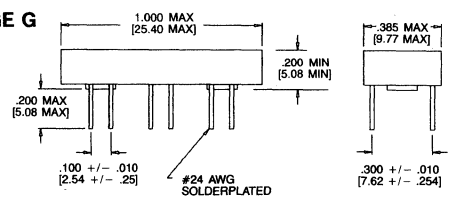
TABLE OF ELECTRICAL SPECIFICATIONS @ 25°C.

Part Number 0553-	Turns Ratio (±5%)	OCL. (μh±20%)	ET Constant (V-μs min.)	Rise Time (ns max.)	CW/W (pf max.)	LL (μh max.)	DCR (ohms max.)
0306-A( )	1:1	30	1.8	3.0	8.0	0.20	0.20
0356-A( )	1:1	35	1.8	3.0	9.0	0.20	0.20
0506-A( )	1:1	50	2.1	3.0	10.0	0.20	0.20
0756-A( )	1:1	75	2.1	3.0	10.0	0.20	0.25
0806-A( )	1:1	80	2.1	3.0	10.0	0.20	0.25
1006-A( )	1:1	100	2.1	3.5	10.0	0.20	0.25
1506-A( )	1:1	150	3.0	3.5	12.0	0.25	0.30
2506-A( )	1:1	250	3.5	3.5	15.0	0.25	0.40

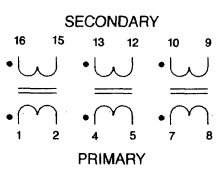
PACKAGE B



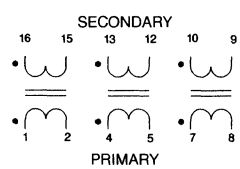
PACKAGE G



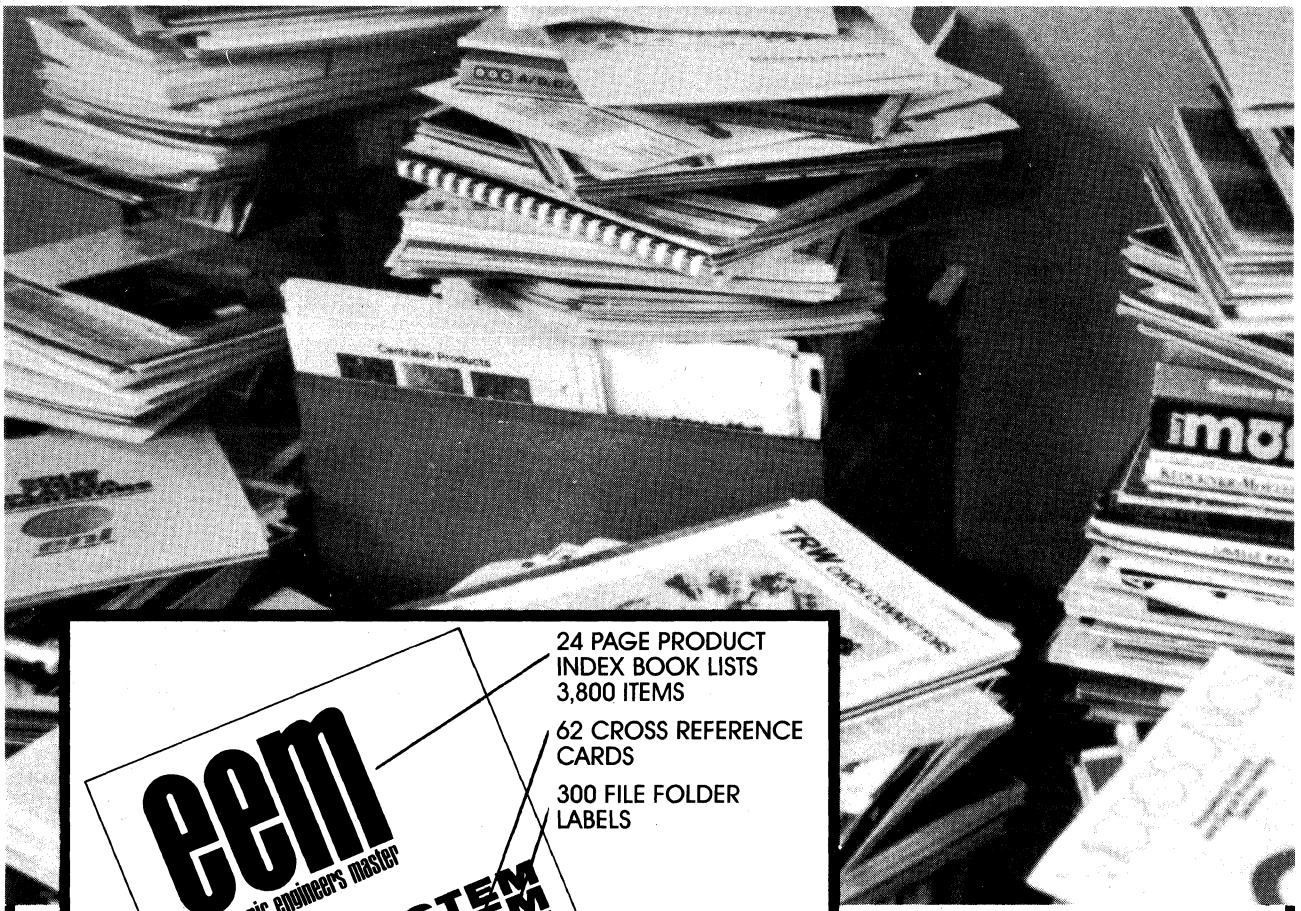
PINOUTS FOR 16 PIN PKG.



PINOUTS FOR 12 PIN PKG.



Specifications Subject To Change Without Notice



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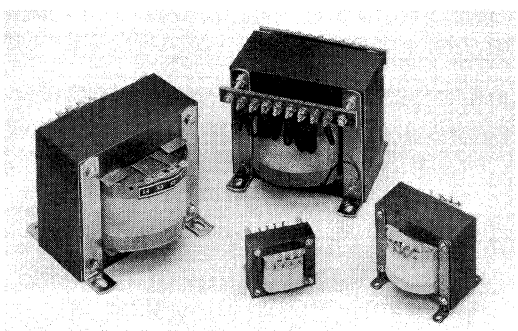

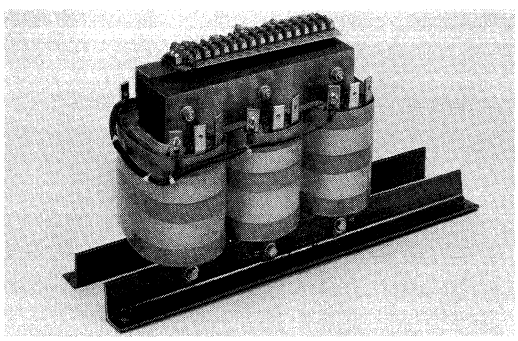

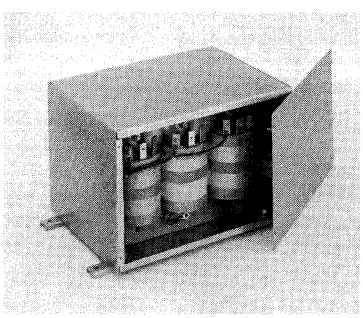

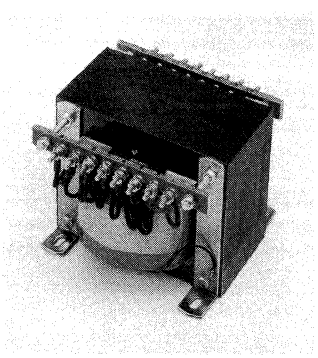

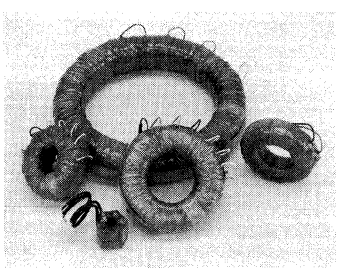

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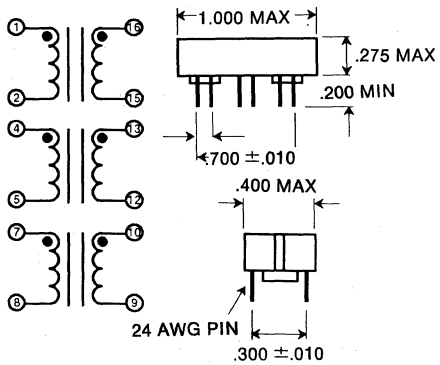
TOP	(Technical Office Protocol)	RS-423	Network interface, unbalanced
IVD	(Integrated Voice Data)	RS-485	Network interface, balanced
MIB	(Medical Information Bus)	802.3	Ethernet and Starlan
ISDN	(Integrated Services Data Network)	802.5	Token Ring
TI	Wide band carrier for Wide Area Networks	Balun	Transformers

Ethernet Isolation Transformers

- IEEE 802.3 Compatible (10 BASE 2 and 10 BASE 5)
- Other Packages Available

Part Number	Turns Ratio	Primary Inductance (μH ±20%)	Primary ET Constant (V μSec Min)	Pri./Sec. Leakage Inductance (μH Max.)	Pri./Sec. CW/W (pF Max.)	DCR (Ohms Max.)	Hi-Pot (V RMS)
500-1344	1:1	35	2.1	0.25	8	0.30	2000
500-1345	1:1	50	2.2	0.25	9	0.30	2000
500-1346	1:1	75	2.4	0.25	10	0.30	2000
500-1347	1:1	100	2.1	0.25	10	0.40	2000
500-1348	1:1	150	3.0	0.25	14	0.50	2000

Package Style



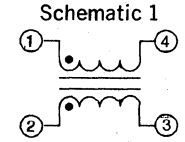
Starlan Isolation Transformers

All of these components are compatible with IEEE 802.3 (1 BASE 5) to transmit data at the rate of 1 megabit per second on unshielded, twisted pair cable.

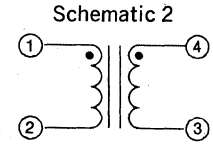
Starlan Transformer Properties

Part Number	Turns Ratio	Pulse Inductance mH ±20%	Rise Time n Sec Min.	Rise Time n Sec Nom.	Rise Time n Sec Max.	Inter-winding Capacitance pF	Leakage Inductance μH	High Voltage Test VRMS For 1 Sec.	ET Constant V μSec. Min.	DC Resistance Ω Max.	Package Style	Schematic
500-1294	1:1	2	40		60	<50	5 Max.	1600	50	1	A	1
500-1400	1:1	2	40		60	<30	3 to 6	2000	25	1	B	1
500-1401	1:1	2	40		60	<30	3 to 6	2000	25	1	C	3
500-1420	1:1	2	40		60	<50	3 to 6	1600	50	1	D	2
500-1425	1:1	2		8	10	<50	.5 Max.	2000	25	1	E	4
500-1428	1:1	2		8	10	<50	.5 Max.	2000	25	1	F	2
500-1431	1:1	2		8	10	<50	.5 Max.	2000	25	1	G	2
500-1436	1:1	2	40		60	<30	3 to 6	2000	25	1	E	4

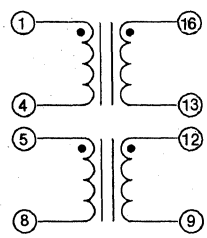
Schematic 1



Schematic 2



Schematic 3



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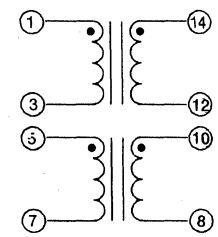


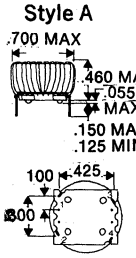
Custom Designs & Packages Available

Contact us for design assistance with your network magnetics requirements. We have a wide variety of special packages including surface mount. Our engineers are specialists in network magnetics design and welcome the opportunity to create products that specifically meet your needs. Domestic and offshore production facilities are available to meet both high and low volume requirements.

Starlan Transformer Packages

Starlan transformers are available in the wide variety of packages described below.

Style A



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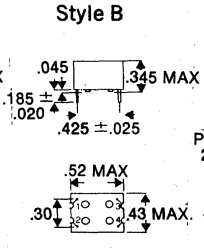
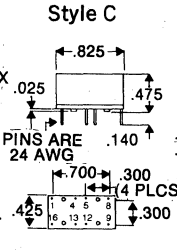


Style C



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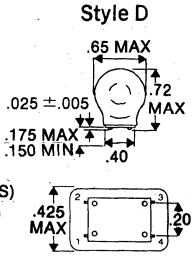

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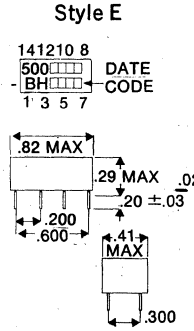

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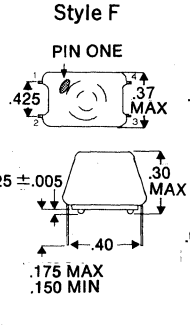

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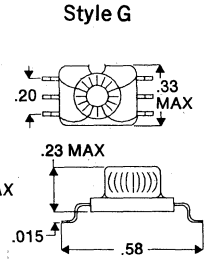
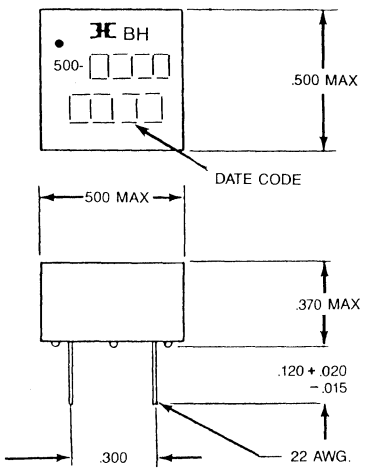


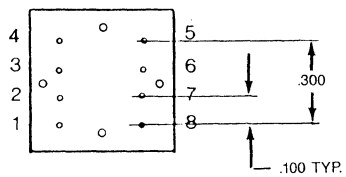
BH Electronics BH Electronics, Inc., 12219 Wood Lake Drive, Burnsville, MN 55337 • (612) 894-9590

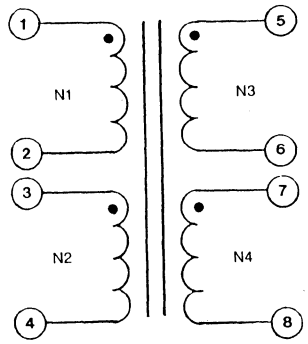
BH Electronics

Token Ring Transformer

- IEEE 802.5 Compatible
- Designed to operate with TM38051 chip
- Part Number 500-1485





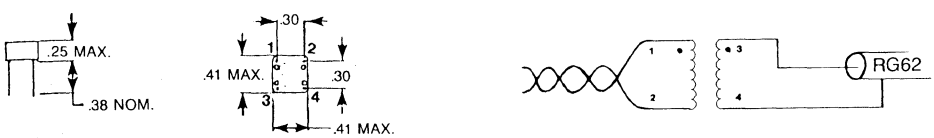


Turns Ratio : 1:1:2:2 (N1:N2:N3:N4)
Open Circuit Inductance: (1-4) 3.34 mH ± 30%
Primary Leakage: .5 μH MAX.
Interwinding Capacitance: 65 pF MAX.
High Voltage Test: 500 VRMS For 1 Sec.

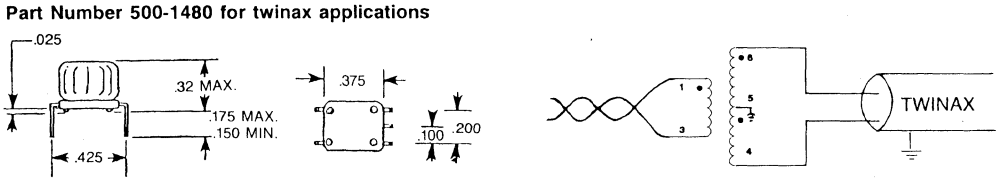
Balun Magnetics For Data Processing Equipment

Transformers and modules designed specifically for conversion of coaxial cable to twisted pair. Each module is available from stock ready for PC board mounting. Also available are complete baluns constructed specifically for your needs using standard or custom cases. Contact your local BH Electronics representative to find out more about these new products.

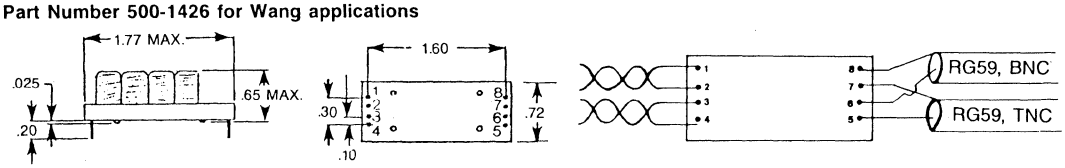
Part Number 500-1433 for 327X applications



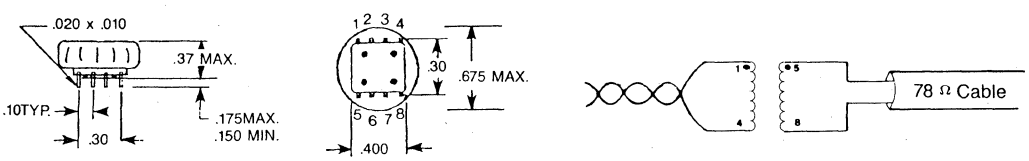
Part Number 500-1480 for twinax applications



Part Number 500-1426 for Wang applications



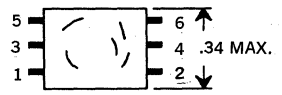
Part Number 500-1481 for Appletalk applications



BH Electronics

General Purpose Pulse Transformers

- **Designed for a Wide Variety of Low Power Applications**
- **PC Board Mounting**
- **Surface Mount Available**
- **500 VDC Hi-Pot**



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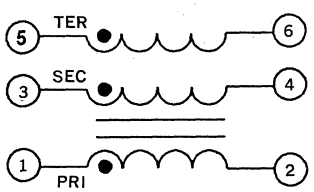
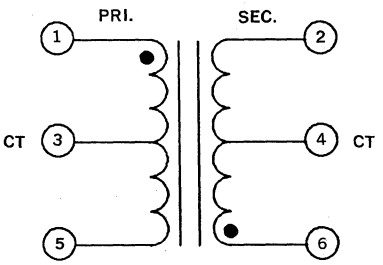
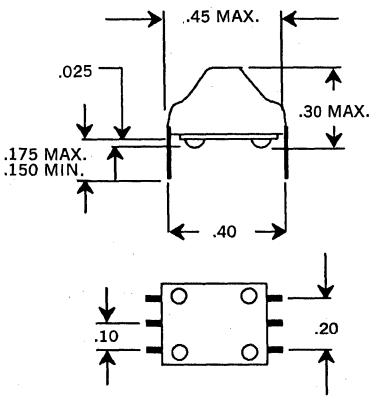


SCHEMATIC B





BH Part Number	Turns Ratio (±5%)	Primary Sine Wave Loc (μ H Min.)	Primary Et-Constant (Vμ Sec. Min.)	Pri./Sec. Cw/w (pf Max.)	Pri./Sec. Leakage Inductance (μ H Max.)	Primary DCR (Ohms Max.)	Secondary DCR (Ohms Max.)	Tertiary DCR (Ohms Max.)	Schematic Style
500-1300	1:1:1	5000	25.0	60	1.3	1.5	1.5	1.5	A
500-1301	1:1:1	2000	16.0	37	0.8	1.0	1.0	1.0	A
500-1302	1:1:1	500	8.5	30	0.4	1.0	1.0	1.0	A
500-1303	1:1:1	200	5.0	18	0.3	0.9	0.9	0.9	A
500-1304	1:1:1	50	5.2	18	0.5	0.5	0.5	0.5	A
500-1305	1:1:1	20	3.2	21	0.4	0.2	0.2	0.2	A
500-1306	1:1:1	10	3.7	22	0.5	0.1	0.1	0.1	A
500-1307	2:1:1	5000	25.0	33	3.6	1.0	1.0	1.0	A
500-1308	2:1:1	2000	16.0	19	1.8	0.5	0.5	1.0	A
500-1309	2:1:1	500	8.5	11	1.1	1.0	0.7	0.7	A
500-1310	2:1:1	200	5.0	8	0.8	0.9	0.5	0.5	A
500-1311	2:1:1	20	5.8	12	1.5	1.0	0.5	0.5	A
500-1312	3:1:1	200	5.0	7	1.1	0.9	0.4	0.4	A
500-1313	3:1:1	20	3.2	6	1.3	0.9	0.4	0.4	A
500-1314	4:2:1	2000	16.0	20	2.5	2.5	1.4	0.8	A
500-1315	4:2:1	500	8.5	13	0.9	1.0	0.8	0.5	A
500-1316	4:2:1	200	5.0	8	0.8	0.9	0.5	0.4	A
500-1317	1CT:1CT	2000	16.0	37	0.8	2.0	2.0	—	B
500-1318	1CT:1CT	500	8.5	32	0.4	1.0	1.0	—	B
500-1319	1CT:1CT	200	5.0	18	0.3	0.5	0.5	—	B
500-1320	1CT:1CT	50	5.2	18	0.5	1.0	1.0	—	B
500-1321	1CT:1CT	20	3.2	21	0.4	0.9	0.9	—	B
500-1322	1CT:1CT	10	3.7	22	0.5	0.9	0.9	—	B
500-1323	2CT:1CT	2000	16.0	19	1.8	1.0	0.5	—	B
500-1324	2CT:1CT	500	8.5	12	1.2	1.0	0.5	—	B
500-1325	2CT:1CT	200	5.0	8	0.8	0.9	0.5	—	B
500-1326	2CT:1CT	50	5.2	12	1.3	1.3	0.7	—	B
500-1327	2CT:1CT	20	5.8	12	1.5	1.0	0.5	—	B
500-1328	2CT:1CT	10	3.7	9	1.5	0.9	0.5	—	B

BH Electronics BH Electronics, Inc., 12219 Wood Lake Drive, Burnsville, MN 55337, (612) 894-9590

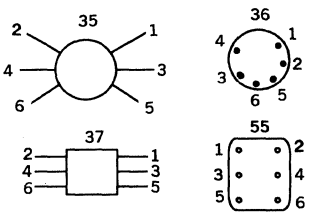
BH Electronics

Series 505 SCR Trigger Transformer

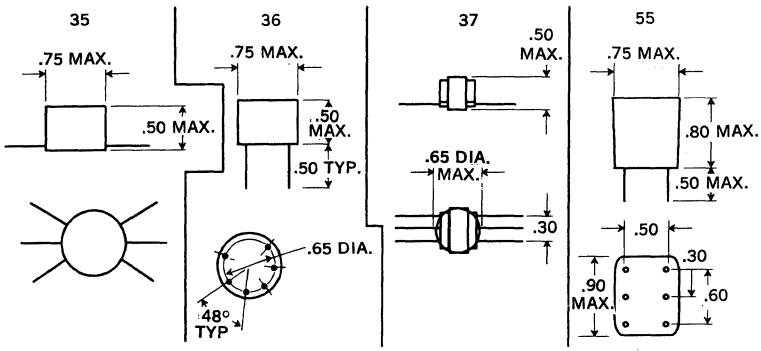
- **Four Case Styles**
- **1600 or 2500 VRMS Isolation**
- **Tinned Copper Leads**
- **Low Ciw To Prevent False Triggering**
- **PC Mountable with 20 AWG Leads**
- **Order by Part Number 505-**

STANDARD CASE STYLES

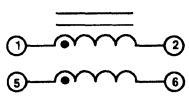
Case No.	Isolation Voltage	Temperature Range	Encapsulated
35	1600 VRMS @ 60Hz	−10° C to 70° C	Yes
36	1600 VRMS @ 60Hz	0° C to 60° C	Yes
37	1600 VRMS @ 60Hz	0° C to 60° C	No
55	2500 VRMS @ 60Hz	0° C to 60° C	Yes



ALL STYLES ARE BOTTOM VIEW



SCHEMATICS



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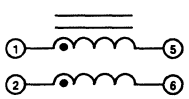
Pins 3 & 4 Removed



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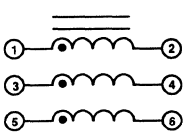
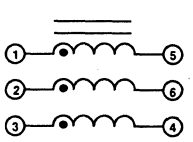
Pins 3 & 4 Removed



SCHEMATIC C



SCHEMATIC D

Electrical Parameter Number	Turns Ratio	Primary Inductance (mH-Min.)	Primary Et Constant (V μ Sec Min)	Leakage Inductance (μ H Max.)	Interwinding Capacitance (pf Max.)	DCR Pri. Ω Max	DCR Sec. Ω Max	DCR Ter Ω Max	Schematic Style
505- 00	1:1	.25	45	5	20	1.0	1.0	N/A	A
505- 01	1:1	1.0	90	20	30	2.0	2.0	N/A	A
505- 02	1:1	5.0	180	45	30	3.0	3.0	N/A	A
505- 03	1.1	20.0	360	45	50	5.0	5.0	N/A	A
505- 04	1:1:1	.25	45	5	20	1.0	1.0	1.0	C
505- 05	1:1:1	1.0	90	20	30	2.0	2.0	2.0	C
505- 06	1:1:1	5.0	180	45	30	3.0	3.0	3.0	C
505-5507	1:1:1	20.0	360	75	50	3.0	3.0	3.0	C
505- 08	2:1	1.0	90	40	30	2.0	1.0	N/A	A
505- 09	2:1	5.0	180	40	30	3.0	2.0	N/A	A
505- 10	2:1:1	1.0	90	40	30	2.0	1.0	1.0	C
505- 11	2:1:1	5.0	180	60	30	3.0	2.0	2.0	C
505- 12	5:1	20.0	360	200	50	5.0	2.0	N/A	A
505- 13	5:1:1	20.0	360	200	50	5.0	2.0	2.0	C
505-5570	1:1	.25	45	5	20	1.0	1.0	N/A	B
505-5571	1:1:1	.25	45	5	20	1.0	1.0	1.0	D
505-5572	1:1	1.0	90	20	30	2.0	2.0	N/A	B
505-5573	1:1:1	1.0	90	20	30	2.0	2.0	2.0	D
505-5574	1:1	5.0	180	45	30	3.0	3.0	N/A	B
505-5575	1:1:1	5.0	180	45	30	3.0	3.0	3.0	D
505-5576	1:1	20.0	360	45	50	5.0	5.0	N/A	B
505-5577	1:1:1	20.0	360	75	50	3.0	3.0	3.0	D
505-5578	2:1	1.0	90	40	30	2.0	1.0	N/A	B
505-5579	2:1:1	1.0	90	60	30	2.0	1.0	1.0	D
505-5580	2:1	5.0	180	40	30	3.0	2.0	N/A	B
505-5581	2:1:1	5.0	180	45	30	3.0	2.0	2.0	D
505-5582	2:1	20.0	360	200	75	5.0	3.0	N/A	B
505-5583	2:1:1	20.0	360	200	75	3.0	2.0	2.0	D
505-5584	5:1	20.0	360	200	50	5.0	2.0	N/A	B
505-5585	5:1:1	20.0	360	200	50	5.0	2.0	2.0	D

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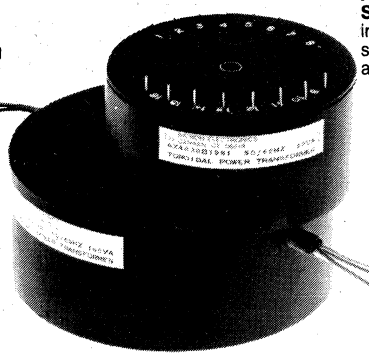
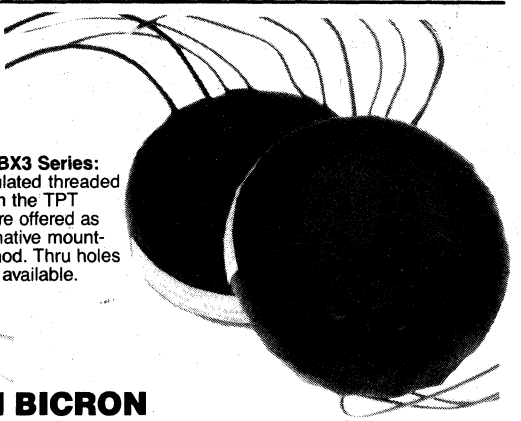
BICRON™

TOROIDAL POWER TRANSFORMER INFORMATION



AX4 or BX4 Series: Available in a variety of sizes, mountings and terminations.



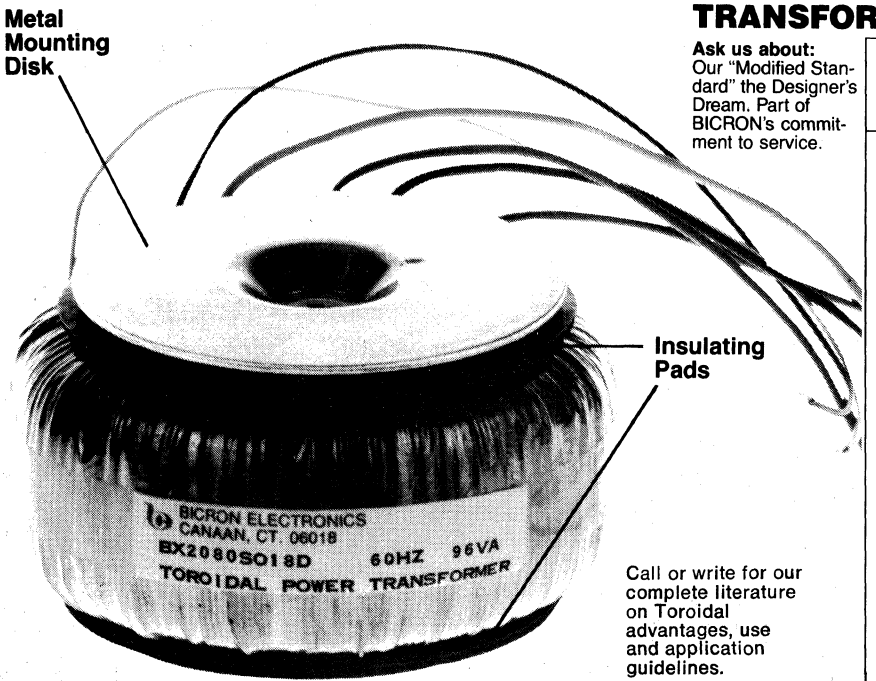
AX3 or BX3 Series: Encapsulated threaded inserts in the TPT center are offered as an alternative mounting method. Thru holes are also available.

ADVANTAGES FOR YOUR PRODUCT

- Lightweight/Typically 50% less weight than laminated types
- Low Profile Dimensions for slim-line applications
- Quiet Operation
- Very Low Strayfield without special shielding because primary and secondary windings are distributed around core and no air gaps in core
- A High Operating Efficiency because of high stacking factor and high operating flux densities
- Your Equipment Runs Cool and reliability is improved
- Choice of Mountings, including Toroidal installation on board (PC Mount) at the same time as other components
- Virtually no special tooling for custom toroidals

WITH BICRON

- Custom Designed products at standard product prices
- The widest range of wire sizes, windings, enclosures and mounting styles in the industry
- U.S. made means fast prototype turnaround
- Personal indepth Bicron commitment
- Sizes up to 3000VA
- Our cores are all special grain oriented steel and are annealed for optimum results
- State of the art computer controlled toroidal winding machines assure quality and reduce costs
- Toroidal product know-how for over 20 years
- Units are designed utilizing proven computer-aided design systems developed exclusively by Bicron for toroidal power transformers
- Standard construction is UL Recognized to UL standard 478



Standard Configurations (AX2 and BX2): Shown is a standard method of mounting. Units can also be supplied without hardware for Tie-Wrap (Signify AX1 or BX1) applications.

CUSTOM POWER TRANSFORMERS:

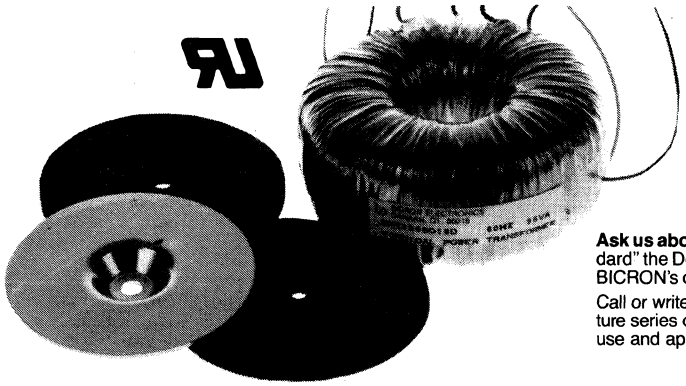
Ask us about: Our "Modified Standard" the Designer's Dream. Part of BICRON's commitment to service.

A Series 50/60 Hz Rating	B Series 60 Hz Rating	Dimensions (ref.)	
		OD × HT	Weight
10VA	12VA	2.5 × 1.1	.6
20VA	24VA	2.7 × 1.3	.8
30VA	36VA	2.7 × 1.7	1.2
40VA	48VA	3.5 × 1.3	1.5
50VA	60VA	3.5 × 1.4	1.7
60VA	72VA	3.5 × 1.6	1.9
80VA	96VA	4.2 × 1.5	2.1
100VA	120VA	4.2 × 1.7	2.3
160VA	200VA	4.7 × 1.7	3.1
230VA	275VA	4.7 × 2.2	5.5
330VA	400VA	4.8 × 2.7	6.8
400VA	480VA	5.7 × 2.3	7.5
530VA	640VA	5.7 × 2.9	9.8
600VA	720VA	5.7 × 3.2	11.0
750VA	900VA	6.3 × 3.1	13.0
1000VA	1200VA	6.3 × 3.7	16.0
1200VA	1440VA	6.3 × 4.4	18.0
1500VA	1800VA	7.9 × 3.5	21.0
2000VA	2400VA	7.9 × 4.1	28.0
2500VA	3000VA	8.7 × 4.7	33.0
3000VA	3600VA	8.7 × 4.8	36.0

NOTE: The above chart is a partial listing of the many core sizes that we have available for your modified standard product.

Call or write for our complete literature on Toroidal advantages, use and application guidelines.

Bicron Electronics Co.
100 Barlow Street
Canaan, CT 06018
203/824-5125
FAX 203/824-1137



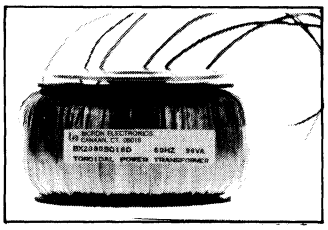
Ask us about: Our "Modified Standard" the Designer's Dream. Part of BICRON's commitment to service.

Call or write for our complete literature series on Toroidal advantages, use and application guidelines.

BICRON™

TOROIDAL POWER TRANSFORMER INFORMATION:

Standard Product 60Hz Toroidal Power Transformers Single 120V Input — UL Recognized Construction:



Standard Configurations (AU2 and BU2):
Shown is a standard method of mounting. Units can also be supplied without hardware for Tie-Wrap (Signify AU1 or BU1) applications.

@ 60 HZ Power Rating	Secondary Full Load Voltage/ Current	Reg. Full Load (%)	Dimension O.D. × HT Weight	BICRON 60HZ Part Number
24VA	2 × 6V/2.00A	17%	2.7″ × 1.3″	BU202AS006D
	2 × 12V/1.00A		0.8 lbs.	BU202AS012D
	2 × 18V/0.67A			BU202AS018D
	2 × 24V/0.50A			BU202AS024D
48VA	2 × 6V/4.00A	16%	3.5″ × 1.3″	BU204AS006D
	2 × 12V/2.00A		1.5 lbs.	BU204AS012D
	2 × 18V/1.33A			BU204AS018D
	2 × 24V/1.00A			BU204AS024D
96VA	2 × 9V/5.33A	12%	4.2″ × 1.5″	BU208AS009D
	2 × 12V/4.00A		2.1 lbs.	BU208AS012D
	2 × 18V/2.67A			BU208AS018D
	2 × 24V/2.00A			BU208AS024D
120VA	2 × 9V/6.67A	11%	4.2″ × 1.7″	BU210AS009D
	2 × 12V/5.00A		2.3 lbs.	BU210AS012D
	2 × 18V/3.33A			BU210AS018D
	2 × 24V/2.50A			BU210AS024D
200VA	2 × 12V/8.00A	10%	4.7″ × 1.7″	BU216AS012D
	2 × 18V/5.33A		3.1 lbs.	BU216AS018D
	2 × 24V/4.00A			BU216AS024D
	2 × 30V/3.20A			BU216AS030D
275VA	2 × 18V/7.64A	8%	4.7″ × 2.2″	BU223AS018D
	2 × 24V/5.73 A		5.5 lbs.	BU223AS024D
	2 × 36V/3.82A			BU223AS036D
400VA	2 × 24V/8.33A	7%	4.8″ × 2.7″	BU233AS024D
	2 × 36V/5.56A		6.8 lbs.	BU233AS036D
	2 × 48V/4.17A			BU233AS048D
640VA	2 × 24V/13.25A	6%	5.7″ × 2.9″	BU253AS024D
	2 × 36V/8.83A		9.8 lbs.	BU253AS036D
	2 × 48V/6.63A			BU253AS048D
900VA	2 × 30V/15.00A	5%	6.3″ × 2.9″	BU275AS030D
	2 × 60V/7.50A		13.0 lbs.	BU275AS060D
	2 × 120V/3.75A			BU275AS120D
1200VA	2 × 30V/20.00A	5%	6.3″ × 3.7″	BU21A0S030D
	2 × 60V/10.00A		16.0 lbs.	BU21A0S060D
	2 × 120V/5.00A			BU21A0S120D

Specifications (B Series):
- 120V, 60Hz Operation
- Standard Leads are stranded, temperature Class A (105 C), 10″ long, UL 1015
- Dielectric stength 2500V RMS between primary and secondary
- Maximum transformer operating temperature 105 C
- Temperature Rise 65 C max at rated output power
- Supplied with metal mounting disk and two insulating pads
- UL Recognized (478)

Available Options:
- Mounting Methods
- Tie-Wrap • Washer/Insulator
- Bolt-Mounting • Molded in Threaded-Insert
- Encapsulated with leads, PC pins or terminal blocks
- Static Shielding between primary and secondary windings
- Magnetic Shielding
- International Safety Agency Guidelines

Our product is manufactured to meet standard UL, CSA, IEC, VDE ano other international specifications. Our product can be modified to meet more stringent specs for data processing, office machines, power supplies, medical equipment, etc.
- Typical Applications: Audio, Communications, Medical Equipment, Power Supplies, Portable Equipment

Data is subject to change without prior notice.

BICRON is the leading manufacturer of Toroidal Power Transformers of *sizes up to 3000VA* in the United States. Our cores are made of special grain oriented steel. All cores are annealed to optimize magnetic properties. Primary and Secondary windings are done on *state-of-the-art* computer controlled toroidal winding machines which provide exact control of winding geometry.

Custom Toroidals: Our Application Engineers have developed a unique computer program to assist in the design of *the optimum toroidal transformer* for each custom application. This program makes possible the best transformer at the most economical price.

The Company: Bicron is a medium size U.S. Company that has *specialized in Toroidal wound products for over 20 years.* Our success over the years is the direct result of our deep and continuing commitment to our products and the people that use them.

CALL:

(203) 824-5125

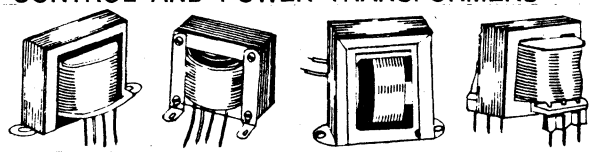
for more information and Technical Brochures regarding our products. Or Fax your requirements to us at 203/824-1137(FAX).

Bicron Electronics Co.
100 Barlow Street
Canaan, CT 06018

C & C JETRONIC, INC.

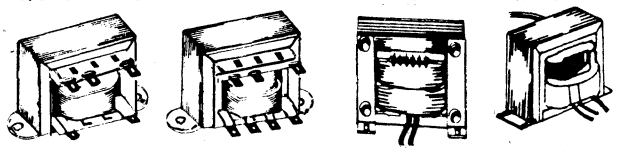
CUSTOM TRANSFORMERS

CONTROL AND POWER TRANSFORMERS

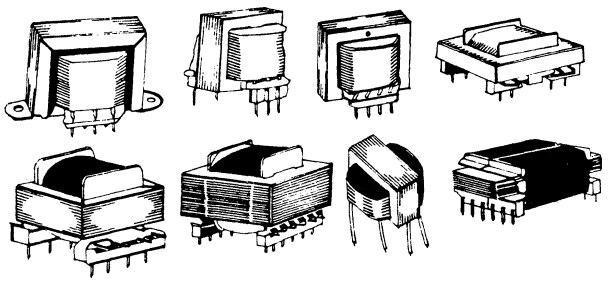


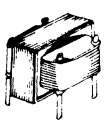
Power Transformers are designed to cover from EI-28 to EI-133.
Capacity from 1 VA to 500 VA or more. UL, CSA, VDE.

QUICK CONNECT SINGLE & DUAL PRIMARY



TELEPHONE INTERCONNECT TRANSFORMERS





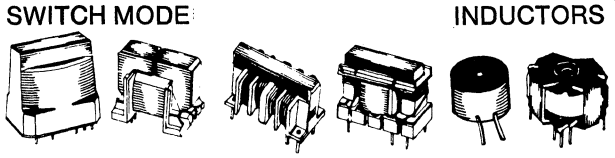
AUDIO TELEPHONE COUPLING TRANSFORMER

- Designed to meet FCC Part 68.310
- Frequency Response: 300-3500 Hz ±0.5 dB
- Impedance Matching: ±10% over center range 1 kHz
- Distortion: ±0.5% max.
- Level: 45 dBm to 7 dBm
- Insertion Loss: 0.5-2.0 dB (max.)
- Core Material: Orient M-6 (Z-11), Permalloy NI 36-78%, Ferrite Core
- Core Type: EE.EI.EP.EC.POT.RM.

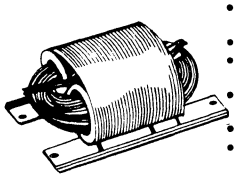
DRIVE & SWITCH MODE

PIN CUSHION

CHOKES & INDUCTORS

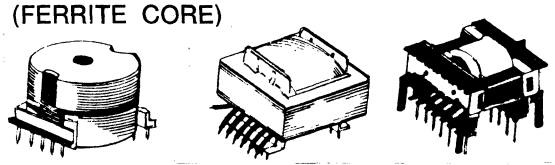


R-CORE



- 30% smaller and lighter. 40% thinner than EI-Lamination
- Leakage Flux is less than 1/10th of EI-Lamination
- Sectionless Core allows noiseless performance
- Temperature Rise is less than half of EI-Lamination
- Compact Design leads to a significant space saving
- UL, CSA & VDE capabilities
- Complete Facilities to design, engineer and produce prototype
- Most competitive prices

HIGH FREQUENCY POWER TRANSFORMER (FERRITE CORE)

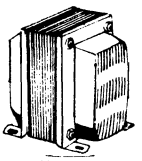


- Switching Power, Current, DC-DC Converter, Driver, Pulse Transformers
- Core Type: EI.EE.PC.PQ.EF.EC.RM.

SPLIT BOBBIN TRANSFORMER

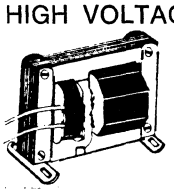
- High Isolation: 2500V Hipot is standard
- Low Capacitive Coupling: No electro-static shield necessary
- Less Manufacturing Time: No cross-overs of primary and secondary loads
- Class S Insulation: 130°C
- Single 115V or Dual 115/230V Primaries
- Secondaries can be Series or Parallel Connected

STEP UP & DOWN TRANSFORMER



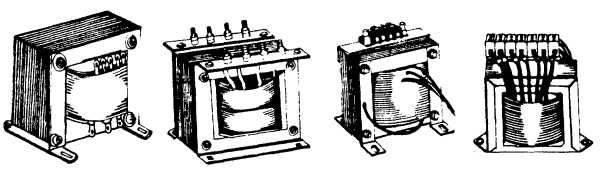
- Step Up: 110/120V, 50/60 Hz to 220/240V
- Step Down: 220/240V, 50/60 Hz to 110/120V
- Compact, High Capacity
- 5% Regulation
- Provided with Flat Pin and Round Pin Adapter
- Twin Plug Power Cord provided

HIGH VOLTAGE TRANSFORMERS



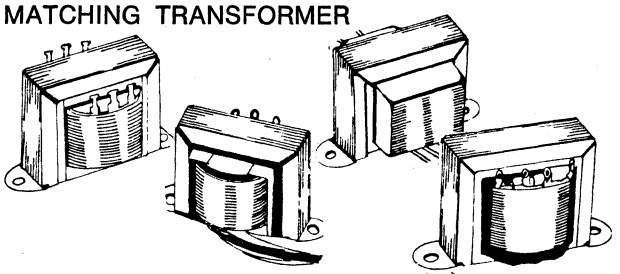
- 2500-6000 VAC, 4-9 mA for use in Insect Killers, Air Filters, Fences, Ion Generators, and other High Voltage Electric Products
- 7500-15,000 VAC,20-30 mA for P.C.B. use

TERMINAL POWER TRANSFORMER

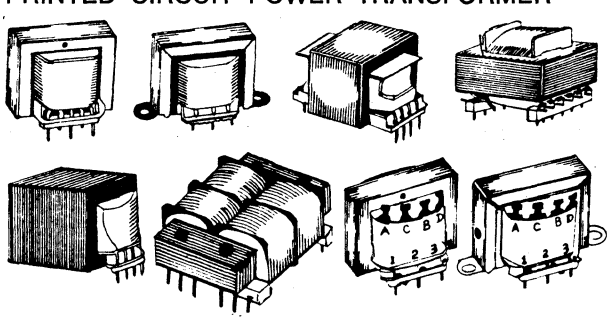


- Tinned Terminals for Easy Soldering
- Capacity is up to 2 KVA

MATCHING TRANSFORMER



PRINTED CIRCUIT POWER TRANSFORMER



POWER TRANSFORMER-P.C.B.

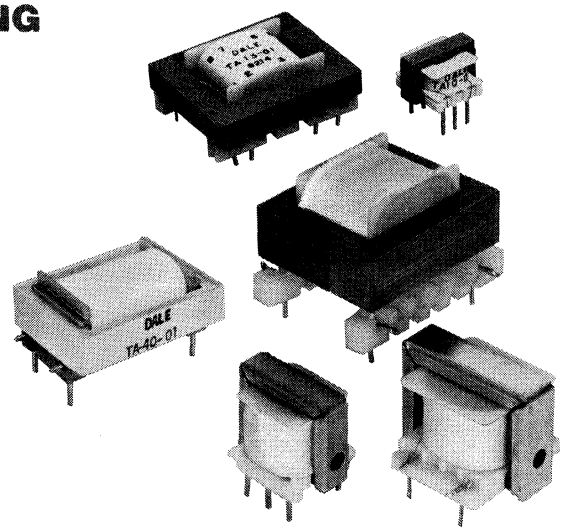
- For Power Supplies, Instruments and Control Applications
- P.C. Pins
- Power from 1.0 VA to 20.0 VA
- Hi-Pot: 2000 Volts standard
- Low Temperature Rise
- Primary Voltage: 115V, 115/230V, 230V (50, 60, 400 Hz)

MAILING ADDRESS: P.O. BOX 1308, PRINCETON, NJ 08540 TELEX: 4971717

RESEARCH PARK, 318 WALL ST., PRINCETON, NJ 08540 TELEPHONE: (609) 921-8540 FAXSIMILI: 609 921-7971

DALE®

TELEPHONE COUPLING AUDIO TRANSFORMERS



MODEL TA

Designed to meet FCC Part 68

FEATURES

- Designed and built to meet telephone company requirements for data and voice access on leased private telephone lines or through dial-up switched telephone networks.
- Provide line isolation, impedance matching and line balance.

SPECIFICATIONS

ELECTRICAL

Power Level: −45 dBm to +7 dBm except TA-40-01 (−45 dBm to +10 dBm)

Longitudinal Balance: Per FCC 68.310 60 dB min. = 200-1000 Hz
45 dB min. = 1000-4000 Hz

Dielectric Strength: Per FCC 68.304 1500 V peak

Frequency Range: Data/Voice = 300 to 3500 Hz
Data = 800 to 3500 Hz

MECHANICAL

Coating: Impregnated with polyester varnish.

Terminals: Precision spaced PC type plug-in terminals.

APPLICATION TABLE*

IMPEDANCE PRI	IMPEDANCE SEC	COUPLING APPLICATION	UNBALANCED DC CURRENT (MA)	RETURN LOSS MIN. (dB)	INSERTION LOSSES @ 1 KHz (dB)	FREQUENCY RESPONSE REF. at 1 KHz (dB)	IMPEDANCE MATCHING (%)	DISTORTION (%)	STYLE	SCHEMATIC NO.	MODEL NO.
600Ω	600Ω	DATA/VOICE	0	26	1.0	±0.5	±10	0.5	C	5	**TA-10-08**
600Ω	600Ω	DATA/VOICE	0	26	1.0	±0.5	±10	0.5	J	5	**TA-10-07**
600Ω	600Ω	DATA/VOICE	0-5	14	1.5	±1.5	±25	5.0	J	5	**TA-30-06**
600Ω	600Ω	DATA/VOICE	0	26	0.6	±0.5	±10	0.5	B	5	**TA-10-05**
600Ω	600Ω	DATA/VOICE	0-5	15	1.4	±1.5	±25	5.0	B	5	**TA-30-02**
600Ω	600Ω	DATA	0-90	8	2.4	±1.0	±25	5.0	G	5	**TA-30-03**
600Ω	600Ω	DATA/VOICE	0-80	11	1.2	±1.5	±25	5.0	M	13	**TA-32-02**
600Ω	600Ω	DATA/VOICE	0-90	14**	1.7**	±0.2**	±20	0.5	N	13	**TA-40-01**
600Ω	600Ω	DATA/VOICE	0-100	8	1.6	±1.5	±25	5.0	E	15	**TA-33-02**
600Ω	600Ω CT	DATA	0-90	8	2.4	±1.0	±25	5.0	H	9	**TA-30-04**
600Ω CT	600Ω CT	DATA/VOICE	0	26	0.6	±0.5	±10	0.5	A	4	**TA-10-04**
600Ω CT	600Ω CT	DATA/VOICE	0-5	15	1.4	±1.5	±25	5.0	A	4	**TA-30-01**
600Ω SPLIT	600Ω	DATA/VOICE	0-50	8	1.4	±1.5	±25	5.0	K	11	**TA-31-01**
600Ω SPLIT	600Ω	DATA/VOICE	0-80	11	1.2	±1.5	±25	5.0	L	14	**TA-32-03**
600Ω	600Ω SPLIT	DATA/VOICE	0-75	13	1.2	±0.5	±10	0.5	E	7	**TA-13-01**
600Ω	600Ω SPLIT	DATA/VOICE	0-100	8	1.6	±1.5	±25	5.0	E	7	**TA-33-01**
600Ω	600Ω/600Ω	DATA/VOICE HYBRID	0	26	0.8	±0.5	±10	0.5	A	1	**TA-10-01**
600Ω	600Ω/600Ω	DATA/VOICE HYBRID	0-5	14	1.4	±1.5	±25	5.0	A	10	**TA-30-05**
600Ω	600Ω/600Ω	DATA/VOICE HYBRID	0	26	0.8	±0.5	±10	0.5	D	1	**TA-11-01**
600Ω	900Ω	DATA/VOICE	0-5	14	1.5	±1.5	±25	5.0	J	2	**TA-30-07**
600Ω	900Ω	DATA/VOICE	0	26	0.7	±0.5	±10	0.5	B	2	**TA-10-02**
600Ω/900Ω	600Ω	DATA/VOICE	0-100/0-120	8	1.4	±1.5	±25	5.0	L	12	**TA-32-01**
600Ω	600Ω/900Ω	DATA/VOICE	0-100/0-120	14	0.5	±0.5	±10	0.5	F	8	**TA-14-01**
900Ω	900Ω	DATA/VOICE	0	26	0.7	±0.5	±10	0.5	A	6	**TA-10-06**
4KΩ	600Ω	DATA/VOICE	0	22	0.7	±0.5	±10	0.5	B	3	**TA-10-03**

Model **TA-3** is the **low-cost** alternative to Model TA-1.

*For HOLDING COIL information, refer to MODEL TE/TD in Section 1800. **Reference for TA-40-01 is 1.8 KHz.

For complete information, write or phone
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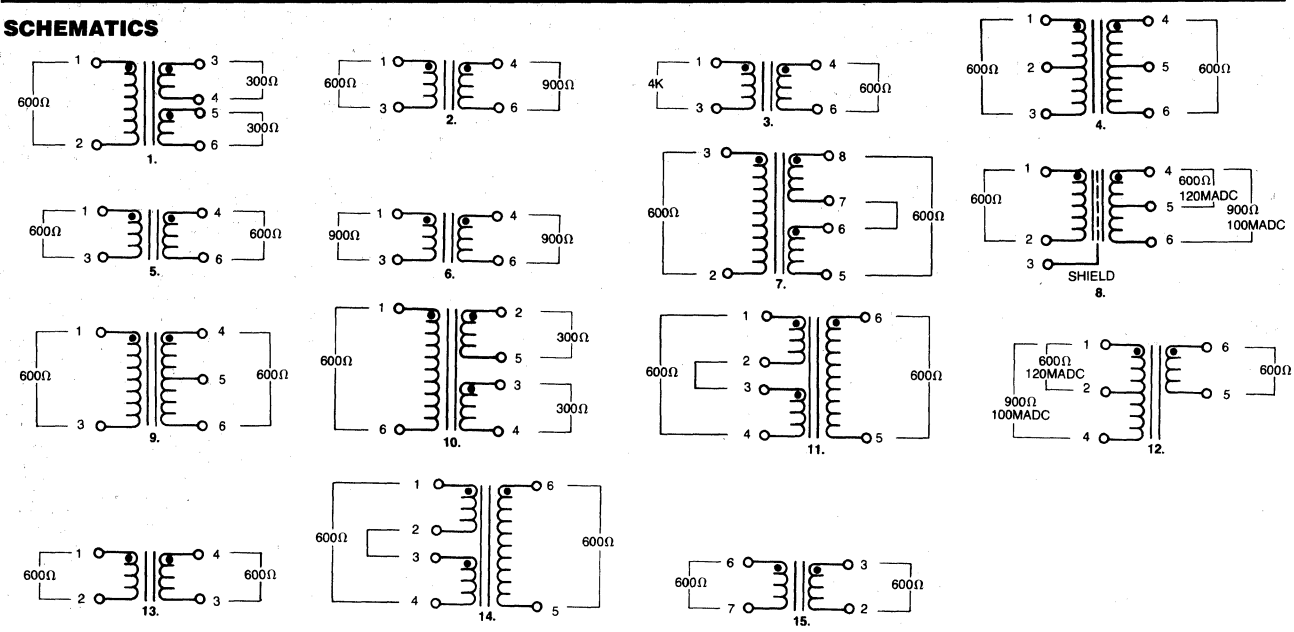
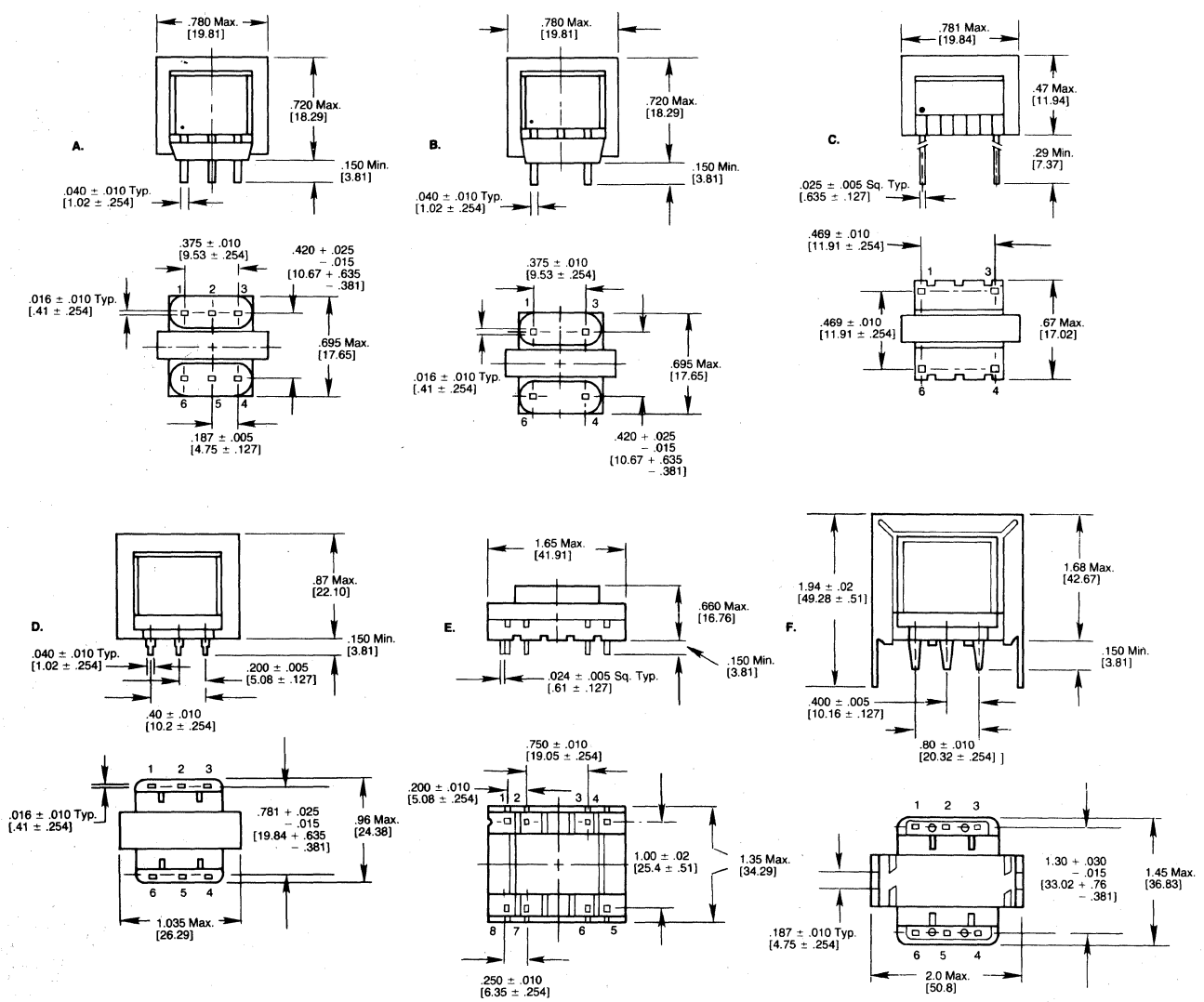
SCHEMATICS



DIMENSIONS (Styles G, H, J, K, L, M shown on next page)



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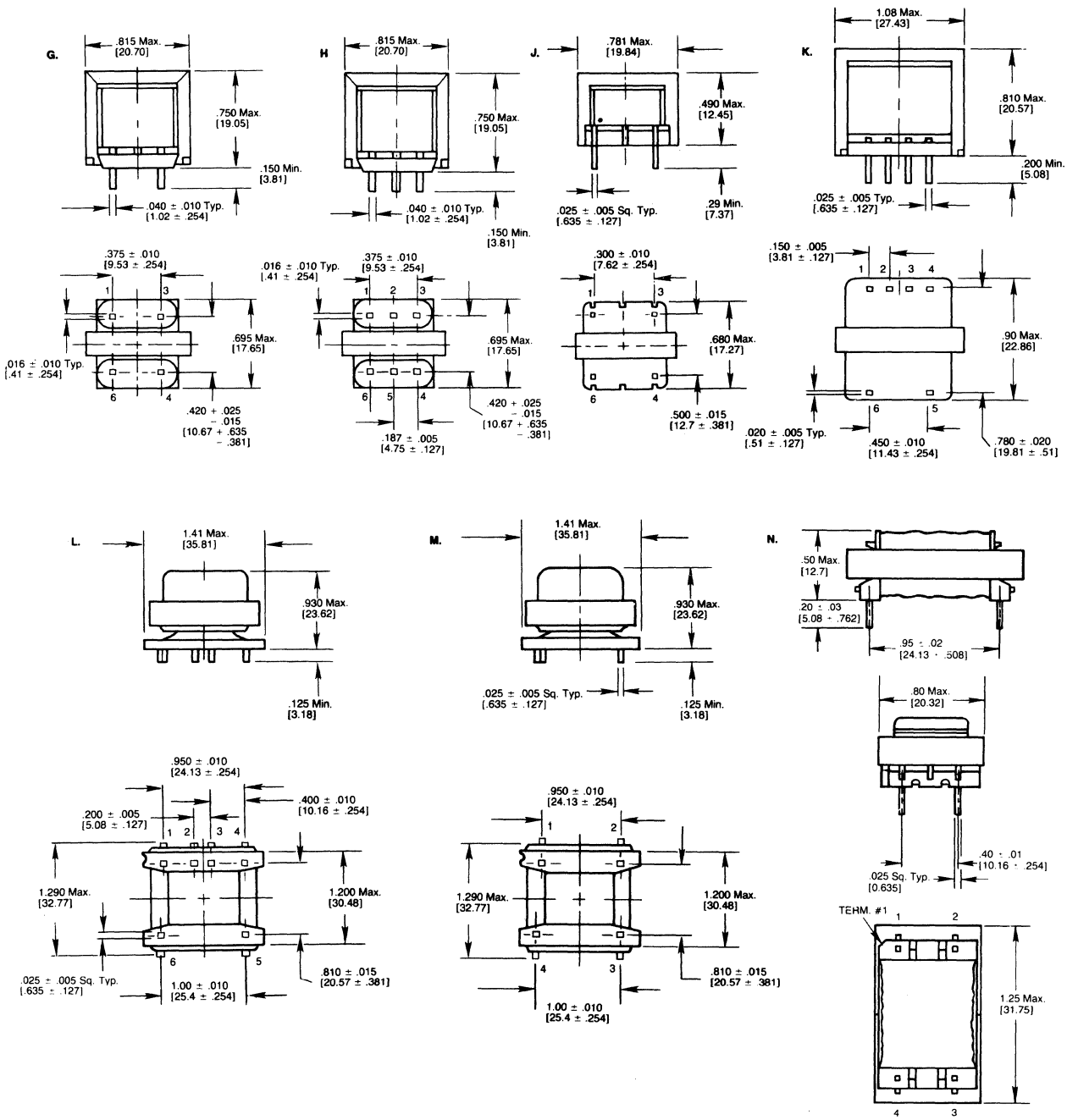
DIMENSIONS (Continued)



ORDERING INFORMATION

The following model number information must be supplied when ordering transformers.

TA	–	10, 11, 13, 14, 30, 31, 32, 33, 40	–	01 thru 08
STYLE		**SIGNIFIES SIZE OF UNIT**		**DASH NUMBER SIGNIFIES VALUE**

Special designs not listed are available on request.

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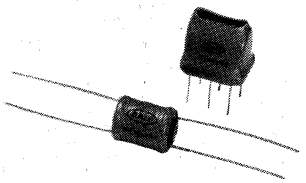
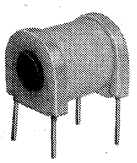
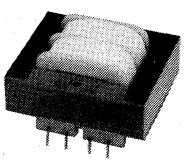
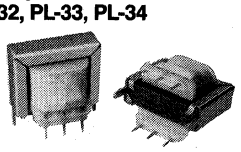
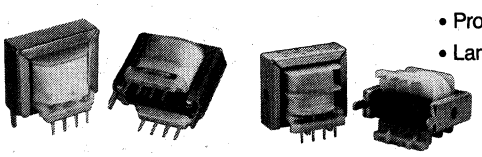
DALE® TRANSFORMERS

MODEL	FEATURES
Trigger Type, Pulse **MODELS PT10 & PT20** 	• Low-cost trigger source isolation in half and full wave SCR Power Control Circuits, including motor speed, heater and lighting controls • Choice of printed circuit or bobbin-type • Transfers high amplitude or long duration pulses without saturation • Inductance: 200 μH - 5000 μH • Temperature Range: −10°C to +70°C • Turns Ratio: 1:1, 1:1:1, 2:1, 2:1:1 and 5:1
SCR Isolation, Trigger **MODEL PT50** 	• Designed for low-cost trigger source isolation in SCR Power Control Circuits • Small physical size and low profile provide packaging advantages • Interchangeable. Designed for circuit board mounting using same mounting dimensions as 11Z and PT20 models. • Transfers high amplitude or long duration pulses without saturation • Applications include motor speed, lighting and heater controls. • Inductance: 200 μH - 5000 μH • Temperature Range: −55°C to +105°C • Turns Ratio: 1:1, 2:1 and 5:1
Power **Single Primary — Dual Secondary** **Dual Primary — Dual Secondary** **MODELS PLS & PLD** 	• P.C. pin mounting. Easily modified for special requirements. • Designed to meet UL and CSA requirements • Dual Secondary for series connection or parallel connection • Split-section winding for increased dielectric strength plus reduced interwinding capacitance • PLD: Dual Primary for operation at 115V or 230V, 50/60 Hz • Provides isolation from power line • Laminated construction for low-cost industrial applications
Low Power **Single Primary Input 115 Volts** **Dual Secondary** **MODELS PL-11, PL-12, PL-13, PL-14** **Single Secondary** **MODELS PL-32, PL-33, PL-34** 	• P.C. pin mounting. Available with mounting frames and bobbin stand-off. Easily modified for special requirements. • Recognized under the Component Program of Underwriters Laboratories, Inc. (U.L. File E71961). For general purpose transformers (U.L. Standard 506). • Provides isolation from power line • Laminated construction for low-cost industrial applications
Low Power **Dual Primary — Dual Secondary** **115/230 Volts** **MODELS PL-22, PL-23, PL-24, PL-42, PL-43, PL-44** 	• P.C. pin mounting. Available with mounting frames and bobbin stand-off. Easily modified for special requirements. • Dual Primary for operation at 115V or 230V, 50/60 Hz • Dual Secondary for series connection or parallel connection • Provides isolation from power line • Laminated construction for low-cost industrial applications

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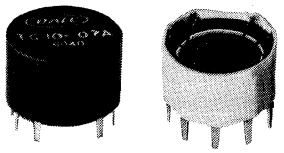
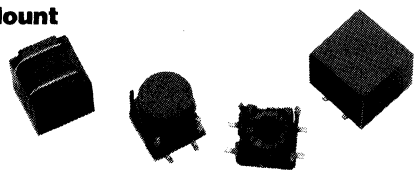
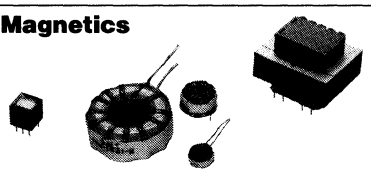
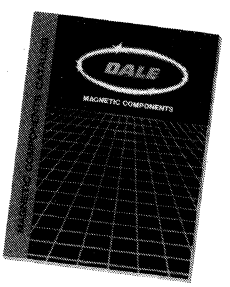
DALE® TRANSFORMERS

MODEL	FEATURES
Converter **MODEL TC** 	• High conversion efficiency from DC input to filtered DC output • Designed for low power, solid state circuits • Miniature size for minimum space requirement • Encapsulated or open (impregnated) styles
Surface Mount 	• Capabilities include power, audio and pulse transformers, inductors and switch mode magnetics styles • Encapsulated or open construction in configurations to meet your board space requirements • Compatible with standard surface mount soldering and automatic handling requirements
Switch Mode Magnetics 	• Custom capabilities include switching converters, power transformers, current sense transformers and inductors • Value-added design services to convert your schematic to a cost-efficient product to meet your needs • Designs to meet UL, CSA, IEEE and VDE requirements

MANY OTHER STANDARD AND CUSTOM PRODUCTS
are described in Dale's new Magnetic Components Catalog.

They include: toroids, E-core, air core, slug core and pot core inductors, plus laminated, pulse and high voltage transformers, and many other standard and custom products. Write for your copy today, or contact your Dale representative.



Send for our NEW MAGNETICS CATALOG

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DALE REPRESENTATIVES CAN SOLVE YOUR TRANSFORMER PROBLEMS

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AL	Huntsville (JWL Associates, Inc.)	(205) 883-1712
AZ	Tempe (Dale Sales Office)	(602) 966-0291
CA	Los Alamitos (Reed Electronic Marketing)	(213) 598-6676
CA	Redwood City (James S. Heaton Co.)	(415) 367-9000
CA	San Diego (Vishay San Diego District Office)	(619) 690-5112
CO	Colorado Springs (Dale Sales Office)	(719) 593-7529
CO	Loveland (Dale Sales Office)	(303) 667-7500
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DC	(See Maryland)	
DE	(See Pennsylvania)	
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FL	Melbourne (Graham Associates, Inc.)	(407) 773-6631
FL	Winter Garden (Graham Associates, Inc.)	(407) 656-9369
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ID	(See Colorado)	
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MO	(Western — See Kansas)	
NJ	(Southern — See Pennsylvania)	
NJ	(Northern) Fairlawn (Kaelber & Mack)	(See Commack, NY)
NM	(See Arizona)	
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OR	Beaverton (LD Electronics)	(503) 684-8221
PA	Horsham (TMI)	(215) 441-4300
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TN	(See North Carolina)	
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VA	(See Maryland)	
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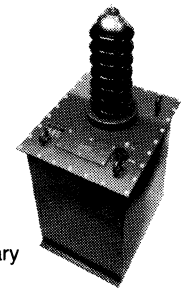
	London, Ont. (Bach-Simpson, Ltd.)	(519) 452-3300
	Ottawa, Ont. (Bach-Simpson, Ltd.)	(613) 829-3828
	Toronto, Ont. (Bach-Simpson, Ltd.)	(416) 288-9932
	Montreal, Que. (Bach-Simpson, Ltd.)	(514) 331-6817

High Voltage Line Isolation Transformers In Oil Insulating Tanks



Model 3–TR–150–11

FEATURES:
- ▼ Complete varnish impregnation under vacuum
- ▼ Epoxy anchoring
- ▼ Immersed in high grade insulating oil*
- ▼ Electrostatic shield between primary and secondary windings
- ▼ "AN" type connector provided for input connections
- ▼ Good regulation

*Note: Shipped without oil to minimize transportation charges, except when otherwise specified in order.

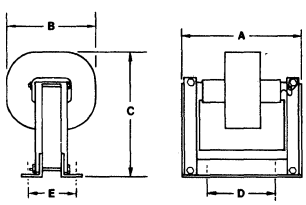
SPECIFICATIONS:
- ▼ Each model available with porcelain output insulator
- ▼ Models also available with two shielded polyethylene output cables in place of porcelain insulator
- ▼ Standard types available for 120V and 240V input lines in 1:1, 1:2, and 2:1 voltage ratios with other input and output voltages available upon request
- ▼ Recommended for industrial, research, and developmental applications

Standard 60Hz Types				
Model No.*	Max. kVA	kV dc Insulation	Tank Size (in.) (W X D X H)**	Insulator Height (in.)***
1-TR-30-XX	1	30	10 X 12 X 11	6
1.5-TR-30-XX	1.5	30	13 X 13⅞ X 16½	6
1-TR-50-XX	1	50	13 X 13⅞ X 16⅜	8½
3-TR-50-XX	3	50	13 X 13⅞ X 16⅜	8½
1-TR-60-XX	1	60	9¾ X 12⅜ X 13⅜	11
2-TR-60-XX	2	60	16½ X 16½ X 21⅜	11
3-TR-60-XX	3	60	16½ x 16½ X 21⅜	11
5-TR-60-XX	5	60	16½ X 16½ X 21⅜	11
3-TR-75-XX	3	75	16½ X 16½ X 22	11
1-TR-100-XX	1	100	20¾ X 17½ X 17$^{13}/_{16}$	14
3-TR-100-XX	3	100	20¾ X 17½ X 17$^{13}/_{16}$	14
3-TR-150-XX	3	150	15½ X 18¾ X 24	19½
5-TR-150-XX	5	150	15½ X 18¾ X 24	19½
0.5-TR-250-XX	0.5	250	25 X 33 X 37$^{5}/_{16}$	28¾
2-TR-250-XX	2	250	25 X 33 X 37$^{5}/_{16}$	28¾
3-TR-250-XX	3	250	29¾ X 29¾ X 36⅜	28¾
5-TR-250-XX	5	250	25 X 33 X 37¼	28¾
4-TR-300-XX	4	300	39½ X 47½ X 50½	35
Models With Shielded Cables Instead Of Porcelain Insulator:				
0.5-CTR-250-XX	0.5	250	25 X 33 X 37$^{5}/_{16}$	
2-CTR-250-XX	2	250	25 X 33 X 37$^{5}/_{16}$	
3-CTR-250-XX	3	250	29¾ X 29¾ X 36⅜	
4-CTR-300-XX	4	300	25 X 33 X 37¼	
5-CTR-250-XX	5	250	39½ X 47½ X 50½	

*Note: Add the following suffix in place of XX:

For	Suffix	For	Suffix
120/120	11	240/120	21
120/240	12	240/240	22

**Note: Dimensions are nominal and outline drawings are available upon request.
***Note: If shielded polyethylene output cables are desired in place of porcelain insulator, designate part number with a "C" prefix, e.g., 1-CTR-30-XX.



Transformer, High Voltage—Filament Isolation Open Type Construction—Epoxy Coated

High Voltage Filament Isolation Transformers				
Type	Secondary Volts	Secondary Amps	Isolation kV dc (Working)	Size (A X B X C)
AD 3227	5	1	10	2⅝ X 2⅜ X 3⅛
AD 3231	5	3	10	3 X 2⅝ X 3½
AD 3234	5	5	10	3¼ X 2⅝ X 3⅞
AD 3226	6.3	1	10	2⅝ X 2⅜ X 3⅛
AD 3230	6.3	3	10	3 X 2⅞ X 3½
AD 3233	6.3	5	10	3¼ X 2⅞ X 3⅞
AD 3238	5	1	20	4½ X 3 X 4
AD 3239	5	3	20	4⅜ X 3½ X 4⅜
AD 3240	5	5	20	4⅞ X 3½ X 5⅛
AD 3241	6.3	1	20	4½ X 3 X 4
AD 3242	6.3	3	20	4⅜ X 3½ X 4⅜
AD 3243	6.3	5	20	4⅞ X 3½ X 5⅛
AD 3247	5	1	30	4⅞ X 3½ X 5
AD 3248	5	3	30	5¾ X 3¾ X 5¼
AD 3249	5	5	30	6¼ X 3¾ X 6½
AD 3250	6.3	1	30	4⅞ X 3½ X 5
AD 3251	6.3	3	30	5¾ X 3¾ X 5¼
AD 3252	6.3	5	30	6¼ X 3¾ X 6½

All primaries: 115 volts, 60Hz.

Transformer, High Voltage—Line Isolation Open Type Construction—Epoxy Coated

FEATURES:
- ▼ Designed for continuous operation at rated voltage and power
- ▼ Epoxy coated, air insulated up to 30kV dc, oil insulated over 30kV dc
- ▼ Well suited to applications requiring reliable isolated line voltage at power ratings up to 1kVA
- ▼ Other higher voltage and power units available upon request

SPECIFICATIONS:
Primaries: 115V or 230V, 60Hz
Secondaries: 115V

Type	Rating kVA	Size (A X B X C)	Mounting Dimensions (D X E)	Insulation kV dc Working
AD 1640	0.200	6⅛ X 4 X 5⅛	4½ X 3	10
AD 1641	0.500	7⅝ X 5⅞ X 7¾	5⅜ X 4¼	10
AD 1642	0.750	9½ X 6$^{5}/_{16}$ X 8¼	7¼ X 4$^{13}/_{16}$	10
AD 1643	1.000	8½ X 8 X 9¾	6 X 5	10
AD 1644	0.200	8½ X 4 X 5⅝	6⅞ X 3⅛	20
AD 1645	0.500	10¼ X 5⅝ X 7½	8 X 4¼	20
AD 1646	0.750	9¾ X 6¾ X 8	7½ X 4$^{13}/_{16}$	20
AD 1647	1.000	11¼ X 6⅝ X 8¾	8¾ X 4⅝	20
AD 3060	0.250	8½ X 7¼ X 6½	7$^{5}/_{16}$ X 3⅜	30
AD 3061	0.500	9¾ X 7 X 8¾	7$^{13}/_{16}$ X 3½	30
AD 3062	0.750	10½ X 7½ X 9½	8½ X 3⅝	30
AD 3063	1.000	11 X 9 X 9½	8¾ X 3¾	30
AD 3064	0.250	10 X 7 X 6½	8$^{13}/_{16}$ X 3⅜	40
AD 3065	0.500	11¼ X 7¼ X 8¾	9⅛ X 3½	40
AD 3066	0.750	12½ X 7½ X 9½	10¼ X 3⅝	40
AD 3067	1.000	12¾ X 9 X 9½	10$^{7}/_{16}$ X 3¾	40
AD 3068	0.250	13¼ X 7¼ X 6½	12 X 3⅜	50
AD 3069	0.500	13¼ X 7¼ X 8¾	11⅛ X 3½	50
AD 3070	0.750	14½ X 7½ X 9½	12¼ X 3⅝	50
AD 3071	1.000	14¾ X 9 X 9½	12$^{7}/_{16}$ X 3¾	50

DEL

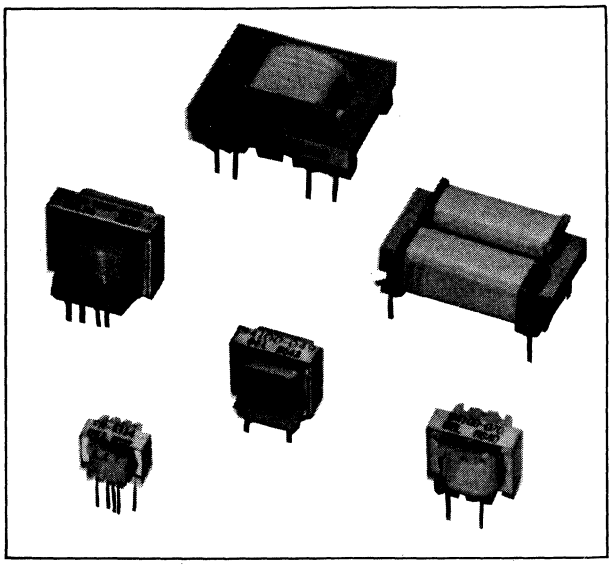
DEL ELECTRONICS CORPORATION
250 East Sandford Boulevard, Mount Vernon, New York 10550
Phone: 914/699-2000 TWX 710-562-0130 FAX 914/699-4005

DELTA

TELEPHONE COUPLING TRANSFORMERS

FEATURES

- Meet FCC Part 68 for safety
- Good frequency response and transmission performance
- Accurate impedance ratio
- Meet flammability retardant rating of UL 94V-0 or UL 94V-1



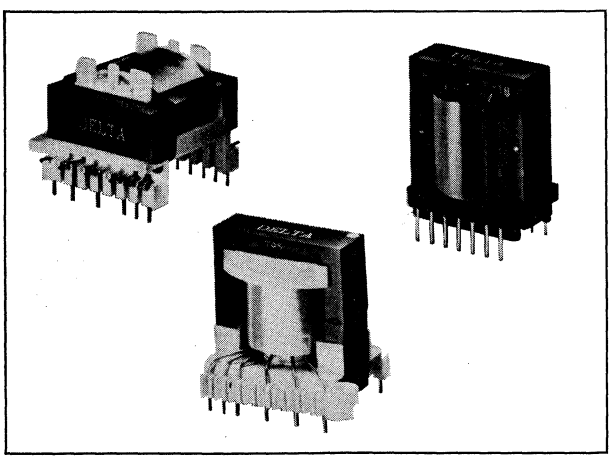
GENERAL SPECIFICATIONS

Operating Temperature: 0° to +70°C
Storage Temperature: −40° to +100°C
Insulation Resistance: 100 MΩ min (100 VDC)
Maximum Rated Current: 80 mA
Frequency Response: 2.5 dB
Frequency Range: 350-3400 Hz
Impedance Ratio/Tolerance: 1:1 ±5%

SWITCHMODE TRANSFORMERS

FEATURES

- Comply with UL, CSA, VDE safety specs
- Use high performance ferrite cores
- Low temperature rise
- Low power loss
- Applicable to forward, flyback, and bridge type circuits
- Insulation materials meet UL temperature and flammability retardant ratings
- Both copper wire and aluminum foil types available



GENERAL SPECIFICATIONS

Power Range: 5-500W
Frequency Range: 10-100 kHz and above
Power Loss: ≤ 15%

SPECIAL FEATURES OF ALUMINUM FOILWOUND TYPES

- Perfect coupling between windings
- Significant size and weight reduction over wirewound types
- Automated winding reduces costs and improves consistency
- Ultrasonic welding used to adhere metal strips to foil for solid connections and more reliable operation

OTHER MAGNETICS FOR SWITCHING POWER SUPPLIES AVAILABLE!

- **DRIVER TRANSFORMERS**
- **CURRENT-SENSING TRANSFORMERS**
- **ENERGY-STORING POWER INDUCTORS**
- **COMMON-MODE EMI SUPPRESSION INDUCTORS**

DELTA

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DELTA PRODUCTS CORP.
3823 SPINNAKER COURT
FREMONT, CA 94538
TELEPHONE: (415) 770-0660
TELEX: 4992342 DELTAITTHY
TELEFAX: (415) 770-0122

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5430 WETTINGEN, SWITZERLAND
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TELEX: 58068A ELBA CH
TELEFAX: (56) 271924

FAR EAST:
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9TH FL., ASIA ENTERPRISE CENTER
NO. 602, MIN CHUAN E. RD.
TAIPEI, TAIWAN, R.O.C.
TELEPHONE: (2) 7164822
TELEX: 26524 DELTATRO
TELEFAX: (2) 7169764

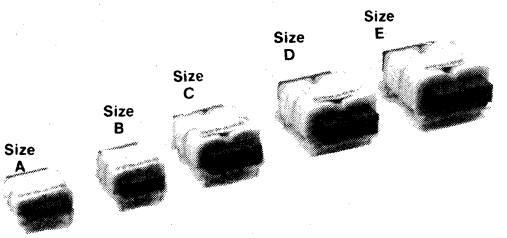
DYNAGE Magnetics

551 Third Avenue P.O. Box 95
Canistota, SD 57012
Telephone: (605) 296-3462
Fax: (605) 296-3231
Telex: 753243 (OAKLEAFINC)

PANCAKE™ PC POWER TRANSFORMERS
53 models, 5 sizes, 24 voltages, dual primaries

CROSS REFERENCE CHART (OTHER MANUFACTURERS MODELS)

SIZE	DYNAGE	SIGNAL	PREM	EWC
A	PCA10-0.250	LP10-250	SPW-050	LP 10-250B23
B	PCB10-0.600	LP10-600	SPW-100	LP 10-600B1
C	PCC10-1.200	LP10-1200	SPW-300	LP 10-1200B2
D	PCD10-2.400	LP10-2400	----	----
E	PCE10-4.800	LP10-4800	----	----
A	PCA12-0.200	LP12-200	SPW-051	LP 12-200B24
B	PCB12-0.450	LP12-450	SPW-101	LP 12-450B3
C	PCC12-0.900	LP12-900	SPW-301	LP 12-900B4
D	PCD12-1.900	LP12-1900	----	----
E	PCE12-3.800	LP12-3800	----	----
A	PCA16-0.150	LP16-150	SPW-052	LP 16-150B25
B	PCB16-0.350	LP16-350	SPW-102	LP 16-350B5
C	PCC16-0.700	LP16-700	SPW-302	LP 16-700B6
D	PCD16-1.500	LP16-1500	----	----
E	PCE16-3.000	LP16-3000	----	----
A	PCA20-0.125	LP20-125	SPW-053	LP 20-125B26
B	PCB20-0.300	LP20-300	SPW-103	LP 20-300B7
C	PCC20-0.600	LP20-600	SPW-303	LP 20-600B8
D	PCD20-1.200	LP20-1200	----	----
E	PCE20-2.400	LP20-2400	----	----
A	PCA24-0.100	LP24-100	SPW-054	LP 24-100B27
B	PCB24-0.250	LP24-250	SPW-104	LP 24-250B9
C	PCC24-0.500	LP24-500	SPW-304	LP 24-500B10
D	PCD24-1.000	LP24-1000	----	----
E	PCE24-2.000	LP24-2000	----	----
A	PCA30-0.85	LP30-85	SPW-061	----
B	PCB30-0.200	LP30-200	SPW-111	----
C	PCC30-0.400	LP30-400	SPW-311	----
D	PCD30-0.800	LP30-800	----	----
E	PCE30-1.600	LP30-1600	----	----
A	PCA34-0.075	LP34-75	SPW-055	LP 34-75B28
B	PCB34-0.170	LP34-170	SPW-105	LP 34-170B11
C	PCC34-0.340	LP34-340	SPW-305	LP 34-340B12
D	PCD34-0.700	LP34-700	----	----
E	PCE34-1.400	LP34-1400	----	----



- Low prices
- High quality

Need a special? We have capability to design and produce to your requirements.

CROSS REFERENCE CHARTS (Cont'd)

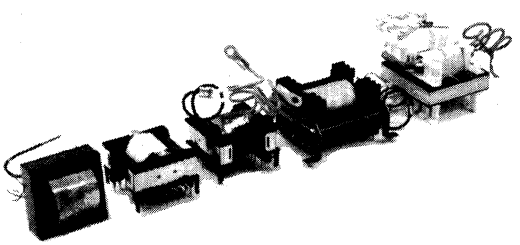
SIZE	DYNAGE	SIGNAL	PREM	EWC
A	PCA40-0.060	LP40-60	SPW-056	LP 40-60B29
B	PCB40-0.150	LP40-150	SPW-106	LP 40-150B13
C	PCC40-0.300	LP40-300	SPW-306	LP 40-300B14
D	PCD40-0.600	LP40-600	----	----
E	PCE40-1.200	LP40-1200	----	----
A	PCA56-0.045	LP56-45	SPW-057	LP 56-45B30
B	PCB56-0.100	LP56-100	SPW-107	LP 56-100B15
C	PCC56-0.200	LP56-200	SPW-307	LP 56-200B16
D	PCD56-0.425	LP56-425	----	----
E	PCE56-0.850	LP56-850	---	----
A	PCA88-0.028	LP88-28	SPW-058	LP 88-28B31
B	PCB88-0.065	LP88-65	LPW-108	LP 88-65B17
C	PCC88-0.130	LP88-130	SPW-308	LP 88-130B18
A	PCA120-0.020	LP120-20	SPW-059	LP 120-20B32
B	PCB120-0.050	LP120-50	SPW-109	LP 120-50B19
C	PCC120-0.100	LP120-100	SPW-309	LP 120-100B20
A	PCA230-0.010	LP230-10	SPW-060	LP 230-10B33
B	PCB230-0.025	LP230-15	SPW-110	LP 230-25B21
C	PCC230-0.050	LP230-50	SPW-310	LP 230-50B22

SWITCHMODE POWER SUPPLY MAGNETICS

Transformers — driver, interstage, and output

We have standard designs for your custom requirements. Selected ferrite "E" cores with associated nylon bobbins are predesigned to minimize the custom design effort to meet your needs.

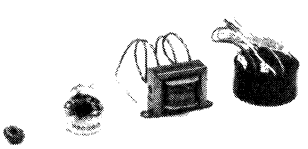
- Low prices
- High quality
- Custom designs



Inductors — toroidal and lamination types

- Designs available up to 300 amps
- Minimum possible size
- Selection of sizes
- Available with open winding or encapsulated or partial encapsulated

- Low prices
- High quality
- Custom designs



Transformers — current sense (toroidal)

- Fourteen (14) standard designs
- Low prices (cost effective designs)
- Open, sealed, or totally encapsulated

- High quality
- Custom designs

- UL, CSA, VDE and IEC Capabilities
- Designs to Military Specifications

DYNAGE Magnetics
DIVISION OF OAKLEAF, INC.

551 Third Avenue, P.O. Box 95 Canistota, SD 57012
Tel: (605) 296-3462 Fax: (605) 296-3231
Telex: 753243 (OAKLEAFINC)

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Canistota, SD 57012
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Telex: 753243 (OAKLEAFINC)

DYNAGE Magnetics

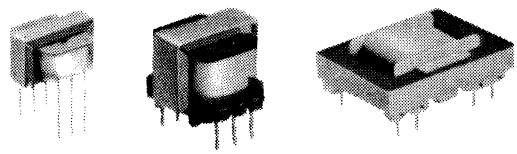
TELEPHONE INTERCONNECT TRANSFORMERS

Line coupling transformers — Hybrid transformers — Holding coils

- Designed to meet FCC Part 68
- 1500 volt dielectric strength
- For interconnecting data/voice devices to telephone lines

REFERENCE CHART (with cross reference to other mfrs.)

Size	Impedance, Pri:Sec	DYNAGE Model	STANCOR Model	MICRO-TRAN Model	DALE Model	Height, inches	Pc Bd Area, in2	Wt., oz.
Voice/Data Coupling								
26	600:600	TC26-A102	TTPC-2	T-1104	TA10-07	0.49	0.52	0.5
26	600:900	TC26-A104	TTPC-4	-----	-----	0.49	0.52	0.5
26	4000:600	TC26-A105	TTPC-5	-----	-----	0.49	0.52	0.5
26	600CT:600CT	TC26-D103	TTPC-3	-----	-----	0.49	0.52	0.5
39	600:600	TC39-A107	TTPC-7	-----	TA10-05	0.74	0.53	0.6
39	600:900	TC39-A110	TTPC-10	-----	TA10-02	0.74	0.53	0.6
39	900:900	TC39-A120	-----	-----	TA10-06	0.74	0.53	.06
39	4000:600	TC39-A111	TTPC-11	-----	TA10-03	0.74	0.53	0.6
39	600:600CT	TC39-B134	-----	-----	-----	0.74	0.53	0.6
39	600CT:600CT	TC39-D101	TTPC-1	-----	TA10-04	0.74	0.53	0.6
39	600CT:600CT	TC39-D108	TTPC-8	-----	-----	0.74	0.53	0.6
40	600:600	TC40-A121	-----	T2104	-----	0.75	0.53	0.6
40	600:900	TC40-A122	-----	T2108	-----	0.75	0.53	0.6
40	900:900	TC40-A123	-----	T2110	-----	0.75	0.53	0.6
40	4000:600	TC40-A124	-----	T2316	-----	0.75	0.53	0.6
40	600:600CT	TC40U-B106	TTPC-6	-----	-----	0.75	0.53	1.0
40	600CT:600CT	TC40-D125	-----	T2106	-----	0.75	0.53	0.6
45	600:600SP	TC45U-E113	TTPC-13	-----	-----	0.59	0.76	0.5
126	600CT:600CT	TC126U-J119	TTPC-19	-----	-----	0.60	2.10	2.5
132	600SP:600SP	TC132U-L118	TTPC-18	T9117	-----	0.63	2.10	2.5
132	600SP:600SP	TC132U-J126	-----	T9116	-----	0.63	2.10	2.5
154	600:600	TC154U-A115	TTPC-15	-----	-----	0.69	2.23	2.5
154	900:600	TC154U-A116	TTPC-16	-----	-----	0.69	2.23	2.5
154	600:600SP	TC154U-E127	-----	T5114	TA13-01	0.69	2.23	2.5
154	600:600SP	TC154U-E114	TTPC-14	-----	-----	0.69	2.23	2.5
Data Modem Coupling — For 300/1200/2400 BPS Modems for Microcomputers								
40	600:600CT	TD40U-B128	-----	T2114	-----	0.75	0.53	0.6
45	600:600	TD45U-A129	-----	T2111	-----	0.59	0.76	0.5
45	600:600CT	TD45U-B130	-----	T2112	-----	0.59	0.76	0.5
50	600:600	TD50U-A131	-----	T9311	-----	0.50	1.00	0.7
50	600:600SP	TD50U-E132	-----	T9312	-----	0.50	1.00	0.7
50	600:600SP	TD50U-E133	-----	T9317	-----	0.50	1.00	0.7



These products will meet telephone interconnect coupling, matching, and bridging requirements for use in voice, instrument, and modem applications.

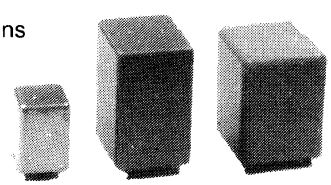
- Contact us for your special requirements.

REFERENCE CHART (with cross reference to other mfrs.)

Size	Impedance, Pri:Sec	DYNAGE Model	STANCOR Model	MICRO-TRAN Model	DALE Model	Height, inches	Pc Bd Area, in2	Wt., oz.
Hybrid — Two required for conventional hybrid operation								
39	600:600/600	THY39-E148	-----	-----	TA10-01	0.74	0.53	0.6
40	600:600/600	THY40-E136	-----	T2220	-----	0.75	0.53	0.6
50	600:600/600	THY50U-E135	-----	T9320	-----	0.50	1.00	0.7
83	600:600/600	THY83-E142	-----	-----	TA11-01	0.85	0.97	1.2
86	600:600/600	THY86-E109	TTPC-9	-----	-----	0.86	1.00	1.0
86	600:600/600	THY86-E137	-----	T3220	-----	0.86	1.00	1.0
133	600:600/600	THY133U-L138	-----	T9220	-----	0.63	2.11	2.2
206	600:600/600	THY206U-P139	-----	T4220	-----	1.21	1.70	3.5
275	600:600/600	THY275U-L140	-----	T5220	-----	1.19	2.31	5.5
Holding Coils								
32		THC32-G141	-----	T7410	-----	0.41	0.79	0.8
39		THC39-G146	-----	-----	1A40-01	0.44	0.89	0.8
78		THC78-G143	-----	T8410	-----	0.63	1.23	2.0
95		THC95-G145	-----	-----	1A50-01	0.69	1.37	2.0
154		THC154-H117	TTPC-17	T5415	-----	0.69	2.23	2.5
185		THC185-G144	-----	-----	TA12-01	1.19	1.55	3.5
213		THC213-G147	-----	T4415	-----	1.25	1.70	3.5
236		THC236-G112	TTPC-12	-----	-----	1.32	1.79	1.5

MIL-T-27 TRANSFORMERS

- For military applications
- For hi-rel industrial applications
- Competitive prices



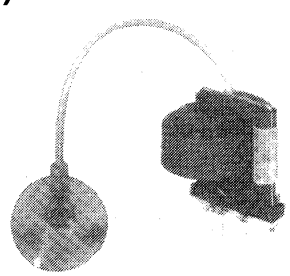
- Construction to MIL-T- 27D, grade 4 or 5, Class "S", life "X", (10,000 hrs.)
- Encapsulated to meet MIL-STD-810C for vibration, shock, sand, dust, humidity, salt spray, fungus, sunshine, rain, explosion, and high altitude.

Call us for your special requirements!

551 Third Avenue, P.O. Box 95 Canistota, SD 57012
Tel: (605) 296-3462 Fax: (605) 296-3231
Telex: 753243 (OAKLEAFINC)

FLYBACK TRANSFORMERS (HIGH VOLTAGE)

- Up to 30KV output
- Epoxy (or silicon) encapsulated
- Up to 32 KHz, typical
- Varicus footprint styles available



- Made to customer specifications

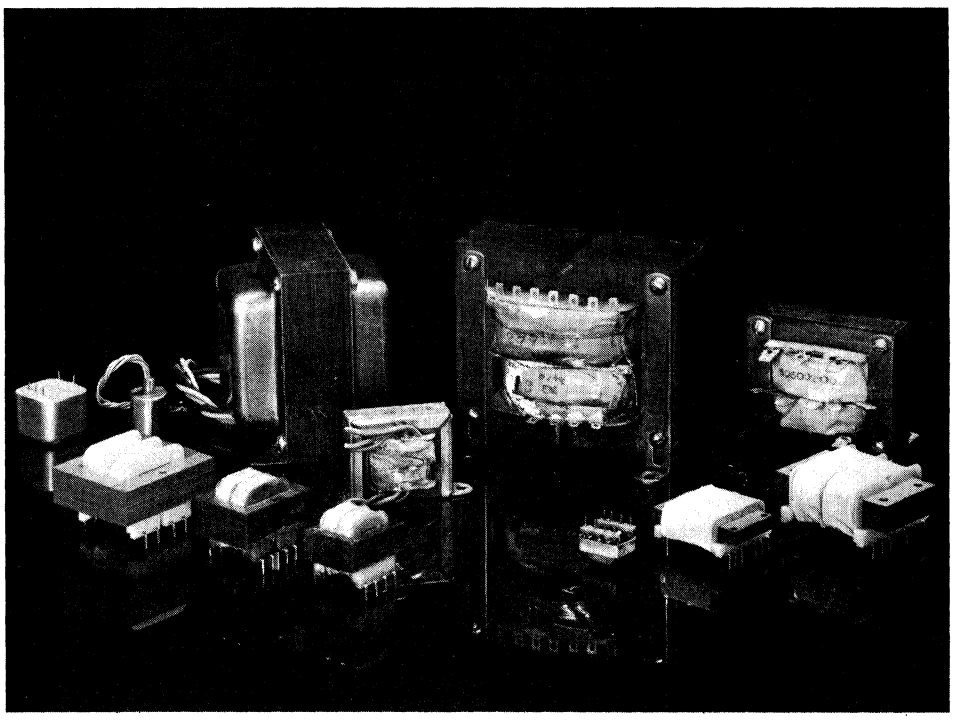
Please send us your specifications for high voltage transformers (flyback). Our engineers will work with you to design transformers for your special needs.

DYNAGE Magnetics
DIVISION OF OAKLEAF, INC.

Electromech

TRANSFORMERS

FULL LINE OF QUALITY MAGNETIC COMPONENTS • TAILORED TO YOUR EXACT NEEDS



- **POWER**
- **ISOLATION**
- **CONTROL**
- **AUTO**
- **STEPUP**
- **STEPDOWN**
- **CURRENT**
- **C.V.T.**
- **CHOKES**
- **HI FREQ**
- **INDUCTORS**

FEATURES

TRANSFORMERS

Power—.5VA to 50KVA

115V, 57 to 63 Hz
115/230V, 47 to 63 Hz
International power input, 47 to 63 Hz
400 Hz
Single or multi outputs
For power supply, control, filament & rectifier circuits (+5, ±12, ±15 or any combination)
• Non concentric winding technique • Minimum inter-winding capacitance • Excellent isolation • Very low leakage • Minimum electrical noise • High efficiency • UL recognized components for Class B (130°C)

Hi Freq—Up to 40 KHz

Ferrite cores
Switching power supply
AC-DC converter
DC-DC converter
Inverter

Current—Up to 500 Amp

Sense
Instrumentation
Measuring devices
AC and DC

INDUCTORS

Power—50, 60, 400 Hz

1 μH to 50H of inductance
1μ Amp to 60 Amp of current

Hi Freq—Up to 40 KHz

1 μH to 50H of inductance
Switching power supply
Ferrite cores
Converter
Inverter

FORMATS

PC MOUNT

(Hi Pot 2500 VRMS)

• Low profile • Split pack
• Horizontal • Vertical

CHASSIS MOUNT

(Hi Pot 2500 VRMS)

• Low profile • Split pack
• Quick connect, solder tab, lead wire, or any type of termination
Open frame/Closed frame

SERVICES

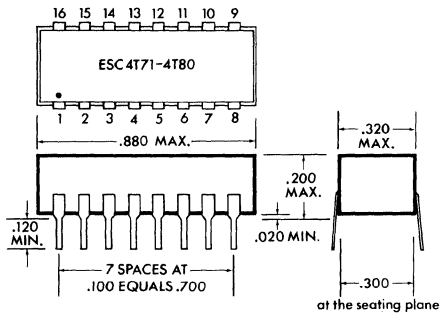
• Design to your specifications • Design to UL standards • First article engineering sample within one week • No engineering set up charge • O.E.M. services • 100% Q.C.—guaranteed reliability • Our CAD system eliminates the need for a catalog

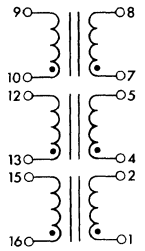
Electromech — THE LAST WORD IN TRANSFORMERS

Electromech, Inc. • 528 Elm Street • Kearny, New Jersey 07032 • (201) 997-0950

ESC DATA TRANSFORMERS
LAN APPLICATIONS

TYPE 4T71-4T80-LAN ETHERNET DATA COUPLING





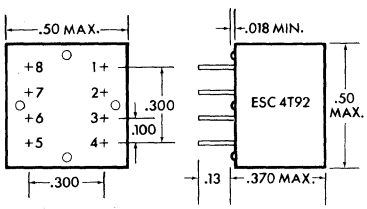
Leads: .020 W X .010 Th.

ESC Mdl No.	TURN Ratio ± 5%	PULSE Inductance (µh ± 20%) Note 1	ET Constant (V-µs min)	RISE Time (ns max)	Pri/Sec LEAKAGE Inductance (µh max)	Pri/Sec Capacitance Cw/w (pf max)	DCR Max (ohms)
4T71	1:1	35	2.1	3.0	.25	10	.30
4T72	1:1	50	2.1	3.0	.25	10	.30
4T73	1:1	75	2.1	3.0	.25	10	.30
4T74	1:1	100	2.1	3.0	.25	10	.30
4T75	1:1	150	2.1	3.0	.25	12	.30
4T76	1:1	35	2.2	3.5	.25	10	.30
4T77	1:1	50	2.2	3.5	.25	10	.30
4T78	1:1	75	2.4	3.5	.25	10	.30
4T79	1:1	100	2.2	3.5	.25	10	.40
4T80	1:1	150	3.0	3.5	.25	15	.50

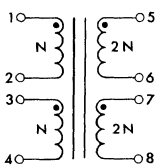
Note 1: Pulse inductance is measured with a pulse voltage of 1.0V peak, a pulse width of 0.4 µsec and a pulse spacing of 1 µsec.
Note 2: Common mode rejection ratio at 1 Mhz is greater than 60 db.
Note 3: Hi-Pot for 4T71 – 4T75 is 500 VRMS. For 4T76 – 4T80 it is 2000 VRMS.

Available in Gull Wing Surface Mounting

TYPE 4T92-TOKEN RING APPLICATIONS-DUAL INTERFACING



White dot locates Pin 1
Leads: #24 AWG (.020) Tinned copper.

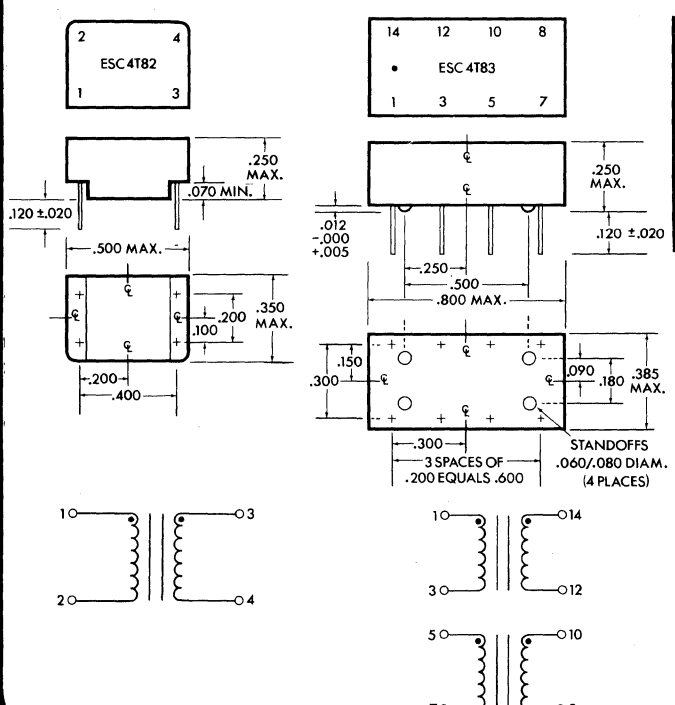


SPECIFICATIONS:	
Electrical Specifications at 25°C	
Turns Ratio:	1:2 ± 2%
Rise Time:	15 ns max
Insertion Loss at 10 Mhz:	0.5db max
CMRR at 1.0 Mhz:	60db min
Return Loss at 5.0 Mhz:	20db min
Dielectric Strength:	500 VRMS

Available as a dual unit packaged in a size 1 X .5 X .37 (consult factory.)

Available in Gull Wing Surface Mounting

TYPE 4T82 & 4T83-STARLAN APPLICATIONS-SINGLE & DUAL-INTERFACING



SPECIFICATIONS: at 25° C	4T82	4T83
Turns Ratio	1:1 ± 5%	1:1 ± 5%
Pulse Inductance Note 1	2.5 Mh ± 20%	2.5 Mh ± 20%
Primary E.T. Constant	20V - µs Min.	20V - µs Min.
Rise Time	100 nsec Max.	100 nsec Max.
Pri/Sec Capacitance	25pf Max.	25pf Max.
Pri-Sec Leakage Inductance	8.0 µh Max.	8.0 µh Max.
Primary D.C.R.	1.0 Ω Max.	1.0 Ω Max.
Hipot Test	2000 VRMS	2000 VRMS (Pri. to Sec. and coil to coil)
Leads: #24 AWG tinned copper	4 Places	8 Places
Common mode rejection at 1 Mhz	60db Min.	60db Min.

Note 1: Pulse inductance is measured with a pulse voltage of 3.0V peak, a pulse width of 3.0 µsec and a pulse spacing of 1000 µsec.

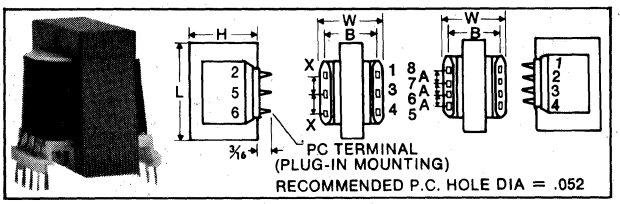
SEE OUR DELAY LINE ADS IN SECTION 2350

WIRE • WRITE OR CALL TOLL FREE
1-800-631-0853 (EXCEPT N.J.)
FOR ESC'S NEW DELAY LINE CATALOG!

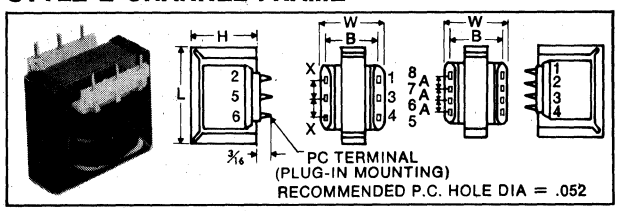
ESC ELECTRONICS CORP.
534 BERGEN BOULEVARD • PALISADES PARK, N.J. 07650
PHONE: (201) 947-0400 • TWX 710-991-9780
NOTE • NEW! FAX NO. 201-947-0406

P.C. Power Transformers—Concentric or Split Bobbin & FORM-TRAN® Construction

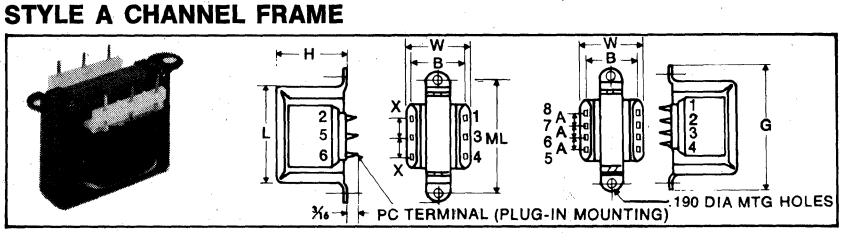
STYLE B NO CHANNEL FRAME



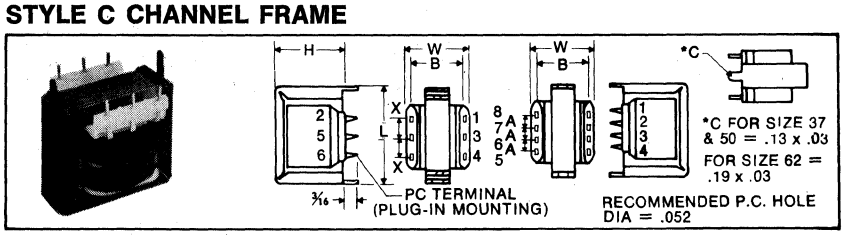
STYLE E CHANNEL FRAME



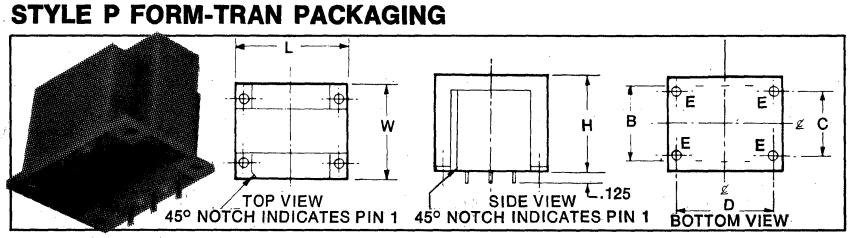
STYLE A CHANNEL FRAME

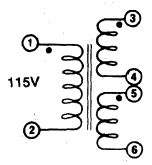


STYLE C CHANNEL FRAME

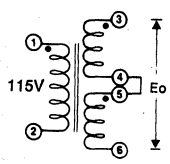


STYLE P FORM-TRAN PACKAGING

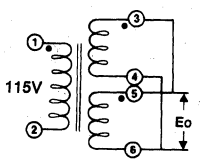




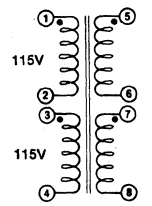
PC-6 PINS



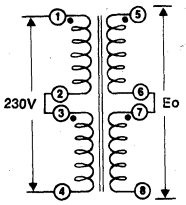
SERIES CONNECTED



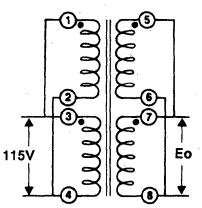
PARALLEL CONNECTED



DPC-8 PINS



SERIES CONNECTED



PARALLEL CONNECTED

HOW TO ORDER

D PC - 10 - 2400 B 4

Primary Rating

No Letter	115V	50/500 Hz	6 pin
C	230V	50/500 Hz	6 pin
D	115/230V	50/500 Hz	8 pin
E	277V	50/500 Hz	6 pin
F	332V	50/500 Hz	6 pin

Transformer Series
PC—Single Section Bobbin PC Transformers
EL—"2" Section" Split Bobbin PC Transformer (50/60 Hz only)

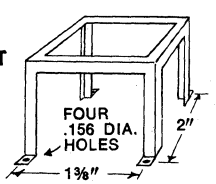
Secondary Voltage Rating
in volts RMS

Secondary Current Rating
in mA RMS

Individual Spec

Mechanical-Configuration
A=Channel Frame Mounting—Style A —Screw Mount
B=No Frame
C=Channel Frame Mounting—Style C —PC Mount
E=Channel Frame—No Mounting
P=Potted—FORM-TRAN™ Construction

"SLIDE ON" BRACKET FOR SIZE 24 P/N B24



SIZE	VA	STYLE A, B, C, E, P 6 PIN X	8 PIN A	B	STYLE B L	W	H	STYLE A, C, E L	W	H	STYLE A G	ML	STYLE P L	W	H	B	C	D	E
25	1.0	0.250	0.200	1.200	1	1.375	0.83	—	—	—	—	—	1.11	1.45	0.92	1.200	N/A	N/A	N/A
37	1.2	0.312	0.200	1.000	1.375	1.125	1.188	1.500	1.125	1.220	2.062	1.75	1.52	1.22	1.26	1.000	.840	1.270	.125
50	4.4	0.400	0.250	1.100	1.625	1.250	1.375	1.720	1.250	1.400	2.375	2.00	1.77	1.30	1.44	1.100	1.000	1.463	.159
62	10	0.400	0.250	1.300	1.875	1.438	1.625	1.970	1.438	1.660	2.813	2.38	2.02	1.50	1.70	1.300	1.125	1.625	.159
24	24	0.400	0.250	2.100	1.625	2.250	1.375	**	**	**	**	**	1.70	2.32	1.42	2.100	2.000	1.463	.159

** USE B24 BRACKET

EWC® INC. 725 FEDERAL AVENUE, KENILWORTH, NJ 07033
(201) 245-3200, FAX 201 245 8430

Recognized Component
Underwriters Labs, Inc.

P.C. Power Transformers
Concentric and Split Bobbin Construction

SECONDARY RMS RATING			PRIMARY 50/500 Hz				
Series	Parallel @ 2x Current		*	*	*		
V.C.T. MA	V MA	Size	Single 115V 6 Pin	Single 230V 6 Pin	Dual 115/230V 8 Pin	Single 277V 6 Pin	Single 332V 6 Pin
10 @ 90	5 @ 180	25	PC-10-90B53	CPC-10-90B53	DPC-10-90B53	Not Available	Not Available
10 @ 120	5 @ 240	37	PC-10-120B1	CPC-10-120B1	DPC-10-120B1	EPC-10-120B1	FPC-10-120B1
10 @ 440	5 @ 880	50	PC-10-440B2	CPC-10-440B2	DPC-10-440B2	EPC-10-440B2	FPC-10-440B2
10 @ 1000	5 @ 2000	62	PC-10-1000B3	CPC-10-1000B3	DPC-10-1000B3	EPC-10-1000B3	FPC-10-1000B3
10 @ 2400	5 @ 4800	24	PC-10-2400B4	CPC-10-2400B4	DPC-10-2400B4	EPC-10-2400B4	FPC-10-2400B4
12.6 @ 70	6.3 @ 140	25	PC-12-70B54	CPC-12-70B54	DPC-12-70B54	Not Available	Not Available
12.6 @ 100	6.3 @ 200	37	PC-12-100B5	CPC-12-100B5	DPC-12-100B5	EPC-12-100B5	FPC-12-100B5
12.6 @ 350	6.3 @ 700	50	PC-12-350B6	CPC-12-350B6	DPC-12-350B6	EPC-12-350B6	FPC-12-350B6
12.6 @ 800	6.3 @ 1600	62	PC-12-800B7	CPC-12-800B7	DPC-12-800B7	EPC-12-800B7	FPC-12-800B7
12.6 @ 2000	6.3 @ 4000	24	PC-12-2000B8	CPC-12-2000B8	DPC-12-2000B8	EPC-12-2000B8	FPC-12-2000B8
16 @ 55	8 @ 110	25	PC-16-55B55	CPC-16-55B55	DPC-16-55B55	Not Available	Not Available
16 @ 75	8 @ 150	37	PC-16-75B9	CPC-16-75B9	DPC-16-75B9	EPC-16-75B9	FPC-16-75B9
16 @ 260	8 @ 520	50	PC-16-260B10	CPC-16-260B10	DPC-16-260B10	EPC-16-260B10	FPC-16-260B10
16 @ 640	8 @ 1280	62	PC-16-640B11	CPC-16-640B11	DPC-16-640B11	EPC-16-640B11	FPC-16-640B11
16 @ 1500	8 @ 3000	24	PC-16-1500B12	CPC-16-1500B12	DPC-16-1500B12	EPC-16-1500B12	FPC-16-1500B12
20 @ 45	10 @ 90	25	PC-20-45B56	CPC-20-45B56	DPC-20-45B56	Not Available	Not Available
20 @ 60	10 @ 120	37	PC-20-60B13	CPC-20-60B13	DPC-20-60B13	EPC-20-60B13	FPC-20-60B13
20 @ 220	10 @ 440	50	PC-20-220B14	CPC-20-220B14	DPC-20-220B14	EPC-20-220B14	FPC-20-220B14
20 @ 500	10 @ 1000	62	PC-20-500B15	CPC-20-500B15	DPC-20-500B15	EPC-20-500B15	FPC-20-500B15
20 @ 1200	10 @ 2400	24	PC-20-1200B16	CPC-20-1200B16	DPC-20-1200B16	EPC-20-1200B16	FPC-20-1200B16
24 @ 35	12 @ 70	25	PC-24-35B57	CPC-24-35B57	DPC-24-35B57	Not Available	Not Available
24 @ 50	12 @ 100	37	PC-24-50B17	CPC-24-50B17	DPC-24-50B17	EPC-24-50B17	FPC-24-50B17
24 @ 180	12 @ 360	50	PC-24-180B18	CPC-24-180B18	DPC-24-180B18	EPC-24-180B18	FPC-24-180B18
24 @ 450	12 @ 900	62	PC-24-450B19	CPC-24-450B19	DPC-24-450B19	EPC-24-450B19	FPC-24-450B19
24 @ 1000	12 @ 2000	24	PC-24-1000B20	CPC-24-1000B20	DPC-24-1000B20	EPC-24-1000B20	FPC-24-1000B20
28 @ 30	14 @ 60	25	PC-28-30B58	CPC-28-30B58	DPC-28-30B58	Not Available	Not Available
28 @ 40	14 @ 80	37	PC-28-40B49	CPC-28-40B49	DPC-28-40B49	EPC-28-40B49	FPC-28-40B49
28 @ 160	14 @ 320	50	PC-28-160B50	CPC-28-160B50	DPC-28-160B50	EPC-28-160B50	FPC-28-160B50
28 @ 360	14 @ 720	62	PC-28-360B51	CPC-28-360B51	DPC-28-360B51	EPC-28-360B51	FPC-28-360B51
28 @ 800	14 @ 1.6A	24	PC-28-800B52	CPC-28-800B52	DPC-28-800B52	EPC-28-800B52	FPC-28-800B52
34 @ 25	17 @ 50	25	PC-34-25B59	CPC-34-25B59	DPC-34-25B59	Not Available	Not Available
34 @ 35	17 @ 70	37	PC-34-35B21	CPC-34-35B21	DPC-34-35B21	EPC-34-35B21	FPC-34-35B21
34 @ 125	17 @ 250	50	PC-34-125B22	CPC-34-125B22	DPC-34-125B22	EPC-34-125B22	FPC-34-125B22
34 @ 300	17 @ 600	62	PC-34-300B23	CPC-34-300B23	DPC-34-300B23	EPC-34-300B23	FPC-34-300B23
34 @ 700	17 @ 1400	24	PC-34-700B24	CPC-34-700B24	DPC-34-700B24	EPC-34-700B24	FPC-34-700B24
40 @ 20	20 @ 40	25	PC-40-20B60	CPC-40-20B60	DPC-40-20B60	Not Available	Not Available
40 @ 30	20 @ 60	37	PC-40-30B25	CPC-40-30B25	DPC-40-30B25	EPC-40-30B25	FPC-40-30B25
40 @ 110	20 @ 220	50	PC-40-110B26	CPC-40-110B26	DPC-40-110B26	EPC-40-110B26	FPC-40-110B26
40 @ 250	20 @ 500	62	PC-40-250B27	CPC-40-250B27	DPC-40-250B27	EPC-40-250B27	FPC-40-250B27
40 @ 600	20 @ 1200	24	PC-40-600B28	CPC-40-600B28	DPC-40-600B28	EPC-40-600B28	FPC-40-600B28
56 @ 15	28 @ 30	25	PC-56-15B61	CPC-56-15B61	DPC-56-15B61	Not Available	Not Available
56 @ 20	28 @ 40	37	PC-56-20B29	CPC-56-20B29	DPC-56-20B29	EPC-56-20B29	FPC-56-20B29
56 @ 80	28 @ 160	50	PC-56-80B30	CPC-56-80B30	DPC-56-80B30	EPC-56-80B30	FPC-56-80B30
56 @ 180	28 @ 360	62	PC-56-180B31	CPC-56-180B31	DPC-56-180B31	EPC-56-180B31	FPC-56-180B31
56 @ 420	28 @ 840	24	PC-56-420B32	CPC-56-420B32	DPC-56-420B32	EPC-56-420B32	FPC-56-420B32
88 @ 10	44 @ 20	25	PC-88-10B62	CPC-88-10B62	DPC-88-10B62	Not Available	Not Available
88 @ 15	44 @ 30	37	PC-88-15B33	CPC-88-15B33	DPC-88-15B33	EPC-88-15B33	FPC-88-15B33
88 @ 50	44 @ 100	50	PC-88-50B34	CPC-88-50B34	DPC-88-50B34	EPC-88-50B34	FPC-88-50B34
88 @ 120	44 @ 240	62	PC-88-120B35	CPC-88-120B35	DPC-88-120B35	EPC-88-120B35	FPC-88-120B35
88 @ 270	44 @ 540	24	PC-88-270B36	CPC-88-270B36	DPC-88-270B36	EPC-88-270B36	FPC-88-270B36
120 @ 8	60 @ 16	25	PC-120-8B63	CPC-120-8B63	DPC-120-8B63	Not Available	Not Available
120 @ 10	60 @ 20	37	PC-120-10B37	CPC-120-10B37	DPC-120-10B37	EPC-120-10B37	FPC-120-10B37
120 @ 35	60 @ 70	50	PC-120-35B38	CPC-120-35B38	DPC-120-35B38	EPC-120-35B38	FPC-120-35B38
120 @ 85	60 @ 170	62	PC-120-85B39	CPC-120-85B39	DPC-120-85B39	EPC-120-85B39	FPC-120-85B39
120 @ 200	60 @ 400	24	PC-120-200B40	CPC-120-200B40	DPC-120-200B40	EPC-120-200B40	FPC-120-200B40
180 @ 5	90 @ 10	25	PC-180-5B64	CPC-180-5B64	DPC-180-5B64	Not Available	Not Available
180 @ 6	90 @ 12	37	PC-180-6B41	CPC-180-6B41	DPC-180-6B41	EPC-180-6B41	FPC-180-6B41
180 @ 24	90 @ 48	50	PC-180-24B42	CPC-180-24B42	DPC-180-24B42	EPC-180-24B42	FPC-180-24B42
180 @ 55	90 @ 110	62	PC-180-55B43	CPC-180-55B43	DPC-180-55B43	EPC-180-55B43	FPC-180-55B43
180 @ 130	90 @ 260	24	PC-180-130B44	CPC-180-130B44	DPC-180-130B44	EPC-180-130B44	FPC-180-130B44
230 @ 4	115 @ 8	25	PC-230-4B65	CPC-230-4B65	DPC-230-4B65	Not Available	Not Available
230 @ 5	115 @ 10	37	PC-230-5B45	CPC-230-5B45	DPC-230-5B45	EPC-230-5B45	FPC-230-5B45
230 @ 20	115 @ 40	50	PC-230-20B46	CPC-230-20B46	DPC-230-20B46	EPC-230-20B46	FPC-230-20B46
230 @ 40	115 @ 80	62	PC-230-40B47	CPC-230-40B47	DPC-230-40B47	EPC-230-40B47	FPC-230-40B47
230 @ 100	115 @ 200	24	PC-230-100B48	CPC-230-100B48	DPC-230-100B48	EPC-230-100B48	FPC-230-100B48

RATINGS BASED ON 20% REGULATION.

METHOD OF DETERMINING SECONDARY RMS CURRENT:

Rectifier Type	Filter Type	RMS Secondary Current
Full Wave Center Tap	Choke Input	.7 x DC Amps
Full Wave Center Tap	Capacitor Input	1.2 x DC Amps
Full Wave Bridge	Choke Input	1.0 x DC Amps
Full Wave Bridge	Capacitor Input	1.8 x DC Amps

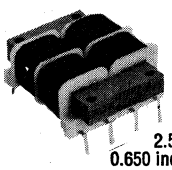
EWC, Inc. reserves the right to make changes without notice in design and specifications in order to effect product improvement.

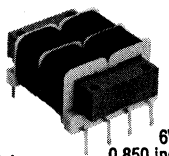
725 FEDERAL AVENUE, KENILWORTH, NJ 07033
(201) 245-3200 FAX 201 245 8430

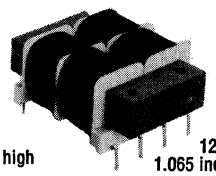
EWC® INC.

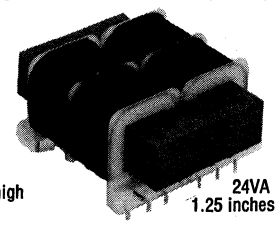
Miniature LO-PROFILE Plug-In Power Transformers

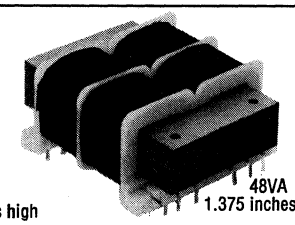
Recognized Component Underwriters Labs, Inc.


2.5VA
0.650 inches high


6VA
0.850 inches high


12VA
1.065 inches high


24VA
1.25 inches high


48VA
1.375 inches high

FIVE SIZES:

EWC's Lo-Profile, plug-in power transformers are designed for low height, critical pc board applications in semiconductor control and instrumentation. Interchangeable with those of other manufacturers, the units are for use in single, dual or reference dc supplies or isolated control circuits. Sizes 2, 6 and 12 are available encapsulated in form-fitting shells to protect against possible damage due to water-soluble or other fluxes as well as electrolytic corrosion experienced on open-type constructions.

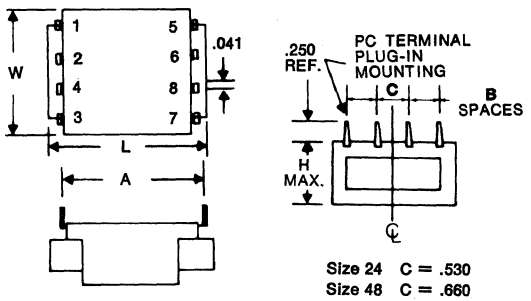


Figure 1

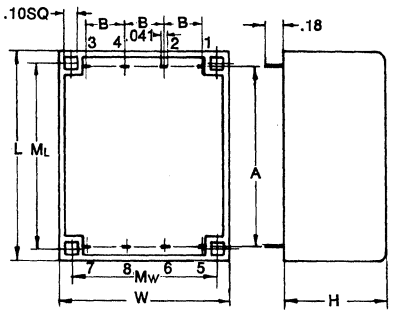
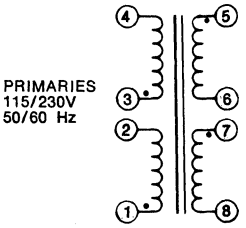


Figure 2 — Replace "B" in part no. with "P"



• INDICATES LIKE POLARITY

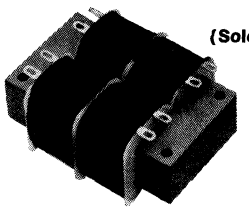
SIZE	FIG.	L	W	H	A	B	ML	MH	Oz.
2	1	1.875	1.562	0.650	1.600	0.375	—	—	5
6	1	1.875	1.562	0.850	1.600	0.375	—	—	7
12	1	2.500	2.000	1.065	2.000	0.500	—	—	11
24	1	2.875	2.250	1.250	1.900	0.600	—	—	15
48	1	3.125	2.500	1.375	2.180	0.600	—	—	21
2	2	2.030	1.635	0.785	1.600	0.375	1.795	1.340	
6	2	2.030	1.635	0.950	1.600	0.375	1.795	1.340	
12	2	2.675	2.126	1.185	2.000	0.500	2.440	1.850	

EWC, Inc. reserves the right to make changes without notice in design and specifications in order to effect product improvement.

PART NO.	SIZE	SECONDARY RMS RATINGS SERIES	SECONDARY RMS RATINGS PARALLEL
LP 10-250B23	2	10V C.T. @ 250mA	5V @ 500mA
LP 10-600B1	6	10V C.T. @ 600mA	5V @ 1.20A
LP 10-1200B2	12	10V C.T. @ 1.20A	5V @ 2.40A
LP 10-2400B89	24	10V C.T. @ 2.40A	5V @ 4.80A
LP 10-4800B90	48	10V C.T. @ 4.80A	5V @ 9.60A
LP 12-200B24	2	12.6V C.T. @ 200mA	6.3V @ 400mA
LP 12-450B3	6	12.6V C.T. @ 450mA	6.3V @ 900mA
LP 12-900B4	12	12.6V C.T. @ 900mA	6.3V @ 1.80A
LP 12-1900B91	24	12.6V C.T. @ 1.90A	6.3V @ 3.80A
LP 12-3800B92	48	12.6V C.T. @ 3.80A	6.3V @ 7.60A
LP 16-150B25	2	16V C.T. @ 150mA	8V @ 300mA
LP 16-350B5	6	16V C.T. @ 350mA	8V @ 700mA
LP 16-700B6	12	16V C.T. @ 700mA	8V @ 1.40A
LP 16-1500B93	24	16V C.T. @ 1.50A	8V @ 3.00A
LP 16-3000B94	48	16V C.T. @ 3.00A	8V @ 6.00A
LP 18-135B105	2	18V C.T. @ 135mA	9V @ 270mA
LP 18-325B106	6	18V C.T. @ 325mA	9V @ 650mA
LP 18-650B107	12	18V C.T. @ 650 mA	9V @ 1.30A
LP 18-1300B108	24	18V C.T. @ 1.30A	9V @ 2.60A
LP 18-2600B109	48	18V C.T. @ 2.60A	9V @ 5.20A
LP 20-125B26	2	20V C.T. @ 125mA	10V @ 250mA
LP 20-300B7	6	20V C.T. @ 300mA	10V @ 600mA
LP 20-600B8	12	20V C.T. @ 600mA	10V @ 1.20A
LP 20-1200B95	24	20V C.T. @ 1.20A	10V @ 2.40A
LP 20-2400B96	48	20V C.T. @ 2.40A	10V @ 4.80A
LP 24-100B27	2	24V C.T. @ 100mA	12V @ 200mA
LP 24-250B9	6	24V C.T. @ 250mA	12V @ 500mA
LP 24-500B10	12	24V C.T. @ 500mA	12V @ 1.00A
LP 24-1000B97	24	24V C.T. @ 1.00A	12V @ 2.00A
LP 24-2000B98	48	24V C.T. @ 2.00A	12V @ 4.00A
LP 28-90B115	2	28V C.T. @ 90 mA	14V @ 180mA
LP 28-215B116	6	28V C.T. @ 215mA	14V @ 430mA
LP 28-430B117	12	28V C.T. @ 430mA	14V @ 860mA
LP 28-850B118	24	28V C.T. @ 850mA	14V @ 1.70A
LP 28-1700B119	48	28V C.T. @ 1.70A	14V @ 3.40A
LP 30-85B125	2	30V C.T. @ 85mA	15V @ 170mA
LP 30-200B126	6	30V C.T. @ 200mA	15V @ 400mA
LP 30-400B127	12	30V C.T. @ 400mA	15V @ 800mA
LP 30-800B128	24	30V C.T. @ 800mA	15V @ 1.60A
LP 30-1600B129	48	30V C.T. @ 1.60A	15V @ 3.20A
LP 34-75B28	2	34V C.T. @ 75mA	17V @ 150mA
LP 34-170B11	6	34V C.T. @ 170mA	17V @ 340mA
LP 34-340B12	12	34V C.T. @ 340mA	17V @ 680mA
LP 34-700B99	24	34V C.T. @ 700mA	17V @ 1.40A
LP 34-1400B100	48	34V C.T. @ 1.40A	17V @ 2.80A
LP 40-60B29	2	40V C.T. @ 60mA	20V @ 120mA
LP 40-150B13	6	40V C.T. @ 150mA	20V @ 300mA
LP 40-300B14	12	40V C.T. @ 300mA	20V @ 600mA
LP 40-600B101	24	40V C.T. @ 600mA	20V @ 1.20A
LP 40-1200B102	48	40V C.T. @ 1.20A	20V @ 2.40A
LP 56-45B30	2	56V C.T. @ 45mA	28V @ 90mA
LP 56-100B15	6	56V C.T. @ 100mA	28V @ 200mA
LP 56-200B16	12	56V C.T. @ 200mA	28V @ 400mA
LP 56-425B103	24	56V C.T. @ 425mA	28V @ 850mA
LP 56-850B104	48	56V C.T. @ 850mA	28V @ 1.70A
LP 88-28B31	2	88V C.T. @ 28mA	44V @ 56mA
LP 88-65B17	6	88V C.T. @ 65mA	44V @ 130mA
LP 88-130B18	12	88V C.T. @ 130mA	44V @ 260mA
LP 120-20B32	2	120V C.T. @ 20mA	60V @ 40mA
LP 120-50B19	6	120V C.T. @ 50mA	60V @ 100mA
LP 120-100B20	12	120V C.T. @ 100mA	60V @ 200mA
LP 230-10B33	2	230V C.T. @ 10 mA	115V @ 20mA
LP 230-25B21	6	230V C.T. @ 25mA	115V @ 50mA
LP 230-50B22	12	230V C.T. @ 50mA	115V @ 100mA

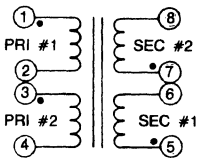
EWC® INC.
725 FEDERAL AVENUE, KENILWORTH, NJ 07033
(201) 245-3200 FAX 201 245 8430

LO-PROFILE Hi-Power Humbucking Transformers



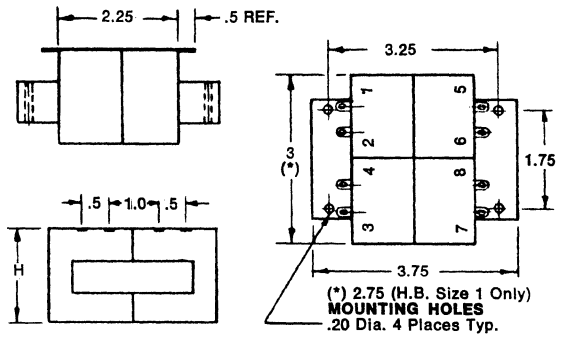
(Solder Terminals)

Varnish Finish (Standard)



115/230V 50/60 Hz
DUAL PRI.

SOLDER TERMINALS (.5-1-.5) Approx. Spacing



H.B. Size	H (Max.)	Wt. (lbs.) (Approx.)	VA (Nom.)	Reg. (%) (Typ.)	T. Rise (°C) (Typ.)
I	.850	1.00	20	30	25
II	1.25	1.75	50	30	45
III	1.50	2.25	75	25	55
IV	1.85	3.00	135	20	65
V	2.35	4.25	200	15	75

- **SOLDER TERMINALS**
- **SIDE-BY-SIDE BOBBINS**
- **20VA TO 200VA • 115/230V @ 50/60Hz**
- **1.5KV RMS HIPOT • CLASS B (130°C)**

ADVANTAGES:

- Side-By-Side Bobbins (Secondary Wound alongside of Primary) Lower Interwinding Capacitance — eliminates the need for electro-static shield
- Hum-bucking (Semi-Toroidal) Construction [Lower Radiated Magnetic Fields, Balanced Wdgs., Larger Heat Radiating Surface and Lower Center of Gravity]
- High Power for Low Panel Heights and Narrow Card Spacing

MOUNTING: (4) Lamination Holes .20 Dia. Insulated hardware required.

RATINGS PER SECONDARY OUTPUT: VA-SEC = 0.5 x VA (Output) • V-SEC = V-SEC (Parallel) • I-SEC = I-SEC (Series)

NON-STANDARD RATINGS: Tapped primaries, secondaries different voltages, currents or frequencies can be furnished.

Units with higher VA ratings up to 1.25 KVA can also be supplied.

EWC, Inc. reserves the right to make changes without notice in design and specifications in order to effect product improvement.

PART NO.	Size	SECONDARY RMS RATINGS SERIES	SECONDARY RMS RATINGS PARALLEL
LP 10-2B34	I	10V C.T. @ 2.00A	5V @ 4.00A
LP 10-5B35	II	10V C.T. @ 5.00A	5V @ 10.0A
LP 10-7.5B36	III	10V C.T. @ 7.50A	5V @ 15.0A
LP 10-13.5B37	IV	10V C.T. @ 13.5A	5V @ 27.0A
LP 10-20B38	V	10V C.T. @ 20.0A	5V @ 40.0A
LP 12-1.6B39	I	12.6V C.T. @ 1.60A	6.3V @ 3.20A
LP 12-4B40	II	12.6V C.T. @ 4.00A	6.3V @ 8.00A
LP 12-6B41	III	12.6V C.T. @ 6.00A	6.3V @ 12.0A
LP 12-11B42	IV	12.6V C.T. @ 11.0A	6.3V @ 22.0A
LP 12-16B43	V	12.6V C.T. @ 16.0A	6.3V @ 32.0A
LP 16-1.25B44	I	16V C.T. @ 1.25A	8V @ 2.50A
LP 16-3.15B45	II	16V C.T. @ 3.15A	8V @ 6.30A
LP 16-4.75B46	III	16V C.T. @ 4.75A	8V @ 9.50A
LP 16-8.5B47	IV	16V C.T. @ 8.50A	8V @ 17.0A
LP 16-12.5B48	V	16V C.T. @ 12.5A	8V @ 25.0A
LP 18-1.1B110	I	18V C.T. @ 1.10A	9V @ 2.20A
LP 18-2.75B111	II	18V C.T. @ 2.75A	9V @ 5.50A
LP 18-4.2B112	III	18V C.T. @ 4.20A	9V @ 8.40A
LP 18-7.5B113	IV	18V C.T. @ 7.50A	9V @ 15.0A
LP 18-11B114	V	18V C.T. @ 11.0A	9V @ 22.0A
LP 20-1B49	I	20V C.T. @ 1.00A	10V @ 2.00A
LP 20-2.5B50	II	20V C.T. @ 2.50A	10V @ 5.00A
LP 20-3.75B51	III	20V C.T. @ 3.75A	10V @ 7.50A
LP 20.6.75B52	IV	20V C.T. @ 6.75A	10V @ 13.5A
LP 20-10B53	V	20V C.T. @ 10.0A	10V @ 20.0A
LP 24-0.85B54	I	24V C.T. @ 0.85A	12V @ 1.70A
LP 24-2.1B55	II	24V C.T. @ 2.10A	12V @ 4.20A
LP 24-3.15B56	III	24V C.T. @ 3.15A	12V @ 6.30A
LP 24-5.75B57	IV	24V C.T. @ 5.75A	12V @ 11.5A
LP 24-8.5B58	V	24V C.T. @ 8.50A	12V @ 17.0A
LP 28-0.7B120	I	28V C.T. @ 0.70A	14V @ 1.40A
LP 28-1.75B121	II	28V C.T. @ 1.75A	14V @ 3.50A
LP 28-2.7B122	III	28V C.T. @ 2.70A	14V @ 5.40A
LP 28-4.8B123	IV	28V C.T. @ 4.80A	14V @ 9.60A
LP 28-7B124	V	28V C.T. @ 7.00A	14V @ 14.0A
LP 30-0.65B130	I	30V C.T. @ 0.65A	15V @ 1.30A
LP 30-1.65B131	II	30V C.T. @ 1.65A	15V @ 3.30A
LP 30-2.5B132	III	30V C.T. @ 2.50A	15V @ 5.00A
LP 30-4.5B133	IV	30V C.T. @ 4.50A	15V @ 9.00A
LP 30-6.65B134	V	30V C.T. @ 6.65A	15V @ 13.3A
LP 34-0.6B59	I	34V C.T. @ 0.60A	17V @ 1.20A
LP 34-1.5B60	II	34V C.T. @ 1.50A	17V @ 3.00A
LP 34-2.25B61	III	34V C.T. @ 2.25A	17V @ 4.50A
LP 34-4B62	IV	34V C.T. @ 4.00A	17V @ 8.00A
LP 34-6B63	V	34V C.T. @ 6.00A	17V @ 12.0A
LP 40-0.5B64	I	40V C.T. @ 0.50A	20V @ 1.00A
LP 40-1.25B65	II	40V C.T. @ 1.25A	20V @ 2.50A
LP 40-1.9B66	III	40V C.T. @ 1.90A	20V @ 3.80A
LP 40-3.4B67	IV	40V C.T. @ 3.40A	20V @ 6.80A
LP 40-5B68	V	40V C.T. @ 5.00A	20V @ 10.0A
LP 56-0.35B69	I	56V C.T. @ 0.35A	28V @ 0.70A
LP 56-0.9B70	II	56V C.T. @ 0.90A	28V @ 1.80A
LP 56-1.35B71	III	56V C.T. @ 1.35A	28V @ 2.70A
LP 56-2.4B72	IV	56V C.T. @ 2.40A	28V @ 4.80A
LP 56-3.5B73	V	56V C.T. @ 3.50A	28V @ 7.00A
LP 88-0.23B74	I	88V C.T. @ 0.23A	44V @ 0.46A
LP 88-0.575B75	II	88V C.T. @ 0.575A	44V @ 1.15A
LP 88-0.85B76	III	88V C.T. @ 0.85A	44V @ 1.70A
LP 88-1.5B77	IV	88V C.T. @ 1.50A	44V @ 3.00A
LP 88-2.3B78	V	88V C.T. @ 2.30A	44V @ 4.60A
LP 120-0.17B79	I	120V C.T. @ 170mA	60V @ 340mA
LP 120-0.425B80	II	120V C.T. @ 425mA	60V @ 850mA
LP 120-0.625B81	III	120V C.T. @ 625mA	60V @ 1.25A
LP 120-1.1B82	IV	120V C.T. @ 1.10A	60V @ 2.20A
LP 120-1.7B83	V	120V C.T. @ 1.70A	60V @ 3.40A
LP 230-0.09B84	I	230V C.T. @ 90mA	115V @ 180mA
LP 230-0.22B95	II	230V C.T. @ 220mA	115V @ 440mA
LP 230-0.325B86	III	230V C.T. @ 325mA	115V @ 650mA
LP 230-0.6B87	IV	230V C.T. @ 600mA	115V @ 1.20A
LP 230-0.9B88	V	230V C.T. @ 900mA	115V @ 1.80A

725 FEDERAL AVENUE, KENILWORTH, NJ 07033
(201) 245-3200 FAX 201 245 8430

EWC® INC.

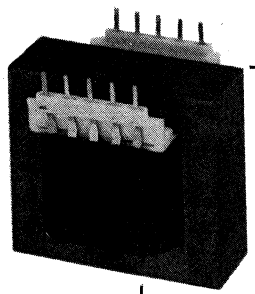
Recognized Component
Underwriters Labs, Inc.

Triple Output Power Transformers

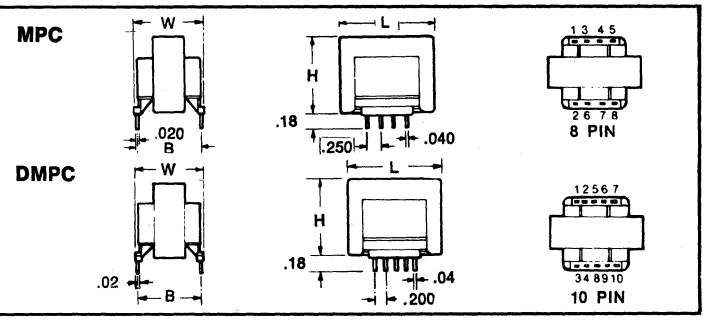
For triple-output regulated supplies

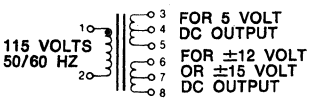
IDEAL FOR MICROPROCESSOR APPLICATIONS

These lines were designed around our standard PC, LP and CHASSIS-TRAN series transformers and are rated in terms of the final DC output after regulation by a 3-terminal IC regulator. 1500V Hipot is standard.



TYPE MPC AND DMPC





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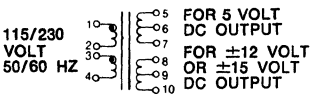

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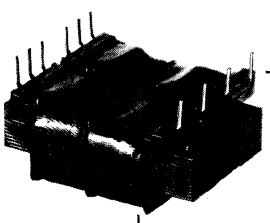

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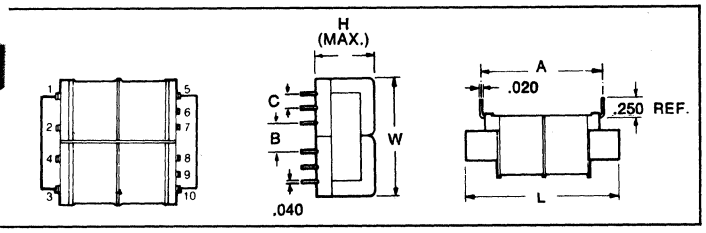

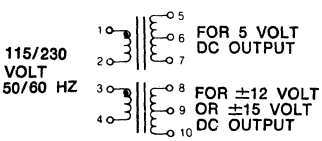

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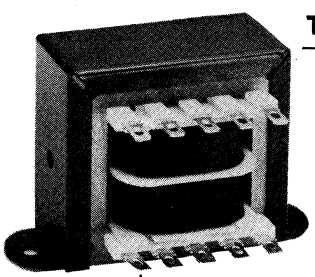

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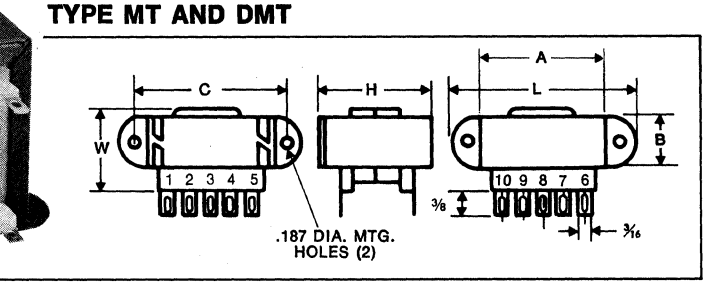

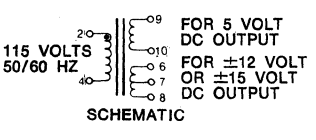

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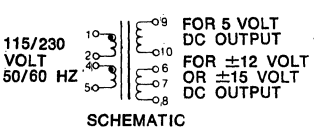


SCHEMATIC

Part Number Primary 50/60 Hz		DC Output		
115V	115/230V	Output 1	Output 2	Size
MPC-V-12B1	N/A	5V @ 180mA	12V @ 35mA	V
MPC-V-15B2	N/A	5V @ 180mA	15V @ 30mA	V
MPC-X-12B11	DMPC-X-12B31	5V @ 360mA	12V @ 60mA	X
MPC-X-15B12	DMPC-X-15B32	5V @ 360mA	15V @ 50mA	X
MPC-Y-12B21	DMPC-Y-12B41	5V @ 835mA	12V @ 150mA	Y
MPC-Y-15B22	DMPC-Y-15B42	5V @ 835mA	15V @ 130mA	Y
N/A	MPL-6-12B51	5V @ 135mA	12V @ 40mA	6
N/A	MPL-6-15B52	5V @ 135mA	15V @ 35mA	6
N/A	MPL-12-12B61	5V @ 270mA	12V @ 85mA	12
N/A	MPL-12-15B62	5V @ 270mA	15V @ 70mA	12
MT-6-12A01	DMT-6-12A01	5V @ 1.75A	12V @ 210mA	6
MT-6-15A02	DMT-6-15A02	5V @ 1.75A	15V @ 175mA	6
MT-7-12A03	DMT-7-12A03	5V @ 2.8A	12V @ 350mA	7
MT-7-15A04	DMT-7-15A04	5V @ 2.8A	15V @ 280mA	7
MT-8-12A05	DMT-8-12A05	5V @ 4A	12V @ 600mA	8
MT-8-15A06	DMT-8-15A06	5V @ 4A	15V @ 500mA	8

Size	Type	Lbs.	L	W	H	A	B	C
6	MT	1.1	3¼	1 11/16	1 15/16	2 5/16	1 1/16	2 13/16
7	MT	1.7	3 11/16	1 13/16	2¼	2 11/16	1 1/16	3 1/8
8	MT	2.75	4 1/32	2¼	2 5/16	3 1/16	1 5/16	3 5/16
V	MPC	0.31	1 5/8	1¼	1 3/8	—	1.100	—
X	MPC	0.56	1 7/8	1 1/16	1 5/8	—	1.300	—
Y	MPC	0.75	1 5/8	2¼	1 3/8	—	2.100	—
6	MPL	0.43	1 7/8	1 5/16	0.850	1.600	0.375	0.187
12	MPL	0.68	2½	2.000	1.065	2.000	0.500	0.250

EWC, Inc. reserves the right to make changes without notice in design and specifications in order to effect product improvement.

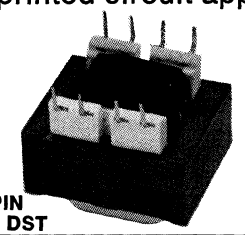
725 FEDERAL AVENUE, KENILWORTH, NJ 07033
(201) 245-3200 FAX 201 245 8430

EWC® INC.

Miniature Split-Bobbin Plug-In Power Transformers

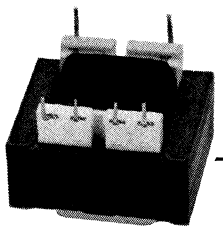
Recognized Component Underwriters Labs, Inc.

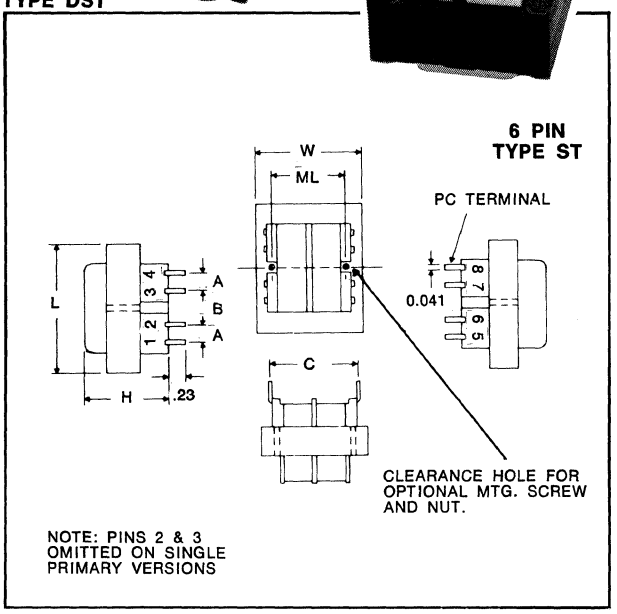
For printed circuit applications

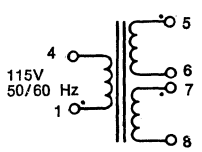


8 PIN TYPE DST

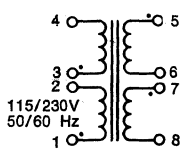
SPLIT BOBBIN — HIGHLY ISOLATED







6 PIN TYPE ST



8 PIN TYPE DST

TRANSFORMERS WOUND ON A SPLIT BOBBIN PERMIT THE PRIMARIES AND SECONDARIES TO BE WOUND SIDE BY SIDE RATHER THAN ONE OVER THE OTHER.

FEATURES ARE:

2500V RMS Hipot
Elimination of electro-static shield
No cross-overs of primary and secondary leads
Class B insulation — 130°C

Transformers can be supplied with single 115V or 115/230V, 50/60 Hz dual primaries. Secondaries can be series or parallel connected.

Size	VA	L	W	H	ML	A	B	C	Lbs.
2	1.1	1 3/8	1 1/8	15/16	—	.250	.250	1.200	0.17
3	2.4	1 3/8	1 1/8	1 3/16	—	.250	.250	1.200	0.25
4	6	1 5/8	1 5/16	1 5/16	1 1/16	.250	.350	1.280	0.44
5	12	1 7/8	1 5/16	1 7/16	1 1/4	.300	.400	1.410	0.70
6	20	2 1/4	1 7/8	1 7/16	1 1/2	.300	.400	1.600	0.80
7	36	2 5/8	2 3/16	1 9/16	†	.400	.400	1.850	1.10

†Size 7 has 4 mtg. holes on 2 3/16 x 1 3/4 centers for a #6 screw. Need not be nylon.

Part Number		Secondary RMS Rating	
Single 115V 6 Pin	Dual 115/230V 8 Pin	Series	Parallel
ST 2-10B41	DST 2-10B41	10V C.T. @ 0.11A	5V @ 0.22A
ST 3-10B1	DST 3-10B1	10V C.T. @ 0.25A	5V @ 0.5A
ST 4-10B2	DST 4-10B2	10V C.T. @ 0.6A	5V @ 1.2A
ST 5-10B3	DST 5-10B3	10V C.T. @ 1.2A	5V @ 2.4A
ST 6-10B4	DST 6-10B4	10V C.T. @ 2A	5V @ 4A
ST 7-10B51	DST 7-10B51	10V C.T. @ 3.6A	5V @ 7.2A
ST 2-12B42	DST 2-12B42	12.6V C.T. @ 0.09A	6.3V @ 0.18A
ST 3-12B5	DST 3-12B5	12.6V C.T. @ 0.2A	6.3V @ 0.4A
ST 4-12B6	DST 4-12B6	12.6V C.T. @ 0.5A	6.3V @ 1.0A
ST 5-12B7	DST 5-12B7	12.6V C.T. @ 1.0A	6.3V @ 2.0A
ST 6-12B8	DST 6-12B8	12.6V C.T. @ 1.6A	6.3V @ 3.2A
ST 7-12B52	DST 7-12B52	12.6V C.T. @ 2.85A	6.3V @ 5.7A
ST 2-16B43	DST 2-16B43	16V C.T. @ 0.07A	8V @ 0.14A
ST 3-16B9	DST 3-16B9	16V C.T. @ 0.15A	8V @ 0.3A
ST 4-16B10	DST 4-16B10	16V C.T. @ 0.4A	8V @ 0.8A
ST 5-16B11	DST 5-16B11	16V C.T. @ 0.8A	8V @ 1.6A
ST 6-16B12	DST 6-16B12	16V C.T. @ 1.25A	8V @ 2.5A
ST 7-16B53	DST 7-16B53	16V C.T. @ 2.25A	8V @ 4.5A
ST 2-20B44	DST 2-20B44	20V C.T. @ 0.055A	10V @ 0.11A
ST 3-20B13	DST 3-20B13	20V C.T. @ 0.12A	10V @ 0.24A
ST 4-20B14	DST 4-20B14	20V C.T. @ 0.3A	10V @ 0.6A
ST 5-20B15	DST 5-20B15	20V C.T. @ 0.6A	10V @ 1.2A
ST 6-20B16	DST 6-20B16	20V C.T. @ 1A	10V @ 2A
ST 7-20B54	DST 7-20B54	20V C.T. @ 1.8A	10V @ 3.6A
ST 2-24B45	DST 2-24B45	24V C.T. @ 0.045A	12V @ 0.09A
ST 3-24B17	DST 3-24B17	24V C.T. @ 0.1A	12V @ 0.2A
ST 4-24B18	DST 4-24B18	24VC.T. @ 0.25A	12V @ 0.5A
ST 5-24B19	DST 5-24B19	24V C.T. @ 0.5A	12V @ 1.0A
ST 6-24B20	DST 6-24B20	24V C.T. @ 0.8A	12V @ 1.6A
ST 7-24B55	DST 7-24B55	24V C.T. @ 1.5A	12V @ 3.0A
ST 2-28B46	DST 2-28B46	28V C.T. @ 0.04A	14V @ 0.08A
ST 3-28B21	DST 3-28B21	28V C.T. @ 0.085A	14V @ 0.17A
ST 4-28B22	DST 4-28B22	28V C.T. @ 0.2A	14V @ 0.4A
ST 5-28B23	DST 5-28B23	28V C.T. @ 0.42A	14V @ 0.84A
ST 6-28B24	DST 6-28B24	28V C.T. @0.7A	14V @ 1.4A
ST 7-28B56	DST 7-28B56	28V C.T. @ 1.3A	14V @ 2.6A
ST 2-36B47	DST 2-36B47	36V C.T. @ 0.03A	18V @ 0.06A
ST 3-36B25	DST 3-36B25	36V C.T. @ 0.065A	18V @ 0.13A
ST 4-36B26	DST 4-36B26	36V C.T. @ 0.17A	18V @ 0.34A
ST 5-36B27	DST 5-36B27	36V C.T. @ 0.35A	18V @ 0.7A
ST 6-36B28	DST 6-36B28	36V C.T. @ 0.55A	18V @ 1.1A
ST 7-36B57	DST 7-36B57	36V C.T. @ 1A	18V @ 2A
ST 2-48B48	DST 2-48B48	48V C.T. @ 0.023A	24V @ 0.046A
ST 3-48B29	DST 3-48B29	48V C.T. @ 0.05A	24V @ 0.1A
ST 4-48B30	DST 4-48B30	48V C.T. @ 0.125A	24V @ 0.25A
ST 5-48B31	DST 5-48B31	48V C.T. @ 0.25A	24V @ 0.5A
ST 6-48B32	DST 6-48B32	48V C.T. @ 0.4A	24V @ 0.8A
ST 7-48B58	DST 7-48B58	48V C.T. @ 0.75A	24V @ 1.5A
ST 2-56B49	DST 2-56B49	56V C.T. @ 0.02A	28V @ 0.04A
ST 3-56B33	DST 3-56B33	56V C.T. @ 0.045A	28V @ 0.09A
ST 4-56B34	DST 4-56B34	56V C.T. @ 0.11A	28V @ 0.22A
ST 5-56B35	DST 5-56B35	56V C.T. @ 0.22A	28V @ 0.44A
ST 6-56B36	DST 6-56B36	56V C.T. @ 0.35A	28V @ 0.7A
ST 7-56B59	DST 7-56B59	56V C.T. @ 0.65A	28V @ 1.3A
ST 2-120B50	DST 2-120B50	120V C.T. @ 0.01A	60V @ 0.02A
ST 3-120B37	DST 3-120B37	120V C.T. @ 0.02A	60V @ 0.04A
ST 4-120B38	DST 4-120B38	120V C.T. @ 0.05A	60V @ 0.1A
ST 5-120B39	DST 5-120B39	120V C.T. @ 0.1A	60V @ 0.2A
ST 6-120B40	DST 6-120B40	120V C.T. @ 0.16A	60V @ 0.32A
ST 7-120B60	DST 7-120B60	120V C.T. @ 0.3A	60V @ 0.6A

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EWC® INC.
725 FEDERAL AVENUE, KENILWORTH, NJ 07033
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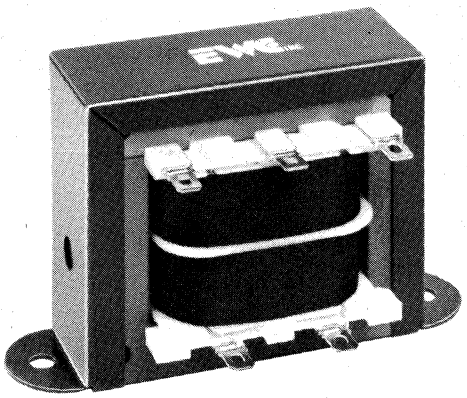
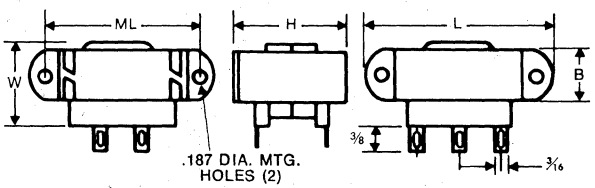
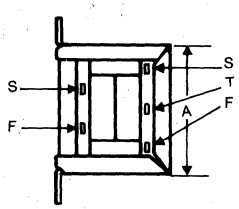
CHASSIS-TRAN®

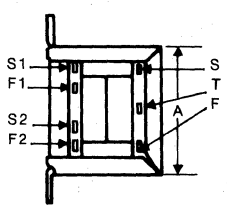
Recognized Component
Underwriters Labs, Inc.



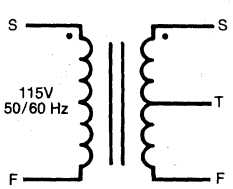




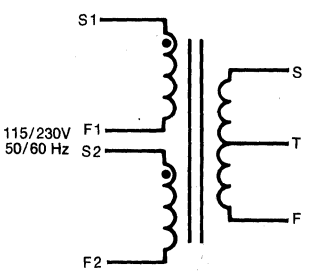
SINGLE 115V



DUAL 115/230V



SINGLE PRIMARY



DUAL PRIMARY

SIZE	VA	L	W	H	A	B	ML	LBS.
3	2.4	2 1/16	1 1/16	1 3/16	1 5/8	9/16	1 3/4	0.25
4	6	2 3/8	1 1/4	1 3/8	1 11/16	11/16	2	0.44
5	12	2 13/16	1 3/8	1 5/8	1 15/16	13/16	2 3/8	0.7
6	30	3 1/4	1 11/16	1 15/16	2 5/16	1 1/16	2 13/16	1.1
7	56	3 11/16	1 13/16	2 1/4	2 11/16	1 1/16	3 1/8	1.7
8	100	4 1/32	2 1/4	2 9/16	3 1/16	1 5/16	3 9/16	2.75

QUICK CONNECT POWER TRANSFORMERS

2500 Volt RMS Hipot in a variety of practical sizes. Maximum operating temperature 130°C available with either single 115 or dual 115/230V primary.

EWC's split bobbin and non-concentric winding provide better insulation and high signal isolation, thus eliminating the need for electrostatic shielding.

Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.

PART NUMBER		SECONDARY
SINGLE 115V	DUAL 115/230V	RMS RATING
241-3-10A1	DP 241-3-10A1	10V C.T. @ 0.25A
241-4-10A11	DP 241-4-10A11	10V C.T. @ 0.6A
241-5-10A21	DP 241-5-10A21	10V C.T. @ 1.2A
241-6-10A31	DP 241-6-10A31	10V C.T. @ 3.0A
241-7-10A41	DP 241-7-10A41	10V C.T. @ 5.0A
241-8-10A51	DP 241-8-10A51	10V C.T. @ 10A
241-3-12A2	DP 241-3-12A2	12.6V C.T. @ 0.2A
241-4-12A12	DP 241-4-12A12	12.6V C.T. @ 0.5A
241-5-12A22	DP 241-5-12A22	12.6V C.T. @ 1.0A
241-6-12A32	DP 241-6-12A32	12.6V C.T. @ 2.5A
241-7-12A42	DP 241-7-12A42	12.6V C.T. @ 4.0A
241-8-12A52	DP 241-8-12A52	12.6V C.T. @ 8.0A
241-3-16A3	DP 241-3-16A3	16V C.T. @ 0.15A
241-4-16A13	DP 241-4-16A13	16V C.T. @ 0.4A
241-5-16A23	DP 241-5-16A23	16V C.T. @ 0.8A
241-6-16A33	DP 241-6-16A33	16V C.T. @ 2.0A
241-7-16A43	DP 241-7-16A43	16V C.T. @ 3.5A
241-8-16A53	DP 241-8-16A53	16V C.T. @ 6.25A
241-3-20A4	DP 241-3-20A4	20V C.T. @ 0.12A
241-4-20A14	DP 241-4-20A14	20V C.T. @ 0.3A
241-5-20A24	DP 241-5-20A24	20V C.T. @ 0.6A
241-6-20A34	DP 241-6-20A34	20V C.T. @ 1.5A
241-7-20A44	DP 241-7-20A44	20V C.T. @ 2.8A
241-8-20A54	DP 241-8-20A54	20V C.T. @ 5.0A
241-3-24A5	DP 241-3-24A5	24V C.T. @ 0.1A
241-4-24A15	DP 241-4-24A15	24V C.T. @ 0.25A
241-5-24A25	DP 241-5-24A25	24V C.T. @ 0.5A
241-6-24A35	DP 241-6-24A35	24V C.T. @ 1.25A
241-7-24A45	DP 241-7-24A45	24V C.T. @ 2.4A
241-8-24A55	DP 241-8-24A55	24V C.T. @ 4.0A
241-3-28A6	DP 241-3-28A6	28V C.T. @ 0.085A
241-4-28A16	DP 241-4-28A16	28V C.T. @ 0.2A
241-5-28A26	DP 241-5-28A26	28V C.T. @ 0.42A
241-6-28A36	DP 241-6-28A36	28V C.T. @ 1.1A
241-7-28A46	DP 241-7-28A46	28V C.T. @ 2.0A
241-8-28A56	DP 241-8-28A56	28V C.T. @ 3.6A
241-3-36A7	DP 241-3-36A7	36V C.T. @ 0.065A
241-4-36A17	DP 241-4-36A17	36V C.T. @ 0.17A
241-5-36A27	DP 241-5-36A27	36V C.T. @ 0.35A
241-6-36A37	DP 241-6-36A37	36V C.T. @ 0.85A
241-7-36A47	DP 241-7-36A47	36V C.T. @ 1.5A
241-8-36A57	DP 241-8-36A57	36V C.T. @ 2.8A
241-3-48A8	DP 241-3-48A8	48V C.T. @ 0.05A
241-4-48A18	DP 241-4-48A18	48V C.T. @ 0.125A
241-5-48A28	DP 241-5-48A28	48V C.T. @ 0.25A
241-6-48A38	DP 241-6-48A38	48V C.T. @ 0.63A
241-7-48A48	DP 241-7-48A48	48V C.T. @ 1.2A
241-8-48A58	DP 241-8-48A58	48V C.T. @ 2.0A
241-3-56A9	DP 241-3-56A9	56V C.T. @ 0.045A
241-4-56A19	DP 241-4-56A19	56V C.T. @ 0.11A
241-5-56A29	DP 241-5-56A29	56V C.T. @ 0.22A
241-6-56A39	DP 241-6-56A39	56V C.T. @ 0.54A
241-7-56A49	DP 241-7-56A49	56V C.T. @ 1.0A
241-8-56A59	DP 241-8-56A59	56V C.T. @ 1.8A
241-3-120A10	DP 241-3-120A10	120V C.T. @ 0.02A
241-4-120A20	DP 241-4-120A20	120V C.T. @ 0.05A
241-5-120A30	DP 241-5-120A30	120V C.T. @ 0.1A
241-6-120A40	DP 241-6-120A40	120V C.T. @ 0.25A
241-7-120A50	DP 241-7-120A50	120V C.T. @ 0.5A
241-8-120A60	DP 241-8-120A60	120V C.T. @ 0.85A

Explanation of part number series 241 Size-4 Sec. Volts – 36 Prefix "DP" used in dual primary versions.

EWC, Inc. reserves the right to make changes without notice in design and specifications in order to effect product improvement.

EWC® INC. 725 FEDERAL AVENUE, KENILWORTH, NJ 07033
(201) 245-3200 FAX 201 245 8430

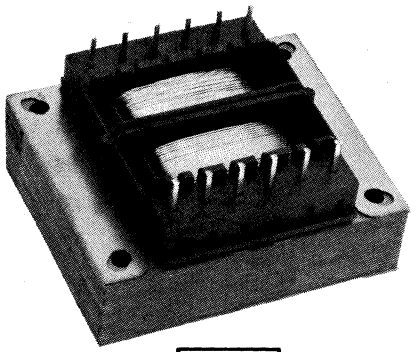
Power Transformers

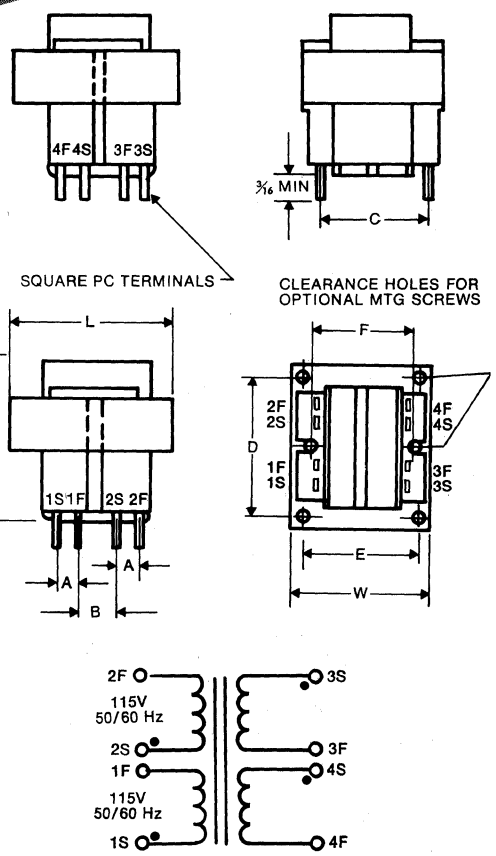
INTERNATIONAL SERIES POWER TRANSFORMERS

Designed to meet UL, VDE, IEC, CSA.

The EWC series of International Transformers is designed and built to meet U.S. and international safety standards.

These transformers are available in both PC and chassis-mount construction. With power ratings of 2.5VA to 175VA, these transformers are built on dual-bobbins with insulating shrouds to provide 4000V RMS isolation between primary and secondary. The non-concentric construction reduces primary to secondary capacitance and eliminates the need for an electrostatic shield.





PART NO. PC MOUNT	VA (SIZE)	SECONDARY RMS RATING	
		SERIES	PARALLEL
14A-2.5-10B1	2.5	10V C.T. @0.25A	5V @0.5A
14A-5.0-10B2	5.0	10V C.T. @0.5A	5V @1.0A
14A-10-10B3	10.0	10V C.T. @1.0A	5V @2.0A
14A-20-10B4	20.0	10V C.T. @2.0A	5V @4.0A
14A-30-10B5	30.0	10V C.T. @3.0A	5V @6.0A
14A-56-10B6	56.0	10V C.T. @5.6A	5V @11.2A
14A-2.5-12B7	2.5	12.6V C.T. @0.2A	6.3V @0.4A
14A-5.0-12B8	5.0	12.6V C.T. @0.4A	6.3V @0.8A
14A-10-12B9	10.0	12.6V C.T. @0.8A	6.3V @1.6A
14A-20-12B10	20.0	12.6V C.T. @1.6A	6.3V @3.2A
14A-30-12B11	30.0	12.6V C.T. @2.4A	6.3V @4.8A
14A-56-12B12	56.0	12.6V C.T. @4.4A	6.3V @8.8A
14A-2.5-16B13	2.5	16V C.T. @0.15A	8V @0.3A
14A-5.0-16B14	5.0	16V C.T. @0.31A	8V @0.62A
14A-10-16B15	10.0	16V C.T. @0.62A	8V @1.25A
14A-20-16B16	20.0	16V C.T. @1.25A	8V @2.5A
14A-30-16B17	30.0	16V C.T. @1.9A	8V @3.8A
14A-56-16B18	56.0	16V C.T. @3.5A	8V @7.0A
14A-2.5-20B19	2.5	20V C.T. @0.12A	10V @0.24A
14A-5.0-20B20	5.0	20V C.T. @0.25A	10V @0.5A
14A-10-20B21	10.0	20V C.T. @0.5A	10V @1.0A
14A-20-20B22	20.0	20V C.T. @1.0A	10V @2.0A
14A-30-20B23	30.0	20V C.T. @1.5A	10V @3.0A
14A-56-20B24	56.0	20V C.T. @2.8A	10V @5.6A
14A-2.5-24B25	2.5	24V C.T. @0.1A	12V @0.2A
14A-5.0-24B26	5.0	24V C.T. @0.21A	12V @0.42A
14A-10-24B27	10.0	24V C.T. @0.42A	12V @0.84A
14A-20-24B28	20.0	24V C.T. @0.83A	12V @1.66A
14A-30-24B29	30.0	24V C.T. @1.25A	12V @2.5A
14A-56-24B30	56.0	24V C.T. @2.33A	12V @4.66A
14A-2.5-28B31	2.5	28V C.T. @0.09A	14V @0.18A
14A-5.0-28B32	5.0	28V C.T. @0.18A	14V @0.36A
14A-10-28B33	10.0	28V C.T. @0.36A	14V @0.72A
14A-20-28B34	20.0	28V C.T. @0.72A	14V @1.44A
14A-30-28B35	30.0	28V C.T. @1.06A	14V @2.12A
14A-56-28B36	56.0	28V C.T. @2.0A	14V @4.0A
14A-2.5-36B37	2.5	36V C.T. @0.07A	18V @0.14A
14A-5.0-36B38	5.0	36V C.T. @0.14A	18V @0.28A
14A-10-36B39	10.0	36V C.T. @0.28A	18V @0.56A
14A-20-36B40	20.0	36V C.T. @0.56A	18V @1.12A
14A-30-36B41	30.0	36V C.T. @0.82A	18V @1.64A
14A-56-36B42	56.0	36V C.T. @1.56A	18V @3.12A

MECHANICAL DIMENSIONS

VA	WT.	L	W	H	A	B
2.5	0.25	1.625	1.312	1.125	.200	.250
5.0	0.37	1.625	1.312	1.375	.200	.400
10.0	0.53	1.875	1.562	1.375	.200	.400
20.0	0.90	2.250	1.875	1.625	.400	.400
30.0	1.15	2.625	2.187	1.562	.550	.275
56.0	1.70	3.000	2.500	1.812	.600	.300

VA	C	D	E	F	PIN DIM	MTG
2.5	1.000	—	—	1.062	.025 SQ	#4
5.0	1.000	—	—	1.062	.025 SQ	#4
10.0	1.140	—	—	1.250	.038 SQ	#4
20.0	1.460	—	—	1.500	.038 SQ	#4
30.0	1.680	2.18	1.75	—	.045 SQ	#6
56.0	1,900	2.50	2	—	.045 SQ	#6

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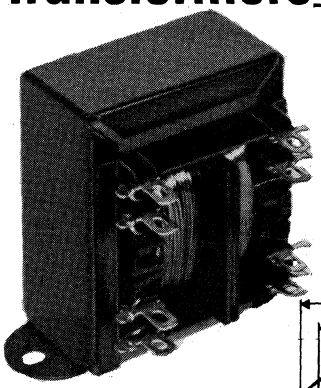
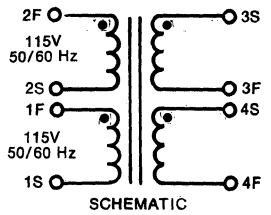
EWC® INC.

Power Transformers





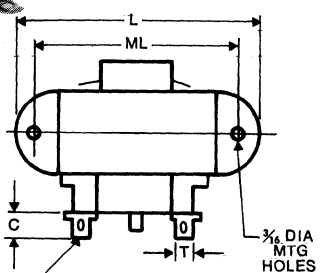
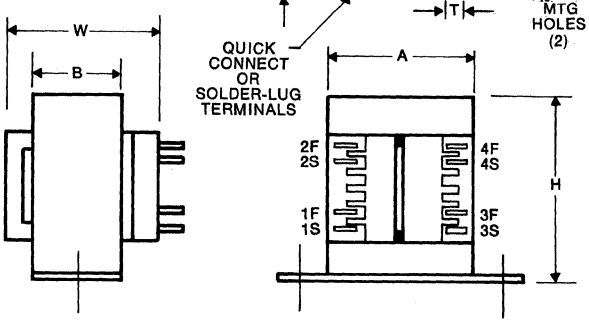
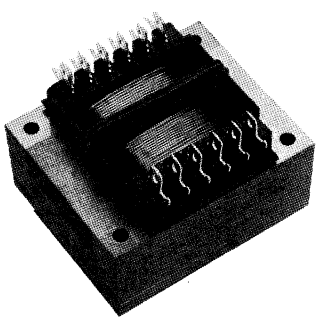


FIGURE A





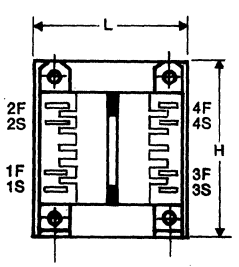
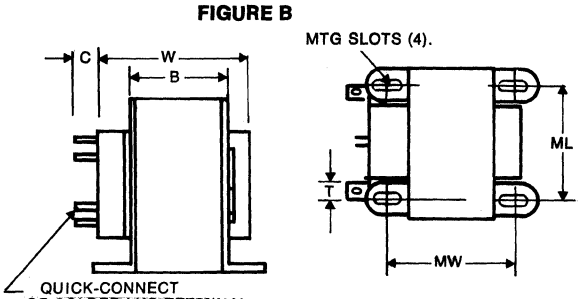


FIGURE B



INTERNATIONAL SERIES POWER TRANSFORMERS

Designed to meet UL, VDE, IEC, CSA.

PART NO. CHASIS MOUNT	(SIZE) VA	SECONDARY RMS RATING	
		SERIES	PARALLEL
A41-25-10A1	25	10V C.T. @2.5A	5V @5.0A
A41-43-10A2	43	10V C.T. @4.3A	5V @8.6A
A41-80-10A3	80	10V C.T. @8.0A	5V @16.0A
A41-130-10A4	130	10V C.T. @13.0A	5V @26.0A
A41-175-10A5	175	10V C.T. @17.5A	5V @35.0A
A41-25-12A7	25	12.6V C.T. @2.0A	6.3V @4.0A
A41-43-12A8	43	12.6V C.T. @3.4A	6.3V @6.8A
A41-80-12A9	80	12.6V C.T. @6.3A	6.3V @12.6A
A41-130-12A10	130	12.6V C.T. @10.3A	6.3V @20.6A
A41-175-12A11	175	12.6V C.T. @14.0A	6.3V @28.0A
A41-25-16A13	25	16V C.T. @1.6A	8V @3.2A
A41-43-16A14	43	16V C.T. @2.7A	8V @5.4A
A41-80-16A15	80	16V C.T. @5.0A	8V @10.0A
A41-130-16A16	130	16V C.T. @8.1A	8V @16.2A
A41-175-16A17	175	16V C.T. @11.0A	8V @22.0A
A41-25-20A19	25	20V C.T. @1.25A	10V @2.5A
A41-43-20A20	43	20V C.T. @2.2A	10V @4.4A
A41-80-20A21	80	20V C.T. @4.0A	10V @8.0A
A41-130-20A22	130	20V C.T. @6.5A	10V @13.0A
A41-175-20A23	175	20V C.T. @8.8A	10V @17.6A
A41-25-24A25	25	24V C.T. @1A	12V @2A
A41-43-24A26	43	24V C.T. @1.8A	12V @3.6A
A41-80-24A27	80	24V C.T. @3.3A	12V @6.6A
A41-130-24A28	130	24V C.T. @5.4A	12V @10.8A
A41-175-24A29	175	24V C.T. @7.3A	12V @14.6A
A41-25-28A31	25	28V C.T. @0.9A	14V @1.86A
A41-43-28A32	43	28V C.T. @1.5A	14V @3.0A
A41-80-28A33	80	28V C.T. @2.8A	14V @5.6A
A41-130-28A34	130	28V C.T. @4.6A	14V @9.2A
A41-175-28A35	175	28V C.T. @6.25A	14V @12.5A
A41-25-36A37	25	36V C.T. @0.7A	18V @1.4A
A41-43-36A38	43	36V C.T. @1.2A	18V @2.4A
A41-80-36A39	80	36V C.T. @2.2A	18V @4.4A
A41-130-36A40	130	36V C.T. @3.6A	18V @7.2A
A41-175-36A41	175	36V C.T. @4.8A	18V @9.6A
A41-25-230A42	25	230V C.T. @0.11A	115V @0.22A
A41-43-230A43	43	230V C.T. @0.19A	115V @0.38A
A41-80-230A44	80	230V C.T. @0.35A	115V @0.7A
A41-130-230A45	130	230V C.T. @0.57A	115V @1.14A
A41-175-230A46	175	230V C.T. @0.76A	115V @1.52A

MECHANICAL DIMENSIONS

VA	WT.	L	W	H	A	B
25	1.25	2.812	1.875	2.312	2.000	1.125
43	1.6	3.125	2.062	2.687	2.250	1.125
80	2.8	2.500	2.375	3.000	—	1.375
130	4.1	2.812	2.875	3.375	—	1.625
175	6.5	3.125	2.875	3.750	—	1.625

VA	C	T	ML	MW	MTG	FIG.
25	.312	.187	2.375	—	#6	A
43	.312	.187	2.812	—	#6	A
80	.312	.187	2.000	2.18	#6	B
130	.375	0.25	2.250	2.50	#8	B
175	.375	0.25	2.500	2.50	#8	B

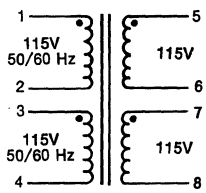
EWC® INC. 725 FEDERAL AVENUE, KENILWORTH, NJ 07033
(201) 245-3200 FAX 201 245 8430

Split-Bobbin Dual Chokes Isolation & Auto Transformers

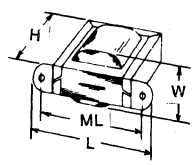
RECTIFIER POWER CHOKE	SERIES (NOM VALUES) L (mH)	Idc (A)	DCR (OHMS)	Et (Vs)	SIZE
RP-CL 0.1/0.2	3000	0.1	280	0.40	I
RP-CM 0.1/0.2	6000	0.1	360	0.75	II
RP-CH 0.1/0.2	14,000	0.1	500	1.75	IV
RP-CL 0.25/0.5	480	0.25	44	0.15	I
RP-CM 0.25/0.5	1500	0.25	72	0.50	III
RP-CH 0.25/0.5	3200	0.25	96	1.00	V
RP-CL 0.5/1	240	0.5	14	0.15	II
RP-CM 0.5/1	560	0.5	20	0.35	IV
RP-CH 0.5/1	1200	0.5	36	0.80	VI
RP-CL 1/2	100	1.0	4.4	.125	III
RP-CM 1/2	200	1.0	6.0	.250	V
RP-CH 1/2	380	1.0	8.0	.500	VII
RP-CL 2/4	25	2.0	1.1	.060	III
RP-CM 2/4	50	2.0	1.4	.125	V
RP-CH 2/4	160	2.0	3.0	.400	VIII
RP-CL 4/8	8.4	4.0	0.3	.045	IV
RP-CM 4/8	24	4.0	0.5	.125	VII
RP-CH 4/8	68	4.0	1.0	.300	IX
RP-CL 6/12	7.2	6.0	0.2	.065	VI
RP-CM 6/12	17	6.0	0.3	.125	VIII
RP-CH 6/12	28	6.0	0.4	.200	IX
RP-CL 8/16	10	8.0	0.18	.10	VIII
RP-CM 8/16	26	8.0	0.36	.25	X
RP-CH 8/16	76	8.0	0.56	.75	XIV
RP-CL 10/20	6	10	0.10	.075	VIII
RP-CM 10/20	22	10	0.28	.25	XI
RP-CH 10/20	46	10	0.34	.55	XIV
RP-CL 12/24	4.6	12	.072	.06	VIII
RP-CM 12/24	15	12	.180	.20	XI
RP-CH 12/24	32	12	.220	.45	XIV
RP-CL 15/30	4	15	.064	.08	IX
RP-CM 15/30	16	15	.140	.30	XII
RP-CH 15/30	32	15	.220	.55	XVI
RP-CL 25/50	1.7	25	.028	.05	IX
RP-CM 25/50	6.8	25	.056	.20	XIV
RP-CH 25/50	12	25	.080	.35	XVI
RP-CL 50/100	0.9	50	.012	.055	XI
RP-CM 50/100	1.7	50	.014	.10	XIV
RP-CH 50/100	3.0	50	.020	.175	XVI

SPLIT BOBBIN ISOLATION TRANSFORMERS

3 VA to 1.25 KVA (50/60 Hz) 230V/230V or 115V/115V or 230V/115V or 115V/230V 1.5 KV RMS Hipot — UL Class B (130°C)



IT SERIES

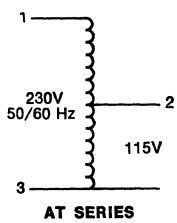


(Mtg. Style: C)
(STD. SIZE I-VII)

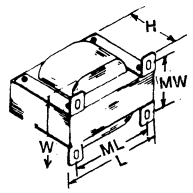
ISOLATION TRANSFORMER	VA MAX.	SIZE
IT 200.3-0F	3	I
IT 200.7-0F	7	II
IT 201.5-0F	15	III
IT 202.5-0F	25	IV
IT 204-0F	40	V
IT 206-0F	60	VI
IT 208-0F	80	VII
IT 212-0F	120	VIII
IT 218-0F	180	IX
IT 225-0F	250	X
IT 235-0F	350	XI
IT 255-0F	550	XII
IT 280-0F	800	XIV
IT 2125-0F	1250	XV

BOBBIN AUTO TRANSFORMERS

10 VA to 2.5 KVA (50-500 Hz) Step Down: 230V/115V or Step Up: 115V/230V 1.5 KV RMS Hipot — UL Class B (130°C)



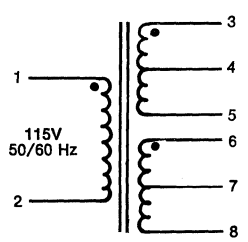
AT SERIES



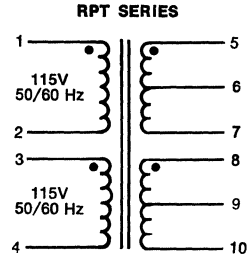
(Mtg. Style B)
(STD: SIZE VIII-XVI)

AUTO TRANSFORMER	VA MAX.	SIZE
AT 101	10	I
AT 102	20	II(a)
AT 104	40	III
AT 107	70	IV
AT 110	100	V
AT 112	120	V(a)
AT 115	150	VI
AT 120	200	VII
AT 125	250	VIII
AT 135	350	IX
AT 150	500	IX(a)
AT 175	750	IX(b)
AT 1100	1000	XII
AT 1150	1500	XIV
AT 1250	2500	XV

SIZE	VA MAX.	WT. (LB.) APPROX.	W	L	H	ML	MW
I	2.5	.25	1¼	2 1/16	1 3/16	1¾	—
II	6.5	.375	1⅜	2⅜	1⅜	2	—
II(a)	20	.5	1½	2⅜	1⅜	2	—
III	13	.625	1½	2 13/16	1⅝	2⅜	—
IV	25	1.0	1⅝	3¼	1 15/16	2 13/16	—
V	40	1.25	1⅞	3¼	1 15/16	2 13/16	—
V(a)	120	1.5	2⅛	3¼	1 15/16	2 13/16	—
VI	65	1.75	2	3 11/16	2¼	3⅛	—
VII	90	2.5	2¼	4	2 5/16	3 5/16	—
VIII	130	3.5	2½	4½	2⅞	4	—
IX	185	4.75	2¾	3¾	3⅛	3⅛	2¼
IX(a)	500	6	3¼	3¾	3⅛	3⅛	2¾
IX(b)	750	8	4	3¾	3⅛	3⅛	3 1/16
X	270	6.25	3	4⅛	3 1/16	3 1/16	2⅜
XI	360	8	3¼	4½	3¾	3¾	2½
XII	550	12	4⅜	4½	3¾	3¾	3½
XIV	825	17	4½	5¼	4⅜	4⅜	3⅝
XV	1600	25	6	5¼	4⅜	4⅜	5⅛
XVI	1500	22.5	4½	6⅜	5 5/16	5 5/16	3¼



RPT SERIES



DRPT SERIES

725 FEDERAL AVENUE, KENILWORTH, NJ 07033
(201) 245-3200 FAX 201 245 8430
EWC® INC.

Split-Bobbin Rectifier Power Transformers

1 VA to 1.5 KVA — 115V @ 50/60 Hz Primary **1500V RMS Hipot — UL Class B (130°C) — Open Frame (STD)**

Primary 115V 50/60 Hz	Secondary Ratings (RMS)		Mtg. Style	Size
	Series	Parallel		
RPT 10-0.1	10V C.T. @ 0.1A	5V C.T. @ 0.2A	C	I
RPT 10-0.25	10V C.T. @ 0.25A	5V C.T. @ 0.5A	C	I
RPT 10-0.5	10V C.T. @ 0.5A	5V C.T. @ 1A	C	II
RPT 10-1	10V C.T. @ 1A	5V C.T. @ 2A	C	III
RPT 10-2	10V C.T. @ 2A	5V C.T. @ 4A	C	IV
RPT 10-4	10V C.T. @ 4A	5V C.T. @ 8A	C	V
RPT 10-6	10V C.T. @ 6A	5V C.T. @ 12A	C	VI
RPT 10-8	10V C.T. @ 8A	5V C.T. @ 16A	C	VII
RPT 10-12	10V C.T. @ 12A	5V C.T. @ 24A	C	VIII
RPT 10-15	10V C.T. @ 15A	5V C.T. @ 30A	B	IX
RPT 10-25	10V C.T. @ 25A	5V C.T. @ 50A	B	X
RPT 10-30	10V C.T. @ 30A	5V C.T. @ 60A	B	XI
RPT 10-50	10V C.T. @ 50A	5V C.T. @ 100A	B	XII
RPT 10-75	10V C.T. @ 75A	5V C.T. @ 150A	B	XIV
RPT 10-100	10V C.T. @ 100A	5V C.T. @ 200A	B	XVI
RPT 12-8-0.1	12.8V C.T. @ 0.1A	6.4V C.T. @ 0.2A	C	I
RPT 12.8-0.25	12.8V C.T. @ 0.25A	6.4V C.T. @ 0.5A	C	II
RPT 12.8-0.5	12.8V C.T. @ 0.5A	6.4V C.T. @ 1A	C	II
RPT 12.8-1	12.8V C.T. @ 1A	6.4V C.T. @ 2A	C	III
RPT 12.8-2	12.8V C.T. @ 2A	6.4V C.T. @ 4A	C	V
RPT 12.8-4	12.8V C.T. @ 4A	6.4V C.T. @ 8A	C	VI
RPT 12.8-6	12.8V C.T. @ 6A	6.4V C.T. @ 12A	C	VII
RPT 12.8-8	12.8V C.T. @ 8A	6.4V C.T. @ 16A	C	VIII
RPT 12.8-12	12.8V C.T. @ 12A	6.4V C.T. @ 24A	B	IX
RPT 12.8-20	12.8V C.T. @ 20A	6.4V C.T. @ 40A	B	X
RPT 12.8-25	12.8V C.T. @ 25A	6.4V C.T. @ 50A	B	XI
RPT 12.8-50	12.8V C.T. @ 50A	6.4V C.T. @ 100A	B	XIV
RPT 12.8-100	12.8V C.T. @ 100A	6.4V C.T. @ 200A	B	XVI
RPT 16-0.1	16V C.T. @ 0.1A	8V C.T. @ 0.2A	C	I
RPT 16-0.25	16V C.T. @ 0.25A	8V C.T. @ 0.5A	C	II
RPT 16-0.5	16V C.T. @ 0.5A	8V C.T. @ 1A	C	III
RPT 16-1	16V C.T. @ 1A	8V C.T. @ 2A	C	IV
RPT 16-2	16V C.T. @ 2A	8V C.T. @ 4A	C	V
RPT-16-4	16V C.T. @ 4A	8V C.T. @ 8A	C	VI
RPT 16-6	16V C.T. @ 6A	8V C.T. @ 12A	C	VIII
RPT 16-8	16V C.T. @ 8A	8V C.T. @ 16A	C	VIII
RPT 16-10	16V C.T. @ 10A	8V C.T. @ 20A	B	IX
RPT 16-12	16V C.T. @ 12A	8V C.T. @ 24A	B	X
RPT 16-20	16V C.T. @ 20A	8V C.T. @ 40A	B	XI
RPT 16-25	16V C.T. @ 25A	8V C.T. @ 50A	B	XII
RPT 16-50	16V C.T. @ 50A	8V C.T. @ 100A	B	XIV
RPT 16-75	16V C.T. @ 75A	8V C.T. @ 150A	B	XVI
RPT 24-0.1	24V C.T. @ 0.1A	12V C.T. @ 0.2A	C	I
RPT 24-0.25	24V C.T. @ 0.25A	12V C.T. @ 0.5A	C	II
RPT 24-0.5	24V C.T. @ 0.5A	12V C.T. @ 1A	C	III
RPT 24-1	24V C.T. @ 1A	12V C.T. @ 2A	C	IV
RPT 24-2	24V C.T. @ 2A	12V C.T. @ 4A	C	VI
RPT 24-3	24V C.T. @ 3A	12V C.T. @ 6A	C	VII
RPT 24-4	24V C.T. @ 4A	12V C.T. @ 8A	C	VIII
RPT 24-6	24V C.T. @ 6A	12V C.T. @ 12A	B	IX
RPT 24-8	24V C.T. @ 8A	12V C.T. @ 16A	B	X
RPT 24-12	24V C.T. @ 12A	12V C.T. @ 24A	B	XI
RPT 24-20	24V C.T. @ 20A	12V C.T. @ 40A	B	XII
RPT 24-25	24V C.T. @ 25A	12V C.T. @ 50A	B	XIV
RPT 24-50	24V C.T. @ 50A	12V C.T. @ 100A	B	XVI
RPT 36-0.1	36V C.T. @ 0.1A	18V C.T. @ 0.2A	C	II
RPT 36-0.25	36V C.T. @ 0.25A	18V C.T. @ 0.5A	C	III
RPT 36-0.5	36V C.T. @ 0.5A	18V C.T. @ 1A	C	IV
RPT 36-1	36V C.T. @ 1A	18V C.T. @ 2A	C	VI
RPT 36-2	36V C.T. @ 2A	18V C.T. @ 4A	C	VII
RPT 36-3	36V C.T. @ 3A	18V C.T. @ 6A	C	VIII
RPT 36-4	36V C.T. @ 4A	18V C.T. @ 8A	B	IX
RPT 36-6	36V C.T. @ 6A	18V C.T. @ 12A	B	X
RPT 36-8	36V C.T. @ 8A	18V C.T. @ 16A	B	XI
RPT 36-12	36V C.T. @ 12A	18V C.T. @ 24A	B	XII
RPT 36-20	36V C.T. @ 20A	18V C.T. @ 40A	B	XIV
RPT 36-25	36V C.T. @ 25A	18V C.T. @ 50A	B	XVI
RPT 36-30	36V C.T. @ 30A	18V C.T. @ 60A	B	XVI
RPT 56-01	56V C.T. @ 0.1A	28V C.T. @ 0.2A	C	II
RPT 56-0.25	56V C.T. @ 0.25A	28V C.T. @ 0.5A	C	IV
RPT 56-0.5	56V C.T. @ 0.5A	28V C.T. @ 1A	C	V
RPT 56-1	56V C.T. @ 1A	28V C.T. @ 2A	C	VI
RPT 56-2	56V C.T. @ 2A	28V C.T. @ 4A	C	VIII
RPT 56-3	56V C.T. @ 3A	28V C.T. @ 6A	B	IX
RPT 56-4	56V C.T. @ 4A	28V C.T. @ 8A	B	X
RPT 56-6	56V C.T. @ 6A	28V C.T. @ 12A	B	XI
RPT 56-8	56V C.T. @ 8A	28V C.T. @ 16A	B	XII
RPT 56-12	56V C.T. @ 12A	28V C.T. @ 24A	B	XIV
RPT 56-20	56V C.T. @ 20A	28V C.T. @ 40A	B	XVI
RPT 56-25	56V C.T. @ 25A	28V C.T. @ 50A	B	XVI

Primary 115V 50/60 Hz	Secondary Ratings (RMS)		Mtg. Style	Size
	Series	Parallel		
RPT 68-0.1	68V C.T. @ 0.1A	34V C.T. @ 0.2A	C	III
RPT 68-0.25	68V C.T. @ 0.25A	34V C.T. @ 0.5A	C	IV
RPT 68-0.5	68V C.T. @ 0.5A	34V C.T. @ 1A	C	V
RPT 68-1	68V C.T. @ 1A	34V C.T. @ 2A	C	VII
RPT 68-1.5	68V C.T. @ 1.5A	34V C.T. @ 3A	C	VIII
RPT 68-2	68V C.T. @ 2A	34V C.T. @ 4A	B	IX
RPT 68-3	68V C.T. @ 3A	34V C.T. @ 6A	B	X
RPT 68-4	68V C.T. @ 4A	34V C.T. @ 8A	B	XI
RPT 68-6	68V C.T. @ 6A	34V C.T. @ 12A	B	XII
RPT 68-8	68V C.T. @ 8A	34V C.T. @ 16A	B	XII
RPT 68-12	68V C.T. @ 12A	34V C.T. @ 24A	B	XIV
RPT 68-15	68V C.T. @ 15A	34V C.T. @ 30A	B	XVI
RPT 68-20	68V C.T. @ 20A	34V C.T. @ 40A	B	XVI
RPT 80-0.1	80V C.T. @ 0.1A	40V C.T. @ 0.2A	C	III
RPT 80-0.25	80V C.T. @ 0.25A	40V C.T. @ 0.5A	C	IV
RPT 80-0.5	80V C.T. @ 0.5A	40V C.T. @ 1A	C	VI
RPT 80-1	80V C.T. @ 1A	40V C.T. @ 2A	C	VII
RPT 80-1.5	80V C.T. @ 1.5A	40V C.T. @ 3A	C	VIII
RPT 80-2	80V C.T. @ 2A	40V C.T. @ 4A	B	IX
RPT 80-3	80V C.T. @ 3A	40V C.T. @ 6A	B	X
RPT 80-4	80V C.T. @ 4A	40V C.T. @ 8A	B	XI
RPT 80-6	80V C.T. @ 6A	40V C.T. @ 12A	B	XII
RPT 80-8	80V C.T. @ 8A	40V C.T. @ 16A	B	XIV
RPT 80-12	80V C.T. @ 12A	40V C.T. @ 24A	B	XVI
RPT 88-0.1	88V C.T. @ 0.1A	44V C.T. @ 0.2A	C	III
RPT 88-0.25	88V C.T. @ 0.25A	44V C.T. @ 0.5A	C	IV
RPT 88-0.5	88V C.T. @ 0.5A	44V C.T. @ 1A	C	VI
RPT 88-1	88V C.T. @ 1A	44V C.T. @ 2A	C	VII
RPT 88-2	88V C.T. @ 2A	44V C.T. @ 4A	B	IX
RPT 88-3	88V C.T. @ 3A	44V C.T. @ 6A	B	X
RPT 88-4	88V C.T. @ 4A	44V C.T. @ 8A	B	XI
RPT 88-6	88V C.T. @ 6A	44V C.T. @ 12A	B	XII
RPT 88-8	88V C.T. @ 8A	44V C.T. @ 16A	B	XIV
RPT 88-12	88V C.T. @ 12A	44V C.T. @ 24A	B	XVI
RPT 120-0.1	120V C.T. @ 0.1A	60V C.T. @ 0.2A	C	III
RPT 120-0.25	120V C.T. @ 0.25A	60V C.T. @ 0.5A	C	V
RPT 120-0.5	120V C.T. @ 0.5A	60V C.T. @ 1A	C	VI
RPT 120-1	120V C.T. @ 1A	60V C.T. @ 2A	C	VIII
RPT 120-1.5	120V C.T. @ 1.5A	60V C.T. @ 3A	B	IX
RPT 120-2	120V C.T. @ 2A	60V C.T. @ 4A	B	X
RPT 120-3	120V C.T. @ 3A	60V C.T. @ 6A	B	XI
RPT 120-4	120V C.T. @ 4A	60V C.T. @ 8A	B	XII
RPT 120-6	120V C.T. @ 6A	60V C.T. @ 12A	B	XIV
RPT 120-8	120V C.T. @ 8A	60V C.T. @ 16A	B	XVI
RPT 120-12	120V C.T. @ 12A	60V C.T. @ 24A	B	XVI
RPT 160-0.1	160V C.T. @ 0.1A	80V C.T. @ 0.2A	C	IV
RPT 160-0.25	160V C.T. @ 0.25A	80V C.T. @ 0.5A	C	VI
RPT 160-0.5	160V C.T. @ 0.5A	80V C.T. @ 1A	C	VII
RPT 160-0.75	160V C.T. @ 0.75A	80V C.T. @ 1.5A	C	VIII
RPT 160-1	160V C.T. @ 1A	80V C.T. @ 2A	B	IX
RPT 160-1.5	160V C.T. @ 1.5A	80V C.T. @ 3A	B	X
RPT 160-2	160V C.T. @ 2A	80V C.T. @ 4A	B	XI
RPT 160-4	160V C.T. @ 4A	80V C.T. @ 8A	B	XIV
RPT 160-6	160V C.T. @ 6A	80V C.T. @ 12A	B	XVI
RPT 160-8	160V C.T. @ 8A	80V C.T. @ 16A	B	XVI
RPT 180-0.1	180V C.T. @ 0.1A	90V C.T. @ 0.2A	C	IV
RPT 180-0.25	180V C.T. @ 0.25A	90V C.T. @ 0.5A	C	VI
RPT 180-0.5	180V C.T. @ 0.5A	90V C.T. @ 1A	C	VII
RPT 180-1	180V C.T. @ 1A	90V C.T. @ 2A	B	IX
RPT 180-1.5	180V C.T. @ 1.5A	90V C.T. @ 3A	B	X
RPT 180-2	180V C.T. @ 2A	90V C.T. @ 4A	B	XI
RPT 180-4	180V C.T. @ 4A	90V C.T. @ 8A	B	XIV
RPT 180-6	180V C.T. @ 6A	90V C.T. @ 12A	B	XVI
RPT 180-8	180V C.T. @ 8A	90V C.T. @ 16A	B	XVI
RPT 230-0.1	230V C.T. @ 0.1A	115V C.T. @ 0.2A	C	IV
RPT 230-0.25	230V C.T. @ 0.25A	115V C.T. @ 0.5A	C	VI
RPT 230-0.5	230V C.T. @ 0.5A	115V C.T. @ 1A	C	VIII
RPT 230-0.75	230V C.T. @ 0.75A	115V C.T. @ 1.5A	B	IX
RPT 230-1	230V C.T. @ 1A	115V C.T. @ 2A	B	X
RPT 230-1.5	230V C.T. @ 1.5A	115V C.T. @ 3A	B	XI
RPT 230-2	230V C.T. @ 2A	115V C.T. @ 4A	B	XII
RPT 230-4	230V C.T. @ 4A	115V C.T. @ 8A	B	XVI
RPT 230-6	230V C.T. @ 6A	115V C.T. @ 12A	B	XVI
RPT 300-0.1	300V C.T. @ 0.1A	150V C.T. @ 0.2A	C	V
RPT 300-0.25	300V C.T. @ 0.25A	150V C.T. @ 0.5A	C	VII
RPT 300-0.5	300V C.T. @ 0.5A	150V C.T. @ 1A	B	IX
RPT 300-1	300V C.T. @ 1A	150V C.T. @ 2A	B	XI
RPT 300-2	300V C.T. @ 2A	150V C.T. @ 4A	B	XIV
RPT 300-4	300V C.T. @ 4A	150V C.T. @ 8A	B	XVI

EWC, Inc. reserves the right to make changes without notice in design and specifications in order to effect product improvement.

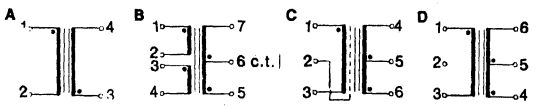
See preceding page for Mechanical Dimensions. NOTE: DRPT also available with 115/230V, 50/60 Hz primary.

EWC® INC. 725 FEDERAL AVENUE, KENILWORTH, NJ 07033
(201) 245-3200 FAX 201 245 8430

Audio and Telephone Coupling Transformers

These audio/matching transformers meet FCC part 68 and feature frequency response of ±0.5 dB from 300-3500 Hz. More specific performance requirements may be met using several standard constructions or let our engineers design a custom unit for your specific application.

SCHEMATICS



MECHANICAL DIMENSIONS

FIG 1

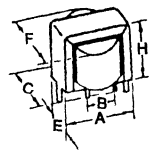


FIG 2

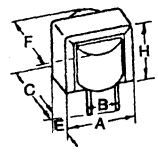
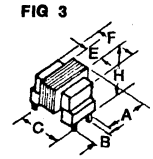


FIG 3



SPECIFICATIONS:

Part Number	Impedance Pri	Impedance Sec	Max. Power	Insert. Loss	DC Current	DC Resist. Pri	DC Resist. Sec	Fig.	Sch.
T6:6A10A	600	600	+7dBm	1.0dB	2mA	55	69	1	A
T6:6A14A	600	600	+6dBm	1.4dB	0mA	60	46	1	A
T6:6A16A	600	600	+7dBm	1.2dB	0mA	52	48	1	A
T6:6A19A	600	600	+7dBm	1.1dB	0mA	35	25	1	A
T15:6A19A	1500	600	+5dBm	1.2dB	0mA	78	67	1	A
T6:6B19A	600	600	0dBm	1.9dB	120mA	69	95	2	A
T6:6B19B	600	600	+9dBm	2.4dB	100mA	65	86	2	B
T6:6C19A	600	600	+7dBm	2.0dB	0mA	35	45	1	A
T6:6D19A	600	600	+9dBm	2.4dB	100mA	65	86	3	A
T6:6C19A01	600	600	+5dBm	3.5dB	80mA	180	75	1	A
T6:6C19C	600	600	+6dBm	1.0dB	10mA	19	26	1	C

MECHANICAL DIMENSIONS:

Case	A	B	C	E	F	R
A10	.415	.160	.330	.165	.435	.335
(mm)	(10.5)	(04.0)	(08.4)	(04.2)	(11.0)	(08.5)
A14	5.70	.230	.470	.215	.525	.435
(mm)	(14.5)	(05.8)	(12.0)	(05.5)	(13.4)	(11.0)
A16	.670	.235	.510	.215	.670	.580
(mm)	(17.0)	(06.0)	(13.0)	(05.5)	(17.0)	(14.7)
A19	.770	.290	.590	.215	.570	.455
(mm)	(19.5)	(07.4)	(15.0)	(05.4)	(14.5)	(11.5)
B19	.770	.375	.420	.225	.690	.690
(mm)	(19.5)	(09.5)	(10.7)	(06.5)	(17.5)	(17.5)
C19	.770	.375	.640	.225	.690	.690
(mm)	(19.5)	(09.5)	(16.3)	(06.5)	(17.5)	(17.5)
D19	.800	.315	.570	.270	.620	.630
(mm)	(20.3)	(08.0)	(14.5)	(06.8)	(15.8)	(16.0)

Wall Plug-in Adapters [Class 2]

FIG. 1

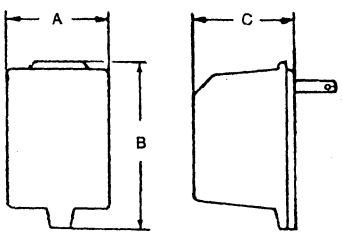
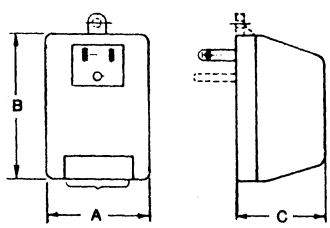
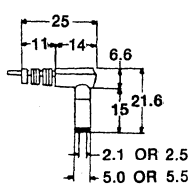


FIG. 2





ALL DIMENSIONS IN MM

The products listed below provide general information about our standard product line. We have many other standard items available as well as custom design and manufacturing capabilities. Please contact our sales or engineering staff at the toll-free number listed below for information on your specific application.

MECHANICAL DIMENSIONS

Series	Figure	Case Size (mm) A	B	C
35	1	43	69	42
41	1	43	69	42
41	2	50	70	40
48	1	54	65	42
48	2	56	82	49

AC OUTPUT MODELS

Model Number	Voltage	Current	Series
A4-900P	4V	900mA	35
A5-700P	5V	700mA	35
A6-700P	6V	700mA	35
A8-500P	8V	500mA	35
A12-400P	12V	400mA	35
A24-200P	24V	200mA	35
A4-1000P	4V	1000mA	41
A8-1000P	8V	1000mA	41
A12-1000P	12V	1000mA	41
A18-600P	18V	600mA	41
A24-500P	24V	500mA	41
A27-400P	27V	400mA	41
A6-3000P	6V	3000mA	48
A8-2400P	8V	2400mA	48
A12-1600P	12V	1600mA	48
A16-1200P	16V	1200mA	48
A24-800P	24V	800mA	48
A27-700P	27V	700mA	48

DC OUTPUT MODELS

Model Number	Voltage	Current	Series
D3-500P	3V	500mA	35
D6-500P	6V	500mA	35
D9-300P	9V	300mA	35
D12-200P	12V	200mA	35
D15-200P	15V	200mA	35
D24-100P	24V	100mA	35
D4-1000P	4.5V	1000mA	41
D6-1000P	6V	1000mA	41
D9-600P	9V	600mA	41
D12-500P	12V	500mA	41
D15-400P	15V	400mA	41
D24-200P	24V	200mA	41
D6-1100P	6V	1100mA	48
D8-1100P	8V	1100mA	48
D12-1100P	12V	1100mA	48
D15-900P	15V	900mA	48
D18-800P	18V	800mA	48
D24-600P	24V	600mA	48

EWC, Inc. reserves the right to make changes without notice in design and specifications in order to effect product improvement.

725 FEDERAL AVENUE, KENILWORTH, NJ 07033
(201) 245-3200 FAX 201 245 8430

Power Transformers

400 Hz Miniature

ELECTRICAL SPECIFICATIONS

Primary voltage [1-2] = 115V ±10%
400 Hz ±5%

Secondary Voltage ±3% with [1-2] = 115V 400 Hz and delivering rated load. [Range 5 to 300V]

Dielectric strength 2.8 x max working voltage

See table for balance of specifications.

PHYSICAL SPECIFICATIONS

Size—sizes for standard VA ratings are given in Table.
Construction: Grade 5, Class S per MIL-T-27.

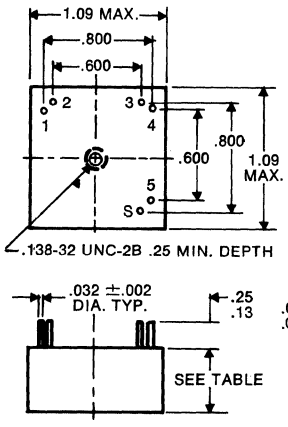
VA Rating	Package Size	Height Max	Reg. Max %	△t Max °C	Weight Max oz
1.5	1.09 sq.	0.47	23	17	.85
1.5S	1.09 sq.	0.59	18	17	1.10
3.0	1.09 sq.	0.59	18	20	1.10
3.0S	1.09 sq.	0.78	12	20	1.65
6.0	1.09 sq.	0.78	12	25	1.65
6.0S	1.09 sq.	1.03	10	25	2.20
9.0	1.09 sq.	1.03	10	30	2.20
9.0S	1.40 sq.	0.97	8	32	3.40
16	1.40 sq.	0.97	8	32	3.40
25	1.40 sq.	1.20	7	45	4.40

HOW TO ORDER

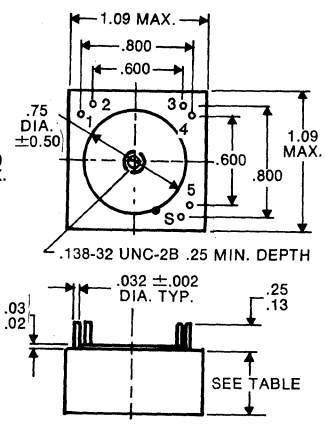
M 1.5 A 26 TS

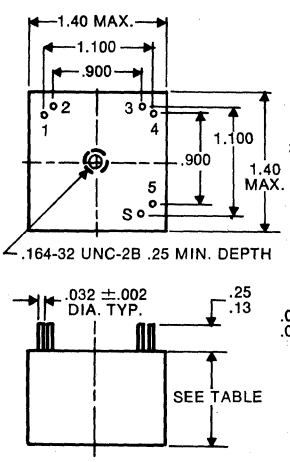
- Series Designation
- VA rating [1.5 to 25VA]
- Package style [A or B]
- Secondary voltage [5 to 300V]
- Schematic [X, T, XS or TS]

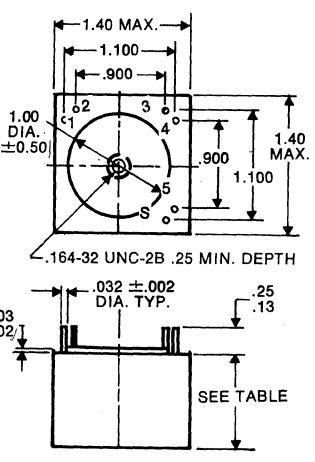
PACKAGE STYLE A



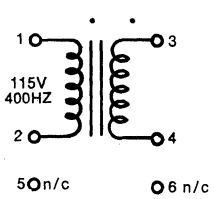
PACKAGE STYLE B



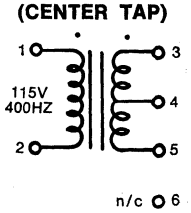




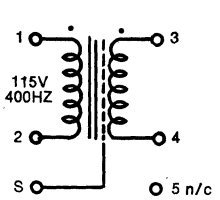
SCHEMATIC "X"



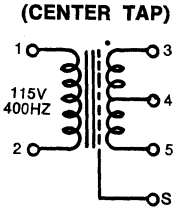
SCHEMATIC "T" (CENTER TAP)



SCHEMATIC "XS"



SCHEMATIC "TS" (CENTER TAP)



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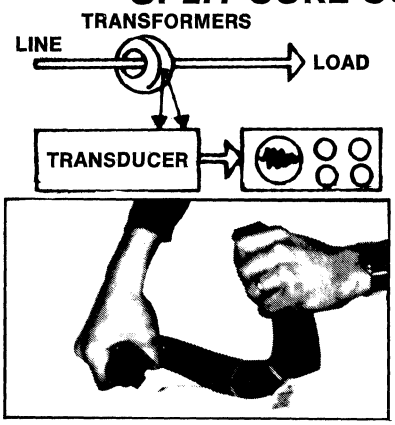
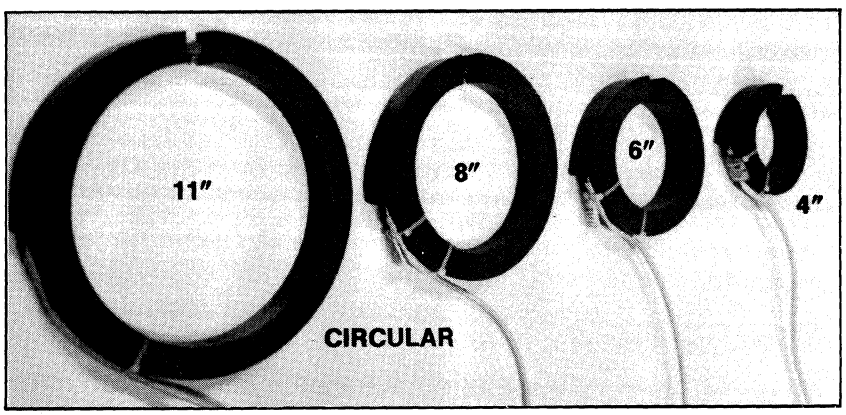
FLEX-CORE DIV.
MORLAN & ASSOCIATES, INC.
6625 McVey Blvd., Worthington, OH 43235
FAX (614) 876-8538 (614) 889-6152

ENERGY MONITORING EQUIPMENT

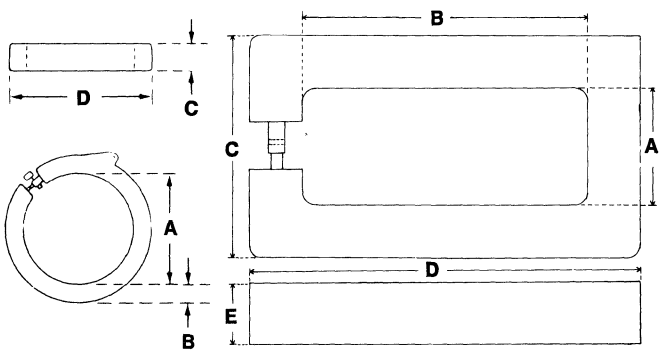
SPLIT CORE CURRENT (INSTRUMENT) TRANSFORMERS





Four models are available for round conductors plus one for buss bars. Use with any 5 Amp indicating or recording ammeter or with an Amp or Watt transducer. The flexible core is made of directional silicon steel. The secondary windings are copper wire. Encapsulation is silicon rubber to protect against moisture, dirt, oil and corona. Remains flexible from −45° to +200°C. Insulation level is 600 Vac and can be used over insulated conductors at higher voltages. Frequency: 50-60 Hz. Safety Factor: Secondary voltage is limited to less than 40 Vac when secondary leads are open. An electronic voltage clamp holds secondary voltage to less than 1 Volt when open circuit voltage exceeds 40 Vac. Transformer is red and secondary leads are yellow with spade connectors.

CIRCULAR **RECTANGULAR**

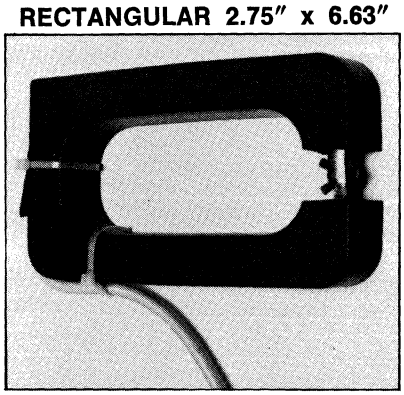


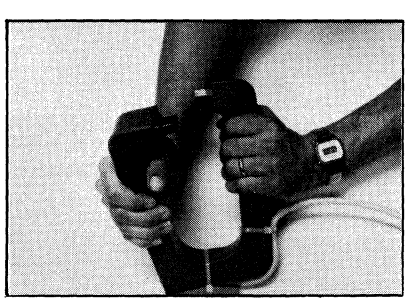
SPECIFICATIONS

Dimensions—Inches					
	4" I.D.	6" I.D.	8" I.D.	11" I.D.	Rectangular
"A"	4.00	6.00	8.00	11.00	2.75
"B"	1.25	1.25	1.25	1.25	6.63
"C"	1.50	1.50	1.50	1.50	5.50
"D"	6.50	8.50	10.50	13.50	9.38
"E"					1.50
Average Weight—Lbs					
	3.50	4.25	5.50	7.50	4.25

Current Ratio	Circular				Rect	Burden VA	Accuracy	Thrml Factor
	4"	6"	8"	11"	2.75x6.63			
200/5	X					2	4%	1.25
250/5	X					2	4%	1.25
300/5	X	X				2	4%	1.25
400/5	X	X				2	3%	1.25
500/5	X	X			X	3	3%	1.25
600/5	X	X			X	3	2%	1.25
800/5	X	X			X	5	2%	1.50
1000/5	X	X			X	10	2%	2.00
1200/5	X	X			X	10	2%	2.00
1500/5	X	X	X		X	10	2%	2.00
2000/5	X	X	X		X	10	2%	2.00
2500/5		X	X		X	10	2%	2.00
3000/5		X	X	X	X	10	2%	1.50
3500/5		X	X	X	X	10	2%	1.50
4000/5		X	X	X	X	10	2%	1.25
5000/5		X	X	X	X	10	2%	1.25
6000/5			X	X		10	2%	1.25

RECTANGULAR 2.75" x 6.63"





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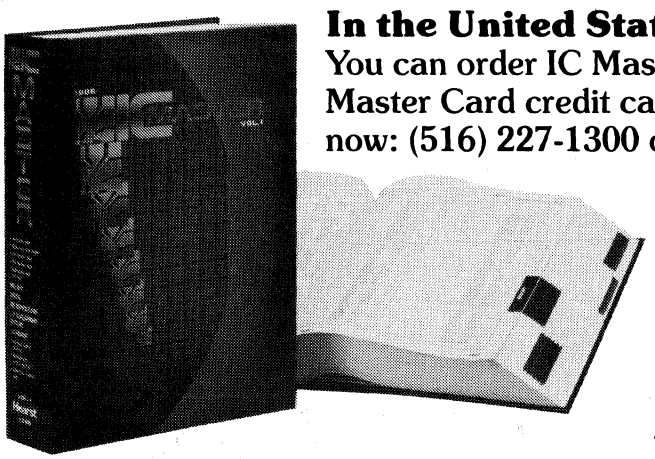

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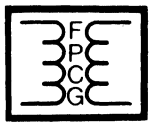

Foxboro Power Components Group

If your business is involved with the processing of oil...petroleum products... food...chemicals...paper...pharmaceuticals...energy...pure water...or almost anything else, you already know The Foxboro Company. Since 1908, processors have depended on Foxboro for ultra-reliable instruments and systems that can stand up to continuous use in the most demanding applications and process environments.

The Foxboro Power Components Group designs and produces transformers for use in Foxboro process control equipment. We can also provide other manufacturers of high-quality electronic equipment, like yourselves, with a full line of standard and custom transformers. Transformers that are engineered and built to tough Foxboro standards.

Why buy your transformers from us?

To make us the most modern transformer production facility in the country, The Foxboro Company has invested hundreds of thousands of dollars in the world's most sophisticated automated production and test equipment.

The automated equipment gives us the capability to produce even more transformers than The Foxboro Company's numerous manufacturing divisions require.

This situation creates an excellent opportunity for you to save money.

Foxboro/PCG can provide you with some of the best transformers you'll find anywhere. At prices that meet, or typically beat, what you're currently paying.

Foxboro has also made a serious commitment in the technical support, engineering, and design areas. As a result, no matter how extensive your needs, Foxboro/PCG can provide you with in-depth application assistance and custom design support.

Transformer Cross-Reference Chart

Foxboro	Signal	Foxboro	Signal	Foxboro	Signal
TPH 2AS/2AD-10	ST/DST 2-10	TPH 5AS/5AD-10	ST/DST 5-10	TPV 3AS/3AD-010	PC/DPC-10-120
TPH 2AS/2AD-12	ST/DST 2-12	TPH 5AS/5AD-12	ST/DST 5-12	TPV 3AS/3AD-012	PC/DPC-12-100
TPH 2AS/2AD-16	ST/DST 2-16	TPH 5AS/5AD-16	ST/DST 5-16	TPV 3AS/3AD-016	PC/DPC-16-75
TPH 2AS/2AD-20	ST/DST 2-20	TPH 5AS/5AD-20	ST/DST 5-20	TPV 3AS/3AD-020	PC/DPC-20-60
TPH 2AS/2AD-24	ST/DST 2-24	TPH 5AS/5AD-24	ST/DST 5-24	TPV 3AS/3AD-024	PC/DPC-24-50
TPH 2AS/2AD-28	ST/DST 2-28	TPH 5AS/5AD-28	ST/DST 5-28	TPV 3AS/3AD-028	PC/DPC-28-40
TPH 2AS/2AD-36	ST/DST 2-36	TPH 5AS/5AD-36	ST/DST 5-36	TPV 3AS/3AD-034	PC/DPC-34-35
TPH 2AS/2AD-48	ST/DST 2-48	TPH 5AS/5AD-48	ST/DST 5-48	TPV 3AS/3AD-040	PC/DPC-40-30
TPH 2AS/2AD-56	ST/DST 2-56	TPH 5AS/5AD-56	ST/DST 5-56	TPV 3AS/3AD-056	PC/DPC-56-20
TPH 2AS/2AD-120	ST/DST 2-120	TPH 5AS/5AD-120	ST/DST 5-120	TPV 3AS/3AD-120	PC/DPC-120-10
				TPV 3AS/3AD-230	N/A
TPH 3AS/3AD-10	ST/DST 3-10	TPH 6AS/6AD-10	ST/DST 6-10	TPV 4AS/4AD-010	PC/DPC-10-440
TPH 3AS/3AD-12	ST/DST 3-12	TPH 6AS/6AD-12	ST/DST 6-12	TPV 4AS/4AD-012	PC/DPC-12-350
TPH 3AS/3AD-16	ST/DST 3-16	TPH 6AS/6AD-16	ST/DST 6-16	TPV 4AS/4AD-016	PC/DPC-16-260
TPH 3AS/3AD-20	ST/DST 3-20	TPH 6AS/6AD-20	ST/DST 6-20	TPV 4AS/4AD-020	PC/DPC-20-220
TPH 3AS/3AD-24	ST/DST 3-24	TPH 6AS/6AD-24	ST/DST 6-24	TPV 4AS/4AD-024	PC/DPC-24-180
TPH 3AS/3AD-28	ST/DST 3-28	TPH 6AS/6AD-28	ST/DST 6-28	TPV 4AS/4AD-028	PC/DPC-28-160
TPH 3AS/3AD-36	ST/DST 3-36	TPH 6AS/6AD-36	ST/DST 6-36	TPV 4AS/4AD-034	PC/DPC-34-125
TPH 3AS/3AD-48	ST/DST 3-48	TPH 6AS/6AD-48	ST/DST 6-48	TPV 4AS/4AD-040	PC/DPC-40-110
TPH 3AS/3AD-56	ST/DST 3-56	TPH 6AS/6AD-56	ST/DST 6-56	TPV 4AS/4AD-056	PC/DPC-56-80
TPH 3AS/3AD-120	ST/DST 3-120	TPH 6AS/6AD-120	ST/DST 6-120	TPV 4AS/4AD-120	PC/DPC-120-35
				TPV 4AS/4AD-230	N/A
TPH 4AS/4AD-10	ST/DST 4-10			TPV 5AS/5AD-010	PC/DPC-10-1000
TPH 4AS/4AD-12	ST/DST 4-12			TPV5AS/5AD-012	PC/DPC-12-800
TPH 4AS/4AD-16	ST/DST 4-16			TPV 5AS/5AD-016	PC/DPC-16-640
TPH 4AS/4AD-20	ST/DST 4-20	Modifications to primary or secondary		TPV 5AS/5AD-020	PC/DPC-20-500
TPH 4AS/4AD-24	ST/DST 4-24	voltages and current ratings for		TPV 5AS/5AD-024	PC/DPC-24-450
TPH 4AS/4AD-28	ST/DST 4-28	TPH/TPV series are available upon		TPV 5AS/5AD-028	PC/DPC-28-360
TPH 4AS/4AD-36	ST/DST 4-36	request.		TPV 5AS/5AD-034	PC/DPC-34-300
TPH 4AS/4AD-48	ST/DST 4-48			TPV5AS/5AD-040	PC/DPC-40-250
TPH 4AS/4AD-56	ST/DST 4-56			TPV 5AS/5AD-056	PC/DPC-56-180
TPH 4AS/4AD-120	ST/DST 4-120			TPV 5AS/5AD-120	PC/DPC-120-85
				TPV 5AS/5AD-230	N/A

Foxboro Power Components Group
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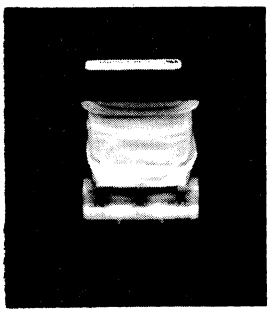
FOXBORO

Transformers

Series TPV Vertical PC Board Transformers



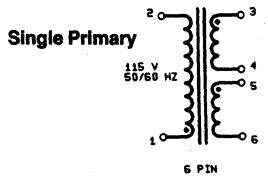
Recognized Component
Underwriters Labs Inc.

Table 1: Size/VA Rating

Code	Size	Nonimal VA Rating
3A	3	1.2
4A	4	4.4
5A	5	10.0

Table 2: Primary Configuration

Code	Description
S	Single primary, 6 pin, 115 V, 50/60 Hz
D	Dual primary, 8 pin, 115/230 V, 50/60 Hz



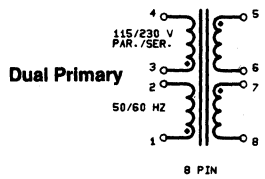


Table 3: Secondary Voltages

Code	Series	Parallel
010	10.0 VC.T.	5.0 V
012	12.6 VC.T.	6.3 V
016	16.0 VC.T.	8.0 V
020	20.0 VC.T.	10.0 V
024	24.0 VC.T.	12.0 V
028	28.0 VC.T.	14.0 V
034	34.0 VC.T.	17.0 V
040	40.0 VC.T.	20.0 V
056	56.0 VC.T.	28.0 V
120	120.0 VC.T.	60.0 V
230	230.0 VC.T.	115.0 V

Series TPH Horizontal PC Board Transformers

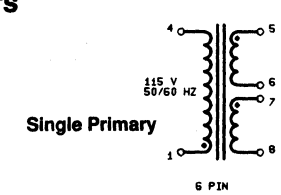
Recognized Component
Underwriters Labs Inc.

Table 1: Size/NA Rating

Code	Size	Nominal VA Rating
2A	2	1.1
3A	3	2.4
4A	4	6.0
5A	5	12.0
6A	6	20.0

Table 2: Primary Configuration

Code	Description
S	Single primary, 6 pin, 115 V, 50/60 Hz
D	Dual primary, 8 pin, 115/230 V, 50/60 Hz



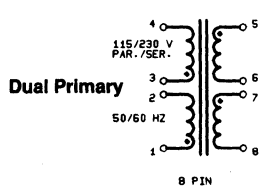


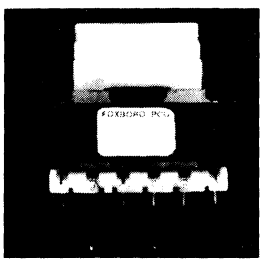
Table 3: Secondary Voltages

Code	Series	Parallel
010	10.0 VC.T.	5.0 V
012	12.6 VC.T.	6.3 V
016	16.0 VC.T.	8.0 V
020	20.0 VC.T.	10.0 V
024	24.0 VC.T.	12.0 V
028	28.0 VC.T.	14.0 V
036	36.0 VC.T.	18.0 V
048	48.0 VC.T.	24.0 V
056	56.0 VC.T.	28.0 V
120	120.0 VC.T.	60.0 V

Foxboro Power Components Group
East Bridgewater, MA 02333
1-800-422-1107 (In MA, call: 1-508-378-5260)

FOXBORO

Series TPHM Custom Horizontal PC Board Transformers



Series TPHM Custom PC Board Transformers offer the quality and application versatility you're looking for—at an extremely attractive price.

- All feature 130°C maximum operating temperature insulations for extended (20,000 hour continuous) service life.
- Audio and higher frequency range up to 500 kHz.
- Dielectric strengths up to 2500 V RMS hipot, primaries to secondaries are available. Higher strengths can also be specified, where required.
- Withstands shock and vibration up to and including Seismic design and qualification.
- Possible configurations include single, dual, or multitapped primaries and, multitapped secondaries to fit your exact application.
- Up to 12 terminal pins for electrical flexibility and mechanical integrity.

TABLE 1: Size Code, Typical 50/60 Hz VA Rating, and Nominal Dimensions

Lam Size	Core Stack	Size Code	Typical 50/60 Hz Output VA Limits	No. Pins	Bobbin Length K	Core Length L	Core Width W	Overal Height H	Pin Row Cntrs C	Typ Pin Cntrs D	Pin 1-2 Cntrs E	Pin Length M	Pin Side Extnsn. N	Weight in lbs.
EI-187	0.188	1A	0.050	8	0.750	0.750	0.625	0.665	0.510	0.200	0.150	0.172	0.094	0.03
EE-2425	0.250	2A	0.200	10	1.030	1.000	0.750	0.840	0.620	0.200	0.150	0.172	0.125	0.06
*EI-375	0.375	3A	1.0	12	1.470	1.375	1.125	1.040	0.860	0.200	0.150	0.172	0.109	0.18
*EI-21	0.500	4A	3.2	12	1.620	1.625	1.312	1.230	0.950	0.250	0.200	0.187	0.109	0.31
*EI-625	0.625	5A	7.7	12	1.750	1.875	1.563	1.430	1.100	0.300	0.200	0.187	0.125	0.54
EI-75	0.750	6A	16.0	12	1.750	2.250	1.875	1.540	1.300	0.300	0.200	0.141	0.125	0.87
EI-75	0.875	7A	21.7	12	1.750	2.250	1.875	1.670	1.300	0.300	0.200	0.141	0.125	1.02
EI-75	1.000	8A	28.3	12	1.750	2.250	1.875	1.790	1.300	0.300	0.200	0.141	0.125	1.14

*Alternate sizes available to meet intermediate height requirements and VA ratings.

Notes:
1 Size 6A, 7A, & 8A Have 2 Mtg. Holes On 1.5 inch Centers With #4 Screw Clearance.
2 Varnish Coating Will Typically Add 0.006 inch To Size Dimensions.

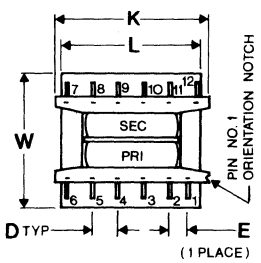
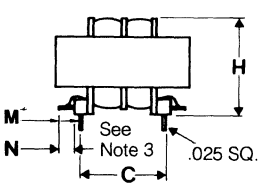


TABLE 2: Size Code, Typical Ferrite Core Hi-Frequency Transformers, and Nominal Dimensions

Ferrite Core	Core Stack	Size Code	Typical Output VA Limits	No. Pins	Bobbin Length K	Core Length L	Core Width W	Overal Height H	Pin Row Cntrs C	Typ Pin Cntrs D	Pin 1-2 Cntrs E	Pin Length M	Pin Side Extnsn. N	Weight in lbs.
EE-187	0.188	1F	Depends	8	0.750	0.750	0.625	0.665	0.510	0.200	0.150	0.172	0.094	0.03
EE-2425	0.250	2F	on	10	1.030	1.000	0.750	0.840	0.620	0.200	0.150	0.172	0.125	0.06
EE-375	0.375	3F	Freq.	12	1.470	1.375	1.125	1.040	0.850	0.200	0.150	0.172	0.109	0.14
EE-21	0.500	4F	and	12	1.750	1.625	1.312	1.230	0.950	0.250	0.200	0.187	0.109	0.23
EE-625	0.625	5F	circuit	12	1.750	1.875	1.563	1.430	1.100	0.300	0.200	0.187	0.125	0.39
EE-75	0.750	6F	used.	12	1.760	2.250	1.875	1.540	1.300	0.300	0.200	0.141	0.125	0.61

Notes:
1 Size 6F Has 2 Mtg. Hold On 1.5 inch Centers With #4 Screw Clearance.
2 Varnish Coating Will Typically Add 0.006 inch to Size Dimensions.



H dimension of sizes 1, 2, 3, 4, and 5 includes 0.040 standoffs but are available without standoffs if necessary. Sizes 6, 7, and 8 are without standoffs.

Primary Configurations

S Single Primary; 100, 115, 120, 220, 230, or 240 V; 50/60 Hz

D Dual Primary; 115/230 V or 120/240 V; 50/60 Hz

M Multitapped Primary, up to 5 input voltages

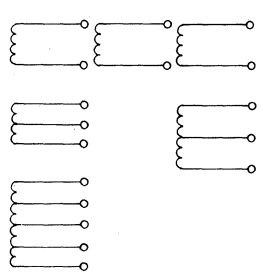
F Audio and Higher Frequency Range up to 500 kHz

Secondary Configurations

Individual Outputs Up to 3

2 Tapped Outputs

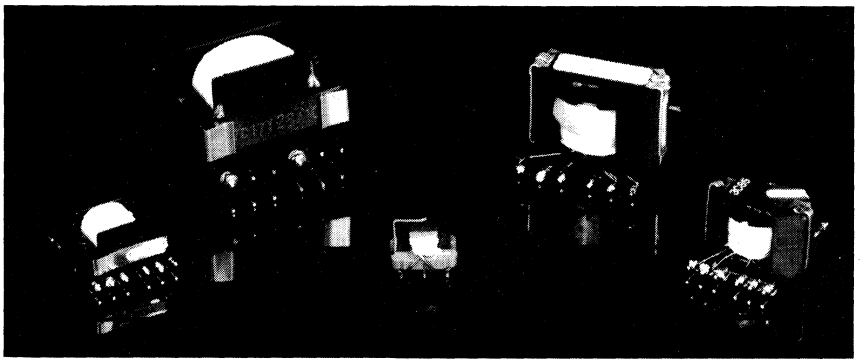
Multitapped Outputs Up to 4



Foxboro Power Components Group
East Bridgewater, MA 02333
1-800-422-1107 (In MA, call: 1-508-378-5260)

FOXBORO

Surface Mount Transformers for Power Conversion and Signal Processing



- All feature 130°C maximum operating temperature insulations for extended (20,000 hour continuous) service life.
- Frequency range up to 500 kHz.
- Dielectric strengths up to 1500 V RMS hipot, primaries to secondaries are available. Higher strengths can also be specified, where required.
- Withstands shock and vibration up to and including Seismic design and qualification.
- Bottom surface of pins coplaner within 0.004 inch for surface mount per industry standards.
- Use surface mount pads 0.010 inch beyond each side of pins.
- Up to 12 terminal pins for electrical flexibility and mechanical integrity.

The following surface-mounted transformers are representative of the design and manufacturing capabilities of the Foxboro/PCG. Please consult our design engineering team when choosing the specific bobbin configuration for your application.

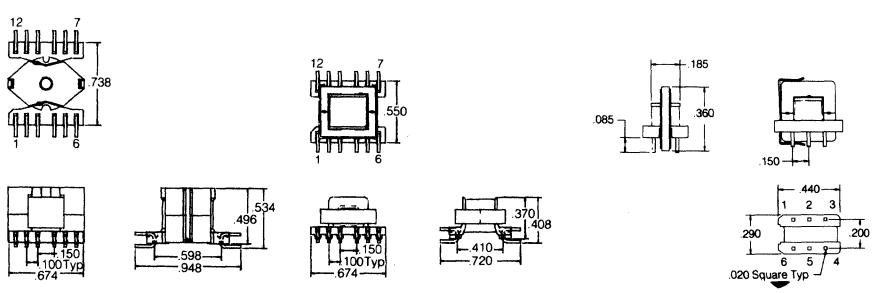
Part No.	Type	Description
BO186QT	Transformer, Converter	For 18 Watt dc-dc converter 18-40 V dc source. 325 kHz P.W. Modulated +12 V, 100 mA (Aux. Output) +12 V 560 mA output. +5, 2 0 A Output. (Used with Cross Coupled Inductor BO187AP)
SF100AF	Transformer, Flyback	For 100 kHz 5 Watt dc-dc Converter 5.0 V dc Source +8.5 V dc, 0.3 A dc output, -8.5 V dc, 0.3 A dc output.
BO186CE	Transformer, Current	1:30 Ratio. 0 to 1.2 A ac 50 to 325 kHz.

Representative Samples
(Other Configurations Are Available)

Gull Wing Mount
P/N BO186QT
Size: RM6S

Gull Wing Mount
P/N SF100AF
Size : EE-125

Butt Mount
P/N BO186CE
Size: EE-075



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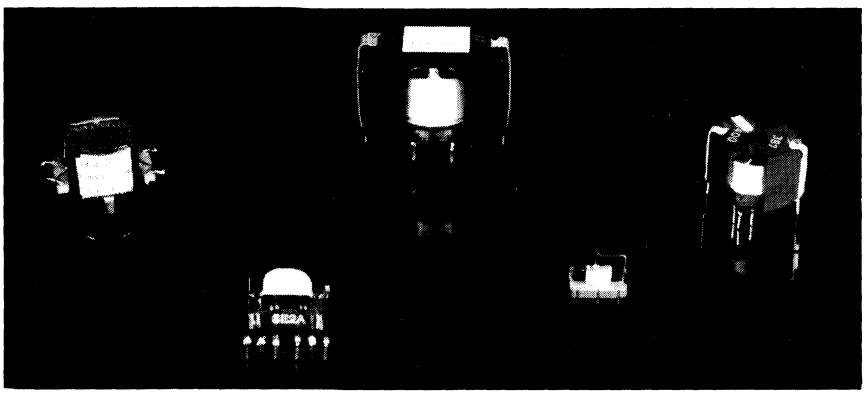
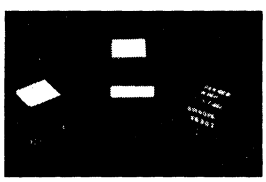
FOXBORO

Custom High Frequency Transformers for PC Board Applications



Open-style high frequency transformers and inductors for signal processing and power conversion.



Encapsulated high frequency transformers and inductors for signal processing and power conversion.

Depend on the magnetics specialists at the Foxboro Power Components Group for the right custom transformers for your specialized applications.

No matter how demanding your requirements, we can provide ultrahigh quality custom transformers that meet your application.

Foxboro custom transformers are available with operating frequencies from 10 kHz to 500 kHz. Possible configurations include RM, Pot, E, EC, and ETD Cores, plus surface-mounted units. Encapsulation is available for harsh environments.

If necessary, our experienced engineering staff can design transformers specifically for your application. By using the latest Computer-Aided Engineering and Design techniques, and employing a unique "team approach" to magnetics problem-solving, our engineers can speed the design process to help keep costs down.

Applications where we have extensive design experience include:

- power supplies using flyback, feedforward, push-pull, and half- or full-bridge circuits
- communications equipment
- instrumentation
- test equipment
- computing equipment

High frequency, high power transformers for off-line switching power supplies.

Examples of Custom Designs

1. For a 1.4 W dc-to-dc converter, we designed a unit on an RM Core with 23.3 V input and a switching frequency of 80 kHz, dual full-wave center tap output to give a +12 V at 90 mA and -12 V at 25 mA, and pass a 2500 V surge withstand.

2. For a 30 V to 250 V 2 W dc-to-dc converter, we designed on an RM Core a unit with 29.1 V input and a switching frequency of 46.4 kHz. Auxiliary output is a 3.50 V full-wave center tap at 1.2 mA. Main output provides 252 V at 8 mA into a full-wave bridge and a capacitor input filter.

3. For a 15 W dc-to-dc converter, we designed on a small EE Core a unit with a primary circuit of 17.0 V push-pull and a switching frequency of 327 kHz. Two outputs provide 5.63 V at 2.0 A, full-wave center tap into an inductive filter, and 12.75 V at 0.4 A, full-wave center tap into an inductive filter.

4. For use in off-line rectified 125 kHz switching 150 W to 190 W power supplies, we designed a series of transformers and inductors on an EC Series ferrite core. Transformer and power MOSFET circuits are fed with line-derived 200 V dc mimimum to 375 V dc maximum bus. The single dc output supplies in the series were for 5 V 30 A, 12 V 6 A, 15 V 10 A, 24 V 8 A, and 28 V 6 A dc.

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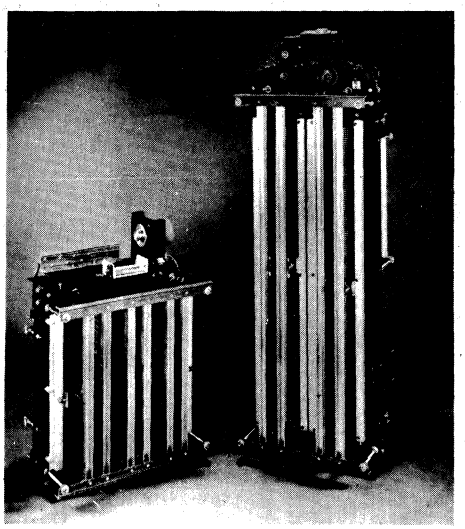
FOXBORO

25 YEARS OF SERVICE

Hipotronics

POWER PRODUCTS DIVISION



ELECTRICAL FEATURES

- NO SHORTED TURNS
- 1-3% IMPEDANCE
- NO THREE-PHASE IMBALANCE
- 15 TIMES OVERLOAD CAPABILITY
- CONTINUOUSLY ADJUSTABLE OUTPUT
- LINE ISOLATION AVAILABLE
- 25% AND 100% STEP-UP AVAILABLE

MECHANICAL FEATURES

- STANDARD SINGLE OR THREE-PHASE CORE
- EPOXY ENCAPSULATED COIL FACE
- PLATED COIL TAPS/TURNS
- SLIDING COPPER CONTACTS
- SINGLE CORE ASSEMBLY UP TO 240 AMPS
- LESS SIZE AND WEIGHT THAN COMPETITION
- CLASS H, HIGH TEMPERATURE COPPER WIRE
- UPPER LIMIT, LOWER LIMIT, AND ZERO START MICRO SWITCHES
- MOTORIZED CONTROL; FIXED OR VARIABLE SPEED

The patented Peschel Variable Transformer is a linearly wound, continuously adjustable auto-transformer. A sliding copper contact traverses the coil face to provide variable voltage control.

The PVT can provide **variable ac voltage from 240V to 13.8 kV**, one or three phase and variable **dc voltage from 300V to 40 kV.** Flexibility in design enables the PVT to meet varied applications. Applications include: primary voltage control of high voltage and high current power supplies; ac or dc test equipment; motor, furnace and oven control; industrial and laboratory use; line stabilization; transformer testing; and much more.

SERVING APPLICATIONS NEVER BEFORE POSSIBLE WITH A VARIABLE TRANSFORMER

AC VARIABLE TRANSFORMERS

480 Volt Input, Three Phase, Delta Connected

	KVA	Amps	Model
0-600 V Output	216	120	30A48-60D12
	324	180	60A48-60D18
	432	240	60A48-60D24
0-960 V Output	346	120	30A48-96D12
	518	180	60A48-96D18
	691	240	60A48-96D24

240 Volt Input, Three Phase, Wye Connected

	KVA	Amps	Model
0-300 V Output	31	60	30A24-30Y6
	46	90	30A24-30Y9
	62	120	30A24-30Y12
	93	180	30A24-30Y18
	124	240	30A24-30Y24
	187	360	30A24-30Y36
0-480 V Output	50	60	30A24-48Y6
	75	90	30A24-48Y9
	100	120	30A24-48Y12
	150	180	30A24-48Y18
	200	240	30A24-48Y24
	300	360	30A24-48Y36

480 Volt Input, Three Phase, Wye Connected

	KVA	Amps	Model
0-600 V Output	62	60	30A48-60Y6
	94	90	30A48-60Y9
	125	120	30A48-60Y12
	187	180	60A48-60Y18
	249	240	60A48-60Y24
	374	360	60A48-60Y36
0-960 V Output	150	90	30A48-96Y9
	200	120	30A48-96Y12
	299	180	60A48-96Y18
	399	240	60A48-96Y24
	599	360	60A48-96Y36

240 Volt Input, Single Phase

	KVA	Amps	Model
0-300 V Output	27	90	30A24-30S9
	36	120	30A24-30S12
	54	180	30A24-30S18
	72	240	30A24-30S24
	108	360	30A24-30S36
	144	480	30A24-30S48
0-480 V Output	43	90	45A24-48S9
	57	120	45A24-48S12
	86	180	45A24-48S18
	115	240	45A24-48S24
	173	360	45A24-48S36
	230	480	45A24-48S48

480 Volt Input, Single Phase

	KVA	Amps	Model
0-600 V Output	54	90	30A48-60S9
	72	120	30A48-60S12
	108	180	30A48-60S18
	144	240	30A48-60S24
	216	360	30A48-60S36
0-960 V Output	86	90	60A48-96S9
	115	120	60A48-96S12
	173	180	60A48-96S18
	230	240	60A48-96S24
	346	360	60A48-96S36

HIPOTRONICS, INC. • POWER PRODUCTS DIV. • P.O. DRAWER W • MILLERTON, NY 12546 • PHONE: 518-789-6464 • FAX: 518-789-4866 • TLX-6716516-HIPOMIL

VARIABLE TRANSFORMER

DESIGN HISTORY

Variable Transformers have been built for over 50 years by many companies around the world. There are two basic designs of electromechanical variable tranformers, linear and toroidal. The linear variable transformer is constructed in a vertical, or linear manner while the toroidal is constructed on a ring core, or "donut." The toroidal variable tranformer is the most common device used.

They are both single layer windings on a laminated steel core. The turns on one face of the coil are exposed. A carbon brush traverses the coil face to provide for voltage adjustment. In order to provide continuous, noninterrupted output voltage, the carbon brush must contact the next turn before leaving the previous turn. This creates a shorted turn condition. When the two turns, at different voltages, are bridged, or shorted, a circulating current results. This current, flowing through the shorted wire loop and carbon brush, creates heat. This heat must be dissipated through the coil and brush holder. This inherent design flaw severely limits the capability of these devices. To build a toroidal variable transformer capable of commutating greater than their limit of 8 kVA of power, would require larger wire sizes and more brushes. Both of these changes would increase the short circuit current, thus rendering such a device impossible, without extravagant heat sinks, forced air, or oil cooling.

In order to use the devices for applications greater than 8 kVA single-phase or 29 kVA three-phase, it becomes necessary to multi-stack or "gang" many core/coil assemblies in a series/parallel configuration. This becomes not only cumbersome, but also less reliable due to the multiple brush and motor drive system required. Serviceability is also difficult with such a "mechanical monster."

Other variable voltage control devices designed for high power voltage control, above 100 kVA, have other design or operational flaws. These devices sacrifice efficiency, size and weight, waveform purity, power factor, and/or cost.

What the industry needed was a variable autotransformer, which is the most efficient variable voltage device, that is smaller, lighter, more reliable, easy to service and reasonably priced.

THE PESCHEL SOLUTION

Having tried every device available, Hipotronics sought to design the perfect voltage control device. What had to be done was to design a variable transformer that eliminated the shorted turn problem. The result of our efforts was the **PESCHEL VARIABLE TRANFORMER.**

Having eliminated the short circuited turn problem, through our patented diode switching technique, it is now possible to build a variable tranformer capable of commutating greater kVAs and voltages than ever before possible. Most PVTs are constructed on a standard single-phase or three-legged, three-phase core. With no series or paralleling of core/coil assemblies necessary (most models), the PVT is generally smaller, lighter, more efficient and more reliable than any other means of variable voltage control.

Construction in a linear fashion affords greater design flexibility; core size, wire size, winding length. This allows for the design and construction of almost any kVA or MVA and any voltage, **enabling the PVT to be used in applications previously impossible with other variable transformers.**

DESIGN

The Peschel Variable Transformer is a continuously adjustable autotransformer. It is constructed of copper coils wound on a linear, laminated steel core. One face of the coil is epoxy encapsulated, then sanded to expose the turns. The exposed coil turns, or taps, are then plated. Each coil is wound in such a fashion as to expose two separate tracks of turns; one track of all the odd turns, the other even. Each track is traversed by a sliding copper contact. The sliding contacts are thinner than the distance between adjacent turns of the same track, thus not shorting the turns. Between the contacts is a series of back-to-back diodes. Using the diodes solely for their forward voltage drop (FVD), the voltage required across the diode before it will conduct current, and maintaining transformer volts per turn less than the total FVD, essentially no current can circulate between the two contacts. As the contacts traverse the coil, the current flow to the load alternates between contacts, depending upon which turn of the transformer is being used, odd or even.

This patented method provides for continuous voltage control with no shorted turns.

PESCHEL VARIABLE TRANSFORMER

Hipotronics

USES:
DC Motor Speed Controller
Chemical Processes
Electro-Magnets
Electropainting

ADVANTAGES:
No Electronics
No Waveshape Chopping
No Effect on Power Factor
No EMI
Same Ripple, Any Voltage

DC VARIABLE TRANSFORMERS

DC Output, Insulated Primary, Three Phase, Full Wave Bridge

Output Voltage	Amps	KW	Model	Input Voltage
300	50	15	D30A24P-30Y5	240
500	50	25	D30A24P-50Y5	240
750	50	30	D30A24P-750Y5	240
1000	50	50	D60A24P-100Y5	240
2500	50	125	D60A48P-250Y5	480
5000	50	250	D60A48P-500Y5	480
10000	50	500	D60A48P-1000Y5	480
20000	50	1000	D60A416P-2000Y5	4160
40000	50	2000	D60A416P-4000Y5	4160

Output Voltage	Amps	KW	Model	Input Voltage
300	90	27	D30A24P-30Y9	240
500	90	45	D30A24P-50Y9	240
750	90	67.5	D30A24P-750Y9	240
1000	90	90	D60A24P-100Y9	240
2500	90	225	D60A48P-250Y9	480
5000	90	450	D60A48P-500Y9	480
10000	90	900	D60A48P-1000Y9	480
20000	90	1800	D60A416P-2000Y9	4160
40000	90	3600	D60A416P-4000Y9	4160

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25 YEARS OF SERVICE

Hipotronics

HIGH VOLTAGE TRANSFORMERS "RM" SERIES

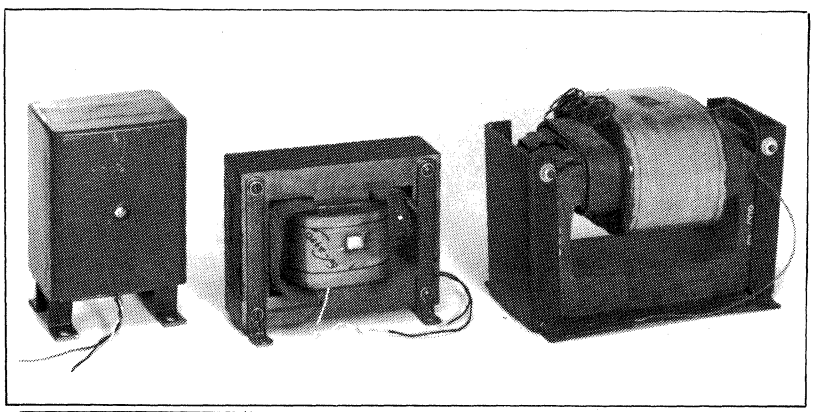
Hipotronics RM Series of high voltage transformers are designed for both air and oil environments. Models RM-17-3, RM 21-3 & RM 25-3 are manufactured for oil environment only.

Models RM 6-1, RM 7-1, RM 8-1, RM 9-1 and RM 10-1 are epoxy cast by special request.

TECHNICAL DATA

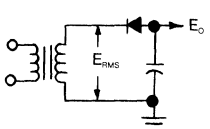
INPUT—117 VOLTS AC
FREQUENCY—TYPE A&C—50/60 Hz TYPE B—60 Hz
OUTPUT CURRENT—15mA AT RATED RMS OUTPUT.

Model Number	Type	Secondary Volts	Half Wave Rectifier (5 mA)	Full Wave Bridge (10 mA)	Full Wave Doubler (5 mA)	Secondary VA	Insulation Primary to Secondary
RM1-1	A	1 kV	1.2 kV	1.2 kV	2.4 kV	15	5 kV
RM1-2	B	1 kV	1.2kV	1.2 kV	2.4	15	5 kV
RM1.5-1	A	1.5 kV	1.8 kV	1.8 kV	3.6	23	5 kV
RM1.5-2	B	1.5 kV	1.8 kV	1.8 kV	3.6	23	5 kV
RM2-1	A	2 kV	2.4 kV	2.4 kV	4.8	30	6 kV
RM2-2	B	2 kV	2.4 kV	2.4 kV	4.8	30	6 kV
RM2.5-1	A	2.5 kV	3 kV	3 kV	6	38	6 kV
RM2.5-2	B	2.5 kV	3 kV	3 kV	6	38	6 kV
RM3-1	A	3 kV	3.6 kV	3.6 kV	7	45	8 kV
RM3-2	B	3 kV	3.6 kV	3.6 kV	7	45	8 kV
RM3.5-1	A	3.5 kV	4.2 kV	4.2 kV	8	53	10 kV
RM3.5-2	B	3.5 kV	4.2 kV	4.2 kV	8	53	10 kV
RM4-1	A	4 kV	4.8 kV	4.8 kV	9.5	60	10 kV
RM4-2	B	4 kV	4.8 kV	4.8 kV	9.5	60	10 kV
RM4.5-1	A	4.5 kV	5.5 kV	5.5 kV	10.5	68	12 kV
RM4.5-2	B	4.5 kV	5.5 kV	5.5 kV	10.5	68	12 kV
RM5-1	A	5 kV	6 kV	6 kV	12	75	12 kV
RM5-2	B	5 kV	6 kV	6 kV	12	75	12 kV
RM6-1	A	6 kV	7 kV	7 kV	14	90	14 kV
RM7-1	A	7 kV	8 kV	8 kV	16	105	15 kV
RM8-1	A	8 kV	9.5 kV	9.5 kV	19	120	17 kV
RM9-1	A	9 kV	10.5 kV	10.5 kV	21	135	20 kV
RM10-1	A	10 kV	12.5 kV	125 kV	24	150	24 kV
RM12.5-3	C	12.5 kV	15 kV	15 kV	30	188	28 kV
RM17-3	C	17 kV	20 kV	20 kV	40	255	32 kV
RM21-3	C	21 kV	25 kV	25 kV	50	315	45 kV
RM25-3	C	25 kV	30 kV	30 kV	60	375	54 kV



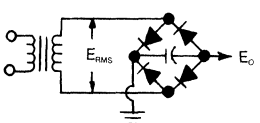
DC RECTIFER CIRCUITS FOR LISTED TRANSFORMERS

HALF WAVE RECTIFIER (COLUMN 4 ABOVE)



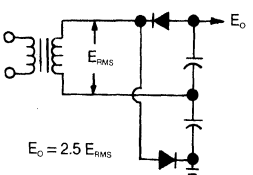
$E_O = 1.25\ E_{RMS}$

FULL WAVE BRIDGE (COLUMN 5 ABOVE)

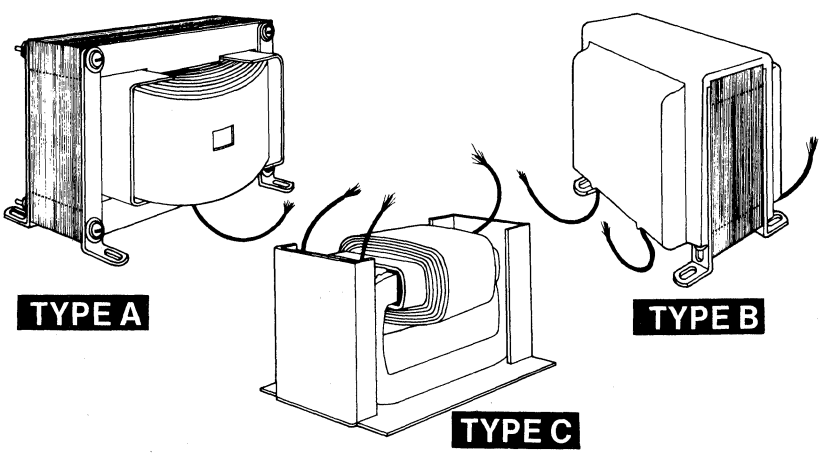


$E_O = 1.25\ E_{RMS}$

FULL WAVE DOUBLER (COLUMN 6 ABOVE)



$E_O = 2.5\ E_{RMS}$

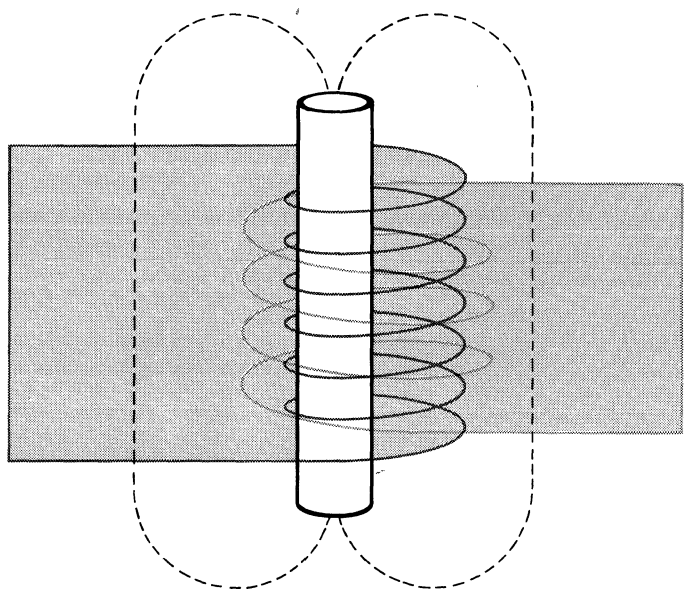


DIMENSIONAL DATA

Model Number	Dimensions A in. (mm)	B in. (mm)	C in. (mm)	Weights lbs. (kg)
RM1-1	2-13/16" (71)	3" (76)	2-1/4" (57)	2 (.9)
RM1-2	3-1/16" (77)	2-7/8" (73)	2-3/8" (60)	2-1/2 (1.1)
RM1.5-1	21-3/16" (71)	3-3/8" (86)	2-3/8" (60)	3 (1.4)
RM1.5-2	3-1/16" (77)	2-7/8" (73)	2-3/8" (60)	2-1/2 (1.1)
RM2-1	2-13/16" (71)	3-3/8" (86)	2-3/8" (60)	3 (1.4)
RM2-2	3-1/16" (77)	2-7/8" (73)	2-3/8" (60)	2-1/2 (1.1)
RM2.5-1	3-3/8" (86)	3-3/4" (95)	2-7/16" (62)	3-1/2 (1.6)
RM2.5-2	3-1/16" (77)	2-7/8" (73)	2-3/8" (60)	2-1/2 (1.1)
RM3-1	3-3/8" (86)	3-3/4" (95)	2-7/16" (62)	3-1/2 (1.6)
RM3-2	3-1/16" (77)	2-7/8" (73)	2-3/8" (60)	2-1/2 (1.1)
RM3.5-1	3-3/8" (86)	3-3/4" (95)	2-7/8" (73)	3-3/4 (17)
RM3.5-2	4-1/8" (105)	3-1/8" (79)	2-3/8" (60)	3-3/4 (17)
RM4-1	4" (101)	4-1/2" (14)	3-1/8" (79)	6 (2.7)
RM4-2	4-1/8" (105)	3-1/8" (79)	2-3/8" (60)	3-3/4 (17)
RM4.5-1	—" (101)	4-1/2" (114)	3-1/8" (79)	6 (2.7)
RM4.5-2	4-1/8" (105)	3-1/8" (79)	2-3/8" (60)	3-3/4 (17)
RM5-1	4" (101)	4-1/2" (114)	3-1/4" (83)	6-1/8 (28)
RM5-2	4-1/8" (105)	3-1/8" (79)	2-3/8" (60)	3-3/4 (17)
RM6-1	4" (101)	4-1/2" (114)	3-3/8" (86)	6-1/4 (28)
RM7-1	4-1/2" (114)	5-3/4" (146)	3-1/16" (78)	8-3/4 (40)
RM8-1	4-1/2" (114)	5-3/4" (146)	3-3/16" (81)	9 (4.0)
RM9-1	4-1/2" (114)	5-3/4" (146)	3-5/16" (84)	9-1/2 (4.3)
RM10-1	4-1/2" (114)	5-3/4" (146)	3-1/2" (89)	1-3/4 (53)
RM12.5-3	5-3/8" (137)	7-5/8" (194)	4-1/2" (114)	18-3/4 (85)
RM17-3	5-5/8" (142)	7-5/8" (194)	4-1/2" (114)	19-1/2 (87)
RM21-3	5-3/4" (148)	7-5/8" (194)	4-1/2" (114)	19-3/4 (90)
RM25-3	6" (152)	7-5/8" (194)	5" (127)	20-1/4 (92)

HIPOTRONICS, INC. ▪ POWER PRODUCTS DIV. ▪ P.O. DRAWER W ▪ MILLERTON, NY 12546 ▪ PHONE: 518-789-6464 ▪ FAX: 518-789-4866 ▪ TLX-6716516-HIPOMIL

hi·sonic... specialists in custom and standard inductor and transformer components

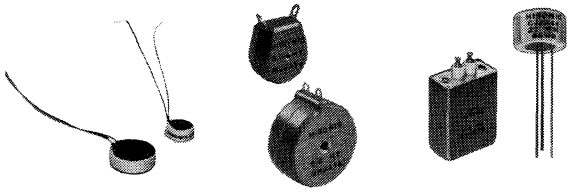


The control of electric current is only as good as the components that carry it.

INDUCTORS: Our manufacturing capabilities are the result of experience dating back to 1950 and now include virtually every known construction your special applications may require . . . and at reasonable prices.

TRANSFORMERS: HI•sonic's special power/converter and signal/matching transformers for both audio and wide video ranges are used in airborne comm/nav and ground communications systems. Included are toroidal, pot core, and laminated core types manufactured to commercial and MIL specifications. Our 30 year experience is at your disposal to help solve your transformer and inductor problems.

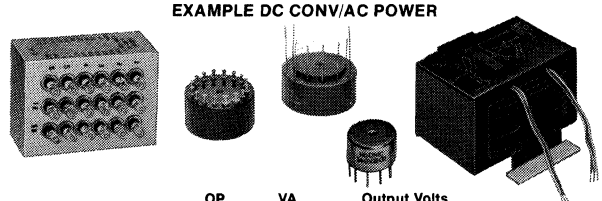
UNCASED STANDARD MOLDED METAL CASED



*Toroidal Series	Ind. Range	Max. Q	Freq. Range	DC R Ohms/MH	Uncased Size
J2	5.6MH to 3.3HY	90	Up to 30 KHZ	.50	.620D x .30H
J3	2.7 to 470MH	110	20 to 150KHZ	1.1	.620D x .30H
J4	.56 to 33MH	110	100 to 400KHZ	5.1	.620D x .30H
J5	.10 to 10MH	150	250KHZ to 1.5MHZ	8.9	.620D x .30H
R2	6.8MH to 6.8HY	135	Up to 20KHZ	.18	.960D x .40H
R3	3.3 to 470MH	180	10 to 60KHZ	.39	.960D x .40H
R4	1.2 to 68MH	170	40 to 160KHZ	.90	.960D x .40H
S2	6.8MH to 15HY	160	Up to 15KHZ	.10	1.250D x .62H
S3	3.3 to 560MH	225	10 to 60KHZ	.21	1.250D x .62H
T2	22MH to 39HY	210	Up to 15KHZ	.045	1.850D x .85H
V2	68MH to 68HY	245	Up to 8KHZ	.028	2.400D x .92H
W2	100MH to 100HY	260	Up to 6KHZ	.021	2.700D x 1.05H

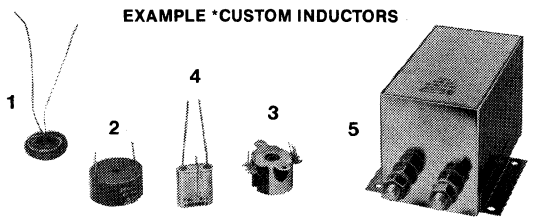
*Write for Series Bulletins on electrical and case style details

EXAMPLE DC CONV/AC POWER



P/N	Input	OP Freq.	VA Rating	Output Volts Peak (or RMS)	Size
24-0170-10	10V DC	24KHZ	0.8	20CT	.28x .6x 48H
24-0193-10	14/28V DC	6KHZ	18	4.7.11.5CT.22.5CT.550	1.8 ODx .94H
06-2124-10	200 V L-L	400HZ-30	840	200L-L	4.3x3.9x2.1H
24-0107-10	14/28V DC	2KHZ	27	90/45CT.180/25.180/25	2.1 ODx .88H
24-0512-10	260V PK	100PPS	20KVA PK	4.6 KV PK PULSE	2.5x2.3x1.1H
24-0114-10	14/28V DC	400HZ	75	26.60	2.9 ODx1.5H
24-0271-10	14/28V DC	5KHZ	80	6.5CT.22.5CT.100.100	2.0x2.0x1.OH
24-0277-10	42V DC	10KHZ	200	100	2.0x2.5x1.2H
24-0177-10	10V AC	400HZ	2	1.4.1.4.10(RMS)	1.9 ODx .86H
24-0169-10	26V AC	400HZ	17	21/13CT(RMS)	1.0x1.4x1.3H
24-0215-10	115V AC	400HZ	180	20.27.27.42(RMS)	3.2x3.8x4.1H

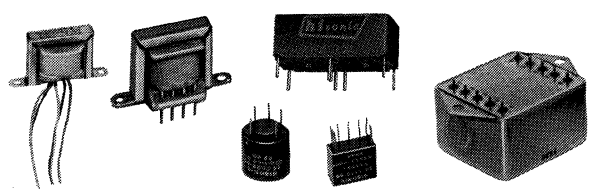
EXAMPLE *CUSTOM INDUCTORS



P/N	Fig.	Description	Characteristics	Type	Size
26-5103 Series	2	Encaps. PC Mtg.	See R Series Std.	Tor.	1.06x.5H
06-4000-27	1	DC Filter Choke	250uH@1.5ACD	Tor.	970Dx.4H
06-4000-39	3	Var. Ind. PC Mtg.	90-110MH Q250	Pot	.80Dx.5H
26-5034 Series	4	Xtal Case Mtg.	See J Series Std.	Tor.	.34x.75x.8H
26-5135-00	5	Shielded Choke	50uH@100ADC	Lam.	2.65x5x3H

*Advise requirements for recommended solution and quotation

EXAMPLE SIGNAL/PULSE/MATCH



P/N	Description	Impedance	Response	Level	Size
24-0239-11	Video Range Match	150:150.25	100KHZ-2.5MHZ	60mw	.63x.63x.44H
24-0275-10	Wide Band Match	135CT:1000	1KHZ-2MHZ	4mw	1.1 ODx.75H
24-0659-10	Syncro/Resolver	800 OHMS	400HZ	270mw	1.5x.75x.56H
24-0240-10	Wide Bank Hybrid	600.600+600	50HZ-50KHZ	1mw	1.8x2.0x1.0H
24-0171-10	Radio Freq. Hybrid	50.100+100	700KHZ-4MHZ	10mw	75 ODx85H
24-0153-10	Pulse Match	10K.40K	tp1.2ms.tr60us	25mw	.53x.53x.7H
24-0180-10	Pulse Output	5.600w/tap	tp.4us.tr.2us	6KW	1.5 ODx.8H

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Designed to provide electrical isolation and voltage transformation for SCR adjustable-speed motor drives. Dry type. 600V class. Single phase and three phase. 50HZ and 60Hz. 5% FCAN and FCBN primary taps. Open frame or NEMA 1 enclosed, 150°C rise/220°C insulation class standard, 115°C or 80°C or 55°C rise/220°C insulation class optional.

Size Range (KVA)

Single Phase

• 1, 1½, 3, 5, 8, 12, 15, 20, 27, 30, 34

Three Phase

• 8, 12, 15, 20, 27, 34, 40, 51, 63, 75, 93, 120, 150, 180, 220, 280, 330, 440, 550, 660, 760, 870, 980, 1100.

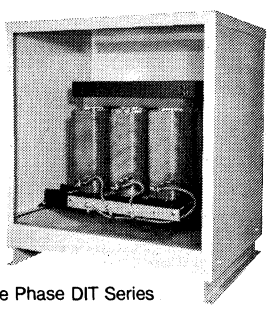
Standard Voltages Available

Single Phase

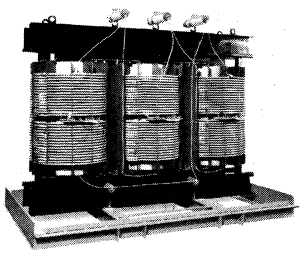
• Primary or Secondary 208, 230, 380, 460, 575, 230/460, 415

Three Phase

• Primary (△) 208, 230, 380, 460, 575, 230/460, 415
• Secondary 208Y/120, 230Y/133, 380Y/220, 460Y/266, 575Y/332, 230x460Y/133x266, 415Y/240



Three Phase DIT Series



HVDT 15KV Class Transformer

GPT SERIES — General Purpose Transformers (3-500KVA, UL Listed)

Designed to provide electrical isolation and voltage transformation for lighting, electric heating and industrial motor loads. Dry type, 600V class, single phase and three phase, 50Hz and 60Hz. FCAN and FCBN primary tap arrangements are standard. 150°C rise/220°C insulation class standard, 110°C or 85°C rise/220°C insulation class optional.

Size Range (KVA)

Single Phase

• 3, 5, 7½, 10, 15, 25, 37½, 50, 75, 100, 167

Three Phase

• 3, 6, 9, 15, 25, 30, 45, 50, 60, 75, 112½, 150, 225, 300, 400, 500, 750, 1000

Standard Voltages Available

Single Phase

• Primary (3KVA-15KVA) 240/480, 208, 277, 480, 600
(25KVA-167KVA) 240x480, 600
• Secondary (All KVA sizes) 120/240

Three Phase

• Primary (Δ) 240, 480, 600
• Secondary 208Y/120, 240Δ, 480Y/277

HVDT SERIES — High Voltage Distribution Transformers

Designed for in-plant distribution and voltage step-down. Conventional dry type or resin cast coil. 5KV through 15KV class. Single phase and three phase. 50Hz and 60Hz. FCAN and FCBN primary tap arrangements are standard. 150°C rise/220°C insulation class standard, 110°C or 85°C or 55°C rise/220°C insulation class optional.

Size Range (KVA)

Single Phase

• 3, 5, 10, 15, 25, 37½, 50, 75, 100, 167, 200, 250, 333, 500

Three Phase

• 15, 30, 45, 75, 112½, 150, 225, 300, 400, 500, 750, 1000

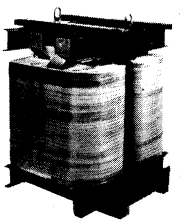
Standard Voltages Available

Single Phase

• Primary
5KV Class: 2400/4160Y
8.66KV Class: 4160/7200Y
15KV Class: 7200/12470Y
7620/13200Y, 7960/13800Y
• Secondary (All KVA Sizes) 120/240

Three Phase

• Primary (△)
5KV Class: 2400, 4160, 4800
8.66KV Class: 7200
15 KV Class: 12000, 12470, 13200, 13800
• Secondary 208Y/120, 240△, 480Y/277



DC Link Choke
4 mH at 1000 Adc
5 KV Class

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• Convection, forced air or water cooled.
• Dry type, liquid filled, cast-resin.
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• High reactance transformers - short circuit current limited.
• Modulation (Output) transformers to 50KW.
• Rectifier and filament transformers.

Inductors

LC Series - Link Chokes (DC)

Designed for use as a smoothing inductor in the DC link between rectifier and inverter in variable-speed AC motor drives from 15 to 1000 HP. Dry type, 600V class.

LR Series - Line Reactors (AC)

Designed for use as a line reactor in the three phase input lines supplying variable-speed AC motor drives from 15 to 1000 HP. Dry type, 600V class; three phase; 50Hz and 60Hz.
Other specialty inductors include:
• AC, DC.
• Iron-core, air-core.
• Linear, swinging.
• AC current limiting reactors.
• AC power factor correction reactors.
• DC filter chokes.
• AM modulation reactors.

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Case Sizes E128 to E157

Regulated and Unregulated

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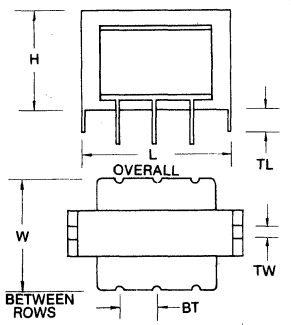
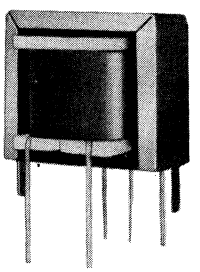
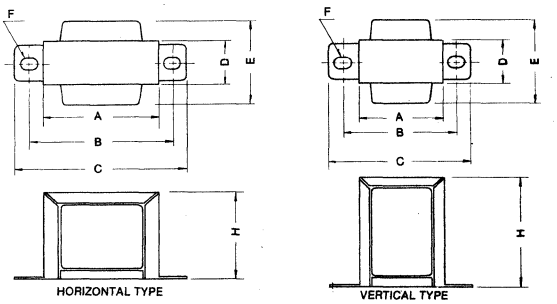




POWER TRANSFORMERS



DIMENSIONS: M/M HORIZONTAL TYPE / VERTICAL TYPE

Type	Part No.	Description	Impedance Pri	Impedance Sec	Resistance Pri	Resistance Sec	Dimension
EI-14 Series .075 Watts Max.	AT-141	Output	500C.T.	8	35	.8	L =15.2mm(.599) H =11.0mm(.433) W =12.0mm(.473) TW= 2.0mm(.079) TL = 3.8mm(.150) BT = 2.5mm(.098) All Dimensions Nom
	AT-142	Coupling	600C.T.	600C.T.	45	40	
	AT-143	Output	1KC.T.	8	60	.8	
	AT-144	Coupling	10KC.T.	600C.T.	450	100	
	AT-145	Driver	10KC.T.	2KC.T.	500	200	
EI-16 Series .100 Watts Max.	AT-161	Output	500C.T.	8	22	.8	L =17.7mm(.697) H =14.0mm(.551) W =16.0mm(.630) TW= 2.2mm(.086) TL = 4.0mm(.157) BT = 2.8mm(.110) All Dimensions Nom
	AT-162	Interstage	500C.T.	500C.T.	30	28	
	AT-163	Output	1.2KC.T.	8	80	.8	
	AT-164	Output	48C.T.	8	2.5	.5	
	AT-165	Output	200C.T.	8	12	.8	
EI-19 Series .200 Watts Max.	AT-191	Output	200C.T.	8	12	.8	L =20.3mm(.800) H =16.2mm(.640) W =14.5mm(.571) TW= 2.2mm(.086) TL = 4.2mm(.165) BT =3.0mm(.118) All Dimensions Nom
	AT-192	Output	500C.T.	8	26	.8	
	AT-193	Coupling	600C.T.	600C.T.	65	55	
	AT-194	Output	800C.T.	8	40	.8	
	AT-195	Output	1.2KC.T.	8	80	.8	
	AT-196	Interstage	1.5KC.T.	500C.T.	120	50	
	AT-197	Coupling	10KC.T.	600C.T.	600	100	
	AT-198	Driver	10KC.T.	2KC.T.	600	155	
EI-24 Series .460 Watts Max.	AT-241	Output	48C.T.	8	2.5	.5	L =25.3mm(.100) H =18.4mm(.725) W =16.0mm(.630) TW= 2.6mm(.102) TL = 4.8mm(.189) BT = 4.5mm(.177) All Dimensions Nom
	AT-242	Output	120C.T.	8	7.0	.7	
	AT-243	Output	200C.T.	8	12.0	.5	
	AT-244	Output	500C.T.	8	180	.7	
	AT-245	Interstage	500C.T.	500C.T.	35	28	
	AT-246	Driver	10KC.T.	2KC.T.	600	155	
	AT-247	Output	1.2KC.T.	8	75	.8	
	AT-248	Coupling	600C.T.	600C.T.	65	55	

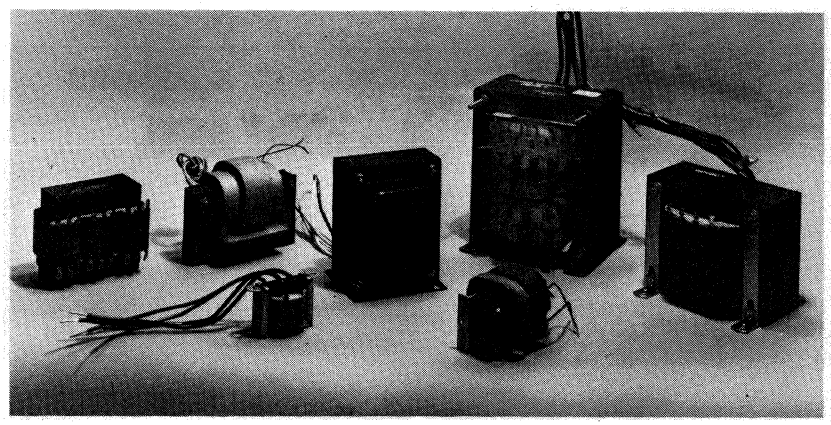
Metric Size Output (VA)	Input	A	B	C	D	E	F	H
EI-28 (1)	120	29.5	37.5	49.5	9-15	25-34	3.5 x 5.8	28
		27	35	47				31
EI-35 (2)	120	36.5	45	56.5	10-17	31-40	3.5 x 5.8	32.5
		31.5	41	53				38
EI-41 (4.5)	120	42.5	52	61	14-24	32-43	3.5 x 5.8	37
		35	45	57				44
EI-48 (7)	120	50.5	60	69.5	17-25	37-46	3.5 x 5.8	43.5
		42	52	64				51
EI-54 (13)	120	56	67	78	20-26	44-56	4.2 x 6.5	49
		48	59	70				56
EI-57 (18)	120	59	70	80	20-26	44-56	4.2 x 6.5	51
		49.5	61	75				60
EI-60 (25)	120	62	75	89	21-33	45-2	4.2 x 6.5	54
		52	66	78				63
EI-66 (40)	120	68.5	81	92	23-41	53-70	4.2 x 6.5	59
		57.5	74	84				69
EI-76 (75)	120	79	90	100	31-41	60	5 x 7	65
		67	78	89				78
EI-86 (110)	120	87.5	105	107	31-41	67	5 x 7	74
		75	86	97				89
EI-96 (300)	120	98	109	120	40-60	77	5 x 7	84
		85	96	107				98

• Welcome Offer Original Sample and Diagram

SEE OUR PAGES IN SECTIONS 1500, 2100, 4100 & 6000

JEROME INDUSTRIES CORPORATION

TRANSFORMERS
CUSTOM DESIGNED AND STANDARD



QUALITY
DELIVERY
PRICE

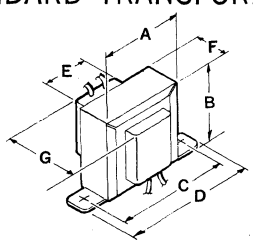
UL, CSA, VDE, IEC, OTHER DOMESTIC-FOREIGN SPECS. CLASS "A" TO CLASS "H"

- Prototypes
- Production From 12 to Large Quantities

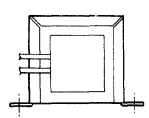
TRANSFORMERS
CHASSIS MOUNT-
P.C. BOARD TYPES

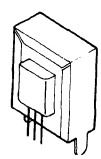
- Power 0.5-3 KVA
- 115V, 57-63 Hz
- 115/230V, 47-63 Hz
- Single, Multiple Output
- Ferroresonant
- Rectifier Types
- Shielded
- Chokes
- Chassis/PC Board
- Auto Transformers

STANDARD TRANSFORMER SIZES



HORIZONTAL MOUNT


VERTICAL MOUNT

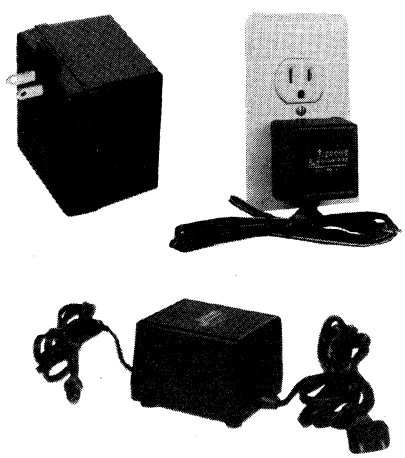

PRINTED CIRCUIT MOUNT

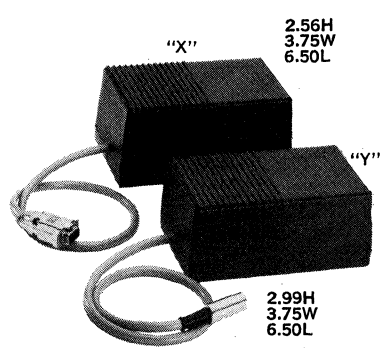
GENERAL DIMENSIONS (INCHES)

V.A. Rating	Core Size	A	B	C	D	E	F	G Appr	Mounting Hole Sizes
1.2	¼ x ¼	1 1/32	13/16	1 3/8	1 5/8	23/32	1 9/64	23/32	.125, .140
2.5	3/8 x 3/8	1 27/64	1 3/16	1 3/4	2 1/16	31/32	2 7/64	1 1/32	.125, .156, .187
6	½ x ½	1 43/64	1 3/8	2	2 3/8	1 3/32	35/64	1 5/32	.125, .156, .187
8	½ x 5/8	1 43/64	1 3/8	2	2 3/8	1 3/32	43/64	1 5/32	.136, .156, .187
11	5/8 x 5/8	1 59/64	1 5/8	2 3/8	2 13/16	1 7/32	43/64	1 9/32	.140, .187
13	5/8 x 3/4	1 59/64	1 5/8	2 3/8	2 13/16	1 7/32	51/64	1 13/32	.156, .187
22	3/4 x 3/4	2 1/64	1 13/16	2 13/16	3 1/4	1 1/2	51/64	1 3/16	.136, .187, .281
30	3/4 x 1	2 1/64	1 13/16	2 13/16	3 1/4	1 1/2	1 3/64	1 13/64	.136, .187
35	7/8 x 7/8	2 41/64	2 3/16	3 1/8	3 11/16	1 47/64	59/64	1 7/8	.187
50	1 x 1	3 1/64	2 1/2	3 5/16	4	1 53/64	1 3/64	2 1/8	.156, .187, .213

EXTERNALLY MOUNTED TRANSFORMERS
WALL PLUG-IN/WALL MOUNTED
DESK TOP
SINGLE & MULTIPLE OUTPUT
0.5 TO 75 WATTS

All items made to U.L. specifications 478, 1310, 504, 516, 544 (Patient & Non Patient Connected), 694, 1012, 1235, 1411 and also equivalent C.S.A., V.D.E. IEC and other National and European specifications.





CALL CUSTOMER SERVICE 201-353-5700

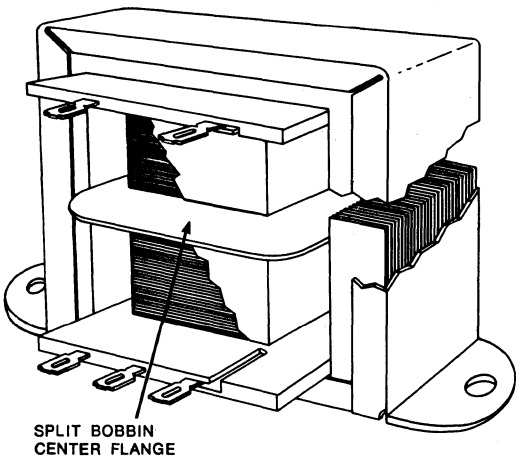
Jerome Industries Corporation / 730E Division St., Elizabeth, NJ 07201 / 201-353-5700 / Telex: 132001 / FAX: 201-353-1021

Split Bobbin Power Transformers & Split Bobbin Isolation Transformers

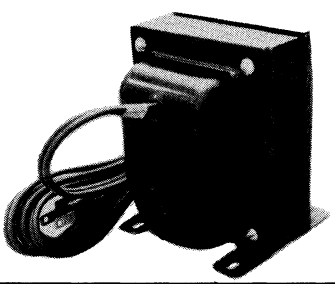
- 50/60 Hz
- Power Ratings to 1800 VA
- Single, Dual, and Tapped Primaries
- Single and Multiple Outputs
- Terminals for Quick-Connect or Soldering
- Flexible Leads also Available
- Available enclosed with Steel Covers

- Non-Concentric Winding — Lower Capacitance — Better Insulation — **2500-4000** VRMS Hipot — No Need for Electro-static Shield
- **LOW LEAKAGE**
- We design to meet UL, CSA, VDE, IEC, and CEE Standards

WE SPECIALIZE IN POWER TRANSFORMERS AND ISOLATION TRANSFORMERS FOR MEDICAL ELECTRONICS (PATIENT ATTACHED EQUIPMENT) FOR DOMESTIC AND FOREIGN APPLICATIONS.

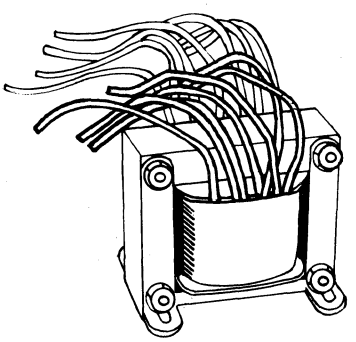


Auto-transformers

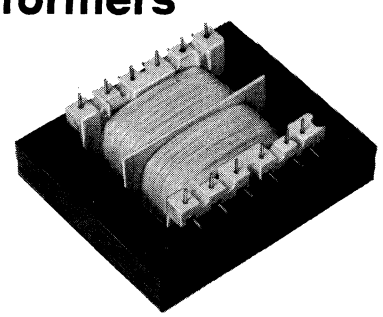


Rectifier Power Transformers with Flexible Leads

- 50/500 Hz
- Power Ratings up to 1800 VA
- Wide Range of Voltages
- Single, Dual, and Tapped Primaries
- Single and Multiple Outputs
- Available Enclosed in Steel Covers
- Terminals for Quick-Connect or Soldering Available

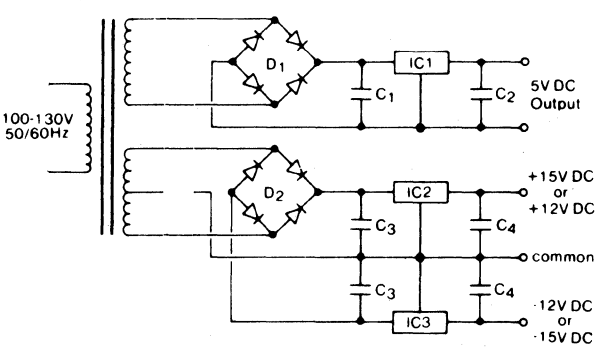


Split Bobbin and Low Profile Split Bobbin PC Board Transformers



- Power Ratings to 30 VA
- See The Following Pages for Our Standard Items and Sizes

Transformers for Triple Output (Microprocessor) Applications



SEE THE FOLLOWING PAGES FOR OUR STANDARD TRANSFORMERS

J M Transformer Co., Inc.

112 FLORIDA STREET, FARMINGDALE, NY 11735 • (516) 293-0475

Split Bobbin Transformers

The use of a Split Bobbin allows winding to be nonconcentric (side-by-side), consequently high isolation is achieved at low cost.

- Better insulation — 2500 VRMS hipot is standard.
- Lower capacitance — no need for electro-static shield.
- Low Leakage

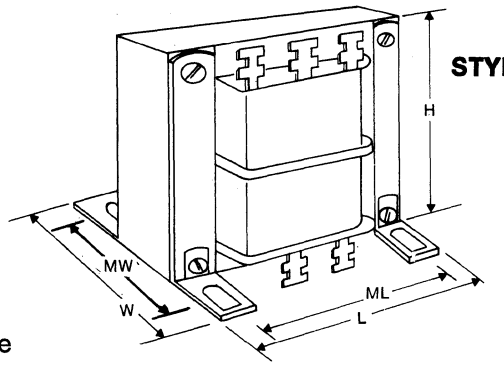
Also available:

- **Units with 4000 VRMS hipot**
- Steel covers
- Flexible leads
- Multiple outputs
- Tapped primaries
- Quick disconnect terminals
- Consult factory for any other configurations you may require

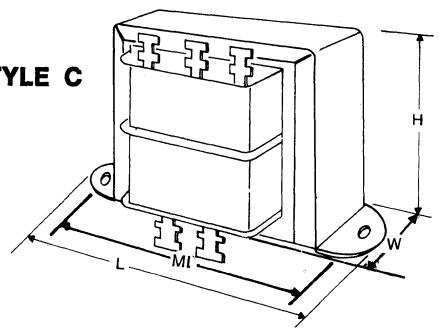
CUSTOM PROTOTYPES AVAILABLE WITHIN ONE WEEK. CHECK OUR LOW PRICES.

WE SPECIALIZE IN POWER TRANSFORMERS AND ISOLATION TRANSFORMERS FOR MEDICAL ELECTRONICS (PATIENT ATTACHED EQUIPMENT) FOR DOMESTIC AND FOREIGN APPLICATIONS

STYLE B



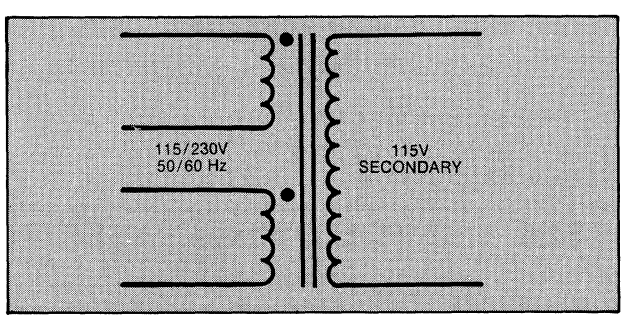
STYLE C



Size	Mounting Style	L	W	H	ML	MW	Approx. Lbs.	Typical Power
40	C	3 11/16	1 31/32	2 1/4	3 1/8	—	1 1/2	40VA
50	C	3 11/16	2 1/16	2 1/4	3 1/8	—	1 3/4	50VA
75	C	4 1/32	2 7/32	2 9/16	3 9/16	—	2	75VA
100	C	4 1/32	2 15/32	2 9/16	3 9/16	—	2 3/4	100VA
120	C	4 1/2	2 15/32	2 7/8	4	—	3	120VA
150	B	3 3/4	2 13/16	3 1/8	3 1/8	2 1/4	4	150VA
200	B	4 1/8	3	3 7/16	3 7/16	2 3/8	5 1/2	200VA
300	B	4 1/2	3 1/4	3 3/4	3 3/4	2 1/2	7	300VA
500	B	4 1/2	4 1/4	3 3/4	3 3/4	3 1/2	11	500VA
750	B	5 1/4	4 1/2	4 3/8	4 3/8	3 5/8	16	750VA
1000	B	6 3/8	4 5/8	5 5/16	5 5/16	3 1/4	20	1000VA
1800	B	7 1/2	5 3/8	6 1/4	6 3/4	3 5/8	32	1800VA

Split Bobbin Power Isolation Transformers

Part Number	Size	Secondary RMS Rating
I-.8	100	115V @ .8A
I-1	120	115V @ 1A
I-1.3	150	115V @ 1.3A
I-1.7	200	115V @ 1.7A
I-2.6	300	115V @ 2.6A
I-4.3	500	115V @ 4.3A
I-6.5	750	115V @ 6.5A
I-9	1000	115V @ 9A
I-15	1800	115V @ 15A



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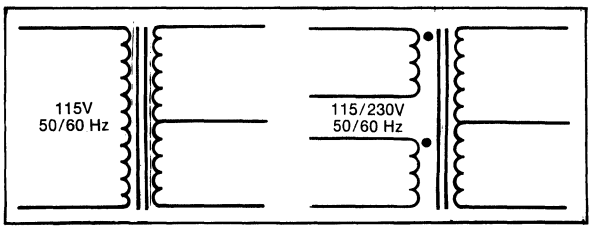
Split Bobbin Power Transformers

Ideal for use in rectifier circuits



Add Prefix D to Part Numbers below if Dual Primary is Required

Part Number	Secondary RMS Rating	Size
10T-4	10VCT @ 4A	40
10T-5	10VCT @ 5A	50
10T-7.5	10VCT @ 7.5A	75
10-10*	10V @ 10A	100
10-12*	10V @ 12A	120
10-15*	10V @ 15A	150
12T-3.2	12.6VCT @ 3.2A	40
12T-4	12.6VCT @ 4A	50
12T-6	12.6VCT @ 6A	75
12T-8	12.6VCT @ 8A	100
12-10*	12.6V @ 10A	120
12-12*	12.6V @ 12A	150
16T-2.5	16VCT @ 2.5A	40
16T-3.2	16VCT @ 3.2A	50
16T-4.5	16VCT @ 4.5A	75
16T-6	16VCT @ 6A	100
16T-8	16VCT @ 8A	120
16-10*	16V @ 10A	150
16-12*	16V @ 12A	200
20T-2	20VCT @ 2A	40
20T-2.5	20VCT @ 2.5A	50
20T-3.8	20VCT @ 3.8A	75
20T-5	20VCT @ 5A	100
20T-6	20VCT @ 6A	120
24T-1.7	24VCT @ 1.7A	40
24T-2	24VCT @ 2A	50
24T-3.2	24VCT @ 3.2A	75
24T-4	24VCT @ 4A	100
24T-5	24VCT @ 5A	120
24T-6	24VCT @ 6A	150
24T-8	24VCT @ 8A	200
24-12*	24V @ 12A	300
28T-1.4	28VCT @ 1.4A	40
28T-1.8	28VCT @ 1.8A	50
28T-2.6	28VCT @ 2.6A	75
28T-3.5	28VCT @ 3.5A	100

Part Number	Secondary RMS Rating	Size
28T-4.2	28VCT @ 4.2A	120
28T-5.4	28VCT @ 5.4A	150
28T-7	28VCT @ 7A	200
28-10*	28V @ 10A	300
32T-1.2	32VCT @ 1.2A	40
32T-1.5	32VCT @ 1.5A	50
32T-2.4	32VCT @ 2.4A	75
32T-3	32VCT @ 3A	100
32T-3.8	32VCT @ 3.8A	120
32T-4.5	32VCT @ 4.5A	150
32T-6	32VCT @ 6A	200
36T-1	36VCT @ 1A	40
36T-1.4	36VCT @ 1.4A	50
36T-2	36VCT @ 2A	75
36T-2.8	36VCT @ 2.8A	100
36T-3.3	36VCT @ 3.3A	120
36T-4	36VCT @ 4A	150
36T-5.5	36VCT @ 5.5A	200
36T-8	36VCT @ 8A	300
36-12*	36V @ 12A	500
40T-1	40VCT @ 1A	40
40T-1.2	40VCT @ 1.2A	50
40T-1.8	40VCT @ 1.8A	75
40T-2.5	40VCT @ 2.5A	100
40T-3	40VCT @ 3A	120
40T-3.8	40VCT @ 3.8A	150
40T-5	40VCT @ 5A	200
40T-7.5	40VCT @ 7.5A	300
48T-.8	48VCT @ .8A	40
48T-1	48VCT @ 1A	50
48T-1.5	48VCT @ 1.5A	75
48T-2	48VCT @ 2A	100
48T-2.5	48VCT @ 2.5A	120
48T-3	48VCT @ 3A	150
48T-4	48VCT @ 4A	200
48T-6	48VCT @ 6A	300

Part Number	Secondary RMS Rating	Size
56T-.7	56VCT @ .7A	40
56T-.9	56VCT @ .9A	50
56T-1.3	56VCT @ 1.3A	75
56T-1.7	56VCT @ 1.7A	100
56T-2.1	56VCT @ 2.1A	120
56T-2.7	56VCT @ 2.7A	150
56T-3.6	56VCT @ 3.6A	200
56T-5.4	56VCT @ 5.4A	300
56-8*	56V @ 8A	500
56-13*	56V @ 13A	750
68T-.6	68VCT @ .6A	40
68T-.7	68VCT @ .7A	50
68T-1.1	68VCT @ 1.1A	75
68T-1.4	68VCT @ 1.4A	100
68T-1.8	68VCT @ 1.8A	120
68T-2.2	68VCT @ 2.2A	150
68T-2.9	68VCT @ 2.9A	200
68T-4.4	68VCT @ 4.4A	300
68-7*	68V @ 7A	500
68-11*	68V @ 11A	750
80T-.5	80VCT @ .5A	40
80T-.6	80VCT @ .6A	50
80T-.9	80VCT @ .9A	75
80T-1.2	80VCT @ 1.2A	100
80T-1.5	80VCT @ 1.5A	120
80T-1.9	80VCT @ 1.9A	150
80T-2.5	80VCT @ 2.5A	200
80T-3.8	80VCT @ 3.8A	300
80T-6	80VCT @ 6A	500
80-9*	80V @ 9A	750
120T-.3	120VCT @ .3A	40
120T-.4	120VCT @ .4A	50
120T-.6	120VCT @ .6A	75
120T-.8	120VCT @ .8A	100

* These items do not have center-tapped secondaries

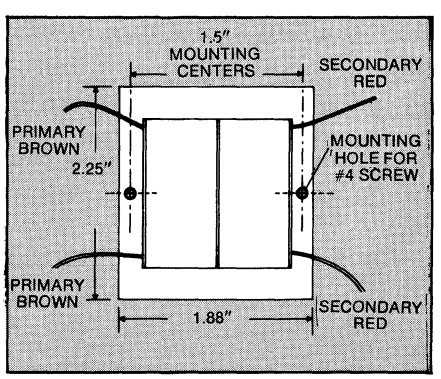
Low Profile Split Bobbin Power Transformers

- **Only 1.1 inches high**
- 4″ flexible leads • Wt. ½ lb. • 2500 VRMS hipot
- Ideal for PC Board and Chassis Mtg. where low height is required

STANDARD TRANSFORMERS: 115V 50/60 Hz PRIMARY - 10 VA

Part Number	Secondary RMS Rating
LPS 10-8	8V @ 1.25A
LPS 10-10	10V @ 1A
LPS 10-12	12.6V @ .8A
LPS 10-16	16V @ .63A

Part Number	Secondary RMS Rating
LPS 10-20	20V @ .5A
LPS 10-24	24V @ .42A
LPS 10-32	32V @ .31A



112 FLORIDA STREET, FARMINGDALE, NY 11735 • (516) 293-0475 **J M Transformer Co., Inc.**

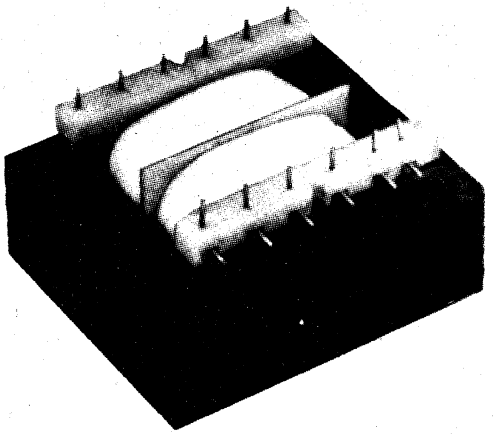
Split Bobbin PC Board Transformers

The use of a Split Bobbin allows winding to be nonconcentric (side-by-side), consequently high isolation is achieved at low cost.

- Better insulation — 2500 VRMS hipot is standard.
- Lower capacitance — no need for electro-static shield.

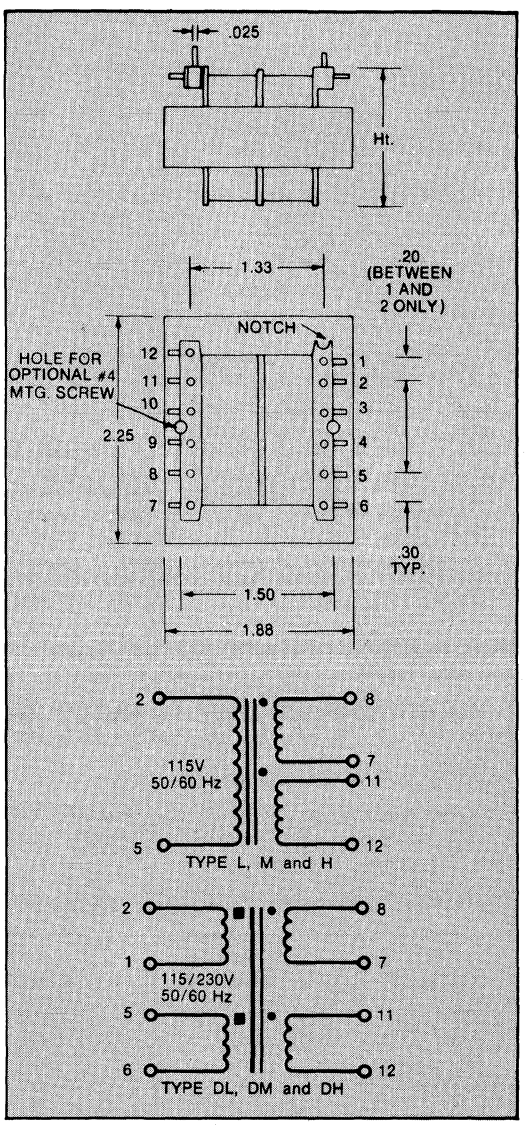
Please note that the standard items listed below utilize 6 or 8 pins, while 12 pins are available. We would like to quote your more complex requirements . . . you may save cost and space by combining two less complex Transformers into one.

We would also be glad to quote your less complex requirements. For example, if only a Single Primary and Single Secondary are needed, you can save considerable cost by utilizing only 4 Pins.



STANDARD TRANSFORMERS

	Part Number		Secondary RMS Ratings			
	Single 115V Pri.	Dual 115/230V Pri.	Series	Parallel	Ht.	Approx. Lbs.
LOW PROFILE	L-10	DL-10	10VCT @ 2A	5V @ 4A	1.34	.75
	L-12	DL-12	12.6VCT @ 1.6A	6.3V @ 3.2A	1.34	.75
	L-16	DL-16	16VCT @ 1.25A	8V @ 2.5A	1.34	.75
	L-20	DL-20	20VCT @ 1A	10V @ 2A	1.34	.75
	L-24	DL-24	24VCT @ .8A	12V @ 1.6A	1.34	.75
	L-32	DL-32	32VCT @ .625A	16V @ 1.25A	1.34	.75
	L-40	DL-40	40VCT @ .5A	20V @ 1A	1.34	.75
	L-48	DL-48	48VCT @ .4A	24V @ .8A	1.34	.75
	L-80	DL-80	80VCT @ .25A	40V @ .5A	1.34	.75
	L-120	DL-120	120VCT @ .16A	60V @ .32A	1.34	.75
	M-10	DM-10	10VCT @ 2.4A	5V @ 4.8A	1.55	.9
	M-12	DM-12	12.6VCT @ 1.9A	6.3V @ 3.8A	1.55	.9
	M-16	DM-16	16VCT @ 1.5A	8V @ 3A	1.55	.9
	M-20	DM-20	20VCT @ 1.2A	10V @ 2.4A	1.55	.9
	M-24	DM-24	24VCT @ 1A	12V @ 2A	1.55	.9
	M-32	DM-32	32VCT @ .75A	16V @ 1.5A	1.55	.9
	M-40	DM-40	40VCT @ .6A	20V @ 1.2A	1.55	.9
	M-48	DM-48	48VCT @ .5A	24V @ 1A	1.55	.9
	M-80	DM-80	80VCT @ .3A	40V @ .6A	1.55	.9
	M-120	DM-120	120VCT @ .2A	60V @ .4A	1.55	.9
	H-10	DH-10	10VCT @ 3A	5V @ 6A	1.79	1.1
	H-12	DH-12	12.6VCT @ 2.4A	6.3V @ 4.8A	1.79	1.1
	H-16	DH-16	16VCT @ 1.8A	8V @ 3.6A	1.79	1.1
	H-20	DH-20	20VCT @ 1.5A	10V @ 3A	1.79	1.1
	H-24	DH-24	24VCT @ 1.25A	12V @ 2.5A	1.79	1.1
	H-32	DH-32	32VCT @ .95A	16V @ 1.9A	1.79	1.1
	H-40	DH-40	40VCT @ .75A	20V @ 1.5A	1.79	1.1
	H-48	DH-48	48VCT @ .625A	24V @ 1.25A	1.79	1.1
	H-80	DH-80	80VCT @ .375A	40V @ .75A	1.79	1.1
	H-120	DH-120	120VCT @ .25A	60V @ .5A	1.79	1.1

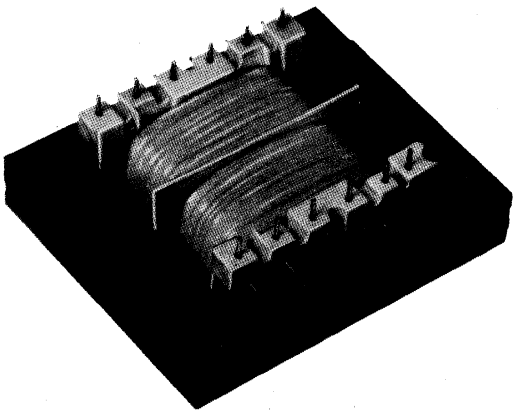


J M Transformer Co., Inc. 112 FLORIDA STREET, FARMINGDALE, NY 11735 • (516) 293-0475

Low Profile Split Bobbin PC Board Transformers

- **Only 1.13″ high**

XL Series transformers offer a particularly low profile for 18VA, allowing for 1.25″ card spacing.



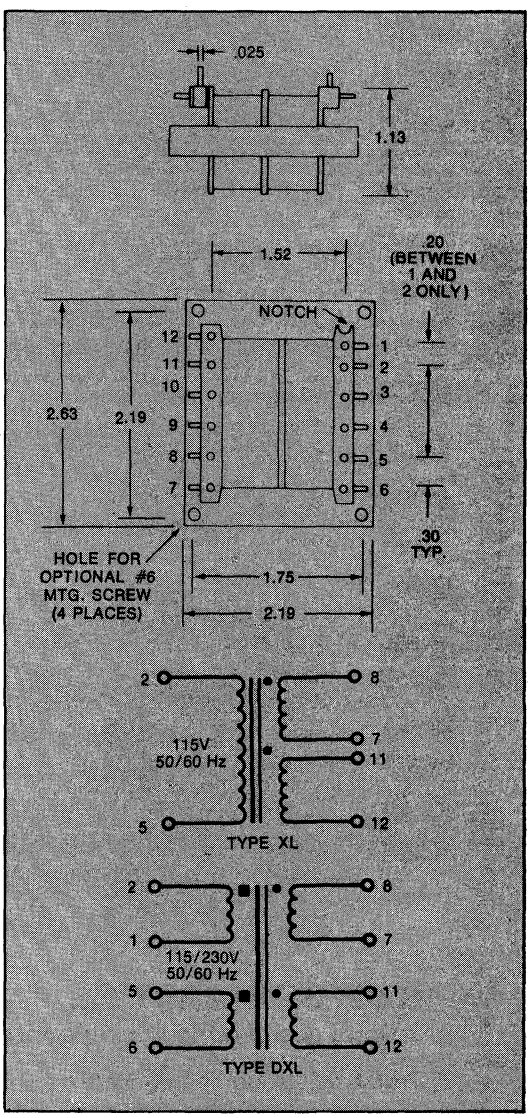
The use of a split bobbin allows winding to be non-concentric (side-by-side), consequently high isolation is achieved at low cost.

- Better Insulation — 2500 VRMS hipot is standard.
- Lower Capacitance — no need for electro-static shield.

If the standard items shown here do not fit your requirements, we would be glad to quote on your custom needs. Often this can save space and considerable cost.

STANDARD TRANSFORMERS

Part Number		Secondary RMS Ratings		Approx. Lbs.
Single 115V Pri.	Dual 115/230V Pri.	Series	Parallel	
XL-10	DXL-10	10VCT @ 1.6A	5V @ 3.2A	.7
XL-12	DXL-12	12.6VCT @ 1.25A	6.3V @ 2.5A	.7
XL-14	DXL-14	14VCT @ 1.28A	7V @ 2.56A	.7
XL-16	DXL-16	16VCT @ 1A	8V @ 2A	.7
XL-18	DXL-18	18VCT @ 1A	9V @ 2A	.7
XL-20	DXL-20	20VCT @ .8A	10V @ 1.6A	.7
XL-22	DXL-22	22VCT @ .8A	11V @ 1.6A	.7
XL-24	DXL-24	24VCT @ .68A	12V @ 1.36A	.7
XL-28	DXL-28	28VCT @ .64A	14V @ 1.28A	.7
XL-32	DXL-32	32VCT @ .5A	16V @ 1A	.7
XL-36	DXL-36	36VCT @ .5A	18V @ 1A	.7
XL-40	DXL-40	40VCT @ .4A	20V @ .8A	.7
XL-44	DXL-44	44VCT @ .4A	22V @ .8A	.7
XL-48	DXL-48	48VCT @ .34A	24V @ .68A	.7
XL-56	DXL-56	56VCT @ .32A	28V @ .64A	.7
XL-72	DXL-72	72VCT @ .25A	36V @ .5A	.7
XL-88	DXL-88	88VCT @ .2A	44V @ .4A	.7
XL-120	DXL-120	120VCT @ .134A	60V @ .268A	.7



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CUSTOM PROTOTYPES AVAILABLE WITHIN ONE WEEK

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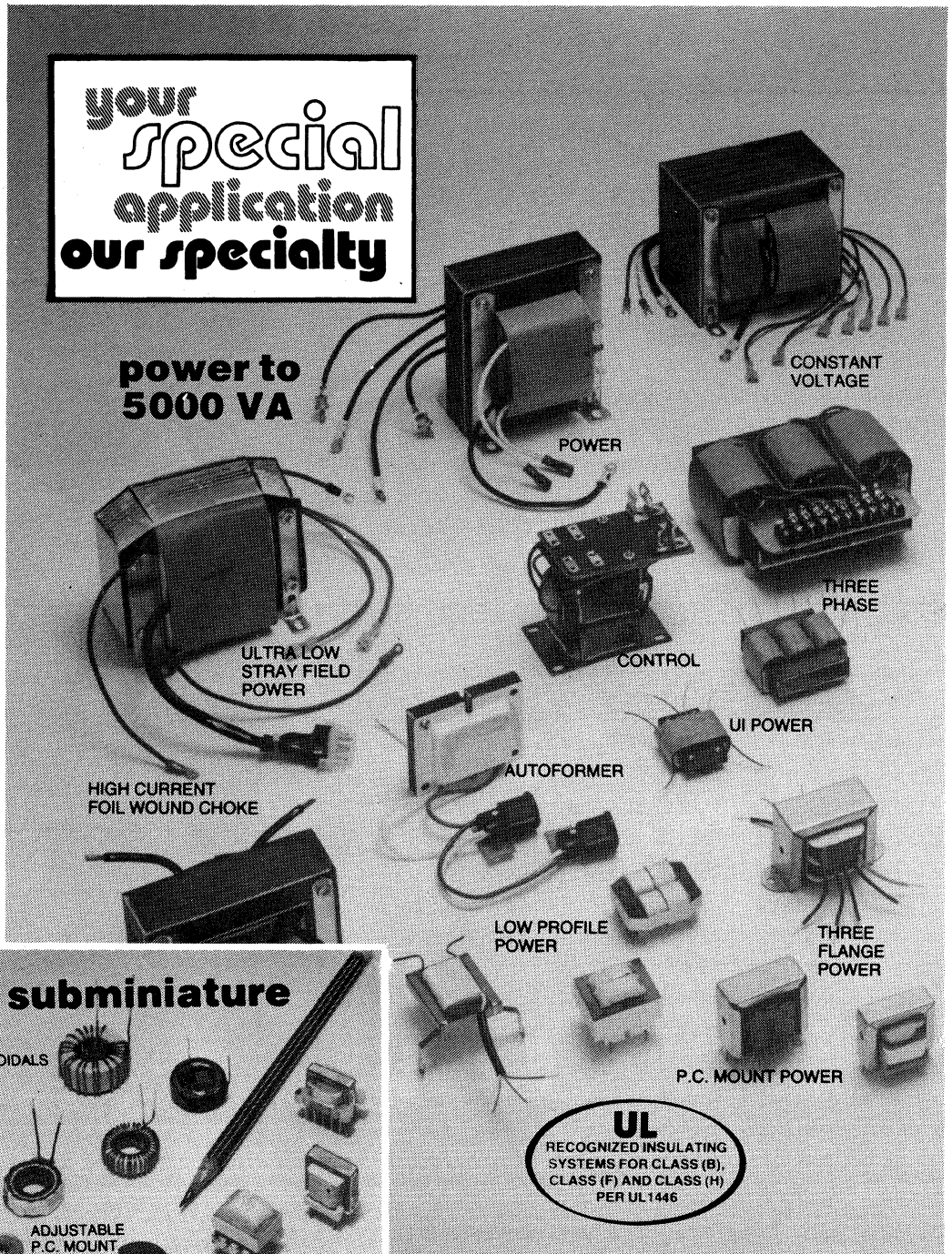
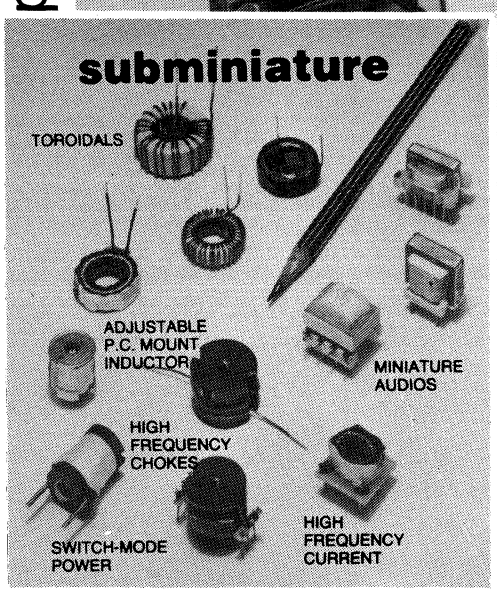
CUSTOM TRANSFORMERS

prototypes / short runs / high volume runs





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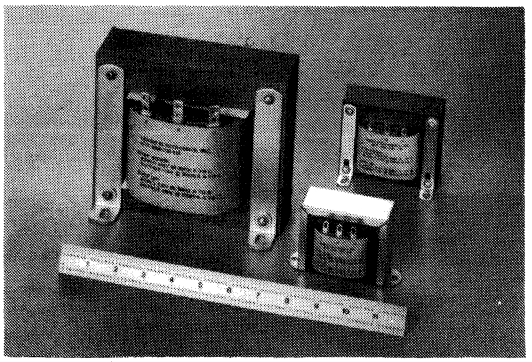
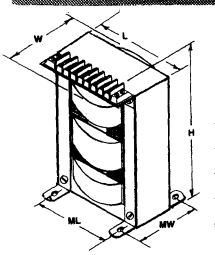


FREQUENCY 60Hz/OUTPUT 120V

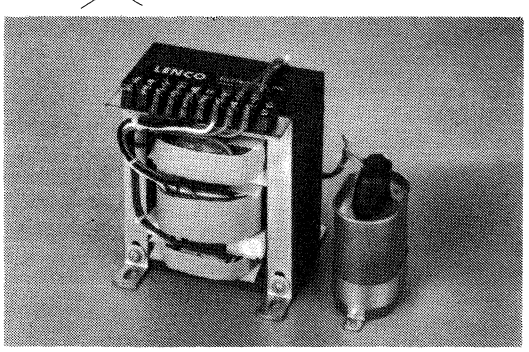
MODEL	POWER	INPUT	MOUNTING
CVS-100-120-60	100VA	120V	A
CVS-100-240-60	100VA	240V	A
CVS-100-480-60	100VA	480V	A
CVS-150-120-60	150VA	120V	B
CVS-150-240-60	150VA	240V	B
CVS-150-480-60	150VA	480V	B
CVS-250-120-60	250VA	120V	C
CVS-250-240-60	250VA	240V	C
CVS-250-480-60	250VA	480V	C
CVS-500-120-60	500VA	120V	D
CVS-500-240-60	500VA	240V	D
CVS-500-480-60	500VA	480V	D
CVS-750-120-60	750VA	120V	E
CVS-750-240-60	750VA	240V	E
CVS-750-480-60	750VA	480V	E
CVS-1000-120-60	1000VA	120V	F
CVS-1000-240-60	1000VA	240V	F
CVS-1000-480-60	1000VA	480V	F
CVS-1500-120/240-60	1500VA	120/240V	G
CVS-1500-240/480-60	1500VA	240/480V	G



MOUNTING	L	W	H	ML	MW
A	4.5	3.8	6	3.75	2.35
B	5.35	4.35	6.51	4.38	2.62
C	5.35	5.15	6.51	4.38	3.62
D	5.85	6.42	7.01	4.81	4.75
E	7.20	6.10	8.70	5.94	3.60
F	7.20	7.0	8.70	5.94	4.68
G	8.69	7.0	10.50	7.22	3.92

Autotransformer

Designed and manufactured to Lenco's high standards. Stocked in 100 VA through 5000 VA for immediate delivery. Approximately 50% reduction in size, cost, high efficiency and bi-directional. Note: Does not provide isolation.



FREQUENCY 50/60Hz

LUG STYLE	MODEL NO.	POWER	INPUT/OUTPUT BI-DIRECTIONAL	FIGURE NO.	MOUNTING
Solder	ATF-100-230-115	100VA	115/230V	1	A
Solder	ATF-100-480-240	100VA	240/480V	1	A
Solder	ATF-150-230-115	150VA	115/230V	1	B
Solder	ATF-150-480-240	150VA	240/480V	1	B
Solder	ATF-250-230-115	250VA	115/230V	2	C
Solder	ATF-250-480-240	250VA	240/480V	2	C
Solder	ATF-500-230-115	500VA	115/230V	2	D
Solder	ATF-500-480-240	500VA	240/480V	2	D
10-32 Tapped	ATF-1000-230-115	1000VA	115/230V	2	E
10-32 Tapped	ATF-1000-480-240	1000VA	240/480V	2	E
10-32 Tapped	ATF-1500-230-115	1500VA	115/230V	2	F
10-32 Tapped	ATF-1500-480-240	1500VA	240/480V	2	F
10-32 Tapped	ATF-2000-230-115	2000VA	115/230V	2	G
10-32 Tapped	ATF-2000-480-240	2000VA	240/480V	2	G
10-32 Tapped	ATF-2500-230-115	2500VA	115/230V	2	H
10-32 Tapped	ATF-2500-480-240	2500VA	240/480V	2	H
10-32 Tapped	ATF-3000-230-115	3000VA	115/230V	2	I
10-32 Tapped	ATF-3000-480-240	3000VA	240/480V	2	J
10-32 Tapped	ATF-5000-230-115	5000VA	115/230V	2	K
10-32 Tapped	ATF-5000-480-240	5000VA	240/480V	2	L

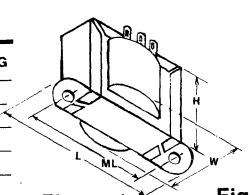


Figure 1

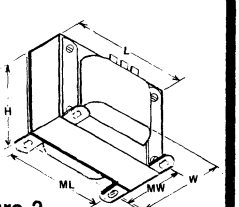


Figure 2

MOUNTING	L	W	H	ML	MW
A	4.06	2.4	2.64	3.56	—
B	4.06	2.7	2.64	3.56	—
C	3.81	2.9	3.19	3.13	2.38
D	4.56	3.5	3.81	3.75	2.75
E	5.31	4.3	4.44	4.38	3.13
F	6.44	4.3	5.38	5.31	2.88
G	6.44	5.6	5.38	5.31	3.75
H	7.13	5.0	6.10	5.81	3
I	7.13	5.3	6.10	5.81	3.25
J	7.13	5.6	6.10	5.81	3.25
K	7.13	7.1	6.10	5.81	4.75
L	7.13	7.0	6.10	5.81	4.75

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ENGINEERING: Magnetek's advanced magnetics technology provides our customers with a unique capability in solving their application problems. Working from specifications supplied by our customers, Magnetek's engineers can often help in optimizing designs or initiating designs to meet their requirements.

MANUFACTURING: Magnetek utilizes a variety of up-to-date precision automatic and semi-automatic production equipment to meet manufacturing requirements. A well-equipped tooling department supports engineering and manufacturing needs.

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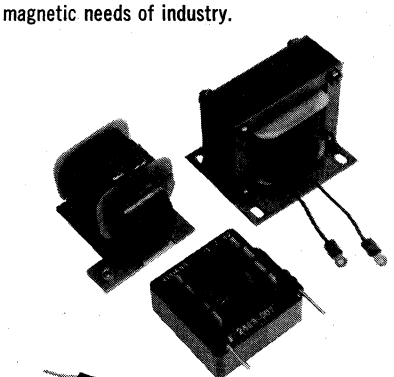
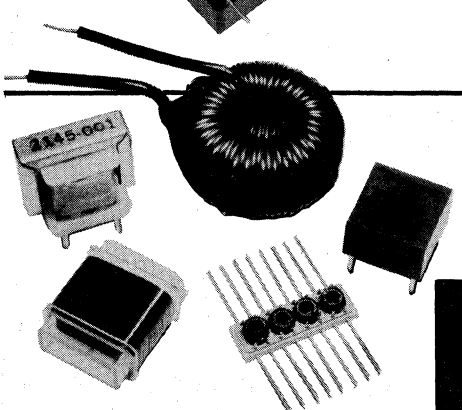
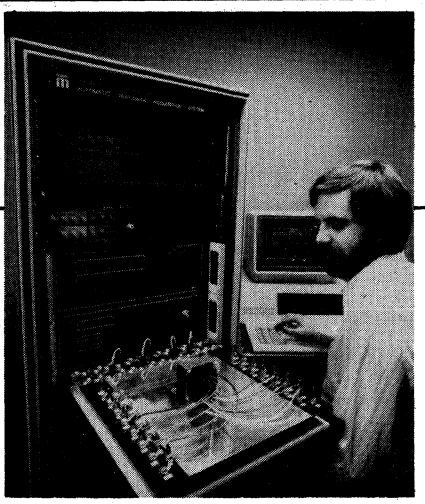
Innovative engineering and manufacturing techniques have been the cornerstone of the company's success. Magnetek will continue to develop new technologies in meeting the growing magnetic needs of industry.







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ZERO DEFECTS IS THE STANDARD FOR OUR MAGNETIC PRODUCTS

At Magnetek we take pride in our reputation for quality military and commercial products. We have always been committed to manufacturing the very best magnetic products for our customers.

DEFECT PREVENTION VS TRADITIONAL DEFECT DETECTION

Automatic Data Acquisition (ADA) equipment in product testing has created a new philosophy about Quality Assurance in manufacturing. This computerized testing capability enables fast, extensive and economical data collection of product parameters.

Statistical Process Control (SPC) is now an inexpensive and practical reality. Our Quality Improvement Team representing engineering, quality assurance, manufacturing, material control and accounting evaluates the data through Histograms, X bar R Charts and Cause & Effect Diagrams.

Action items from this analysis then close the loop by:

- Tracking part-to-part variation within a process to determine consistency.
- Revealing trends and step changes before they lead to defects.
- Targeting processes to be measured.
- Reducing variation caused by Materials, Methods, Machines, Man, Measurements and Mother Nature (environment).

ADA + SPC + ACTION = ZERO DEFECTS

Although Zero Defects is a tall order, we at Magnetek are committed to it and have the tools for achieving it.

MAGNETEK CORPORATION

Design and Manufacture Of Transformer Products
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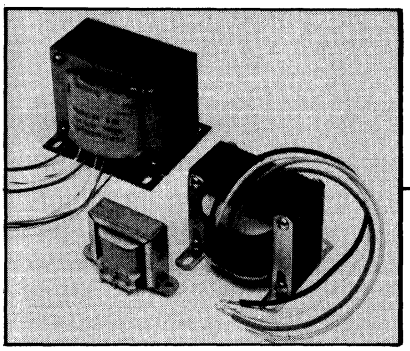
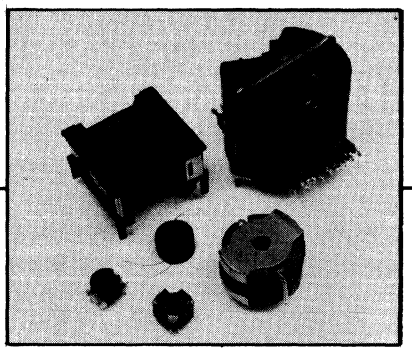


LAMINATED TRANSFORMERS



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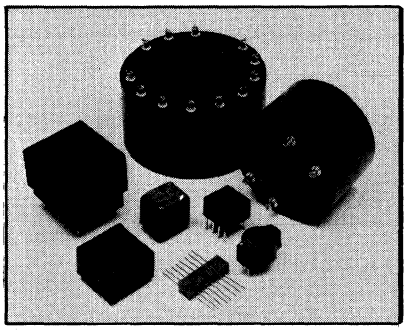
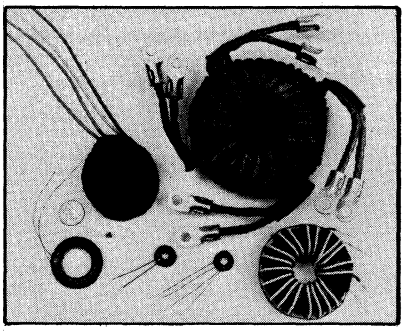
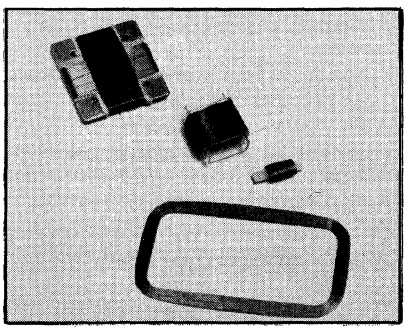


MIL-T-27 TRANSFORMERS



TOROIDAL TRANSFORMERS



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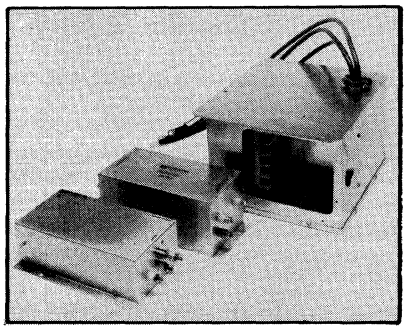
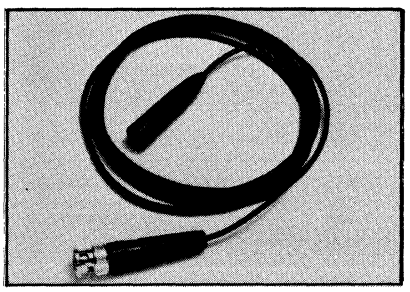
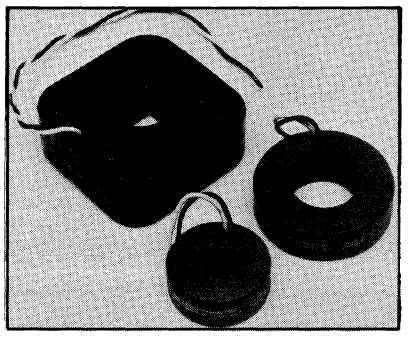


EMI/RFI LINE FILTERS



FLUX PROBE



CURRENT TRANSFORMERS

U.L. RECOGNIZED TOROIDAL CURRENT TRANSFORMERS

This series of five "C.T.'s" was developed for monitoring service entrance currents and circuit currents in residential and commercial buildings. They were designed originally for energy audit programs for the U.S. Department of Energy.

Since these devices are mounted in all conceivable locations, from old electrical systems to new construction, safety is paramount. The design was accomplished in close coordination with Underwriters Laboratories to assure a safe installation in the factory or the field, regarding prevention of shock hazard, fire prevention and physical ruggedness of the product for rough handling in extreme environments. Many states now require U.L. recognized devices for these installations.

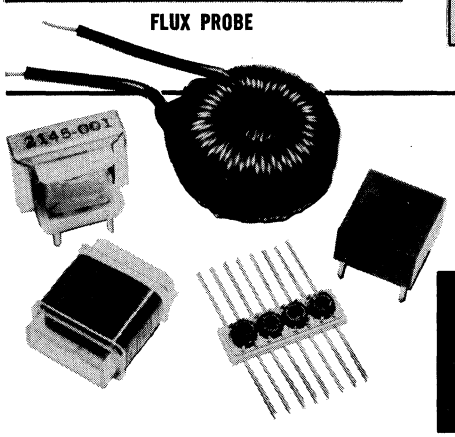
As a result we have developed a product well suited to the task and with excellent performance characteristics. Linearity of the output signal to monitored current is within 2% from $^1/_{10}$ to full rated value.

Each unit is fully encapsulated in a molded case of Noryl. The primary of the C.T. is formed by passing the wire to be monitored through the center of the toroid, creating a single turn. The secondary is lead out to an 8 foot twisted pair of U.L. 1015 stranded PVC lead wires.

The "C.T.'s" are offered with (—001) and without (—002) a precision 1.00 ohm internal burden resistor across the secondary. With the resistor, the output is .333 volts ±2% at the rated input current.

PHYSICAL DIMENSIONS IN INCHES

Part No.	Amps	ID x OD x HT
2697-XXX	30	0.30 x 1.70 x 0.75
2749-XXX	60	0.50 x 1.90 x 0.75
2685-XXX	100	0.75 x 2.10 x 0.75
2750-XXX	200	1.00 x 2.40 x 0.80
2686-XXX	400	1.25 x 2.70 x 0.80



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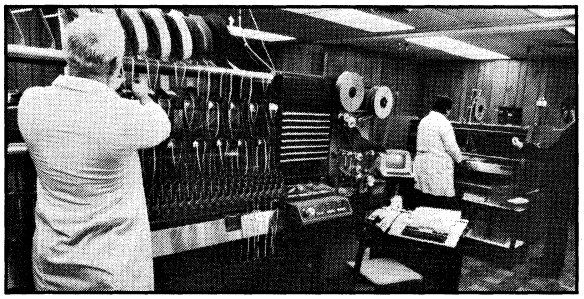

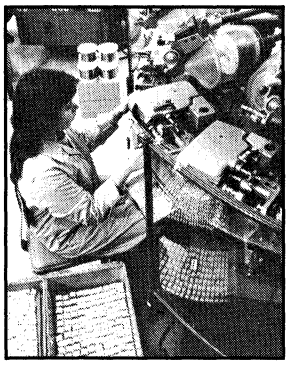

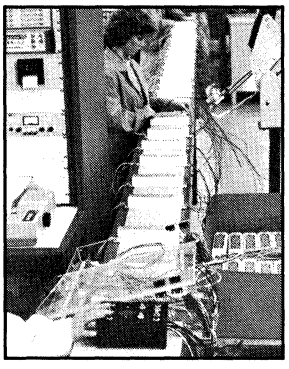

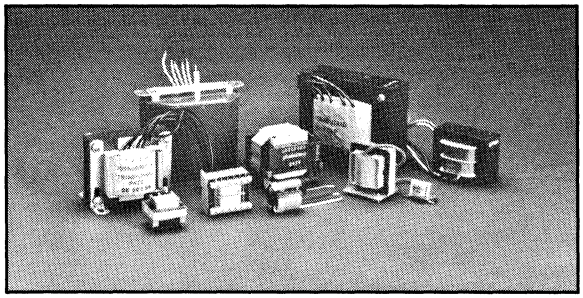

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Triad can meet the complete range of OEM requirements, from simple coils to assembled power supplies, in quantities from prototype to millions of units. We offer total facilities to serve the electronics industry, with one of the most modern and efficient plants in the country for the production of transformers, related magnetic components and custom designs.

Triad employs the latest in manufacturing techniques, many of which were developed by our own engineers. This sophisticated production equipment, plus a highly skilled workforce of nearly a thousand, assures high productivity. Our production capabilities and use of quality materials, means Triad can promise on-time delivery and competitive pricing, while maintaining our unsurpassed performance standards.

We meet your innovative designs

Triad engineers work closely with you, providing production and design solutions. Our design engineering staff offers over 100 years of combined experience in the lab and field, keeping Triad at the forefront of magnetics technology. Plus, Triad can design to agency specifications. We maintain close working relationships with all domestic and international agencies, including UL, BSA, VDE, CSA, IEC, and others.

We meet your custom requirements

For more than 25 years, original equipment manufacturers and design engineers have relied upon Triad for innovative solutions. We design and manufacture thousands of different custom transformers, from small switcher to large ferro resonant models.

These components are built to your specifications and application needs. Triad's production capabilities include power transformers of 1 watt to 2000 watts, from 45 to more than 20,000 Hz, and from printed circuit board-mounted, open frame or hermetically sealed units. Our winding department is capable of single, multiple and bobbin winding. Depending on the components required, we can offer a firm quotation in a few days and deliver prototype quantities in a few weeks.

We meet your quality standards

Triad's formal quality assurance system verifies that your specifications are consistently met or exceeded. All incoming components are tested to MIL-STD-105D, and continued inspection of wire, core, insulation and electronic components virtually eliminates imperfections. Statistical process controls are employed to ensure consistent quality. In addition, a periodic instrument calibration program in effect throughout the plant, and outgoing quality control inspections of all Triad products ensure that the specifications and top quality you demand are exactly what you receive.

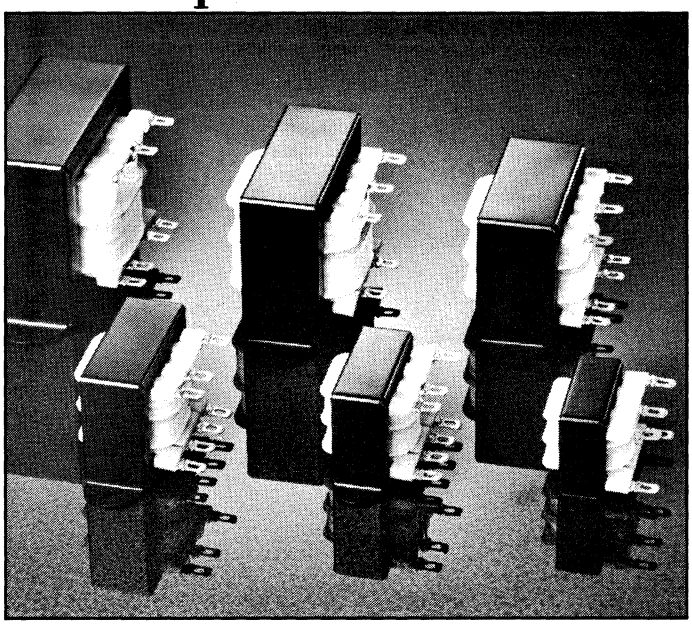
We meet your deadlines

Triad is ready to respond the day you call, no matter where you're calling from. And chances are, our hundreds of stocking distributors nationwide probably have the transformer you need, in stock and ready to ship. Triad's multi-million dollar inventory of thousands of designs means you're assured fast delivery whatever your specifications, custom or standard.

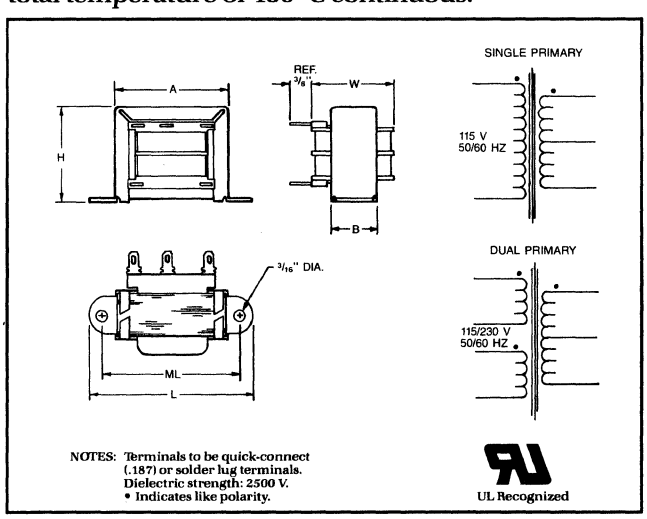
With so much to offer, it's no wonder Triad has been selected by many of the industry's largest manufacturers as the prime source for transformers. And we're ready to go to work for you too, with products and solutions as innovative as you are.

MagneTek Triad
1124 E. Franklin St., Huntington, IN 46750 • 219-356-6500 • FAX 219-356-3148 • ESL 62007688

Quick Pack™
small power transformers



Quick Pack™ transformers offer a significant size and height reduction for a given VA rating and come with a quick-connect or solder terminal. Bobbin winding reduces transformer size and space. Split Bobbin non-concentric winding eliminates costly electrostatic shielding, making possible higher HiPot testing - 2500V. Class B insulation insures maximum total temperature of 130° C continuous.



NOTES: Terminals to be quick-connect (.187) or solder lug terminals.
Dielectric strength: 2500 V.
• Indicates like polarity.

UL Recognized

Dimensions

Size	VA	L	W	H	A	B	ML	Lbs.
F3	2.4	2 1/16	1 1/16	1 3/16	1 5/8	9/16	1 3/4	0.25
F4 & FD4	6	2 3/8	1 1/4	1 3/8	1 11/16	11/16	2	0.44
F5 & FD5	12	2 13/16	1 3/8	1 5/8	1 15/16	13/16	2 3/8	0.7
F6 & FD6	30	3 1/4	1 11/16	1 15/16	2 5/16	1 1/16	2 13/16	1.1
F7 & FD7	56	3 11/16	1 13/16	2 1/4	2 11/16	1 1/16	3 1/8	1.7
F8 & FD8	100	4 1/32	2 1/4	2 9/16	3 1/16	1 5/16	3 9/16	2.75

Six sizes with single 115V or dual 115/230V primary, rated 50/60 Hz.

115V	115-230V	VA	OUTPUT RATING
F3-10	—	2.4	10VCT @ 0.25A
F4-10	FD4-10	6	10VCT @ 0.6A
F5-10	FD5-10	12	10VCT @ 1.2A
F6-10	FD6-10	30	10VCT @ 3.0A
F7-10	FD7-10	56	10VCT @ 5.0A
F8-10	FD8-10	100	10VCT @ 10.0A
F3-12	—	2.4	12.6VCT @ 0.2A
F4-12	FD4-12	6	12.6VCT @ 0.5A
F5-12	FD5-12	12	12.6VCT @ 1.0A
F6-12	FD6-12	30	12.6VCT @ 2.5A
F7-12	FD7-12	56	12.6VCT @ 4.0A
F8-12	FD8-12	100	12.6VCT @ 8.0A
F3-16	—	2.4	16VCT @ 0.15A
F4-16	FD4-16	6	16VCT @ 0.4A
F5-16	FD5-16	12	16VCT @ 0.8A
F6-16	FD6-16	30	16VCT @ 2.0A
F7-16	FD7-16	56	16VCT @ 3.5A
F8-16	FD8-16	100	16VCT @ 6.25A
F3-20	—	2.4	20VCT @ 0.12A
F4-20	FD4-20	6	20VCT @ 0.3A
F5-20	FD5-20	12	20VCT @ 0.6A
F6-20	FD6-20	30	20VCT @ 1.5A
F7-20	FD7-20	56	20VCT @ 2.8A
F8-20	FD8-20	100	20VCT @ 5.0A
F3-24	—	2.4	24VCT @ 0.1A
F4-24	FD4-24	6	24VCT @ 0.25A
F5-24	FD5-24	12	24VCT @ 0.5A
F6-24	FD6-24	30	24VCT @ 1.25A
F7-24	FD7-24	56	24VCT @ 2.4A
F8-24	FD8-24	100	24VCT @ 4.0A
F3-28	—	2.4	28VCT @ 0.085A
F4-28	FD4-28	6	28VCT @ 0.2A
F5-28	FD5-28	12	28VCT @ 0.42A
F6-28	FD6-28	30	28VCT @ 1.1A
F7-28	FD7-28	56	28VCT @ 2.0A
F8-28	FD8-28	100	28VCT @ 3.6A
F3-36	—	2.4	36VCT @ 0.065A
F4-36	FD4-36	6	36VCT @ 0.17A
F5-36	FD5-36	12	36VCT @ 0.35A
F6-36	FD6-36	30	36VCT @ 0.85A
F7-36	FD7-36	56	36VCT @ 1.5A
F8-36	FD8-36	100	36VCT @ 2.8A
F3-48	—	2.4	48VCT @ 0.05A
F4-48	FD4-48	6	48VCT @ 0.125A
F5-48	FD5-48	12	48VCT @ 0.25A
F6-48	FD6-48	30	48VCT @ 0.63A
F7-48	FD7-48	56	48VCT @ 1.2A
F8-48	FD8-48	100	48VCT @ 2.0A
F3-56	—	2.4	56VCT @ 0.045A
F4-56	FD4-56	6	56VCT @ 0.11A
F5-56	FD5-56	12	56VCT @ 0.22A
F6-56	FD6-56	30	56VCT @ 0.54A
F7-56	FD7-56	56	56VCT @ 1.0A
F8-56	FD8-56	100	56VCT @ 1.8A
F3-120	—	2.4	120VCT @ 0.02A
F4-120	FD4-120	6	120VCT @ 0.05A
F5-120	FD5-120	12	120VCT @ 0.1A
F6-120	FD6-120	30	120VCT @ 0.25A
F7-120	FD7-120	56	120VCT @ 0.5A
F8-120	FD8-120	100	120VCT @ 0.85A

For manufacturers' sales offices, see Yellow Pages.

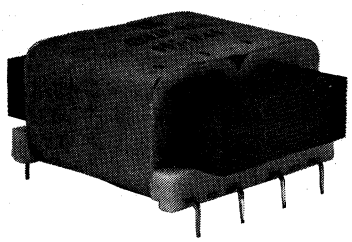
MagneTek Triad

New Product

Flat Pack Power

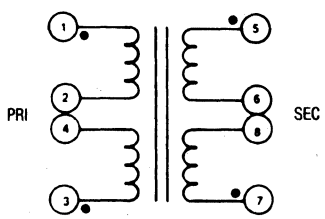
1124 E. Franklin St., Huntington, IN 46750 • 219-356-6500 • FAX 219-356-3148 • ESL 62007688

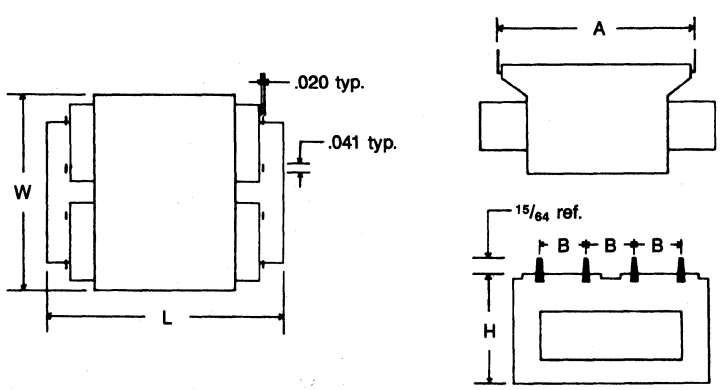
Triad's new Flat Pack power transformer is designed to meet the needs of low clearance printed circuit board and solid state power designs. These new units can also be used for control and instrumentation applications. Voltages and currents were chosen for widely used power applications and could be used in single or dual output supplies. The Triad Flat Pack has a unique construction feature allowing them to pass a 2000V HiPot test.



UL RECOGNIZED

TYPE NO.	OUTPUT WATTS	INDIVIDUAL	SECONDARY SERIES	PARALLEL
FP10-250	2.5	5V @ .25A	10V CT @ .25A	5V @ .5A
FP10-600	6	5V @ .6A	10V CT @ .6A	5V @ 1.2A
FP101200	12	5V @ 1.2A	10V CT @ 1.2A	5V @ 2.4A
FP12-200	2.5	6.3V @ .2A	12.6V CT @ .2A	6.3V @ .4A
FP12-475	6	6.3V @ .475A	12.6V CT @ .475A	6.3V @ .95A
FP12-950	12	6.3V @ .95A	12.6V CT @ .95A	6.3V @ 1.9A
FP16-150	2.5	8V @ .15A	16V CT @ .15A	8V @ .3A
FP16-375	6	8V @ .375A	16V CT @ .375A	8V @ .75A
FP16-750	12	8V @ .75A	16V CT @ .75A	8V @ 1.5A
FP20-125	2.5	10V @ .125A	20V CT @ .125A	10V @ .25A
FP20-300	6	10V @ .3A	20V CT @ .3A	10V @ .6A
FP20-600	12	10V @ .6A	20V CT @ .6A	10V @ 1.2A
FP24-100	2.5	12V @ .1A	24V CT @ .1A	12V @ .2A
FP24-250	6	12V @ .25A	24V CT @ .25A	12V @ .5A
FP24-500	12	12V @ .5A	24V CT @ .5A	12V @ 1.0A
FP30-85	2.5	15V @ .08A	30V CT @ .08A	15V @ .16A
FP30-200	6	15V @ .2A	30V CT @ .2A	15V @ .4A
FP30-400	12	15V @ .4A	30V CT @ .4A	15V @ .8A
FP34-75	2.5	17V @ .075A	34V CT @ .075A	17V @ .15A
FP34-170	6	17V @ .17A	34V CT @ .17A	17V @ .34A
FP34-340	12	17V @ .34A	34V CT @ .34A	17V @ .68A
FP40-60	2.5	20V @ .06A	40V CT @ .06A	20V @ .12A
FP40-150	6	20V @ .15A	40V CT @ .15A	20V @ .3A
FP40-300	12	20V @ .3A	40V CT @ .3A	20V @ .6A
FP56-45	2.5	28V @ .045A	56V CT @ .045A	28V @ .09A
FP56-100	6	28V @ .1A	56V CT @ .1A	28V @ .2A
FP56-200	12	28V @ .2A	56V CT @ .2A	28V @ .4A
FP88-28	2.5	44V @ .028A	88V CT @ .028A	44V @ .056A
FP88-65	6	44V @ .065A	88V CT @ .065A	44V @ .13A
FP88-130	12	44V @ .13A	88V CT @ .13A	44V @ .26A
FP120-20	2.5	60V @ .02A	120V CT @ .02A	60V @ .04A
FP120-50	6	60V @ .05A	120V CT @ .05A	60V @ .1A
FP120100	12	60V @ .1A	120V CT @ .1A	60V @ .2A
FP230-10	2.5	115V @ .01A	230V CT @ .01A	115V @ .02A
FP230-25	6	115V @ .025A	230V CT @ .025A	115V @ .05A
FP230-50	12	115V @ .05A	230V CT @ .05A	115V @ .1A





OUTPUT WATTS	H	W	L	A	B	WT OZ
2.5	.650	1.562	1.875	1.600	.375	5
6	.875	1.562	1.875	1.600	.375	7
12	1.062	2.000	2.500	2.000	.500	11

Specifications:

Flat Pack = allows ¾" card spacing for 2.5VA units, 1" card spacing for 6VA units or 1¼" for 12VA units

Split Bobbin = side by side windings reduce interwinding capacitance and eliminates the need for a static shield

Semi-Toroidal Construction reduces radiated magnetic fields and results in balanced windings

Terminals are precision spaced

Split Pack™

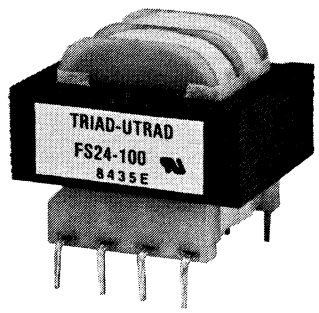
New Product

MagneTek Triad

1124 E. Franklin St., Huntington, IN 46750 • 219-356-6500 • FAX 219-356-3148 • ESL 62007688

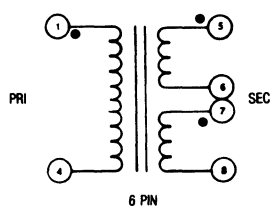
Split Bobbin Transformer

Triad's new Split Pack split bobbin transformer increases the depth and versatility of Triad's already extensive line of PC board mounted transformers. Like Triad's recent Flat Pack™ series, the Split Pack transformers are nonconcentrically wound—with primary and secondaries wound side by side, unlike the secondary-on-top-of-primary windings of standard PC board transformers. Split bobbin winding and low capacitive coupling eliminate costly electrostatic shielding. The Split Pack's unique construction make possible higher HiPot testing—2,500V rather than 1,500V. Dual primaries-115/230V, 50/400 Hz, plus precision spaced terminals.

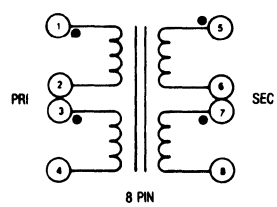


UL RECOGNIZED

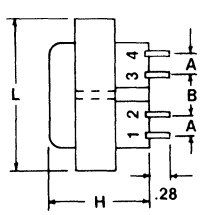
PRIMARY			SECONDARY RATINGS (RMS)		
115V 6 PIN	115-230V 8 PIN	VA	INDIVIDUAL	SERIES	PARALLEL
F10-110	FS10-110	1.1	5V @ .11A	10V CT @ .11A	5V @ .22A
F10-250	FS10-250	2.5	5V @ .25A	10V CT @ .25A	5V @ .5A
F10-600	FS10-600	6	5V @ .6A	10V CT @ .6A	5V @ 1.2A
F10-1200	FS101200	12	5V @ 1.2A	10V CT @ 1.2A	5V @ 2.4A
F10-2000	FS102000	20	5V @ 2A	10V CT @ 2A	5V @ 4A
F10-3600	FS103600	36	5V @ 3.6A	10V CT @ 3.6A	5V @ 7.2A
F12-090	FS12-090	1.1	6.3V @ .09A	12.6V CT @ .09A	6.3V @ .18A
F12-200	FS12-200	2.5	6.3V @ .2A	12.6V CT @ .2A	6.3V @ .4A
F12-500	FS12-500	6	6.3V @ .5A	12.6V CT @ .5A	6.3V @ 1.0A
F12-1000	FS121000	12	6.3V @ 1.0A	12.6V CT @ 1.0A	6.3V @ 2.0A
F12-1600	FS121600	20	6.3V @ 1.6A	12.6V CT @ 1.6A	6.3V @ 3.2A
F12-2850	FS122850	36	6.3V @ 2.85A	12.6V CT @ 2.85A	6.3V @ 5.7A
F16-070	FS16-070	1.1	8V @ .07A	16V CT @ .07A	8V @ .14A
F16-150	FS16-150	2.5	8V @ .15A	16V CT @ .15A	8V @ .3A
F16-400	FS16-400	6	8V @ .4A	16V CT @ .4A	8V @ .8A
F16-800	FS16-800	12	8V @ .8A	16V CT @ .8A	8V @ 1.6A
F16-1250	FS161250	20	8V @ 1.25A	16V CT @ 1.25A	8V @ 2.5A
F16-2250	FS162250	36	8V @ 2.25A	16V CT @ 2.25A	8V @ 4.5A
F20-055	FS20-055	1.1	10V @ .055A	20V CT @ .055A	10V @ .11A
F20-120	FS20-120	2.5	10V @ .12A	20V CT @ .12A	10V @ .24A
F20-300	FS20-300	6	10V @ .3A	20V CT @ .3A	10V @ .6A
F20-600	FS20-600	12	10V @ .6A	20V CT @ .6A	10V @ 1.2A
F20-1000	FS201000	20	10V @ 1.0A	20V CT @ 1.0A	10V @ 2A
F20-1800	FS201800	36	10V @ 1.8A	20V CT @ 1.8A	10V @ 3.6A
F24-045	FS24-045	1.1	12V @ .045A	24V CT @ .045A	12V @ .09A
F24-100	FS24-100	2.5	12V @ .1A	24V CT @ .1A	12V @ .2A
F24-250	FS24-250	6	12V @ .25A	24V CT @ .25A	12V @ .5A
F24-500	FS24-500	12	12V @ .5A	24V CT @ .5A	12V @ 1.0A
F24-800	FS24-800	20	12V @ .8A	24V CT @ .8A	12V @ 1.6A
F24-1500	FS241500	36	12V @ 1.5A	24V CT @ 1.5A	12V @ 3A
F28-040	FS28-040	1.1	14V @ .04A	28V CT @ .04A	14V @ .08A
F28-85	FS28-85	2.5	14V @ .085A	28V CT @ .085A	14V @ .17A
F28-200	FS28-200	6	14V @ .2A	28V CT @ .2A	14V @ .4A
F28-420	FS28-420	12	14V @ .42A	28V CT @ .42A	14V @ .84A
F28-700	FS28-700	20	14V @ .7A	28V CT @ .7A	14V @ 1.4A
F28-1300	FS281300	36	14V @ 1.3A	28V CT @ 1.3A	14V @ 2.6A
F36-030	FS36-030	1.1	18V @ .03A	36V CT @ .03A	18V @ .06A
F36-65	FS36-65	2.5	18V @ .065A	36V CT @ .065A	18V @ .13A
F36-170	FS36-170	6	18V @ .17A	36V CT @ .17A	18V @ .34A
F36-350	FS36-350	12	18V @ .35A	36V CT @ .35A	18V @ .7A
F36-550	FS36-550	20	18V @ .55A	36V CT @ .55A	18V @ 1.1A
F36-1000	FS361000	36	18V @ 1A	36V CT @ 1A	18V @ 2A
F48-023	FS48-023	1.1	24V @ .023A	48V CT @ .023A	24V @ .046A
F48-050	FS48-050	2.5	24V @ .05A	48V CT @ .05A	24V @ .1A
F48-125	FS48-125	6	24V @ .125A	48V CT @ .125A	24V @ .25A
F48-250	FS48-250	12	24V @ .25A	48V CT @ .25A	24V @ .5A
F48-400	FS48-400	20	24V @ .4A	48V CT @ .4A	24V @ .8A
F48-750	FS48-750	36	24V @ .75A	48V CT @ .75A	24V @ 1.5A
F56-020	FS56-020	1.1	28V @ .02A	56V CT @ .02A	28V @ .04A
F56-045	FS56-045	2.5	28V @ .045A	56V CT @ .045A	28V @ .09A
F56-110	FS56-110	6	28V @ .11A	56V CT @ .11A	28V @ .22A
F56-220	FS56-220	12	28V @ .22A	56V CT @ .22A	28V @ .44A
F56-350	FS56-350	20	28V @ .35A	56V CT @ .35A	28V @ .7A
F56-650	FS56-650	36	28V @ .65A	56V CT @ .65A	28V @ 1.3A
F120-010	FS120-01	1.1	60V @ .01A	120V CT @ .01A	60V @ .02A
F120-020	FS120-02	2.5	60V @ .02A	120V CT @ .02A	60V @ .04A
F120-050	FS120-05	6	60V @ .05A	120V CT @ .05A	60V @ .1A
F120-100	FS120100	12	60V @ .1A	120V CT @ .1A	60V @ .2A
F120-160	FS120160	20	60V @ .16A	120V CT @ .16A	60V @ .32A
F120-300	FS120300	36	60V @ .3A	120V CT @ .3A	60V @ .6A

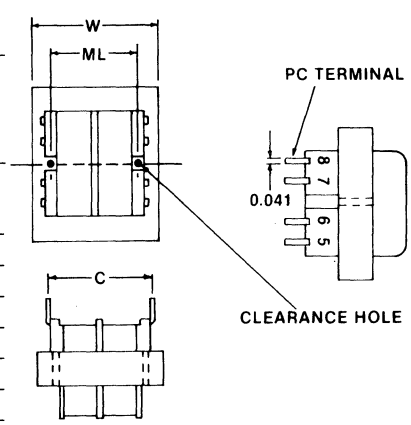


6 PIN



8 PIN





VA	H	W	L	ML	A	B	C	WT
1.1	15/16	1-1/8	1-3/8	—	.250	.250	1.200	.17
2.5	1-3/16	1-1/8	1-3/8	—	.250	.250	1.20	.25
6	1-5/16	1-5/16	1-5/8	1-1/16	.250	.350	1.280	.44
12	1-7/16	1-9/16	1-7/8	1-1/4	.300	.400	1.410	.70
20	1-7/16	1-7/8	2-1/4	1-1/2	.300	.400	1.600	.80
36	1-9/16	2-3/16	2-5/8	!	.400	.400	1.850	1.1

! 36VA size has 4 mtg. holes on 2-3/16 × 1-3/4 centers

MagneTek Triad

1124 E. Franklin St., Huntington, IN 46750 • 219-356-6500 • FAX 219-356-3148 • ESL 62007688

POWER TRANSFORMERS

FOR POWER SUPPLY, CONTROL AND FILAMENT CIRCUITS

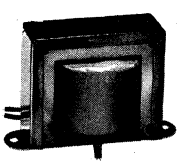
115V PRIMARY—SINGLE SECONDARY/50-60 Hz UNLESS NOTED (‡)

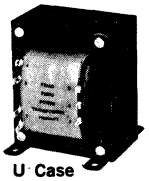
LISTED IN ORDER OF INCREASING SECONDARY VOLTAGES

Triad Part No.	Secondary Volts	Secondary Amps	RMS Test Voltage	Case Type	Connections or Lead Holes Used	Case Dimension H	Case Dimension W	Case Dimension D	Mounting Dimension MW	Mounting Dimension MD	Mounting Hole Size	Max. Unit Wt. Lbs.
F-1X‡+	2.5 CT	3	1500	X	Leads	1 5/8	2 13/16	1 5/8	2 3/8	—	3/16	.68
F-72Z‡	2.5 CT	5	Sec. 7500	Z	Sec.-Lugs	2 23/32	3 1/8	2 1/8	2 13/16	—	3/16	1.7
F-6X‡+	2.5 CT	6	Sec. 2500	X	Leads	1 15/16	3 5/16	1 3/4	2 13/16	—	3/16	1
F-3X‡	2.5 CT	10	Sec. 3000	X	Leads	2 9/32	3 3/4	2 1/8	3 1/8	—	3/16	1.7
F-5U	2.5 CT	10	Sec. 7500	U	Leads	3 1/16	2 1/2	2 7/16	2	1 7/8	5/16 x 3/16	2.2
F-7X	5.0 CT	3	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	—	3/16	1.3
F-8X	5.0 CT	6	1500	X	Leads	2 9/32	3 3/4	2 1/8	3 1/8	—	3/16	1.7
F-12X	5.0 CT	8	2500	X	Leads	2 19/32	4	2 1/4	3 9/16	—	3/16	2.5
F-10U‡	5.0 CT	14	Sec.10,000	U	Leads	3 13/16	3 3/16	3 1/4	2 1/2	2 5/16	5/16 x 3/16	4.75
F-15U‡	5.0 CT	15	Sec. 3000	U	Lugs	3 1/2	2 7/8	2 11/16	2 1/4	2 3/16	5/16 x 3/16	3.25
F-9U	5.2 CT	13	1500	U	Leads	3 7/16	2 13/16	3 1/4	2 1/4	2 3/8	5/16 x 3/16	4
F-11U	5.2 CT	24	1500	U	Leads	3 13/16	3 5/16	3 7/8	2 1/2	3 1/16	5/16 x 3/16	6.75
F-13X+	6.3	.6	1500	X	Leads	1 3/8	2 3/8	1 3/8	2	—	3/16	.37
R-84K	6.3§	.6	Sec. 3500	K	2-Leads	2 3/4	2 1/4	2 11/16	1 1/2	2 3/8	3/16	1.5
F-14X‡+	6.3 CT	1.2	Sec. 2500	X	Leads	1 5/8	2 13/16	1 5/8	2 3/8	—	3/16	.7
F-14Z‡	6.3 CT	1.2	Sec. 2500	Z	Leads	1 15/16	2 3/8	1 5/8	2	—	3/16	.7
F-52X	6.3§	1.2	Sec. 5000	X	Leads	1 15/16	3 5/16	1 3/4	2 13/16	—	3/16	1
F-51X‡	6.3§	2	Sec. 5000	X	Leads	1 15/16	3 5/16	2	2 13/16	—	3/16	1.25
F-16X+	6.3 CT	3	Sec. 2500	X	Leads	1 15/16	3 5/16	2	2 13/16	—	3/16	1.3
F-53X	6.3	4	Sec. 5000	X	Leads	2 19/32	4	2 1/4	3 9/16	—	3/16	2.1
F-43X‡	6.3	4	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	—	3/16	1.25
F-18A	6.3 CT	6	1500	A	1-Leads	3 3/16	2 21/32	2 5/8	2	1 11/16	3/8 x 3/16	2.5
F-18X+	6.3 CT	6	1500	X	Leads	2 19/32	4	2 1/4	3 9/16	—	3/16	2.3
F-69X	6.3 CT	8	1500	X	Leads	2 9/16	4	2 1/4	3 9/16	—	3/16	2.3
F-21A	6.3 CT	10	1500	A	1-Leads	3 19/32	2 31/32	3 1/8	2 1/4	2	3/8 x 3/16	3.8
F-20U†	6.3 CT-6 CT	11	Sec. 3000	U	Leads	3 1/2	2 7/8	3	2 1/4	2 7/16	5/16 x 3/16	4
F-17U‡	6.3 CT	15	Sec.10,000	U	Pri. Leads	4 1/4	3 1/2	3 3/4	2 3/4	2 13/16	5/16 x 3/16	7.5
F-22A	6.3 CT	20	2000	A	2-Leads	3 7/8	3 9/32	4 1/8	2 1/2	3	3/8 x 3/16	7
F-24U†	7.5 CT-6.3 CT	8	Sec. 3000	U	2-Leads	3 1/2	2 7/8	2 13/16	2 1/4	2 5/16	5/16 x 3/16	3.65
F-28U†	7.5 CT-6.3 CT	25	Sec. 3000	U	Leads/Lugs	4 5/8	3 13/16	3 5/8	3	3 1/16	5/16 x 3/16	7.5
F-180X	10.0 CT	1	1500	X	Leads	1 15/16	3 5/16	1 3/4	2 13/16	—	3/16	.9
F-31X	10.0 CT	3	2000	X	Leads	2 9/32	3 3/4	2 1/8	3 1/8	—	3/16	1.7
F-95X	10.0 CT	4	1500	X	Leads	2 5/8	4	2 1/8	3 9/16	—	3/16	2.1
F-33U	10.0 CT	5	2000	U	Leads	3	2 1/2	2 5/8	2	2 1/16	3/16 x 3/8	2.5
F-96U	10.0 CT	6	1500	U	Leads	3	2 1/2	2 3/4	2	2 5/16	3/8 x 3/16	2.1
F-23U	10.0 CT	7	1500	U	Leads	3 1/2	2 7/8	2 15/16	2 1/4	2 7/16	5/16 x 3/16	3.9
F-97U	10.0 CT	8	1500	U	Leads	3 7/16	2 13/16	3	2 1/4	2 1/2	3/8 x 3/16	4.0
F-35U	10.0 CT	10	2000	U	Leads	4 1/8	4 1/2	3 1/4	2 3/4	2 7/16	3/16 x 3/8	9.1
F-113X	12.0	0.15	1500	X	Leads	1 3/8	2 3/8	1 3/8	—	2	3/16	.4
F-216X‡	12.0	.35	1500	X	Leads	1 3/8	2 3/8	1 3/8	2	—	3/16	.37
F-114X	12.0	0.7	1500	X	Leads	1 5/8	2 13/16	1 5/8	—	2 3/8	3/16	.8
F-217X‡	12.0	1.2	1500	X	Leads	2	3 1/4	1 3/4	2 13/16	—	3/16	1.0
F-218X‡	12.0	2	1500	X	Leads	2	3 1/4	1 7/8	2 7/8	—	3/16	1.13
F-219X‡	12.0	4	1500	X	Leads	2 9/16	4	2 1/4	3 9/16	—	3/16	2.3
F-220U‡	12.0	6	1500	U	Leads	3 7/16	2 13/16	2 1/2	2 1/4	2 1/8	3/8 x 3/16	3.5
F-221U‡	12.0	8	1500	U	Leads	3 13/16	3 1/8	2 3/8	2 1/2	2 1/8	3/8 x 3/16	4.0
F-29U†	12 CT-11 CT 10.0 CT	11	Sec. 3000	U	Leads	4 3/8	3 1/2	3 3/8	2 3/4	2 9/16	5/16 x 3/16	6.5
F-70X	12.6 CT	1.0	1500	X	Leads	1 15/16	3 5/16	1 3/4	2 13/16	—	3/16	1.3
F-25X +	12.6 CT	1.5	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	—	3/16	1.3
F-44X‡+	12.6 CT	2	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	—	3/16	1.25
F-26X‡+	12.6 CT	2.5	1500	X	Leads	2 9/32	3 1/16	2	3 1/8	—	3/16	1.55
F-224X‡	12.6	3	1500	X	Leads	2 1/4	3 3/4	2 1/8	3 1/8	—	3/16	1.6
F-225X‡	12.6	4	1500	X	Leads	2 5/8	4	2 1/16	3 9/16	—	3/16	2.3
F-181U+	12.6 CT	4	1500	U	Leads	3 1/16	2 9/16	2 3/16	2	2	3/16	2.3
F-182U	12.6 CT	6	1500	U	Leads	3 3/8	2 13/16	2 7/16	2 1/4	2 3/8	5/16 x 3/16	3.8

§ Static shield. † Tapped primary to produce lower voltages. ‡ 60 cycle operation. + Available 115/230 PRI.

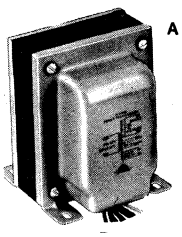
X Case



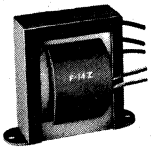


U Case

A Case



Z Case



POWER TRANSFORMERS

1124 E. Franklin St., Huntington, IN 46750 • 219-356-6500 • FAX 219-356-3148 • ESL 62007688

115V PRIMARY—SINGLE SECONDARY/50-60 Hz UNLESS NOTED (‡) CONTINUED

Triad Part No.	Secondary Volts	Secondary Amps	RMS Test Voltage	Case Type	Connections or Lead Holes Used	Case Dimension H	Case Dimension W	Case Dimension D	Mounting Dimension MW	Mounting Dimension MD	Mounting Hole Size	Max. Unit Wt. Lbs.
F-183U	12.6 CT	8	1500	U	Leads	3 13/16	3 3/16	2 15/16	2 1/2	2 1/4	5/16 x 3/16	5
F-112X+	14.0 CT	0.25	1500	X	Leads	1 3/8	2 3/8	1 3/8	2	—	3/16	.4
F-250X	14.0 CT	1	1500	X	Leads	1 15/16	3 1/4	1 3/4	2 13/16	—	3/16	1.2
F-251X	14.0 CT	2	1500	X	Leads	2 1/4	3 11/16	1 15/16	3 1/8	3/16	—	1.5
F-252U	14.0 CT	4	1500	U	Leads	3	2 1/2	2 7/16	2	2 1/4	5/16 x 3/16	3
F-253U	14.0 CT	6	1500	U	Leads	3 3/8	2 13/16	2 7/8	2 1/4	2 3/8	5/16 x 3/16	4
F-410X	18.0 CT	.75	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	—	3/16	1.3
F-411X	18.0 CT	1	1500	X	Leads	1 15/16	3 5/16	2 1/8	2 13/16	—	3/16	1.45
F-412X	18.0 CT	1.5	1500	X	Leads	2 9/32	3 3/4	2 1/8	3 1/8	—	3/16	1.7
F-413X	18.0 CT	2	1500	X	Leads	2 9/32	3 3/4	2 1/4	3 1/8	—	3/16	1.95
F-254X	20.0 CT	1	1500	X	Leads	2 1/4	3 11/16	1 15/16	3 1/8	—	3/16	1.5
F-255X	20.0 CT	2	1500	X	Leads	2 9/16	4	2 1/4	3 9/16	—	3/16	2.5
F-256U	20.0 CT	4	1500	U	Leads	3 3/8	2 13/16	2 7/8	2 1/4	2 3/8	5/16 x 3/16	4
F-257U	20.0 CT	6	1500	U	Leads	3 3/4	3 1/8	3 1/8	2 1/2	2 5/8	5/16 x 3/16	5.7
F-258U	20.0 CT	8	1500	U	Leads	3 3/4	3 1/8	3 1/2	2 1/2	2 7/8	5/16 x 3/16	6.4
F-259U	20.0 CT	10	1500	U	Leads	4 1/8	3 5/16	3 1/2	2 3/4	2 3/4	5/16 x 3/16	7.4
F-115X+	24.0 CT	0.085	1500	X	Leads	1 3/16	2 1/16	1 1/4	1 3/4	—	3/16	3
F-116X+	24.0 CT	0.2	1500	X	Leads	1 3/8	2 3/8	1 1/2	2	—	3/16	.45
F-117X+	24.0 CT	0.4	1500	X	Leads	1 5/8	2 13/16	1 5/8	2 3/8	—	3/16	.8
F-118X+	24.0 CT	0.7	1500	X	Leads	1 15/16	3 1/4	2	2 13/16	—	3/16	1.3
F-45X‡+	24.0 CT	1	1500	X	Leads	1 15/16	3 5/16	2	3 1/8	—	3/16	1.3
F-46X‡+	24.0	1	1500	X	Leads	1 15/16	3 11/16	2 1/8	3 1/8	—	3/16	1.4
F-192X	24.0 CT	2	1500	X	Leads	2 19/32	4	2 1/4	3 9/16	—	3/16	2.3
F-229X‡	24.0	2	1500	X	Leads	2 9/16	4	1 7/8	3 9/16	—	3/16	2.3
F-193U	24.0 CT	4	1500	U	Leads	3 13/16	3 1/8	2 13/16	2 1/2	2 1/8	5/16 x 3/16	4
F-260U	24.0 CT	6	1500	U	Leads	3 3/4	3 1/8	3 1/2	2 1/2	2 7/8	5/16 x 3/16	6.4
F-261U	24.0 CT	8	1500	U	Leads	4 1/8	3 5/16	3 1/2	2 3/4	2 3/4	5/16 x 3/16	7.4
F-401U	24.0 CT	10	1500	U	Leads	4 1/8	3 7/16	3 3/4	2 3/4	3	3/8 x 3/16	8.0
F-226U	24.0 CT	12	1500	U	Leads	4 5/16	3 3/4	4 1/8	3	3 1/4	3/8 x 3/16	10.4
F-57X†	25.2 CT	1	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	—	3/16	1.5
F-41X‡+	25.2 CT	2	1500	X	Leads	2 19/32	4	2 1/4	3 9/16	—	3/16	2.2
F-56X	25.2 CT	2.8	1500	X	Leads	2 21/32	4	2 1/4	3 9/16	—	3/16	2.5
F-119X	26.8 CT	0.15	1500	X	Leads	1 3/8	2 3/8	1 1/2	2	—	3/16	.45
F-120X	26.8 CT	0.5	1500	X	Leads	1 15/16	3 1/4	2	2 13/16	—	3/16	1.3
F-40X‡+	26.8 CT	1	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	—	3/16	1.3
F-55X+	26.8 CT	1.7	1500	X	Leads	2 19/32	4	2 1/4	3 9/16	—	3/16	2.3
F-121X	28.0 CT	.085	1500	X	Leads	1 3/16	2 1/16	1 3/8	1 3/4	—	3/16	.25
F-122X	28.0 CT	.175	1500	X	Leads	1 3/8	2 3/8	1 1/2	2	—	3/16	.35
F-123X	28.0 CT	.300	1500	X	Leads	1 5/8	2 13/16	1 5/8	2 3/8	—	3/16	.6
F-124X	28.0 CT	.800	1500	X	Leads	1 15/16	3 1/4	2	2 13/16	—	3/16	1
F-184X	28.0 CT	1	1500	X	Leads	2 9/32	3 3/4	2 1/8	2 13/16	—	3/16	1.4
F-185U+	28.0 CT	2	1500	U	Leads	3 1/16	2 1/2	2 7/16	2	2 1/4	3/16 x 3/8	2.9
F-187U	28.0 CT	4	1500	U	Leads	3 1/2	2 7/8	3 1/16	2 1/4	2 3/4	5/16 x 3/16	5.3
F-262X	30.0 CT	1	1500	X	Leads	2 1/4	3 11/16	1 15/16	3 1/8	—	3/16	1.5
F-210X	30.0 CT	1.7	1500	X	Leads	2 19/32	4	2 1/4	3 9/16	—	3/16	1.55
F-263U	30.0 CT	2	1500	U	Leads	3	2 1/2	2 9/16	2	2 3/8	5/16 x 3/16	3.2
F-264U	30.0 CT	4	1500	U	Leads	3 3/4	3 1/8	3 1/8	2 1/2	2 5/8	5/16 x 3/16	5.7
F-265U	30.0 CT	6	1500	U	Leads	4 1/8	3 7/16	3 1/2	2 3/4	2 3/4	5/16 x 3/16	7.4
F-266U‡	30.0 CT	8	1500	U	Leads	4 1/2	3 3/4	4	3	3	5/16 x 3/16	10
F-227X‡	35.0 CT	.065	1500	X	Leads	1 3/16	2 1/16	1 5/16	1 3/4	—	3/16	.3
F-188X	35.0 CT	.1	1500	X	Leads	1 5/8	2 13/16	1 7/16	2 3/8	—	3/16	.35
F-228X‡	35.0 CT	.3	1500	X	Leads	1 5/8	2 13/16	1 5/8	2 3/8	—	3/16	.6
F-189X	35.0 CT	.5	1500	X	Leads	2 5/16	3 11/16	1 15/16	3 1/8	—	3/16	1
F-54X+	35.0 CT	1.5	1500	X	Leads	2 19/32	4	2 1/4	3 9/16	—	3/16	2.2
F-190U	35.0 CT	2	1500	U	Leads	3 3/8	2 13/16	2 3/4	2 1/4	2 3/8	5/16 x 3/16	3.5
F-191U	35.0 CT	4	1500	U	Leads	3 13/16	3 3/16	3 3/16	2 3/4	2 1/2	5/16 x 3/16	6
F-267U	35.0 CT	6	1500	U	Leads	4 1/8	3 7/16	3 1/2	2 3/4	2 3/4	5/16 x 3/16	7.4
F-268U	35.0 CT	8	1500	U	Leads	4 1/2	3 3/4	4 1/4	3	3 1/4	5/16 x 3/16	11
F-269U	35.0 CT	10	1500	U	Leads	5 1/4	4 3/8	4 1/8	3 1/2	2 3/4	5/16 x 3/16	12
F-270X	40.0 CT	1	1500	X	Leads	2 9/16	4	2 1/4	3 9/16	—	3/16	2.6
F-271U	40.0 CT	2	1500	U	Leads	3 3/8	2 13/16	2 7/8	2 1/4	2 3/8	5/16 x 3/16	4
F-272U	40.0 CT	4	1500	U	Leads	3 3/4	3 1/8	3 1/2	2 1/2	2 7/8	5/16 x 3/16	6.4
F-273U	40.0 CT	6	1500	U	Leads	4 1/2	3 3/4	4	3	3	5/16 x 3/16	10
F-274U	40.0 CT	8	1500	U	Leads	4 1/2	3 3/4	4 1/4	3	3 5/8	5/16 x 3/16	10.5
F-275U	40.0 CT	10	1500	U	Leads	5 1/4	4 3/8	4 1/2	3 1/2	3 1/4	5/16 x 3/16	14.5
F-276X	50.0 CT	1	1500	X	Leads	2 9/16	4	2 1/4	3 9/16	—	3/16	2.4
F-277U	50.0 CT	2	1500	U	Leads	3 3/4	3 1/8	2 7/8	2 1/2	2 3/8	5/16 x 3/16	4.7
F-278U	50.0 CT	4	1500	U	Leads	4 1/8	3 7/16	3 1/2	2 3/4	2 3/4	5/16 x 3/16	7.4
F-58A	50.0 CT	5	1500	A	Leads	4 5/8	3 15/16	4 1/2	3	3 3/8	3/8 x 3/16	10
F-59X	60.0 CT	.4	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	—	3/16	1.3
F-279U	60.0 CT	1	1500	U	Leads	3	2 1/2	2 5/8	2	2 3/8	5/16 x 3/16	3.4
F-280U	60.0 CT	2	1500	U	Leads	3 3/4	3 1/8	3 1/8	2 1/2	2 5/8	5/16 x 3/16	5.6
F-281U	60.0 CT	4	1500	U	Leads	4 1/2	3 3/4	4	3	3	5/16 x 3/16	10
F-282U	60.0 CT	6	1500	U	Leads	5 1/4	4 3/8	4 1/8	3 1/2	2 7/8	5/16 x 3/16	12.5
F-283U	70.0 CT	1	1500	U	Leads	3 3/8	2 13/16	2 5/8	2 1/4	2 1/4	5/16 x 3/16	4
F-284U	70.0 CT	2	1500	U	Leads	3 3/4	3 1/8	3 1/2	2 1/2	2 7/8	5/16 x 3/16	6

§ Static shield. † Tapped primary to produce lower voltages. ‡ 60 cycle operation. + Available 115/230 PRI.

MagneTek Triad

1124 E. Franklin St., Huntington, IN 46750 • 219-356-6500 • FAX 219-356-3148 • ESL 62007688

POWER TRANSFORMERS

MICROPROCESSOR POWER TRANSFORMERS

DUAL C.T. SECONDARIES, 115V PRIMARY/50/60 Hz

F234Z-F245U HAVE 2 ISOLATED WINDINGS

Triad Part No.	Secondary Volts	Secondary Amps	RMS Test Voltage	Case Type	Connections or Lead Holes Used	Case Dimension H	Case Dimension W	Case Dimension D	Mounting Dimension MW	Mounting Dimension MD	Mounting Hole Size	Max. Unit Wt. Lbs.
F-234Z‡	12.0 CT	.1	1500	Z	Lugs	1 3/8	2	1 5/16	1 3/4	—	3/16	.3
F-235Z‡	12.0 CT	.25	1500	Z	Lugs	2	2 3/8	1 7/16	2	—	3/16	.6
F-236Z‡	12.0 CT	.5	1500	Z	Lugs	2 5/16	2 7/8	1 5/8	2 3/8	—	3/16	.9
F-237Z‡	12.0 CT	1	1500	Z	Lugs	2 3/8	2 13/16	2 1/16	2 3/8	—	3/16	1.1
F-238U‡	12.0 CT	2	1500	U	Lugs	2 1/2	3	2 3/16	2 1/2	2	3/8 x 3/16	2.2
F-239U‡	12.0 CT	4	1500	U	Lugs	3 1/8	3 3/4	2 3/4	3 1/8	2 1/4	3/8 x 3/16	4.3
F-240U‡	12.0 CT	6	1500	U	Lugs	3 1/2	4 1/8	3 1/16	2 1/2	2 1/4	3/8 x 3/16	5.4
F-241U‡	18.0 CT	1	1500	U	Lugs	2 1/2	3	2 1/2	2 1/8	2	3/8 x 3/16	2.2
F-242U‡	18.0 CT	2	1500	U	Lugs	3 1/8	3 3/4	3 1/8	3 7/16	2	3/8 x 3/16	4.0
F-243U‡	18.0 CT	4	1500	U	Lugs	3 1/2	4 1/8	3 1/4	3 3/4	2 1/4	3/8 x 3/16	5.2
F-244U‡	18.0 CT	8	1500	U	Lugs	3 3/4	4 1/2	4	3 3/4	2 3/4	3/8 x 3/16	8.3
F-245U‡	18.0 CT	12	1500	U	Lugs	4 3/8	5 3/16	4 1/4	4 1/2	2 3/4	3/8 x 3/16	11.9
F-194X	32.0 CT 15.5 CT	.050 .200	1500	X	Leads	1 5/8	2 7/8	1 3/8	2 3/8	—	3/16	.45
F-195X	32.0 CT 15.5 CT	.250 .750	1500	X	Leads	2 1/4	3 3/4	1 7/8	3 1/8	—	3/16	1.3
F-196U	32.0 CT 15.0 CT	1 2	1500	U	Leads	3 3/8	2 13/16	2 5/8	2 1/4	2 1/4	5/16 x 3/16	4
F-197U	32.0 CT 15.0 CT	1 4	1500	U	Leads	3 3/4	3 1/8	2 15/16	2 1/2	2 1/4	5/16 x 3/16	4.7
F-198U	32.0 CT 15.0 CT	1 6	1500	U	Leads	3 3/4	3 1/8	3 3/16	2 1/2	2 3/4	5/16 x 3/16	6.2
F-199U	32.0 CT 15.0 CT	1 10	1500	U	Leads	4 1/8	3 7/16	3 1/2	2 3/4	2 3/4	5/16 x 3/16	7.4

* Windings may be connected in series to obtain their combined voltage when properly phased. Current will be equal to the current of the lowest winding. Example: Two 6.3V windings @ 2A in series would be 12.6V @ 2A. Windings may also be connected in parallel to obtain combined current. Example: Two 6.3V windings @ 2A in parallel would be 6.3V @ 4A. ¶ Tapped primary 105-115-125. ‡ 60 cycle operation.

DUAL C.T. SECONDARIES/PRIMARY 230V, 50/60 Hz

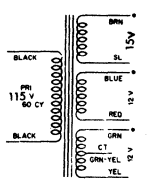
Triad Part No.	Secondary Volts	Secondary Amps	RMS Test Voltage	Case Type	Connections or Lead Holes Used	Case Dimension H	Case Dimension W	Case Dimension D	Mounting Dimension MW	Mounting Dimension MD	Mounting Hole Size	Max. Unit Wt. Lbs.
F-395X	32.0 CT 15.0 CT	.250 .750	1500	X	Leads	2 1/4	3 3/4	1 7/8	3 1/8	—	3/16	1.3
F-396U	32.0 CT 15.0 CT	1 2	1500	U	Leads	3 3/8	2 13/16	2 5/8	2 1/4	2 1/4	5/16 x 3/16	4
F-397U	32.0 CT 15.0 CT	1 4	1500	U	Leads	3 3/4	3 1/8	2 15/16	2 1/2	2 1/4	5/16 x 3/16	4.7

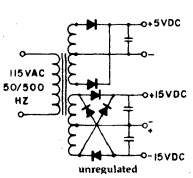
TRIPLE SECONDARIES, 115V PRIMARY, 60 Hz ONLY (3 ISOLATED WINDINGS)

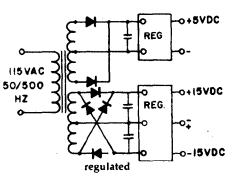
Type No.	Secondary Volts	Secondary Amps	RMS Test Voltage	Case Type	Connections	Case Dimensions H	Case Dimensions W	Case Dimensions D	Case Dimensions MW	Mtg. Hole Size	Max. Unit Wt. Lbs.
F-295Z	12VCT-12V 15V	.1	1500	Z	Leads	1 3/4	2	1 1/2	1 3/4	3/16	.4
F-296Z		.15	1500	Z	Leads	1 15/16	2 3/8	1 1/2	2	3/16	.6
F-297Z		.25	1500	Z	Leads	1 15/16	2 7/16	1 5/8	2	3/16	.7
F-298Z		.5	1500	Z	Leads	2 1/4	3 3/4	1 7/8	3	3/16	1.3
F-299X		1.5	1500	X	Leads	2 5/16	4	2 1/4	3 3/16	3/16	2.3

TRIPLE SECONDARIES, 115-230V PRIMARY, 50-60 Hz (3 ISOLATED WINDINGS)

F-3295Z	12VCT-12V 15V	.1	1500	Z	Leads	1 3/4	2	1 1/2	1 3/4	3/16	.41
F-3297Z		.25	1500	Z	Leads	2 3/8	2 7/8	1 5/8	2 3/8	3/16	.8
F-3298Z		.5	1500	Z	Leads	2 3/8	2 13/16	2	2 3/8	3/16	1.25







TRANSFORMERS

MagneTek Triad

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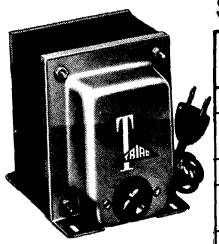

M Case

STEPDOWN AUTOFORMERS/50-60 Hz

Triad Part No.	Output Watts (VA)	Primary Volts	Secondary Volts ±5%	Secondary RMS Amps	RMS Test Voltage	Case Type	Connections	Mounting Dimension MW	Mounting Dimension MD
N-1X	50	230	115	.435	1500	X	Leads	3⅛	—
N-3M	85	230	115	.74	1500	M	6′ Cord & Plug & Socket	2¼	1⅝
N-2X	100	230	115	.87	1500	X	Leads	3⅝	—
N-4M	150	230	115	1.3	1500	M	6′ Cord & Plug & Socket	2¼	2⅜
N-6U	200	230	115	1.7	1500	U	Leads	2¼	2¼
N-5M	250	230	115	2.17	1500	M	6′ Cord & Plug & Socket	2½	3
N-7M	600	230	115	5.22	1500	M	6′ Cord & Plug & Socket	3	3⅞
N-39X	50	0-100-115-127-135	115	.43	1500	X	Lugs	2 13/16	—
N-40X	100	0-100-115-127-135	115	.87	1500	X	Lugs	2 13/16	—
N-100MG	100	115	230	.65	1500	MG	6′ 3 Wire, Cord Plug & Socket	2¼	2 31/32
N-250MG	250	115	230	1.1	1500	MG	6′ 3 Wire, Cord Plug & Socket	2½	3¼
N-500MG	500	115	230	2.2	1500	MG	6′ 3 Wire, Cord Plug & Socket	3	3⅝
N-1000MG	1000	115	230	4.35	1500	MG	6′ 3 Wire, Cord Plug & Socket	3½	4⅛

LOW VOLTAGE RECTIFIER/TRANSISTOR DRIVE VOLTAGE, 50-60 Hz

Triad Part No.	Primary Volts	Secondary AC Volts	Secondary AC Amps	DC Volts Half Wave	DC Volts Bridge	RMS Test Voltage	Case Type	Connections	Case Dimension H	Case Dimension W	Case Dimension D	Mounting Dimension MW	Mounting Dimension MD
F-94X	115†	10-20 CT—40 CT	.035	15	30	1500	X	Leads	1⅜	2⅜	1⅜	2	—
F-90X	115†	10-20 CT—40 CT	.1	15	30	1500	X	Leads	1⅝	2 13/16	1⅝	2⅜	—
F-91X	115†	10-20 CT—40 CT	.3	15	30	1500	X	Leads	2 9/32	3 11/16	2	3⅛	—
F-93X	115†	10-20 CT—40 CT	.75	15	30	1500	X	Leads	2 19/32	4	2¼	3 9/16	—
F-92A	115†	10-20 CT—40 CT	1.0	15	30	1500	A	Leads (2 Holes)	3 3/16	2 21/32	3	2	2 1/16
F-394X	230	10-20 CT—40 CT	.035	15	30	1500	X	Leads	1⅜	2⅜	1⅜	2	—
F-390X	230	10-20 CT—40 CT	.1	15	30	1500	X	Leads	1⅝	2 13/16	1⅝	2⅜	—
F-391X	230	10-20 CT—40 CT	.3	15	30	1500	X	Leads	2¼	3 11/16	2	3⅛	—
F-393X	230	10-20 CT—40 CT	.75	15	30	1500	X	Leads	2 19/32	4	2¼	3 9/16	—
F-392A	230	10-20 CT—40 CT	1.0	15	30	1500	A	Leads	3 3/16	2 21/32	3	2	2 1/16

UNIVERSAL RECTIFIER POWER/PRIMARY 117V, 50-60 Hz

Triad Part No.	Secondary No. 1 AC Volts	Secondary DC Amps Full Wave CT	Secondary DC Amps Bridge	Secondary No. 2 AC Volts	Secondary No. 2 DC Amps	RMS Test Volts	Case Type	Connections	Case Dimension H	Case Dimension W	Case Dimension D	Mounting Dimension MW	Mounting Dimension MD
F-202U	11.0 to 29.5	2.0	1.25	—	—	1000	U	Lugs	3	2½	3	2	2⅛
F-203U	12.0 to 30.0	4.0	2.0	—	—	1000	U	Lugs	3⅜	2 13/16	3¼	2¼	2⅜
F-204U	11.5 to 29.0	8.0	4.0	—	—	1000	U	Lugs	3¾	3⅛	4⅛	2½	2⅞
F-205U	12.0 to 29.5	12.0	6.0	—	—	1000	U	Lugs	4⅛	3 7/16	5⅛	2¾	3¼

Triad Part No.	Primary Volts	Secondary AC Volts	Secondary AC Amps	DC Volts Half Wave	DC Volts Bridge	RMS Test Voltage	Case Type	Connections	Case Dimension H	Case Dimension W	Case Dimension D	Mounting Dimension MW	Mounting Dimension MD
F-47U **F-347U**	115 115/230	0-17-18	3	6-7	13-14	1500	U	Leads	3	2½	2¾	1⅝	2⅜
F-48U	115	0-17-18	6	6-7	13-14	1500	U	Leads	3 13/16	3 3/16	3 3/16	2½	2 11/16
F-49U	115	36* 36*	3 3	13 13	26 26	1500	U	Leads	4⅝	3 13/16	3¾	3	3 1/16
F-60U	115	0-6.5-13-19.5-26	3	9	18	1500	U	Leads	3⅜	2 13/16	2⅝	2¼	2 1/16
F-360U	115/230	—	—	—	—	—	—	—	—	—	—	—	—
F-61U	115	0-24-27-30-33-36	3	13	26	1500	U	Leads	3¾	3⅛	3¼	2½	2⅝
F-361U	115/230	–	—	—	—	—	—	—	—	—	—	—	—
F-67U‡	110-120	0-24-27-30-33-36	8	13	26	1500	U	Leads	4⅝	3 13/16	4⅜	3	3 5/16
F-64U	115	0-7-8-9	7	—	5-6-7	1500	U	Leads	3⅜	2 13/16	2¾	2¼	2 1/16

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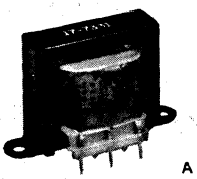
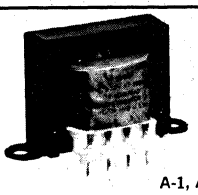

A

B


A-1, A-2

B-1

LOW-VOLTAGE, LOW-CURRENT PLUG-IN PRINTED CIRCUIT POWER

115V, 50-60 Hz PRIMARY/DUAL SECONDARIES*

Cat. No.	Fig.	Output Watts	Secondary		Dimensions						Mtg. Dim.	Wt. Oz.
			Series Connection	Parallel Connection	H	W	D	L	A	B		
F-131P	B	1½	8V CT @ .188A	4V @ .376A	1⅛	1 25/64	1 5/32	1 25/64	5/16	1	—	3.5
F-139P	B	1½	12.6V CT @ .12A	6.3V @ .24A	1⅛	1 25/64	1 5/32	1 25/64	5/16	1	—	3.5
F-132P	B	1½	15V CT @ .100A	7.5V @ .200A	1⅛	1 25/64	1 5/32	1 25/64	5/16	1	—	3.5
F-150P	B	1½	17V CT @ .085A	8.5V @ .170A	1⅛	1 25/64	1 5/32	1 25/64	5/16	1	—	3.5
F-138P	B	1½	25.2V CT @ .06A	12.6V @ .12A	1⅛	1 25/64	1 5/32	1 25/64	5/16	1	—	3.5
F-133P	B	1½	30V CT @ .050A	15V @ .100A	1⅛	1 25/64	1 5/32	1 25/64	5/16	1	—	3.5
F-160P	B	1½	34V CT @ .045A	17V @ .090A	1⅛	1 25/64	1 5/32	1 25/64	5/16	1	—	3.5
F-135P	B	1½	76V CT @ .020A	38V @ .040A	1⅛	1 25/64	1 5/32	1 25/64	5/16	1	—	3.5
F-149XP	A	4½	12.6V CT @ .35A	6.3V @ .70A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-142XP	A	4½	15V CT @ .300A	7.5V @ .600A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-161XP	A	4½	17V CT @ .264A	8.5V @ .528A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-148XP	A	4½	25.2V CT @ .178A	12.6V @ .356A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-143XP	A	4½	30V CT @ .150A	15V @ .300A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-162XP	A	4½	34V CT @ .132A	17V @ .264A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-147XP	A	4½	40V CT @ .112A	20V @ .224A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-144XP	A	4½	54V CT @ .084A	27V @ .168A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-159XP	A	7½	12.6V CT @ .60A	6.3V @ 1.2A	1 41/64	2 13/16	1 15/32	1 61/64	13/32	1 5/16	2 3/8	10.5
F-152XP	A	7½	15V CT @ .500A	7.5V @ 1.000A	1 41/64	2 13/16	1 15/32	1 61/64	13/32	1 5/16	2 3/8	10.5
F-163XP	A	7½	17V CT @ .441A	8.5V @ .882A	1 41/64	2 13/16	1 15/32	1 61/64	13/32	1 5/16	2 3/8	10.5
F-158XP	A	7½	25.2V CT @ .30A	12.6V @ .60A	1 41/64	2 13/16	1 15/32	1 61/64	13/32	1 5/16	2 3/8	10.5
F-153XP	A	7½	30V CT @ .250A	15V @ .500A	1 41/64	2 13/16	1 15/32	1 61/64	13/32	1 5/16	2 3/8	10.5
F-164XP	A	7½	34V CT @ .220A	17V @ .440A	1 41/64	2 13/16	1 15/32	1 61/64	13/32	1 5/16	2 3/8	10.5
F-154XP	A	7½	54V CT @ .140A	27V @ .280A	1 41/64	2 13/16	1 15/32	1 61/64	13/32	1 5/16	2 3/8	10.5

115-230V, 50-60 Hz DUAL PRIMARY*/DUAL SECONDARIES*

F-3132P	B-1	1½	15V CT @ .1A	7.5V @ .200A	1⅛	1 3/8	1⅛	1 3/8	13/64	1	1 3/8	4.0
F-3142XP	A-1	4½	15V CT @ .3A	7.5V @ .600A	1 3/8	2 3/8	1 1/4	1 5/8	1/4	1 7/64	2	6.5
F-3152XP	A-1	7½	15V CT @ .5A	7.5V @ .100A	1 5/8	2 13/16	1 61/64	1 7/16	1/4	1 15/16	2 3/8	11.0
F-3143XP	A-1	4½	30V CT @ .150A	15V @ .300A	1 3/8	2 3/8	1 1/4	1 5/8	1/4	1 7/64	2	6.5
F-3153XP	A-1	7½	30V CT @ .250A	15V @ .500A	1 5/8	2 13/16	1 61/64	1 7/16	1/4	1 15/16	2 3/8	11.0
F-333P	B-1	1½	30V CT @ .050A	15V @ .100A	1⅛	—	1⅛	1 3/8	13/64	1	—	4.0
F-349XP	A-1	4½	16V CT @ .280A	8V @ .560A	1 3/8	2 3/8	1 1/4	1 5/8	1/4	1 7/64	2	6.5
F-359XP	A-2	10	24V CT @ .450A	12V @ .900A	1 5/8	2 13/16	1 7/16	1 7/8	1/4	1 5/16	2 3/8	11.0
F-362XP	A-2	10	20V CT @ .500A	10V @ 1.0A	1 5/8	2 13/16	1 7/16	1 7/8	1/4	1 5/16	2 3/8	11.0

PLUG-IN PRINTED CIRCUIT POWER TRANSFORMERS/

115V, 50-60 Hz PRIMARY/TRIPLE OUTPUT SECONDARIES FOR ±15V AND ±5V DC

Cat. No.	Fig.	Output Watts	Secondary		Dimensions						Mtg. Dim.	Wt. Oz.
			Series Connection	Parallel Connection	H	W	D	L	A	B		
F-165P	B	1½	24V CT @ .025A	9V CT @ .100A	1⅛	1 25/64	1 5/32	1 25/64	13/64	1	—	3.5
F-167P	B	1½	32V CT @ .020A	15V CT @ .060A	1⅛	1 25/64	1 5/32	1 25/64	13/64	1	—	3.5
F-168XP	A	4½	32V CT @ .050A	15V CT @ .195A	1 25/64	2 3/8	1 1/4	1 45/64	1/4	1 3/32	2	7.5
F-166XP	A	7½	24V CT @ .125A	9V CT @ .500A	1 41/64	2 13/16	1 15/32	1 61/64	1/4	1 5/16	2 3/8	10.5
F-169XP	A	7½	32V CT @ .100A	15V CT @ .287A	1 41/64	2 13/16	1 15/32	1 61/64	1/4	1 5/16	2 3/8	10.5

PLUG-IN PRINTED CIRCUIT AUDIO TRANSFORMERS

Cat. No.	Fig.	Output M.W.	Primary Impedance	Secondary Impedance	Primary D.C. Unbalance	Dimensions			Pin Dimension		Wt. Oz.
						H	W	D			
TY-141P	A-1	100	10,000 CT	10,000 CT	4 ma.	5/8	13/16	19/32	3/16	.042	1
TY-142P	A-1	100	10,000 CT	2,000 CT	4 ma.	5/8	13/16	19/32	3/16	.042	1
TY-147P	A-1	100	150 CT	600 CT	15 ma.	5/8	13/16	19/32	3/16	.042	5

* Two isolated windings.

TRANSFORMERS

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ISOLATION/50-60 Hz ALL ISOLATION UNITS HAVE STATIC SHIELDS

Type No.	Output Watts (VA)	Primary Volts	Secondary AC Volts ±5%	Secondary AC Amps	RMS Test Voltage	Case Type	Connections	Lead Holes Used	Case Dimensions H	Case Dimensions W	Case Dimensions D	Mounting Dimensions MW	Mounting Dimensions MD
N-48X	15	115	115	.13	1500	X	Leads	—	1 15/16	3 5/16	2	2 13/16	—
N-51X‡	35	115	115	.3	1500	X	Leads	—	2 2/32	3 11/16	2 1/8	3 1/8	—
N-68X	50	115-230§	115	.435	1500	X	Leads	—	2 2/32	3 11/16	2 1/8	3 1/8	—
N-53M	85	115	115	.74	1500	M	6' Cord, Plug & Socket	—	3 19/32	2 31/32	3 5/8	2 1/4	2 3/8
N-54M	150	115	115	1.3	1500	M	6' Cord, Plug & Socket	—	3 7/8	3 9/32	4 1/4	2 1/2	3
N-73A	150	115	115-230§	.65	1500	A	Leads	1	3 7/8	3 9/32	3 7/8	2 1/2	2 3/4
N-67A	150	115-230§	115	1.3	1500	A	Leads	2	3 7/8	3 9/32	4 1/8	2 1/2	3
N-55M	250	115	115	2.17	1500	M	6' Cord, Plug & Socket	—	4 5/8	3 15/16	5	3	3 7/8
N-55MG†	—	115	—	—	—	—	—	—	—	—	—	—	—
N-66A	250	115-230§	115	2.17	1500	A	Leads	2	4 5/8	3 15/16	4 5/8	3	3 5/8
N-469A‡	50	220-440§	115	.435	1500	A	Leads	1	3 3/16	2 21/32	2 1/2	2	1 9/16
N-471A‡	300	220-440§	115	2.6	2000	A	Leads	1	4 5/8	3 15/16	4 3/8	3	3 3/8

CONTROL TRANSFORMERS/6V, 12V, 24V SECONDARIES

Triad Part No.	Primary	Secondary Parallel	Secondary Series	VA Rating	Case Type	Connections	Height Overall	Base Area	Mounting Dimension	Shpg. Wt. in lbs.
F-105Z		6V @ 2A	12V @ 1A	12	Z	Lugs	3 3/8	2 7/8 x 1 3/4	2 3/8	1
F-106Z		6V @ 4A	12V @ 2A	24	Z	Lugs	2 3/4	3 1/8 x 2	2 13/16	1 1/2
F-107Z		12V @ 4A	24V @ 2A	48	Z	Lugs	3 1/8	3 5/8 x 2 3/8	3 1/8	2 1/2
F-398U		12V @ 6A	24V @ 3A	72	U	Lugs	3 1/2	2 13/16 x 2 13/16	2 1/4 x 2 1/4	4 1/4
F-108U		12V @ 8A	24V @ 4A	96	U	Lugs	3 1/2	2 7/8 x 3	2 1/4 x 2 1/4	4 1/4
F-399U	115V/230V	12V @ 12A	24V @ 6A	144	U	Lugs	3 3/4	3 1/8 x 3 1/2	2 1/2 x 2 7/8	5.9
F-109U	50/60 CPS	12V @ 16A	24V @ 8A	192	U	Lugs	4 1/8	3 3/4 x 3 1/2	3 x 2 3/4	8
F-211Z	on all	24V @ .5A	48V @ .25A	12	Z	Lugs	2 5/16	2 13/16 x 1 1/2	2 3/8	.678
F-212Z		24V @ 1A	48V @ .50A	24	Z	Lugs	2 3/4	3 1/8 x 2 1/4	2 13/16	1.05
F-213Z		24V @ 2A	48V @ 1A	48	Z	Lugs	3 1/16	3 5/8 x 2 3/8	3 1/8	1.55
F-214U		24V @ 4A	48V @ 2A	96	U	Lugs	3 31/32	3 3/16 x 2 3/16	2 1/4 x 2 5/8	3.24
F-400U		24V @ 6A	48V @ 3A	144	U	Lugs	3 3/4	3 1/8 x 3 1/2	2 1/2 x 2 7/8	5.9
F-215U		24V @ 8A	48V @ 4A	192	U	Lugs	4 5/32	3 3/4 x 3 7/16	2 3/4 x 3	6.06

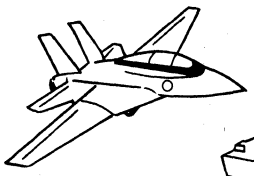
MINIATURE AUDIO TRANSFORMERS

Type No.	Power Output	Application	Matching Impedance Primary	Matching Impedance Secondary	DC Resistance Primary	DC Resistance Secondary	Overall Turns Ratio	Frequency Response ±3DB	RMS Test Volts	Case Type	Case Dimension H	Case Dimension W	Case Dimension D	Mtg. Dimen. MW
T-1X‡	1MW	Line or Mike to Grid	600/250/50	50,000	80	3200	1:9.16	60-15,000	500	X	5/8	1 1/32	3/4	1
T-31X‡	10MW	Line to Line	600/250/50	600/250/50	55	80	1:1	50-15,000	500	X	5/8	1 1/32	3/4	1
T-34X	20MW	Transistor or Line to Transistor or Line	500 CT 2 MA. D.C.	500 CT/ 125§	45	55	1:1.03	50-20,000	500	X	5/8	1 9/32	11/16	1 1/16
T-35X	10MW	Transistor or Line to Transistor	600 CT 1 MA. D.C.	2000 CT/ 500§	68	200	1:1.7	50-20,000	500	X	5/8	1 1/32	3/4	1

TELEPHONE COUPLING TRANSFORMERS

Cat. No.	Fig. No.	Application	Primary Impedance	Secondary Impedance	Dimensions A	B	C	D	E	F	G	H	I	J	Wt. Oz.
TY-300P	A-1	Hybrid*	600	600/600†	.63	.75	.55	.421	.187	.375	.25	.203	.020	.041	3.2
TY-301P	B	Coupling	600	900	.63	.75	.55	.421		.375	.25	.203	.020	.041	3.2
TY-302P	A-1	Hybrid*	600	600/600	.75	1.00	.94	.781	.200	.400	.26	.203	.020	.041	3.2
TY-303P	B	Bridging	4000	600	.63	.75	.55	.421		.375	.25	.203	.020	.041	3.2
TY-304P	A-1	Coupling	600 CT	600 CT	.63	.75	.55	.421	.187	.375	.25	.188	.018	.041	4.8
TY-350P	A-1	Holding Coil	2.0 hy @ 60 ma. 1.3 hy @ 100 maDC, 180 ohms DCR		1.19	1.44	.98	1.00		.63	.25		.020	.040	4.8

* Two required for hybrid operation. † Split winding; one wide band, one narrow band.



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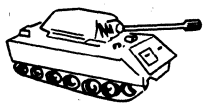

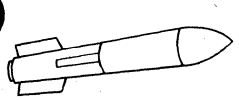

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Call for information on any design requirement or for technical assistance. Call Engineering "Hot Line."

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Send for catalog M-T101

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Switching power supply magnetics designed and manufactured to meet all high reliability military requirements. Typical circuit designs include push pull, forward converter and flyback. Power requirements from milliwatts to approximately 1 kilowatt. Units available in Grade 4, 5, 6 and temperature Class S through U.

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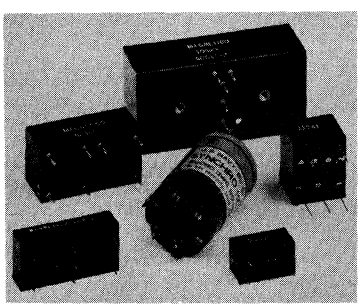

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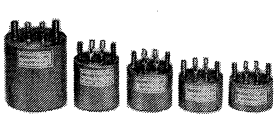

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STANDARD SCOTT T TRANSFORMERS

SYNCHRO TO RESOLVER CONVERTER TRANSFORMERS

Part No.	Input Voltage (L-L)	Output RMS Sine & Cosine	Frequency Hz	Input Z kΩ	Typical Load kΩ	Accuracy Arc Seconds	Size Inches	Weight Oz.
52975	11.8	1	400	20	100	4 min.	⅞ x ½ x 7/16	.5
10472	11.8	6	400	10	10	5 min.	¾ x 1½ x ⅜	.6
11870	90	6 CT	60	500	100	60	1.1 x 2.1 x 1.1	4
12094	90	6 CT	60 & 400	500	100	2 min.	1.1 x 2.1 x 1.1	4
50460	90	6	400	60	10	60	⅞ x 1⅝ x 1 1/16	2
50642	11.8	6	400	30	10	60	⅞ x 1⅝ x 1 1/16	2
50726	90	6 CT	400	500	100	60	1 3/16 x 1½ x ⅝	1.5
9652	11.8	5	400	100	10	30	1⅜ x 2¾ x ⅞	5
9514	90	4.25	400	1000	10	30	1⅜ x 2¾ x ⅞	5
52910	11.8	1	400	10	100	4 min.	½ x ⅞ x .31	.5
52450	90	6	400	100	100	5 min.	⅝ x 1¼ x ½	3¾
52290	11.8	3.£	400	20	10	3 min.	⅞ x ½ x 7/16	⅓
52569	90	2 CT	400	80	100	5 min.	⅝ x ⅞ x 5/16	⅓
13084	11.8	6 CT	400	100	100	1 min.	¾ x 1½ x ⅜	½
13530	11.8	1	400	10	50	1 min.	⅝ x 1¼ x .3	.5

RESOLVER TO SYNCHRO CONVERTER TRANSFORMERS

Part No.	Input Voltage (L-L)	Output 3 Wire (L-L)	Frequency Hz	Load Ohms (L-L)	Input Z Ohms	Accuracy Arc Minutes	Size Inches	VA Rating
10084	11.8	11.8	400	150	1.5K	2	1 x 2 x .65 H	1
10086	6.0	11.8	400	150	1K	2	1 x 2 x .65 H	1
10088	9.0	11.8	400	150	2K	1.5	1⅜ x 2¾ x .65 H	1
10090	9.0	90	400	2500	1K	1	1⅜ x 2¾ x ⅞ H	1
11999	7.0	11.8	400	30	500	1	2 x 4 x 1 H	3
50749	7.2	90	60	8000	700	2	1½ x 3⅜ x 1¼ H	3
12186	7.0	90	60	4000	250	1	2 x 4 x 1½ H	3.2
52020	9	11.8	400	14	100	3.5	1½ x 2½ x 1¼	4.5
52021	9	90	400	800	100	3.5	2 x 4 x 1¼	1
52449	6	90	400	2500	150	3	1 x 1⅝ x 1 1/16	2
52164	6	90	400	2500	100	2	1½ x 3 x 1⅛	10
12945	6	11.8	400	300	1K	5	¾ x 1½ x 5/16	½

STANDARD MINIATURE 400 Hz POWER TRANSFORMERS

CONDENSED PERFORMANCE DATA — PRIMARY VOLTAGE 115 VRMS.
All Units Designed to Meet MIL-T-27E.
IMMEDIATE DELIVERY FOR PROTOTYPE QUANTITIES.

Catalog Number	VA Rating	Secondary Voltage (RMS)	O.D. ±1/32	Height ±1/32	Nominal Weight	Nom. Reg.	Nom.* Temp. Rise
9600	2	6-300 V	1″	1 19/32″	1 oz/ 30 gm	18%	10°C
9601	4	6-300 V	1″	1 1/16″	1.2 oz/ 35 gm	15%	12°C
9602	6	6-300 V	1″	⅞″	1.6 oz/ 45 gm	10%	18°C
9603	9	6-300 V	1″	1 1/16″	2.1 oz/ 60 gm	8%	20°C
9604	30	6-300 V	1⅜″	1½″	5.3 oz/150 gm	7%	23°C
10648	75	10-300 V	2″	1 5/16″	10 oz	±3%	30°C
10649	150	10-300 V	2¼″	1 9/16″	18 oz	±3%	40°C

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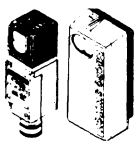
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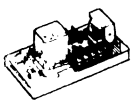
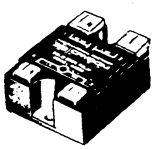

LIQUID LEVEL CONTROLS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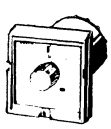
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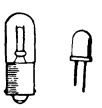
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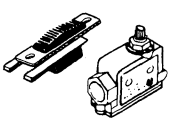
SWITCHES

RELAYS

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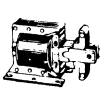
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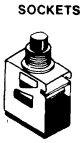
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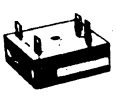
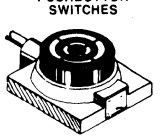

TIMERS

COUNTERS

FANS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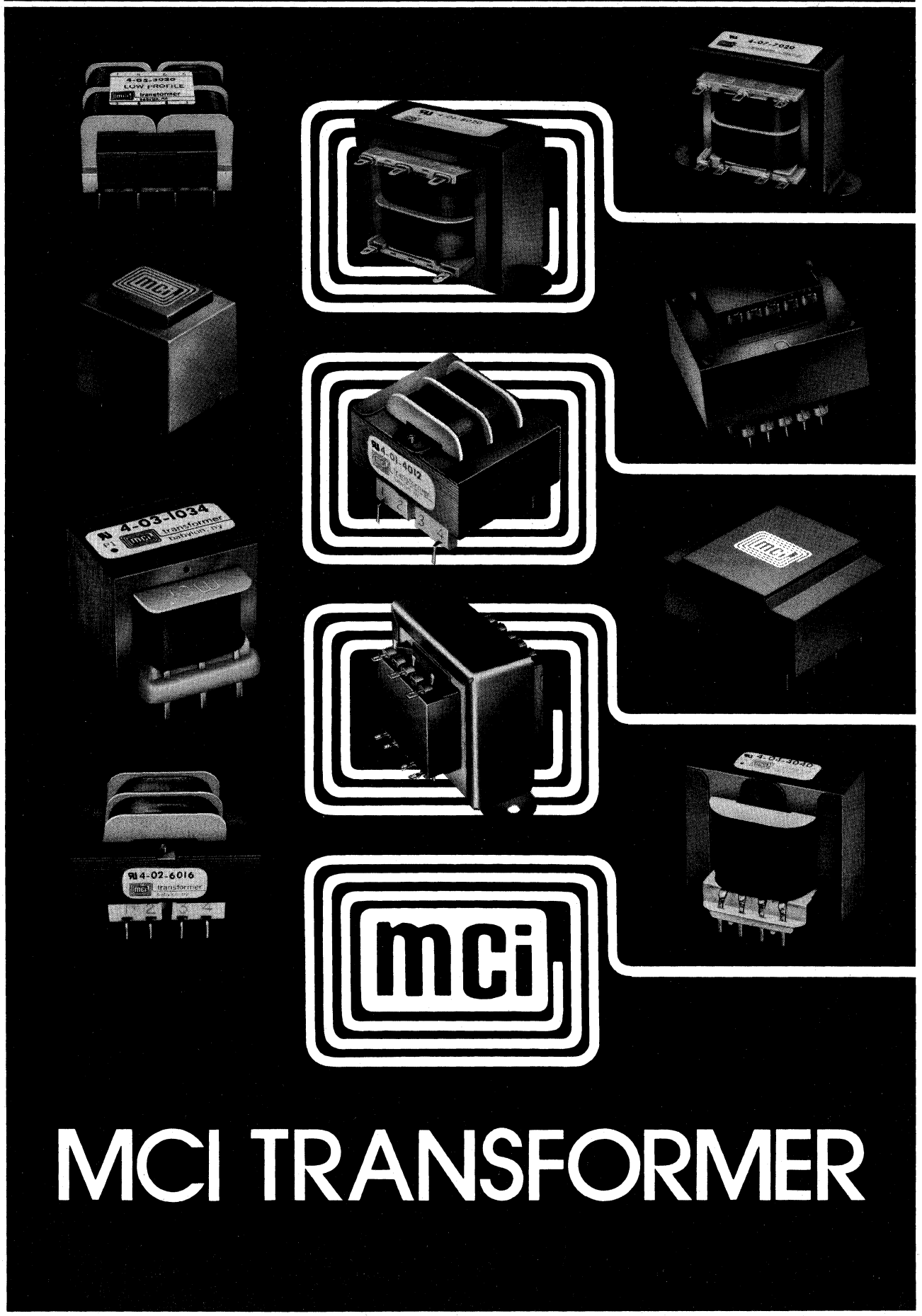

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- **Delivery of 1 to 5 stock transformers within 48 hours**
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IF we don't keep these promises, we will pay the freight on the delivery. Many manufacturers promise prompt delivery but no one else is truly guaranteeing delivery in this manner.

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STANDARD STOCK LINE MCI maintains an extensive inventory of Horizontal, Vertical and Low Profile printed circuit board transformers and quick-connect Power Transformers which are recognized under Underwriters Laboratories File No. E86403 (M). MCI promises "Guaranteed Delivery" of 1 to 5 transformers within 48 hours and 1,000 transformers in four weeks.

ENGINEERING AND CUSTOMER SERVICE Many times only one source is listed on an engineering blueprint. The next time you have a requirement, let us assist you. Perhaps you will be able to use one of our stock transformers. If so, you will benefit by saving substantially and having the convenience of off-the-shelf delivery. If your requirements cannot be satisfied by using one of our standard stock units, MCI will assist you in designing the exact transformer you require and, as always, at a competitive price. Start saving today—put MCI on all your transformer prints.

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VALUE ANALYSIS You can be confident when you order an MCI transformer, as only the highest quality materials are ever used in all MCI products. All our transformers are made with strict quality control and each unit is inspected and tested at the end of each manufacturing operation and then tested 100% for output voltages and exciting current in order to comply with our rigid standards.

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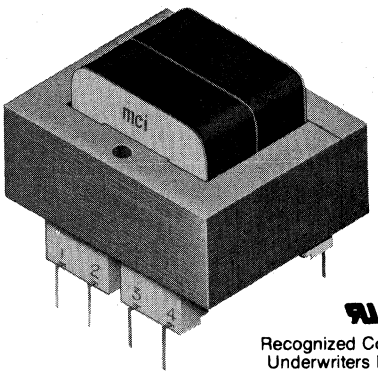
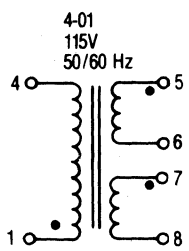
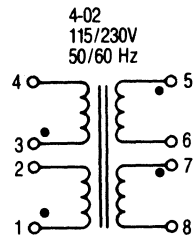
HORIZONTAL PC TRANSFORMERS

SERIES 4-01 & 4-02







Recognized Component
Underwriters Labs Inc.

2,500-volt RMS Hipot, available in a variety of sizes. Maximum operating temperature 130°C. Available with either single 115V, or dual 115/230V primary. MCI's pin configuration is designed for ease of connection in printed circuit boards. Heavier transformers are provided with mounting holes for additional mounting security. Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.

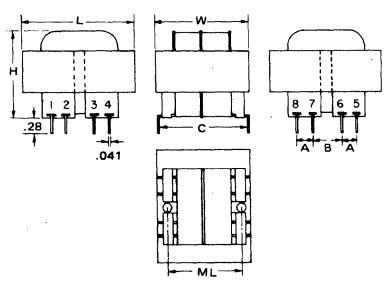
CURRENT RATING

Secondary Voltage	Series Parallel	−010 10V C.T. 5V	−012 12.6V C.T. 6.3V	−016 16V C.T. 8V	−020 20V C.T. 10V	−024 24V C.T. 12V	−028 28V C.T. 14V	−036 36V C.T. 18V	−048 48V C.T. 24V	−056 56V C.T. 28V	−120 120V C.T. 60V
Series											
Size 2		.11A	.09A	.07A	.055A	.045A	.04A	.03A	.023A	.02A	.01A
Size 3		.25A	.2A	.15A	.12A	.1A	.085A	.065A	.05A	.045A	.02A
Size 4		.6A	.5A	.4A	.3A	.25A	.2A	.17A	.125A	.11A	.05A
Size 5		1.2A	1.0A	.8A	.6A	.5A	.42A	.35A	.25A	.22A	.1A
Size 6		2.0A	1.6A	1.25A	1.0A	.8A	.7A	.55A	.4A	.35A	.16A
Size 7		3.6A	2.85A	2.25A	1.8A	1.5A	1.3A	1.0A	.75A	.65A	.3A
Parallel											
Size 2		.22A	.18A	.14A	.11A	.09A	.08A	.06A	.046A	.04A	.02A
Size 3		.5A	.4A	.3A	.24A	.2A	.17 A	.13A	.1A	.09A	.04A
Size 4		1.2A	1.0A	.8A	.6A	.5A	.4A	.34A	.25A	.22A	.1A
Size 5		2.4A	2.0A	1.6A	1.2A	1.0A	.84A	.7A	.5A	.44A	.2A
Size 6		4.0A	3.2A	2.5A	2.0A	1.6A	1.4A	1.1A	.8A	.7A	.32A
Size 7		7.2A	5.7A	4.5A	3.6A	3.0A	2.6A	2.0A	1.5A	1.3A	.6A

DIMENSIONS

Size	VA	L	W	H	ML	A	B	C	Optional Mtg. Screw & Nut	Lbs.
2	1.1	1-3/8	1-1/8	15/16	—	.250	.250	1.200	None	0.17
3	2.4	1-3/8	1-1/8	1-3/16	—	.250	.250	1.200	None	0.25
4	6.0	1-5/8	1-5/16	1-5/16	1-1/16	.250	.350	1.280	4-40 × 1-3/8 Nylon	0.44
5	12.0	1-7/8	1-9/16	1-7/16	1-1/4	.300	.400	1.410	4-40 × 1-3/8 Nylon	0.70
6	20.0	2-1/4	1-7/8	1-7/16	1-1/2	.300	.400	1.600	4-40 × 1-3/8 Nylon	0.80
7	36.0	2-5/8	2-3/16	1-9/16	†	.400	.400	1.850	†	1.1

† 4 mounting holes 2³⁄₁₆ × 1¾ for #6 screw



HOW TO ORDER A HORIZONTAL PC TRANSFORMER

MCI uses a Seven Digit Part Number

First Digit	4	MCI Product Identification
Second & Third Digits	01	Single 115V Primary
	02	Dual 115/230V Primary
Fourth Digit	2 to 7	Transformer size *(See current rating chart)*
Last three Digits	010 to 120	Secondary voltage *(See current rating chart)*

Example: 4-01-4016 is a 115V primary 6VA transformer with two 8 volt secondary windings to be used as either 16V CT or 8V.

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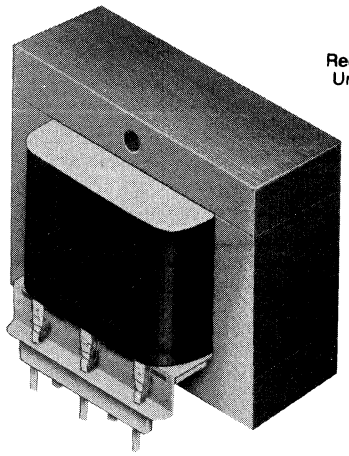
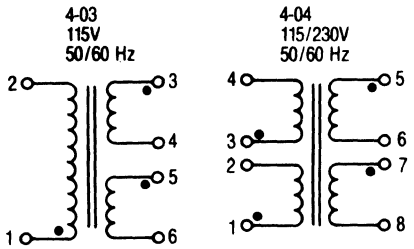
VERTICAL PC TRANSFORMERS

SERIES 4-03 & 4-04



Recognized Component
Underwriters Labs Inc.



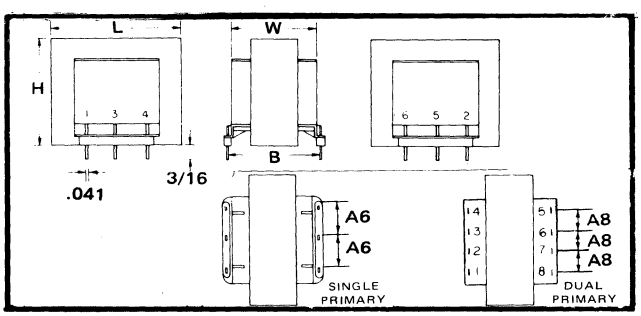
1,500-volt RMS Hipot, available in a variety of sizes. Maximum operating temperature 130°C. Available with dual 115/230V primary. MCI's pin configuration is designed for ease of connection in printed circuit boards. Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.

CURRENT RATING

Secondary Voltage	Series Parallel	-010 10V C.T. 5V	-012 12.6V C.T. 6.3V	-016 16V C.T. 8V	-020 20V C.T. 10V	-024 24V C.T. 12V	-028 28V C.T. 14V	-034 34V C.T. 17V	-040 40V C.T. 20V	-056 56V C.T. 28V	-088 88V C.T. 44V	-120 120V C.T. 60V	-180 180V C.T. 90V	-230 230V C.T. 115V
Series														
Size 1		.090A	.070A	.055A	.045A	.035A	.030A	.025A	.020A	.015A	.010A	.008A		
Size 2		.120A	.100A	.075A	.060A	.050A	.040A	.035A	.030A	.020A	.015A	.010A	.006A	.005A
Size 3		.440A	.350A	.260A	.220A	.180A	.160A	.125A	.110A	.080A	.050A	.035A	.024A	.020A
Size 4		1.0A	.800A	.640A	.500A	.450A	.360A	.300A	.250A	.180A	.120A	.085A	.055A	.040A
Size 5		2.4A	2.0A	1.5A	1.2A	1.0A	.800A	.700A	.600A	.420A	.270A	.200A	.130A	.100A
Parallel														
Size 1		.180A	.140A	.110A	.090A	.070A	.060A	.050A	.040A	.030A	.020A	.016A		
Size 2		.240A	.200A	.150A	.120A	.100A	.080A	.070A	.060A	.040A	.030A	.020A	.012A	.010A
Size 3		.880A	.700A	.520A	.440A	.360A	.320A	.250A	.220A	.160A	.100A	.070A	.048A	.040A
Size 4		2.0A	1.6A	1.28A	1.0A	.900A	.720A	.600A	.500A	.360A	.240A	.170A	.110A	.080A
Size 5		4.8A	4.0A	3.0A	2.4A	2.0A	1.6A	1.4A	1.2A	.840A	.540A	.400A	.260A	.200A

DIMENSIONS

Size	VA	L	W	H	A-6 (6 Pin)	A-8 (8 Pin)	B	WT. (oz.)
1	1.0	1	1-3/8	0.83	0.250	0.200	1.200	2.5
2	1.2	1-3/8	1-1/8	1-3/16	0.312	0.200	1.000	3.0
3	4.4	1-5/8	1-1/4	1-3/8	0.400	0.250	1.100	5.0
4	10.0	1-7/8	1-7/16	1-5/8	0.400	0.250	1.300	9.0
5	24.0	1-5/8	2-1/4	1-3/8	0.400	0.250	2.100	12.0



HOW TO ORDER A VERTICAL PC TRANSFORMER

MCI uses a Seven Digit Part Number

First Digit	4	MCI Product Identification
Second & Third Digits	03	Single 115V Primary
	04	Dual 115/230V Primary
Fourth Digit	1 to 5	Transformer size *(See current rating chart)*
Last three Digits	010 to 230	Secondary voltage *(See current rating chart)*

Example: 4-04-3034 is a dual 115/230V primary, 4.4VA transformer with two 17 volt secondary windings to be used as either 34V CT or 17V.

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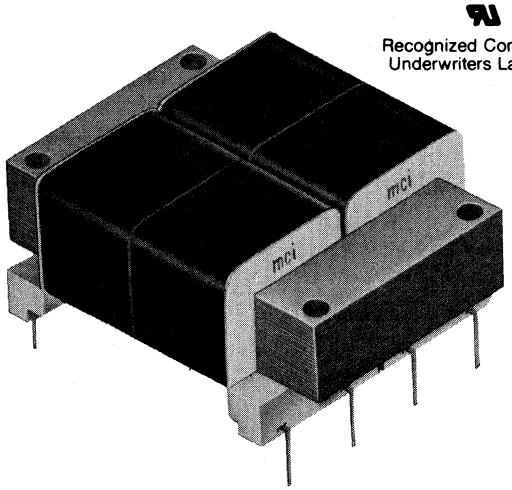
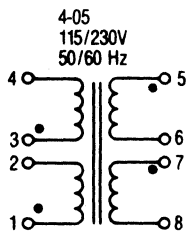
LOW PROFILE PC TRANSFORMERS

SERIES 4-05

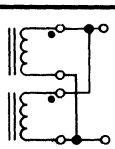
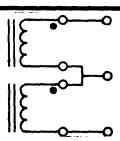
Recognized Component
Underwriters Labs Inc.





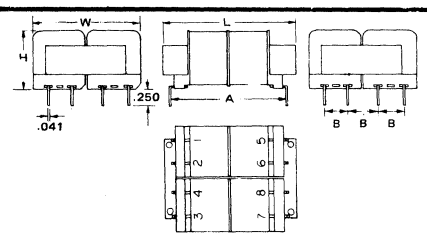
1,500-volt RMS Hipot, available in a variety of sizes. Maximum operating temperature 130°C. Available with either single 115V, or dual 115/230V primary. MCI's pin configuration is designed for ease of connection in printed circuit boards. Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.

CURRENT RATING

Secondary Voltage	Series Parallel	-010 10V C.T. 5V	-012 12.6V C.T. 6.3V	-016 16V C.T. 8V	-020 20V C.T. 10V	-024 24V C.T. 12V	-034 34V C.T. 17V	-040 40V C.T. 20V	-056 56V C.T. 28V	-088 88V C.T. 44V	-120 120V C.T. 60V	-230 230V C.T. 115V
Series												
Size 1		.250A	.200A	.156A	.125A	.104A	.073A	.062A	.044A	.028A	.020A	.010A
Size 2		.600A	.450A	.350A	.300A	.250A	.170A	.150A	.100A	.065A	.050A	.025A
Size 3		1.200A	.900A	.700A	.600A	.500A	.340A	.300A	.200A	.130A	.100A	.050A
Parallel												
Size 1		.500A	.400A	.312A	.250A	.208A	.146A	.124A	.088A	.056A	.040A	.020A
Size 2		1.2A	.900A	.700A	.600A	.500A	.340A	.300A	.200A	.130A	.100A	.050A
Size 3		2.4A	1.8A	1.4A	1.2A	1.0A	.680A	.600A	.400A	.260A	.200A	.100A

DIMENSIONS

Size	VA	L	W	H	A	B	Oz.
1	2.5	1-7/8	1-9/16	0.650	1.600	0.375	5
2	6.0	1-7/8	1-9/16	0.850	1.600	0.375	7
3	12.0	2-1/2	2	1.065	2.000	0.500	11



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HOW TO ORDER A LOW PROFILE TRANSFORMER

MCI uses a Seven Digit Part Number

First Digit	4	MCI Product Identification
Second & Third Digits	05	Dual 115/230V Primary
Fourth Digit	1 to 5	Transformer size *(See current rating chart)*
Last three Digits	010 to 230	Secondary voltage *(See current rating chart)*

Example: 4-05-1020 is a dual 115/230V primary, 2.5VA transformer with two 10 volt secondary windings to be used as either 20V CT or 10V.

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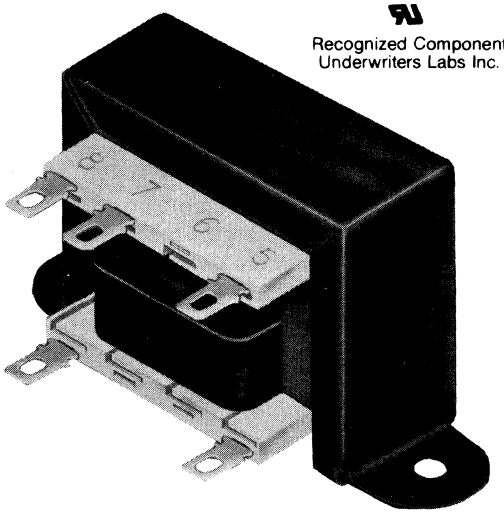
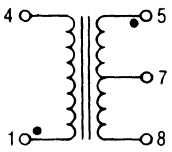
QUICK CONNECT POWER TRANSFORMERS

SERIES 4-06 & 4-07

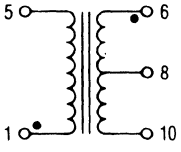


Recognized Component
Underwriters Labs Inc.

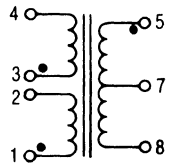
4-06-3, 4, 5
115V
50/60 Hz



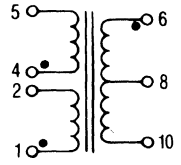
4-06-6, 7, 8
115V
50/60 Hz



4-07-4, 5
115/230V
50/60 Hz



4-07-6, 7, 8
115/230V
50/60 Hz



2500 Volt RMS Hipot in a variety of practical sizes. Maximum operating temperature 130°C available with either single 115 or dual 115/230V primary (for all but 2.4 VA size).

MCI's split bobbin and non-concentric winding provide better insulation and high signal isolation, thus eliminating the need for electrostatic shielding.

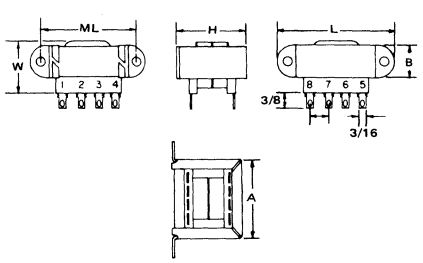
Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.

CURRENT RATING

Secondary Voltage	–010 10V C.T.	–012 12.6V C.T.	–016 16V C.T.	–020 20V C.T.	–024 24V C.T.	–028 28V C.T.	–036 36V C.T.	–048 48V C.T.	–056 56V C.T.	–120 120V C.T.
Transformer Size										
3	.25A	.2A	.15A	.12A	.1A	.085A	.065A	.05A	.045A	.02A
4	.6A	.5A	.4A	.3A	.25A	.2A	.17A	.125A	.11A	.05A
5	1.2A	1.0A	.8A	.6A	.5A	.42A	.35A	.25A	.22A	.1A
6	3.0A	2.5A	2.0A	1.5A	1.25A	1.1A	.85A	.63A	.54A	.25A
7	5.0A	4.0A	3.5A	2.8A	2.4A	2.0A	1.5A	1.2A	1.0A	.5A
8	10.0A	8.0A	6.25A	5.0A	4.0A	3.6A	2.8A	2.0A	1.8A	.85A

DIMENSIONS

Size	VA	L	W	H	A	B	ML	Lbs.
3	2.4	2-1/16	1-1/16	1-3/16	1-7/16	9/16	1-3/4	0.25
4	6	2-3/8	1-1/4	1-3/8	1-11/16	11/16	2	0.44
5	12	2-13/16	1-3/8	1-5/8	1-15/16	13/16	2-3/8	0.7
6	30	3-1/4	1-11/16	1-15/16	2-5/16	1-1/16	2-13/16	1.1
7	56	3-11/16	1-13/16	2-1/4	2-11/16	1-1/16	3-1/8	1.7
8	100	4-1/32	2-1/4	2-9/16	3-1/16	1-5/16	3-9/16	2.75



HOW TO ORDER A QUICK CONNECT POWER TRANSFORMER

MCI uses a Seven Digit Part Number

First Digit	4	MCI Product Identification
Second & Third Digits	06	Single 115V Primary
	07	Dual 115/230V Primary
Fourth Digit	3 to 8	Transformer size *(See current rating chart)*
Last three Digits	010 to 120	Secondary voltage *(See current rating chart)*

Example: 4-06-6016 is a 115V primary 30VA transformer with 16V CT secondary.

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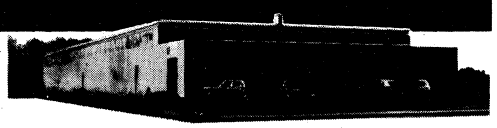
QUALITY TRANSFORMERS AT COMPETITIVE PRICES



Founded a quarter-century ago, MCI Transformer Corporation is an established leader in the manufacture of horizontal, vertical and low profile transformers for printed circuit boards. Recently, the line has been expanded to include quick-connect and encapsulated models.

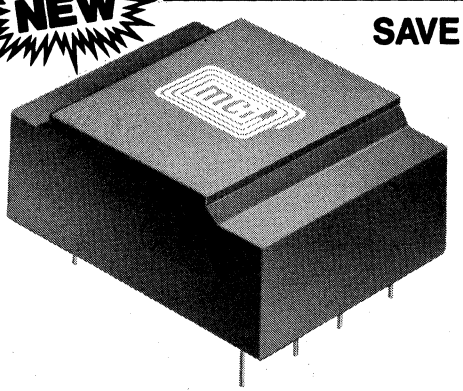
At MCI, the very latest production automation techniques are employed to ensure the highest possible quality at low competitive prices.

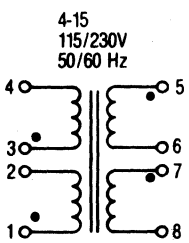
- Made in U.S.A.
- UL-Recognized
- In stock for fast delivery
- Custom designs available
- Shipped in protective vacuum-formed trays

LOW PROFILE PC ENCAPSULATED TRANSFORMERS SERIES 4-15

NEW

SAVE UP TO 40% IN VOLUME





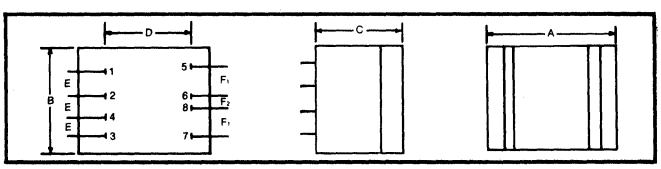
Our encapsulated design offers high reliability because of its mechanical strength, electrical insulation and moisture resistance. The internal construction consists of 2 split bobbins which isolates the primary and secondary thereby eliminating any need for an electrostatic shield. The construction will pass requirements of U.L., C.S.A. and V.D.E.

CURRENT RATING (AMPS)

Secondary Voltage	Series Parallel	-010 10V C.T. 5V	-012 12.6V C.T. 6.3V	-016 16V C.T. 8V	-020 20V C.T. 10V	-024 24V C.T. 12V	-030 30V C.T. 15V	-034 34V C.T. 17V	-040 40V C.T. 20V	-056 56V C.T. 28V	-088 88V C.T. 44V	-120 120V C.T. 60V	-230 230V C.T. 115V
Series													
Size 2		.600	.450	.350	.300	.250	.200	.170	.150	.100	.065	.050	.025
Parallel													
Size 2		1.200	.900	.700	.600	.500	.400	.340	.300	.200	.130	.100	.050

DIMENSIONS

Size	VA	A	B	C	D	Primary E	Secondary F1	Secondary F2	WT.
2	6	2.080	1.655	.850	1.300	.400	.600	.200	.46



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HOW TO ORDER A LOW PROFILE PC ENCAPSULATED TRANSFORMER

MCI uses a Seven Digit Part Number

First Digit	4	MCI Product Identification
Second & Third Digits	15	Dual 115/230V Primary
Fourth Digit	2	Transformer size *(See current rating chart)*
Last three Digits	010 to 230	Secondary voltage *(See current rating chart)*

Example: 4-15-2010 is a dual 115/230V primary, 6VA transformer with two 5 volt secondary windings to be used as either 10V CT or 5V.

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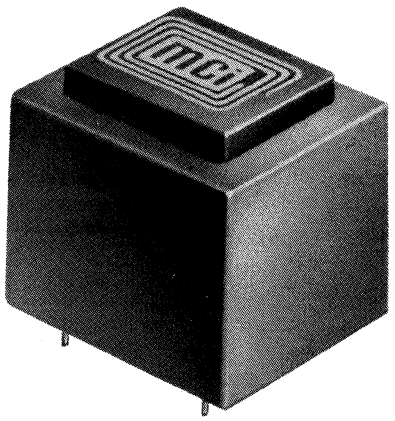
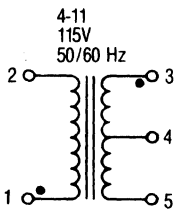
HORIZONTAL PC ENCAPSULATED TRANSFORMERS

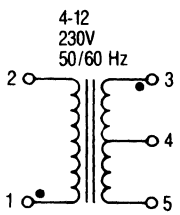
NEW

SAVE UP TO 40% IN VOLUME

SERIES 4-11 & 4-12







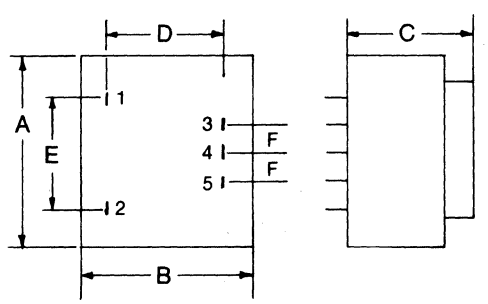
Our encapsulated design offers high reliability because of its mechanical strength, electrical insulation and moisture resistance. The internal construction consits of a split bobbin which isolates the primary and secondary thereby eliminating any need for an electrostatic shield. The construction will pass requirements of U.L., C.S.A. and V.D.E.

CURRENT RATING (AMPS)

Secondary Voltage	-010 10V C.T.	-012 12.6V C.T.	-016 16V C.T.	-020 20V C.T.	-024 24V C.T.	-028 28V C.T.	-036 36V C.T.	-048 48V C.T.	-056 56V C.T.	-120 120V C.T.
Transformer Size										
2	.100	.080	.065	.050	.045	.035	.030	.020	.018	.008
3	.120	.095	.075	.060	.050	.045	.035	.025	.021	.010
4	.180	.145	.115	.090	.075	.065	.050	.038	.032	.015
5	.220	.175	.140	.110	.095	.080	.060	.045	.040	.018
6	.320	.255	.200	.160	.135	.115	.090	.067	.057	.027
7	.450	.360	.280	.225	.190	.160	.125	.095	.080	.038

DIMENSIONS

Size	VA	A	B	C	D	Primary E	Secondary F	Wt. (Lb.)
2	1.0	1.280	1.080	.925	.800	.800	.200	.16
3	1.2	1.280	1.080	.970	.800	.800	.200	.19
4	1.8	1.280	1.080	1.085	.800	.800	.200	.21
5	2.2	1.280	1.080	1.185	.800	.800	.200	.25
6	3.2	1.660	1.415	1.125	1.000	.800	.200	.33
7	4.5	1.780	1.500	1.300	1.000	1.000	.300	.44



HOW TO ORDER A HORIZONTAL PC ENCAPSULATED TRANSFORMER

MCI uses a Seven Digit Part Number

First Digit	4	MCI Product Identification
Second & Third Digits	11	Single 115V Primary
	12	Single 230V Primary
Fourth Digit	2 to 7	Transformer size *(See current rating chart)*
Last three Digits	010 to 120	Secondary voltage *(See current rating chart)*

Example: 4-12-5012 is a 230V primary, 2.2VA transformer with a 12V CT secondary.

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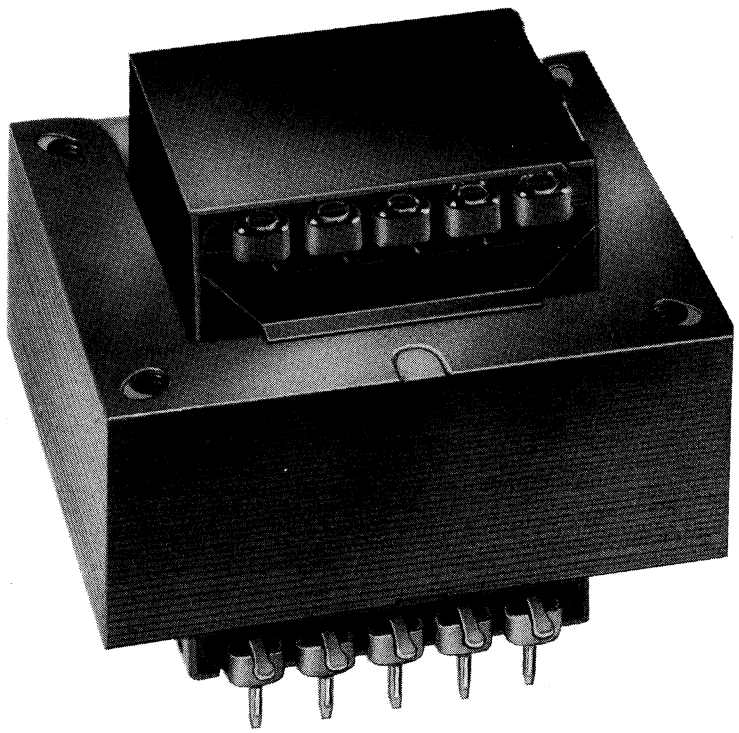
VDE HORIZONTAL P.C. TRANSFORMERS

SERIES 4-41& 4-42



Secondary Voltage	-010 10V C.T.	-012 12.6V C.T.	-016 16V C.T.	-020 20V C.T.	-024 24V C.T.	-028 28V C.T.	-036 36V C.T.	-048 48V C.T.	-056 56V C.T.	-120 120V C.T.
	CURRENT RATING									
Transformer Size										
2	1.000	.800	.625	.500	.420	.360	.280	.210	.180	.085
3	2.000	1.600	1.250	1.000	.840	.720	.560	.420	.360	.170
4	3.000	2.400	1.875	1.500	1.250	1.075	.835	.625	.540	.250
5	4.500	3.600	2.815	2.250	1.875	1.610	1.250	.940	.805	.375

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HOW TO ORDER A VDE HORIZONTAL PC TRANSFORMER

MCI uses a Seven Digit Part Number

First Digit	4	MCI Product Identification
Second & Third Digits	41	Single 115V Primary
	42	Dual 115/230V Primary
Fourth Digit	2 to 5	Transformer size *(See current rating chart)*
Last three Digits	010 to 120	Second voltage *(See current rating chart)*

Example: 4-41-4024 is a 115V primary 30VA transformer with 24V CT secondary.

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VDE HORIZONTAL P.C. TRANSFORMERS

SERIES 4-41& 4-42

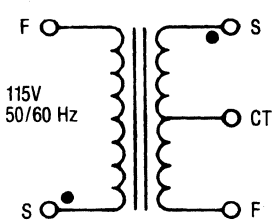
Series 4-41, 4-42

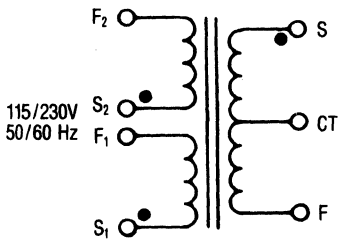
4000 Volt RMS Hipot. In a variety of sizes. Maximum operating temperature 130° C. Available with either 115V or dual 115/230V primary.

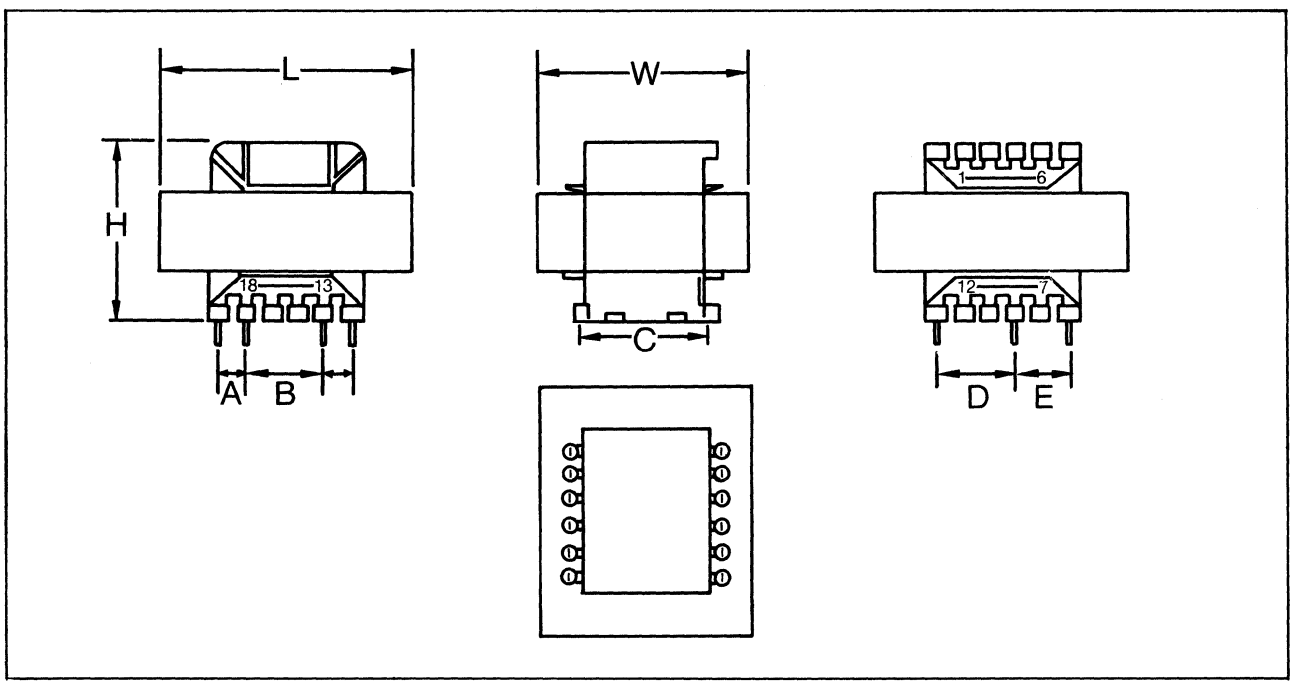
MCI's split bobbin and non-concentric winding provide better insulation and high signal isolation, thus eliminating the need for electrostatic shielding.

These transformers are designed to pass VDE's strict creepage distance requirements.

Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.





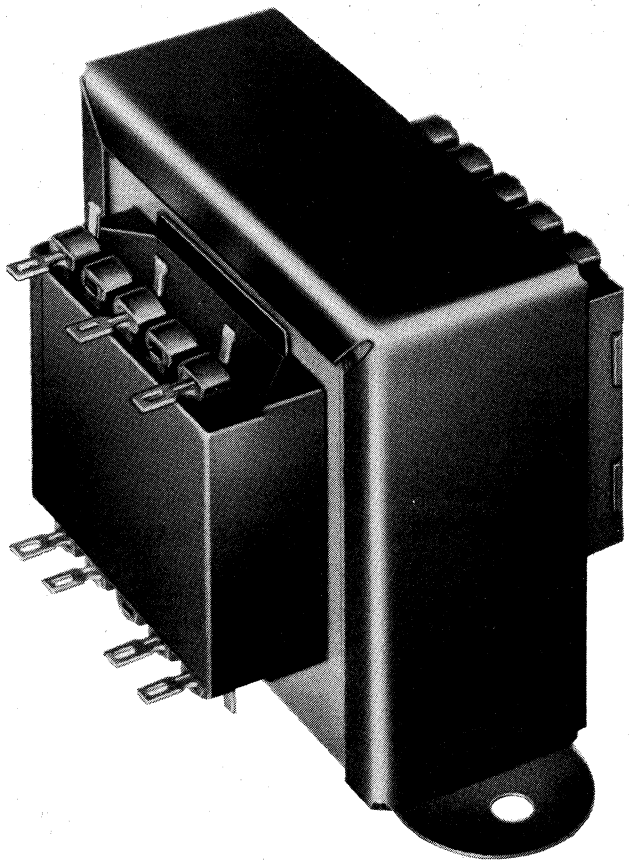


TERMINAL POSITIONS									
	4-41 115V Primary		4-42 115/230V Primary				Secondary		
	S	F	S1	F1	S2	F2	S	C.T.	F
2	13	18	13	14	17	18	7	9	12
3	11	15	11	12	14	15	6	8	10
4	11	15	11	12	14	15	6	8	10
5	11	15	11	12	14	15	6	8	10

SIZE	VA	L	W	H	A	B	C	D	E	Lbs.
2	10	1⅞	1⁹⁄₁₆	1½	.200	.600	1.000	.600	.400	.57
3	20	2¼	1⅞	1¹³⁄₁₆	.300	.600	1.200	.600	.600	.97
4	30	2¼	1⅞	2¹⁄₁₆	.300	.600	1.200	.600	.600	1.20
5	45	2⅝	2³⁄₁₆	2¹⁄₃₂	.300	.600	1.400	.600	.600	1.40

VDE QUICK CONNECT POWER TRANSFORMERS

SERIES 4-46 & 4-47



Secondary Voltage	-010 10V C.T.	-012 12.6V C.T.	-016 16V C.T.	-020 20V C.T.	-024 24V C.T.	-028 28V C.T.	-036 36V C.T.	-048 48V C.T.	-056 56V C.T.	-120 120V C.T.
	CURRENT RATING									
Transformer Size										
2	1.000	.800	.625	.500	.420	.360	.280	.210	.180	.085
3	2.000	1.600	1.250	1.000	.840	.720	.560	.420	.360	.170
4	3.000	2.400	1.875	1.500	1.250	1.075	.835	.625	.540	.250
5	4.500	3.600	2.815	2.250	1.875	1.610	1.250	.940	.805	.375
6	5.600	4.500	3.500	2.800	2.335	2.000	1.560	1.170	1.000	.470
7		5.560	4.375	3.500	2.920	2.500	1.950	1.460	1.250	.585
8			5.000	4.000	3.335	2.860	2.225	1.670	1.430	.670
9				5.000	4.170	3.575	2.780	2.090	1.790	.835

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HOW TO ORDER A VDE QUICK CONNECT POWER TRANSFORMER

MCI uses a Seven Digit Part Number

First Digit	4	MCI Product Identification
Second & Third Digits	46	Single 115V Primary
	47	Dual 115/230V Primary
Fourth Digit	2 to 9	Transformer size *(See current rating chart)*
Last three Digits	010 to 120	Secondary voltage *(See current rating chart)*

Example: 4-47-6028 is a 115/230V primary 56 VA transformer with 28V CT secondary.

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VDE QUICK CONNECT POWER TRANSFORMERS

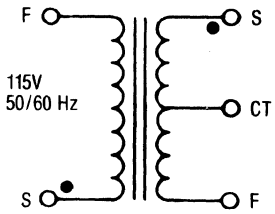
SERIES 4-46 & 4-47

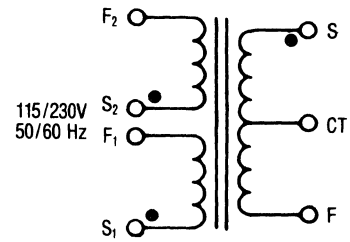
4000 Volt RMS Hipot. In a variety of sizes. Maximum operating temperature 130°C. Available with either 115V or dual 115/230V primary.

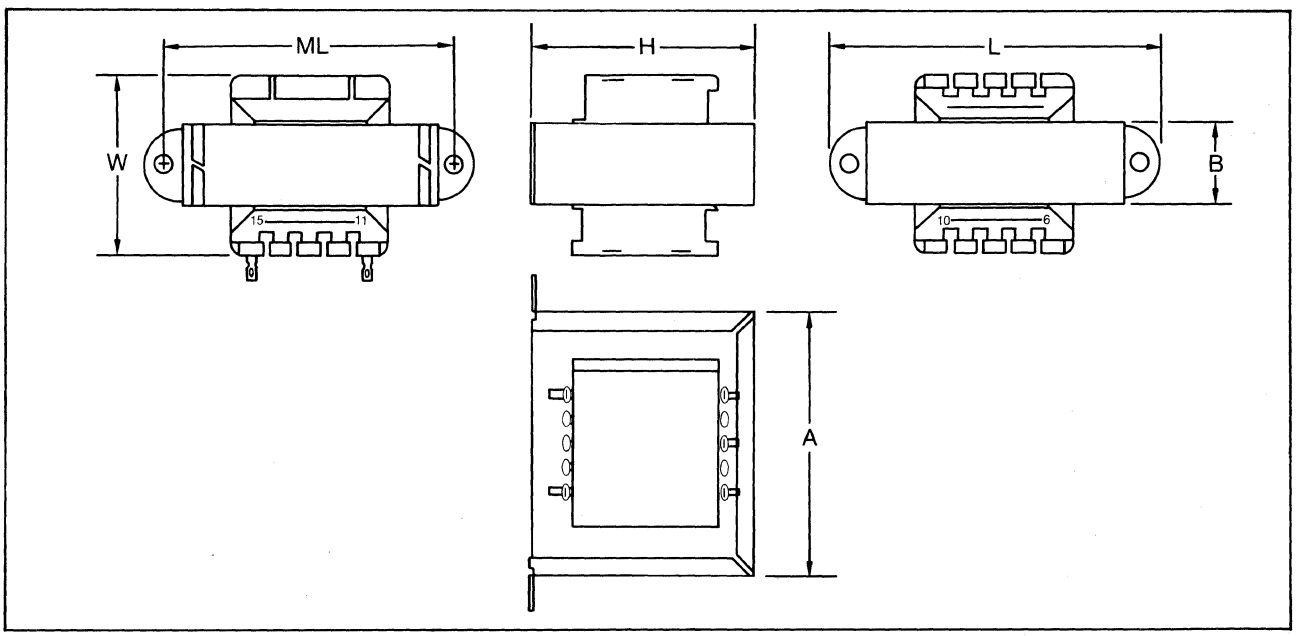
MCI's split bobbin and non-concentric winding provide better insulation and high signal isolation, thus eliminating the need for electrostatic shielding.

These transformers are designed to pass VDE's strict creepage distance requirements.

Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.







TERMINAL POSITIONS

	4-46 115V Primary		4-47 115/230V Primary				Secondary		
	S	F	S1	F1	S2	F2	S	C.T.	F
2	13	18	13	14	17	18	7	9	12
3	11	15	11	12	14	15	6	8	10
4	11	15	11	12	14	15	6	8	10
5	11	15	11	12	14	15	6	8	10
6	11	15	11	12	14	15	6	8	10
7	13	18	13	14	17	18	7	9	12
8	13	18	13	14	17	18	7	9	12
9	13	18	13	14	17	18	7	9	12

SIZE	VA	L	W	H	A	B	ML	Lbs.
2	10	2 13/16	1 1/2	1 5/8	1 15/16	11/16	2 3/8	.57
3	20	3 1/4	1 13/16	1 15/16	2 5/16	7/8	2 13/16	.97
4	30	3 1/4	2 1/32	1 15/16	2 5/16	1 1/8	2 13/16	1.20
5	45	3 11/16	2 1/32	2 1/4	2 11/16	1	3 1/8	1.40
6	56	3 11/16	2 5/32	2 1/4	2 11/16	1 1/8	3 1/8	1.70
7	70	4 1/32	2 9/32	2 9/16	3 1/16	1 1/16	3 9/16	2.40
8	80	4 1/32	2 1/2	2 9/16	3 1/16	1 5/16	3 9/16	2.80
9	100	4 1/2	2 17/32	2 13/16	3 13/32	1 7/32	4	3.20

MCI CROSS REFERENCE GUIDE

HORIZONTAL PC TRANSFORMERS

MCI	SIGNAL	MCI	SIGNAL	MCI	SIGNAL	MCI	SIGNAL
4-01-2010	ST 2-10	4-01-5010	ST 5-10	4-02-2010	DST 2-10	4-02-5010	DST 5-10
4-01-2012	ST 2-12	4-01-5012	ST 5-12	4-02-2012	DST 2-12	4-02-5012	DST 5-12
4-01-2016	ST 2-16	4-01-5016	ST 5-16	4-02-2016	DST 2-16	4-02-5016	DST 5-16
4-01-2020	ST 2-20	4-01-5020	ST 5-20	4-02-2020	DST 2-20	4-02-5020	DST 5-20
4-01-2024	ST 2-24	4-01-5024	ST 5-24	4-02-2024	DST 2-24	4-02-5024	DST 5-24
4-01-2028	ST 2-28	4-01-5028	ST 5-28	4-02-2028	DST 2-28	4-02-5028	DST 5-28
4-01-2036	ST 2-36	4-01-5036	ST 5-36	4-02-2036	DST 2-36	4-02-5036	DST 5-36
4-01-2048	ST 2-48	4-01-5048	ST 5-48	4-02-2048	DST 2-48	4-02-5048	DST 5-48
4-01-2056	ST 2-56	4-01-5056	ST 5-56	4-02-2056	DST 2-56	4-02-5056	DST 5-56
4-01-2120	ST 2-120	4-01-5120	ST 5-120	4-02-2120	DST 2-120	4-02-5120	DST 5-120
4-01-3010	ST 3-10	4-01-6010	ST 6-10	4-02-3010	DST 3-10	4-02-6010	DST 6-10
4-01-3012	ST 3-12	4-01-6012	ST 6-12	4-02-3012	DST 3-12	4-02-6012	DST 6-12
4-01-3016	ST 3-16	4-01-6016	ST 6-16	4-02-3016	DST 3-16	4-02-6016	DST 6-16
4-01-3020	ST 3-20	4-01-6020	ST 6-20	4-02-3020	DST 3-20	4-02-6020	DST 6-20
4-01-3024	ST 3-24	4-01-6024	ST 6-24	4-02-3024	DST 3-24	4-02-6024	DST 6-24
4-01-3028	ST 3-28	4-01-6028	ST 6-28	4-02-3028	DST 3-28	4-02-6028	DST 6-28
4-01-3036	ST 3-36	4-01-6036	ST 6-36	4-02-3036	DST 3-36	4-02-6036	DST 6-36
4-01-3048	ST 3-48	4-01-6048	ST 6-48	4-02-3048	DST 3-48	4-02-6048	DST 6-48
4-01-3056	ST 3-56	4-01-6056	ST 6-56	4-02-3056	DST 3-56	4-02-6056	DST 6-56
4-01-3120	ST 3-120	4-01-6120	ST 6-120	4-02-3120	DST 3-120	4-02-6120	DST 6-120
4-01-4010	ST 4-10	4-01-7010	ST 7-10	4-02-4010	DST 4-10	4-02-7010	DST 7-10
4-01-4012	ST 4-12	4-01-7012	ST 7-12	4-02-4012	DST 4-12	4-02-7012	DST 7-12
4-01-4016	ST 4-16	4-01-7016	ST 7-16	4-02-4016	DST 4-16	4-02-7016	DST 7-16
4-01-4020	ST 4-20	4-01-7020	ST 7-20	4-02-4020	DST 4-20	4-02-7020	DST 7-20
4-01-4024	ST 4-24	4-01-7024	ST 7-24	4-02-4024	DST 4-24	4-02-7024	DST 7-24
4-01-4028	ST 4-28	4-01-7028	ST 7-28	4-02-4028	DST 4-28	4-02-7028	DST 7-28
4-01-4036	ST 4-36	4-01-7036	ST 7-36	4-02-4036	DST 4-36	4-02-7036	DST 7-36
4-01-4048	ST 4-48	4-01-7048	ST 7-48	4-02-4048	DST 4-48	4-02-7048	DST 7-48
4-01-4056	ST 4-56	4-01-7056	ST 7-56	4-02-4056	DST 4-56	4-02-7056	DST 7-56
4-01-4120	ST 4-120	4-01-7120	ST 7-120	4-02-4120	DST 4-120	4-02-7120	DST 7-120

VERTICAL PC TRANSFORMERS

MCI	SIGNAL	MCI	SIGNAL	MCI	SIGNAL	MCI	SIGNAL
4-03-1010	PC 10-90	4-03-1034	PC 34-25	4-04-1010	DPC 10-90	4-04-1034	DPC 34-25
4-03-2010	PC 10-120	4-03-2034	PC 34-35	4-04-2010	DPC 10-120	4-04-2034	DPC 34-35
4-03-3010	PC 10-440	4-03-3034	PC 34-125	4-04-3010	DPC 10-440	4-04-3034	DPC 34-125
4-03-4010	PC 10-1000	4-03-4034	PC 34-300	4-04-4010	DPC 10-1000	4-04-4034	DPC 34-300
4-03-5010	PC 10-2400	4-03-5034	PC 34-700	4-04-5010	DPC 10-2400	4-04-5034	DPC 34-700
4-03-1012	PC 12-70	4-03-1040	PC 40-20	4-04-1012	DPC 12-70	4-04-1040	DPC 40-20
4-03-2012	PC 12-100	4-03-2040	PC 40-30	4-04-2012	DPC 12-100	4-04-2040	DPC 40-30
4-03-3012	PC 12-350	4-03-3040	PC 40-110	4-04-3012	DPC 12-350	4-04-3040	DPC 40-110
4-03-4012	PC 12-800	4-03-4040	PC 40-250	4-04-4012	DPC 12-800	4-04-4040	DPC 40-250
4-03-5012	PC 12-2000	4-03-5040	PC 40-600	4-04-5012	DPC 12-2000	4-04-5040	DPC 40-600
4-03-1016	PC 16-55	4-03-1056	PC 56-15	4-04-1016	DPC 16-55	4-04-1056	DPC 56-15
4-03-2016	PC 16-75	4-03-2056	PC 56-20	4-04-2016	DPC 16-75	4-04-2056	DPC 56-20
4-03-3016	PC 16-260	4-03-3056	PC 56-80	4-04-3016	DPC 16-260	4-04-3056	DPC 56-80
4-03-4016	PC 16-640	4-03-4056	PC 56-180	4-04-4016	DPC 16-640	4-04-4056	DPC 56-180
4-03-5016	PC 16-1500	4-03-5056	PC 56-420	4-04-5016	DPC 16-1500	4-04-5056	DPC 56-420
4-03-1020	PC 20-45	4-03-1088	PC 88-10	4-04-1020	DPC 20-45	4-04-1088	DPC 88-10
4-03-2020	PC 20-60	4-03-2088	PC 88-15	4-04-2020	DPC 20-60	4-04-2088	DPC 88-15
4-03-3020	PC 20-220	4-03-3088	PC 88-50	4-04-3020	DPC 20-220	4-04-3088	DPC 88-50
4-03-4020	PC 20-500	4-03-4088	PC 88-120	4-04-4020	DPC 20-500	4-04-4088	DPC 88-120
4-03-5020	PC 20-1200	4-03-5088	PC 88-270	4-04-5020	DPC 20-1200	4-04-5088	DPC 88-270
4-03-1024	PC 24-35	4-03-1120	PC 120-8	4-04-1024	DPC 24-35	4-04-1120	DPC 120-8
4-03-2024	PC 24-50	4-03-2120	PC 120-10	4-04-2024	DPC 24-50	4-04-2120	DPC 120-10
4-03-3024	PC 24-180	4-03-3120	PC 120-35	4-04-3024	DPC 24-180	4-04-3120	DPC 120-35
4-03-4024	PC 24-450	4-03-4120	PC 120-85	4-04-4024	DPC 24-450	4-04-4120	DPC 120-85
4-03-5024	PC 24-1000	4-03-5120	PC 120-2000	4-04-5024	DPC 24-1000	4-04-5120	DPC 120-2000
4-03-1028	PC 28-30	4-03-2230	PC 230-5	4-04-1028	DPC 28-30	4-04-2230	DPC 230-5
4-03-2028	PC 28-40	4-03-3230	PC 230-20	4-04-2028	DPC 28-40	4-04-3230	DPC 230-20
4-03-3028	PC 28-160	4-03-4230	PC 230-40	4-04-3028	DPC 28-160	4-04-4230	DPC 230-40
4-03-4028	PC 28-360	4-03-5230	PC 230-100	4-04-4028	DPC 28-360	4-04-5230	DPC 230-100
4-03-5028	PC 28-800			4-04-5028	DPC 28-800		

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MCI CROSS REFERENCE GUIDE

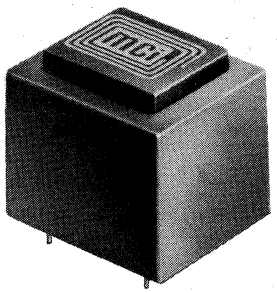
LOW PROFILE PC TRANSFORMERS

MCI	SIGNAL	MCI	SIGNAL	MCI	SIGNAL	MCI	SIGNAL
4-05-1010	LP 10-250	4-05-1020	LP 20-125	4-05-1040	LP 40-60	4-05-1120	LP 120-20
4-05-2010	LP 10-600	4-05-2020	LP 20-300	4-05-2040	LP 40-150	4-05-2120	LP 120-50
4-05-3010	LP 10-1200	4-05-3020	LP 20-600	4-05-3040	LP 40-3000	4-05-3120	LP 120-100
4-05-1012	LP 12-200	4-05-1024	LP 24-100	4-05-1056	LP 56-45	4-05-1230	LP 230-10
4-05-2012	LP 12-450	4-05-2024	LP 24-250	4-05-2056	LP 56-100	4-05-2230	LP 230-25
4-05-3012	LP 12-900	4-05-3024	LP 24-500	4-05-3056	LP 56-200	4-05-3230	LP 230-50
4-05-1016	LP 16-150	4-05-1034	LP 34-75	4-05-1088	LP 88-28		
4-05-2016	LP 16-350	4-05-2034	LP 34-170	4-05-2088	LP 88-65		
4-05-3016	LP 16-700	4-05-3034	LP 34-340	4-05-3088	LP 88-130		

QUICK CONNECT POWER TRANSFORMERS

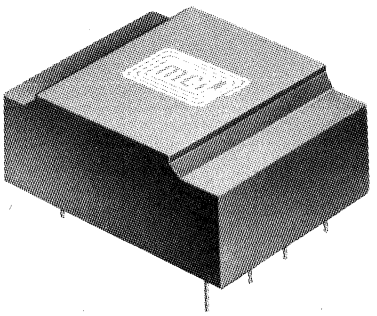
MCI	SIGNAL	MCI	SIGNAL	MCI	SIGNAL	MCI	SIGNAL
4-06-3010	241-3-10	4-06-6010	241-6-10	4-07-4010	DP 241-4-10	4-07-7010	DP 241-7-10
4-06-3012	241-3-12	4-06-6012	241-6-12	4-07-4012	DP 241-4-12	4-07-7012	DP 241-7-12
4-06-3016	241-3-16	4-06-6016	241-6-16	4-07-4016	DP 241-4-16	4-07-7016	DP 241-7-16
4-06-3020	241-3-20	4-06-6020	241-6-20	4-07-4020	DP 241-4-20	4-07-7020	DP 241-7-20
4-06-3024	241-3-24	4-06-6024	241-6-24	4-07-4024	DP 241-4-24	4-07-7024	DP 241-7-24
4-06-3028	241-3-28	4-06-6028	241-6-28	4-07-4028	DP 241-4-28	4-07-7028	DP 241-7-28
4-06-3036	241-3-36	4-06-6036	241-6-36	4-07-4036	DP 241-4-36	4-07-7036	DP 241-7-36
4-06-3048	241-3-48	4-06-6048	241-6-48	4-07-4048	DP 241-4-48	4-07-7048	DP 241-7-48
4-06-3056	241-3-56	4-06-6056	241-6-56	4-07-4056	DP 241-4-56	4-07-7056	DP 241-7-56
4-06-3120	241-3-120	4-06-6120	241-6-120	4-07-4120	DP 241-4-120	4-07-7120	DP 241-7-120
4-06-4010	241-4-10	4-06-7010	241-7-10	4-07-5010	DP 241-5-10	4-07-8010	DP 241-8-10
4-06-4012	241-4-12	4-06-7012	241-7-12	4-07-5012	DP 241-5-12	4-07-8012	DP 241-8-12
4-06-4016	241-4-16	4-06-7016	241-7-16	4-07-5016	DP 241-5-16	4-07-8016	DP 241-8-16
4-06-4020	241-4-20	4-06-7020	241-7-20	4-07-5020	DP 241-5-20	4-07-8020	DP 241-8-20
4-06-4024	241-4-24	4-06-7024	241-7-24	4-07-5024	DP 241-5-24	4-07-8024	DP 241-8-24
4-06-4028	241-4-28	4-06-7028	241-7-28	4-07-5028	DP 241-5-28	4-07-8028	DP 241-8-28
4-06-4036	241-4-36	4-06-7036	241-7-36	4-07-5036	DP 241-5-36	4-07-8036	DP 241-8-36
4-06-4048	241-4-48	4-06-7048	241-7-48	4-07-5048	DP 241-5-48	4-07-8048	DP 241-8-48
4-06-4056	241-4-56	4-06-7056	241-7-56	4-07-5056	DP 241-5-56	4-07-8056	DP 241-8-56
4-06-4120	241-4-120	4-06-7120	241-7-120	4-07-5120	DP 241-5-120	4-07-8120	DP 241-8-120
4-06-5010	241-5-10	4-06-8010	241-8-10	4-07-6010	DP 241-6-10		
4-06-5012	241-5-12	4-06-8012	241-8-12	4-07-6012	DP 241-6-12		
4-06-5016	241-5-16	4-06-8016	241-8-16	4-07-6016	DP 241-6-16		
4-06-5020	241-5-20	4-06-8020	241-8-20	4-07-6020	DP 241-6-20		
4-06-5024	241-5-24	4-06-8024	241-8-24	4-07-6024	DP 241-6-24		
4-06-5028	241-5-28	4-06-8028	241-8-28	4-07-6028	DP 241-6-28		
4-06-5036	241-5-36	4-06-8036	241-8-36	4-07-6036	DP 241-6-36		
4-06-5048	241-5-48	4-06-8048	241-8-48	4-07-6048	DP 241-6-48		
4-06-5056	241-5-56	4-06-8056	241-8-56	4-07-6056	DP 241-6-56		
4-06-5120	241-5-120	4-06-8120	241-8-120	4-07-6120	DP 241-6-120		

TOP QUALITY AT THE BEST PRICES



PRICE LIST

SEPTEMBER 1, 1985



HORIZONTAL PC ENCAPSULATED TRANSFORMERS

	QUANTITY				
	1,000	2,500	5,000	10,000	25,000
4-11-2	2.03	1.83	1.66	1.52	1.42
4-11-3	2.16	1.94	1.77	1.62	1.51
4-11-4	2.29	2.06	1.88	1.72	1.60
4-11-5	2.42	2.18	1.98	1.82	1.69
4-11-6	2.52	2.27	2.07	1.89	1.76
4-11-7	2.76	2.48	2.26	2.07	1.93
4-12-2	2.09	1.88	1.71	1.57	1.46
4-12-3	2.21	1.99	1.81	1.66	1.55
4-12-4	2.34	2.11	1.92	1.76	1.64
4-12-5	2.47	2.22	2.03	1.85	1.73
4-12-6	2.56	2.30	2.10	1.92	1.79
4-12-7	2.80	2.52	2.30	2.10	1.96

LOW PROFILE PC ENCAPSULATED TRANSFORMERS

	QUANTITY				
	1,000	2,500	5,000	10,000	25,000
4-15-2	4.22	3.81	3.46	3.17	2.95

mci

TOLL FREE:
1-800-MCI-TRAN

TERMS—NET 30 DAYS ON APPROVED CREDIT—F.O.B., BABYLON, N.Y.

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

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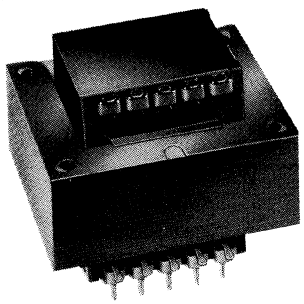
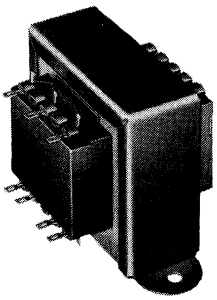
TOP QUALITY AT THE BEST PRICES



PRICE LIST
SEPTEMBER 1, 1985



V.D.E. HORIZONTAL PC TRANSFORMERS

	QUANTITY				
	1-9	10-24	25-49	50-99	100-249
4-41-2	8.05	6.76	5.80	4.55	3.74
4-41-3	10.39	8.73	7.48	5.87	4.83
4-41-4	11.40	9.58	8.21	6.44	5.30
4-41-5	13.52	11.36	9.73	7.64	6.29
4-42-2	9.36	7.86	6.74	5.29	4.35
4-42-3	11.83	9.94	8.52	6.68	5.50
4-42-4	13.03	10.95	9.38	7.36	6.06
4-42-5	15.33	12.88	11.04	8.66	7.13

V.D.E. QUICK CONNECT POWER TRANSFORMERS

	QUANTITY				
	1-9	10-24	25-49	50-99	100-249
4-46-2	8.23	6.91	5.93	4.65	3.83
4-46-3	10.62	8.92	7.65	6.00	4.94
4-46-4	11.69	9.82	8.42	6.60	5.44
4-46-5	13.85	11.63	9.97	7.83	6.44
4-46-6	15.15	12.73	10.91	8.56	7.04
4-46-7	20.31	17.06	14.62	11.48	9.44
4-46-8	22.65	19.03	16.31	12.80	10.53
4-46-9	26.50	22.26	19.08	14.97	12.32
4-47-2	9.54	8.01	6.87	5.39	4.44
4-47-3	12.06	10.13	8.68	6.81	5.61
4-47-4	13.32	11.19	9.59	7.53	6.19
4-47-5	15.66	13.15	11.28	8.85	7.28
4-47-6	17.09	14.36	12.30	9.66	7.95
4-47-7	22.44	18.85	16.16	12.68	10.43
4-47-8	24.90	20.92	17.93	14.07	11.58
4-47-9	28.94	24.31	20.84	16.35	13.46

TERMS—NET 30 DAYS ON APPROVED CREDIT—F.O.B., BABYLON, N.Y.

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SMPS MAGNETICS

MICROTRAN company, inc.

toroidal power inductors

Part No.	Inductance @ 0 DC μH	Max. DCR (Ohms)	Rated Current (Amps)	5% L Drop (DC Amps)	10% L Drop (DC Amps)	20% L Drop (DC Amps)	30% L Drop (DC Amps)	40% L Drop (DC Amps)	50% L Drop (DC Amps)
SL1 SIZE SERIES									
SL1-1.1 (*)	1.1	.002	5.0	26.3	34.1	50.0	59.8	71.8	83.3
SL1-2.5 (*)	2.5	.003	5.0	17.0	22.1	32.4	38.8	46.6	54.1
SL1-4.5 (*)	4.5	.004	5.0	10.7	14.3	21.0	25.2	30.2	35.1
SL1-8.0 (*)	8.0	.005	5.0	8.8	11.6	16.0	20.0	24.0	27.8
SL1-15 (*)	15	.007	5.0	5.1	7.5	11.0	14.0	16.9	20.0
SL1-30 (*)	30	.009	5.0	4.2	5.5	8.0	10.2	12.4	14.9
SL1-60 (*)	60	.017	5.0	2.1	3.6	5.4	6.9	8.5	10.2
SL1-120 (*)	120	.027	5.0	1.7	2.6	3.9	5.0	6.1	7.4
SL1-220 (*)	220	.037	5.0	1.5	2.0	3.0	3.8	4.6	5.5
SL1-450 (*)	450	.080	3.2	1.3	1.6	2.2	2.8	3.4	4.0
SL1-900 (*)	900	.230	1.5	.9	1.2	1.6	1.9	2.4	2.8
SL1-1500(*)	1500	.470	1.1	.6	.8	1.2	1.5	1.8	2.1
SL2 SIZE SERIES									
SL2-1.4 (*)	1.4	.003	5.0	28.3	43.8	62.2	82.1	102.5	123.0
SL2-2.5 (*)	2.5	.003	5.0	23.8	36.8	52.5	69.7	87.0	104.3
SL2-5.5 (*)	5.5	.005	5.0	16.0	24.8	35.4	47.0	58.7	70.4
SL2-13 (*)	13	.007	5.0	9.5	14.7	21.0	31.5	39.3	47.1
SL2-26 (*)	26	.010	5.0	6.3	10.0	15.0	20.0	25.0	30.0
SL2-50 (*)	50	.013	5.0	4.2	6.9	10.3	13.9	17.4	21.0
SL2-100 (*)	100	.018	5.0	3.3	4.9	7.5	9.8	12.2	14.9
SL2-225 (*)	225	.034	5.0	2.9	3.7	5.1	6.9	8.3	9.9
SL2-475 (*)	475	.055	4.5	1.5	2.0	3.4	4.4	5.5	6.8
SL2-1000(*)	1000	.130	4.5	1.2	1.6	2.3	3.1	3.9	4.7
SL2-1800(*)	1800	.340	2.0	1.0	1.3	1.9	2.4	2.9	3.5
SL2-2700(*)	2700	.520	2.0	.6	.9	1.4	1.8	2.3	2.8
SL3 SIZE SERIES									
SL3-1.3 (*)	1.3	.003	9.0	51.6	72.2	101.0	128.3	160.3	192.3
SL3-3.0 (*)	3.0	.004	9.0	40.0	56.0	78.4	99.5	124.3	149.0
SL3-6.5 (*)	6.5	.005	9.0	31.2	43.6	61.0	77.5	96.8	116.1
SL3-14 (*)	14	.008	9.0	24.4	34.3	48.6	62.1	77.5	92.9
SL3-30 (*)	30	.011	9.0	17.6	24.8	35.2	45.0	56.2	67.4
SL3-55 (*)	55	.015	9.0	12.2	18.5	26.3	33.6	42.0	50.4
SL3-100 (*)	100	.020	9.0	9.4	13.3	19.7	25.2	31.6	37.9
SL3-220 (*)	220	.020	9.0	4.9	6.6	9.4	11.9	14.4	17.1
SL3-470 (*)	470	.034	7.0	2.7	4.1	6.3	8.1	10.0	12.0
SL3-1000(*)	1000	.120	3.5	2.0	2.7	4.2	5.4	6.8	8.2
SL3-2200(*)	2200	.220	2.8	1.6	2.1	3.0	3.8	4.6	5.5
SL3-4000(*)	4000	.300	2.0	1.1	1.5	2.1	2.8	3.3	4.0
SL4 SIZE SERIES									
SL4-2.2 (*)	2.2	.003	14.0	49.8	67.2	100.2	130.2	158.8	190.6
SL4-5 (*)	5.0	.004	14.0	40.0	54.0	80.5	104.6	127.6	153.1
SL4-11 (*)	11	.005	14.0	32.1	43.3	64.5	83.8	102.2	122.6
SL4-23 (*)	23	.007	14.0	24.6	33.2	49.5	64.3	78.4	94.1
SL4-50 (*)	50	.011	14.0	18.3	24.7	36.9	47.8	58.3	70.0
SL4-100 (*)	100	.016	14.0	12.8	17.3	25.9	33.6	41.0	49.2
SL4-230 (*)	230	.023	14.0	7.1	10.4	15.8	20.5	25.0	30.0
SL4-470 (*)	470	.023	14.0	3.5	5.4	8.0	10.4	12.7	15.4
SL4-1000(*)	1000	.065	9.0	2.4	3.5	5.5	7.2	8.8	10.7
SL4-2200(*)	2200	.120	7.0	2.0	3.0	4.0	5.0	6.1	7.3
SL4-4000(*)	4000	.260	4.5	1.1	1.8	2.8	3.5	4.5	5.4
SL4-5600(*)	5600	.310	4.5	.9	1.4	2.2	3.0	3.8	4.5

*** Add either -F, -B, or -M to Part No. to designate construction.**
See photos and outline drawings on adjacent page.

NOTES:

1. Non-standard inductance values available on special order, i.e., specify P/N SL2-75-F for 75 μH.
2. Inductance ±15% measured at 1 kHz. See drive level test condition chart.
3. DCR measured at 20°C. Temperature rise 60°C max.
4. Current values for percentage inductance drop are typical.

DRIVE LEVEL TEST CONDITIONS

Inductance	Drive Level @ 1 kHz
0-200 μH	100 mA AC
200 μH — 2 mH	10 mA AC
2 mH — 20 mH	1 mA AC

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MICROTRAN company, inc.

SMPS MAGNETICS

toroidal power inductors OUTLINE DRAWINGS FOR PAGE 00000

New Swinging Chokes for Switch Mode Power Supplies, Regulators, and EMI/RFI Filter Applications

NEW!

- Specially designed for controlled saturation — repeatable specific inductance at a specific current.
- Application frequencies up to 1 MHz.
- Toroidal construction — closed magnetic field — low EMI.
- Designed to handle high current spikes typically encountered in high current SMPS applications.

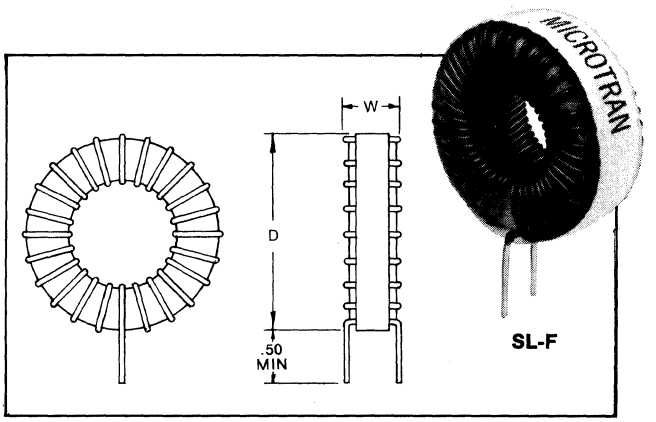
OPEN FRAME -F

Tinned leads to 1/16" of body for PCB mounting. Additional mechanical mounting recommended for larger units with finer wire. To order add -F to Part No., i.e. SL2-50-F.

DIMENSIONS (Inches)

Series	D Max.	W Max.	Wt. Oz.
SL1-F	1.00	.50	.14
SL2-F	1.25	.60	.44
SL3-F	1.90	.90	1.10
SL4-F	2.20	1.10	2.10

Recommended PC board clearance hole .065 dia. min.



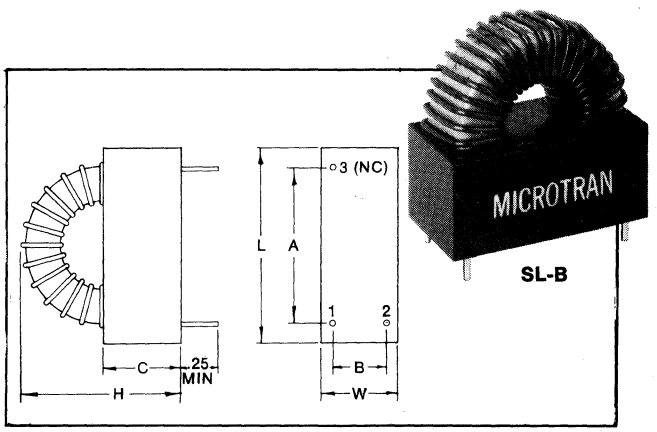
BASE MOUNTED -B

Rugged, epoxy base mounted for PCB applications. To order add -B to Part No., i.e. SL2-50-B.

DIMENSIONS (Inches)

Series	L Max.	W Max.	H Max.	A	B	C Max.	Wt. Oz.
SL1-B	1.00	.56	1.05	.75	.35	.40	.23
SL2-B	1.25	.70	1.30	.95	.40	.60	.65
SL3-B	1.96	.91	1.95	1.625	.50	.70	1.60
SL4-B	2.12	1.08	2.30	1.75	.90	1.00	3.00

Tolerances dimensions A and B ±.010.
Recommended PC board clearance hole .065 dia. min.



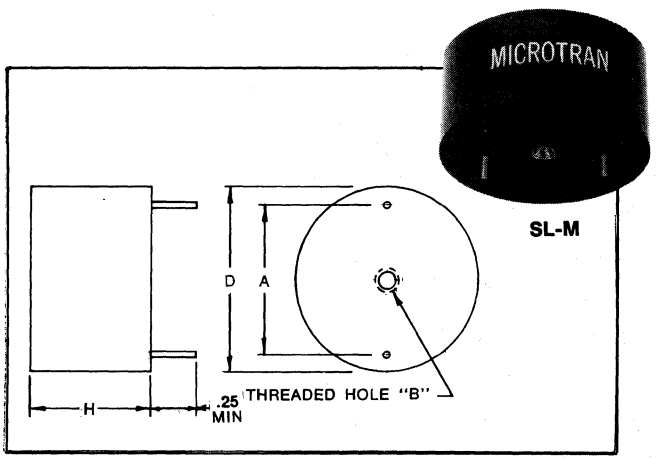
MOLDED -M

Epoxy molded with threaded insert for MIL and industrial PCB applications. MIL designation TF5S04ZZ. To order add -M to Part No., i.e. SL2-50-M.

DIMENSIONS (Inches)

Series	D	H	A	B	Wt. Oz.
SL1-M	1.06	.50	.90	4-40	.26
SL2-M	1.375	.65	1.20	6-32	.80
SL3-M	2.00	1.00	1.70	8-32	2.10
SL4-M	2.50	1.25	1.25	10-32	3.80

Tolerance ±.015. Recommended PC board clearance hole .065 dia. min.



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SMPS MAGNETICS
COMMON MODE INDUCTORS—TRANSFORMERS

MICROTRAN company, inc.

common mode suppression inductors

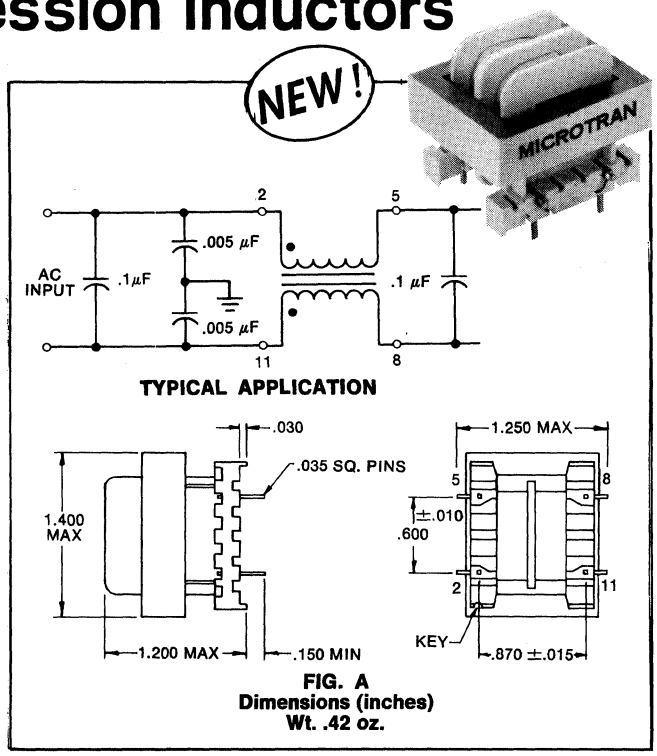
For Elimination of Line Transmitted EMI/RFI Interference from SMPS Equipment

- Compact PC construction.
- 3750V RMS hipot.
- VDE, IEC, UL, CSA compatible.
- 130°C insulation system.
- Cost effective design.

Common mode suppression inductors are used to minimize AC line-conducted interference produced by switching power supplies and regulators. Balun winding to within 1% produces opposing magnetic fluxes in the core to effectively cancel differential-mode noise signals appearing across the AC line. Use of common mode chokes substantially reduces component count as well as inductor size, as compared to differential filtering. Constructed with spacing between windings to meet international safety requirements.

Part No.	Inductance mH	RMS Max. Amps	DCR Max. Ohms	Fig.
SC1-16800	16.8	.50	1.0	A
SC1-07900	7.9	.75	.43	A
SC1-04900	4.9	1.00	.22	A
SC1-03770	3.77	1.25	.156	A
SC1-01960	1.96	1.5	.11	A
SC1-01280	1.28	2.0	.071	A
SC1-00840	.84	2.5	.046	A
SC1-00490	.49	3.0	.027	A
SC1-00290	.29	4.0	.0166	A

Other ratings and MIL constructions available on special order.
NOTES: Inductance shown is for each winding. Inductance ±25% measured @ 10 kHz, 1V RMS. Inductance with each winding connected series opposing under 100 μH typical @ 10 kHz, 1V RMS. Inter-winding capacitance: 5 pF typical @ 10 kHz, 1V RMS.



TYPICAL APPLICATION

FIG. A
Dimensions (inches)
Wt. .42 oz.

custom switch mode power transformers

For Switching Power Supplies

Utilizes latest core materials and shape factor to provide smallest possible volume and minimum PC board footprint for effective manufacturing cost reduction. These transformers are available in standard size/power ratings from 25 to 880 watts output for use over a wide frequency range. Standard configurations allow short turn-around time on custom-design samples. Other packaging and styles are available, such as horizontally mounted units. For application assistance, contact our Engineering Department.

- Standardized components speeds delivery.
- VDE, IEC, UL, CSA compatible.
- Frequency range 20 kHz — 300 kHz and higher.
- Core material for newest generation of higher frequency SMPS.

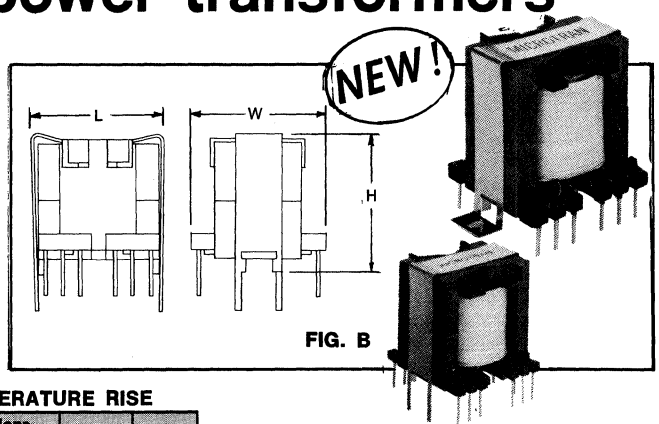


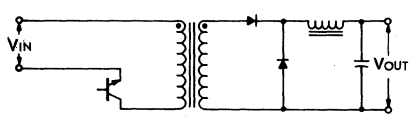
FIG. B

TRANSFORMER OUTPUT POWER VS. FREQUENCY AND TEMPERATURE RISE

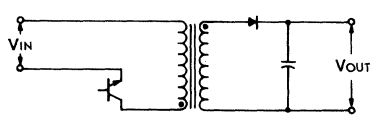
Size Series	Power (W) 50 kHz			Power (W) 100 kHz			Max. Dimensions (Inches)			Wt. Oz.	Fig.
	20°C	30°C	40°C	20°C	30°C	40°C	L	W	H		
SP2016-(*)	25	35	40	40	55	63	.92	.92	.83	.8	B
SP2020-(*)	35	45	55	55	70	80	.92	.92	1.0	.9	B
SP2620-(*)	60	80	95	90	115	135	1.15	1.17	1.0	1.5	B
SP2625-(*)	70	90	110	105	130	160	1.15	1.17	1.17	1.8	B
SP3220-(*)	80	110	130	120	155	190	1.36	1.34	1.0	2.2	B
SP3230-(*)	115	150	185	155	210	260	1.36	1.34	1.4	3.2	B
SP3535-(*)	170	220	265	230	315	355	1.48	1.55	1.6	4.4	B
SP4040-(*)	225	325	385	350	460	525	1.67	1.67	1.76	6.9	B
SP5050-(*)	310	445	525	580	740	880	2.10	2.10	2.10	12.9	B

* Custom P/N assigned by factory.

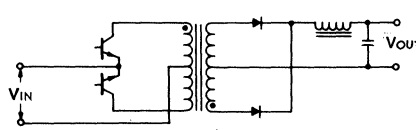
NOTES: The power ratings are based on forward converter circuitry with 40% duty cycle. Flyback circuits provide less power; bi-polar circuits will provide more. If the design is to meet VDE or IEC requirements, derate output power by 20%.



TYPICAL FORWARD CONVERTER



TYPICAL FLYBACK CONVERTER



TYPICAL BI-POLAR PUSH-PULL CONVERTER

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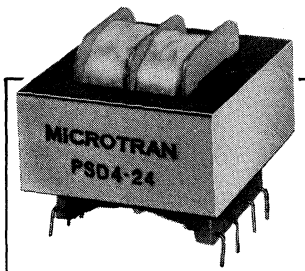
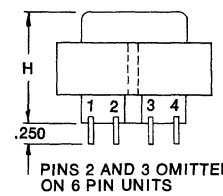
  Low Capacitive Coupling Minimizes Line Noise and False Triggering
- 2,500V RMS Hipot
- 115V Single or 115/230V 50/60 Hz Dual Primary
- Dual Secondaries may be either Parallel or Series Connected
- Precision Spaced Molded-in Terminals
  Terminal Numbers are Molded on Bobbin
- Class S 130°C Insulation
- Attractive Pricing — Superior Quality

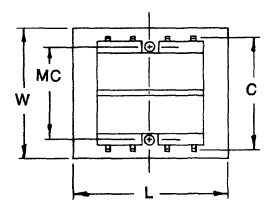
PART NO.		SECONDARY RMS RATING			
		Parallel Connected		Series Connected	
Single 115V PSS Series	Dual 115/230V PSD Series	AC Volts	RMS Amps	AC Volts	RMS Amps
PSS2-10	PSD2-10	5.0	0.22	10.0 CT	0.11
PSS3-10	PSD3-10	5.0	0.5	10.0 CT	0.25
PSS4-10	PSD4-10	5.0	1.2	10.0 CT	0.60
PSS5-10	PSD5-10	5.0	2.4	10.0 CT	1.2
PSS2-12	PSD2-12	6.3	0.18	12.6 CT	0.09
PSS3-12	PSD3-12	6.3	0.4	12.6 CT	0.2
PSS4-12	PSD4-12	6.3	1.0	12.6 CT	0.5
PSS5-12	PSD5-12	6.3	2.0	12.6 CT	1.0
PSS2-16	PSD2-16	8.0	0.14	16.0 CT	0.07
PSS3-16	PSD3-16	8.0	0.3	16.0 CT	0.15
PSS4-16	PSD4-16	8.0	0.8	16.0 CT	0.4
PSS5-16	PSD5-16	8.0	1.6	16.0 CT	0.8
PSS2-20	PSD2-20	10.0	0.11	20.0 CT	0.055
PSS3-20	PSD3-20	10.0	0.24	20.0 CT	0.12
PSS4-20	PSD4-20	10.0	0.6	20.0 CT	0.3
PSS5-20	PSD5-20	10.0	1.2	20.0 CT	0.6
PSS2-24	PSD2-24	12.0	0.09	24.0 CT	0.045
PSS3-24	PSD3-24	12.0	0.2	24.0 CT	0.1
PSS4-24	PSD4-24	12.0	0.5	24.0 CT	0.25
PSS5-24	PSD5-24	12.0	1.0	24.0 CT	0.5
PSS2-28	PSD2-28	14.0	0.08	28.0 CT	0.04
PSS3-28	PSD3-28	14.0	0.17	28.0 CT	0.085
PSS4-28	PSD4-28	14.0	0.4	28.0 CT	0.2
PSS5-28	PSD5-28	14.0	0.84	28.0 CT	0.42
PSS2-36	PSD2-36	18.0	0.06	36.0 CT	0.03
PSS3-36	PSD3-36	18.0	0.13	36.0 CT	0.065
PSS4-36	PSD4-36	18.0	0.34	36.0 CT	0.17
PSS5-36	PSD5-36	18.0	0.7	36.0 CT	0.35
PSS2-48	PSD2-48	24.0	0.046	48.0 CT	0.023
PSS3-48	PSD3-48	24.0	0.1	48.0 CT	0.05
PSS4-48	PSD4-48	24.0	0.25	48.0 CT	0.125
PSS5-48	PSD5-48	24.0	0.5	48.0 CT	0.25
PSS2-56	PSD2-56	28.0	0.04	56.0 CT	0.02
PSS3-56	PSD3-56	28.0	0.09	56.0 CT	0.045
PSS4-56	PSD4-56	28.0	0.22	56.0 CT	0.11
PSS5-56	PSD5-56	28.0	0.44	56.0 CT	0.22
PSS2-120	PSD2-120	60.0	0.02	120.0 CT	0.01
PSS3-120	PSD3-120	60.0	0.04	120.0 CT	0.02
PSS4-120	PSD4-120	60.0	0.1	120.0 CT	0.05
PSS5-120	PSD5-120	60.0	0.2	120.0 CT	0.1

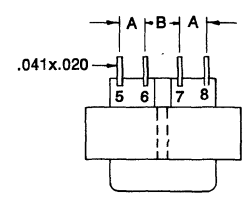


Recognized Component Underwriters Labs Inc.

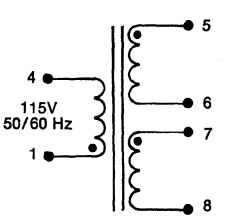
UL 1585 Class 2 & 3 — File #E96720.
UL General Purpose — File #E79781.
UL Class B Insulation System.



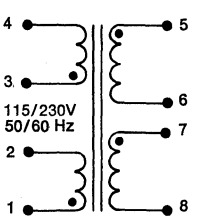




SCHEMATICS



6 PIN PSS SERIES



8 PIN PSD SERIES

DIMENSIONS Inches (mm)									
PSS, PSD Series	VA	L	W	H	MC	A	B	C	Lb. (Gm.)
2	1.1	1.44 (36.6)	1.23 (31.2)	1.00 (25.4)	— —	.250 (6.35)	.250 (6.35)	1.200 (30.5)	0.17 (77.4)
3	2.4	1.44 (36.6)	1.23 (31.2)	1.26 (32)	— —	.250 (6.35)	.250 (6.35)	1.200 (30.5)	0.25 (114)
4	6	1.69 (43)	1.39 (35.3)	1.36 (34.5)	1.0625* (27.0)*	.250 (6.35)	.350 (8.9)	1.280 (32.5)	0.44 (200)
5	12	1.97 (50)	1.63 (41.4)	1.5 (38.1)	1.250* (31.8)*	.300 (7.62)	.400 (10.16)	1.410 (35.8)	0.70 (319)

* Clearance hole for 4-40 x 1⅜" nylon mtg. screws. Order screw as P/N PS-S and nut as P/N PS-N; Sold only in pkgs. of 100 each.

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- 130°C Insulation System — Insulating Materials Meet UL 94V-0 Flammability Requirements
- Cost Effective Design

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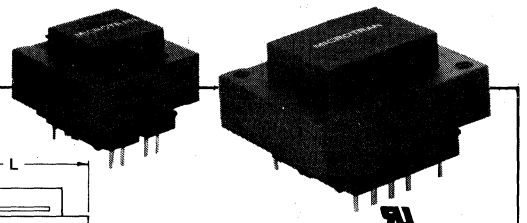
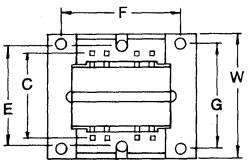
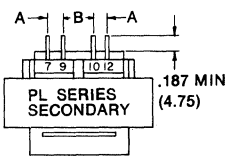
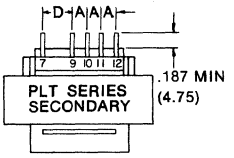


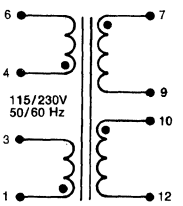
Recognized Component Underwriters Labs Inc.

UL General Purpose — File #E79781.
UL Class B Insulation System.

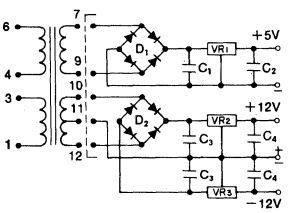








PL SERIES



PLT SERIES — TYPICAL SCHEMATIC

PL SERIES — FOR CONTROL AND POWER SUPPLY APPLICATIONS

Part No.	VA (Size)	Secondary: Parallel Connected AC Volts	Secondary: Parallel Connected RMS Amps	Secondary: Series Connected AC Volts	Secondary: Series Connected RMS Amps
PL2.5-10	2.5	5.0	0.5	10.0 CT	0.25
PL5.0-10	5.0	5.0	1.0	10.0 CT	0.5
PL10-10	10.0	5.0	2.0	10.0 CT	1.0
PL20-10	20.0	5.0	4.0	10.0 CT	2.0
PL30-10	30.0	5.0	6.0	10.0 CT	3.0
PL56-10	56.0	5.0	11.2	10.0 CT	5.6
PL2.5-12	2.5	6.3	0.4	12.6 CT	0.2
PL5.0-12	5.0	6.3	0.8	12.6 CT	0.4
PL10-12	10.0	6.3	1.6	12.6 CT	0.8
PL20-12	20.0	6.3	3.2	12.6 CT	1.6
PL30-12	30.0	6.3	4.8	12.6 CT	2.4
PL56-12	56.0	6.3	8.8	12.6 CT	4.4
PL2.5-16	2.5	8.0	0.3	16.0 CT	0.15
PL5.0-16	5.0	8.0	0.62	16.0 CT	0.31
PL10-16	10.0	8.0	1.25	16.0 CT	0.62
PL20-16	20.0	8.0	2.5	16.0 CT	1.25
PL30-16	30.0	8.0	3.8	16.0 CT	1.9
PL56-16	56.0	8.0	7.0	16.0 CT	3.5
PL2.5-20	2.5	10.0	0.24	20.0 CT	0.12
PL5.0-20	5.0	10.0	0.5	20.0 CT	0.25
PL10-20	10.0	10.0	1.0	20.0 CT	0.5
PL20-20	20.0	10.0	2.0	20.0 CT	1.0
PL30-20	30.0	10.0	3.0	20.0 CT	1.5
PL56-20	56.0	10.0	5.6	20.0 CT	2.8
PL2.5-24	2.5	12.0	0.2	24.0 CT	0.1
PL5.0-24	5.0	12.0	0.42	24.0 CT	0.21
PL10-24	10.0	12.0	0.84	24.0 CT	0.42
PL20-24	20.0	12.0	1.66	24.0 CT	0.83
PL30-24	30.0	12.0	2.5	24.0 CT	1.25
PL56-24	56.0	12.0	4.66	24.0 CT	2.33
PL2.5-28	2.5	14.0	0.18	28.0 CT	0.09
PL5.0-28	5.0	14.0	0.36	28.0 CT	0.18
PL10-28	10.0	14.0	0.72	28.0 CT	0.36
PL20-28	20.0	14.0	1.44	28.0 CT	0.72
PL30-28	30.0	14.0	2.12	28.0 CT	1.06
PL56-28	56.0	14.0	4.0	28.0 CT	2.0
PL2.5-36	2.5	18.0	0.14	36.0 CT	0.07
PL5.0-36	5.0	18.0	0.28	36.0 CT	0.14
PL10-36	10.0	18.0	0.56	36.0 CT	0.28
PL20-36	20.0	18.0	1.12	36.0 CT	0.56
PL30-36	30.0	18.0	1.64	36.0 CT	0.82
PL56-36	56.0	18.0	3.12	36.0 CT	1.56

DIMENSIONS Inches (mm)

VA (Size)	L	W	H	A†	B	C	D	Mounting E	Mounting F	Mounting G	Mtg. Screws	Pin Square	Lbs. (Kg.)
2.5	1.625 (41.3)	1.313 (33.3)	1.125 (28.6)	.200 (5.1)	.250 (6.4)	1.000 (25.4)	—	1.063 (27.0)	—	—	2X #4 (2X M3)	.025 (.635)	.25 (.11)
5.0	1.625 (41.3)	1.313 (33.3)	1.375 (34.9)	.200 (5.1)	.400 (10.2)	1.000 (25.4)	—	1.063 (27.0)	—	—	2X #4 (2X M3)	.025 (.635)	.37 (.17)
10.0	1.875 (47.6)	1.563 (39.7)	1.375 (34.9)	.200 (5.1)	.400 (10.2)	1.140 (29.0)	—	1.250 (31.8)	—	—	2X #4 (2X M3)	.038 (.965)	.53 (.24)
20.0	2.250 (50.8)	1.875 (47.6)	1.625 (41.3)	.400 (10.2)	.400 (10.2)	1.460 (29.0)	.40 (10.2)	1.500 (38.1)	—	—	2X #4 (2X M3)	.038 (.965)	.90 (.41)
30.0	2.625 (66.7)	2.188 (55.6)	1.563 (39.7)	.550 (14.0)	.275 (7.0)	1.680 (42.7)	.55 (14.0)	—	2.19 (55.6)	1.75 (44.5)	4X #6 (4X M3)	.045 (1.14)	1.15 (.52)
56.0	3.000 (76.2)	2.500 (63.5)	1.813 (46.0)	.600 (15.2)	.300 (7.6)	1.900 (48.3)	.60 (15.2)	—	2.50 (63.5)	2.00 (50.8)	4X #6 (4X M5)	.045 (1.14)	1.70 (.77)

† For PLT series secondary, dimension A is ½ of value shown.

PLT SERIES — FOR TRIPLE OUTPUT REGULATED POWER SUPPLIES
For Microprocessor, Logic, and Op Amp Applications

Part No.	VA AC (Size)	DC Output #1 DC Volts	DC Output #1 Amps DC	DC Output #2 DC Volts	DC Output #2 mA DC	C_1	C_3	VR_1	VR_2	VR_3	D_1	D_2
PLT20-32	20.0	5.0	1.25	±12	150	7,500 µF 20V DC	1,500 µF 50V DC	LM-323K-5	LM-340K-12	LM-320K-12	3N253	3N247
PLT30-32	30.0	5.0	1.75	±12	210	10,000 µF 20V DC	1,500 µF 50V DC	LM-323K-5	LM-340K-12	LM-320K-12	3N253	3N247
PLT56-32	56.0	5.0	2.8	±12	350	15,000 µF 20V DC	2,000 µF 50V DC	LM-323K-5	LM-340K-12	LM-320K-12	MDA-400	3N247

C_2 and C_4 10,000 µF @ 20V. All VR's are National Semiconductor P/N's. All diodes are Motorola P/N's.

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For PC Board Solid-State Power, Control, and Instrumentation Applications

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- Physical Barriers Between Primary and Secondary — Double Protection System — 4,000 Volt Hipot

PW SERIES — FOR CONTROL AND POWER SUPPLY APPLICATIONS

115/230V 50/60 Hz Primary

Part No.	Secondary: Parallel Connected AC Volts	Parallel Connected RMS Amps	Series Connected AC Volts	Series Connected RMS Amps	Schematic	Fig.
PW28 SERIES • 0.5 VA						
PW28-10	10.0 CT	.050	(Single Secondary)		1†	A
PW28-16	16.0 CT	.031	(Single Secondary)		1†	A
PW28-24	24.0 CT	.021	(Single Secondary)		1†	A
PW35 SERIES • 1.1 VA						
PW35-10	10.0 CT	.110	(Single Secondary)		1	A
PW35-12	12.6 CT	.090	(Single Secondary)		1	A
PW35-16	16.0 CT	.070	(Single Secondary)		1	A
PW35-24	24.0 CT	.046	(Single Secondary)		1	A
PW35-36	36.0 CT	.031	(Single Secondary)		1	A
PW41 SERIES • 3.5 VA						
PW41-10	10.0 CT	.350	(Single Secondary)		1	B
PW41-12	12.6 CT	.280	(Single Secondary)		1	B
PW41-16	16.0 CT	.220	(Single Secondary)		1	B
PW41-24	24.0 CT	.150	(Single Secondary)		1	B
PW41-36	36.0 CT	.100	(Single Secondary)		1	B
PW48 SERIES • 9.5 VA						
PW48-10	5.0	1.900	10.0 CT	.950	2	B
PW48-12	6.3	1.500	12.6 CT	.750	2	B
PW48-16	8.0	1.200	16.0 CT	.600	2	B
PW48-24	12.0	.800	24.0 CT	.400	2	B
PW48-36	18.0	.520	36.0 CT	.260	2	B
PW48-56	28.0	.340	56.0 CT	.170	2	B
PW54 SERIES • 12.5 VA						
PW54-10	5.0	2.500	10.0 CT	1.250	2	C
PW54-12	6.3	2.000	12.0 CT	1.000	2	C
PW54-16	8.0	1.560	16.0 CT	.780	2	C
PW54-24	12.0	1.040	24.0 CT	.520	2	C
PW54-36	17.0	.700	36.0 CT	.350	2	C
PW54-56	28.0	.446	56.0 CT	.223	2	C

† PW28 Series has 115V only primary. For 230V only primary, order as PW28-10-230, etc.

PWT SERIES — FOR TRIPLE OUTPUT REGULATED AND UNREGULATED POWER SUPPLIES

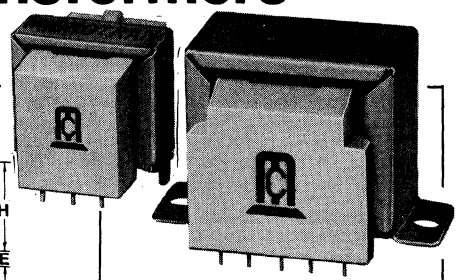
115/230V 50/60 Hz Primary

Part No.	Secondary #1 AC Volts	Secondary #1 RMS Amps	Secondary #2 AC Volts	Secondary #2 RMS Amps	DC Output #1 CT FW DC Volts	DC Output #1 mA DC	DC Output #2 CT FW DC Volts	DC Output #2 mA DC	Schematic	Fig.
PWT54-1024	9.0 CT	.800	24.0 CT	.300	+5	670	±15	170	3	C
PWT54-1633	16.0 CT	.550	33.0 CT	.180	+9.0*	470	±21*	120	4	C

* +9.0 and ±21 DC output volts are for inputs to +5V and ±15V IC Voltage Regulator; see Schematic #4.

Recognized Component Underwriters Labs Inc.

UL 1411
File #E82992



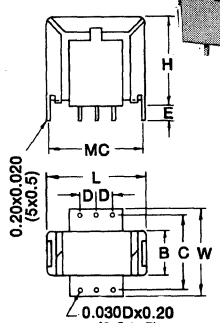
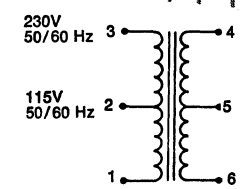


FIG. A*



SCHEMATIC 1

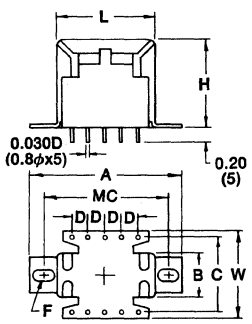
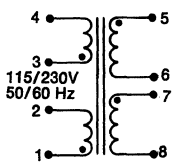


FIG. B*



SCHEMATIC 2

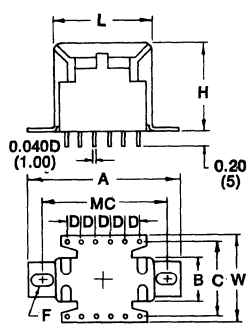
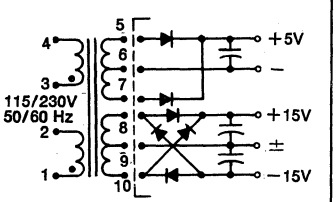
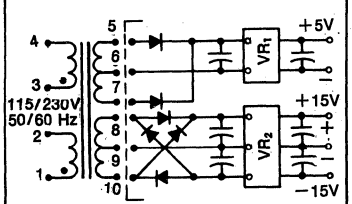


FIG. C*



SCHEMATIC 3



SCHEMATIC 4

DIMENSIONS Inches (mm)

Series	Max VA	L	W	H	MC	A	B	C	D	E	F	Oz. (Gm)
PW28	0.7	1.16 (29.5)	1.32 (33.5)	1.10 (28)	1.12 (28.5)	– –	0.50 (12.5)	0.984 (25)	0.197 (5)	0.20 (5)	– –	2.5 (70)
PW35	2	1.44 (36.5)	1.69 (43)	1.26 (32)	1.40 (35.5)	– –	0.61 (15.5)	1.380 (35)	0.295 (7.5)	0.24 (6)	– –	4.5 (130)
PW41	5	1.67 (42.5)	1.91 (48.5)	1.42 (36)	2.05 (52)	2.36 (60)	0.85 (21.5)	1.575 (40)	0.394 (10)	– –	0.138x0.177 (3.5x4.5)	8.0 (230)
PW48	9.5	1.99 (50.5)	2.05 (52)	1.69 (43)	2.32 (59)	2.72 (69)	1.08 (27.5)	1.772 (45)	0.295 (7.5)	– –	0.177x0.256 (4.5x6.5)	14.0 (400)
PW54	15	2.22 (56.5)	2.09 (53)	1.93 (49)	2.72 (69)	3.15 (80)	1.08 (27.5)	1.772 (45)	0.295 (7.5)	– –	0.177x0.256 (4.5x6.5)	18.0 (510)

PWT54 and PW54 have same dimensions
* Request terminal layout sheet for pin locations.

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MICROTRAN company, inc.

FLATSTACK® low profile power transformers

For Low Height PC Board Solid-State Power, Control, and Instrumentation Applications

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  6 VA Size 0.85″ high for 1″ Card Spacing
  12 VA Size 1.065″ high for 1¼″ Card Spacing
  NEW! 24 VA Size 1.250″ high for 1 19/16″ Card Spacing
- **SPLIT BOBBIN**—Primaries and Secondaries Wound Side by Side.
  1500V Hipot.
  High Isolation for Low Leakage Applications.
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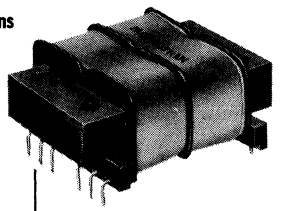
- **DUAL PRIMARIES: 115/230V, 50/60 Hz.**



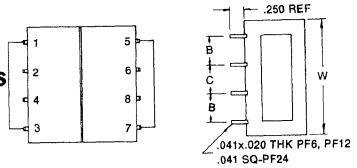
Recognized Component
Underwriter Labs Inc.

UL General Purpose
File #E79781

PF SERIES—FOR POWER SUPPLIES, INSTRUMENTS, CONTROL EQUIPMENT

Part No.	VA (Size)	Secondary: Parallel Connected AC Volts	Parallel Connected RMS Amps	Series Connected AC Volts	Series Connected RMS Amps
PF6-10	6	5.0	1.20	10.0 CT	.60
PF12-10	12	5.0	2.40	10.0 CT	1.20
PF24-10	24	5.0	4.80	10.0 CT	2.40
PF6-12	6	6.3	.90	12.6 CT	.45
PF12-12	12	6.3	1.80	12.6 CT	.90
PF24-12	24	6.3	3.80	12.6 CT	1.90
PF6-16	6	8.0	.70	16.0 CT	.35
PF12-16	12	8.0	1.40	16.0 CT	.70
PF24-16	24	8.0	3.00	16.0 CT	1.50
PF6-20	6	10.0	.60	20.0 CT	.30
PF12-20	12	10.0	1.20	20.0 CT	.60
PF24-20	24	10.0	2.40	20.0 CT	1.20
PF6-24	6	12.0	.50	24.0 CT	.25
PF12-24	12	12.0	1.00	24.0 CT	.50
PF24-24	24	12.0	2.00	24.0 CT	1.00
PF6-30	6	15.0	.40	30.0 CT	.20
PF12-30	12	15.0	.80	30.0 CT	.40
PF24-30	24	15.0	1.60	30.0 CT	.80
PF6-34	6	17.0	.34	34.0 CT	.17
PF12-34	12	17.0	.68	34.0 CT	.34
PF24-34	24	17.0	1.40	34.0 CT	.70
PF6-56	6	28.0	.20	56.0 CT	.10
PF12-56	12	28.0	.40	56.0 CT	.20
PF24-56	24	28.0	.85	56.0 CT	.43

PF SERIES

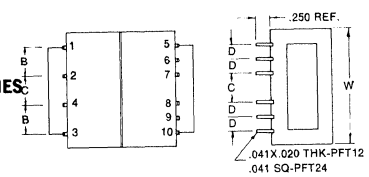


PFT SERIES—FOR TRIPLE OUTPUT REGULATED POWER SUPPLIES

Part No.	VA (Size)	Secondary #1 AC Volts	Secondary #1 RMS Amps	Secondary #2 AC Volts	Secondary #2 RMS Amps	DC Output #1 CT FW DC Volts	DC Output #1 mA DC	DC Output #2 CT FW DC Volts	DC Output #2 mA DC
PFT12-35	12	16.0 CT	.36	35.0 CT	.15	+8.75*	300	±22*	85
PFT24-35	24	16.0 CT	.72	35.0 CT	.30	+8.75*	600	±22*	170

• +8.75 and ±22 DC output volts are for inputs to +5V and ±12 or ±15V IC Voltage Regulators. See PFT schematic. Line input 115/230V ±10%.

PFT SERIES



DIMENSIONS (Inches)

VA (Size)	L	W	H	A	B	C	D†	Wt. Oz.
6	1.875	1.563	0.850	1.600	0.375	0.375	—	7
12	2.500	2.000	1.065	2.000	0.500	0.500	0.250	11
24	2.870	2.250	1.250	1.900	0.600	0.530	0.300	15

† Dimension D only applies to PFT Series.

PLUG-IN PRINTED CIRCUIT POWER TRANSFORMERS

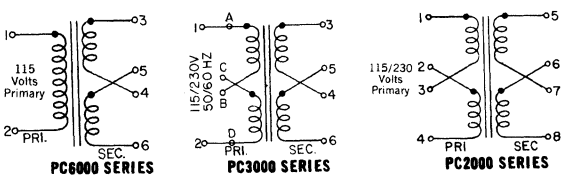
- COMPACT DESIGN FOR MINIATURIZED SOLID STATE CIRCUITRY
- FOR POWER SUPPLIES, INSTRUMENTS AND CONTROL APPLICATIONS
- DUAL SECONDARIES MAY BE PARALLEL OR SERIES CONNECTED

Top lugs on PC2000 series provide for 115/230V primary voltage options without changes in PC board. PC3000 series has 8 PC pins. 50/60 Hz.

Primary: 115V Part No.	Fig.	115/230V Part No.	Fig.	Part No.	Fig.	Secondary: Parallel Connected AC Volts	Parallel Connected RMS Amps	Series Connected AC Volts	Series Connected RMS Amps
PC6506	A	PC2506	C	PC3506	A	6.3 CT	.250	(Single Secondary)	
PC6512	A	PC2512	C	PC3512	A	12.6	.120	25.2 CT	.060
PC6524	A	PC2524	C	PC3524	A	40.0	.040	80.0 CT	.020
PC6528	A	PC2528	C	PC3528	A	58.0	.026	116.0 CT	.013
PC6608	B	PC2608	D	PC3608	B	6.3	.700	12.6 CT	.350
PC6616	B	PC2616	D	PC3616	B	28.0	.156	56.0 CT	.078
PC6624	B	PC2624	D	PC3624	B	40.0	.110	80.0 CT	.055
PC6628	B	PC2628	D	PC3628	B	58.0	.066	116.0 CT	.033
PC6632	B	PC2632	D	PC3632	B	115.0V	@ .020A	& 12.6V	@ .150A
PC6708	B	PC2708	D	PC3708	B	6.3	1.200	12.6 CT	.600
PC6712	B	PC2712	D	PC3712	B	12.6	.600	25.2 CT	.300
PC6715	B	PC2715	D	PC3715	B	20.0	.370	40.0 CT	.185
PC6716	B	PC2716	D	PC3716	B	28.0	.270	56.0 CT	.135
PC6724	B	PC2724	D	PC3724	B	40.0	.180	80.0 CT	.090
PC6728	B	PC2728	D	PC3728	B	58.0	.130	116.0 CT	.065
PC6732	B	PC2732	D	PC3732	B	115.0V	@ .025A	& 12.6V	@ .250A

Series	Watts	W	D	H	Wt. Oz.
PC2500/PC3500/PC6500	1½	125/64	15/32	111/64	3.2
PC2600/PC3600/PC6600†	4½	145/64	1¼	125/64	6.5
PC2700/PC3700/PC6700‡	7½	161/64	115/32	141/64	9.5

† Channel mounting 2″ M.C. ‡ 2⅛″ M.C.



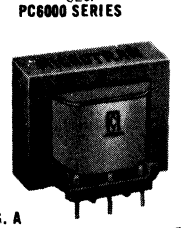


FIG. A

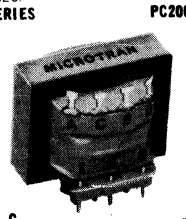


FIG. C

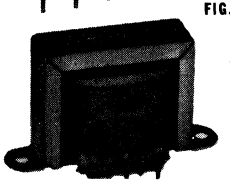


FIG. B

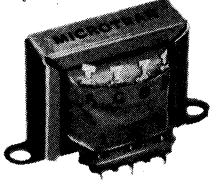


FIG. D

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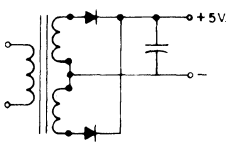
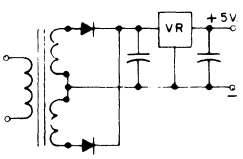
FOR DC POWER SUPPLIES

For Microprocessor Logic and OP AMP Power Supplies. For construction of low cost, miniaturized, regulated and unregulated DC power supplies for latest solid-state digital and linear circuitry. Permits packaging flexibility unobtainable with prepackaged power supplies. Low-profile, miniaturized construction permits close stacking of P.C. boards. Precision spaced molded-in terminals. All primaries 115 V 50/60 Hz except PCL6600 Series. 115 230V 50/60 Hz. **Transformers supplied with engineering bulletin providing schematics and suggested components.**

TRANSFORMERS FOR +5V DC UNREGULATED AND REGULATED POWER SUPPLIES



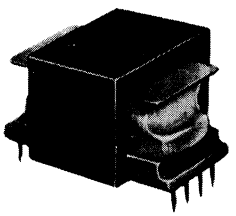
#1 — UNREGULATED



#2 — REGULATED

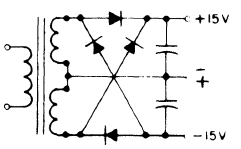
Part No.	SECONDARY Parallel Connected AC Volts	SECONDARY Parallel Connected RMS Amps	SECONDARY Series Connected AC Volts	SECONDARY Series Connected RMS Amps	DC OUTPUT C.T.F.W. DC Volts	DC OUTPUT Current mA DC	DC OUTPUT Schematic No.	Fig.
PC6205	4.50	0.18	9.0 CT	0.09	+5	75	1	A
PC6505	4.50	0.36	9.0 CT	0.18	+5	150	1	B
PC6605	4.50	1.10	9.0 CT	0.55	+5	450	1	D
PCL6605	4.50	1.10	9.0 CT	0.55	+5	450	1	C
PC6705	4.50	2.00	9.0 CT	1.00	+5	825	1	D
PC6905	4.50	5.00	9.0 CT	2.50	+5	2000	1	A
PC6210	7.75	0.12	15.5 CT	0.06	+8.5†	50	2	A
PC6510	7.75	0.22	15.5 CT	0.11	+8.5†	90	2	B
PC6610	7.75	0.64	15.5 CT	0.32	+8.5†	265	2	D
PCL6610	7.75	0.64	15.5 CT	0.32	+8.5†	265	2	C
PC6710	7.75	1.20	15.5 CT	0.60	+8.5†	500	2	D
PC6910	7.75	3.10	15.5 CT	1.55	+8.5†	1300	2	A

†+8.5 DC output volts for input to +5V IC Voltage Regulator, see Typical Schematic Regulated.



6200/PCT6200 SERIES
PC6900/PCT6900 SERIES
FIG. A

TRANSFORMERS FOR ±15V DC DUAL OUTPUT UNREGULATED AND REGULATED POWER SUPPLIES



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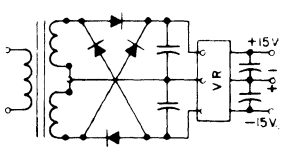


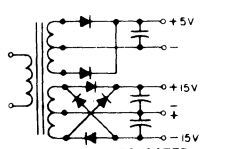
#4 — REGULATED

Part No.	SECONDARY Parallel Connected AC Volts	SECONDARY Parallel Connected RMS Amps	SECONDARY Series Connected AC Volts	SECONDARY Series Connected RMS Amps	DC OUTPUT C.T.F.W. DC Volts	DC OUTPUT Current mA DC	DC OUTPUT Schematic No.	Fig.
PC6211	12.0	0.07	24.0 CT	0.035	±15	22	3	A
PC6511	12.0	0.13	24.0 CT	0.065	±15	40	3	B
PC6611	12.0	0.40	24.0 CT	0.200	±15	120	3	D
PCL6611	12.0	0.40	24.0 CT	0.200	±15	120	3	C
PC6711	12.0	0.76	24.0 CT	0.380	±15	220	3	D
PC6911	12.0	1.90	24.0 CT	0.950	±15	550	3	A
PC6214	16.0	0.05	32.0 CT	0.025	±20†	15	4	A
PC6514	16.0	0.10	32.0 CT	0.050	±20†	30	4	B
PC6614	16.0	0.30	32.0 CT	0.150	±20†	90	4	D
PCL6614	16.0	0.30	32.0 CT	0.150	±20†	90	4	C
PC6714	16.0	0.56	32.0 CT	0.280	±20†	165	4	D
PC6914	16.0	1.40	32.0 CT	0.700	±20†	410	4	A

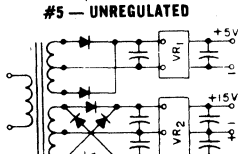
† ±20 DC output volts for input to ±15V IC Voltage Regulator, see Typical Schematic - Regulated.

PCL6600 SERIES
FIG. C

TRANSFORMERS FOR +5V AND ±15V DC TRIPLE OUTPUT UNREGULATED AND REGULATED POWER SUPPLIES



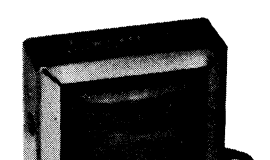
#5 — UNREGULATED



#6 — REGULATED

Part No.	SECONDARY #1 AC Volts	SECONDARY #1 RMS Amps	SECONDARY #2 AC Volts	SECONDARY #2 RMS Amps	DC OUTPUT #1 C.T.F.W. DC Volts	DC OUTPUT #1 mA DC	DC OUTPUT #2 C.T.F.W. DC Volts	DC OUTPUT #2 mA DC	Schematic No.	Fig.
PCT6230	9.0 CT	0.048	24.0 CT	0.020	+5	40	±15	12	5	A
PCT6530	9.0 CT	0.072	24.0 CT	0.032	+5	60	±15	20	5	B
PCT6630	9.0 CT	0.240	24.0 CT	0.080	+5	200	±15	50	5	D
PCL6630	9.0 CT	0.240	24.0 CT	0.080	+5	200	±15	50	5	C
PCT6730	9.0 CT	0.480	24.0 CT	0.160	+5	400	±15	100	5	D
PCT6930	9.0 CT	1.200	24.0 CT	0.440	+5	1000	±15	275	5	A
PCT6531	15.5 CT	0.048	32.0 CT	0.020	+8.5†	40	±20†	12	6	B
PCT6631	15.5 CT	0.140	32.0 CT	0.058	+8.5†	115	±20†	35	6	D
PCL6631	15.5 CT	0.140	32.0 CT	0.058	+8.5†	115	±20†	35	6	C
PCT6731	15.5 CT	0.300	32.0 CT	0.100	+8.5†	250	±20†	60	6	D
PCT6931	15.5 CT	0.690	32.0 CT	0.298	+8.5†	575	±20†	175	6	A

† +8.5 and ±20 DC output volts are for inputs to +5V and ±15V IC Voltage Regulator, see Typical Schematic - Regulated.

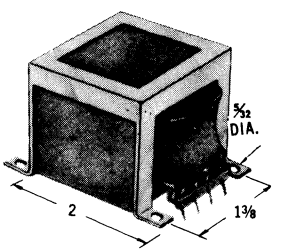


PC6600/PCT6600 SERIES
PC6700/PCT6700 SERIES
FIG. D

DIMENSIONAL CHART

Series	Watts	W (Inches)	D (Inches)	H (Inches)	Wt. Oz.
PC6200/PCT6200	1	1 1/64	1 3/8	27/32	2.3
PC6500/PCT6500	1 1/2	1 25/64	1 3/32	1 11/64	3.2
PC6600/PCT6600†	4 1/2	1 45/64	1 1/4	1 25/64	6.5
PCL6600	4 1/2	1 51/64	1 13/32	1 3/16	6.6
PC6700/PCT6700‡	7 1/2	1 61/64	1 15/32	1 41/64	9.5
PC6900/PCT6900	24	1 61/64	2 1/4	1 11/32	12.0

† Channel mounting 2" M.C. ‡ 2 3/8" M.C.



SLIP-ON BRACKET
For PC6900 Series
Order as Part Number PC6900-FB
Max. Height 1 7/16"

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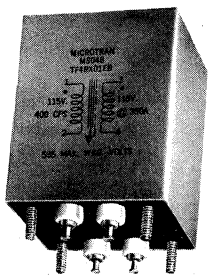
POWER TRANSFORMERS AND INDUCTORS
MIL AND COMMERCIAL

MICROTRAN company, inc.

FIG A:



HERMETICALLY SEALED PER MIL-T-27.
See Page 31 for MIL Case Dimensions.

FIG. FB

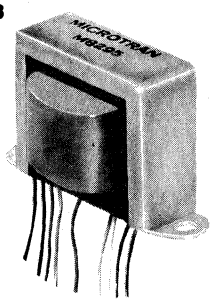
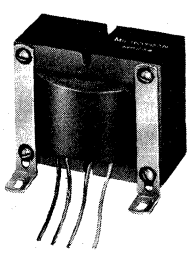
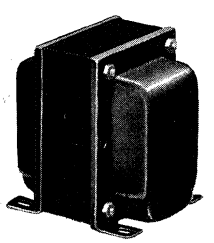


FIG. K





VERTICAL END BELL

50/60 Hz CONTROL AND POWER SUPPLY TRANSFORMERS—MIL/COMMERCIAL

Designed for solid state and low voltage power supply applications. Primary 105/115/125 Volts. Part numbers listed on left are hermetically sealed per MIL Designation: TF4R03XX. Part numbers listed on right are open frame construction.

MIL		COMMON ELECTRICAL RATINGS				COMMERCIAL					
		Secondary		Rectifier Circuit				Open Frame Dimensions			
MIL Part No.	Fig. A MIL Case XX	AC Volts	RMS Amps	CT FW DC Volts**	FW Bridge DC Volts**	Open Frame Part No.	Fig.	L	W	H	Mounting Centers
M8042	AJ	6.3 CT	.6	1.9	3.8	M8242	FB	2⅜	1⅜	1½	2
M8043	FB	6.3 CT	2.0	1.9	3.8	M8243	FB	3¼	1⅝	1 15/16	2 13/16
M8086	GA	6.3 CT	6.0	1.9	3.8	M8286*	FB	3 11/16	2⅛	2¼	3⅛
M8087	GA	12.6 CT	3.0	4.7	9.4	M8287	FB	3 11/16	2⅛	2¼	3⅛
—	—	12	4.0	9.9 (series)	19.8 (series)	M8247†	K	4⅛	3⅛	3¾	3 7/16 × 2½
		12	4.0	9.9 (series)	19.8 (series)						
M8044	JB	12.6 CT	2.0	10.5 (series)	21 (series)	M8244	K	3⅜	2⅞	3 3/32	2 13/16 × 2½
		12.6	2.0	10.5 (series)	21 (series)						
M8022	JB	18.5 CT	3.0	7.4	14.8	M8222	K	3⅜	2½	3 3/32	2 13/16 × 2⅛
M8088	HA	26 CT	2.5	10.8	21.6	M8288	K	3	2¾	2¾	2½ × 2⅜
M8152	AJ	28 CT	0.15	11.7	23.4	—	—	—	—	—	—
M8045	FA	28 CT	.6	11.7	23.4	M8245	FB	3¼	2⅛	1 15/16	2 13/16
M8055	JA	30 CT	2.5	12.5	25	M8255	K	3¾	2¾	3 15/32	3⅛ × 2¼
M8023	KA	35 CT	3.0	14.5	29	M8223*	K	4⅛	3	3¾	3 7/16 × 2⅜
M8089	AJ	40 CT	.1	17	34	M8289	FB	2⅜	1⅜	1½	2
M8090	EA	40 CT	.3	17	34	M8290	FB	2 13/16	1⅝	1⅝	2⅜
M8091	GB	40 CT	.75	17	34	M8291	FB	3 11/16	2⅛	2¼	3⅛
M8046	LA	49 CT	2.5	21	42	M8246	K	4½	3¼	4 1/32	3¾ × 2½
M8024	JA	70 CT	1.0	30	60	M8224	K	3¾	2¾	3 15/32	3⅛ × 2¼
M8056	HA	80 CT	.6	35	70	M8256	K	3	2⅝	2¾	2½ × 2⅜

†Secondary may be connected in series to provide 24V @ 4A or parallel for 12 V @ 8A. *60 Hz only.
**DC Output for resistive or inductive loads. Output volts based on approx. 1V drop per rectifier.

50/60 Hz ISOLATION/POWER TRANSFORMERS—MIL/COMMERCIAL

Center tap permits use in either F.W. Bridge or F.W. CT circuitry. Electrostatic shielding. Part numbers listed on left are hermetically sealed per MIL Designation: TF4R03XX. Part numbers listed on right are open frame construction.

MIL		COMMON ELECTRICAL RATINGS				COMMERCIAL					
								Open Frame Dimensions			
MIL Part No.	Fig. A MIL Case XX	Input Voltage	Output Voltage	Current RMS Amps	VA Rating	Open Frame Part No.	Fig.	L	W	H	Mounting Centers
M8094	AH	115	115 CT	0.0085	1	M8294	FB	2⅛	1⅛	1 3/16	1¾
M8095	EA	115	115 CT	0.030	3.5	M8295	FB	2 13/16	1⅝	1⅝	2⅜
			12.6 CT	0.25	3.15						
			12.6	0.25	3.15						
M8151	FA	115	115 CT	0.13	15	M8251	FB	3¼	1⅝	1 15/16	2 13/16
M8096*	GA	115	115 CT	0.35	40	M8296*	FB	4	2¼	2 9/16	3 9/16
M8078*	KA	115	115 CT	0.9	100	M8278*	K	3¾	3¼	3 15/32	3⅛ × 2¾

*Primary 105/115/125V.

FILTER INDUCTORS—MIL/COMMERCIAL

For 50/60 and 400 Hz Power Supplies. 1500 Test Volt. May be connected in series or parallel for inductive requirements. Part numbers listed on left are hermetically sealed per MIL Designation: TF4R04XX. Part numbers listed on right are open frame construction. Inductance values shown are for 60 Hz, except M8102 120 Hz.

MIL		COMMON ELECTRICAL RATINGS						COMMERCIAL						
		Series Connected			Parallel Connected					Open Frame Dimensions			
MIL Part No.	Fig. A MIL Case XX	Inductance Henrys	DC Amps	DCR Ohms	Inductance Henrys	DC Amps	DCR Ohms	Open Frame Part No.	Fig.	L	W	H	Mounting Centers
M8098	AH	3.5	0.050	200	0.875	0.10	50	M8198	FB	2⅛	1⅛	1 3/16	1¾
M8099	AJ	1.0	0.15	65	0.25	0.30	16	M8199	FB	2⅜	1¼	1½	2
M8100	EB	0.5	0.3	30	0.125	0.6	7.5	M8200	FB	2 13/16	1⅜	1⅝	2⅜
M8101	FB	0.32	0.6	16	0.08	1.2	4	M8201	FB	3¼	1⅝	1 15/16	2 13/16
M8102	JA	0.2	1.0	4	0.05	2.0	1	M8202	K	3⅜	2⅜	3 3/32	2 13/16 × 2⅛
M8103	JA	0.07	2.5	0.84	0.0175	5.0	0.21	M8203	K	3¾	2⅞	3 15/32	3⅛ × 2½
M8104	JA	0.022	4.0	0.4	0.0055	8.0	0.1	M8204	K	3⅜	2¾	3 3/32	2 13/16 × 2½
M8105	KA	0.022	5.0	0.2	0.0055	10.0	0.05	M8205	K	4½	3⅛	4 1/32	3¾ × 2½

50/60 Hz STEP DOWN AUTOFORMER—COMMERCIAL

240/220V to 120/110V. Equipped with 3 prong 6 foot U.L. line cord & receptacle for safety. Baked enamel finish.

Part No.	Output Watts (VA)	Dimensions			Mounting Centers	Wt. Lbs.
		L	W	H		
M1552*	80	3 23/32	2½	2 9/32	3⅛	3.5
M1556	100	3⅛	2⅞	3½	1¾ × 2¼	4
M1553	150	3¼	2⅞	3½	2¼ × 2⅜	5
M1555	250	3⅞	3¼	3⅞	2 11/16 × 2½	6
M1559	350	3¾	3⅞	4⅝	2 7/16 × 3	7
M1558	500	4⅞	3⅞	4⅝	3 9/16 × 3	12
M1551	750	5½	4½	5⅜	3¼ × 3½	16
M1557	1000	7	4½	5⅜	5¼ × 3½	25
M1554	1500	8	4½	5⅜	6¼ × 3½	29
M1550	2000	8½	4⅜	6	6 5/16 × 3 7/16	37

*Supplied with 2 prong line cord and receptacle.

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MICROTRAN company, inc.

POWER TRANSFORMERS 400 Hz

FIG. A

FIG. A:
HERMETICALLY SEALED

Per MIL-T-27
MIL Designation: TF4R03XX
See Page 31 for MIL Case Dimensions

FIG. B:
HERMETIC

Height (H) for M8063 — 1 1/16"; M8069 — 15/16"; M8058, M8075, M8081, M8082 — 1 7/16".
MIL Designation: TF4R03YY

FIG. B

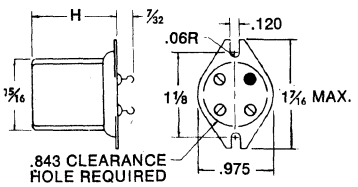


FIG. C

FIG. C:
TOROIDAL MOLDED

Molded with ½" pins for printed circuit applications.
MIL Designation: TF5S03XX

400 Hz ISOLATION POWER TRANSFORMERS

Center Tap Permits Use in Either FW Bridge or FW CT Circuitry.
Electrostatic Shielding MIL Designation: TF4R03XX

Part No.	Primary Volts	Secondary AC Volts	Secondary RMS Amps	VA Rating	Fig. A MIL Case XX
M8082	26	12.6 CT 12.6	0.15 0.15	1.9 1.9	YY (Fig. B)
M8058	115	115 CT	0.017	2	YY (Fig. B)
M8083	115	115 CT 12.6 CT 12.6	0.030 0.25 0.25	10 Total	AJ
M8084	115	115 CT	0.12	14	AJ
M8059	115	115 CT	0.35	40	EB
M8085	115	115 CT	0.7	80	FA
M8060	115	115 CT	1.3	150	GA
M8061*	115	115 CT	2.6	300	JA
M8062*	115	115 CT	4.4	500	KA

* Primary 105/115/125V.

400 Hz PRINTED CIRCUIT POWER

Compact design for miniature solid state circuitry. Precision spaced molded-in terminals for power supplies, control equipment, instrument and similar applications. — Dual secondaries may be connected in series or parallel for varied voltage and current requirements. 115V Primary. See chart to right.

Part No.	Secondary Parallel	Secondary Series
PC4304	3.15V @ .1A	6.3V CT @ .05A
PC4312	12.6V @ .026A	25.2V CT @ .013A
PC4316	28V @ .012A	56V CT @ .006A
PC4320	35V @ .01A	70V CT @ .005A
PC4408	6.3V @ .60A	12.6V CT @ .30A
PC4412	12.6V @ .30A	25.2V CT @ .15A
PC4416	28V @ .14A	56V CT @ .07A
PC4424	40V @ .10A	80V CT @ .05A
PC4428	58V @ .066A	116V CT @ .033A
PC4432	115V @ .010A, 12.6V @ .150A	

400 Hz POWER SUPPLY TRANSFORMERS

For Silicon Rectifier Circuitry, and Filament Applications
Primary 105/115/125 Volts MIL Designation: TF4R03XX

Part No.	Secondary AC Volts	Secondary RMS Amps	Rectifier Circuit CT FW DC Volts**	Rectifier Circuit FW Bridge DC Volts**	Fig. A MIL Case XX
M8063†	2.85 2.85	0.045 0.045	1.5 (series)	3	YY Fig. B
M8064†	6.3 CT	0.6	1.9	3.8	AH
M8075†	6.3 CT	0.3	1.9	3.8	YY Fig. B
M8076†	12.6 CT	0.3	4.7	9.4	AH
M8039	12.6 12.6 CT	0.8 0.8	10.5 (series)	21 (series)	AJ
M8077	12.6 12.6 CT	2 2	10.5 (series)	21 (series)	FA
M8038	12.6 12.6 12.6	0.3 0.3 0.3	16 (series)	32 (series)	AJ
M8018	18.5 CT	1	7.4	14.8	EA
M8019	18.5 CT	3	7.4	14.8	FA
M8065	26 CT	1.5	10.8	21.6	EA
M8066	26 CT	3	10.7	21.5	FA
M8079	26 CT	4	10.8	21.6	HA
M8067	30 CT	1.5	12.5	25	FB
M8020	35 CT	3	14.5	29	GA
M8068	40 CT	0.2	17	34	AJ
M8041†	50 CT	0.25	21.5	43	AH
M8080	50 CT	0.20	21.5	43	AJ
M8069†	60 CT	0.003	26	52	YY Fig. B
M8070†	65 CT	0.170	28.4	56.8	AH
M8081†	65 CT	0.030	28.4	56.8	YY Fig. B
M8021	70 CT	1	30	60	FA
M8071	80 CT	0.90	35	70	FA

** DC Output for resistive or inductive loads. Output volts based on approx. 1V drop per rectifier.
† Primary 115V only.

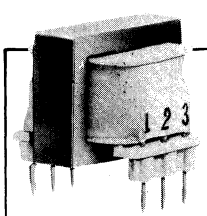
400 Hz TOROIDAL POWER TRANSFORMERS

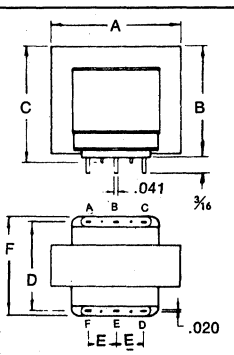
Toroidal cores permit smaller height and package and greater efficiency. Size and savings up to 30%. Epoxy molded. Printed circuit pins can be bent for chassis mounting. Low phase shift. See Fig. C for illustration.

For Applications Requiring Minimum Size and Weight.
Primary 115 Volts MIL Designation: TF5S03ZZ

Part No.	Secondary AC Volts	Secondary RMS mA	VA	Dimensions OD	Dimensions Height	Nominal Wt. Oz.
M8106	28 CT	320	9	1 5/32	1 1/8	2
M8107	28 CT	710	20	1 1/2	1 1/4	4
M8108	56 CT	160	9	1 5/32	1 1/8	2
M8109	56 CT	356	20	1 1/2	1 1/4	4
M8110	115 CT	78	9	1 5/32	1 1/8	2
M8111	115 CT	170	20	1 1/2	1 1/4	4

.170 Clearance Hole for #8 Screw.





PC4300/PC4400 SERIES

DIMENSIONS

Series	A	B	C	D	E	F	Wt. Oz.
PC4300	49/64	23/32	†	0.420	0.187	1 1/16	0.5
PC4400	1 1/64	27/32	†	0.781	0.200	6 1/64	1.2

† Do not have standoff.

CONVERTER TRANSFORMERS
POWER TRANSFORMERS

MICROTRAN company, inc.

d.c. to d.c. converter transformers

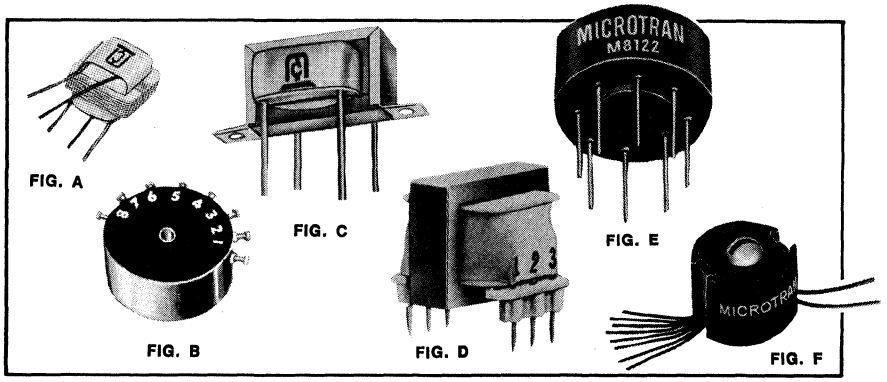


FIG. A FIG. B FIG. C FIG. D FIG. E FIG. F

APPLICATIONS:

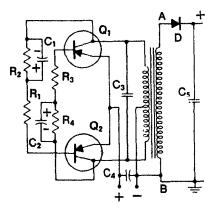
- Portable Radiation Monitors
- Infra-Red Detectors
- Op-Amp Power Supplies
- DC Isolation
- Geodetic-Oceanographic-Medical Equipment
- Mobile Equipment
- High Intensity Flashers
- DC Supply for Modular Equipment

Select Unit to meet your Power and Size Requirements	Part No.	Total VA Output	DC Input Volts	DC Output: Bridge Volts	Bridge mA	CT Full Wave Volts	CT Full Wave mA	Switch Freq. Hz Approx.	Typical Transistor	Dimensions: L	W	H	Mounting Centers MD	Mounting Centers MW	Type of Construction	Fig.	Approx. Wt. Oz.
25 mW to 190 mW HIGH VOLTAGE LOW POWER MINIATURE DESIGN	M8149	25 mW	3	1000*	25 μA	—	—	400	2N670	1¼	6/64	27/32	—	—	Printed Circuit	D	1.25
	M8050	25 mW	3	1000*	25 μA	—	—	400	2N670	1 11/16	13/16	27/32	1 3/8	—	Open Frame	C	1.25
	M8073	25 mW	4	425-500*	50 μA	—	—	50-3k†	2N1305	3/8	3/8	—	—	—	Open Frame	A	0.1
	M8074	50 mW	3	535*	90 μA	—	—	400	2N414	1 11/16	13/16	27/32	1 3/8	—	Open Frame	C	1.25
	M8072	190 mW	2.7	480*	400 μA	—	—	800	2N1307	1 11/16	13/16	27/32	1 3/8	—	Open Frame	C	1.25
	M8120	190 mW	28	480*	400 μA	—	—	3.5k	2N4355	1 11/16	13/16	27/32	1 3/8	—	Open Frame	C	1.25
3 VA	M8121	3	5	190*	15	—	—	20k	2N6121	9/16D x 1 1/32H—‡					Pot Core	F	0.3
5 VA LOW PROFILE ENCAPSULATED	M8115	5	13.8	±250 or 500	10	250	20	6k	2N3054	1¼ D x ¾ H—0.140 Cl. Hole					Molded Toroid	B	1.1
	M8117	5	28	±250 or 500	10	250	20	6k	2N3054	1¼ D x ¾ H—0.140 Cl. Hole					Molded Toroid	B	1.1
	M8122	5	5	±15 or 30	175	15	350	20k	2N3055	7/8 D x 17/32H					P.C. Molded Toroid	E	1.1
30 VA LOW PROFILE ENCAPSULATED	M8132	30	13.8	±15 or 30	1000	15	2000	20k	2N3055	1¼ D x ¾ H—0.140 Cl. Hole					Molded Toroid	B	1.1
	M8133	30	28	±15 or 30	1000	15	2000	20k	2N3055	1¼ D x ¾ H—0.140 Cl. Hole					Molded Toroid	B	1.1

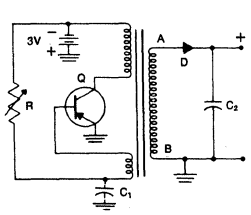
‡ Supplied with 4-40 nylon mtg. screw and nut in center hole. * Output when used with schematic indicated. † Frequency depends on load and bias conditions.

ALL CONVERTER TRANSFORMERS ARE SUPPLIED WITH ENGINEERING BULLETIN, LISTING COMPONENT VALUES

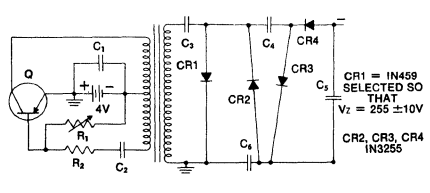
TYPICAL DC-DC CONVERTER TRANSFORMER CIRCUITS



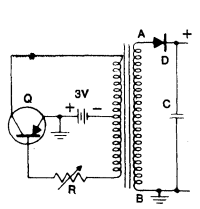
SCHEMATIC 1



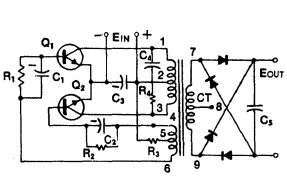
SCHEMATIC 2



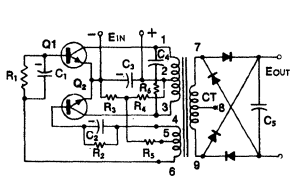
SCHEMATIC 3



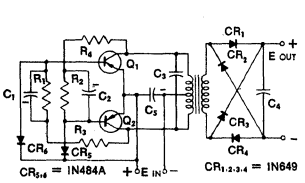
SCHEMATIC 4



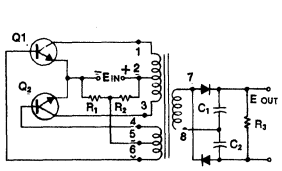
SCHEMATIC 5



SCHEMATIC 6



SCHEMATIC 7



SCHEMATIC 8

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MICROTRAN company, inc.

MINIATURIZED AUDIO TRANSFORMERS

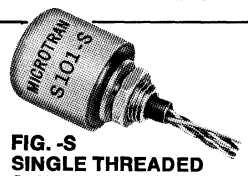


FIG. -S
SINGLE THREADED STUD MOUNTING
Double Mu-metal shielding. 3″ color coded leads. 5/16″D. stud provided with nut. 5/8″D x 13/16″ H. Wt. 0.55 oz.

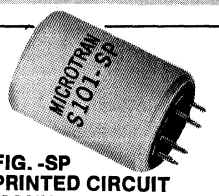


FIG. -SP
PRINTED CIRCUIT MOUNTED
Double Mu-metal shielded. 3/4″ D x 1 1/16″H. 7-.040 pins 1/8″ H. Wt. 0.62 oz.

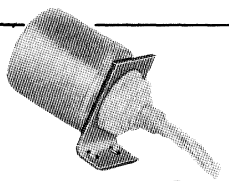
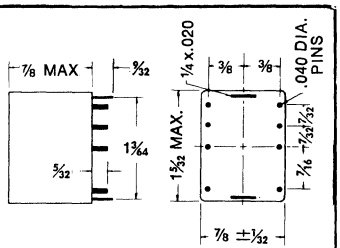
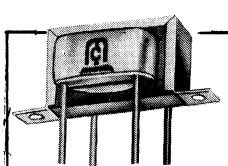


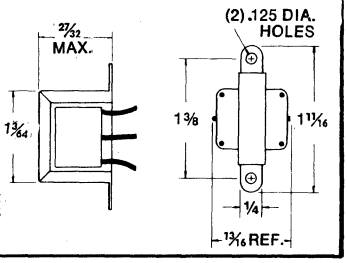
FIG. -FB
RIGHT ANGLE MOUNTING BRACKET
For mounting of -S series transformers. M.C. 3/8″.

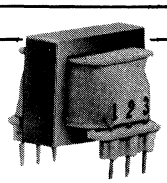
MOLDED M-M
To order add -M to Part No. For plug-in printed circuit applications. Epoxy resin provides resistance to extremes of ambient. Wt. 1.75 oz.



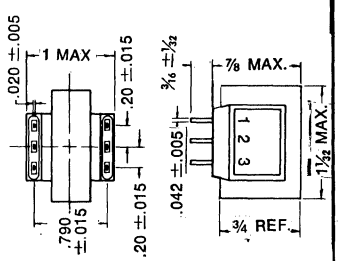


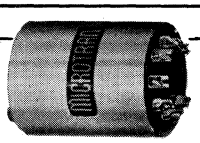
OPEN FRAME WITH CHANNEL M-FB
To order add -FB to Part No. Leads 4″ long. #28 PVC Wt. 1.13 oz.



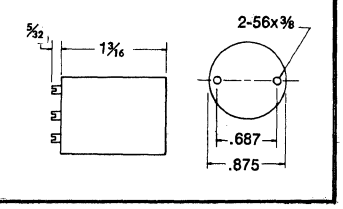


OPEN FRAME PRINTED CIRCUIT M-PC
To order add -PC to Part No. Units with more than 6 pins have 7 or 8 — .025 x .015 pins on .150 centers. Wt. 1.2 oz.





ALUMINUM CASED M-A
To order add -A to Part No. Supplied with 2-56 screws. Wt. 1.25 oz.



MICROPHONE/TRANSDUCER INPUT

FOR: PROFESSIONAL SOUND STUDIOS — BROADCAST MIXING CONSOLES — CONTROL AND INSTRUMENT AMPLIFIERS

EQUIVALENT TO IMPORTED EUROPEAN STUDIO GRADE TRANSFORMERS

- WIDE BANDWIDTH — BROAD FREQUENCY RESPONSE
- EXTREMELY LOW DISTORTION
- NEGLIGIBLE HUM PICK UP
- SUBMINIATURE SIZE
- EASE OF MOUNTING AND ORIENTATION
- POLARIZING VOLTAGE CONNECTION FOR CONDENSER MICROPHONES
- LOW MICROPHONICS
- ELECTROSTATIC SHIELDING

Part No.	Nom. Turns Ratio Pri:Sec	Nominal Impedance Ratio Primary	Nominal Impedance Ratio Secondary	Typ. Open Circuit Primary Impedance @ 50 Hz†	Frequency Response‡	Fig.	Replaces Beyer Part No.
S101-S	1:20	12.5	5000	100	30-15,000 Hz ±1 dB	-S	TR-BV35704
S101-SP	1:20	12.5	5000	100	30-15,000 Hz ±1 dB	-SP	STR-BV37704
S105-S	1:15	200	45,000	2000	30-15,000 Hz ±1 dB	-S	351.015.006
S105-SP	1:15	200	45,000	2000	30-15,000 Hz ±1 dB	-SP	370.015.006
S107-S	1:15	200/50 split	45,000	2000	30-15,000 Hz ±1 dB	-S	351.215.006
S107-SP	1:15	200/50 split	45,000	2000	30-15,000 Hz ±1 dB	-SP	370.215.006
S108-S	1:10	200	20,000	2000	30-15,000 Hz ±1 dB	-S	351.010.005
S108-SP	1:10	200	20,000	2000	30-15,000 Hz ±1 dB	-SP	370.010.005
S111-S	1:7.1	200	10,000	2000	30-15,000 Hz ±1 dB	-S	351.007.004
S111-SP	1:7.1	200	10,000	2000	30-15,000 Hz ±1 dB	-SP	370.007.004
S116-S	1:5	200	5000	2000	30-15,000 Hz ±1 dB	-S	351.005.003
S116-SP	1:5	200	5000	2000	30-15,000 Hz ±1 dB	-SP	370.005.003
S118-S	1:5	200/50 split	5000	2000	30-15,000 Hz ±1 dB	-S	351.205.003
S118-SP	1:5	200/50 split	5000	2000	30-15,000 Hz ±1 dB	-SP	370.205.003
S126-S	1:1	600 CT	600	3750	30-20,000 Hz ±.5 dB	-S	TR145/BV35508
S126-SP	1:1	600 CT	600	3750	30-20,000 Hz ±.5 dB	-SP	STR-145/BV37508
S130-S	1:1	10,000	10,000	100,000	30-15,000 Hz ±1 dB	-S	TR-145/BV35590
S130-SP	1:1	10,000	10,000	100,000	30-15,000 Hz ±1 dB	-SP	STR-145/BV37590
S100-FB	Right angle mounting bracket for S100-S series.					-FB	

† Designed for optional bridging termination use to provide additional 6 dB output voltage gain.
‡ Frequency response measured with source equal to nominal primary impedance and with unloaded secondary except 100k load on S105 and S107 series.

MINIATURE AUDIO M & MT SERIES

All items shown in charts below are available in any of the mechanical packages shown. These units can be used as input, interstage, output, isolation and other impedance matching applications. Primary and secondary windings may be interchanged to obtain required impedance matching. Also available in hermetic construction.

Part No.*	Primary Impedance	Secondary Impedance	Primary Unbalance mA DC	Operating Level dBm	Frequency Response ±2 dB
M3-(*)•	7.5/30	50,000	0	5	20-20,000
M12-(*)	50/250 CT	50/250/600 CT	0	8	20-20,000
M1-(*)•	50/250/600 CT	50,000	0	5	20-20,000
M1-S	Same as M1 above — with dual nickel alloy shield				
M2-(*)•	50/250/600 CT	50,000 CT	0	5	20-20,000
M14-(*)	200	½ Megohm	0	9	80-3,000
M15-(*)	10,000	1 Megohm	0	11	100-2,500
M8-(*)	15,000	50/250/600 CT	0	8	20-20,000
M9-(*)	15,000	50/250/600 CT	4	21	150-20,000
M4-(*)	15,000	60,000	0	8	20-15,000
M5-(*)	15,000	60,000	4	14	200-20,000
M6-(*)	15,000	95,000 CT	0	5	20-15,000
M7-(*)	15,000	95,000 CT	4	11	200-20,000
M10-(*)•	30,000 CT	50/250/600 CT	0	8	30-50,000
M11-(*)•	50,000	50/250/600 CT	0	5	20-20,000
M13-(*)	Reactor	300 hy. 0 DC 50 hy. @ 3 mA			6000Ω D.C.R.
M90	Magnetic Shield Mu-Metal slip on can for M-A Series 25 dB shielding				
MT2-(*)	100	10 CT/40 CT	100	27	200-20,000
MT30-(*)	250 CT	500	10	30	200-15,000
MT23-(*)	250 CT	1000	10	30	200-15,000
MT14-(*)	400	10	50	25	200-20,000
MT15-(*)	500 CT	210	30	27	300-20,000
MT1-(*)	600	600	10	23	200-15,000
MT35-(*)‡	600	600 CT & 600 CT	0	5	40-20,000
MT36-(*)†	600 CT	600 CT	0	15	50-15,000
MT26-(*)	600 CT	600 CT	20	23	200-15,000
MT9-(*)	600 CT	1,200 CT	4	23	200-15,000
MT33-(*)	600/150 Split	600, 150 Split	20	23	200-20,000
MT22-(*)	600/150 Split	1,200 CT	4	23	200-15,000
MT29-(*)	1600 CT	450	15	30	200-15,000
MT12-(*)	2,000	3.4	10	32	200-15,000
MT24-(*)	2,500	600 CT	10	32	200-15,000
MT13-(*)	4,000 CT	3.4	3	32	200-15,000
MT11-(*)	4,000 CT	600 CT	3	32	200-15,000
MT21-(*)	4,000 CT	600/150 Split	3	32	200-15,000
MT25-(*)	7,500 CT	600 CT	8	32	200-15,000
MT34-(*)	10,000/2500 Split	2000/500 Split	4	20	200-20,000
MT10-(*)•	25,000	600	3	22	200-15,000
MT7-(*)•	25,000	1,200 CT	3	22	200-15,000
MT18-(*)•	25,000 CT	1,200 CT	6	22	200-15,000
MT5-(*)•	50,000	6	3	20	300-15,000
MT3-(*)	50,000	600	3	20	300-15,000
MT8-(*)•	50,000 CT	1,200 CT	3	20	300-15,000
MT20-(*)•	50,000 CT	1200/300 Split	3	20	300-15,000
MT6-(*)•	100,000	1,200 CT	1.4	17	200-15,000

* Add -M. -PC, -A, or -FB to Part No. to designate construction.
• These items not available in -PC construction.
‡ For telephone line coupling or hybrid telephone line.
† Broadcast fidelity line matching transformer. Frequency response ±0.5 dB.

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TELEPHONE INTERCONNECT TRANSFORMERS

MICROTRAN company, inc.

line coupling-hybrid-holding coils

FOR INTERCONNECT OF VOICE/DATA MODEM TERMINALS TO TELEPHONE LINES

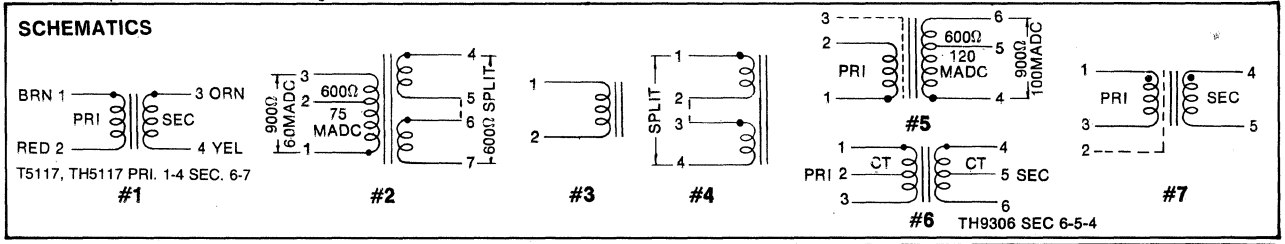
Provides line isolation and matching — Prevents line imbalance — Wide dynamic signal capability — Low distortion
Permits Optimum use of Voice-Grade Telephone Lines for Broadband Data Signals — Designed to meet FCC Part 68

- Frequency Response: 300-3500 Hz ±0.5 dB
- Longitudinal Balance: Per FCC 68.310
- Impedance Matching: ±10% over entire frequency range
- Dielectric Strength 1500V RMS
- Level: −45 dBm to +7 dBm
- Distortion: 0.5% Max.
- Return Loss: 26 dB Min.

Part No.	Primary Impedance	Secondary Impedance	mA DC	Ins. L. dB	Pri. DCR	Sec. DCR	Schematic	Page	Fig.	Page	Application Notes
VOICE/DATA COUPLING											
PM32-F	600	600	1.5	1.6	75	105	1	2292	PM-F	2295	Freq. resp. 300 Hz — 100 kHz ±2 dB. 0.27" H. 1000V hipot.
PM34-F	600 CT	600 CT	1.5	1.6	75	105	14	2294	PM-F	2295	Freq. resp. 300 Hz — 100 kHz ±2 dB. 0.27" H. 1000V hipot.
PM32-M	600	600	1.5	1.6	75	105	1	2292	PM-M	2295	Freq. resp. 300 Hz — 100 kHz ±2 dB. Molded construction.
PM34-M	600 CT	600 CT	1.5	1.6	75	105	14	2294	PM-M	2295	Freq. resp. 300 Hz — 100 kHz ±2 dB. Molded construction.
T1104	600	600	0	1.0	46	63	1	2292	A	2293	Very low profile.
T1104-M	600	600	0	1.0	46	63	1	2292	R	2294	Very low profile. Molded per MIL-T-27 Grade 5.
T2104	600	600	0	1.0	36	50	1	2292	B	2293	
TH2104	600	600	0	1.0	38	52	1	2292	B	2293	3750V RMS hipot. For International applications.
T2106	600 CT	600 CT	0	1.0	36	50	6	2292	E	2293	
TH2106	600 CT	600 CT	0	1.0	38	52	6	2292	E	2293	3750V RMS hipot. For International applications.
TH9306	600 CT	600 CT	0	1.5	44	56	14	2294	P	2294	375CV RMS hipot between windings, 1250V between windings and core. For International applications. Return loss 18 dB min.
T2108	600	900	0	1.0	36	77	1	2292	B	2293	
T2110	900	900	0	1.0	55	78	7	2292	C	2293	Electrostatic shield.
T2316	4000	600	0	1.0	340	51	1	2292	B	2293	For bridging applications.
T4113	900/600	600 Split	60/75 Pri.	1.2	62	36/36	2	2292	J	2293	Level −15 to +7 dBm.
T5114	600	600 Split	75	1.7	100	49/49	8	2293	K	2294	
TH5114	600	600 Split	75	2.0	127	76/76	8	2293	K	2294	3750V RMS hipot. For International applications.
T5115	600	600 Split	120	0.8	40	25/25	9	2293	L	2294	
TH5116	600	600 Split	125	1.0	56	37/37	8	2293	K	2294	3750V RMS hipot. For International applications. Longitudinal balance 40 dB min. Return loss 14 dB min.
T5117	600	600	125	1.1	45	58	1	2292	K	2294	Return loss 14 dB min.
TH5117	600	600	125	1.1	56	74	1	2292	K	2294	3750V RMS hipot. Return loss 14 dB min.
TH5118	600 Split	600	125	1.0	74	28/28	8	2293	K	2294	3750V RMS hipot. Return loss 14 dB min.
T6112	600	900/600	100/120 Sec.	0.5	25	126	5	2292	G	2293	Electrostatic shield.
T9116	600 CT	600 CT	80	2.0	95	180	16	2294	N	2294	Low crosstalk. 1500V Pri. to sec. and core. 1000V sec. to core.
T9117	600 CT	600 CT	80	1.3	78	92	17	2294	N	2294	Low crosstalk. Return loss 23 dB @ 440Ω + 0.035 μF. Parallel load. 1500V Pri. to sec. and core. 1000V sec. to core.
DATA MODEM COUPLING — NON-VOICE APPLICATION — FOR 300/1200/2400 BPS MODEM BOARD FOR MICROCOMPUTERS											
T2111*	600	600	90	2.0	55	78	12	2293	Q	2294	Low profile. Freq. resp. ±1 dB 660 Hz −3.5 kHz @ 0 dBm.
T2112*	600	600 CT	90	2.0	71	117	13	2293	Q	2294	Low profile. Freq. resp. ±1 dB 660 Hz −3.5 kHz @ 0 dBm.
T2113*	600	600	90	2.0	71	117	12	2293	B	2293	Freq. resp. ±1 dB 660 Hz −3.5 kHz @ 0 dBm, 2 kHz. ref.
T2114*	600	600 CT	90	2.1	71	117	13	2293	E	2293	Freq. resp. ±1 dB 660 Hz −3.5 kHz @ 0 dBm, 2 kHz. ref.
T9311	600	600	90	1.8	75	100	1	2292	O	2294	0.50" max. ht. Freq. resp. ±1.3 dB 500 Hz −3.5 kHz, ±2.5 dB 300 Hz −3.5 kHz @ 0 dBm. Return loss 14 dB min. 1.8 kHz ref.
T9312	600	600 Split	90	1.8	75	100	8	2293	P	2294	0.50" max. ht. Freq. resp. ±1.3 dB 500 Hz −3.5 kHz, ±2.5 dB 300 Hz −3.5 kHz @ 0 dBm. Return loss 14 dB min. 1.8 kHz ref.
T9317	600	600 Split	50	1.6	75	95	8	2293	P	2294	0.50" max. ht. Freq resp. ±0.7 dB 500 Hz −3.5 kHz, ±1.6 dB 300 Hz −3.5 kHz @ 0 dBm. Return loss 14 dB min. 1 kHz ref.
* Except sec. to core, hipot 1000V RMS											
HOLDING COILS											
T4415	2.0 H/1.3 H		60/100	N/A	180	N/A	3	2292	H	2293	
T5415	1.4 H ±20%		120	N/A	90/90	N/A	4	2292	K	2294	Split winding. 1500V windings to core. 1500V between windings.
T7410	1.0 H/0.8 H		0/25	N/A	225	N/A	3	2292	D	2293	Toroidal construction. Low crosstalk. 1000V hipot.
T8410	1.0 H/0.8 H		0/40	N/A	113	N/A	3	2292	D	2293	Toroidal construction. Low crosstalk. 1000V hipot.
HYBRID — TWO REQUIRED FOR CONVENTIONAL HYBRID OPERATION											
T2220	600 (4W)	600/600	0	4.0	57	42/42	10	2293	E	2293	Trans-hybrid loss 45 dB typical.
TH2220	600 (4W)	600/600	0	4.2	60	25/25	2	2292	S	2294	3750V RMS hipot except 200V between 2 wire and balance windings. Trans-hybrid loss 45 dB typ. Return loss 17 dB min.
T3220	600 (4W)	600/600	0	3.7	34	25/25	10	2293	F	2293	Trans-hybrid loss 45 dB typical.
T4220	600 (4W)	600/600	60 (2W)	4.0	61	62/62	11	2293	J	2293	Electrostatic shield.
T5220	600 (4W)	600/600	100 (2W)	3.6	48	23/23	15	2294	M	2294	Trans-hybrid loss and longitudinal bal. >60 dB. Max. level +20 dBm. Electrostatic shield.
TH5220	600 (4W)	600/600	100 (2W)	3.7	50	30/30	15	2294	M	2294	3750V RMS hipot except 1500V between 2 wire and balance windings. For Intl. applications. Max level +20 dBm. E.S.S.
T9220	600 (4W)	600/600	80 (2W)	4.6	100	190	18	2294	N	2294	Low profile. Low crosstalk. DCR values are max.
T9320	600 (4W)	600/600	50 (2W)	4.4	75	85/85	10	2293	P	2294	.050" max. ht. Freq. resp. ±0.7 dB 500 Hz −3.5 kHz, ±1.6 dB 300 Hz −3.5 kHz @ 0 dBm. Return loss 14 dB min. 1 kHz ref.

Available on special order with other ratings and constructions. REQUEST ENGINEERING APPLICATION BULLETIN F232.

SCHEMATICS



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TELEPHONE INTERCONNECT TRANSFORMERS

OUTLINE DRAWINGS AND SCHEMATICS FOR PAGE A. 2292

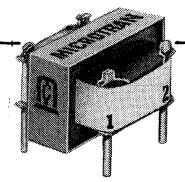
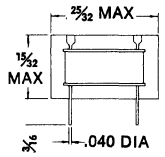
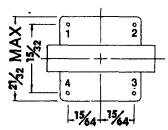


FIG. A





Plug-in printed circuit construction.
Vacuum varnish impregnated. Wt. 0.4 Oz.

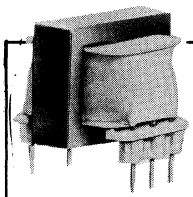


FIG. B

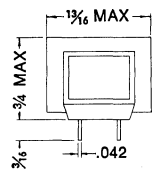
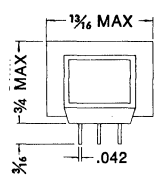
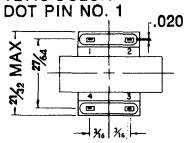


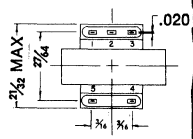
FIG. C



Plug-in printed circuit construction.
Vacuum varnish impregnated. Wt. 0.5 Oz.

T2113 COLOR DOT PIN NO. 1





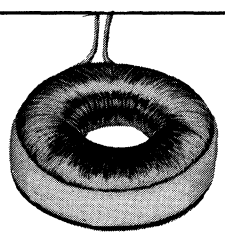
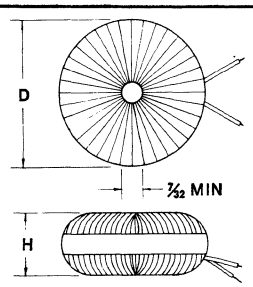


FIG. D



High-Q Toroid.
Microcrystalline wax impregnated.
Supplied with 4″ #28 leads.

Size Series	D	H	Wt. Oz.
T7400	1	13/32	3/4
T8400	1 1/4	5/8	2

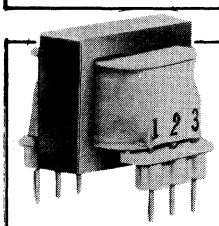


FIG. E
Wt. 0.5 Oz.

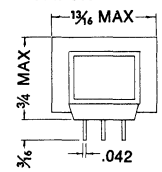
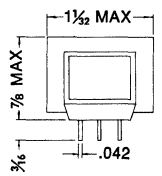
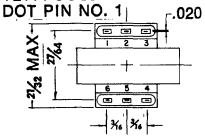
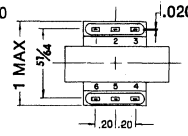


FIG. F
Wt. 1.2 Oz.



T2114 COLOR DOT PIN NO. 1





Plug-in printed circuit construction.
Vacuum varnish impregnated.

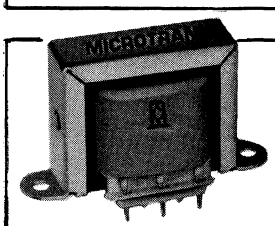
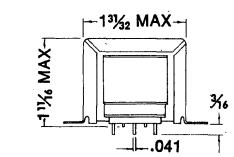
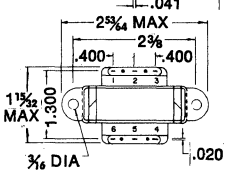


FIG. G





Plug-in printed circuit construction with mounting channel.
Vacuum varnish impregnated. Wt. 9.5 Oz.

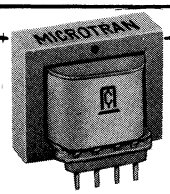


FIG. H

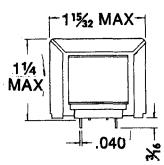
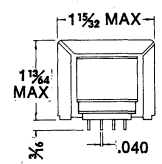
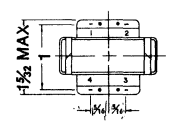
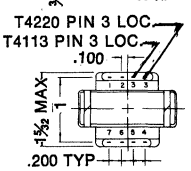


FIG. J

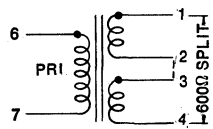


Plug-in printed circuit construction.
Vacuum varnish impregnated. Wt. 3.5 Oz.
Available with mounting flanges **on Special Order.**
3/16 Dia. holes, 1 3/4 mounting centers.
Add -FB to Part No.

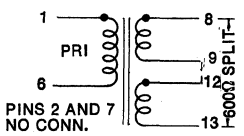




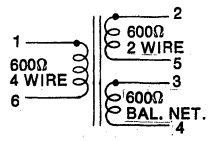
SCHEMATICS



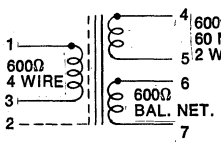
#8
T9312 & T9317 PRI 1-6, SEC 2-5, 3-4
TH5118 PRI 6-7 SEC 1-2, 3-4



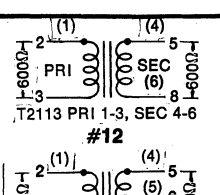
#9



#10
TH2220 4 Wire 6-10
2 Wire 1-2 Bal. 4-5



#11



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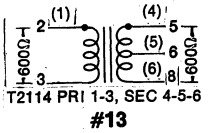

#13

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TELEPHONE INTERCONNECT TRANSFORMERS

MICROTRAN company, inc.

OUTLINE DRAWINGS AND SCHEMATICS FOR PAGE A. 2292

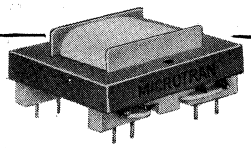
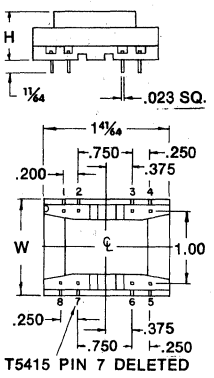


FIG. K



Flat Profile.
Plug-in printed circuit construction.
Vacuum varnish impregnated.
Wt. 2.5 Oz.

Part No.	H	W
T5114, T5415	1 1/16	1 11/32
TH5114	1 1/16	1 29/64
TH5116, T5117	53/64	1 29/64
TH5117, TH5118		

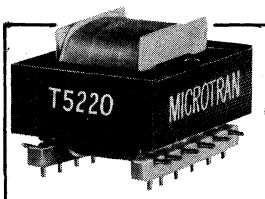


FIG. L

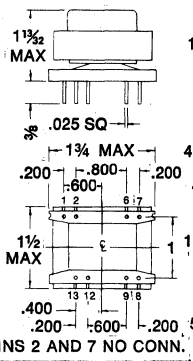
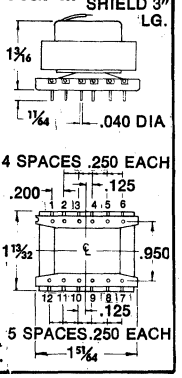


FIG. M



Plug-in printed circuit construction.
Vacuum varnish impregnated.
Wt. 5.5 Oz.

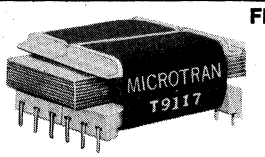
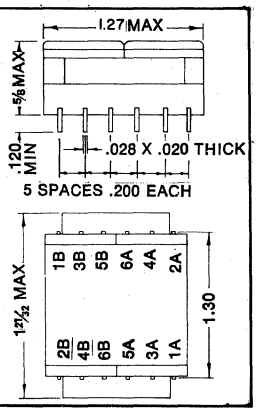


FIG. N



Low profile hum-bucking semi-toroidal construction.
High crosstalk attenuation.
Plug-in printed circuit construction. Vacuum varnish impregnated.
Wt. 2.2 Oz.

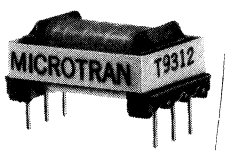


FIG. O

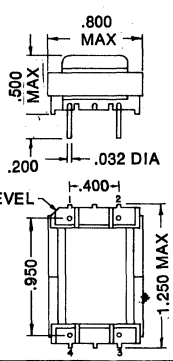
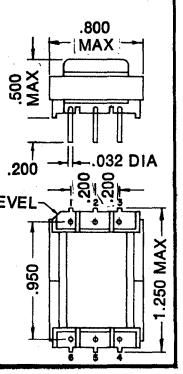


FIG. P



Very low profile plug-in printed circuit construction.
Vacuum varnish impregnated.
Wt. 0.66 oz.

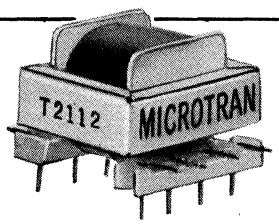
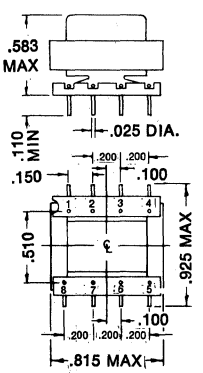
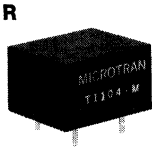


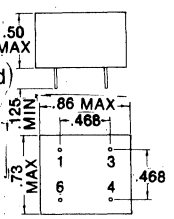
FIG. Q



Low-profile plug-in printed circuit construction.
Vacuum varnish impregnated.
Wt. 0.5 Oz.

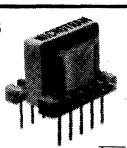
FIG. R

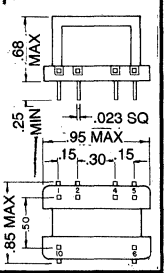




Very low profile. PC epoxy molded construction.
MIL-T-27
TF5R21ZZ.
Wt. 0.5 Oz.

FIG. S

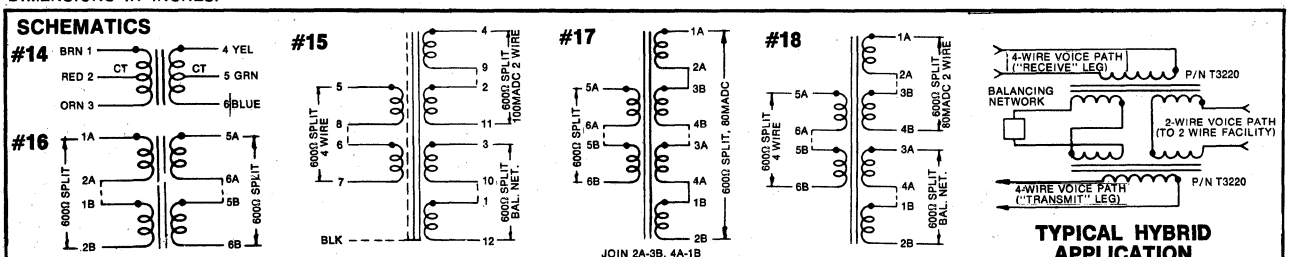




PC construction.
Vacuum varnish impregnated.
Wt. 0.5 Oz.

DIMENSIONS IN INCHES.

SCHEMATICS



TYPICAL HYBRID APPLICATION

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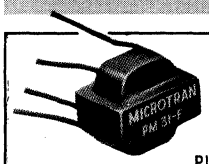
MICROTRAN company, inc.

MINIATURIZED AUDIO TRANSFORMERS

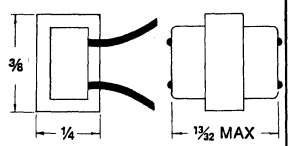
PICO — ULTRA — VERI-MINIATURE

OPEN FRAME PM-F

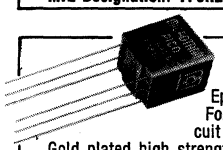


4 inch #30 Plastic color coded leads. Thorough resin impregnation and baking assures reliable life. To order add -F to Part No., i.e. PM33-F. Wt. .05 oz.

MIL Designation: TF6R21ZZ

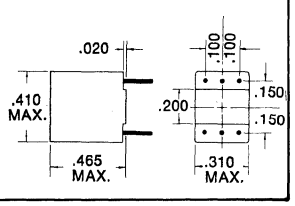


MOLDED PM-M

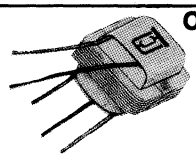


Epoxy molded. For printed circuit application. Gold plated high strength nickel alloy leads .020 x ¾" for reliable soldered joints and high-density welded lead packaging. Wt. .1 oz. To order add -M to Part No., i.e. PM12-M.

MIL Designation: TF5R21ZZ

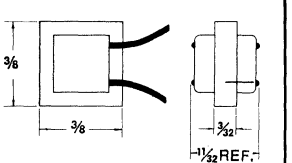


OPEN FRAME UM-F

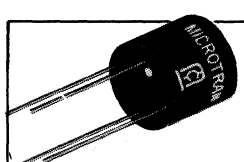


To order add -F to Part No., i.e. UM22-F. Wt. 0.08 oz. 4" color coded leads.

MIL Designation: TF6R21ZZ

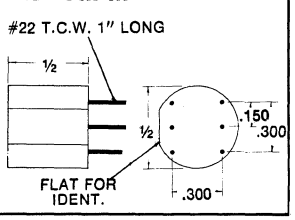


MOLDED UM-M

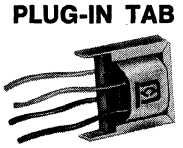


To order add **-M** to Part No., i.e. UM22-M. Wt. 0.14 oz.

MIL Designation: TF5R21ZZ

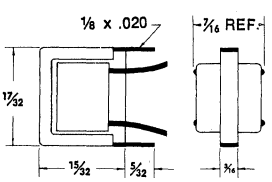


PLUG-IN TAB MOUNTED CHANNEL VM-FPB

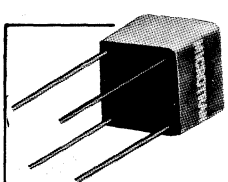


To order add -FPB to Part No., i.e. VM2-FPB. Wt. 0.2 oz. 4" color coded leads.

MIL Designation: TF6R21ZZ

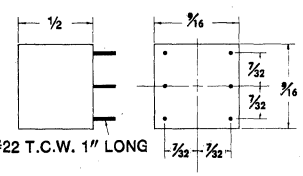


MOLDED VM-M



Epoxy molded. Wt. 0.25 oz. To order add -M to Part No., i.e. VM2-M.

MIL Designation: TF5R21ZZ



PICO-MINIATURE — PM SERIES

Frequency Response ±2 dB 300 Hz to 100 kHz†

For maximum utilization of space in miniaturized printed circuit board applications. Manufactured per MIL-T-27.

Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Pri. DCR	Sec. DCR	Power Level mW
PM37-(*)	120 CT	3.2	10	16	0.75	50
PM38-(*)	300 CT	600	7	41	98	50
PM35-(*)	500	50	3	60	8	50
PM36-(*)	500	500/125 split	3	72	85	50
PM32-(*)	600	600	1.5	75	105	50
PM34-(*)	600 CT	600 CT	3	75	105	50
PM33-(*)	1500 CT	600	3	170	95	50
PM31-(*)	2500	2500 CT	1	250	325	50
• PM29(*)	10,000 CT	500 CT	1	1050	80	50
PM27(*)	10,000	1200	0.5	1050	280	50
• PM23(*)	10,000 CT	1200 CT	1	1050	280	50
• PM25(*)	10,000	1200/300 split	0.5	1050	280	50
• PM19(*)	10,000 CT	2000 CT	1	1000	300	50
• PM21(*)	10,000	2000/500 split	0.5	1000	300	50
• PM17(*)	10,000 CT	10,000 CT	1	1000	1300	50
PM15(*)	25,000	1000	0.25	1700	110	40
• PM11(*)	25,000 CT	1000 CT	0.5	1700	110	40
• PM13(*)	25,000	1000/250 split	0.25	1700	110	40
• PM7(*)	50,000 CT	1000 CT	0	3300	75	10
• PM9(*)	50,000	1000/250 split	0	3300	75	10
• PM5(*)	200,000	1000	0	5300	110	10
• PM3(*)	200,000 CT	1000 CT	0	5300	110	10
PM41-(*)	Audio Choke	.3 H	4	43		
PM40-(*)	Audio Choke	3.5 H	2	700		
PM39-(*)	Audio Choke	6 H	2	1800		
PM90	Magnetic Shield Mu-metal slip-on can for PM-M series. 20dB shielding. 0.365" x 0.465" x 0.0500" high.					

• These items not available in open frame construction.
* Add either -F, -M to Part No. See photos figures PM-M & PM-F. Frequency response measured as stated power level above.
† PM3 and PM5 — 45 kHz.

ULTRA-MINIATURE — UM SERIES

Frequency Response ±2 dB 300 to 10,000 Hz

Measured at level stated for 300 Hz. Miniaturized design offers a relatively high power level and printed circuit packaging. Response measured at level stated for 300 Hz. Mfd. per MIL-T-27.

Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Pri. DCR	Sec. DCR	Level mW @ 300 Hz	Level mW @ 1 kHz
UM26-(*)	400	11	3	35	1.5	15	500
UM27-(*)	400 CT	11	6	35	1.5	15	500
UM25-(*)	400	50	3	35	5	15	500
UM29-(*)	600 CT	600 CT	7	45	60	5	400
UM24-(*)	1000	50	3	65	10	5	500
UM33-(*)	1000 CT	600	6	80	65	5	500
UM32-(*)	1500 CT	600	5	135	65	5	500
UM39-(*)	2500 CT	600 CT	2	250	50	5	500
UM34-(*)	10,000 CT	600 CT	2	850	40	5	500
UM31-(*)	10,000 CT	1200 CT	2	850	120	5	500
UM37-(*)	10,000	2000 CT	1	850	200	5	500
UM35-(*)	15,000 CT	15,000 CT	1	930	1210	5	300
UM36-(*)	20,000 CT	800 CT	0.5	1100	80	5	500
UM22-(*)	20,000	1000	0.5	1100	100	5	300
UM23-(*)	20,000	1200 CT	0.5	1100	110	5	300
UM21-(*)	100,000	1000	0	1900	135	5	70
UM30-(*)	Choke	1.5 H (0 mA) 0.7 H (2 mA) 100 DCR					
UM28-(*)	Choke	10 H (0 mA) 8 H (0.5 mA) 650 DCR					
UM90	Magnetic Shield Mu-metal slip-on can for UM-M series. 20 dB shielding. 17/32"D x 7/16"H.						

* Add either -F, or -M to Part No. to designate construction. See Photos. Power levels shown are for 7½% maximum distortion.

VERI-MINIATURE — VM SERIES

Frequency Response ±2 dB 200 to 10,000 Hz

Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Pri. DCR	Sec. DCR	Level mW
VM1-(*)	50	600	5.5	7	90	15
VM7-(*)	500	3.4	3.5	50	0.5	15
VM16-(*)	500 CT	250 CT	7.5	50	25	15
VM14-(*)	600 CT	600 CT	7.0	50	65	15
VM8-(*)	1250	3.4	2.0	135	0.5	15
VM9-(*)	1250	50	2.0	135	6.5	15
VM10-(*)	2500	2500 CT	1.5	225	215	3
VM17-(*)	10,000 CT	5000 CT	0	400	300	5
VM12-(*)	20,000	1000	0.16	625	85	5
VM13-(*)	20,000	1000 CT	0.16	625	85	5
VM3-(*)	25,000	600	0.15	720	45	5
VM5-(*)	50,000	600	0.1	830	55	5
VM15-(*)	50,000 CT	50,000 CT	0	2000	2600	5
VM6-(*)	100,000	1200 CT	0.07	2000	150	5
VM2-(*)	200,000	600	0.05	3000	110	2.5
VM4-(*)	200,000	1200	0.035	3100	165	5
VM11-(*)	Choke	20 H (0 mA) 12 H (0.5 mA)			1000	
VM90	Magnetic Shield Mu-metal slip-on can for VM-M series. 20 dB shielding. 5/8" x 5/8" x 17/32" high.					

* Add either -FPB, or -M to Part No. to designate construction. See Photos.

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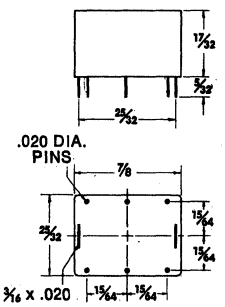
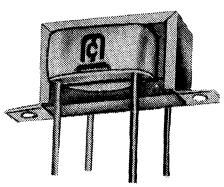
MINIATURIZED AUDIO TRANSFORMERS

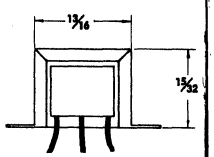
MICROTRAN company, inc.

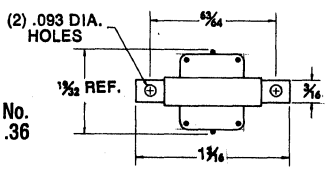


MOLDED MM-M

To order add -M to Part No. For plug-in printed circuit applications. Epoxy resin provides resistance to extremes of ambient. Wt. .5 oz.

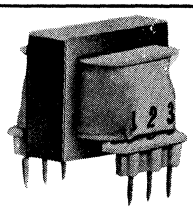


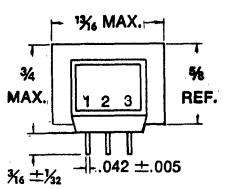


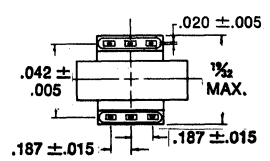


OPEN FRAME WITH CHANNEL MM-FB

To order add -FB to Part No. Leads #28 PVC 4" long. Wt. .36 oz.







PRINTED CIRCUIT — DCM SERIES

Industrial/Commercial grade miniature printed circuit transformers. Rigid terminals provide fixed mounting centers usually found in expensive molded transformers. Wt. .5 oz.

MICRO-MINIATURE TRANSFORMERS MM & MMT SERIES

Primary and secondary windings may be interchanged to obtain required impedance matching. These units can be used as input, interstage, output, isolation and other impedance matching requirements. Also available in hermetic construction.
The low profile design of this series makes them ideal for use on plug-in printed circuit boards.

Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Oper. Level dBm	Frequency Response ±2 dB
MM1-(*)	200/50	250,000/62,500	0	4	200-10,000
MM3-(*)	10,000	200	3	20	150-10,000
MM2-(*)	10,000	90,000	0	4	150-10,000
MM4-(*)	30,000	50	1	20	150-10,000
MM7-(*)	30,000	1,200	0.5	20	200-10,000
MM6-(*)	100,000	60	0.5	20	250-10,000
MM5-(*)	Reactor 50H @ 1 mA DC		4,700 DCR		
MMT1-(*)	600	600	8	22	200-15,000
MMT26-(*)	600 CT	600 CT	16	22	200-15,000
MMT33-(*)	600 CT	600/150 Split	16	22	200-15,000
MMT9-(*)	600 CT	1,200 CT	16	22	200-15,000
MMT32-(*)	600 CT	1200/300 Split	16	22	200-15,000
MMT12-(*)	2,000	3.4	5	28	200-15,000
MMT31-(*)	2,000 CT	500 CT	10	28	200-15,000
MMT19-(*)	2,500	2,500 CT	2	23	200-15,000
MMT13-(*)	4,000 CT	3.4	5	28	200-15,000
MMT11-(*)	4,000 CT	600 CT	5	28	200-15,000
MMT21-(*)	4,000 CT	600/150-split	5	28	200-15,000
MMT25-(*)	7,500 CT	600 CT	4	22	200-15,000
MMT30-(*)	7,500 CT	1,200 CT	4	22	200-15,000
MMT35-(*)	10,000 CT	150/37.5 split	2	20	200-15,000
MMT17-(*)	10,000 CT	200 CT	6	20	200-15,000
MMT16-(*)	10,000	1,500 CT	1	20	200-15,000
MMT28-(*)	10,000 CT	1,500 CT	2	20	200-15,000
MMT29-(*)	10,000 CT	10,000	2	20	200-15,000
MMT10-(*)	25,000	600	1	20	200-15,000
MMT27-(*)	25,000 CT	600 CT	2	20	200-15,000
MMT7-(*)	25,000	1,200 CT	1	20	200-15,000
MMT18-(*)	25,000 CT	1,200 CT	2	20	200-15,000
MMT5-(*)	50,000	6	1	20	200-15,000
MMT3-(*)	50,000	600	0.7	20	200-15,000
MMT4-(*)	50,000 CT	600 CT	1.4	20	200-15,000
MMT8-(*)	50,000 CT	1,200 CT	1.4	20	200-15,000

* Add either -M or -FB to Part No. to designate construction.

DECI-MINIATURE TRANSFORMERS DCM SERIES

FREQUENCY RESPONSE 200-15,000 Hz ±2 dB

Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Operating Level dBm
DCM1-PC	25,000 CT	1,200 CT	2	18
DCM2-PC	15,000 CT	15,000 CT	3	19
DCM3-PC	15,000 CT	600 CT	3	19
DCM4-PC	10,000 CT	5,000 CT	4	20
DCM5-PC	10,000	2,500/625 Split	2	20
DCM6-PC	10,000 CT	1,500 CT	4	20
DCM7-PC	5,000 CT	80,000 CT	6	15
DCM8-PC	4,000 CT	1,200 CT	6	20
DCM9-PC	4,000 CT	600 CT	6	20
DCM10-PC	4,000	600/150 Split	3	20
DCM11-PC	2,500 CT	2,500 CT	8	20
DCM12-PC	2,500	2,500/625 Split	4	20
DCM13-PC	2,500 CT	625 CT	8	20
DCM14-PC	2,500 CT	200 CT	8	20
DCM18-PC	600 CT	50,000 CT	16	20
DCM19-PC	600	8000/2000 Split	8	20
DCM20-PC	600 CT	200 CT	16	20
DCM21-PC	600 CT	600 CT	16	20
DCM22-PC	250 CT	600 CT	25	20
DCM51-PC	Choke 10H @ 0 mA DC	5H @ 3 mA DC		300 DCR
DCM52-PC	Choke 5H @ 0 mA DC	2H @ 5 mA DC		155 DCR
DCM53-PC	Choke 2.5H @ 0 mA DC	1H @ 7 mA DC		75 DCR

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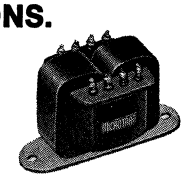

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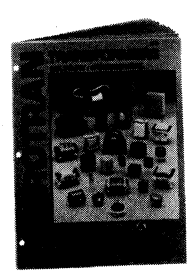

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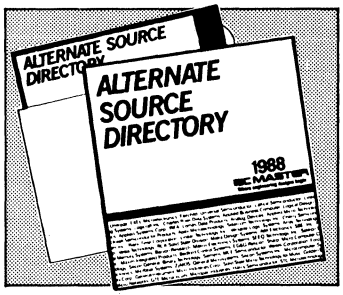

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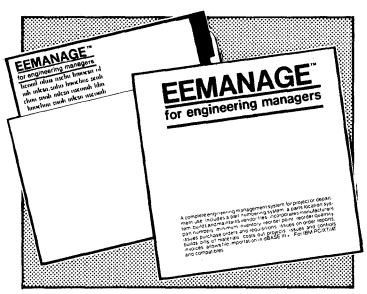

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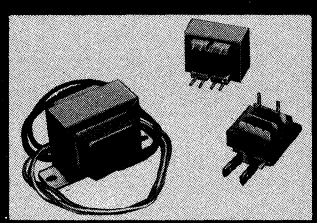
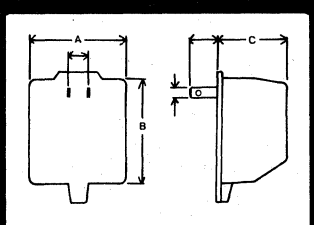
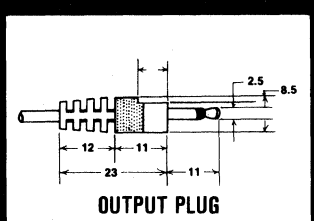
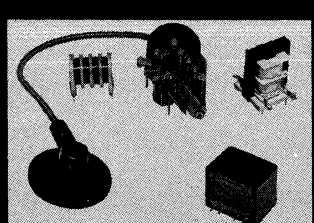
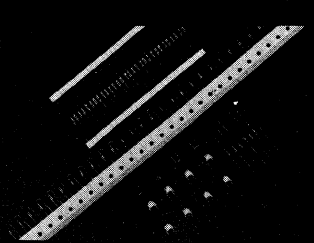






OUTPUT PLUG





POWER TRANSFORMERS

Typical Input For All Transformers
100 ~ 120V
220 ~ 240V
50 ~ 60Hz

METRIC SIZE	OUTPUT	METRIC SIZE	OUTPUT
EI-24	0.5VA	EI-66	50VA
EI-28	1 VA	EI-76	80VA
EI-35	1.8VA	EI-86	150VA
EI-41	5.0VA	EI-96	200VA
EI-48	12 VA	EI-105	300VA
EI-54	15 VA	EI-115	400VA
EI-57	25 VA	EI-133	1000VA

WALL PLUG-IN UNITS

AC/AC ADAPTERS

INPUT: 120 Vac 60 Hertz

OUTPUT: Part Number:	Volts AC (NL)	Volts AC	Curr. Ma	Case Size (mm) A	B	C
W41A-G1000-2/1	9.4	8.0	1000	50.6	50.6	43.0
W41A-J700-2/1	14.5	12.0	700	50.6	50.6	43.0
W41A-N500-2/1	21.0	18.0	500	50.6	50.6	43.0
W48A-Q700-2/1	26.7	24.0	700	60.0	58.0	47.7

AC/DC ADAPTERS

INPUT: 120 Vac 60 Hertz

OUTPUT: Part Number:	Volts DC (NL)	Volts DC	Curr. Ma	Case Size (mm) A	B	C
W35D-E500-2/1	10.5	6.0	500	44.0	57.0	36.0
W41D-E900-2/1	10.5	6.0	900	50.0	60.0	39.0
W35D-H300-2/1	12.5	9.0	300	44.0	57.0	36.0
W41D-H600-2/1	12.5	9.0	600	50.0	60.0	39.0
W41D-J500-2/1	16.5	12.0	500	50.0	60.0	39.0
W48D-J1000-2/1	16.5	12.0	1000	61.5	66.1	47.0
W41D-L400-2/1	20.7	15.0	400	50.0	60.0	39.0
W48D-L900-2/1	20.7	15.0	900	61.5	66.1	47.0
W48D-Q500-2/1	32.0	24.0	500	61.5	66.1	47.0

All above items in stock & UL listed. Others available as special order.

SPECIALTY ITEMS

- IF and RF Transformers
- Antenna Coils and Assemblies
- Pin cushion Transformers
- Switch Mode Transformers
- Pulse Transformers
- Ballast Transformers
- Deflection Yokes
- Flyback Transformers
- P.C. Board Assemblies
- Delay Lines
- Coil Windings
- Ignition Coils

INDUCTORS

PEAKING COIL AL TYPE

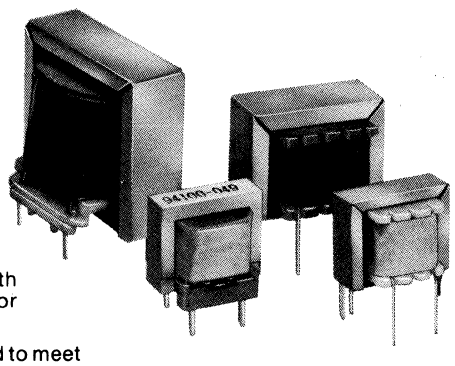
Style ..... Axial lead
Temperature rise ..... 20°C
Ambient temperature.. 80°C
Temperature range.... −20°C to +100°C
Terminal tensile strength..... 2.5kg.
Inductance range .... 0.22μH – 1000μH

PEAKING COIL EL TYPE

Style ..... Radial lead
Temperature rise ..... 20°C
Ambient temp ..... 80°C
Temperature range.... −20°C to +100°C
Terminal tensile strength ..... 1.5Kg.
Inductance range .... 0.22μH – 1000μH

Multi Products International
218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009
(201) 239-8183 • TELEX: 219289 • FAX (201) 239-8449

AUDIO/MATCHING TRANSFORMERS



MPI's miniature audio transformers are highly reliable and extraordinarily economical. All can be supplied vacuum epoxy impregnated with either standard leads or plug-in printed circuit construction. There are several standard bobbins with various pin spacings permitting optimum use of voice-grade telephone lines for broadband data signals.

Our newest line of extremely small telephone coupling transformers were designed to meet FCC Part 68 specifications for use with telephone equipment, modems and a variety of communications products.

They feature a frequency response of 300-3500 Hz ± 0.5dB; wide dynamic signal level of -45dBm to +7dBm; low distortion (0.5% max.); impedance matching of ± 10% over entire range; return loss of 16 dB min.

Depending on your requirements, any of several standard cores can be used in the construction of specific high quality designs.

Custom designs for your special requirements necessitating other ratings and construction can be met by our MPI design engineers.

Part No.	Impedance Pri	Impedance Sec	DC Resist. Pri	DC Resist. Sec	Max. Power	Insert. Loss	DC Current	FIG.	Sch.
*A10N-HH-1A/1	600	600	55	69	+7dBm	1.0dB	2mA	3	1A
*A14N-HH-1A/1	600	600	60	46	+6dBm	1.4dB	0mA	3	1A
A16N-HH-1A/1	600	600	52	48	+7dBm	1.2dB	0mA	3	1A
*A19S-HH-1A/1	600	600	35	25	+7dBm	1.1dB	0mA	3	1A
*A19S-MH-1A/2	1500	600	78	67	+5dBm	1.2dB	0mA	3	1A
A19F-HH-1A/1	600	600	45	45	+7dBm	1.0dB	2mA	4	1A
A19H-CC-1A/1	150	150	25	35	+7dBm	1.0dB	2mA	1	1A
A19H-HC-1A/1	600	150	45	35	+7dBm	1.0dB	2mA	1	1A
A19H-MH-1A/1	1500	600	78	67	0dBm	1.7dB	0mA	1	1A
A19H-HK-1A/1	600	900	45	55	+7dBm	1.0dB	2mA	1	1A
A19H-HH-1A/2	600	600	180	80	+1dBm	2.5dB	80mA	1	1A
*A19H-HH-1A/1	600	600	69	95	0dBm	1.9dB	120mA	1	1A
A19H-HH-1C/1	600	600	25	40	+7dBm	1.0dB	2mA	1	1C
*A19H-HH-4C/1	600	600	65	86	+9dBm	2.4dB	100mA	1	4C
A19N-HH-1A/1	600	600	65	85	+7dBm	2.5dB	100mA	3	1A
*A19N-HH-1A/6	600	600	35	45	+7dBm	2.0dB	0mA	3	1A
*A19M-HH-1A/3	600	600	65	86	+9dBm	2.4dB	100mA	2	1A
*A19N-HH-1A/2	600	600	180	75	+5dBm	3.5dB	80mA	3	1A
*A19N-HH-5C/1	600	600	19	26	+6dBm	1.0dB	10mA	3	5C
A28H-HH-1A/1	600	600	36	28	+27dBm	1.0dB	120mA	1	1A

*Indicates stocked items (others available as special order)

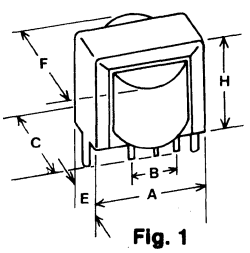


Fig. 1

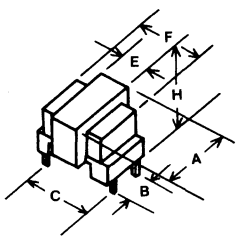


Fig. 2

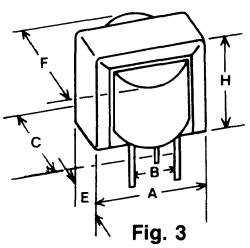


Fig. 3

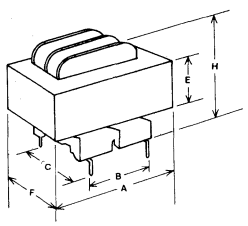
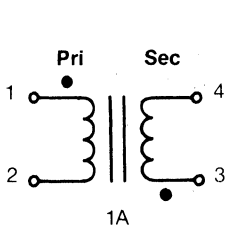


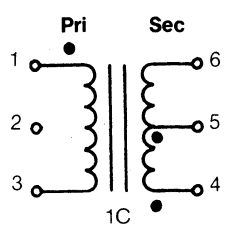
Fig. 4

DIMENSIONS (in millimeters)

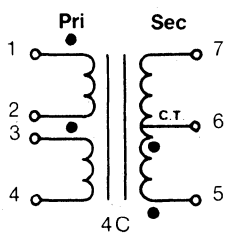
CASE	A	B	C	E	F	H
10N	10.5	4.0	8.4	4.2	11.0	8.5
14N	14.5	5.8	12.0	5.5	13.4	11.0
16N	17.0	6.0	13.0	5.5	17.0	14.7
19S	19.5	7.4	15.0	5.4	14.5	11.5
19F	20.0	15.2	13.0	6.5	16.5	17.5
19N	19.5	9.5	10.7	6.5	17.5	17.5
19M	*19.5*	*9.5*	*16.3*	*6.5*	*17.5*	*17.5*
19H	20.3	8.0	14.5	6.8	15.8	16.0
28N	29.5	12.0	23.5	12.5	28.0	26.5



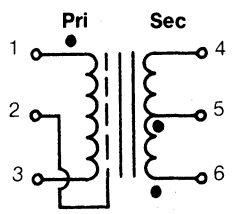
1A



1C



4C



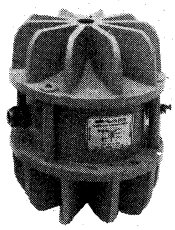
5C

WIDEBAND SIGNAL TRANSFORMERS

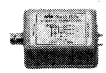
North Hills Electronics, Inc.
1 ALEXANDER PLACE, GLEN COVE, NEW YORK 11542-3796
TELEPHONE: (516) 671-5700• TELEX: 46-6886

CASE STYLES

Case Styles BA and LA have solder terminals on balanced and unbalanced sides. Styles BB, LB, and PB have BNC connectors on unbalanced side and solder terminals on balanced sides.

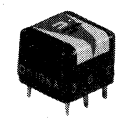

KA

PB


LB

BA

HB


NA

WIDEBAND BALUN TRANSFORMERS

Baluns, consisting of one unbalanced primary and one DC-isolated, center-tapped, balanced secondary winding, transfer power bi-directionally and are matched in both directions.

North Hills' baluns are precision-engineered for low insertion and return losses. Bandwidths extend from low-frequency cut-off (LCO), where response is down no more than 3 dB with respect to that at mid-band, to high-frequency cut-off (HCO), where the VSWR does not exceed 1.25.
Mid-band insertion loss <0.5 dB.

APPLICATIONS

- Impedance matching between balanced and unbalanced circuits
- Measurement/test system load matching
- Computer Local Area Network cable impedance matching
- Antenna coupling
- DC isolation and common-mode noise rejection

FEATURES

- Extremely wide, flat frequency response
- Broadest selection of products available from stock
- 120 dB isolation at power frequencies
- Low VSWR (<1.25) and flat loss (<0.5 dB)

OVERALL DIMENSIONS (INCHES) INCLUDES CONNECTORS

Case	L	W	H
BA	2.3	1.3	1.2
BB	2.6	1.3	1.2
HB	0.9	0.9	0.7
KA	5.4	4.6	5.5
LA	2.9	1.7	1.3
LB	3.2	1.7	1.3
NA	0.6	0.6	0.4
PA	3.0	4.0	2.0
PB	3.0	3.6	2.0

LOW POWER SERIES (1 W)

Series		Extended Video		Video Frequency		Medium Frequency		Radio Frequency	
Cases		PB		LA, LB		BA, BB		BA, BB, HB	
LCO		20 Hz		1 kHz		10 kHz		100 kHz	
Impedance Unb.	Bal.	Type No.	HCO MHz	Type No.	HCO MHz	Type No.	HCO MHz	Type No.	HCO MHz
50	50	0014	6	0009	25	0010	80	0001	125
	75	0113	6	0104	25	0111	80	0101	125
	90			0203	20	0202	60	0200	125
	100	0315		0311	20	0301	60	0300	100
	124	0316	6	0306	20	0302	60	0307	100
	135			0303	18	0312	60	0310	100
	150			0415	15	0401	60	0400	100
	200	0522	4	0511	15	0520	60	0500	100
	300			0517	12	0521	50	0501	100
	450			0603	10	0602	40	0600	65
	600			0706	8	0703	32	0700	65
	800			0802	7	0801	25	0800	60
	1200			0904	6	0902	15	0900	30
75	50	1003	6	1002	25	1001	60	1000	100
	75	1111	6	1102	25	1112	60	1100	100
	90			1202	20	1201	60	1200	100
	100	1321	6	1314	20	1310	60	1300	100
	110	1307	6	1318	20	1319	60	1320	100
	124	1309	10	1301	20	1311	60	1302	100
	135			1312	20	1315	60	1317	100
	150	1408	6	1404	16	1405	60	1400	100
	200			1516	15	1513	60	1500	100
	300	1520	4	1502	15	1514	60	1501	100
	450			1602	12	1601	40	1600	60
	600			1704	10	1707	32	1700	60
	800			1802	10	1801	20	1800	30
	1200			1902	9	1905	15	1900	30
	1875			1903	6	1901	8	1906	15

HIGH POWER SERIES

Power Level	10 W	25 W	25 W	100 W	1 kW
Cases	HB	BA, BB	BA, BB	BA, BB	KA
Range (MHz)	.1-30	.1-30	30-80	.5-30	2-32
Unb./Bal. Ω	Type No.	Type No.	Type No.	Type No.	Type No.
50:50	0008	0011		0012	0013
50:75	0108	0109	0106	0105	0107
50:100	0309	0308	0305	0304	0314
50:150	0406	0402	0403	0404	0407
50:200	0519	0512	0507	0516	0515
50:300	0514	0518		0506	0513
50:450	0604	0605		0606	0601
50:600	0705	0701		0704	0702
75:75	1105	1110		1118	1108
75:100	1306	1304	1303	1305	1316
75:150	1406	1401	1402	1403	1407
75:200	1517	1519		1512	1518
75:300	1515	1510	1509	1505	1511
75:450	1603	1604		1605	1606
75:600	1709	1703		1708	1705

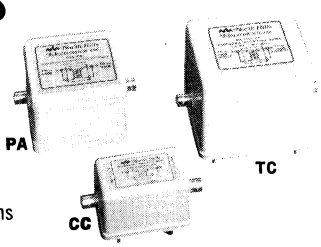
SUBMINIATURE SERIES

Power Level		0.5 W-2 W
Case		NA
Bandwidth (MHz)		0.1-300
In/Out (Ω)	Type No.	Characteristics
50:50	0003	Unbalanced to unbalanced, phase reversing, DC coupled
75:75	1106	
90:90	2200	
50:50	0007	Unbalanced to unbalanced, phase reversing, DC isolated
75:75	1107	
90:90	2201	
50:12.5	0002	Unbalanced to unbalanced, non-inverting, DC coupled
50:200	0508	
75:300	1506	
50:50	0004	Unbalanced to balanced, DC coupled
50:200	0509	
75:75	1101	
75:300	1507	
100:100	2202	
50:200	0510	Balanced to balanced, DC coupled
75:300	1508	

WIDEBAND SIGNAL TRANSFORMERS

North Hills Electronics, Inc.
1 ALEXANDER PLACE, GLEN COVE, NEW YORK 11542-3796
TELEPHONE: (516) 671-5700 • TELEX: 46-6886

VIDEO ISOLATION TRANSFORMERS AND HUMBUCKERS



APPLICATIONS

- Studio and remote video lines
- Security systems/CCTV
- Industrial process control systems
- Medical imaging systems

FEATURES

- Eliminates hum on data/video transmission lines due to
  — induced common-mode noise
  — differences in ground potentials
- Extremely wide bandwidth
- Insulated BNC connectors standard
- 120 dB isolation at power frequencies
- 500 Vrms withstanding voltage, winding to winding to case
- Flat frequency and linear phase response

ISOLATION TRANSFORMERS FOR COAXIAL SYSTEM

Type No.	Impedance (Ohms)	Bandwidth
0017-CC	50:50	10 Hz — 5 MHz
0016-PA	50:50	20 Hz — 25 MHz
0005-CC	50:50	1 kHz — 25 MHz
0018-VA	50:50	20 kHz — 300 MHz
1121-TC	75:75	3.5 Hz — 8 MHz
1117-CC	75:75	10 Hz — 5 MHz
1116-PA	75:75	20 Hz — 25 MHz
1103-CC	75:75	1 kHz — 25 MHz
1122-VA	75:75	20 kHz — 300 MHz
0115-PA	50:75	15 Hz — 5 MHz
0112-CC	50:75	1 kHz — 25 MHz
1204-PA	50:93	15 Hz — 4 MHz

10 kV ISOLATION TRANSFORMERS

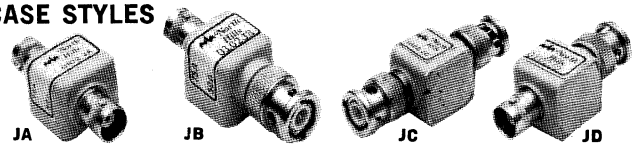
Type No.	Impedance (Ohms)	Bandwidth
1115-CD	75 Unb.: 75 Unb.	0.5 kHz — 8 MHz
1313-CD	75 Unb.: 124 Bal.	0.5 kHz — 8 MHz

HUMBUCKING TRANSFORMERS

- Flat response down to dc • Ultra-wide bandwidths

Type No.	Impedance (Ohms)	Bandwidth	Isolation at 60 Hz
0019-PA	50:50	dc — 20 MHz	50 dB
0020-CC	50:50	dc — 25 MHz	40 dB
1119-PA	75:75	dc — 20 MHz	50 dB
1120-CC	75:75	dc — 25 MHz	40 dB

CASE STYLES



COAXIAL IMPEDANCE ADAPTORS

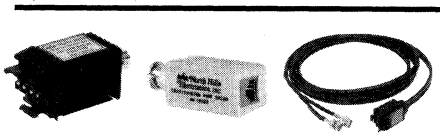
APPLICATIONS

Matching of coaxial cables and equipment of different impedances: Data transmission cabling/LANs, Communications systems, Test/measurement instrumentation.

FEATURES

- Low insertion loss
- BNC connectors in any combination of male/female
- 5-Watt capacity
- Bi-directionally matched
- Phase reversing available

Impedance (Ohms)	Model No.	50 Ohms M	50 Ohms F	75 Ohms M	75 Ohms F	90 Ohms M	90 Ohms F	Bandwidth (MHz)
50:75	0102-JA		x		x			.050-300
	0102-JB	x			x			
	0102-JC	x		x				
	0102-JD		x	x				
	0114-JA		x		x			5-1000
	0114-JB	x			x			
	0114-JC	x		x				
	0114-JD		x	x				
50:90	0201-JA		x				x	.05-300
	0201-JB	x					x	
	0201-JC	x				x		
	0201-JD		x			x		
75:90	1203-JA				x		x	
	1203-JB			x			x	
	1203-JC			x		x		
	1203-JD				x	x		



COMPUTER INTERFACE BALUNS/ADAPTORS

APPLICATIONS

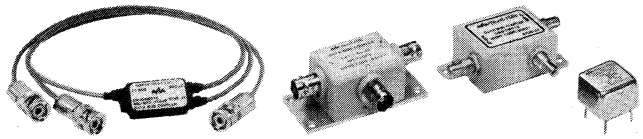
For matching Data Processing Equipment to Network Cabling Systems such as telephone wire, IBM Type 1, IBM Type 2 or Coaxial Cable.

LAN BALUN SELECTOR CHART (Custom Designs Also Available)

Interconnecting Cable Systems

Application	IBM® Type 1 & 2 Cable	Telephone Twisted Pair IBM® Type 3 Cable	RG58 50 Ohm Coax	RG59 75 Ohm Coax
IBM® "Category A" Devices (3270-type terminals & plug compatibles)	Red Balun L1A2457 L1A2459 L1A2591 L1A2592	L3A2448 L3A2749 L3A2550 L3A2742 L3A2483 L3A2750 L3A2662 L3A2743 L3A2546 L3A2751 L3A2610 L3A2744 L3A2746 L3A2543 L3A2740 L3A2745 L3A2747 L3A2541 L3A2741 L3A2612 L3A2748 L3A2564	L4A2603	L4A2604
IBM® "Category B" Devices (3277-type terminals & plug compatibles)	Yellow Balun L1B2458 L1B2460	L3B2768 L3B2762 L3B2766 L3B2569 L3B2763 L3B2767 L3B2616 L3B2764 L3B2570 L3B2617 L3B2765	L4B2769	L4B2770
ETHERNET/802.3	L1E2691	L3E2790 L3E2778 L3E2791 L2E2779	Not Required	L4E2692

MIL-STD-1553 DATA BUS COUPLERS



Standard units available from stock. Custom designs also available.

WIDEBAND POWER DIVIDERS/ COMBINERS, HYBRID TRANSFORMERS AND TERMINATIONS

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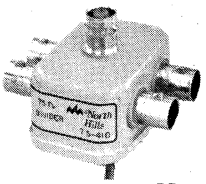
1 ALEXANDER PLACE, GLEN COVE, NEW YORK 11542-3796
TELEPHONE: (516) 671-5700 • TELEX: 46-6886

RA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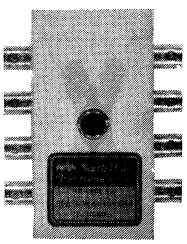
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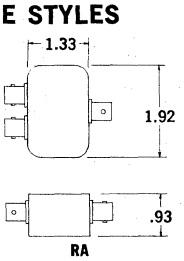
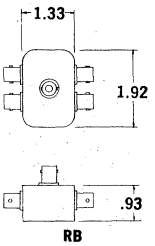
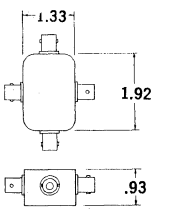
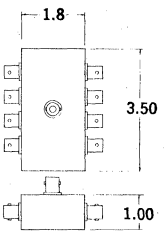
CASE STYLES









- Hybrid Junction techniques are employed to assure superior isolation and minimal insertion loss.
- VSWR is optimized at all ports.
- BNC Connectors are standard. Other connectors available on special order.
- Stud mounting is standard.
- Different case styles, including printed circuit types with solder terminals, available on special order.

SPECIAL UNITS — 10 Hz TO 1 GHz

In addition to our standard lines, North Hills custom designs to specific requirements. Example of these include:

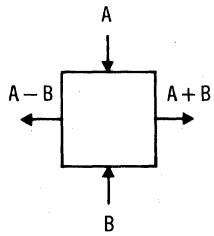
- Active unity—or high-gain power splitters, adders and combiners.
- High power dividers.
- Resistive dividers from dc to 500 MHz
- Power dividers for video applications with response down to 1 kHz.
- Non-standard impedances.

POWER DIVIDERS/COMBINERS

Model	2-WAY				4-WAY				8-WAY			
	50-201RA	75-201RA	50-210 RA	75-210 RA	50-401RB	75-401RB	50-410 RB	75-410 RB	50-801SA	75-801SA	50-810 SA	75-810 SA
Impedance (Ω)*	50	75	50	75	50	75	50	75	50	75	50	75
Frequency Range (MHz)	0.2 - 110		30 - 225		0.2 - 110		30 - 225		0.2 - 110		30 - 225	
Insertion Loss (dB max)	0.5		1.0		0.5		1.0		1.0		1.5	
Isolation (dB min)	30		30		30		30		30		30	
Amplitude Balance (±dB)	0.5		0.5		0.5		0.5		1.0		0.5	
Phase Balance (±°)	0.5		2.0		1.0		2.0		0.5		2.0	
Input VSWR (max)	1.1		1.25		1.1		1.25		1.1		1.25	
Input Power (watts, max)	5		3		5		3		5		3	
Case Style	RA		RA		RB		RB		SA		SA	
Weight (gm)	50		50		65		65		160		160	

* Other impedances available on special order

HYBRID TRANSFORMERS



SUM & DIFFERENCE (4-port)

Port Impedance Type	50Ω 50-212RE	75Ω 75-212RE
Frequency Range	0.2 - 110 MHz	
Insertion Loss	1 dB max	
Isolation	30 dB min	
Amplitude Balance	±.3 dB	
Phase Balance	1° max	
VSWR	1.20 max	
Power	0.5 watt max	

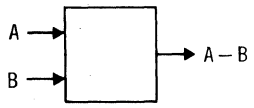


FIG. 2

DIFFERENCE DIVIDER (3-port)

Port Impedance Type	50Ω 50-221RA	75Ω 75-221RA
Frequency Range	0.2 - 110 MHz	
Insertion Loss	1 dB max	
Isolation	30 dB min	
Null	40 dB min	
VSWR	1.20 max	
Power	0.5 watt max	

TERMINATIONS

Model	Impedance	Frequency Range	VSWR	Connector
R50-101	50Ω	DC - 1 GHz	1.06 max.	BNC Male
R75-101	75Ω	DC - 1 GHz	1.06 max.	BNC Male

See Section 3450 for other North Hills Power Dividers and Microwave Components

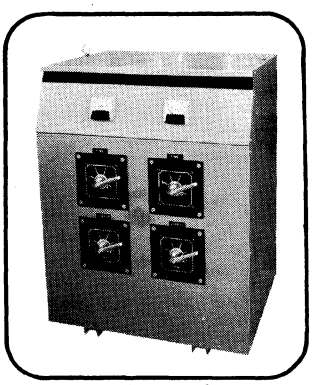
NWL ...the source for industrial and electronic transformers

FROM WATTS to MEGAWATTS

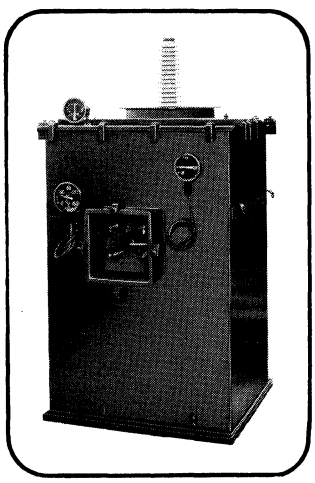
Since 1929, NWL has consistently been in the forefront of transformer design and manufacture.

High voltage, high frequency and high current transformers are particular strengths at NWL — whether for prototype, standard or special applications.

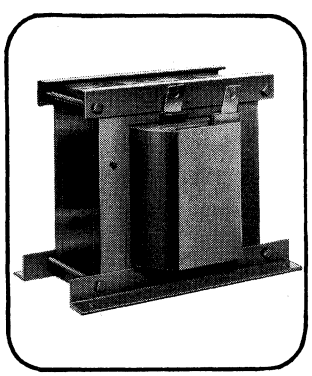
There's another reason you should look to NWL for solutions to your specific transformer problems. We've never hesitated to tackle the tough design problems head-on. In fact, NWL's technological superiority is a recognized fact in the precipitator, furnace, desalting, nuclear, and other fields requiring high technology.



Heating transformers for resistance and induction furnaces

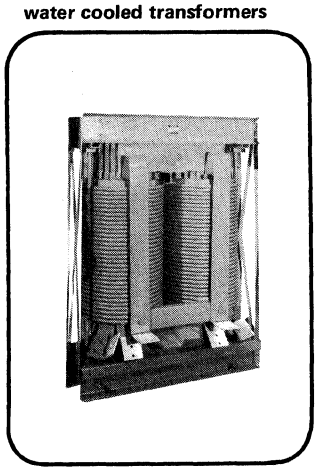


Oil-filled, high voltage Transformer/Rectifier Sets



Current limiting reactors

High power and high current water cooled transformers



15 KV Class, 3,000 KVA-equivalent multiple-tapped oil-filled transformer

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TRANSFORMERS ● Furnace ● Filament ● Heating ● Lighting ● SCR Controls ● Plate ● High Frequency ● Instrument ● Phase Changing ● Welding ● High Voltage ● Testing ● High Reactance ● Output ● Constant Voltage

PLUS ● Saturable Core Reactors ● Chokes ● Packaged Controls ● AC Reactors ● Air Core Reactors

MANUFACTURING RANGE
Up to 300 KV
1 mA to 50,000 AMP
4 Hz to 50 kHz
1 VA to 6,000 KVA
Dry, Oil-Filled, Silicone Fluid-Filled, Water Cooled, and Epoxy Cast Units Available.

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1150 DOMINGUEZ ST. □ CARSON, CA 90746-3518 □ 213/638-1790 □ FAX: 2136389956

Isolation Transformers for LAN-ETHERNET Applications

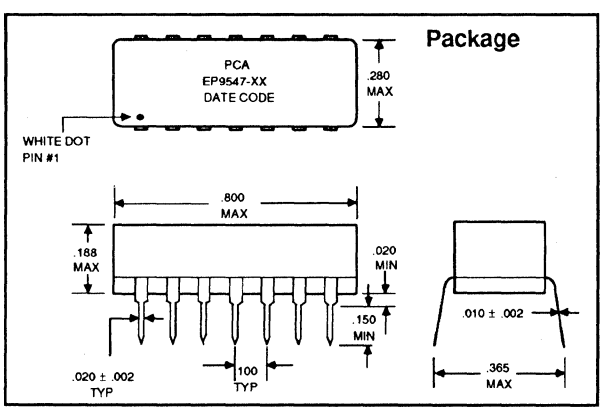
Features

- Low profile for auto-insertion
- Low leakage inductance (LE) and interwinding capacitance (CW)
- Turns ratio - 1:1 ± 5%
- Available on 14 or 16 pin package
- HIPOT-2000Vrms. (to comply with LANS safety requirements)

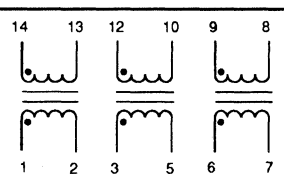
ELECTRICAL SPECIFICATIONS AT 25 °C

PCA PART NO. PKG A	PKG B	OCL µH ± 20%	ET-CONSTANT V-µS MIN	RISE TIME nS MAX	CW pF MAX	LE µH MAX	DCR Ω MAX
EP9547-1	EP9531-1	25	2.0	3.0	5	0.15	0.15
EP9547-2	EP9531-2	30	2.0	3.0	5	0.15	0.Q5
EP9547-3	EP9531-3	35	2.2	3.0	6	0.15	0.20
EP9547-4	EP9531-4	50	2.2	3.0	7	0.20	0.20
EP9547-5	EP9531-5	75	2.5	3.0	8	0.20	0.25
EP9547-6	EP9531-6	100	2.5	3.0	9	0.25	0.30
EP9547-7	EP9531-7	125	3.0	3.0	10	0.25	0.30
EP9547-8	EP9531-8	150	3.0	3.0	11	0.25	0.40
EP9547-9	EP9531-9	175	3.5	3.5	12	0.25	0.5O
EP9547-10	EP9531-10	200	3.5	3.5	13	0.30	0.50

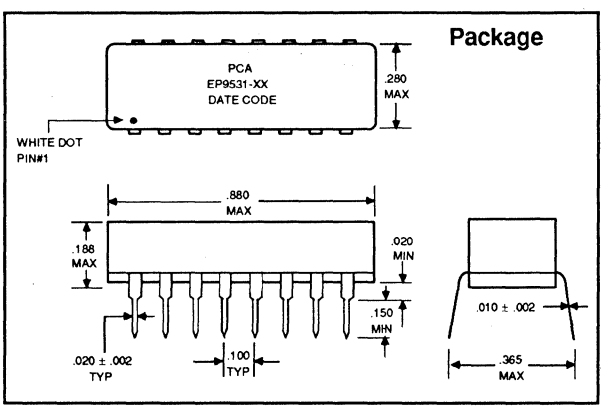
Package



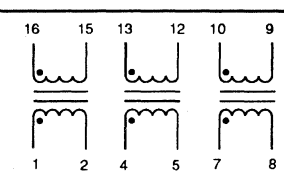
Schematic



Package



Schematic



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TWX: (910) 496-1525

EP9547 7/88

Token Ring Isolation Transformers

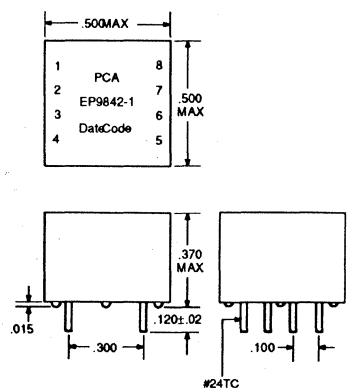
ELECTRICAL SPECIFICATIONS @ 25 °C	
PARAMETERS	**SPECIFICATIONS**
Primary Inductance @ 1 KHz	1.0 mH for ref. only
Primary DCR	0.55 Ω max
Secondary DCR	0.85 Ω max
Insertion Loss @ 10 mHz	0.5 dB max
Common Mode Rejection Ratio @ 1.0 mHz	-60 dB min
Return Loss @ 5 mHz	20 dB min
Turns Ratio	1:1:2:2 ±5%
HIPOT between Pri and Sec and also from coil to coil in the Dual Package	500 Vrms

Features

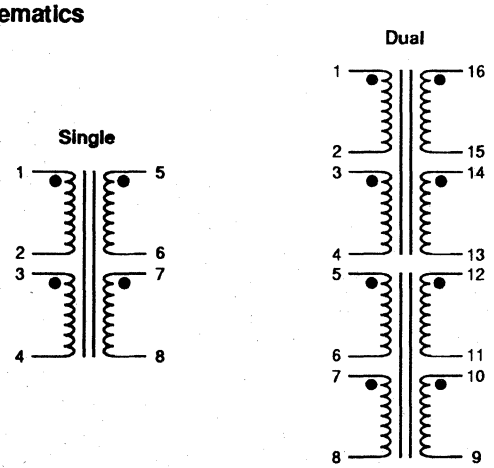
- Available in single and dual low profile packages
- Hipot - 500Vrms (to comply with LAN's International Safety Requirements)
- Designed for IBM and TI token ring applications IEEE 802.5 compatible

PCA P/N	TYPE	PACKAGE STYLE
EP9842-1 EP9842-2	Single Dual	Case 16 Pin DIL

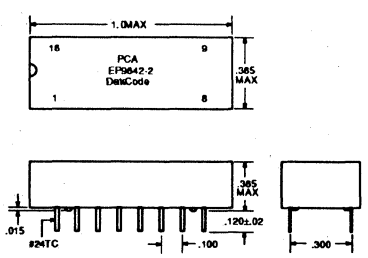
Single Package



Schematics



Dual Package



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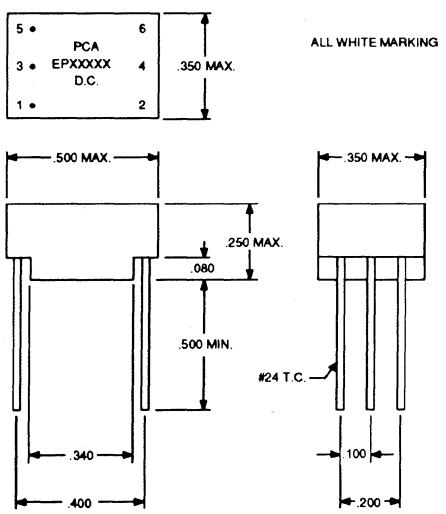
EP9842 7/88

Stand - Off Type Pulse Transformer

Turns Ratio (±5%)	Primary Sine Wave OCL (µH Min)	Primary ET Constant (v-µs Min)	Rise Time (nS Max)	Pri Sec Cw / w (pF Max)	Pri Sec Leakage Inductance (µH Max)	Primary DCR (Ω Max)	Secondary DCR (Ω Max)	Tertiary DCR (Ω Max)	PCA Part No.
1:1:1	5000	25.0	10.5	60	1.3	3.9	3.9	3.9	EP15760
	2000	16.0	8.2	37	0.8	2.5	2.5	2.5	EP15761
	500	8.5	5.3	32	0.4	1.3	1.3	1.3	EP15762
	200	5.0	4.2	18	0.3	0.9	0.9	0.9	EP15763
	50	5.2	5.6	18	0.5	1.3	1.3	1.3	EP15764
	20	3.2	4.1	21	0.4	0.9	0.9	0.9	EP15765
	10	3.7	5.1	22	0.5	0.9	0.9	0.9	EP15766
2:1:1	5000	25.0	16.0	33	3.6	3.9	2.0	2.0	EP15767
	2000	16.0	11.0	19	1.8	2.5	1.4	1.4	EP15768
	500	8.5	5.6	11	1.1	1.3	0.7	0.7	EP15769
	200	5.0	3.2	8	0.8	0.9	0.5	0.5	EP15770
	20	5.8	7.5	12	1.5	1.3	0.8	0.8	EP15772
3:1:1	200	5.0	3.6	7	1.1	0.9	0.4	0.4	EP15777
	20	3.2	2.7	6	1.3	0.9	0.4	0.4	EP15779
4:2:1	2000	16.0	13.0	20	2.5	2.5	1.4	0.8	EP15782
	500	8.5	4.7	13	0.9	1.4	0.8	0.5	EP15783
	200	5.0	3.7	8	0.8	0.9	0.5	0.4	EP15784
1ct:1ct	2000	16.0	8.2	37	0.8	2.5	2.5		EP18270
	500	8.5	5.3	32	0.4	1.3	1.3		EP18271
	200	5.0	4.2	18	0.3	0.9	0.9		EP18272
	50	5.2	5.6	18	0.5	1.3	1.3		EP18273
	20	3.2	4.1	21	0.4	0.9	0.9		EP18274
	10	3.7	5.1	22	0.5	0.9	0.9		EP18275
2ct:1ct	2000	16.0	11.0	19	1.8	2.5	1.4		EP18276
	500	8.5	5.6	12	1.2	1.4	0.8		EP18277
	200	5.0	3.2	8	0.8	0.9	0.5		EP18278
	50	5.2	5.2	12	1.3	1.3	0.7		EP18279
	20	5.8	7.5	12	1.5	1.3	0.8		EP18280
	10	3.7	4.5	9	1.5	0.9	0.5		EP18281

Package Dimensions

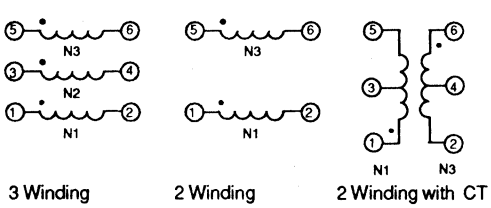


EP15760 9/87

Method of Testing

For primary inductance (OCL): HP4275A, 100KHz, 0.1Vrms
Multi- Freq LCR Meter
For leakage inductance and interwinding capacitance:
Tektronix Type 130 LC Meter
Hipot : 500 Vrms IR : 10 K Meg Ω Min @ 500 Vdc

Schematic



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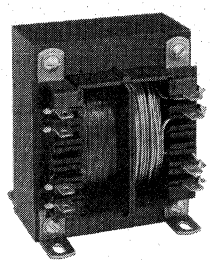
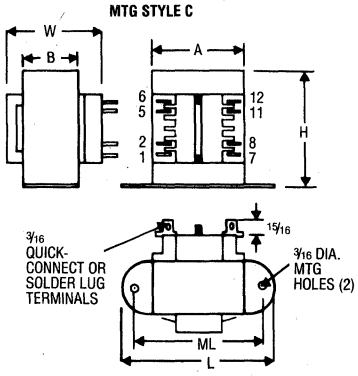
INTERNATIONAL SERIES CHASSIS MOUNT TYPE DUAL BOBBIN POWER TRANSFORMERS



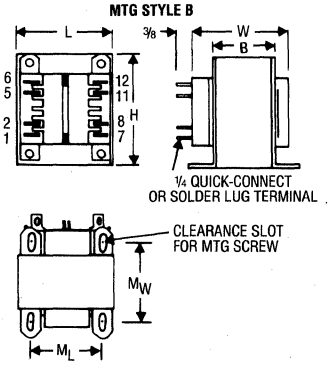
- **Designed to meet UL, VDE, IEC-65, CSA.**
- Dual bobbin construction with insulating shrouds — provides 4000V hipot and results in low interwinding capacitance eliminating the need for electro-static shielding.
- 130°C insulating system — materials meet UL flammability requirements.
- Dual 115V/230V 50/60 HZ primaries.
- Dual secondaries for variety of utilization.
- Low cost.

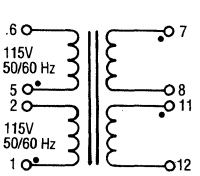
Part No.	R.M.S. SECONDARY RATINGS			
	Series	Parallel	Size	VA
VRP6-10	10 VCT @ 2.5 A	5 V @ 5.0 A	6	25
VRP6-12	12.6VCT @ 2.0 A	6.3V @ 4.0 A	6	25
VRP6-16	16 VCT @ 1.6 A	8 V @ 3.2 A	6	25
VRP6-20	20 VCT @ 1.25A	10 V @ 2.5 A	6	25
VRP6-24	24 VCT @ 1.0 A	12 V @ 2.0 A	6	25
VRP6-28	28 VCT @ 0.9 A	14 V @ 1.8 A	6	25
VRP6-36	36 VCT @ 0.7 A	18 V @ 1.4 A	6	25
VRP6-230	230 VCT @ 0.11A	115 V @ 0.22A	6	25
VRP7-10	10 VCT @ 4.3 A	5 V @ 8.6 A	7	43
VRP7-12	12.6VCT @ 3.4 A	6.3V @ 6.8 A	7	43
VRP7-16	16 VCT @ 2.7 A	8 V @ 5.4 A	7	43
VRP7-20	20 VCT @ 2.2 A	10 V @ 4.4 A	7	43
VRP7-24	24 VCT @ 1.8 A	12 V @ 3.6 A	7	43
VRP7-28	28 VCT @ 1.5 A	14 V @ 3.0 A	7	43
VRP7-36	36 VCT @ 1.2 A	18 V @ 2.4 A	7	43
VRP7-230	230 VCT @ 0.19A	115 V @ 0.38A	7	43
VRP8-10	10 VCT @ 8.0 A	5 V @ 16.0 A	8	80
VRP8-12	12.6VCT @ 6.3 A	6.3V @ 12.6 A	8	80
VRP8-16	16 VCT @ 5.0 A	8 V @ 10.0 A	8	80
VRP8-20	20 VCT @ 4.0 A	10 V @ 8.0 A	8	80
VRP8-24	24 VCT @ 3.3 A	12 V @ 6.6 A	8	80
VRP8-28	28 VCT @ 2.8 A	14 V @ 5.6 A	8	80
VRP8-36	36 VCT @ 2.2 A	18 V @ 4.4 A	8	80
VRP8-230	230 VCT @ 0.35A	115 V @ 0.7 A	8	80
VRP9-10	10 VCT @ 13.0 A	5 V @ 26.0 A	9	130
VRP9-12	12.6VCT @ 10.3 A	6.3V @ 20.6 A	9	130
VRP9-16	16 VCT @ 8.1 A	8 V @ 16.2 A	9	130
VRP9-20	20 VCT @ 6.5 A	10 V @ 13.0 A	9	130
VRP9-24	24 VCT @ 5.4 A	12 V @ 10.8 A	9	130
VRP9-28	28 VCT @ 4.6 A	14 V @ 9.2 A	9	130
VRP9-36	36 VCT @ 3.6 A	18 V @ 7.2 A	9	130
VRP9-230	230 VCT @ 0.57A	115 V @ 1.14A	9	130
VRP10-16	16 VCT @ 11.0 A	8 V @ 22.0 A	10	175
VRP10-20	20 VCT @ 8.8 A	10 V @ 17.6 A	10	175
VRP10-24	24 VCT @ 7.3 A	12 V @ 14.6 A	10	175
VRP10-28	28 VCT @ 6.25A	14 V @ 12.5 A	10	175
VRP10-36	36 VCT @ 4.8 A	18 V @ 9.6 A	10	175
VRP10-230	230 VCT @ 0.76A	115 V @ 1.52A	10	175

MTG STYLE C



MTG STYLE B





SIZE	VA	L	W	H	A	B	MTG Style	MTG ML	MTG MW	MTG Screw	WT. lbs.
6	25	2 13/16	1 7/8	2 5/16	2	1 1/8	C	2 3/8	—	#6	1.25
7	43	3 1/8	2 1/16	2 11/16	2 1/4	1 1/8	C	2 13/16	—	#6	1.60
8	80	3 9/16	2 3/8	3 1/16	2 5/8	1 5/16	C	3 1/8	—	#6	2.60
9	130	2 13/16	2 7/8	3 3/8	—	1 5/8	B	2 1/4	2 1/2	#8	4.10
10	175	3 1/8	2 7/8	3 3/4	—	1 5/8	B	2 1/2	2 1/2	#8	6.50

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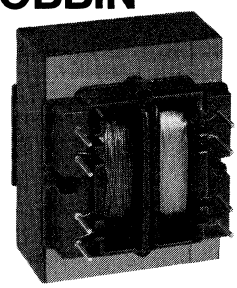
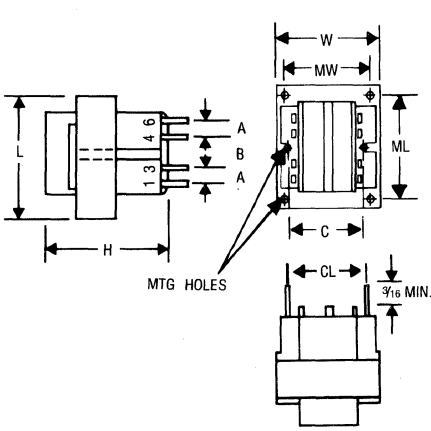
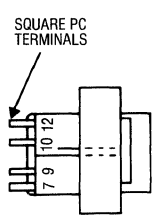


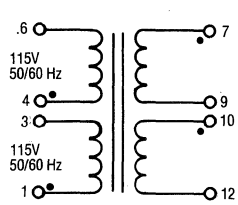
• Designed to meet UL, VDE, IEC-65, CSA.

- Dual bobbin construction with insulating shrouds—provides 4000V hipot and results in low interwinding capacitance, eliminating the need for electro-static shielding.
- 130°C insulating system—materials meet UL flammability requirements.
- Dual 115V/230V 50/60 HZ primaries.
- Dual secondaries for variety of utilization.
- Low cost.

Part No.	R.M.S. SECONDARY RATINGS			
	Series	Parallel	Size	VA
VPC3-10	10 VCT @ 0.25A	5 V @ 0.5 A	3	2.5
VPC3-12	12.6VCT @ 0.2 A	6.3V @ 0.4 A	3	2.5
VPC3-16	16 VCT @ 0.15A	8 V @ 0.3 A	3	2.5
VPC3-20	20 VCT @ 0.12A	10 V @ 0.24A	3	2.5
VPC3-24	24 VCT @ 0.1 A	12 V @ 0.2 A	3	2.5
VPC3-28	28 VCT @ 0.09A	14 V @ 0.18A	3	2.5
VPC3-36	36 VCT @ 0.07A	18 V @ 0.14A	3	2.5
VPC4-10	10 VCT @ 0.5 A	5 V @ 1.0 A	4	5.0
VPC4-12	12.6VCT @ 0.4 A	6.3V @ 0.8 A	4	5.0
VPC4-16	16 VCT @ 0.31A	8 V @ 0.62A	4	5.0
VPC4-20	20 VCT @ 0.25A	10 V @ 0.5 A	4	5.0
VPC4-24	24 VCT @ 0.21A	12 V @ 0.42A	4	5.0
VPC4-28	28 VCT @ 0.18A	14 V @ 0.36A	4	5.0
VPC4-36	36 VCT @ 0.14A	18 V @ 0.28A	4	5.0
VPC5-10	10 VCT @ 1.0 A	5 V @ 2.0 A	5	10.0
VPC5-12	12.6VCT @ 0.8 A	6.3V @ 1.6 A	5	10.0
VPC5-16	16 VCT @ 0.62A	8 V @ 1.25A	5	10.0
VPC5-20	20 VCT @ 0.5 A	10 V @ 1.0 A	5	10.0
VPC5-24	24 VCT @ 0.42A	12 V @ 0.84A	5	10.0
VPC5-28	28 VCT @ 0.36A	14 V @ 0.72A	5	10.0
VPC5-36	36 VCT @ 0.28A	18 V @ 0.56A	5	10.0
VPC6-10	10 VCT @ 2.0 A	5 V @ 4.0 A	6	20.0
VPC6-12	12.6VCT @ 1.6 A	6.3V @ 3.2 A	6	20.0
VPC6-16	16 VCT @ 1.25A	8 V @ 2.5 A	6	20.0
VPC6-20	20 VCT @ 1.0 A	10 V @ 2.0 A	6	20.0
VPC6-24	24 VCT @ .83A	12 V @ 1.66A	6	20.0
VPC6-28	28 VCT @ .72A	14 V @ 1.44A	6	20.0
VPC6-36	36 VCT @ .56A	18 V @ 1.12A	6	20.0
VPC7-10	10 VCT @ 3.0 A	5 V @ 6.0 A	7	30.0
VPC7-12	12.6VCT @ 2.4 A	6.3V @ 4.8 A	7	30.0
VPC7-16	16 VCT @ 1.9 A	8 V @ 3.8 A	7	30.0
VPC7-20	20 VCT @ 1.5 A	10 V @ 3.0 A	7	30.0
VPC7-24	24 VCT @ 1.25A	12 V @ 2.5 A	7	30.0
VPC7-28	28 VCT @ 1.06A	14 V @ 2.12A	7	30.0
VPC7-36	36 VCT @ .82A	18 V @ 1.64A	7	30.0
VPC8-10	10 VCT @ 5.6 A	5 V @ 11.2 A	8	56.0
VPC8-12	12.6VCT @ 4.4 A	6.3V @ 8.8 A	8	56.0
VPC8-16	16 VCT @ 3.5 A	8 V @ 7.0 A	8	56.0
VPC8-20	20 VCT @ 2.8 A	10 V @ 5.6 A	8	56.0
VPC8-24	24 VCT @ 2.33A	12 V @ 4.66A	8	56.0
VPC8-28	28 VCT @ 2.0 A	14 V @ 4.0 A	8	56.0
VPC8-36	36 VCT @ 1.56A	18 V @ 3.12A	8	56.0







SIZE	VA	L	W	H	A	B	C	PIN	MTG CL	MTG MW	MTG ML	MTG Screw	WT. lbs.
3	2.5	1 5/8	1 5/16	1 1/8	.200	.250	1.000	.025SQ	1 1/16	—	—	#4	0.25
4	5.0	1 5/8	1 5/16	1 3/8	.200	.400	1.000	.025SQ	1 1/16	—	—	#4	0.37
5	10.0	1 7/8	1 9/16	1 3/8	.200	.400	1.140	.038SQ	1 1/4	—	—	#4	0.53
6	20.0	2 1/4	1 7/8	1 5/8	.400	.400	1.460	.038SQ	1 1/2	—	—	#4	0.90
7	30.0	2 5/8	2 3/16	1 9/16	.275	.275	1.680	.045SQ	—	1 3/4	2 3/16	#6	1.15
8	56.0	3	2 1/2	1 13/16	.300	.300	1.900	.045SQ	—	2	2 1/2	#6	1.70

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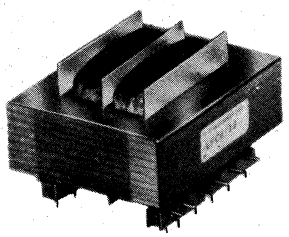
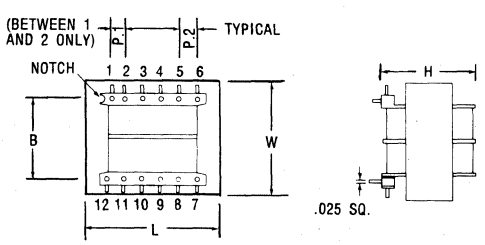
LOW PROFILE SPLIT BOBBIN PRINTED CIRCUIT POWER TRANSFORMERS

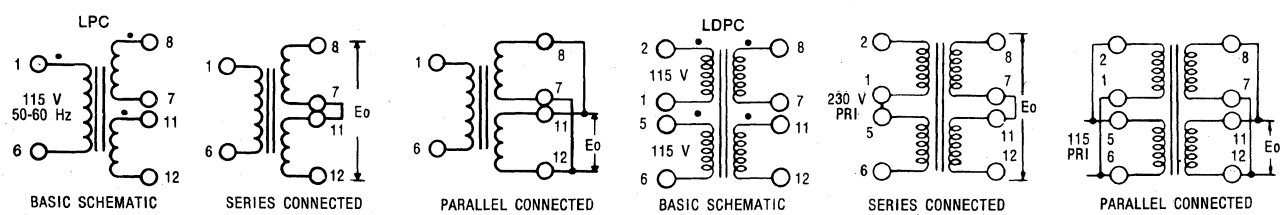
- Low profile — allows closer printed circuit board stacking
- Split bobbin construction — center flange insulation barrier provides 2500 VRMs Hipot — non concentric coil winding results in low interwinding capacitance, eliminates need for electro-static shielding.
- Class S (130°C) insulation system
- Single 115V and dual 115V/230V primaries are standard.
- Dual secondaries for variety of utilization
- 12 pin bobbin design increases available options for multi-winding special orders
- Low regulation



PRIMARY 50/60HZ		R.M.S. SECONDARY RATINGS			
Single 115V	Dual 115V/230V	Series	Parallel	SIZE	VA
LPC3- 12	LDPC3- 12	12.6VCT @ 105MA	6.3V @ 210MA	3	1.25
LPC3- 16	LDPC3- 16	16 VCT @ 80MA	8 V @ 160MA	3	1.25
LPC3- 20	LDPC3- 20	20 VCT @ 65MA	10 V @ 130MA	3	1.25
LPC3- 24	LDPC3- 24	24 VCT @ 55MA	12 V @ 110MA	3	1.25
LPC3- 34	LDPC3- 34	34 VCT @ 35MA	17 V @ 70MA	3	1.25
LPC3- 40	LDPC3- 40	40 VCT @ 30MA	20 V @ 60MA	3	1.25
LPC3- 56	LDPC3- 56	56 VCT @ 20MA	28 V @ 40MA	3	1.25
LPC3-120	LDPC3-120	120 VCT @ 10MA	60 V @ 20MA	3	1.25
LPC4- 12	LDPC4- 12	12.6VCT @ 360MA	6.3V @ 720MA	4	4.50
LPC4- 16	LDPC4- 16	16 VCT @ 280MA	8 V @ 560MA	4	4.50
LPC4- 20	LDPC4- 20	20 VCT @ 225MA	10 V @ 450MA	4	4.50
LPC4- 24	LDPC4- 24	24 VCT @ 185MA	12 V @ 370MA	4	4.50
LPC4- 34	LDPC4- 34	34 VCT @ 130MA	17 V @ 260MA	4	4.50
LPC4- 40	LDPC4- 40	40 VCT @ 110MA	20 V @ 220MA	4	4.50
LPC4- 56	LDPC4- 56	56 VCT @ 80MA	28 V @ 160MA	4	4.50
LPC4-120	LDPC4-120	120 VCT @ 40MA	60 V @ 80MA	4	4.50
LPC5- 12	LDPC5- 12	12.6VCT @ 795MA	6.3V @ 1.59A	5	10.0
LPC5- 16	LDPC5- 16	16 VCT @ 625MA	8 V @ 1.25A	5	10.0
LPC5- 20	LDPC5- 20	20 VCT @ 500MA	10 V @ 1.00A	5	10.0
LPC5- 24	LDPC5- 24	24 VCT @ 415MA	12 V @ 930MA	5	10.0
LPC5- 34	LDPC5- 34	34 VCT @ 295MA	17 V @ 590MA	5	10.0
LPC5- 40	LDPC5- 40	40 VCT @ 250MA	20 V @ 500MA	5	10.0
LPC5- 56	LDPC5- 56	56 VCT @ 180MA	28 V @ 360MA	5	10.0
LPC5-120	LDPC5-120	120 VCT @ 85MA	60 V @ 170MA	5	10.0
LPC6- 12	LDPC6- 12	12.6VCT @ 1.9A	6.3V @ 3.8A	6	24.0
LPC6- 16	LDPC6- 16	16 VCT @ 1.5A	8 V @ 3.0A	6	24.0
LPC6- 20	LDPC6- 20	20 VCT @ 1.2A	10 V @ 2.4A	6	24.0
LPC6- 24	LDPC6- 24	24 VCT @ 1.0A	12 V @ 2.0A	6	24.0
LPC6- 34	LDPC6- 34	34 VCT @ 705MA	17 V @ 1.4A	6	24.0
LPC6- 40	LDPC6- 40	40 VCT @ 600MA	20 V @ 1.2A	6	24.0
LPC6- 56	LDPC6- 56	56 VCT @ 430MA	28 V @ 860MA	6	24.0
LPC6-120	LDPC6-120	120 VCT @ 200MA	60 V @ 400MA	6	24.0



LPC, LDPC SIZE	VA	L″	W″	H″	P-1	P-2	B	WT. (oz.)
3	1.25	1⅜	1 5/16	1 1/16	.150	.200	.862	3
4	4.50	1⅝	1⅜	1 3/16	.200	.250	.950	5
5	10.0	1⅞	1⅝	1 5/16	.200	.300	1.100	9
6	24.0	2¼	1⅞	1 5/16	.200	.300	1.300	14



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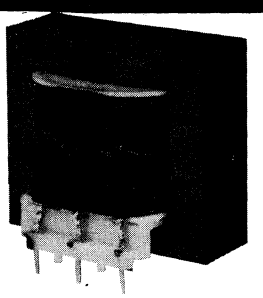
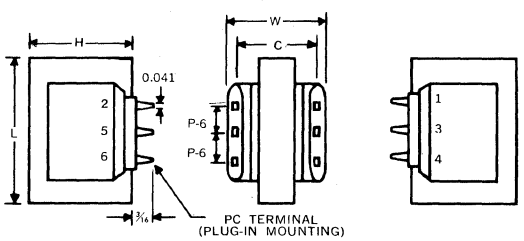
PLUG-IN PRINTED CIRCUIT POWER TRANSFORMERS

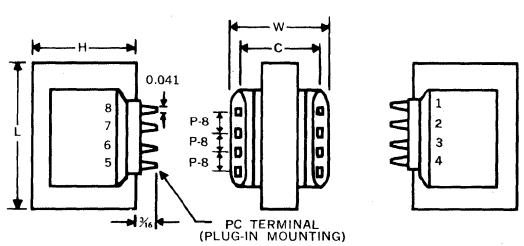


- Packaging flexibility
- Miniaturized construction
- Precision spaced molded-in terminals
- 105°C insulation system
- 1500V Hipot
- Low regulation
- Single 115V and dual 115V/230V primaries are standard
- Dual secondaries for variety of utilization

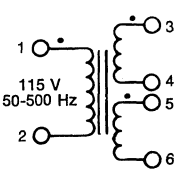
PRIMARY 50/400HZ		R.M.S. SECONDARY RATINGS			
Single 115V	Dual 115V/230V	Series	Parallel	SIZE	VA
PC2- 12	DPC2- 12	12.6VCT @ 70MA	6.3V @ 140MA	2	1.0
PC2- 16	DPC2- 16	16 VCT @ 55MA	8 V @ 110MA	2	1.0
PC2- 20	DPC2- 20	20 VCT @ 45MA	10 V @ 90MA	2	1.0
PC2- 24	DPC2- 24	24 VCT @ 35MA	12 V @ 70MA	2	1.0
PC2- 34	DPC2- 34	34 VCT @ 25MA	17 V @ 50MA	2	1.0
PC2- 40	DPC2- 40	40 VCT @ 20MA	20 V @ 40 MA	2	1.0
PC2- 56	DPC2- 56	56 VCT @ 15MA	28 V @ 30MA	2	1.0
PC3- 12	DPC3- 12	12.6VCT @ 105MA	6.3V @ 210MA	3	1.25
PC3- 16	DPC3- 16	16 VCT @ 80MA	8 V @ 160MA	3	1.25
PC3- 20	DPC3- 20	20 VCT @ 65MA	10 V @ 130MA	3	1.25
PC3- 24	DPC3- 24	24 VCT @ 55MA	12 V @ 110MA	3	1.25
PC3- 34	DPC3- 34	34 VCT @ 35MA	17 V @ 70MA	3	1.25
PC3- 40	DPC3- 40	40 VCT @ 30MA	20 V @ 60MA	3	1.25
PC3- 56	DPC3- 56	56 VCT @ 20MA	28 V @ 40MA	3	1.25
PC3-120	DPC3-120	120 VCT @ 10MA	60 V @ 20MA	3	1.25
PC4- 12	DPC4- 12	12.6VCT @ 360MA	6.3V @ 720MA	4	4.50
PC4- 16	DPC4- 16	16 VCT @ 280MA	8 V @ 560MA	4	4.50
PC4- 20	DPC4- 20	20 VCT @ 225MA	10 V @ 450MA	4	4.50
PC4- 24	DPC4- 24	24 VCT @ 185MA	12 V @ 370MA	4	4.50
PC4- 34	DPC4- 34	34 VCT @ 130MA	17 V @ 260MA	4	4.50
PC4- 40	DPC4- 40	40 VCT @ 110MA	20 V @ 220MA	4	4.50
PC4- 56	DPC4- 56	56 VCT @ 80MA	28 V @ 160MA	4	4.50
PC4-120	DPC4-120	120 VCT @ 40MA	60 V @ 80MA	4	4.50
PC5- 12	DPC5- 12	12.6VCT @ 795MA	6.3V @ 1.59A	5	10.0
PC5- 16	DPC5- 16	16 VCT @ 625MA	8 V @ 1.25A	5	10.0
PC5- 20	DPC5- 20	20 VCT @ 500MA	10 V @ 1.00A	5	10.0
PC5- 24	DPC5- 24	24 VCT @ 415MA	12 V @ 930MA	5	10.0
PC5- 34	DPC5- 34	34 VCT @ 295MA	17 V @ 590MA	5	10.0
PC5- 40	DPC5- 40	40 VCT @ 250MA	20 V @ 500MA	5	10.0
PC5- 56	DPC5- 56	56 VCT @ 180MA	28 V @ 360MA	5	10.0
PC5-120	DPC5-120	120 VCT @ 85MA	60 V @ 170MA	5	10.0
PC6- 12	DPC6- 12	12.6VCT @ 1.9A	6.3V @ 3.8A	6	24.0
PC6- 16	DPC6- 16	16 VCT @ 1.5A	8 V @ 3.0A	6	24.0
PC6- 20	DPC6- 20	20 VCT @ 1.2A	10 V @ 2.4A	6	24.0
PC6- 24	DPC6- 24	24 VCT @ 1.0A	12 V @ 2.0A	6	24.0
PC6- 34	DPC6- 34	34 VCT @ 705MA	17 V @ 1.4A	6	24.0
PC6- 40	DPC6- 40	40 VCT @ 600MA	20 V @ 1.2A	6	24.0
PC6- 56	DPC6- 56	56 VCT @ 430MA	28 V @ 860MA	6	24.0
PC6-120	DPC6-120	120 VCT @ 200MA	60 V @ 400MA	6	24.0



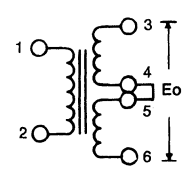
PC-6 PINS



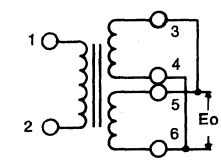
DPC-8 PINS



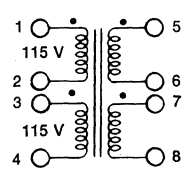
BASIC SCHEMATIC



SERIES CONNECTED



PARALLEL CONNECTED



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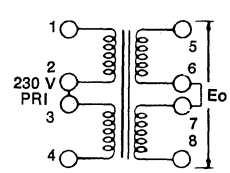

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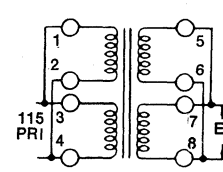

PARALLEL CONNECTED

SIZE	VA	L	W	H	P-6 PIN	P-8 PIN	C	WT. (oz.)
2	1.0	1	1⅜	0.83	.250	.200	1.200	2.5
3	1.25	1⅜	1⅛	1 3/16	.312	.200	1.000	3
4	4.50	1⅝	1¼	1⅜	.400	.250	1.100	5
5	10.0	1⅞	1 7/16	1⅝	.400	.250	1.300	9
6	24.0	1⅝	2¼	1⅜	.400	.250	2.100	12

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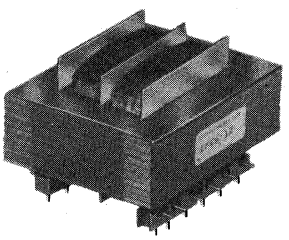
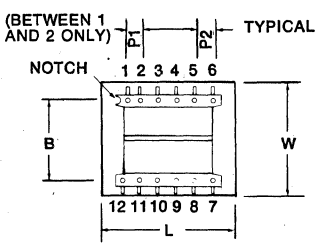
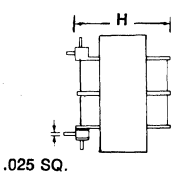
- Low profile — allows closer printed circuit board stacking
- Split bobbin construction—center flange insulation barrier provides 2500 VRMs Hipot—non concentric coil winding results in low inter-winding capacitance, eliminates need for electro-static shielding
- Class S (130°C) insulation system
- Single 115V and dual 115V/230V primaries are standard
- DC output combinations — ±12 and 5V or ±15 and 5V rated at the regulator output with allowance for line variations up to ±13%
- Packaging Flexibility



Primary 50/60 Hz		Regulated DC Ratings		
Single 115V	Dual 115V/230V	IC1	IC2	Size
LM4-12	LDM4-12	5VDC@185mA	±12VDC@35mA	4
LM5-12	LDM5-12	5VDC@365mA	±12VDC@60mA	5
LM6-12	LDM6-12	5VDC@850mA	±12VDC@150mA	6
LM4-15	LDM4-15	5VDC@185mA	±15VDC@30mA	4
LM5-15	LDM5-15	5VDC@365mA	±15VDC@50mA	5
LM6-15	LDM6-15	5VDC@850mA	±15VDC@130mA	6



LM, LDM Size	L″	W″	H″	P-1	P-2	B	WT. (oz.)
4	1⅝	1⅜	1 3/16	.200	.250	.950	5
5	1⅞	1⅝	1 5/16	.200	.300	1.100	9
6	2¼	1⅞	1 3/16	.200	.300	1.300	14

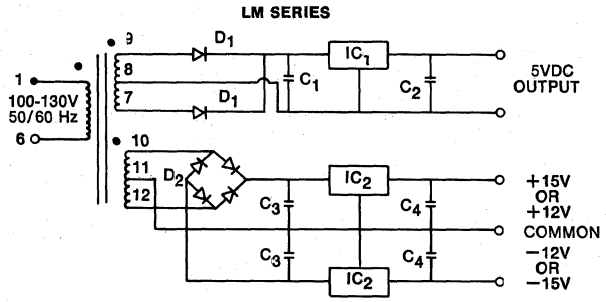


RECOMMENDED COMPONENTS

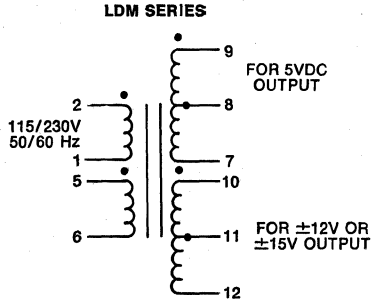
Part Number	C_1 MFD	C_1 V	C_2 MFD	C_2 V	C_3 MFD	C_3 V	C_4 MFD	C_4 V	D_1(2)	D_2(4)	IC_1	IC_2
LM4-12/LDM4-12	1000	20	2.7	20	150	50	10	20	1N4001	1N4002	LM342P-5.0	LM326N
LM4-15/LDM4-15	1000	20	2.7	20	150	50	10	20	1N4001	1N4002	LM342P-5.0	LM325N
LM5-12/LDM5-12	2100	30	2.7	20	250	50	10	20	1N4001	1N4002	LM341P-5.0	LM326N
LM5-15/LDM5-15	2100	30	2.7	20	250	50	10	20	1N4001	1N4002	LM341P-5.0	LM325N
LM6-12/LDM6-12	4000	20	2.7	20	1000	50	2.7	20	1N4001	1N4002	LM340K-5.0	LM326N
LM6-15/LDM6-15	4000	20	2.7	20	1000	50	2.7	20	1N4001	1N4002	LM340K-5.0	LM325N

SCHEMATIC DIAGRAMS

LM SERIES



LDM SERIES



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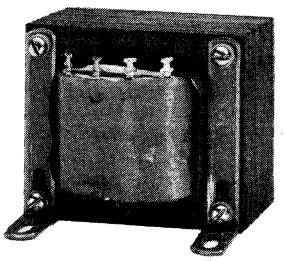
FOR CUSTOM PROTOTYPES

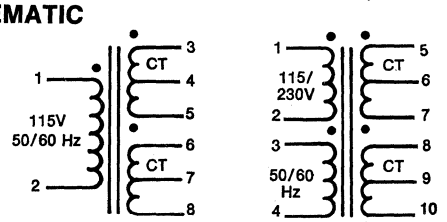
RECTIFIER POWER TRANSFORMERS



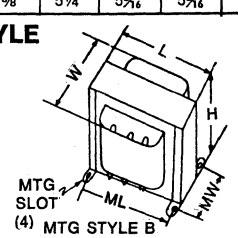
- Single 115V or dual 115V/230V — 50/60 Hz primaries.
- (2) center tapped secondaries provide variety of utilization.
- 1500 VRMS hipot.
- Class 130°C insulation system.
- Rugged construction — only prime raw materials are used.
- Secondary voltage and currents are R.M.S. and are designed for a wide range of rectifier power circuit applications. Our Engineering/Applications staff can assist you with selecting the unit that best suits your rectifier circuit requirements. Custom design and construction is available for your special requirements.

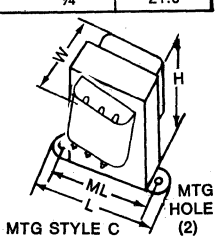
PRIMARY 50/60 Hz		R.M.S. SECONDARY RATINGS		Mtg.						Mtg.	Approx.
Single 115V	Dual 115V/230V	Series	Parallel	Style	L	W	H	ML	MW	Screw	Wt.
RP10- 1	DRP10- 1	10 VCT @ 1A	5 VCT @ 2A	C	2 13/16	1 1/2	1 5/8	2 3/8	—	# 8	.6
RP10- 2	DRP10- 2	10 VCT @ 2A	5 VCT @ 4A	C	3 1/4	1 3/4	1 15/16	2 13/16	—	# 8	1.0
RP10- 4	DRP10- 4	10 VCT @ 4A	5 VCT @ 8A	C	3 11/16	2	2 1/4	3 1/8	—	# 8	1.5
RP10- 6	DRP10- 6	10 VCT @ 6A	5 VCT @ 12A	C	3 11/16	2 1/8	2 1/4	3 1/8	—	# 8	1.7
RP10- 8	DRP10- 8	10 VCT @ 8A	5 VCT @ 16A	C	4 1/32	2 1/4	2 5/16	3 5/16	—	# 8	2.3
RP10-10	DRP10-10	10 VCT @ 10A	5 VCT @ 20A	C	4 1/32	2 1/2	2 5/16	3 5/16	—	# 8	2.8
RP10-12	DRP10-12	10 VCT @ 12A	5 VCT @ 24A	C	4 1/2	2 1/2	2 7/8	4	—	# 8	3.0
RP12.8- 1	DRP12.8- 1	12.8 VCT @ 1A	6.4 VCT @ 2A	C	2 13/16	1 5/8	1 5/8	2 3/8	—	# 8	.7
RP12.8- 2	DRP12.8- 2	12.8 VCT @ 2A	6.4 VCT @ 4A	C	3 1/4	2	1 15/16	2 13/16	—	# 8	1.1
RP12.8- 4	DRP12.8- 4	12.8 VCT @ 4A	6.4 VCT @ 8A	C	3 11/16	2 1/8	2 1/4	3 1/8	—	# 8	1.7
RP12.8- 6	DRP12.8- 6	12.8 VCT @ 6A	6.4 VCT @ 12A	C	4 1/32	2 1/4	2 5/16	3 5/16	—	# 8	2.3
RP12.8- 8	DRP12.8- 8	12.8 VCT @ 8A	6.4 VCT @ 16A	C	4 1/32	2 1/2	2 5/16	3 5/16	—	# 8	2.8
RP12.8-10	DRP12.8-10	12.8 VCT @ 10A	6.4 VCT @ 20A	C	4 1/2	2 1/2	2 7/8	4	—	# 8	3.0
RP12.8-12	DRP12.8-12	12.8 VCT @ 12A	6.4 VCT @ 24A	B	3 3/4	2 3/4	3 1/8	3 1/8	2 1/4	# 8	4.5
RP16- 1	DRP16- 1	16 VCT @ 1A	8 VCT @ 2A	C	3 1/4	1 3/4	1 15/16	2 13/16	—	# 8	1.0
RP16- 2	DRP16- 2	16 VCT @ 2A	8 VCT @ 4A	C	3 11/16	2	2 1/4	3 1/8	—	# 8	1.5
RP16- 4	DRP16- 4	16 VCT @ 4A	8 VCT @ 8A	C	4 1/32	2 1/4	2 5/16	3 5/16	—	# 8	2.3
RP16- 6	DRP16- 6	16 VCT @ 6A	8 VCT @ 12A	C	4 1/32	2 1/2	2 5/16	3 5/16	—	# 8	2.8
RP16- 8	DRP16- 8	16 VCT @ 8A	8 VCT @ 16A	C	4 1/2	2 1/2	2 7/8	4	—	# 8	3.0
RP16-10	DRP16-10	16 VCT @ 10A	8 VCT @ 20A	B	3 3/4	2 3/4	3 1/8	3 1/8	2 1/4	# 8	4.5
RP16-12	DRP16-12	16 VCT @ 12A	8 VCT @ 24A	B	4 1/8	3	3 5/16	3 5/16	2 3/8	#10	5.5
RP24- 1	DRP24- 1	24 VCT @ 1A	12 VCT @ 2A	C	3 1/4	1 3/4	1 15/16	2 13/16	—	# 8	1.0
RP24- 2	DRP24- 2	24 VCT @ 2A	12 VCT @ 4A	C	3 11/16	2 1/8	2 1/4	3 1/8	—	# 8	1.7
RP24- 4	DRP24- 4	24 VCT @ 4A	12 VCT @ 8A	C	4 1/32	2 1/2	2 5/16	3 5/16	—	# 8	2.8
RP24- 6	DRP24- 6	24 VCT @ 6A	12 VCT @ 12A	B	3 3/4	2 3/4	3 1/8	3 1/8	2 1/4	# 8	4.5
RP24- 8	DRP24- 8	24 VCT @ 8A	12 VCT @ 16A	B	4 1/8	3	3 5/16	3 5/16	2 3/8	#10	5.5
RP24-10	DRP24-10	24 VCT @ 10A	12 VCT @ 20A	B	4 1/2	3 1/4	3 3/4	3 3/4	2 1/2	#10	7.0
RP24-12	DRP24-12	24 VCT @ 12A	12 VCT @ 24A	B	4 1/2	3 1/2	3 3/4	3 3/4	2 3/4	#10	8.7
RP36- 1	DRP36- 1	36 VCT @ 1A	18 VCT @ 2A	C	3 11/16	2	2 1/4	3 1/8	—	# 8	1.5
RP36- 2	DRP36- 2	36 VCT @ 2A	18 VCT @ 4A	C	4 1/32	2 1/4	2 5/16	3 5/16	—	# 8	2.3
RP36- 4	DRP36- 4	36 VCT @ 4A	18 VCT @ 8A	B	3 3/4	2 3/4	3 1/8	3 1/8	2 1/4	# 8	4.5
RP36- 6	DRP36- 6	36 VCT @ 6A	18 VCT @ 12A	B	4 1/8	3	3 5/16	3 5/16	2 3/8	#10	5.5
RP36- 8	DRP36- 8	36 VCT @ 8A	18 VCT @ 16A	B	4 1/2	3 1/2	3 3/4	3 3/4	2 3/4	#10	8.7
RP36-10	DRP36-10	36 VCT @ 10A	18 VCT @ 20A	B	4 1/2	3 3/4	3 3/4	3 3/4	3	#10	9.4
RP36-12	DRP36-12	36 VCT @ 12A	18 VCT @ 24A	B	5 1/4	4	4 3/8	4 3/8	2 7/8	1/4	12.3
RP56- 1	DRP56- 1	56 VCT @ 1A	28 VCT @ 2A	C	3 11/16	2 1/8	2 1/4	3 1/8	—	# 8	1.7
RP56- 2	DRP56- 2	56 VCT @ 2A	28 VCT @ 4A	C	4 1/2	2 1/2	2 7/8	4	—	# 8	3.0
RP56- 4	DRP56- 4	56 VCT @ 4A	28 VCT @ 8A	B	4 1/8	3	3 5/16	3 5/16	2 3/8	#10	5.5
RP56- 6	DRP56- 6	56 VCT @ 6A	28 VCT @ 12A	B	4 1/2	3 3/4	3 3/4	3 3/4	3	#10	9.4
RP56- 8	DRP56- 8	56 VCT @ 8A	28 VCT @ 16A	B	5 1/4	4	4 3/8	4 3/8	2 7/8	1/4	12.3
RP56-10	DRP56-10	56 VCT @ 10A	28 VCT @ 20A	B	5 1/4	4 1/4	4 3/8	4 3/8	3 1/8	1/4	13.4
RP56-12	DRP56-12	56 VCT @ 12A	28 VCT @ 24A	B	5 1/4	4 3/4	4 3/8	4 3/8	3 5/8	1/4	15.8
RP68- 1	DRP68- 1	68 VCT @ 1A	34 VCT @ 2A	C	4 1/32	2 1/4	2 5/16	3 5/16	—	# 8	2.3
RP68- 2	DRP68- 2	68 VCT @ 2A	34 VCT @ 4A	B	3 3/4	2 3/4	3 1/8	3 1/8	2 1/4	# 8	4.5
RP68- 4	DRP68- 4	68 VCT @ 4A	34 VCT @ 8A	B	4 1/2	3 1/2	3 3/4	3 3/4	2 3/4	#10	8.7
RP68- 6	DRP68- 6	68 VCT @ 6A	34 VCT @ 12A	B	5 1/4	4	4 3/8	4 3/8	2 7/8	1/4	12.3
RP68- 8	DRP68- 8	68 VCT @ 8A	34 VCT @ 16A	B	5 1/4	4 1/4	4 3/8	4 3/8	3 1/8	1/4	13.4
RP68-10	DRP68-10	68 VCT @ 10A	34 VCT @ 20A	B	5 1/4	4 3/4	4 3/8	4 3/8	3 5/8	1/4	15.8
RP68-12	DRP68-12	68 VCT @ 12A	34 VCT @ 24A	B	6 3/8	5 1/4	5 5/16	5 5/16	3 1/4	1/4	21.0
RP80- 1	DRP80- 1	80 VCT @ 1A	40 VCT @ 2A	C	4 1/32	2 1/4	2 5/16	3 5/16	—	# 8	2.3
RP80- 2	DRP80- 2	80 VCT @ 2A	40 VCT @ 4A	B	3 3/4	2 3/4	3 1/8	3 1/8	2 1/4	# 8	4.5
RP80- 4	DRP80- 4	80 VCT @ 4A	40 VCT @ 8A	B	4 1/2	3 3/4	3 3/4	3 3/4	3	#10	9.4
RP80- 6	DRP80- 6	80 VCT @ 6A	40 VCT @ 12A	B	5 1/4	4	4 3/8	4 3/8	2 7/8	1/4	12.3
RP80- 8	DRP80- 8	80 VCT @ 8A	40 VCT @ 16A	B	5 1/4	4 3/4	4 3/8	4 3/8	3 5/8	1/4	15.8
RP80-10	DRP80-10	80 VCT @ 10A	40 VCT @ 20A	B	6 3/8	5 1/4	5 5/16	5 5/16	3 1/4	1/4	21.0
RP80-12	DRP80-12	80 VCT @ 12A	40 VCT @ 24A	B	6 3/8	5 1/4	5 5/16	5 5/16	3 1/4	1/4	21.0

SCHEMATIC



MTG. STYLE





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64D NANCY ST. / WEST BABYLON, NY 11704 / (516) 491-3300 / FAX 516-491-3689

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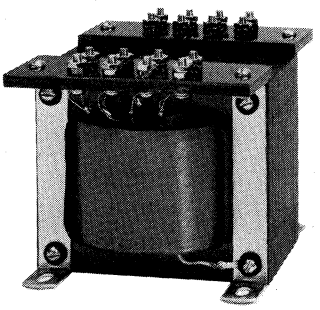
ISOLATION POWER TRANSFORMERS STEP-UP/STEP-DOWN VARIABLE VOLTAGE RATINGS

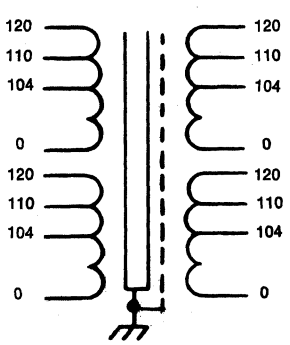
- The IPS Series features (4) identical windings; (2) primaries and (2) secondaries; each rated at 0/104/110/120 volts allowing for rating combinations of 104V, 110V, 120V, 208V, 214V, 220V, and 240V with primary and secondary isolated from each other. Step-down of 440V to 220V or step-up of 220V to 440V can be achieved by inter-connecting primaries and secondaries in an Auto-Transformer configuration. This eliminates isolation but a doubling of the power rating can be realized.
- The DIPS series is similar to the IPS series except the dual secondaries are each rated 0/208/220/240 volts.
- 50 Hz to 500 Hz operating frequency range.
- Electrostatically shielded with shield grounded to the core. This connection can be opened for floating shield.
- ¼ inch thick phenolic terminal boards with nickel plated brass hardware (#10-32 on 250 VA and 500 VA; ¼-20 on 1000 VA and 2000 VA). Voltage rating can be varied with easy to make interconnections.
- Completely varnish impregnated and ruggedly constructed with prime raw materials.
- Well insulated and designed to withstand 2500 VRMS hipot.
- 55°C temperature rise above ambient



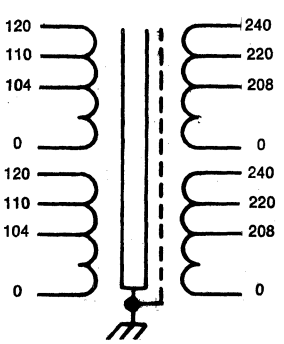
Part No.	Power Volt-Amps	Secondary Ratings				Mechanical Dimensions					Mtg. & Term. Screw	Approx. Wt. (lbs.)
		Series Volts	Max. Amps	Parallel Volts	Max. Amps	L	W	H	ML	MW		
IPS-250	250	0/208/220/240	1.1	0/104/110/120	2.2	5 5/16	4 1/4	5 1/4	4 3/8	2 1/2	#10	12
IPS-500	500	0/208/220/240	2.3	0/104/110/120	4.6	5 5/16	5 5/16	5 1/4	4 3/8	3 5/8	#10	18
IPS-1000	1000	0/208/220/240	4.5	0/104/110/120	9.0	7 7/16	7	7 3/8	6 3/4	3 1/8	¼	33
IPS-2000	2000	0/208/220/240	9.0	0/104/110/120	18.0	7 7/16	9	7 3/8	6 3/4	5 1/8	¼	56
DIPS-250	250	0/416/440/480	0.55	0/208/220/240	1.1	5 5/16	4 1/4	5 1/4	4 3/8	2 1/2	#10	12
DIPS-500	500	0/416/440/480	1.15	0/208/220/240	2.3	5 5/16	5 5/16	5 1/4	4 3/8	3 5/8	#10	18
DIPS-1000	1000	0/416/440/480	2.25	0/208/220/240	4.5	7 7/16	7	7 3/8	6 3/4	3 1/8	¼	33
DIPS-2000	2000	0/416/440/480	4.50	0/208/220/240	9.0	7 7/16	9	7 3/8	6 3/4	5 1/8	¼	56

SCHEMATIC DIAGRAMS

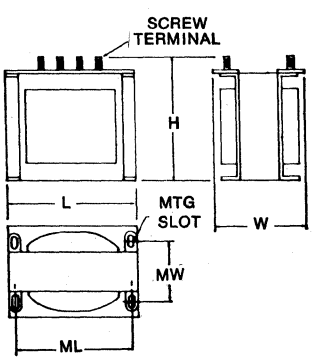
IPS SCHEMATIC



DIPS SCHEMATIC



MECHANICAL OUTLINE



PTC TRANSFORMER CORP.
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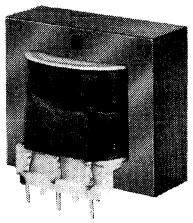
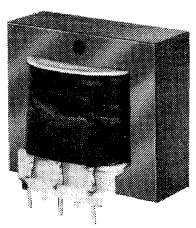
PLUG-IN PRINTED CIRCUIT AUDIO TRANSFORMERS



Designed for Input, Interstage, Output and Isolation Circuits. ±2db 200 Hz-15,000 Hz Frequency Response and 20dbm Power Rating for Entire Series.

P/N	PRI Z	Sec Z	Idc	Schematic
APC1-1	600Ω	600Ω	8mA	1
APC1-2	600Ω C.T.	600Ω C.T.	16mA	2
APC1-3	600Ω	8000/2000Ω Split	8mA	4
APC1-4	2500Ω	600Ω	4mA	1
APC1-5	2500Ω C.T.	600Ω C.T.	8mA	2
APC1-6	2500Ω C.T.	2500Ω C.T.	8mA	2
APC1-7	4000Ω	600Ω/150Ω Split	3mA	4
APC1-8	4000Ω C.T.	600Ω C.T.	6mA	2
APC1-9	4000Ω C.T.	1200Ω C.T.	6mA	2

PLUG-IN PRINTED CIRCUIT TELEPHONE COUPLING TRANSFORMERS

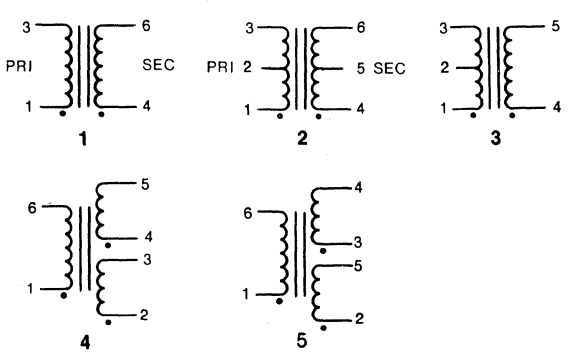


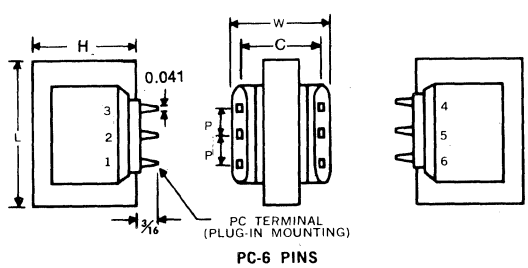
Designed for Interconnection of Voice/Data Modem Terminals to Telephone Lines.

- Frequency response ±0.5dB 300Hz-3500Hz
- Power level −45dbm to +7dbm
- Longitudinal balance — per FCC Part 68
- Distortion — 0.5% max.
- Impedance matching ±10% over frequency range
- Return loss — 26dB min.

P/N	PRI Z	Sec Z	Application	Schematic
TPC1-1	600Ω	600Ω	Coupling	1
TPC1-2	600Ω C.T.	600Ω C.T.	Coupling	2
TPC1-3	600Ω	900Ω	Coupling	1
TPC1-4	900Ω	900Ω	Coupling	1
TPC1-5	900Ω/600Ω	600Ω	Coupling	3
TPC1-6	4000Ω	600Ω	Bridging	1
TPC1-7	600Ω (4W)	600Ω/600Ω	Hybrid (2) Req'd	5

APC & TPC SCHEMATICS AND MECHANICAL LAYOUT



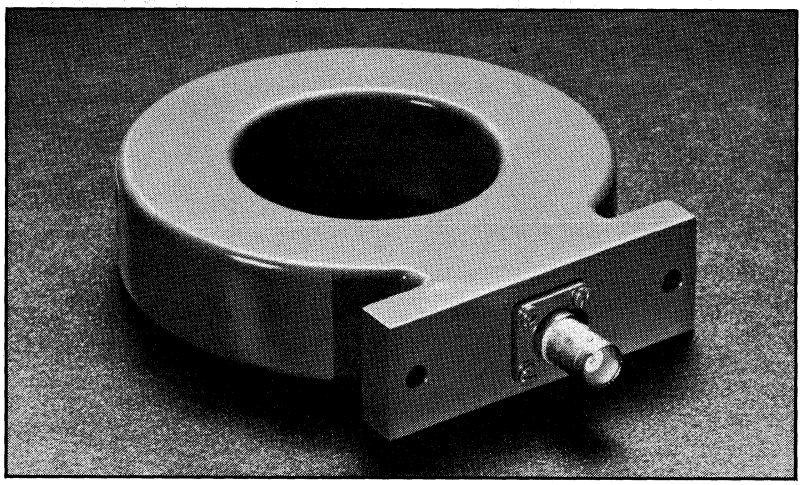


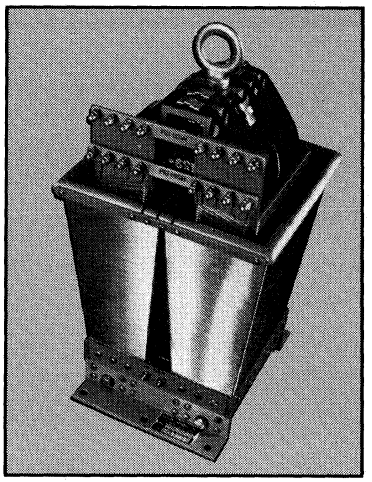
PC-6 PINS

L	W	H	P	C	Wt. (oz.)
13/16	19/32	3/4	.187	.420	.5

Other ratings and configurations are available on special order for your custom requirements.

PEARSON ELECTRONICS, INC.





Wide Band, Precision Current Monitor Transformers

With a Pearson current monitor and an oscilloscope, you can measure pulse or ac currents from milliamperes to kiloamperes, in any conductor or beam of charged particles, at any voltage level up to a million volts, at frequencies up to 200 MHz or down to below 1 Hz.

The monitor is physically isolated from the circuit. It is a current transformer capable of highly precise measurement of pulse amplitude and waveshape. The one shown above, for example, offers pulse-amplitude accuracy of + 1%, − 0% (typical of all Pearson current monitors), 20 nanosecond rise time, and droop of only 0.8% per millisecond. Three db bandwidth is 1 Hz to 20 MHz. Whether you wish to measure current in a conductor, an electron device or a particle accelerator, it is likely that one of our off-the-shelf models (ranging from ¼" to 10¾" ID) will do the job. In addition to our standard models, we build many custom designed current transformers to meet special needs and applications.

Very High Voltage & Very High Current Pulse Transformers

Pearson Electronics specializes in the development, design and manufacture of high and super high voltage pulse transformers. Typical of the applications for which we have designed and manufactured pulse transformers are units for supplying beam power to high power microwave tubes such as klystrons and traveling wave tubes, units providing pulse voltage to particle accelerator injection systems, pulsed x-ray tubes and high power lasers.

Pearson Current Monitor Transformers

Model Number	Output † (volts/amp.)	Hole Dia. (inches)	Maximum Peak Curr. (amps)	Maximum RMS Curr. (amps)	Droop (%/microsec.)	Useable Rise Time (nanosec.)	IT Max. (amp-sec.)	Approx. Low Freq. 3db pt. (Hz)	I/f (peak amps/ Hz)	Connector
2877	1.0	0.25	100	2.5	0.2	2	0.0004**	300	0.0024	SMA
4100	1.0	0.5	500	5	0.09	10	0.002**	140	0.006	UG-290A/U
2100	1.0	2	500	7.5	0.08	20	0.005**	125	0.017	UG-290A/U
3100	1.0	3.5	500	12	0.04	50	0.03**	40	0.1	SO-239
150	0.5	2	1,000	15	0.02	20	0.02**	40	0.07	UG-290A/U
325	0.25	3.5	2,000	60	0.1	30	0.09	160	0.06	SO-239
2878	0.1	0.25	400	10	0.02	5	0.004**	30	0.025	SMA
410	0.1	0.5	5,000	50	0.06	20	0.25	120	1.7	UG-290A/U
411	0.1	0.5	5,000	50	0.0009	20	0.2**	1	0.6	UG-290A/U
110	0.1	2	5,000	65	0.0008	20	0.5**	1	1.5	UG-290A/U
110A	0.1	2	10,000	65	0.0008	20	0.5**	1	1.5	UG-568/U
310*	0.1	3.5	5,000	140	0.02	40	0.6	40	3.6	SO-239
1010*	0.1	10.75	5,000	120	0.25	50	0.7	400	4.4	SO-239
1025	0.025	2	20,000	100	0.1	100	0.5	160	3.0	UG-290A/U
3025*	0.025	3.5	20,000	325	0.004	100	3.0	7	20	SO-239
2879	0.01	0.25	2,000	25	0.002	20	0.04**	3	0.25	SMA
101	0.01	2	50,000	200	0.0001	100	2.5**	0.25	12	UG-290A/U
301X*	0.01	3.5	50,000	400	0.003	200	22.	5	140.0	SO-239

† Initial pulse response with one megohm in parallel with 20 pF load impedance. A 50 ohm termination will cut the output in half.
* Double shielded **May need small bias current through secondary for maximum rating.

Contact us and we will send you engineering data.

PEARSON ELECTRONICS, INC.
1860 Embarcadero Road, Palo Alto, California 94303 U.S.A. • Telephone (415) 494-6444 • Telex 171-412 • FAX (415) 494-6716

PERKIN-ELMER

PRECISION TOROIDAL TRANSFORMERS

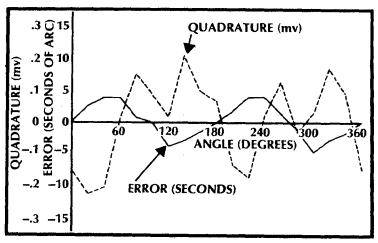
- INPUT SCOTT T
- REFERENCE ISOLATION
- OUTPUT SCOTT T
- DIGITALLY TAPPED
- COMBINATION
- PRECISION RATIO
- RESOLVER ISOLATION
- CUSTOM DESIGNS

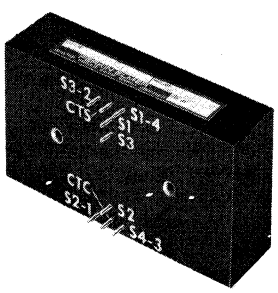
The Electronic Products Department of the Perkin-Elmer Corporation is in a unique position to provide Custom Precision Signal Transformers as a result of 20 years of experience designing and manufacturing very special transformers for the Vernistat® a.c. potentiometer and allied products. **High Performance in small size has always been a successful objective.** Our State of The Art Winding Equipment and Techniques enable close control of turns and taps for close matching of windings and repeatibility of product.

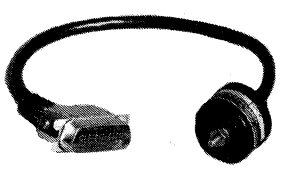
Perkin-Elmer can provide Custom Signal Transformers with high accuracies over the full MIL temperature range. For example, exponential function units with 80 taps to an accuracy of ±0.003% can be provided. SCOTT T Transformers have been built to an accuracy of 5 seconds of arc with a null of 0.1 millivolt. The transformers are fully encapsulated toroidal units and are available with contact pins for PC board mounting. They are manufactured in accordance with MIL-T-27C Grade 5. High input impedance and low output impedance can be matched to specifications. Operating frequency can also be per specifications.

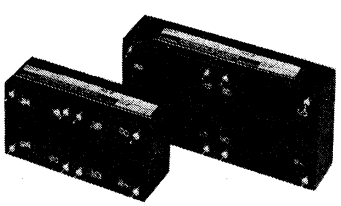
SCOTT T TRANSFORMERS

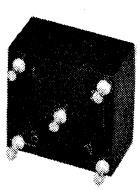
The SCOTT T input transformers converts 3 wire synchro inputs to 4 wire resolver outputs (sin θ and cos θ) with high transformation accuracy and minimum quadrature. SCOTT T Transformers for converting 4 wire resolver inputs to 3 wire synchro outputs can also be supplied. Our output SCOTT T Transformers maintain high accuracies even under heavy load conditions. These units are useful in solid state synchro to digital and digital to synchro converter applications and are particularly applicable in multiplexed conversion systems.











INPUT SCOTT T TRANSFORMERS (SYNCHRO TO RESOLVER)

Input V rms L-L	Output V rms	Load K Ω	Trans. Accuracy Arc. Sec.	Output Quadrature Null mV	Z in K Ω	Z out Ω	Dimensions L x W x H	Mount	Part Number
11.8	2.5	25	45	1.0	40	8	2x1x.625	PC 2x6-32	403-2187
	5.0	20	30	1.0	50	75	2x1x.6	PC 2x4-40	403-2064
	7.2 CT	10 to CT	60	1.0	20	10 to CT	2x1x.6	PC 2x4-40	403-2065
	10.2	10	60	2.0	50	50	2x1x.6	PC 2-4-40	403-2066
12	7.5	10	15	1.0	50	75	2x1x.6	PC 2x4-40	403-2055
90	1.1	10	15	0.03	300	1	2x1x1.1	PC 2x4-40	403-2078
	4.25	10	30	1.0	1000	11	2.5x1.25x.65	PC 2x4-40	403-2034
	4.25 CT	10	30	1.0	1000	11	2.78x1.41x.8	PC 2x4-40	403-2033
	17.8 CT	2.3 to CT	30	.7	100	12 to CT	2.78x1.41x.8	PC 2x4-40	403-2019
	26.0 CT	10 to CT	30	1.4	100	15 to CT	2.78x1.41x.8	PC 2x4-40	403-2051
90 (60 Hz)	14 CT	100 to CT	360	12.0	45	15 to CT	4x2.25x1.15	2x6-32	403-2058
96	14.4 CT	10 to CT	15	.25	200	12 to CT	2.78x1.41x.8	PC 2x4-40	403-2067
			45	.75	200	12 to CT	2.78x1.41x.8	PC 2x4-40	403-2068
			180	5.0	30	12 to CT	2.78x1.41x.8	PC 2x4-40	403-2069
	20 CT	10 to CT	15	.25	200	10 to CT	2.78x1.41x.8	PC 2x4-40	403-2007

COMBINATION INPUT SCOTT T TRANSFORMERS

11.8 2 channel	5.0	20	30	1.0	50	45	2x1x.8	PC 2x4-40	403-2042
11.8 3 channel	3.2	300	45	.5	50	20	2.94x1.06x.8	PC 2x4-40	403-2048

COMBINATION SCOTT T / RESOLVER ISOLATION

Scott T 11.8	6.0	20	30	1.0	35	20	2x1x.6	PC 2x4-40	403-2070
OR									
Resolver 26	6.0	20	30	1.0	300	20			

OUTPUT SCOTT T TRANSFORMERS (RESOLVER TO SYNCHRO)

Output V rms	Input V rms L-L	Load Ω L-L	Trans. Accuracy Arc. Min.	Output Quadrature Null mV	Z in K Ω	Z out Ω	Dimensions L x W x H	Mount	Part Number
11.8	4.7	150	1	15	.25	7	2.78x1.41x.8	PC 2x4-40	403-2027
	6	150	2	8	.5	8	2.78x1.41x.61	PC 2x4-40	403-2071
	5 F.B. 2.5	100	3	8	.35	8	2.78x1.41x.61	PC 2x4-40	403-2075
	11.8 F.B. 6 CT	25	6	12	.8	2	2.78x1.41x.61	PC 2x4-40	403-2056
90	7	6000	1.5	50	3.0	600	2x1x1.1	PC 2x4-40	403-2077
	F.B. 2.8	6000	1.5	80	3.0	500	2.3x1.3x1	PC 4x4-40	403-2176

F.B. = Feedback winding.

RESOLVER ISOLATION TRANSFORMERS

Output V rms L-L	Input V rms L-L	Load K Ω L-L	Trans. Accuracy Arc. Sec.	Output Quadrature Null mV	Z in K Ω	Z out Ω	Dimensions L x W x H	Mount	Part Number
7	7 (5 KHz)	10	.5	2	50	25	2x1x.6	PC 2x4-40	403-2072
9 CT	11.8	25 to CT	.3	1	80	50 to CT	1.63x.81x.5	PC	403-2063
11.1	6	.4	2	36	6	14	2.5x1.25x.65	PC 2x4-40	403-2003
26	6	6	3	36	.2	10	2.78x1.41x.61	PC 2x4-40	403-2073

PRECISION REFERENCE ISOLATION TRANSFORMERS

Output V rms	Input V rms	Load K Ω	Trans. Accuracy %	Output Quadrature Null mV	Z in K Ω	Z out Ω	Dimensions L x W x H	Mount	Part Number
3	115	90	.05	2.5	40	.7	1.5x1.5x.75	PC 1x6-32	403-2061
	26			5	4.5				
	115	10	.1	1.3	180	2.75	.814x.814x.5	PC	403-2166
5	26	.4	.1	1	100	5.5	1x1x.58	PC	403-2026
		20	2	6	100	30	.813x.813x.5	PC	403-2189
6	26	10	.01	2.5	70	15	1x1x.58	PC	403-2040
			.02	2.5	70	15	1x1x.58	PC	403-2041
6 CT	26	45 to CT	.1	1.5	100	4 to CT	1.25x1.25x.5	PC	403-2015
20	20	5	.2	2	50	140	1x1x.5	PC	403-2062
30	7.5	50	.2	200	.5	225	.88x.88x.88	2x2-56	403-2047

Operating Temperature Range −55°C to +125°C.
Frequencies 400 Hz except as otherwise stated.

Manufactured in accordance with MIL-T-27 Grade 5.
Specified transformation accuracies are with stated load.

For information on price, delivery and other standard or custom designed transformers call or write
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Contact us about our **VERNISTAT® a.c. Potentiometers, Adjustable Function Generators and Digital Converters.**

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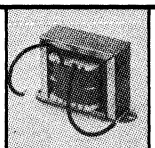
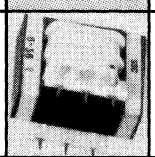
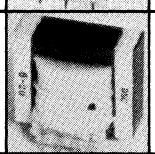
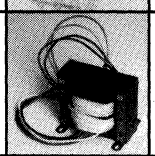
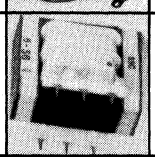
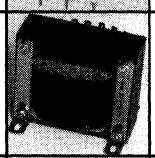
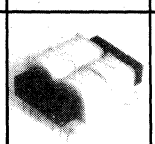
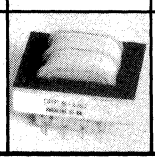
SSA SERIES		Primary Voltages Available 115 & 230 VAC, 50/60 HZ. Single Center Tapped Secondaries. Lead Wires or Lugs-Secondary Voltages Ranging from 4 VCT to 230 VCT. Power Ranging from 2 VA to 50 VA.
SSC SERIES		Printed Circuit Types with Single Primary. Available 115 or 230 VAC, 50/60 HZ, with Single Center Tapped Secondaries. Secondary Voltages from 4 to 230 VAC. Power Available from 0.5 to 20 VA.
CSC SERIES		Printed Circuit Types with Single Primary. Available 115 or 230 VAC, 50/60 HZ with Two Equal Secondaries. Secondary Voltages from 4 to 230 Total Series Volts. Power Available from 2 VA to 20 VA.
DSF SERIES		Lead Wires or Lugs with Dual 115 or 230 VAC Primaries, 50/60 HZ. Two Separate and Equal Secondaries. Total Secondary Volts in Series from 6.3 to 480 VAC. Power Available from 50 VA to 450 VA.
TTC SERIES		Telephone Couplers, Hybrids, and Holding Coils. Printed Circuit Types.
MSH SERIES		Dual Primaries for 115/230 VAC, 50/60 HZ Operation. Voltages from 6.3 to 480 VAC. Power from 50-450 VA. Multiple Secondary Types Including Designs for Microprocessor Supplies and Multiple-Tapped Control Types.
DLP SERIES		Low Profile Printed Circuit Types Dual Primaries for 115/230 VAC, 50/60 HZ Operation. Voltages from 6.3 to 230 VAC. Power from 5-50 VA.
MLP SERIES		Low Profile Printed Circuit Types with Multiple Dual 115 VAC Primaries and Secondary Outputs for Logic and OP AMP Supplies.
DHP SERIES		Printed Circuit Types-Compact Design. Single or Dual 115 VAC Primaries 50/60 HZ. Dual Identical Secondaries 5 to 230 VAC. Power from 5-80 VA.

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PICO Catalog Contents

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	.35" X .32" TRANSFORMERS; 2 OHM TO 40K OHM; 400 Hz TO 100 KHz 400 MILLIWATT AT 1 KHz	A•2324 A•2325
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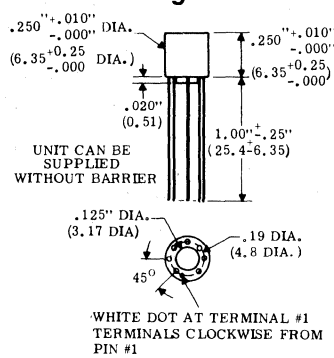
1/4" x 1/4"

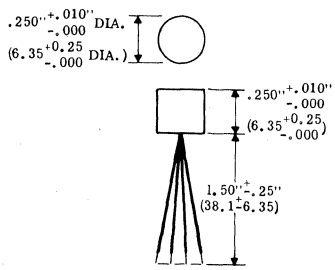
PICO's ultra-miniature transformers

For Surface Mount Versions of this series, see pages A-2322 and A-2323

F SERIES Plug-In



G SERIES Insulated Leads



DIMENSIONS ARE IN INCHES (MM)

PART NUMBER F Series Plug-In	PART NUMBER G Series Insulated Leads	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER MILLIWATTS 1 KHz and higher	POWER MILLIWATTS 400 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	TURNS RATIO PRIM/SEC SEC PAR CONN	PRICES 1-9 *** F-Series	PRICES 1-9 *** G-Series
F-28003	G-29003	10 ct	10 ct	2.5	125	20	11.5	1.1	1.35	.34	1:1	2:1	21.48	20.42
F-28005	G-29005	20 ct	8 ct	2	125	20	8	2.1	1.28	.32	1.58:1	3.16:1	21.48	20.42
F-28010	G-29010	20 ct	20 ct	5	125	20	8	2.1	2.56	.64	1:1	2:1	21.48	20.42
F-28015	G-29015	32 ct	32 ct	8	125	20	6.5	3.52	4.32	1.08	1:1	2:1	21.48	20.42
F-28020	G-29020	40 ct	40 ct	10	125	20	5.6	4	4.77	1.19	1:1	2:1	21.31	20.42
F-28025	G-29025	48 ct	16 ct	4	125	20	5.2	4.3	2.3	.58	1.73:1	3.46:1	19.52	18.59
F-28030	G-29030	50 ct	50 ct	12.5	125	20	5	5.5	6.6	1.65	1:1	2:1	19.52	18.59
F-28035	G-29035	80 ct	32 ct	8	125	20	4	8.5	4.25	1.06	1.58:1	3.16:1	21.31	18.59
F-28040	G-29040	100 ct	40 ct	10	125	20	3.6	12.1	4.85	1.21	1.58:1	3.16:1	21.31	18.59
F-28045	G-29045	100 ct	100 ct	25	125	20	3.6	12.1	12	3	1:1	2:1	19.52	18.59
F-28050	G-29050	120 ct	12.8 ct	3.2	125	20	3.3	13.2	1.6	.4	3.06:1	6.12:1	19.52	18.59
F-28055	G-29055	120 ct	60 ct	15	125	20	3.3	13.2	7.3	1.83	1.41:1	2.83:1	23.34	18.59
F-28060	G-29060	120 ct	120 ct	30	125	20	3.3	13.2	16	4	1:1	2:1	23.34	22.15
F-28065	G-29065	150 ct	12 ct	3	125	20	3	15	1.56	.39	3.54:1	7.07:1	22.59	20.19
F-28070	G-29070	150 ct	50 ct	12.5	125	20	3	15	6.6	1.65	1.73:1	3.46:1	23.34	20.19
F-28075	G-29075	150 ct	100 ct	25	125	20	3	15	14.5	3.63	1.22:1	2.45:1	23.34	22.15
F-28080	G-29080	150 ct	150 ct	37.5	125	20	3	15	18.3	4.58	1:1	2:1	23.34	22.15
F-28085	G-29085	150 ct	600 ct	150	125	20	3	15	72	18	1:2	1:1	23.34	22.15
F-28090	G-29090	200 ct	200 ct	50	125	20	2.5	22	26.8	6.7	1:1	2:1	23.34	22.15
F-28095	G-29095	300 ct	12 ct	3	125	20	2	33	1.56	.39	5:1	10:1	23.34	22.15
F-28100	G-29100	300 ct	50 ct	12.5	125	20	2	33	6.6	1.65	2.45:1	4.9:1	23.34	22.15
F-28105	G-29105	300 ct	150 ct	37.5	125	20	2	33	18.3	4.58	1.41:1	2.83:1	23.34	22.15
F-28110	G-29110	300 ct	300 ct	75	125	20	2	33	40.3	10.08	1:1	2:1	23.34	22.15
F-28115	G-29115	300 ct	600 ct	150	125	20	2	33	72	18	1:1.41	1.41:1	21.21	20.19
F-28120	G-29120	320 ct	12.8ct	3.2	125	20	2	34	1.6	0.4	5:1	10:1	25.03	23.77
F-28125	G-29125	400 ct	40 ct	10	125	20	1.8	49	4.7	1.18	3.16:1	6.32:1	25.03	23.77
F-28130	G-29130	400 ct	120 ct	30	125	20	1.8	49	16.3	4.08	1.83:1	3.65:1	25.03	23.77
F-28135	G-29135	400 ct	200 ct	50	125	20	1.8	49	27.3	6.83	1.41:1	2.83:1	25.03	23.77
F-28140	G-29140	400 ct	400 ct	100	125	20	1.8	49	49	12.25	1:1	2:1	22.75	21.65
F-28145	G-29145	400 ct	1000 ct	250	125	20	1.8	49	120	30	1:1.58	1.26:1	25.03	23.77
F-28150	G-29150	400 ct	2000 ct	500	125	20	1.8	49	270	67.5	1:2.24	1:1.12	25.03	23.77
F-28155	G-29155	400 ct	4000 ct	1000	125	20	1.8	49	476	119	1:3.16	1:1.58	25.03	23.77
F-28160	G-29160	500 ct	12.8ct	3.2	125	20	1.6	54	1.6	0.4	6.25:1	12.5:1	22.75	21.65
F-28165	G-29165	500 ct	16 ct	4	125	20	1.6	54	2.3	0.58	5.6:1	11.2:1	22.75	21.65
F-28170	G-29170	500 ct	50 ct	12.5	125	20	1.6	54	6.6	1.65	3.16:1	6.32:1	22.75	21.65
F-28175	G-29175	500 ct	150 ct	37.5	125	20	1.6	54	18.3	4.58	1.83:1	3.65:1	22.75	21.65
F-28180	G-29180	500 ct	500 ct	125	125	20	1.6	54	65	16.3	1:1	2:1	25.03	23.77
F-28185	G-29185	*500 ct	500 ct	-	125	20	1.6	54	65	-	1:1	-	25.03	23.77
F-28190	G-29190	500 ct	600 ct	150	125	20	1.6	54	72	18	1:1.1	1.83:1	25.03	23.77
F-28195	G-29195	600 ct	12.8 ct	3.2	125	20	1.5	59	1.6	0.4	6.85:1	13.7:1	25.03	23.77
F-28200	G-29200	600 ct	30 ct	7.5	125	20	1.5	59	4.1	1.03	4.47:1	8.94:1	22.75	21.65
F-28205	G-29205	600 ct	48 ct	12	125	20	1.5	59	5.2	1.3	3.54:1	7.07:1	22.75	21.65
F-28210	G-29210	600 ct	200 ct	50	125	20	1.5	59	26.5	6.63	1.73:1	3.46:1	22.75	21.65
F-28215	G-29215	600 ct	600 ct	150	125	20	1.5	59	72	18	1:1	2:1	22.75	21.65
F-28220	G-29220	*600 ct	600 ct	-	125	20	1.5	59	72	-	1:1	-	25.03	23.77
F-28225	G-29225	600 ct	1200 ct	300	125	20	1.5	59	160	40	1:1.41	1.41:1	22.75	21.65
F-28230	G-29230	640 ct	12.8 ct	3.2	125	20	1.5	62	1.6	0.4	7.07:1	14.14:1	22.75	21.65
F-28235	G-29235	700 ct	100 ct	25	125	20	1.35	65	12	3	2.65:1	5.29:1	22.75	21.65
F-28240	G-29240	800 ct	12.8 ct	3.2	125	20	1.3	88	16	4	7.9:1	15.8:1	25.03	23.77
F-28245	G-29245	800 ct	48 ct	12	125	20	1.3	88	6.7	1.68	4.08:1	8.16:1	23.34	22.22
F-28250	G-29250	800 ct	800 ct	200	125	20	1.3	88	106	26.5	1:1	2:1	23.34	22.22
F-28255	G-29255	900 ct	600 ct	150	125	20	1.2	93	74	18.5	1.22:1	2.45:1	23.34	22.22
F-28260	G-29260	1000 ct	12 ct	3	125	20	1.2	120	1.55	0.39	9.13:1	18.3:1	25.69	24.39
F-28265	G-29265	1000 ct	50 ct	12.5	125	20	1.2	120	6.6	1.65	4.47:1	8.94:1	25.69	24.39
F-28270	G-29270	1000 ct	1000 ct	250	125	20	1.2	120	120	30	1:1	2:1	23.34	22.22
F-28275	G-29275	1060 ct	12.8 ct	3.2	125	20	1.2	125	1.6	0.4	9.1:1	18.2:1	25.69	24.39
F-28280	G-29280	1200 ct	12.8 ct	3.2	125	20	1	133	1.6	0.4	9.68:1	19.4:1	25.69	24.39
F-28285	G-29285	1200 ct	500 ct	125	125	20	1	133	65	16.25	1.55:1	3.1:1	25.69	24.39
F-28290	G-29290	1200 ct	1200 ct	300	125	20	1	133	160	40	1:1	2:1	25.69	24.39
F-28295	G-29295	*1200 ct	1200 ct	-	125	20	1	133	160	-	1:1	-	25.69	24.39
F-28300	G-29300	1500 ct	12 ct	3	125	20	1	180	1.55	0.39	11.2:1	22.4:1	25.69	24.39
F-28305	G-29305	1500 ct	500 ct	125	125	20	1	180	65	16.3	1.73:1	3.46:1	23.34	22.22
F-28310	G-29310	*1500 ct	600 ct	-	125	20	1	180	73	-	1.58:1	-	23.34	22.22
F-28315	G-29315	*1500 ct	1500 ct	-	125	20	1	180	215	-	1:1	-	25.69	24.39
F-28320	G-29320	1600 ct	12.8 ct	3.2	125	20	1	190	1.6	0.4	11.2:1	22.4:1	25.69	24.39
F-28325	G-29325	2000 ct	8 ct	2	125	20	0.8	218	1	.25	15.8:1	31.6:1	25.69	24.39
F-28330	G-29330	2000 ct	2000 ct	500	125	20	0.8	218	260	65	1:1	2:1	25.69	24.39
F-28335	G-29335	*2000 ct	2000 ct	-	125	20	0.8	218	260	-	1:1	-	25.69	24.39
F-28340	G-29340	2000 ct	8000 ct	2000	125	20	0.8	218	830	207.5	1:2	1:1	25.03	23.82

*INCLUDES ELECTROSTATIC SHIELD

*** **Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%**
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

SPECIFICATIONS

- **MIL-T-27:** All Units Meet MIL-T-27, Military Designation is TF5R21ZZ for Transformers, TF5R20ZZ for Inductors.
- **FREQUENCY RESPONSE:** ±3dB, 400 Hz-250 KHz at 1.0 Milliwatt.
- **MAXIMUM DISTORTION:** 5% With Rated Power Level at 1 KHz and 400 Hz.
- **DIELECTRIC STRENGTH:** All Units Tested at 200 V RMS.
- **INSULATION RESISTANCE:** Greater Than 10,000 Megohms at 300 V DC.
- **WEIGHT:** 1.1 Grams.
- **OPERATING TEMPERATURE:** -55°c to +105°c (All Units Can Be Supplied to Class S Requirements, +130°c).
- **TERMINALS:** Solid .012 Diameter Conductor. Conductor is copper clad steel, Tinned 100%. Electroplated Per MIL-T-10727A and ASTM CCS B452.
- **THERMAL SHOCK:** 25 Cycles, Method 107D, MIL-STD-202E, Test Condition A-1.

*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

Delivery—stock to one week

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • 914-699-5514 • TWX 7105620113

PART NUMBER F Series Plug-In	PART NUMBER G Series Insulated Leads	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER MILLIWATTS 1 KHz and higher	POWER MILLIWATTS 400 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	TURNS RATIO PRIM/SEC SEC PAR CONN	PRICES 1-9 *** F-Series	PRICES 1-9 *** G-Series
F-28345	G-29345	2500 ct	2500 ct	625	125	20	0.75	280	280	70	1:1	2:1	25.03	23.82
F-28350	G-29350	3000 ct	3000 ct	725	125	20	0.65	330	330	82.5	1:1	2:1	25.03	23.82
F-28355	G-29355	*3000 ct	3000 ct	-	125	20	0.65	330	330	-	1:1	-	25.69	24.39
F-28360	G-29360	3600 ct	3600 ct	900	125	20	0.6	370	450	112.5	1:1	2:1	25.03	23.82
F-28365	G-29365	4000 ct	16 ct	4	125	20	0.57	400	2.3	0.58	15.8:1	31.6:1	25.03	23.82
F-28370	G-29370	4000 ct	600 ct	150	125	20	0.57	400	73	18.25	2.58:1	5.16:1	25.03	23.82
F-28375	G-29375	4000 ct	1000 ct	250	125	20	0.57	400	120	30	2:1	4:1	25.03	23.82
F-28380	G-29380	*4000 ct	8000 ct	-	125	20	0.57	400	1070	-	1:1.41	-	27.53	26.15
F-28385	G-29385	5000 ct	500 ct	125	125	20	0.5	540	65	16.25	3.16:1	6.32:1	25.03	23.82
F-28390	G-29390	5000 ct	5000 ct	1250	125	20	0.5	540	650	162.5	1:1	2:1	27.53	26.15
F-28395	G-29395	7500 ct	50 ct	12.5	125	20	0.5	835	6.6	1.65	12.2:1	24.5:1	27.53	26.15
F-28400	G-29400	7500 ct	100 ct	25	125	20	0.4	835	12	3	8.66:1	17.3:1	25.61	24.40
F-28405	G-29405	7500 ct	600 ct	150	125	20	0.4	835	72	18	3.54:1	7.07:1	25.61	24.40
F-28410	G-29410	7500 ct	2500 ct	625	125	20	0.4	835	280	70	1.73:1	3.46:1	25.61	24.40
F-28415	G-29415	*7500 ct	7500 ct	-	125	20	0.4	835	1020	-	1:1	-	25.61	24.40
F-28420	G-29420	8000 ct	12.8 ct	3.2	125	20	0.4	865	1.6	0.4	25:1	50:1	27.53	26.15
F-28425	G-29425	8000 ct	1000 ct	250	125	20	0.4	865	120	30	2.83:1	5.66:1	27.53	26.15
F-28430	G-29430	*8000 ct	1200 ct	-	125	20	0.4	865	160	-	2.58:1	-	27.53	26.15
F-28435	G-29435	*9000 ct	9000 ct	-	125	20	0.4	1160	1160	-	1:1	-	27.53	26.15
F-28440	G-29440	10,000 ct	12.8 ct	3.2	125	20	0.36	1200	1.6	0.4	28:1	56:1	27.53	26.15
F-28445	G-29445	10,000 ct	16 ct	4	125	20	0.36	1200	1.77	0.44	25:1	50:1	25.61	24.40
F-28450	G-29450	10,000 ct	100 ct	25	125	20	0.36	1200	12	3	10:1	20:1	25.61	24.40
F-28455	G-29455	10,000 ct	200 ct	50	125	20	0.36	1200	27	6.75	7.07:1	14.14:1	25.61	24.40
F-28460	G-29460	10,000 ct	500 ct	125	125	20	0.36	1200	65	16.25	4.47:1	8.94:1	25.61	24.40
F-28465	G-29465	10,000 ct	600 ct	150	125	20	0.36	1200	72	18	4.08:1	8.16:1	25.61	24.40
F-28470	G-29470	10,000 ct	1000 ct	250	125	20	0.36	1200	120	30	3.16:1	6.32:1	25.61	24.40
F-28475	G-29475	10,000 ct	1200 ct	300	125	20	0.36	1200	160	40	2.88:1	5.77:1	25.61	24.40
F-28480	G-29480	10,000 ct	1500 ct	375	125	20	0.36	1200	215	53.8	2.58:1	5.16:1	25.69	26.15
F-28485	G-29485	10,000 ct	2000 ct	500	125	20	0.36	1200	260	65	2.24:1	4.47:1	25.69	24.40
F-28490	G-29490	10,000 ct	5000 ct	1250	125	20	0.36	1200	650	162.5	1.41:1	2.83:1	25.69	24.40
F-28495	G-29495	10,000 ct	7500 ct	1875	125	20	0.36	1200	1020	255	1.15:1	2.3:1	25.69	24.40
F-28500	G-29500	10,000 ct	10,000 ct	2500	125	20	0.36	1200	1200	300	1:1	2:1	23.34	22.22
F-28505	G-29505	*10,000 ct	10,000 ct	-	125	20	0.36	1200	1440	-	1:1	-	27.53	26.15
F-28510	G-29510	15,000 ct	400 ct	100	100	15	0.35	1420	43	10.75	6.12:1	12.24:1	25.69	24.40
F-28515	G-29515	15,000 ct	500 ct	125	100	15	0.35	1420	49	12.25	5.48:1	10.95:1	25.69	24.40
F-28520	G-29520	15,000 ct	600 ct	150	100	15	0.35	1420	68	17	5:1	10:1	25.69	24.40
F-28525	G-29525	15,000 ct	10,000 ct	2500	100	15	0.35	1420	1100	275	1.22:1	2.45:1	25.69	24.40
F-28530	G-29530	*15,000 ct	15,000 ct	-	100	15	0.35	1420	1730	-	1:1	-	27.53	26.15
F-28535	G-29535	15,000 ct	15,000 ct	3750	100	15	0.35	1420	1730	433	1:1	2:1	25.69	24.40
F-28540	G-29540	16,000 ct	1000 ct	250	100	15	0.35	1500	115	28.75	4:1	8:1	25.69	24.40
F-28545	G-29545	20,000 ct	500 ct	125	100	15	0.3	1600	60	15	6.33:1	12.65:1	27.53	26.15
F-28550	G-29550	20,000 ct	600 ct	150	100	15	0.3	1600	66	16.5	5.77:1	11.55:1	27.53	26.15
F-28555	G-29555	20,000 ct	800 ct	200	100	15	0.3	1600	94	23.5	5:1	10:1	27.53	26.15
F-28560	G-29560	20,000 ct	1000 ct	250	100	15	0.3	1600	106	26.5	4.47:1	8.94:1	27.53	26.15
F-28565	G-29565	20,000 ct	5000 ct	1250	100	15	0.3	1600	600	150	2:1	4:1	27.53	26.15
F-28570	G-29570	20,000 ct	10,000 ct	2500	100	15	0.3	1600	1100	275	1.41:1	2.83:1	27.53	26.15
F-SHIELD		MU-METAL SHIELD .285" d X .268" h (7.24 mm d X 6.73 mm h) SINGLE SHIELD											2.33	
FYY-SHIELD		MU-METAL SHIELD .315" d X .275" h (8.0 mm d X 6.99 mm h) USE WITH F-SHIELD FOR DOUBLE SHIELDING											2.33	
G-SHIELD		MU-METAL SHIELD .285" d X .335" h (7.24 mm d X 8.51 mm h) SINGLE SHIELD												2.33
GYY-SHIELD		MU-METAL SHIELD .315" d X .40" h (8.00 mm d X 10.16 mm h) USE WITH G-SHIELD FOR DOUBLE SHIELDING												2.33
GXX-SHIELD		MU-METAL SHIELD .35" d X .465" h (8.89 mm d X 11.81 mm h) USE WITH G-SHIELD AND GYY SHIELD FOR TRIPLE SHIELDING												2.33

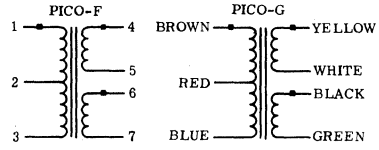
*INCLUDES ELECTROSTATIC SHIELD

*** **Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%**
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

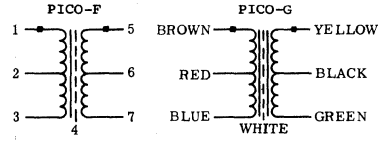
F SERIES Plug-In

G SERIES Insulated Leads

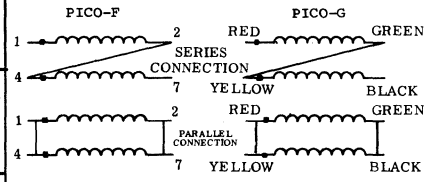
SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



SCHEMATIC FOR INDUCTORS



FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- 5 MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

This Product is Patented

INDUCTORS

PART NUMBER F-SERIES	PART NUMBER G-SERIES	INDUCTANCE HENRIES	DC CURRENT ma	DC RESISTANCE OHMS	PRICES 1-9*** F SERIES	PRICES 1-9*** G SERIES
F-5825	G-6125	SERIES 10.0	0	2250	21.21	20.19
		SERIES 2.75	2			
		PARALLEL 2.5	0	560		
		PARALLEL .65	4			
F-5830	G-6130	SERIES 5.5	0	1000	21.21	20.19
		SERIES 1.5	2			
		PARALLEL 1.3	0	250		
		PARALLEL .40	4			
F-5835	G-6135	SERIES .85	1	240	21.21	20.19
		SERIES .25	6			
		PARALLEL .21	2	60		
		PARALLEL .06	12			
F-5840	G-6140	SERIES .6	0	144	21.21	20.19
		SERIES .15	5			
		PARALLEL .15	0	36		
		PARALLEL .04	10			

INDUCTORS

ALL INDUCTORS HAVE SPLIT WINDINGS AND MEASUREMENTS ARE LISTED FOR BOTH SERIES AND PARALLEL CONNECTIONS. TWO VALUES OF INDUCTANCE, EACH AT A PARTICULAR VALUE OF D.C. CURRENT, ARE LISTED FOR EACH INDUCTOR.

*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

Delivery—stock to one week

PICO Electronics, Inc.

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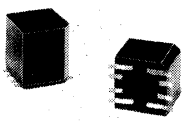
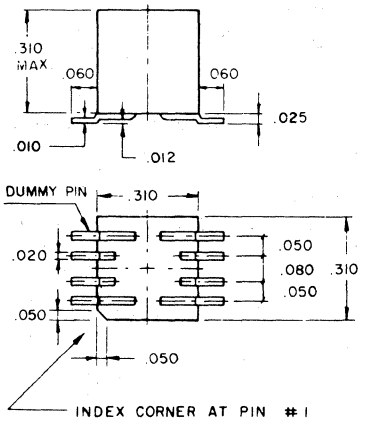
SURFACE MOUNT

PICO's ultra-miniature transformers



70000 SERIES



DIMENSIONS ARE IN INCHES

PICO PART NUMBER	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER MILLIWATTS 1 KHz and higher	400 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9 ***
70003	10 ct	10 ct	2.5	125	20	11.5	1.1	1.35	.34	1:1	2:1	22.52
70005	20 ct	8 ct	2	125	20	8	2.1	1.28	.32	1.58:1	3.16:1	22.52
70010	20 ct	20 ct	5	125	20	8	2.1	2.56	.64	1:1	2:1	22.52
70015	32 ct	32 ct	8	125	20	6.5	3.52	4.32	1.08	1:1	2:1	22.52
70020	40 ct	40 ct	10	125	20	5.6	4	4.77	1.19	1:1	2:1	22.34
70025	48 ct	16 ct	4	125	20	5.2	4.3	2.3	.58	1.73:1	3.46:1	20.47
70030	50 ct	50 ct	12.5	125	20	5	5.5	6.6	1.65	1:1	2:1	20.47
70035	80 ct	32 ct	8	125	20	4	8.5	4.25	1.06	1.58:1	3.16:1	22.34
70040	100 ct	40 ct	10	125	20	3.6	12.1	4.85	1.21	1.58:1	3.16:1	22.34
70045	100 ct	100 ct	25	125	20	3.6	12.1	12	3	1:1	2:1	20.47
70050	120 ct	12.8 ct	3.2	125	20	3.3	13.2	1.6	.4	3.06:1	6.12:1	20.47
70055	120 ct	60 ct	15	125	20	3.3	13.2	7.3	1.83	1.41:1	2.83:1	24.48
70060	120 ct	120 ct	30	125	20	3.3	13.2	16	4	1:1	2:1	24.48
70065	150 ct	12 ct	3	125	20	3	15	1.56	.39	3.54:1	7.07:1	23.69
70070	150 ct	50 ct	12.5	125	20	3	15	6.6	1.65	1.73:1	3.46:1	24.48
70075	150 ct	100 ct	25	125	20	3	15	14.5	3.63	1.22:1	2.45:1	24.48
70080	150 ct	150 ct	37.5	125	20	3	15	18.3	4.58	1:1	2:1	24.48
70085	150 ct	600 ct	150	125	20	3	15	72	18	1:2	1:1	24.48
70090	200 ct	200 ct	50	125	20	2.5	22	26.8	6.7	1:1	2:1	24.48
70095	300 ct	12 ct	3	125	20	2	33	1.56	.39	5:1	10:1	24.48
70100	300 ct	50 ct	12.5	125	20	2	33	6.6	1.65	2.45:1	4.9:1	24.48
70105	300 ct	150 ct	37.5	125	20	2	33	18.3	4.58	1.41:1	2.83:1	24.48
70110	300 ct	300 ct	75	125	20	2	33	40.3	10.08	1:1	2:1	24.48
70115	300 ct	600 ct	150	125	20	2	33	72	18	1:1.41	1.41:1	22.25
70120	320 ct	12.8 ct	3.2	125	20	2	34	1.6	0.4	5:1	10:1	26.24
70125	400 ct	40 ct	10	125	20	1.8	49	4.7	1.18	3.16:1	6.32:1	26.24
70130	400 ct	120 ct	30	125	20	1.8	49	16.3	4.08	1.83:1	3.65:1	26.24
70135	400 ct	200 ct	50	125	20	1.8	49	27.3	6.83	1.41:1	2.83:1	26.24
70140	400 ct	400 ct	100	125	20	1.8	49	49	12.25	1:1	2:1	23.86
70145	400 ct	1000 ct	250	125	20	1.8	49	120	30	1:1.58	1.26:1	26.24
70150	400 ct	2000 ct	500	125	20	1.8	49	270	67.5	1:2.24	1:1.12	26.24
70155	400 ct	4000 ct	1000	125	20	1.8	49	476	119	1:3.16	1:1.58	26.24
70160	500 ct	12.8 ct	3.2	125	20	1.6	54	1.6	0.4	6.25:1	12.5:1	23.86
70165	500 ct	16 ct	4	125	20	1.6	54	2.3	0.58	5.6:1	11.2:1	23.86
70170	500 ct	50 ct	12.5	125	20	1.6	54	6.6	1.65	3.16:1	6.32:1	23.86
70175	500 ct	150 ct	37.5	125	20	1.6	54	18.3	4.58	1.83:1	3.65:1	23.86
70180	500 ct	500 ct	125	125	20	1.6	54	65	16.3	1:1	2:1	26.24
70185	*500 ct	500 ct	-	125	20	1.6	54	65	-	1:1	-	26.24
70190	500 ct	600 ct	150	125	20	1.6	54	72	18	1:1.1	1.83:1	26.24
70195	600 ct	12.8 ct	3.2	125	20	1.5	59	1.6	0.4	6.85:1	13.7:1	26.24
70200	600 ct	30 ct	7.5	125	20	1.5	59	4.1	1.03	4.47:1	8.94:1	23.86
70205	600 ct	48 ct	12	125	20	1.5	59	5.2	1.3	3.54:1	7.07:1	23.86
70210	600 ct	200 ct	50	125	20	1.5	59	26.5	6.63	1.73:1	3.46:1	23.86
70215	600 ct	600 ct	150	125	20	1.5	59	72	18	1:1	2:1	23.86
70220	*600 ct	600 ct	-	125	20	1.5	59	72	-	1:1	-	26.24
70225	600 ct	1200 ct	300	125	20	1.5	59	160	40	1:1.41	1.41:1	23.86
70230	640 ct	12.8 ct	3.2	125	20	1.5	62	1.6	0.4	7.07:1	14.14:1	23.86
70235	700 ct	100 ct	25	125	20	1.35	65	12	3	2.65:1	5.29:1	23.86
70240	800 ct	12.8 ct	3.2	125	20	1.3	88	16	4	7.9:1	15.8:1	26.24
70245	800 ct	48 ct	12	125	20	1.3	88	6.7	1.68	4.08:1	8.16:1	24.48
70250	800 ct	800 ct	200	125	20	1.3	88	106	26.5	1:1	2:1	24.48
70255	900 ct	600 ct	150	125	20	1.2	93	74	18.5	1.22:1	2.45:1	24.48
70260	1000 ct	12 ct	3	125	20	1.2	120	1.55	0.39	9.13:1	18.3:1	26.93
70265	1000 ct	50 ct	12.5	125	20	1.2	120	6.6	1.65	4.47:1	8.94:1	26.93
70270	1000 ct	1000 ct	250	125	20	1.2	120	120	30	1:1	2:1	24.48
70275	1060 ct	12.8 ct	3.2	125	20	1.2	125	1.6	0.4	9.1:1	18.2:1	26.93
70280	1200 ct	12.8 ct	3.2	125	20	1	133	1.6	0.4	9.68:1	19.4:1	26.93
70285	1200 ct	500 ct	125	125	20	1	133	65	16.25	1.55:1	3.1:1	26.93
70290	1200 ct	1200 ct	300	125	20	1	133	160	40	1:1	2:1	26.93
70295	*1200 ct	1200 ct	-	125	20	1	133	160	-	1:1	-	26.93
70300	1500 ct	12 ct	3	125	20	1	180	1.55	0.39	11.2:1	22.4:1	26.93
70305	1500 ct	500 ct	125	125	20	1	180	65	16.3	1.73:1	3.46:1	24.48
70310	*1500 ct	600 ct	-	125	20	1	180	73	-	1.58:1	-	24.48
70315	*1500 ct	1500 ct	-	125	20	1	180	215	-	1:1	-	26.93
70320	1600 ct	12.8 ct	3.2	125	20	1	190	1.6	0.4	11.2:1	22.4:1	26.93
70325	2000 ct	8 ct	2	125	20	0.8	218	1	.25	15.8:1	31.6:1	26.93
70330	2000 ct	2000 ct	500	125	20	0.8	218	260	65	1:1	2:1	26.93
70335	*2000 ct	2000 ct	-	125	20	0.8	218	260	-	1:1	-	26.93
70340	2000 ct	8000 ct	2000	125	20	0.8	218	830	207.5	1:2	1:1	26.24

*INCLUDES ELECTROSTATIC SHIELD

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

SPECIFICATIONS

- MIL-T-27: . . . . . All Units Meet MIL-T-27, Military Designation is TF5R21ZZ for Transformers, TF5R20ZZ for Inductors.
- FREQUENCY RESPONSE: . . . . -3dB, 400 Hz-250 KHz at 1.0 Milliwatt.
- MAXIMUM DISTORTION: . . . . 5% With Rated Power Level at 1 KHz and 400 Hz.
- DIELECTRIC STRENGTH: . . . All Units Tested at 200 V RMS.
- INSULATION RESISTANCE: . . . Greater Than 10,000 Megohms at 300 V DC.
- WEIGHT: . . . . . 1.5 Grams
- OPERATING TEMPERATURE: . . -55^{0}c to $+105^{0}$c (All Units Can Be Supplied to Class S Requirements, $+130^{0}$c).
- TERMINALS: . . . . . Conductor is copper clad steel, Tinned 100%. Electroplated Per MIL-T-10727A and ASTM CCS B452.
- THERMAL SHOCK: . . . . . 25 Cycles, Method 107D, MIL-STD-202E, Test Condition A-1.

Delivery— stock to one week

For immediate engineering assistance or to place an order— ***Call Toll Free 800-431-1064***

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • 914-699-5514 • TWX 7105620113

PICO PART NUMBER	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER MILLIWATTS 1 KHz and higher	400 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9 ***
70345	2500 ct	2500 ct	625	125	20	0.75	280	280	70	1:1	2:1	26.24
70350	3000 ct	3000 ct	725	125	20	0.65	330	330	82.5	1:1	2:1	26.24
70355	*3000 ct	3000 ct	-	125	20	0.65	330	330	-	1:1	-	26.93
70360	3600 ct	3600 ct	900	125	20	0.6	370	450	112.5	1:1	2:1	26.24
70365	4000 ct	16 ct	4	125	20	0.57	400	2.3	0.58	15.8:1	31.6:1	26.24
70370	4000 ct	600 ct	150	125	20	0.57	400	73	18.25	2.58:1	5.16:1	26.24
70375	4000 ct	1000 ct	250	125	20	0.57	400	120	30	2:1	4:1	26.24
70380	*4000 ct	8000 ct	-	125	20	0.57	400	1070	-	1:1.41	-	28.86
70385	5000 ct	500 ct	125	125	20	0.5	540	65	16.25	3.16:1	6.32:1	26.24
70390	5000 ct	5000 ct	1250	125	20	0.5	540	650	162.5	1:1	2:1	28.86
70395	7500 ct	50 ct	12.5	125	20	0.5	835	6.6	1.65	12.2:1	24.5:1	28.86
70400	7500 ct	100 ct	25	125	20	0.4	835	12	3	8.66:1	17.3:1	26.86
70405	7500 ct	600 ct	150	125	20	0.4	835	72	18	3.54:1	7.07:1	26.86
70410	7500 ct	2500 ct	625	125	20	0.4	835	280	70	1.73:1	3.46:1	26.86
70415	*7500 ct	7500 ct	-	125	20	0.4	835	1020	-	1:1	-	26.86
70420	8000 ct	12.8 ct	3.2	125	20	0.4	865	1.6	0.4	25:1	50:1	28.86
70425	8000 ct	1000 ct	250	125	20	0.4	865	120	30	2.83:1	5.66:1	28.86
70430	*8000 ct	1200 ct	-	125	20	0.4	865	160	-	2.58:1	-	28.86
70435	*9000 ct	9000 ct	-	125	20	0.4	1160	1160	-	1:1	-	28.86
70440	10,000 ct	12.8 ct	3.2	125	20	0.36	1200	1.6	0.4	28:1	56:1	28.86
70445	10,000 ct	16 ct	4	125	20	0.36	1200	1.77	0.44	25:1	50:1	26.86
70450	10,000 ct	100 ct	25	125	20	0.36	1200	12	3	10:1	20:1	26.86
70455	10,000 ct	200 ct	50	125	20	0.36	1200	27	6.75	7.07:1	14.14:1	26.86
70460	10,000 ct	500 ct	125	125	20	0.36	1200	65	16.25	4.47:1	8.94:1	26.86
70465	10,000 ct	600 ct	150	125	20	0.36	1200	72	18	4.08:1	8.16:1	26.86
70470	10,000 ct	1000 ct	250	125	20	0.36	1200	120	30	3.16:1	6.32:1	26.86
70475	10,000 ct	1200 ct	300	125	20	0.36	1200	160	40	2.88:1	5.77:1	26.86
70480	10,000 ct	1500 ct	375	125	20	0.36	1200	215	53.8	2.58:1	5.16:1	26.93
70485	10,000 ct	2000 ct	500	125	20	0.36	1200	260	65	2.24:1	4.47:1	26.93
70490	10,000 ct	5000 ct	1250	125	20	0.36	1200	650	162.5	1.41:1	2.83:1	26.93
70495	10,000 ct	7500 ct	1875	125	20	0.36	1200	1020	255	1.15:1	2.3:1	26.93
70500	10,000 ct	10,000 ct	2500	125	20	0.36	1200	1200	300	1:1	2:1	24.48
70505	*10,000 ct	10,000 ct	-	125	20	0.36	1200	1440	-	1:1	-	28.86
70510	15,000 ct	400 ct	100	100	15	0.35	1420	43	10.75	6.12:1	12.24:1	26.93
70515	15,000 ct	500 ct	125	100	15	0.35	1420	49	12.25	5.48:1	10.95:1	26.93
70520	15,000 ct	600 ct	150	100	15	0.35	1420	68	17	5:1	10:1	26.93
70525	15,000 ct	10,000 ct	2500	100	15	0.35	1420	1100	275	1.22:1	2.45:1	26.93
70530	*15,000 ct	15,000 ct	-	100	15	0.35	1420	1730	-	1:1	-	28.86
70535	15,000 ct	15,000 ct	3750	100	15	0.35	1420	1730	433	1:1	2:1	26.93
70540	16,000 ct	1000 ct	250	100	15	0.35	1500	115	28.75	4:1	8:1	26.93
70545	20,000 ct	500 ct	125	100	15	0.3	1600	60	15	6.33:1	12.65:1	28.86
70550	20,000 ct	600 ct	150	100	15	0.3	1600	66	16.5	5.77:1	11.55:1	28.86
70555	20,000 ct	800 ct	200	100	15	0.3	1600	94	23.5	5:1	10:1	28.86
70560	20,000 ct	1000 ct	250	100	15	0.3	1600	106	26.5	4.47:1	8.94:1	28.86
70565	20,000 ct	5000 ct	1250	100	15	0.3	1600	600	150	2:1	4:1	28.86
70570	20,000 ct	10,000 ct	2500	100	15	0.3	1600	1100	275	1.41:1	2.83:1	28.86

*INCLUDES ELECTROSTATIC SHIELD

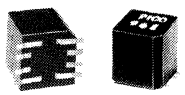
*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

INDUCTORS

PART NUMBER	INDUCTANCE HENRIES		DC CURRENT ma	DC RESISTANCE OHMS	PRICES 1-9***
70825	SERIES	10.0	0	2250	22.25
		2.75	2		
	PARALLEL	2.5	0	560	
		.65	4		
70830	SERIES	5.5	0	1000	22.25
		1.5	2		
	PARALLEL	1.3	0	250	
		.40	4		
70835	SERIES	.85	1	240	22.25
		.25	6		
	PARALLEL	.21	2	60	
		.06	12		
70840	SERIES	.6	0	144	22.25
		.15	5		
	PARALLEL	.15	0	36	
		.04	10		

SURFACE MOUNT

70000 SERIES



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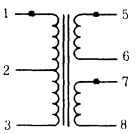

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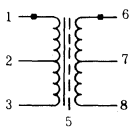

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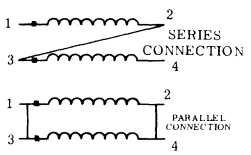


FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELD DESIGN AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

This Product is Patented

INDUCTORS

ALL INDUCTORS HAVE SPLIT WINDINGS AND MEASUREMENTS ARE LISTED FOR BOTH SERIES AND PARALLEL CONNECTIONS. TWO VALUES OF INDUCTANCE, EACH AT A PARTICULAR VALUE OF D.C. CURRENT, ARE LISTED FOR EACH INDUCTOR.

*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

Delivery—stock to one week

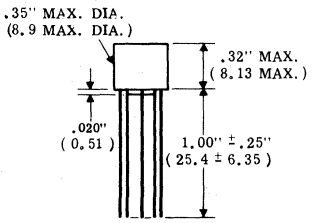
PICO Electronics, Inc.

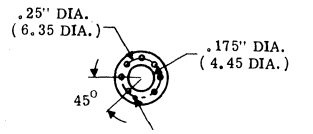
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • 914-699-5514 • TWX 7105620113

PICO's ultra-miniature transformers

For Surface Mount Versions of this series, see pages A-2326 and A-2327

W SERIES Plug-In





WHITE DOT AT TERMINAL #1
TERMINALS CLOCKWISE FROM PIN #1

DIMENSIONS ARE IN INCHES (MM)

PICO PART NUMBER W Series Plug-In	PRIMARY IMPED OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1KHz and higher	400 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIM DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9*** W-Series
W-26003	10 ct	10 ct	2.5	.4	.075	31.6	1.1	1.3	.33	1:1	2:1	15.84
W-26005	20 ct	8 ct	2	.4	.075	22.3	2.2	1	.25	1.58:1	3.16:1	15.84
W-26010	20 ct	20 ct	5	.4	.075	22.3	2.2	2.6	.65	1:1	2:1	15.84
W-26015	32 ct	32 ct	8	.4	.075	17.6	3.5	4.2	1.05	1:1	2:1	15.84
W-26020	40 ct	40 ct	10	.4	.075	15.8	4	4.5	1.2	1:1	2:1	15.84
W-26025	48 ct	16 ct	4	.4	.075	14.4	5.3	1.9	.48	1.73:1	3.46:1	16.80
W-26030	50 ct	50 ct	12.5	.4	.075	14.1	5.6	6.5	1.6	1:1	2:1	16.80
W-26035	80 ct	32 ct	8	.4	.075	11.1	8	4	1	1.58:1	3.16:1	19.96
W-26040	100 ct	40 ct	10	.4	.075	10	10	4.5	1.2	1.58:1	3.16:1	16.80
W-26045	100 ct	100 ct	25	.4	.075	10	10	12	3	1:1	2:1	16.80
W-26050	120 ct	12.8 ct	3.2	.4	.075	9.1	12	1.5	.38	3.06:1	6.12:1	15.11
W-26055	120 ct	60 ct	15	.4	.075	9.1	12	7.2	1.8	1.41:1	2.83:1	19.96
W-26060	120 ct	120 ct	30	.4	.075	9.1	12	14.5	3.6	1:1	2:1	19.96
W-26065	150 ct	12 ct	3	.4	.075	8.2	15	1.5	.38	3.54:1	7.08:1	15.11
W-26070	150 ct	50 ct	12.5	.4	.075	8.2	15	6	1.5	1.73:1	3.46:1	16.80
W-26075	150 ct	100 ct	25	.4	.075	8.2	15	12	3	1.22:1	2.45:1	16.80
W-26080	150 ct	150 ct	37.5	.4	.075	8.2	15	16.8	4.2	1:1	2:1	19.96
W-26085	150 ct	600 ct	150	.4	.075	8.2	15	70	17.5	1:2	1:1	16.80
W-26090	200 ct	200 ct	50	.4	.075	7	20	24	6	1:1	2:1	16.80
W-26095	300 ct	12 ct	3	.4	.075	5.8	30	1.5	.38	5:1	10:1	15.11
W-26100	300 ct	50 ct	12.5	.4	.075	5.8	30	6	1.5	2.45:1	4.9:1	16.80
W-26105	300 ct	150 ct	37.5	.4	.075	5.8	30	18	4.5	1.41:1	2.83:1	16.80
W-26110	300 ct	300 ct	75	.4	.075	5.8	30	36	9	1:1	2:1	19.96
W-26115	300 ct	600 ct	150	.4	.075	5.8	30	72	18	1:1.41	1.41:1	15.11
W-26120	320 ct	12.8 ct	3.2	.4	.075	5.6	32	1.5	.38	5:1	10:1	15.11
W-26125	400 ct	40 ct	10	.4	.075	5	40	4.5	1.1	3.16:1	6.32:1	19.96
W-26130	400 ct	120 ct	30	.4	.075	5	40	14	3.5	1.83:1	3.65:1	19.96
W-26135	400 ct	200 ct	50	.4	.075	5	40	24	6	1.41:1	2.83:1	16.80
W-26140	400 ct	400 ct	100	.4	.075	5	40	48	12	1:1	2:1	19.96
W-26145	400 ct	1000 ct	250	.4	.075	5	40	120	30	1:1.58	1.26:1	22.90
W-26150	400 ct	2000 ct	500	.4	.075	5	40	240	60	1:2.24	1:1.12	22.90
W-26155	400 ct	4000 ct	1000	.4	.075	5	40	480	120	1:3.16	1:1.58	20.68
W-26160	500 ct	12.8 ct	3.2	.4	.075	4.5	50	1.5	.38	6.25:1	12.5:1	17.52
W-26165	500 ct	16 ct	4	.4	.075	4.5	50	2	.5	5.6:1	11.2:1	17.52
W-26170	500 ct	50 ct	12.5	.4	.075	4.5	50	6	1.5	3.16:1	6.32:1	17.52
W-26175	500 ct	150 ct	37.5	.4	.075	4.5	50	18	4.5	1.83:1	3.65:1	17.52
W-26180	500 ct	500 ct	125	.4	.075	4.5	50	60	15	1:1	2:1	17.52
W-26185	*500 ct	500 ct	-	.4	.075	4.5	50	60	-	1:1	-	17.52
W-26190	500 ct	600 ct	150	.4	.075	4.5	50	72	18	1:1.1	1.83:1	17.52
W-26195	600 ct	12.8 ct	3.2	.4	.075	4.1	60	1.5	.38	6.85:1	13.7:1	15.11
W-26200	600 ct	30 ct	7.5	.4	.075	4.1	60	3.6	.9	4.47:1	8.94:1	15.84
W-26205	600 ct	48 ct	12	.4	.075	4.1	60	5.8	1.45	3.54:1	7.07:1	15.84
W-26210	600 ct	200 ct	50	.4	.075	4.1	60	24	6	1.73:1	3.46:1	15.84
W-26215	600 ct	600 ct	150	.4	.075	4.1	60	72	18	1:1	2:1	15.84
W-26220	*600 ct	600 ct	-	.4	.075	4.1	60	72	-	1:1	-	17.52
W-26225	600 ct	1200 ct	300	.4	.075	4.1	60	144	36	1:1.41	1.41:1	15.84
W-26230	640 ct	12.8 ct	3.2	.4	.075	3.9	64	1.5	.38	7.07:1	14.14:1	15.84
W-26235	700 ct	100 ct	25	.4	.075	3.8	70	12	3	2.65:1	5.29:1	15.84
W-26240	800 ct	12.8 ct	3.2	.4	.075	3.5	80	1.5	.38	7.9 :1	15.8:1	15.84
W-26245	800 ct	48 ct	12	.4	.075	3.5	80	5.8	1.45	4.08:1	8.16:1	23.64
W-26250	800 ct	800 ct	200	.4	.075	3.5	80	96	24	1:1	2:1	15.84
W-26255	900 ct	600 ct	150	.4	.075	3.3	90	72	18	1.22:1	2.45:1	15.84
W-26260	1000 ct	12 ct	3	.4	.075	3.2	100	1.5	.38	9.13:1	18.3:1	15.84
W-26265	1000 ct	50 ct	12.5	.4	.075	3.2	100	6	1.5	4.47:1	8.94:1	17.52
W-26270	1000 ct	1000 ct	250	.4	.075	3.2	100	120	30	1:1	2:1	17.52
W-26275	1060 ct	12.8 ct	3.2	.4	.075	3.1	106	1.5	.38	9.1:1	18.2:1	15.84
W-26280	1200 ct	12.8 ct	3.2	.4	.075	2.9	120	1.5	.38	9.68:1	19.4:1	14.27
W-26285	1200 ct	500 ct	125	.4	.075	2.9	120	60	15	1.55:1	3.1:1	14.27
W-26290	1200 ct	1200 ct	300	.4	.075	2.9	120	140	35	1:1	2:1	14.27
W-26295	*1200 ct	1200 ct	-	.4	.075	2.9	120	140	-	1:1	-	19.51
W-26300	1500 ct	12 ct	3	.4	.075	2.6	150	1.5	.38	11.2:1	22.4:1	15.84
W-26305	1500 ct	500 ct	126	4	.075	2.6	150	60	15	1.73:1	3.46:1	17.52
W-26310	*1500 ct	600 ct	-	.4	.075	2.6	150	72	-	1.58:1	-	17.52
W-26315	*1500 ct	1500 ct	-	.4	.075	2.6	150	180	-	1:1	-	17.52
W-26320	1600 ct	12.8 ct	3.2	.4	.075	2.5	160	1.5	.38	11.2:1	22.4:1	15.84
W-26325	2000 ct	8 ct	2	.4	.075	2.2	200	1	.25	15.8:1	31.6:1	20.68
W-26330	2000 ct	2000 ct	500	.4	.075	2.2	200	240	60	1:1	2:1	20.68
W-26335	*2000 ct	2000 ct	-	.4	.075	2.2	200	240	-	1:1	-	22.90
W-26340	2000 ct	8000 ct	2000	.4	.075	2.2	200	960	240	1:2	1:1	20.68
W-26345	2500 ct	2500 ct	625	.4	.075	2	250	300	75	1:1	2:1	20.68

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

*INCLUDES ELECTROSTATIC SHIELD

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

SPECIFICATIONS

- **MIL-T-27:** All Units Meet MIL-T-27. Military Designation is TF5R21ZZ for Transformers, TF5R20ZZ for Inductors.
- **FREQUENCY RESPONSE:** -3dB, 400 Hz-100 KHz at 1.0 Milliwatt.
- **MAXIMUM DISTORTION:** 5% With Rated Power Level at 1 KHz and 400 Hz.
- **DIELECTRIC STRENGTH:** All Units Tested at 200 V RMS.

  INSULATION RESISTANCE: Greater Than 10,000 Megohms at 300 V DC.
- **WEIGHT:** 2.5 Grams.
- **OPERATING TEMPERATURE:** -55°c to +105°c (All Units Can Be Supplied to Class S Requirements, +130°c)
- **TERMINALS:** Solid .016 Diameter Conductor. Conductor is Copper Clad Steel. Tinned 100%. Electroplated Per MIL-T-10727A and ASTM CCS B452.
- **THERMAL SHOCK:** 25 Cycles, Method 107D, MIL-STD-202E, Test Condition A-1.

Delivery— stock to one week

For immediate engineering assistance or to place an order— ***Call Toll Free 800-431-1064***

PICO Electronics, Inc.
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • 914-699-5514 • TWX 7105620113

PICO PART NUMBER W Series Plug-In	PRIMARY IMPED OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1KHz and higher	400 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIM DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9*** W-Series
W-26350	3000 ct	3000 ct	725	.4	.075	1.8	300	360	90	1:1	2:1	16.80
W-26355	*3000 ct	3000 ct	-	.4	.075	1.8	300	360	-	1:1	-	22.90
W-26360	3600 ct	3600 ct	900	.4	.075	1.7	360	432	108	1:1	2:1	16.80
W-26365	4000 ct	16 ct	4	.4	.075	1.6	400	1.9	.47	15.8:1	31.6:1	20.68
W-26370	4000 ct	600 ct	150	.4	.075	1.6	400	72	18	2.58:1	5.16:1	20.68
W-26375	4000 ct	1000 ct	250	.4	.075	1.6	400	120	30	2:1	4:1	22.90
W-26380	*4000 ct	8000 ct	-	.4	.075	1.6	400	960	-	1:1.41	-	22.90
W-26385	5000 ct	500 ct	125	.4	.075	1.4	500	60	15	3.16:1	6.32:1	17.52
W-26390	5000 ct	5000 ct	1250	.4	.075	1.4	500	600	150	1:1	2:1	17.52
W-26395	7500 ct	50 ct	12.5	.33	.075	1.2	750	6	1.5	12.2:1	24.5:1	17.52
W-26400	7500 ct	100 ct	25	.33	.075	1.2	750	12	3	8.66:1	17.3:1	17.52
W-26405	7500 ct	600 ct	150	.33	.075	1.2	750	72	18	3.54:1	7.07:1	19.51
W-26410	7500 ct	2500 ct	625	.33	.075	1.2	750	300	75	1.73:1	3.46:1	19.51
W-26415	*7500 ct	7500 ct	-	.33	.075	1.2	750	900	-	1:1	-	22.90
W-26420	8000 ct	12.8 ct	3.2	.3	.075	1.1	800	1.5	.38	25:1	50:1	17.52
W-26425	8000 ct	1000 ct	250	.3	.075	1.1	800	120	30	2.83:1	5.66:1	19.51
W-26430	*8000 ct	1200 ct	-	.3	.075	1.1	800	144	-	2.58:1	-	22.90
W-26435	*9000 ct	9000 ct	-	.27	.075	1.1	900	1080	-	1:1	-	22.90
W-26440	10,000 ct	12.8 ct	3.2	.25	.075	1.0	1000	1.5	.38	28:1	56:1	15.84
W-26445	10,000 ct	16 ct	4	.25	.075	1.0	1000	1.92	.48	25:1	50:1	15.84
W-26450	10,000 ct	100 ct	25	.25	.075	1.0	1000	12	3	10:1	20:1	17.52
W-26455	10,000 ct	200 ct	50	.25	.075	1.0	1000	24	6	7.07:1	14.14:1	17.52
W-26460	10,000 ct	500 ct	125	.25	.075	1.0	1000	60	15	4.47:1	8.94:1	17.52
W-26465	10,000 ct	600 ct	150	.25	.075	1.0	1000	72	18	4.08:1	8.16:1	17.52
W-26470	10,000 ct	1000 ct	250	.25	.075	1.0	1000	120	30	3.16:1	6.32:1	17.52
W-26475	10,000 ct	1200 ct	300	.25	.075	1.0	1000	144	36	2.89:1	5.77:1	20.68
W-26480	10,000 ct	1500 ct	375	.25	.075	1.0	1000	180	45	2.58:1	5.16:1	20.68
W-26485	10,000 ct	2000 ct	500	.25	.075	1.0	1000	240	60	2.24:1	4.47:1	20.25
W-26490	10,000 ct	5000 ct	1250	.25	.075	1.0	1000	600	150	1.41:1	2.83:1	20.62
W-26495	10,000 ct	7500 ct	1875	.25	.075	1.0	1000	900	225	1.15:1	2.3:1	20.68
W-26500	10,000 ct	10,000 ct	2500	.25	.075	1.0	1000	1200	300	1:1	2:1	19.96
W-26505	*10,000 ct	10,000 ct	-	.25	.075	1.0	1000	1200	-	1:1	-	22.90
W-26510	15,000 ct	400 ct	100	.16	.075	.82	1500	48	12	6.12:1	12.24:1	19.96
W-26515	15,000 ct	500 ct	125	.16	.075	.82	1500	60	15	5.48:1	10.95:1	19.96
W-26520	15,000 ct	600 ct	150	.16	.075	.82	1500	72	18	5:1	10:1	19.96
W-26525	15,000 ct	10,000 ct	2500	.16	.075	.82	1500	1200	300	1.22:1	2.45:1	19.96
W-26530	*15,000 ct	15,000 ct	-	.16	.075	.82	1500	1800	-	1:1	-	22.90
W-26535	15,000 ct	15,000 ct	3750	.16	.075	.82	1500	1800	450	1:1	2:1	20.68
W-26540	16,000 ct	1,000 ct	250	.15	.075	.8	1600	120	30	4:1	8:1	20.68
W-26545	20,000 ct	500 ct	125	.125	.075	.7	2000	60	15	6.33:1	12.65:1	19.96
W-26550	20,000 ct	600 ct	150	.125	.075	.7	2000	72	18	5.77:1	11.55:1	19.96
W-26555	20,000 ct	800 ct	200	.125	.075	.7	2000	96	24	5:1	10:1	18.24
W-26560	20,000 ct	1000 ct	250	.125	.075	.7	2000	120	30	4.47:1	8.94:1	22.90
W-26565	20,000 ct	5000 ct	1250	.125	.075	.7	2000	600	150	2:1	4:1	19.96
W-26570	20,000 ct	10,000 ct	2500	.125	.075	.7	2000	1200	300	1.41:1	2.83:1	19.96
W-26575	*20,000 ct	20,000 ct	-	.125	.075	.7	2000	2400	-	1:1	-	22.90
W-26580	25,000 ct	500 ct	125	.1	.075	.63	2500	60	15	7.07:1	14.14:1	20.68
W-26585	25,000 ct	1000 ct	250	.1	.075	.63	2500	120	30	5:1	10:1	20.68
W-26590	30,000 ct	50 ct	12.5	.083	.075	.58	3000	6	1.5	24.5:1	49:1	20.68
W-26595	30,000 ct	1200 ct	300	.083	.075	.58	3000	144	36	5:1	10:1	20.68
W-26600	30,000 ct	500 ct	125	.083	.075	.58	3000	60	15	7.75:1	15.5:1	20.68
W-26605	30,000 ct	200 ct	50	.083	.075	.58	3000	24	6	12.25:1	24.5:1	20.68
W-26610	30,000 ct	5,000 ct	1250	.083	.075	.58	3000	600	150	2.45:1	4.9:1	20.68
W-26615	30,000 ct	10,000 ct	2500	.083	.075	.58	3000	1200	300	1.73:1	3.46:1	20.68
W-26620	*30,000 ct	30,000 ct	-	.083	.075	.58	3000	3600	-	1:1	-	22.90
W-26625	40,000 ct	400 ct	100	.062	.062	.5	4000	48	12	10:1	20:1	22.90
W-SHIELD	MU-METAL SHIELD .37"D x .32"H (9.4mmD x 8.1mmH) SINGLE SHIELD											2.34
WXX-SHIELD	MU-METAL SHIELD .395"D x .33"H (10mmD x 8.4mmH) USE WITH W SHIELD FOR DOUBLE SHIELDING											2.34

*INCLUDES ELECTROSTATIC SHIELD

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

INDUCTORS

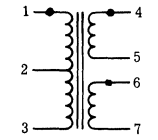
ALL INDUCTORS HAVE SPLIT WINDINGS AND MEASUREMENTS ARE LISTED FOR BOTH SERIES AND PARALLEL CONNECTIONS. TWO VALUES OF INDUCTANCE, EACH AT A PARTICULAR VALUE OF D.C. CURRENT, ARE LISTED FOR EACH INDUCTOR.

PICO PART NUMBER	INDUCTANCE HENRIES	DC CURRENT ma	DC RESISTANCE OHMS	PRICE*** 1-9
W-26705	SERIES 0.1	4	25	15.84
	SERIES .08	10		
	PARALLEL .025	8	6.5	
	PARALLEL .02	20		
W-26710	SERIES 0.9	2	105	15.84
	SERIES 0.5	6		
	PARALLEL .23	4	26	
	PARALLEL .13	12		
W-26715	SERIES 2.5	2	630	15.84
	SERIES 0.9	4		
	PARALLEL 0.6	4	160	
	PARALLEL 0.23	8		
W-26720	SERIES 4.5	2	2300	16.82
	SERIES 1.2	4		
	PARALLEL 1.1	4	575	
	PARALLEL 0.3	8		

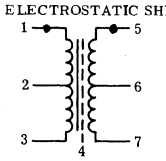
PICO's ultra-miniature transformers

W SERIES Plug-In

SCHEMATICS FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



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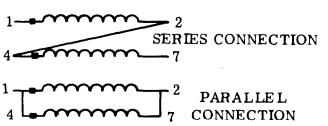


FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

This Product is Patented

Delivery— stock to one week

For immediate engineering assistance or to place an order—

Call Toll Free 800-431-1064

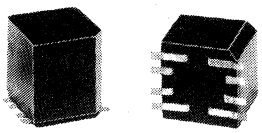
PICO Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

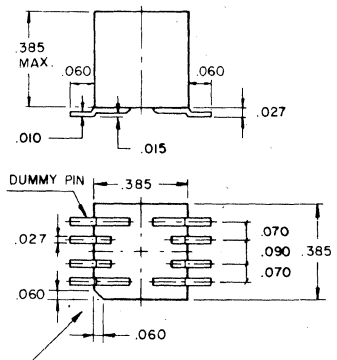
914-699-5514
TWX 7105620113

SURFACE MOUNT

PICO's ultra-miniature transformers



71000 SERIES



DIMENSIONS ARE IN INCHES (MM)

SPECIFICATIONS

- MIL-T-27: . . . . . All Units Meet MIL-T-27. Military Designation is TF5R21ZZ for Transformers, TF5R20ZZ for Inductors.
- FREQUENCY RESPONSE: . . . . -3dB, 400 Hz-100 KHz at 1.0 Milliwatt.
- MAXIMUM DISTORTION: . . . . 5% With Rated Power Level at 1 KHz and 400 Hz.
- DIELECTRIC STRENGTH: . . . . All Units Tested at 200 V RMS.

INSULATION RESISTANCE: . . . Greater Than 10,000 Megohms at 300 V DC.

- WEIGHT: . . . . . 3 Grams.
- OPERATING TEMPERATURE: . . -55^{o}c to $+105^{o}$c (All Units Can Be Supplied to Class S Requirements, $+130^{o}$c)
- TERMINALS: . . . . . Conductor is Copper Clad Steel. Tinned 100%. Electroplated Per MIL-T-10727A and ASTM CCS B452.
- THERMAL SHOCK: . . . . . 25 Cycles, Method 107D, MIL-STD-202E, Test Condition A-1.

PICO PART NUMBER	PRIMARY IMPED OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1KHz and higher	400 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIM DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9***
71003	10 ct	10 ct	2.5	.4	.075	31.6	1.1	1.3	.33	1:1	2:1	16.62
71005	20 ct	8 ct	2	.4	.075	22.3	2.2	1	.25	1.58:1	3.16:1	16.62
71010	20 ct	20 ct	5	.4	.075	22.3	2.2	2.6	.65	1:1	2:1	16.62
71015	32 ct	32 ct	8	.4	.075	17.6	3.5	4.2	1.05	1:1	2:1	16.62
71020	40 ct	40 ct	10	.4	.075	15.8	4	4.5	1.2	1:1	2:1	16.62
71025	48 ct	16 ct	4	.4	.075	14.4	5.3	1.9	.48	1.73:1	3.46:1	17.63
71030	50 ct	50 ct	12.5	.4	.075	14.1	5.6	6.5	1.6	1:1	2:1	17.63
71035	80 ct	32 ct	8	.4	.075	11.1	8	4	1	1.58:1	3.16:1	20.93
71040	100 ct	40 ct	10	.4	.075	10	10	4.5	1.2	1.58:1	3.16:1	17.63
71045	100 ct	100 ct	25	.4	.075	10	10	12	3	1:1	2:1	17.63
71050	120 ct	12.8 ct	3.2	.4	.075	9.1	12	1.5	.38	3.06:1	6.12:1	15.85
71055	120 ct	60 ct	15	.4	.075	9.1	12	7.2	1.8	1.41:1	2.83:1	20.93
71060	120 ct	120 ct	30	.4	.075	9.1	12	14.5	3.6	1:1	2:1	20.93
71065	150 ct	12 ct	3	.4	.075	8.2	15	1.5	.38	3.54:1	7.08:1	15.85
71070	150 ct	50 ct	12.5	.4	.075	8.2	15	6	1.5	1.73:1	3.46:1	17.63
71075	150 ct	100 ct	25	.4	.075	8.2	15	12	3	1.22:1	2.45:1	17.63
71080	150 ct	150 ct	37.5	.4	.075	8.2	15	16.8	4.2	1:1	2:1	20.93
71085	150 ct	600 ct	150	.4	.075	8.2	15	70	17.5	1:2	1:1	17.63
71090	200 ct	200 ct	50	.4	.075	7	20	24	6	1:1	2:1	17.63
71095	300 ct	12 ct	3	.4	.075	5.8	30	1.5	.38	5:1	10:1	15.85
71100	300 ct	50 ct	12.5	.4	.075	5.8	30	6	1.5	2.45:1	4.9:1	17.63
71105	300 ct	150 ct	37.5	.4	.075	5.8	30	18	4.5	1.41:1	2.83:1	17.63
71110	300 ct	300 ct	75	.4	.075	5.8	30	36	9	1:1	2:1	20.93
71115	300 ct	600 ct	150	.4	.075	5.8	30	72	18	1:1.41	1.41:1	15.85
71120	320 ct	12.8 ct	3.2	.4	.075	5.6	32	1.5	.38	5:1	10:1	15.85
71125	400 ct	40 ct	10	.4	.075	5	40	4.5	1.1	3.16:1	6.32:1	20.93
71130	400 ct	120 ct	30	.4	.075	5	40	14	3.5	1.83:1	3.65:1	20.93
71135	400 ct	200 ct	50	.4	.075	5	40	24	6	1.41:1	2.83:1	17.63
71140	400 ct	400 ct	100	.4	.075	5	40	48	12	1:1	2:1	20.93
71145	400 ct	1000 ct	250	.4	.075	5	40	120	30	1:1.58	1.26:1	24.01
71150	400 ct	2000 ct	500	.4	.075	5	40	240	60	1:2.24	1:1.12	24.01
71155	400 ct	4000 ct	1000	.4	.075	5	40	480	120	1:3.16	1:1.58	21.68
71160	500 ct	12.8 ct	3.2	.4	.075	4.5	50	1.5	.38	6.25:1	12.5:1	18.37
71165	500 ct	16 ct	4	.4	.075	4.5	50	2	.5	5.6:1	11.2:1	18.37
71170	500 ct	50 ct	12.5	.4	.075	4.5	50	6	1.5	3.16:1	6.32:1	18.37
71175	500 ct	150 ct	37.5	.4	.075	4.5	50	18	4.5	1.83:1	3.65:1	18.37
71180	500 ct	500 ct	125	.4	.075	4.5	50	60	15	1:1	2:1	18.37
71185	*500 ct	500 ct	-	.4	.075	4.5	50	60	-	1:1	-	18.37
71190	500 ct	600 ct	150	.4	.075	4.5	50	72	18	1:1.1	1.83:1	18.37
71195	600 ct	12.8 ct	3.2	.4	.075	4.1	60	1.5	.38	6.85:1	13.7:1	15.85
71200	600 ct	30 ct	7.5	.4	.075	4.1	60	3.6	.9	4.47:1	8.94:1	16.62
71205	600 ct	48 ct	12	.4	.075	4.1	60	5.8	1.45	3.54:1	7.07:1	16.62
71210	600 ct	200 ct	50	.4	.075	4.1	60	24	6	1.73:1	3.46:1	16.62
71215	600 ct	600 ct	150	.4	.075	4.1	60	72	18	1:1	2:1	16.62
71220	*600 ct	600 ct	-	.4	.075	4.1	60	72	-	1:1	-	18.37
71225	600 ct	1200 ct	300	.4	.075	4.1	60	144	36	1:1.41	1.41:1	16.62
71230	640 ct	12.8 ct	3.2	.4	.075	3.9	64	1.5	.38	7.07:1	14.14:1	16.62
71235	700 ct	100 ct	25	.4	.075	3.8	70	12	3	2.65:1	5.29:1	16.62
71240	800 ct	12.8 ct	3.2	.4	.075	3.5	80	1.5	.38	7.9 :1	15.8:1	16.62
71245	800 ct	48 ct	12	.4	.075	3.5	80	5.8	1.45	4.08:1	8.16:1	24.79
71250	800 ct	800 ct	200	.4	.075	3.5	80	96	24	1:1	2:1	16.62
71255	900 ct	600 ct	150	.4	.075	3.3	90	72	18	1.22:1	2.45:1	16.62
71260	1000 ct	12 ct	3	.4	.075	3.2	100	1.5	.38	9.13:1	18.3:1	16.62
71265	1000 ct	50 ct	12.5	.4	.075	3.2	100	6	1.5	4.47:1	8.94:1	18.37
71270	1000 ct	1000 ct	250	.4	.075	3.2	100	120	30	1:1	2:1	18.37
71275	1060 ct	12.8 ct	3.2	.4	.075	3.1	106	1.5	.38	9.1:1	18.2:1	16.62
71280	1200 ct	12.8 ct	3.2	.4	.075	2.9	120	1.5	.38	9.68:1	19.4:1	14.96
71285	1200 ct	500 ct	125	.4	.075	2.9	120	60	15	1.55:1	3.1:1	14.96
71290	1200 ct	1200 ct	300	.4	.075	2.9	120	140	35	1:1	2:1	14.96
71295	*1200 ct	1200 ct	-	.4	.075	2.9	120	140	-	1:1	-	20.46
71300	1500 ct	12 ct	3	.4	.075	2.6	150	1.5	.38	11.2:1	22.4:1	16.62
71305	1500 ct	500 ct	126	4	.075	2.6	150	60	15	1.73:1	3.46:1	18.37
71310	*1500 ct	600 ct	- .	.4	.075	2.6	150	72	-	1.58:1	-	18.37
71315	*1500 ct	1500 ct	-	.4	.075	2.6	150	180	-	1:1	-	18.37
71320	1600 ct	12.8 ct	3.2	.4	.075	2.5	160	1.5	.38	11.2:1	22.4:1	16.62
71325	2000 ct	8 ct	2	.4	.075	2.2	200	1	.25	15.8:1	31.6:1	21.68
71330	2000 ct	2000 ct	500	.4	.075	2.2	200	240	60	1:1	2:1	21.68
71335	*2000 ct	2000 ct	-	.4	.075	2.2	200	240	-	1:1	-	24.01
71340	2000 ct	8000 ct	2000	.4	.075	2.2	200	960	240	1:2	1:1	21.68
71345	2500 ct	2500 ct	625	.4	.075	2	250	300	75	1:1	2:1	21.68

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

*INCLUDES ELECTROSTATIC SHIELD

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

Delivery— stock to one week

For immediate engineering assistance or to place an order— ***Call Toll Free 800-431-1064***

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • 914-699-5514 • TWX 7105620113

PICO PART NUMBER	PRIMARY IMPED OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1KHz and higher	400 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIM DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9 * * *
71350	3000 ct	3000 ct	725	.4	.075	1.8	300	360	90	1:1	2:1	17.63
71355	*3000 ct	3000 ct	-	.4	.075	1.8	300	360	-	1:1	-	24.01
71360	3600 ct	3600 ct	900	.4	.075	1.7	360	432	108	1:1	2:1	17.63
71365	4000 ct	16 ct	4	.4	.075	1.6	400	1.9	.47	15.8:1	31.6:1	21.68
71370	4000 ct	600 ct	150	.4	.075	1.6	400	72	18	2.58:1	5.16:1	21.68
71375	4000 ct	1000 ct	250	.4	.075	1.6	400	120	30	2:1	4:1	24.01
71380	*4000 ct	8000 ct	-	.4	.075	1.6	400	960	-	1:1.41	-	24.01
71385	5000 ct	500 ct	125	.4	.075	1.4	500	60	15	3.16:1	6.32:1	18.37
71390	5000 ct	5000 ct	1250	.4	.075	1.4	500	600	150	1:1	2:1	18.37
71395	7500 ct	50 ct	12.5	.33	.075	1.2	750	6	1.5	12.2:1	24.5:1	18.37
71400	7500 ct	100 ct	25	.33	.075	1.2	750	12	3	8.66:1	17.3:1	18.37
71405	7500 ct	600 ct	150	.33	.075	1.2	750	72	18	3.54:1	7.07:1	20.46
71410	7500 ct	2500 ct	625	.33	.075	1.2	750	300	75	1.73:1	3.46:1	20.46
71415	*7500 ct	7500 ct	-	.33	.075	1.2	750	900	-	1:1	-	24.01
71420	8000 ct	12.8 ct	3.2	.3	.075	1.1	800	1.5	.38	25:1	50:1	18.37
71425	8000 ct	1000 ct	250	.3	.075	1.1	800	120	30	2.83:1	5.66:1	20.46
71430	*8000 ct	1200 ct	-	.3	.075	1.1	800	144	-	2.58:1	-	24.01
71435	*9000 ct	9000 ct	-	.27	.075	1.1	900	1080	-	1:1	-	24.01
71440	10,000 ct	12.8 ct	3.2	.25	.075	1.0	1000	1.5	.38	28:1	56:1	16.62
71445	10,000 ct	16 ct	4	.25	.075	1.0	1000	1.92	.48	25:1	50:1	16.62
71450	10,000 ct	100 ct	25	.25	.075	1.0	1000	12	3	10:1	20:1	18.37
71455	10,000 ct	200 ct	50	.25	.075	1.0	1000	24	6	7.07:1	14.14:1	18.37
71460	10,000 ct	500 ct	125	.25	.075	1.0	1000	60	15	4.47:1	8.94:1	18.37
71465	10,000 ct	600 ct	150	.25	.075	1.0	1000	72	18	4.08:1	8.16:1	18.37
71470	10,000 ct	1000 ct	250	.25	.075	1.0	1000	120	30	3.16:1	6.32:1	18.37
71475	10,000 ct	1200 ct	300	.25	.075	1.0	1000	144	36	2.89:1	5.77:1	21.68
71480	10,000 ct	1500 ct	375	.25	.075	1.0	1000	180	45	2.58:1	5.16:1	21.68
71485	10,000 ct	2000 ct	500	.25	.075	1.0	1000	240	60	2.24:1	4.47:1	21.24
71490	10,000 ct	5000 ct	1250	.25	.075	1.0	1000	600	150	1.41:1	2.83:1	21.62
71495	10,000 ct	7500 ct	1875	.25	.075	1.0	1000	900	225	1.15:1	2.3:1	21.68
71500	10,000 ct	10,000 ct	2500	.25	.075	1.0	1000	1200	300	1:1	2:1	20.92
71505	*10,000 ct	10,000 ct	-	.25	.075	1.0	1000	1200	-	1:1	-	24.01
71510	15,000 ct	400 ct	100	.16	.075	.82	1500	48	12	6.12:1	12.24:1	20.92
71515	15,000 ct	500 ct	125	.16	.075	.82	1500	60	15	5.48:1	10.95:1	20.92
71520	15,000 ct	600 ct	150	.16	.075	.82	1500	72	18	5:1	10:1	20.92
71525	15,000 ct	10,000 ct	2500	.16	.075	.82	1500	1200	300	1.22:1	2.45:1	20.92
71530	*15,000 ct	15,000 ct	-	.16	.075	.82	1500	1800	-	1:1	-	24.01
71535	15,000 ct	15,000 ct	3750	.16	.075	.82	1500	1800	450	1:1	2:1	21.68
71540	16,000 ct	1,000 ct	250	.15	.075	.8	1600	120	30	4:1	8:1	21.68
71545	20,000 ct	500 ct	125	.125	.075	.7	2000	60	15	6.33:1	12.65:1	20.92
71550	20,000 ct	600 ct	150	.125	.075	.7	2000	72	18	5.77:1	11.55:1	20.92
71555	20,000 ct	800 ct	200	.125	.075	.7	2000	96	24	5:1	10:1	19.13
71560	20,000 ct	1000 ct	250	.125	.075	.7	2000	120	30	4.47:1	8.94:1	24.01
71565	20,000 ct	5000 ct	1250	.125	.075	.7	2000	600	150	2:1	4:1	20.93
71570	20,000 ct	10,000 ct	2500	.125	.075	.7	2000	1200	300	1.41:1	2.83:1	20.93
71575	*20,000 ct	20,000 ct	-	.125	.075	.7	2000	2400	-	1:1	-	24.01
71580	25,000 ct	500 ct	125	.1	.075	.63	2500	60	15	7.07:1	14.14:1	21.68
71585	25,000 ct	1000 ct	250	.1	.075	.63	2500	120	30	5:1	10:1	21.68
71590	30,000 ct	50 ct	12.5	.083	.075	.58	3000	6	1.5	24.5:1	49:1	21.68
71595	30,000 ct	1200 ct	300	.083	.075	.58	3000	144	36	5:1	10:1	21.68
71600	30,000 ct	500 ct	125	.083	.075	.58	3000	60	15	7.75:1	15.5:1	21.68
71605	30,000 ct	200 ct	50	.083	.075	.58	3000	24	6	12.25:1	24.5:1	21.68
71610	30,000 ct	5,000 ct	1250	.083	.075	.58	3000	600	150	2.45:1	4.9:1	21.68
71615	30,000 ct	10,000 ct	2500	.083	.075	.58	3000	1200	300	1.73:1	3.46:1	21.68
71620	*30,000 ct	30,000 ct	-	.083	.075	.58	3000	3600	-	1:1	-	24.01
71625	40,000 ct	400 ct	100	.062	.062	.5	4000	48	12	10:1	20:1	24.01

*INCLUDES ELECTROSTATIC SHIELD

* * * Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

INDUCTORS

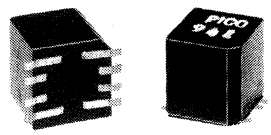
ALL INDUCTORS HAVE SPLIT WINDINGS AND MEASUREMENTS ARE LISTED FOR BOTH SERIES AND PARALLEL CONNECTIONS. TWO VALUES OF INDUCTANCE, EACH AT A PARTICULAR VALUE OF D.C. CURRENT, ARE LISTED FOR EACH INDUCTOR.

PICO PART NUMBER	INDUCTANCE HENRIES	DC CURRENT ma	DC RESISTANCE OHMS	PRICE*** 1-9
71705	SERIES 0.1	4	25	16.62
	SERIES 08	10		
	PARALLEL .025	8	6.5	
	PARALLEL .02	20		
71710	SERIES 0.9	2	105	16.62
	SERIES 0.5	6		
	PARALLEL .23	4	26	
	PARALLEL .13	12		
71715	SERIES 2.5	2	630	16.62
	SERIES 0.9	4		
	PARALLEL 0.6	4	160	
	PARALLEL 0.23	8		
71720	SERIES 4.5	2	2300	17.64
	SERIES 1.2	4		
	PARALLEL 1.1	4	575	
	PARALLEL 0.3	8		

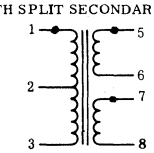
For immediate engineering assistance or to place an order—
Call Toll Free 800-431-1064

SURFACE MOUNT

71000 SERIES



SCHEMATICS FOR TRANSFORMERS WITH SPLIT SECONDARIES



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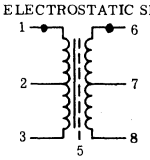

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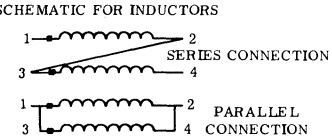


FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELD DESIGN AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

This Product is Patented

Delivery— stock to one week

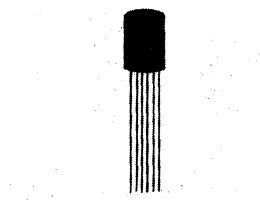
PICO Electronics, Inc.

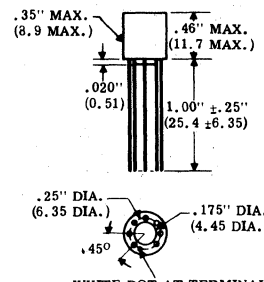
453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

914-699-5514
TWX 7105620113

PICO's ultra-miniature transformers

Y SERIES Plug-In





DIMENSIONS ARE IN INCHES (MM)

SPECIFICATIONS

- MIL-T-27: . . . . . All Units Meet MIL-T-27, Military Designation is TF5R21ZZ, for Transformers, TFR20ZZ for Inductors.
- FREQUENCY RESPONSE: . . . ±3db, 300 Hz - 100 KHz at 1.0 Milliwatt.
- MAXIMUM DISTORTION: . . . 5% With Rated Power Level at 1 KHz, 400 Hz and 300 Hz.
- DIELECTRIC STRENGTH: . . . All Units Tested at 200 V RMS.
- INSULATION RESISTANCE: . . Greater Than 10,000 Megohms at 300 V DC.
- WEIGHT: . . . . . 3 Grams
- OPERATING TEMPERATURE: . -55°c to +105°c (All Units Can Be Supplied to Class S Requirements, +130°C).
- TERMINALS: . . . . . Solid .016 Diameter Conductor. Conductor is Copper Clad Steel, Tinned 100%, Electroplated Per MIL-T-10727A and ASTM CCS B452.
- THERMAL SHOCK: . . . . . 25 Cycles, Method 107D, MIL-STD-202E, Test Condition A-1.

For immediate engineering assistance or to place an order—
Call Toll Free 800-431-1064

PICO Electronics, Inc.

453 North Mac Questen Pkwy.
Mt. Vernon, New York 10552

914-699-5514 • TWX 7105620113

Delivery— stock to one week

PICO PART NUMBER Y Series Plug-In	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1KHz and higher	400 Hz and higher	300 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9 *** Y-Series
Y-27003	10 ct	10 ct	2.5	.6	.2	.1	31.6	1	1.25	.32	1:1	2:1	15.84
Y-27005	20 ct	8 ct	2	.6	.2	.1	22.3	2	.9	.23	1.58:1	3.16:1	15.84
Y-27010	20 ct	20 ct	5	.6	.2	.1	22.3	2.1	2.25	.56	1:1	2:1	15.84
Y-27015	32 ct	32 ct	8	.6	.2	.1	17.6	3.4	4	1	1:1	2:1	15.84
Y-27020	40 ct	40 ct	10	.6	.2	.1	15.8	4.2	4.5	1.13	1:1	2:1	15.84
Y-27025	48 ct	16 ct	4	.6	.2	.1	14.4	5	1.8	.45	1.73:1	3.46:1	15.84
Y-27030	50 ct	50 ct	12.5	.6	.2	.1	14.1	5.25	5.6	1.4	1:1	2:1	15.84
Y-27035	80 ct	32 ct	8	.6	.2	.1	11.1	8.4	4	1	1.58:1	3.16:1	19.95
Y-27040	100 ct	40 ct	10	.6	.2	.1	10	10	4.5	1.13	1.58:1	3.16:1	19.95
Y-27045	100 ct	100 ct	25	.6	.2	.1	10	11	11.25	2.8	1:1	2:1	19.95
Y-27050	120 ct	12.8 ct	3.2	.6	.2	.1	9.1	14.4	1.8	.45	3.06:1	6.12:1	15.11
Y-27055	120 ct	60 ct	15	.6	.2	.1	9.1	14.4	8.4	2.1	1.41:1	2.83:1	19.95
Y-27060	120 ct	120 ct	30	.6	.2	.1	9.1	14.4	16.8	4.2	1:1	2:1	19.95
Y-27065	150 ct	12 ct	3	.6	.2	.1	8.2	15	1.5	.38	3.54:1	7.08:1	15.11
Y-27070	150 ct	50 ct	12.5	.6	.2	.1	8.2	15	6	1.5	1.73:1	3.46:1	16.79
Y-27075	150 ct	100 ct	25	.6	.2	.1	8.2	15	12	3	1.22:1	2.45:1	16.79
Y-27080	150 ct	150 ct	37.5	.6	.2	.1	8.2	15	18	4.5	1:1	2:1	19.81
Y-27085	150 ct	600 ct	150	.6	.2	.1	8.2	15	72	18	1:2	1:1	16.79
Y-27090	200 ct	200 ct	50	.6	.2	.1	7	22	24	6	1:1	2:1	16.79
Y-27095	300 ct	12 ct	3	.6	.2	.1	5.8	30	1.4	.35	5:1	10:1	15.11
Y-27100	300 ct	50 ct	12.5	.6	.2	.1	5.8	30	6	1.5	2.45:1	4.9:1	16.79
Y-27105	300 ct	150 ct	37.5	.6	.2	.1	5.8	30	18	4.5	1.41:1	2.83:1	16.79
Y-27110	300 ct	300 ct	75	.6	.2	.1	5.8	30	36	9	1:1	2:1	19.95
Y-27115	300 ct	600 ct	150	.6	.2	.1	5.8	30	72	18	1:1.41	1.41:1	15.84
Y-27120	320 ct	12.8 ct	3.2	.6	.2	.1	5.6	36	1.8	.45	5:1	10:1	15.11
Y-27125	400 ct	40 ct	10	.6	.2	.1	5	40	4.8	1.2	3.16:1	6.32:1	19.95
Y-27130	400 ct	120 ct	30	.6	.2	.1	5	40	14.5	3.6	1.83:1	3.65:1	19.95
Y-27135	400 ct	200 ct	50	.6	.2	.1	5	40	24	6	1.4:1	2.83:1	16.79
Y-27140	400 ct	400 ct	100	.6	.2	.1	5	40	48	12	1:1	2:1	19.95
Y-27145	400 ct	1000 ct	250	.6	.2	.1	5	40	125	31	1:1.58	1.26:1	22.89
Y-27150	400 ct	2000 ct	500	.6	.2	.1	5	40	240	60	1:2.24	1:1.12	22.89
Y-27155	400 ct	4000 ct	1000	.6	.2	.1	5	40	480	120	1:3.16	1:1.58	20.67
Y-27160	500 ct	12.8 ct	3.2	.6	.2	.1	4.5	50	1.5	.38	6.25:1	12.5:1	17.75
Y-27165	500 ct	16 ct	4	.6	.2	.1	4.5	50	1.9	.48	5.6:1	11.2:1	17.75
Y-27170	500 ct	50 ct	12.5	.6	.2	.1	4.5	50	6	1.5	3.16:1	6.32:1	17.75
Y-27175	500 ct	150 ct	37.5	.6	.2	.1	4.5	50	18	4.5	1.83:1	3.65:1	17.75
Y-27180	500 ct	500 ct	125	.6	.2	.1	4.5	50	60	15	1:1	2:1	17.75
Y-27185	* 500 ct	500 ct	-	.6	.2	.1	4.5	50	60	-	1:1	-	17.75
Y-27190	500 ct	600 ct	150	.6	.2	.1	4.5	50	72	18	1:1.1	1.83:1	15.84
Y-27195	600 ct	12.8 ct	3.2	.6	.2	.1	4.1	60	1.5	.38	6.85:1	13.7:1	14.27
Y-27200	600 ct	30 ct	7.5	.6	.2	.1	4.1	60	3.6	.9	4.47:1	8.94:1	14.93
Y-27205	600 ct	48 ct	12	.6	.2	.1	4.1	60	5.8	1.45	3.54:1	7.07:1	14.93
Y-27210	600 ct	200 ct	50	.6	.2	.1	4.1	60	24	6	1.73:1	3.46:1	14.93
Y-27215**	600 ct	600 ct	150	.6	.2	.1	4.1	60	72	18	1:1	2:1	14.93
Y-27220**	*600 ct	600 ct	-	.6	.2	.1	4.1	60	72	-	1:1	-	14.93
Y-27225**	600 ct	1200 ct	300	.6	.2	.1	4.1	60	144	36	1:1.41	1.41:1	14.93
Y-27230	640 ct	12.8 ct	3.2	.6	.2	.1	3.9	64	1.5	.38	7.07:1	14.14:1	14.93
Y-27235	700 ct	100 ct	25	.6	.2	.1	3.8	70	12	3	2.65:1	5.29:1	14.93
Y-27240	800 ct	12.8 ct	3.2	.6	.2	.1	3.5	80	1.5	.38	7.9:1	15.8:1	14.93
Y-27245	800 ct	48 ct	12	.6	.2	.1	3.5	80	5.8	1.45	4.08:1	8.16:1	17.75
Y-27250	800 ct	800 ct	200	.6	.2	.1	3.5	80	96	24	1:1	2:1	17.75
Y-27255	900 ct	600 ct	150	.6	.2	.1	3.3	90	72	18	1.22:1	2.45:1	15.84
Y-27260	1000 ct	12 ct	3	.6	.2	.1	3.2	100	1.4	.35	9.13:1	18.3:1	15.84
Y-27265	1000 ct	50 ct	12.5	.6	.2	.1	3.2	100	6	1.5	4.47:1	8.94:1	17.75
Y-27270	1000 ct	1000 ct	250	.6	.2	.1	3.2	100	120	30	1:1	2:1	17.75
Y-27275	1060 ct	12.8 ct	3.2	.6	.2	.1	3.1	106	1.5	.38	9.1:1	18.2:1	15.84
Y-27280	1200 ct	12.8 ct	3.2	.6	.2	.1	2.9	120	1.5	.38	9.68:1	19.4:1	14.27
Y-27285	1200 ct	500 ct	125	.6	.2	.1	2.9	120	60	15	1.55:1	3.1:1	14.27
Y-27290	1200 ct	1200 ct	300	.6	.2	.1	2.9	120	144	36	1:1	2:1	14.27
Y-27295	*1200 ct	1200 ct	-	.6	.2	.1	2.9	120	144	-	1:1	-	15.84
Y-27300	1500 ct	12 ct	3	.6	.2	.1	2.6	150	1.44	.36	11.2:1	22.4:1	15.84
Y-27305	1500 ct	500 ct	125	.6	.2	.1	2.6	150	60	15	1.73:1	3.46:1	17.75
Y-27310	*1500 ct	600 ct	-	.6	.2	.1	2.6	150	72	-	1.58:1	-	22.89
Y-27315	*1500 ct	1500 ct	-	.6	.2	.1	2.6	150	180	-	1:1	-	17.75
Y-27320	1600 ct	12.8 ct	3.2	.6	.2	.1	2.5	160	1.5	.38	11.2:1	22.4:1	15.84
Y-27325	2000 ct	8 ct	2	.6	.2	.1	2.2	200	.96	.24	15.8:1	31.6:1	17.75
Y-27330	2000 ct	2000 ct	500	.6	.2	.1	2.2	200	240	60	1:1	2:1	20.67
Y-27335	*2000 ct	2000 ct	-	.6	.2	.1	2.2	200	240	-	1:1	-	22.89
Y-27340	2000 ct	8000 ct	2000	.6	.2	.1	2.2	200	960	240	1:2	1:1	20.67
Y-27345	2500 ct	2500 ct	625	.6	.2	.1	2	250	300	75	1:1	2:1	20.67
Y-27350	3000 ct	3000 ct	725	.6	.2	.1	1.8	300	360	90	1:1	2:1	16.62
Y-27355	*3000 ct	3000 ct	-	.6	.2	.1	1.8	300	360	-	1:1	-	22.89
Y-27360	3600 ct	3600 ct	900	.6	.2	.1	1.7	360	432	108	1:1	2:1	20.67
Y-27365	4000 ct	16 ct	4	.6	.2	.1	1.6	400	1.92	.48	15.8:1	31.6:1	20.67
Y-27370**	4000 ct	600 ct	150	.6	.2	.1	1.6	400	72	18	2.58:1	5.16:1	20.67
Y-27375	4000 ct	1000 ct	250	.6	.2	.1	1.6	400	120	30	2:1	4:1	20.67
Y-27380	*4000 ct	8000 ct	-	.6	.2	.1	1.6	400	960	-	1:1.41	-	20.67
Y-27385	5000 ct	500 ct	125	.5	.2	.1	1.4	500	60	15	3.16:1	6.32:1	16.62
Y-27390	5000 ct	5000 ct	1250	.5	.2	.1	1.4	500	600	150	1:1	2:1	16.62
Y-27395	7500 ct	50 ct	12.5	.33	.2	.1	1.2	750	6	1.5	12.2:1	24.5:1	16.62
Y-27400	7500 ct	100 ct	25	.33	.2	.1	1.2	750	12	3	8.66:1	17.3:1	17.75
Y-27405	7500 ct	600 ct	150	.33	.2	.1	1.2	750	72	18	3.54:1	7.07:1	19.50

***Discount Prices: 1-9 Net:
10-24 less 10%: 25-49 less 16%:
50-99 less 23%: 100-499 less 30%

Ordering Instructions:
No minimum. Net 30 days
F.O.B. Mt. Vernon, New York

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

PICO PART NUMBER Y Series Plug-In	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1KHz and higher	400 Hz and higher	300 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9 *** Y-Series
Y-27410	7500 ct	2500 ct	625	.33	.2	.1	1.2	750	300	75	1.73:1	3.46:1	19.50
Y-27415	*7500 ct	7500 ct	-	.33	.2	.1	1.2	750	900	-	1:1	-	22.89
Y-27420	8000 ct	12.8 ct	3.2	.3	.2	.1	1.1	800	1.5	.38	25:1	50:1	16.62
Y-27425	8000 ct	1000 ct	250	.3	.2	.1	1.1	800	120	30	2.83:1	5.66:1	19.50
Y-27430	*8000 ct	1200 ct	-	.3	.2	.1	1.1	800	144	-	2.58:1	-	20.67
Y-27435	*9000 ct	9000 ct	-	.27	.2	.1	1.1	900	1080	-	1:1	-	21.49
Y-27440	10,000 ct	12.8 ct	3.2	.25	.2	.1	1.0	1000	1.5	.38	28:1	56:1	15.84
Y-27445	10,000 ct	16 ct	4	.25	.2	.1	1.0	1000	1.92	.48	25:1	50:1	17.51
Y-27450	10,000 ct	100 ct	25	.25	.2	.1	1.0	1000	12	3	10:1	20:1	17.51
Y-27455	10,000 ct	200 ct	50	.25	.2	.1	1.0	1000	24	6	7.07:1	14.14:1	17.51
Y-27460	10,000 ct	500 ct	125	.25	.2	.1	1.0	1000	60	15	4.47:1	8.94:1	17.51
Y-27465	10,000 ct	600 ct	150	.25	.2	.1	1.0	1000	72	18	4.08:1	8.16:1	17.51
Y-27470	10,000 ct	1000 ct	250	.25	.2	.1	1.0	1000	120	30	3.16:1	6.32:1	17.51
Y-27475	10,000 ct	1200 ct	300	.25	.2	.1	1.0	1000	144	36	2.89:1	5.77:1	17.51
Y-27480	10,000 ct	1500 ct	375	.25	.2	.1	1.0	1000	180	45	2.58:1	5.16:1	19.09
Y-27485	10,000 ct	2000 ct	500	.25	.2	.1	1.0	1000	240	60	2.24:1	4.47:1	19.09
Y-27490	10,000 ct	5000 ct	1250	.25	.2	.1	1.0	1000	600	150	1.41:1	2.83:1	20.44
Y-27495	10,000 ct	7500 ct	1875	.25	.2	.1	1.0	1000	900	225	1.15:1	2.3:1	20.44
Y-27500	10,000 ct	10,000 ct	2500	.25	.2	.1	1.0	1000	1200	300	1:1	2:1	19.95
Y-27505	*10,000 ct	10,000 ct	-	.25	.2	.1	1.0	1000	1200	-	1:1	-	22.24
Y-27510	15,000 ct	400 ct	100	.16	.16	.1	.82	1500	48	12	6.12:1	12.24:1	19.95
Y-27515	15,000 ct	500 ct	125	.16	.16	.1	.82	1500	60	15	5.48:1	10.95:1	19.95
Y-27520	15,000 ct	600 ct	150	.16	.16	.1	.82	1500	72	18	5:1	10:1	19.95
Y-27525	15,000 ct	10,000 ct	2500	.16	.16	.1	.82	1500	1200	300	1.22:1	2.45:1	22.24
Y-27530	*15,000 ct	15,000 ct	-	.16	.16	.1	.82	1500	1800	-	1:1	-	22.24
Y-27535	15,000 ct	15,000 ct	3750	.16	.16	.1	.82	1500	1800	450	1:1	2:1	22.24
Y-27540	16,000 ct	1000 ct	250	.15	.15	.1	.8	1600	120	30	4:1	8:1	20.67
Y-27545	20,000 ct	500 ct	125	.125	.125	.1	.7	2000	60	15	6.33:1	12.65:1	19.95
Y-27550	20,000 ct	600 ct	150	.125	.125	.1	.7	2000	72	18	5.77:1	11.55:1	19.95
Y-27555	20,000 ct	800 ct	200	.125	.125	.1	.7	2000	96	24	5:1	10:1	15.84
Y-27560	20,000 ct	1000 ct	250	.125	.125	.1	.7	2000	120	30	4.47:1	8.94:1	19.95
Y-27565	20,000 ct	5000 ct	1250	.125	.125	.1	.7	2000	600	150	2:1	4:1	19.95
Y-27570	20,000 ct	10,000 ct	2500	.125	.125	.1	.7	2000	1200	300	1.41:1	2.83:1	19.95
Y-27575	*20,000 ct	20,000 ct	-	.125	.125	.1	.7	2000	2400	-	1:1	-	19.95
Y-27580	25,000 ct	500 ct	125	.1	.1	.1	.63	2500	60	15	7.07:1	14.14:1	19.95
Y-27585	25,000 ct	1000 ct	250	.1	.1	.1	.63	2500	120	30	5:1	10:1	19.95
Y-27590	30,000 ct	50 ct	12.5	.08	.08	.08	.58	3000	6	1.5	24.5:1	49:1	19.95
Y-27595	30,000 ct	1200 ct	300	.08	.08	.08	.58	3000	144	36	5:1	10:1	19.95
Y-27600	30,000 ct	500 ct	125	.08	.08	.08	.58	3000	60	15	7.75:1	15.5:1	19.95
Y-27605	30,000 ct	200 ct	50	.08	.08	.08	.58	3000	24	6	12.25:1	24.5:1	19.95
Y-27610	30,000 ct	5000 ct	1250	.08	.08	.08	.58	3000	600	150	2.45:1	4.9:1	22.24
Y-27615	30,000 ct	10,000 ct	2500	.08	.08	.08	.58	3000	1200	300	1.73:1	3.46:1	22.24
Y-27620	*30,000 ct	30,000 ct	-	.08	.08	.08	.58	3000	3600	-	1:1	-	22.24
Y-27625	40,000 ct	400 ct	100	.06	.06	.06	.5	4000	48	12	10:1	20:1	22.24
Y-27630	40,000 ct	2,000 ct	500	.06	.06	.06	.5	4000	240	60	4.47:1	8.94:1	22.24
Y-27635	40,000 ct	4,000 ct	1000	.06	.06	.06	.5	4000	480	120	3.16:1	6.32:1	23.07
Y-27640	40,000 ct	20,000 ct	5000	.06	.06	.06	.5	4000	2400	600	1.41:1	2.83:1	22.24
Y-27645	*40,000 ct	40,000 ct	-	.06	.06	.06	.5	4000	4800	-	1:1	-	22.24
Y-27650	50,000 ct	200 ct	50	.05	.05	.05	.45	5000	24	6	15.8:1	31.6:1	23.07
Y-27655	50,000 ct	500 ct	125	.05	.05	.05	.45	5000	60	15	10:1	20:1	23.07
Y-27660	50,000 ct	600 ct	150	.05	.05	.05	.45	5000	72	18	9.13:1	18.26:1	23.07
Y-27665	60,000 ct	15,000 ct	3750	.04	.04	.04	.41	6000	1800	450	2:1	4:1	23.07
Y-27670	62,500 ct	50 ct	12.5	.04	.04	.04	.4	6250	6	1.5	35.4:1	70.7:1	23.07
Y-27675	80,000 ct	15,000 ct	3750	.03	.03	.03	.35	8000	1800	450	2.3:1	4.6:1	23.07
Y-27680	90,000 ct	10,000 ct	2500	.028	.028	.028	.33	9000	1200	300	3:1	6:1	23.07
Y-27685	95,000 ct	15,000 ct	3750	.026	.026	.026	.32	9500	1800	450	2.52:1	5.03:1	23.07
Y-27690	100,000 ct	60 ct	15	.025	.025	.025	.31	10,000	7.2	1.8	40.8:1	81.6:1	25.53
Y-27695	100,000 ct	100 ct	25	.025	.025	.025	.31	10,000	12	3	31.6:1	63.2:1	25.53
Y-27700	100,000 ct	500 ct	125	.025	.025	.025	.31	10,000	60	15	14.1:1	28.3:1	25.53
Y-27705	100,000 ct	10,000 ct	2500	.025	.025	.025	.31	10,000	1200	300	3.16:1	6.32:1	25.53
Y-SHIELD	MU-METAL SHIELD .37" DIA. X .46" HT. (9.4MM DIA. X 11.7MM HT.) SINGLE SHIELD												2.33
YXX-SHIELD	MU-METAL SHIELD .395" DIA. X .47" HT. (10.1MM DIA. X 11.9"MM HT.) USE WITH Y-SHIELD FOR DOUBLE SHIELDING												2.33

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

• INCLUDES ELECTROSTATIC SHIELD

PICO's ultra-miniature transformers

Y SERIES Plug-In

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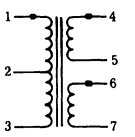

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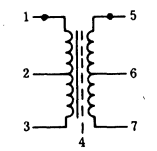

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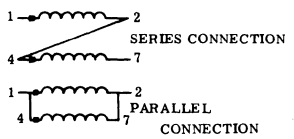

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- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
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- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS

This Product is Patented

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Y-Series Plug-In	INDUCTANCE HENRIES	DC CURRENT ma	DC RESISTANCE OHMS	PRICES 1-9***
Y-27750	SERIES .075 / .06	10 / 30	10.5	15.12
	PARALLEL .018 / .015	20 / 60	2.6	
Y-27760	SERIES .3 / .15	4 / 20	25	16.80
	PARALLEL .075 / .04	8 / 40	6.2	
Y-27770	SERIES 3.5 / 1.0	2 / 5	560	16.80
	PARALLEL 0.9 / 0.25	4 / 10	140	
Y-27780	SERIES 6.0 / 1.5	2 / 5	2100	16.80
	PARALLEL 1.5 / 0.38	4 / 10	525	
Y-27790	SERIES 20 / 8	1 / 3	5100	20.67
	PARALLEL 5 / 2	2 / 6	1275	

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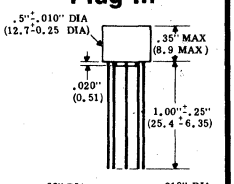
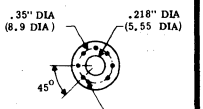
PICO's ultra-miniature transformers

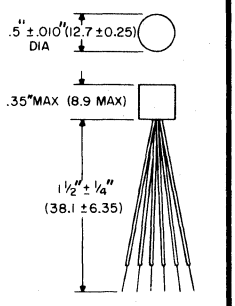
L SERIES Plug-In





WHITE DOT AT TERMINAL #1
TERMINALS CLOCKWISE FROM PIN #1

P SERIES Insulated Leads



Dimensions are in inches (MM)

SPECIFICATIONS

- MIL-T-27 . . . . . **All Units Meet MIL-T-27** and are Hermetically Sealed in a Metal Case. Audio Transformers are Type TF5R21ZZ.
- FREQUENCY RESPONSE: . . . . ±3db, 300 Hz - 75 KHz At 1.0 Milliwatt
- MAXIMUM DISTORTION: . . . . . 5% With Rated Power Level at 1 KHz, 400 Hz and 300 Hz
- DIELECTRIC STRENGTH: . . . . All Units Tested at 200 V RMS
- INSULATION RESISTANCE: . . . Greater than 10,000 Megohms at 300 V DC
- WEIGHT: . . . . . 5 Grams
- OPERATING TEMPERATURE: . . -55°c to 105°c (All Units Can Be Supplied to Class S Requirements 130°c maximum)
- TERMINALS: . . . . . Solid .016 Diameter Conductor. Conductor is Copper Clad Steel, Tinned 100%, Electroplated Per MIL-T-10727A and ASTM CCS B452.
- THERMAL SHOCK: . . . . . 25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

This Product is Patented

PICO PART NUMBER		PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS			PRIMARY UNBALANCED DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9 ***	
L-Series Plug-in	P-Series Insulated Leads		SER	PAR	1KHz and higher	400 Hz and higher	300 Hz and higher			SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	L-Series	P-Series
L-8203	P-9203	20 ct	8 ct	2	.6	.4	.3	30.0	2	1.2	.3	1.58:1	3.16:1	18.83	18.02
L-8205	P-9205	20 ct	20 ct	5	.6	.4	.3	30.0	2	2.8	.7	1:1	2:1	18.83	18.02
L-8210	P-9210	32 ct	32 ct	8	.6	.4	.3	23.0	3.3	4.5	1.13	1:1	2:1	18.83	18.02
L-8215	P-9215	40 ct	40 ct	10	.6	.4	.3	21.0	3.7	5	1.25	1:1	2:1	18.83	18.02
L-8218	P-9218	48 ct	16 ct	4	.6	.4	.3	19.0	3.75	3	.75	1.73:1	3.46:1	18.83	18.02
L-8220	P-9220	50 ct	50 ct	12.5	.6	.4	.3	19.0	5	7	1.75	1:1	2:1	18.83	18.02
L-8225	P-9225	80 ct	32 ct	8	.6	.4	.3	15.0	7.5	4.3	1.13	1.58:1	3.16:1	18.83	18.02
L-8228	P-9228	100 ct	40 ct	10	.6	.4	.3	13.0	10.8	5	1.25	1.58:1	3.16:1	18.83	18.02
L-8230	P-9230	100 ct	100 ct	25	.6	.4	.3	13.0	10.8	12	3	1:1	2:1	18.83	18.02
L-8235	P-9235	120 ct	12.8 ct	3.2	.6	.4	.3	12.0	9.3	2.2	.55	3.06:1	6.12:1	18.83	18.02
L-8240	P-9240	120 ct	60 ct	15	.6	.4	.3	12.0	9	7.2	1.8	1.41:1	2.83:1	18.83	18.02
L-8245	P-9245	120 ct	120 ct	30	.6	.4	.3	12.0	11.6	13	3.3	1:1	2:1	18.83	18.02
L-8250	P-9250	150 ct	12 ct	3	.6	.4	.3	11.0	11.2	2.2	.55	3.54:1	7.08:1	18.83	18.02
L-8255	P-9255	150 ct	50 ct	12.5	.6	.4	.3	11.0	13	6.8	1.7	1.73:1	3.46:1	18.83	18.02
L-8260	P-9260	150 ct	100 ct	25	.6	.4	.3	11.0	13	11.8	3	1.22:1	2.45:1	18.83	18.02
L-8265	P-9265	150 ct	150 ct	37.5	.6	.4	.3	11.0	13	18.3	4.6	1:1	2:1	18.83	18.02
L-8270	P-9270	150 ct	600 ct	150	.6	.4	.3	11.0	13	75	19	1:2	1:1	18.83	18.02
L-8275	P-9275	200 ct	200 ct	50	.6	.4	.3	10.0	19	21.3	5.4	1:1	2:1	18.83	18.02
L-8280	P-9280	300 ct	12 ct	3	.6	.4	.3	8.0	24	1.7	.43	5:1	10:1	18.83	18.02
L-8285	P-9285	300 ct	50 ct	12.5	.6	.4	.3	8.0	30	6.8	1.7	2.45:1	4.9:1	18.83	18.02
L-8290	P-9290	300 ct	150 ct	37.5	.6	.4	.3	8.0	30	18	4.6	1.41:1	2.83:1	18.83	18.02
L-8295	P-9295	300 ct	300 ct	75	.6	.4	.3	8.0	30	34	8.5	1:1	2:1	18.83	18.02
L-8300	P-9300	300 ct	600 ct	150	.6	.4	.3	8.0	30	60	15	1:1.41	1.41:1	18.83	18.02
L-8305	P-9305	320 ct	12.8 ct	3.2	.6	.4	.3	7.5	31	1.7	.43	5:1	10:1	18.83	18.02
L-8310	P-9310	400 ct	40 ct	10	.6	.4	.3	7.0	41	4.5	1.13	3.16:1	6.32:1	18.83	18.02
L-8315	P-9315	400 ct	120 ct	30	.6	.4	.3	7.0	41	12	3	1.83:1	3.65:1	18.83	18.02
L-8320	P-9320	400 ct	200 ct	50	.6	.4	.3	7.0	41	21.3	5.4	1.41:1	2.83:1	18.83	18.02
L-8325	P-9325	400 ct	400 ct	100	.6	.4	.3	7.0	41	37.5	9.4	1:1	2:1	18.83	18.02
L-8330	P-9330	400 ct	1000 ct	250	.6	.4	.3	7.0	41	96	24	1:1.58	1.26:1	18.83	18.02
L-8335	P-9335	400 ct	2000 ct	500	.6	.4	.3	7.0	41	212	53	1:2.24	1:1.12	18.83	18.02
L-8340	P-9340	400 ct	4000 ct	1000	.6	.4	.3	7.0	41	375	94	1:3.16	1:1.58	18.83	18.02
L-8342	P-9342	500 ct	12.8 ct	3.2	.6	.4	.3	6.0	48	1.7	.43	6.25:1	12.5:1	18.83	18.02
L-8344	P-9344	500 ct	16 ct	4	.6	.4	.3	6.0	48	1.9	.5	5.6:1	11.2:1	18.83	18.02
L-8345	P-9345	500 ct	50 ct	12.5	.6	.4	.3	6.0	39	6.8	1.7	3.16:1	6.32:1	18.83	18.02
L-8347	P-9347	500 ct	150 ct	37.5	.6	.4	.3	6.0	48	18	4.6	1.83:1	3.65:1	18.83	18.02
L-8350	P-9350	500 ct	500 ct	125	.6	.4	.3	6.0	48	54	13.5	1:1	2:1	18.83	18.02
L-8355	P-9355	*500 ct	500 ct	-	.6	.4	.3	6.0	48	68	-	1:1	-	19.61	18.83
L-8360	P-9360	500 ct	600 ct	150	.6	.4	.3	6.0	48	59	15	1:1.1	1.83:1	18.83	18.83
L-8365	P-9365	600 ct	12.8 ct	3.2	.6	.4	.3	5.5	53	1.7	.43	6.85:1	13.7:1	18.83	18.83
L-8367	P-9367	600 ct	30 ct	7.5	.6	.4	.3	5.5	53	4.2	1.1	4.47:1	8.94:1	18.83	18.83
L-8370	P-9370	600 ct	48 ct	12	.6	.4	.3	5.5	53	6.8	1.7	3.54:1	7.07:1	18.83	18.83
L-8375	P-9375	600 ct	200 ct	50	.6	.4	.3	5.5	53	21.3	5.3	1.73:1	3.46:1	18.83	18.20
L-8380**	P-9380	600 ct	600 ct	150	.6	.4	.3	5.5	57	79	20	1:1	2:1	18.83	18.20
L-8385**	P-9385	*600 ct	600 ct	-	.6	.4	.3	5.5	53	75	-	1:1	-	19.61	18.83
L-8387**	P-9387	600 ct	1200 ct	300	.6	.4	.3	5.5	53	105	26	1:1.41	1.41:1	18.83	18.20
L-8390	P-9390	640 ct	12.8 ct	3.2	.6	.4	.3	5.5	66	1.7	.43	7.07:1	14.14:1	18.83	18.20
L-8395	P-9395	700 ct	100 ct	25	.6	.4	.3	5.0	69	12	3	2.65:1	5.29:1	18.83	18.20
L-8400	P-9400	800 ct	12.8 ct	3.2	.6	.4	.3	5.0	75	1.7	.43	7.9:1	15.8:1	18.83	18.20
L-8405	P-9405	800 ct	48 ct	12	.6	.4	.3	5.0	75	6.8	1.7	4.08:1	8.16:1	18.83	18.20
L-8410	P-9410	800 ct	800 ct	200	.6	.4	.3	5.0	75	105	26	1:1	2:1	18.83	18.20
L-8415	P-9415	900 ct	600 ct	150	.6	.4	.3	4.5	79	75	19	1.22:1	2.45:1	18.83	18.20
L-8420	P-9420	1000 ct	12 ct	3	.6	.4	.3	4.5	103	1.6	.4	9.13:1	18.3:1	18.83	18.20
L-8425	P-9425	1000 ct	50 ct	12.5	.6	.4	.3	4.5	103	6.4	1.6	4.47:1	8.94:1	18.83	18.20
L-8430	P-9430	1000 ct	1000 ct	250	.6	.4	.3	4.5	103	115	29	1:1	2:1	18.83	18.20
L-8435	P-9435	1060 ct	12.8 ct	3.2	.6	.4	.3	4.0	108	1.7	.43	9.1:1	18.2:1	18.83	18.20
L-8440	P-9440	1200 ct	12.8 ct	3.2	.6	.4	.3	4.0	113	1.7	.43	9.68:1	19.4:1	18.83	18.20
L-8445	P-9445	1200 ct	500 ct	125	.6	.4	.3	4.0	113	54	13.5	1.55:1	3.1:1	18.83	18.20
L-8450	P-9450	1200 ct	1200 ct	300	.6	.4	.3	4.0	113	126	31.6	1:1	2:1	18.83	18.20
L-8455	P-9455	*1200 ct	1200 ct	-	.6	.4	.3	4.0	111	125	-	1:1	-	19.61	18.83
L-8460	P-9460	1500 ct	12 ct	3	.6	.4	.3	3.5	126	1.6	.4	11.2:1	22.4:1	18.83	18.20
L-8465	P-9465	1500 ct	500 ct	125	.6	.4	.3	3.5	126	68	17	1.73:1	3.46:1	18.83	18.20
L-8470	P-9470	*1500 ct	600 ct	-	.6	.4	.3	3.5	126	94	-	1.58:1	-	19.61	18.83
L-8475	P-9475	*1500 ct	1500 ct	-	.6	.4	.3	3.5	126	176	-	1:1	-	19.61	18.83
L-8480	P-9480	1600 ct	12.8 ct	3.2	.6	.4	.3	3.5	130	1.7	.43	11.2:1	22.4:1	18.83	18.20
L-8483	P-9483	2000 ct	8 ct	2	.6	.4	.3	3.0	210	1.2	.3	15.8:1	31.6:1	18.83	18.20
L-8485	P-9485	2000 ct	2000 ct	500	.6	.4	.3	3.0	198	218	55	1:1	2:1	18.83	18.20
L-8490	P-9490	*2000 ct	2000 ct	-	.6	.4	.3	3.0	198	218	-	1:1	-	18.83	18.20
L-8495	P-9495	2000 ct	8000 ct	2000	.6	.4	.3	3.0	198	850	213	1:2	1:1	18.83	18.20
L-8497	P-9497	2500 ct	2500 ct	625	.6	.4	.3	2.5	220	305	76	1:1	2:1	18.83	18.20
L-8500	P-9500	3000 ct	3000 ct	750	.6	.4	.3	2.5	243	335	84	1:1	2:1	18.83	18.20

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
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PICO PART NUMBER L-Series Plug-in	PICO PART NUMBER P-Series Insulated Leads	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER WATTS 1KHz and higher	POWER WATTS 400 Hz and higher	POWER WATTS 300 Hz and higher	PRIMARY UNBALANCED DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	TURNS RATIO PRIM/SEC SEC PAR CONN	PICO PRICES 1-9 *** L-Series	PICO PRICES 1-9 *** P-Series
L-8505	P-9505	*3000 ct	3000 ct	-	.6	.4	.3	2.5	304	335	-	1:1	-	19.61	18.83
L-8510	P-9510	3600 ct	3600 ct	900	.6	.4	.3	2.5	330	366	92	1:1	2:1	18.83	18.20
L-8512	P-9512	4000 ct	16 ct	4	.6	.4	.3	2.0	350	3	.75	15.8:1	31.6:1	18.83	18.20
L-8514	P-9514	4000 ct	600 ct	150	.6	.4	.3	2.0	350	76	19	2.58:1	5.16:1	18.83	18.20
L-8515	P-9515	4000 ct	1000 ct	250	.6	.4	.3	2.0	350	115	29	2:1	4:1	18.83	18.20
L-8520	P-9520	*4000 ct	8000 ct	-	.6	.4	.3	2.0	350	1062	-	1:1.41	-	19.61	18.83
L-8525	P-9525	5000 ct	500 ct	125	.6	.4	.3	2.0	350	67	17	3.16:1	6.32:1	18.83	18.20
L-8530	P-9530	5000 ct	5000 ct	1250	.6	.4	.3	2.0	390	538	135	1:1	2:1	18.83	18.20
L-8535	P-9535	7500 ct	50 ct	12.5	.6	.4	.3	1.5	600	7	1.75	12.2:1	24.5:1	20.89	20.28
L-8540	P-9540	7500 ct	100 ct	25	.6	.4	.3	1.5	600	12	3	8.66:1	17.3:1	20.89	20.28
L-8545	P-9545	7500 ct	600 ct	150	.6	.4	.3	1.5	600	78	19.5	3.54:1	7.07:1	20.89	20.28
L-8550	P-9550	7500 ct	2500 ct	625	.6	.4	.3	1.5	600	305	77	1.73:1	3.46:1	20.89	20.28
L-8555	P-9555	*7500 ct	7500 ct	-	.6	.4	.3	1.5	750	828	-	1:1	-	22.37	20.88
L-8560	P-9560	8000 ct	12.8 ct	3.2	.6	.4	.3	1.5	750	1.7	.43	25:1	50:1	20.89	20.28
L-8565	P-9565	8000 ct	1000 ct	250	.6	.4	.3	1.5	750	115	29	2.83:1	5.66:1	20.89	20.28
L-8570	P-9570	*8000 ct	1200 ct	-	.6	.4	.3	1.5	750	158	-	2.58:1	-	22.37	20.88
L-8575	P-9575	*9000 ct	9000 ct	-	.6	.4	.3	1.4	796	1100	-	1:1	-	22.37	20.88
L-8580	P-9580	10,000 ct	12.8 ct	3.2	.6	.4	.3	1.4	1048	1.7	.43	28:1	56:1	20.89	20.28
L-8585	P-9585	10,000 ct	16 ct	4	.6	.4	.3	1.4	1048	3	.75	25:1	50:1	20.89	20.28
L-8590	P-9590	10,000 ct	100 ct	25	.6	.4	.3	1.4	839	12	3	10:1	20:1	20.89	20.28
L-8595	P-9595	10,000 ct	200 ct	50	.6	.4	.3	1.4	839	27	6.7	7.07:1	14.14:1	20.89	20.28
L-8600	P-9600	10,000 ct	500 ct	125	.6	.4	.3	1.4	850	67	17	4.47:1	8.94:1	20.89	20.28
L-8605	P-9605	10,000 ct	600 ct	150	.6	.4	.3	1.4	850	74	18.5	4.08:1	8.16:1	20.89	20.28
L-8610	P-9610	10,000 ct	1000 ct	250	.6	.4	.3	1.4	850	115	29	3.16:1	6.32:1	20.89	20.28
L-8615	P-9615	10,000 ct	1200 ct	300	.6	.4	.3	1.4	850	158	39.5	2.89:1	5.77:1	20.89	20.28
L-8620	P-9620	10,000 ct	1500 ct	375	.6	.4	.3	1.4	850	177	44	2.58:1	5.16:1	20.89	20.28
L-8625	P-9625	10,000 ct	2000 ct	500	.6	.4	.3	1.4	850	255	64	2.24:1	4.47:1	20.89	20.28
L-8630	P-9630	10,000 ct	5000 ct	1250	.6	.4	.3	1.4	850	630	158	1.41:1	2.83:1	20.89	20.28
L-8635	P-9635	10,000 ct	7500 ct	1875	.6	.4	.3	1.4	850	772	193	1.15:1	2.3:1	20.89	20.28
L-8640	P-9640	10,000 ct	10,000 ct	2500	.6	.4	.3	1.4	866	1215	304	1:1	2:1	20.89	20.28
L-8645	P-9645	*10,000 ct	10,000 ct	-	.6	.4	.3	1.4	1060	1215	-	1:1	-	22.37	20.88
L-8650	P-9650	15,000 ct	400 ct	100	.6	.4	.3	1.0	1305	47	12	6.12:1	12.24:1	20.89	20.28
L-8652	P-9652	15,000 ct	500 ct	125	.6	.4	.3	1.0	1305	53	13	5.48:1	10.95:1	20.89	20.28
L-8655	P-9655	15,000 ct	600 ct	150	.6	.4	.3	1.0	1305	72.5	18	5:1	10:1	20.89	20.28
L-8660	P-9660	15,000 ct	10,000 ct	2500	.6	.4	.3	1.0	1305	1215	304	1.22:1	2.45:1	20.89	20.28
L-8665	P-9665	*15,000 ct	15,000 ct	-	.6	.4	.3	1.0	1305	1800	-	1:1	-	22.37	20.88
L-8670	P-9670	15,000 ct	15,000 ct	3750	.6	.4	.3	1.0	1305	1800	450	1:1	2:1	20.89	20.28
L-8675	P-9675	16,000 ct	1000 ct	250	.6	.4	.3	1.0	1343	115	29	4:1	8:1	20.89	20.28
L-8680	P-9680	20,000 ct	500 ct	125	.5	.4	.3	1.0	1560	68	17	6.33:1	12.65:1	22.37	20.88
L-8685	P-9685	20,000 ct	600 ct	150	.5	.4	.3	1.0	1560	75	19	5.77:1	11.55:1	22.37	20.88
L-8690	P-9690	20,000 ct	800 ct	200	.5	.4	.3	1.0	1560	108	27	5:1	10:1	22.37	20.88
L-8695	P-9695	20,000 ct	1000 ct	250	.5	.4	.3	1.0	1560	121	30.5	4.47:1	8.94:1	22.37	20.88
L-8700	P-9700	20,000 ct	5000 ct	1250	.5	.4	.3	1.0	1560	672	168	2:1	4:1	22.37	20.88
L-8705	P-9705	20,000 ct	10,000 ct	2500	.5	.4	.3	1.0	1560	1520	380	1.41:1	2.83:1	22.37	20.88
L-8710	P-9710	*20,000 ct	20,000 ct	-	.5	.4	.3	1.0	1560	2727	682	1:1	-	23.27	22.37
L-8715	P-9715	25,000 ct	500 ct	125	.4	.4	.3	0.8	2170	68	17	7.07:1	14.14:1	22.37	20.88
L-8720	P-9720	25,000 ct	1000 ct	250	.4	.4	.3	0.8	2170	120	30	5:1	10:1	22.37	20.88
L-8725	P-9725	30,000 ct	50 ct	12.5	.33	.33	.3	0.8	2400	7	1.75	24.5:1	49:1	23.27	22.37
L-8730	P-9730	30,000 ct	1200 ct	300	.33	.33	.3	0.8	2400	156	39	5:1	10:1	23.27	22.37
L-8732	P-9732	30,000 ct	500 ct	125	.33	.33	.3	0.8	2400	68	17	7.75:1	15.5:1	23.27	22.37
L-8734	P-9734	30,000 ct	200 ct	50	.33	.33	.3	0.8	2400	29	7.2	12.25:1	24.5:1	23.27	22.37
L-8735	P-9735	30,000 ct	5000 ct	1250	.33	.33	.3	0.8	2400	673	169	2.45:1	4.9:1	23.27	22.37
L-8740	P-9740	30,000 ct	10,000 ct	2500	.33	.33	.3	0.8	2400	1520	380	1.73:1	3.46:1	23.27	22.37
L-8745	P-9745	*30,000 ct	30,000 ct	-	.33	.33	.3	0.8	3000	3310	-	1:1	-	24.98	23.49
L-8750	P-9750	40,000 ct	400 ct	100	.25	.25	.25	0.7	3400	57	14.3	10:1	20:1	24.98	23.49
L-8755	P-9755	40,000 ct	2000 ct	500	.25	.25	.25	0.7	3400	268	67	4.47:1	8.94:1	24.98	23.49
L-8760	P-9760	40,000 ct	4000 ct	1000	.25	.25	.25	0.7	3400	476	119	3.16:1	6.32:1	24.98	23.49
L-8765	P-9765	40,000 ct	20,000 ct	5000	.25	.25	.25	0.7	3400	2700	675	1.41:1	2.83:1	24.98	23.49
L-8770	P-9770	*40,000 ct	40,000 ct	-	.25	.25	.25	0.7	3400	4750	-	1:1	-	27.86	26.64
L-8775	P-9775	50,000 ct	200 ct	50	.2	.2	.2	0.6	4850	27	6.7	15.8:1	31.6:1	27.86	26.64
L-8777	P-9777	50,000 ct	500 ct	125	.2	.2	.2	0.6	4850	68	17	10:1	20:1	27.86	26.64
L-8779	P-9779	50,000 ct	600 ct	150	.2	.2	.2	0.6	4850	75	18.5	9.13:1	18.26:1	27.86	26.64
L-8780	P-9780	60,000 ct	15,000 ct	3750	.16	.16	.16	0.5	5275	2250	563	2:1	4:1	30.04	29.30
L-8785	P-9785	62,500 ct	50 ct	12.5	.16	.16	.16	0.5	5445	8.7	2.2	35.4:1	70.7:1	30.04	29.30
L-8787	P-9787	80,000 ct	15,000 ct	3750	.12	.12	.12	0.4	6130	2250	563	2.3:1	4.6:1	30.04	29.30
L-8790	P-9790	90,000 ct	10,000 ct	2500	.1	.1	.1	0.4	8140	1520	380	3:1	6:1	31.55	30.40
L-8795	P-9795	95,000 ct	15,000 ct	3750	.1	.1	.1	0.4	8400	2250	563	2.52:1	5.03:1	31.55	30.40
L-8800	P-9800	100,000 ct	60 ct	15	.1	.1	.1	0.4	8750	9.2	2.3	40.8:1	81.6:1	31.55	30.40
L-8805	P-9805	100,000 ct	100 ct	25	.1	.1	.1	0.4	8750	15	3.8	31.6:1	63.2:1	31.55	30.40
L-8810	P-9810	100,000 ct	500 ct	125	.1	.1	.1	0.4	8750	68	17	14.1:1	28.3:1	31.55	30.40
L-8815	P-9815	100,000 ct	10,000 ct	2500	.1	.1	.1	0.4	8750	1535	385	3.16:1	6.32:1	31.55	30.40
L-SHIELD	MU-METAL SHIELD .53" d X .41" h (13.46 mm d X 10.41 mm h)													2.34	
P-SHIELD	MU-METAL SHIELD .53" d X .41" h (13.46 mm d X 10.41 mm h)														2.33

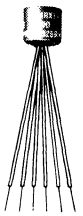
*INCLUDES ELECTROSTATIC SHIELD

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

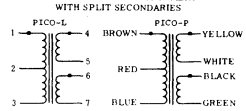
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

L SERIES Plug-In

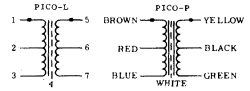
P SERIES Insulated Leads



SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

PICO Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

914-699-5514
TWX 7105620113

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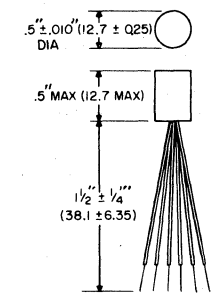
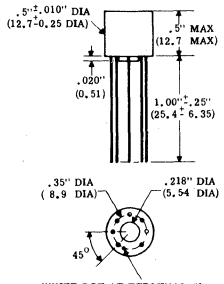
Call Toll Free 800-431-1064

PICO's ultra-miniature transformers

K SERIES Insulated Leads



N SERIES Plug-In



Dimensions are in inches (MM)

SPECIFICATIONS

- MIL-T-27 . . . . . All Units Meet MIL-T-27, and Are Hermetically Sealed in a Metal Case, Audio Transformers Are Type TF5R21ZZ.
- FREQUENCY RESPONSE: . . . ±3 db, 150 Hz - 75 KHz at 1.0 Milliwatt (When Primary Impedance ≧ 50K Ohms, ±3 db 150 Hz to 20 KHz)
- MAXIMUM DISTORTION: . . . . 5% With Rated Power Level at 1 KHz, 400 Hz and 150 Hz
- DIELECTRIC STRENGTH: . . . . All Units Tested at 200 V RMS
- INSULATION RESISTANCE: . . . Greater Than 10,000 Megohms at 300 V DC
- WEIGHT: . . . . . 7.5 Grams
- OPERATING TEMPERATURE: . . -55°c to 105°c (All Units Can Be Supplied to Class S Requirements 130°c maximum)
- TERMINALS: . . . . . Solid .016 Diameter Conductor, Conductor is Copper Clad Steel, Tinned 100%, Electroplated Per MIL-T-10727A and ASTM CCS B452.
- THERMAL SHOCK: . . . . . 25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

Delivery: Stock to one week

This Product is Patented

PICO PART NUMBER			SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS			PRIMARY UNBALANCED DC CURRENT	PRIMARY DC RESISTANCE	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9 ***	
K-Series Insulated Leads	N-Series Plug-in	PRIMARY IMPEDANCE OHMS	SER	PAR	1KHz and higher	400 Hz and higher	150 Hz and higher	ma	OHMS	SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	K-Series	N-Series
K-7203	N-6203	20 ct	8 ct	2	1.0	.75	.11	22.0	1.75	1.0	.25	1.58:1	3.16:1	18.20	18.84
K-7205	N-6205	20 ct	20 ct	5	1.0	.75	.11	22.0	1.75	2.5	.63	1:1	2:1	18.20	18.84
K-7210	N-6210	32 ct	32 ct	8	1.0	.75	.11	18.0	2.7	3.7	.93	1:1	2:1	18.20	18.84
K-7215	N-6215	40 ct	40 ct	10	1.0	.75	.11	16.0	3	5.2	1.3	1:1	2:1	18.20	18.84
K-7218	N-6218	48 ct	16 ct	4	1.0	.75	.11	13.0	4.5	2.4	.6	1.73:1	3.46:1	18.20	18.84
K-7220	N-6220	50 ct	50 ct	12.5	1.0	.75	.11	13.0	4.5	6.2	1.6	1:1	2:1	18.20	18.84
K-7225	N-6225	80 ct	32 ct	8	1.0	.75	.11	11.0	6.6	3.7	.93	1.58:1	3.16:1	18.20	18.84
K-7228	N-6228	100 ct	40 ct	10	1.0	.75	.11	10.0	9.7	5.6	1.4	1.58:1	3.16:1	18.20	18.84
K-7230	N-6230	100 ct	100 ct	25	1.0	.75	.11	10.0	9.7	11	2.8	1:1	2:1	18.20	18.84
K-7235	N-6235	120 ct	12.8 ct	3.2	1.0	.75	.11	9.0	10.8	1.6	.4	3.06:1	6.12:1	18.20	18.84
K-7240	N-6240	120 ct	60 ct	15	1.0	.75	.11	9.0	10.8	8.5	2.2	1.41:1	2.83:1	18.20	18.84
K-7245	N-6245	120 ct	120 ct	30	1.0	.75	.11	9.0	10.8	15	3.8	1:1	2:1	18.20	18.84
K-7250	N-6250	150 ct	12 ct	3	1.0	.75	.11	8.0	13.5	1.75	.44	3.54:1	7.08:1	18.20	18.84
K-7255	N-6255	150 ct	50 ct	12.5	1.0	.75	.11	8.0	12	5.8	1.5	1.73:1	3.46:1	18.20	18.84
K-7260	N-6260	150 ct	100 ct	25	1.0	.75	.11	8.0	12	13	3.3	1.22:1	2.44:1	18.20	18.84
K-7265	N-6265	150 ct	150 ct	37.5	1.0	.75	.11	8.0	12	20	5	1:1	2:1	18.20	18.84
K-7270	N-6270	150 ct	600 ct	150	1.0	.75	.11	8.0	12	82	20.5	1:2	1:1	18.20	18.84
K-7275	N-6275	200 ct	200 ct	50	1.0	.75	.11	7.0	17	24	6.0	1:1	2:1	18.20	18.84
K-7280	N-6280	300 ct	12 ct	3	1.0	.75	.11	5.0	30	1.75	.44	5:1	10:1	18.20	18.84
K-7285	N-6285	300 ct	50 ct	12.5	1.0	.75	.11	5.0	27	6.2	1.6	2.45:1	4.9:1	18.20	18.84
K-7290	N-6290	300 ct	150 ct	37.5	1.0	.75	.11	5.0	26	21	5.3	1.41:1	2.83:1	18.20	18.84
K-7295	N-6295	300 ct	300 ct	75	1.0	.75	.11	5.0	27	38	9.5	1:1	2:1	18.20	18.84
K-7300	N-6300	300 ct	600 ct	150	1.0	.75	.11	5.0	27	66	17	1:1.41	1.41:1	18.20	18.84
K-7305	N-6305	320 ct	12.8 ct	3.2	1.0	.75	.11	5.0	30	1.75	.44	5:1	10:1	18.20	18.84
K-7310	N-6310	400 ct	40 ct	10	1.0	.75	.11	5.0	39	4.3	1.1	3.16:1	6.32:1	18.20	18.84
K-7315	N-6315	400 ct	120 ct	30	1.0	.75	.11	5.0	30	14	3.5	1:83:1	3.65:1	18.20	18.84
K-7320	N-6320	400 ct	200 ct	50	1.0	.75	.11	5.0	39	24	6	1.41:1	2.83:1	18.20	18.84
K-7325	N-6325	400 ct	400 ct	100	1.0	.75	.11	5.0	39	42	10.5	1:1	2:1	18.20	18.84
K-7330	N-6330	400 ct	1000 ct	250	1.0	.75	.11	5.0	39	109	28	1:1.58	1.26:1	18.20	18.84
K-7335	N-6335	400 ct	2000 ct	500	1.0	.75	.11	5.0	39	198	49	1:2.24	1:1.12	18.20	18.84
K-7340	N-6340	400 ct	4000 ct	1000	1.0	.75	.11	5.0	39	436	109	1:3.16	1:1.58	18.20	18.84
K-7342	N-6342	500 ct	12.8 ct	3.2	1.0	.75	.11	4.5	43	1.6	.4	6.25:1	12.5:1	18.20	18.84
K-7344	N-6344	500 ct	16 ct	4	1.0	.75	.11	4.5	43	2.3	.56	5.6:1	11.2:1	18.20	18.84
K-7345	N-6345	500 ct	50 ct	12.5	1.0	.75	.11	4.5	43	5.8	1.5	3.16:1	6.32:1	18.20	18.84
K-7347	N-6347	500 ct	150 ct	37.5	1.0	.75	.11	4.5	43	19.8	5	1.83:1	3.65:1	18.20	18.84
K-7350	N-6350	500 ct	500 ct	125	1.0	.75	.11	4.5	43	60	15	1:1	2:1	18.20	18.84
K-7355	N-6355	*500 ct	500 ct	-	1.0	.75	.11	4.5	43	60	-	1:1	-	18.83	19.61
K-7360	N-6360	500 ct	600 ct	150	1.0	.75	.11	4.5	43	66	17	1:1.1	1.83:1	18.20	18.84
K-7365	N-6365	600 ct	12.8 ct	3.2	1.0	.75	.11	4.0	68	1.75	.44	6.85:1	13.7:1	18.20	18.84
K-7367	N-6367	600 ct	30 ct	7.5	1.0	.75	.11	4.0	60	3.7	.93	4.47:1	8.94:1	18.20	18.84
K-7370	N-6370	600 ct	48 ct	12	1.0	.75	.11	4.0	60	5.9	1.5	3.54:1	7.07:1	18.20	18.84
K-7375	N-6375	600 ct	200 ct	50	1.0	.75	.11	4.0	60	25	6.3	1.73:1	3.46:1	18.20	18.84
K-7380**	N-6380**	600 ct	600 ct	150	1.0	.75	.11	4.0	60	66	17	1:1	2:1	18.20	18.84
K-7385**	N-6385**	*600 ct	600 ct	-	1.0	.75	.11	4.0	60	68	-	1:1	-	18.83	19.61
K-7386**	N-6386**	*600 ct	900 ct	-	1.0	.75	.11	4.0	60	104	-	1:1.22	-	18.83	19.61
K-7387**	N-6387**	600 ct	1200 ct	300	1.0	.75	.11	4.0	60	116	29	1:1.41	1.41:1	18.20	18.84
K-7390	N-6390	640 ct	12.8 ct	3.2	1.0	.75	.11	4.0	69	1.75	.44	7.07:1	14.14:1	18.20	18.84
K-7395	N-6395	700 ct	100 ct	25	1.0	.75	.11	4.0	62	10.6	2.7	2.65:1	5.29:1	18.20	18.84
K-7400	N-6400	800 ct	12.8 ct	3.2	1.0	.75	.11	3.5	78	1.75	.44	7.91:1	15.8:1	18.20	18.84
K-7405	N-6405	800 ct	48 ct	12	1.0	.75	.11	3.5	74	6	1.5	4.08:1	8.16:1	18.20	18.84
K-7410	N-6410	800 ct	800 ct	200	1.0	.75	.11	3.5	74	102	26	1:1	2:1	18.20	18.84
K-7415	N-6415	900 ct	600 ct	150	1.0	.75	.11	3.0	90	66	17	1.23:1	2.45:1	18.20	18.84
K-7417**	N-6417**	*900 ct	900 ct	-	1.0	.75	.11	3.0	90	102	-	1:1	-	18.83	19.61
K-7420	N-6420	1000 ct	12 ct	3	1.0	.75	.11	3.0	115	1.75	.44	9.13:1	18.26:1	18.20	18.84
K-7425	N-6425	1000 ct	50 ct	12.5	1.0	.75	.11	3.0	100	5.8	1.5	4.47:1	8.94:1	18.20	18.84
K-7430	N-6430	1000 ct	1000 ct	250	1.0	.75	.11	3.0	75	103	26	1:1	2:1	18.20	18.84
K-7435	N-6435	1060 ct	12.8 ct	3.2	1.0	.75	.11	3.0	115	1.75	.44	9.1:1	18.2:1	18.20	18.84
K-7440	N-6440	1200 ct	12.8 ct	3.2	1.0	.75	.11	3.0	122	1.75	.44	9.68:1	19.4:1	18.20	18.84
K-7445	N-6445	1200 ct	500 ct	125	1.0	.75	.11	3.0	113	63	16	1.55:1	3.1:1	18.20	18.84
K-7450	N-6450	1200 ct	1200 ct	300	1.0	.75	.11	3.0	113	155	39	1:1	2:1	18.20	18.84
K-7455	N-6455	*1200 ct	1200 ct	-	1.0	.75	.11	3.0	109	150	-	1:1	-	18.83	19.61
K-7460	N-6460	1500 ct	12 ct	3	1.0	.75	.11	2.5	140	1.75	.44	11.18:1	22.36:1	18.20	18.84
K-7465	N-6465	1500 ct	500 ct	125	1.0	.75	.11	2.5	150	60	15	1.73:1	3.46:1	18.20	18.84
K-7470	N-6470	*1500 ct	600 ct	-	1.0	.75	.11	2.5	150	66	-	1.58:1	-	18.83	19.61
K-7475	N-6475	*1500 ct	1500 ct	-	1.0	.75	.11	2.5	150	168	-	1:1	-	18.83	19.61
K-7480	N-6480	1600 ct	12.8 ct	3.2	1.0	.75	.11	2.5	140	1.75	.44	11.18:1	22.36:1	18.20	18.84
K-7483	N-6483	2000 ct	8 ct	2	1.0	.75	.11	2.0	250	1.0	.25	15.8:1	31.6:1	18.20	18.84
K-7485	N-6485	2000 ct	2000 ct	500	1.0	.75	.11	2.0	185	255	64	1:1	2:1	18.20	18.84
K-7490	N-6490	*2000 ct	2000 ct	-	1.0	.75	.11	2.0	175	240	-	1:1	-	18.83	19.61
K-7495	N-6495	2000 ct	8000 ct	2000	1.0	.75	.11	2.0	185	1015	254	1:2	1:1	18.20	18.84
K-7497	N-6497	2500 ct	2500 ct	625	1.0	.75	.11	2.0	245	268	68	1:1	2:1	18.20	18.84
K-7500	N-6500	3000 ct	3000 ct	750	1.0	.75	.11	1.8	267	295	74	1:1	2:1	18.20	18.84
K-7505	N-6505	*3000 ct	3000 ct	-	1.0	.75	.11	1.8	267	368	-	1:1	-	18.83	19.61
K-7510	N-6510	3600 ct	3600 ct	900	1.0	.75	.11	1.5	300	413	103	1:1	2:1	18.20	18.84
K-7512	N-6512	4000 ct	16 ct	4	1.0	.75	.11	1.5	395	2.5	.65	15.8:1	31.6:1	18.20	18.84
K-7514**	N-6514**	4000 ct	600 ct	150	1.0	.75	.11	1.5	395	66	17	2.58:1	5.16:1	18.20	18.84

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

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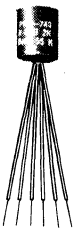
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

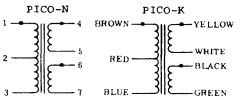
PICO PART NUMBER K-Series Insulated Leads	PICO PART NUMBER N-Series Plug-in	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER WATTS 1KHz and higher	POWER WATTS 400 Hz and higher	POWER WATTS 150 Hz and higher	PRIMARY UNBALANCED DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	TURNS RATIO PRIM/SEC SEC PAR CONN	PICO PRICES 1-9 * * * K-Series	PICO PRICES 1-9 * * * N-Series
K-7515	N-6515	4000 ct	1000 ct	250	1.0	.75	.11	1.5	395	108	27	2:1	4:1	18.20	18.84
K-7520	N-6520	*4000 ct	8000 ct	-	1.0	.75	.11	1.5	390	955	-	1:1.41	-	18.83	19.61
K-7525	N-6525	5000 ct	500 ct	125	1.0	.75	.11	1.3	450	62	16	3.16:1	6.32:1	18.20	18.84
K-7530	N-6530	5000 ct	5000 ct	1250	1.0	.75	.11	1.3	450	620	155	1:1	2:1	18.20	18.84
K-7535	N-6535	7500 ct	50 ct	12.5	1.0	.75	.11	1.0	670	6	1.5	12.25:1	24.5:1	20.28	20.90
K-7540	N-6540	7500 ct	100 ct	25	1.0	.75	.11	1.0	670	11	2.8	8.66:1	17.32:1	20.28	20.90
K-7545	N-6545	7500 ct	600 ct	150	1.0	.75	.11	1.0	670	66	16.5	3.54:1	7.07:1	20.28	20.90
K-7550	N-6550	7500 ct	2500 ct	625	1.0	.75	.11	1.0	670	268	67	1.73:1	3.46:1	20.28	20.90
K-7555	N-6555	*7500 ct	7500 ct	-	1.0	.75	.11	1.0	670	925	-	1:1	-	20.88	23.04
K-7560	N-6560	8000 ct	12.8 ct	3.2	1.0	.75	.11	1.0	765	1.75	.44	25:1	50:1	20.28	20.90
K-7565	N-6565	8000 ct	1000 ct	250	1.0	.75	.11	1.0	695	106	26.5	2.83:1	5.66:1	20.28	20.90
K-7570	N-6570	*8000 ct	1200 ct	-	1.0	.75	.11	1.0	715	153	-	2.58:1	-	20.88	23.04
K-7575	N-6575	*9000 ct	9000 ct	-	1.0	.75	.11	1.0	925	1020	-	1:1	-	20.88	23.04
K-7580	N-6580	10,000 ct	12.8 ct	3.2	1.0	.75	.11	1.0	768	1.6	.4	28:1	56:1	20.28	20.90
K-7585	N-6585	10,000 ct	16 ct	4	1.0	.75	.11	1.0	756	1.7	.43	25:1	50:1	20.28	20.90
K-7590	N-6590	10,000 ct	100 ct	25	1.0	.75	.11	1.0	780	10	2.5	10:1	20:1	20.28	20.90
K-7595	N-6595	10,000 ct	200 ct	50	1.0	.75	.11	1.0	780	24	6	7.07:1	14.14:1	20.28	20.90
K-7600	N-6600	10,000 ct	500 ct	125	1.0	.75	.11	1.0	780	60	15	4.47:1	8.94:1	20.28	20.90
K-7605	N-6605	10,000 ct	600 ct	150	1.0	.75	.11	1.0	780	83	21	4.08:1	8.16:1	20.28	20.90
K-7610	N-6610	10,000 ct	1000 ct	250	1.0	.75	.11	1.0	780	106	27	3.16:1	6.32:1	20.28	20.90
K-7615	N-6615	10,000 ct	1200 ct	300	1.0	.75	.11	1.0	780	145	36	2.89:1	5.77:1	20.28	20.90
K-7620	N-6620	10,000 ct	1500 ct	375	1.0	.75	.11	1.0	780	160	40	2.58:1	5.16:1	20.28	20.90
K-7625	N-6625	10,000 ct	2000 ct	500	1.0	.75	.11	1.0	780	300	75	2.24:1	4.47:1	20.28	20.90
K-7630	N-6630	10,000 ct	5000 ct	1250	1.0	.75	.11	1.0	780	610	153	1.41:1	2.83:1	20.28	20.90
K-7635	N-6635	10,000 ct	7500 ct	1875	1.0	.75	.11	1.0	780	932	233	1.16:1	2.31:1	20.28	20.90
K-7640	N-6640	10,000 ct	10,000 ct	2500	1.0	.75	.11	1.0	780	1075	269	1:1	2:1	20.28	20.90
K-7645	N-6645	*10,000 ct	10,000 ct	-	1.0	.75	.11	1.0	715	985	-	1:1	-	20.88	23.04
K-7650	N-6650	15,000 ct	400 ct	100	.66	.66	.11	0.8	1165	52	13	6.12:1	12.25:1	20.28	20.90
K-7652	N-6652	15,000 ct	500 ct	125	.66	.66	.11	0.8	1165	60	15	5.48:1	10.95:1	20.28	20.90
K-7655	N-6655	15,000 ct	600 ct	150	.66	.66	.11	0.8	1165	80	20	.5:1	10:1	20.28	20.90
K-7660	N-6660	15,000 ct	10,000 ct	2500	.66	.66	.11	0.8	1165	1050	263	1.22:1	2.45:1	20.28	20.90
K-7665	N-6665	*15,000 ct	15,000 ct	-	.66	.66	.11	0.8	1165	1600	-	1:1	-	20.88	23.04
K-7670	N-6670	15,000 ct	15,000 ct	3750	.66	.66	.11	0.8	1165	1600	400	1:1	2:1	20.28	20.90
K-7675	N-6675	16,000 ct	1000 ct	250	.62	.62	.11	0.8	1560	108	27	4:1	8:1	20.28	20.90
K-7680	N-6680	20,000 ct	500 ct	125	.5	.5	.11	0.7	1750	60	15	6.32:1	12.65:1	20.88	23.04
K-7685	N-6685	20,000 ct	600 ct	150	.5	.5	.11	0.7	1750	82	20.5	5.77:1	11.55:1	20.88	23.04
K-7690	N-6690	20,000 ct	800 ct	200	.5	.5	.11	0.7	1750	98	24.5	5:1	10:1	20.88	23.04
K-7695	N-6695	20,000 ct	1000 ct	250	.5	.5	.11	0.7	1750	135	34	4.47:1	8.94:1	20.88	23.04
K-7700	N-6700	20,000 ct	5000 ct	1250	.5	.5	.11	0.7	1750	610	153	2:1	4:1	20.88	23.04
K-7705	N-6705	20,000 ct	10,000 ct	2500	.5	.5	.11	0.7	1750	1075	269	1.41:1	2.83:1	20.88	23.04
K-7710	N-6710	*20,000 ct	20,000 ct	-	.5	.5	.11	0.7	1715	2370	-	1:1	-	22.37	23.27
K-7715	N-6715	25,000 ct	500 ct	125	.4	.4	.11	0.6	2470	60	15	7.07:1	14.14:1	20.88	23.04
K-7720	N-6720	25,000 ct	1000 ct	250	.4	.4	.11	0.6	2470	106	27	5:1	10:1	20.88	23.04
K-7725	N-6725	30,000 ct	50 ct	12.5	.33	.33	.11	0.5	2730	6.2	1.6	24.5:1	49:1	22.37	23.27
K-7730	N-6730	30,000 ct	1200 ct	300	.33	.33	.11	0.5	2815	156	39	5:1	10:1	22.37	23.27
K-7732	N-6732	30,000 ct	500 ct	125	.33	.33	.11	0.5	2730	61	15.3	7.7:1	15.5:1	22.37	23.27
K-7734	N-6734	30,000 ct	200 ct	50	.33	.33	.11	0.5	2730	24	6	12.2:1	24.5:1	22.37	23.27
K-7735	N-6735	30,000 ct	5000 ct	1250	.33	.33	.11	0.5	2730	620	155	2.45:1	4.9:1	22.37	23.27
K-7740	N-6740	30,000 ct	10,000 ct	2500	.33	.33	.11	0.5	2730	1090	272	1.73:1	3.46:1	22.37	23.27
K-7745	N-6745	*30,000 ct	30,000 ct	-	.33	.33	.11	0.5	2730	3740	-	1:1	-	23.49	24.98
K-7750	N-6750	40,000 ct	400 ct	100	.25	.25	.11	0.5	3150	53	13	10:1	20:1	23.49	24.98
K-7755	N-6755	40,000 ct	2000 ct	500	.25	.25	.11	0.5	3150	300	75	4.47:1	8.94:1	23.49	24.98
K-7760	N-6760	40,000 ct	4000 ct	1000	.25	.25	.11	0.5	3150	548	137	3.16:1	6.32:1	23.49	24.98
K-7765	N-6765	40,000 ct	20,000 ct	5000	.25	.25	.11	0.5	3150	3075	769	1.41:1	2.83:1	23.49	24.98
K-7770	N-6770	*40,000 ct	40,000 ct	-	.25	.25	.11	0.5	3940	4350	-	1:1	-	26.64	27.86
K-7775	N-6775	50,000 ct	200 ct	50	.2	.2	.11	0.4	4275	24	6	15.8:1	31.6:1	26.64	27.86
K-7777	N-6777	50,000 ct	500 ct	125	.2	.2	.11	0.4	4275	60	15	10:1	20:1	26.64	27.86
K-7778	N-6778	50,000 ct	600 ct	150	.2	.2	.11	0.4	4275	82	21	9.13:1	18.26:1	26.64	27.86
K-7779	N-6779	50,000 ct	50,000 ct	12,500	.2	.2	.11	0.4	4500	6270	1568	1:1	2:1	26.64	27.86
K-7780	N-6780	60,000 ct	15,000 ct	3750	.16	.16	.11	0.4	5960	1650	412	2:1	4:1	29.30	30.16
K-7785	N-6785	62,500 ct	50 ct	12.5	.16	.16	.11	0.4	5960	6	1.5	35.4:1	70.7:1	29.30	30.16
K-7787	N-6787	80,000 ct	15,000 ct	3750	.12	.12	.11	0.3	7200	1690	423	2.3:1	4.6:1	29.30	30.16
K-7789	N-6789	80,000 ct	80,000 ct	20,000	.12	.12	.11	0.3	7200	9920	2480	1:1	2:1	29.30	30.16
K-7790	N-6790	90,000 ct	10,000 ct	2500	.11	.11	.11	0.3	7500	1350	338	3:1	6:1	33.26	31.55
K-7795	N-6795	95,000 ct	15,000 ct	3750	.1	.1	.10	0.3	9550	1635	410	2.5:1	5:1	33.26	31.55
K-7800	N-6800	100,000 ct	60 ct	15	.1	.1	.10	0.3	10,000	8.5	2.2	40.8:1	81.6:1	33.26	31.55
K-7805	N-6805	100,000 ct	100 ct	25	.1	.1	.10	0.3	10,000	14	3.5	31.6:1	63.2:1	33.26	31.55
K-7810	N-6810	100,000 ct	500 ct	125	.1	.1	.10	0.3	10,000	62	15.5	14.1:1	28.3:1	33.26	31.55
K-7813	N-6813	100,000 ct	1000 ct	250	.1	.1	.10	0.3	10,000	140	35	10:1	20:1	33.26	31.55
K-7814	N-6814	100,000 ct	2000 ct	500	.1	.1	.10	0.3	10,000	248	62	7.07:1	14.14:1	33.26	31.55
K-7815	N-6815	100,000 ct	10,000 ct	2500	.1	.1	.10	0.3	10,000	1075	270	3.16:1	6.32:1	33.26	31.55
K-7820	N-6820	135,000 ct	82 ct	20.5	.074	.074	.074	0.25	13,700	9.5	2.4	40.6:1	81.2:1	32.03	32.98
K-7823	N-6823	200,000 ct	500 ct	125	.05	.05	.05	0.2	17,340	75	19	20:1	40:1	32.03	32.98
K-7825	N-6825	200,000 ct	1000 ct	250	.05	.05	.05	0.2	17,340	133	33	14.1:1	28.3:1	32.03	32.98
K-7830	N-6830	200,000 ct	10,000 ct	2500	.05	.05	.05	0.2	17,340	1350	336	4.47:1	8.94:1	32.03	32.98
K-7835	N-6835	200,000 ct	20,000 ct	5000	.05	.05	.05	0.2	17,340	3000	750	3.16:1	6.32:1	32.03	32.98
K-7837	N-6837	250,000 ct	200 ct	50	.04	.04	.04	0.2	17,340	28	7	35.4:1	70.7:1	32.97	33.82
K-7840	N-6840	250,000 ct	1000 ct	250	.04	.04	.04	0.2	17,340	118	30	15.8:1	31.6:1	32.97	33.82
K-SHIELD	MU-METAL SHIELD .53" d X .56" h (13.46 mm d X 14.22 mm h)													2.33	
N-SHIELD	MU-METAL SHIELD .53" d X .56" h (13.46 mm d X 14.22 mm h)														2.34

K SERIES Insulated Leads

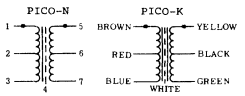


N SERIES Plug-In

SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

PICO Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

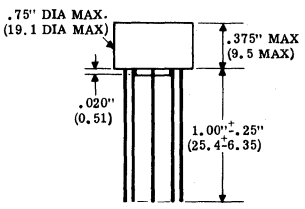
914-699-5514
TWX 7105620113

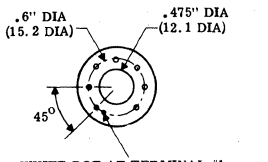
For immediate engineering assistance or to place an order—

Call Toll Free 800-431-1064

PICO's ultra-miniature transformers

R SERIES Plug-In





WHITE DOT AT TERMINAL #1
TERMINALS CLOCKWISE FROM
PIN #1

Dimensions are in inches (MM)

SPECIFICATIONS

- MIL-T-27: . . . . . All Units Meet MIL-T-27 And Are Hermetically Sealed in a Metal Case, Audio Transformers Are Type TF5R21ZZ.
- FREQUENCY RESPONSE: . . . ± 3 db, 75 Hz - 30 KHz at 1.0 Milliwatt.
- MAXIMUM DISTORTION: . . . 5% With Rated Power Level at 1 KHz, 300 Hz and 75 Hz
- DIELECTRIC STRENGTH: . . . All Units Tested at 200 V RMS.
- INSULATION RESISTANCE: . . Greater Than 10,000 Megohms at 300 V DC.
- WEIGHT: . . . . . 12 Grams
- OPERATING TEMPERATURE: . -55°c to 105°c (All Units Can Be Supplied to Class S Requirements 130°c Maximum).
- TERMINALS: . . . . . Solid .016 Diameter Conductor. Conductor is Copper Clad Steel, Tinned 100%, Electroplated Per MIL-T-10727A and ASTM CCS B452.
- THERMAL SHOCK: . . . . . 25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

This Product is Patented

Delivery— stock to one week

PICO PART NUMBER R-Series Plug-in	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1KHz and higher	300 Hz and higher	75 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9*** R-Series
R-20003	20 ct	8 ct	2	1.5	.9	.03	22	1.6	.76	.19	1.58:1	3.16:1	25.32
R-20005	20 ct	20 ct	5	1.5	.9	.03	22	1.6	1.9	.48	1:1	2:1	25.32
R-20010	32 ct	32 ct	8	1.5	.9	.03	17.5	2.56	3	.75	1:1	2:1	25.32
R-20015	40 ct	40 ct	10	1.5	.9	.03	16	3.2	3.8	.95	1:1	2:1	25.32
R-20018	48 ct	16 ct	4	1.5	.9	.03	14.5	3.84	1.52	.38	1.73:1	3.46:1	25.32
R-20020	50 ct	50 ct	12.5	1.5	.9	.03	14	4	4.75	1.19	1:1	2:1	25.32
R-20025	80 ct	32 ct	8	1.5	.9	.03	11	6.4	3	.75	1.58:1	3.16:1	25.32
R-20028	100 ct	40 ct	10	1.5	.9	.03	10	8	3.8	.95	1.58:1	3.16:1	25.32
R-20030	100 ct	100 ct	25	1.5	.9	.03	10	8	9.5	2.38	1:1	2:1	25.32
R-20035	120 ct	12.8 ct	3.2	1.5	.9	.03	9	9.6	1.22	.3	3.06:1	6.12:1	25.32
R-20040	120 ct	60 ct	15	1.5	.9	.03	9	9.6	5.7	1.4	1.41:1	2.83:1	25.32
R-20045	120 ct	120 ct	30	1.5	.9	.03	9	9.6	11.4	2.85	1:1	2:1	25.32
R-20050	150 ct	12 ct	3	1.5	.9	.03	8	12	1.14	.29	3.54:1	7.08:1	25.32
R-20055	150 ct	50 ct	12.5	1.5	.9	.03	8	12	4.75	1.19	1.73:1	3.46:1	25.32
R-20060	150 ct	100 ct	25	1.5	.9	.03	8	12	9.5	2.38	1.22:1	2.44:1	25.32
R-20065	150 ct	150 ct	37.5	1.5	.9	.03	8	12	14.3	3.56	1:1	2:1	25.32
R-20070	150 ct	600 ct	150	1.5	.9	.03	8	12	57	14.3	1:2	1:1	25.32
R-20075	200 ct	200 ct	50	1.5	.9	.03	7	16	19	4.75	1:1	2:1	25.32
R-20080	300 ct	12 ct	3	1.5	.9	.03	5.5	24	1.14	.29	5:1	10:1	25.32
R-20085	300 ct	50 ct	12.5	1.5	.9	.03	5.5	24	4.75	1.19	2.45:1	4.9:1	25.32
R-20090	300 ct	150 ct	37.5	1.5	.9	.03	5.5	24	14.25	3.56	1.41:1	2.83:1	25.32
R-20095	300 ct	300 ct	75	1.5	.9	.03	5.5	24	28.5	7.13	1:1	2:1	25.32
R-20100	300 ct	600 ct	150	1.5	.9	.03	5.5	24	57	14.25	1:1.41	1.41:1	25.32
R-20105	320 ct	12.8 ct	3.2	1.5	.9	.03	5.5	25.6	1.22	.3	5:1	10:1	25.32
R-20110	400 ct	40 ct	10	1.5	.9	.03	5	32	3.8	.95	3.16:1	6.32:1	25.32
R-20115	400 ct	120 ct	30	1.5	.9	.03	5	32	11.4	2.85	1.83:1	3.65:1	25.32
R-20120	400 ct	200 ct	50	1.5	.9	.03	5	32	19	4.75	1.41:1	2.83:1	25.32
R-20125	400 ct	400 ct	100	1.5	.9	.03	5	32	38	9.5	1:1	2:1	25.32
R-20130	400 ct	1000 ct	250	1.5	.9	.03	5	32	95	23.8	1:1.58	1.26:1	25.32
R-20135	400 ct	2000 ct	500	1.5	.9	.03	5	32	190	47.5	1:2.24	1:1.12	25.32
R-20140	400 ct	4000 ct	1000	1.5	.9	.03	5	32	380	95	1:3.16	1:1.58	25.32
R-20142	500 ct	12.8 ct	3.2	1.5	.9	.03	4.5	40	1.22	.3	6.25:1	12.5:1	25.32
R-20144	500 ct	16 ct	4	1.5	.9	.03	4.5	40	1.52	.38	5.6:1	11.2:1	25.32
R-20145	500 ct	50 ct	12.5	1.5	.9	.03	4.5	40	4.75	1.19	3.16:1	6.32:1	25.32
R-20147	500 ct	150 ct	37.5	1.5	.9	.03	4.5	40	14.25	3.56	1.83:1	3.65:1	25.32
R-20150	500 ct	500 ct	125	1.5	.9	.03	4.5	40	47.5	11.88	1:1	2:1	25.32
R-20155	*500 ct	500 ct	-	1.5	.9	.03	4.5	40	47.5	-	1:1	-	26.36
R-20160	500 ct	600 ct	150	1.5	.9	.03	4.5	40	57	14.25	1:1.1	1.83:1	25.32
R-20165	600 ct	12.8 ct	3.2	1.5	.9	.03	4	48	1.22	.3	6.85:1	13.7	25.32
R-20167	600 ct	30 ct	7.5	1.5	.9	.03	4	48	2.85	.71	4.47:1	8.94:1	25.32
R-20170	600 ct	48 ct	12	1.5	.9	.03	4	48	4.56	1.14	3.54:1	7.07:1	25.32
R-20175	600 ct	200 ct	50	1.5	.9	.03	4	48	19	4.75	1.73:1	3.46:1	25.32
R-20180**	600 ct	600 ct	150	1.5	.9	.03	4	48	57	14.25	1:1	2:1	25.32
R-20185**	*600 ct	600 ct	-	1.5	.9	.03	4	48	57	-	1:1	-	26.36
R-20186**	*600 ct	900 ct	-	1.5	.9	.03	4	48	85.5	-	1:1.22	-	26.36
R-20187**	600 ct	1200 ct	300	1.5	.9	.03	4	48	114	28.5	1:1.41	1.41:1	25.32
R-20190	640 ct	12.8 ct	3.2	1.5	.9	.03	4	51.2	1.22	.3	7.07:1	14.14:1	25.32
R-20195	700 ct	100 ct	25	1.5	.9	.03	3.5	56	9.5	2.38	2.65:1	5.29:1	25.32
R-20200	800 ct	12.8 ct	3.2	1.5	.9	.03	3.5	64	1.22	.3	7.91:1	15.8:1	25.32
R-20205	800 ct	48 ct	12	1.5	.9	.03	3.5	64	4.56	1.14	4.08:1	8.16:1	25.32
R-20210	800 ct	800 ct	200	1.5	.9	.03	3.5	64	76	19	1:1	2:1	25.32
R-20215	900 ct	600 ct	150	1.5	.9	.03	3	72	57	14.3	1.23:1	2.45:1	25.32
R-20217**	*900 ct	900 ct	-	1.5	.9	.03	3	72	85.5	-	1:1	-	26.36
R-20220	1000 ct	12 ct	3	1.5	.9	.03	3	80	1.14	.29	9.13:1	18.26:1	25.32
R-20225	1000 ct	50 ct	12.5	1.5	.9	.03	3	80	4.75	1.19	4.47:1	8.94:1	25.32
R-20230	1000 ct	1000 ct	250	1.5	.9	.03	3	80	95	23.8	1:1	2:1	25.32
R-20235	1060 ct	12.8 ct	3.2	1.5	.9	.03	3	85	1.22	.3	9.1:1	18.2:1	25.32
R-20240	1200 ct	12.8 ct	3.2	1.5	.9	.03	3	96	1.22	.3	9.68:1	19.4:1	25.32
R-20245	1200 ct	500 ct	125	1.5	.9	.03	3	96	47.5	11.88	1.55:1	3.1:1	25.32
R-20250	1200 ct	1200 ct	300	1.5	.9	.03	3	96	114	28.5	1:1	2:1	25.32
R-20255	*1200 ct	1200 ct	-	1.5	.9	.03	3	96	114	-	1:1	-	26.36
R-20260	1500 ct	12 ct	3	1.5	.9	.03	2.5	120	1.14	.29	11.18:1	22.36:1	25.32
R-20265	1500 ct	500 ct	125	1.5	.9	.03	2.5	120	47.5	11.88	1.73:1	3.46:1	25.32
R-20270	*1500 ct	600 ct	-	1.5	.9	.03	2.5	120	57	-	1.58:1	-	26.36
R-20275	*1500 ct	1500 ct	-	1.5	.9	.03	2.5	120	142	-	1:1	-	26.36
R-20280	1600 ct	12.8 ct	3.2	1.5	.9	.03	2.5	128	1.22	3	11.18:1	22.36:1	25.32
R-20283	2000 ct	8 ct	2	1.5	.9	.03	2.2	160	.76	.19	15.8:1	31.6:1	25.32
R-20285	2000 ct	2000 ct	500	1.5	.9	.03	2.2	160	190	47.5	1:1	2:1	25.32
R-20290	*2000 ct	2000 ct	-	1.5	.9	.03	2.2	160	190	-	1:1	-	26.36
R-20295	2000 ct	8000 ct	2000	1.5	.9	.03	2.2	160	760	190	1:2	1:1	25.32
R-20297	2500 ct	2500 ct	625	1.5	.9	.03	2	200	238	59.5	1:1	2:1	25.32
R-20300	3000 ct	3000 ct	750	1.5	.9	.03	1.8	240	285	71.3	1:1	2:1	25.32
R-20305	*3000 ct	3000 ct	-	1.5	.9	.03	1.8	240	285	-	1:1	-	26.36

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

For immediate engineering assistance or to place an order— ***Call Toll Free 800-431-1064***

PICO PART NUMBER R-Series Plug-in	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER WATTS 1KHz and higher	POWER WATTS 300 Hz and higher	POWER WATTS 75 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	TURNS RATIO PRIM/SEC SEC PAR CONN	PICO PRICES 1-9*** R-Series
R-20310	3600 ct	3600 ct	900	1.5	.9	.03	1.7	288	342	86	1:1	2:1	25.32
R-20312	4000 ct	16 ct	4	1.5	.9	.03	1.6	320	1.52	.38	15.8:1	31.6:1	25.32
R-20314**	4000 ct	600 ct	150	1.5	.9	.03	1.6	320	57	14.3	2.58:1	5.16:1	25.32
R-20315	4000 ct	1000 ct	250	1.5	.9	.03	1.6	320	95	23.8	2:1	4:1	25.32
R-20320	*4000 ct	8000 ct	-	1.5	.9	.03	1.6	320	760	-	1:1.41	-	26.36
R-20325	5000 ct	500 ct	125	1.5	.9	.03	1.4	400	47.5	11.88	3.16:1	6.32:1	25.32
R-20330	5000 ct	5000 ct	1250	1.5	.9	.03	1.4	400	475	119	1:1	2:1	25.32
R-20335	7500 ct	50 ct	12.5	1.3	.9	.03	1.2	600	4.75	1.19	12.25:1	24.5:1	28.21
R-20340	7500 ct	100 ct	25	1.3	.9	.03	1.2	600	9.5	2.38	8.66:1	17.32:1	28.21
R-20345	7500 ct	600 ct	150	1.3	.9	.03	1.2	600	57	14.3	3.54:1	7.07:1	28.21
R-20350	7500 ct	2500 ct	625	1.3	.9	.03	1.2	600	238	59.5	1.73:1	3.46:1	28.21
R-20355	*7500 ct	7500 ct	-	1.3	.9	.03	1.2	600	713	-	1:1	-	30.08
R-20360	8000 ct	12.8 ct	3.2	1.2	.9	.03	1.1	640	1.22	.3	25:1	50:1	28.21
R-20365	8000 ct	1000 ct	250	1.2	.9	.03	1.1	640	95	23.8	2.83:1	5.66:1	28.21
R-20370	*8000 ct	1200 ct	-	1.2	.9	.03	1.1	640	114	-	2.58:1	-	30.08
R-20375	*9000 ct	9000 ct	-	1.1	.9	.03	1.1	720	855	-	1:1	-	30.08
R-20380	10,000 ct	12.8 ct	3.2	1.0	.9	.03	1	800	1.22	.3	28:1	56:1	28.21
R-20385	10,000 ct	16 ct	4	1.0	.9	.03	1	800	1.52	.38	25:1	50:1	28.21
R-20390	10,000 ct	100 ct	25	1.0	.9	.03	1	800	9.5	2.38	10:1	20:1	28.21
R-20395	10,000 ct	200 ct	50	1.0	.9	.03	1	800	19	4.75	7.07:1	14.14:1	28.21
R-20400	10,000 ct	500 ct	125	1.0	.9	.03	1	800	47.5	11.88	4.47:1	8.94:1	28.21
R-20405	10,000 ct	600 ct	150	1.0	.9	.03	1	800	57	14.25	4.08:1	8.16:1	28.21
R-20410	10,000 ct	1000 ct	250	1.0	.9	.03	1	800	95	23.8	3.16:1	6.32:1	28.21
R-20415	10,000 ct	1200 ct	300	1.0	.9	.03	1	800	114	28.5	2.89:1	5.77:1	28.21
R-20420	10,000 ct	1500 ct	375	1.0	.9	.03	1	800	143	35.8	2.58:1	5.16:1	28.21
R-20425	10,000 ct	2000 ct	500	1.0	.9	.03	1	800	190	47.5	2.24:1	4.47:1	28.21
R-20430	10,000 ct	5000 ct	1250	1.0	.9	.03	1	800	475	119	1.41:1	2.83:1	28.21
R-20435	10,000 ct	7500 ct	1875	1.0	.9	.03	1	800	713	178	1.16:1	2.31:1	28.21
R-20440	10,000 ct	10,000 ct	2500	1.0	.9	.03	1	800	950	238	1:1	2:1	28.21
R-20445	*10,000 ct	10,000 ct	-	1.0	.9	.03	1	800	950	-	1:1	-	30.08
R-20450	15,000 ct	400 ct	100	.66	.66	.03	.8	1200	38	9.5	6.12:1	12.25:1	28.21
R-20452	15,000 ct	500 ct	125	.66	.66	.03	.8	1200	48	12	5.48:1	10.95:1	28.21
R-20455	15,000 ct	600 ct	150	.66	.66	.03	.8	1200	57	14.3	5:1	10:1	28.21
R-20460	15,000 ct	10,000 ct	2500	.66	.66	.03	.8	1200	950	238	1.22:1	2.45:1	28.21
R-20465	*15,000 ct	15,000 ct	-	.66	.66	.03	.8	1200	1430	-	1:1	-	30.08
R-20470	15,000 ct	15,000 ct	3750	.66	.66	.03	.8	1200	1430	357	1:1	2:1	28.21
R-20475	16,000 ct	1000 ct	250	.62	.62	.03	.8	1280	95	23.8	4:1	8:1	28.21
R-20480	20,000 ct	500 ct	125	.5	.5	.03	.7	1600	47.5	11.88	6.32:1	12.65:1	30.08
R-20485	20,000 ct	600 ct	150	.5	.5	.03	.7	1600	57	14.25	5.77:1	11.55:1	30.08
R-20490	20,000 ct	800 ct	200	.5	.5	.03	.7	1600	76	19	5:1	10:1	30.08
R-20495	20,000 ct	1000 ct	250	.5	.5	.03	.7	1600	95	23.8	4.47:1	8.94:1	30.08
R-20500	20,000 ct	5000 ct	1250	.5	.5	.03	.7	1600	475	119	2:1	4:1	30.08
R-20505	20,000 ct	10,000 ct	2500	.5	.5	.03	.7	1600	950	238	1.41:1	2.83:1	30.08
R-20510	*20,000 ct	20,000 ct	-	.5	.5	.03	.7	1600	1900	-	1:1	-	31.27
R-20515	25,000 ct	500 ct	125	.4	.4	.03	.6	2000	47.5	11.88	7.07:1	14.14:1	30.08
R-20520	25,000 ct	1000 ct	250	.4	.4	.03	.6	2000	95	23.8	5:1	10:1	30.08
R-20525	30,000 ct	50 ct	12.5	.33	.33	.03	.6	2400	4.75	1.19	24.5:1	49:1	31.27
R-20530	30,000 ct	1200 ct	300	.33	.33	.03	.6	2400	114	28.5	5:1	10:1	31.26
R-20532	30,000 ct	500 ct	125	.33	.33	.03	.6	2400	47.5	11.88	7.7:1	15.5:1	31.26
R-20534	30,000 ct	200 ct	50	.33	.33	.03	.6	2400	19	4.75	12.2:1	24.5:1	31.26
R-20535	30,000 ct	5000 ct	1250	.33	.33	.03	.6	2400	475	119	2.45:1	4.9:1	31.26
R-20540	30,000 ct	10,000 ct	2500	.33	.33	.03	.6	2400	950	238	1.73:1	3.46:1	31.26
R-20545	*30,000 ct	30,000 ct	-	.33	.33	.03	.6	2400	2850	-	1:1	-	33.59
R-20550	40,000 ct	400 ct	100	.25	.25	.03	.5	3200	38	9.5	10:1	20:1	33.59
R-20555	40,000 ct	2000 ct	500	.25	.25	.03	.5	3200	190	47.5	4.47:1	8.94:1	33.59
R-20560	40,000 ct	4000 ct	1000	.25	.25	.03	.5	3200	380	95	3.16:1	6.32:1	33.59
R-20565	40,000 ct	20,000 ct	5000	.25	.25	.03	.5	3200	1900	475	1.41:1	2.83:1	33.59
R-20570	*40,000 ct	40,000 ct	-	.25	.25	.03	.5	3200	3800	-	1:1	-	37.39
R-20575	50,000 ct	200 ct	50	.2	.2	.03	.4	4000	19	4.75	15.8:1	31.6:1	37.39
R-20577	50,000 ct	500 ct	125	.2	.2	.03	.4	4000	47.5	11.88	10:1	20:1	37.39
R-20578	50,000 ct	600 ct	150	.2	.2	.03	.4	4000	57	14.3	9.13:1	18.26:1	37.39
R-20579	50,000 ct	50,000 ct	12,500	.2	.2	.03	.4	4000	4750	1190	1:1	2:1	37.39
R-20580	60,000 ct	15,000 ct	3750	.16	.16	.03	.4	4800	1430	358	2:1	4:1	40.39
R-20585	62,500 ct	50 ct	12.5	.16	.16	.03	.4	5000	4.75	1.19	35.4:1	70.7:1	40.39
R-20587	80,000 ct	15,000 ct	3750	.12	.12	.03	.3	6400	1430	358	2.3:1	4.6:1	40.39
R-20590	90,000 ct	10,000 ct	2500	.11	.11	.03	.3	7200	950	238	3:1	6:1	42.39
R-20595	95,000 ct	15,000 ct	3750	.1	.1	.03	.3	7600	1430	358	2.5:1	5:1	42.39
R-20600	100,000 ct	60 ct	15	.1	.1	.03	.3	8000	5.7	1.43	40.8:1	81.6:1	42.39
R-20605	100,000 ct	100 ct	25	.1	.1	.03	.3	8000	9.5	2.38	31.6:1	63.2:1	42.39
R-20610	100,000 ct	500 ct	125	.1	.1	.03	.3	8000	47.5	11.88	14.1:1	28.3:1	42.39
R-20613	100,000 ct	1000 ct	250	.1	.1	.03	.3	8000	95	23.8	10:1	20:1	42.39
R-20614	100,000 ct	2000 ct	500	.1	.1	.03	.3	8000	190	47.5	7.07:1	14.14:1	42.39
R-20615	100,000 ct	10,000 ct	2500	.1	.1	.03	.3	8000	950	238	3.16:1	6.32:1	42.39
R-20620	135,000 ct	82 ct	20.5	.07	.07	.03	.2	10,800	7.8	1.9	40.6:1	81.2:1	44.29

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**MINIATURIZED TELEPHONE COUPLING APPLICATION

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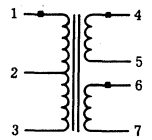
PICO's ultra-miniature transformers

R SERIES Plug-In

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



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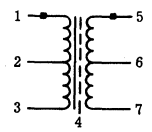

PICO Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

914-699-5514
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For immediate engineering assistance or to place an order—

Delivery—stock to one week

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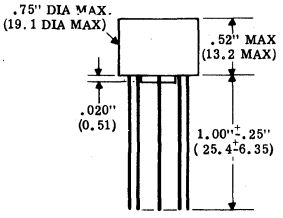
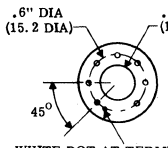
PICO's ultra-miniature transformers

S SERIES Plug-In





WHITE DOT AT TERMINAL #1
TERMINALS CLOCKWISE FROM
PIN #1

Dimensions are in inches (MM)

SPECIFICATIONS

- MIL-T-27: . . . . . All Units Meet MIL-T-27 And Are Hermetically Sealed in a Metal Case, Audio Transformers Are Type TF5R21ZZ.
- FREQUENCY RESPONSE: . . . ± 3 db, 50 Hz - 30 KHz at 1.0 Milliwatt. **(±0.5 db, 300 Hz-5 KHz)**
- MAXIMUM DISTORTION: . . . 5% With Rated Power Level at 1 KHz, 300 Hz and 50 Hz.
- DIELECTRIC STRENGTH: . . . All Units Tested at 200 V RMS.
- INSULATION RESISTANCE: . . Greater Than 10,000 Megohms at 300 V DC.
- WEIGHT: . . . . . 17 Grams
- OPERATING TEMPERATURE: . -55°c to 105°c (All Units Can Be Supplied to Class S Requirements 130°c Maximum).
- TERMINALS: . . . . . Solid .020 Conductor, Copper Clad Steel Tinned 100%, Electroplated Per MIL-T-10727A and ASTM CCS B452
- THERMAL SHOCK: . . . . . 25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

This Product is Patented

PICO PART NUMBER S-Series Plug-in	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER WATTS 1KHz and higher	POWER WATTS 300 Hz and higher	POWER WATTS 50 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	TURNS RATIO PRIM/SEC SEC PAR CONN	PICO PRICES 1-9*** S-Series
S-21003	20 ct	8 ct	2	2.0	1.5	.05	22	1.6	.88	.22	1.58:1	3.16:1	20.65
S-21005	20 ct	20 ct	5	2.0	1.5	.05	22	1.6	2.2	.55	1:1	2:1	20.65
S-21010	32 ct	32 ct	8	2.0	1.5	.05	17.5	2.56	3.52	.88	1:1	2:1	20.65
S-21015	40 ct	40 ct	10	2.0	1.5	.05	16	3.2	4.4	1.1	1:1	2:1	20.65
S-21018	48 ct	16 ct	4	2.0	1.5	.05	14.5	3.84	1.76	.44	1.73:1	3.46:1	20.65
S-21020	50 ct	50 ct	12.5	2.0	1.5	.05	14	4	5.5	1.38	1:1	2:1	20.65
S-21025	80 ct	32 ct	8	2.0	1.5	.05	11	6.4	3.52	.88	1.58:1	3.16:1	20.65
S-21028	100 ct	40 ct	10	2.0	1.5	.05	10	8	4.4	1.1	1.58:1	3.16:1	20.65
S-21030	100 ct	100 ct	25	2.0	1.5	.05	10	8	11	2.75	1:1	2:1	20.65
S-21035	120 ct	12.8 ct	3.2	2.0	1.5	.05	9	9.6	1.41	.35	3.06:1	6.12:1	20.65
S-21040	120 ct	60 ct	15	2.0	1.5	.05	9	9.6	6.6	1.65	1.41:1	2.83:1	20.65
S-21045	120 ct	120 ct	30	2.0	1.5	.05	9	9.6	13.2	3.3	1:1	2:1	20.65
S-21050	150 ct	12 ct	3	2.0	1.5	.05	8	12	1.32	.33	3.54:1	7.08:1	20.65
S-21055	150 ct	50 ct	12.5	2.0	1.5	.05	8	12	5.5	1.38	1.73:1	3.46:1	20.65
S-21060	150 ct	100 ct	25	2.0	1.5	.05	8	12	11	2.75	1.22:1	2.44:1	20.65
S-21065	150 ct	150 ct	37.5	2.0	1.5	.05	8	12	16.5	4.13	1:1	2:1	20.65
S-21070	150 ct	600 ct	150	2.0	1.5	.05	8	12	66	16.5	1:2	1:1	20.65
S-21075	200 ct	200 ct	50	2.0	1.5	.05	7	16	22	5.5	1:1	2:1	20.65
S-21080	300 ct	12 ct	3	2.0	1.5	.05	5.5	24	1.32	.33	5:1	10:1	20.65
S-21085	300 ct	50 ct	12.5	2.0	1.5	.05	5.5	24	5.5	1.38	2.45:1	4.9:1	20.65
S-21090	300 ct	150 ct	37.5	2.0	1.5	.05	5.5	24	16.5	4.13	1.41:1	2.83:1	20.65
S-21095	300 ct	300 ct	75	2.0	1.5	.05	5.5	24	33	8.25	1:1	2:1	20.65
S-21100	300 ct	600 ct	150	2.0	1.5	.05	5.5	24	66	16.5	1:1.41	1.41:1	20.65
S-21105	320 ct	12.8 ct	3.2	2.0	1.5	.05	5.5	25.6	1.41	.35	5:1	10:1	20.65
S-21110	400 ct	40 ct	10	2.0	1.5	.05	5	32	4.4	1.1	3.16:1	6.32:1	20.65
S-21115	400 ct	120 ct	30	2.0	1.5	.05	5	32	13.2	3.3	1.83:1	3.65:1	20.65
S-21120	400 ct	200 ct	50	2.0	1.5	.05	5	32	22	5.5	1.41:1	2.83:1	20.65
S-21125	400 ct	400 ct	100	2.0	1.5	.05	5	32	44	11	1:1	2:1	20.65
S-21130	400 ct	1000 ct	250	2.0	1.5	.05	5	32	110	27.5	1:1.58	1.26:1	20.65
S-21135	400 ct	2000 ct	500	2.0	1.5	.05	5	32	220	55	1:2.24	1:1.12	20.65
S-21140	400 ct	4000 ct	1000	2.0	1.5	.05	5	32	440	110	1:3.16	1:1.58	20.65
S-21142	500 ct	12.8 ct	3.2	2.0	1.5	.05	4.5	40	1.41	.35	6.25:1	12.5:1	20.65
S-21144	500 ct	16 ct	4	2.0	1.5	.05	4.5	40	1.76	.44	5.6:1	11.2:1	20.65
S-21145	500 ct	50 ct	12.5	2.0	1.5	.05	4.5	40	5.5	1.38	3.16:1	6.32:1	20.65
S-21147	500 ct	150 ct	37.5	2.0	1.5	.05	4.5	40	16.5	4.13	1.83:1	3.65:1	20.65
S-21150	500 ct	500 ct	125	2.0	1.5	.05	4.5	40	55	13.75	1:1	2:1	20.65
S-21155	*500 ct	500 ct	-	2.0	1.5	.05	4.5	40	55	-	1:1	-	21.49
S-21160	500 ct	600 ct	150	2.0	1.5	.05	4.5	40	66	16.5	1:1.1	1.83:1	20.65
S-21165	600 ct	12.8 ct	3.2	2.0	1.5	.05	4	48	1.41	.35	6.85:1	13.7	20.65
S-21167	600 ct	30 ct	7.5	2.0	1.5	.05	4	48	3.3	.83	4.47:1	8.94:1	20.65
S-21170	600 ct	48 ct	12	2.0	1.5	.05	4	48	5.28	1.37	3.54:1	7.07:1	20.65
S-21175	600 ct	200 ct	50	2.0	1.5	.05	4	48	22	5.5	1.73:1	3.46:1	20.65
S-21180**	600 ct	600 ct	150	2.0	1.5	.05	4	48	66	16.5	1:1	2:1	20.65
S-21185**	*600 ct	600 ct	-	2.0	1.5	.05	4	48	66	-	1:1	-	21.49
S-21186**	*600 ct	900 ct	-	2.0	1.5	.05	4	48	99	-	1:1.22	-	21.49
S-21187**	600 ct	1200 ct	300	2.0	1.5	.05	4	48	132	33	1:1.41	1.41:1	20.65
S-21190	640 ct	12.8 ct	3.2	2.0	1.5	.05	4	51	1.41	.35	7.07:1	14.14:1	20.65
S-21195	700 ct	100 ct	25	2.0	1.5	.05	3.5	56	11	2.75	2.65:1	5.29:1	20.65
S-21200	800 ct	12.8 ct	3.2	2.0	1.5	.05	3.5	64	1.41	.35	7.91:1	15.8:1	20.65
S-21205	800 ct	48 ct	12	2.0	1.5	.05	3.5	64	5.28	1.32	4.08:1	8.16:1	20.65
S-21210	800 ct	800 ct	200	2.0	1.5	.05	3.5	64	88	22	1:1	2:1	20.65
S-21215	900 ct	600 ct	150	2.0	1.5	.05	3	72	66	16.5	1.23:1	2.45:1	20.65
S-21217**	*900 ct	900 ct	-	2.0	1.5	.05	3	72	99	-	1:1	-	21.49
S-21220	1000 ct	12 ct	3	2.0	1.5	.05	3	80	1.32	.33	9.13:1	18.26:1	20.65
S-21225	1000 ct	50 ct	12.5	2.0	1.5	.05	3	80	5.5	1.38	4.47:1	8.94:1	20.65
S-21230	1000 ct	1000 ct	250	2.0	1.5	.05	3	80	110	27.5	1:1	2:1	20.65
S-21235	1060 ct	12.8 ct	3.2	2.0	1.5	.05	3	85	1.41	.35	9.1:1	18.2:1	20.65
S-21240	1200 ct	12.8 ct	3.2	2.0	1.5	.05	3	96	1.41	.35	9.68:1	19.4:1	20.65
S-21245	1200 ct	500 ct	125	2.0	1.5	.05	3	96	55	13.75	1.55:1	3.1:1	20.65
S-21250	1200 ct	1200 ct	300	2.0	1.5	.05	3	96	132	33	1:1	2:1	20.65
S-21255	*1200 ct	1200 ct	-	2.0	1.5	.05	3	96	132	-	1:1	-	21.49
S-21260	1500 ct	12 ct	3	2.0	1.5	.05	2.5	120	1.32	.33	11.18:1	22.36:1	20.65
S-21265	1500 ct	500 ct	125	2.0	1.5	.05	2.5	120	55	13.75	1.73:1	3.46:1	20.65
S-21270	*1500 ct	600 ct	-	2.0	1.5	.05	2.5	120	66	-	1.58:1	-	21.49
S-21275	*1500 ct	1500 ct	-	2.0	1.5	.05	2.5	120	165	-	1:1	-	21.49
S-21280	1600 ct	12.8 ct	3.2	2.0	1.5	.05	2.5	128	1.41	.35	11.18:1	22.36:1	20.65
S-21283	2000 ct	8 ct	2	2.0	1.5	.05	2.2	160	.88	.22	15.8:1	31.6:1	20.65
S-21285	2000 ct	2000 ct	500	2.0	1.5	.05	2.2	160	220	55	1:1	2:1	20.65
S-21290	*2000 ct	2000 ct	-	2.0	1.5	.05	2.2	160	220	-	1:1	-	21.49
S-21295	2000 ct	8000 ct	2000	2.0	1.5	.05	2.2	160	880	220	1:2	1:1	21.49
S-21297	2500 ct	2500 ct	625	2.0	1.5	.05	2	200	275	69	1:1	2:1	21.49
S-21300	3000 ct	3000 ct	750	2.0	1.5	.05	1.8	240	330	83	1:1	2:1	21.49
S-21305	*3000 ct	3000 ct	-	2.0	1.5	.05	1.8	240	330	-	1:1	-	21.49

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

PICO Electronics, Inc.

453 N. MacQuesten Pkwy.. Mt. Vernon. N.Y. 10552 • 914-699-5514 • TWX 7105620113

PICO PART NUMBER S-Series Plug-in	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1KHz and higher	300 Hz and higher	50 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9*** S-Series
S-21310	3600 ct	3600 ct	900	2.0	1.5	.05	1.7	288	396	99	1:1	2:1	21.49
S-21312	4000 ct	16 ct	4	2.0	1.5	.05	1.6	320	1.76	.44	15.8:1	31.6:1	21.49
S-21314**	4000 ct	600 ct	150	2.0	1.5	.05	1.6	320	66	16.5	2.58:1	5.16:1	21.49
S-21315	4000 ct	1000 ct	250	2.0	1.5	.05	1.6	320	110	27.5	2:1	4:1	21.49
S-21320	*4000 ct	8000 ct	-	2.0	1.5	.05	1.6	320	880	-	1:1.41	-	21.49
S-21325	5000 ct	500 ct	125	2.0	1.5	.05	1.4	400	55	13.8	3.16:1	6.32:1	20.65
S-21330	5000 ct	5000 ct	1250	2.0	1.5	.05	1.4	400	550	138	1:1	2:1	20.65
S-21335	7500 ct	50 ct	12.5	1.3	1.3	.05	1.2	600	5.5	1.38	12.25:1	24.5:1	22.89
S-21340	7500 ct	100 ct	25	1.3	1.3	.05	1.2	600	11	2.75	8.66:1	17.32:1	22.89
S-21345	7500 ct	600 ct	150	1.3	1.3	.05	1.2	600	66	16.5	3.54:1	7.07:1	22.89
S-21350	7500 ct	2500 ct	625	1.3	1.3	.05	1.2	600	275	69	1.73:1	3.46:1	22.89
S-21355	*7500 ct	7500 ct	-	1.3	1.3	.05	1.2	600	825	-	1:1	-	24.53
S-21360	8000 ct	12.8 ct	3.2	1.2	1.2	.05	1.1	640	1.4	.35	25:1	50:1	22.89
S-21365	8000 ct	1000 ct	250	1.2	1.2	.05	1.1	640	110	27.5	2.83:1	5.66:1	22.89
S-21370	*8000 ct	1200 ct	-	1.2	1.2	.05	1.1	640	132	-	2.58:1	-	24.53
S-21375	*9000 ct	9000 ct	-	1.1	1.1	.05	1.1	720	990	-	1:1	-	24.53
S-21380	10,000 ct	12.8 ct	3.2	1.0	1.0	.05	1	800	1.4	.35	28:1	56:1	22.89
S-21385	10,000 ct	16 ct	4	1.0	1.0	.05	1	800	1.76	.44	25:1	50:1	22.89
S-21390	10,000 ct	100 ct	25	1.0	1.0	.05	1	800	11	2.75	10:1	20:1	22.89
S-21395	10,000 ct	200 ct	50	1.0	1.0	.05	1	800	22	5.5	7.07:1	14.14:1	22.89
S-21400	10,000 ct	500 ct	125	1.0	1.0	.05	1	800	55	13.75	4.47:1	8.94:1	22.89
S-21405	10,000 ct	600 ct	150	1.0	1.0	.05	1	800	66	16.5	4.08:1	8.16:1	22.89
S-21410	10,000 ct	1000 ct	250	1.0	1.0	.05	1	800	110	27.5	3.16:1	6.32:1	22.89
S-21415	10,000 ct	1200 ct	300	1.0	1.0	.05	1	800	132	33	2.89:1	5.77:1	22.89
S-21420	10,000 ct	1500 ct	375	1.0	1.0	.05	1	800	165	41.3	2.58:1	5.16:1	22.89
S-21425	10,000 ct	2000 ct	500	1.0	1.0	.05	1	800	220	55	2.24:1	4.47:1	22.89
S-21430	10,000 ct	5000 ct	1250	1.0	1.0	.05	1	800	550	138	1.41:1	2.83:1	22.89
S-21435	10,000 ct	7500 ct	1875	1.0	1.0	.05	1	800	825	206	1.16:1	2.31:1	22.89
S-21440	10,000 ct	10,000 ct	2500	1.0	1.0	.05	1	800	1100	275	1:1	2:1	22.89
S-21445	*10,000 ct	10,000 ct	-	1.0	1.0	.05	1	800	1100	-	1:1	-	24.53
S-21450	15,000 ct	400 ct	100	.65	.65	.05	.8	1200	44	11	6.12:1	12.25:1	22.89
S-21452	15,000 ct	500 ct	125	.65	.65	.05	.8	1200	55	13.8	5.48:1	10.95:1	22.89
S-21455	15,000 ct	600 ct	150	.65	.65	.05	.8	1200	66	16.5	5:1	10:1	22.89
S-21460	15,000 ct	10,000 ct	2500	.65	.65	.05	.8	1200	1100	275	1.22:1	2.45:1	22.89
S-21465	*15,000 ct	15,000 ct	-	.65	.65	.05	.8	1200	1650	-	1:1	-	24.53
S-21470	15,000 ct	15,000 ct	3750	.65	.65	.05	.8	1200	1650	413	1:1	2:1	22.89
S-21475	16,000 ct	1000 ct	250	.62	.62	.05	.8	1280	110	27.5	4:1	8:1	22.89
S-21480	20,000 ct	500 ct	125	.5	.5	.05	.7	1600	55	13.8	6.32:1	12.65:1	24.53
S-21485	20,000 ct	600 ct	150	.5	.5	.05	.7	1600	66	16.5	5.77:1	11.55:1	24.53
S-21490	20,000 ct	800 ct	200	.5	.5	.05	.7	1600	88	22	5:1	10:1	24.53
S-21495	20,000 ct	1000 ct	250	.5	.5	.05	.7	1600	110	27.5	4.47:1	8.94:1	24.53
S-21500	20,000 ct	5000 ct	1250	.5	.5	.05	.7	1600	550	138	2:1	4:1	24.53
S-21505	20,000 ct	10,000 ct	2500	.5	.5	.05	.7	1600	1100	275	1.41:1	2.83:1	24.53
S-21510	*20,000 ct	20,000 ct	-	.5	.5	.05	.7	1600	2200	-	1:1	-	25.48
S-21515	25,000 ct	500 ct	125	.4	.4	.05	.6	2000	55	13.8	7.07:1	14.14:1	24.53
S-21520	25,000 ct	1000 ct	250	.4	.4	.05	.6	2000	110	27.5	5:1	10:1	24.53
S-21525	30,000 ct	50 ct	12.5	.33	.33	.05	.6	2400	5.5	1.38	24.5:1	49:1	25.48
S-21530	30,000 ct	1200 ct	300	.33	.33	.05	.6	2400	132	33	5:1	10:1	25.48
S-21532	30,000 ct	500 ct	125	.33	.33	.05	.6	2400	55	13.8	7.7:1	15.5:1	25.48
S-21534	30,000 ct	200 ct	50	.33	.33	.05	.6	2400	22	5.5	12.2:1	24.5:1	25.48
S-21535	30,000 ct	5000 ct	1250	.33	.33	.05	.6	2400	550	137.5	2.45:1	4.9:1	25.48
S-21540	30,000 ct	10,000 ct	2500	.33	.33	.05	.6	2400	1100	275	1.73:1	3.46:1	25.48
S-21545	*30,000 ct	30,000 ct	-	.33	.33	.05	.6	2400	3300	-	1:1	-	27.39
S-21550	40,000 ct	400 ct	100	.25	.25	.05	.5	3200	44	11	10:1	20:1	27.39
S-21555	40,000 ct	2000 ct	500	.25	.25	.05	.5	3200	220	55	4.47:1	8.94:1	27.39
S-21560	40,000 ct	4000 ct	1000	.25	.25	.05	.5	3200	440	110	3.16:1	6.32:1	27.39
S-21565	40,000 ct	20,000 ct	5000	.25	.25	.05	.5	3200	2200	550	1.41:1	2.83:1	27.39
S-21570	*40,000 ct	40,000 ct	-	.25	.25	.05	.5	3200	4400	-	1:1	-	30.49
S-21575	50,000 ct	200 ct	50	.2	.2	.05	.4	4000	22	5.5	15.8:1	31.6:1	30.49
S-21577	50,000 ct	500 ct	125	.2	.2	.05	.4	4000	55	13.8	10:1	20:1	30.49
S-21578	50,000 ct	600 ct	150	.2	.2	.05	.4	4000	66	16.5	9.13:1	18.26:1	30.49
S-21579	50,000 ct	50,000 ct	12,500	.2	.2	.05	.4	4000	5500	1380	1:1	2:1	30.49
S-21580	60,000 ct	15,000 ct	3750	.16	.16	.05	.4	4800	1650	413	2:1	4:1	22.23
S-21585	62,500 ct	50 ct	12.5	.16	.16	.05	.4	5000	5.5	1.38	35.4:1	70.7:1	22.23
S-21587	80,000 ct	15,000 ct	3750	.12	.12	.05	.3	6400	1650	413	2.3:1	4.6:1	22.23
S-21590	90,000 ct	10,000 ct	2500	.11	.11	.05	.3	7200	1100	275	3:1	6:1	34.57
S-21595	95,000 ct	15,000 ct	3750	.1	.1	.05	.3	7600	1650	413	2.5:1	5:1	34.57
S-21600	100,000 ct	60 ct	15	.1	.1	.05	.3	8000	6.6	1.65	40.8:1	81.6:1	34.57
S-21605	100,000 ct	100 ct	25	.1	.1	.05	.3	8000	11	2.75	31.6:1	63.2:1	34.57
S-21610	100,000 ct	500 ct	125	.1	.1	.05	.3	8000	55	13.8	14.1:1	28.3:1	34.57
S-21613	100,000 ct	1000 ct	250	.1	.1	.05	.3	8000	110	27.5	10:1	20:1	34.57
S-21614	100,000 ct	2000 ct	500	.1	.1	.05	.3	8000	220	55	7.07:1	14.14:1	34.57
S-21615	100,000 ct	10,000 ct	2500	.1	.1	.05	.3	8000	1100	275	3.16:1	6.32:1	34.57
S-21620	135,000 ct	82 ct	20.5	.07	.07	.05	.2	10,800	9	2.25	40.6:1	81.2:1	36.11

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Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

PICO's ultra-miniature transformers

S SERIES Plug-In

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
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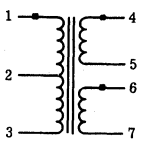
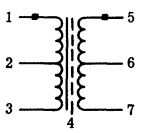
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



PICO Electronics, Inc.
453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552
914-699-5514
TWX 7105620113

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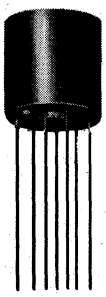
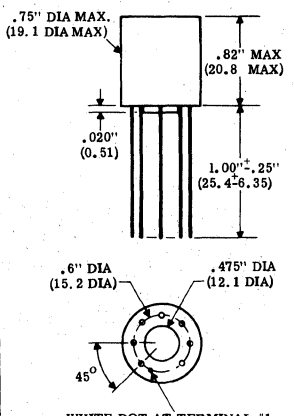
Delivery— stock to one week

PICO's ultra-miniature transformers

T SERIES Plug-In





Dimensions are in inches (MM)

SPECIFICATIONS

- MIL-T-27: . . . . . All Units Meet MIL-T-27 And Are Hermetically Sealed in a Metal Case, Audio Transformers Are Type TF5R21ZZ.
- FREQUENCY RESPONSE: . . . ± 3 db, 20 Hz - 25 KHz at 1.0 Milliwatt.
- MAXIMUM DISTORTION: . . . 5% With Rated Power Level at 1 KHz and 300 Hz. 10% Distortion at 20 Hz.
- DIELECTRIC STRENGTH: . . . All Units Tested at 200 V RMS.
- INSULATION RESISTANCE: . . Greater Than 10,000 Megohms at 300 V DC.
- WEIGHT: . . . . . 28 Grams
- OPERATING TEMPERATURE: . -55°c to 105°c (All Units Can Be Supplied to Class S Requirements 130°c Maximum).
- TERMINALS: . . . . . Solid .020 Conductor, Copper Clad Steel Tinned 100%, Electroplated Per MIL-T-10727A and ASTM CCS B452
- THERMAL SHOCK: . . . . . 25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

This Product is Patented

Delivery— stock to one week

PICO PART NUMBER T-Series Plug-In	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER WATTS 1KHz and higher	POWER WATTS 300 Hz and higher	POWER WATTS 20 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	TURNS RATIO PRIM/SEC SEC PAR CONN	PICO PRICES 1-9*** T-Series
T-22003	20 ct	8 ct	2	3.0	2.0	.006	22	1.6	.8	.2	1.58:1	3.16:1	22.68
T-22005	20 ct	20 ct	5	3.0	2.0	.006	22	1.6	2	.5	1:1	2:1	22.68
T-22010	32 ct	32 ct	8	3.0	2.0	.006	17.5	2.56	3.2	.8	1:1	2:1	22.68
T-22015	40 ct	40 ct	10	3.0	2.0	.006	16	3.2	4	1	1:1	2:1	22.68
T-22018	48 ct	16 ct	4	3.0	2.0	.006	14.5	3.84	1.6	.4	1.73:1	3.46:1	22.68
T-22020	50 ct	50 ct	12.5	3.0	2.0	.006	14	4	5	1.25	1:1	2:1	22.68
T-22025	80 ct	32 ct	8	3.0	2.0	.006	11	6.4	3.2	.8	1.58:1	3.16:1	22.68
T-22028	100 ct	40 ct	10	3.0	2.0	.006	10	8	4	1	1.58:1	3.16:1	22.68
T-22030	100 ct	100 ct	25	3.0	2.0	.006	10	8	10	2.5	1:1	2:1	22.68
T-22035	120 ct	12.8 ct	3.2	3.0	2.0	.006	9	9.6	1.3	.32	3.06:1	6.12:1	22.68
T-22040	120 ct	60 ct	15	3.0	2.0	.006	9	9.6	6	1.5	1.41:1	2.83:1	22.68
T-22045	120 ct	120 ct	30	3.0	2.0	.006	9	9.6	12	3	1:1	2:1	22.68
T-22050	150 ct	12 ct	3	3.0	2.0	.006	8	12	1.2	.3	3.54:1	7.08:1	22.68
T-22055	150 ct	50 ct	12.5	3.0	2.0	.006	8	12	5	1.25	1.73:1	3.46:1	22.68
T-22060	150 ct	100 ct	25	3.0	2.0	.006	8	12	10	2.5	1.22:1	2.44:1	22.68
T-22065	150 ct	150 ct	37.5	3.0	2.0	.006	8	12	15	3.75	1:1	2:1	22.68
T-22070	150 ct	600 ct	150	3.0	2.0	.006	8	12	60	15	1:2	1:1	22.68
T-22075	200 ct	200 ct	50	3.0	2.0	.006	7	16	20	5	1:1	2:1	22.68
T-22080	300 ct	12 ct	3	3.0	2.0	.006	5.5	24	1.2	.3	5:1	10:1	22.68
T-22085	300 ct	50 ct	12.5	3.0	2.0	.006	5.5	24	5	1.25	2.45:1	4.9:1	22.68
T-22090	300 ct	150 ct	37.5	3.0	2.0	.006	5.5	24	15	3.75	1.41:1	2.83:1	22.68
T-22095	300 ct	300 ct	75	3.0	2.0	.006	5.5	24	30	7.5	1:1	2:1	22.68
T-22100	300 ct	600 ct	150	3.0	2.0	.006	5.5	24	60	15	1:1.41	1.41:1	22.68
T-22105	320 ct	12.8 ct	3.2	3.0	2.0	.006	5.5	25.6	1.3	.32	5:1	10:1	22.68
T-22110	400 ct	40 ct	10	3.0	2.0	.006	5	32	4	1	3.16:1	6.32:1	22.68
T-22115	400 ct	120 ct	30	3.0	2.0	.006	5	32	12	3	1.83:1	3.65:1	22.68
T-22120	400 ct	200 ct	50	3.0	2.0	.006	5	32	20	5	1.41:1	2.83:1	22.68
T-22125	400 ct	400 ct	100	3.0	2.0	.006	5	32	40	10	1:1	2:1	22.68
T-22130	400 ct	1000 ct	250	3.0	2.0	.006	5	32	100	25	1:1.58	1.26:1	22.68
T-22135	400 ct	2000 ct	500	3.0	2.0	.006	5	32	200	50	1:2.24	1:1.12	22.68
T-22140	400 ct	4000 ct	1000	3.0	2.0	.006	5	32	400	100	1:3.16	1:1.58	22.68
T-22142	500 ct	12.8 ct	3.2	3.0	2.0	.006	4.5	40	1.3	.32	6.25:1	12.5:1	22.68
T-22144	500 ct	16 ct	4	3.0	2.0	.006	4.5	40	1.6	.4	5.6:1	11.2:1	22.68
T-22145	500 ct	50 ct	12.5	3.0	2.0	.006	4.5	40	5	1.25	3.16:1	6.32:1	22.68
T-22147	500 ct	150 ct	37.5	3.0	2.0	.006	4.5	40	15	3.75	1.83:1	3.65:1	22.68
T-22150	500 ct	500 ct	125	3.0	2.0	.006	4.5	40	50	12.5	1:1	2:1	22.68
T-22155	*500 ct	500 ct	-	3.0	2.0	.006	4.5	40	50	-	1:1	-	23.64
T-22160	500 ct	600 ct	150	3.0	2.0	.006	4.5	40	60	15	1:1.1	1.83:1	22.68
T-22165	600 ct	12.8 ct	3.2	3.0	2.0	.006	4	48	1.3	.32	6.85:1	13.7:1	22.68
T-22167	600 ct	30 ct	7.5	3.0	2.0	.006	4	48	3	.75	4.47:1	8.94:1	22.68
T-22170	600 ct	48 ct	12	3.0	2.0	.006	4	48	4.8	1.2	3.54:1	7.07:1	22.68
T-22175	600 ct	200 ct	50	3.0	2.0	.006	4	48	20	5	1.73:1	3.46:1	22.68
T-22180**	600 ct	600 ct	150	3.0	2.0	.006	4	48	60	15	1:1	2:1	22.68
T-22185**	*600 ct	600 ct	-	3.0	2.0	.006	4	48	60	-	1:1	-	23.64
T-22186**	*600 ct	900 ct	-	3.0	2.0	.006	4	48	90	-	1:1.22	-	23.64
T-22187**	600 ct	1200 ct	300	3.0	2.0	.006	4	48	120	30	1:1.41	1.41:1	22.68
T-22190	640 ct	12.8 ct	3.2	3.0	2.0	.006	4	51	1.3	.32	7.07:1	14.14:1	22.68
T-22195	700 ct	100 ct	25	3.0	2.0	.006	3.5	56	10	2.5	2.65:1	5.29:1	22.68
T-22200	800 ct	12.8 ct	3.2	3.0	2.0	.006	3.5	64	1.3	.32	7.91:1	15.8:1	22.68
T-22205	800 ct	48 ct	12	3.0	2.0	.006	3.5	64	4.8	1.2	4.08:1	8.16:1	22.68
T-22210	800 ct	800 ct	200	3.0	2.0	.006	3.5	64	80	20	1:1	2:1	22.68
T-22215	900 ct	600 ct	150	3.0	2.0	.006	3	72	60	15	1.22:1	2.45:1	22.68
T-22217**	*900 ct	900 ct	-	3.0	2.0	.006	3	72	90	-	1:1	-	23.64
T-22220	1000 ct	12 ct	3	3.0	2.0	.006	3	80	1.2	.3	9.13:1	18.26:1	22.68
T-22225	1000 ct	50 ct	12.5	3.0	2.0	.006	3	80	5	1.25	4.47:1	8.94:1	22.68
T-22230	1000 ct	1000 ct	250	3.0	2.0	.006	3	80	100	25	1:1	2:1	22.68
T-22235	1060 ct	12.8 ct	3.2	3.0	2.0	.006	3	85	1.3	.32	9.1:1	18.2:1	22.68
T-22240	1200 ct	12.8 ct	3.2	3.0	2.0	.006	3	96	1.3	.32	9.68:1	19.4:1	22.68
T-22245	1200 ct	500 ct	125	3.0	2.0	.006	3	96	50	12.5	1.55:1	3.1:1	22.68
T-22250	1200 ct	1200 ct	300	3.0	2.0	.006	3	96	120	30	1:1	2:1	22.68
T-22255	*1200 ct	1200 ct	-	3.0	2.0	.006	3	96	120	-	1:1	-	23.64
T-22260	1500 ct	12 ct	3	3.0	2.0	.006	2.5	120	1.2	.3	11.18:1	22.36:1	22.68
T-22265	1500 ct	500 ct	125	3.0	2.0	.006	2.5	120	50	12.5	1.73:1	3.46:1	22.68
T-22270	*1500 ct	600 ct	-	3.0	2.0	.006	2.5	120	60	-	1.58:1	-	23.64
T-22275	*1500 ct	1500 ct	-	3.0	2.0	.006	2.5	120	150	-	1:1	-	23.64
T-22280	1600 ct	12.8 ct	3.2	3.0	2.0	.006	2.5	128	1.3	.32	11.18:1	22.36:1	22.68
T-22283	2000 ct	8 ct	2	3.0	2.0	.006	2.2	160	.8	.2	15.8:1	31.6:1	22.68
T-22285	2000 ct	2000 ct	500	3.0	2.0	.006	2.2	160	200	50	1:1	2:1	22.68
T-22290	*2000 ct	2000 ct	-	3.0	2.0	.006	2.2	160	200	-	1:1	-	23.64
T-22295	2000 ct	8000 ct	2000	3.0	2.0	.006	2.2	160	800	200	1:2	1:1	22.68
T-22297	2500 ct	2500 ct	625	3.0	2.0	.006	2	200	250	63	1:1	2:1	22.68
T-22300	3000 ct	3000 ct	750	3.0	2.0	.006	1.8	240	300	75	1:1	2:1	22.68
T-22305	*3000 ct	3000 ct	-	3.0	2.0	.006	1.8	240	300	-	1:1	-	22.68

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
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PICO PART NUMBER T-Series Plug-in	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1KHz and higher	300 Hz and higher	20 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9*** T-Series
T-22310	3600 ct	3600 ct	900	2.7	2.0	.006	1.7	288	360	90	1:1	2:1	22.68
T-22312	4000 ct	16 ct	4	2.5	2.0	.006	1.6	320	1.6	.4	15.8:1	31.6:1	22.68
T-22314**	4000 ct	600 ct	150	2.5	2.0	.006	1.6	320	60	15	2.58:1	5.16:1	22.68
T-22315	4000 ct	1000 ct	250	2.5	2.0	.006	1.6	320	100	25	2:1	4:1	22.68
T-22320	*4000 ct	8000 ct	-	2.5	2.0	.006	1.6	320	800	-	1:1.41	-	23.64
T-22325	5000 ct	500 ct	125	2.0	2.0	.006	1.4	400	50	12.5	3.16:1	6.32:1	22.68
T-22330	5000 ct	5000 ct	1250	2.0	2.0	.006	1.4	400	500	125	1:1	2:1	22.68
T-22335	7500 ct	50 ct	12.5	1.3	1.3	.006	1.2	600	5	1.25	12.25:1	24.5:1	25.16
T-22340	7500 ct	100 ct	25	1.3	1.3	.006	1.2	600	10	2.5	8.66:1	17.32:1	25.16
T-22345	7500 ct	600 ct	150	1.3	1.3	.006	1.2	600	60	15	3.54:1	7.07:1	25.16
T-22350	7500 ct	2500 ct	625	1.3	1.3	.006	1.2	600	250	63	1.73:1	3.46:1	25.16
T-22355	*7500 ct	7500 ct	-	1.3	1.3	.006	1.2	600	750	-	1:1	-	26.97
T-22360	8000 ct	12.8 ct	3.2	1.2	1.2	.006	1.1	640	1.3	.32	25:1	50:1	25.16
T-22365	8000 ct	1000 ct	250	1.2	1.2	.006	1.1	640	100	25	2.83:1	5.66:1	25.16
T-22370	*8000 ct	1200 ct	-	1.2	1.2	.006	1.1	640	120	-	2.58:1	-	26.97
T-22375	*9000 ct	9000 ct	-	1.1	1.1	.006	1.1	720	900	-	1:1	-	26.97
T-22380	10,000 ct	12.8 ct	3.2	1.0	1.0	.006	1	800	1.3	.32	28:1	56:1	25.16
T-22385	10,000 ct	16 ct	4	1.0	1.0	.006	1	800	1.6	.4	25:1	50:1	25.16
T-22390	10,000 ct	100 ct	25	1.0	1.0	.006	1	800	10	2.5	10:1	20:1	25.16
T-22395	10,000 ct	200 ct	50	1.0	1.0	.006	1	800	20	5	7.07:1	14.14:1	25.16
T-22400	10,000 ct	500 ct	125	1.0	1.0	.006	1	800	50	12.5	4.47:1	8.94:1	25.16
T-22405	10,000 ct	600 ct	150	1.0	1.0	.006	1	800	60	15	4.08:1	8.16:1	25.16
T-22410	10,000 ct	1000 ct	250	1.0	1.0	.006	1	800	100	25	3.16:1	6.32:1	25.16
T-22415	10,000 ct	1200 ct	300	1.0	1.0	.006	1	800	120	30	2.89:1	5.77:1	25.16
T-22420	10,000 ct	1500 ct	375	1.0	1.0	.006	1	800	150	38	2.58:1	5.16:1	25.16
T-22425	10,000 ct	2000 ct	500	1.0	1.0	.006	1	800	200	50	2.24:1	4.47:1	25.16
T-22430	10,000 ct	5000 ct	1250	1.0	1.0	.006	1	800	500	125	1.41:1	2.83:1	25.16
T-22435	10,000 ct	7500 ct	1875	1.0	1.0	.006	1	800	750	188	1.16:1	2.31:1	25.16
T-22440	10,000 ct	10,000 ct	2500	1.0	1.0	.006	1	800	1000	250	1:1	2:1	25.16
T-22445	*10,000 ct	10,000 ct	-	1.0	1.0	.006	1	800	1000	-	1:1	-	26.97
T-22450	15,000 ct	400 ct	100	.66	.66	.006	.8	1200	40	10	6.12:1	12.25:1	25.16
T-22452	15,000 ct	500 ct	125	.66	.66	.006	.8	1200	50	12.5	5.48:1	10.95:1	25.16
T-22455	15,000 ct	600 ct	150	.66	.66	.006	.8	1200	60	15	5:1	10:1	25.16
T-22460	15,000 ct	10,000 ct	2500	.66	.66	.006	.8	1200	1000	250	1.22:1	2.45:1	25.16
T-22465	*15,000 ct	15,000 ct	-	.66	.66	.006	.8	1200	1500	-	1:1	-	26.97
T-22470	15,000 ct	15,000 ct	3750	.66	.66	.006	.8	1200	1500	375	1:1	2:1	25.16
T-22475	16,000 ct	1000 ct	250	.62	.62	.006	.8	1280	100	25	4:1	8:1	25.16
T-22480	20,000 ct	500 ct	125	.5	.5	.006	.7	1600	50	12.5	6.32:1	12.65:1	26.97
T-22485	20,000 ct	600 ct	150	.5	.5	.006	.7	1600	60	15	5.77:1	11.55:1	26.97
T-22490	20,000 ct	800 ct	200	.5	.5	.006	.7	1600	80	20	5:1	10:1	26.97
T-22495	20,000 ct	1000 ct	250	.5	.5	.006	.7	1600	100	25	4.47:1	8.94:1	26.97
T-22500	20,000 ct	5000 ct	1250	.5	.5	.006	.7	1600	500	125	2:1	4:1	26.97
T-22505	20,000 ct	10,000 ct	2500	.5	.5	.006	.7	1600	1000	250	1.41:1	2.83:1	26.97
T-22510	*20,000 ct	20,000 ct	-	.5	.5	.006	.7	1600	2000	-	1:1	-	28.03
T-22515	25,000 ct	500 ct	125	.4	.4	.006	.6	2000	50	12.5	7.07:1	14.14:1	26.97
T-22520	25,000 ct	1000 ct	250	.4	.4	.006	.6	2000	100	25	5:1	10:1	26.97
T-22525	30,000 ct	50 ct	12.5	.33	.33	.006	.6	2400	5	1.25	24.5:1	49:1	28.03
T-22530	30,000 ct	1200 ct	300	.33	.33	.006	.6	2400	120	30	5:1	10:1	28.03
T-22532	30,000 ct	500 ct	125	.33	.33	.006	.6	2400	50	12.5	7.7:1	15.5:1	28.03
T-22534	30,000 ct	200 ct	50	.33	.33	.006	.6	2400	20	5	12.2:1	24.5:1	28.03
T-22535	30,000 ct	5000 ct	1250	.33	.33	.006	.6	2400	500	125	2.45:1	4.9:1	28.03
T-22540	30,000 ct	10,000 ct	2500	.33	.33	.006	.6	2400	1000	250	1.73:1	3.46:1	28.03
T-22545	*30,000 ct	30,000 ct	-	.33	.33	.006	.6	2400	3000	-	1:1	-	30.06
T-22550	40,000 ct	400 ct	100	.25	.25	.006	.5	3200	40	10	10:1	20:1	30.06
T-22555	40,000 ct	2000 ct	500	.25	.25	.006	.5	3200	200	50	4.47:1	8.94:1	30.06
T-22560	40,000 ct	4000 ct	1000	.25	.25	.006	.5	3200	400	100	3.16:1	6.32:1	30.06
T-22565	40,000 ct	20,000 ct	5000	.25	.25	.006	.5	3200	2000	500	1.41:1	2.83:1	30.06
T-22570	*40,000 ct	40,000 ct	-	.25	.25	.006	.5	3200	4000	-	1:1	-	33.54
T-22575	50,000 ct	200 ct	50	.2	.2	.006	.4	4000	20	5	15.8:1	31.6:1	33.54
T-22577	50,000 ct	500 ct	125	.2	.2	.006	.4	4000	50	12.5	10:1	20:1	33.54
T-22578	50,000 ct	600 ct	150	.2	.2	.006	.4	4000	60	15	9.13:1	18.26:1	33.54
T-22579	50,000 ct	50,000 ct	12,500	.2	.2	.006	.4	4000	5000	1250	1:1	2:1	33.54
T-22580	60,000 ct	15,000 ct	3750	.16	.16	.006	.4	4800	1500	375	2:1	4:1	36.20
T-22585	62,500 ct	50 ct	12.5	.16	.16	.006	.4	5000	5	1.25	35.4:1	70.7:1	36.20
T-22587	80,000 ct	15,000 ct	3750	.12	.12	.006	.3	6400	1500	375	2.3:1	4.6:1	36.20

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

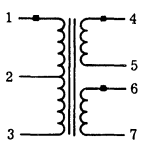
PICO's ultra-miniature transformers

T SERIES Plug-In

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



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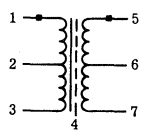


For immediate engineering assistance or to place an order—

Call Toll Free 800-431-1064

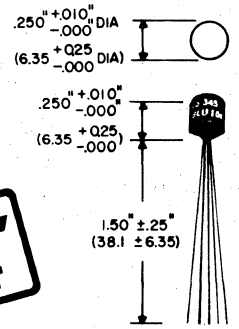
Delivery— stock to one week

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • 914-699-5514 • TWX 7105620113

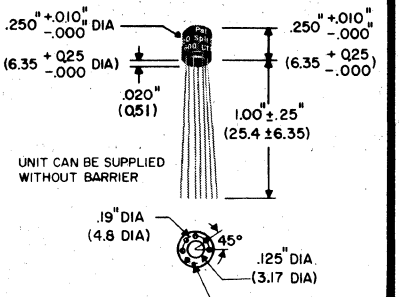
PICO's ultra-miniature PULSE transformers

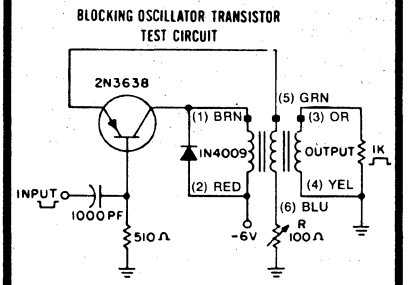
1/4"x1/4"



J SERIES
Insulated Leads

H SERIES Plug-In





Dimensions are in inches (MM)

SPECIFICATIONS

- MIL-T-21038:
  Units Meet MIL-T-21038
  and are Hermetically Sealed in a Metal Case
- DIELECTRIC STRENGTH:
  All Units tested at 200 V RMS
- INSULATION RESISTANCE:
  Greater than 10,000 Megohms at 300 V DC
- WEIGHT:
  1.1 Grams
- OPERATING TEMPERATURE:
  -55°c to 105°c (All Units Can be Supplied to Class S Requirements 130°c maximum)
- **TERMINALS: . . . . . .**
  Solid .012 Diameter Conductor. Conductor is copper clad steel, Tinned 100%. Electroplated Per MIL-T-10727A and ASTM CCS B452.
- THERMAL SHOCK:
  25 Cycles, Method 107C, MIL-STD-202D. Test Conduction A-1

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- BUILT TO MIL-T-21038
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

This Product is Patented

MILITARY DESIGNATION TP7RX4410CZ TURNS RATIO 4:4:1

PICO PART NUMBER		COUPLING CIRCUIT CHARACTERISTICS							BLOCKING OSCILLATOR CIRCUIT					PICO PRICES 1-9 *	
H-Series Plug-In	J-Series Insulated Leads	P Width μSec	Volt Out	Rise Time	% Over Shoot	Droop %	% Back Swing	Imp* in/out,	P Width μSec	Rise Time	% Over Shoot	Droop %	% Back Swing	H-Series	J-Series
H-5400	J-5600	0.05	0.2	0.01	0	0	20	50	0.05	0.01	0	0	35	17.80	15.87
H-5405	J-5605	0.1	0.5	0.015	0	0	20	50	0.1	0.012	0	0	25	17.80	15.87
H-5410	J-5610	0.2	1.2	0.02	0	0	20	100	0.2	0.02	0	0	15	17.80	15.87
H-5415	J-5615	0.5	1.5	0.023	0	5	25	100	0.5	0.023	0	5	15	17.80	15.87
H-5420	J-5620	1	1.5	0.025	0	20	28	100	1	0.03	0	10	15	17.80	15.87
H-5425	J-5625	2	1.5	0.028	0	15	23	100	2	0.035	0	10	15	17.80	15.87
H-5430	J-5630	3	1.5	0.030	0	15	28	100	3	0.04	0	10	15	17.80	15.87
H-5435	J-5635	5	2	0.035	0	20	20	200	5	0.040	0	15	15	17.80	15.87
H-5440	J-5640	10	2	0.05	0	25	25	200	10	0.060	0	15	10	17.80	15.87
H-5445	J-5645	15	2	0.06	0	25	18	200	15	0.07	0	15	15	17.80	15.87
H-5450	J-5650	25	3	0.1	0	30	30	500	25	0.08	0	15	15	17.80	15.87
H-5455	J-5655	50	3	0.3	0	20	20	500	50	0.2	0	10	5	17.80	15.87
H-5460	J-5660	100	6	0.4	0	15	18	500	100	0.35	0	10	15	17.80	15.87

Coupling circuit measurements made with (1) BRN–(2) RED as input and (3) OR–(4) YEL as output, (5) GRN–(6) BLU winding is open: Input Voltage = 1V

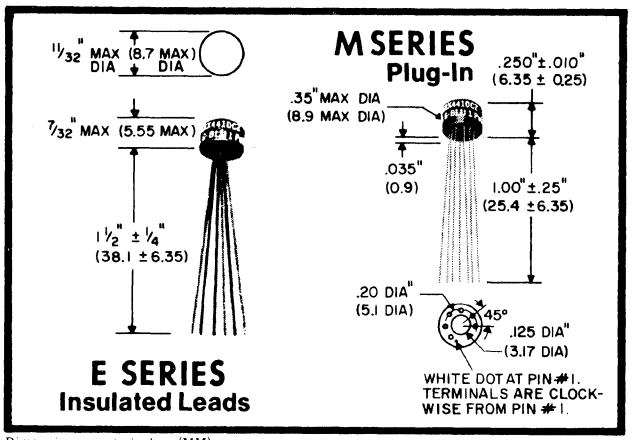
* Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

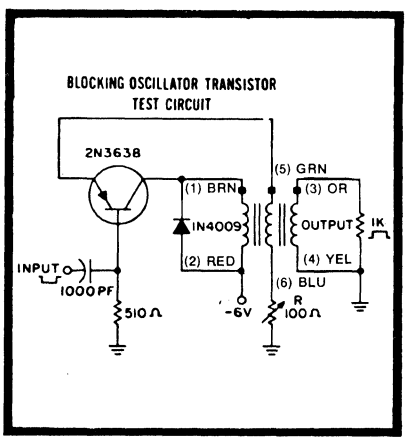
Delivery— stock to one week

For immediate engineering assistance or to place an order— ***Call Toll Free 800-431-1064***

PICO Electronics, Inc.
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • 914-699-5514 • TWX 7105620113



Dimensions are in inches (MM)



PICO's ultra-miniature PULSE transformers

SPECIFICATIONS

- MIL-T-21038: All Units Meet MIL-T-21038 and are Hermetically Sealed in a Metal Case
- DIELECTRIC STRENGTH: All Units tested at 200 V RMS
- INSULATION RESISTANCE: Greater than 10,000 Megohms at 300 V DC
- WEIGHT: 1/20 Ounce
- OPERATING TEMPERATURE: -55°c to 105°c (All Units Can be Supplied to Class S Requirements 130°c maximum)
- **TERMINALS: . . . . . Solid .012 Diameter Conductor. Conductor is copper clad steel, Tinned 100%. Electroplated Per MIL-T-10727A and ASTM CCS B452.**
- THERMAL SHOCK: 25 Cycles, Method 107C, MIL-STD-202D. Test Conduction A-1

This Product is Patented

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- BUILT TO MIL-T-21038
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

MILITARY DESIGNATION TP6RX4410CZ TURNS RATIO 4:4:1

PICO PART NUMBER		COUPLING CIRCUIT CHARACTERISTICS								BLOCKING OSCILLATOR CIRCUIT					D.C. RESISTANCE			PICO PRICES 1-9 *	
E-Series Insulated Leads	M-Series Plug-In	P. WIDTH μ SEC.	VOLT OUT	RISE TIME μ SEC.	% OVER SHOOT	% DROOP	% BACK SWING	IMP IN/OUT	FREQ RESP. WITHIN 2DB	P. WIDTH μ SEC.	RISE TIME μ SEC.	% OVER SHOOT	% DROOP	% BACK SWING	4 TNS BRN RED	4 TNS OR YEL	1 TURN GRN BLU	E-Series	M-Series
E5020	M5300	0.05	10	0.018	0	0	10	50	150 KHz-30 MHz	0.05	0.02	0	0	35	0.21	0.23	0.13	12.36	13.71
E5040	M5305	0.1	10	0.02	0	0	5	50	100 KHz-17 MHz	0.1	0.025	0	0	25	0.47	0.56	0.17	12.36	13.71
E5060	M5310	0.2	8	0.035	0	0	5	100	16 KHz-10 MHz	0.2	0.030	0	0	15	1.0	1.25	0.37	12.36	13.71
E5080	M5315	0.5	8	0.06	0	0	0	100	7 KHz-3.3 MHz	0.5	0.05	0	0	15	1.5	1.80	0.54	12.36	13.71
E5100	M5320	1	8	0.15	0	0	5	100	7 KHz-2.3 MHz	1	0.08	0	0	15	2.5	3.1	0.9	12.36	13.71
E5120	M5325	2	8	0.17	0	0	10	100	2.2 KHz-1.3 MHz	2	0.10	0	0	15	3.0	3.7	1.1	12.36	13.71
E5140	M5330	3	8	0.20	0	0	10	100	1.7 KHz-1.5 MHz	3	0.20	0	0	15	4.9	6.0	1.8	12.36	13.71
E5160	M5335	5	8	0.20	0	15	25	200	1.8 KHz-1.5 MHz	5	0.30	0	0	3	8.0	9.7	2.9	12.36	13.71
E5180	M5340	10	8	0.4	0	15	20	200	1.5 KHz-1.2 MHz	10	0.35	0	5	10	13.0	15.8	4.7	12.36	13.71

MILITARY DESIGNATION TP6RX5310CZ TURNS RATIO 5:3:1

															5 TURNS	3 TURNS	1 TURN		
E5200	M5345	0.1	8	0.01	0	0	5	140/50	170 KHz-32 MHz	0.1	0.01	0	0	20	0.55	0.40	0.15	12.36	13.71
E5220	M5350	1	8	0.05	0	6	10	280/100	12.5 KHz-3.3 MHz	1	0.02	5	5	5	3.0	2.2	0.9	12.36	13.71
E5240	M5355	5	8	0.09	0	12	25	560/200	15 KHz-4 MHz	5	0.05	0	10	10	9.5	7.0	2.6	12.36	13.71

MILITARY DESIGNATION TP6RX4440CZ TURNS RATIO 4:4:4

PICO PART NUMBER		COUPLING CIRCUIT CHARACTERISTICS											PICO PRICES 1-9 *	
E-Series Insulated Leads	M-Series Plug-In	P. WIDTH μ SEC.	VOLT OUT	RISE TIME μ SEC.	% OVER SHOOT	% DROOP	% BACK SWING	IMP IN OUT	FREQ RESP. WITHIN 2DB	4 TNS BRN RED	4 TNS OR YEL	4 TURNS GRN BLU	E-Series	M-Series
E5181	M-5356	0.05	10	0.018	0	0	10	50	150 KHz-30 MHz	0.21	0.23	0.25	13.71	13.71
E5182	M-5357	0.1	10	0.02	0	0	5	50	100 KHz-17 MHz	0.47	0.56	0.67	13.71	13.71
E5183	M-5358	0.2	8	0.035	0	0	5	100	16 KHz-10 MHz	1.0	1.25	1.56	13.71	13.71
E5184	M-5359	0.5	8	0.06	0	0	0	100	7 KHz-3.3 MHz	1.5	1.80	2.2	13.71	13.71
E5185	M-5360	1	8	0.15	0	0	5	100	7 KHz-2.3 MHz	2.5	3.1	3.9	13.71	13.71
E5186	M-5361	2	8	0.17	0	0	10	100	2.2 KHz-1.3 MHz	3.0	3.7	4.6	13.71	13.71
E5187	M-5362	3	8	0.20	0	0	10	100	1.7 KHz-1.5 MHz	4.9	6.0	7.4	13.71	13.71
E5188	M-5363	5	8	0.20	0	15	25	200	1.8 KHz-1.5 MHz	8.0	9.7	11.8	13.71	13.71
E5189	M-5364	10	8	0.4	0	15	20	200	1.5 KHz-1.2 MHz	13.0	15.8	19.2	13.71	13.71

Coupling circuit measurements made with (1) BRN—(2) RED as input and (3) OR—(4) YEL as output, (5) GRN—(6) BLU winding is open: Input Voltage = 1V

* Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

Delivery— stock to one week

For immediate engineering assistance or to place an order— ***Call Toll Free 800-431-1064***

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • 914-699-5514 • TWX 7105620113

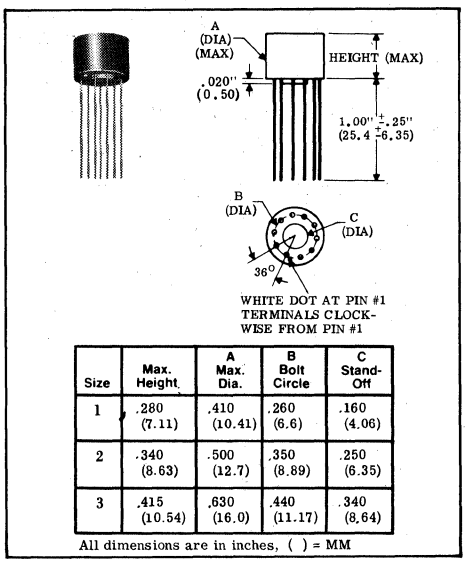
Ultra Miniature DC-DC Converter Transformers

Input Voltages of: 5V, 12V, 24V and 48V

Power Levels up to 40 Watts

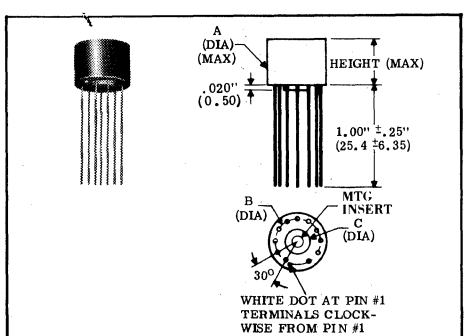
All units are magnetically shielded

All units can be supplied with higher or lower output voltages. Delivery- stock to one week, special voltages 9 days.



Size	Max. Height	A Max. Dia.	B Bolt Circle	C Stand-Off
1	.280 (7.11)	.410 (10.41)	.260 (6.6)	.160 (4.06)
2	.340 (8.63)	.500 (12.7)	.350 (8.89)	.250 (6.35)
3	.415 (10.54)	.630 (16.0)	.440 (11.17)	.340 (8.64)

All dimensions are in inches, ( ) = MM



Size	Max. Height	A Max. Dia.	B Bolt Circle	C Stand-Off	Mtg. Insert
4	.500 (12.7)	.800 (20.32)	.560 (14.22)	.460 (11.68)	-
5	.650 (16.51)	.950 (24.13)	.670 (17.0)	.570 (14.48)	6-32 UNC 8 Threads Deep
6	.745 (18.92)	1.125 (28.57)	.800 (20.32)	.700 (17.78)	6-32 UNC 8 Threads Deep

All dimensions are in inches, ( ) = MM
Note: Sizes 5 and 6 - pins 5, 8 and 9 are omitted

FEATURES

1) Units can be used as self-saturating or for linear switching applications. Operation over ambient temperature range from −55°c to +105°c. All units meet the requirements of MIL-T-27 (TF5S40ZZ)
2) All units can be supplied with higher or lower secondary voltages at the same power levels.
3) Secondary can be connected for full-wave bridge or dual bridge.
4) All units are magnetically shielded.

INPUT 5 VOLTS

PART NUMBER	D.C. OUT VOLTS FULL BRIDGE	D.C. OUT VOLTS FULL WAVE	D.C. OUT VOLTS DUAL BRIDGE	MAX. POWER OUT -55°c-+105°c	MAX. POWER OUT -55°c -+70°c	APPROX. SWITCH FREQ. SELF-SATURATED	APPROX. SWITCH FREQ. SQUARE-WAVE DRIVEN**	SIZE	*** PRICE 1-9
31020	10	5	±5	1.5W	3W	15K	30K TO 60K	1	29.31
31040	12	6	±6	1.5W	3W	15K	30K TO 60K	1	29.31
31060	28	14	±14	1.5W	3W	15K	30K TO 60K	1	29.31
31080	48	24	±24	1.5W	3W	20K	40K TO 60K	1	29.31
31100	100	50	±50	1.5W	3W	20K	40K TO 60K	1	29.31
32105	10	5	±5	3W	4.5W	15K	30K TO 60K	2	29.31
32125	12	6	±6	3W	4.5W	15K	30K TO 60K	2	29.31
32145	28	14	±14	3W	4.5W	15K	30K TO 60K	2	29.31
32165	48	24	±24	3W	4.5W	20K	40K TO 60K	2	29.31
32185	100	50	±50	3W	4.5W	20K	40K TO 60K	2	29.31
32188	150	75	±75	3W	-	10K	30K TO 60K	2	33.76
32191	200	100	±100	3W	-	10K	30K TO 60K	2	33.76
32194	300	150	±150	3W	-	10K	30K TO 60K	2	33.76
33103	10	5	±5	5W	7.5W	10K	20K TO 50K	3	29.31
33123	12	6	±6	5W	7.5W	10K	20K TO 50K	3	29.31
33143	28	14	±14	5W	7.5W	10K	20K TO 50K	3	29.31
33163	48	24	±24	5W	7.5W	10K	20K TO 50K	3	29.31
33183	100	50	±50	5W	7.5W	10K	20K TO 50K	3	29.31
33186	150	75	±75	5W	-	10K	30K TO 60K	3	33.76
33189	200	100	±100	5W	-	10K	30K TO 60K	3	33.76
33192	300	150	±150	5W	-	10K	30K TO 60K	3	33.76
34500	10	5	±5	10W	14W	10K	20K TO 40K	4	29.31
34520	28	14	±14	10W	14W	10K	20K TO 40K	4	29.31
34540	40	24	±24	10W	14W	10K	20K TO 40K	4	29.31

** Lower switching frequency may be used at lower output power.

INPUT 12 VOLTS

PART NUMBER	D.C. OUT VOLTS FULL BRIDGE	D.C. OUT VOLTS FULL WAVE	D.C. OUT VOLTS DUAL BRIDGE	MAX. POWER OUT -55°c-+105°c	MAX. POWER OUT -55°c -+70°c	APPROX. SWITCH FREQ. SELF-SATURATED	APPROX. SWITCH FREQ. SQUARE-WAVE DRIVEN**	SIZE	*** PRICE 1-9
31120	12	6	±6	1.5W	3W	15K	30K TO 60K	1	29.31
31140	24	12	±12	1.5W	3W	15K	30K TO 60K	1	29.31
31160	28	14	±14	1.5W	3W	15K	30K TO 60K	1	29.31
31180	48	24	±24	1.5W	3W	20K	40K TO 60K	1	29.31
31200	100	50	±50	1.5W	3W	20K	40K TO 60K	1	29.31
32205	12	6	±6	3W	4.5W	15K	30K TO 60K	2	29.31
32225	24	12	±12	3W	4.5W	15K	30K TO 60K	2	29.31
32245	28	14	±14	3W	4.5W	15K	30K TO 60K	2	29.31
32265	48	24	±24	3W	4.5W	20K	40K TO 60K	2	29.31
32285	100	50	±50	3W	4.5W	20K	40K TO 60K	2	29.31
32288	150	75	±75	3W	-	10K	30K TO 60K	2	33.76
32291	200	100	±100	3W	-	10K	30K TO 60K	2	33.76
32294	300	150	±150	3W	-	10K	30K TO 60K	2	33.76
33203	12	6	±6	5W	7.5W	15K	30K TO 60K	3	29.31
33223	28	14	±14	5W	7.5W	15K	30K TO 60K	3	29.31
33243	48	24	±24	5W	7.5W	20K	40K TO 60K	3	29.31
33263	100	50	±50	5W	7.5W	20K	40K TO 60K	3	29.31
33266	150	75	±75	5W	-	10K	30K TO 60K	3	33.76
33269	200	100	±100	5W	-	10K	30K TO 60K	3	33.76
33272	300	150	±150	5W	-	10K	30K TO 60K	3	33.76
34560	24	12	±12	10W	14W	15K	30K TO 50K	4	29.31
34580	28	14	±14	10W	14W	15K	30K TO 50K	4	29.31
34600	48	24	±24	10W	14W	15K	30K TO 50K	4	29.31
34603	100	50	±50	7.5W	-	10K	30K TO 60K	4	33.76
34606	150	75	±75	7.5W	-	10K	30K TO 60K	4	33.76
34609	200	100	±100	7.5W	-	10K	30K TO 60K	4	33.76
34612	300	150	±150	7.5W	-	10K	30K TO 60K	4	33.76
35110	24	12	±12	17W	25W	-	30K TO 60K	5	42.17
35130	28	14	±14	17W	25W	-	30K TO 60K	5	42.17
35150	48	24	±24	17W	25W	-	30K TO 60K	5	42.17

**Lower switching frequency may be used at lower output power.

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

INPUT 24 VOLTS

PART NUMBER	D.C. OUT VOLTS BRIDGE	FULL WAVE	DUAL BRIDGE	MAX. POWER OUT -55°c-+105°c	-55°c-+70°c	APPROX. SWITCH FREQ. SELF-SATURATED	SQUARE-WAVE DRIVEN**	SIZE	*** PRICE 1-9
31220	10	5	±5	1.5W	3W	15K	30K TO 60K	1	29.31
31240	28	14	±14	1.5W	3W	15K	30K TO 60K	1	29.31
31260	48	24	±24	1.5W	3W	20K	40K TO 60K	1	29.31
31280	100	50	±50	1.5W	3W	20K	40K TO 60K	1	29.31
32305	10	5	±5	3W	4.5W	15K	30K TO 60K	2	29.31
32325	28	14	±14	3W	4.5W	15K	30K TO 60K	2	29.31
32345	48	24	±24	3W	4.5W	20K	40K TO 60K	2	29.31
32365	100	50	±50	3W	4.5W	20K	40K TO 60K	2	29.31
32368	150	75	±75	3W	-	10K	30K TO 60K	2	33.76
32371	200	100	±100	3W	-	10K	30K TO 60K	2	33.76
32374	300	150	±150	3W	-	10K	30K TO 60K	2	33.76
33283	10	5	±5	5W	7.5W	15K	30K TO 60K	3	29.31
33303	28	14	±14	5W	7.5W	15K	30K TO 60K	3	29.31
33323	48	24	±24	5W	7.5W	20K	40K TO 60K	3	29.31
33343	100	50	±50	5W	7.5W	20K	40K TO 60K	3	29.31
33346	150	75	±75	5W	-	10K	30K TO 60K	3	33.76
33349	200	100	±100	5W	-	10K	30K TO 60K	3	33.76
33352	300	150	±150	5W	-	10K	30K TO 60K	3	33.76
34620	28	14	±14	10W	14W	15K	30K TO 50K	4	29.31
34640	48	24	±24	10W	14W	15K	30K TO 50K	4	29.31
34643	100	50	±50	7.5W	-	10K	30K TO 60K	4	33.76
34646	150	75	±75	7.5W	-	10K	30K TO 60K	4	33.76
34649	200	100	±100	7.5W	-	10K	30K TO 60K	4	33.76
34652	300	150	±150	7.5W	-	10K	30K TO 60K	4	33.76
35170	24	12	±12	17W	25W	-	30K TO 60K	5	42.17
35190	28	14	±14	17W	25W	-	30K TO 60K	5	42.17
35210	48	24	±24	17W	25W	-	30K TO 60K	5	42.17
36710	48	24	±24	25W	40W	-	30K TO 60K	6	50.75
36730	56	28	±28	25W	40W	-	30K TO 60K	6	50.75

** Lower switching frequency may be used at lower output power.

INPUT 48 VOLTS

PART NUMBER	D.C. OUT VOLTS BRIDGE	FULL WAVE	DUAL BRIDGE	MAX. POWER OUT -55°c-+105°c	-55°c-+70°c	APPROX. SWITCH FREQ. SELF-SATURATED	SQUARE-WAVE DRIVEN**	SIZE	*** PRICE 1-9
31300	24	12	±12	1.5W	3W	15K	30K TO 60K	1	29.31
31320	48	24	±24	1.5W	3W	20K	40K TO 60K	1	29.31
31340	100	50	±50	1.5W	3W	20K	40K TO 60K	1	29.31
31360	150	75	±75	1.5W	3W	20K	40K TO 60K	1	29.31
32385	24	12	±12	3W	4.5W	15K	30K TO 60K	2	29.31
32405	48	24	±24	3W	4.5W	20K	40K TO 60K	2	29.31
32425	100	50	±50	3W	4.5W	20K	40K TO 60K	2	29.31
32445	150	75	±75	3W	4.5W	20K	40K TO 60K	2	29.31
32448	200	100	±100	3W	4.5W	10K	30K TO 60K	2	33.76
32451	300	150	±150	3W	4.5W	10K	30K TO 60K	2	33.76
33363	24	12	±12	5W	7.5W	15K	30K TO 60K	3	29.31
33383	48	24	±24	5W	7.5W	20K	40K TO 60K	3	29.31
33403	100	50	±50	5W	7.5W	20K	40K TO 60K	3	29.31
33423	150	75	±75	5W	7.5W	20K	40K TO 60K	3	29.31
33426	200	100	±100	5W	-	10K	30K TO 60K	3	33.76
33429	300	150	±150	5W	-	10K	30K TO 60K	3	33.76
34660	24	12	±12	10W	14W	15K	30K TO 50K	4	29.31
34680	48	24	±24	10W	14W	15K	30K TO 50K	4	29.31
34700	56	28	±28	10W	14W	15K	30K TO 50K	4	29.31
34703	100	50	±50	7.5W	-	10K	30K TO 60K	4	33.76
34706	150	75	±75	7.5W	-	10K	30K TO 60K	4	33.76
34709	200	100	±100	7.5W	-	10K	30K TO 60K	4	33.76
34712	300	150	±150	7.5W	-	10K	30K TO 60K	4	33.76
35230	24	12	±12	17W	25W	-	30K TO 60K	5	42.17
35250	48	24	±24	17W	25W	-	30K TO 60K	5	42.17
35270	56	28	±28	17W	25W	-	30K TO 60K	5	42.17
36750	48	24	±24	25W	40W	-	30K TO 60K	6	50.75
36770	56	28	±28	25W	40W	-	30K TO 60K	6	50.75
36790	100	50	±50	25W	40W	-	30K TO 60K	6	50.75

** Lower switching frequency may be used at lower output power.

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

SCHEMATIC FOR SIZES 1, 2 & 3 USING TRANSFORMERS AS SELF-SATURATING

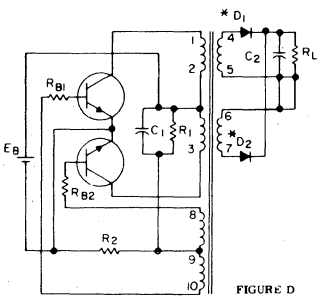


FIGURE D

SCHEMATIC FOR SIZES 1, 2, AND 3 USING TRANSFORMERS AS LINEAR SWITCHING

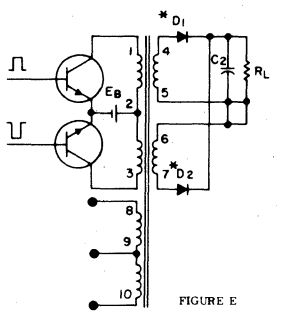


FIGURE E

* D1 AND D2 USE SCHOTTKY OR FAST SWITCHING DIODES

SCHEMATIC FOR SIZE 4 USING TRANSFORMER AS SELF-SATURATING

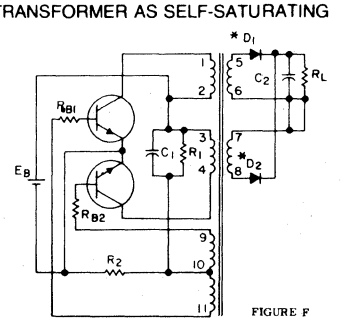


FIGURE F

SCHEMATIC FOR SIZE 4 USING TRANSFORMERS AS LINEAR SWITCHING.

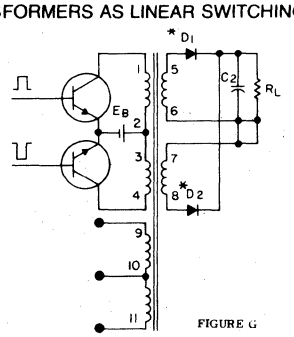


FIGURE G

*D1 & D2 USE SCHOTTKY OR FAST SWITCHING DIODES

SCHEMATIC FOR SIZES 5 & 6 USING TRANSFORMERS AS LINEAR SWITCHING.

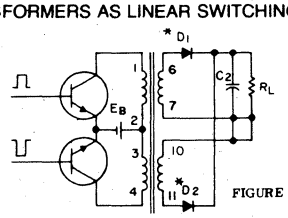


FIGURE H

*D1 & D2 USE SCHOTTKY OR FAST SWITCHING DIODES

PICO Electronics, Inc. 453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552

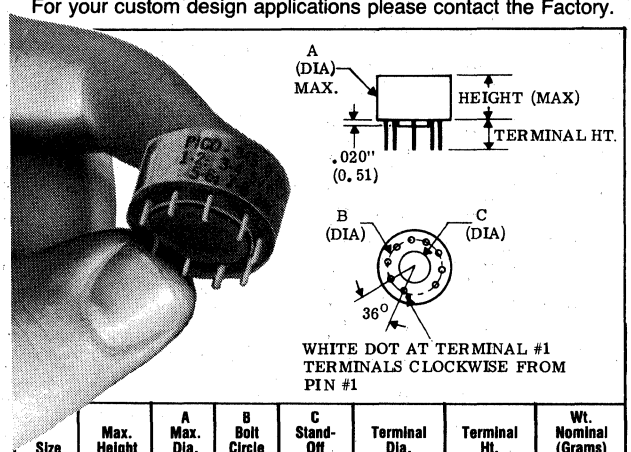
MINIATURIZED SWITCH MODE INVERTER TRANSFORMERS

50KHz-150KHz / 10 Watts-60 Watts

Engineers are increasing the frequency of operation in DC-DC Converters for higher power applications. The availability of power MOSFETS which do not exhibit some of the problems encountered with the bi-polar transistors help to ease the Designer's task. For this reason Pico has developed a series of standard 50KHz to 150KHz transformers for use in push-pull circuits.

For low power applications please consider our self saturating transformers shown on pages 20 and 21 which offer many advantages.

For your custom design applications please contact the Factory.



Size	Max. Height	A Max. Dia.	B Bolt Circle	C Stand-Off	Terminal Dia.	Terminal Ht.	Wt. Nominal (Grams)
A	.350 (8.9)	.760 (19.3)	.580 (14.7)	.470 (11.9)	.028 (.71)	.150 (3.8)	8
B	.450 (11.4)	.870 (22.1)	.690 (17.5)	.590 (15.0)	.028 (.71)	.150 (3.8)	14
C	.510 (13.0)	1.110 (28.2)	.915 (23.2)	.750 (19.1)	.035 (.89)	.250 (6.4)	23
D	.650 (16.5)	1.260 (32.0)	1.040 (26.4)	.900 (22.9)	.035 (.89)	.250 (6.4)	37
E	.800 (20.3)	1.510 (38.4)	1.230 (31.2)	1.060 (26.9)	.035 (.00)	.250 (6.4)	54

All dimensions are in inches, ( ) = MM

FEATURES:

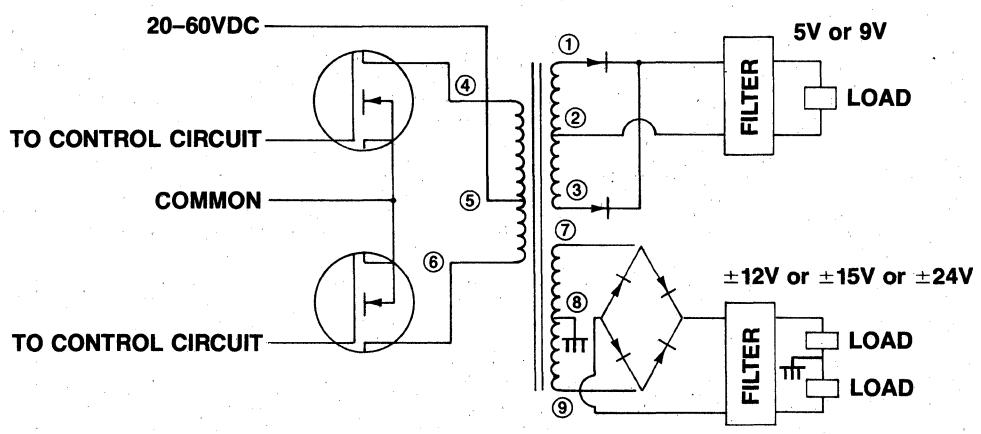
- ***Frequency Range 50KHz–150KHz***
- ***Ultra-Miniature Size***
- ***MIL-T-27E***
- ***Can be used for both MOSFET and Bi-Polar drives***
- ***Magnetically Shielded***
- ***LITZ Wire for Maximum Efficiency***
- ***Special units can be supplied with higher or lower secondary voltages, addition of extra windings and taps, smaller size***

SPECIFICATIONS:

- Frequency Range 50KHz–150KHz
- 20 volt input corresponds to 45% duty cycle (i.e. 4.5μsec on time per pulse for 100KHz operation). Units have been designed with an additional 1 volt output to account for losses in switchers, transformer, rectifier and filter.
- MIL-T-27E
  All units meet MIL-T-27E and are hermetically sealed in a metal case, Type TF5S03ZZ
- Magnetically Shielded
- Operating Temperature ..... −55°C to +90°C
- Dielectric Strength ..... 500V RMS
- Insulation Resistance ..... Greater than 10,000 Megohms at 500V DC
- Thermal Shock ..... 25 Cycles, Method 107C, MIL-STD-202D. Test Conduction A-1

PUSH PULL CONVERTER

20 Volt input corresponds to 45% duty cycle (i.e. 4.5μsec on time per pulse for 100KHz operation). Units have been designed with an additional 1 Volt output to account for losses in switcher, transformer, rectifier and filter.



*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

Delivery—stock to one week

PICO Electronics, Inc.
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • 914-699-5514 • TWX 7105620113

POWER = 10 WATTS SIZE 0.76″ DIAM. × 0.35″ HT.

PICO MODEL NUMBER	INPUT VOLTAGE (DC)	SECONDARY OUTPUT #1 (DC)	SECONDARY OUTPUT #2 (DC)	TYPICAL* PRIMARY INDUCTANCE (mH)	TYPICAL** PRIMARY LEAKAGE INDUCTANCE (μH)	SIZE	*** PRICE 1–9
67010	20–60	5	±12	2	3.5	A	35.23
67030	20–60	5	±15	2	3.5	A	35.23
67050	20–60	5	±24	2	3.5	A	35.23
67070	20–60	9	±12	2	3.5	A	35.23
67090	20–60	9	±15	2	3.5	A	35.23
67110	20–60	9	±24	2	3.5	A	35.23

POWER = 20 WATTS SIZE 0.87″ DIAM. × 0.45″ HT.

PICO MODEL NUMBER	INPUT VOLTAGE (DC)	SECONDARY OUTPUT #1 (DC)	SECONDARY OUTPUT #2 (DC)	TYPICAL* PRIMARY INDUCTANCE (mH)	TYPICAL** PRIMARY LEAKAGE INDUCTANCE (μH)	SIZE	*** PRICE 1–9
67130	20–60	5	±12	2.5	4	B	41.45
67150	20–60	5	±15	2.5	4	B	41.45
67170	20–60	5	±24	2.5	4	B	41.45
67190	20–60	9	±12	2.5	4	B	41.45
67210	20–60	9	±15	2.5	4	B	41.45
67230	20–60	9	±24	2.5	4	B	41.45

POWER = 30 WATTS SIZE 1.11″ DIAM. × 0.51″ HT.

PICO MODEL NUMBER	INPUT VOLTAGE (DC)	SECONDARY OUTPUT #1 (DC)	SECONDARY OUTPUT #2 (DC)	TYPICAL* PRIMARY INDUCTANCE (mH)	TYPICAL** PRIMARY LEAKAGE INDUCTANCE (μH)	SIZE	*** PRICE 1–9
67250	20–60	5	±12	1	1	C	48.77
67270	20–60	5	±15	1	1	C	48.77
67290	20–60	5	±24	1	1	C	48.77
67310	20–60	9	±12	1	1	C	48.77
67330	20–60	9	±15	1	1	C	48.77
67350	20–60	9	±24	1	1	C	48.77

POWER = 45 WATTS SIZE 1.26″ DIAM. × 0.65″ HT.

PICO MODEL NUMBER	INPUT VOLTAGE (DC)	SECONDARY OUTPUT #1 (DC)	SECONDARY OUTPUT #2 (DC)	TYPICAL* PRIMARY INDUCTANCE (mH)	TYPICAL** PRIMARY LEAKAGE INDUCTANCE (μH)	SIZE	*** PRICE 1–9
67370	20–60	5	±12	0.7	0.35	D	57.38
67390	20–60	5	±15	0.7	0.35	D	57.38
67410	20–60	5	±24	0.7	0.35	D	57.38
67430	20–60	9	±12	0.7	0.35	D	57.38
67450	20–60	9	±15	0.7	0.35	D	57.38
67470	20–60	9	±24	0.7	0.35	D	57.38

POWER = 60 WATTS SIZE 1.51″ DIAM. × 0.80″ HT.

PICO MODEL NUMBER	INPUT VOLTAGE (DC)	SECONDARY OUTPUT #1 (DC)	SECONDARY OUTPUT #2 (DC)	TYPICAL* PRIMARY INDUCTANCE (mH)	TYPICAL** PRIMARY LEAKAGE INDUCTANCE (μH)	SIZE	*** PRICE 1–9
67490	20–60	5	±12	0.6	0.4	E	67.50
67510	20–60	5	±15	0.6	0.4	E	67.50
67530	20–60	5	±24	0.6	0.4	E	67.50
67550	20–60	9	±12	0.6	0.4	E	67.50
67570	20–60	9	±15	0.6	0.4	E	67.50
67590	20–60	9	±24	0.6	0.4	E	67.50

*MEASURED AT TERMINALS 4-6 WITH 5 VOLTS RMS-100KHz
**MEASURED AT TERMINALS 4-6 WITH 1-3 AND 7-9 SHORTED (O.IV RMS-300 KHz)
***DISCOUNT PRICES: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

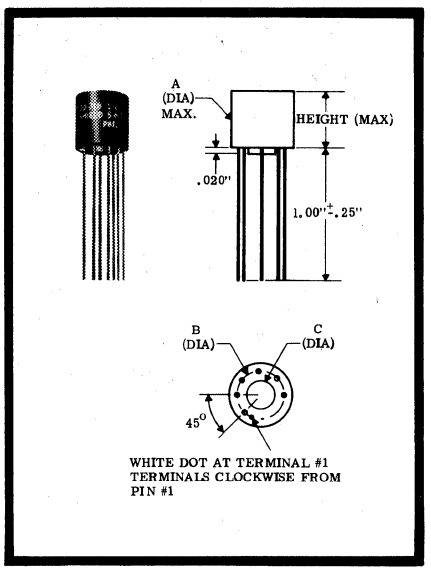
Delivery—stock to one week

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • 914-699-5514 • TWX 7105620113

PICO's miniature 400 Hz transformers

115V/26V Primary Printed Circuit Construction



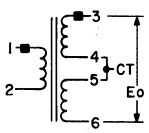
CASE SIZE	HEIGHT (MAX)	A (DIA) MAX	B (DIA)	C (DIA)
L	.35	.51	.35	.218
N	.5	.51	.35	.218
R	.375	.75	.6	.475
S	.52	.75	.6	.475
T	.82	.75	.6	.475

FEATURES

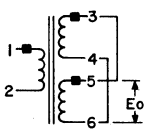
- 400 Hz Aerospace Application
- Smallest Possible Size
- Printed Circuit Plug-In Construction
- Secondary Has Split Winding (Secondary can Be Used at Half Voltage Twice the Current.)

SPECIFICATIONS

- MIL-T-27D (TF5S03ZZ)
- 90 °c Ambient
- Input Primary 115v-400 Hz ±20 Hz or 26V-400HZ-±20 Hz (Your Choice-Just Choose The Proper Part No.)
- Regulation is 24% (T Units Have Regulation of 17%)
- Secondary Voltage Adjusted to Nominal Value at Half Load.



SERIES CONNECTED SECONDARY



PARALLEL CONNECTED SECONDARY

This Product is Patented

SEC/ VOLT	SEC/ CURRENT ma	SIZE	MODEL NUMBER 115V PRIMARY	MODEL NUMBER 26V PRIMARY	PICO PRICES 1-9*
5.0 CT	75	L	L-8948	L-8951	24.98
	150	N	N-6948	N-6951	24.98
	204	R	R-20650	R-20815	36.89
	338	S	S-21650	S-21815	32.82
	480	T	T-22650	T-22815	34.21
6.3 CT	59.5	L	L-8947	L-8952	24.98
	119	N	N-6947	N-6952	24.98
	162	R	R-20655	R-20820	36.89
	268	S	S-21655	S-21820	32.82
	381	T	T-22655	T-22820	34.21
8.0 CT	47	L	L-8946	L-8953	24.98
	94	N	N-6946	N-6953	24.98
	128	R	R-20660	R-20825	36.89
	211	S	S-21660	S-21825	32.82
	300	T	T-22660	T-22825	34.21
10 CT	37.5	L	L-8945	L-8954	24.98
	75	N	N-6945	N-6954	24.98
	102	R	R-20665	R-20830	36.89
	169	S	S-21665	S-21830	32.82
	240	T	T-22665	T-22830	34.21
12.8 CT	29	L	L-8940	L-8956	24.98
	58.6	N	N-6940	N-6956	24.98
	79.7	R	R-20670	R-20835	36.89
	132	S	S-21670	S-21835	32.82
	188	T	T-22670	T-22835	34.21
14 CT	26.8	L	L-8937	L-8957	24.98
	53.6	N	N-6937	N-6957	24.98
	72.9	R	R-20675	R-20840	36.89
	121	S	S-21675	S-21840	32.82
	171	T	T-22675	T-22840	34.21
16 CT	23	L	L-8935	L-8958	24.98
	47	N	N-6935	N-6958	24.98
	63.8	R	R-20680	R-20845	36.89
	106	S	S-21680	S-21845	32.82
	150	T	T-22680	T-22845	34.21
18 CT	20.8	L	L-8934	L-8959	24.98
	41.7	N	N-6934	N-6959	24.98
	56.7	R	R-20685	R-20850	36.89
	93.9	S	S-21685	S-21850	32.82
	133	T	T-22685	T-22850	34.21
20 CT	18.8	L	L-8933	L-8961	24.98
	37.5	N	N-6933	N-6961	24.98
	51	R	R-20690	R-20855	36.89
	84.5	S	S-21690	S-21855	32.82
	120	T	T-22690	T-22855	34.21
22 CT	17	L	L-8932	L-8962	24.98
	34	N	N-6932	N-6962	24.98
	46.4	R	R-20695	R-20860	36.89
	76.8	S	S-21695	S-21860	32.82
	109	T	T-22695	T-22860	34.21
24 CT	15.5	L	L-8930	L-8963	24.98
	31	N	N-6930	N-6963	24.98
	42.5	R	R-20700	R-20865	36.89
	70.4	S	S-21700	S-21865	32.82
	100	T	T-22700	T-22865	34.21
28 CT	13.4	L	L-8929	L-8964	24.98
	26.8	N	N-6929	N-6964	24.98
	36.4	R	R-20705	R-20870	36.89
	60.4	S	S-21705	S-21870	32.82
	85.7	T	T-22705	T-22870	34.21
31 CT	12	L	L-8927	L-8966	24.98
	24	N	N-6927	N-6966	24.98
	32.9	R	R-20710	R-20875	36.89
	54.5	S	S-21710	S-21875	32.82
	77.4	T	T-22710	T-22875	34.21
36 CT	10.4	L	L-8925	L-8967	24.98
	20.8	N	N-6925	N-6967	24.98
	28.3	R	R-20715	R-20880	36.89
	46.9	S	S-21715	S-21880	32.82
	66.7	T	T-22715	T-22880	34.21
39 CT	9.6	L	L-8924	L-8968	24.98
	19.2	N	N-6924	N-6968	24.98
	26.2	R	R-20720	R-20885	36.89
	43.3	S	S-21720	S-21885	32.82
	61.5	T	T-22720	T-22885	34.21

SEC/ VOLT	SEC/ CURRENT ma	SIZE	MODEL NUMBER 115V PRIMARY	MODEL NUMBER 26V PRIMARY	PICO PRICES 1-9*
43 CT	8.7	L	L-8923	L-8969	24.98
	17.4	N	N-6923	N-6969	24.98
	23.7	R	R-20725	R-20890	36.89
	39.3	S	S-21725	S-21890	32.82
	55.8	T	T-22725	T-22890	34.21
48 CT	7.8	L	L-8922	L-8971	24.98
	15.6	N	N-6922	N-6971	24.98
	21.1	R	R-20730	R-20895	36.89
	35.2	S	S-21730	S-21895	32.82
	50	T	T-22730	T-22895	34.21
56 CT	6.6	L	L-8920	L-8972	24.98
	13.2	N	N-6920	N-6972	24.98
	18.2	R	R-20735	R-20900	36.89
	30.2	S	S-21735	S-21900	32.82
	42.9	T	T-22735	T-22900	34.21
63 CT	6	L	L-8917	L-8973	24.98
	11.9	N	N-6917	N-6973	24.98
	16.2	R	R-20740	R-20905	36.89
	26.9	S	S-21740	S-21905	32.82
	38.2	T	T-22740	T-22905	34.21
68 CT	5.5	L	L-8915	L-8974	24.98
	11	N	N-6915	N-6974	24.98
	15	R	R-20745	R-20910	36.89
	24.9	S	S-21745	S-21910	32.82
	35.3	T	T-22745	T-22910	34.21
80 CT	4.6	L	L-8910	L-8976	24.98
	9.4	N	N-6910	N-6976	24.98
	12.1	R	R-20750	R-20915	36.89
	21.1	S	S-21750	S-21915	32.82
	30	T	T-22750	T-22915	34.21
88 CT	4.2	L	L-8905	L-8977	24.98
	8.5	N	N-6905	N-6977	24.98
	11.6	R	R-20755	R-20920	36.89
	19.2	S	S-21755	S-21920	32.82
	27.3	T	T-22755	T-22920	34.21
100 CT	3.7	L	L-8902	L-8978	24.98
	8.5	N	N-6902	N-6978	24.98
	10.2	R	R-20760	R-20925	36.89
	16.9	S	S-21760	S-21925	32.82
	24	T	T-22760	T-22925	34.21
115 CT	3.2	L	L-8900	L-8979	24.98
	6.5	N	N-6900	N-6979	24.98
	8.9	R	R-20765	R-20930	36.89
	14.7	S	S-21765	S-21930	32.82
	20.9	T	T-22765	T-22930	34.21
123 CT	8.3	R	R-20770	R-20935	36.89
	13.7	S	S-21770	S-21935	32.82
	19.5	T	T-22770	T-22935	34.21
138 CT	7.4	R	R-20775	R-20940	36.89
	12.2	S	S-21775	S-21940	32.82
	17.4	T	T-22775	T-22940	34.21
157 CT	6.5	R	R-20780	R-20945	36.89
	10.8	S	S-21780	S-21945	32.82
	15.3	T	T-22780	T-22945	34.21
175 CT	5.8	R	R-20785	R-20950	36.89
	9.6	S	S-21785	S-21950	32.82
	13.7	T	T-22785	T-22950	34.21
200 CT	5.1	R	R-20790	R-20955	36.89
	8.4	S	S-21790	S-21955	32.82
	12	T	T-22790	T-22955	34.21
220 CT	7.7	S	S-21795	S-21960	34.48
	10.9	T	T-22795	T-22960	35.94
250 CT	6.8	S	S-21800	S-21965	36.11
	9.6	T	T-22800	T-22965	37.65
275 CT	6.1	S	S-21805	S-21970	37.91
	8.7	T	T-22805	T-22970	44.23
310 CT	5.4	S	S-21810	S-21975	39.41
	7.7	T	T-22810	T-22975	41.09

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

* Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%, 50-99 less 23%; 100-499 less 30%

*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

Delivery— stock to one week

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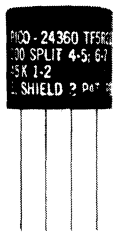
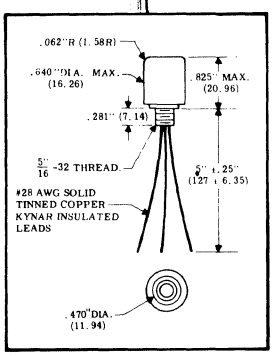
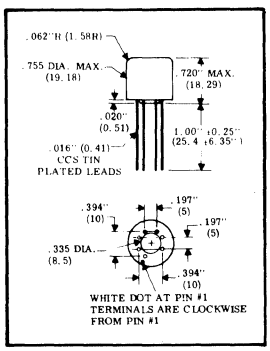




NOTE:
ALL DIMENSIONS ARE IN INCHES, ( ) = MM



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- ***Gapless laminations provide wide bandwidth with extremely low distortion. Use of two magnetic shields made with extra thick mu-metal and gapless core provide negligible hum pick up. All units provided with electrostatic shield.***
- ***Your choice of two package styles, stud mounting with flying leads or low profile plug-in. Identical electrical performance regardless of package style.***
- ***Frequency response ±1 dB, 30 Hz – 15 kHz.***
- ***Low profile plug-in (24000 series) meets MIL-T-27D (TF5R21ZZ).***
- ***Because of gapless laminations, unbalanced DC current should be avoided.***
- ***Typical distortion of 1% at power level of 0 dBm (1 Milliwatt), 30 Hz – 15 kHz. If the low frequency is raised, the power level for 1% distortion is as follows:***

50 Hz - 3 Milliwatts (4.7 dBm)
100 Hz - 10 Milliwatts (10 dBm)
300 Hz - 150 Milliwatts (21.7 dBm)

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All units have two extra thick mu-metal shields.

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PART NUMBER		IMPEDANCE OHMS		TURNS RATIO PRIM/SEC		D.C. RESISTANCE			TYPICAL PRIM OPEN CIRCUIT IMPEDANCE AT 50 Hz	REPLACES BEYER/GERMANY PART NUMBER		PRICES 1-9***	
COMMERCIAL STUD MOUNTING	MILITARY PLUG-IN	PRIM	SEC	PRIM SERIES CONN	PRIM PAR CONN	PRIM SERIES CONN	PRIM PAR CONN	SEC		STUD MOUNTING (23000 SERIES)	PLUG-IN (24000 SERIES)	COMMERCIAL STUD MOUNTING	MILITARY PLUG-IN
23120	24120	12.5	5K	1:20	-	4.6	-	1K	125	TR-BV35704	STR-BV37704	23.46	28.18
23140	24140	200	200	1:1	-	50	-	75	2K	351 001 001	370 001 001	22.20	25.89
23160	24160	200 ct/50 SPLIT	200	1:1	1:2	50	12.5	75	2K	351 201 001	370 201 001	21.88	26.61
23180	24180	200	2K	1:3.16	-	50	-	580	2K	351 003 002	370 003 002	22.20	25.89
23200	24200	200 ct/50 SPLIT	2K	1:3.16	1:6.33	50	12.5	580	2K	351 203 002	370 203 002	21.88	26.61
23220	24220	200	5K	1:5	-	50	-	1.45K	2K	351 005 003	370 005 003	22.20	25.89
23240	24240	200 ct/50 SPLIT	5K	1:5	1:10	50	12.5	1.45K	2K	351 205 003	370 205 003	22.20	29.03
23260	24260	200	10K	1:7.07	-	50	-	3.45K	2K	351 007 004	370 007 004	21.88	26.61
23280	24280	200 ct/50 SPLIT	10K	1:7.07	1:14.14	50	12.5	3.45K	2K	351 207 004	370 207 004	25.03	29.76
23300	24300	200	20K	1:10	-	85	-	4.75K	2K	351 010 005	370 010 005	22.76	27.47
23320	24320	200 ct/50 SPLIT	20K	1:10	1:20	85	21	4.75K	2K	351 210 005	370 210 005	25.89	30.62
23340	24340	200	45K	1:15	-	85	-	10.4 K	2K	351 015 006	370 015 006	26.61	31.32
23360	24360	200 ct/50 SPLIT	45K	1:15	1:30	85	21	10.4 K	2K	351 215 006	370 215 006	29.76	34.46
23380	24380	200	80K	1:20	-	115	-	13.5 K	2K	351 020 007	370 020 007	28.18	32.89
23400	24400	200 ct/50 SPLIT	80K	1:20	1:40	115	29	13.5 K	2K	351 220 007	370 220 007	31.32	36.03
23420	24420	600 ct	600	1:1	-	140	-	190	6K	TR-145/BV35508 351 101 031	STR-145/BV37508 370 101 031	21.88	26.61
23440	24440	600 ct/150 SPLIT	600	1:1	1:2	140	35	190	6K	351 201 031	370 201 031	23.46	28.18
23460	24460	600 ct/150 SPLIT	2.4K	1:2	1:4	140	35	575	6K	351 202 032	370 202 032	25.03	29.76
23480	24480	600 ct/150 SPLIT	6K	1:3.16	1:6.33	140	35	1.45K	6K	351 203 033	370 203 033	26.61	31.32
23500	24500	600 ct/150 SPLIT	15K	1:5	1:10	140	35	3.9 K	6K	351 205 034	370 205 034	28.18	32.89
23520	24520	600 ct/150 SPLIT	30K	1:7.07	1:14.14	140	35	7.05K	6K	351 207 035	370 207 035	29.76	34.46
23540	24540	600 ct/150 SPLIT	60K	1:10	1:20	199	50	11 K	6K	351 210 036	370 210 036	31.32	36.03
23560	24560	1.2K ct/300 SPLIT	1.2K	1:1	1:2	310	78	430	12K	351 201 061	370 201 061	23.46	28.18
23580	24580	1.2K ct/300 SPLIT	5K	1:2.04	1:4.08	310	78	1.4 K	12K	351 202 062	370 202 062	25.03	29.76
23600	24600	1.2K ct/300 SPLIT	12K	1:3.16	1:6.33	310	78	3.75K	12K	351 203 063	370 203 063	26.61	31.32
23620	24620	1.2K ct/300 SPLIT	30K	1:5	1:10	475	119	8.45K	12K	351 205 064	370 205 064	28.18	32.89
23640	24640	10K	10K	1:1	-	2.5 K	-	3.1K	100K	TR-145/BV35590	STR-145/BV37590	22.20	25.89

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

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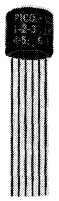
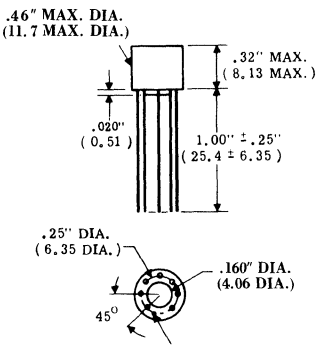
MIL-STD-1553 Interface Transformers Multiplex Data BUS Pulse Transformers





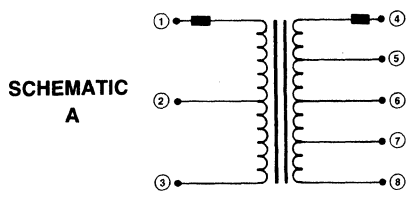
These pulse transformers meet MIL-STD-1553 COMMAND/RESPONSE MULTIPLEX DATA BUS requirements. They also meet MIL-T-21038 specifications and are designed to meet MAC AIR SPECIFICATIONS A3818, A5690, A5232 and A4905.

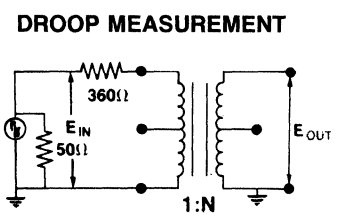
All of these transformers exhibit superior electrical performance. Common mode rejection ratio is greater than 45dB at 1 MHz. Input impedance is greater than 3000 ohms over the band from 75 kHz to 1mHz at 1V rms. This series possesses exceptional waveform integrity: Rise time and fall time is less than 100 nanoseconds. Overshoot and ringing is less than ± 1V peak. Droop is less than 20%.

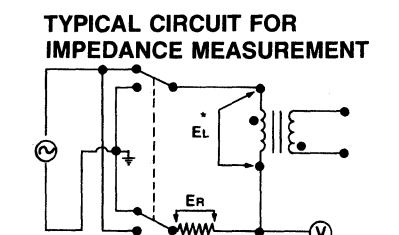
PICO PART NUMBER	TURNS RATIO	PRIMARY	SECOND-ARY	% DROOP (Typical)	CMR dB (Typical)	SCHEMATIC	PRICE (1–9)
68010	1CT : 1CT 1CT : .707CT	1–3 1–3	4–8 5–7	10	50	A	29.50
68020	1.4CT : 1CT 2CT : 1CT	1–3 1–3	4–8 5–7	10	50	A	29.50
68030	1.25CT : 1CT 1.66CT : 1CT	1–3 1–3	4–8 5–7	10	50	A	29.50
68040	2.3CT : 1CT 3.2CT : 1CT	1–3 1–3	4–8 5–7	10	50	A	29.50
68050	1CT : 1CT	1–3	5–7	10	50	B	27.45
68060	1CT : 1.41CT	1–3	5–7	10	50	B	27.45
68070	1CT : 1.66CT	1–3	5–7	10	50	B	27.45
68080	1CT : 2CT	1–3	5–7	10	50	B	27.45

SPECIFICATIONS:

- Units meet MIL-T-21038 and MIL STD 1553
- IMPEDANCE ..... greater than 3KΩ over the band from 75kHz to 1MHz
- DROOP ..... 20% max.
- OVERSHOOT ..... 1V peak
- COMMON MODE REJECTION (CMR) greater than 45dB.
- DIELECTRIC STRENGTH: ..... All Units Tested at 200 V RMS.
- INSULATION RESISTANCE ..... Greater Than 10,000 Megohms at 300 V DC.
- WEIGHT: ..... 4 Grams.
- OPERATING TEMPERATURE: ..... −55°c to +105°c (All Units Can Be Supplied to Class S Requirements, +130°c).
- TERMINALS: ..... Solid .012 Diameter Conductor. Conductor is copper clad steel, Tinned 100%. Electroplated Per MIL-T-10727A and ASTM CCS B452.
- THERMAL SHOCK: ..... 25 Cycles, Method 107D, MIL-STD-202E Test Condition A-1.







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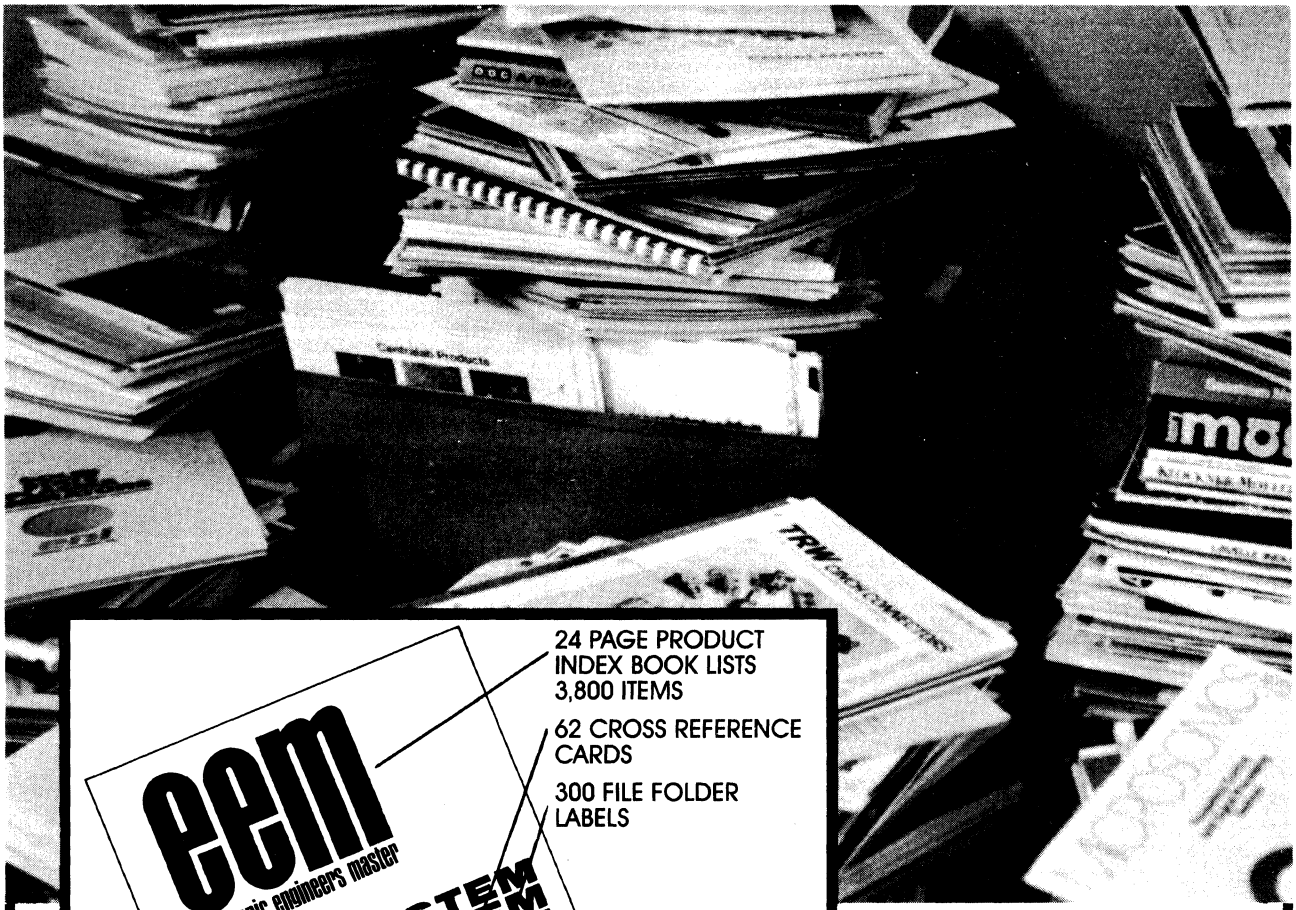

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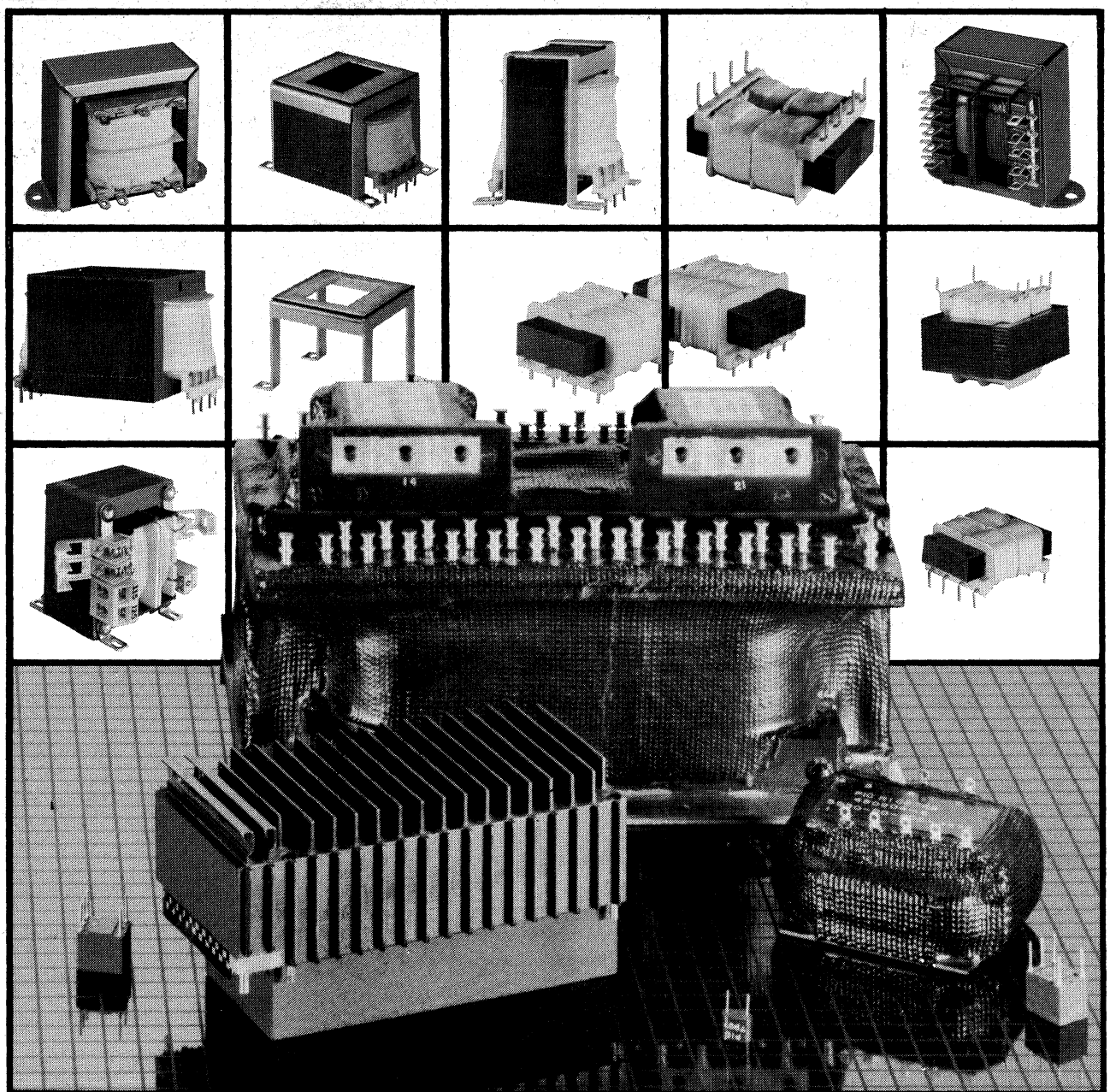

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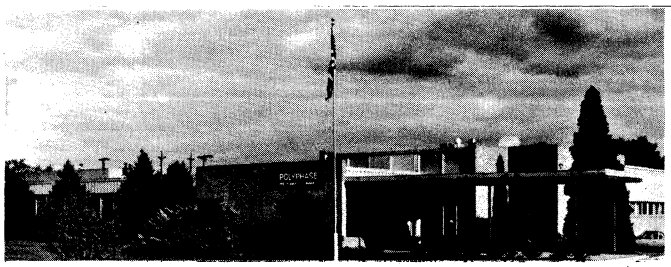

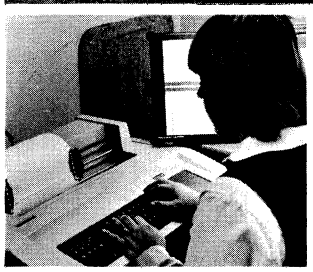
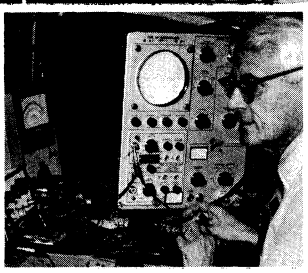

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Filters, Band Pass
Filters, Dual — ILS
Filters, High Pass
Filters, Line
Filters, Low Pass
Filters, Octave
Filters, Power 400 Hz
Inductors, Toroid
Modules, Encapsulated Circuit
Modules, SHP
Networks, Pulse-Custom
Reactors, Saturable
Transformers, Audio
Transformers, Converter DC-DC and AC-DC
Transformers, Current
Transformers, Current Limiting
Transformers, Discriminator
Transformers, Driver
Transformers, Filament
Transformers, High Voltage, Corona Free
Transformers, Input
Transformers, Instrument
Transformers, Interstage
Transformers, Isolation
Transformers, Line
Transformers, Linear
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Transformers, Output
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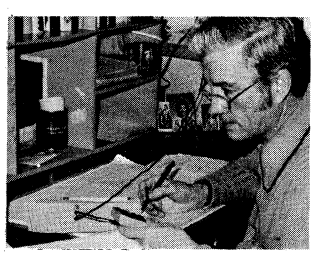
Transformers, SCR Trigger
Transformers, Step-Down & Step-Up
Transformers, Toroidal
Transformers, Transistor Circuit
Transformers, Wide Band

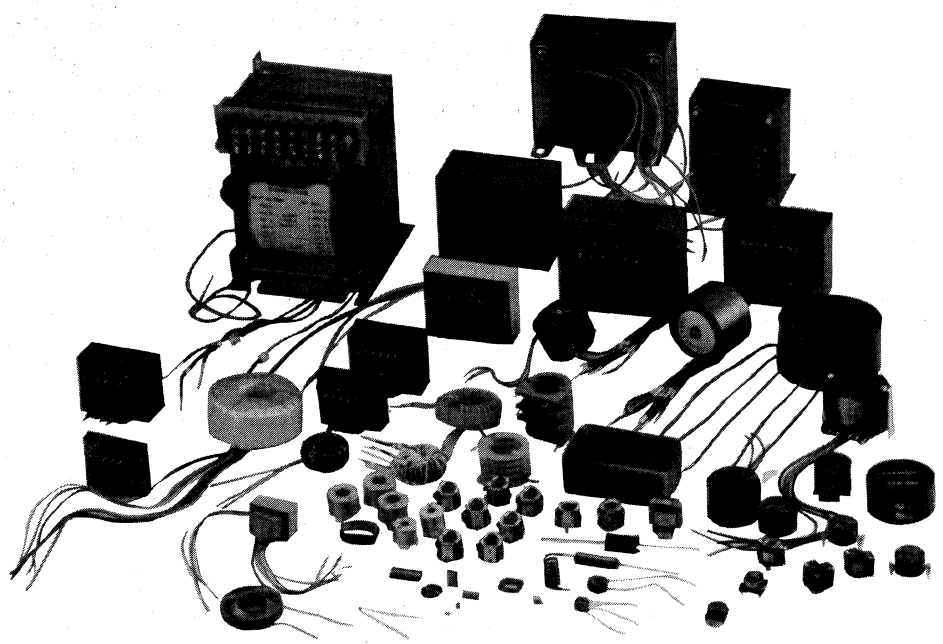


WARRANTY
Supplier warrants products of its own manufacture against faulty workmanship or the use of defective materials for a period of one year from the date of shipment. This warranty is the only warranty made by the Supplier and is in lieu of all other warranties, expressed or implied, and can be amended only by a written instrument signed by an officer of the Supplier. The liability of the Supplier under this warranty is limited solely to replacing, repairing or issuing credit (at Supplier's discretion) for any products which are returned by Buyer during the warranty period, provided that (a) Supplier is promptly notified in writing upon discovery of such defects by Buyer, (b) the defective unit is returned to Supplier, transportation charges prepaid by Buyer, and (c) Supplier's examination of such unit shall disclose, to its satisfaction, that such defects have not been caused by misuse, neglect, improper installation, repair, alteration or accident. In no event shall Supplier be liable to Buyer for loss of profits, loss of use, or damages of any kind based upon a breach of warranty.

POLYPHASE INSTRUMENT COMPANY
175 Commerce Drive, Fort Washington, PA 19034
Toll free (800) 221-POLY • In PA (215) 643-6950
Telex 130081 KAPPA RHWY; FAX: (215) 643-5237

POLYPHASE
A KAPPA NETWORKS COMPANY

POWER MAGNE-TECH CORP.



TRANSFORMERS & INDUCTORS

POWER 50-400 Hz
AUDIO
PULSE
TOROIDAL
INVERTERS

COILS

SELF SUPPORTING COILS
COILS OF ULTRA FINE WIRES

SPECIALTY WINDINGS

WE WOULD BE GLAD TO PLACE OUR EXPERTISE AT YOUR DISPOSAL, AND WELCOME YOU TO THE CLUB OF OUR SATISFIED CUSTOMERS.

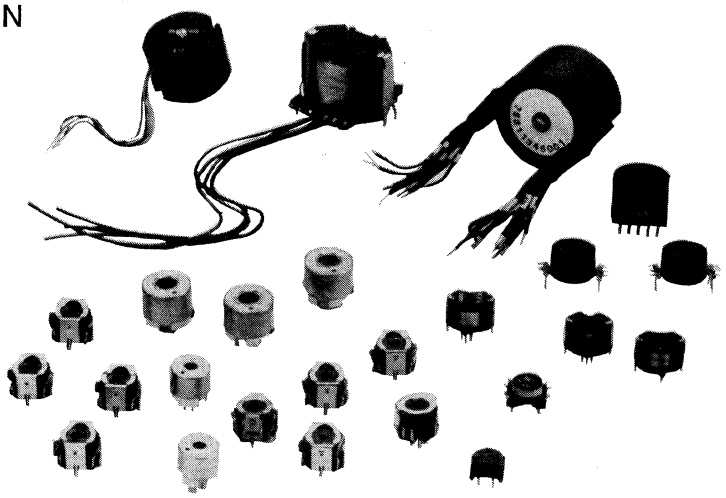
POWER MAGNE-TECH CORP.

441 HIGH ST. / PERTH AMBOY, NJ 08861 / TEL: (201) 826-4700 / TLX: 284401 PMCQ / FAX: (201) 826-4706

POWER MAGNE-TECH CORP.

POWER MAGNE-TECH CORP. MANUFACTURES ELECTROMAGNETIC COMPONENTS FOR BOTH COMMERCIAL AND MILITARY APPLICATIONS.

OUR SOPHISTICATED MANUFACTURING CAPABILITES, AND SKILLED DESIGN ACHIEVEMENTS, NETWORKS HIGH TECHNOLOGY AT COMPETITIVE PRICING.



POWER MAGNE-TECH CORP.'S RANGE OF PRODUCTS INCLUDE:

- ☐ Power Transformers up to 1500 VA single phase 50-400 Hz.
- ☐ Power Transformers up to 3000 VA for 3 phase units.
- ☐ Audio Transformers.
- ☐ Inverters.
- ☐ Coils of fine/self bonding wires. (Self supporting coils.)
- ☐ Chokes, Inductors and Coils.

OUR SPECIALTY IN THE HIGH PRODUCTION OF POT CORE TYPE TRANSFORMERS, ENABLES POWER MAGNE-TECH TO SELL YOU THE WOUND COMPONENT AT THE COST OF THE MAGNET WIRE!!!

Molding the highest quality of product uniformity and a mastership staff, Power Magne-Tech Corp. complies to the most stringent criteria of MIL-T-27, UL & CSA, VDE and IEC. Power Magne-Tech Corp. has integrated all forms of magnetics; steel laminations, cut cores, pot-cores and other shapes of ferrites, for both long and short production runs.

Our commitment to technological innovations is assurance of the very highest quality transformers, inductors and our complete line of electromagnetic components. Our plant is equipped with the most advanced machinery. This includes computerized high precision winding machines with electronic controls for ±0 turns tolerance and multi stage counters, winding machines for fine self-bonding coils, vacuum impregnating and encapsulating systems, printing machines, ovens, testing and measuring instruments.

Thus, the product ultimately sold, is a reflection of our customers electrical and mechanical requirements, as applied and implemented by both our engineering and production facilities.

POWER MAGNE-TECH CORP.

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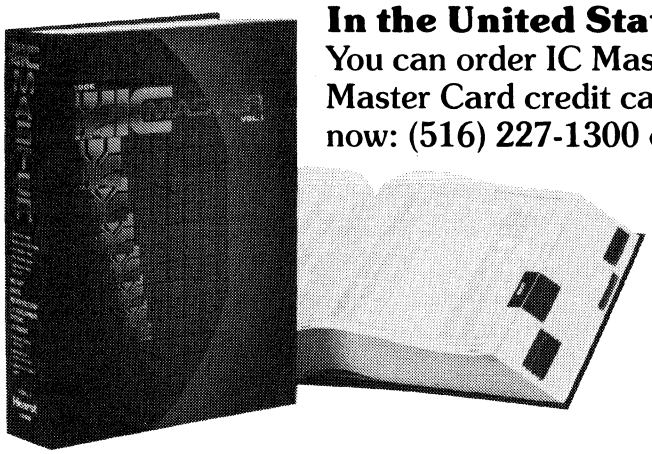

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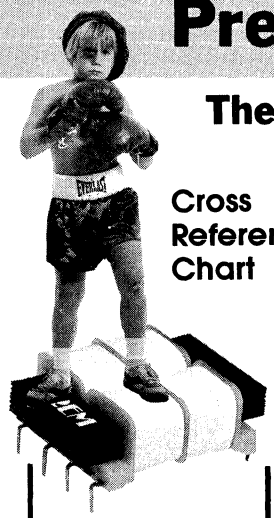
Prem PC Power Transformers

The New Kid on the Board is a Price Fighter



Cross Reference Chart

PREM	STANCOR	MICROTRAN	TRIAD	SIGNAL
SPW-050	N/A	N/A	FP 10-250	LP 10-250
SPW-051	N/A	N/A	FP 12-200	LP 12-200
SPW-052	N/A	N/A	FP 16-150	LP 16-150
SPW-053	N/A	N/A	FP 20-125	LP 20-125
SPW-054	N/A	N/A	FP 24-100	LP 24-100
SPW-055	N/A	N/A	FP 34-75	LP 34-75
SPW-056	N/A	N/A	FP 40-60	LP 40-60
SPW-057	N/A	N/A	FP 56-45	LP 56-45
SPW-058	N/A	N/A	FP 38-28	LP 88-28
SPW-059	N/A	N/A	FP 120-20	LP 120-20
SPW-060	N/A	N/A	FP 230-10	LP 230-10
SPW-061	N/A	N/A	FP 30-80	LP 30-85
SPW-100	LB 610	PF 6-10	FP 10-600	LP 10-600
SPW-101	LB 612	PF 6-12	FP 12-475	LP 12-450
SPW-102	LB 616	PF 6-16	FP 16-375	LP 16-350
SPW-103	LB 620	N/A	FP 20-300	LP 20-300
SPW-104	LB 624	PF 6-24	FP 24-250	LP 24-250
SPW-105	LB 634	PF 6-34	FP 34-170	LP 34-170
SPW-106	LB 640	N/A	FP 40-150	LP 40-150
SPW-107	LB 656	PF 6-56	FP 56-100	LP 56-100
SPW-108	LB 688	N/A	FP 88-65	LP 88-65
SPW-109	LB 6120	N/A	FP 120-50	LP 120-50
SPW-110	LB 6230	N/A	FP 230-25	LP 230-25
SPW-111	N/A	N/A	FP 30-200	LP 30-200
SPW-300	LB 1210	PF 12-10	FP 10-1200	LP 10-1200
SPW-301	LB 1212	PF 12-12	FP 12-950	LP 12-900
SPW-302	LB 1216	PF 12-16	FP 16-750	LP 16-700
SPW-303	LB 1220	N/A	FP 20-600	LP 20-600
SPW-304	LB 1224	PF 12-24	FP 24-500	LP 24-500
SPW-305	LB 1234	PF 12-34	FP 34-340	LP 34-340
SPW-306	LB 1240	N/A	FP 40-300	LP 40-300
SPW-307	LB 1256	PF 12-56	FP 56-200	LP 56-200
SPW-308	LB 1288	N/A	FP 88-130	LP 88-130
SPW-309	LB 12120	N/A	FP 120-100	LP 120-100
SPW-310	LB 12230	N/A	FP 230-50	LP 230-50
SPW-311	N/A	N/A	FP 30-400	LP 30-400
SPW-350-S/D	SW/DSW 210	PSS/PSD 2-10	F/FS 10-110	ST/DST 2-10
SPW-351-S/D	SW/DSW 212	PSS/PSD 2-12	F/FS 12-090	ST/DST 2-12
SPW-352-S/D	SW/DSW 216	PSS/PSD 2-16	F/FS 16-070	ST/DST 2-16
SPW-353-S/D	SW/DSW 220	PSS/PSD 2-20	F/FS 20-055	ST/DST 2-20
SPW-354-S/D	SW/DSW 224	PSS/PSD 2-24	F/FS 24-045	ST/DST 2-24
SPW-355-S/D	SW/DSW 228	PSS/PSD 2-28	F/FS 28-040	ST/DST 2-28
SPW-356-S/D	SW/DSW 236	PSS/PSD 2-36	F/FS 36-030	ST/DST 2-36
SPW-357-S/D	SW/DSW 248	PSS/PSD 2-48	F/FS 48-023	ST/DST 2-48
SPW-358-S/D	SW/DSW 256	PSS/PSD 2-56	F/FS 56-020	ST/DST 2-56
SPW-359-S/D	SW/DSW 2120	PSS/PSD 2-120	F/FS 120-010	ST/DST 2-120
SPW-400-S/D	SW/DSW 310	PSS/PSD 3-10	F/FS 10-250	ST/DST 3-10
SPW-401-S/D	SW/DSW 312	PSS/PSD 3-12	F/FS 12-200	ST/DST 3-12
SPW-402-S/D	SW/DSW 316	PSS/PSD 3-16	F/FS 16-150	ST/DST 3-16
SPW-403-S/D	SW/DSW 320	PSS/PSD 3-20	F/FS 20-120	ST/DST 3-20
SPW-404-S/D	SW/DSW 324	PSS/PSD 3-24	F/FS 24-100	ST/DST 3-24
SPW-405-S/D	SW/DSW 328	PSS/PSD 3-28	F/FS 28-85	ST/DST 3-28
SPW-406-S/D	SW/DSW 336	PSS/PSD 3-36	F/FS 36-65	ST/DST 3-36
SPW-407-S/D	SW/DSW 348	PSS/PSD 3-48	F/FS 48-050	ST/DST 3-48
SPW-408-S/D	SW/DSW 356	PSS/PSD 3-56	F/FS 56-045	ST/DST 3-56
SPW-409-S/D	SW/DSW 3120	PSS/PSD 3-120	F/FS 120-020	ST/DST 3-120
SPW-500-S/D	SW/DSW 410	PSS/PSD 4-10	F/FS 10-600	ST/DST 4-10
SPW-501-S/D	SW/DSW 412	PSS/PSD 4-12	F/FS 12-500	ST/DST 4-12
SPW-502-S/D	SW/DSW 416	PSS/PSD 4-16	F/FS 16-400	ST/DST 4-16
SPW-503-S/D	SW/DSW 420	PSS/PSD 4-20	F/FS 20-300	ST/DST 4-20
SPW-504-S/D	SW/DSW 424	PSS/PSD 4-24	F/FS 24-250	ST/DST 4-24
SPW-505-S/D	SW/DSW 428	PSS/PSD 4-28	F/FS 28-200	ST/DST 4-28
SPW-506-S/D	SW/DSW 436	PSS/PSD 4-36	F/FS 36-170	ST/DST 4-36
SPW-507-S/D	SW/DSW 448	PSS/PSD 4-48	F/FS 48-125	ST/DST 4-48
SPW-508-S/D	SW/DSW 456	PSS/PSD 4-56	F/FS 56-110	ST/DST 4-56
SPW-509-S/D	SW/DSW 4120	PSS/PSD 4-120	F/FS 120-050	ST/DST 4-120
SPW-600-S/D	SW/DSW 510	PSS/PSD 5-10	F/FS 10-1200	ST/DST 5-10
SPW-601-S/D	SW/DSW 512	PSS/PSD 5-12	F/FS 12-1000	ST/DST 5-12
SPW-602-S/D	SW/DSW 516	PSS/PSD 5-16	F/FS 16-800	ST/DST 5-16
SPW-603-S/D	SW/DSW 520	PSS/PSD 5-20	F/FS 20-600	ST/DST 5-20
SPW-604-S/D	SW/DSW 524	PSS/PSD 5-24	F/FS 24-500	ST/DST 5-24
SPW-605-S/D	SW/DSW 528	PSS/PSD 5-28	F/FS 28-420	ST/DST 5-28
SPW-606-S/D	SW/DSW 536	PSS/PSD 5-36	F/FS 36-350	ST/DST 5-36
SPW-607-S/D	SW/DSW 548	PSS/PSD 5-48	F/FS 48-250	ST/DST 5-48
SPW-608-S/D	SW/DSW 556	PSS/PSD 5-56	F/FS 56-220	ST/DST 5-56
SPW-609-S/D	SW/DSW 5120	PSS/PSD 5-120	F/FS 120-100	ST/DST 5-120
SPW-610-S/D	SW/DSW 610	N/A	F/FS 10-2000	ST/DST 6-10
SPW-611-S/D	SW/DSW 612	N/A	F/FS 12-1600	ST/DST 6-12
SPW-612-S/D	SW/DSW 616	N/A	F/FS 16-1250	ST/DST 6-16
SPW-613-S/D	SW/DSW 620	N/A	F/FS 20-1000	ST/DST 6-20
SPW-614-S/D	SW/DSW 624	N/A	F/FS 24-800	ST/DST 6-24
SPW-615-S/D	SW/DSW 628	N/A	F/FS 28-700	ST/DST 6-28
SPW-616-S/D	SW/DSW 636	N/A	F/FS 36-550	ST/DST 6-36
SPW-617-S/D	SW/DSW 648	N/A	F/FS 48-400	ST/DST 6-48
SPW-618-S/D	SW/DSW 656	N/A	F/FS 56-350	ST/DST 6-56
SPW-619-S/D	SW/DSW 6120	N/A	F/FS 120-160	ST/DST 6-120
SPW-620-S/D	N/A	N/A	F/FS 10-3600	ST/DST 7-10
SPW-621-S/D	N/A	N/A	F/FS 12-2850	ST/DST 7-12
SPW-622-S/D	N/A	N/A	F/FS 16-2250	ST/DST 7-16
SPW-623-S/D	N/A	N/A	F/FS 20-1800	ST/DST 7-20
SPW-624-S/D	N/A	N/A	F/FS 24-1500	ST/DST 7-24
SPW-625-S/D	N/A	N/A	F/FS 28-1300	ST/DST 7-28
SPW-626-S/D	N/A	N/A	F/FS 36-1000	ST/DST 7-36
SPW-627-S/D	N/A	N/A	F/FS 48-750	ST/DST 7-48
SPW-628-S/D	N/A	N/A	F/FS 56-650	ST/DST 7-56
SPW-629-S/D	N/A	N/A	F/FS 120-300	ST/DST 7-120

N/A — To the best of our knowledge, these items are not available.

Prem has taken on the Ol' Boys head-to-head. And you come out the winner. Prem stocks the same low profile, three-flange designs and delivers fast with consistent, reliable quality. Why pay more? Check out Prem's prices today, you'll find it's nice to have someone in your corner for a change.

For further information and pricing, contact Prem's Customer Service Department.

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(815) 385-2700
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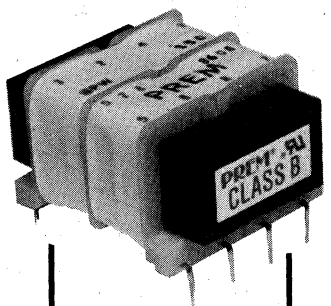
Prem PC Power Transformers

Recognized Component
Underwriters Labs, Inc.

Certified Component
Canadian Standards Association



Prem — the price leader in Low Profile Power Transformers.

- Three flange bobbin design — 1500 VRMS High-pot
- No electro-static shield needed

Other primary and secondary voltages may be custom-designed to your specifications. Since 12 terminals are available, tapped primaries or secondaries may also be utilized.

For further information and pricing, contact Prem's Customer Service Department.

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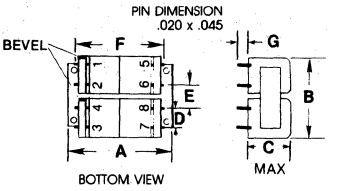
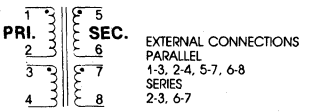
FAX (815) 385-8578

	SPW 050	SPW 100	SPW 150	SPW 300
VA	2.5	6	9	12
A	1.875	1.875	1.875	2.500
B	1.562	1.562	1.562	2.000
C	.660	.850	1.080	1.065
D	.375	.375	.375	.500
E	.375	.375	.375	.500
F	1.600	1.600	1.600	2.000
G	.200	.200	.200	.200





LOW PROFILE POWER TRANSFORMERS

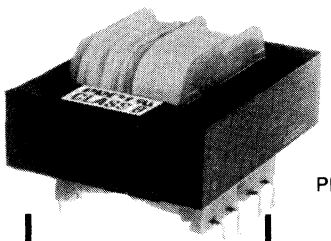
VA	115/230V Dual Primaries Part No.	Secondary Parallel	Secondary Series
2.5	SPW-050	5V @ 500 mA	10V CT @ 250 mA
	SPW-051	6.3V @ 400 mA	12.6V CT @ 200 mA
	SPW-052	8V @ 300 mA	16V CT @ 150 mA
	SPW-053	10V @ 250 mA	20V CT @ 125mA
	SPW-054	12V @ 200 mA	24V CT @ 100 mA
	SPW-055	17V @ 150 mA	34V CT @ 75 mA
	SPW-056	20V @ 120 mA	40V CT @ 60 mA
	SPW-057	28V @ 90 mA	56V CT @ 45 mA
	SPW-058	44V @ 56 mA	88V CT @ 28 mA
	SPW-059	60V @ 40 mA	120V CT @ 20 mA
	SPW-060	115V @ 20 mA	230V CT @ 10 mA
	SPW-061	15V @ 170 mA	30V CT @ 85 mA
6.0	SPW-100	5V @ 1.2A	10V CT @ 600 mA
	SPW-101	6.3V @ 900 mA	12.6V CT @ 450 mA
	SPW-102	8V @ 700 mA	16V CT @ 350 mA
	SPW-103	10V @ 600 mA	20V CT @ 300 mA
	SPW-104	12V @ 500 mA	24V CT @ 250 mA
	SPW-105	17V @ 340 mA	34V CT @ 170 mA
	SPW-106	20V @ 300 mA	40V CT @ 150 mA
	SPW-107	28V @ 200 mA	56V CT @ 100 mA
	SPW-108	44V @ 130 mA	88V CT @ 65 mA
	SPW-109	60V @ 100 mA	120V CT @ 50 mA
	SPW-110	115V @ 50 mA	230V CT @ 25 mA
	SPW-111	15V @ 400 mA	30V CT @ 200 mA
9.0	SPW-150 **New**	5V @ 1.80A	10V CT @ 900 mA
	SPW-151 **New**	6.3V @ 1.43A	12.6V CT @ 715 mA
	SPW-152 **New**	8.0V @ 1.125A	16.0V CT @ 562 mA
	SPW-153 **New**	10.0V @ 900 mA	20.0V CT @ 450 mA
	SPW-154 **New**	12.0V @ 750 mA	24.0V CT @ 375 mA
	SPW-155 **New**	17.0V @ 530 mA	34.0V CT @ 265 mA
	SPW-156 **New**	20.0V @ 450 mA	40.0V CT @ 225 mA
	SPW-157 **New**	28.0V @ 322 mA	56.0V CT @ 161 mA
	SPW-158 **New**	44.0V @ 204 mA	88.0V CT @ 102 mA
	SPW-159 **New**	60.0V @ 150 mA	120.0V CT @ 75 mA
	SPW-160 **New**	115.0V @ 78 mA	230.0V CT @ 39 mA
	SPW-161 **New**	15.0V @ 600 mA	30.0V CT @ 300 mA
12.0	SPW-300	5V @ 2.4A	10V CT @ 1.2A
	SPW-301	6.3V @ 1.8A	12.6V CT @ 900 mA
	SPW-302	8V @ 1.4A	16V CT @ 700 mA
	SPW-303	10V @ 1.2A	20V CT @ 600 mA
	SPW-304	12V @ 1.0A	24V CT @ 500 mA
	SPW-305	17V @ 680 mA	34V CT @ 340 mA
	SPW-306	20V @ 600 mA	40V CT @ 300 mA
	SPW-307	28V @ 400 mA	56V CT @ 200 mA
	SPW-308	44V @ 260 mA	88V CT @ 130 mA
	SPW-309	60V @ 200 mA	120V CT @ 100 mA
	SPW-310	115V @ 100 mA	230V CT @ 50 mA
	SPW-311	15V @ 800 mA	30V CT @ 400 mA

Prem PC Power Transformers

	SPW-350	SPW-400	SPW-500	SPW-600	SPW-610	SPW-620
VA	1.1	2.4	6.0	12.0	20.0	36.0
A	1.375	1.375	1.625	1.875	2.250	2.625
B	1.125	1.125	1.312	1.5625	1.875	2.187
C	.9375	1.187	1.290	1.4375	1.410	1.562
D	.250	.250	.250	.300	.300	.400
E	.250	.250	.350	.400	.400	.400
F	1.200	1.200	1.270	1.410	1.600	1.850
G	N/A	N/A	1.0625	1.250	1.50	NOTE
Screw Size	N/A	N/A	#4	#4	#4	#6
H	.20	.20	.20	.20	.20	.20

Recognized Component
Underwriters Labs, Inc.

Certified Component
Canadian Standards Association



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- Three flange bobbin design — 2500 VRMS High-pot
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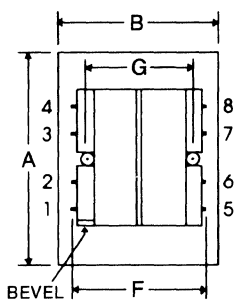
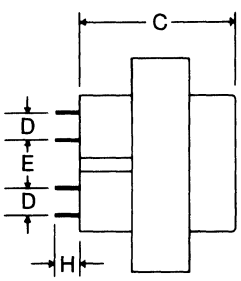
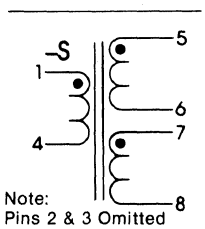
TWX 910/642-3763
FAX (815) 385-8578

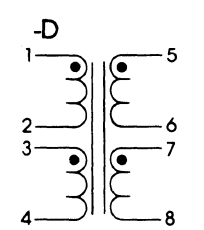
PIN DIMENSION
.020 x .041







Note:
Pins 2 & 3 Omitted



VA	Part Number* Single 115V 6 pin	Part Number* Dual 115/230V 8 pin	Secondary RMS Rating Parallel	Secondary RMS Rating Series
1.1	SPW-350-S	SPW-350-D	5V @ 220 mA	10V CT @ 110 mA
	SPW-351-S	SPW-351-D	6.3V @ 180 mA	12.6V CT @ 90 mA
	SPW-352-S	SPW-352-D	8V @ 140 mA	16V CT @ 70 mA
	SPW-353-S	SPW-353-D	10V @ 110 mA	20V CT @ 55 mA
	SPW-354-S	SPW-354-D	12V @ 90 mA	24V CT @ 45 mA
	SPW-355-S	SPW-355-D	14V @ 80 mA	28V CT @ 40 mA
	SPW-356-S	SPW-356-D	18V @ 60 mA	36V CT @ 30 mA
	SPW-357-S	SPW-357-D	24V @ 46 mA	48V CT @ 23 mA
	SPW-358-S	SPW-358-D	28V @ 40 mA	56V CT @ 20 mA
	SPW-359-S	SPW-359-D	60V @ 20 mA	120V CT @ 10mA
2.4	SPW-400-S	SPW-400-D	5V @ 500 mA	10V CT @ 250 mA
	SPW-401-S	SPW-401-D	6.3V @ 400 mA	12.6V CT @ 200 mA
	SPW-402-S	SPW-402-D	8V @ 300 mA	16V CT @ 150 mA
	SPW-403-S	SPW-403-D	10V @ 240 mA	20V CT @ 120 mA
	SPW-404-S	SPW-404-D	12V @ 200 mA	24V CT @ 100 mA
	SPW-405-S	SPW-405-D	14V @ 170 mA	28V CT @ 85 mA
	SPW-406-S	SPW-406-D	18V @ 130 mA	36V CT @ 65 mA
	SPW-407-S	SPW-407-D	24V @ 100 mA	48V CT @ 50 mA
	SPW-408-S	SPW-408-D	28V @ 90 mA	56V CT @ 45 mA
	SPW-409-S	SPW-409-D	60V @ 40 mA	120V CT @ 20 mA
6.0	SPW-500-S	SPW-500-D	5V @ 1.2A	10V CT @ 600 mA
	SPW-501-S	SPW-501-D	6.3V @ 1.0A	12.6V CT @ 500 mA
	SPW-502-S	SPW-502-D	8V @ 800 mA	16V CT @ 400 mA
	SPW-503-S	SPW-503-D	10V @ 600 mA	20V CT @ 300 mA
	SPW-504-S	SPW-504-D	12V @ 500 mA	24V CT @ 250 mA
	SPW-505-S	SPW-505-D	14V @ 400 mA	28V CT @ 200 mA
	SPW-506-S	SPW-506-D	18V @ 340 mA	36V CT @ 170 mA
	SPW-507-S	SPW-507-D	24V @ 250 mA	48V CT @ 125 mA
	SPW-508-S	SPW-508-D	28V @ 220 mA	56V CT @ 110 mA
	SPW-509-S	SPW-509-D	60V @ 100 mA	120V CT @ 50 mA
12.0	SPW-600-S	SPW-600-D	5V @ 2.4A	10V CT @ 1.2A
	SPW-601-S	SPW-601-D	6.3V @ 2.0A	12.6V CT @ 1.0A
	SPW-602-S	SPW-602-D	8V @ 1.6A	16V CT @ 800 mA
	SPW-603-S	SPW-603-D	10V @ 1.2A	20V CT @ 600 mA
	SPW-604-S	SPW-604-D	12V @ 1.0A	24V CT @ 500 mA
	SPW-605-S	SPW-605-D	14V @ 850 mA	28V CT @ 420 mA
	SPW-606-S	SPW-606-D	18V @ 700 mA	36V CT @ 350 mA
	SPW-607-S	SPW-607-D	24V @ 500 mA	48V CT @ 250 mA
	SPW-608-S	SPW-608-D	28V @ 440 mA	56V CT @ 220 mA
	SPW-609-S	SPW-609-D	60V @ 200 mA	120V CT @ 100 mA
20.0	SPW-610-S	SPW-610-D	5V @ 4.0A	10V CT @ 2.0A
	SPW-611-S	SPW-611-D	6.3V @ 3.2A	12.6V CT @ 1.6A
	SPW-612-S	SPW-612-D	8V @ 2.5A	16V CT @ 1.25A
	SPW-613-S	SPW-613-D	10V @ 2.0A	20V CT @ 1.0A
	SPW-614-S	SPW-614-D	12V @ 1.6A	24V CT @ 800 mA
	SPW-615-S	SPW-615-D	14V @ 1.4A	28V CT @ 700 mA
	SPW-616-S	SPW-616-D	18V @ 1.1A	36V CT @ 550 mA
	SPW-617-S	SPW-617-D	24V @ 800 mA	48V CT @ 400 mA
	SPW-618-S	SPW-618-D	28V @ 700 mA	56V CT @ 350 mA
	SPW-619-S	SPW-619-D	60V @ 320 mA	120V CT @ 160 mA
36.0	SPW-620-S	SPW-620-D	5V @ 7.2A	10V CT @ 3.6A
	SPW-621-S	SPW-621-D	6.3V @ 5.7A	12.6V CT @ 2.85A
	SPW-622-S	SPW-622-D	8V @ 4.5A	16V CT @ 2.25A
	SPW-623-S	SPW-623-D	10V @ 3.6A	20V CT @ 1.8A
	SPW-624-S	SPW-624-D	12V @ 3.0A	24V CT @ 1.5A
	SPW-625-S	SPW-625-D	14V @ 2.6A	28V CT @ 1.3A
	SPW-626-S	SPW-626-D	18V @ 2.0A	36V CT @ 1.0A
	SPW-627-S	SPW-627-D	24V @ 1.5A	48V CT @ 750 mA
	SPW-628-S	SPW-628-D	28V @ 1.3A	56V CT @ 650 mA
	SPW-629-S	SPW-629-D	60V @ 600 mA	120V CT @ 300 mA

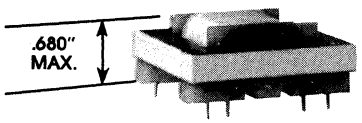
*Primary Voltage — S (115V) — D (115/230V)

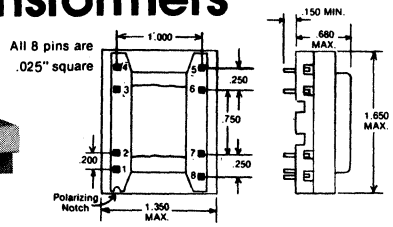
NOTE: 4 corner mounting holes 2.187 x 1.750 centers.

PREM®
MAGNETICS, INCORPORATED
3521 North Chapel Hill Road
McHenry, IL 60050
(815) 385-2700
TWX 910/642-3763
FAX (815) 385-8578

Coupling Transformers

Voice and Data



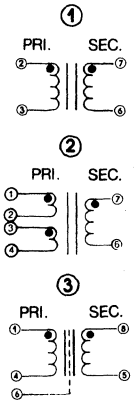


FREQUENCY RESPONSE
±.5dB (300-3500Hz)

DIELECTRIC STRENGTH
1500 VAC (PRI-SEC-CORE)

LONGITUDINAL BALANCE
MEETS FCC PART 68.310(a) REQUIREMENTS, TEST UNIT RL 600Ω.

SCHEMATIC



SECONDARY LOAD 600Ω W/D.C. PRI

	PREM PT. NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX D.C. UNBAL.	INS. LOSS REF.@1KHz	RETURN LOSS MIN@300Hz	HARM. DIST. @300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC	SCH. NO
	SPT-109	600	600	1:1	80mA	1.15dB	11.5dB ①	.1% TYP.	60Ω	72 Ω	1
ECONOMY	SPT-190	600	600	1:1	80mA	1.20dB	11.0dB	.3% TYP.	60Ω	72 Ω	1
	SPT-110	600	600	1:1.127	80mA	1.15dB	14.5dB ①	.1% TYP.	67Ω	75.5Ω	2
ECONOMY	SPT-191	600	600	1:1.127	80mA	1.30dB	12.5dB	.3% TYP.	67Ω	75.5Ω	2
	SPT-111	900	600	1:.8168	80mA	1.55dB	11.0dB ①	.1% TYP.	76Ω	92 Ω	1
ECONOMY	SPT-192	900	600	1:.8168	80mA	1.60dB	10.5dB	.3% TYP.	76Ω	92 Ω	1
	SPT-112	900	600	1:.942	80mA	1.20dB	12.5dB ①	.1% TYP.	92Ω	126Ω	2
ECONOMY	SPT-193	900	600	1:.942	80mA	1.30dB	11.0dB	.3% TYP.	92Ω	126Ω	2
②	SPT-127	600	600	1:1	120mA	1.30dB	11.0dB	.1% TYP.	62Ω	100 Ω	3

① OTHER OPTIMIZED VALUES OBTAINABLE
② DIELECTRIC STRENGTH 2400VDC (PRI-SEC-CORE)

Fig. 1

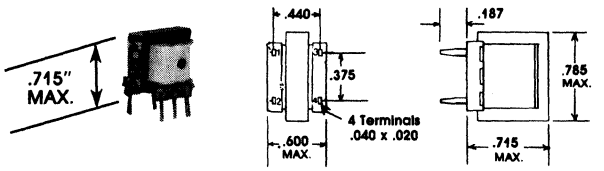
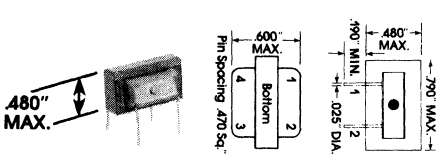


Fig. 3



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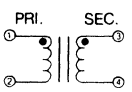


Fig. 2

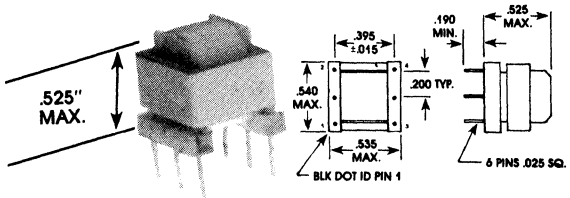
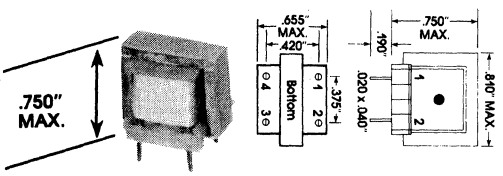


Fig. 4



LONGITUDINAL BALANCE
MEETS FCC PART 68.310(a) REQUIREMENTS, TEST UNIT RL 600Ω.

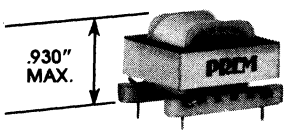
SECONDARY LOAD 600Ω W/D.C. PRI

	PREM PT. NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX D.C. UNBAL.	INS. LOSS REF.@1KHz	RETURN LOSS MIN@300Hz	ECHO RETURN LOSS MIN.	HARM. DIST. @300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC	FIG. NO.	DIELECTRIC STRENGTH PRE-SEC-CORE	FREQUENCY RESPONSE 300-3500Hz
	SPT-128	600	600	1:1	0mA	1.00dB	14.5dB	21.5dB	.3% TYP.	35Ω	35 Ω	1	1500VAC	±.5dB
†	SPT-2104	600	600	1:1.037	0mA	.90dB	23.0dB	26.0dB	.15% TYP.	36Ω	48.5Ω	4	1500VAC	±.5dB
	SPT-2105	600	600	1:1	80mA	2.30dB	6.0dB	9.0dB	.15% TYP.	180Ω	75 Ω	4	1500VAC	*
†	SPT-1104	600	600	1:1.028	0mA	1.00dB	23.0dB	26.0dB	.5% TYP.	39Ω	50 Ω	3	1500VAC	±.5dB
	SPT-2106	600	600	1:1.0523	0mA	1.25dB	21.0dB	25.0dB	.2% TYP.	49Ω	65 Ω	2	1000VAC	±.25dB

*FREQUENCY RESPONSE 600-3.5KHz ±1.0dB, 300-600Hz ± 3.0dB
†IMPEDANCE MATCHING:: ±10% OVER ENTIRE FREQUENCY RANGE.

For further information, pricing and delivery, contact Prem's Sales Services Department

Available from stock.



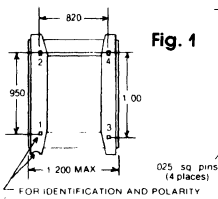


Fig. 1

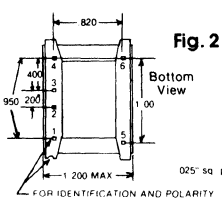


Fig. 2

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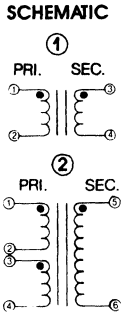


FREQUENCY RESPONSE
±.5dB (300-3500Hz)

DIELECTRIC STRENGTH
1500 VAC (PRI-SEC-CORE)

LONGITUDINAL BALANCE
MEETS FCC PART 68.310(a) REQUIREMENTS, TEST UNIT RL 600Ω.

SECONDARY LOAD 600Ω W/D.C. PRI

	PREM PT. NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX D.C. UNBAL.	INS. LOSS REF.@1KHz	RETURN LOSS MIN@300Hz	HARM. DIST. @300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC	SCH. NO.	FIG. NO.
ECONOMY	SPT-116	600	600	1:1	80mA	1.20dB	13.0dB ①	.3% TYP.	66.2Ω	82.2Ω	1	1
	SPT-117	600	600	1:1.125	80mA	1.25dB	16.0dB ①	.1% TYP.	76Ω	86Ω	2	2
ECONOMY	SPT-118	900	600	1:.8163	80mA	1.50dB	9.5dB ①	.3% TYP.	82.8Ω	85.4Ω	1	1
ECONOMY	SPT-119	900	600	1:.946	80mA	1.55dB	12.0dB	.3% TYP.	90Ω	110Ω	2	2
ECONOMY	SPT-124	600	600	1:1	80mA	1.20dB	13.0dB ①	.3% TYP.	66Ω	82Ω	2	2

① OTHER OPTIMIZED VALUES OBTAINABLE

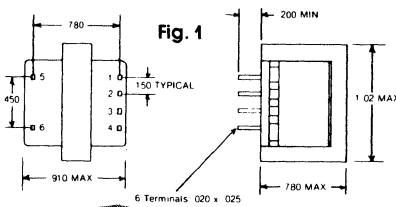
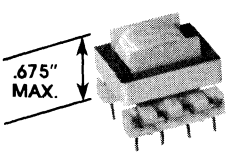


Fig. 1



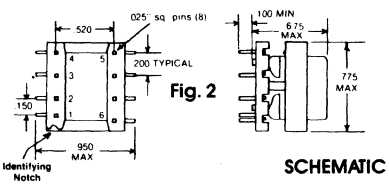
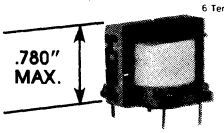


Fig. 2



FREQUENCY RESPONSE
(300-3500Hz) ±.5dB

DIELECTRIC STRENGTH
1500 VAC (PRI-SEC-CORE)

LONGITUDINAL BALANCE
MEETS FCC PART 68.310(a) REQUIREMENTS, TEST UNIT RL 600Ω.

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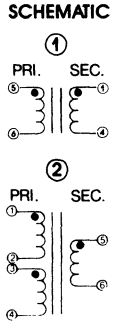


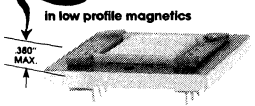
SECONDARY LOAD 600Ω W/D.C. PRI

	PREM PT. NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX D.C. UNBAL.	INS. LOSS REF.@1KHz	RETURN LOSS MIN@300Hz	HARM. DIST. @300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC	SCH. NO.	FIG. NO.
	SPT-113	600	600	1:1	50mA	1.25dB	12.5dB ①	.13% TYP.	75Ω	76Ω	2	1
ECONOMY	SPT-196	600	600	1:1	50mA	1.30dB	11.0dB	.3% TYP.	75Ω	76Ω	2	1
	SPT-115	600	600	1:1	60mA	1.30dB	10.5dB ①	.3% TYP.	63Ω	88Ω	1	1
	SPT-131	600	600	1:1	0mA	1.00dB	18.0dB	.15% TYP.	24.5Ω	31Ω	2	2
ECONOMY	SPT-197	600	600	1:1	0mA	1.15dB	12.5dB	.3% TYP.	24.5Ω	31Ω	2	2

① OTHER OPTIMIZED VALUES OBTAINABLE

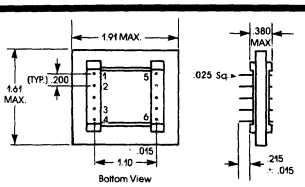
A new low in low profile magnetics

The Hugger Concept



The Hugger is an extremely low profile package used primarily as a coupling transformer or feed bridge inductor.

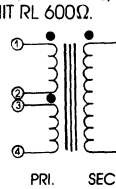
This device is easily adaptable to card spacings of 1/2 inch



FREQUENCY RESPONSE
±.5dB (300-3500Hz)

DIELECTRIC STRENGTH
1500 VAC (PRI-SEC-CORE)

LONGITUDINAL BALANCE
MEETS FCC PART 68.310(a) REQUIREMENTS, TEST UNIT RL 600Ω.



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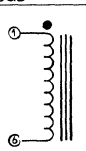
Coupling Transformer

SECONDARY LOAD 600Ω W/D.C. PRI

PREM PT. NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX D.C. UNBAL.	INS. LOSS REF.@1KHz	RETURN LOSS MIN@300Hz	ECHO RETURN LOSS MIN	HARM. DIST. @300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC
SPT-172	600	600	1:1	50mA	1.5dB	11.5dB	16.5dB	.1% TYP.	73Ω	103Ω

Feed Bridge Inductor

PREM PT. NO.	RESISTANCE ±15%	DIELECTRIC STRENGTH (WINDING-CORE)	INDUCTANCE
SPT-169	114Ω	1500 VAC	@0mA D.C. .90Hy min. 80mA D.C. .75Hy min. 120mA D.C. .60Hy min.



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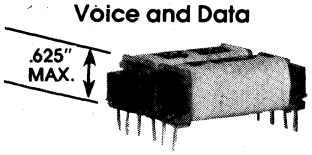
PREM®
MAGNETICS, INCORPORATED
3521 North Chapel Hill Road
McHenry, IL 60050
(815) 385-2700
TWX 910/642-3763
FAX (815) 385-8578

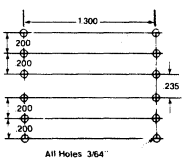
Coupling Transformers

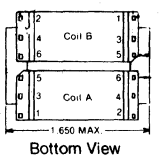
Mini-1 Series HIGH CROSSTALK ATTENUATION

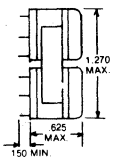
Voice and Data



Note: This unit is symmetrical and can be rotated 180° without changing the pin-out or electrical performance.





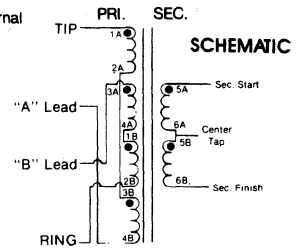


FREQUENCY RESPONSE
±.5dB (300-3500Hz)

DIELECTRIC STRENGTH
1500 VAC (PRI-SEC-CORE)

LONGITUDINAL BALANCE
MEETS FCC PART 68.310(a) REQUIREMENTS, TEST UNIT RL 600Ω.

Necessary External Connections:
Short 2A-3B
4A-1B
6A-5B



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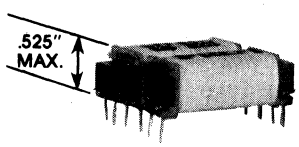
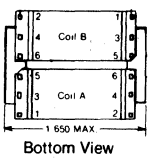
SECONDARY LOAD 600Ω W/D.C. PRI

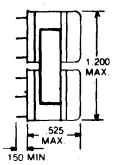
	PREM PT. NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX D.C. UNBAL.	INS. LOSS REF.@1KHz	RETURN LOSS MIN@300Hz	HARM. DIST. @300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC
	SPT-125	600	600	1:1	90mA	1.35dB	13.0dB	.1% TYP.	80Ω	100Ω
ECONOMY	SPT-194	600	600	1:1	90mA	1.40dB	12.0dB	.3% TYP.	80Ω	100Ω

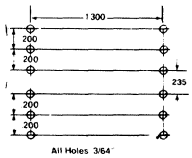
Mini-2 Series HIGH CROSSTALK ATTENUATION



Note: This unit is symmetrical and can be rotated 180° without changing the pin-out or electrical performance.







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Short 2A-3B
4A-1B
6A-5B

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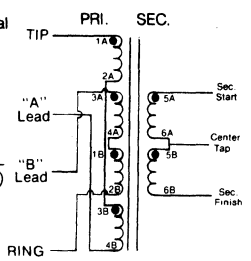


LONGITUDINAL BALANCE
MEETS FCC PART 68.310(a) REQUIREMENTS, TEST UNIT RL 600Ω.

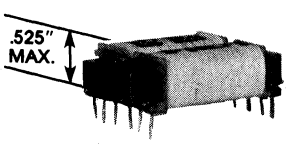
FREQUENCY RESPONSE
±.5dB (300-3500Hz)

DIELECTRIC STRENGTH
1500 VAC (PRI-SEC-CORE)

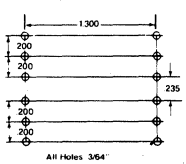
SECONDARY LOAD 600Ω W/D.C. PRI

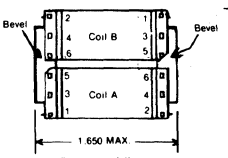
	PREM PT. NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX D.C. UNBAL.	INS. LOSS REF.@1KHz	RETURN LOSS MIN@300Hz	HARM. DIST. @300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC
	SPT-123	600	600	1:1	90mA	1.85dB	12.0dB	.1% TYP.	95Ω	180Ω
ECONOMY	SPT-126	600	600	1:1	80mA	2.00dB	11.5dB	.3% TYP.	95Ω	180Ω

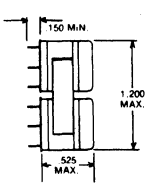
Mini-2 Series HIGH CROSSTALK ATTENUATION



Note: This unit is symmetrical and can be rotated 180° without changing the pin-out or electrical performance.







FREQUENCY RESPONSE
±.5dB (300-3500Hz)

DIELECTRIC STRENGTH
1500 VAC (PRI-SEC-CORE)

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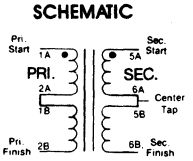

Necessary External Connections:
Short 2A-1B
and 6A-5B

SECONDARY LOAD 600Ω W/D.C. PRI

	PREM PT. NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX D.C. UNBAL.	INS. LOSS REF.@1KHz	RETURN LOSS MIN@300Hz	HARM. DIST. @300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC
	SPT-101	600	600	1:1	90mA	1.80dB	11.0dB	.1% TYP.	95Ω	180 Ω
ECONOMY	SPT-195	600	600	1:1	80mA	2.10dB	11.0dB	.3% TYP.	95Ω	180 Ω

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MAGNETICS, INCORPORATED
3521 North Chapel Hill Road
McHenry, IL 60050
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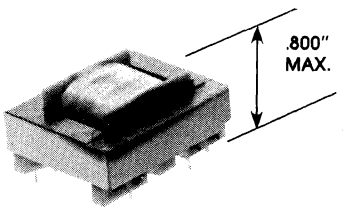
Single Hybrid Transformers and Feed-Bridge Inductors

operating level -45 to +7dBm



PT#	Feed-Bridge Inductors		
SPT 175	INDUCTANCE AT	0 DC:	1.7HY
		80mA DC	1.5HY
		120mA DC	1.3HY
	DC Resistance: 95Ω ±15%		
	Dielectric Strength: 1500 VAC (Winding to Core)		

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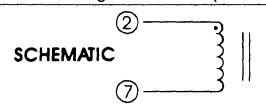

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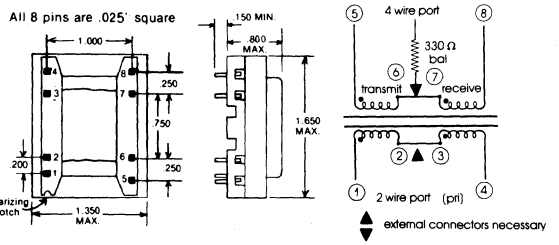
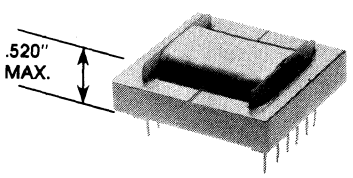


Single-Hybrids

PT#	Primary Impedance	Secondary Impedance	Primary Return Loss	Long Bal.	Hybrid Loss	Trans-Hybrid Balance	Primary mA DC
SPT 176	600Ω	600/600Ω	>11dB 300Hz >22dB* 1KHz	60dB	4.5dB	>15dB 300Hz >31dB* 1KHz	120
SPT 177	900Ω	600/600Ω	>10dB 300Hz >21dB* 1KHz	60dB	4.5dB	>14dB 300Hz >28dB* 1KHz	120

* .012μf capacitor across 5-8 for optimum transhybrid balance and primary return loss

Dielectric Strength: 1500 VAC (PRI-SEC-CORE)



PT#	Feed-Bridge Inductors		
SPT 178	INDUCTANCE AT	0 DC:	.95HY
		50mA DC	.90HY
		75mA DC	.88HY
		100mA DC	.85HY
	DC Resistance: 88Ω ±15%		
	Dielectric Strength: 1500 VAC (Winding to Core)		
SPT 179	INDUCTANCE AT	0 DC:	1.4HY
		50mA DC	1.3HY
		90mA DC	1.2HY
	DC Resistance: 142Ω ±15%		
	Dielectric Strength: 1500 VAC (Winding to Core)		

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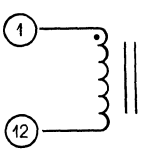

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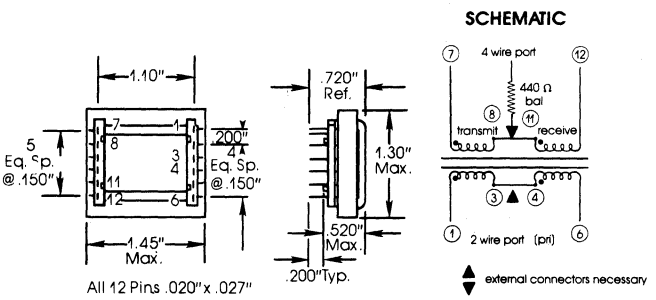


Single-Hybrids

PT#	Primary Impedance	Secondary Impedance	Primary Return Loss	Long Bal.	Hybrid Loss	Trans-Hybrid Balance	Primary mA DC
SPT 180	600Ω	600/600Ω	>20dB-300Hz >25dB-1KHz >28dB-4KHz	60dB	4.5dB	>25dB 300Hz >34dB 1KHz	0
SPT 181	900Ω	600/600Ω	>20dB-300Hz >25dB-1KHz >28dB-4KHz	60dB	4.5dB	>23dB 300Hz >32dB 1KHz	0
SPT 182	600Ω	600/600Ω	>14dB-300Hz >23dB-1KHz >28dB-4KHz	60dB	4.5dB	>18dB 300Hz >28dB 1KHz	50
SPT 183	900Ω	600/600Ω	>12dB-300Hz >20dB-1KHz >26dB-4KHz	58dB	4.5dB	>17dB 300Hz >27dB 1KHz	50

Dielectric Strength: 1500 VAC (PRI-SEC-CORE)

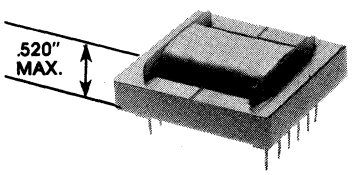
For further information, pricing and delivery, contact Prem's Sales Services Department

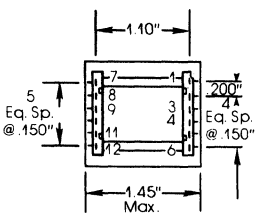
Available from stock.

Very Low Profile Coupling Transformers

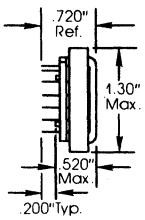
for British Standard and Domestic Applications

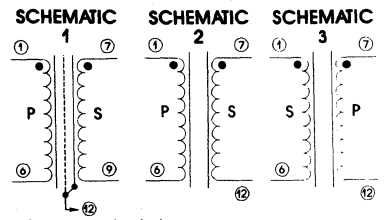
-45 to +7dBm OPERATING LEVEL





All 12 Pins .020"x .027"





Note: Screen constructed with solid copper foil. Ends overlap > 5mm.

INSULATION RESISTANCE
>100MΩ @500 V.D.C.
(BRITISH STANDARD)

LONGITUDINAL BALANCE
MEETS FCC PART 68.310(a)
REQUIREMENTS, TEST
UNIT RL 600Ω.

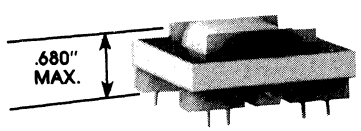
SECONDARY LOAD 600Ω W/D.C. PRI

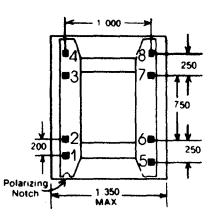
Application	PREM PT. NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX D.C. UNBAL.	INS. LOSS REF.@1KHz	RETURN LOSS MIN@300Hz	ECHO RETURN LOSS MIN.	HARM. DIST. @300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC	SCH. NO.	FREQUENCY RESPONSE 300-3500Hz	DIELECTRIC STRENGTH P-S-CORE	
BRITISH STANDARD	SPT-186*	600	600	1:1	70mA	1.20dB	10.0dB	16.5dB	.1% TYP.	66Ω	66Ω	1	± .6dB	2200VDC ①	
	SPT-1106	600	600	1:1	70mA	1.30dB	8.5dB	15.0dB	.3% TYP.	66Ω	66Ω	1	±1.0dB	2200VDC ①	ECONOMY
	SPT-187*	600	600	1:1.08	70mA	1.20dB	11.0dB	19.0dB	.1% TYP.	66Ω	72Ω	1	± .5dB	2200VDC ①	
	SPT-1107	600	600	1:1.08	70mA	1.30dB	10.0dB	18.0dB	.3% TYP.	66Ω	72Ω	1	±1.0dB	2200VDC ①	ECONOMY
DOMESTIC	SPT-188	600	600	1:1	70mA	1.30dB	12.0dB	16.0dB	.1% TYP.	70Ω	81Ω	2	± .5dB	1500VAC	
	SPT-189	600	600	1:1	60mA	2.00dB	12.0dB	16.5dB	.3% TYP.	75Ω	80Ω	3	± .5dB	1500VAC	
	SPT-1105	600	600	1:1.045	80mA	1.30dB	9.5dB	17.0dB	.5% TYP.	62.4Ω	60.1Ω	2	±1.0dB	1500VAC	

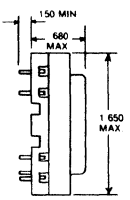
* Prem has supplied SPT 186 and 187 configurations to customers who have BPO approval on their systems; however, usage of SPT 186 and 187 will not guarantee BPO or BSI approval for your specific equipment.
SPT 186 and 187 are also applicable for domestic use.

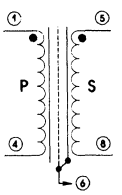
① **DIELECTRIC STRENGTH**
2200 VDC
(1 MINUTE MIN.)
PRI, CORE, SCREEN-SEC
SEC, CORE, SCREEN-PRI

All 8 pins are .025" square









Note: Screen constructed with solid copper foil. Ends overlap > 5mm.

DIELECTRIC STRENGTH
2200 VDC
(1 MINUTE MIN.)
PRI, CORE, SCREEN-SEC
SEC, CORE, SCREEN-PRI

LONGITUDINAL BALANCE
MEETS FCC PART 68.310(a)
REQUIREMENTS, TEST
UNIT RL 600Ω.

INSULATION RESISTANCE
>100MΩ @500 V.D.C.
(BRITISH STANDARD)

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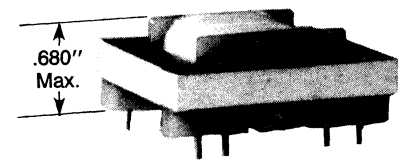
BRITISH STANDARD	SPT-184*	600	600	1:1	120mA	1.30dB	10.0dB	15.0dB	.1% TYP.	63.5Ω	99Ω	±.5dB	
	SPT-198	600	600	1:1	120mA	1.50dB	9.0dB	12.5dB	.3% TYP.	63.5Ω	99Ω	±1.0dB	ECONOMY VERSION
	SPT-185*	600	600	1:1.1036	120mA	1.30dB	11.0dB	18.0dB	.1% TYP.	57.5Ω	99Ω	±.5dB	
	SPT-199	600	600	1:1.1036	120mA	1.50dB	10.0dB	14.5dB	.3% TYP.	57.5Ω	99Ω	±1.0dB	ECONOMY VERSION

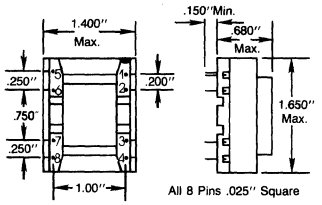
* Prem has supplied SPT 184 and 185 configurations to customers who have BPO approval on their systems; however, usage of SPT 184 and 185 will not guarantee BPO or BSI approval for your specific equipment.
SPT 184 and 185 are also applicable for domestic use.

Low Profile Coupling Transformers

Telecom Australia Approved • Approval #RA-87/117

3750 VAC Dielectric for 1 minute
PRI.—SEC. & PRI.—CORE
>100MΩ Insulation Resistance
—45 to +7dBm Operating Level





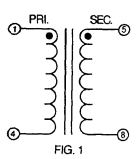


FIG. 1

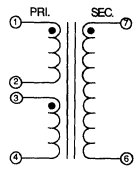


FIG. 2

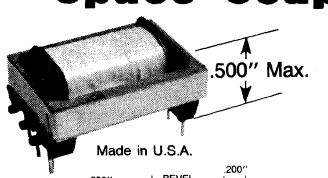
LONGITUDINAL BALANCE

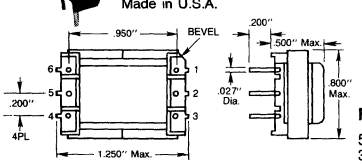
MEETS FCC PART 68.310 (a) REQUIREMENTS

SECONDARY LOAD 600Ω W/D.C. PRI.

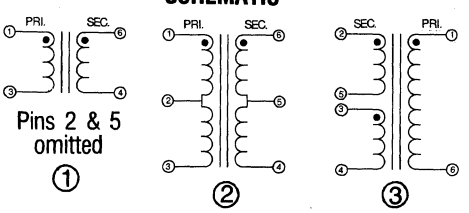
Prem Part No.	IMPEDANCE Pri.	IMPEDANCE Sec.	Turns Ratio ±2%	Max. D.C. Unbal.	Ins. Loss Ref. @1KHz	Return Loss Min. @ 300Hz	Echo Return Loss Min.	Typ. Harm. Dist. @ 300Hz	Resistance ±10% Pri.	Resistance ±10% Sec.	Sch. No.	Frequency Response 300-3500Hz
SPT-1108	600	600	1:1	120mA	1.3dB	10.0dB	14.0dB	.1%	66Ω	105Ω	1	± .5dB
SPT-1109	600	600	1:1	120mA	1.4dB	9.0dB	12.5dB	.3%	66Ω	105Ω	1	±1.0dB
SPT-1110	600	600	1:1	80mA	1.2dB	11.0dB	16.0dB	.1%	67Ω	80Ω	2	± .5dB
SPT-1111	600	600	1:1	80mA	1.3dB	10.0dB	15.0dB	.3%	67Ω	80Ω	2	±1.0dB
SPT-1112	600	600	1:1	80mA	1.2dB	11.0dB	16.0dB	.1%	67Ω	80Ω	1	± .5dB
SPT-1113	600	600	1:1	80mA	1.3dB	10.0dB	15.0dB	.3%	67Ω	80Ω	1	±1.0dB
SPT-1114	600	600	1:1	120mA	1.3dB	10.0dB	14.0dB	.1%	66Ω	105Ω	2	± .5dB
SPT-1115	600	600	1:1	120mA	1.4dB	9.0dB	12.5dB	.3%	66Ω	105Ω	2	±1.0dB

Very Low Profile - Condensed Board Space Coupling Transformers





SCHEMATIC



FREQUENCY RESPONSE
500 - 3500Hz ±1.3dB
300 - 3500Hz ±2.5dB

DIELECTRIC STRENGTH
1500 VAC (PRI-SEC-CORE)

LONGITUDINAL BALANCE
MEETS FCC PART 68.310 (a) REQUIREMENTS.

SECONDARY LOAD 600Ω W/D.C. PRI.

Prem Part No.	IMPEDANCE Pri.	IMPEDANCE Sec.	Turns Ratio ±2%	Max.D.C. Unbal.	Ins. Loss Ref. @1.8KHz	Return Loss Min. @ 1.8KHz	Max. Harm. Dist. @ 300Hz	Resistance ±10% Pri.	Resistance ±10% Sec.	Sch. No.
SPT-2107	600	600	1:1.04	90mA	1.7dB	14.0dB	.5%	75Ω	100Ω	1
SPT-2108	600	600	1:1.04	90mA	1.7dB	14.0dB	.5%	75Ω	100Ω	2
SPT-2109	600	600	1:1.04	90mA	1.7dB	14.0dB	.5%	75Ω	100Ω	3

Voice and Data Transformers for Telephone Interconnect Systems.

These Standard Products are Available from Stock.

For further information and pricing, contact Prem's Sales Services Department

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3521 North Chapel Hill Road
McHenry, Illinois 60050
Phone: (815) 385-2700
TWX 910/642-3763
FAX (815) 385-8578

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MAGNETICS, INCORPORATED

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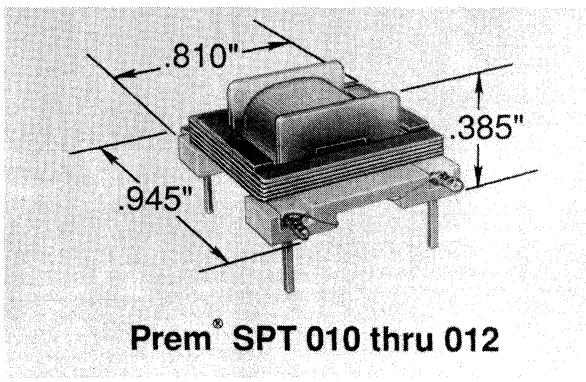
FAX (815) 385-8578

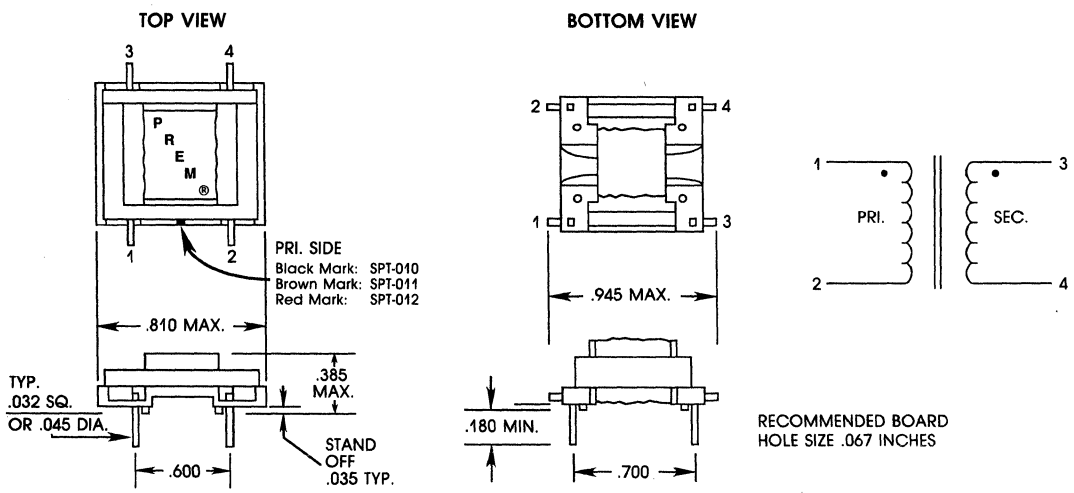
New Sub-Miniature Voice/Data Coupling Transformers

These transformers are ideal for applications requiring minimal use of pc board area and very low above board height. The SPT-010 and SPT-011 are both dry [ODC 600Ω:600Ω] coupling transformers with excellent performance for voice and data applications. The SPT-012 has an impedance ratio of 600Ω:600Ω with a dc current rating of 30mA for data applications. All three parts meet FCC Part 68 dielectric strength and longitudinal balance requirements.



Prem® SPT 010 thru 012

SCHEMATIC



DIELECTRIC STRENGTH
1500 VAC (PRI-SEC-CORE)

LONGITUDINAL BALANCE
MEETS FCC PART 68.310(a) REQUIREMENTS, SPT-010 AND SPT-011 TEST UNIT 0mA and SEC Load 600Ω, SPT-012 TEST UNIT 30mA dc and SEC Load 470Ω.

SECONDARY LOAD ON THE SPT-010 and 011 600Ω, SPT-012 470Ω WITH D.C. PRI

PREM PT. NO.	IMPEDANCE TURNS PRI	SEC	TURNS RATIO (±2%)	MAX dc UNBAL. (mA)	INS. LOSS @ 1KHz	RETURN LOSS MIN.	ECHO RETURN LOSS MIN.	HARM. DIST. @ 300 Hz	RESISTANCE ±10% PRI	SEC	FREQUENCY RESPONSE
SPT-010	600	600	1:1.0428	0	1.5dB ref.	18.5dB @ 300Hz	23.5dB	.3% TYP.	59.3Ω	74.4Ω	300-3500Hz ±0.5dB
SPT-011	600	600	1:1.100	0	1.3dB ref.	25.0dB @ 300Hz	28.0dB	.2% TYP.	62.5Ω	84.5Ω	300-3500Hz ±0.25dB
SPT-012	600	600	1:1	30	2.0dB ±.5dB	16.0dB @ 1800Hz	15.0dB	.1% TYP.	108.0Ω	131.3Ω	300-600Hz ±2.0dB 600-3500Hz ±0.65dB

For further information, pricing and delivery, contact Prem's Sales Service Department

Available from stock

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Also Available from Prem Magnetics:

Low Cost Inductors

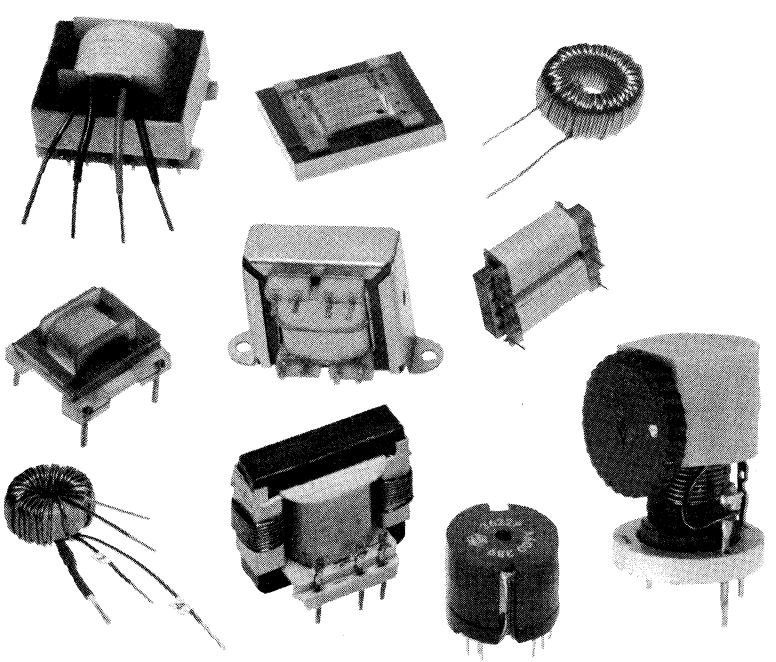
Write or call for information on our standard low cost inductors:

- PC-mountable inductors with ferrite-core construction
- Economically priced
- Inductors utilize drum-core, slug-core and bobbin-core construction
- Wide-band shield-bead ferrite chokes
- Physical, electrical specifications and available options

Custom Designed Transformers and Inductors

Any Prem standard component can be modified to fit your needs. Or, our experienced engineering staff can create a custom design just for you. Send for our Custom Quotation Specification Sheet or call our engineering staff to discuss a component that will meet your needs economically.

- Audio (impedance matching) transformers
- Telephone coupling transformers
- High current inductors
- Specialty power transformers
- Linearity and width coils for CRT applications
- PC power transformers
- Pot core assemblies
- Horizontal oscillator and driver transformers for CRT applications
- Toroidal assemblies
- Miniature transformers
- RF Coils



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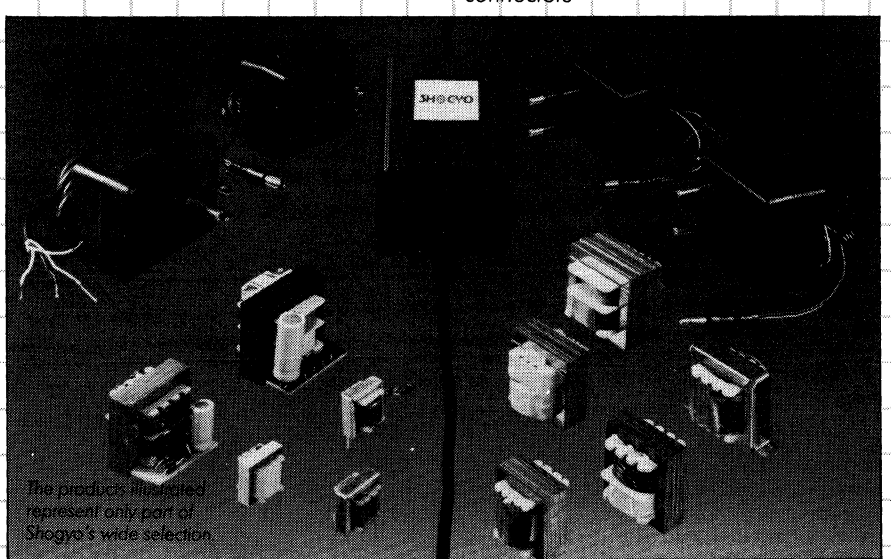
Your design deserves Shogyo quality and reliability.
You deserve...
Shogyo Service...comprehensive, responsive and fast
Shogyo Professionalism...the helpful experience you need
Shogyo Prices...always competitive, usually better
and...
Shogyo Selection...with complete custom design capabilities

Including a diverse offering of UL/CSA approved:

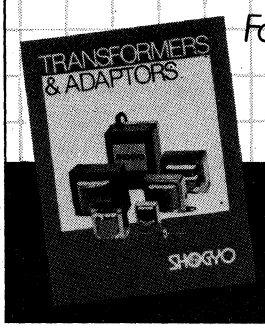
- *Power transformers:*
  standard core sizes from EI-28 to EI-86, Nylon 66, PBT or Phinolic bobbin materials, channel frame or PCB mounting, enclosures with or without endbells, and UL recognized AWM, terminal, or pin connections
- *Double protection power transformers:*
  conform with UL 1411 seven hours construction and abnormal test requirements, 3500V dielectric test voltage
- *Line matching transformers:*
  70.7 and 25 volt, maximum power levels from 2 to 16 watts, standard core sizes from EI-41 to EI-66, and a secondary impedance of 8 ohms
- *Telephone coupling transformers:*
  high quality low insertion loss, core sizes from EI-19 to EI-35, frequency response of 300–3500Hz ± 3dBa, and a secondary impedance of 500, 600, or 900 ohms
- *Lamp ballast transformers:*
  UL 935 listed simple reactance coil type
- *Wall-mount, plug-in adapters:*
  European or American, 120V, 50/60Hz inputs, outputs from 3VDC to 24VDC, 100mA to 1.7Amp, and 0.3 to 14.4 watts

And featuring:

- *PC pin, solder leg mount or lead wire connections*
- *A complete line of mating cords and terminating plug connectors*



The products illustrated represent only part of Shogyo's wide selection.



For immediate assistance and specific information on the product(s) you require:
Dial 516-466-0911 or FAX 516-466-0922

For complete product listings and specifications, request our free catalog.

SPECIFY SHOGYO. ELECTRONIC COMPONENTS AS GOOD AS YOUR DESIGN.
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SHOGYO

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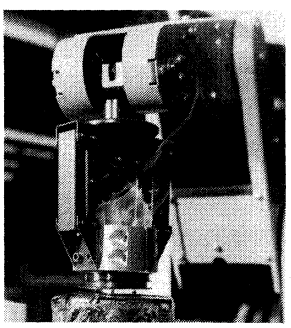
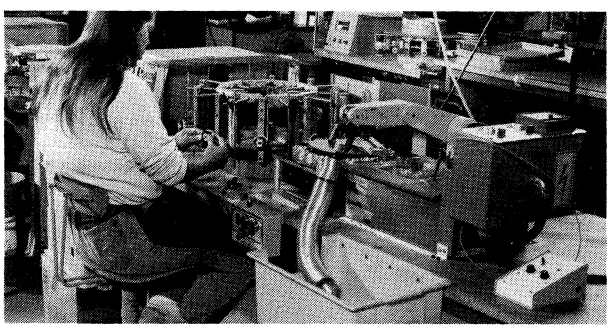


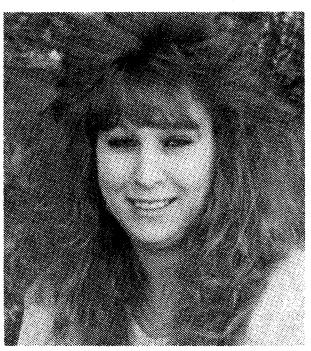


The robot tins the coil's three 3/8-inch leads at one time with repetitive precision.

If we don't make your job easier, we don't deserve your business.

Just call Renco's Rhonda Rizzo or Ed Rensing or Chris Lubicich for a quote on your transformer or coil requirement.

You'll be assigned a caring person to responsibly handle all the details of your account. If you have a technical problem that can't be solved by phone, we'll send an engineer across the country to help. In price and delivery, we keep our word: If there develops an unforeseen delay, we tell you early so you can make a timely decision. Standard samples go out same-day as your request; "customs" depend on complexity. Our application engineers will help your engineers even if you have to buy elsewhere: You'll remember us when your next requirement is in our domain. We've been doing business this way for over 30 years.



Rhonda Rizzo

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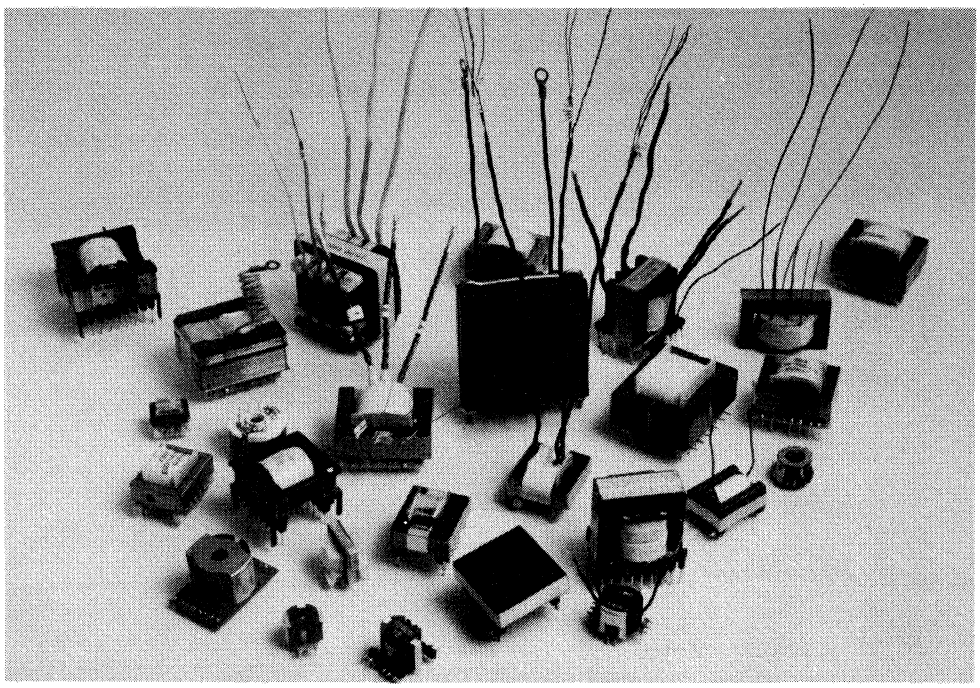

PQ, ETD, pot core, toroidal, LP, RM, EC, EP, EE, EI from 2 KHz to 1 MHz, up to 750W

If you can describe your custom transformer need, we can make it. And if you can't describe it in sufficient detail, we'll gladly help you. Just tell us what your application requires and rely on our 32 years experience to come up with the right solution. Although we offer over 1500 standard coils and transformers in our catalog, a major segment of our business is, and has always been, the design and production of "specials" to meet customers' needs.

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After extensive research, we selected six standard ferrite "E" cores which are good for most applications at all popular switching frequencies; and glass filled nylon bobbins, which have excellent rigidity and high temperature performance, and can easily be mounted on printed circuit boards.

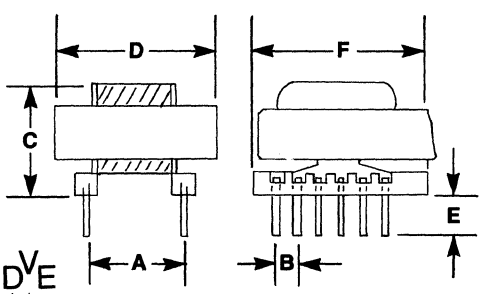
With these cores and bobbins we can custom-design your transformers, and normally ship prototypes to you within ten days. Since we always have large stocks of cores and bobbins on hand, you'll get fast delivery on your complete order. And since we buy in volume, you're never charged a premium, even for small quantity orders.

And your transformers are wound on custom engineered equipment that ensures conformance to requirements.

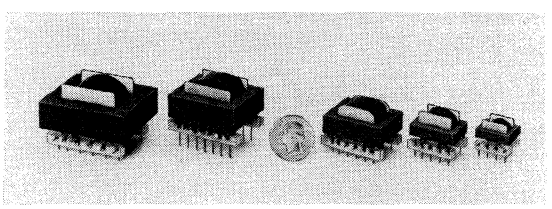
Other companies have copied this system. But none offer nearly as much engineering assistance as we do. All you have to do is give us your bare specs, and we'll translate them into transformers.

And none have nearly as much experience as we do. We've been exclusively engaged in the design and manufacture of coil wound products for over 30 years. So when you come to us you can be certain that your transformers will be exactly right for your application.

Just call our Engineering Hotline (800-645-5828 outside of New York State; in New York, call 516-586-5566) and tell us your requirements. Note: a small charge may be required on some designs.



DVE designs



RL-1287-6 not shown in photo.

Recognized under the Component Program of Underwriters Laboratories Inc. Insulation Class B

STYLE NUMBER	TYPICAL DIMENSIONS							TERMINAL
	A	B	C	D	E	F	NO.	SIZE
RL-1287-1	.515	.200	.660	.650	.175	.780	8*	.025 SQ.
RL-1287-2	.630	.200	.830	.770	.175	1.030	10*	.025 SQ.
RL-1287-3	.800	.200	.915	1.140	.175	1.375	12*	.025 SQ.
RL-1287-4	1.000	.200	1.050	1.325	.375	1.700	14	.025 SQ.
RL-1287-5	1.100	.300	1.300	1.700	.185	2.000	12*	.025 SQ.
RL-1287-6	1.300	.300	1.500	2.000	.250	2.300	12*	.025 SQ.

All Dimensions in Inches *Pin 1 — 2 spacing is less for polarity

DESIGN NOTES:
1 - Primary to secondary isolation 1500V RMS Min.
2 - All designs meet Class B requirements (130°C).
3 - Encapsulation available.
4 - Winding to core isolation 2500V RMS Min.
5 - Higher isolation voltages available.
6 - Higher temperature classes available.

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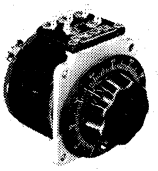
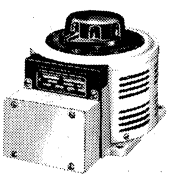
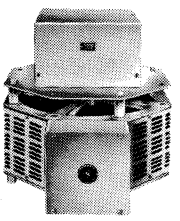
POWERSTAT Variable Transformers are designed to deliver continuously adjustable voltage from a-c power lines. They introduce no waveform distortion and feature rugged construction, precious metal plated commutators, excellent regulation, high efficiency and conservative ratings. All manually operated types listed in the charts except the 10C-12 Series are available with motor drives if desired. Motor-driven speeds are 5, 15, 30 or 60 seconds for full range travel on all except types having -4, -5, or -6 suffixes which do not offer the 5-second speed. Single types in the 116C-216C, 117C-217C, 126-226 and 136B-236B Series are also offered with 3-wire cord-plug sets. 1156D-1256D Series types are available in ratings to 244 kva.



TYPE 21



TYPE 136BT



TYPE 5MB1156DT

RATINGS AND SPECIFICATIONS

INPUT		OUTPUT					TYPE	Ship. Wt. Lbs.
			Const. Current Load		Const. Impedance Load			
Volts	Hertz	Volts	Max. Amp.	Max. KVA	Max. Amp.	Max. KVA		
10C-12 SERIES								
Single Phase								
120	50/60	0-120	2.25*	0.27	3‡	0.36	✓ 10C	21/2
120	60	0-132	2.25*	0.30	—	—		
240	50/60	0-240	0.7*	0.17	0.9‡	0.22	✓ 12	21/2
240	50/60	0-264	0.5**	0.13	—	—		
240	50/60	0-240	2.25*	0.54	3‡	0.72	10C-2	6
240	60	0-264	2.25*	0.59	—	—		
480	50/60	0-480	0.7*	0.34	0.9‡	0.43	12-2	6
480	50/60	0-528	0.5**	0.26	—	—		
Three Phase								
120	50/60	0-120	2.25*	0.47	3‡	0.62	10C-2	6
120	60	0-132	2.25*	0.51	—	—		
240	50/60	0-240	0.7*	0.29	0.9‡	0.37	✓ 12-2	6
240	50/60	0-264	0.5**	0.23	—	—		
240	60	0-240	2.25*	0.94	3‡	1.2	10C-3	81/2
480	50/60	0-480	0.7*	0.58	0.9‡	0.75	12-3	81/2
480	60	0-528	0.5**	0.46	—	—		
21-22 SERIES								
Single Phase								
120	50/60	0-120	4.5	0.60	6.5	0.84	✓ 21	6
120	50/60	0-140	4.5	0.70	—	—		
240	50/60	0-240	2.25	0.54	3.25	0.78	✓ 22	6
240	50/60	0-280	2.25	0.63	—	—		
240	50/60	0-240	4.5	1.2	6.5	1.7	✓ 21-2	131/2
240	50/60	0-280	4.5	1.4	—	—		
480	50/60	0-480	2.25	1	3.25	1.6	22-2	131/2
480	50/60	0-560	2.25	1.3	—	—		
Three Phase								
120	50/60	0-120	4.5	1.0	6.5	1.5	21-2	131/2
120	50/60	0-140	4.5	1.2	—	—		
240	50/60	0-240	2.25	0.94	3.25	1.4	22-2	131/2
240	50/60	0-280	2.25	1.1	—	—		
240	50/60	0-240	4.5	2.1	6.5	2.9	21-3	19
240	60	0-280	4.5	2.4	—	—		
480	50/60	0-480	2.25	1.9	3.25	2.7	✓ 22-3	19
480	60	0-560	2.25	2.2	—	—		

INPUT		OUTPUT					TYPE	Ship. Wt. Lbs.
			Const. Current Load		Const. Impedance Load			
Volts	Hertz	Volts	Max. Amp.	Max. KVA	Max. Amp.	Max. KVA		
116C-216C and 117C-217C SERIES†								
Single Phase								
120	50/60	0-120	10	1.2	13	1.6	116CT	12
120	50/60	0-140	10	1.4	—	—	✓ 116CU	
120	60	0-120	12	1.4	15	1.8	117CT	12
							✓ 117CU	
240	50/60	0-240	3.5	0.84	5	1.2	216CT	12
240	50/60	0-280	3.5	0.98	—	—	✓ 216CU	
240	60	0-240	5	1.2	7	1.7	217CT	12
							217CU	
240	50/60	0-240	10	2.4	13	3.1	✓116CU-2	24
240	50/60	0-280	10	2.8	—	—		
240	60	0-240	12	2.9	15	3.6	117CU-2	24
480	50/60	0-480	3.5	1.7	5	2.4	216CU-2	24
480	50/60	0-560	3.5	2.0	—	—		
480	60	0-480	5	2.4	7	3.4	217CU-2	24
Three Phase								
120	50/60	0-120	10	2.1	13	2.7	116CU-2	24
120	50/60	0-140	10	2.4	—	—		
120	60	0-120	12	2.5	15	3.1	117CU-2	24
240	50/60	0-240	3.5	1.5	5	2.1	216CU-2	24
240	50/60	0-280	3.5	1.7	—	—		
240	60	0-240	5	2.1	7	2.9	217CU-2	24
240	50/60	0-240	10	4.2	13	5.4	116CU-3	36
240	60	0-280	10	4.8	—	—		
240	60	0-240	12	5.0	15	6.2	117CU-3	36
480	50/60	0-480	3.5	2.9	5	4.2	216CU-3	36
480	60	0-560	3.5	3.4	—	—		
480	60	0-480	5	4.2	7	5.8	217CU-3	36
40-VOLT SERIES								
Single Phase								
40	60	0-40	7	0.28	9	0.36	✓ 10C-40	31/2
			18	0.72	22	0.88	✓ 21-40	6

LW136B SERIES

INPUT		OUTPUT‡‡			TYPE	Ship. Wt. Lbs.
Volts	Hertz	Volts	Max. Amps.	Max. KVA		
Single Phase						
120 240	50/60	15-0-15	35	0.52	✓LW136B	25
120 240	50/60	0.30	25	0.75		

✓LW136B Series ratings are for use as low voltage isolated output transformer.

*Rating when mounted on metal panel. On bracket or nonmetallic panel, derate 10C Series to 1.75 amp., 12 Series to 0.5 amp.

‡Rating when mounted on metal panel. On bracket or nonmetallic panel, derate 10C Series to 2.5 amp., 12 Series to 0.75 amp.

**0.7 amp. maximum in range from 0 to line voltage when mounted on metal panel.

†Also available with open construction. Suffix U when ordering.

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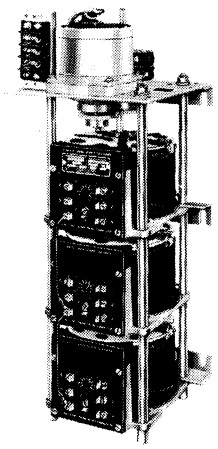
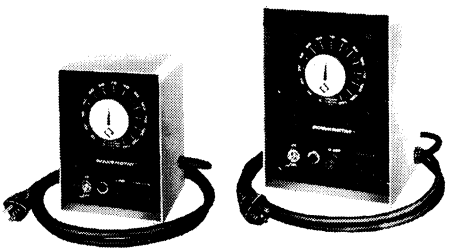


MOTOR-DRIVEN U TYPES

ENCLOSED TYPES



Designed to meet OSHA requirements. Portable 120 volt, single-phase units have grounded NEMA cord-plug assembly, on-off switch, grounded output receptacle, pilot light and fuse. Panel controls are recessed for protection from accidental bumping. Slots at rear for wall hanger brackets. Type L10C rated 0-132 volts, 2.0 amp; type L21C rated 0-140 volts, 4.5 amp; type L116C rated 0-140 volts, 10 amp. All available off-the-shelf from distributor stock.

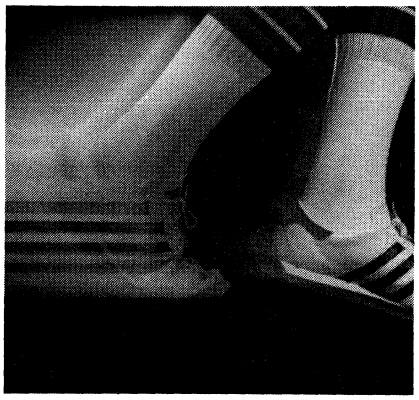
INPUT		OUTPUT						
			Const. Current Load		Const. Impedance Load			
Volts	Hertz	Volts	Max. Amp.	Max. KVA	Max. Amp.	Max. KVA	TYPE	Ship. Wt. Lbs.
126-226 SERIES†								
Single Phase								
120 120	50/60 50/60	0-120 0-140	15 15	1.8 2.1	20 —	2.4 —	✓126	17
240 240	50/60 50/60	0-240 0-280	7.5 7.5	1.8 2.1	10 —	2.4 —	✓226	17
240 240	50/60 50/60	0-240 0-280	15 15	3.6 4.2	20 —	4.8 —	126-2	32
480 480	50/60 50/60	0-480 0-560	7.5 7.5	3.6 4.2	10 —	4.8 —	✓226U-2	32
Three Phase								
120 120	50/60 50/60	0-120 0-140	15 15	3.1 3.6	20 —	4.2 —	126-2	32
240 240	50/60 50/60	0-240 0-280	7.5 7.5	3.1 3.6	10 —	4.2 —	✓226U-2	32
240 240	50/60 60	0-240 0-280	15 15	6.2 7.3	20 —	8.3 —	126-3	49
480 480	50/60 60	0-480 0-560	7.5 7.5	6.2 7.3	10 —	8.3 —	✓226T-3	49
136-236B SERIES†								
Single Phase								
120 120	50/60 50/60	0-120 0-140	22 22	2.6 3.1	28 —	3.4 —	✓136B	25
120 120	50/60 50/60	0-120 0-140	44 44	5.3 6.2	56 —	6.7 —	136B-2§	52
240 240	50/60 50/60	0-240 0-280	10 10	2.4 2.8	13 —	3.1 —	✓236B	25
240 240	50/60 50/60	0-240 0-280	22 22	5.3 6.2	28 —	6.7 —	✓136B-2	52
480 480	50/60 50/60	0-480 0-560	20 20	4.8 5.6	26 —	6.2 —	✓236B-2	52
Three Phase								
120 120	50/60 50/60	0-120 0-140	22 22	4.6 5.3	28 —	5.8 —	✓136B-2	52
240 240	50/60 50/60	0-240 0-280	10 10	4.2 4.8	13 —	5.4 —	✓236B-2	52
240 240	50/60 60	0-240 0-280	22 22	9.1 10.7	28 —	11.6 —	✓136B-3	76
480 480	50/60 60	0-480 0-560	10 10	8.3 9.7	13 —	10.8 —	✓236B-3	76
146-246 SERIES†								
Single Phase								
120 120	50/60 50/60	0-120 0-140	30 30	3.6 4.2	35 —	4.2 —	✓146	38
120 120	50/60 50/60	0-120 0-140	60 60	7.2 8.4	70 —	8.4 —	146-2§§	83
240 240	50/60 50/60	0-240 0-280	15 15	3.6 4.2	19 —	4.6 —	✓246	38
240 240	50/60 50/60	0-240 0-280	30 30	7.2 8.4	35 —	8.4 —	146-2	83
480 480	50/60 50/60	0-480 0-560	15 15	7.2 8.4	19 —	9.1 —	246-2	83

INPUT		OUTPUT						
			Const. Current Load		Const. Impedance Load			
Volts	Hertz	Volts	Max. Amp.	Max. KVA	Max. Amp.	Max. KVA	TYPE	Ship. Wt. Lbs.
146-246 SERIES† (cont'd.)								
Three Phase								
120 120	50/60 50/60	0-120 0-140	30 30	6.2 7.3	35 —	7.3 —	146-2	83
240 240	50/60 50/60	0-240 0-280	15 15	6.2 7.3	19 —	7.9 —	246-2	83
240 240	50/60 60	0-240 0-280	30 30	12.5 14.5	35 —	14.5 —	146-3	125
480 480	50/60 60	0-480 0-560	15 15	12.5 14.5	19 —	15.8 —	246-3	125
1156D-1256D SERIES†								
Single Phase								
120 120	50/60 50/60	0-120 0-140	50 50	6.0 7.0	55 —	6.6 —	✓1156D	82
120 120	50/60 50/60	0-120 0-140	100 100	12.0 14.0	110 —	13.2 —	1156D-2P	169
120 120	50/60 50/60	0-120 0-140	150 150	18.0 21.0	165 —	19.8 —	1156D-3P	272
240 240	50/60 50/60	0-240 0-280	28 28	6.7 7.8	28 —	6.7 —	✓1256D	82
240 240	50/60 50/60	0-240 0-280	50 50	12.0 14.0	55 —	13.2 —	1156D-2S	156
240 240	50/60 50/60	0-240 0-280	56 56	13.4 15.7	56 —	13.4 —	✓1256D-2P	169
240 240	50/60 50/60	0-240 0-280	84 84	20.2 23.5	84 —	20.2 —	1256D-3P	272
240 240	50/60 50/60	0-240 0-280	100 100	24.0 28.0	110 —	26.4 —	1156D-4PS	361
480 480	50/60 50/60	0-480 0-560	28 28	13.4 15.7	28 —	13.4 —	✓1256D-2S	156
480 480	50/60 50/60	0-480 0-560	56 56	26.9 31.4	56 —	26.9 —	1256D-4PS	361
Three Phase								
120 120	50/60 50/60	0-120 0-140	50 50	10.4 12.1	55 —	11.4 —	1156D-2D	155
240 240	50/60 50/60	0-240 0-280	28 28	11.6 13.6	28 —	11.6 —	✓1256D-2D	155
240 240	50/60 60	0-240 0-280	50 50	20.8 24.2	55 —	22.9 —	✓1156D-3Y	230
240 240	50/60 50/60	0-240 0-280	100 100	41.6 48.5	110 —	45.7 —	1156D-6Y	507
480 480	50/60 60	0-480 0-560	28 28	23.3 27.2	28 —	23.3 —	✓1256D-3Y	235
480 480	50/60 60	0-480 0-560	56 56	46.6 54.3	56 —	46.6 —	1256D-6Y	507

†Also available with open construction. Suffix U when ordering.
§Requires also one paralleling choke type T5000.
§§Requires also one paralleling choke type T6053.

✓ AVAILABLE OFF-THE-SHELF FROM DISTRIBUTOR STOCK

THE SIGNAL WAY OF DOING BUSINESS



PRONTO 24-Hour Shipment

We have long recognized that, in most instances, engineers and buyers need immediate delivery of transformers and chokes. To meet this challenge, Signal maintains an extensive inventory of every item in this catalog – over 1,000 different transformers and chokes. More importantly, we're dedicated to shipping out each and every order (moderate quantities) within 24 hours: and we can usually fill your entire order. We call this service "PRONTO." Last year we shipped over 20,000 such orders and we didn't disappoint anyone.

How and Why We Are Able to Maintain Our Low Price Policy

At Signal, we sell direct. There are no salesmen, or distributors – no middlemen, no extra mark-ups. We pass the savings on to you. We answer your questions directly. There is no chance of misinterpretation and you get fast, accurate answers. We maintain larger inventories than any distributors could. We're able to react to your order requirements more quickly and efficiently. These savings have enabled us to install modern machinery, specify better materials and continuously invest in new R & D. In this manner, our prices are kept as low as possible. We both profit from this policy.

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Signal has always been the leader in recognizing future trends in the industry. And we have successfully pioneered the development of revolutionary new products such as:

■**SPLIT/TRAN®** Split bobbin PC Board Transformers featuring non-concentric windings

■**FLATHEAD®** Low profile, split bobbin designs for low height and closer board stacking

■**2-4-1™ Series** Lower cost/more efficient power transformers.

All of these have subsequently become industry standards. Now we are pleased and proud to announce two new series of transformers designed to meet all international standards as well as the new, emerging generation of UL standards. Our VDE certified **ONE-4-ALL™** Series, uses dual bobbins and an insulating shroud to meet international standards. It withstands a 4,000 VRMS test voltage and gives even better isolation and performance than our previous split bobbin types. At lower cost.

The same principal has been extended to our **MORE-4-LESS™** line featured on the opposite page. Our FLATHEAD Series has been expanded to higher power levels to accommodate the demand for higher PC board power densities. All of this is renewed confirmation of Signal's leadership in setting the standards for the entire electronic transformer industry.

CUSTOM ORDERS

We also recognize that no matter how hard we try, it is impossible to anticipate everyone's needs. Therefore, we are eager to discuss and evaluate your transformer and choke requirements. If we can't recommend a standard product that will do the job and save you money and time, we'll gladly quote on your requirement. Many times all that is needed is a modification of one of our standards. Again, you will get consistently high quality and very competitive prices, whether your order is for 10 or 10,000 pieces.

We don't have anyone out in the field telling you how good we are. We have to prove it to you by deed. Thank you for considering Signal.

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CONTENTS (See Following Pages)

- ■International Series with Lower Cost & Better Performance
  - More-4-Less® High Power
  - One-4-All® P.C.B. & Chassis Mount
- ■P.C. Board Power Transformers
  - FLATHEAD® – Low Profile
  - SPLIT/TRAN® – High Isolation
  - Standard Miniature
- ■Lightweight/Low-Cost Small Power Transformers("2-4-1" Series)
- ■Transformers for Triple-Output Regulated DC Supplies
- ■Rectifier Power Transformers
- ■Chokes
  - Filter
  - Dual
- ■Step-down Auto Transformers
- ■Industrial Grade Power Isolation Transformers
- ■Custom Transformers
- ■Price List

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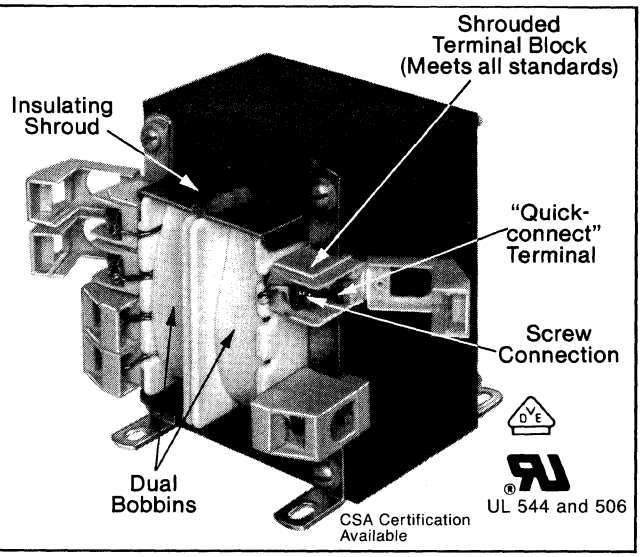


Signal's M4L Line is designed with the following "ingredients":

- Grain-Oriented Low Loss, High Saturation Steel
- High Temperature Magnet Wire
- Dual High Temperature Bobbins & Insulating Shroud
- Rugged Dual Terminals (Screw or Quick-Connect) that have international approvals (VDE, IEC, etc.) **AND**
- Superior Electrical & Manufacturing Engineering meeting UL, CSA, VDE, IEC and all international standards.

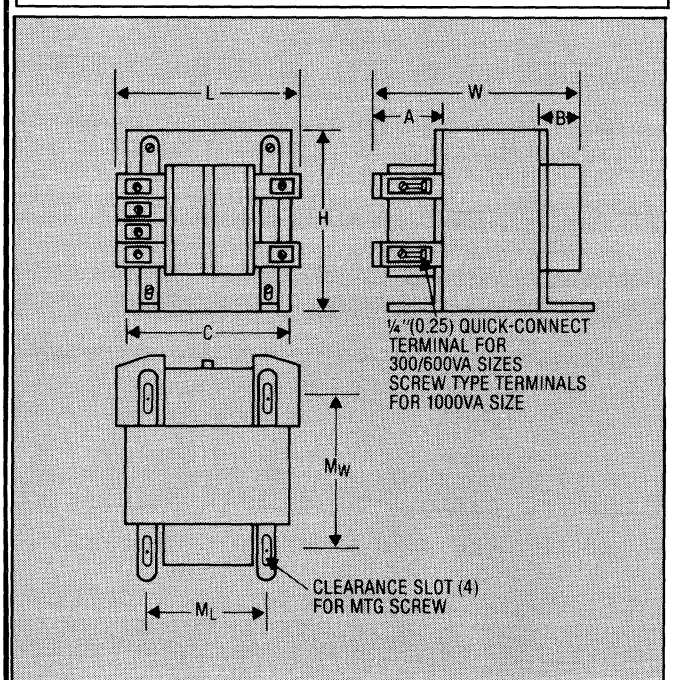
Which accomplish further savings by:

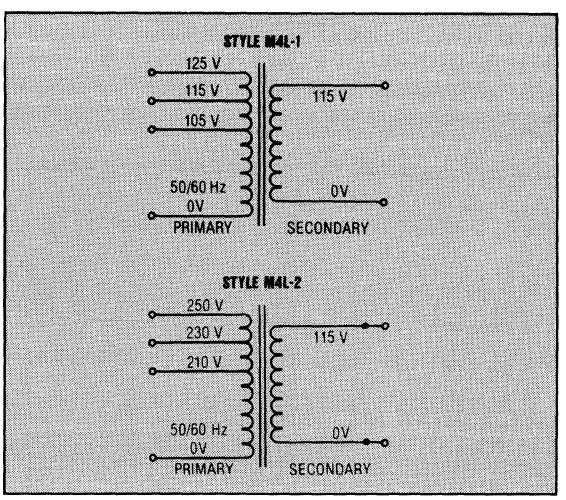
- Reducing the amount of steel and copper required for a given power rating
- Eliminating hand applied tapes, pads or cross-over insulation
- Reducing winding & lead terminating time.

All of which leads to more:

- ■Efficiency
- ■Isolation (4000v RMS TEST)
- ■Safety Standards (meets UL, VDE, CSA, IEC, etc.)

AND Approximately ⅓ less space & weight. Hence, we call it the More-4-Less Series.





Part Number* 115V Nominal	Part Number* 230V Nominal	VA	Secondary RMS Rating	L	W	H	A	B	C	Mtg. ML	Mtg. MW	Mtg. Screw	Lbs.
M4L-1-3	M4L-2-3	300	115V @ 2.6A	3½	3⅞	3¾	1⅛	⅝	3⅛	2½	3⅛	#10	7.0
M4L-1-6	M4L-2-6	600	115V @ 5.2A	3⅞	4 15/16	4½	1 3/16	¾	3¾	3	4 1/16	#10	14.3
M4L-1-10	M4L-2-10	1000	115V @ 8.7A	5⅜	5⅞	5¼	1½	⅞	4⅜	3½	4 11/16	¼	22.0

*Less expensive versions with wire leads that do not meet VDE are available on special order.

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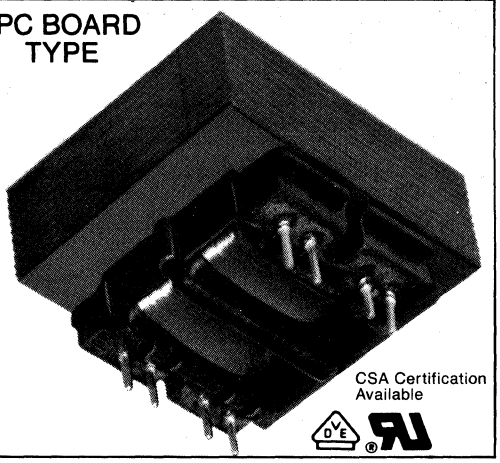
PC BOARD TYPE



CSA Certification Available

Signal's International Series of transformers is designed and constructed to meet all U.S. and international standards such as UL, VDE, IEC and CSA. This is accomplished by two factors:

1. The dual bobbin construction including an overall insulating shroud as indicated in the exploded view of constructional details.
2. The use of highly stable, high temperature material which more than meets UL flammability requirements.

The insulation system results in very high isolation between primary and secondary windings and from either to the core (or ground). **Hipot Test is 4000v RMS.** The dual bobbin non-concentric design reduces capacitance and eliminates the need for an electrostatic-shield.

These parts are available in both PC Board and Chassis Mount types from 2.5 to 175 va. Coil winding and wire termination are simplified by the bobbin construction and the method of winding. The dual windings, when possible, are wound "bifilar" so that **all anchor and insulating tapes are eliminated.**

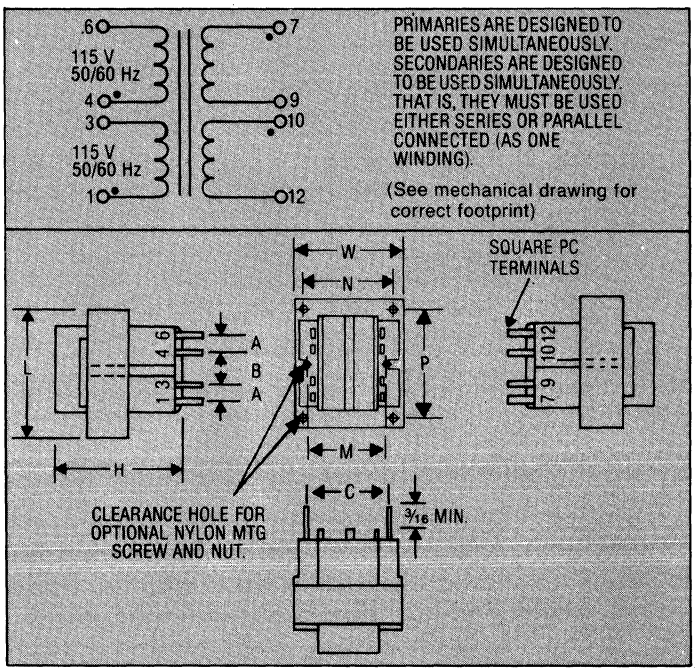
Also, since the windings are electrically balanced, there are no primary circulating currents and, if the secondaries are series-connected for a FWCT rectifier, the balance makes filtering easier.

The bobbin wall slots allow for all leads to be brought out of the winding area for termination. As a result, **all wire crossovers and insulating pads are eliminated.** The insulating shroud positions both bobbins accurately for core stacking and also provides the barriers for the 4000v RMS Test Voltage.

These design improvements lower manufacturing costs. As a result, the series is truly universal and can be sold at lower prices than previous "split bobbin" and "PC" types.

Again, Signal is there first – with the best – and at lower cost.

Part No.	VA (Size)	Secondary RMS Rating	
		Series	Parallel
14A-2.5-10	2.5	10V C.T. @ 0.25A	5V @ 0.5A
14A-5.0-10	5.0	10V C.T. @ 0.5A	5V @ 1.0A
14A-10-10	10.0	10V C.T. @ 1.0A	5V @ 2.0A
14A-20-10	20.0	10V C.T. @ 2.0A	5V @ 4.0A
14A-30-10	30.0	10V C.T. @ 3.0A	5V @ 6.0A
14A-56-10	56.0	10V C.T. @ 5.6A	5V @ 11.2A
14A-2.5-12	2.5	12.6V C.T. @ 0.2A	6.3V @ 0.4A
14A-5.0-12	5.0	12.6V C.T. @ 0.4A	6.3V @ 0.8A
14A-10-12	10.0	12.6V C.T. @ 0.8A	6.3V @ 1.6A
14A-20-12	20.0	12.6V C.T. @ 1.6A	6.3V @ 3.2A
14A-30-12	30.0	12.6V C.T. @ 2.4A	6.3V @ 4.8A
14A-56-12	56.0	12.6V C.T. @ 4.4A	6.3V @ 8.8A
14A-2.5-16	2.5	16V C.T. @ 0.15A	8V @ 0.3A
14A-5.0-16	5.0	16V C.T. @ 0.31A	8V @ 0.62A
14A-10-16	10.0	16V C.T. @ 0.62A	8V @ 1.25A
14A-20-16	20.0	16V C.T. @ 1.25A	8V @ 2.5A
14A-30-16	30.0	16V C.T. @ 1.9A	8V @ 3.8A
14A-56-16	56.0	16V C.T. @ 3.5A	8V @ 7.0A
14A-2.5-20	2.5	20V C.T. @ 0.12A	10V @ 0.24A
14A-5.0-20	5.0	20V C.T. @ 0.25A	10V @ 0.5A
14A-10-20	10.0	20V C.T. @ 0.5A	10V @ 1.0A
14A-20-20	20.0	20V C.T. @ 1.0A	10V @ 2.0A
14A-30-20	30.0	20V C.T. @ 1.5A	10V @ 3.0A
14A-56-20	56.0	20V C.T. @ 2.8A	10V @ 5.6A
14A-2.5-24	2.5	24V C.T. @ 0.1A	12V @ 0.2A
14A-5.0-24	5.0	24V C.T. @ 0.21A	12V @ 0.42A
14A-10-24	10.0	24V C.T. @ 0.42A	12V @ 0.84A
14A-20-24	20.0	24V C.T. @ 0.83A	12V @ 1.66A
14A-30-24	30.0	24V C.T. @ 1.25A	12V @ 2.50A
14A-56-24	56.0	24V C.T. @ 2.33A	12V @ 4.66A
14A-2.5-28	2.5	28V C.T. @ 0.09A	14V @ 0.18A
14A-5.0-28	5.0	28V C.T. @ 0.18A	14V @ 0.36A
14A-10-28	10.0	28V C.T. @ 0.36A	14V @ 0.72A
14A-20-28	20.0	28V C.T. @ 0.72A	14V @ 1.44A
14A-30-28	30.0	28V C.T. @ 1.06A	14V @ 2.12A
14A-56-28	56.0	28V C.T. @ 2.0A	14V @ 4.0A
14A-2.5-36	2.5	36V C.T. @ 0.07A	18V @ 0.14A
14A-5.0-36	5.0	36V C.T. @ 0.14A	18V @ 0.28A
14A-10-36	10.0	36V C.T. @ 0.28A	18V @ 0.56A
14A-20-36	20.0	36V C.T. @ 0.56A	18V @ 1.12A
14A-30-36	30.0	36V C.T. @ 0.82A	18V @ 1.64A
14A-56-36	56.0	36V C.T. @ 1.56A	18V @ 3.12A



Dimensions							Pin	Mtg.			Mtg. Screw		
VA	L	W	H	A	B	C	Dimensions	M	N	P	Size	Quantity	Lbs.
2.5	1 5/8	1 5/16	1 1/8	.200	.250	1.000	0.025SQ	1 1/16	—	—	#4	2	0.25
5.0	1 5/8	1 5/16	1 3/8	.200	.400	1.000	0.025SQ	1 1/16	—	—	#4	2	0.37
10.0	1 7/8	1 9/16	1 3/8	.200	.400	1.140	0.038SQ	1 1/4	—	—	#4	2	0.53
20.0	2 1/4	1 7/8	1 5/8	.400	.400	1.460	0.038SQ	1 1/2	—	—	#4	2	0.90
30.0	2 5/8	2 3/16	1 9/16	.550	.275	1.680	0.045SQ	—	1 3/4	2 3/16	#6	4	1.15
56.0	3	2 1/2	1 13/16	.600	.300	1.900	0.045SQ	—	2	2 1/2	#6	4	1.70

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...series transformers

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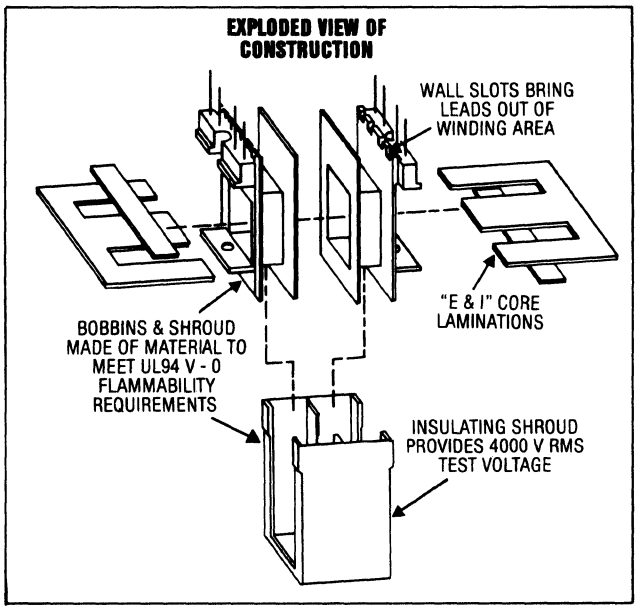
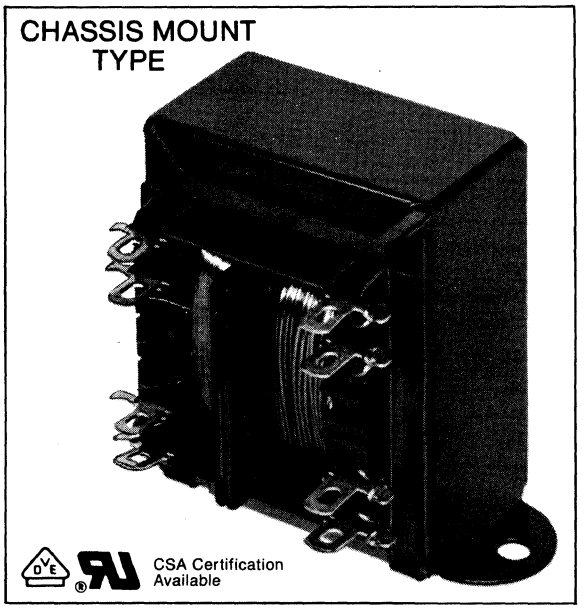
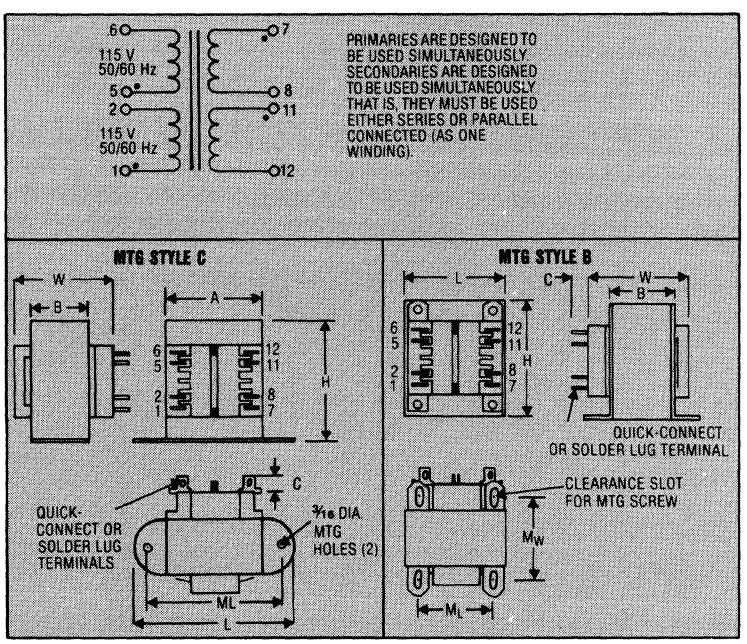




Part No.	VA (Size)	Secondary RMS Rating Series	Parallel
A41-25-10	25	10V C.T. @ 2.5A	5V @ 5.0A
A41-43-10	43	10V C.T. @ 4.3A	5V @ 8.6A
A41-80-10	80	10V C.T. @ 8.0A	5V @ 16.0A
A41-130-10	130	10V C.T. @ 13.0A	5V @ 26.0A
A41-175-10	175	10V C.T. @ 17.5A	5V @ 35.0A
A41-25-12	25	12.6V C.T. @ 2.0A	6.3V @ 4.0A
A41-43-12	43	12.6V C.T. @ 3.4A	6.3V @ 6.8A
A41-80-12	80	12.6V C.T. @ 6.3A	6.3V @ 12.6A
A41-130-12	130	12.6V C.T. @ 10.3A	6.3V @ 20.6A
A41-175-12	175	12.6V C.T. @ 14.0A	6.3V @ 28.0A
A41-25-16	25	16V C.T. @ 1.6A	8V @ 3.2A
A41-43-16	43	16V C.T. @ 2.7A	8V @ 5.4A
A41-80-16	80	16V C.T. @ 5.0A	8V @ 10.0A
A41-130-16	130	16V C.T. @ 8.1A	8V @ 16.2A
A41-175-16	175	16V C.T. @ 11.0A	8V @ 22.0A
A41-25-20	25	20V C.T. @ 1.25A	10V @ 2.5A
A41-43-20	43	20V C.T. @ 2.2A	10V @ 4.4A
A41-80-20	80	20V C.T. @ 4.0A	10V @ 8.0A
A41-130-20	130	20V C.T. @ 6.5A	10V @ 13.0A
A41-175-20	175	20V C.T. @ 8.8A	10V @ 17.6A
A41-25-24	25	24V C.T. @ 1A	12V @ 2A
A41-43-24	43	24V C.T. @ 1.8A	12V @ 3.6A
A41-80-24	80	24V C.T. @ 3.3A	12V @ 6.6A
A41-130-24	130	24V C.T. @ 5.4A	12V @ 10.8A
A41-175-24	175	24V C.T. @ 7.3A	12V @ 14.6A
A41-25-28	25	28V C.T. @ 0.9A	14V @ 1.86A
A41-43-28	43	28V C.T. @ 1.5A	14V @ 3.0A
A41-80-28	80	28V C.T. @ 2.8A	14V @ 5.6A
A41-130-28	130	28V C.T. @ 4.6A	14V @ 9.2A
A41-175-28	175	28V C.T. @ 6.25A	14V @ 12.5A
A41-25-36	25	36V C.T. @ 0.7A	18V @ 1.4A
A41-43-36	43	36V C.T. @ 1.2A	18V @ 2.4A
A41-80-36	80	36V C.T. @ 2.2A	18V @ 4.4A
A41-130-36	130	36V C.T. @ 3.6A	18V @ 7.2A
A41-175-36	175	36V C.T. @ 4.8A	18V @ 9.6A
A41-25-230	25	230V C.T. @ 0.11A	115V @ 0.22A
A41-43-230	43	230V C.T. @ 0.19A	115V @ 0.38A
A41-80-230	80	230V C.T. @ 0.35A	115V @ 0.7A
A41-130-230	130	230V C.T. @ 0.57A	115V @ 1.14A
A41-175-230	175	230V C.T. @ 0.76A	115V @ 1.52A



Dimensions VA	L	W	H	A	B	C	Terminals	Mtg. Style	Mtg. ML	Mtg. MW	Mtg. Screw	Lbs.
25	2 13/16	1 7/8	2 5/16	2	1 1/8	5/16	3/16 (.187)	C	2 3/8	–	#6	1.25
43	3 1/8	2 1/16	2 11/16	2 1/4	1 1/8	5/16	3/16 (.187)	C	2 13/16	–	#6	1.6
80	2 1/2	2 3/8	3	–	1 3/8	5/16	3/16 (.187)	B	2	2 3/16	#6	2.8
130	2 13/16	2 7/8	3 3/8	–	1 5/8	3/8	1/4 (0.25)	B	2 1/4	2 1/2	#8	4.1
175	3 1/8	2 7/8	3 3/4	–	1 5/8	3/8	1/4 (0.25)	B	2 1/2	2 1/2	#8	5.5

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2.5VA – 0.650 inches high
6VA – 0.850 inches high
12VA – 1.065 inches high
24 VA – 1.250 inches high
48 VA – 1.375 inches high

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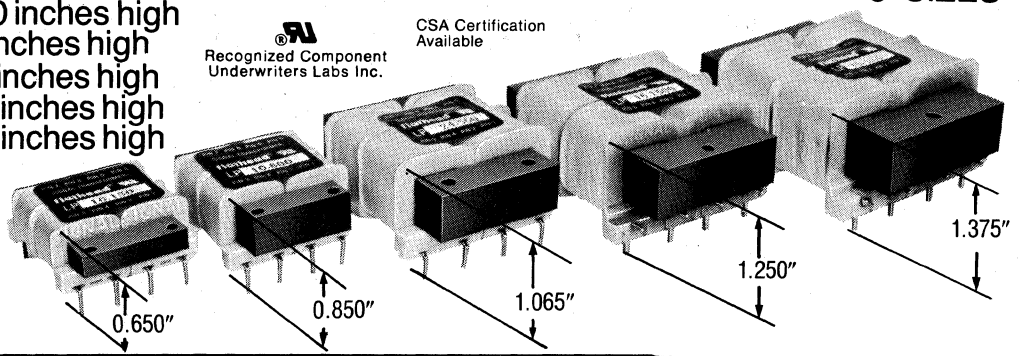
CSA Certification Available

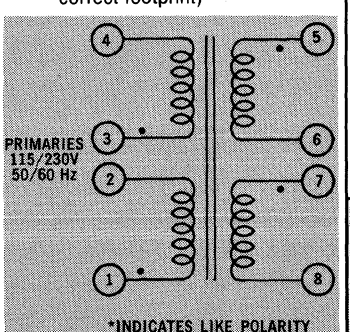


Part No.	Size	SECONDARY* Series	Parallel
LP 10-250	2	10V C.T. @ 250MA	5V @ 500MA
LP 10-600	6	10V C.T. @ 600MA	5V @ 1.2A
LP 10-1200	12	10V C.T. @ 1200MA	5V @ 2.4A
LP 10-2400	24	10V C.T. @ 2.40A	5V @ 4.80A
LP 10-4800	48	10V C.T. @ 4.80A	5V @ 9.60A
LP 12-200	2	12.6V C.T. @ 200MA	6.3V @ 400MA
LP 12-450	6	12.6V C.T. @ 450MA	6.3V @ 900MA
LP 12-900	12	12.6V C.T. @ 900MA	6.3V @ 1.8A
LP 12-1900	24	12.6V C.T. @ 1.90MA	6.3V @ 3.80A
LP 12-3800	48	12.6V C.T. @ 3.80MA	6.3V @ 7.60A
LP 16-150	2	16V C.T. @ 150MA	8V @ 300MA
LP 16-350	6	16V C.T. @ 350MA	8V @ 700MA
LP 16-700	12	16V C.T. @ 700MA	8V @ 1.4A
LP 16-1500	24	16V C.T. @ 1.50A	8V @ 3.00A
LP 16-3000	48	16V C.T. @ 3.00A	8V @ 6.00A
LP 20-125	2	20V C.T. @ 125MA	10V @ 250MA
LP 20-300	6	20V C.T. @ 300MA	10V @ 600MA
LP 20-600	12	20V C.T. @ 600MA	10V @ 1.2A
LP 20-1200	24	20V C.T. @ 1.20A	10V @ 2.40A
LP 20-2400	48	20V C.T. @ 2.40A	10V @ 4.80A
LP 24-100	2	24V C.T. @ 100MA	12V @ 200MA
LP 24-250	6	24V C.T. @ 250MA	12V @ 500MA
LP 24-500	12	24V C.T. @ 500MA	12V @ 1A
LP 24-1000	24	24V C.T. @ 1.00A	12V @ 2.00A
LP 24-2000	48	24V C.T. @ 2.00A	12V @ 4.00A
LP 30-85	2	30V C.T. @ 85MA	15V @ 170MA
LP 30-200	6	30V C.T. @ 200MA	15V @ 400MA
LP 30-400	12	30V C.T. @ 400MA	15V @ 800MA
LP 30-800	24	30V C.T. @ 800MA	15V @ 1.60A
LP 30-1600	48	30V C.T. @ 1.60A	15V @ 3.20A
LP 34-75	2	34V C.T. @ 75MA	17V @ 150MA
LP 34-170	6	34V C.T. @ 170MA	17V @ 340MA
LP 34-340	12	34V C.T. @ 340MA	17V @ 680MA
LP 34-700	24	34V C.T. @ 700MA	17V @ 1.40A
LP 34-1400	48	34V C.T. @ 1.40A	17V @ 2.80A
LP 40-60	2	40V C.T. @ 60MA	20V @ 120MA
LP 40-150	6	40V C.T. @ 150MA	20V @ 300MA
LP 40-300	12	40V C.T. @ 300MA	20V @ 600MA
LP 40-600	24	40V C.T. @ 600MA	20V @ 1.20A
LP 40-1200	48	40V C.T. @ 1.20A	20V @ 2.40A
LP 56-45	2	56V C.T. @ 45MA	28V @ 90MA
LP 56-100	6	56V C.T. @ 100MA	28V @ 200MA
LP 56-200	12	56V C.T. @ 200MA	28V @ 400MA
LP 56-425	24	56V C.T. @ 425MA	28V @ 850MA
LP 56-850	48	56V C.T. @ 850MA	28V @ 1.70A
LP 88-28	2	88V C.T. @ 28MA	44V @ 56MA
LP 88-65	6	88V C.T. @ 65MA	44V @ 130MA
LP 88-130	12	88V C.T. @ 130MA	44V @ 260MA
LP 120-20	2	120V C.T. @ 20MA	60V @ 40MA
LP 120-50	6	120V C.T. @ 50MA	60V @ 100MA
LP 120-100	12	120V C.T. @ 100MA	60V @ 200MA
LP 230-10	2	230V C.T. @ 10MA	115V @ 20MA
LP 230-25	6	230V C.T. @ 25MA	115V @ 50MA
LP 230-50	12	230V C.T. @ 50MA	115V @ 100MA

Signal expanded its Flathead® Series because of the trend toward higher power usage on PC boards. Two larger sizes (24 and 48 VA) are now available.

Basic design, layout and construction specifications have not changed. The only exception is that more rugged plug-in pins, using square wire, have been incorporated in order to properly handle the weights and currents required.

(See mechanical drawing for correct footprint)



Regulation of size 2 and 6 units is 30%; size 12 units is 20%; size 24 and 48 units is 15%; i.e., no load-secondary voltage is 15% higher than full load.

LOW PROFILE: Allows ¾″ card spacing for 2.5va units, 1 inch card spacing for 6va units, or 1¼″ inch card spacing for 12va units, 1½″ inch card spacing for 24va and 1⅝″ inch card spacing for 48va.

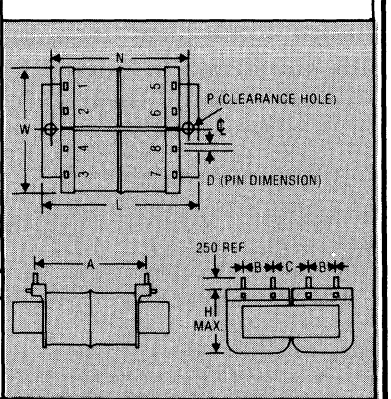
DUAL PRIMARIES: 115/230v, 50/60 Hz.

NON-CONCENTRIC WINDING: Where secondary is wound alongside primary rather than directly over it. This added isolation reduces inter-winding capacitance and **eliminates the need for an electro-static shield.**

1500V. RMS HIPOT: Is standard because of the advantage of non-concentric windings.

HUM-BUCKING CONSTRUCTION: (Semi-toroidal) results in reduced radiated magnetic field and balanced windings.

The LP line of transformers is ideal for low height, critical pc board power applications in semi-conductor control and instrumentation. They are used extensively in single or dual output dc supplies and isolated control circuit and reference supplies.



Size	A	B	C	L	W	H	N	D	P	Oz.
2	1.600	0.375	0.375	1.87	1.56	0.650	——	.041 x .020	——	5
6	1.600	0.375	0.375	1.87	1.56	0.850	——	.041 x .020	——	7
12	2.000	0.500	0.500	2.50	2.00	1.065	——	.041 x .020	——	11
24	1.900	0.600	0.530	2.87	2.25	1.250	2.41	.041 Sq.	CLEARANCE HOLE FOR # 4 SCREW	15
48	2.180	0.600	0.660	3.12	2.50	1.375	2.62	.041 Sq.	CLEARANCE HOLE FOR # 6 SCREW	21

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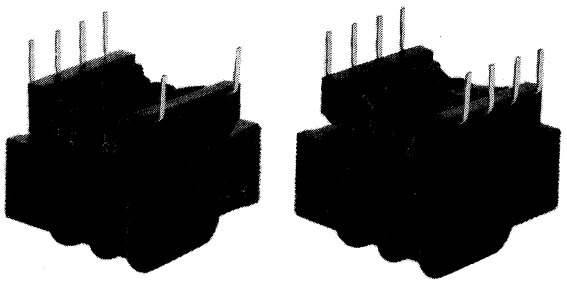

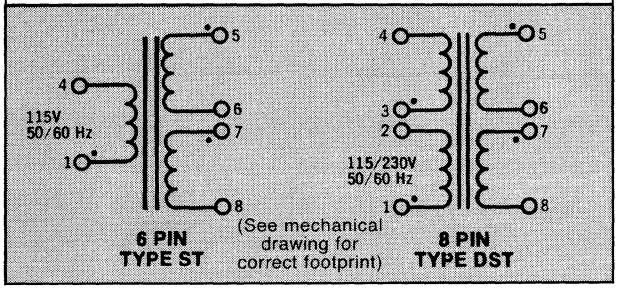

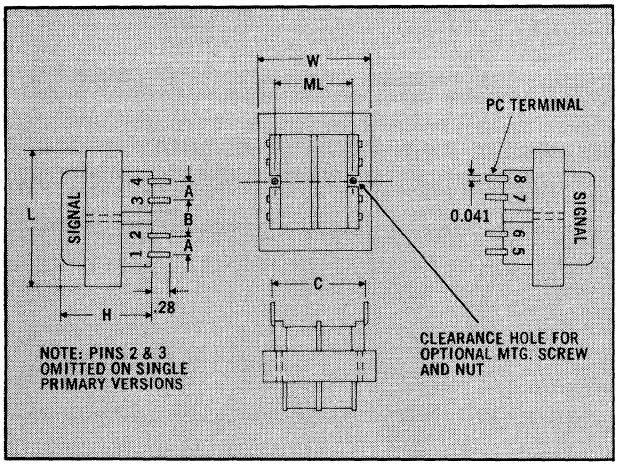

Size	VA	L	W	H	ML	A	B	C	Optional Mtg. Screw & Nut*	Lbs.
2	1.1	1 3/8	1 1/8	15/16	—	.250	.250	1.200	None	0.17
3	2.4	1 3/8	1 1/8	1 3/16	—	.250	.250	1.200	None	0.25
4	6	1 5/8	1 5/16	1 5/16	1 1/16	.250	.350	1.280	4-40 x 1 3/8 Nylon	0.44
5	12	1 7/8	1 5/16	1 7/16	1 1/4	.300	.400	1.410	4-40 x 1 3/8 Nylon	0.70
6	20	2 1/4	1 7/8	1 7/16	1 1/2	.300	.400	1.600	4-40 x 1 3/8 Nylon	0.80
7	36	2 5/8	2 3/16	1 5/16	†	.400	.400	1.850	†	1.1

* Available from Signal: Part No. ST-MS (Screw) & Part No. ST-MN (Nut).
† Size 7 has 4 mtg. holes on 2 3/16 x 1 3/4 centers for a #6 screw. Need not be nylon.

"Split-Tran" transformers combine the best features of our "2-4-1" Series and Signal's pioneering line of pc board miniature transformers.

The use of a "split bobbin" allows the primaries and secondaries to be wound non-concentrically, i.e., side by side rather than one over the other. This results in cost savings and superior performance, namely:

- High isolation — **2500V** hipot is standard.
- Low capacitive coupling — no electro-static shield necessary.
- Less manufacturing time — no cross-overs of primary and secondary leads.
- PC pins — allow direct insertion in PC boards.
- Class S insulation — 130°C.

Each transformer is available with single 115V or dual 115/230V primaries. In addition, secondaries are split so that they can be series or parallel connected.

Special variations will be quoted and shipped promptly.

PART NUMBER*		SECONDARY RMS RATING	
Single 115V 6 Pin	Dual 115/230V 8 Pin	Series	Parallel
ST 2-10	DST 2-10	10V C.T. @ 0.11A	5V @ 0.22A
ST 3-10	DST 3-10	10V C.T. @ 0.25A	5V @ 0.5A
ST 4-10	DST 4-10	10V C.T. @ 0.6A	5V @ 1.2A
ST 5-10	DST 5-10	10V C.T. @ 1.2A	5V @ 2.4A
ST 6-10	DST 6-10	10V C.T. @ 2A	5V @ 4A
ST 7-10	DST 7-10	10V C.T. @ 3.6A	5V @ 7.2A
ST 2-12	DST 2-12	12.6V C.T. @ 0.09A	6.3V @ 0.18A
ST 3-12	DST 3-12	12.6V C.T. @ 0.2A	6.3V @ 0.4A
ST 4-12	DST 4-12	12.6V C.T. @ 0.5A	6.3V @ 1.0A
ST 5-12	DST 5-12	12.6V C.T. @ 1.0A	6.3V @ 2.0A
ST 6-12	DST 6-12	12.6V C.T. @ 1.6A	6.3V @ 3.2A
ST 7-12	DST 7-12	12.6V C.T. @ 2.85A	6.3V @ 5.7A
ST 2-16	DST 2-16	16V C.T. @ 0.07A	8V @ 0.14A
ST 3-16	DST 3-16	16V C.T. @ 0.15A	8V @ 0.3A
ST 4-16	DST 4-16	16V C.T. @ 0.4A	8V @ 0.8A
ST 5-16	DST 5-16	16V C.T. @ 0.8A	8V @ 1.6A
ST 6-16	DST 6-16	16V C.T. @ 1.25A	8V @ 2.5A
ST 7-16	DST 7-16	16V C.T. @ 2.25A	8V @ 4.5A
ST 2-20	DST 2-20	20V C.T. @ 0.055A	10V @ 0.11A
ST 3-20	DST 3-20	20V C.T. @ 0.12A	10V @ 0.24A
ST 4-20	DST 4-20	20V C.T. @ 0.3A	10V @ 0.6A
ST 5-20	DST 5-20	20V C.T. @ 0.6A	10V @ 1.2A
ST 6-20	DST 6-20	20V C.T. @ 1A	10V @ 2A
ST 7-20	DST 7-20	20V C.T. @ 1.8A	10V @ 3.6A
ST 2-24	DST 2-24	24V C.T. @ 0.045A	12V @ 0.09A
ST 3-24	DST 3-24	24V C.T. @ 0.1A	12V @ 0.2A
ST 4-24	DST 4-24	24V C.T. @ 0.25A	12V @ 0.5A
ST 5-24	DST 5-24	24V C.T. @ 0.5A	12V @ 1.0A
ST 6-24	DST 6-24	24V C.T. @ 0.8A	12V @ 1.6A
ST 7-24	DST 7-24	24V C.T. @ 1.5A	12V @ 3.0A
ST 2-28	DST 2-28	28V C.T. @ 0.04A	14V @ 0.08A
ST 3-28	DST 3-28	28V C.T. @ 0.085A	14V @ 0.17A
ST 4-28	DST 4-28	28V C.T. @ 0.2A	14V @ 0.4A
ST 5 28	DST 5-28	28V C.T. @ 0.42A	14V @ 0.84A
ST 6-28	DST 6-28	28V C.T. @ 0.7A	14V @ 1.4A
ST 7-28	DST 7-28	28V C.T. @ 1.3A	14V @ 2.6A
ST 2-36	DST 2-36	36V C.T. @ 0.03A	18V @ 0.06A
ST 3-36	DST 3-36	36V C.T. @ 0.065A	18V @ 0.13A
ST 4-36	DST 4-36	36V C.T. @ 0.17A	18V @ 0.34A
ST 5-36	DST 5-36	36V C.T. @ 0.35A	18V @ 0.7A
ST 6-36	DST 6-36	36V C.T. @ 0.55A	18V @ 1.1A
ST 7-36	DST 7-36	36V C.T. @ 1A	18V @ 2A
ST 2-48	DST 2-48	48V C.T. @ 0.023A	24V @ 0.046A
ST 3-48	DST 3-48	48V C.T. @ 0.05A	24V @ 0.1A
ST 4-48	DST 4-48	48V C.T. @ 0.125A	24V @ 0.25A
ST 5-48	DST 5-48	48V C.T. @ 0.25A	24V @ 0.5A
ST 6-48	DST 6-48	48V C.T. @ 0.4A	24V @ 0.8A
ST 7-48	DST 7-48	48V C.T. @ 0.75A	24V @ 1.5A
ST 2-56	DST 2-56	56V C.T. @ 0.02A	28V @ 0.04A
ST 3-56	DST 3-56	56V C.T. @ 0.045A	28V @ 0.09A
ST 4-56	DST 4-56	56V C.T. @ 0.11A	28V @ 0.22A
ST 5-56	DST 5-56	56V C.T. @ 0.22A	28V @ 0.44A
ST 6-56	DST 6-56	56V C.T. @ 0.35A	28V @ 0.7A
ST 7-56	DST 7-56	56V C.T. @ 0.65A	28V @ 1.3A
ST 2-120	DST 2-120	120V C.T. @ 0.01A	60V @ 0.02A
ST 3-120	DST 3-120	120V C.T. @ 0.02A	60V @ 0.04A
ST 4-120	DST 4-120	120V C.T. @ 0.05A	60V @ 0.1A
ST 5-120	DST 5-120	120V C.T. @ 0.1A	60V @ 0.2A
ST 6-120	DST 6-120	120V C.T. @ 0.16A	60V @ 0.32A
ST 7-120	DST 7-120	120V C.T. @ 0.3A	60V @ 0.6A

* Explanation of Part Number: Series - ST; Size 4; Series Secondary Volts - 36

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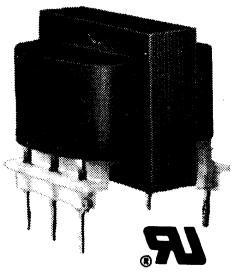
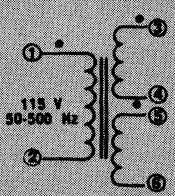
miniature plug in power transformers

SINGLE 115V PRIMARY TYPE PC 6 PINS

CSA Certification Available





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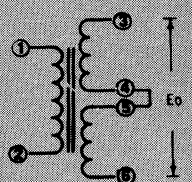
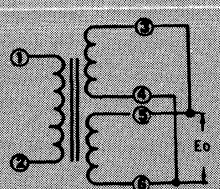


SERIES CONNECTED



PARALLEL CONNECTED

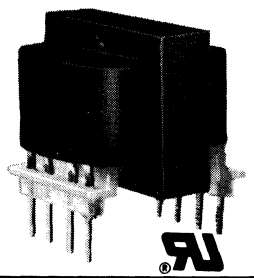
(See mechanical drawing for correct footprint)

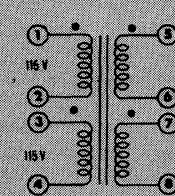
PRIMARY 50/500 Hz		SECONDARY RMS RATING*		
Single 115V (6 Pin)	Dual 115/230V (8 Pin)	Series	Parallel	Size (VA)
PC 10-90	DPC 10-90	10V C.T. @ 90MA	5V @ 180MA	1.0
PC 10-120	DPC 10-120	10V C.T. @ 120MA	5V @ 240MA	1.2
PC 10-440	DPC 10-440	10V C.T. @ 440MA	5V @ 880MA	4.4
PC 10-1000	DPC 10-1000	10V C.T. @ 1A	5V @ 2A	10
PC 10-2400	DPC 10-2400	10V C.T. @ 2.4A	5V @ 4.8A	24
PC 12-70	DPC 12-70	12.6V C.T. @ 70MA	6.3V @ 140MA	1.0
PC 12-100	DPC 12-100	12.6V C.T. @ 100MA	6.3V @ 200MA	1.2
PC 12-350	DPC 12-350	12.6V C.T. @ 350MA	6.3V @ 700MA	4.4
PC 12-800	DPC 12-800	12.6V C.T. @ 800MA	6.3V @ 1.6A	10
PC 12-2000	DPC 12-2000	12.6V C.T. @ 2A	6.3V @ 4A	24
PC 16-55	DPC 16-55	16V C.T. @ 55MA	8V @ 110MA	1.0
PC 16-75	DPC 16-75	16V C.T. @ 75MA	8V @ 150MA	1.2
PC 16-260	DPC 16-260	16V C.T. @ 260MA	8V @ 520MA	4.4
PC 16-640	DPC 16-640	16V C.T. @ 640MA	8V @ 1.28A	10
PC 16-1500	DPC 16-1500	16V C.T. @ 1.5A	8V @ 3A	24
PC 20-45	DPC 20-45	20V C.T. @ 45MA	10V @ 90MA	1.0
PC 20-60	DPC 20-60	20V C.T. @ 60MA	10V @ 120MA	1.2
PC 20-220	DPC 20-220	20V C.T. @ 220MA	10V @ 440MA	4.4
PC 20-500	DPC 20-500	20V C.T. @ 500MA	10V @ 1A	10
PC 20-1200	DPC 20-1200	20V C.T. @ 1.2A	10V @ 2.4A	24
PC 24-35	DPC 24-35	24V C.T. @ 35MA	12V @ 70MA	1.0
PC 24-50	DPC 24-50	24V C.T. @ 50MA	12V @ 100MA	1.2
PC 24-180	DPC 24-180	24V C.T. @ 180MA	12V @ 360MA	4.4
PC 24-450	DPC 24-450	24V C.T. @ 450MA	12V @ 900MA	10
PC 24-1000	DPC 24-1000	24V C.T. @ 1A	12V @ 2A	24
PC 28-30	DPC 28-30	28V C.T. @ 30MA	14V @ 60MA	1.0
PC 28-40	DPC 28-40	28V C.T. @ 40MA	14V @ 80MA	1.2
PC 28-160	DPC 28-160	28V C.T. @ 160MA	14V @ 320MA	4.4
PC 28-360	DPC 28-360	28V C.T. @ 360MA	14V @ 720MA	10
PC 28-800	DPC 28-800	28V C.T. @ 800MA	14V @ 1.6A	24
PC 34-25	DPC 34-25	34V C.T. @ 25MA	17V @ 50MA	1.0
PC 34-35	DPC 34-35	34V C.T. @ 35MA	17V @ 70MA	1.2
PC 34-125	DPC 34-125	34V C.T. @ 125MA	17V @ 250MA	4.4
PC 34-300	DPC 34-300	34V C.T. @ 300MA	17V @ 600MA	10
PC 34-700	DPC 34-700	34V C.T. @ 700MA	17V @ 1.4A	24
PC 40-20	DPC 40-20	40V C.T. @ 20MA	20V @ 40MA	1.0
PC 40-30	DPC 40-30	40V C.T. @ 30MA	20V @ 60MA	1.2
PC 40-110	DPC 40-110	40V C.T. @ 110MA	20V @ 220MA	4.4
PC 40-250	DPC 40-250	40V C.T. @ 250MA	20V @ 500MA	10
PC 40-600	DPC 40-600	40V C.T. @ 600MA	20V @ 1.2A	24
PC 56-15	DPC 56-15	56V C.T. @ 15MA	28V @ 30MA	1.0
PC 56-20	DPC 56-20	56V C.T. @ 20MA	28V @ 40MA	1.2
PC 56-80	DPC 56-80	56V C.T. @ 80MA	28V @ 160MA	4.4
PC 56-180	DPC 56-180	56V C.T. @ 180MA	28V @ 360MA	10
PC 56-420	DPC 56-420	56V C.T. @ 420MA	28V @ 840MA	24
PC 120-8	DPC 120-8	120V C.T. @ 8MA	60V @ 16MA	1.0
PC 120-10	DPC 120-10	120V C.T. @ 10MA	60V @ 20MA	1.2
PC 120-35	DPC 120-35	120V C.T. @ 35MA	60V @ 70MA	4.4
PC 120-85	DPC 120-85	120V C.T. @ 85MA	60V @ 170MA	10
PC 120-200	DPC 120-200	120V C.T. @ 200MA	60V @ 400MA	24

* See Table on opposite page for method of determining RMS Secondary Current.

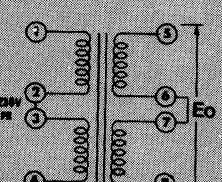
DUAL 115/230V PRIMARY TYPE DPC 8 PINS

CSA Certification Available

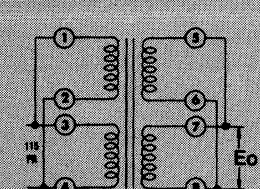




BASIC SCHEMATIC



SERIES CONNECTED



PARALLEL CONNECTED

(See mechanical drawing for correct footprint)

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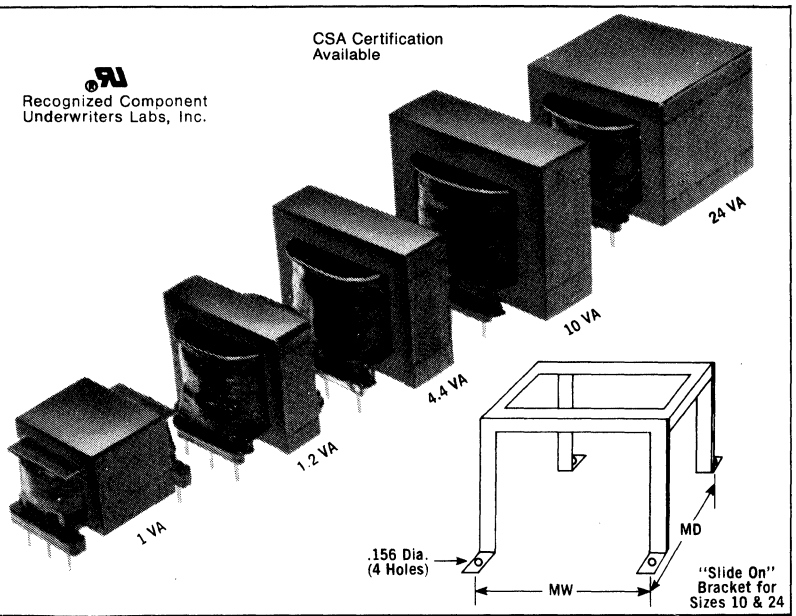
. . . for printed circuits applications

Signal has the most complete and diversified selection of miniature plug-in power transformers.

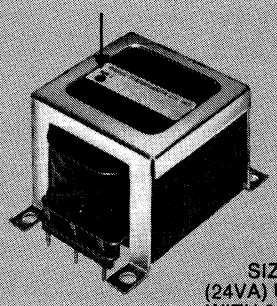
Primary ratings of 115V (Style PC - 6 Pin) or Dual 115/230V (Style DPC -8 Pin) are standard for the entire line. 1500V. Hipot is standard.

Size 1.0 is used extensively where height is a limiting factor since its height of 0.83 inches allows 1 inch spacing of PC boards. Size 24 is unusual since 24 watt PC transformers are not readily available, especially with a height of 1⅜ inches.

The RMS current ratings are based on a load regulation of 15-20% and not on temperature rise (except for the largest item, size 24). Therefore, these ratings may be exceeded without overheating, if the additional drop in full load voltage is acceptable. There is, of course, a limit and it would be best to check with our engineering department on specific units.



BLACK DOT ON LABEL INDICATES POSITION OF TERMINAL #1.



SIZE 24 (24VA) UNIT WITH 24-BR SLIDE-ON MOUNTING BRACKET

DIMENSIONS

Size (VA)	L	W	H	A-6 (6 Pin)	A-8 (8 Pin)	B	WT. (oz.)	OPTIONAL BRACKET* No.	MW	MD
1.0	1	1⅜	0.83	0.250	0.200	1.200	2.5	—	—	—
1.2	1⅜	1⅛	1 3/16	0.312	0.200	1.000	3	—	—	—
4.4	1⅝	1¼	1⅜	0.400	0.250	1.100	5	—	—	—
10	1⅞	1 7/16	1⅝	0.400	0.250	1.300	9	10-BR	1 41/64	1⅛
24	1⅝	2¼	1⅜	0.400	0.250	2.100	12	24-BR	1⅜	2

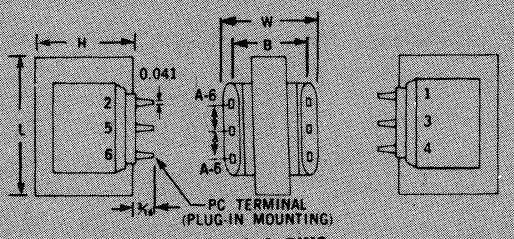
* An optional "Slide On" Mounting Bracket is available for sizes 10 and 24. The brackets do not use up any extra "Floor Space" but add 1/32" to the height of the transformer.

METHOD OF DETERMINING SECONDARY CURRENT RATINGS

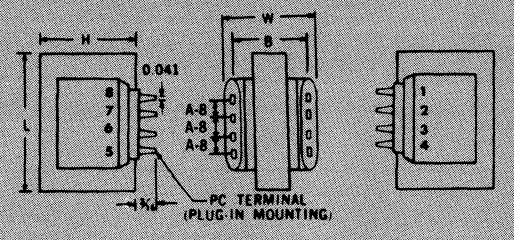
The secondary currents shown in the tables are RMS ratings. Depending upon rectifier circuit configurations, the RMS secondary current is different than the DC output current. This is indicated in the chart below:

Rectifier Type	Filter Type	RMS Secondary Current Is
Full Wave Center-Tap	Choke Input	= 0.7 x DC Amps
Full Wave Center-Tap	Capacitor Input	= 1 to 1.2 x DC Amps
Full Wave Bridge	Choke Input	= DC Amps
Full Wave Bridge	Capacitor Input	= 1.6 to 1.8 x DC Amps

For example, in a F.W. Bridge circuit with a capacitive filter, if the load is 1 Amp DC, the RMS Secondary current is 1.6 to 1.8 Amp RMS.



TYPE PC 6 PINS



TYPE DPC 8 PINS

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cut size and weight with "2-4-1"™ . . . .

The 2-4-1 series is an illustration of the use of creative design applied to small power transformers. The result is a line where, for a given va rating, size and weight are reduced almost 50%. Hence the name "241" series.

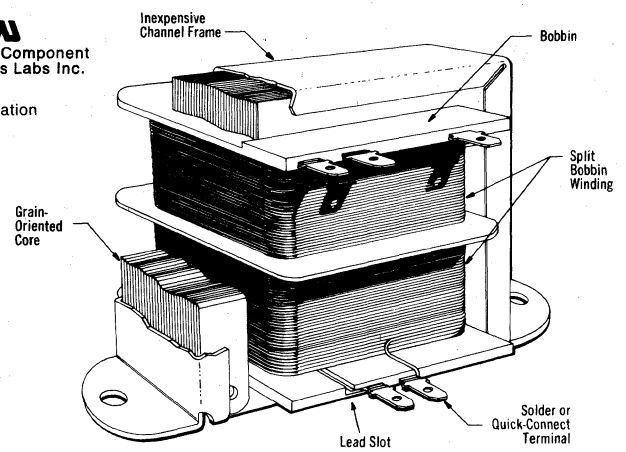
- GRAIN ORIENTED CORE — High Saturation Density — Lower Core Loss — Less Steel and Copper.
- BOBBIN WOUND — Maximum Utilization of Winding Area — Space and Size Reduced.
- SPLIT BOBBIN — NON-CONCENTRIC WINDING — Lower Capacitance — Better Insulation — 2500V RMS Hipot — No need for Electro-Static Shield — High Isolation and Insulation Resistance. No Cross-Overs of Primary and Secondary Leads.
- SPECIAL TERMINAL — Solder or Quick-Connect.

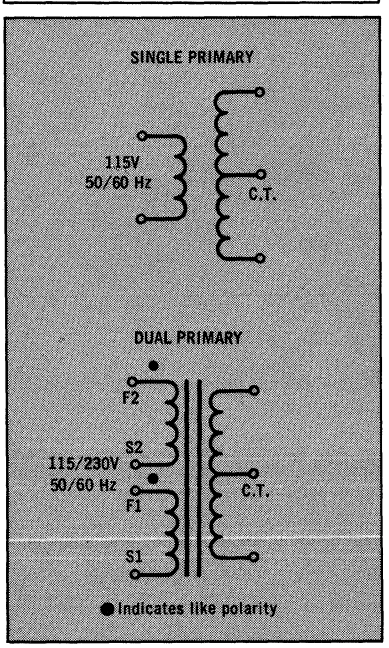
The series is available with single 115V or dual 115/230V primary, rated 50/60 Hz. Class S insulation is used for a maximum total temperature rating of 130°C continuous.

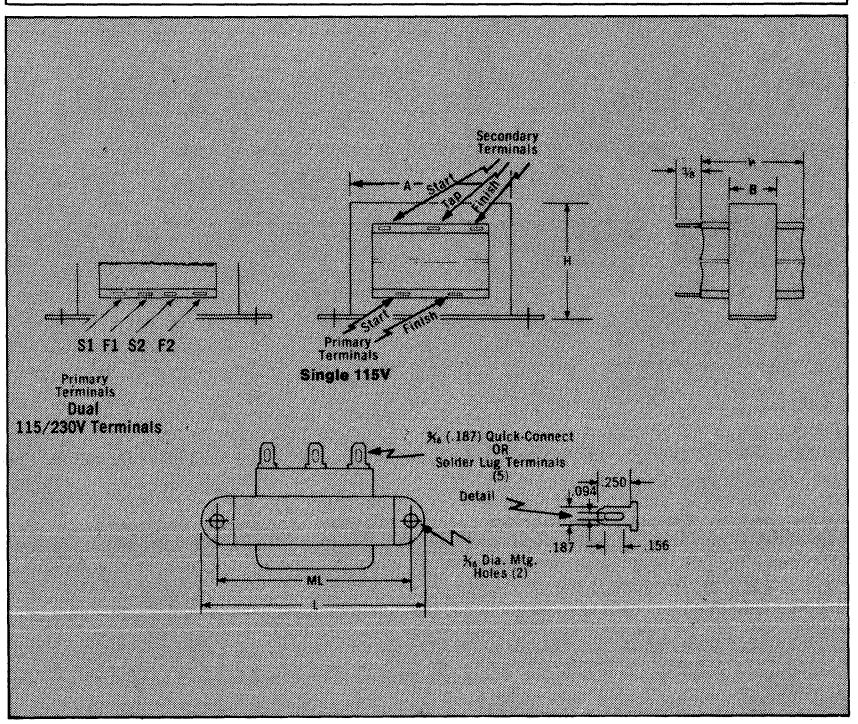
AVAILABLE WITH SINGLE (115V) OR DUAL (115/230V) PRIMARIES

Recognized Component Underwriters Labs Inc.

CSA Certification Available







DIMENSIONS

Size	VA	L	W	H	A	B	ML	Lbs.
3	2.4	2 1/16	1 1/16	1 3/16	1 5/8	5/16	1 3/4	0.25
4	6	2 3/8	1 1/4	1 3/8	1 11/16	11/16	2	0.44
5	12	2 13/16	1 3/8	1 5/8	1 15/16	13/16	2 3/8	0.7
6	30	3 1/4	1 11/16	1 15/16	2 5/16	1 1/16	2 13/16	1.1
7	56	3 11/16	1 13/16	2 1/4	2 11/16	1 1/16	3 1/8	1.7
8	100	4 1/32	2 1/4	2 5/16	3 1/16	1 5/16	3 5/16	2.75

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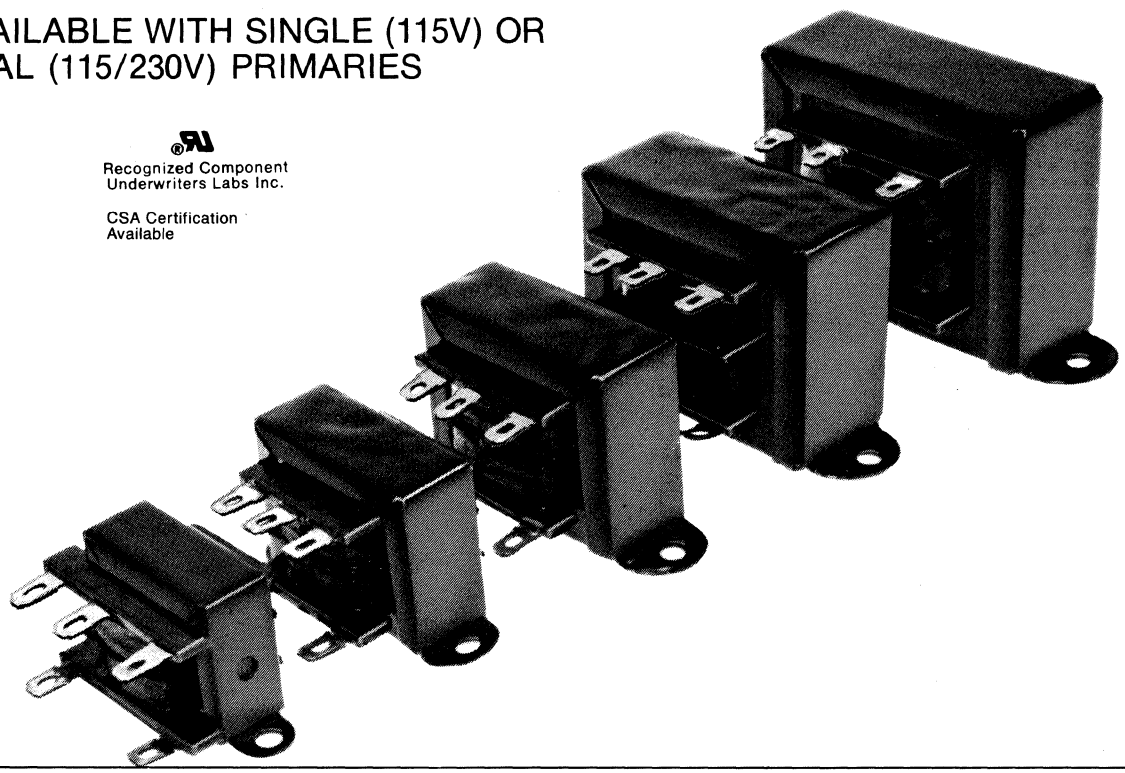
series of small power transformers

AVAILABLE WITH SINGLE (115V) OR DUAL (115/230V) PRIMARIES

Recognized Component
Underwriters Labs Inc.

CSA Certification
Available



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For example, in a F. W. Bridge circuit with a capacitive filter, if the load is 1 Amp DC, the RMS Secondary current is 1.6 to 1.8 Amp RMS.

CUSTOM VARIATIONS

Signal is equipped to quote on Custom Variations of "241" types. The secondary combinations are restricted by the number of secondary terminals available, as follows:

Size	Maximum Number of Secondary Terminals	VA Rating
3	3	2.4
4	4	6
5	4	12
6	5	30
7	5	56
8	5	100

We answer requests promptly and can deliver prototypes in one to three weeks. Production lead times can be scheduled with very reasonable lead times.

Part Number Single 115V	Part Number Dual 115/230V	Secondary RMS Ratng	Part Number Single 115V	Part Number Dual 115/230V	Secondary RMS Rating
241-3-10	Not Available	10V C.T. @ 0.25A	241-3-28	Not Available	28V C.T. @ 0.085A
241-4-10	DP 241-4-10	10V C.T. @ 0.6A	241-4-28	DP 241-4-28	28V C.T. @ 0:2A
241-5-10	DP 241-5-10	10V C.T. @ 1.2A	241-5-28	DP 241-5-28	28V C.T. @ 0.42A
241-6-10	DP 241-6-10	10V C.T. @ 3.0A	241-6-28	DP 241-6-28	28V C.T. @ 1.1A
241-7-10	DP 241-7-10	10V C.T. @ 5.0A	241-7-28	DP 241-7-28	28V C.T. @ 2.0A
241-8-10	DP 241-8-10	10V C.T. @ 10A	241-8-28	DP 241-8-28	28V C.T. @ 3.6A
241-3-12	Not Available	12.6V C.T. @ 0.2A	241-3-36	Not Available	36V C.T. @ 0.065A
241-4-12	DP 241-4-12	12.6V C.T. @ 0.5A	241-4-36	DP 241-4-36	36V C.T. @ 0.17A
241-5-12	DP 241-5-12	12.6V C.T. @ 1.0A	241-5-36	DP 241-5-36	36V C.T. @ 0.35A
241-6-12	DP 241-6-12	12.6V C.T. @ 2.5A	241-6-36	DP 241-6-36	36V C.T. @ 0.85A
241-7-12	DP 241-7-12	12.6V C.T. @ 4.0A	241-7-36	DP 241-7-36	36V C.T. @ 1.5A
241-8-12	DP 241-8-12	12.6V C.T. @ 8.0A	241-8-36	DP 241-8-36	36V C.T. @ 2.8A
241-3-16	Not Available	16V C.T. @ 0.15A	241-3-48	Not Available	48V C.T. @ 0.05A
241-4-16	DP 241-4-16	16V C.T. @ 0.4A	241-4-48	DP 241-4-48	48V C.T. @ 0.125A
241-5-16	DP 241-5-16	16V C.T. @ 0.8A	241-5-48	DP 241-5-48	48V C.T. @ 0.25A
241-6-16	DP 241-6-16	16V C.T. @ 2.0A	241-6-48	DP 241-6-48	48V C.T. @ 0.63A
241-7-16	DP 241-7-16	16V C.T. @ 3.5A	241-7-48	DP 241-7-48	48V C.T. @ 1.2A
241-8-16	DP 241-8-16	16V C.T. @ 6.25A	241-8-48	DP 241-8-48	48V C.T. @ 2.0A
241-3-20	Not Available	20V C.T. @ 0.12A	241-3-56	Not Available	56V C.T. @ 0.045A
241-4-20	DP 241-4-20	20V C.T. @ 0.3A	241-4-56	DP 241-4-56	56V C.T. @ 0.11A
241-5-20	DP 241-5-20	20V C.T. @ 0.6A	241-5-56	DP 241-5-56	56V C.T. @ 0.22A
241-6-20	DP 241-6-20	20V C.T. @ 1.5A	241-6-56	DP 241-6-56	56V C.T. @ 0.54A
241-7-20	DP 241-7-20	20V C.T. @ 2.8A	241-7-56	DP 241-7-56	56V C.T. @ 1.0A
241-8-20	DP 241-8-20	20V C.T. @ 5.0A	241-8-56	DP 241-8-56	56V C.T. @ 1.8A
241-3-24	Not Available	24V C.T. @ 0.1A	241-3-120	Not Available	120V C.T. @ 0.02A
241-4-24	DP 241-4-24	24V C.T. @ 0.25A	241-4-120	DP 241-4-120	120V C.T. @ 0.05A
241-5-24	DP 241-5-24	24V C.T. @ 0.5A	241-5-120	DP 241-5-120	120V C.T. @ 0.1A
241-6-24	DP 241-6-24	24V C.T. @ 1.25A	241-6-120	DP 241-6-120	120V C.T. @ 0.25A
241-7-24	DP 241-7-24	24V C.T. @ 2.4A	241-7-120	DP 241-7-120	120V C.T. @ 0.5A
241-8-24	DP 241-8-24	24V C.T. @ 4.0A	241-8-120	DP 241-8-120	120V C.T. @ 0.85A

Explanation of part number series 241 Size-4 Sec. Volts - 36 Prefix "DP" used for dual primary versions

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p.c. board transformers for triple-output regulated supplies

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"MP" types have been developed specifically for use in triple-output regulated DC supplies that are commonly used in **Microprocessor Circuits** and other logic, op-amp combinations. Two output combinations have been provided, namely 5V and ±12V, and 5V and ±15V.

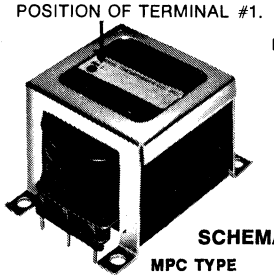
All "MP" units are rated in terms of the final **DC** output after a standard three terminal IC regulator. They are designed to provide these outputs with AC line inputs of 100 to 130V 50/60 Hz (or 200 to 260V for nominal 230V lines).

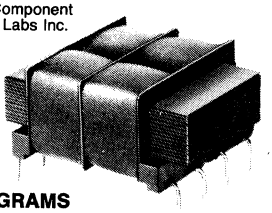
Two basic mechanical configurations are available. Standard PC types (MPC or DMPC) are tested to pass 1500V RMS hipot. Optional mounting brackets are available. MPL types are based on Signal's "flat-head" style and feature low profile, 115/230V primaries, hum-bucking construction, 1500V RMS hipot and the advantages of non-concentric winding (low inter-winding capacitance, high isolation, and no need for an electro-static shield).

All MP's are stocked in depth for immediate delivery. In addition, special variations can be supplied with reasonable delivery times.

BLACK DOT ON LABEL INDICATES POSITION OF TERMINAL #1.

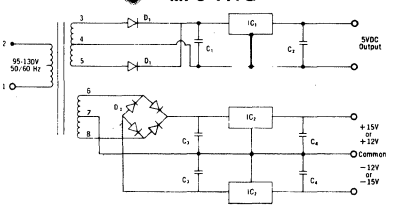
Recognized Component Underwriters Labs Inc.



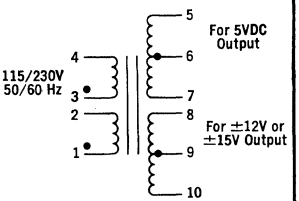


SCHEMATIC DIAGRAMS

MPC TYPE



DMPC & MPL TYPES



(See mechanical drawing for correct footprint)

MPC & DMPC TYPES

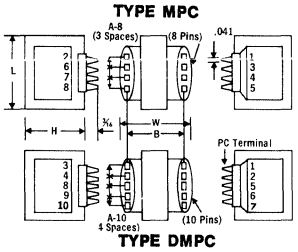
PART NUMBER PRIMARY 50/60 Hz 115V (8 Pin)	115/230V (10 Pin)	DC OUTPUT Regulator I	Regulator II	Size	SUGGESTED COMPONENTS C_1	C_2	C_3	C_4	D_1(2)	D_2(4)	IC_1*	IC_2*
MPC-X-12	DMPC-X-12	5VDC 360ma	±12VDC 60ma	X	2100MFD 30V	2.7MFD 20V	250MFD 50V	10MFD 20V	1N4001	1N4002	LM341P-5.0	LM326N
MPC-X-15	DMPC-X-15	5VDC 360ma	±15VDC 50ma	X	2100MFD 30V	2.7MFD 20V	250MFD 50V	10MFD 20V	1N4001	1N4002	LM341P-5.0	LM325N
MPC-Y-12	DMPC-Y-12	5VDC 835ma	±12VDC 150ma	Y	4000MFD 20V	2.7MFD 20V	1000MFD 50V	2.7MFD 20V	1N4001	1N4002	LM340K-5.0	LM326N
MPC-Y-15	DMPC-Y-15	5VDC 835ma	±15VDC 130ma	Y	4000MFD 20V	2.7MFD 20V	1000MFD 50V	2.7MFD 20V	1N4001	1N4002	LM340K-5.0	LM325N

MPL TYPES (Dual 115/230V Primary is Standard)

MPL- 6-12	5VDC 135ma	±12VDC 40ma	6	1000MFD 20V	2.7MFD 20V	150MFD 50V	10MFD 20V	1N4001	1N4002	LM342P-5.0	LM326N
MPL- 6-15	5VDC 135ma	±15VDC 35ma	6	1000MFD 20V	2.7MFD 20V	150MFD 50V	10MFD 20V	1N4001	1N4002	LM342P-5.0	LM325N
MPL-12-12	5VDC 270ma	±12VDC 85ma	12	2100MFD 30V	2.7MFD 20V	250MFD 50V	10MFD 20V	1N4001	1N4002	LM341P-5.0	LM326N
MPL-12-15	5VDC 270ma	±15VDC 70ma	12	2100MFD 30V	2.7MFD 20V	250MFD 50V	10MFD 20V	1N4001	1N4002	LM341P-5.0	LM325N

*National Semiconductor

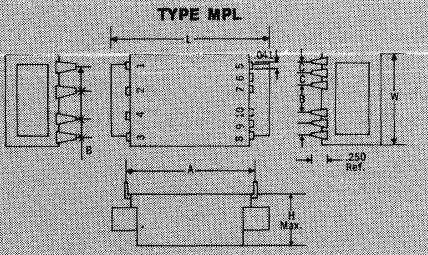
TYPE MPC



TYPE DMPC

Size	L	W	H	A-8 (8 Pin)	A-10 (10 Pin)	B	Lbs.	Optional Bracket No.	MW	MD
X	1⅞	1 1/16	1⅝	.250	.200	1.300	.56	10-BR	1 41/64	1⅛
Y	1⅝	2¼	1⅜	.250	.200	2.100	.75	24-BR	1⅜	2

TYPE MPL



Size	L	W	H	A	B	C	Lbs.
6	1⅞	1 1/16	0.850	1.600	0.375	0.187	.43
12	2½	2	1.065	2.000	0.500	0.250	.68

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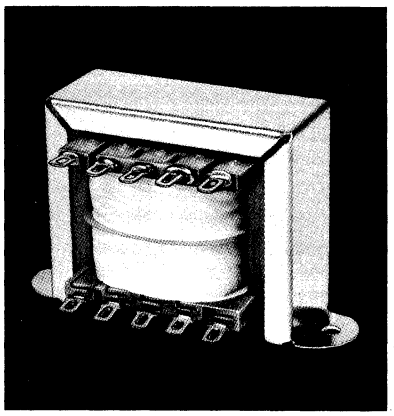
"2-4-1"™ style split-bobbin transformers for triple-output (μp) applications (type MT)



Signal has extended its line of triple-output transformers for microprocessor applications with three new sizes rated to 100VA (35 watts DC regulated). Similar to the split-bobbin design used in Signal's "2-4-1" series, the chassis-mounted style allows for these new higher power applications.

Two output combinations are provided: 5V and ±12V; and 5V and ±15V. Designated "MT" (single primary) and "DMT" (dual primary), these transformers are rated in terms of the final DC output after a 3-terminal IC regulator. They are designed to provide these outputs with AC line inputs of 100-130V, 50/60 Hz (or 200-260V for nominal 230V lines). All auxiliary components required to complete the DC supply are tabulated.

All MT types are stocked in depth for immediate delivery. In addition, custom variations can be supplied with minimal turnaround time.

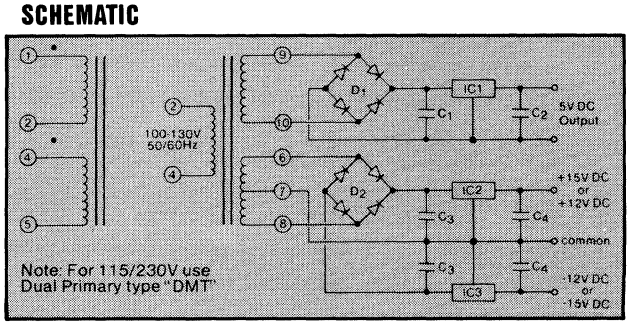
Specifications

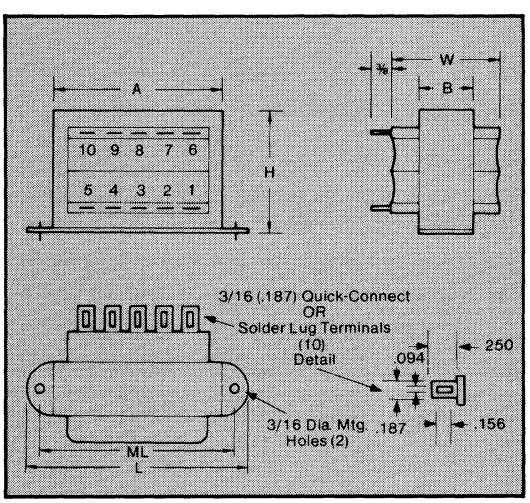
Recognized Component
Underwriters Labs Inc.

PART NUMBER PRIMARY 50/60Hz		DC OUTPUT		SIZE	SUGGESTED COMPONENTS C_2 C_4 See Note ①						
115V	115/230V	Regulator 1	Regulator 2		C_1	C_3	IC1③	IC2③	IC3③	D1④	D2④
MT-6-12	DMT-6-12	5V @ 1.75A	±12V @ 210MA	6	10 KMFD @ 20V DC	1.5 KMFD @ 50V DC	LM-323K-5	LM-340K-12	LM-320K-12	3N253	3N247
MT-6-15	DMT-6-15	5V @ 1.75A	±15V @ 175MA	6			LM-323K-5	LM-340K-15	LM-320K-15	3N253	3N247
MT-7-12	DMT-7-12	5V @ 2.8A	±12V @ 350MA	7	15 KMFD @ 20V DC	2 KMFD @ 50V DC	LM-323K-5	LM-340K-12	LM-320K-12	MDA-400	3N247
MT-7-15	DMT-7-15	5V @ 2.8A	±15V @ 280MA	7			LM-323K-5	LM-340K-15	LM-320K-15	MDA-400	3N247
MT-8-12	DMT-8-12	5V @ 4A	±12V @ 600MA	8	26 KMFD @ 20V DC	3.1 KMFD @ 50V DC	LM-338②	LM-340K-12	LM-320K-12	MDA-800	3N247
MT-8-15	DMT-8-15	5V @ 4A	±15V @ 500MA	8			LM-338②	LM-340K-15	LM-320K-15	MDA-800	3N247

Note ① : Output capacitors C_2 and C_4 are required to stabilize regulators. Values can be 1 MFD min. tantalum or 10 MFD min. electrolytic, 20V min.
Note ② : LM-338 is an adjustable regulator and MFR's specifications (National Semiconductor) should be consulted for values of external components.
Note ③ : All IC's are National Semiconductor types.
Note ④ : All diodes are Motorola types.

SCHEMATIC





DIMENSIONS

Size	L	W	H	A	B	ML	Lbs.
6	3 1/4	1 3/4	1 15/16	2 5/16	1 1/16	2 13/16	1.1
7	3 11/16	1 13/16	2 1/4	2 11/16	1 1/16	3 1/8	1.7
8	4 1/32	2 1/4	2 9/16	3 1/16	1 5/16	3 9/16	2.75

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rectifier power transformers

CHOICE OF SINGLE 115V OR DUAL 115/230V PRIMARIES

Primary 50/60 Hz		Secondary RMS Rating*									
Single 115V.	Dual* 115/230V.	Series	Parallel	Mtg. Style	L	W	H	ML	MW	Mtg. Screw	Approx. Lbs.
10-1	DL 10-1	10V C.T. @ 1A	5V C.T. @ 2A	C	2⅞	1¾	2⅝	2⅜	—	#8	1.0
10-2	DL 10-2	10V C.T. @ 2A	5V C.T. @ 4A	C	3⅛	2⅛	2¾	2 13/16	—	#8	1.5
10-4	DL 10-4	10V C.T. @ 4A	5V C.T. @ 8A	C	3 5/16	2⅜	3 1/16	3⅛	—	#8	2.3
10-6	DL 10-6	10V C.T. @ 6A	5V C.T. @ 12A	B	3⅜	2¾	2 13/16	2 13/16	2⅛	#8	3.3
10-8	DL 10-8	10V C.T. @ 8A	5V C.T. @ 16A	B	3⅜	3⅛	2 13/16	2 13/16	2½	#8	4.0
10-12	DL 10-12	10V C.T. @ 12A	5V C.T. @ 24A	B	3¾	3¼	3⅛	3⅛	2½	#8	5.0
10-25	DL 10-25	10V C.T. @ 25A	5V C.T. @ 50A	B	4½	3¾	3¾	3¾	2¾	#10	8.7
10-50‡	DL 10-50	10V C.T. @ 50A	5V C.T. @ 100A	B	5¼	5½	4⅜	4⅜	3⅝	¼	17.0
10-100‡	DL 10-100	10V C.T. @ 100A	5V C.T. @ 200A	B	6⅜	7¼	5 5/16	5 5/16	4⅜	¼	34.5
12.8-1	DL 12.8-1	12.8V C.T. @ 1A	6.4V C.T. @ 2A	C	2⅞	2	2 5/16	2⅜	—	#8	1.2
12.8-2	DL 12.8-2	12.8V C.T. @ 2A	6.4V C.T. @ 4A	B	3	2½	2½	2½	2	#8	2.3
12.8-4	DL 12.8-4	12.8V C.T. @ 4A	6.4V C.T. @ 8A	B	3	2⅞	2½	2½	2⅜	#8	2.8
12.8-6	DL 12.8-6	12.8V C.T. @ 6A	6.4V C.T. @ 12A	B	3⅜	3 1/16	2 13/16	2 13/16	2½	#8	4.0
12.8-8	DL 12.8-8	12.8V C.T. @ 8A	6.4V C.T. @ 16A	B	3¾	3⅛	3⅛	3⅛	2¼	#8	4.5
12.8-12	DL 12.8-12	12.8V C.T. @ 12A	6.4V C.T. @ 24A	B	4⅛	3¼	3 7/16	3 7/16	2⅜	#10	6.0
12.8-25	DL 12.8-25	12.8V C.T. @ 25A	6.4V C.T. @ 50A	B	5¼	4¼	4⅜	4⅜	2⅞	#10	12.5
12.8-50‡	DL 12.8-50	12.8V C.T. @ 50A	6.4V C.T. @ 100A	B	5¼	6	4⅜	4⅜	4⅛	¼	20.7
12.8-100‡	DL 12.8-100	12.8V C.T. @ 100A	6.4V C.T. @ 200A	B	6⅜	7¼	5 5/16	5 5/16	4⅜	¼	34.5
16-1	DL 16-1	16V C.T. @ 1A	8V C.T. @ 2A	C	2⅞	2	2 5/16	2⅜	—	#8	1.2
16-2	DL 16-2	16V C.T. @ 2A	8V C.T. @ 4A	C	3⅛	2¼	2¾	2 13/16	—	#8	1.7
16-4	DL 16-4	16V C.T. @ 4A	8V C.T. @ 8A	B	3⅜	2¾	2 13/16	2 13/16	2⅛	#8	3.3
16-6	DL 16-6	16V C.T. @ 6A	8V C.T. @ 12A	B	3¾	3⅛	3⅛	3⅛	2¼	#10	4.5
16-8	DL 16-8	16V C.T. @ 8A	8V C.T. @ 16A	B	3¾	3½	3⅛	3⅛	2⅝	#10	5.4
16-12	DL 16-12	16V C.T. @ 12A	8V C.T. @ 24A	B	4⅛	3⅞	3 7/16	3 7/16	3	#10	7.9
16-25	DL 16-25	16V C.T. @ 25A	8V C.T. @ 50A	B	4½	5⅜	3¾	3¾	4	#10	14.5
16-50‡	DL 16-50	16V C.T. @ 50A	8V C.T. @ 100A	B	6⅜	5¾	5 5/16	5 5/16	3¾	¼	26.5
16-100‡	DL 16-100	16V C.T. @ 100A	8V C.T. @ 200A	B	7½	7½	6⅜	6¾	4⅝	¼	50.0
24-1	DL 24-1	24V C.T. @ 1A	12V C.T. @ 2A	B	3	2½	2½	2½	2	#8	2.3
24-2	DL 24-2	24V C.T. @ 2A	12V C.T. @ 4A	B	3	2⅞	2½	2½	2⅜	#8	2.9
24-4	DL 24-4	24V C.T. @ 4A	12V C.T. @ 8A	B	3¾	3⅛	3⅛	3⅛	2¼	#8	4.5
24-6	DL 24-6	24V C.T. @ 6A	12V C.T. @ 12A	B	4⅛	3¼	3 7/16	3 7/16	2⅜	#10	5.8
24-8	DL 24-8	24V C.T. @ 8A	12V C.T. @ 16A	B	4⅛	3⅞	3 7/16	3 7/16	3	#10	7.9
24-12‡	DL 24-12	24V C.T. @ 12A	12V C.T. @ 24A	B	4½	4½	3¾	3¾	3⅜	#10	11.0
24-20‡	DL 24-20	24V C.T. @ 20A	12V C.T. @ 40A	B	5¼	4¾	4⅜	4⅜	3⅜	¼	15.3
24-25‡	DL 24-25	24V C.T. @ 25A	12V C.T. @ 50A	B	5¼	5⅜	4⅜	4⅜	4⅛	¼	19.5
24-50‡	DL 24-50	24V C.T. @ 50A	12V C.T. @ 100A	B	6⅜	6¼	5 5/16	5 5/16	4⅜	¼	31.3
——	24-100 △	24V C.T. @ 100A	12V C.T. @ 200A	B	7½	7	6¾	6¾	4⅛	¼	43.0
36-1	DL 36-1	36V C.T. @ 1A	18V C.T. @ 2A	B	3	2¾	2½	2½	2¼	#8	2.6
36-2	DL 36-2	36V C.T. @ 2A	18V C.T. @ 4A	B	3⅜	2 13/16	2 13/16	2 13/16	2⅜	#8	3.8
36-4	DL 36-4	36V C.T. @ 4A	18V C.T. @ 8A	B	4⅛	3⅜	3 7/16	3 7/16	2⅝	#10	6.8
36-6	DL 36-6	36V C.T. @ 6A	18V C.T. @ 12A	B	4½	3¾	3¾	3¾	2¾	#10	8.7
36-8‡	DL 36-8	36V C.T. @ 8A	18V C.T. @ 16A	B	4½	4½	3¾	3¾	3⅛	#10	11.0
36-12‡	DL 36-12	36V C.T. @ 12A	18V C.T. @ 24A	B	5¼	5	4⅜	4⅜	3⅜	¼	15.0
36-20‡	DL 36-20	36V C.T. @ 20A	18V C.T. @ 40A	B	6⅜	5⅜	5 5/16	5 5/16	3⅜	¼	22.8
36-25‡	DL 36-25	36V C.T. @ 25A	18V C.T. @ 50A	B	6⅜	5¾	5 5/16	5 5/16	3¾	¼	26.5
36-30‡	DL 36-30	36V C.T. @ 30A	18V C.T. @ 60A	B	6⅜	6	5 5/16	5 5/16	4⅜	¼	31.5
——	36-50△	36V C.T. @ 50A	18V C.T. @ 100A	B	6⅜	7¼	5 5/16	5 5/16	5⅛	¼	40.0
56-1	DL 56-1	56V C.T. @ 1A	28V C.T. @ 2A	B	3⅜	2⅞	2 13/16	2 13/16	2¼	#8	3.5
56-2	DL 56-2	56V C.T. @ 2A	28V C.T. @ 4A	B	3¾	3¼	3⅛	3⅛	2½	#8	5.0
56-4	DL 56-4	56V C.T. @ 4A	28V C.T. @ 8A	B	4⅛	3¾	3 7/16	3 7/16	3	#10	7.7
56-6	DL 56-6	56V C.T. @ 6A	28V C.T. @ 12A	B	5¼	4¼	4⅜	4⅜	2⅞	#10	12.0
56-8‡	DL 56-8	56V C.T. @ 8A	28V C.T. @ 16A	B	5¼	5	4⅜	4⅜	3⅝	¼	17.0
56-12‡	DL 56-12	56V C.T. @ 12A	28V C.T. @ 24A	B	6⅜	5¼	5 5/16	5 5/16	3⅜	¼	22.0
56-25‡	DL 56-25	56V C.T. @ 25A	28V C.T. @ 50A	B	6⅜	7⅛	5 5/16	5 5/16	5⅛	¼	38.0
——	56-50△	56V C.T. @ 50A	28V C.T. @ 100A	B	7½	7½	6¼	6¾	4⅞	¼	56.3
68-1	DL 68-1	68V C.T. @ 1A	34V C.T. @ 2A	B	3⅜	2 13/16	2 13/16	2 13/16	2⅜	#8	3.8
68-2	DL 68-2	68V C.T. @ 2A	34V C.T. @ 4A	B	4⅛	3⅜	3 7/16	3 7/16	2⅝	#10	6.8
68-4	DL 68-4	68V C.T. @ 4A	34V C.T. @ 8A	B	4½	4½	3¾	3¾	3⅜	#10	11.5
68-6‡	DL 68-6	68V C.T. @ 6A	34V C.T. @ 12A	B	5¼	5	4⅜	4⅜	3⅜	¼	15.0
68-8‡	DL 68-8	68V C.T. @ 8A	34V C.T. @ 16A	B	5¼	5½	4⅜	4⅜	3⅞	¼	19.0
68-12‡	DL 68-12	68V C.T. @ 12A	34V C.T. @ 24A	B	6⅜	5¾	5 5/16	5 5/16	3¾	¼	26.5
——	68-25△	68V C.T. @ 25A	34V C.T. @ 50A	B	6⅜	7¼	5 5/16	5 5/16	5⅛	¼	39.7
80-1	DL 80-1	80V C.T. @ 1A	40V C.T. @ 2A	B	3⅜	3 1/16	2 13/16	2 13/16	2½	#8	4.0
80-2	DL 80-2	80V C.T. @ 2A	40V C.T. @ 4A	B	4⅛	3⅜	3 7/16	3 7/16	2⅝	#10	6.8
80-4	DL 80-4	80V C.T. @ 4A	40V C.T. @ 8A	B	5¼	4¼	4⅜	4⅜	2⅞	¼	12.3
80-6‡	DL 80-6	80V C.T. @ 6A	40V C.T. @ 12A	B	5¼	5½	4⅜	4⅜	3⅞	¼	19.0
80-8‡	DL 80-8	80V C.T. @ 8A	40V C.T. @ 16A	B	6⅜	5¼	5 5/16	5 5/16	3¼	¼	20.5
80-12‡	DL 80-12	80V C.T. @ 12A	40V C.T. @ 24A	B	6⅜	6	5 5/16	5 5/16	4⅛	¼	29.0
——	80-25△	80V C.T. @ 25A	40V C.T. @ 50A	B	7½	6½	6¼	6¾	3⅞	¼	40.3

△Available with dual primary only. Therefore, prefix "DL" is not required.
‡ Nominal 115V primary has added taps, I.E., 105/115/125V, Dual (DL) version is 115/230V only.

Items shown in shaded area are not normally in stock. They are standard designs generally available in 3-4 weeks.

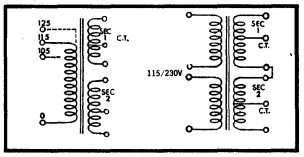
All transformers are designed conservatively and are rated for 50/60 Hz. Only prime raw materials are used. Units are thoroughly impregnated and baked with Signal's own high gloss varnish. The transformers and chokes are rugged in construction, well insulated, and have a consistently uniform appearance. All ratings are at full load current continuous operation. Hipot rating of 1500V RMS is standard.

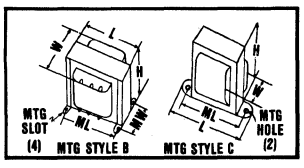
Electrical ratings have been chosen to cover a wide range of applications. All transformers have two center-tapped secondary windings, which may be series or parallel connected as indicated in rating chart.

*The secondary currents shown in the tables are RMS ratings. Depending upon rectifier circuit configurations, the RMS secondary current is different than the DC output current. This is indicated in the chart below:

Rectifier Type	Filter Type	RMS Secondary Current Is
Full Wave Center-Tap	Choke Input	= 0.7 x DC Amps
Full Wave Center-Tap	Capacitor Input	= 1 to 1.2 x DC Amps
Full Wave Bridge	Choke Input	= DC Amps
Full Wave Bridge	Capacitor Input	= 1.6 to 1.8 x DC Amps

For example, in a F.W. Bridge circuit with a capacitive filter, if the load is 1 Amp DC, the RMS Secondary current is 1.6 to 1.8 Amp RMS.





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filter chokes

1.0 TO 200 AMPS

Signal's line of filter chokes is the most extensive available. It is designed to complement the selection of Rectifier Power Transformers so that a set may be specified for power supplies using inductive filters.

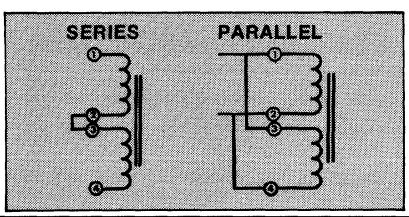
The inductance ratings given are minimum values guaranteed at full DC current. All resistance ratings are maximum values. Special variations or intermediate values of inductance, current, or resistance can be supplied promptly and accurately.

FOR MECHANICAL DIMENSIONS REFER TO TRANSFORMER OUTLINES ON PREVIOUS PAGE

Part No.	Inductance (MHY)	Current (Amps)	Resistance (Ohms)	Mtg. Style	L	W	H	ML	MW	Mtg. Screw	Approx. Lbs.
CH-1	100	1	1.5	B	3	2½	2½	2½	2	#8	2.3
CH-2	70	2	0.9	B	3⅜	2¾	2⅞	2 13/16	2⅛	#8	3.2
CH-4	70	4	0.6	B	3¾	3⅛	3¼	3⅛	2½	#8	5.3
CH-6	40	6	0.4	B	3¾	3⅝	3¼	3⅛	3	#8	6.5
CH-8	30	8	0.3	B	4⅛	3⅝	3½	3 1/16	3	#10	8
CH-12	15	12	0.1	B	5¼	4	4 1/16	4⅜	3⅛	#10	13.7
CH-16	15	16	0.08	B	5¼	4⅝	4 1/16	4⅜	3⅝	#10	17.5
CH-20	7	20	0.05	B	5¼	4	4 1/16	4⅜	3⅛	#10	13.3
CH-25	5	25	0.025	B	5¼	4¾	4 1/16	4⅜	3⅞	#10	17.8
CH-30	4	30	0.01	B	6⅜	5	5⅜	5 5/16	3⅜	¼	24.4
CH-50	1.4	50	0.01	B	6⅜	5¼	5⅜	5 5/16	3¾	¼	26.7
CH-100	0.5	100	0.005	B	6⅜	6¼	5⅜	5 5/16	4⅛	¼	31.4
CH-200	0.3	200	0.001	B	7½	7½	6¼	6¾	4⅛	¼	48.0

dual chokes

FOR LOWER INDUCTANCE APPLICATIONS

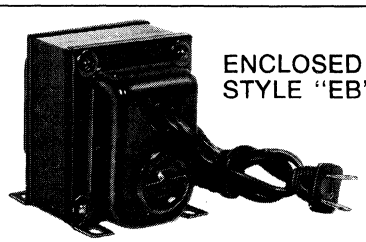


Part No.	Series Connected Ind. (MHY)	Series Connected Curr. (Amps)	Series Connected Res. Ω	Parallel Connected Ind. (MHY)	Parallel Connected Curr. (Amps)	Parallel Connected Res. Ω	Mtg. Style	Dimensions L	W	H	ML	MW	Mtg. Screw	Appr. Lbs.
CL-1-2	72	1	1.4	18	2	0.35	C	2⅞	1¾	2 5/16	2⅜	—	#8	0.9
CL-2-4	40	2	0.7	10	4	0.18	C	3⅛	2⅛	2¾	2 13/16	—	#8	1.5
CL-4-8	20	4	0.3	5	8	0.075	B	3	2⅞	2½	2½	2½	#8	3.0
CL-6-12	12	6	0.15	3	12	0.038	B	3⅜	3 1/16	2 13/16	2 13/16	2½	#8	4.0
CL-12-24	4.8	12	0.052	1.2	24	0.013	B	3⅜	3 1/16	2 13/16	2 13/16	3	#8	5.3
CL-25-50	1.2	25	0.012	0.3	50	0.003	B	3¾	3⅜	3⅜	3⅛	2¾	#8	6.0
CL-50-100	0.5	50	0.0043	0.12	100	0.0011	B	4½	3¾	3¾	3¾	2½	#8	8.0

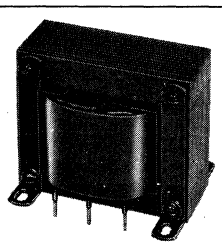
Signal's Dual Chokes are supplied with 2 windings which may be series or parallel connected with rating shown on chart. This line is basically designed for application requiring lower inductance value at high currents, such as low voltage, DC supplies or SCR filters.

step down auto transformers

50/60 Hz 100-2000 VA — 230/115V



ENCLOSED STYLE "EB"



OPEN FRAME STYLE "OF"

(May be used step-up or step-down)

UL APPROVED 2 PRONG LINE CORD RECEPTACLE — LOW REGULATION
BLACK ENAMEL FINISH

VA	Cat. No.	Width	Depth	Height	Mtg. Centers	Lbs.
100	110	1⅞	2⅜	2½	1½ x 1 1/16	1.5
120	112	2⅞	2⅛	3½	2¼ x 1¾	3.0
150	115	2⅞	3⅜	3½	2¼ x 2	3.5
200	120	2⅞	3½	3½	2¼ x 2⅛	4.0
250	125	2⅞	3⅞	3½	2¼ x 2½	4.8
300	130	3¼	3⅞	3⅞	2½ x 2 7/16	5.5
500	150	3¼	4⅞	3⅞	2½ x 3 7/16	8
750	175	3¼	5⅞	3⅞	2½ x 4 7/16	11
1000	1100	4½	5⅛	5½	3½ x 5½	14
1500	1150	4½	6⅛	5½	3½ x 4½	20
2000	1200	4½	7⅛	5½	3½ x 5½	26

BLACK ENAMEL FINISH. 8" LEADS
INEXPENSIVE VERSION FOR USE IN EQUIPMENT

VA	Cat. No.	Width	Depth	Height	Mtg. Centers	Lbs.
100	110-OF	2¼	2	1 15/16	2 13/16*	1.3
120	112-OF	3⅜	2½	2⅞	2 13/16 x 1⅞	2.5
150	115-OF	3⅜	2¾	2⅞	2 13/16 x 2⅛	3.0
200	120-OF	3⅜	2⅞	2⅞	2 13/16 x 2¼	3.5
250	125-OF	3⅜	3¼	2⅞	2 13/16 x 2⅝	4.2
300	130-OF	3¾	3¼	3⅛	3⅛ x 2½	5.0
500	150-OF	3¾	4¼	3⅛	3⅛ x 3½	8.0
750	175-OF	3¾	5¼	3⅛	3⅛ x 4½	11
1000	1100-OF	5¼	4½	4⅜	4⅜ x 3⅛	14
1500	1150-OF	5¼	5½	4⅜	4⅜ x 4⅛	19
2000	1200-OF	5¼	6½	4⅜	4⅜ x 5⅛	25

* Part 110-OF is mounted by means of a channel with 2 mtg. tabs.

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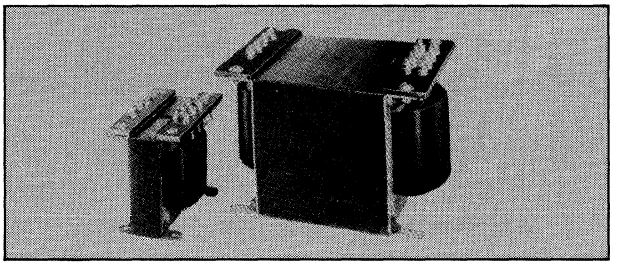
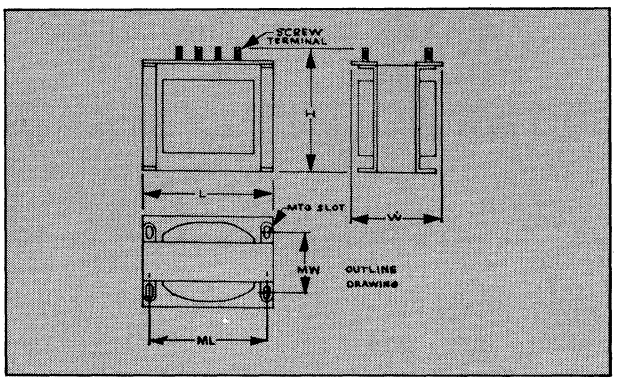
power isolation transformers

INDUSTRIAL GRADE/STEP-UP OR STEP-DOWN. MANY POSSIBLE VOLTAGE RATINGS.



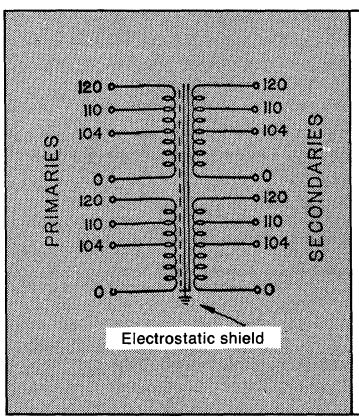


AVAILABLE FROM STOCK FOR IMMEDIATE SHIPMENT

The "DU" and "SU" lines are designed for a maximum of 55°C rise above ambient for use on standard power lines from 50 to 500 Cps. Only prime raw materials are used. Units are thoroughly impregnated and baked with Signal's own high gloss black baking varnish. The transformers are rugged in construction, well-insulated and have a consistently uniform appearance. All ratings are at full load current, continuous operation. 2500V. RMS Hipot is standard.

Heavy ¼ inch phenolic terminal boards are provided with plated brass screws and flat washers (10-32 on ¼ and ½ KVA, ¼-20 on larger sizes). Connections can be easily made with a nut driver. It is also simple to alter the interconnections to change transformer ratings. **Electrostatic shields are provided grounded to the core.** The connection is made with a lug to ground and may be opened if an ungrounded shield is desired.

DU SERIES 110/220 Dual Primary to 110/220V. Dual Sec. (Primary & Secondary may be reversed)

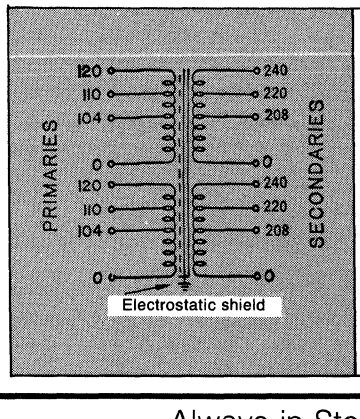


As shown on the schematic diagram the "DU" line is designed with dual primaries and secondaries. All four windings are identically rated at 0/104/110/120 volts. This permits series or parallel connections on either primary or secondary. Therefore, a nominal 110 to 110 volt, 220 to 220 volt, 110 to 220 volt, or 220 to 110 volt transformer can be set up. The winding taps permit intermediate series ratings such as 208, 214, or 230 volts. It is also possible to make auto-transformer connections by connecting a primary group in series with a secondary group. Such nominal ratings as 440 to 220 volts or 220 to 440 volts can be set-up, in addition to the standard ratings described above. A further advantage to auto-transformer connection is the fact that the KVA rating of a particular type is doubled.

Part No.	KVA	Series Secondaries Volts	Series Secondaries Max. Amps	Parallel Secondaries Volts	Parallel Secondaries Max. Amps	Mechanical Dimensions L *	W *	H *	ML †	MW ‡	Mtg. & Term. Screw	Appr. Lbs.
DU-¼	¼	0/208/220/240	1.1	0/104/110/120	2.2	5 5/16	4¼	5¼	4⅜	2½	#10	12
DU-½	½	0/208/220/240	2.3	0/104/110/120	4.6	5 5/16	5 5/16	5¼	4⅜	3⅝	#10	18
DU-1	1	0/208/220/240	4.5	0/104/110/120	9	7 5/16	6¼	7⅜	6¾	4⅛	¼	33
DU-2	2	0/208/220/240	9	0/104/110/120	18	7 5/16	8¼	7⅜	6¾	6	¼	56
DU-3	3	0/208/220/240	14	0/104/110/120	28	7 5/16	9¼	7⅜	6¾	7	¼	70
DU-5	5	0/208/220/240	23	0/104/110/120	46	7 5/16	10¾	7⅜	6¾	8½	¼	89
DU-7.5	7.5	0/208/220/240	31	0/104/110/120	62	9	10¾	8	7½	6½	¼	105
DU-10	10	0/208/220/240	41	0/104/110/120	83	9	13	8	7½	9	¼	150

* Maximum. † ±1/16 ‡ ±⅛

SU SERIES 110/220 Dual Primary to 220/440V. Dual Sec. (Primary & Secondary may be reversed)



"SU" transformers are similar to "DU" types except that a 220/240V secondary is provided.

Part No.	KVA	Series Secondaries Volts	Series Secondaries Max. Amps	Parallel Secondaries Volts	Parallel Secondaries Max. Amps	Mechanical Dimensions L *	W *	H *	ML †	MW ‡	Mtg. & Term. Screw	Appr. Lbs.
SU-¼	¼	0/416/440/480	0.55	0/208/220/240	1.1	5 5/16	4¼	5¼	4⅜	2½	#10	12
SU-½	½	0/416/440/480	1.15	0/208/220/240	2.3	5 5/16	5 5/16	5¼	4⅜	3⅝	#10	18
SU-1	1	0/416/440/480	2.25	0/208/220/240	4.5	7 5/16	6¼	7¼	6¾	4⅛	¼	33
SU-2	2	0/416/440/480	4.5	0/208/220/240	9	7 5/16	8¼	7¼	6¾	6	¼	56
SU-3	3	0/416/440/480	7	0/208/220/240	14	7 5/16	9¼	7¼	6¾	7	¼	70
SU-5	5	0/416/440/480	11.5	0/208/220/240	23	7 5/16	10¾	7¼	6¾	8½	¼	89
SU-7.5	7.5	0/416/440/480	15.5	0/208/220/240	31	9	10¾	8	7½	6½	¼	105
SU-10	10	0/416/440/480	20.5	0/208/220/240	41	9	13	8	7½	9	¼	150

* Maximum. † ±1/16 ‡ ±⅛

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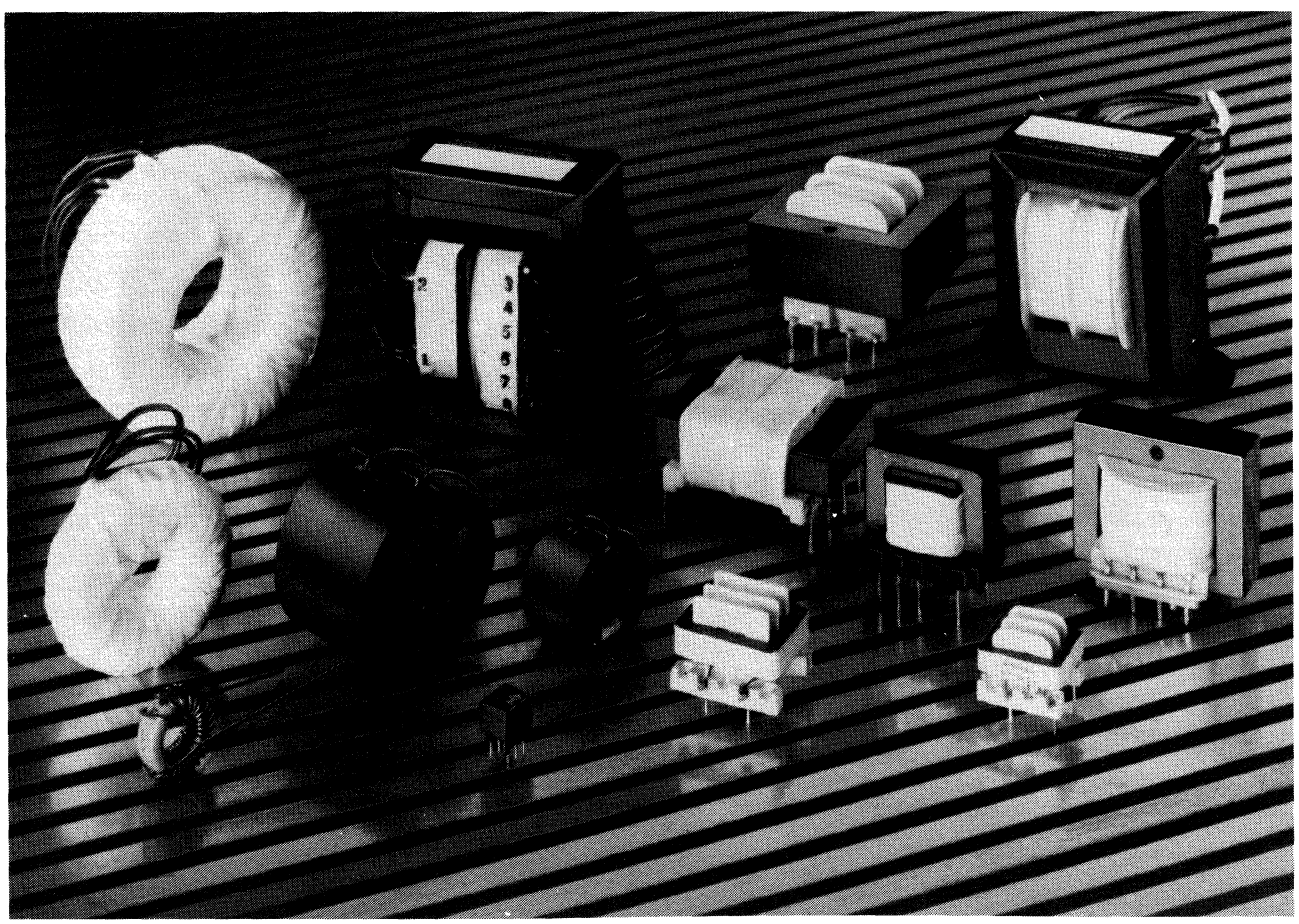

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LP-20-1200	13.97	A•2376
LP-20-2400	16.58	A•2376
LP-24-100	9.36	A•2376
LP-24-250	10.32	A•2376
LP-24-500	12.98	A•2376
LP-24-1000	13.97	A•2376
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LP-34-75	9.36	A•2376
LP-34-170	10.32	A•2376
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LP-34-700	13.97	A•2376
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DMPC-X-15	12.20	A•2382
DMPC-Y-12	14.85	A•2382
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MT-8-12	24.15	A•2383
MT-8-15	24.15	A•2383
DMT-6-12	15.45	A•2383
DMT-6-15	15.45	A•2383
DMT-7-12	18.85	A•2383
DMT-7-15	18.85	A•2383
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PC-12-70	8.65	A•2378
PC-12-100	6.49	A•2378
PC-12-350	7.60	A•2378
PC-12-800	8.75	A•2378
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PC-16-55	8.65	A•2378
PC-16-75	6.49	A•2378
PC-16-260	7.60	A•2378
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PC-20-60	6.49	A•2378
PC-20-220	7.60	A•2378
PC-20-500	8.75	A•2378
PC-20-1200	11.98	A•2378
PC-24-35	8.65	A•2378
PC-24-50	6.49	A•2378
PC-24-180	7.60	A•2378
PC-24-450	8.75	A•2378
PC-24-1000	11.98	A•2378
PC-28-30	8.65	A•2378
PC-28-40	6.49	A•2378
PC-28-160	7.60	A•2378
PC-28-360	8.75	A•2378
PC-28-800	11.98	A•2378
PC-34-25	8.65	A•2378
PC-34-35	6.49	A•2378
PC-34-125	7.60	A•2378
PC-34-300	8.75	A•2378
PC-34-700	11.98	A•2378
PC-40-20	8.65	A•2378
PC-40-30	6.49	A•2378
PC-40-110	7.60	A•2378
PC-40-250	8.75	A•2378
PC-40-600	11.98	A•2378
PC-56-15	8.65	A•2378
PC-56-20	6.49	A•2378
PC-56-80	7.60	A•2378
PC-56-180	8.75	A•2378
PC-56-420	11.98	A•2378
PC-120-8	8.65	A•2378
PC-120-10	6.49	A•2378
PC-120-35	7.60	A•2378
PC-120-85	8.75	A•2378
PC-120-200	11.98	A•2378
DPC-10-90	10.00	A•2378
DPC-10-120	7.55	A•2378
DPC-10-440	8.83	A•2378
DPC-10-1000	10.22	A•2378
DPC-10-2400	13.24	A•2378
DPC-12-70	10.00	A•2378
DPC-12-100	7.55	A•2378
DPC-12-350	8.83	A•2378
DPC-12-800	10.22	A•2378
DPC-12-2000	13.24	A•2378
DPC-16-55	10.00	A•2378
DPC-16-75	7.55	A•2378
DPC-16-260	8.83	A•2378
DPC-16-640	10.22	A•2378
DPC-16-1500	13.24	A•2378
DPC-20-45	10.00	A•2378
DPC-20-60	7.55	A•2378
DPC-20-220	8.83	A•2378
DPC-20-500	10.22	A•2378
DPC-20-1200	13.24	A•2378
DPC-24-35	10.00	A•2378
DPC-24-50	7.55	A•2378
DPC-24-180	8.83	A•2378
DPC-24-450	10.22	A•2378
DPC-24-1000	13.24	A•2378
DPC-28-30	10.00	A•2378
DPC-28-40	7.55	A•2378
DPC-28-160	8.83	A•2378
DPC-28-360	10.22	A•2378
DPC-28-800	13.24	A•2378
DPC-34-25	10.00	A•2378
DPC-34-35	7.55	A•2378
DPC-34-125	8.83	A•2378
DPC-34-300	10.22	A•2378
DPC-34-700	13.24	A•2378
DPC-40-20	10.00	A•2378
DPC-40-30	7.55	A•2378
DPC-40-110	8.83	A•2378
DPC-40-250	10.22	A•2378
DPC-40-600	13.24	A•2378
DPC-56-15	10.00	A•2378
DPC-56-20	7.55	A•2378
DPC-56-80	8.83	A•2378
DPC-56-180	10.22	A•2378
DPC-56-420	13.24	A•2378
DPC-120-8	10.00	A•2378
DPC-120-10	7.55	A•2378
DPC-120-35	8.83	A•2378
DPC-120-85	10.22	A•2378
DPC-120-200	13.24	A•2378
10-BR	.75	A•2378
24-BR	.75	A•2378

DISCOUNT SCHEDULE*

Quantity	Discount
1-9	Net
10-24	25%
25-49	35%
50-99	43%
100-249	50%
250 Over	Quote

* Different part numbers may not be aggregated to obtain quantity discount. Terms: Net 30 days on approved credit. FOB Factory, Inwood, NY. Prices subject to change without notice.

Signal Transformer Co., Inc.
500 Bayview Ave., Inwood, NY 11696-1792
Tel. (516) 239-5777
TWX: 510-225-8440 Telex: 96-8112 Fax: 516-239-7208

PRICE LIST Effective Date: MARCH 15, 1988

Signal Transformer.

The American Original.

CONVENTIONAL POWER MAGNETICS

RECTIFIER POWER

Part No.	Net	Page No.
10-1	$24.90	A•2384
10-2	28.80	A•2384
10-4	32.55	A•2384
10-6	42.15	A•2384
10-8	45.50	A•2384
10-12	50.65	A•2384
10-25	71.25	A•2384
10-50	113.00	A•2384
10-100	178.00	A•2384
12.8-1	26.55	A•2384
12.8-2	34.35	A•2384
12.8-4	40.50	A•2384
12.8-6	46.50	A•2384
12.8-8	49.25	A•2384
12.8-12	56.85	A•2384
12.8-25	78.00	A•2384
12.8-50	124.00	A•2384
12.8-100	188.00	A•2384
16-1	23.27	A•2384
16-2	25.74	A•2384
16-4	36.40	A•2384
16-6	42.77	A•2384
16-8	51.24	A•2384
16-12	56.25	A•2384
16-25	94.00	A•2384
16-50	173.00	A•2384
16-100	248.00	A•2384
24-1	25.60	A•2384
24-2	29.25	A•2384
24-4	36.70	A•2384
24-6	44.85	A•2384
24-8	50.60	A•2384
24-12	72.50	A•2384
24-20	97.00	A•2384
24-25	114.00	A•2384
24-50	157.00	A•2384
24-100	268.00	A•2384
36-1	26.90	A•2384
36-2	33.00	A•2384
36-4	44.95	A•2384
36-6	52.55	A•2384
36-8	66.10	A•2384
36-12	87.00	A•2384
36-20	128.00	A•2384
36-25	139.00	A•2384
36-30	163.00	A•2384
36-50	211.00	A•2384
56-1	31.05	A•2384
56-2	36.30	A•2384
56-4	46.80	A•2384
56-6	66.10	A•2384
56-8	93.00	A•2384
56-12	111.00	A•2384
56-25	187.00	A•2384
56-50	363.00	A•2384
68-1	36.25	A•2384
68-2	47.30	A•2384
68-4	64.80	A•2384
68-6	83.00	A•2384
68-8	106.00	A•2384
68-12	153.00	A•2384
68-25	240.00	A•2384
80-1	34.50	A•2384
80-2	44.95	A•2384
80-4	71.90	A•2384
80-6	104.00	A•2384
80-8	119.00	A•2384
80-12	145.00	A•2384
80-25	228.00	A•2384
DL-10-1	26.15	A•2384
DL-10-2	30.24	A•2384
DL-10-4	34.19	A•2384
DL-10-6	44.27	A•2384
DL-10-8	51.46	A•2384
DL-10-12	57.42	A•2384
DL-10-25	81.00	A•2384
DL-10-50	128.00	A•2384
DL-10-100	202.00	A•2384
DL-12-8-1	27.89	A•2384
DL-12-8-2	36.08	A•2384
DL-12-8-4	42.53	A•2384
DL-12-8-6	48.83	A•2384
DL-12-8-8	51.98	A•2384
DL-12-8-12	59.73	A•2384
DL-12-8-25	82.00	A•2384
DL-12-8-50	130.00	A•2384
DL-12-8-100	197.00	A•2384
DL-16-1	24.44	A•2384
DL-16-2	27.03	A•2384
DL-16-4	38.22	A•2384
DL-16-6	44.92	A•2384
DL-16-8	53.81	A•2384
DL-16-12	58.75	A•2384
DL-16-25	99.00	A•2384
DL-16-50	182.00	A•2384
DL-16-100	253.00	A•2384
DL-24-1	26.81	A•2384
DL-24-2	30.67	A•2384
DL-24-4	38.53	A•2384
DL-24-6	47.09	A•2384
DL-24-8	52.90	A•2384
DL-24-12	76.00	A•2384
DL-24-20	100.00	A•2384
DL-24-25	120.00	A•2384
DL-24-50	165.00	A•2384
DL-36-1	28.26	A•2384
DL-36-2	34.66	A•2384
DL-36-4	47.22	A•2384
DL-36-6	55.16	A•2384
DL-36-8	69.38	A•2384
DL-36-12	90.00	A•2384
DL-36-20	133.00	A•2384
DL-36-25	141.00	A•2384
DL-36-30	168.00	A•2384
DL-56-1	32.60	A•2384
DL-56-2	38.10	A•2384
DL-56-4	49.16	A•2384
DL-56-6	69.38	A•2384
DL-56-8	97.00	A•2384
DL-56-12	117.00	A•2384
DL-56-25	197.00	A•2384
DL-68-1	38.09	A•2384
DL-68-2	49.69	A•2384
DL-68-4	68.04	A•2384
DL-68-6	87.00	A•2384
DL-68-8	111.00	A•2384
DL-68-12	160.00	A•2384
DL-80-1	36.23	A•2384
DL-80-2	47.15	A•2384
DL-80-4	75.50	A•2384
DL-80-6	110.00	A•2384
DL-80-8	125.00	A•2384
DL-80-12	153.00	A•2384

CHOKES

Part No.	Net	Page No.
CH-1	$19.95	A•2385
CH-2	25.50	A•2385
CH-4	41.15	A•2385
CH-6	44.80	A•2385
CH-8	48.95	A•2385
CH-12	67.45	A•2385
CH-16	95.00	A•2385
CH-20	77.00	A•2385
CH-25	89.00	A•2385
CH-30	111.00	A•2385
CH-50	121.00	A•2385
CH-100	139.00	A•2385
CH-200	204.00	A•2385

DUAL CHOKES

Part No.	Net	Page No.
CL-1-2	$18.15	A•2385
CL-2-4	20.70	A•2385
CL-4-8	35.75	A•2385
CL-6-12	40.00	A•2385
CL-12-24	46.00	A•2385
CL-25-50	54.00	A•2385
CL-50-100	73.00	A•2385

POWER ISOLATION TRANSFORMERS

Part No.	Net	Page No.
DU-¼	$98.00	A•2386
DU-½	124.00	A•2386
DU-1	202.00	A•2386
DU-2	276.00	A•2386
DU-3	382.00	A•2386
DU-5	468.00	A•2386
DU-7.5	615.00	A•2386
DU-10	838.00	A•2386
SU-¼	98.00	A•2386
SU-½	124.00	A•2386
SU-1	202.00	A•2386
SU-2	276.00	A•2386
SU-3	382.00	A•2386
SU-5	468.00	A•2386
SU-7.5	615.00	A•2386
SU-10	838.00	A•2386

AUTO TRANSFORMERS

Part No.	Net	Page No.
110	$33.00	A•2385
112	37.40	A•2385
115	39.05	A•2385
120	40.70	A•2385
125	42.90	A•2385
130	46.20	A•2385
150	53.90	A•2385
175	66.00	A•2385
1100	85.00	A•2385
1150	109.00	A•2385
1200	132.00	A•2385
110-OF	20.15	A•2385
112-OF	24.40	A•2385
115-OF	26.50	A•2385
120-OF	28.10	A•2385
125-OF	30.55	A•2385
130-OF	33.95	A•2385
150-OF	43.25	A•2385
175-OF	56.75	A•2385
1100-OF	65.10	A•2385
1150-OF	100.00	A•2385
1200-OF	119.00	A•2385

DISCOUNT SCHEDULE*	
Quantity	**Discount**
1-9	Net
10-24	25%
25-49	35%
50-99	43%
100-249	50%
250 Over	Quote

* Different part numbers may not be aggregated to obtain quantity discount. Terms: Net 30 days on approved credit. FOB Factory, Inwood, NY. Prices subject to change without notice.

An Insilco International Specialty Company

Signal Transformer Co., Inc.
500 Bayview Ave., Inwood, NY 11696-1792
Tel. (516) 239-5777
TWX: 510-225-8440 Telex: 96-8112
Fax: 516-239-7208

FOR PRONTO DELIVERY CALL (516) 239-5777

TALEMA ELECTRONIC INC.
301 NORTH HIGHWAY 63
ROLLA, MISSOURI 65401
314/364-0882 • FAX: 314-364-6320

TOROIDAL COMPONENTS TECHNICAL INFORMATION

IN-RUSH CURRENT

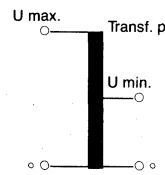
Due to the lack of air gaps, toroidal components generally have a higher in-rush current than normal transformers. For main fuses we recommend the use of slow blowing types, especially for output power rates in excess of 500 VA.

FREQUENCY RANGE

TALEMA power transformers may be designed for international operating frequencies and operate up to 450 Hz maximum. With increasing frequency, the transformer size decreases accordingly. Core materials for frequencies up to 100 KHz are available in materials such as thin tape wound nickel alloy, molded powder cores or sintered ferrite.

AUTOTRANSFORMERS

An autotransformer allows smaller dimensions and a more economical overall design in cases where galvanically separated windings are not required.



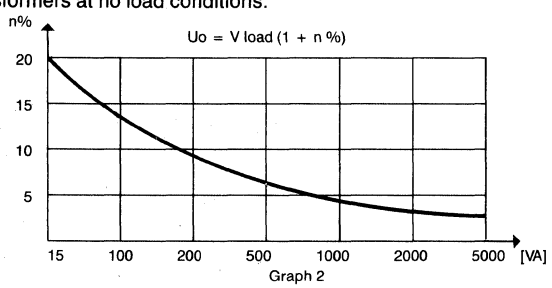
$$= P\,out \frac{U\,max. - U\,min.}{U\,max.} [VA]$$

P out = Output Power [VA]

$$Optimum\ Size = \frac{U\,min.}{U\,max.} < 0.5$$

VOLTAGE DROP

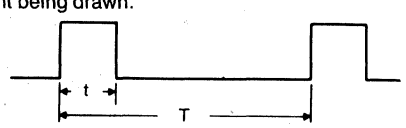
The secondary voltages and currents are valid as shown on page 4 for normal output power. At partial load the output voltage, as a function of transformer size, will be accordingly higher. Graph 2 shows the percent of voltage increase for standard toroidal transformers at no load conditions.



Graph 2

DUTY CYCLE

A smaller transformer can be used if the load is intermittent. Because the output power in this case significantly exceeds the nominal power, the secondary voltage drops below the voltages shown on page 4. The voltage drop increases proportionately with the current being drawn.

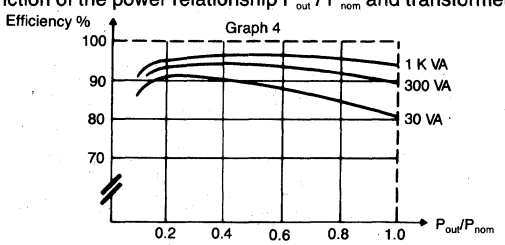


$$P\,out \leqslant P_{nom}\sqrt{\frac{T}{t}} [VA]$$

T ≪ than heat sink coefficient

EFFICIENCY

Graph 4 shows typical efficiency which can be expected as a function of the power relationship P_{out} / P_{nom} and transformer size.



TEMPERATURE RISE

TALEMA toroidal components are designed for a temperature rise of 25°C to 45°C at full load. Designs are available which employ higher temperature rise above ambient. Heat sink, mounting configuration, load duty cycle and ventilation are important considerations.

RECTIFYING

Figures 5 and 6 give formulas for calculation of approximate values of the transformers and are primarily dependent on the size of the loading capacitor to be used. The applied form factor "F" is rated between 1.1 for smaller capacitors, up to 2.5 for relatively larger capacitors.

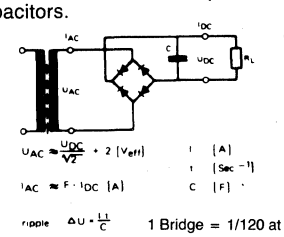


Fig. 5

1 Bridge = 1/120 at 60 cycles

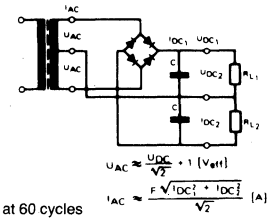


Fig. 6

SPECIAL COMPONENTS

If we do not have a standard which meets your requirements, we can offer expert engineering assistance to develop the special you need. We can supply other sizes as well on short notice.

SPECIAL OPTIONS

- Power: 5 VA-7.5 KVA per phase
- Assembled three phase sets
- Special sizes–extremely flat or small diameter
- Static copper shielding
- Magnetic shielding
- Operating frequencies to 20 KHz
- Potting in special housings
- Secondary voltages to 2000 V
- Up to 8 primaries or taps
- Reinforced dielectric to 4.5 KV/AC
- Special housing upon request

ORDERING INFORMATION

Special Transformers (for special transformers, the following information is required)

1. Total Output Power VA
2. Ambient Temperature °C
3. Phase
4. Frequency Hz
5. Dimensions mm
6. Weight kg
7. Load: Rectifier
   Resistance
   Inductance
8. Primary
   1) V, Tap V
   2) V, Tap V
9. Static Shield
10. Test voltage, Primary-Secondary, etc. kv
11. Secondary
    1) V, A, Tap V
    2) V, A, Tap V
    3) V, A, Tap V
    4) V, A, Tap V
12. Magnetic Shield
13. Mounting-Encapsulation without centering washers, with centering washers, in nylon housing, with mounting plates.

TALEMA ELECTRONIC INC.
301 NORTH HIGHWAY 63
ROLLA, MISSOURI 65401
314/364-0882 • FAX: 314-364-6320

TOROIDAL COMPONENTS TECHNICAL INFORMATION

CUSTOMER STANDARDS

Toroidal transformers with centering washers are available from 15 VA through 1000 VA - All are UL recognized and marked.

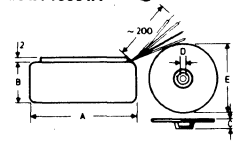
Without Centering Washers

With Centering Washers

15VA-300VA

30VA-120VA

120VA-1000VA



With or Without Centering Washers

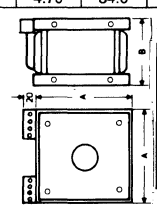
Output Power VA	Core Loss W	Copper Loss typical T= 20° C W	Copper Loss typical T= 120° C W	Dimensions mm A	Dimensions mm B	Wt. kg
15	0.20	2.4	3.3	60	31	0.3
30	0.25	4.6	6.4	72	32	0.5
50	0.45	5.9	8.3	82	35	0.7
80	0.50	9.6	13.2	95	36	1.0
120	0.75	11.7	16.4	95	45	1.3
160	1.00	16.7	23.3	115	40	1.5
225	1.4	18.0	25.0	115	48	2.0
300	2.00	19.0	26.0	115	58	2.4
500	2.50	25.0	35.0	140	60	3.7
625	3.00	31.0	43.0	140	70	4.4
1000	4.70	34.0	47.0	160	72	6.6

Potted in Nylon Case

30	0.25	4.5	6.4	75	38	0.6
50	0.45	5.9	8.3	90	40	0.9
80	0.50	9.6	13.2	100	43	1.2
120	0.75	11.7	16.4	100	53	1.6

With Mounting Plates

120	0.75	11.7	16.4	100	66	1.6
160	1.00	16.7	23.3	120	64	2.1
225	1.40	18.0	25.0	120	72	2.6
300	2.00	19.0	26.0	120	82	3.0
500	2.50	25.0	35.0	145	90	4.6
625	3.00	31.0	43.0	145	100	5.3
1000	4.70	34.0	47.0	175	102	7.7



Centering Washer mm

Power	C	D	E	Mtg. Torque IN-LB
15	5	4.2	50	3.5
30–50	7	5.2	60	7
80–120	7	6.2	70	10
160–300	7	6.2	90	15
500–625	7	6.2	112	15
500–1000	10	12	145	18

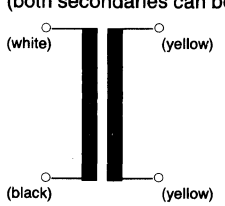
UL RECOGNIZED STANDARD TRANSFORMERS

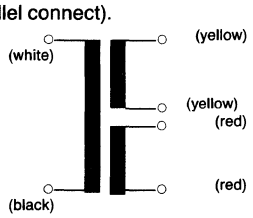
ORDERING INFORMATION

Orders for standard transformers must include the following information:
1. Trans. part no. 2. Quantity per item 3. Method of shipment
4. Delivery address 5. Date of delivery

CONNECTION WIRES

Standard length: 200 mm
(both secondaries can be series or parallel connect).





UL RECOGNIZED STANDARD TOROIDAL TRANFORMERS

Part Number	Voltage	Current	No Load Voltage
15 VA UR0015-1-010	10	1.50	11.9
UR0015-1-015	15	1.00	17.8
UR0015-1-030	30	0.50	35.7
UR0015-2-006	2x6	1.25	2x7.2
UR0015-2-010	2x10	0.75	2x11.9
UR0015-2-012	2x12	0.62	2x14.3
UR0015-2-015	2x15	0.50	2x17.8
UR0015-2-018	2x18	0.41	2x21.4
30 VA UR0030-1-010	10	3.00	11.9
UR0030-1-024	24	1.25	28.6
UR0030-1-030	30	1.00	35.7
UR0030-2-006	2x6	2.50	2x7.2
UR0030-2-010	2x10	1.50	2x11.9
UR0030-2-015	2x15	1.00	2x17.8
UR0030-2-018	2x18	0.83	2x21.4
50 VA UR0050-1-024	24	2.10	27.8
UR0050-1-035	35	1.40	40.6
UR0050-1-117	117	0.43	135.8
UR0050-2-006	2x6	4.10	2x6.9
UR0050-2-010	2x10	2.50	2x11.6
UR0050-2-015	2x15	1.60	2x17.4
UR0050-2-020	2x20	1.25	2x23.2
80 VA UR0080-1-015	15	5.30	17.4
UR0080-1-024	24	3.30	27.8
UR0080-1-035	35	2.30	40.6
UR0080-2-042	42	1.90	48.7
UR0080-2-117	117	0.68	135.8
UR0080-2-006	2x6	6.60	2x6.9
UR0080-2-018	2x18	2.20	2x20.9
UR0080-2-022	2x22	1.80	2x25.5
UR0080-2-030	2x30	1.30	2x34.8
120 VA UR0120-1-024	25	5.00	27.2
UR0120-1-042	42	2.80	47.5
UR0120-1-117	117	1.00	132.3
UR0120-2-018	2x18	3.30	2x20.4
UR0120-2-022	2x22	2.70	2x24.9
UR0120-2-030	2x30	2.00	2x34.5
160 VA UR0160-1-024	24	6.70	27.3
UR0160-1-042	42	3.80	47.8
UR0160-1-054	54	2.90	61.6
UR0160-1-117	117	1.37	133.3
UR0160-2-018	2x18	4.40	2x20.5
UR0160-2-022	2x22	3.60	2x25.1
UR0160-2-030	2x30	2.60	2x34.2
225 VA UR0225-1-024	24	9.40	27.0
UR0225-1-060	60	3.70	67.2
UR0225-1-117	117	1.90	131.0
UR0225-2-030	2x30	3.70	2x33.7
330 VA UR0300-1-024	24	12.50	26.2
UR0300-1-060	60	5.00	65.8
UR0300-1-117	117	2.60	128.0
UR0300-2-030	2x30	5.00	2x32.9
500 VA UR0500-1-117	117	4.30	126.5
UR0500-2-024	2x24	10.40	2x25.9
UR0500-2-030	2x30	8.30	2x32.4
UR0500-2-060	2x60	4.20	2x65.2
625 VA UR0625-1-117	117	5.30	127.0
UR0625-2-024	2x24	13.00	2x26.0
UR0625-2-030	2x30	10.40	2x32.7
UR0625-2-060	2x60	5.20	2x65.0
800 VA UR0800-1-117	117	6.80	125.2
UR0800-2-024	2x24	16.70	2x25.5
UR0800-2-030	2x30	13.30	2x32.2
UR0800-2-060	2x60	6.70	2x64.0
1000 VA UR1000-1-117	117	8.50	123.4
UR1000-2-024	2x24	20.80	2x25.6
UR1000-2-030	2x30	16.70	2x31.4
UR1000-2-060	2x60	8.30	2x63.4

Secondary Power VA	Primary Current with Load A	Primary No Load Current mA	Primary Resistance T = 20° C Ohm	No Load Core Loss W	Copper Loss T = 20° C W	Copper Loss T = 120° C W	Dimensions and weight with Centering Washers ϕ mm	Height/mm	Weight/kg
15	0.15	1.8	43	0.21	2.1	2.9	60	31	0.3
30	0.31	2.3	23	0.27	4.1	5.6	72	32	0.48
50	0.49	3.8	11	0.44	5.0	6.9	82	35	0.67
80	0.79	4.4	7.4	0.52	8.5	11.8	95	36	0.92
120	1.2	6.6	4.5	0.78	10.4	14.5	95	45	1.2
160	1.6	7.2	3.1	0.85	13.9	19.5	115	40	1.5
225	2.1	10.9	1.9	1.3	16.5	23.0	115	48	1.9
300	2.8	14.4	1.4	1.7	18.3	25.5	115	58	2.5
500	4.6	21.5	0.5	2.5	24.6	34.3	140	60	3.6
625	5.8	24.8	0.4	2.9	31.6	44.0	160	48	4.4
800	7.3	33.3	0.3	3.9	33.0	46.0	160	60	5.6
1000	9.0	41.3	0.2	4.8	41.1	57.3	160	72	6.7

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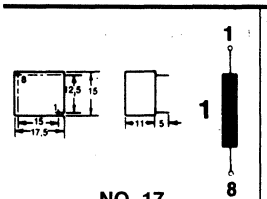
FILTER CHOKES

Switched power supplies allow small size with high efficiency and stabilized output. Switching regulators use a load coil for interim energy storage. The use of powdered iron cores for this purpose gives excellent efficiency and outstanding alternating field modulation along with the possibility of an extensive constant inductivity over a wide, varying bias current. Additionally, powdered iron cores give outstanding results in ringing choke applications and in filter circuits requiring small dimensions and high "Q," with operating frequencies of up to 300 kHz.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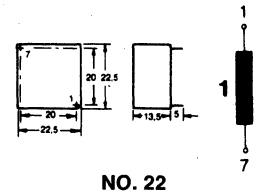
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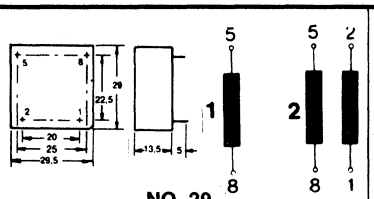
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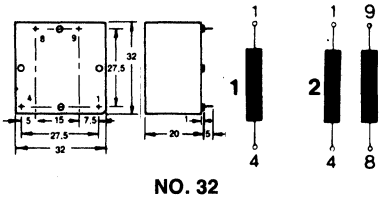
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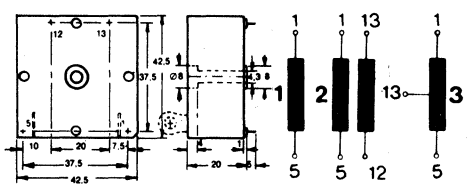
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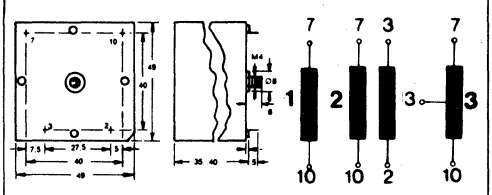
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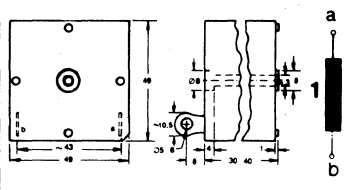
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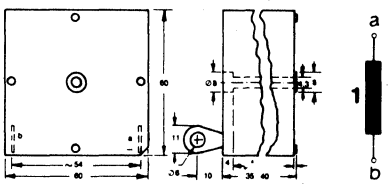
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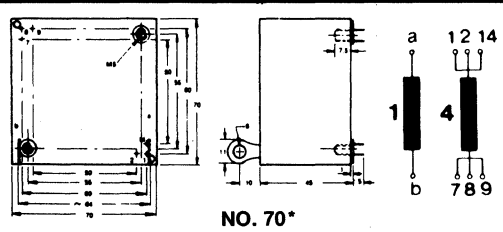
NO. 70*

I_N (A)	L (μH)	R_{CU}* (mΩ)	Housing No.	Housing Height mm	Part No. SD	Terminals Winding	Terminals Pins	Terminals Ø mm
0,63	500	750	17	11	0,63/500/17/1 - P	1	1 - 8	0,6
	1000	760	22	13,5	0,63/1000/22/1 - P	1	1 - 7	0,6
	2500	850	29	13,5	0,63/2500/29/1 - P	1	5 - 8	0,6
	4000	1100	29	13,5	0,63/4000/29/1 - P	1	5 - 8	0,6
	6000	1300	32	20	0,63/6000/32/1 - P	1	1 - 4	0,6
1	500	200	22	13,5	1,0/500/22/1 - P	1	1 - 7	0,6
	1000	280	29	13,5	1,0/1000/29/1 - P	1	5 - 8	0,6
	2500	500	29	13,5	1,0/2500/29/1 - P	1	5 - 8	0,6
	4000	900	32	20	1,0/4000/32/1 - P	1	1 - 4	0,6
	6000	900	42	20	1,0/6000/42/2R - P	2R	1 - 5/13 - 12	0,6
1,6	500	115	29	13,5	1,6/500/29/1 - P	1	5 - 8	0,8
	1000	195	32	20	1,6/1000/32/2R - P	2R	1 - 4/9 - 8	0,8
	2500	350	42	20	1,6/2500/42/1 - P	1	1 - 5	0,8
	4000	450	49	30	1,6/4000/49/1 - P	1	7 - 10	0,8
2	315	70	29	13,5	2,0/315/29/1 - P	1	5 - 8	0,8
	630	100	29	13,5	2,0/630/29/1 - P	1	5 - 8	0,8
	1000	145	42	20	2,0/1000/42/1 - P	1	1 - 5	0,8
	1600	190	42	20	2,0/1600/42/1 - P	1	1 - 5	0,8
	2500	290	49	30	2,0/2500/49/1 - P	1	7 - 10	0,8
2,5	200	80	29	13,5	2,5/200/29/2R - P	2R	5 - 8/2 - 1	0,9
	400	130	29	13,5	2,5/400/29/2R - P	2R	5 - 8/2 - 1	0,9
	1000	145	42	20	2,5/1000/42/2R - P	2R	1 - 5/13 - 12	0,9
	1600	250	42	20	2,5/1600/42/2R - P	2R +	1 - 5/13 - 12 +	0,9
	2500	320	49	30	2,5/2500/49/2R - M	2R +	7 - 10/3 - 2 +	0,9
3,15	250	80	29	13,5	3,15/250/29/2P - P	2P	5/2 - 8/1	1,0
	630	110	42	20	3,15/630/42/2R - P	2R	1 - 5/13 - 12	1,0
	1000	160	42	20	3,15/1000/42/2R - M	2R	1 - 5/13 - 12	1,0
	1600	220	42	20	3,15/1600/42/2R - M	2R	1 - 5/13 - 12	1,0
	2000	240	49	30	3,15/2000/49/2R - M	2R	7 - 10/3 - 2	1,0
4	160	40	29	13,5	4,0/160/29/1 - P	1	5 - 8	1,0
	250	45	42	20	4,0/250/42/1 - P	1	1 - 5	1,0
	500	85	42	20	4,0/500/42/1 - M	1	1 - 5	1,0
	1000	130	42	20	4,0/1000/42/2R - M	2R	1 - 5/13 - 12	1,0
	2000	200	49	30	4,0/2000/49/2R - M	2R	7 - 10/3 - 2	1,0
5	100	28	29	13,5	5,0/100/29/2P - P	2P	5/2 - 8/1	1,2
	250	38	42	20	5,0/250/42/2R - P	2R	1 - 5/13 - 12	1,2
	630	80	42	20	5,0/630/42/2R - M	2R	1 - 5/13 - 12	1,2
	1250	120	49	30	5,0/1250/49/2R - M	2R	7 - 10/3 - 2	1,2
	1600	150	49	40	5,0/1600/49/2R - M	2R	7 - 10/3 - 2	1,2
6,3	63	17	29	13,5	6,3/63/29/1 - P	1	5 - 8	1,2
	200	40	42	20	6,3/200/42/2P - P	2P	1/13 - 5/12	1,2
	400	55	42	20	6,3/400/42/2P - M	2P	1/13 - 5/12	1,2
	630	65	49	30	6,3/630/49/2P - M	2P	7/3 - 10/2	1,2
	1000	100	49	30	6,3/1000/49/2P - M	2P	7/3 - 10/2	1,2

I_N (A)	L (μH)	R_{CU}* (mΩ)	Housing No.	Housing Height mm	Part No. SD	Terminals Winding	Terminals Pins	Terminals Ø mm
8	63	12	32	20	8,0/63/32/2P - P	2P	1/9 - 4/8	1,2
	125	20	42	20	8,0/125/42/2P - M	2P	1/13 - 5/12	1,2
	250	35	42	20	8,0/250/42/2P - M	2P	1/13 - 5/12	1,2
	400	45	49	30	8,0/400/49/2P - M	2P	7/3 - 10/2	1,2
	630	45	49	35	8,0/630/49/2P - M	2P	7/3 - 10/2	1,2
10	63	14	32	20	10/63/32/2P - M	2P	1/9 - 4/8	1,4
	100	18	42	20	10/100/42/2P - M	2P	1/13 - 5/12	1,4
	160	22	42	20	10/160/42/2P - M	2P	1/13 - 5/12	1,4
	400	24	49	30	10/400/49/2P - M	2P	7/3 - 10/2	1,4
	630	26	49	40	10/630/49/2P - M	2P	7/3 - 10/2	1,4
16	63	9	42	20	16/63/42/1K - M	1K	a - b	5
	100	13	49	30	16/100/49/1K - M	1K	a - b	5
	160	12	49	35	16/160/49/1K - M	1K	a - b	5
	250	12	49	40	16/250/49/1K - M	1K	a - b	5
	400	14	70	45	16/400/70/1K - M	1K	a - b	5
20	21	3,0	42	20	20/21/42/1K - M	1K	a - b	5
	40	5,5	49	30	20/40/49/1K - M	1K	a - b	5
	63	7,0	49	40	20/63/49/1K - M	1K	a - b	5
	100	8,5	60	35	20/100/60/1K - M	1K	a - b	5
	160	9,5	60	35	20/160/60/1K - M	1K	a - b	5
25	21	3,5	42	20	25/21/42/1K - M	1K	a - b	5
	40	5,5	49	30	25/40/49/1K - M	1K	a - b	5
	63	7,0	49	40	25/63/49/1K - M	1K	a - b	5
	100	6,0	70	45	25/100/70/1K - M	1K	a - b	5
	160	7,0	80	50	25/160/70/1K - M	1K	a - b	5
31,5	13,5	2,5	42	20	31,5/13,5/42/1K - M	1K	a - b	5
	21	3,0	49	30	31,5/21/49/1K - M	1K	a - b	5
	40	3,5	49	40	31,5/40/49/1K - M	1K	a - b	5
	63	3,5	70	45	31,5/63/70/1K - M	1K	a - b	5
	125	4,0	80	50	31.5/125/70/1K - M	1K	a - b	5
40	13,5	1,5	42	25	40/13,5/42/1K - M	1K	a - b	6
	21	1,9	49	30	40/21/49/1K - M	1K	a - b	6
	40	2,7	60	35	40/40/60/1K - M	1K	a - b	6
	63	3,1	70	45	40/63/70/1K - M	1K	a - b	6
	125	3,7	80	50	40/125/70/1K - M	1K	a - b	6
50	8,5	1,2	49	30	50/8,5/49/1K - M	1K	a - b	6
	13,5	1,2	60	35	50/13,5/60/1K - M	1K	a - b	6
	21	1,6	70	45	50/21/70/1K - M	1K	a - b	6
	40	2,2	80	50	50/40/80/1K - M	1K	a - b	6
	63	2,8	80	50	50/63/70/1K - M	1K	a - b	6
63	8,5	0,7	60	40	63/8,5/60/1K - M	1K	a - b	6
	13,5	0,9	70	45	63/13,5/70/1K - M	1K	a - b	6
	21	1,2	70	45	63/21/70/1K - M	1K	a - b	6
	40	1,4	80	52	63/40/70/1K - M	1K	a - b	6

1. SD = Filter choke
2. I = Operating current (A)
3. L = Inductance at rated current (μH)
4. Case No.
5. Circuit 1 = One winding
   2P = 2 windings, parallel connection
   2R = 2 windings, series connection
   1K = 1 winding, cable connection
   3 = 1 winding, three connections
6. Core
   P = Powdered iron core
   M = Tape wound core

+ (also available in configuration 3)
*R_{CU} = Winding resistance at 20° C

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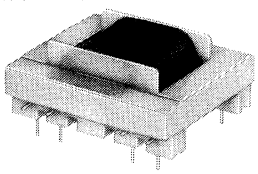
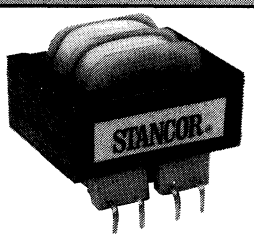


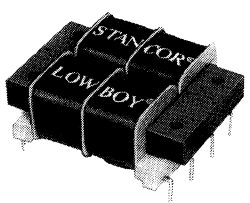
An expansive series of telephone coupling transformers available in either direct connect or dry coupling versions. Single/multiple primaries and secondaries lend maximum versatility in application. All units designed to meet FCC Part 68 and 1,500 volt dielectric strength.

SIDE WINDER COMPACT TRANSFORMERS



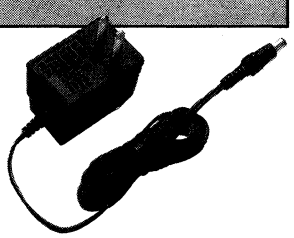
A compact transformer with primary and secondaries wound side-by-side. "Side Winders" are available with single 115V or dual 115/230V primaries. Split secondaries allow series or parallel connection. Secondaries from 5 volts to 120 volts and power ratings from 1.1VA to 20VA. UL recognized.

LOW BOY™ LOW PROFILE TRANSFORMERS



Excellent for low clearance, stacked printed circuit board designs. Available in 2, 3, 4, 5, 6 & 12 VA sizes. Secondaries from 5 volts through 230 volts. Side-by-side windings eliminate need for static shield. Semi-toroidal construction reduces radiated magnetic fields. UL recognized.

WALL PLUG TRANSFORMERS



Reliable power sources eliminate heat build-up problems generated by on-board power supplies and simplify agency safety approvals. Available as AC-AC or AC-DC in regulated and unregulated units from three to 24 volts. Standard output termination compatible with Switchcraft® PC-722A, 722A or equivalent. Domestic and European models carry the appropriate UL, CSA or VDE approvals.

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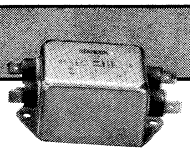
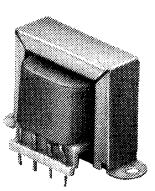


A complete selection of attenuation characteristics and physical configurations allows effective filtering in even the most stringent of applications. Off-the-self availability and appropriate safety agency approvals simplify your filter selection process.

PPC PRINTED CIRCUIT TRANSFORMERS



A series of over 60 off-the-shelf transformers available with single 115 or dual 115/230 primary voltages. Secondaries from four volts to 230 volts allow almost endless applications. Sizes range from 1.5 VA to 24 VA. UL recognized.

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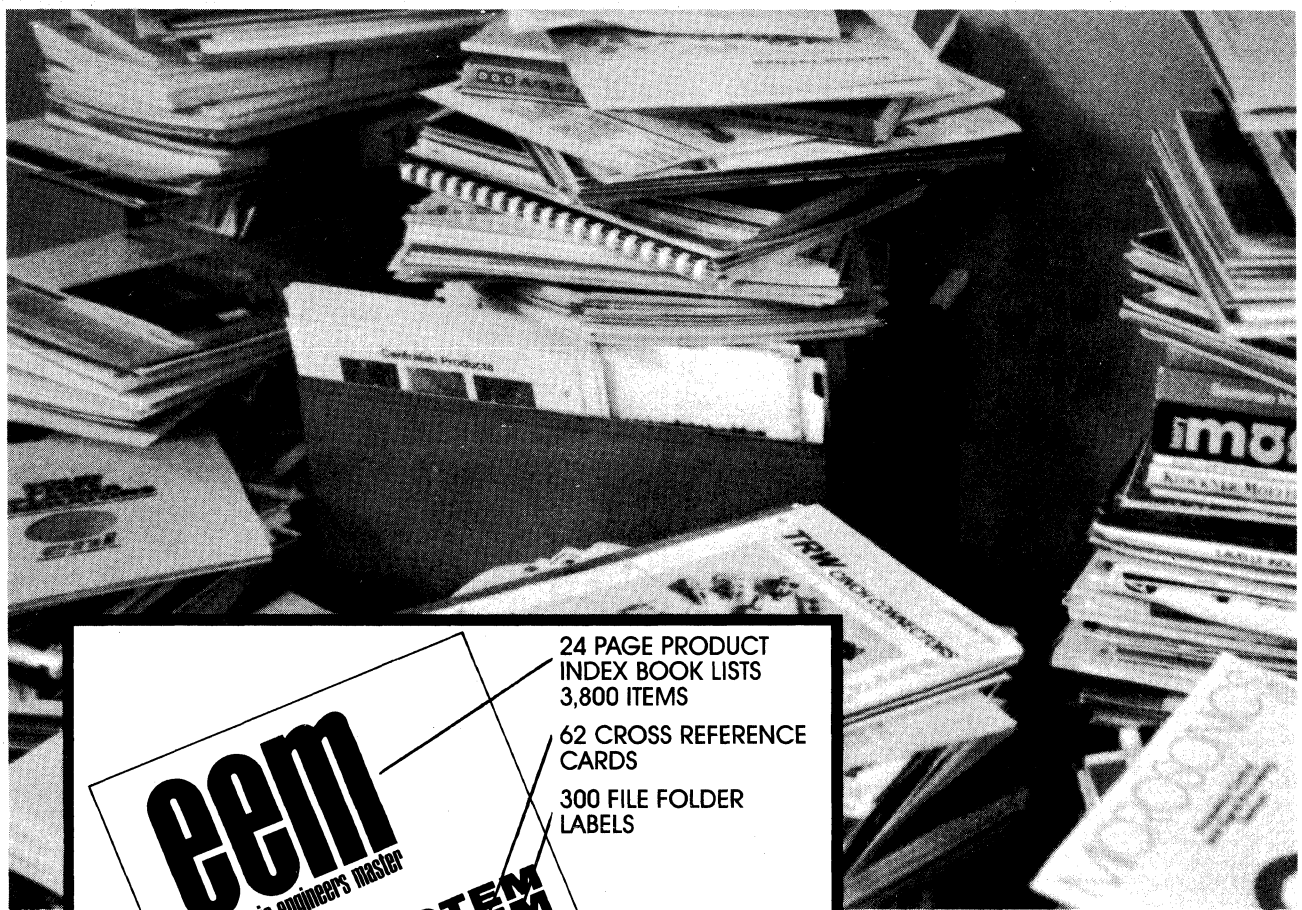

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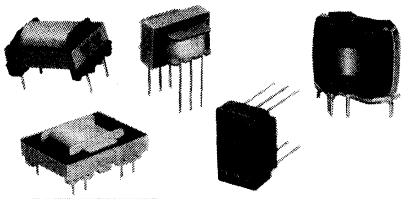
PRODUCT LINE SUMMARY

TRANSFORMERS & INDUCTORS FOR TELEPHONE INTERCONNECT. The TTC SERIES meets the high performance requirements of telephone central office, modem, facsimile, and voice communication applications. These **FCC PART 68** coupling, direct connect, hybrid transformers and holding coils **COMPLY WITH UL & MEET FCC PART 68** requirements.

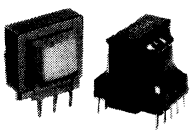
FOR DETAILS SEE A•2396, 2397

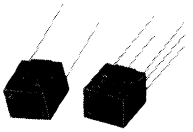


TELECOMMUNICATION TRANSFORMERS for DATA, DIGITAL, LOCAL-AREA-NETWORK & T-1 CARRIER circuit applications. These wide-band & pulse transformers feature low loss & low distortion performance characteristics. Miniature size, & low profiles are achieved with high-perm cores. Many models **MEET FCC PART 68** isolation requirements.

THE ATT SERIES **AUDIO TRANSFORMERS** are a low cost, volume produced series of transformers for impedance matching, isolation & sound distribution applications. The DP SERIES **ENCAPSULATED AUDIO TRANSFORMERS** are cost effective for severe environments & are tested to **MIL-T-27;** several items **MEET FCC PART 68** requirements

FOR DETAILS SEE A•2399



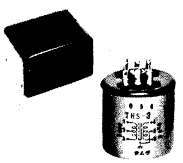


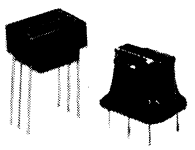
MINIATURE ENCAPSULATED TRANSFORMERS AND INDUCTORS are the smallest (0.31" x 0.41" x 0.465") audio magnetic components available with **1000V R M S HIPOT.** Several models **MEET FCC PART 68 & 1500V R M S HIPOT.** The MET SERIES transformers & MEI SERIES inductors are manufactured to **MEET MIL-T-27** as type TF5S21ZZ.

FOR DETAILS SEE A•2398

PROFESSIONAL AUDIO TRANSFORMER SERIES of high performance audio transformers are widely used in communications, broadcasting, recording & measuring apparatus. These transformers are available with electrostatic and MU-metal shields; lead, solder lug, or PC pin terminations; & open or metal case construction.

FOR DETAILS CONTACT FACTORY





SCR—TRIAC TRIGGER & PULSE—ISOLATION TRANSFORMERS. The STT SERIES is designed for low cost source isolation with **2600V R M S HIPOT** for SCR & TRIAC control circuits. The PHT & G SERIES PULSE TRANSFORMERS offer a wide range of characteristics. Encapsulated for protection against severe environments.

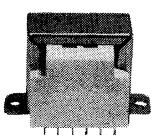
FOR DETAILS SEE A•2399

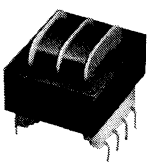
The PEP **INTERNATIONAL SERIES POWER TRANSFORMERS** have physical barriers between primary & secondary windings. The PEP SERIES incorporates a double protection insulation system and passes **4000V R M S HIPOT.**

UL 1411 RECOGNIZED—FILE NO. E 98949

MEETS CSA, IEC 65 & VDE SAFETY STANDARDS

FOR DETAILS SEE A•2400





3 FLANGE BOBBIN POWER TRANSFORMERS—80 MODELS IN STOCK. The 3F SERIES POWER TRANSFORMERS are drop-in compatible to all competitors & tube packed for auto-insertion.

UL1585 CLASS II & III—FILE NO. E 95844

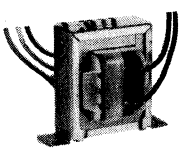
UL GENERAL PURPOSE TRANSFORMER—E 91239

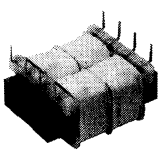
UL CLASS B INSULATION SYSTEM

FOR DETAILS SEE A•2401

CUSTOM OEM POWER & AUDIO TRANSFORMERS—UL RECOGNIZED under **UL1411** and Tamura FILE NO. E 59673. These designed-to-customer performance transformers also **COMPLY WITH CSA, IEC-65, MITI-JIS, & VDE** SAFETY STANDARDS. This series offers many different construction styles and OUTPOWER RATINGS FROM 0.7VA TO 400VA.

FOR DETAILS CONTACT FACTORY



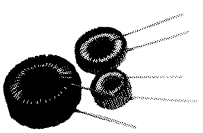


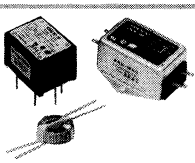
LOW PROFILE—3 FLANGE BOBBIN PC POWER TRANSFORMERS. The 3FL SERIES power transformers are designed and manufactured to comply with **UL** requirements and utilize a **UL CLASS B INSULATION SYSTEM.** Available in 5 power ranges: 2VA, 6VA, 12VA, 24VA & 48VA. These transformers have max. heights above the PC board of 0.65" to 1.375".

FOR DETAILS SEE A•2401

NOISE FILTERING & POWER INDUCTORS for switchmode power, regulator, control & filtering circuit applications. **SKP SERIES INDUCTORS** for **EMI/RFI** noise absorbing use. **SKL SERIES INDUCTORS** have **SWINGING L** with varying DC. **SKC SERIES INDUCTORS** are wound on gapped toroidal cores & have current ratings from 5 to 50A DC

FOR DETAILS SEE A•1293





EMI/RFI AC LINE FILTERS & COMMON MODE INDUCTORS. This series MEETS **FCC PART 15 & VDE-0871 CLASS A & B** requirements; UL1283 RECOGNIZED under E 92559; CSA CERTIFIED to C22.2 #8; & TUV CERTIFIED to VDE0565, Teil 3. *FOR DETAILS SEE A•1292, 1712, 1713*

DC-DC CONVERTERS NON-ISOLATION, SINGLE-IN-LINE PACKAGE for POLARITY REVERSING & VOLTAGE BOOSTING use. This series of DC-DC converters is encapsulated for environmental protection & available with single or dual outputs. In four package sizes, they have output power ratings of 0.2, 0.3, 0.5, & 1.0 WATT.

FOR DETAILS SEE D•1986, 1987

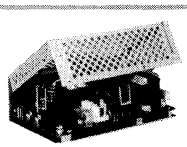
ISOLATION SERIES DC-DC CONVERTERS mount on a PC board. These COST EFFECTIVE, LOW PROFILE, SMALL SIZE power modules are ENCAPSULATED SURFACE-MOUNT HIGH-DENSITY HYBRID packaged to guarantee LONG LIFE & HIGH RELIABILITY. Most models in this series of DC-DC converter modules include a NOISE FILTER INDUCTOR & OVERCURRENT PROTECTION.

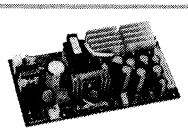
FOR DETAILS SEE D•1986, 1987

DIRECT PLUG-IN AC-DC REGULATED & UNREGULATED POWER SOURCES comply to WORLDWIDE safety agency requirements. This series is available in a variety of output ratings & terminations. Custom logo & multiple listings available. *FOR DETAILS SEE A•2402 and D•1988*

PLUG-IN POWER SOURCES are available in CORD-CORD DESK TOP, UL-CSA PLUG & EUROPEAN PLUG configurations with a variety of output terminations. Includes barrel plug & screw terminal styles. A wide range of output ratings including AC-AC, AC-DC regulated, & AC-DC unregulated models, & OEM CUSTOM designs are available.

The OLYMPIAN SERIES **SWITCHING POWER SUPPLIES** are the highest **WATTS/INCH³ VDE** certified units available. The series is **UL & CSA** approved. The Olympian series features WORLDWIDE AC INPUT with VDE0871 & VDE0875 filtering, SURFACE-MOUNT HYBRID TECHNOLOGY, OVP, ENABLE/INHIBIT, POWER FAIL, **& 80,000 HOURS MTBF.** *FOR DETAILS SEE A•1984, 1985, 1989*





OPEN FRAME POWER SUPPLIES—These LINEAR & SWITCHMODE SERIES meet all international safety and emission standards. They are available in multiple and single output models with WORLDWIDE AC INPUT. **HIGH MTBF** components are used throughout these power supplies for high performance and long operating life.

FOR DETAILS SEE D•1989, 1990, 1991

TAMURA QUALITY CIRCLES THE ELECTRON WORLD

TAMURA CORPORATION OF AMERICA

1150 DOMINGUEZ ST. □ CARSON, CA 90746-3518 □ 213/638-1790 □ FAX: 2136389956

TTC SERIES — MEETS FCC PART 68 FOR TELECOMMUNICATION APPLICATIONS
COUPLING TRANSFORMERS - HYBRID TRANSFORMERS - HOLDING COILS

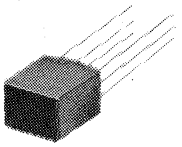


FIG. 1

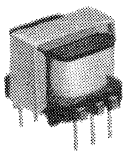


FIG. 2, 3, 4

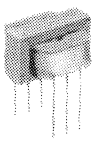


FIG. 5 & 6M

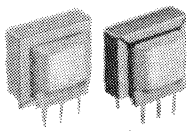


FIG. 6

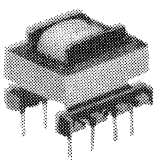


FIG. 6H

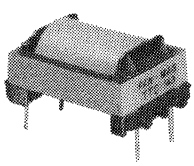


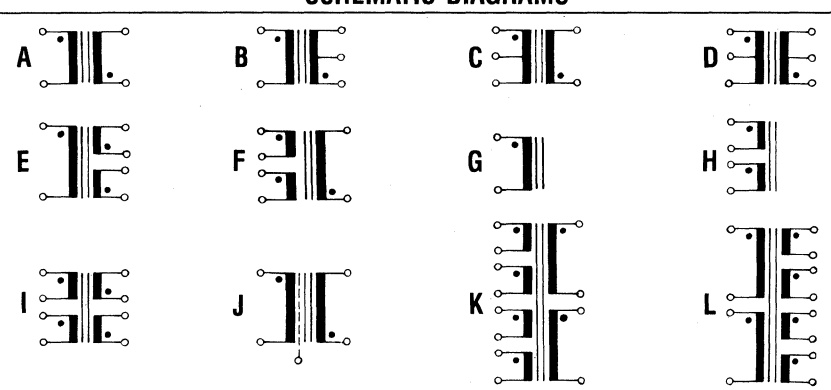
FIG. 7H

PERFORMANCE SELECTOR — CALL PAN-MAG FOR COMPLETE SPECIFICATIONS

STYLE FIG.	MODEL NUMBER	IMPEDANCE (OHMS) PRI : SEC	MADC UNBAL.	I.L. dB	F.R. ±dB	CKT. DIA.	FEATURES (CROSS REF.)
1	**MET-46**	600:600	3	1.5	1.0	A	1500V RMS HIPOT
1	**MET-32**	600:600CT*	3	1.5	1.2	E	300Hz TO 100KHz
1	**MET-31**	600CT:600CT	3	1.5	1.0	D	(TRIAD SP-67)
1	**MET-29**	900CT:600	3	1.5	1.0	C	—
1	**METC-99**	MU METAL SHIELD				—	EMI SLIP-ON CAN
2	**TTC-170**	600:600	0	1.7	0.7	A	0.385" TYP. HT.
2	**TTC-170-2**	600:600CT*	0	1.7	0.7	E	—
2	**TTC-170-1**	600CT:600CT	0	1.7	0.7	D	—
3	**TTC-171**	600:600	0	2.0	1.0	A	0.490" TYP. HT.
3	**TTC-172**	600:600CT	0	1.2	0.3	B	1 TO 1CT TURNS RATIO
3	**TTC-135**	600:S:600	0	1.3	0.3	J	W/STATIC SHIELD
3	**TTC-171-1**	600CT:600CT	0	2.0	1.0	D	—
3	**TTC-152**	600CT:1200CT	0	1.2	0.3	D	W/PC MTG FRAME**
3	**TTC-167**	10K:10K	0	1.4	0.7	A	—
4	**TTC-173**	600:600	0	1.5	0.7	A	0.630" TYP. HT.
4	**TTC-173-1**	600CT:600CT	0	1.5	0.7	D	—
5	**TTC-02**	600:600	0	1.2	0.4	A	0.490" MAX. HT.
5	**TTC-118**	600:600	0	0.8	0.3	A	(MICROTRAN T1104)
5	**TTC-177**	600:S:600	0	0.8	0.5	J	—
5	**TTC-03**	600CT:600CT	0	0.8	0.3	D	(STANCOR TTPC-03)
5	**TTC-04**	600:900	0	1.0	0.3	A	—
5	**TTC-05**	4000:600	0	1.0	0.3	A	BRIDGING CIRCUIT
5	**TTC-06**	10KCT:10KCT	0	1.0	0.3	D	—
6M	**TTC-180**	600:S:600	0	0.8	0.2	J	0.630" MAX. HT.
6M	**TTC-161**	600:S:600CT	0	0.7	0.2	J	SEC. AS IN DIA. B
6M	**TTC-103**	600:600CT*	0	1.1	0.3	E	—
6M	**TTC-103-1**	600CT:600CT	0	1.1	1.4	D	LOW COST
6M	**TTC-100-1**	600CT:600CT	0	0.7	0.2	D	—
6M	**TTC-100**	600CT:600CT*	0	0.7	0.2	E	PRI. AS IN DIA. C
6	**TTC-110**	600:600	0	0.8	0.3	A	(MIDCOM 671-0064)
6	**TTC-114**	600:600	0	1.2	0.3	A	—
6	**TTC-145**	600:600	100	2.3	3.0	A	(MPI A19N-HH-1A/1)
6	**TTC-105**	600:600	90	2.0	3.0	A	LOW COST
6	**TTC-105-1**	600:600CT	90	2.0	3.0	B	FOR SMART MODEM
6	**TTC-113-1**	600CT:S:600	0	0.6	0.2	J	—
6	**TTC-108**	600CT:600CT	0	1.2	0.3	D	LOW COST
6	**TTC-09**	600CT:600CT	0	0.8	0.3	D	(DALE TA10-04)
6	**TTC-140**	600CT*:600	100	2.3	3.0	F	—
6	**TTC-10**	600:600/600	0	1.0	0.2	E	SINGLE HYBRID**
6	**TTC-112**	600:900	0	0.9	0.2	A	(JAMES 13648)
6	**TTC-13**	4000:600	0	0.9	0.3	A	(TRIAD TY-303P)
6H	**TTC-175**	600:600	0	1.2	0.3	A	0.055" TYP. HT.
6H	**TTC-109**	600:600	90	2.0	3.0	A	—
6H	**TTC-109-1**	600:600CT	90	2.0	3.0	C	(MICROTRAN T2112)
6H	**TTC-109-2**	600:600CT*	90	2.0	3.0	E	(STANCOR TTPC-13)
6H	**TTC-175-1**	600CT:600	0	1.0	0.3	F	(PREM SPT-131)
7H	**TTC-142**	600:600	90	1.8	2.0	A	0.500" MAX. HT.
7H	**TTC-143**	600:600	90	1.6	1.8	A	FOR HI-SPEED MODEM
7H	**TTC-158**	600:600	0	1.1	0.3	A	3750V Hipot for Europe
7H	**TTC-178**	600:S:600	90	2.0	2.0	J	—
7H	**TTC-142-2**	600:600CT*	90	1.8	2.0	E	—
7H	**TTC-143-2**	600:600CT*	90	1.6	1.8	E	—
7H	**TTC-176-2**	600:600CT*	50	1.0	1.4	E	(MICROTRAN T9317)
7H	**TTC-142-1**	600CT:600CT	90	1.8	2.0	D	—
7H	**TTC-143-1**	600CT:600CT	90	1.6	1.8	D	—
7H	**TTC-174**	600:600/600	50	1.0	1.4	E	SINGLE HYBRID**
7H	**TTCC-7H**	MU METAL SHIELD				—	EMI SLIP-ON CAN

Data, dimensions and cross references are offered as a guide only. Contact Pan-Mag for detailed specifications & samples to determine suitability for a particular application.

SCHEMATIC DIAGRAMS



DIMENSIONS MM

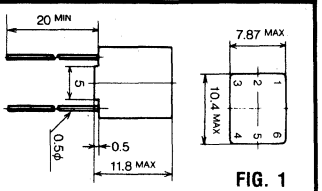


FIG. 1

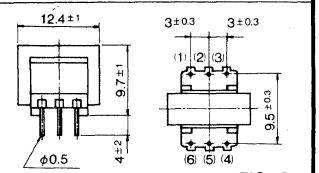


FIG. 2

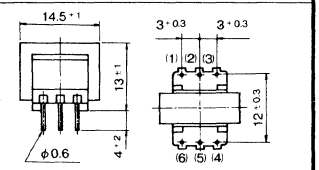


FIG. 3

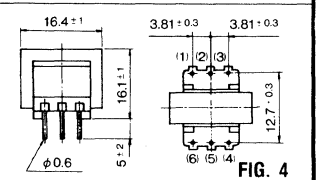


FIG. 4

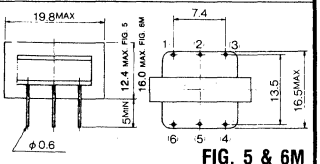


FIG. 5 & 6M

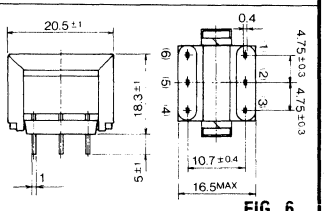


FIG. 6

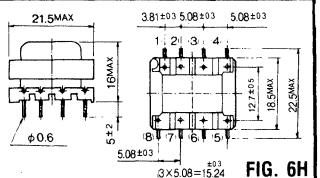


FIG. 6H

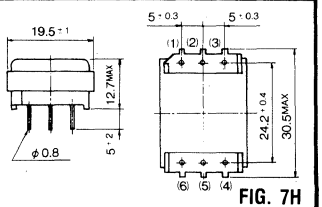


FIG. 7H

TAMURA QUALITY CIRCLES THE ELECTRON WORLD
TAMURA CORPORATION OF AMERICA
1150 DOMINGUEZ ST. □ CARSON, CA 90746-3518 □ 213/638-1790 □ FAX: 2136389956

TTC SERIES — MEETS FCC PART 68 FOR TELECOMMUNICATION APPLICATIONS
COUPLING TRANSFORMERS - HYBRID TRANSFORMERS - HOLDING COILS

DIMENSIONS MM

FIG. 8M

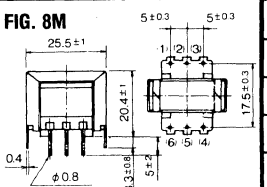


FIG. 8MH

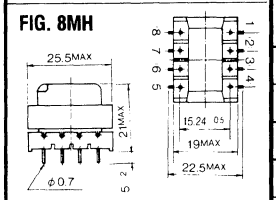


FIG. 9H2

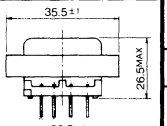
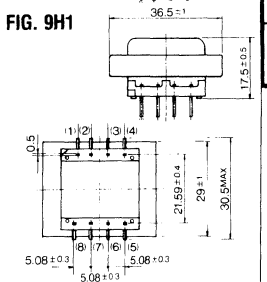


FIG. 9H1



PERFORMANCE SELECTOR — CALL PAN-MAG FOR COMPLETE SPECIFICATIONS

STYLE FIG.	MODEL NUMBER	IMPEDANCE (OHMS) PRI : SEC	MADC UNBAL	I.L. dB	F.R. ±dB	CKT. DIA.	FEATURES (CROSS REF.)
8	**TTC-101**	600:600/600	0	0.8	0.3	E	(TRIAD TY302P)**
8	**TTC-168**	600:600/600	0	0.6	0.1	E	(MIDCOM 671-0256)**
8H	**TTC-128**	PRI:1200-600-150CT SEC:600CT	3	0.7	0.1	Contact Factory	CENTRAL OFFICE LINE MATCHING
8M	**TTC-181-2**	600CT:600CT	0	1.0	0.2	D	
8M	**TTC-115**	600CT:600/600	0	0.9	0.4	E	LOW COST-SINGLE HYB.**
8MH	**TTC-182-2**	600CT*:600CT*	0	1.0	0.2	I	
8MH	**TTC-183-1**	600:600CT*	50	2.2	0.4	E	
9H1	**TTC-130**	600:600	90	1.8	0.3	A	HIGH SPEED MODEM
9H1	**TTC-164**	600:S:600	0	0.9	0.2	J	EUROPE BI-DIRECTIONAL
9H1	**TTC-131**	600:S:600	90	1.8	0.3	J	
9H2	**TTC-111-1**	600:600	0	0.7	0.3	A	F.R. @ 40Hz to 20KHz
9H2	**TTC-126-2**	600:600	90	0.8	0.6	A	
9H2	**TTC-126-3**	600:600/600	50	0.8	0.3	E	HI-PERFORM. HYBRID**
9H2	**TTC-126**	600CT*:600CT*	90	0.8	0.6	I	
9V	**TTC-119**	1.3HY HOLDING 2.0HY COIL	100 60			H	(DALE TA12-01) (TRIAD TY350P)
11H1	**TTC-122**	600:600	80	0.9	0.5	A	(PREM SPT-109)
11H1	**TTC-121**	600:600CT*	80	0.9	0.5	E	(MTC T5514)
11H1	**TTC-123**	900:600	80	0.9	0.6	A	(PREM SPT-111)
11H1	**TTC-127**	600CT*:600CT*	80	1.1	0.4	I	
11H1	**TTC-120**	1.4HY INDUCTOR	120			H	(MIDCOM 671-4031)
11H3	**TTC-160**	600:S:600	120	1.3	0.5	A	(PREM SPT-185)
11H4	**TTC-156**	600CT*:600	100	2.0	0.3	F	MINIMUM CROSSTALK
25H2	**TTC-125**	600:600	80	1.8	0.3	I	(PREM SPT-101)
25H2	**TTC-124**	600CT*:600	80	1.3	0.4	K	(PREM SPT-125)
25H3	**TTC-129**	600:600/600	80	1.5	0.4	L	HI-PERFORM. HYBRID**

NOTES: I.L. is typical insertion loss in dB measured at rated unbalanced MADC, 0dBm & 1000Hz.
F.R. is typ. freq. response in ±dB, 300 to 3500 Hz relative to 1000 Hz. at rated MADC & 0dBm.
CT* winding can be connected as a centertapped winding or as two isolated windings.
**Add 3dB to I.L. for single hybrid use with balancing network on two wire side.

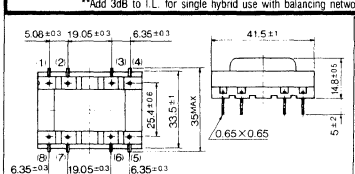


FIG. 11H1

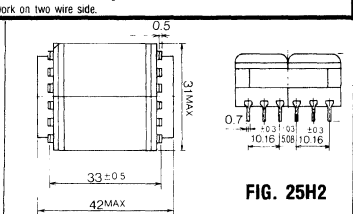


FIG. 25H2

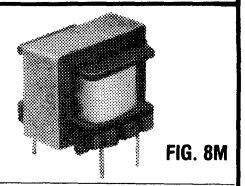


FIG. 8M

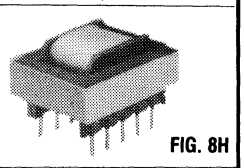


FIG. 8H

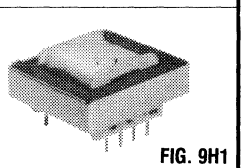


FIG. 9H1

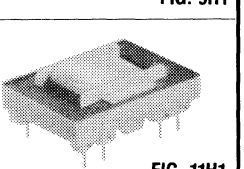


FIG. 11H1

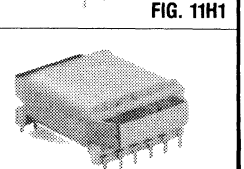


FIG. 25H2

WIDE BAND & PULSE TRANSFORMERS FOR DATA, T-1 & DIGITAL CIRCUITS

STYLE FIG.	MODEL NUMBER	PRIMARY OCL	TURNS RATIO	PRI CPF	SEC LμH	DCR OHMS	CKT. DIA.	FEATURES (CROSS REF.)
G5	**G52J111P**	800μH	1:1:1	20	0.4	1.4:1.4:1.4	E	(PE 5762)
G5	**G52J21CP**	800μH	1:2CT	22	0.5	1.4:2.8	B	0.25" HT.
G5	**G53J21CP**	2.5MH	2:1CT	30	3.8	2.4:1.2	B	ENCAPSULATED
G5	**PHT-019**	2.5MH	2:1:1	14	1.5	1.2:0.8:0.8	E	(PE 5768)
G5	**G53E111P**	2.5MH	1:1:1	35	0.8	2.4:2.4:2.4	E	
G5	**PHT-027**	4.0MH	1CT:1CT	21	0.8	1.0:1.0	D	(TECHNITROL T1553-21)
G5	**PHT-036**	4.0MH	1CT:1.41CT	24	0.9	1.0:1.4	D	(TECHNITROL T1553-22)
G7	**G73H111P**	5.0MH	1:1:1	60	1.6	4.0:4.0:4.0	E	0.35" HT.
2F	**PHT-015**	600μH	4:1:4	12	19	0.6:0.2:0.6	E	
2F	**PHT-022**	650μH	1:1	20	0.8	0.7:0.7	A	(PE 2227X)
2F	**PHT-035**	2.5MH	1:1	8	40	3.5:3.5	A	
2F	**PHT-034**	2.5MH	1:1:1	30	5.0	2.0:2.0:2.0	E	(PE 2229X)
2F	**PHT-018**	5.0MH	1:1	27	14	7.0:8.0	A	
2F	**PHT-032**	7.0MH	1CT:1CT	30	19	2.4:2.8	D	
RM5	**PHT-023**	2.5MH	2.6CT:1	17	1.2	0.37:0.08	C	
RM5	**PHT-025**	12.5MH	1:1CT*	11	5.0	1.2:1.2	E	
EP7	**PHT-030**	11.0MH	1CT:2	8	10	1.6:3.8	C	
EP10	**PHT-031**	40.0MH	1:4	15	350	7.3:23	A	2500VAC HIPOT
2H	**TTC-165**	18.0MH	1CT*:1	10	4.0	2.5:2.6	F	
2H	**TTC-166**	18.0MH	1CT*:1.5	10	5.0	2.5:4.0	F	
3	**PHT-029**	1.7MH	1.2:1	80	4.0	0.28:0.13	A	
3	**TTC-157**	4.0MH	1CT:1	15	14	1.5:1.8	C	
6M	**TTC-169**	68.0MH	1CT:2	3	170	1.5:1.5	C	150CT TO 600 OHMS

NOTES: OCL=Primary typical open circuit inductance, i.e. on LC meter.
PRI/SEC CPF = Primary winding to secondary winding is capacitance in picofarad.
PRI/SEC LμH = Primary winding with secondary(s) shorted, leakage inductance in μH.

FIG. 2F

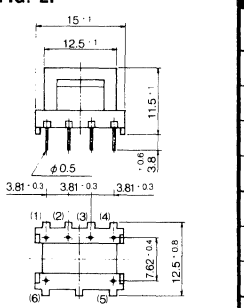
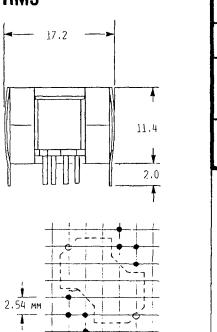


FIG. RM5



• Holes for bobbin pins
o Holes for clip pins

FIG. EP10

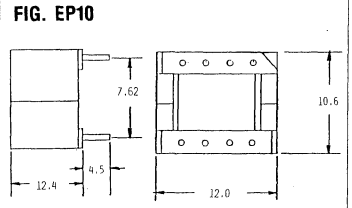


FIG. G5

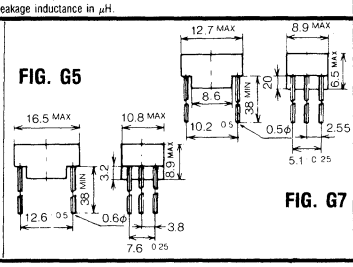


FIG. G7

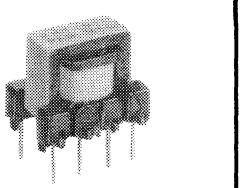


FIG. 2F

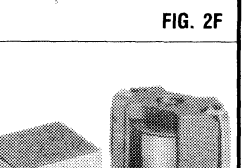


FIG. EP10 & RM5

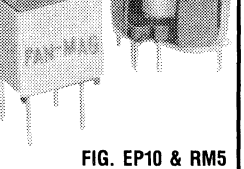
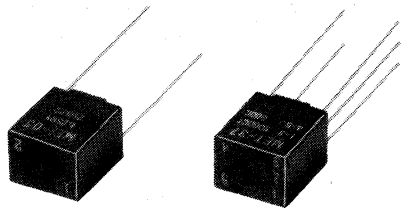


FIG. G5 & G7

TAMURA QUALITY CIRCLES THE ELECTRON WORLD
TAMURA CORPORATION OF AMERICA
1150 DOMINGUEZ ST. □ CARSON, CA 90746-3518 □ 213/638-1790 □ FAX: 2136389956

MINIATURE ENCAPSULATED TRANSFORMERS & INDUCTORS
MET & MEI SERIES

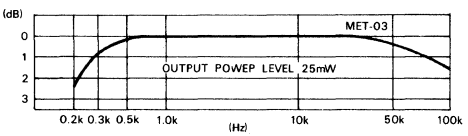
* FCC PART 68 (Hi-Pot 1.5kV or 1.0kV)

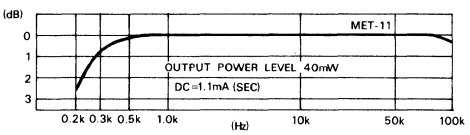


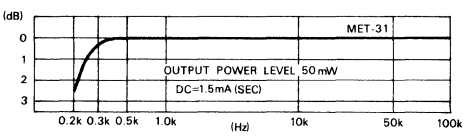
Miniature size ..... 0.310" 0.410" 0.465"
7.87mm 10.4mm 11.8mm
Meets requirements of MIL-T-27
Dielectric strength ..... 500 VRMS
Insulation resistance ..... 10K M OHMS
Max operating temperature ..... 105°C
Thermal shock ..... 5 cycles -55°C to 105°C
Response ..... ±2db, 300Hz to 100kHz
Max distortion 10 to 25% at rated power
Impedance range ..... 3.2 to 200K OHMS

All MET series transformers and MEI series inductors are designed and constructed to meet the requirements of MIL-T-27. They feature a molded case construction with base mounting pad for easy inspection of solder joints; high strength gold plated nickel leads which meet a 2.0 1b on axis of pin terminal strength; and weight of less than 3.0 grams. These transformers offer exceptional performance characteristics for use in all high performance impedance matching circuits requiring miniature magnetic components; including input, interstage, isolation, and output circuit applications.

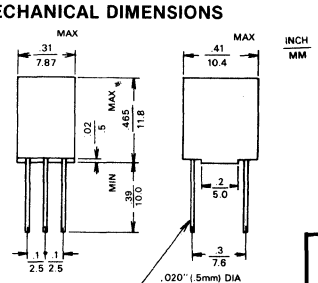
TYPICAL PERFORMANCE CHARACTERISTIC CHARTS







MECHANICAL DIMENSIONS



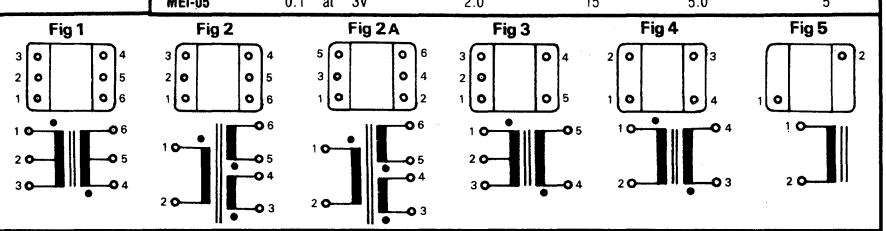
TRANSFORMERS — MET SERIES

PART NO.	MATCHING IMPEDANCE Pri.	MATCHING IMPEDANCE Sec.	MAX UNBAL. Pri. DC mA	D. C. R. Pri.	D. C. R. Sec.	MAX POWER LEVEL MW at 300Hz	TURNS RATIO Pri.	TURNS RATIO Sec.	CONNECTION FIG
MET-01	200KCT	1KCT	0	5300	120	10	14.1	1.0	1
MET-02	100KCT	1KCT	0	4300	120	10	10.0	1.0	1
MET-03	50KCT	1KCT	0	3800	90	25	7.07	1.0	1
MET-04	50K	1KCT 250Split	0	3800	90	25	14.1	1.0/1.0	2
MET-05	25KCT	1KCT	0.5	1600	95	30	5.0	1.0	1
MET-06	25K	1KCT 250Split	0.25	1600	95	30	10.0	1.0/1.0	2
MET-07	25KCT	600CT	0.5	1600	95	30	6.45	1.0	1
MET-08	20KCT	800CT	0.5	1500	95	30	5.0	1.0	1
MET-09	10KCT	10KCT	1.0	1000	1300	40	1.0	1.0	1
MET-10	10KCT	4KCT	1.0	1000	500	40	1.58	1.0	1
MET-11	10KCT	2KCT	1.0	1000	300	40	2.23	1.0	1
MET-12	10K	2KCT 500Split	0.5	1000	300	40	4.47	1.0/1.0	2
MET-13	10KCT	1.5KCT	1.0	1000	260	40	2.58	1.0	1
MET-14	10KCT	1.2KCT	1.0	1000	220	40	2.88	1.0	1
MET-15	10K	1.2KCT 300Split	0.5	1000	220	40	5.77	1.0/1.0	2
MET-16	10KCT	600CT	1.0	1000	110	40	4.08	1.0	1
MET-17	10KCT	500CT	1.0	1000	80	40	4.47	1.0	1
MET-18	10KCT	4.0	1.0	1200	1.0	40	50.0	1.0	3
MET-19	10K	3.2	0.5	1200	0.8	40	55.9	1.0	4
MET-20	8KCT	3.2	1.0	1000	0.8	40	50.0	1.0	3
MET-21	5KCT	2KCT	1.0	490	300	40	1.58	1.0	1
MET-22	2.5KCT	2.5KCT	1.0	280	350	40	1.0	1.0	1
MET-23	1.6KCT	3.2	2.5	186	0.8	50	22.3	1.0	3
MET-24	1.5KCT	600	3.0	160	95	50	1.58	1.0	3
MET-25	1.2KCT	3.2	3.0	125	0.7	50	19.4	1.0	3
MET-26	1KCT	1KCT	3.0	80	100	50	1.0	1.0	1
MET-27	1KCT	600CT	3.0	85	95	50	1.29	1.0	1
MET-28	1K	50	3.0	110	8	50	4.47	1.0	4
*MET-29	900CT	600	3.0	80	95	50	1.22	1.0	3
MET-30	800CT	3.2	3.0	110	0.7	50	15.8	1.0	3
*MET-31	600CT	600CT	3.0	70	95	50	1.0	1.0	1
*MET-32	600	600CT 150Split	3.0	70	95	50	2.0	1.0/1.0	2
MET-33	600CT	250CT	3.0	70	35	50	1.55	1.0	1
MET-34	600CT	12	4.5	60	2.5	50	7.07	1.0	3
MET-35	600CT	8	4.5	60	1.5	50	8.66	1.0	3
MET-36	600CT	3.2	4.5	60	0.7	50	13.7	1.0	3
MET-37	500CT	600	3.0	65	95	50	0.91	1.0	3
MET-38	500	500CT 125Split	3.0	65	90	50	2.0	1.0/1.0	2
MET-39	500	50	3.0	55	8	50	3.16	1.0	4
MET-40	320CT	3.2	6.0	35	0.7	50	10.0	1.0	3
MET-41	300CT	600	7.0	41	98	50	0.71	1.0	3
MET-42	150	12	10.0	20	2.5	50	3.54	1.0	4
MET-43	120CT	3.2	10.0	13	0.7	50	6.12	1.0	3
MET-44	300CT	12	7	42	3.4	50	5	1	3
MET-45	10K	10K, 2.5K Split	1	1.1K	1.3K	50	2	1/1	2
*MET-46	600	600	3	72	93	50	1	1	4
*MET-47	600	600	3	28	37	50	1	1	4
MET-48	200K	1K	0	5.3K	120	10	14.1	1	4
*MET-49	600	600/600	3	72	210	50	1.41	1/1	2
MET-50	10K	125	0	1.1K	28	10	8.62	1	4
MET-51	200K	1K	0	6K	119	10	14.1	1	4
MET-52	25K	1K	0.5	1.7K	110	50	5	1	4
MET-53	600	3.2	3	60	0.7	50	13.6	1	4
MET-54	1200	3.2	2	125	0.7	50	19.3	1	4
MET-55	150CT	12	10	18	3.5	50	3.54	1	3
MET-56	1KCT	12	3.5	120	3	50	9.14	1	3
MET-57	1.5KCT	12	3	180	3	50	11.2	1	3
MET-58	7.5KCT	12	1	800	3	50	25	1	3
*MET-59	600	600 150Split	3	70	95	50	2	1/1	2A
MET-60	135	135CT	10	10	10	50	i	i	i

INDUCTORS — MEI SERIES

PART NO.	INDUCTANCE Hy(Min) @ 300Hz	Q MIN @ 1V, 1kHZ	D. C. R. Ω	DC CURRENT mA	CONNECTION FIG
MEI-01	6 at 15V	5.0	1800	2.0	5
MEI-02	3.5 at 5V	4.0	1200	2.0	5
MEI-03	1.25 at 3V	3.5	180	2.0	5
MEI-04	0.3 at 3V	3.0	40	4.0	5
MEI-05	0.1 at 3V	2.0	15	5.0	5

MET & MEI SERIES SCHEMATIC AND CONNECTION DIAGRAMS



* FCC PART 68 (Hi-Pot 1.5kV or 1.0kV)

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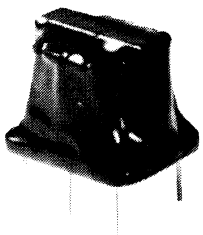
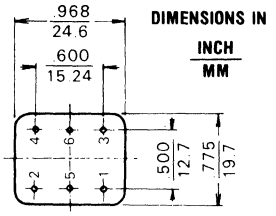
STT SERIES
ENCAPSULATED SCR & TRIAC TRIGGER TRANSFORMERS

The **STT SERIES TRIGGER TRANSFORMERS** are designed for low cost source isolation in half and full wave **SCR** or **TRIAC** control circuits. The **STT TRIGGER TRANSFORMERS** are encapsulated for environmental protection and pass **2600 V RMS** dielectric breakdown testing.





MAX. HT. = .775 / 19.7

PART NUMBER	TURNS RATIO	PRIMARY "L" MH	LEAKAGE "L" μH	WDG. "C" PF	E.T. V-μSEC	D.C.R. OHMS (Max.)	DIA. NO.
STT-101	1:1	> 1.0	< 15	80	> 90	2.5/2.5	1
STT-102	1:1	> 5.0	< 50	80	> 200	5.0/5.0	1
STT-103	1:1	> 10.0	< 100	80	> 280	7.0/7.0	1
STT-104	1:1:1	> 1.0	< 25	80	> 90	2.5/2.5/2.5	2
STT-105	1:1:1	> 5.0	< 100	80	> 200	5.0/5.0/5.0	2
STT-106	1:1:1	> 10.0	< 200	80	> 280	7.0/7.0/7.0	2
STT-107	2:1	> 1.0	< 20	80	> 90	2.5/1.5	1
STT-108	2:1	> 5.0	< 60	80	> 200	5.0/2.5	1
STT-109	2:1	> 10.0	< 130	80	> 280	7.0/3.5	1
STT-110	2:1:1	> 1.0	< 30	80	> 90	2.5/1.5/1.5	2
STT-111	2:1:1	> 5.0	< 130	80	> 200	5.0/2.5/2.5	2
STT-112	2:1:1	> 10.0	< 200	80	> 280	7.0/3.5/3.5	2

DIAGRAM 1

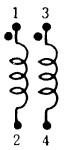
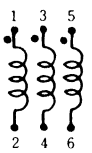


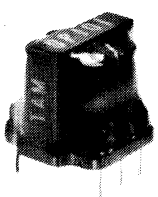
DIAGRAM 2



DP SERIES ENCAPSULATED AUDIO TRANSFORMERS

The **DP SERIES** of encapsulated audio transformers are cost effective for applications involving severe environments. Completely encapsulated, these small audio transformers eliminate environmental and board washing problems associated with open style transformers. The environmental quality of the **DP SERIES** is established through testing for humidity, immersion, solvent resistance and temperature cycling to the exacting reqirements of MIL-T-27. Several part numbers meet the requirements of **FCC PART 68** for telephone or modem applications. All **DP SERIES** audio transformers have frequency response characteristics within ±2dB from 200 Hz to 20 KHz.

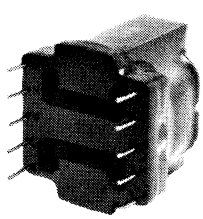
EI 19 DP SERIES



PART NUMBER	IMPEDANCE (Ω) PRI	IMPEDANCE (Ω) SEC	D.C.R. (Ω) PRI	D.C.R. (Ω) SEC	LEVEL (MAX.)	DCMA (MAX.)	REFER FIG	REFER DIA
DP-101+	600CT	600CT	38	48	15dbm	5	A	1
DP-103	600CT	1.2KCT	38	84	15dbm	5	A	1
DP-105+	4KCT	600CT	277	35	15dbm	1	A	1
DP-107	300	600CT	19	48	15dbm	5	A	2
DP-108+	600	600CT	38	48	15dbm	5	A	2
DP-111	1K	2KCT	53	152	15dbm	2	A	2
DP-114	2.5K	2.5KCT	172	220	15dbm	2	A	2
DP-116	4K	2KCT	277	160	15dbm	1	A	2
DP-118	8K	2KCT	500	143	15dbm	0.5	A	2
DP-119	10K	600CT	370	90	15dbm	0.5	A	2
DP-122	10K	10KCT	695	900	15dbm	0.5	A	2
DP-124	20K	4KCT	1900	305	15dbm	0.5	A	2
DP-126	1KCT	8	55	0.62	15dbm	2	A	3
DP-128+	600	600CT×2	37	42×2	15dbm	0	B	4
DP-129++	600CT	600CT	26	34	15dbm	0	B	1*

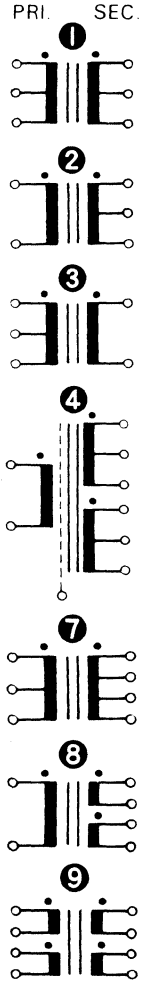
+ Meets requirements of FCC PART 68
*Insertion loss 0 9db typical and frequency response ±0.1db, 300 to 3400 Hz and with electrostatic shield.

EI 28 DP SERIES

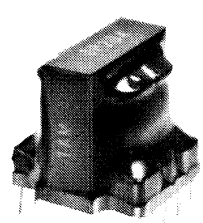


PART NUMBER	IMPEDANCE (Ω) PRI	IMPEDANCE (Ω) SEC	D.C.R. (Ω) PRI	D.C.R. (Ω) SEC	LEVEL (MAX.)	DCMA (MAX.)	REFER FIG	REFER DIA
DP-204+	600	600CT	36	50	28dbm	10	C	2
DP-208	4K	2KCT	250	145	28dbm	3	C	2
DP-210	200CT	4, 8, 16	10	0.4, 0.5, 0.7	28dbm	10	C	7
DP-214	600CT	4, 8, 16	32	0.4, 0.5, 0.7	28dbm	10	C	7
DP-220	1.3K	600/150	72	19×2	28dbm	6	C	8
DP-222+	500/125	500/125	19×2	22×2	28dbm	10	C	9
DP-222+	600/150	600/150	19×2	22×2	28dbm	10	C	9
DP-225+	4K/1K	600/150	63×2	20×2	28dbm	3	C	9
DP-226+	600	600CT×2	41	36×2	28dbm	0	C	4

SCHEMATIC DIAGRAMS



DP SERIES MECHANICAL DIAGRAMS



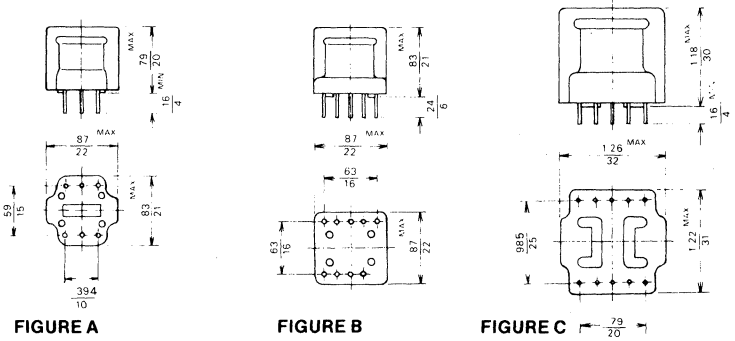


FIGURE A FIGURE B FIGURE C

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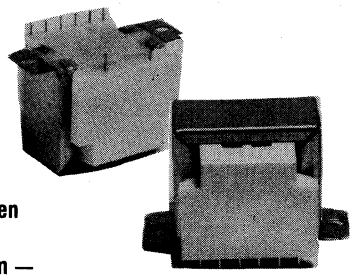
INTERNATIONAL PEP SERIES OEM POWER TRANSFORMER MEETS UL-1411, IEC & VDE STANDARDS

PEP Series

FILE NO. TAMRADIO E59673



- UL 1411 Recognized.
- Meets IEC-65 & VDE Safety Standards.
- Physical Barriers Between Primary and Secondary.
- Double Protection System — 4000V Hipot.

PEP Series • 115V/230V • 50/60Hz Primary

FOR USE IN CONTROL AND POWER SUPPLY APPLICATIONS

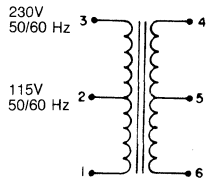
PART NO.	SECONDARY				CIRCUIT NO.	FIG. NO.
	PARALLEL CONNECTED		SERIES CONNECTED			
	V AC	A RMS	V AC	A RMS		
PEP28 x 0.7 VA SERIES						
10A006			10.0 CT	.050	1-115V*	
10A009			10.0 CT	.050	1-230V*	
10A007	(Single Secondary)		16.0 CT	.031	1-115V*	A
10A010			16.0 CT	.031	1-230V*	
10A008			24.0 CT	.021	1-115V*	
10A011			24.0 CT	.021	1-230V*	
*PEP28 Series is not available in Dual Primary versions.						
PEP35 x 2.0 VA SERIES						
10B004			10.0 CT	.110		
10B005			12.6 CT	.090		
10B006	(Single Secondary)		16.0 CT	.070	1	A
11B001H			24.0 CT	.046		
11B002H			36.0 CT	.031		
PEP41 x 5.0 VA SERIES						
10C009			10.0 CT	.350		
10C010			12.6 CT	.280		
10C011	(Single Secondary)		16.0 CT	.220	1	B
10C012			24.0 CT	.150		
11C005H			36.0 CT	.100		
PEP48 x 9.5 VA SERIES						
11D014H	5.0	1.900	10.0 CT	.950		
11D015H	6.3	1.500	12.6 CT	.750		
11D016H	8.0	1.200	16.0 CT	.600	2	B
11D017H	12.0	.800	24.0 CT	.400		
11D018H	18.0	.520	36.0 CT	.260		
11D019H	28.0	.340	56.0 CT	.170		
PEP54 x 15 VA SERIES						
11E006H	5.0	2.500	10.0 CT	1.250		
11E007H	6.3	2.000	12.6 CT	1.000		
11E008H	8.0	1.560	16.0 CT	.780	2	C
11E009H	12.0	1.040	24.0 CT	.520		
11E010H	17.0	.700	36.0 CT	.350		
11E011H	28.0	.446	56.0 CT	.223		

PEP54 SERIES FOR 3-OUTPUT REGULATED AND UNREGULATED POWER SUPPLIES

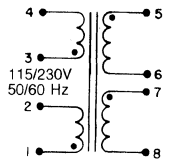
PART NO.	SECONDARY 1		SECONDARY 2		DC OUTPUT 1		DC OUTPUT 2		CIR. NO.	FIG. NO.
	V AC	A RMS	V AC	A RMS	CTFW Vdc	I mAdc	CTFW Vdc	I mAdc		
11E012H	9 CT	.800	24 CT	.300	+5	670	±15	170	3	C
11E013H	16 CT	.550	33 CT	.180	+9†	470	±21†	120	4	C

† +9Vdc and ±21 Vdc outputs are for input to +5 Vdc and ±15 Vdc IC Voltage Regulation (See Circuit 4)

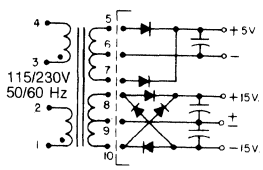
CIRCUIT SCHEMATICS



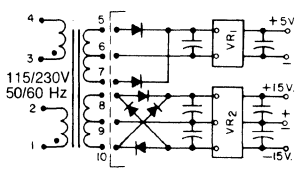
CIRCUIT 1



CIRCUIT 2



CIRCUIT 3



CIRCUIT 4

DIMENSIONS

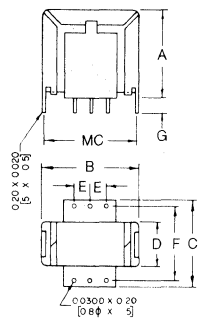


FIGURE A

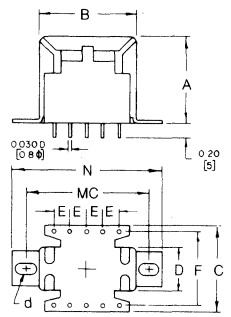


FIGURE B

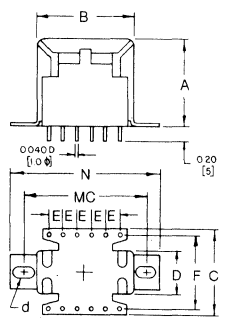


FIGURE C

DIMENSIONS • Inches (mm) WT • Oz. (Gm)

TYPE	A	B	C	MC	D	E	F	G	N	WT.
10A	1.10 (28)	1.16 (29.5)	1.32 (33.5)	1.12 (28.5)	0.50 (12.5)	.197 (5)	0.984 (25)	0.20 (5)	--	2.5 (70)
10B OR 11B	1.26 (32)	1.44 (36.5)	1.69 (43)	1.40 (35.5)	0.61 (15.5)	.295 (7.5)	1.380 (35)	0.24 (6)	--	4.5 (130)
10C OR 11C	1.42 (36)	1.67 (42.5)	1.91 (48.5)	2.05 (52)	0.85 (21.5)	.394 (10)	1.575 (40)	--	2.36 (60)	8 (230)
11D	1.69 (43)	1.99 (50.5)	2.05 (52)	2.32 (59)	1.08 (27.5)	.295 (7.5)	1.772 (45)	--	2.72 (69)	16 (450)
11E	1.93 (49)	2.22 (56.5)	2.09 (53)	2.72 (69)	1.08 (27.5)	.295 (7.5)	1.772 (45)	--	3.15 (80)	19 (540)

Note: d = PEP41 Series; 0.138 x 0.177 (3.5 x 4.5)
d = PEP48 and PEP54 Series; 0.177 x 0.256 (4.5 x 6.5)

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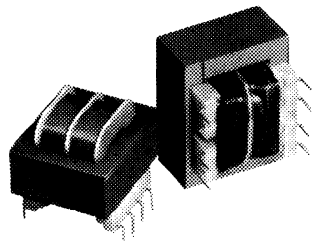
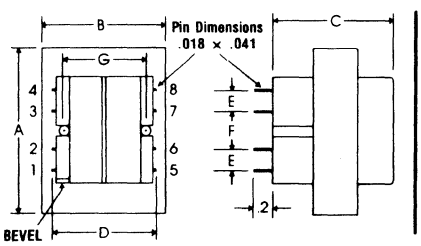
3F SERIES—3 FLANGE BOBBIN
OEM PC BOARD POWER TRANSFORMERS

The **3F SERIES POWER TRANSFORMERS** are designed to include the most desirable features required for printed circuit board mounted applications. The 3F Series is constructed on a three flanged bobbin which is molded with UL listed material providing low capacitive coupling without electro-static shielding.



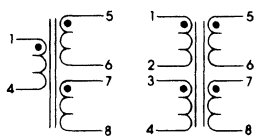
- **UL 1585 Class II & III Transformers — File No. E95844.**
- **UL General Purpose Transformers — File No. E91239.**
- **UL Class B Insulation System**

- **2500 VAC Hipot, Primary to Secondary Isolation**
- **115V Single or 115/230V Dual Primary**
- **Terminal Numbers are Molded on Bobbin.**
- **Complies with Most UL Safety Standards.**



NOTE: #4 Clearance Hole — 2 Places

SCHEMATIC S
115V 50/60Hz



SCHEMATIC D
115/230V 50/60Hz

Note:
Pins 2 & 3 Omitted

3F SERIES PART NUMBER	DIMENSIONS							
	A	B	C	D	E	F	G	WT
3F(*)-2XX	1.38 / 35.0	1.16 / 29.5	0.94 / 23.9	1.200 / 30.48	0.250 / 6.350	0.250 / 6.350	N/A	0.17LB / 77.4GM
3F(*)-3XX	1.38 / 35.0	1.16 / 29.5	1.18 / 30.0	1.200 / 30.48	0.250 / 6.350	0.25 / 6.35	N/A	0.25LB / 114GM
3F(*)-4XX	1.62 / 41.0	1.31 / 33.0	1.31 / 33.3	1.280 / 32.51	0.250 / 6.350	0.350 / 8.890	1.062 / 26.97	0.44LB / 200GM
3F(*)-5XX	1.89 / 48.0	1.58 / 40.0	1.44 / 36.6	1.410 / 35.81	0.300 / 7.62	0.400 / 10.16	1.250 / 31.75	0.70LB / 319GM

DIMENSIONS SHOWN IN: INCH / MM

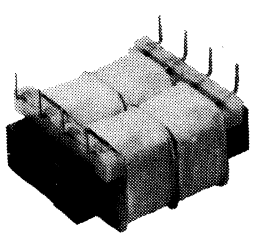
PART NUMBER	SECONDARY RATINGS - R.M.S.		VA
	SERIES	PARALLEL	
3F(*)-210	10.0VCT @ 0.110A	5.0V @ 0.220A	1.1
3F(*)-310	10.0VCT @ 0.250A	5.0V @ 0.500A	2.4
3F(*)-410	10.0VCT @ 0.600A	5.0V @ 1.200A	6.0
3F(*)-510	10.0VCT @ 1.200A	5.0V @ 2.400A	12.0
3F(*)-212	12.6VCT @ 0.090A	6.3V @ 0.180A	1.1
3F(*)-312	12.6VCT @ 0.200A	6.3V @ 0.400A	2.4
3F(*)-412	12.6VCT @ 0.500A	6.3V @ 1.000A	6.0
3F(*)-512	12.6VCT @ 1.000A	6.3V @ 2.000A	12.0
3F(*)-216	16.0VCT @ 0.070A	8.0V @ 0.140A	1.1
3F(*)-316	16.0VCT @ 0.150A	8.0V @ 0.300A	2.4
3F(*)-416	16.0VCT @ 0.400A	8.0V @ 0.800A	6.0
3F(*)-516	16.0VCT @ 0.800A	8.0V @ 1.600A	12.0
3F(*)-220	20.0VCT @ 0.055A	10.0V @ 0.110A	1.1
3F(*)-320	20.0VCT @ 0.120A	10.0V @ 0.240A	2.4
3F(*)-420	20.0VCT @ 0.300A	10.0V @ 0.600A	6.0
3F(*)-520	20.0VCT @ 0.600A	10.0V @ 1.200A	12.0
3F(*)-224	24.0VCT @ 0.045A	12.0V @ 0.090A	1.1
3F(*)-324	24.0VCT @ 0.100A	12.0V @ 0.200A	2.4
3F(*)-424	24.0VCT @ 0.250A	12.0V @ 0.500A	6.0
3F(*)-524	24.0VCT @ 0.500A	12.0V @ 1.000A	12.0
3F(*)-228	28.0VCT @ 0.040A	14.0V @ 0.080A	1.1
3F(*)-328	28.0VCT @ 0.085A	14.0V @ 0.170A	2.4
3F(*)-428	28.0VCT @ 0.200A	14.0V @ 0.400A	6.0
3F(*)-528	28.0VCT @ 0.420A	14.0V @ 0.840A	12.0
3F(*)-236	36.0VCT @ 0.030A	18.0V @ 0.060A	1.1
3F(*)-336	36.0VCT @ 0.065A	18.0V @ 0.130A	2.4
3F(*)-436	36.0VCT @ 0.170A	18.0V @ 0.340A	6.0
3F(*)-536	36.0VCT @ 0.350A	18.0V @ 0.700A	12.0
3F(*)-248	48.0VCT @ 0.023A	24.0V @ 0.046A	1.1
3F(*)-348	48.0VCT @ 0.050A	24.0V @ 0.100A	2.4
3F(*)-448	48.0VCT @ 0.125A	24.0V @ 0.250A	6.0
3F(*)-548	48.0VCT @ 0.250A	24.0V @ 0.500A	12.0
3F(*)-256	56.0VCT @ 0.020A	28.0V @ 0.040A	1.1
3F(*)-356	56.0VCT @ 0.045A	28.0V @ 0.090A	2.4
3F(*)-456	56.0VCT @ 0.110A	28.0V @ 0.220A	6.0
3F(*)-556	56.0VCT @ 0.220A	28.0V @ 0.440A	12.0
3F(*)-2120	120.0VCT @ 0.010A	60.0V @ 0.020A	1.1
3F(*)-3120	120.0VCT @ 0.020A	60.0V @ 0.040A	2.4
3F(*)-4120	120.0VCT @ 0.050A	60.0V @ 0.100A	6.0
3F(*)-5120	120.0VCT @ 0.100A	60.0V @ 0.200A	12.0

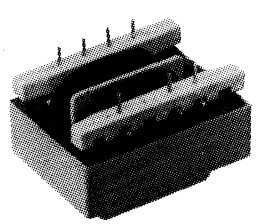
NOTE (*) Insert S for Single Primary 3F Series Transformer
Insert D for Double Primary 3F Series Transformer

3 FLANGE BOBBIN TRANSFORMER FOR UNREGULATED & REGULATED POWER SUPPLIES

The **LPP SERIES LOW-PROFILE PLUG-IN POWER TRANSFORMERS** offer the circuit designer a variety of options including dual output which may be connected in series or parallel, secondary voltages for unregulated or regulated power supplies, and dual output voltages.

3 FL SERIES LOW PROFILE





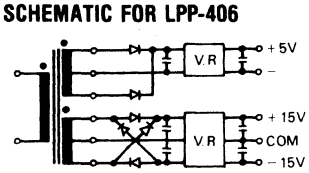
3FL SERIES DIMENSIONS*

VA	L	W	H	MTG
2	1.88	1.57	0.65	1.6 x 0.375
6	1.88	1.57	0.85	1.6 x 0.375
12	2.50	2.00	1.06	2.00 x 0.500

*All dimensions in inches

TYPICAL SCHEMATIC FOR LPP-406

PRIMARY
115V ±10%
50/60Hz



TAMURA QUALITY CIRCLES THE ELECTRON WORLD
TAMURA CORPORATION OF AMERICA
1150 DOMINGUEZ ST. □ CARSON, CA 90746-3518 □ 213/638-1790 □ FAX: 2136389956

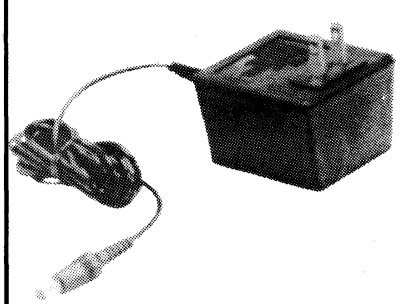
WALL PLUG-IN POWER SOURCES
AC-DC REGULATED OR UNREGULATED & AC-AC MODELS

UL-CSA UNREGULATED SERIES

INPUT: 120V 60Hz (ALL MODELS)

UL MODEL NUMBER	RATED OUTPUT VDC	RATED OUTPUT MADC	CSA
212A2212	3.0	150	LISTED
310A2210	3.0	200	LISTED
318A2213	3.0	600	COMPLY
416A2214	3.0	1000	LISTED
212A2143	3.3	300	LISTED
212A2220	4.5	150	LISTED
216A4222	4.5	350	COMPLY
318A4221	4.5	550	LISTED
416A2219	4.5	600	LISTED
820A2656	4.5	1500	COMPLY
825A2611	4.5	2000	N/A
212A2226	6.0	100	LISTED
310A2223	6.0	200	LISTED
318A2226	6.0	300	LISTED
318A4227	6.0	400	LISTED
416A2226	6.0	600	LISTED
420A4338	6.0	800	LISTED
820A4660	6.0	1200	COMPLY
825A2617	6.0	2000	N/A
521A4318	7.0	1200	LISTED
310A2223	7.5	100	LISTED
216A2134	7.5	200	COMPLY
420A2128	7.5	500	LISTED
212A2144	8.3	120	LISTED
318A4248	8.5	100	LISTED
212A2136	9.0	100	LISTED
318A2138	9.0	150	LISTED
216A4139	9.0	200	LISTED
420A2128	9.0	300	LISTED
416A4136	9.0	500	LISTED
820A4465	9.0	900	COMPLY
825A4620	9.0	1200	N/A
420A4246	10.0	500	LISTED
216A2045	12.0	100	COMPLY
318A2045	12.0	150	LISTED
318A4146	12.0	200	LISTED
416A2141	12.0	300	LISTED
420A4147	12.0	400	LISTED
420A4141	12.0	500	LISTED
820A4470	12.0	700	COMPLY
825A4425	12.0	900	N/A
521A4317	12.0	1000	LISTED
420A2249	14.0	350	LISTED
310A1941	18.0	50	LISTED
416A2045	18.0	100	COMPLY
420A4143	20.0	280	LISTED
318A4049	24.0	50	LISTED
811A4212	*	300	LISTED

*5 Switched Output Voltages: 3.0 - 4.5 - 6.0 - 7.5 - 9.0 VDC and Universal Output Plug



UL-CSA REGULATED SERIES

REGULATED TO LINE & LOAD CHANGES

UL MODEL NUMBER	RATED OUTPUT VDC	RATED OUTPUT REG	RATED OUTPUT MADC	CSA
420AR4301	3.0	0.5	400	COMPLY
416AR4242	4.5	0.5	400	LISTED
816AR4205	4.5	0.2	500	COMPLY
420AR4203	5.0	0.5	350	COMPLY
816AR4201	5.0	0.2	600	COMPLY
NEWAR4201	5.2	0.2	1000	COMPLY
420AR4204	6.0	0.5	300	COMPLY
420AR4207	6.0	0.5	400	COMPLY
816AR4202	6.0	0.2	500	COMPLY
420AR4008	7.5	0.5	600	LISTED
420AR4105	9.0	0.5	250	COMPLY
816AR4103	9.0	0.2	400	COMPLY
420AR4106	12.0	0.5	200	COMPLY
816AR4104	12.0	0.2	300	COMPLY
NEWAR4101	+12.0 −12.0	0.2 0.2	250 250	COMPLY
NEWAR4102	+15.0 −15.0	0.2 0.2	200 200	COMPLY

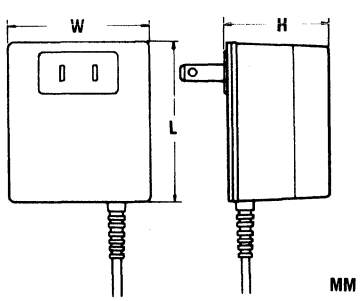
REG=TYPICAL OUTPUT DC VOLTAGE CHANGE AT 108V OR 132V INPUT LINE CONDITION

UL-CSA AC-AC SERIES CLASS II TRANSFORMERS

INPUT: 120V 60Hz (ALL MODELS)

UL MODEL NUMBER	RATED OUTPUT VAC	RATED OUTPUT MA RMS	CSA
310A0001	2.5	500	LISTED
420A0003	9.0	800	COMPLY
825A0004	9.0	1700	N/A
420A0001	11.0	600	LISTED
310A0002	12.0	110	COMPLY
825A0001	12.0	1300	N/A
NEWA5701	12.0	2000	N/A
NEWA6601	12.0	3300	N/A
816A0001	14.0	500	LISTED
420A0002	14.0	770	LISTED
825A0005	15.0	1000	N/A
818A0001	17.0CT	500	LISTED
825A0002	18.0	880	N/A
NEWA6602	18.0	2200	N/A
420A0004	24.0	300	COMPLY
420A0005	24.0	450	COMPLY
825A0003	24.0	660	N/A
NEWA5702	24.0	1000	N/A
NEWA6603	24.0	1670	N/A

UL-CSA SERIES DIMENSIONS



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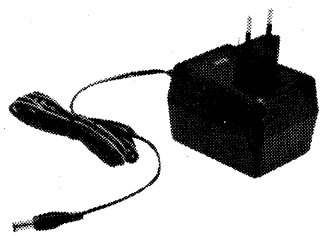
MODEL SERIES	L	W	H
212A, 216A	53	36	38
310A, 316A	60	45	42
416A, 420A	61	55	41
816A	81	59	52
820A, 825A	82	60	48

EUROPEAN VDE SERIES



VDE UNREGULATED SERIES

INPUT: 220V 50Hz (ALL MODELS)

VDE MODEL NUMBER	RATED OUTPUT VDC	RATED OUTPUT MADC	VDE
416F4211	3.0	300	COMPLY
818F4311	3.0	1000	COMPLY
310F2102	3.5	200	LISTED
310F2104	4.5	200	LISTED
416F4212	4.5	300	COMPLY
818F4315	4.5	1000	COMPLY
310F4107	6.0	200	LISTED
416F4215	6.0	300	COMPLY
818F4225	6.0	400	LISTED
818F4217	6.0	800	COMPLY
416F4117	7.5	300	COMPLY
818F4119	7.5	700	COMPLY
416F4119	9.0	300	COMPLY
818F4120	9.0	500	LISTED
818F4121	9.0	600	COMPLY
416F4020	12.0	200	COMPLY
818F4124	12.0	500	LISTED

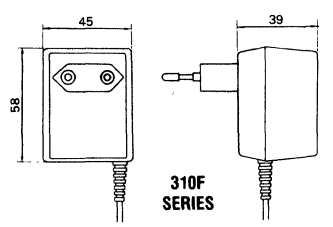
VDE REGULATED MODELS

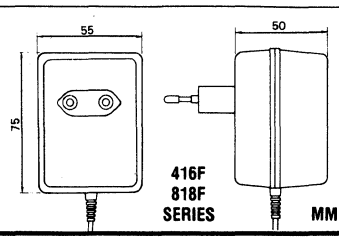
818FR4202	3.0	1000	LISTED
818FR4103	4.5	500	LISTED
818FR4104	6.0	400	LISTED
818FR4106	7.5	400	LISTED
818FR4107	9.0	300	LISTED
818FR4109	12.0	250	LISTED

VDE AC-AC MODELS

VDE MODEL NUMBER	RATED OUTPUT VAC	RATED OUTPUT MA RMS	VDE
310F0001	4.5	300	LISTED
310F0002	6.0	250	LISTED
310F0006	9.5	150	LISTED
310F0007	12.0	100	LISTED

EUROPEAN SERIES DIMENSIONS





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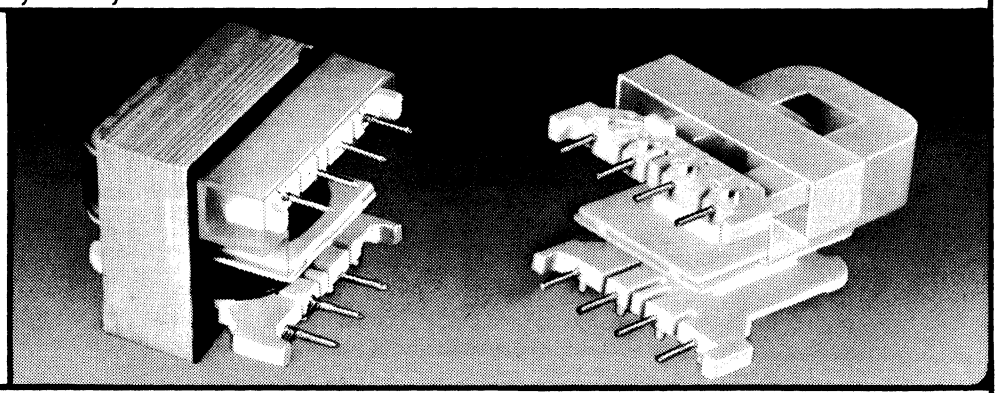
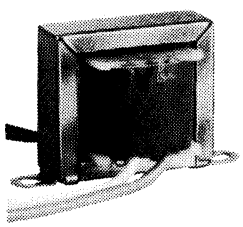
CUSTOM DESIGNED AUDIO AND POWER TRANSFORMERS
UL RECOGNIZED, CSA, EUROPEAN AND JAPANESE SAFETY STANDARDS

FILE NO.
TAMRADIO
E59673



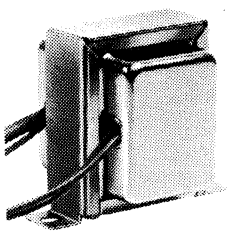
UL RECOGNIZED POWER TRANSFORMERS

PEY Series



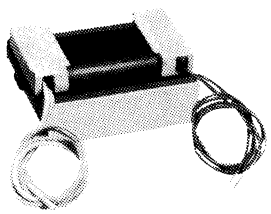
- Ratings — 1 to 80 VA
- Mounting Style
  - . . . Vertical Type
  - . . . Horizontal Type

PEWT Series



- Ratings — 2 to 35 VA
- Enclosed Construction with Metal End Bells

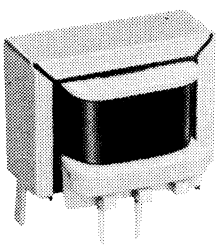
PMZF Series



- 10 to 80 VA
- Minimum Flux Field for CRT Applications
- Low Profile

AUDIO TRANSFORMERS

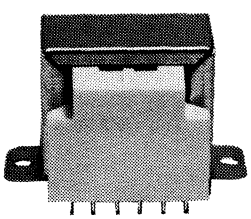
EPH Series



- Double Protection System
- 3500 VAC HiPot
- Isolation for TV Audio and Video External Connections

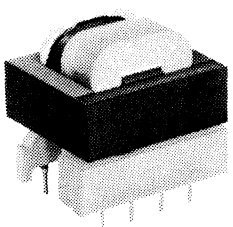
INTERNATIONAL POWER TRANSFORMERS — CSA — IEC — MITI — VDE — UL RECOGNIZED

PEP Series



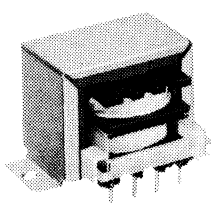
- Ratings — 0.7 to 15 VA
- 4000 VAC HiPot
- 30 P/Ns Stocked

PEPF Series



- Ratings — 0.7 to 6 VA

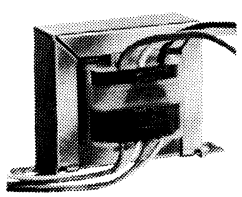
PEPY Series



- Ratings — 4 to 20 VA

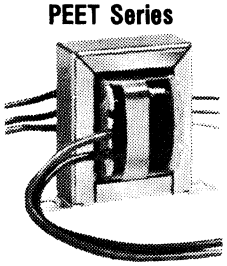
- Physical Barrier Between Primary, Secondary and Core

PEE Series



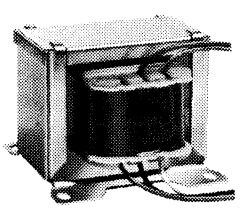
- Ratings — 0.7 to 40 VA
- 8mm Creepage
- 4000 VAC HiPot

PEET Series



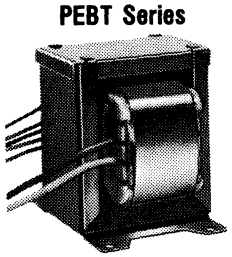
- Ratings — 0.7 to 40 VA
- 8mm Creepage
- 4000 VAC HiPot

PEB Series



- Horizontal Mounting

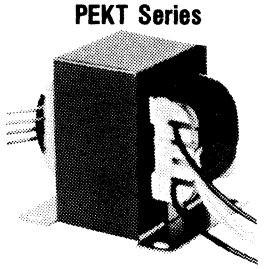
PEBT Series



- Vertical Mounting

- Ratings — 70 to 300 VA
- CU Flux Shorting Band
- Concentric Wound Coils "CY Type" Bobbin Construction

PEKT Series



- Ratings — 70 to 200 VA
- Welded Stack
- Shielded Core to Reduce Stray Field

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 88/89 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1134, **B**•1098, **C**•1082, **D**•1038
ASCII Code ..... **D**•1073
Batteries, Product Selection Guide ..... **D**•1428
Batteries & Fuel Cells, Characteristics ..... **D**•1454
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1030
Capacitors, Miniglossary ..... **A**•1027
Capacitors, Product Selection Guide ..... **A**•1003
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1193
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1760
Connectors, Miniglossary ..... **C**•1374
Connectors, Terminals & Sockets, Product Selection Guide ..... **C**•1127
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide ..... **A**•1331
Delay Lines, Product Selection Guide ..... **A**•1495
Discrete Semiconductors, Product Selection Guide ..... **A**•2113
Displays, Readouts, & CRTs, Product Selection Guide ..... **B**•1033
EBCDIC Code ..... **D**•1162
Encapsulation, Miniglossary ..... **C**•1110
Fans, Blowers, Cooling Equipment & Heat Exchangers, Product Selection Guide ..... **C**•1643
Filters, Product Selection Guide ..... **A**•1633
IC Master ..... **A**•1718
Instruments, Panel Meters, Product Selection Guide ..... **D**•1350
Instruments, Test & Measuring, Product Selection Guide ..... **D**•1190
Interconnection Systems, Product Selection Guide ..... **C**•1719
Keyboards & Keypads, Product Selection Guide ..... **B**•1808
Lamps, Lights, & Inductors, Product Selection Guide ..... **B**•1104
Logofinder & Trademark Directories ..... **C**•901
Microwave Components, Product Selection Guide ..... **A**•1761
Military Qualified Products List ..... **B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1181
Opto Semiconductors, Miniglossary ..... **B**•1262
Oscilloscopes, Product Selection Guide ..... **D**•1408
Panel Hardware, Product Selection Guide ..... **C**•1603
Potentiometers, Trimmers, Controls & Rheostats, Product Selection Guide ..... **A**•2057
Power Supplies, Miniglossary ..... **D**•1504
Power Supplies, AC, Product Selection Guide ..... **D**•2060
Power Supplies, DC, Product Selection Guide ..... **D**•1497
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide ..... **B**•1297
Relay Contact Forms ..... **B**•1371
Relays, Electromechanical, Miniglossary ..... **B**•1364
Relays, Product Selection Guide ..... **B**•1355
Resistor Color Codes ..... **A**•1911
Resistors, Product Selection Guide ..... **A**•1849
Servo Components, Miniglossary ..... **B**•1238, **D**•2176
SI Units, Basic Guide To, ... **A**•1090, **B**•1050, **C**•1092, **D**•1048
Solenoids, Product Selection Guide ..... **B**•1612
Switches, Product Selection Guide ..... **B**•1636
Thermal Components, Product Selection Guide ..... **B**•1834
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1842
Thyristors/High Power Diodes, Miniglossary ..... **A**•2145
Trademark & Logofinder Directories ..... **C**•901
Transducers & Encoders, Product Selection Guide ..... **B**•1874
Transformers, Product Selection Guide ..... **A**•2153
Voltage Drop Nomograph ..... **C**•1912, **D**•2042
Wire & Cable, Product Selection Guide ..... **C**•1763
Wire Guages—Diameter, Area, Copper Weight ..... **C**•1864

TECHNIPOWER® A Penril COMPANY

VARIAC® VARIABLE AUTOTRANSFORMERS

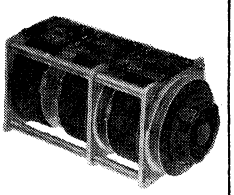
The industry standard for performance and reliability. 700 models and more than 1,000 variations to 'spec'. Overloadable to 1000% short term with output from 0 to line or above line voltage despite load size or power. Single and 3-phase models, manual and motor driven, 120 to 480V outputs. Militarized "400Hz" units also offered.

SINGLE PHASE VARIAC® AUTOTRANSFORMERS

In 120, 240, 480 V inputs, 50/60 Hz, many with UL and CSA listings and from 2.0-300.0 Amps. Choose from fully enclosed or open designs, in single phase or three phase configurations, 50/60 Hz and 400 Hz models. Connectable in parallel or series and single line.

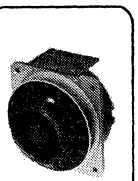
MANUAL 3-PHASE GANGED VARIAC® AUTOTRANSFORMERS

Control 3-phase power requiring 208, 240 or 480 V inputs. These Variacs come in 208, 240 and 50/60 Hz ratings and in 7.1, 8.5 and 10 Amps. 29 other units permit overvoltage use on an open Delta connection. 14 other models are Y connected. Ball bearings are also included.



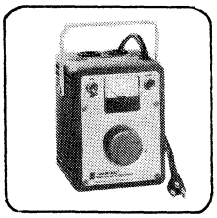
MILITARIZED "400 Hz" VARIAC® AUTOTRANSFORMERS

For ruggedized use from 350 to 1200 Hz. With excellent regulation, smaller and lighter than 60 Hz units, they conform to most mil-specs for harsh environments. Single Phase and 3-Phase configurations.



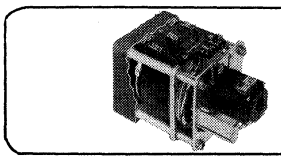
PORTABLE VARIAC® AUTOTRANSFORMERS

Metered, encased and available in 20 models featuring an autotransformer and overload protection. Some have Voltmeters, Ammeters, and Wattmeters. 120 V and 240 V models to 18.0A; 2 and 3 wire versions also offered.



MOTOR DRIVEN VARIAC® AUTOTRANSFORMERS

More than 60 motor driven models, single or ganged. Motors are fully enclosed, 2 phase, gear-reduction, servo types with motor speeds of 2, 4, 8, 16, 32, 64 and 128 secs at 60 Hz. All have ball bearings and adjustable limit switches.



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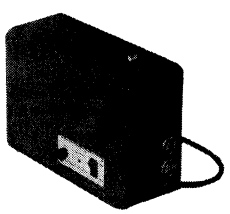
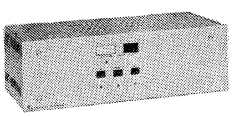
VARIAC® AUTOMATIC VOLTAGE REGULATORS

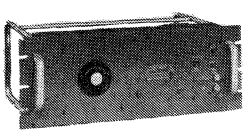
Encourage peak performance and protect your equipment with Variac Voltage Regulators. Offering smooth control and fast response, they function up to 10X the rating for transient surges. They will not introduce distortion or noise, and will offset brownout effects. Choose from five basic models plus 100 custom variations.



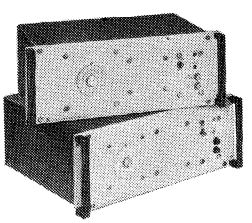
TYPE 1591
Compact 1 kVA with 115 V ratings. Low cost, small and available in portable and rack mounted models.



TYPE 1592
Provides proper voltage for long term operation — remotely programmable. In 2 models, capacity to 5.3 kVA, handle 120-480 V and are used in single and three-phase applications.



TYPE 1571
Militarized, in 4 models, for use where shock or vibration is encountered. Available in 400 Hz or 50/60 Hz with 115 V outputs, rack mountable. 5.8 kVA.



TYPES 1581 and 1582
High capacity. Automatically compensate for line voltage fluctuations. 115 V and 230 V models, 19.7 kVA capacities. For industrial and lab use e.g. computers, transmitters and critical processes.

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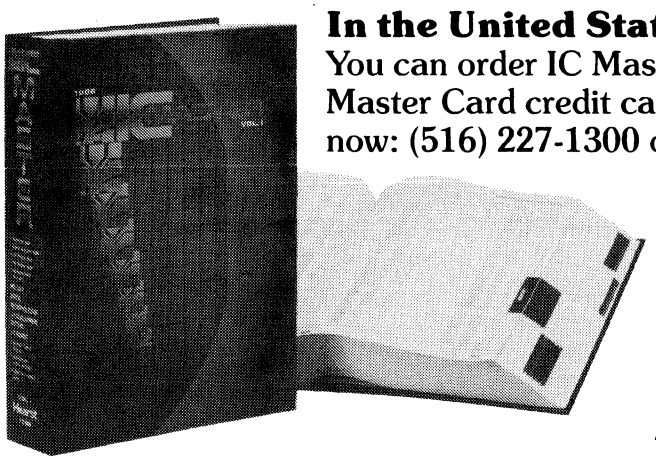

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MIL-T-27 transformers, Grades 4, 5, and 6

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- High-voltage.
- High-voltage pulse.
- 400 Hz.
- Voltage-regulating/ferroresonant.
- Custom, to your specifications.

MIL-T-21038 pulse transformers

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- Surface-mount and flat-pack available.
- Wide selection of standard models.
- Custom designs.

MIL-Std-21038/27 MIL-Std-1553 data-bus interface transformers

- Meet MIL-Std-1553B.
- Meet MAC Air specifications A3818, A5690, A5232, and A4905.
- Surface-mount and flat-pack available.
- Wide selection of standard models.
- Custom designs.

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- Single- and dual-stub-terminal models.
- Single- and dual-bus-terminal models.
- Use of our MIL-Std-1553 interface transformers within the couplers provides a large choice of coupling characteristics.

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Technitrol products: Manchester encoder/decoders • pulse transformers • data bus couplers • pulse-width regulators • delay lines including digital, fixed-constant-distributed, fixed-lumped-constant, programmable, and trimmer types • transformers including audio, autotransformer, chopper, constant-voltage, dc-to-dc-conversion, decade, differential, discriminator, driver, ferroresonant, filament, 400 Hz, 50-60 Hz high-voltage, input, instrument, current instrument, interstage, inverter, isolation, magnetic-amplifier, matching, microminiature, microphone, mixing, modulation, output, plate, power, pc-mounting, pulse, rf, rectifier, reference, Scott T, servo, switch mode, synchro-control, telephone-coupling, toroidal, transistor, voltage-dividing, voltage-regulating, voltage-stabilizing, wideband, MIL-audio, MIL-power, MIL-rf, and MIL-pulse types • saturable reactors • filter reactors • square-wave oscillators • magnetic amplifiers • coils including foil-wound, high-Q/low frequency, toroidal, and transformer types.

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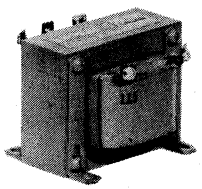
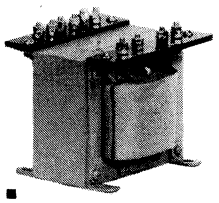
• NAME PLATES • WIRING DIAGRAMS

HIGH CURRENT TRANSFORMERS

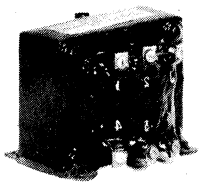
• 45° TEMP. RISE • MINIMUM REGULATION



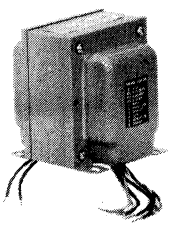
STYLE B



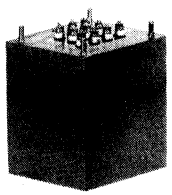
■ STYLE B (OVER 700 VA)



STYLE BE



STYLE V



STYLE CM

FOUR STYLES STOCKED IN DEPTH

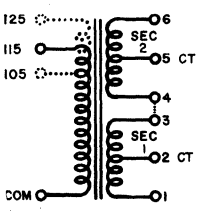
SECONDARY VOLTS TAP VOLTS	PART NO.	RATING VA	PRIMARY VOLTS 50-500 Hz.	OPTIONAL SECONDARY HOOKUP SERIES VOLTS	SERIES AMPS (RMS)	PARALLEL VOLTS	PARALLEL AMPS (RMS)
10 VOLTS Parallel: 2.5, 5V Series: 7.5, 10V	10 02	20	115	10V CT	2	5V CT	4
	10 05	50	115	OR	5	OR	10
	10 10	100	115	7.5V	10	2.5V	20
	10 20	200	115		20		40
12.6 VOLTS Parallel: 3.1, 6.3V Series: 9.4, 12.6V	12 02	24	115	12.6V CT	2	6.3V CT	4
	12 05	60	115	OR	5	OR	10
	12 10	120	115	9.4V	10	3.1V	20
	12 20	240	115		20		40
16 VOLTS Parallel: 4, 8V Series: 12, 16V	16 01	16	115	16V CT	1	8V CT	2
	16 02	32	115		2		4
	16 05	80	115	OR	5	OR	10
	16 10	160	115	12V	10	4V	20
	16 20	320	115		20		40
24 VOLTS Parallel: 6, 12V Series: 18, 24V	24 01	24	115		1		2
	24 02	48	115		2		4
	24 04	96	115	24V CT	4	12V CT	8
	24 06	144	115		6		12
	24 08	192	115	OR	8	OR	16
	24 12	288	105, 115, 125		12		24
	24 20	480	105, 115, 125	18V	20	6V	40
	24 25	600	105, 115, 125		25		50
	24 50	1200	105, 115, 125		50		100
	24 100	2400	115, 230		100		200
36 VOLTS Parallel: 9, 18V Series: 27, 36V	36 00	18	115		0.5		1
	36 01	36	115		1		2
	36 02	72	115		2		4
	36 04	144	115	36V CT	4	18V CT	8
	36 06	216	115		6		12
	36 08	288	115	OR	8	OR	16
	36 12	432	105, 115, 125		12		24
	36 20	720	105, 115, 125	27V	20	9V	40
	36 30	1080	105, 115, 125		30		60
	36 50	1800	115, 230		50		100
	36 100	3600	115, 230		100		200
56 VOLTS Parallel: 14, 28V Series: 42, 56V	56 01	56	115		1		2
	56 02	112	115	56V CT	2	28V CT	4
	56 05	280	115		5		10
	56 08	448	105, 115, 125	OR	8	OR	16
	56 12	672	105, 115, 125		12		24
	56 25	1400	105, 115, 125	42V	25	14V	50
	56 50	2800	115, 230		50		100
	56 100	5600	115, 230		100		200
64 VOLTS Parallel: 16, 32V Series: 48, 64V	64 00	32	115		0.5		1
	64 01	64	115	64V CT	1	32V CT	2
	64 02	128	115		2		4
	64 04	256	115	OR	4	OR	8
	64 08	512	105, 115, 125		8		16
	64 12	780	105, 115, 125	48V	12	16V	24
	64 25	1600	105, 115, 125		25		50
	64 50	3200	115, 230		50		100
68 VOLTS Parallel: 17, 34V Series: 51, 68V	68 01	68	115		1		2
	68 02	136	115	68V CT	2	34V CT	4
	68 04	272	115	OR	4	OR	8
	68 08	544	105, 115, 125	51V	8	17V	16
	68 12	816	105, 115, 125		12		24
80 VOLTS Parallel: 20, 40V Series: 60, 80V	80 01	80	115		1		2
	80 02	160	115	80V CT	2	40V CT	4
	80 05	400	115	OR	5	OR	10
	80 10	800	105, 115, 125	60V	10	20V	20
	80 25	2000	115, 230		25		50
	80 50	4000	115, 230		50		100
120 VOLTS Parallel: 30, 60V Series: 90, 120V	120 01	120	115		1		2
	120 02	240	115	120V CT	2	60V CT	4
	120 04	480	115	OR	4	OR	8
	120 08	960	105, 115, 125	90V	8	30V	16
	120 12	1440	105, 115, 125		12		24
180 VOLTS Parallel: 45, 90V Series: 135, 180V	180 00	90	115	180V CT	0.5	90V CT	1
	180 01	180	115	OR	1	OR	2
	180 04	720	105, 115, 125	135V	4	45V	8
	180 08	1440	105, 115, 125		8		16
230 VOLTS Parallel: 57.5, 115V Series: 172.5, 230V	230 00	115	115		0.5		1
	230 01	230	115	230V CT	1	115V CT	2
	230 02	460	115	OR	2	OR	4
	230 05	1150	105, 115, 125	172.5V	5	57.5V	10
	230 08	1840	115, 230		8		16
300 VOLTS Parallel: 75, 150V Series: 225, 300V	300 00	150	115	300V CT	0.5	150V CT	1
	300 01	300	115	OR	1	OR	2
	300 02	600	115	225V	2	75V	4
	300 05	1500	105, 115, 125		5		10

DC TO RMS CONVERSION CHART

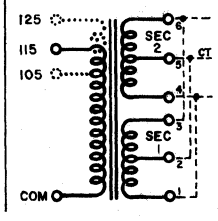
SECONDARY RMS CURRENT = DC CURRENT × FACTOR BELOW	Choke Input Filter or Inductive Load	Resistive Load	Capacitor Input Filter or Capacitive Load
FULL WAVE BRIDGE	1.0	1.0	1.8
FULL WAVE C.T.	.7	1.0	1.15

CUSTOM VARIATIONS QUOTED PROMPTLY

SERIES HOOKUP



PARALLEL HOOKUP



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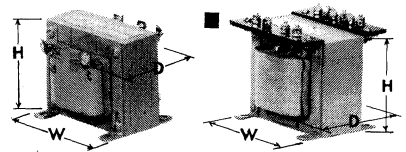
HIGH CURRENT TRANSFORMERS

MECHANICAL SPECIFICATIONS · · · · · · · · · · · · · SPECIFY STYLE REQUIRED

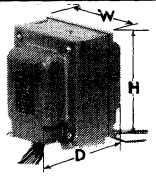
PART NO.	• BRACKET MTD. (STYLE B) • ENCAPSULATED (STYLE BE) H	W	D	MW	MD	WGT.	• FULLY MTD. SHELLS (STYLE V) H	W	D	MW	MD	WGT.	• HERMETIC SEALED MIL-T (STYLE CM) H	W	D	MW	MD	WGT.	PART NO.
10 02	2¼	2⅝	2 1/16	2 3/16	1 11/16	1¼	2⅝	2 3/16	2	1¾	1¼	1¼	3⅛	3	2 3/16	2 3/32	1 27/32	2	10 02
10 05	2½	3	2⅝	2½	2⅛	2⅜	3 1/16	2½	2¾	2	1 13/16	2½	3 13/16	3½	3	2⅝	2⅛	4	10 05
10 10	3⅛	3¾	3	3⅛	2⅛	4⅜	3⅞	3¼	3⅝	2½	2⅜	5	4¼	3⅞	3⅝	3	2 7/16	7¾	10 10
10 20	3¾	4½	3⅝	3¾	2⅜	7½	4⅝	3⅞	3⅞	3	2 13/16	8	5 1/16	5	4¼	4 1/16	3 5/16	12½	10 20
12 02	2½	3	2⅛	2½	1⅝	1½	3 1/16	2½	2¼	2	1 5/16	1⅝	3 13/16	3½	3	2⅝	2⅛	2½	12 02
12 05	2½	3	2⅞	2½	2⅜	2¾	3 1/16	2½	3	2	2 1/16	2⅞	3 13/16	3½	3	2⅝	2⅛	4	12 05
12 10	3⅛	3¾	3 11/16	3⅛	2½	5¼	3⅞	3¼	3¾	2½	2½	5½	4 7/16	4¼	3⅝	3 5/16	2 11/16	8	12 10
12 20	3¾	4½	4	3¾	2¾	9	4⅝	3⅞	4 5/16	3	3⅛	9¼	5 1/16	5	4¼	4 1/16	3 5/16	13	12 20
16 01	2¼	2⅝	2	2 3/16	1⅝	1¼	2⅝	2 3/16	1 13/16	1¾	1 3/16	1⅜	3⅛	3	2 3/16	2 3/32	1 27/32	2⅛	16 01
16 02	2½	3	2	2½	1¾	1⅞	3 1/16	2½	2½	2	1 5/16	1⅞	3 13/16	3½	3	2⅝	2⅛	3⅛	16 02
16 05	2 13/16	3⅜	2¾	2 13/16	2¼	3½	3⅜	2 13/16	3 5/16	2¼	2 3/16	3¾	4¼	3⅞	3 15/16	3	2 7/16	5¼	16 05
16 10	3 7/16	4⅛	3¾	3 7/16	2⅝	7	4⅛	3 7/16	4	2¾	3	7⅛	4⅞	4⅝	3 15/16	3 11/16	3	11	16 10
16 20	3¾	4½	5	3¾	3¾	12¾	4⅝	3⅞	5 3/16	3	3¼	13	5 7/16	5	4¼	4 1/16	3 5/16	16¼	16 20
24 01	2½	3	2⅛	2½	1¾	1¾	3 1/16	2½	2½	2	1 5/16	1¾	3 13/16	3½	3	2⅝	2⅛	3¼	24 01
24 02	2½	3	2½	2½	2	2¼	3 1/16	2½	2 5/8	2	1¾	2¼	3 13/16	3½	3	2⅝	2⅛	4¼	24 02
24 04	3⅛	3¾	3⅛	3⅛	2⅛	4¼	3⅞	3¼	3¼	2½	2 1/16	4⅜	4 7/16	4¼	3⅝	3 5/16	2 11/16	7½	24 04
24 06	3 7/16	4⅛	3½	3 7/16	2⅜	6	4⅛	3 7/16	3¾	2¾	2 11/16	6¼	4⅞	4⅝	3 15/16	3 11/16	3	10	24 06
24 08	3 7/16	4⅛	4	3 7/16	2⅞	7½	4⅛	3 7/16	4¼	2¾	3 3/16	7¾	4⅞	4⅝	3 15/16	3 11/16	3	13	24 08
24 12	3¾	4½	4⅝	3¾	3⅜	11	4⅝	3⅞	4⅞	3	3¾	11⅜	5 7/16	5	4¼	4 1/16	3 5/16	15	24 12
24 20	4⅜	5¼	5¼	4⅜	3 7/16	16¼	5⅜	4½	5⅜	3½	3⅞	16⅞	6¼	5¾	4⅞	4⅜	3½	23	24 20
24 25	4⅜	5¼	5¼	4⅜	3⅞	18½	5⅜	4½	5¾	3½	4¼	19½	6¼	5¾	4⅞	4⅜	3½	26	24 25
24 50	■5½	6⅜	7⅛	5 5/16	5¼	42	6⅜	5 5/16	7¼	4¼	5½	43	7½	6⅞	5 13/16	5 5/16	4¼	53	24 50
24 100	■6½	7 1/16	7⅜	5 13/16	5¼	51							8¼	7⅜	6 1/32	5 13/16	4 25/32	65	24 100
36 00	2¼	2⅝	1⅞	2¾	1⅝	1¼	2⅝	2 3/16	2⅛	1¾	1⅜	1½	3 13/16	3½	3	2⅝	2⅛	3⅜	36 00
36 01	2½	3	2⅛	2½	1⅞	2	3 1/16	2½	2 5/8	2	1 11/16	2	3 13/16	3½	3	2⅝	2⅛	3¼	36 01
36 02	2 13/16	3⅜	2¾	2 13/16	2¼	3½	3⅜	2 13/16	3 5/16	2¼	2⅛	3½	4¼	3⅞	3 5/16	3	2 7/16	5¼	36 02
36 04	3 7/16	4⅛	3⅝	3 7/16	2½	6¼	4⅛	3 7/16	4	2¾	2⅞	6½	4⅞	4⅝	3 15/16	3 11/16	3	10	36 04
36 06	3¾	4½	3¾	3¾	2⅝	8¼	4⅝	3⅞	4 1/16	3	2⅞	8½	5 7/16	5	4¼	4 1/16	3 5/16	11	36 06
36 08	3¾	4½	4¾	3¾	3½	11¾	4⅝	3⅞	5 1/16	3	3⅞	12½	5 7/16	5	4¼	4 1/16	3 5/16	15½	36 08
36 12	4⅜	5¼	5⅜	4 3/8	3¾	17⅛	5⅜	4½	5¾	3½	4⅛	17⅞	6¼	5¾	4⅞	4⅜	3½	22½	36 12
36 20	4⅜	5¼	6⅜	4 3/8	4⅞	23¾	5⅜	4½	6¾	3½	5¼	25	7⅜	5¾	4⅞	4⅜	3½	29	36 20
36 30	■5½	6⅜	6¾	5 5/16	4⅞	34½	6⅜	5 5/16	6¾	4¼	4 1/16	36	7½	6⅞	5 13/16	5 5/16	4¼	42	36 30
36 50	■6½	7 1/16	6¾	5 13/16	5¼	48							8¼	7⅜	6 1/32	5 13/16	4 25/32	55	36 50
36 100	■7½	9	9¼	7⅝	7⅛	85													36 100
56 01	2½	3	2¾	2½	2¼	2½	3 1/16	2½	3	2	2	2¾	3 13/16	3½	3	2⅝	2⅛	4	56 01
56 02	3⅛	3¾	3 1/16	3⅛	2⅜	4½	3⅞	3¼	3 9/16	2½	2⅜	4¾	4 7/16	4¼	3⅝	3 5/16	2 11/16	6¾	56 02
56 05	3¾	4½	4¾	3¾	3½	11½	4⅝	3⅞	5 1/16	3	4	12	5 7/16	5	4¼	4 1/16	3 5/16	18	56 05
56 08	4⅜	5¼	5	4 3/8	3 11/16	16¾	5⅜	4½	5 5/8	3½	4	17	6¼	5¾	4⅞	4⅜	3½	24	56 08
56 12	■5½	6⅜	5½	5 5/16	3 7/16	24	6⅜	5 5/16	5½	4¼	3½	25	7½	6⅞	5 13/16	5 5/16	4¼	30	56 12
56 25	■5½	6⅜	7	5 5/16	5⅛	33	6⅜	5 5/16	7	4¼	5 1/16	34½	7½	6⅞	5 13/16	5 5/16	4¼	45	56 25
56 50	■6½	7 1/16	8	5 13/16	6	60							8¼	7⅜	6 1/32	5 13/16	4 25/32	68	56 50
56 100	■7⅝	9	11½	7⅝	9⅝	146													56 100
64 00	2¼	2⅝	2 5/16	2 3/16	2	1¾	2⅝	2 3/16	2 5/16	1¾	1½	1¾	3⅛	3	2 3/16	2 3/32	1 27/32	2½	64 00
64 01	2½	3	2 13/16	2½	2⅜	3	3 1/16	2½	3	2	2⅛	2¾	3 13/16	3½	3	2⅝	2⅛	4½	64 01
64 02	3⅛	3¾	3 1/16	3⅛	2⅜	4¾	3⅞	3¼	3⅛	2½	2	4⅛	4 7/16	4¼	3⅝	3 5/16	2 11/16	8	64 02
64 04	3¾	4½	4¼	3¾	3 1/16	10	4⅝	3⅞	4 5/8	3	3½	10½	5 7/16	5	4¼	4 1/16	3 5/16	14½	64 04
64 08	4⅜	5¼	5⅝	4 3/8	3 15/16	18¾	5⅜	4½	6	3½	4⅜	18½	6¼	5¾	4⅞	4⅜	3½	24	64 08
64 12	■5½	6⅜	5¾	5 5/16	3⅞	26	6⅜	5 5/16	5 7/8	4¼	3⅞	28	7½	6⅞	5 13/16	5 5/16	4¼	34	64 12
64 25	■6 3/32	7 1/16	7½	5 13/16	5 7/16	52							8¼	7⅜	6 1/32	5 13/16	4 25/32	66	64 25
64 50	■7⅝	9	7⅝	7⅝	5¾	75							10 3/8	8	6¾	6¾	5½	105	64 50
68 01	2½	3	2 13/16	2½	2⅜	3¼	3 1/16	2½	3	2	2 1/16	2⅞	3 13/16	3½	3	2⅝	2⅛	4½	68 01
68 02	3⅛	3¾	3⅛	3⅛	2½	5	3⅞	3¼	3¾	2½	2½	5½	4 7/16	4¼	3⅝	3 5/16	2 11/16	8	68 02
68 04	3¾	4½	4⅜	3¾	3⅛	10½	4⅝	3⅞	5 1/8	3	3⅞	12½	5 7/16	5	4¼	4 1/16	3 5/16	15	68 04
68 08	4⅜	5¼	5¾	4⅜	4	19½	5⅜	4½	6	3½	4⅜	19	6¼	5¾	4⅞	4⅜	3½	23	68 08
68 12	■5½	6⅜	5 7/8	5 5/16	4	26	6⅜	5 5/16	6	4¼	4	30	7½	6⅞	5 13/16	5 5/16	4¼	35	68 12
80 01	2 13/16	3⅜	2¾	2 13/16	2¼	3½	3⅜	2 13/16	3 5/16	2¼	2 3/16	3¾	4¼	3⅞	3 15/16	3	2 7/16	5½	80 01
80 02	3 7/16	4⅛	3⅝	3 7/16	2½	6½	4⅛	3 7/16	4 3/16	2¾	2⅝	7	4⅞	4⅝	3 15/16	3 11/16	3	11	80 02
80 05	4⅜	5¼	5⅛	4 3/8	3½	15¼	5⅜	4½	5½	3½	3⅞	16½	6¼	5¾	4⅞	4⅜	3½	27	80 05
80 10	■5½	6⅜	5½	5 5/16	4	28	6⅜	5 5/16	5¾	4¼	4	29	7½	6⅞	5 13/16	5 5/16	4¼	35	80 10
80 25	■6 3/32	7 1/16	6⅜	5 13/16	4¼	39							8¼	7⅜	6 1/32	5 13/16	4 25/32	53	80 25
80 50	■7⅝	9	8½	7⅝	6⅝	89													80 50
120 01	3⅛	3¾	3⅜	3⅛	2½	5⅜	3⅞	3¼	3¾	2½	2½	5½	4 7/16	4¼	3⅝	3 5/16	2 11/16	8	120 01
120 02	3¾	4½	4	3¾	3⅛	9¾	4⅝	3⅞	4 3/8	3	3⅛	9	5 7/16	5	4¼	4 1/16	3 5/16	12	120 02
120 04	4⅜	5¼	4⅞	4 3/8	3⅝	16 3/8	5⅜	4½	5½	3½	3⅞	15	6¼	5¾	4⅞	4⅜	3½	25	120 04
120 08	■5½	6⅜	5¾	5 5/16	4⅝	33	6⅜	5 5/16	6	4¼	4¼	34	7½	6⅞	5 13/16	5 5/16	4¼	34	120 08
120 12	■5½	6⅜	7½	5 5/16	5¾	43	6⅜	5 5/16	7¾	4¼	6	44	7½	6⅞	5 13/16	5 5/16	4¼	47	120 12
180 00	3⅛	3¾	3	3⅛	2⅛	4¼	3⅞	3¼	3⅛	2½	2	4¼	4 7/16	4¼	3⅝	3 5/16	2 11/16	7⅛	180 00
180 01	3 7/16	4⅛	3⅞	3 7/16	2⅝	7	4⅛	3 7/16	4⅛	2¾	3	7¼	4⅞	4⅝	3 15/16	3 11/16	3	12	180 01
180 04	■4⅜	5¼	6⅜	4⅜	4⅞	24	5⅜	4½	6¾	3½	5¼	25	7⅜	5¾	4⅞	4⅜	3½	29	180 04
180 08	■5½	6⅜	7½	5 5/16	5¾	43	6⅜	5 5/16	7¾	4¼	6	44	7½	6⅞	5 13/16	5 5/16	4¼	47	180 08
230 00	3⅛	3¾	3¼	3⅛	2⅜	5	3⅞	3¼	3 9/16	2½	2⅜	5⅛	4 7/16	4¼	3⅝	3 5/16	2 11/16	7¾	230 00
230 01	3 7/16	4⅛	4⅜	3 7/16	3⅛	8¼	4⅛	3 7/16	4 5/8	2¾	3½	8¾	4⅞	4⅝	3 15/16	3 11/16	3	12¾	230 01
230 02	4⅜	5¼	5⅛	4⅜	3¾	17	5⅜	4½	5 1/16	3½	4	17	6¼	5¾	4⅞	4⅜	3½	27	230 02
230 05	■5½	6⅜	5⅞	5 5/16	4	29	6⅜	5 5/16	6⅛	4¼	4⅜	30	7½	6⅞	5 13/16	5 5/16	4¼	35	230 05
230 08	■6 3/32	7 1/16	7⅝	5 13/16	5½	50							8¼	7⅜	6 1/32	5 13/16	4 25/32	68	230 08
300 00	3 7/16	4⅛	3⅜	3 7/16	2 5/16	6	4⅛	3 7/16	3⅞	2¾	2¾	6¼	4⅞	4⅝	3 15/16	3 11/16	3	10½	300 00
300 01	3¾	4½	4⅝	3¾	3 7/16	11¼	4⅝	3⅞	4 13/16	3	3¾	11¼	5 7/16	5	4¼	4 1/16	3 5/16	14½	300 01
300 02	4⅜	5¼	6	4⅜	4⅝	20	5⅜	4½	6½	3½	5	21	7⅜	5¾	4⅞	4⅜	3½	28	300 02
300 05	■5½	6⅜	6⅝	5 5/16	5	38	6⅜	5 5/16	6⅞	4¼	5⅛	40	8¾	6⅞	5 13/16	5 5/16	4¼	53	300 05

Add 3/16 to H W D for Style BE



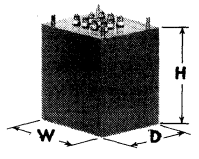
STYLE B: • "Open Frame" Bracket Mounted
• Double Vacuum Varnish Impregnated

STYLE BE: • Conforms to MIL-T-27B
• Epoxy Encapsulation added to Style B



STYLE V: • Fully Enclosed in Metal Shells
• Ease of "Wiring with Leads"
• Attractive Appearance
• Dbl Vacuum Varnish Impregnated

OUTLINE DRAWINGS AVAILABLE



STYLE CM: • Hermetically Sealed to MIL-T-27B
• Environment Proof
• Attractive Gray Finish
• Permanent Name Plate

CONTACT FACTORY FOR PRICES

QUALITY ENGINEERED **TODD SYSTEMS INC.** PRECISION BUILT
FAX: (914) 963-3506 50 ASH STREET, YONKERS, NY, U.S.A. 10701 (914) 963-3400

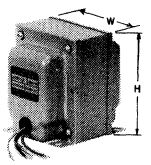
TODD ENGINEERED LINE ISOLATION . . . . . HIGH CURRENT CHOKES

LINE ISOLATION — OUTPUT 115 VOLTS — 50/60 HERTZ *UL* COMPONENTS

STRAIGHT ISOLATION — ELECTROSTATIC SHIELD CONNECTED TO CORE — TWO STYLES

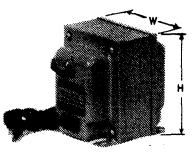
CATALOG NUMBER	WATTS (VA)	INPUT VOLTS	HIPOT TEST VOLTS	DIMENSIONS H	W	D	MW	MD	WGT.
LI-25	25	115	1500	3 1/8	2 5/8	2 1/2	2	1 1/2	1 5/8
LI-50	50	115	1500	3 1/2	2 7/8	3	2 1/4	1 7/8	3
LI-100	100	115	1500	3 1/2	2 7/8	3 1/2	2 1/4	2 1/4	4
LI-175	175	115	1500	4 5/8	3 7/8	3 7/8	3	2 3/4	7
LI-250	250	115	1500	4 5/8	3 7/8	4 3/8	3	3 1/4	10
LI-350	350	115	1500	4 5/8	3 7/8	5 1/4	3	4 1/8	14
LI-500	500	115	1500	6	4 3/8	5 1/8	3 7/16	3 3/8	17 1/2
LI-750	750	115	1500	6	4 3/8	6 3/8	3 7/16	4 1/2	24
LI-1000	1000	115	1500	6	4 3/8	7 1/4	3 7/16	5 1/2	30
LI-1500	1500	115	1500	6 1/2	5 1/2	7 1/2	4 1/4	5 3/8	42
LI-2000	2000	115	1500	6 1/2	5 1/2	9	4 1/4	6 7/8	58
LI-100-1	100	230	2000	3 1/2	2 7/8	3 1/2	2 1/4	2 1/4	4
LI-250-1	250	230	2000	4 5/8	3 7/8	4 3/8	3	3 1/4	10
LI-500-1	500	230	2000	6	4 3/8	5 1/8	3 7/16	3 3/8	17 1/2
LI-1000-1	1000	230	2000	6	4 3/8	7 1/4	3 7/16	5 1/2	30
LI-1500-1	1500	230	2000	6 1/2	5 1/2	7 1/2	4 1/4	5 3/8	42
LI-2000-1	2000	230	2000	6 1/2	5 1/2	9	4 1/4	6 7/8	58

STYLE LO



LEAD WIRE TERMINALS

STYLE LRG

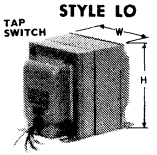


LINE CORD RECEPTACLE (W/GROUND)

ADJUSTABLE ISOLATION — ELECTROSTATIC SHIELD CONNECTED TO CORE — • PRIMARY TAPPED • TWO STYLES

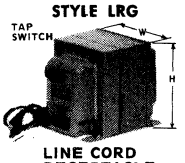
CATALOG NUMBER	WATTS (VA)	INPUT VOLTS	HIPOT TEST VOLTS	DIMENSIONS H	W	D	MW	MD	WGT.
LI-50-2	50	105/115/125	1500	3 1/2	2 7/8	3 7/8	2 1/4	2 1/2	3
LI-100-2	100	105/115/125	1500	3 1/2	2 7/8	4 3/8	2 1/4	3	4 1/2
LI-250-2	250	105/115/125	1500	4 5/8	3 7/8	5 1/8	3	4	11 1/2
LI-500-2	500	105/115/125	1500	6	4 3/8	5 7/8	3 7/16	4 1/8	19
LI-1000-2	1000	105/115/125	1500	6	4 3/8	8 1/8	3 7/16	6 3/8	34
LI-50-3	50	210/230/250	2000	3 1/2	2 7/8	3 7/8	2 1/4	2 1/2	3
LI-100-3	100	210/230/250	2000	3 1/2	2 7/8	4 3/8	2 1/4	3	4 1/2
LI-250-3	250	210/230/250	2000	4 5/8	3 7/8	5 1/8	3	4	11 1/2
LI-500-3	500	210/230/250	2000	6	4 3/8	5 7/8	3 7/16	4 1/8	19
LI-1000-3	1000	210/230/250	2000	6	4 3/8	8 1/8	3 7/16	6 3/8	34

STYLE LO



LEAD WIRE TERMINALS

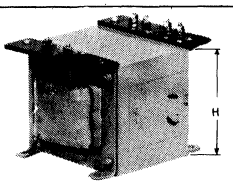
STYLE LRG



LINE CORD RECEPTACLE (W/GROUND)

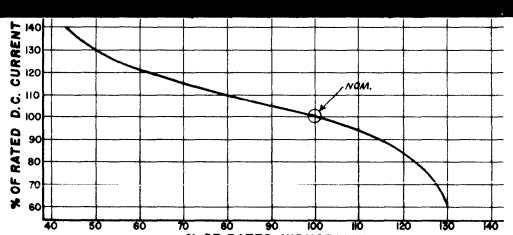
HI-POWER ISOLATION — ELECTROSTATIC SHIELD CONNECTED TO CORE — BRACKET MOUNTED

CATALOG NUMBER	WATTS (VA)	INPUT VOLTS	HIPOT TEST VOLTS	DIMENSIONS H	W	D	MW	MD	WGT.
LI-2500-4	2500	115/230	2000	6 1/8	7 1/8	8 3/4	5 7/8	7	60
LI-3000-4	3000	115/230	2000	7 1/2	9	7 7/8	7 1/2	6 1/2	95
LI-4000-4	4000	115/230	2000	7 1/2	9	9	7 1/2	7 5/8	113
LI-5000-4	5000	115/230	2000	7 1/2	9	10 1/4	7 1/2	8 7/8	135
LI-6000-4	6000	115/230	2000	7 1/2	9	11 3/4	7 1/2	10 1/4	168
LI-2500-5	2500	230/460	2500	6 1/8	7 1/8	8 3/4	5 7/8	7	60
LI-3000-5	3000	230/460	2500	7 1/2	9	7 7/8	7 1/2	6 1/2	95
LI-4000-5	4000	230/460	2500	7 1/2	9	9	7 1/2	7 5/8	113
LI-5000-5	5000	230/460	2500	7 1/2	9	10 1/4	7 1/2	8 7/8	135
LI-6000-5	6000	230/460	2500	7 1/2	9	11 3/4	7 1/2	10 1/4	168



SCREW TERMINALS

HIGH CURRENT CHOKES — 50/500 HERTZ | DIMENSIONS REFER TO HIGH CURRENT XFMR SKETCHES



- **Matching styles complement high current transformers**
- **Wide variety of compatible current ratings**

INDUCTANCE VARIATION

Graph indicates typical variation of inductance (%) when used at D.C. currents (%) other than the rated values.

Chokes operated at D. C. currents higher than rated value must be run on an intermittent basis to avoid overheating.

CATALOG NUMBER	INDUCTANCE (mh)	D.C. CURRENT (AMPS)	RESISTANCE (OHMS)	• BRACKET MTD. (STYLE B) • ENCAPSULATED (STYLE BE) H	W	D	MW	MD	WGT.	• FULLY MTD. SHELLS (STYLE V) H	W	D	MW	MD	WGT.	• HERMETICALLY SEALED MIL-T (STYLE CM) H	W	D	MW	MD	WGT.
CH-00	200	.5	3.00	2 1/4	2 5/8	2	2	1 3/4	11 1/2	2 5/8	2 1/4	2 1/4	1 3/4	1 5/8	13/4	3 1/8	3	2 5/16	2 5/16	1 7/8	2 1/8
CH-01	100	1	1.50	2 1/2	2	2 1/8	2 1/2	2	2 1/4	3 1/8	2 1/2	2 5/8	2	1 3/4	21/4	3 13/16	3 1/2	3	2 5/8	2 1/8	3 1/4
CH-02	80	2	1.30	2 1/2	3	2 1/2	2 1/2	2	2 1/2	3 1/8	2 1/2	2 1/2	2	1 3/4	21/2	3 13/16	3 1/2	3	2 5/8	2 1/8	3 1/2
CH-04	60	4	.60	3 1/8	3 3/4	3 1/4	3 1/8	2 1/2	5 1/4	3 7/8	3 3/16	3 3/4	2 1/2	2 1/4	6	4 7/16	4 1/4	3 5/8	3 5/16	2 11/16	7 1/4
CH-05	50	5	.50	3 1/8	3 3/4	3 3/8	3 1/8	2 3/4	5 3/4	3 7/8	3 3/16	4	2 1/2	3	6 1/2	4 7/16	4 1/4	3 5/8	3 5/16	2 11/16	8
CH-06	40	6	.35	3 1/8	3 3/4	3 3/8	3 1/8	2 3/4	6	3 7/8	3 3/16	4	2 1/2	3	6 1/2	4 7/16	4 1/4	3 5/8	3 5/16	2 11/16	8 5/8
CH-08	30	8	.25	3 1/2	4 1/8	3 7/8	3 3/8	3	8	4 1/8	3 1/2	4 3/8	2 3/4	3 3/8	8 1/2	4 7/8	4 5/8	4	3 11/16	3	11 1/8
CH-12	20	12	.12	3 3/4	4 1/2	4 7/8	3 3/8	3 1/2	15 1/2	4 5/8	3 7/8	4 7/8	3	3 3/4	14	5 7/16	5	4 1/4	4 1/16	3 5/16	20
CH-16	15	16	.08	4 7/16	5 1/4	4 5/8	4 3/8	3 3/8	14 1/4	5 7/16	4 1/2	5 1/4	3 1/2	3 3/4	15	6 1/4	5 3/4	4 7/8	4 3/8	3 1/2	22 1/2
CH-20	10	20	.05	4 7/16	5 1/4	4 1/2	4 3/8	3 1/2	15 1/2	5 7/16	4 1/2	5 3/8	3 1/2	3 7/8	16	6 1/4	5 3/4	4 7/8	4 3/8	3 1/2	24
CH-25	6.5	25	.028	4 7/16	5 1/4	5	4 3/8	4	18 1/2	5 7/16	4 1/2	5 7/8	3 1/2	4 3/8	19 1/2	6 1/4	5 3/4	4 7/8	4 3/8	3 1/2	26 1/2
CH-30	5.5	30	.022	5 3/8	6 3/8	4 1/2	5 1/4	3 1/4	21	6 1/2	5 7/16	5 1/2	4 1/4	3 1/4	24	7 1/2	6 7/8	5 13/16	5 5/16	4 1/4	29 1/2
CH-40	4.0	40	.014	5 3/8	6 3/8	4 5/8	5 1/4	3 1/2	23	6 1/2	5 7/16	5 3/4	4 1/4	3 1/2	25	7 1/2	6 7/8	5 13/16	5 5/16	4 1/4	32 1/2
CH-50	3.0	50	.010	5 3/8	6 3/8	5 1/2	5 1/4	4 1/8	29	6 1/2	5 7/16	6 3/8	4 1/2	4 1/8	30	7 1/2	6 7/8	5 13/16	5 5/16	4 1/4	37
CH-100	.8	100	.003	5 3/8	6 3/8	5 3/4	5 1/4	4 5/8	35	6 1/2	5 7/16	6 7/8	4 1/4	4 5/8	36	7 1/2	6 7/8	5 13/16	5 5/16	4 1/4	45
CH-200	.35	200	.001	6 1/8	7 1/8	6 3/4	5 7/8	5 1/2	43												

CONTACT FACTORY FOR PRICES

QUALITY ENGINEERED
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TODD ENGINEERED

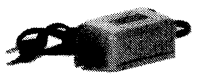
STEPDOWN AUTOTRANSFORMERS

CONVERT DOMESTIC APPLIANCES FOR USE ON FOREIGN VOLTAGES

50/60 HERTZ—*UL* COMPONENTS

PORTABLE MODEL — 220/240 INPUT 110/120 OUTPUT

CATALOG NUMBER	RATING WATTS	WEIGHT LBS.	DIMENSIONS H	W	D
SD-35	20	7/8	1 1/2	2	2 5/8
SD-36	40	1 1/4	1 7/16	2 1/8	3 1/2
SD-37	60	1 5/16	1 7/16	2 1/8	3 1/2
SD-41	80	1 7/16	1 7/16	2 1/8	3 1/2



LINE CORD • RECEPTACLE

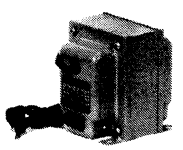
NORMAL DUTY MODEL — 220/240 INPUT 110/120 OUTPUT

CATALOG NUMBER	RATING WATTS	WEIGHT LBS.	DIMENSIONS H	W	D
SD-24	50	1 5/8	2 1/4	2 3/4	2 1/4
SD-21	65	1 5/8	2 1/4	2 3/4	2 1/4
SD-25	80	1 3/4	2 1/4	2 3/4	2 3/8
SD-23	100	1 3/4	2 1/4	2 3/4	2 3/8
SD-26	125	2 3/8	2 5/8	3 1/16	2 1/2
SD-27	150	2 3/8	2 5/8	3 1/16	2 1/2

LINE CORD • PIGTAIL

HEAVY DUTY MODEL — 220/240 INPUT 110/120 OUTPUT

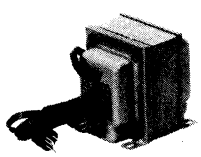
CATALOG NUMBER	RATING WATTS	WEIGHT LBS.	DIMENSIONS H	W	D
SD-16	100	2 1/2	3 1/8	2 5/8	3 1/4
SD-17	150	3 1/4	3 1/8	2 5/8	3 5/8
SD-38	200	4	3 1/8	2 5/8	4
SD-12	250	4 1/2	3 1/8	2 5/8	4 3/8
SD-43	300	4 5/8	3 1/8	2 5/8	4 1/2
SD-18	350	6 1/2	4 5/8	3 7/8	3 5/8
SD-11	500	9 3/4	4 5/8	3 7/8	4 1/4
SD-19	750	12	4 5/8	3 7/8	5
SD-13	1000	13 3/4	4 5/8	3 7/8	5 1/4
SD-14	1500	19	4 5/8	3 7/8	6 5/8



TWO PRONG LINE CORD/RECEPTACLE

HEAVY DUTY GROUNDED MODEL — 220/240 INPUT 110/120 OUTPUT

CATALOG NUMBER	RATING WATTS	WEIGHT LBS.	DIMENSIONS H	W	D
SD-16LRG	100	2 1/2	3 1/8	2 5/8	3 3/8
SD-17LRG	150	3 1/4	3 1/8	2 5/8	3 3/4
SD-38LRG	200	3 3/4	3 1/8	2 5/8	4 3/16
SD-12LRG	250	4 1/2	3 1/8	2 5/8	4 3/16
SD-43LRG	300	4 1/2	3 1/8	2 5/8	4 5/8
SD-18LRG	350	6 3/4	4 5/8	3 7/8	4 1/8
SD-11LRG	500	8 3/4	4 5/8	3 7/8	4 3/4
SD-19LRG	750	12 3/8	4 5/8	3 7/8	5 5/8
SD-13LRG	1000	13 3/4	4 5/8	3 7/8	6
SD-14LRG	1500	18 1/8	4 5/8	3 7/8	7 1/16
SD-20LRG	2000	24 1/4	5 13/16	4 3/8	6 7/16
SD-39LRG	2500	36	6 3/8	5 5/16	7 5/8

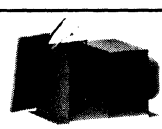


THREE PRONG LINE CORD/RECEPTACLE

HEAVY DUTY GROUNDED MODEL AVAILABLE AS STEPUP—SEE GENERAL CATALOG

INDUSTRIAL MODEL — 220/240 INPUT 110/120 OUTPUT

CATALOG NUMBER	RATING WATTS	WEIGHT LBS.	DIMENSIONS H	W	D
SD-28	3000	47	6 1/8	7 1/16	10 1/4
SD-29	4000	54	6 1/8	7 1/16	12
SD-22	5000	59	6 1/8	7 1/16	11 1/4
SD-30	6000	70	6 1/8	7 1/16	12 1/4



JUNCTION BOX LEAD TERMINALS

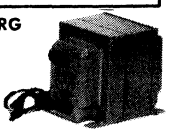
3 TAP REFRIGERATION — 188/210 210/236 236/260 → 105V-50Hz 115V - 60Hz. INPUT V. +10%

CATALOG NUMBER	RATING WATTS	WEIGHT LBS.	DIMENSIONS H	W	D
SD-31LRG	350	7.7	4 5/8	3 7/8	4 7/8
SD-32LRG	550	10.5	4 5/8	3 7/8	5 3/8
SD-33LRG	750	12.7	4 5/8	3 7/8	6
SD-42LRG	850	14.7	4 5/8	3 7/8	6 3/8
SD-34LRG	1000	17	4 5/8	3 7/8	7
SD-40LRG	1500	24.5	5 1/2	4 1/2	7 7/8
SD-44LRG	2000	24.7	5 1/2	4 1/2	7 7/8

CATALOG NUMBER	RATING WATTS	WEIGHT LBS.	DIMENSIONS H	W	D
SD-31LO	350	7.5	4 5/8	3 7/8	3 7/8
SD-32LO	550	9.9	4 5/8	3 7/8	4 3/8
SD-33LO	750	12.2	4 5/8	3 7/8	5
SD-42LO	850	14	4 5/8	3 7/8	5 1/2
SD-34LO	1000	16.2	4 5/8	3 7/8	6
SD-40LO	1500	24	5 1/2	4 1/2	6 7/8
SD-44LO	2000	24	5 1/2	4 1/2	6 7/8

STYLE LRG

TAP SWITCH



3 WIRE LINE CORD & RECEPTACLE (WITH GROUND)

STYLE LO

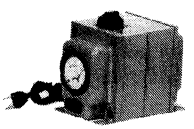
JUNCTION BOX

LEAD WIRE TERMINALS

MULTI-TAPPED VOLTAGE REGULATOR — METER • SWITCH

TYPE	PRIMARY VOLTS (SELECTOR SWITCH TAPS)								OUTPUT VOLTS
11	84	92	100	108	115	122	130	138	115
12	84	92	100	108	115	122	130	138	208, 230
21	170	185	200	215	230	245	260	275	115
22	170	185	200	215	230	245	260	275	208, 230

CATALOG NUMBER	TYPE	RATING WATTS	WGT. LBS.	DIMENSIONS H	W	D
MVR-17	11 or 22	150	4 5/8	4 5/8	3 7/8	5
MVR-18	11 or 22	350	6 1/2	4 5/8	3 7/8	5 1/2
MVR-11	11 or 22	500	8	4 5/8	3 7/8	5 3/4
MVR-19	11 or 22	750	11	4 5/8	3 7/8	6 5/8
MVR-13	11 or 22	1000	13 1/4	4 5/8	3 7/8	7 1/8
MVR-14	11 or 22	1500	17	6	4 3/8	7 3/8
MVR-20	11 or 22	2000	22	6	4 3/8	8 1/4
MVR-17	12 or 21	150	6	4 5/8	3 7/8	5 1/8
MVR-18	12 or 21	350	9	4 5/8	3 7/8	5 7/8
MVR-11	12 or 21	500	12 1/2	4 5/8	3 7/8	6 3/4
MVR-19	12 or 21	750	15	4 5/8	3 7/8	7 1/4
MVR-13	12 or 21	1000	18 3/4	6	4 3/8	7 1/2
MVR-14	12 or 21	1500	24	6	4 3/8	8 1/2
MVR-20	12 or 21	2000	30 1/2	6	4 3/8	9 1/4

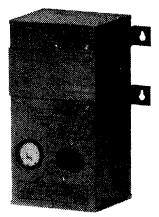


3 WIRE LINE CORD & RECEPTACLE (WITH GROUND)

PANEL MOUNTED VOLTAGE REGULATOR — METER • SWITCH JUNCTION BOX

TYPE	PRIMARY VOLTS (SELECTOR SWITCH TAPS)								OUTPUT VOLTS
11	84	92	100	108	115	122	130	138	115
12	84	92	100	108	115	122	130	138	208, 230
21	170	185	200	215	230	245	260	275	115
22	170	185	200	215	230	245	260	275	208, 230

CATALOG NUMBER	TYPE	RATING WATTS	WGT. LBS.	DIMENSIONS H	W	D
PVR-20	11 or 22	2000	29	5 3/8	6 3/8	11 1/4
PVR-28	11 or 22	3000	40	5 3/8	6 3/8	12 1/4
PVR-29	11 or 22	4000	49	5 3/8	6 3/8	13 3/8
PVR-22	11 or 22	5000	57	5 3/8	6 3/8	14 5/8
PVR-30	11 or 22	6000	63	6 1/8	7 1/8	13 3/4
PVR-20	12 or 21	2000	44	6 1/8	7 1/8	13
PVR-28	12 or 21	3000	58	6 1/8	7 1/8	14
PVR-29	12 or 21	4000	78	6 1/8	7 1/8	15 1/2
PVR-22	12 or 21	5000	91	6 1/8	7 1/8	16 1/2
PVR-30	12 or 21	6000	105	6 1/8	7 1/8	18



- JUNCTION BOX
- LEAD TERMINALS

CONTACT FACTORY FOR PRICES

QUALITY ENGINEERED **TODD SYSTEMS INC.** PRECISION BUILT

FAX: (914) 963-3506 50 ASH STREET, YONKERS, NY, U.S.A. 10701 (914) 963-3400

SUPERIOR Toroid® TRANSFORMERS

TOROIDAL POWER TRANSFORMERS
FOR 50/60 HZ LINE FREQUENCY

FEATURES OF TOROIDAL DESIGN

Our transformers will be your solutions in critical areas of:

Magnetic Strayfield

Transformer Noise

Small Dimensions

Low Weight

High Efficiency

PRODUCT PROGRAM

CUSTOM DESIGN

CUSTOM MADE TRANSFORMERS from 20VA to 5000VA for 60 Hz or 50/60Hz operation with UL family recognition. The table on the next page lists maximum data for custom made transformers using our standard core sizes. Other core sizes are available. Custom made transformers are often a preferred choice for optimized technical performance. For certain applications, custom design is also a cost saving alternative to standard transformers.

STANDARD OFF-THE-SHELF

STANDARD TRANSFORMERS UL recognized, for both 117V/60Hz and 115/230V 50-60Hz, 26VA-1000VA power range. All types are available from stock in Bowie, MD. (See separate page A•2515.)

We also offer **transformer kits** with factory made primary windings in sizes from 80VA to 1400VA. A line of **multi-voltage rectifier transformers** for 5V and ± 15V regulated DC are also stock items. (See separate page A•2416.)

OTHER PRODUCTS

3-PHASE TRANSFORMERS

AUTO TRANSFORMERS

INVERTER TRANSFORMERS FOR 50 OR 60 HZ

CURRENT TRANSFORMERS FOR CONTROL APPLICATIONS

FILTER CHOKES OF TOROIDAL DESIGN FOR 50/60 HZ
(See section 1800 page A•1298.)

TOROID CORPORATION OF MARYLAND OFFERS

Over 15 years of experience from design and manufacturing toroidal power transformers.

Computerized transformer design.
For rectifier transformers we use proprietary software to calculate and optimize the design to meet the DC-data required after your rectifier circuitry.

UL recognized construction including UL544 Medical Standard. UL recognition of custom designs can be obtained quickly under our UL family recognition.

Our transformers are built to meet basic requirements of IEC, VDE, CSA and other foreign safety agencies.

THE FACTORY

TOROID CORPORATION OF MARYLAND started its operation in late 1982. The rapid growth of the company and its early position as the market leader was made possible by design and manufacturing technology transferred from its Swedish affiliate Toroid Transformator AB. The U.S. operation occupies a modern 10,000 sq. ft. plant in Bowie, MD. 20 miles east of Washington DC.

QUALITY

To ensure that our customers will always receive the ultimate design solution and the highest quality workmanship, the two factories maintain close cooperation for evaluation of design and manufacturing processes. In-house production engineering is continuously working on development of new manufacturing equipment.

With our proprietary software programs, we can quickly and accurately design transformers for rectifier loads without approximations . . . . Thus we guarantee that a prototype will meet specified DC data the first time.

Winding our own cores of grain oriented silicon steel is another important step we have taken to have full control of every aspect of our manufacturing process.

For further information, please contact the factory sales department (301) 464-2100 or our sales representative in your area:

U.S. Sales Representatives

California South	(213) 596-9411	FAX (213) 430-9084
California North	(406) 272-6836	FAX (408) 259-7376
Chicagoland	(312) 520-1200	FAX (312) 520-7927
New England	(617) 485-2215	FAX (617) 485-5186
Eastern Penn.	(215) 659-8938	FAX (215) 659-8076
MD, VA, DC	(703) 360-9039	FAX (703) 360-9202
Upstate New York	(802) 228-5240	
Metro New York	(516) 482-4080	FAX (516) 482-4589

European Distributors

West Germany	(49) 69 724 752	FAX (49) 69 72 94 96
Switzerland	(41) 32 84 35 80	FAX (41) 32 84 62 87
Finland	(358) 07 39 100	FAX (358) 07 12 414
The Netherlands	(31) 80 58 38 58	FAX (31) 80 58 25 96
Norway	(47) 47 65 111	FAX (47) 47 65 339
Sweden	(46) 470 81010	FAX (46) 470 82012

TOROID CORPORATION OF MARYLAND

6000 Laurel-Bowie Road • Bowie, MD 20715-4037 • (301) 464-2100 • FAX (301) 464-4657

TOROIDAL POWER TRANSFORMERS
FOR 50/60 HZ LINE FREQUENCY

Toroid® SUPERIOR TRANSFORMERS

SAFETY PARAMETERS

COMPLIANCE WITH SAFETY STANDARDS

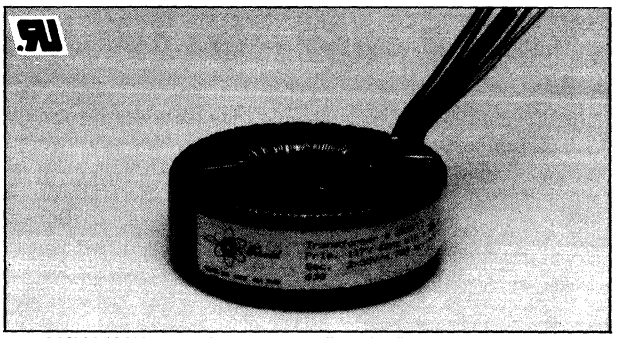
Our basic program of transformers is UL recognized to UL standard 1411. Transformers for medical applications, recognized to UL 544 is one of our specialties. Our transformers are designed and built to meet the basic standards of IEC, VDE, CSA and other foreign safety regulatory agencies.

INSULATIONS

To meet the stringent safety requirements for transformers, we use only UL recognized insulation material. Our transformers are constructed with reinforced insulation, which allows the transformer to be used without grounding. All our transformers are 100% hi-pot tested at 4000V rms for 2 seconds and have a minimum creep distance of 8 mm.

TEMPERATURE CONSIDERATIONS

Operating temperature is another important safety factor. Our transformers, built for Class A (105°C) operation, are normally calculated for a temperature rise of 60°-65°C. Actual increase will depend on how and where the transformer is mounted and how well it is cooled.



360VA/60Hz transformer — 4.5″ × 2.3″H Weight = 5.3 lbs

APPLICATION NOTES

Our engineering staff has written three application notes (Transformer Facts):

- Bulletin #1—Form Factor and Size of Rectifier Transformers
- Bulletin #2—Supply Voltage and Primary Windings for Power Transformers
- Bulletin #3—Fuses and Overload Protection of Transformers

We will be glad to send you any of these free of charge.

Maximum data for custom made transformers using our standard core sizes

60Hz operation		50/60Hz operation		Approx Size & Weight of finished transformer		Core #
Max rated power (VA)	No-load loss (W)	Max rated power (VA)	No-load loss (W)	OD × H (inches)	Weight (lbs)	
26	.26	20	.20	2.4×1.2	.7	532
45	.32	35	.24	2.8×1.3	1.1	642
65	*.48*	*50*	*.36*	*2.9×1.8*	*1.4*	*643*
70	.54	57	.40	3.2×1.4	1.5	742
100	*.79*	*85*	*.59*	*3.3×1.9*	*2.0*	*743*
105	.63	87	.47	3.7×1.4	2.2	852
120	.77	100	.57	3.9×1.5	2.2	952
150	.94	120	.70	3.7×1.8	2.9	853
180	1.14	150	.85	3.9×1.9	3.0	953
185	1.21	150	.90	4.5×1.6	3.3	052
200	*1.26*	*165*	*.94*	*3.8×2.3*	*3.3*	*854*
240	*1.52*	*190*	*1.13*	*3.9×2.3*	*3.8*	*954*
265	1.81	225	1.35	4.5×1.9	4.4	1053
360	2.41	300	1.80	4.5×2.3	5.3	1064
440	2.60	360	1.94	5.5×2.0	5.7	1263
600	3.06	500	2.28	5.5×2.4	8.2	1274
720	3.82	600	2.85	5.5×2.8	9.7	1275
1,000	4.70	800	3.51	6.3×2.4	12.1	1584
1,200	5.90	1,000	4.40	6.3×2.9	15.0	1585
1,450	7.10	1,200	5.30	6.3×3.3	17.4	1586
1,700	7.20	1,400	5.40	7.9×2.6	20.0	18104
2,000	9.00	1,700	6.70	7.9×3.0	24.0	18105
2,400	10.80	2,000	8.10	7.9×3.3	27.8	18106
2,750	10.30	2,300	7.70	8.7×3.2	29.7	20125
3,250	12.40	2,700	9.30	8.7×3.5	35.2	20126

Transformers with data in italic may require longer delivery times.
(Other core sizes available for custom design.)
Power rating (VA) is determined by secondary RMS data.
Also see Design Data on page A•2412.

Continued next page

TOROID CORPORATION OF MARYLAND
6000 Laurel-Bowie Road • Bowie, MD 20715-4037 • (301) 464-2100 • FAX (301) 464-4657

SUPERIOR Toroid® TRANSFORMERS

TOROIDAL POWER TRANSFORMERS

AVAILABLE DESIGN OPTIONS

ULTRA-LOW MAGNETIC STRAYFIELD EMISSION DESIGN

Our standard design considerably reduces the strayfields in comparison with a laminated transformer. For sensitive applications, our optional Ultra-low Strayfield Design, achieved through a special process, further reduces the emission. In applications such as high resolution CRT displays, a magnetic shield around the circumference of the transformer can be added to allow even lower emission levels.

STATIC SHIELDING

Static shielding may be required to minimize capacitive coupling between primary and secondary winding when the transformer is used in an extremely noisy environment. Since the shield adds layers, a larger core size may be necessary to provide adequate inside diameter for the shuttle of the winding machine.

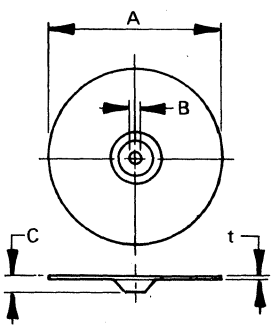
LEADS AND CONNECTORS

Standard is 8" long flying self-leads. Other lead lengths, multi stranded leads, and mounted connectors are options.

MOUNTING METHODS

MOUNTING WASHER

The normal mounting method of our transformers is using a metal washer and two rubber pads, furnished at no extra charge.

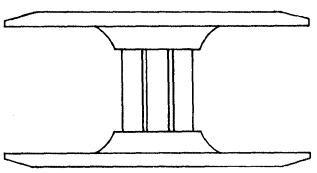


P/N	A	B	C	t
W050	2.0	0.17	0.18	0.04
W060	2.4	0.20	0.22	0.05
W070	2.8	0.24	0.26	0.05
W090	3.5	0.20	0.28	0.06
W110	4.4	0.32	0.33	0.08
W145	5.7	0.32	0.37	0.08

MOUNTING WASHER

POLY-MOUNT

Our new **Poly-Mount** is an option and replaces the standard metal washer and rubber pads for transformers with power ratings up to 600VA. The Poly-Mount is shipped as an integral part of the transformer and will reduce the mounting time of the transformer. If required, the Poly-Mount can be removed from the transformer. The Poly-Mount consists of two parts made of UL recognized Polyamide with high temperature rating. A screw through the center hole holds the assembly to the chassis. The Poly-Mount adds slightly to the total height of the transformer.



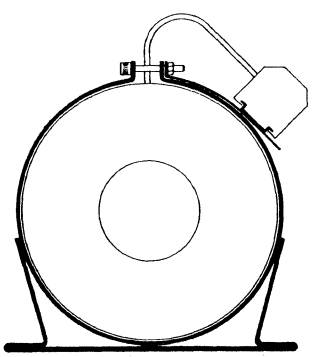
POLY-MOUNT

OMEGA BRACKET

For applications when vertical mounting is preferred, our **Omega** bracket is available with or without UL listed terminal blocks. It provides firm support for the transformer without any significant increase of size and weight. The bracket is made of yellow chromated steel welded onto a stand with slots for screw mounting. A large part of the transformer surface is exposed to the surrounding air, allowing for maximum cooling. The Omega bracket is available for transformers up to 3800 VA.

POTTED CENTER

For large size transformers, 15 lbs or more, or when the washer may cause height problems, we recommend Epoxy potting of the center hole. The top of the potting will be recessed to accommodate the screw head. A flat bottom of the potting is available upon request.



OMEGA BRACKET

See previous page

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TOROIDAL POWER TRANSFORMERS

OFF-THE-SHELF TRANSFORMERS FOR 117V/60 Hz, UL RECOGNIZED

Toroid® SUPERIOR TRANSFORMERS

Part No.	Rated Power (VA)	Size OD × H (inches) Weight	Secondary Data		Typical DC data when transformer supplies bridge rectifier with large filter capacitor				Price FOB Factory Bowie, MD (includes 1 washer and 2 rubber pads)		
					Secondaries in series		Secondaries in parallel				
			Volts/Amps	No-load Voltage (V)	DC Voltage (V)	DC Current (A)	DC Voltage (V)	DC Current (A)	Part No.	1–4	5–24
602.082	26	2.4 × 1.2	2 × 8.5/1.47	2 × 10.7	19.2 or 2 × 9.6	.94	8.6	1.88	602.082	$ 31.00	$26.70
602.122		.7 lbs	2 × 12/1.08	2 × 14.9	28.6 or 2 × 14.3	.68	13.3	1.36	602.122	$ 31.00	$26.70
602.152			2 × 15/0.87	2 × 18.6	36.0 or 2 × 18.0	.55	17.0	1.20	602.152	$ 31.00	$26.70
602.182			2 × 18/0.71	2 × 22.5	44.0 or 2 × 22.0	.45	21.0	.90	602.182	$ 31.00	$26.70
602.242			2 × 24/0.54	2 × 29.8	59.0 or 2 × 29.5	.34	28.5	.68	602.242	$ 31.00	$26.70
604.082	45	2.8 × 1.3	2 × 8.5/2.59	2 × 10.2	19.8 or 2 × 9.9	1.58	8.9	3.16	604.082	$ 32.85	$28.10
604.122		1.1 lbs	2 × 12/1.77	2 × 14.5	29.0 or 2 × 14.5	1.08	13.5	2.16	604.122	$ 32.85	$28.10
604.152			2 × 15/1.40	2 × 18.1	36.6 or 2 × 18.3	.86	17.3	1.72	604.152	$ 32.85	$28.10
604.182			2 × 18/1.24	2 × 21.6	44.0 or 2 × 22.0	.76	21.0	1.52	604.182	$ 32.85	$28.10
604.242			2 × 24/0.88	2 × 29.0	60.0 or 2 × 30.0	.54	29.0	1.08	604.242	$ 32.85	$28.10
607.082	70	3.2 × 1.4	2 × 8.5/3.94	2 × 9.80	20.0 or 2 × 10.0	2.30	9.0	4.60	607.082	$ 34.50	$29.50
607.122		1.5 lbs	2 × 12/2.92	2 × 13.8	29.4 or 2 × 14.7	1.70	13.7	3.40	607.122	$ 34.50	$29.50
607.152			2 × 15/2.30	2 × 17.3	37.0 or 2 × 18.5	1.34	17.5	2.68	607.152	$ 34.50	$29.50
607.182			2 × 18/1.90	2 × 20.8	44.8 or 2 × 22.4	1.10	21.4	2.20	607.182	$ 34.50	$29.50
607.242			2 × 24/1.44	2 × 27.6	60.0 or 2 × 30.0	.84	29.0	1.68	607.242	$ 34.50	$29.50
612.082	120	3.9 × 1.5	2 × 8.5/7.06	2 × 9.50	20.0 or 2 × 10.0	3.90	9.0	7.80	612.082	$ 39.45	$33.70
612.122		2.2 lbs	2 × 12/5.00	2 × 13.3	29.4 or 2 × 14.7	2.70	13.7	5.40	612.122	$ 39.45	$33.70
612.152			2 × 15/4.00	2 × 16.6	37.6 or 2 × 18.8	2.20	17.8	4.40	612.152	$ 39.45	$33.70
612.182			2 × 18/3.33	2 × 20.2	45.2 or 2 × 22.6	1.85	21.6	3.70	612.182	$ 39.45	$33.70
612.242			2 × 24/2.50	2 × 26.7	61.4 or 2 × 30.7	1.37	29.7	2.74	612.242	$ 39.45	$33.70
612.220			220/0.55	247	N/A						
617.122	180	3.9 × 1.9	2 × 12/7.50	2 × 13.0	29.6 or 2 × 14.8	3.90	13.8	7.80	617.122	$ 46.00	$39.35
617.152		3.0 lbs	2 × 15/5.90	2 × 16.4	38.0 or 2 × 19.0	3.10	18.0	6.20	617.152	$ 46.00	$39.35
617.182			2 × 18/5.00	2 × 19.5	45.8 or 2 × 12.9	2.60	21.9	5.20	617.182	$ 46.00	$39.35
617.242			2 × 24/3.58	2 × 26.3	61.8 or 2 × 30.9	1.90	29.9	3.80	617.242	$ 46.00	$39.35
636.242	360	4.5 × 2.3	2 × 24/7.45	2 × 25.4	62.0 or 2 × 31.0	3.63	30.0	7.26	636.242	$ 60.80	$52.00
636.302		5.3 lbs	2 × 30/6.00	2 × 31.7	78.8 or 2 × 39.4	2.90	38.4	5.80	636.302	$ 60.80	$52.00
636.332			2 × 33/5.45	2 × 34.9	87.0 or 2 × 43.5	2.60	42.5	5.20	636.332	$ 60.80	$52.00
636.382			2 × 38/4.74	2 × 40.3	100.0 or 2 × 50.0	2.30	49.0	4.60	636.382	$ 60.80	$52.00
636.502			2 × 50/3.60	2 × 52.9	132.0 or 2 × 66.0	1.75	65.0	3.50	636.502	$ 60.80	$52.00
636.220			220/1.64	233	N/A				636.220	$ 60.80	$52.00
660.242	600	5.5 × 2.4	2 × 24/12.50	2 × 25.2	65.0 or 2 × 32.5	5.85	31.5	11.70	660.242	$ 82.20	$70.25
660.302		8.1 lbs	2 × 30/10.00	2 × 31.5	79.0 or 2 × 39.5	4.70	38.5	9.40	660.302	$ 82.20	$70.25
660.332			2 × 33/8.64	2 × 34.7	87.0 or 2 × 43.5	4.10	42.5	8.20	660.332	$ 82.20	$70.25
660.382			2 × 38/7.76	2 × 39.9	100 or 2 × 50.0	3.65	49.0	7.30	660.382	$ 82.20	$70.25
660.502			2 × 50/6.00	2 × 52.5	133 or 2 × 66.5	2.80	65.5	5.60	660.502	$ 82.20	$70.25
660.220			220/2.59	231	N/A				660.220	$ 82.20	$70.25
699.502	1000	6.3 × 2.4	2 × 50/10.00	2 × 51.8	134 or 2 × 67.0	4.40	66.0	8.80	699.502	$115.00	$98.30
699.652		12.1 lbs	2 × 65/7.69	2 × 67.4	175 or 2 × 87.5	3.40	86.5	6.80	699.652	$115.00	$98.30

OFF-THE-SHELF TRANSFORMERS FOR 2 × 115V, 50–60 Hz, UL RECOGNIZED

Part No.	Rated Power (VA)	Size OD × H (inches) Weight	Secondary Data		Typical DC data when transformer supplies bridge rectifier with large filter capacitor				Price FOB Factory Bowie, MD (includes 1 washer and 2 rubber pads)		
					Secondaries in series		Secondaries in parallel				
			Volts/Amps	No-load Voltage (V)	DC Voltage (V)	DC Current (A)	DC Voltage (V)	DC Current (A)	Part No.	1–4	5–24
703.082	35	2.8 × 1.3	2 × 8.5/2.10	2 × 10.3	19.2 or 2 × 9.6	1.40	18.2	2.80	703.082	$ 36.15	$30.90
703.152		1.1 lbs	2 × 15/1.20	2 × 18.8	36.2 or 2 × 18.1	.75	17.1	1.50	703.152	$ 36.15	$30.90
703.182			2 × 18/1.00	2 × 21.9	43.6 or 2 × 21.8	.65	20.8	1.30	703.182	$ 36.15	$30.90
706.082	57	3.2 × 1.4	2 × 8.5/3.30	2 × 10.1	20.0 or 2 × 10.0	2.00	9.0	4.00	706.082	$ 37.95	$32.45
706.152		1.5 lbs	2 × 15/1.90	2 × 17.6	36.8 or 2 × 18.4	1.15	17.4	2.30	706.152	$ 37.95	$32.45
706.182			2 × 18/1.60	2 × 21.2	44.6 or 2 × 12.3	.95	21.3	1.90	706.182	$ 37.95	$32.45
710.082	100	3.9 × 1.5	2 × 8.5/5.90	2 × 9.6	20.2 or 2 × 10.1	3.50	9.1	7.00	710.082	$ 43.40	$37.00
710.122		2.2 lbs	2 × 12/4.20	2 × 13.7	29.4 or 2 × 14.7	2.40	13.7	4.80	710.122	$ 43.40	$37.00
710.152			2 × 15/3.30	2 × 17.3	37.4 or 2 × 18.7	1.90	17.7	3.80	710.152	$ 43.40	$37.00
710.182			2 × 18/2.80	2 × 40.4	45.0 or 2 × 22.5	1.65	21.5	3.30	710.182	$ 43.40	$37.00
714.152	150	3.9 × 1.9	2 × 15/5.00	2 × 16.6	37.6 or 2 × 18.8	2.75	17.8	5.50	714.152	$ 50.60	$43.30
714.182		3.0 lbs	2 × 18/4.20	2 × 20.0	46.0 or 2 × 23.0	2.20	22.0	4.40	714.182	$ 50.60	$43.30
714.120			115/1.30	126.6	—	—	—	—	714.120	$ 50.60	$43.30

Prices are FOB factory Bowie, MD and include 1 mounting metal washer and 2 rubber pads.

AC and DC voltages are nominal. Tolerance for standard transformers ±3%.
Minimum order value $50.00. Prices apply to total order quantity. Mixing and scheduled shipments over maximum 6 months allowed.
Please call factory for larger volume prices. Prices and data are subject to change without prior notice.

Continued next page

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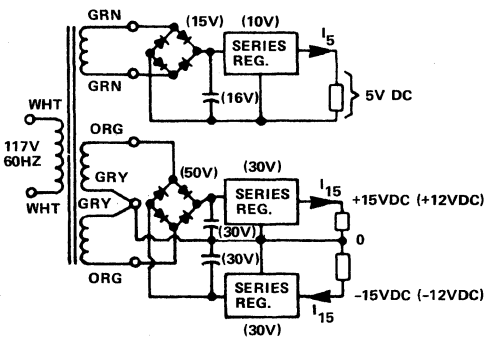
SUPERIOR Toroid® TRANSFORMERS

TOROIDAL POWER TRANSFORMERS

MULTIVOLTAGE RECTIFIER TRANSFORMERS FOR 5V AND ±15V (OR ±12V) REGULATED DC AT 108V–130V LINE, 60 HZ (AVAILABLE FROM STOCK)

Max DC Current		OD × H Weight	Part No.	Price FOB Factory (includes 1 washer and 2 rubber pads)	
I_5	I_{15}			1-4	5-24
1.0A	.25A	2.4" × 1.2" .7 lbs	102.515	$39.00	$33.70
2.0A	.30A	2.8" × 1.3" 1.1 lbs	104.515	$42.00	$36.25
3.0A	.50A	3.2" × 1.4" 1.5 lbs	107.515	$45.00	$40.00
5.0A	.90A	3.9" × 1.5" 2.2 lbs	112.515	$51.00	$45.00

These transformers are designed to work with user-provided components per schematic shown. Note that the rated operating voltage for each component must be larger than the voltage shown in the diagram, and diodes and regulators must be rated to handle the DC current actually used. Capacitor sizes should be at least 7,000 μF per ampere DC used.



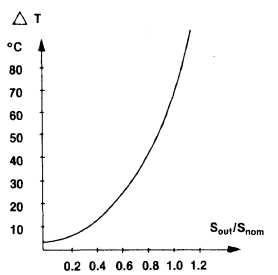
DESIGN DATA AND APPLICATION NOTES

A custom designed transformer is usually based on a standard core with appropriate power rating. Data for TOROID standard cores are shown on page A•2415. Special cores can be manufactured to meet unusual requirements, e.g. extremely low profile designs.

Temperature rise.

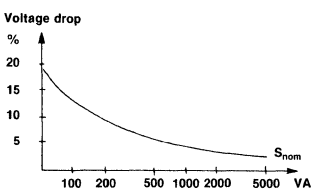
Our transformers are typically designed for a temperature rise of 60°C over ambient at full load. Using a larger core size will reduce the temperature rise due to the small core losses (in comparison with a laminated E/I core). The temperature rise will drop drastically when the output power is reduced. At half the load the temperature rise will only be approximately 25% of the rise at full load.

The figure shows how the temperature rise varies with the actual output power (S out) in relation to nominal power (S nom) for a given core size.



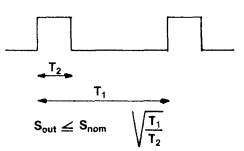
Voltage drop.

Figure 2 shows voltage drop at full load for standard cores at 50/60 Hz. The voltage drop is slightly higher for a 60 Hz transformer. A design with an oversized core will reduce voltage drop and temperature rise.



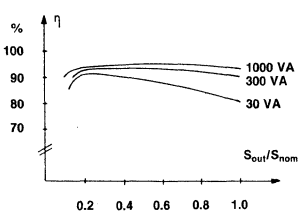
Duty cycle.

A smaller transformer can be designed if the load is not constant and the duty cycle is much shorter than the transformer's thermal time constant (which has the magnitude hours). Note that the voltage drop increases linearly with the instantaneous current.



Efficiency.

Figure 4 shows typical curves for efficiency as a function of output power in relation to nominal output power for different core sizes.



See preceding four pages for more information on our product program.

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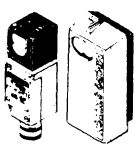
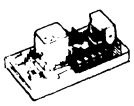
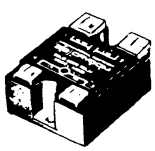
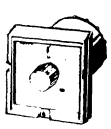

PHOTOELECTRICS

RELAYS


LIQUID LEVEL CONTROLS


SOLID STATE RELAYS

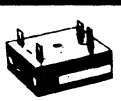
TERMINAL BLOCKS


TEMPERATURE CONTROLS

TIMERS

PADDLE SWITCHES

TRANSFORMERS

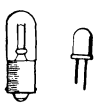

TIMERS

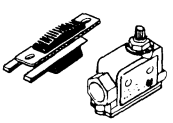
COUNTERS

FANS

CIRCUIT BREAKERS FUSES & FUSEHOLDERS

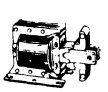
KNOBS


LAMPS & LEDS


SWITCHES

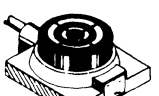
RELAYS

INDICATOR LIGHTS


SOLENOIDS

SOCKETS

PUSHBUTTON SWITCHES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LU SERIES

The LS Series is electrically and mechanically the same as the LT Series except for phase relationships between terminals.

LS, LT, and LU Series transformers have successfully passed the rigid requirements of MIL-T-27, Class S, Grade 5.

Subminiature in size, weighing less than 0.1 ounce, these transformers have tenth inch grid spacing between terminals and are ideally suited for transistor circuit applications which utilize printed circuit board design. All three series have risers on mountng surfaces to facilitate inspection and board cleaning and also to prevent moisture traps.

A wide range of standard designs are available which meet the requirements of most common applications and allow for rapid delivery of prototype quantities. Special designs are also available in all three types.

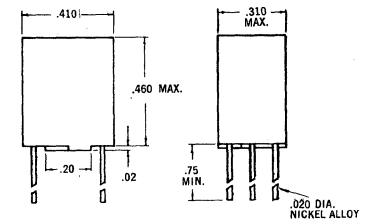
The new LU Series exhibits the same electrical characteristics as the LS and LT Series but has been packaged in a "thin line" configuration to allow for closer board spacing for "card cage" applications or where height dimensions are critical.

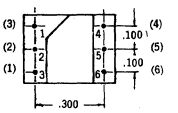
MAGNETIC SHIELDING

LS, LT and LU Series transformers are available with magnetic shields.

To order transformers with shields installed, add 500 to dash numbers shown in the table below. For example: to order an LS-22 with shield, specify LS-522.

LS/LT SERIES

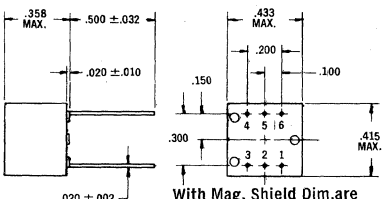




WT. 0.1oz

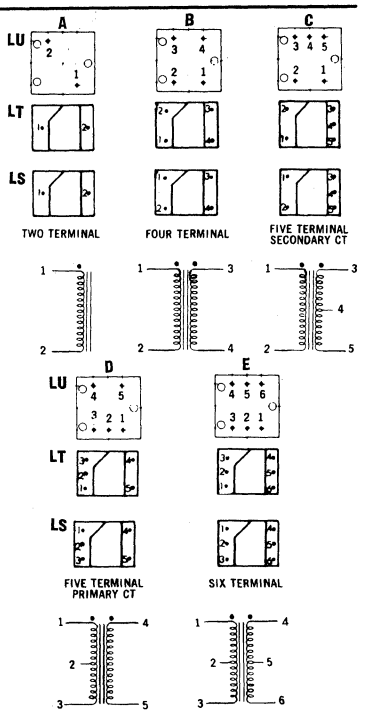
With Mag. Shield Dimensions are .365 Max. x .465 Max. x .531 Max.

LU SERIES



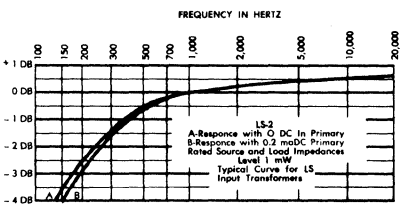
With Mag. Shield Dim.are .448 x Max. x .494 Max. x .400 Max.

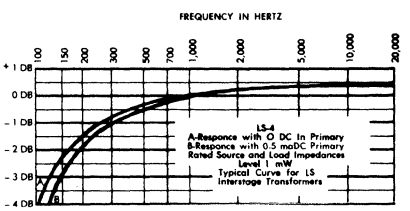
Mech. Tol. = ±.010 unless indicated.

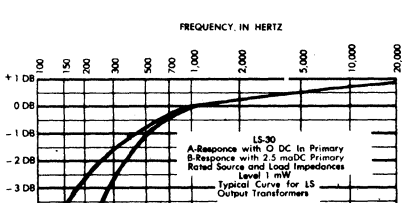


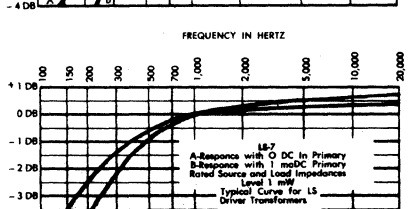
LS, LT or LU No.	Type	MIL-T-27 Designation	Primary Impedance	DCR Pri. Ohms	DC ma Pri.	Secondary Impedance	Max. Power mW	Terminal Layout
2	Input	TF5S21ZZ	50000 CT	3800	0.2	1000CT	25	E
4	Interstage	TF5S21ZZ	20,000/30,000	1700	0.5	800/1200	40	B
5	Interstage	TF5S21ZZ	20,000/30,000CT	1700	0.5	800/1200CT	40	E
6	Interstage	TF5S21ZZ	10,000/12,000CT	1050	1	1500/1800CT	50	E
7	Driver	TF5S21ZZ	10,000/12,000CT	1050	1	1200/1500CT	50	E
8	Driver	TF5S21ZZ	10,000/12,000CT	1050	1	2000/2500CT	50	E
9	Driver	TF5S21ZZ	10,000/12,000CT	1050	1	500/600CT	50	E
10	Output	TF5S21ZZ	500/600	60	3	50/60	50	B
11	Output	TF5S21ZZ	1000/1200	145	3	50/60	50	B
12	Output	TF5S21ZZ	600	70	3	3.2	50	B
13	Output	TF5S21ZZ	1200	120	2	3.2	50	B
14	Output	TF5S21ZZ	10,000	1160	1	3.2	50	B
15	Output	TF5S21ZZ	150/200CT	18	10	12/16	50	D
16	Output	TF5S21ZZ	300/400CT	38	7	12/16	50	D
17	Output	TF5S21ZZ	600/800CT	75	4.5	12/16	50	D
18	Output	TF5S21ZZ	1000/1330CT	120	3.5	12/16	50	D
19	Output	TF5S21ZZ	1500/2000CT	180	3	12/16	50	D
20	Output	TF5S21ZZ	7500/10,000CT	820	1	12/16	50	D
21	Output	TF5S21ZZ	300CT	37	7	600	50	D
22	Output	TF5S21ZZ	500CT	60	3	600	50	D
23	Output	TF5S21ZZ	900CT	100	4	600	50	D
24	Output	TF5S21ZZ	1500CT	170	3	600	50	D
25	Output	TF5S21ZZ	120/150CT	15	10	3.2/4	50	D
26	Output	TF5S21ZZ	320/400CT	40	6	3.2/4	50	D
27	Output	TF5S21ZZ	600/750CT	70	4.5	3.2/4	50	D
28	Output	TF5S21ZZ	800/1000CT	100	4	3.2/4	50	D
29	Output	TF5S21ZZ	1200/1500CT	125	3	3.2/4	50	D
30	Output	TF5S21ZZ	1600/2000CT	190	2.5	3.2/4	50	D
31	Output	TF5S21ZZ	8000/10,000CT	820	1	3.2/4	50	D
32	Output	TF5S21ZZ	10,000CT	1000	1	10,000CT	50	E
33	Driver	TF5S21ZZ	10,000/12,000	1050	1	500/600CT	50	C
34	Driver	TF5S21ZZ	20000	1700	0.3	1000	50	B
35	Output	TF5S21ZZ	1000	135	3	50	50	B
36	Output	TF5S21ZZ	400CT	40	3	11	50	D
37	Driver	TF5S21ZZ	10,000/12,000	1050	1	2000/2500CT	50	C
38	Output	TF5S21ZZ	600CT	72	3	600CT	50	E
39	Output	TF5S21ZZ	10,000	1000	1	10,000 split	50	*
40	Output	TF5S21ZZ	600	72	3	600 split	50	*
41	Input	TF5S21ZZ	25,000CT	4300	0.6	1000CT	30	E
42	Isolation	TF5S21ZZ	600CT	90	4	600CT	30	E
101	Choke	TF5S20ZZ	6 H @ 2 ma DC	1700				A
102	Choke	TF5S20ZZ	1.25 H @ 2 ma DC	180				A
103	Choke	TF5S20ZZ	3.5 M @ 2 ma DC	1100				A
104	Choke	TF5S20ZZ	.3 H @ 4 ma DC	42				A

* Primary terminals 1-2, secondary 3-4 & 5-6.









The above are typical response curves up to 20 kHz however many items in this series have useful frequency ranges up to 100 kHz and beyond.

TOROTEL PRODUCTS INC.

TRANSFORMERS

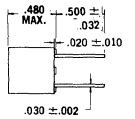
13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 FAX 816-763-2278

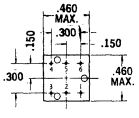
SUBMINIATURE AUDIO TRANSFORMERS

Torotel LA and LB series transformers are manufacturered to MIL-T-27, Grade 5, Class S specification. These series have 0.1 grid spaced terminals for printed circuit application. Both types have risers on mounting surfaces to prevent the formation of moisture traps and to facilitate cleaning of board assemblies.

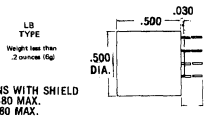
The LA Series is electrically the same as the LB Series, but is packaged in a .460 inch cube with smaller outline dimensions for application where this configuration is more suitable.

Leads are made of 20 AWG tinned copper. Units utilizing Dumet wire are available on special request.

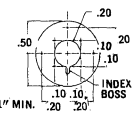




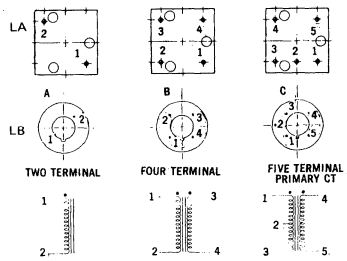
LA TYPE
Weight less than .2 ounces (6g)

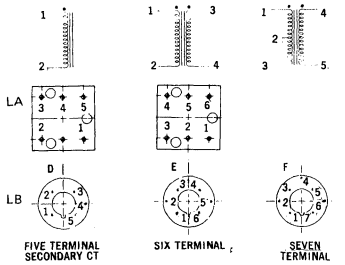


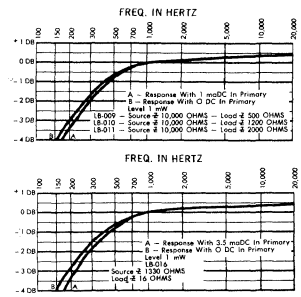
†LB DIMENSIONS WITH SHIELD
O.D. .580 MAX.
HT. .580 MAX.

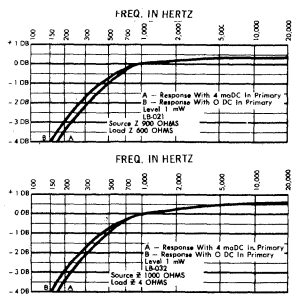


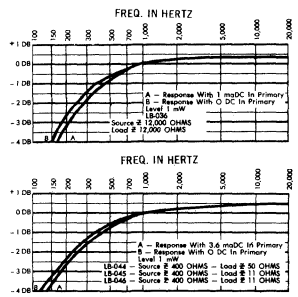
MOUNTING TEMPLATE AND LB PIN LAYOUT











LA or LB No.	MIL Type	Application	Pri. Imp.	DC ma in Pri.	Sec. Imp.	Nom. Pri. DCR	mW Level @ 1 KHz	Term. Layout
001	TF5S21ZZ	Interstage	20,000 30,000	.5 .5	800 1200	850	50	B
002	TF5S21ZZ	Output	500 600	3 3	50 60	60	100	B
003	TF5S21ZZ	Output	1000 1200	3 3	50 60	115	100	B
004	TF5S21ZZ	Output	600	3	3.2	60	100	B
005	TF5S21ZZ	Output	1200	2	3.2	115	100	B
006	TF5S21ZZ	Output	10,000	1	3.2	790	100	B
007	TF5S21ZZ	Input Other Application	200,000 500	0 0	1000 100,000	8500	25	B
008	TF5S20ZZ	Reactor 3.5 H @ 2 maDC, 1 H @ 5 maDC				630		A
009	TF5S21ZZ	Output or Driver	10,000 12,000	1 1	500CT 600CT	800	100	D
010	TF5S21ZZ	Driver	10,000 12,000	1 1	1200CT 1500CT	800	100	D
011	TF5S21ZZ	Driver	10,000 12,000	1 1	2000CT 2500CT	800	100	D
012	TF5S21ZZ	Single or PP Output	150CT 200CT	10 10	12 16	11	500	C
013	TF5S21ZZ	Single or PP Output	300CT 400CT	7 7	12 16	20	500	C
014	TF5S21ZZ	Single or PP Output	600CT 800CT	5 5	12 16	43	500	C
015	TF5S21ZZ	Single or PP Output	800CT 1070CT	4 4	12 16	51	500	C
016	TF5S21ZZ	Single or PP Output	1000CT 1330CT	3.5 3.5	12 16	71	500	C
017	TF5S21ZZ	Single or PP Output	1500CT 2000CT	3 3	12 16	108	500	C
018	TF5S21ZZ	Single or PP Output	7500CT 10,000CT	1 1	12 16	505	500	C
019	TF5S21ZZ	Output to Line	300CT	7	600	19	500	C
020	TF5S21ZZ	Output or Line to Line or Mixing	500CT	5.5	600	31	500	C
021	TF5S21ZZ	Output to Line	900CT	4	600	53	500	C
022	TF5S21ZZ	Output to Line	1500CT	3	600	86	500	C
023	TF5S21ZZ	Interstage	20,000CT 30,000CT	0.5 0.5	800CT 1200CT	850	100	E
024	TF5S21ZZ	Input Other Application	200,000CT 500CT	0 0	1000CT 100,000CT	8500	25	E
025	TF5S21ZZ	Interstage	10,000CT 12,000CT	1 1	1500CT 1800CT	800	100	E
026	TF5S20ZZ	Reactor 6 H @ 2 maDC, 1.5 H @ 5 maDC				2100		A
027	TF5S20ZZ	Reactor 1.2 H @ 2 maDC, 0.5 H @ 1 maDC				100		A
028	TF5S20ZZ	Reactor 0.3 H @ 4 maDC, 0.15 H @ 20 maDC				31		A
029	TF5S21ZZ	Single or PP Output	120CT 150CT	10 10	3.2 4	10	500	C
030	TF5S21ZZ	Single or PP Output	320CT 400CT	7 7	3.2 4	20	500	C

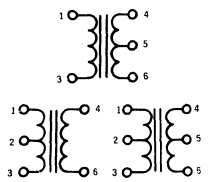
* These LA types have no primary center tap

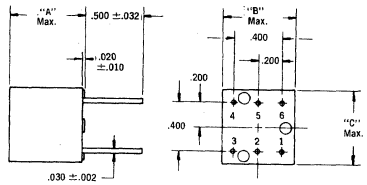
LA or LB No.	MIL Type	Application	Pri. Imp.	DC ma in Pri.	Sec. Imp.	Nom. Pri. DCR	mW Level @ 1 KHz	Term. Layout
031	TF5S21ZZ	Single or PP Output	640CT 800CT	5 5	3.2 4	43	500	C
032	TF5S21ZZ	Single or PP Output	800CT 1000CT	4 4	3.2 4	51	500	C
033	TF5S21ZZ	Single or PP Output	1060CT 1330CT	3.5 3.5	3.2 4	71	500	C
034	TF5S21ZZ	Single or PP Output	1600CT 2000CT	3 3	3.2 4	109	500	C
035	TF5S21ZZ	Single or PP Output	8000CT 10,000CT	1 1	3.2 4	505	100	C
036	TF5S21ZZ	Isolation or Interstage	10,000CT 12,000CT	1 1	10,000CT 12,000CT	950	100	E
037	TF5S21ZZ	Driver	10,000CT 12,000CT	1 1	1200CT 1500CT	800	100	E
038	TF5S21ZZ	Driver	10,000CT 12,000CT	1 1	2000CT 2500CT	800	100	E
039	TF5S21ZZ	Driver	10,000CT 12,000CT	1 1	500CT 600CT	800	100	E
040	TF5S21ZZ	Input	100,000	0	1000	1700	70	B
041	TF5S21ZZ	Driver	20,000	0.5	1000	1000	100	B
042	TF5S21ZZ	Driver	20,000	0.5	1200CT	1000	100	D
043	TF5S21ZZ	Output	1000	3	50	60	100	B
044	TF5S21ZZ	Output	400	3	50	30	100	B
045	TF5S21ZZ	Output	400	3	11	30	100	B
046	TF5S21ZZ	Single or PP Output	400CT	3	11	30	500	C
047	TF5S20ZZ	Reactor 10 H @ 0 maDC, 8 H @ 5 maDC				650		A
*048	TF5S21ZZ	Isolation or Interstage Ratio 1:1:1	2000CT 2500CT	3 3	8000 split 10,000 split	195	100	F
*049	TF5S21ZZ	Interstage	10,000CT 12,000CT	1 1	2000 split 2400 split	560	100	F
*050	TF5S21ZZ	Interstage	20,000CT 30,000CT	0.5 0.5	1000 split 1500 split	800	100	F
*051	TF5S21ZZ	Interstage	40,000CT 50,000CT	0.25 0.25	400 split 500 split	1700	50	F
*052	TF5S21ZZ	Interstage or Output	400CT 500CT	8 6	400 split 500 split	46	500	F
*053	TF5S21ZZ	Interstage	400CT 500CT	8 6	120 split 150 split	46	500	F
*054	TF5S21ZZ	Interstage	400CT 500CT	8 6	40 split 50 split	46	500	F
*055	TF5S21ZZ	Interstage	80CT 100CT	12 10	32 split 40 split	9.8	500	F
056	TF5S21ZZ	Input	50,000CT	0.3	1000CT	1900	50	E
057	TF5S21ZZ	Output	600CT 750CT	4.5	3.2 4	40	500	C
058	TF5S21ZZ	Output	1200CT 1500CT	3	3.2 4	100	500	C
059	TF5S21ZZ	Input	100,000CT	0	1000CT	3300	50	E
060	TF5S21ZZ	Driver	10,000CT	1	600CT	1100	100	E
061	TF5S21ZZ	Driver	4000CT	1.5	10,000CT	440	100	E
062	TF5S21ZZ	Output	1000CT	3	600CT	110	100	E
063	TF5S21ZZ	Output	600CT	4	25,000CT	65	100	E
064	TF5S21ZZ	Output	600CT	4	600CT	67	100	E
065	TF5S21ZZ	Output	600CT	4	60CT	65	100	E
066	TF5S21ZZ	Output	600CT	4	4	65	100	C
† 500		Magnetic Shielding Case						

† The LB-Mag. Shield may be supplied for all LB Types.
Add 500 to dash no. (I.E. LB-001 with Shield, order LB-501)

AUDIO TRANSFORMERS

LL & LR SERIES





Series	A	B	C
LL	.600	.590	.590
LR	.925	.800	.710

These tiny, versatile "LL" transformers are provided with .020 risers and 0.1 grid spacing for printed circuit board applications and are manufactured to MIL-T-27, Grade 5, Class S specifications.

Response: ±1 db 200 to 50,000 Hz

Distortion: 10% max. at rated power, 200 to 50,000 Hz

Weight: 0.4 oz.

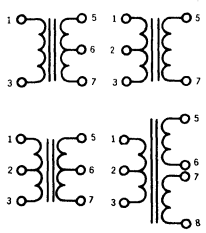
These miniaturized "LR" transformers are manufactured to MIL-T-27, Grade 5, Class S specifications and are ideally suited for a wide range of printed circuit applications.

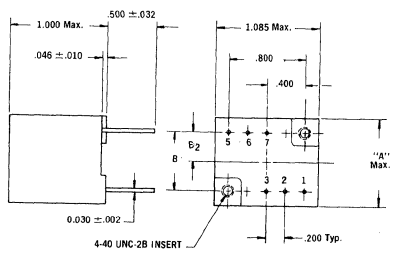
Response: ±1 db 200 to 20,000 Hz

Distortion: 10% max. at rated power, 200 to 20,000 Hz

Weight: 1.0 oz.

LW & LY SERIES





Series	A	B	B_2
LW	.900	.600	.300
LY	1.125	.800	.400

"LW" Series transformers are manufactured to MIL-T-27, Grade 5, Class S specifications. Riser areas and 0.1 grid spacing make these units ideal for printed circuit board applications.

Response: ±1 db 100 to 10,000 Hz

Distortion: 1.5% max. at 60 mW, 200 to 10,000 Hz

Weight: 2.0 oz.

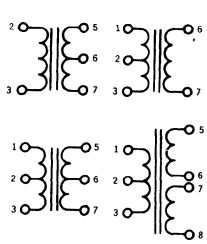
"LY" Series transformers are highly compact, efficient units with power output ratings to 7.5 watts. These transformers are manufactured to MIL-T-27, Grade 5, Class S specifications.

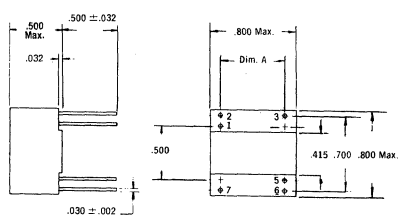
Response: ±1 db 60 to 10,000 Hz

Distortion: 1% max. at 250 mW, 200 to 10,000 Hz — 10% max. at rated power, 200 to 10,000 Hz

Weight: 2.5 oz.

LH & LK SERIES





Series	A
LK	.700
LH	.600

"LH & LK" Series transformers are the ultimate in compactness. Designed to meet MIL-T-27, Grade 5, Class S.

Response: ±1 db 200 to 10,000 Hz

Distortion: 10% max. at rated power, 200 to 10,000 Hz

Weight: .75 oz.

LL Series

No.	MIL-T-27 Designation	Application	Impedance Ohms Pri.	Impedance Ohms Sec.	DC Resistance Ohms Pri.	DC Resistance Ohms Sec.	Max. Pri. DC (ma)	Max. 200 Hz Power† (mW)
001	TF5S21ZZ	Input	100,000CT	1000CT	6000	60	0	150
002	TF5S21ZZ	Interstage	25,000CT	1000CT	2800	120	0	150
003	TF5S21ZZ	Interstage	10,000CT	10,000CT	1100	1200	1	150
004	TF5S21ZZ	Driver	10,000CT	1500CT	1100	200	1	150
005	TF5S21ZZ	Output to Line	10,000CT	600CT	1100	75	1	150
006	TF5S21ZZ	Interstage	4000CT	10,000CT	440	1200	1.5	150
007	TF5S21ZZ	Output to Line	1000CT	600CT	100	60	3	150
008	TF5S21ZZ	Output	1000CT	4	100	0.4	3	150
009	TF5S21ZZ	Input	600CT	25,000CT	65	3500	4	150
010	TF5S21ZZ	Isolation	600CT	600CT	65	75	4	150
011	TF5S21ZZ	Output	600CT	60	65	7	4	150
012	TF5S21ZZ	Output	600CT	4	65	0.5	4	150
013	TF5S21ZZ	Driver	10,000CT	2000CT	1100	240	1	150
014	TF5S21ZZ	Driver	10,000CT	500CT	1100	65	1	150
015	TF5S21ZZ	Line to Line	500CT	600CT	55	75	4.5	150
016	TF5S21ZZ	Output to Line	300CT	600CT	33	75	5.5	150

LR Series

No.	MIL-T-27 Designation	Application	Impedance Ohms Pri.	Impedance Ohms Sec.	DC Resistance Ohms Pri.	DC Resistance Ohms Sec.	Max. Pri. DC (ma)	Max. 200 Hz Power† (mW)
001	TF5S21ZZ	Interstage	25,000CT	1000CT	2600	110	0.5	750
002	TF5S21ZZ	Interstage	10,000CT	10,000CT	1000	1100	1	750
003	TF5S21ZZ	Driver	10,000CT	1500CT	1000	165	1	750
004	TF5S21ZZ	Output to Line	10,000CT	600CT	1000	70	1	750
005	TF5S21ZZ	Output	10,000CT	4	1000	0.5	1	750
006	TF5S21ZZ	Interstage	4000CT	10,000CT	400	1100	1.5	750
007	TF5S21ZZ	Output	1500CT	15	150	2	2.5	750
008	TF5S21ZZ	Output to Line	1000CT	600CT	100	70	3	750
009	TF5S21ZZ	Output	1000CT	4	100	0.5	3	750
010	TF5S21ZZ	Input	600CT	25,000CT	60	2900	4	750
011	TF5S21ZZ	Isolation	600CT	600CT	60	70	4	750
012	TF5S21ZZ	Output	600CT	60	60	6.5	4	750
013	TF5S21ZZ	Output	600CT	15	60	2	4	750
014	TF5S21ZZ	Output	600CT	4	60	0.5	4	750
015	TF5S21ZZ	Output to Line	250	600CT	25	70	7	750
016	TF5S21ZZ	Driver	10,000CT	2000CT	1000	110	1	750
017	TF5S21ZZ	Driver	10,000CT	500CT	1000	110	1	750
018	TF5S21ZZ	Line to Line	500CT	600CT	50	70	4.5	750
019	TF5S21ZZ	Output to Line	300CT	600CT	30	70	5.5	750

LW Series

No.	MIL-T-27 Designation	Application	Impedance Ohms Pri.	Impedance Ohms Sec.	DC Resistance Ohms Pri.	DC Resistance Ohms Sec.	Max. Pri. DC (ma)	Max. 200 Hz Power† (watts)
001	TF5S21ZZ	Interstage	10,000CT	10,000CT	800	1050	1	3.5
002	TF5S21ZZ	Output to Line	10,000CT	600CT	800	60	1	3.5
003	TF5S21ZZ	Output	10,000CT	4	800	0.5	1	3.5
004	TF5S21ZZ	Output	1500CT	15	110	1.5	2.5	3.5
005	TF5S21ZZ	Output to Line	1000CT	600CT	75	60	3	3.5
006	TF5S21ZZ	Output	1000CT	4	75	0.5	3	3.5
007	TF5S21ZZ	Input	600CT	25,000CT	45	2700	4	2.5
008	TF5S21ZZ	Isolation	600CT	600CT	45	60	4	3.5
009	TF5S21ZZ	Output	600CT	60	45	6.5	4	3.5
010	TF5S21ZZ	Output	600CT	15	45	1.5	4	3.5
011	TF5S21ZZ	Output	600CT	4	45	0.5	4	3.5
012	TF5S21ZZ	Output to Line	250	600CT	20	60	7	3.5
013	TF5S21ZZ	Interstage	25,000CT	1000CT	2500	85	0.5	2.5
014	TF5S21ZZ	Driver	10,000CT	2000CT	800	170	1	3.5
015	TF5S21ZZ	Driver	10,000CT	500CT	800	50	1	3.5
016	TF5S21ZZ	Line to Line	500CT	600CT	50	60	4.5	3.5
017	TF5S21ZZ	Output to Line	300CT	600CT	30	60	5.5	3.5
018	TF5S21ZZ	Interstage	2500CT	10K split	200	900	1.5	3.5

LY Series

No.	MIL-T-27 Designation	Application	Impedance Ohms Pri.	Impedance Ohms Sec.	DC Resistance Ohms Pri.	DC Resistance Ohms Sec.	Max. Pri. DC (ma)	Max. 200 Hz Power† (mW)
001	TF5S21ZZ	Interstage	10,000CT	10,000CT	700	900	1	6
002	TF5S21ZZ	Output to Line	10,000CT	600CT	700	55	1	6
003	TF5S21ZZ	Output	10,000CT	4	700	0.4	1	6
004	TF5S21ZZ	Output	1500CT	15	100	1.5	2.5	7.5
005	TF5S21ZZ	Output to Line	1000CT	600CT	65	55	3	7.5
006	TF5S21ZZ	Output	1000CT	4	65	0.4	3	7.5
007	TF5S21ZZ	Isolation	600CT	600CT	40	55	4	7.5
008	TF5S21ZZ	Output	600CT	60	40	6	4	7.5
009	TF5S21ZZ	Output	600CT	15	40	1.5	4	7.5
010	TF5S21ZZ	Output	600CT	4	40	0.4	4	7.5
011	TF5S21ZZ	Output to Line	250	600CT	16	55	7	7.5
012	TF5S21ZZ	Driver	10,000CT	2000CT	700	150	1	6
013	TF5S21ZZ	Driver	10,000CT	500CT	700	45	1	6
014	TF5S21ZZ	Line to Line	500CT	600CT	45	55	4.5	7.5
015	TF5S21ZZ	Output to Line	300CT	600CT	27	55	5.5	7.5
016	TF5S21ZZ	Interstage	2500CT	10K split	170	800	1.5	7.5

LH & LK No.	Application	Impedance Ohms Pri.	Impedance Ohms Sec.	DC Resistance Ohms Pri.	DC Resistance Ohms Sec.	Max. Pri. DC (ma)	Max. 200 Hz Power† (mW)
001	Interstage	25,000CT	1000CT	1325	53	0.5	300
002	Interstage	10,000CT	10,000CT	510	525	1	325
003	Driver	10,000CT	1500CT	510	80	1	325
004	Output to Line	10,000CT	600CT	510	31	1	325
005	Output	10,000CT	4	510	0.3	1	325
006	Interstage	4000CT	10,000CT	200	525	1.5	325
007	Output	1500CT	15	75	1	2.5	325
008	Output to Line	1000CT	600CT	50	31	3	325
009	Output	1000CT	4	50	0.3	3	325
010	Input	600CT	25,000CT	30	1500	4	300
011	Isolation	600CT	600CT	30	31	4	325
012	Output	600CT	60	30	3	4	325
013	Output	600CT	15	30	1	4	325
014	Output	600CT	4	30	0.3	4	325
015	Output to Line	250	600CT	13	31	7	325
016	Driver	10,000CT	2000CT	510	106	1	325
017	Driver	10,000CT	500CT	510	26	1	325
018	Line to Line	500CT	600CT	25	31	4.5	325
019	Output to Line	300CT	600CT	15	31	5.5	325
020	Isolation-Ratio 1:1:1	2000CT	8K split	100	425	2	300
021	Isolation	10,000CT	2K split	510	106	1	300

† These power ratings are based upon lowest frequency operation. Much higher ratings are possible at higher operating frequencies.

TOROTEL PRODUCTS INC.
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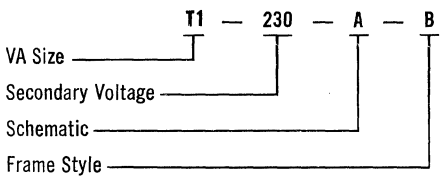
TRANSFORMERS

PC MOUNT POWER TRANSFORMERS

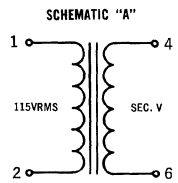
Torotel standard PC mount transformers are designed for 115 Vrms 60 Hz input and are generally usable to above 400 Hz. Voltages listed in table are standard values but transformers can be furnished with other voltage and current ratings. Transformers are available with Channel Frame mounting, either tab style, (Type C) twist prong (Type B) or without Frame (Style A).

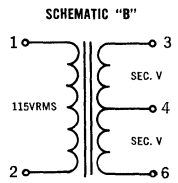
Also custom designed power transformers and audio transformers are available in these and other types and sizes upon special request.

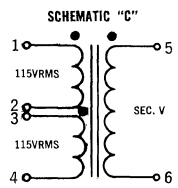
PART NUMBER EXAMPLE

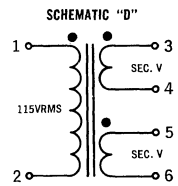


Prefix	VA Size
T1	.50
T2	1.50
T3	4.50
T4	7.50

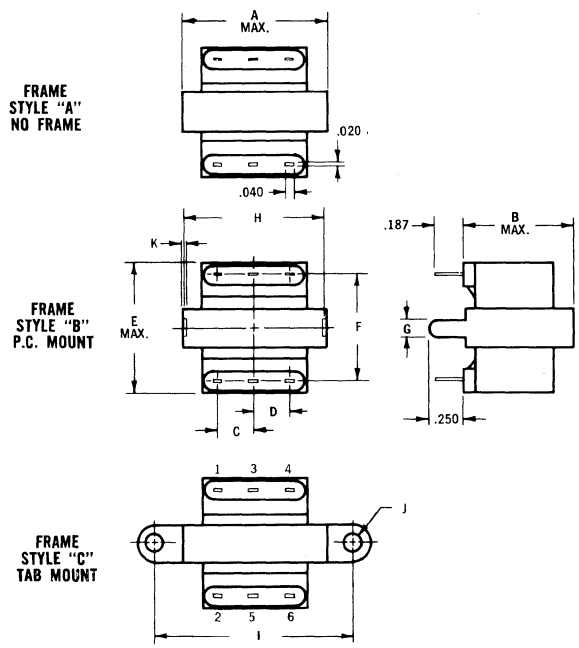








Standard Secondary Voltages Available With 115V Primary	
4	30
5	34
6.3	40
7.5	44
8	54
10	56
12	60
12.6	76
15	88
16	90
17	115
20	120
24	180
27	230
28	



DIMENSION TABLE

Size	A	B	C	D	E	F	G	H	I	J	K
T1	1.125	.870	.250	.250	.930	.720	.125	1.040	1.375	.125	.018
T2	1.500	1.250	.310	.310	1.156	1.000	.125	1.420	1.750	.187	.032
T3	1.750	1.450	.400	.400	1.275	1.100	.125	1.680	2.000	.187	.032
T4	1.970	1.690	.400	.400	1.468	1.300	.187	1.940	2.375	.187	.032

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TRANSFORMERS

400 Hz MINIATURE POWER TRANSFORMERS

Reference for all Industrial and Military Standard 400 Hz Miniature Power Transformers

These 400 Hz Miniature Power Transformers are selected for use in all Military and Industrial applications requiring high performance in the smallest possible package size. They conform to all of the requirements of MIL-T-27, Class S (−55°C to +130°C). The minimum continuous operating life expectancy is 10,000 hours. This series is available having power ratings of 0.5 VA through 25 VA. The primaries are 115 Vrms with secondary voltages ranging from 5 Vrms through 300 Vrms.

SEE MIL-T27/XX QPL LISTING FOR QUALIFIED PARTS

It is recommended that these transformers be specified for all applications where space, weight, and cost effectiveness are prime considerations.

PART NUMBER EXAMPLE

0.5 S T 26

0.5 — V.A. Rating (See Table I)
S — Package Style
T — Schematic (See Table I)
26 — Secondary Voltage (See Table II)

TABLE I

VA Rating	Package Style	Schematic	Size	Max. Height (Inches)	Regulation (%)		Available Secondary Voltages (VRMS)		Exciting Current (ma)	Efficiency (%)		Temperature Rise (°C) — MIL-T-27 No Heat Sink		Weight (Oz.)	
					Nom.	Max.	Min.	Max.	Max.	Min.	Nom.	Nom.	Max.	Nom.	Max.
0.5	S	T, X	—	—	15	18	5	300	1.5	65	70	10	15	0.38	0.4
0.5	S	S, Y	—	—	17	21	5	300	1.5	65	70	12	17	0.38	0.4
1.5	E, P	T, X	A	0.47	20	23	5	300	1.5	70	76	13	17	0.76	0.85
1.5	E, P	S, Y	A	0.59	15	18	5	300	3	70	76	13	17	0.97	1.1
2	E, P	T, X	A	0.78	3	3.7	5	300	6	72	87	10	15	1.5	1.65
2.4	E, P	S, Y	A	1.03	3	3.8	5	300	9	73	88	11	16	1.9	2.2
3	E, P	T, X	A	0.59	15	18	5	300	3	75	84	15	20	0.97	1.1
3	E, P	S, Y	A	0.78	10	12	5	300	6	75	84	15	20	1.5	1.65
3.6	E, P	T, X	A	1.03	3	3.8	5	300	9	76	87	10	15	1.9	2.2
6	E, P	T, X	A	0.78	10	12	5	300	6	81	88	18	25	1.5	1.65
6	E, P	S, Y	A	1.03	8	10	5	300	9	80	88	18	25	1.9	2.2
7.3	E, P	S, T, X, Y	B	0.97	3	3.5	5	300	16	84	92	15	23	3.2	3.4
9	E, P	T, X	A	1.03	8	10	5	300	9	83	89	23	30	1.9	2.2
13	E, P	S, T, X, Y	B	1.20	3	3.6	5	300	25	87	93	21	28	4.2	4.4
16	E, P	S, T, X, Y	B	0.97	7	8	5	300	16	87	92	25	32	3.2	3.4
25	E, P	S, T, X, Y	B	1.20	6	7	5	300	25	88	93	36	45	4.2	4.4

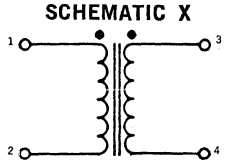
TABLE II INDUSTRY STANDARD SECONDARY VOLTAGES

Secondary Voltage	5	5.5	6	6.3	7	7.5	8	9	10	11	12	12.6	13	15	16	18	20	22	24	26	28	30	33
Maximum Working Voltage	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325

Secondary Voltage	36	39	43	47	51	56	62	68	75	82	91	100	110	115	120	130	150	180	200	220	240	270	300
Maximum Working Voltage	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	440	440	440	580	580

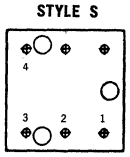
SCHEMATIC AND TERMINAL CONFIGURATIONS

SCHEMATIC X



TERMINAL LAYOUTS

STYLE S



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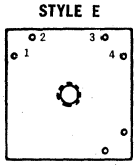

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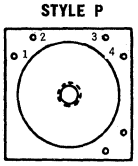

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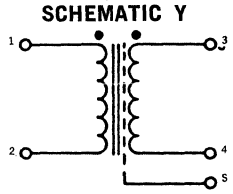

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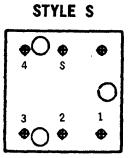

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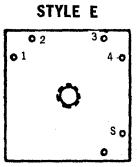

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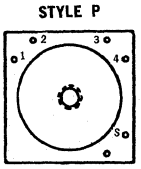

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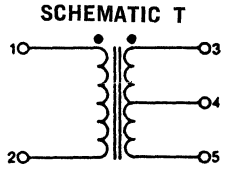

TERMINAL LAYOUTS

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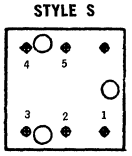

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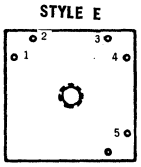

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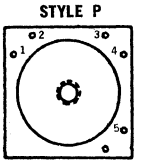

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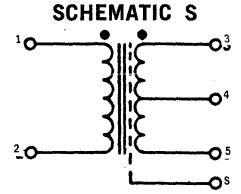

TERMINAL LAYOUTS

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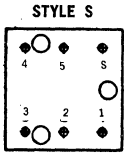

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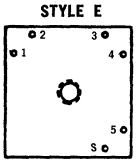

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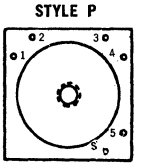

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TRANSFORMERS

400 Hz MINIATURE POWER TRANSFORMERS

Reference for all Industrial and Military Standard 400 Hz Miniature Power Transformers

PHYSICAL SPECIFICATIONS

Size: Sizes for Standard VA Types are given in Table I, and Outline Drawings.

Construction: MIL-T-27, Grade 5; Black Epoxy Encapsulated.

Terminals: Printed circuit pins — tinned brass.

Terminal Strength (Method 211 of MIL-STD-202, Test Condition A): 2.0 pounds.

Marking: Includes MIL-T-27 Type Designation, winding ratings, maximum working voltage, schematc, Torotel name, and part number.

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature Range: −55°C to +130°C (ambient plus temperature rise).

Altitude: 70,000 feet, maximum.

Vibration: MIL-STD-202, Method 204, Test Condition D.

Life Expectancy: 10,000 hours minimum.

Other Environmental Specifications: In accordance with MIL-T-27, Grade 5 Class S, Family 03.

ELECTRICAL SPECIFICATIONS

Primary Voltage: 115 volts rms ±10%.

Frequency: 400 Hz ±5%.

Secondary Voltage: See Table II.

Secondary Voltage Tolerance: ±3% at full load and 115 volts, 400 Hz applied to primary.

Electrostatic Shielding (Schematics S and Y): 5 to 1 minimum voltage ratio at 20 KHz.

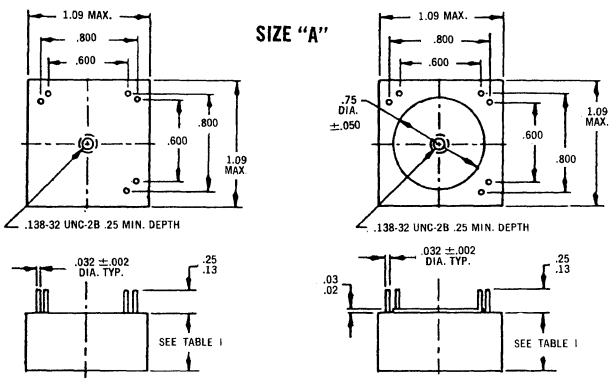
Phase Shift: 1.0 electrical degree between primary and secondary voltage at rated load, maximum.

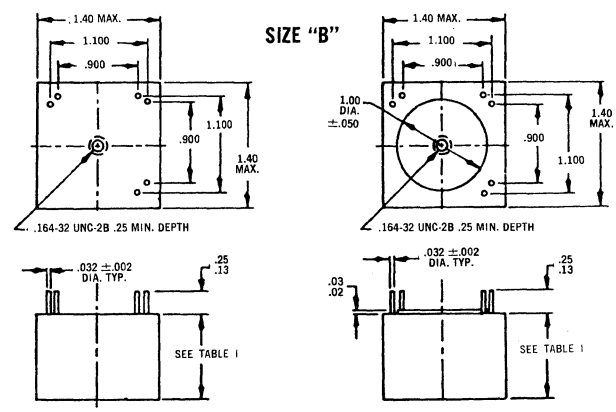
Insulation Resistance: 10,000 megohms minimum at 500 VDC.

Dielectric Strength: At sea level—2.8 times the maximum working voltage. At reduced barometric pressure—1.25 times the maximum working voltage.

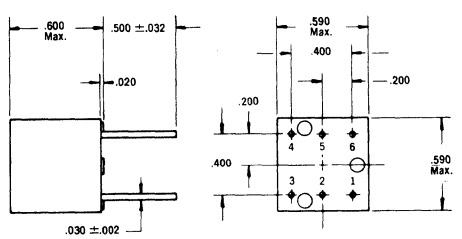
Mech. Tol. = ±.005 unless indicated.

PACKAGE STYLE E **PACKAGE STYLE P**





PACKAGE STYLE S



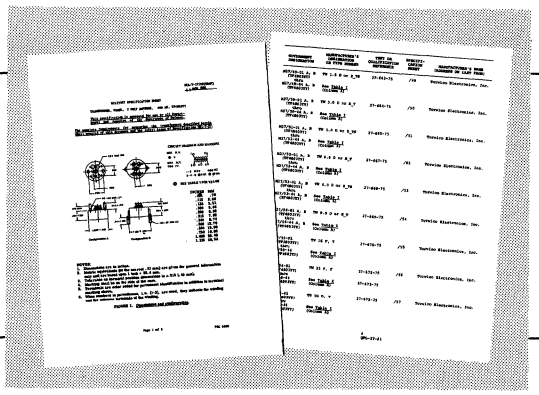
MECH. TOL. FOR STYLE "S" = ±.010 UNLESS INDICATED.

SEE MIL-T27/XX QPL LISTING FOR QUALIFIED PARTS

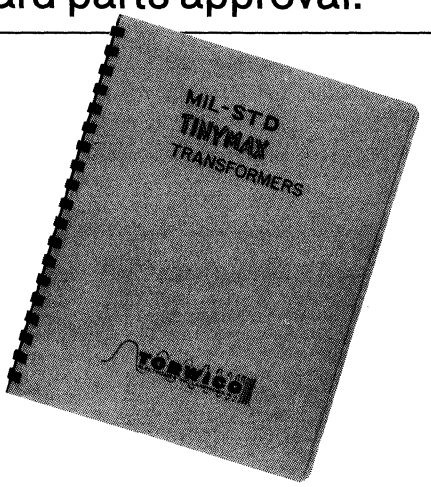
CALL TOROTEL PRODUCTS FOR COMPETIVELY PRICED MAGNETICS REQUIREMENTS

TORWICO ELECTRONICS INC. LEADER IN MAGNETIC COMPONENTS

TINYMAX® Transformers have QPL Status on Qualified Product List 27.



Now you can specify Military Standard Transformers without the need for Qualification Testing or requests for non-standard parts approval.



These miniature transformers are of toroidal construction and offer a size and weight reduction when compared to conventional laminated and "C" core designs. Yet, the prices on these custom engineered transformers are competitive with off-the-shelf stock items.

So, when you need a 115V, 400 Hz transformer have a specific secondary voltage don't settle for an off-the-shelf item that may only approximate your requirement. Torwico has over 2,000 MIL / STD units and an almost infinite selection of STD TINYMAX.

What's more, Torwico offers fast delivery and competitive pricing. Selection, delivery and Price--Torwico has it all.

STD TINYMAX -- MIL-T-27, Grade 4 and Grade 5, Class S, 115 volt, 400 Hz transformers available in power ratings ranging from 1.5 VA through 250 VA, with an almost infinite combination of secondary voltages of 6V through 300V.

MIL-STD TINYMAX -- Grade 4 and Grade 5, Class S, 115 Volt, 400 Hz transformers. Reference M27/37 through M27/66. Over 2,000 choices of secondary voltages.

EXTENSION OF APPROVAL -- Any Design selected directly from, or based, on our MIL / STD TINYMAX transformer may be qualified to MIL-T-27 by similarity.

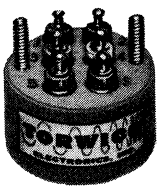
PROCUREMENT NOTE -- Catalog information and cross referenced sheets may be obtained from the factory or for MIL / STD units, refer directly to specification sheets M27/37 through M27/66.

PROTOTYPE DELIVERIES -- A large assortment of TINYMAX transformers is always maintained in stock for immediate delivery. Others can be shipped within 10 days.

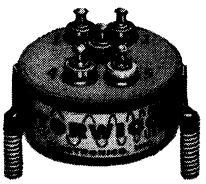
For a copy of Torwico's MIL-STD TINYMAX catalog, contact your local Torwico representative. He'll show you why Torwico is the easy way to deal with military standards.

TORWICO ELECTRONICS INC. LEADER IN MAGNETIC COMPONENTS

TINYMAX® 400 HZ Power Transformers



This Case style available in 1.5 through 250 VA



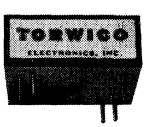
This Case style available in 1.5 through 9 VA

TINYMAX®

CONDENSED PERFORMANCE DATA FOR "STANDARD" GRADE 4 TINYMAX 400 HZ TRANSFORMERS MIL-T-27 DESIGNATION TF4S03YY

VA RATING	SELECTED FULL LOAD SEC. V (RMS) ± 3% (from range shown) with 115V PRI.	O.D ± .031"	HT. ± .031"	WEIGHT MAX.	REGULATION MAX.	TEMP. RISE MAX.
1.5	6.0 to 300	1.000	.469	1.00 oz.	23%	17°C
1.5 (With Electrostatic Shield)	6.0 to 300	1.000	.594	1.25 oz.	18%	17°C
3	6.0 to 300	1.000	.594	1.25 oz.	18%	20°C
3 (With Electrostatic Shield)	6.0 to 300	1.000	.812	1.70 oz.	12%	20°C
6	6.0 to 300	1.000	.812	1.70 oz.	12%	25°C
6 (With Electrostatic Shield)	6.0 to 300	1.000	1.062	2.30 oz.	10%	25°C
9	6.0 to 300	1.000	1.062	2.30 oz.	10%	30°C
9 (With Electrostatic Shield)	6.0 to 300	1.375	1.125	3.80 oz.	8%	32°C
16	6.0 to 300	1.375	1.125	3.80 oz.	8%	32°C
25	6.0 to 300	1.375	1.375	4.95 oz.	7%	45°C
50	6.0 to 300	2.000	1.500	11.00 oz.	3%	35°C
75	10 to 300	2.000	1.750	13.50 oz.	3%	40°C
100	12 to 300	2.250	2.000	18.70 oz.	2.5%	43°C
250	26 to 300	2.875	2.000	30.00 oz.	2%	55°C

WITH OR WITHOUT ELECTROSTATIC SHIELD



TINYMAX®

CONDENSED PERFORMANCE DATA FOR "STANDARD" GRADE 5 TINYMAX 400 HZ TRANSFORMERS MIL-T-27 DESIGNATION TF5S03ZZ

VA RATING	SELECTED FULL LOAD SEC. V (RMS) ± 3% (from range shown) with 115V PRI.	SIZE MAX- INCHES	WEIGHT MAX.	REGULATION MAX.	TEMP. RISE MAX.
1.5	6.0 to 300	1.09 Sq. X .47 ht.	.85 oz.	23%	17°C
1.5 (With Electrostatic Shield)	6.0 to 300	1.09 Sq. X .59 ht.	1.10 oz.	18%	17°C
3	6.0 to 300	1.09 Sq. X .59 ht.	1.10 oz.	18%	20°C
3 (With Electrostatic Shield)	6.0 to 300	1.09 Sq. X .78 ht.	1.65 oz.	12%	20°C
6	6.0 to 300	1.09 Sq. X .78 ht.	1.65 oz.	12%	25°C
6 (With Electrostatic Shield)	6.0 to 300	1.09 Sq. X 1.03 ht.	2.20 oz.	10%	25°C
9	6.0 to 300	1.09 Sq. X 1.03 ht.	2.20 oz.	10%	30°C
9 (With Electrostatic Shield)	6.0 to 300	1.40 Sq. X .97 ht.	3.40 oz.	8%	32°C
16	6.0 to 300	1.40 Sq. X .97 ht.	3.40 oz.	8%	32°C
25	6.0 to 300	1.40 Sq. X 1.20 ht.	4.40 oz.	7%	45°C

WITH OR WITHOUT ELECTROSTATIC SHIELD

TORWICO ELECTRONICS INC.

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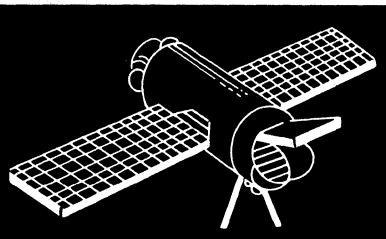


CUSTOM MILITARY MAGNETICS

ENGINEERING • CONSULTING • DESIGN • MANUFACTURE

CADD design optimization — Computer aided electrical design

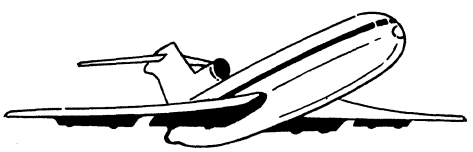
QPL QUALITY

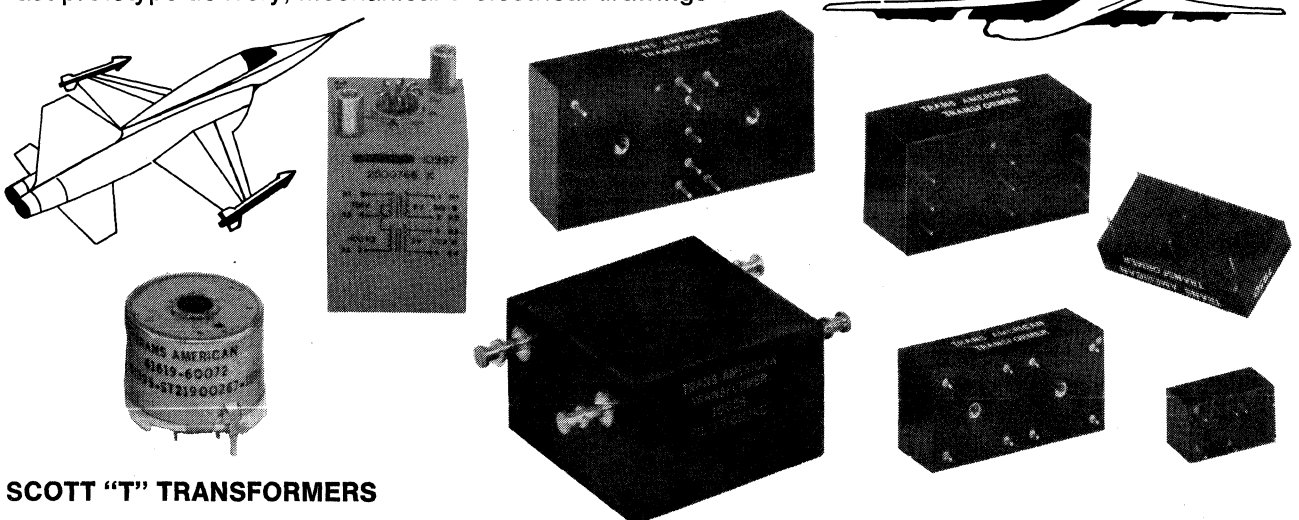
Mil-T-27 — Mil-Q-9858 — Mil-I-43208

Power	micro watts to 1 KW	Toroidal Specialists	
Frequency	60 Hz - 400 Hz 1ϕ & 3ϕ to 200 KHz	Laminated - Precision	
Class	S thru U	Switching - Flyback	
Grades	4, 5 & 6	Pulse - Inductors	
Reliability/Environmental	testing		

ENGINEERING SERVICE:

Fast prototype delivery, mechanical & electrical drawings





SCOTT "T" TRANSFORMERS

Trans American Transformer manufactures these transformers in accordance with Mil-T-27E Grades 4 and 5. Ideal for synchro to digital and digital to synchro conversion. Encapsulated, P-C mount, toroidal or laminated. All units have the highest transformation accuracy and are 100% tested.

Trans American Transformer, Inc.

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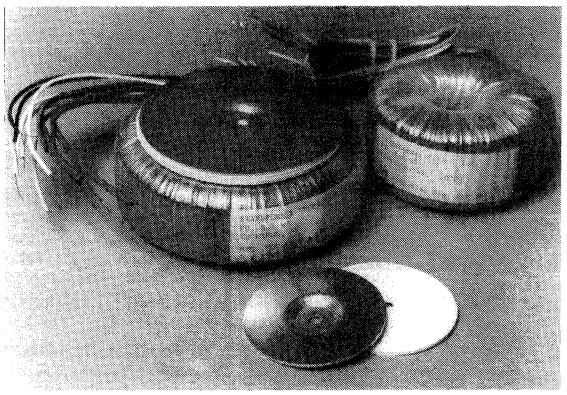

Standard and Custom Toroidal Power Transformers up to 3000VA.

Also Conventional EI. and Ferrite Custom Designed to your Specifications.

The Single Transformer Source to solve all your Transformer Needs.

UL Recognized

The transformers listed below are supplied with a dimpled mounting washer and two rubber insulators.
Inputs based on 120V 60Hz
115/230V 50Hz also available.

NOMINAL POWER VA	SECONDARY OUTPUT VOLTS AC.			SECONDARY CURRENT AMPS AC		SIZE OD x H WEIGHT	PART NUMBER
	OUTPUT	PARALLEL	SERIES	PARALLEL	SERIES		
20	2 x 9	9V	18V	2.22	1.11	2.4 x 1.3 .7 LBS	SPT-20-9
	2 x 12	12V	24V	1.67	.835		SPT-20-12
	2 x 15	15V	30V	1.33	.666		SPT-20-15
	2 x 18	18V	36V	1.12	.560		SPT-20-18
	2 x 24	24V	48V	.83	.417		SPT-20-24
40	2 x 9	9V	18V	4.44	2.22	2.8 x 1.3 1.2 LBS	SPT-40-9
	2 x 12	12V	24V	3.34	1.67		SPT-40-12
	2 x 15	15V	30V	2.66	1.33		SPT-40-15
	2 x 18	18V	36V	2.24	1.12		SPT-40-18
	2 x 24	24V	48V	1.66	.83		SPT-40-24
60	2 x 9	9V	18V	6.66	3.33	3.2 x 1.5 1.5 LBS	SPT-60-9
	2 x 12	12V	24V	5.00	2.50		SPT-60-12
	2 x 15	15V	30V	4.00	2.00		SPT-60-15
	2 x 18	18V	36V	3.34	1.67		SPT-60-18
	2 x 24	24V	48V	2.50	1.25		SPT-60-24
80	2 x 9	9V	18V	8.88	4.44	3.6 x 1.5 1.8 LBS	SPT-80-9
	2 x 12	12V	24V	6.66	3.33		SPT-80-12
	2 x 15	15V	30V	5.33	2.66		SPT-80-15
	2 x 18	18V	36V	4.44	2.22		SPT-80-18
	2 x 24	24V	48V	3.33	1.66		SPT-80-24
100	2 x 9	9V	18V	11.11	5.55	3.9 x 1.5 2.2 LBS	SPT-100-9
	2 x 12	12V	24V	8.33	4.17		SPT-100-12
	2 x 15	15V	30V	6.67	3.33		SPT-100-15
	2 x 18	18V	36V	5.56	2.78		SPT-100-18
	2 x 24	24V	48V	4.17	2.08		SPT-100-24
120	2 x 12	12V	24V	10.00	5.00	3.9 x 1.7 2.7 LBS	SPT-120-12
	2 x 15	15V	30V	8.00	4.00		SPT-120-15
	2 x 18	18V	36V	6.67	3.33		SPT-120-18
	2 x 24	24V	48V	5.00	2.50		SPT-120-24
150	2 x 12	12V	24V	12.50	6.25	3.9 x 1.9 3.2 LBS	SPT-150-12
	2 x 15	15V	30V	10.00	5.00		SPT-150-15
	2 x 18	18V	36V	8.33	4.17		SPT-150-18
	2 x 24	24V	48V	6.25	3.12		SPT-150-24
180	2 x 12	12V	24V	15.00	7.50	4.5 x 1.5 3.6 LBS	SPT-180-12
	2 x 15	15V	30V	12.00	6.00		SPT-180-15
	2 x 18	18V	36V	10.00	5.00		SPT-180-18
	2 x 24	24V	48V	7.50	3.75		SPT-180-24
200	2 x 15	15V	30V	13.33	6.66	4.5 x 1.7 4.0 LBS	SPT-200-15
	2 x 18	18V	36V	11.11	5.55		SPT-200-18
	2 x 22	22V	44V	9.09	4.54		SPT-200-22
	2 x 24	24V	48V	8.33	4.16		SPT-200-24
	220V	—	—	.90	—		SPT-200-220
250	2 x 18	18V	36V	13.89	6.95	4.5 x 1.9 4.6 LBS	SPT-250-18
	2 x 22	22V	44V	11.36	5.68		SPT-250-22
	2 x 24	24V	48V	10.42	5.21		SPT-250-24
	2 x 30	30V	60V	8.33	4.17		SPT-250-30
	220V	—	—	1.14	—		SPT-250-220
300	2 x 18	18V	36V	16.67	8.33	4.5 x 2.2 5.2 LBS	SPT-300-18
	2 x 22	22V	44V	13.64	6.82		SPT-300-22
	2 x 24	24V	48V	12.50	6.25		SPT-300-24
	2 x 30	30V	60V	10.00	5.00		SPT-300-30
	220V	—	—	1.36	—		SPT-300-220
350	2 x 24	24V	48V	14.58	7.29	4.5 x 2.4 5.8 LBS	SPT-350-24
	2 x 30	30V	60V	11.66	5.38		SPT-350-30
	2 x 33	33V	66V	10.60	5.30		SPT-350-33
	2 x 38	38V	76V	9.21	4.60		SPT-305-38
	220V	—	—	1.59	—	—	SPT-350-220
400	2 x 30	30V	60V	13.33	6.66	5.2 x 2.1 6.1 LBS	SPT-400-30
	2 x 33	33V	66V	12.12	6.06		SPT-400-33
	2 x 38	38V	76V	10.52	5.26		SPT-400-38
	220V	—	—	1.81	—	—	SPT-400-220
550	2 x 30	30V	60V	18.33	9.16	5.5 x 2.4 8.5 LBS	SPT-550-30
	2 x 33	33V	66V	16.66	8.33		SPT-550-33
	2 x 38	38V	76V	14.47	7.23		SPT-550-38
	220V	—	—	2.50	—	—	SPT-550-220

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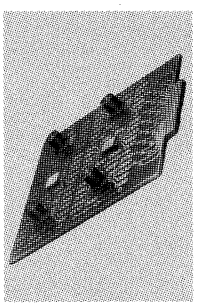
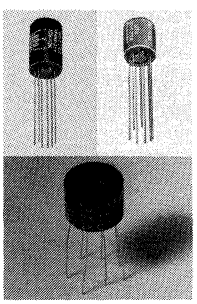
Standard Lines

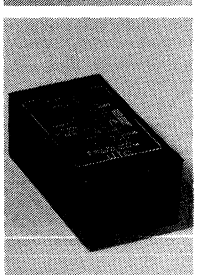


BIT 250® Surface Mount Style Metal Clad to Grade 5 of MIL-T-27
Transformers qualified to M27/173 or MIL-T-21038 for audio, signaling or pulse application. Electrostatically and electromagnetically shielded. 10 lead packages available. Operation to 130°C (Class S), Weight = .04 ozs., Size: ¼" Dia. x ¼" H.

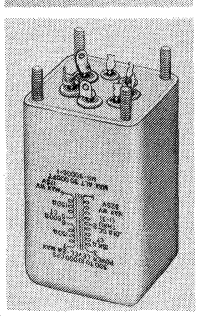


DO-T®/DI-T®/TOP — Plug in or leaded styles
Cylindrical, low stress windings. MIL Grade 5 qualified to M27/172; M27/76; M27/103 or M27/361,/362 or /363.

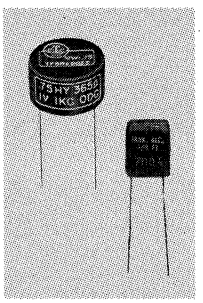
Powerful, rugged, highly miniaturized devices for frequencies from 50 Hz to 100 KHz. Power levels range from microwatts to 5 watts.



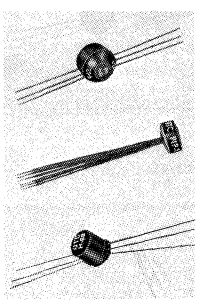
MTC/TC — Telephone Interconnect Transformers
MIL (M27/323) and industrial grades available. Meets FCC 68.310 requirements for longitudinal balance. Low Distortion, high return loss capability. For coupling, bridging and hybrid applications. Parts available for 120 ma. D.C. unbalance.



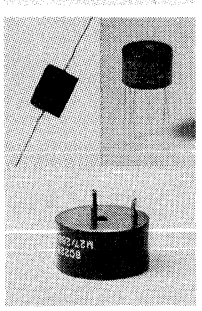
Audio Transformers
Available lines cover communications, broadcast, signaling, measurement and recording applications. Most products are available in MIL and/or industrial configurations. Plug in, leaded and insert mounted styles are carried.



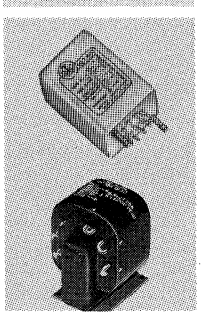
High Q Coils — MIL Grade Fixed and Variable Types
Temperature stable, precision tolerance, toroidal and laminated styles, qualified to MIL slash sheet requirements. Specialized configurations in molybdenum permalloy, ferrite, and nickel steels are used to achieve superior results. Hum reduction shapes and hipermalloy cases meet electromagnetic shielding needs. Most application needs can be served from our complete catalog line.



Pulse — Low Power & Multiplex Types
Surface mounted, plug in and terminal connection styles for pulse coupling or oscillator application. Lines meet MIL-T-21038 Pulse specification requirements. "MPX" line available for applications in MIL-STD-1553 Data Bus. High efficiency, low loss lines with exceptional waveform integrity.



Switch Mode Magnetics
Filtering, Common-mode EMI suppression, switching regulator, and inverter applications are handled by lines of miniaturized plug-in, axially leaded or board mounted components. Parts are qualified to MIL requirements. Notable for inductance stability with D.C. saturation and frequency shift.



Power Components
Complete catalog of power line step down & isolation transformer and filter chokes for 50/60 Hz and 400 Hz application. MIL qualified Grade 4 & Grade 5 types for chassis or board mounting. Low profile shapes available. Single and three phase transformers are described in the standard catalog.

For brochure and additional information call United Transformer Corporation.

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Switch-Mode Components Selection Guide

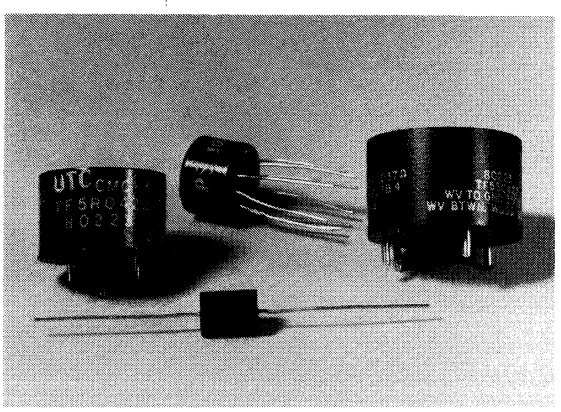
UTC answers your special inductive requirements by providing you with the most recent technology. With the addition of the CMA, B, C series common-mode inductors and PS series inverter transformers to our SR and LL lines, we now offer a complete line of components for use in SMPS equipment operating in the 50-100 KHz range. The creation of these lines is another part of UTC's commitment to serve as the one-stop center for all your inductive needs.

These components are suitable for all switch-mode applications — input filtering, output filtering, EMI suppression and interstage voltage transformation. Included are components for both common-mode (CMA, B, C) and differential mode (LL, SR) filtering. Some of the devices have multiple applications, such as the CMA, B, C inductors which can be used as high-frequency matching transformers.

Regardless of the application, each of our SMPS devices will meet or exceed your reliability requirements. All part numbers are MIL-type and some can operate in Class V environments. Many components are PC mounting style, the larger units featuring a stud for adding stability.

The SMPS line's performance is unmatched. These small, low profile packages disguise unusually high power-handling abilities, giving you exceptional "power density" along with high-frequency capability. Special winding techniques keep leakage inductances low and yield excellent voltage stability with frequency change.

For brochure and additional information call United Transformer Corporation.



Clockwise from top: PS300, SRC Inductor, LL-120 and CMC-3

PS Inverter Transformers

Type	Output/W	S_1 D.C. Out	S_2 D.C. Out	Size	Wt. (gms)	MIL Gr
PS-300	16	±12V @ .25A	+5V @ 2A	.750″D x .470″H	10	5
PS-310	16	±15V @ .20A	+5V @ 2A	.750″D x .470″H	10	5
PS-400	38	±12V @ .75A	+5V @ 4A	.900″D x .525″H	12	5
PS-410	38	±15V @ .60A	+5V @ 4A	.900″D x .525″H	12	5
PS-500	60	±12V @ 1.25A	+5V @ 6A	1.000″D x .650″H	24	5
PS-510	60	±15V @ 1.0 A	+5V @ 6A	1.000″D x .650″H	24	5

SR Inductors

Type No	Stock Line Inductance Range	DC Current Range	Approx. Ohm/Hy	Inductance Tolerance	MIL Gr
SRA	8 μHy-1250 μHy	up to 15A	510	+15%, −5% @ 1V, 10 kHz	5
SRB	20 μHy-3000 μHy	up to 15A	360	+15%, −5% @ 1V, 10 kHz	5
SRC	60 μHy-10,000 μHy	up to 13.6A	190	+15%, −5% @ 1V, 10 kHz	5
SRD	500 μHy-5.6 Hy	up to 13A	63	+15%, −5% @ 1V, 10 kHz	5

LL Inductors

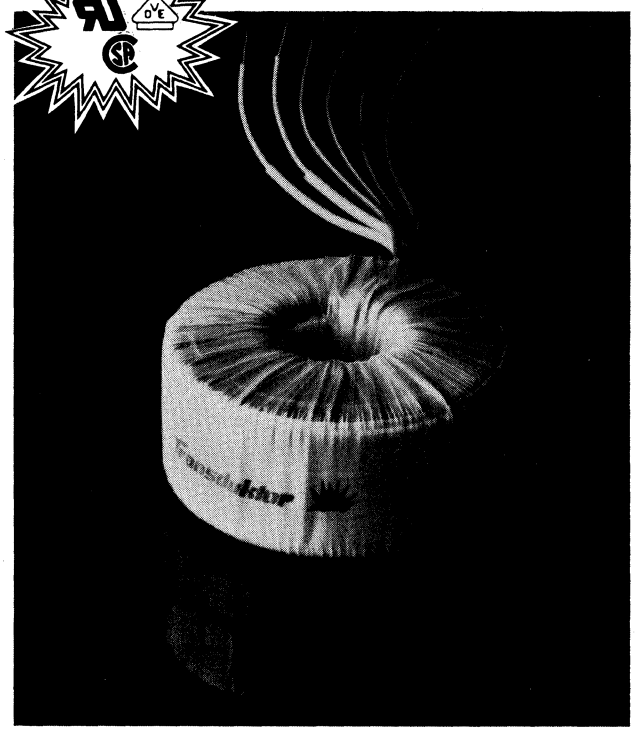
Type	Inductance at 1V, 20 kHz (μH)	Max. DCR (ohms)	Rated Current (amps)	MIL Part No.
LL-30	30	.035	3.0	M27/286-07
LL-50	50	.056	2.5	M27/286-08
LL-120	120	0.14	1.6	M27/286-01
LL-300	300	0.35	1.0	M27/286-02
LL-500	500	0.56	0.75	M27/286-03
LL-1200	1200	1.40	0.50	M27/286-04
LL-3000	3000	3.50	0.30	M27/286-05
LL-5000	5000	5.60	0.25	M27/286-06

CMA, B, C Common Mode Inductors

Type	LmHy	I RMS A	Leak μHys	DCR Ω	Wt. (gms)	MIL Gr
CMA-1	1	2.4	10	.096	12	5
CMA-3	3	1.5	20	.24	12	5
CMA-9	9	1.1	40	.50	12	5
CMB-1	1	4.4	15	.064	24	5
CMB-3	3	2.8	20	.16	24	5
CMB-9	9	2.0	40	.32	24	5
CMC-3	3	4.8	20	.07	42	5
CMC-9	9	3.0	40	.18	42	5
CMC-16	16	2.2	60	.32	42	5

Ulveco

Toroidal Power Transformers



Low Weight
Typically 50% lighter than traditional stacked lamination transformers.

Small Dimensions
Low height profile allows slim, compact design of electronic equipment.

Flexible Dimensions
The Ulveco Toroidal Power Transformer can be "modeled" to fit very limited spaces and still conform to your electrical requirements.

Easy To Mount
Just one center screw easily and quickly mounts the Ulveco Toroidal Power Transformer to the chassis.

Low Magnetic Strayfield
No air gap and with primary and secondary windings evenly spread around the core, resulting in a very low radiated magnetic field.

Low Mechanical Hum
A single continuous strip of steel tightly wound into a roll results in a very solid and stable unit. No loose parts to buzz.

Small No Load Losses
Ulveco Toroidal Power Transformers can reduce open circuit power by 90% compared to traditional stacked lamination transformers.

Ulveco *Is* Dedicated To Product Quality And Customer Service.

Deciding on toroids is only the first step. When you select our toroidals, you choose a **team that supports** yours at every step of the way, from development to production and delivery.

ULVECO, with its quantity and diversity of toroidal winding machines, enjoys the position of **world leader** in the design and manufacture of toroidal power transformers and inductors. Founded in 1964, the company pioneered the development of **efficient and cost effective** techniques for toroidal design and manufacture. Today ULVECO has more than 200 toroidal winding machines and three (3) manufacturing facilities.

Ulveco's engineering sales office, located in Foster City, California, is staffed with **experienced transformer designers** and equipped with interactive computer aided design facilities to provide virtually overnight response to customer inquiries and requests for quotation. An extensive **network of technical sales representatives** throughout the United States and Canada insures our customers close support. We take pride in the **rapid reaction to requests** from engineers looking for solutions to their transformer design problems. You may choose to evaluate low cost prototype samples from our **large inventory of standard toroids** or have a customized toroid made according to your specification.

QUALITY ASSURANCE AT ULVECO

ULVECO Quality Assurance Policy conforms to the requirements of MIL-Q-9858 and NATO AQAP-I.

Flying Inspection Squad
In order to detect defects at the earliest possible manufacturing level, a fully equipped mobile test bench is constantly kept moving around our production lines to perform "flying" inspections. Both mechanical and electrical tests are included.

Final Inspection
Finally, each unit is subjected to a visual inspection, insulation tests (4kV AC), no load primary current, and no load secondary voltage tests.

UL, CSA, VDE, Approved
ULVECO is certified as a manufacturer of "Recognized" transformers for various toroidal configurations for class A (105°C) to class H (180°C) service by electrical safety agencies throughout the world. These agencies maintain a schedule of unannounced visits to our facilities to insure conformation to their specs. Our **familiarity with safety agency procedures** and personnel helps expedite new design through testing and approval.

QUALITY IS AN ULVECO TRADITION

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Ulveco

Custom Designed Toroidals

- **You're just a phone call away from custom designed-UL, CSA, certified-toroidal transformers**
- **Custom designed toroidals are our specialty**
- **Quick response to design inquiries**
- **Computer aided programs provide quick solutions**
- **Rapid delivery of low cost prototype samples**
- **Wide choice of mounting arrangements**

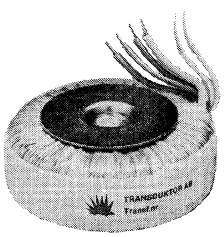
Over 90% of our output is for custom designs. Because they require no elaborate production tools and are individually wound, **toroidal transformers are particularly suited to custom designs.**

Take advantage of our **custom design service at no obligation.**

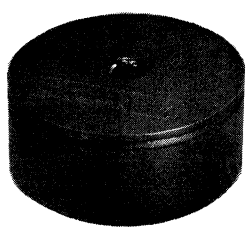
Our experts can become part of your power supply design group. We'll show you how you can optimize your product's appearance and performance without increasing cost.

Our interactive computer aided design facilities enable us to optimize designs for either AC or DC loads.

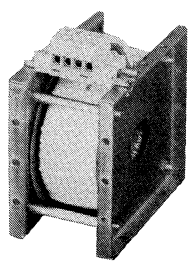
General Data Custom Designed Toroidals



Disk Mounting



TD-Capsule



Flange Mounting

Power Range		Copper losses	No Load losses	Dimensions			Dimensions			Dimensions		
50Hz VA	60Hz VA	(W)	(W)	Diameter inch	Height inch	Weight lb.	Diameter inch	Height inch	Weight lb.	Width inch	Depth inch	Weight lb.
17	20	3.0	0.20	2.4	1.2	0.7	2.6	1.65	0.8			
33	40	5.8	0.25	2.8	1.3	1.1	3.1	1.65	1.2			
55	65	8.6	0.45	3.2	1.4	1.6	3.5	1.65	1.8			
95	115	12	0.60	3.9	1.5	2.2	3.9	1.65	2.7			
140	170	16	0.90	3.9	1.9	2.9	3.9	2.25	3.4	4.0	2.8	4.0
185	220	19	1.2	4.5	1.7	3.5	4.8	1.85	4.0	4.7	2.8	5.1
300	360	22	1.7	4.5	2.0	4.7	4.8	2.6	6.1	4.7	3.5	5.8
375	450	27	2.0	4.5	2.7	5.5				4.7	3.8	6.7
460	550	31	2.4	5.5	2.4	7.1				5.7	3.3	8.7
625	750	36	3.1	5.5	3.0	8.4				5.7	3.7	10
800	960	45	3.8	6.3	2.4	9.8				6.9	4.2	12
1000	1200	45	4.7	6.3	3.0	12				6.9	4.3	12
1100	1320	45	6.5	6.3	3.3	17				6.9	4.7	19
1300	1560	60	5.7	7.9	2.6	20				8.3	3.9	22
1600	1920	62	7.1	7.9	3.0	23				8.3	4.3	24
1900	2280	65	8.5	7.9	3.3	26				8.3	4.7	29
2200	2640	73	8.1	8.9	3.3	29				9.3	5.1	33
2500	3000	79	9.7	8.9	3.5	33				9.3	5.3	37
2800	3360	89	11	9.6	3.1	35				10.2	4.9	40
3200	3840	91	13	9.6	3.5	42				10.2	5.3	46
3700	4440	93	15	9.6	3.9	46				10.2	5.7	51
4400	5280	112	17	11.2	4.3	53				11.6	6.1	59
5000	6000	112	20	11.2	4.7	62				11.6	6.5	68
6300	7560	130	27	12.4	4.7	84				13.8	6.5	89
8000	9600	140	28	13.4	4.7	88				13.8	6.5	97
10000	12000	140	39	13.4	5.9	120				13.8	7.7	130

Data above are typical and may be changed without prior notice.

ULVECO CUSTOM TOROIDALS...JUST A PHONE CALL AWAY

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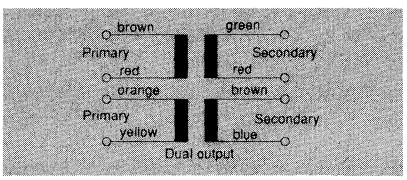
Ulveco

Standard off-the-shelf Toroidals, 2 × 117V, 50/60 Hz

- **Immediately available from stock**
- **For breadboards, prototypes and short run requirements**
- **2×117V, 50/60 Hz primary**
- **Wide choice...single or dual isolated secondaries**
- **17 to 990VA ratings available**
- **Listed as recognized/certified components (UL, CSA, etc)**
- **Class A (105°C)**



Our inventory of off-the-shelf toroidal transformers has been refined by years of experience in satisfying the requirements of engineers and designers for breadboards, prototypes, and short production runs.

Series AA 5 XXXX-YYY

Dual (2) 117 Volt, 50/60 Hz primaries to be connected in series or parallel. UL recognized and CSA certified.

Mounting

Supplied with one metal mounting disk and two rubber washers for simple, inexpensive one hole, one screw mounting.

Leads

Each winding is terminated with 10 inch insulated "flying leads" stripped at 1/4". Secondaries may be connected in series or parallel. Primary leads are double insulated.

Transformer Data, Standard Off-The-Shelf Toroidals

Nominal Power VA	Secondary Voltage VAC	Secondary Current AAC	Size Weight lbs. Mounting screw	Type No.
17	2×6 2×9 2×12 2×15 2×18 2×22	1.42 0.94 0.71 0.57 0.47 0.39	2.4"×1.2" 0.7 lbs	AA50172-006 AA50172-009 AA50172-012 AA50172-015 AA50172-018 AA50172-022
33	2×6 2×9 2×12 2×15 2×18 2×22	2.75 1.80 1.38 1.10 0.92 0.75	2.8"×1.3" 1.1 lbs	AA50332-006 AA50332-009 AA50332-012 AA50332-015 AA50332-018 AA50332-022
55	2×6 2×9 2×12 2×15 2×18 2×22 2×24	4.6 3.1 2.3 1.8 1.5 1.2 1.1	3.2"×1.4" 1.6 lbs	AA50552-006 AA50552-009 AA50552-012 AA50552-015 AA50552-018 AA50552-022 AA50552-024
95	2×9 2×12 2×15 2×18 2×22 2×24 2×28 2×30	5.3 3.9 3.2 2.6 2.2 2.0 1.7 1.6	3.9"×1.5" 2.2 lbs	AA50952-009 AA50952-012 AA50952-015 AA50952-018 AA50952-022 AA50952-024 AA50952-028 AA50952-030
140	2×12 2×15 2×18 2×22 2×24 2×28 2×30 2×117	5.8 4.7 3.9 3.2 2.9 2.5 2.3 0.6	3.9"×1.9" 2.9 lbs	AA51402-012 AA51402-015 AA51402-018 AA51402-022 AA51402-024 AA51402-028 AA51402-030 AA51402-117
185	2×12 2×15 2×18 2×22 2×24 2×28 2×30 2×117	7.7 6.2 5.1 4.2 3.9 3.3 3.1 0.8	4.5"×1.7" 3.5 lbs	AA51852-012 AA51852-015 AA51852-018 AA51852-022 AA51852-024 AA51852-028 AA51852-030 AA51852-117
300	2×15 2×18 2×24 2×30 2×38 2×117	10.0 8.3 6.2 5.0 3.9 1.3	4.5"×2.0" 4.7 lbs	AA53002-015 AA53002-018 AA53002-024 AA53002-030 AA53002-038 AA53002-117
375	2×18 2×24 2×30 2×38 2×117	10.4 7.8 6.3 4.9 1.6	4.5"×2.7" 5.5 lbs	AA53752-018 AA53752-024 AA53752-030 AA53752-038 AA53752-117
460	2×24 2×30 2×38 2×117	9.6 7.7 6.0 2.0	5.5"×2.4" 7.1 lbs	AA54602-024 AA54602-030 AA54602-038 AA54602-117
625	2×24 2×30 2×33 2×38 2×117	13.0 10.4 9.5 8.2 3.1	5.5"×3.0" 8.4 lbs	AA56252-024 AA56252-030 AA56252-033 AA56252-038 AA56252-117
800	2×24 2×30 2×38 2×48 2×117	16.7 13.3 10.5 8.3 3.4	6.3"×2.4" 9.8 lbs	AA58002-024 AA58002-030 AA58002-038 AA58002-048 AA58002-117
990	2×24 2×42 2×55 2×117	20.6 11.8 9.0 4.2	6.3"×3.0" 12.0 lbs	AA59902-024 AA59902-042 AA59902-055 AA59902-117

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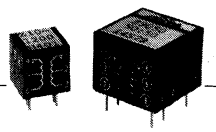
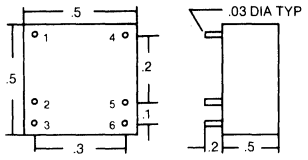
TTE, Incorporated

MINIATURE WIDEBAND TRANSFORMERS 100 MILLIWATT SERIES:

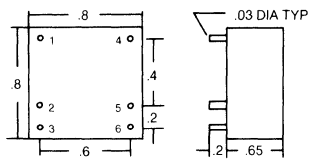


Model No.	Z1	Z2	Minimum F'-3 dB (Hz)	Bandwidth F"-3 dB (Hz)	VSWR = 1.5:1 @ (Hz)
Z5	50	*	300	500 K	
Z10	50	*	10 K		5M
Z15	50	*	20 K		10M
Z20	75	*	300	500 K	
Z25	75	*	10 K		5M
Z30	75	*	20 K		10M
Z40	400	*	100	500 K	
Z50	600	*	100	500 K	



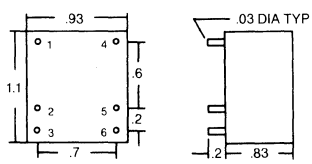
500 MILLIWATT SERIES:

Model No.	Z1	Z2	Minimum F'-3 dB (Hz)	Bandwidth F"-3 dB (Hz)	VSWR = 1.5:1 @ (Hz)
Z80	50	*	300	300 K	
Z90	50	*	10 K		5M
Z95	50	*	20 K		10M
Z100	75	*	100	300 K	
Z110	75	*	10 K		5M
Z115	75	*	20 K		10M
Z120	400	*	90	300 K	
Z130	600	*	90	300 K	



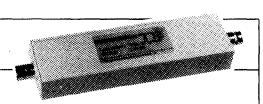
1 WATT SERIES:

Model No.	Z1	Z2	Minimum F'-3 dB (Hz)	Bandwidth F"-3 dB (Hz)	VSWR = 1.5:1 @ (Hz)
Z205	50	*	100	500 K	
Z210	50	*	10 K		5M
Z215	50	*	20 K		10M
Z230	75	*	100	500 K	
Z240	75	*	10 K		5M
Z250	75	*	20 K		10M
Z260	400	*	30	300 K	
Z290	600	*	30	200 K	



ISOLATION TRANSFORMERS:

Model No.	Z1:Z2 (Ohms)	Minimum 3 dB BW (Hz)	VSWR = 1.5:1 at:
Z15050	50:50	50-15M	10M
Z17575	75:75	50-15M	10M

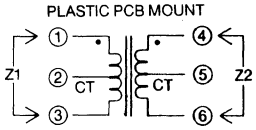


*Specify any resistance value up to 1200 ohms

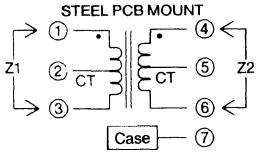
BASIC SCHEMATICS

WIDEBAND TRANSFORMERS

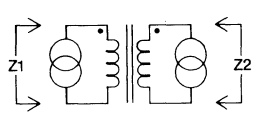
PLASTIC PCB MOUNT



STEEL PCB MOUNT

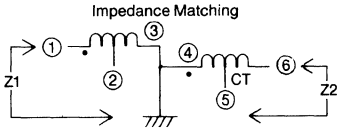


ISOLATION TRANSFORMERS

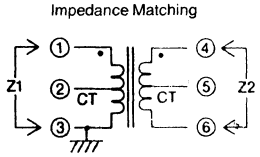


TYPICAL APPLICATIONS FOR WIDEBAND TRANSFORMERS

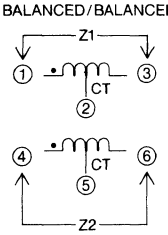
WIDEBAND TRANSFORMERS
Unbal/Unbal
Impedance Matching



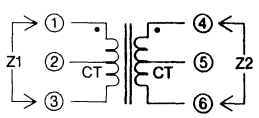
BALUN TRANSFORMERS
Unbal/Bal
Impedance Matching



BALANCED/BALANCED



ISOLATION TRANSFORMERS



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PART NUMBER DERIVATION:
Z5-1200
series no. Z2 in ohms

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HEARST ENGINEERING SOFTWARE

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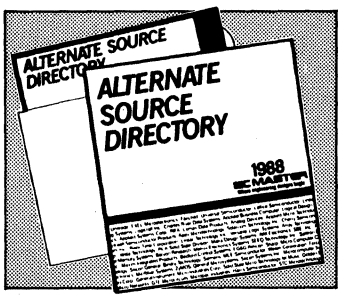

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The electronic ASD is FLEXIBLE! You can add ICs and you can add comments.

You can add part numbers, prices, technical notes or anything else you like. You can customize the ASD to fit your needs and the needs of your company.

Order the 1988 Alternate Source Directory for your AT, XT or compatible. We'll send you two floppies and a very simple piece of printed documentation. Download the floppies and you're in business. All you need is a hard disk.

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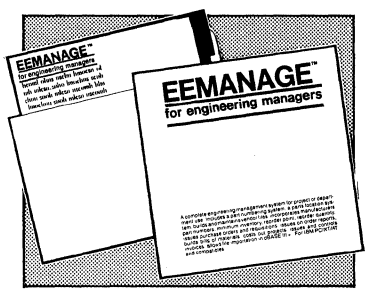

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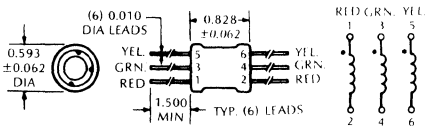
VITEC

TRANSFORMERS & INDUCTORS

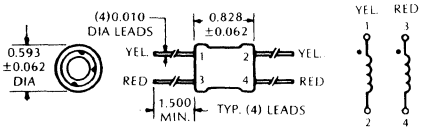
TYPE 11Z *TRIGATE® PULSE TRANSFORMERS*

- Designed for low cost SCR triggering applications including motor speed controls, heater controls and incandescent lighting controls.
- Choice of flexible lead and printed circuit mounting constructions.
- Balanced pulse characteristics and energy transfer from the primary to secondary and tertiary windings.
- Minimum saturation effect to allow operations where increased pulse widths are required.
- Fast pulse rise time and increased current capability to prevent SCR failure.
- Increased energy transfer efficiency.
- Operating Temperature: −10°C to +70°C

STYLE 1



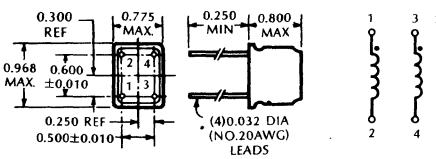
STYLE 2



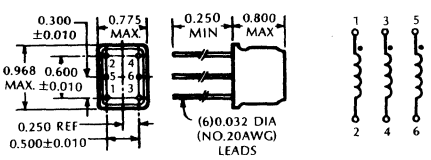
Part Number	Turns Ratio	Lp µH Min.	LI µH Max.	Cc pF Max.	DCR OHM Max.	Dielectric Test @ 60 Cy Vrms Min.	A-C Line Voltage @ 60 Cy Vrms Max.	Case Style
11Z12	1:1	200	3	800	1.5-1.5	1600	240	1
11Z13	1:1:1	200	3	800	2-2-2	1600	240	2
11Z14	2:1	1000	10	1300	10-2	1600	240	1
11Z15	2:1:1	1000	15	1300	10-2-2	1600	240	2
11Z16	5:1	5000	1500	400	19-3	1600	240	1

TYPE 11Z *PRINTED CIRCUIT BOARD DESIGNS/ THERMOPLASTIC SHEATH*

STYLE 3



STYLE 4

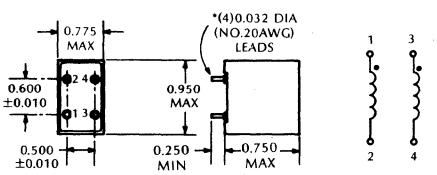


11Z2000	1:1	200	3.0	800	1.5-1.5	1600	240	3
11Z2001	1:1	1000	12.0	2000	8-8	1600	240	3
11Z2002	1:1	5000	15.0	3500	18-18	1600	240	3
11Z2003	2:1	1000	10.0	1300	10-2	1600	240	3
11Z2004	5:1	5000	1500	400	19-3	1600	240	3
11Z2100	1:1:1	200	3.0	800	2-2-2	1600	240	4
11Z2101	1:1:1	1000	12.0	2000	10-10-10	1600	240	4
11Z2102	1:1:1	5000	15.0	3500	2-27-27	1600	240	4
11Z2103	2:1:1	1000	15.0	1300	10-2-2	1600	240	4
11Z2104	5:1:1	5000	1500	400	20-4-4	1600	240	4
11Z2200	1:1	200	5.0	500	3-3	2500	550	3
11Z2201	2:1	1000	16.0	1300	10-5	2500	550	3
11Z2300	1:1:1	200	5.0	500	5-5-5	2500	550	4
11Z2301	2:1:1	1000	20.0	1300	40-20-20	2500	550	4

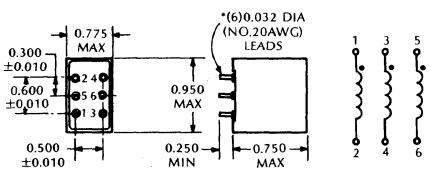
TYPE 11Z *PRINTED CIRCUIT BOARD DESIGN/PRE-MOLDED CASE*

- Superior moisture protection under conditions of high humidity.
- Mechanical and electrically interchangeable with 11Z 2000 series having the corresponding last digits in the part number.
- Underwriter Laboratories recognized.

STYLE 5



STYLE 6



11Z3000	1:1	200	3.0	800	1.5-1.5	1600	240	5
11Z3001	1:1	1000	12.0	2000	8-8	1600	240	5
11Z3002	1:1	5000	15.0	3500	18-18	1600	240	5
11Z3003	2:1	1000	10.0	1300	10-2	1600	240	5
11Z3004	5:1	5000	1500	400	19-3	1600	240	5
11Z3100	1:1:1	200	3.0	800	2-2-2	1600	240	6
11Z3101	1:1:1	1000	12.0	2000	10-10-10	1600	240	6
11Z3102	1:1:1	5000	15.0	3500	27-27-27	1600	240	6
11Z3103	2:1:1	1000	15.0	1300	10-2-2	1600	240	6
11Z3104	5:1:1	5000	1500	400	20-4-4	1600	240	6
11Z3200	1:1	200	5.0	500	3-3	2500	550	5
11Z3201	2:1	1000	16.0	1300	10-5	2500	550	5
11Z3300	1:1:1	200	5.0	500	5-5-5	2500	550	6
11Z3301	2:1:1	1000	20.0	1500	40-20-20	2500	550	6

TYPE 12Z *SCR TIRGGER TRANSFORMERS IN PRE-MOLDED CASE*

- Designed specifically for industrial and military SCR triggering applications
- Epoxy encapsulated in a small pre-molded case gives superior humidity resistance.
- Provide low-noise operation of high pwoer SCR resonant inverters.
- Meet design requirements of most sine wave inverter circuits.
- Operating Temperature: −55°C to +125°C
- Peak Working Voltage: 10,000 Megohms Per MIL-STD-202, Method 302
- Dissipation Rating: 0.3 Watts at +25°C

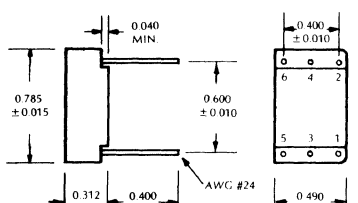
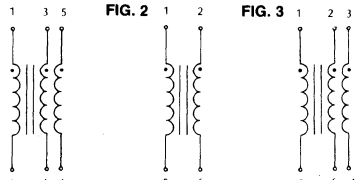


FIG. 1 FIG. 2 FIG. 3



Part Number	Turn Ratio ±5%	Primary* Inductance mH Min.	Primary ET-Rating $V_\mu S$ Min.	Pri/Sec** CC pF Max.	Pri/Sec** LL µH Max.	Primary DCR OHMS Max.	Secondary DCR OHMS Max.	Dielectric Test Vrms Min.	Schematic Fig.
12Z4903	1:1:1	0.7	60	25	300	6.5	6.5	2200	1
12Z4906	1:1	4.8	110	50	20	3.0	3.5	2200	2
12Z4923	1:1	0.7	60	25	350	5.5	5.5	2200	2
12Z4932	1:1:1	4.8	110	50	20	5.0	6.0	2200	3

*Test Frequency at 10 KHz
**Test Frequency at 130 KHz

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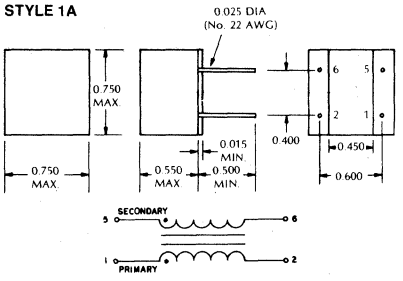
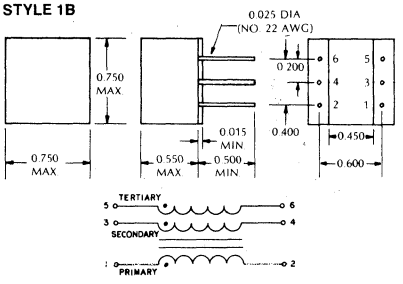
TRANSFORMERS & INDUCTORS

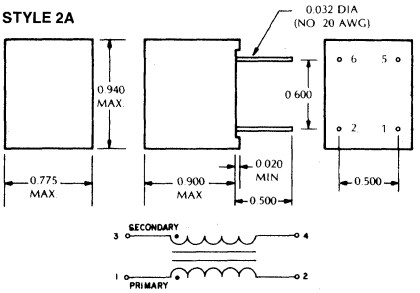
STYLE 1A



STYLE 1B



STYLE 2A



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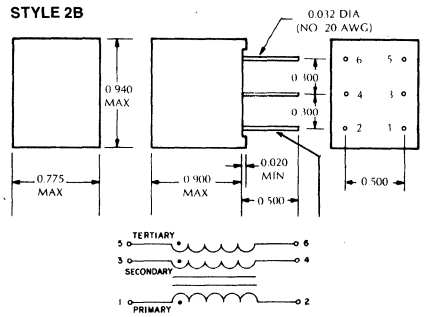

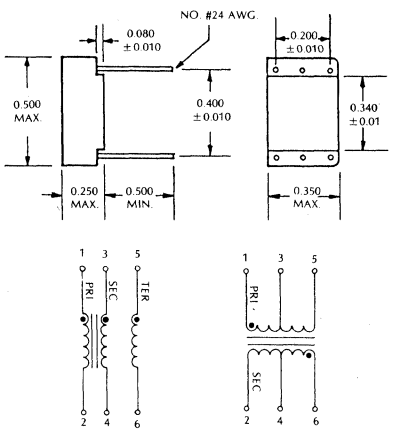

FIG. 1 FIG. 2

TYPE 13Z *SCR TRIGGER TRANSFORMER*

- Meet design requirements of most sine wave inverter circuits.
- High ET-Ratings.
- High dielectric strength capability.
- Fast rise time.
- Low interwinding capacitance.
- Average Power Rating: 2 Watts
- Peak Pulse Voltage: 100 to 300 Volts
- Insulation Resistance: 10,000 Megohms

Part Number	Turn Ratio	Primary* Inductance	Primary ET-Rating	Pri/Sec CC	Pri/Sec LL	Primary DCR	Secondary DCR	Dielectric Test	Case Style
		mH	$V_\mu S$	pF	μH	OHMS	OHMS	Vrms	
	±5%	Min.	Min.	Max.	Max.	Max.	Max.	Min.	
13Z1000	1:1	0.2	180	24	3.2	1.4	1.5	1600	1A
13Z1001	1:1	1.0	360	30	15.0	2.8	3.1	1600	1A
13Z1002	1:1	5.0	866	36	64.0	6.0	7.5	1600	1A
13Z1003	2:1	0.2	180	24	5.0	1.4	0.9	1600	1A
13Z1004	2:1	1.0	360	30	13.0	2.8	1.8	1600	1A
13Z1005	2:1	5.0	866	36	65.0	6.0	3.6	1600	1A
13Z1006	1:1:1	0.2	180	30	5.0	1.4	1.5	1600	1B
13Z1007	1:1:1	1.0	360	36	12.0	2.8	3.6	1600	1B
13Z1008	1:1:1	5.0	866	42	80.0	6.0	7.2	1600	1B
13Z1009	2:1:1	0.2	180	30	4.1	1.4	1.0	1600	1B
13Z1010	2:1:1	1.0	360	36	30.0	2.8	2.0	1600	1B
13Z1011	2:1:1	5.0	866	42	80.0	6.0	3.8	1600	1B
13Z1013	1:1	0.2	290	30	6.2	1.4	1.5	2400	2A
13Z1014	1:1	1.0	700	36	26.0	3.0	3.2	2400	2A
13Z1015	1:1	5.0	1500	62	130.0	6.3	7.0	2400	2A
13Z1016	2:1	0.2	290	30	8.9	1.4	1.0	2400	2A
13Z1017	2:1	1.0	700	36	24.0	3.0	2.0	2400	2A
13Z1018	2:1	5.0	1500	42	125.0	6.3	4.0	2400	2A
13Z1019	1:1:1	0.2	290	34	4.7	1.4	1.5	2400	2B
13Z1020	1:1:1	1.0	700	40	25.0	3.0	3.3	2400	2B
13Z1021	1:1:1	5.0	1500	46	174.0	6.3	7.5	2400	2B
13Z1022	2:1:1	0.2	290	34	6.0	1.4	1.0	2400	2B
13Z1023	2:1:1	1.0	700	40	27.0	3.0	2.0	2400	2B
13Z1024	2:1:1	5.0	1500	46	160.0	6.1	4.0	2400	2B

*Test Frequency at 60Hz

TYPE 16Z *PULSE TRANSFORMERS FOR GENERAL PURPOSES*

- Wide range of inductances for a variety of circuit applications.
- Small physical size.
- Flexible leads adaptable to PC board or axial lead mounting.
- Low cost.
- Operating Temperature: −20°C to +105°C
- Peak Pulse Voltage: 100 Volts
- Insulation Resistance: 10,000 Megohms
- Average Power Rating: 500 mW
- Dissipation Rating: 150 mW
- Dielectric Test Voltage: 500 VDC

Part Number	Turn Ratio	Primary Inductance	Primary ET-Rating	Rise Time	Pri/Sec CC	Pri/Sec LL	Primary DCR	Secondary DCR	Tertiary DCR	Sch. Fig.
		μH	$V_\mu S$	nS	pF	μH	OHMS	OHMS	Vrms	
	±5%	Min.	Min.	Max.	Max.	Max.	Max.	Max.	Min.	
16Z5760	1:1:1	5000	25.0	10.5	60	1.3	3.9	3.9	3.9	1
16Z5761	1:1:1	2000	16.0	8.2	37	0.8	2.5	2.5	2.5	1
16Z5762	1:1:1	500	8.5	5.3	32	0.4	1.3	1.3	1.3	1
16Z5763	1:1:1	200	5.0	4.2	18	0.3	0.9	0.9	0.9	1
16Z5764	1:1:1	50	5.2	5.6	18	0.5	1.3	1.3	1.3	1
16Z5765	1:1:1	20	3.2	4.1	21	0.4	0.9	0.9	0.9	1
16Z5765	1:1:1	10	3.7	5.1	22	0.5	0.9	0.9	0.9	1
16Z5767	2:1:1	5000	25.0	16.0	33	3.6	3.9	2.0	2.0	1
16Z5768	2:1:1	2000	16.0	11.0	19	1.8	2.5	1.4	1.4	1
16Z5769	2:1:1	500	8.5	5.6	11	1.1	1.3	0.7	0.7	1
16Z5770	2:1:1	200	5.0	3.2	8	0.8	0.9	0.5	0.5	1
16Z5772	2:1:1	20	5.8	7.5	12	1.5	1.3	0.8	0.8	1
16Z5777	3:1:1	200	5.0	3.6	7	1.1	0.9	0.4	0.4	1
16Z5779	3:1:1	20	3.2	2.7	6	1.3	0.9	0.4	0.4	1
16Z5782	4:2:1	2000	16.0	13.0	20	2.5	2.5	1.4	0.8	1
16Z5783	4:2:1	500	8.5	4.7	13	0.9	1.4	0.8	0.5	1
16Z5784	4:2:1	200	5.0	3.7	8	0.8	0.9	0.5	0.4	1
16Z8270	1:1 *	2000	16.0	8.2	37	0.8	2.5	2.5	—	2
16Z8271	1:1 *	500	8.5	5.3	32	0.4	1.3	1.3	—	2
16Z8272	1:1 *	200	5.0	4.2	18	0.3	0.9	0.9	—	2
16Z8273	1:1 *	50	5.2	5.6	18	0.5	1.3	1.3	—	2
16Z8274	1:1 *	20	3.2	4.1	21	0.4	0.9	0.9	—	2
16Z8275	1:1 *	10	3.7	5.1	22	0.5	0.9	0.9	—	2
16Z8276	2:1 *	2000	16.0	11.0	19	1.8	2.5	1.4	—	2
16Z8277	2:1 *	500	8.5	5.6	12	1.2	1.4	0.8	—	2
16Z8278	2:1 *	200	5.0	3.2	8	0.8	0.9	0.5	—	2
16Z8279	2:1 *	50	5.2	5.2	12	1.3	1.3	0.7	—	2
16Z8280	2:1 *	20	5.8	7.5	12	1.5	1.3	0.8	—	2
16Z8281	2:1 *	10	3.7	4.5	9	1.5	0.9	0.5	—	2

* Center Taped, Both Primary and Secondary Windings.

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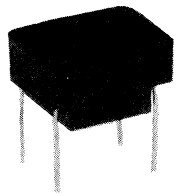
VITEC

ISOLATION TRANSFORMERS FOR LOCAL AREA NETWORK

FOR ETHERNET APPLICATIONS

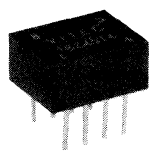


- Low profile automatic insertable
- IEEE 802.3 (10 Base 2, 10 Base 5) and ECMA compatible
- High isolation voltage to meet international safety requirement for local area network
- Fast rise time
- Low cost

PART NUMBER		TURN RATIO	PULSE(1) INDUCTANCE	PRIMARY ET-RATING	RISE TIME (2)*	PRI/SEC CC	PRI/SEC LL	PRIMARY DCR	DIELECTRIC TEST (3)
CASE	STYLE		μH	V-μH	nS	pF	μH	OHMS	Vrms
1	2	±5%	±20%	MIN.	MAX.	MAX.	MAX.	MAX.	MIN.
14Z4500	24Z4105	1:1	35	1.8	3.5	8	0.25	0.3	2000
14Z4501	24Z4106	1:1	50	2.2	3.5	9	0.25	0.3	2000
14Z4502	24Z4107	1:1	75	2.4	3.5	10	0.25	0.3	2000
14Z4503	24Z4108	1:1	100	2.5	3.5	10	0.25	0.4	2000
14Z4504	24Z4109	1:1	150	3.0	3.5	12	0.25	0.5	2000

NOTES:
(1) PULSE INDUCTANCE, measured at 1 volt and 0.4 μSec. at a PRR of 1 Khz.
(2) RISE TIME measured in 78 OHM system.
(3) DIELECTRIC TEST of 2KV is between PRI & SEC and from coils to coils.

FOR STARLAN APPLICATIONS

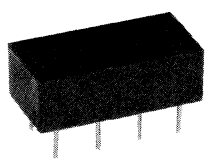


- Designed for HUB and NODE use.
- IEEE 802.3 (1 Base 5) compatible.
- High isolation voltage to meet international safety requirement for local area networks.
- Alternate packages may be available.

PART NUMBER	TURN RATIO	PULSE (1) INDUCTANCE	PRIMARY ET-RATING	RISE TIME	PRI/SEC CC	PRI/SEC LL	PRIMARY DCR	DIELECTRIC TEST (3)	CASE STYLE
		mH	V-μH	nS	pF	μH	OHMS	Vrms	
	±5%	±20%	MIN.	MAX.	MAX.	MAX.	MAX.	MIN.	
16Z4352	1:1	2.5	20	100	25	8	1.0	2000	1
16Z4552	1:1	2.5	20	25	40	1.1	1.0	2000	1
24Z4382	1:1	2.5	20	100	25	8	1.0	2000	2 (4)
24Z4582	1:1	2.5	20	25	40	1.1	1.0	2000	2 (4)
18Z4514	1:1:1:1	(2)	N/A	N/A	30	0.3	0.06	2000	3

NOTES:
(1) PURSE INDUCTANCE measured per test schematic at 3 volts and 3 sec. at a PRR of 1 KHz.
(2) OPEN CIRCUIT SINE WAVE INDUCTANCE at 40 μH Min. measured on Tek 130 LC Meter.
(3) DIELECTRIC TEST of 2 KV is between PRI and SEC and from coil to coil in the 24Z Type.
(4) Characteristics are for each coil.

FOR TOKEN RING APPLICATIONS

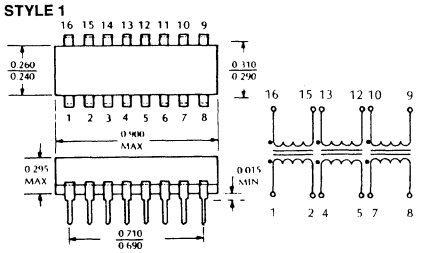


- Designed to meet Texas Instruments TMS380 Chipset requirements.
- IEEE 802.5 compatible.
- High isolation voltage to meet international safety requirement for local area network.
- Low cost

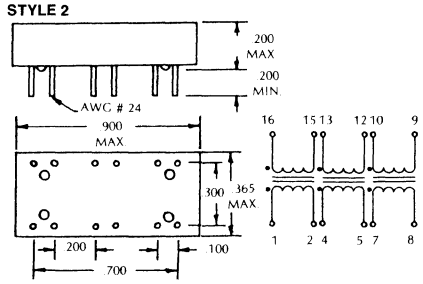
PART NUMBER	TURN RATIO	INSERTION LOSS (1)	RISE TIME	CMRR (2)	RETURN LOSS (3)	DIELECTRIC TEST (4)	CASE STYLE
		dB	nS	dB	dB	Vrms	
	±1%	MAX.	MAX.	MIN.	MIN.	MIN.	
18Z4838	1:2:2:2	0.5	15	-60	20	500	1
24Z4538	1:1:2:2	0.5	15	-60	20	500	2

NOTES:
(1) INSERTION LOSS is measured at 10 MHz.
(2) COMMON MODE REJECTION RATIO is measured as common mode to differential at 1 MHz.
(3) RETURN LOSS is measured at 5 MHz.
(4) DIELECTRIC TEST of 500 Vrms is between PIR&SEC and from winding to winding. It's also applied between coils for dual transformer version Type 24Z.

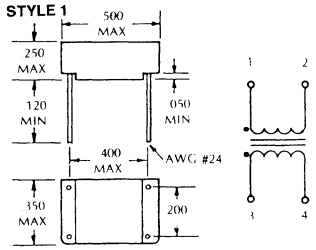
STYLE 1



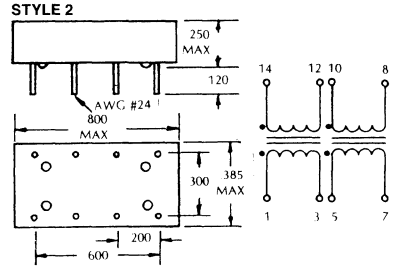
STYLE 2



STYLE 1



STYLE 2



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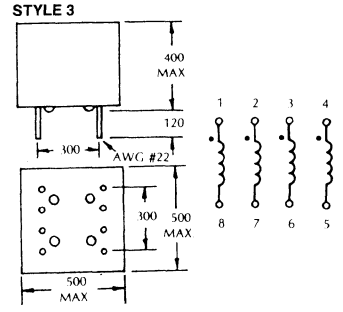
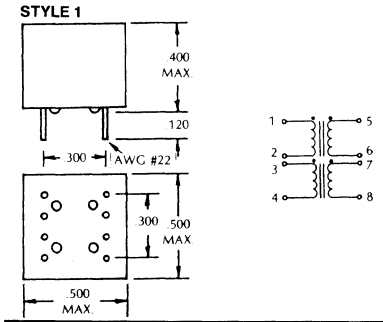
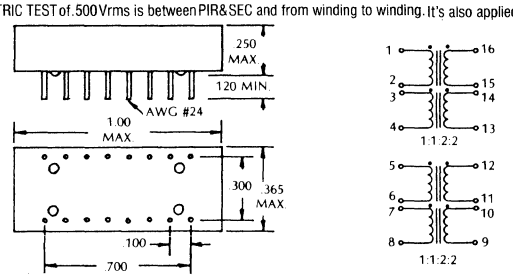


STYLE 1



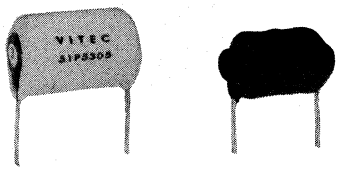
STYLE 2

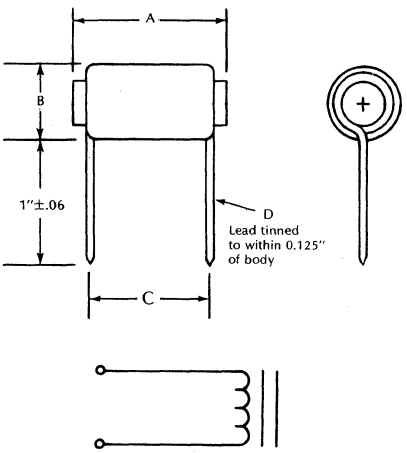


VITEC

TRANSFORMERS & INDUCTORS

TYPE 51P *HIGH CURRENT FILTER CHOKE IN RADIAL LEAD*

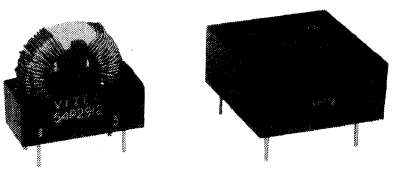




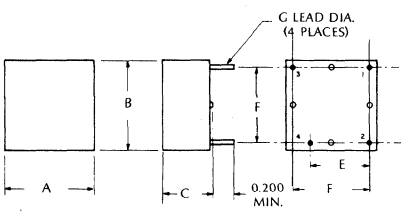
- Designed for use with switching power supplies
- Printed circuit mounting
- Low cost construction
- Pre-tinned leads
- Operating Temperature: −55°C to +105°C
- Inductance: measured at 1 KHz with no DC current
- Rated current: cont. operating at +25°C
- Winding: Layered solenoid type with magnetic core

Part Number	Inductance µH ±10%	Rated Current Amp. Max.	DCR OHM Max.	SRF MHz Min.	Incremental Current Amp. Typ.	Dimensions A Max.	B Max.	C ±0.062	D ±0.005
51P5301	5	3	0.015	35	19	0.88	0.63	0.50	0.042
51P5302	10	3	0.018	25	17	1.12	0.63	0.69	0.042
51P5303	27	3	0.035	5.5	15	0.88	0.81	0.44	0.042
51P5304	50	3	0.050	3.5	12	1.12	0.81	0.75	0.042
51P5305	100	3	0.065	2.5	8	1.12	0.81	0.94	0.042
51P5306	150	3	0.075	2.0	5	1.38	0.81	1.06	0.042
51P5308	5	5	0.015	30	20	0.88	0.64	0.75	0.053
51P5309	10	5	0.015	20	18	1.12	0.64	1.00	0.053
51P5310	27	5	0.025	6	15	0.88	0.88	0.56	0.053
51P5311	50	5	0.030	4	10	1.12	0.88	0.75	0.053
51P5313	100	5	0.050	2.5	7	1.38	0.88	1.00	0.053
51P5315	5	10	0.010	30	19	1.12	0.69	0.81	0.065
51P5316	10	10	0.012	20	17	1.38	0.69	1.22	0.065
51P5317	27	10	0.018	7	15	1.12	0.94	0.69	0.065
51P5318	50	10	0.025	4	9	1.38	0.94	0.94	0.065
51P5321	5	15	0.010	30	20	1.38	0.72	0.94	0.082
51P5322	10	15	0.010	20	17	1.69	0.72	1.50	0.082
51P5323	27	15	0.015	7	14	1.38	1.00	0.94	0.082

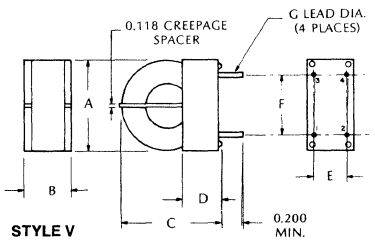
TYPE 54P *EMI COMMON-MODE SUPPRESSION INDUCTORS*



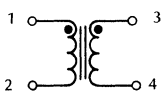
- Designed for use in input filter circuits of switching power supplies
- Low profile or vertical mounting for printed circuit mounting
- Encapsulation materials meet UL 94 V-0
- Operating Temperature: −55°C to +105°C
- Inductance: measured at 1 KHz with no DC current
- Rated current: continuous operating at any input voltage
- Dielectric Strength: 1250 Vrms
- Winding: Balun-wound to within 1%



STYLE H



STYLE V



Part Number	Rated Current AMP Typ.	Primary Inductance mH Min.	Test Level Vrms	Leakage Inductance µH Max.	DCR/ Winding OHM Max.	Case Style	Dimensions A Max.	B Max.	C Max.	D Max.	E ±0.010	F ±0.010	G ±0.005
54P2891	1.8	10	0.50	130	0.25	H	1.25	1.25	0.60	—	0.900	1.00	0.032
54P2892	3.5	3	0.20	35	0.06	H	1.25	1.25	0.60	—	0.900	1.00	0.032
54P2893	6.0	1	0.08	12	0.02	H	1.25	1.25	0.60	—	0.900	1.00	0.036
54P2894	2.6	16	1.00	180	0.16	H	1.52	1.52	0.80	—	1.083	1.28	0.032
54P2895	3.2	8	0.50	90	0.12	H	1.52	1.52	0.80	—	1.083	1.28	0.032
54P2896	5.2	4	0.20	45	0.04	H	1.52	1.52	0.80	—	1.083	1.28	0.036
54P2897	7.5	2	0.08	25	0.02	H	1.52	1.52	0.80	—	1.083	1.28	0.047
54P2911	1.8	10	0.50	130	0.24	V	1.15	0.55	1.15	0.45	0.400	0.80	0.032
54P2912	3.5	3	0.20	35	0.06	V	1.15	0.55	1.15	0.45	0.400	0.80	0.032
54P2913	6.0	1	0.08	12	0.02	V	1.15	0.55	1.15	0.45	0.400	0.80	0.036
54P2914	2.6	16	1.00	180	0.16	V	1.52	0.80	1.50	0.70	0.600	0.90	0.040
54P2915	3.2	8	0.50	90	0.12	V	1.52	0.80	1.50	0.70	0.600	0.90	0.040
54P2916	5.2	4	0.20	45	0.04	V	1.52	0.80	1.50	0.70	0.600	0.90	0.036
54P2917	7.5	2	0.08	25	0.02	V	1.52	0.80	1.50	0.70	0.600	0.90	0.047

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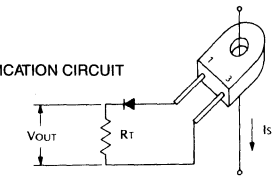
VITEC

TRANSFORMERS & INDUCTORS

TYPE 57P *CURRENT SENSE INDUCTORS*

- Designed for use with switching power supplies
- Frequency range above 50 KHz
- Epoxy encapsulated construction
- Low cost

TYPICAL APPLICATION CIRCUIT



PART NUMBER	SCHEMATIC FIG.	TURNS	INDUCTANCE (1-3)	INDUCTANCE TEST VOLTS	DC RESISTANCE* (1-3)	TERMINATING RESISTANCE
			mH	VOLT	OHMS	OHMS
		±5%	MIN.		MAX.	TYP.
57P1686	1	50	5.0	0.50	0.70	50
57P1687	1	100	20.0	1.00	1.40	100
57P1688	1	200	80.0	2.00	4.50	200
57P1717	2	50 C.T.	5.0	0.50	0.70	50**
57P1718	2	100 C.T.	20.0	1.00	1.40	100**
57P1719	2	200 C.T.	80.0	2.00	4.50	200**

*For voltage across terminating resistance of 1 volt per ampere.
**For center taped units, terminating resistance for each half of winding is ½ the listed value.

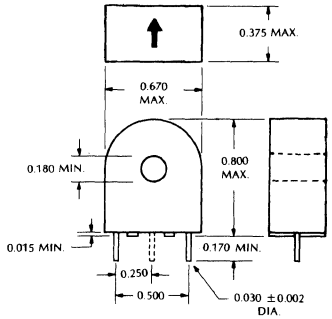
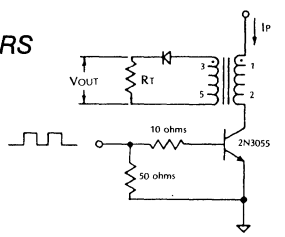


FIG. 1 FIG. 2

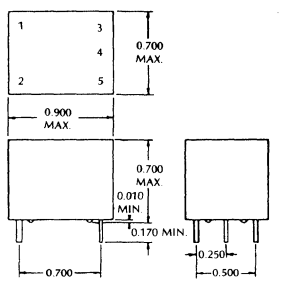
TYPE 57P *CURRENT SENSE TRANSFORMERS*

- Designed for use with switching power supplies.
- One turn primary furnished
- Operating temperature to +105°C
- Frequency range above 20 KHz
- Epoxy encapsulated construction
- 3750 Vrms primary to secondary hipot
- Low cost



PART NUMBER	SCHEMATIC FIG.	SECONDARY TURNS	SECONDARY INDUCTANCE (1-3)	SECONDARY INDUCTANCE TEST VOLTS	SECONDARY DC Resistance (1-3)	SECONDARY TERMINATING* RESISTANCE	PRIMARY UNIPOLAR RATING
			mH	VOLT	OHMS	OHMS	AMP μ SEC
		±5%	MIN.		MAX.	TYP.	MAX.
57P3586	1	50	5.0	0.50	0.70	50	150
57P3587	1	100	20.0	1.00	1.40	100	300
57P3588	1	200	80.0	2.00	4.50	200	600
57P3617	2	50 C.T.	5.0	0.50	0.70	50**	150
57P3618	2	100 C.T.	20.0	1.00	1.40	100**	300
57P3619	2	200 C.T.	80.0	2.00	4.50	200**	600

*For voltage across terminating resistance of 1 volt per ampere.
**For center taped units, terminating resistance for each half of winding is ½ the listed value.
Peak sense current 20 ampere max.



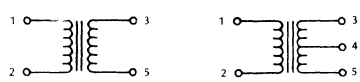
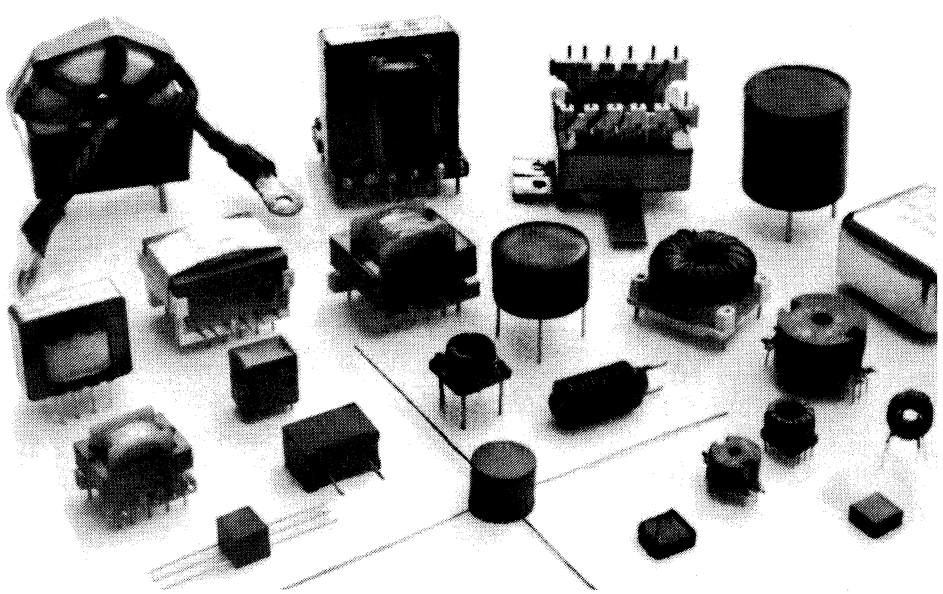


FIG. 1 FIG. 2



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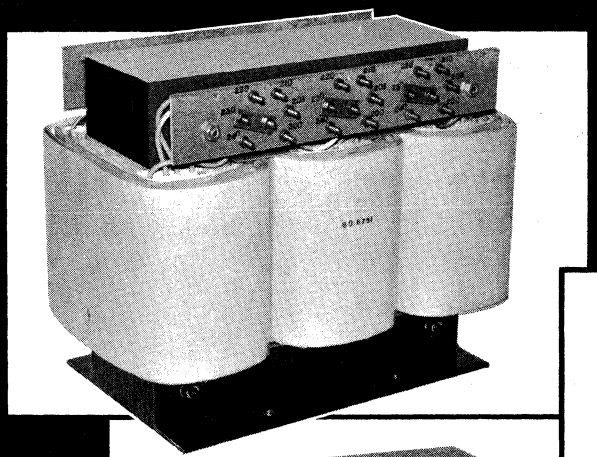

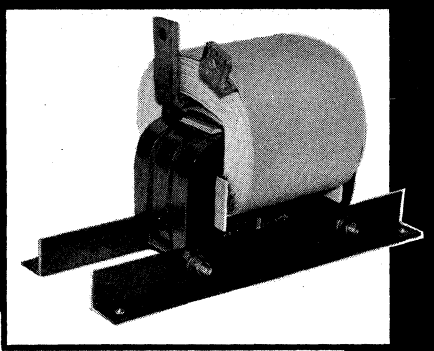

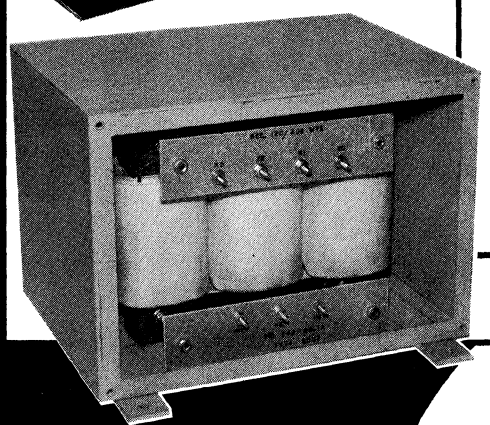

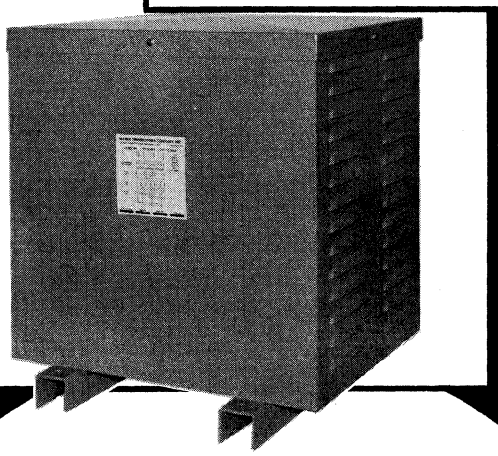

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